An Application to the International Dark-Sky Association for a Starlight Reserve in the Aoraki/Mt Cook National Park and the Mackenzie Basin of the central South Island of New Zealand

27 January 2012

MACKENZIE DISTRICT COUNCIL

UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Royal Astronomical Society of New Zealand RASNZ

Department of Conservation
Te Papa Atawhai

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Letters of Committal:

Royal Astronomical Society of New Zealand
(INCORPORATED)
Signatory to New Zealand Urban Design Protocol
Supporter of the International Dark-Sky Association

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WELLINGTON
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Email: pres@rasnz.org.nz

20 January 2012

The Board of Directors
International Dark-Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

Dear Board Members

The Royal Astronomical Society of New Zealand (RASNZ) is proud to submit and support the New Zealand Aoraki Mackenzie Starlight Reserve proposal. In supporting this application to the International Dark-Sky Association for recognition of the Aoraki Mackenzie as an International Dark Sky Reserve, the RASNZ is conscious of its objective to promote and extend knowledge of astronomy and related branches of science.

An International Dark Sky Reserve is a public or private land possessing an exceptional or distinguished quality of starry nights and nocturnal environment that is specifically protected for its scientific, natural, educational, cultural, heritage and/or public enjoyment mission of a large peripheral area.

The natural features of the Mackenzie Basin led to the establishment of the University of Canterbury Mt John Astronomical Observatory at Tekapo as well as astro-tourism ventures at Tekapo and Aoraki / Mt Cook. By day the area is rich in the outstanding natural beauty of an inland high country valley with snow covered Alps within a World Heritage Area as a background. By night the southern skies come alive with clear views of the universe with its ever changing displays of beauty and inspiration.

The Mt John Observatory is a major contributor to astronomical knowledge within New Zealand and to the membership of the RASNZ. In recent years the observatory has opened its grounds and facilities to encourage the public to visit and appreciate the study of the universe.

The RASNZ asks that the IDA Board consider this Dark Sky Reserve application most favourably as the most appropriate means to ensure its future protection and public roles. The dossier of supporting material provides the authenticity for the application.

Yours sincerely

Glen Rowe
President – Royal Astronomical Society of New Zealand

Aoraki Mackenzie Starlight Reserve Working Party
c/- 11A St Clio Street
Christchurch 8041
New Zealand

The Board of Directors
International Dark Sky Association
3225 North First Avenue
Tuscon, Arizona 85719-2103

25 January 2012

Dear Board Members,

The members of the Aoraki Mackenzie Starlight Reserve Working Party, in conjunction with the Royal Astronomical Society of New Zealand, are very pleased to submit this application for recognition of the Starlight Reserve as an International Dark Sky Reserve by the International Dark-Sky Association.

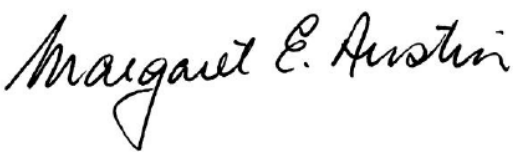
In doing so we are pleased to have the on-going support of the Member of Parliament for Waitaki, Jacqui Dean, the Mackenzie District Council, the University of Canterbury and the Department of Conservation. In addition a collaborative group of twenty-six organisations in the Mackenzie District, known as the Mackenzie Sustainability Forum, have included their support for the proposal in their first report to be published in March 2012. There has been strong support for the project from the Lake Tekapo Community Board and the Lake Tekapo Community. Furthermore, Environment Canterbury as the Legislated Body responsible for environmental management have indicated their endorsement.

The Working Party acts under the auspices of the Mackenzie Tourism and Development Trust of the District Council and has welcomed their support since the initiation of the project and in putting together the application for recognition. Much of the monitoring work which is included in the presentation has been supervised by Mr Alan Gilmore, the Resident Superintendent at the Mt John Observatory, Lake Tekapo. Mr Gilmore has accepted the role of Manager of the Reserve once the evaluation is completed.

The Working Party acknowledges the commitments made by the Mackenzie District Council in setting in place Lighting Ordinances more than thirty years ago. They have had a dramatic effect in controlling Light Pollution in the Mackenzie. This has given the people there great advantage in promoting the area for education, astro-tourism and research activities at night as well as during the day. These protections are enshrined in the Mackenzie District Plan and the Aoraki Mt Cook National Park Management Plan both of which are supported by Local Government, the Conservation and Resource Management Acts.

We are confident the International Dark-Sky Association will recognise the extent to which the application fully meets its objectives and aspirations. We believe that the exceptionally dark and unpolluted night sky in the Mackenzie Basin (Bortle class 2), and the history of more than thirty years of lighting controls in the Mackenzie enshrined as they are in New Zealand law should make our application a strong contender for the highest tier of Dark-Sky (Starlight) Reserve.

Yours sincerely



Members of the Aoraki Mackenzie Starlight Reserve Working Party

Hon Margaret Austin – Chair, former New Zealand Government Minister and Chair of the National Commission for UNESCO NZ
Claire Barlow – Mayor of the Mackenzie District
Philip Brownie – General Manager, Destination Mt Cook Mackenzie
Steve Butler – Royal Astronomical Society of New Zealand
Denis Callesen – General Manager, Tourism Aoraki Mt Cook Alpine Village Ltd.
Alan Gilmore – Superintendent Mt John Observatory, University of Canterbury
Professor John Hearnshaw – Professor of Astronomy, University of Canterbury
Richard McNamara – Area Manager, Department of Conservation, Aoraki Area
Peter Maxwell – Mackenzie District Councillor
Graeme Murray – Director of Earth and Sky Ltd, Lake Tekapo
Dr Karen Pollard – Director of the Mt John Observatory, University of Canterbury
Andrew Simpson – Balmoral High Country Station

Office of the Mayor

REF: PAD 11/5

16 January 2012

The Board of Directors
International Dark Sky Association
3225 North First Avenue
Tuscon, Arizona 85719-2103
USA

Dear Sir/Madam

It gives me great pleasure to lend my personal support and that of the Mackenzie District Council to the application of the Aoraki Mackenzie Starlight Reserve to the International Dark Sky Association for recognition as a Starlight Reserve.

The night sky in our District can be a truly magnificent sight as was emphasised in 2007 when Comet McNaught's appearance was caught on camera from the Mt John Observatory.

Previous Councils have recognised the importance of the night sky by providing lighting ordinances in the District Plan that control the spill of light upwards. Originally these covered the Mackenzie Basin and Tekapo township, but they have recently been extended to include Twizel within the same regime.

The night sky has a particular fascination for many of our overseas visitors who come from areas where light pollution masks the stars from view.

As well, important research continues to be carried out at the Mt John observatory which is dependent upon the night skies being free from light pollution.

The Mackenzie District Council is committed to supporting the Starlight Reserve and to ensuring that the Lighting Ordinances in place are adhered to. We commend the enthusiasm of all those involved in securing international recognition for one of New Zealand's treasures for its citizens and its international visitors. We welcome too the support of the New Zealand Government for the venture.

Yours sincerely

Claire Barlow
MAYOR

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UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

26 January 2012

The Board of Directors
International Dark Sky Association
3225 North First Avenue
Tuscon, Arizona 85719-2103
USA

Dear IDA Board members

Aoraki Mackenzie Starlight Reserve

I have been asked to be the initial manager of the Aoraki Mackenzie Starlight Reserve. This is a position I will be happy to fulfil.

At present I am the Resident Superintendent of the Mt John University Observatory at Lake Tekapo. The observatory is owned and operated by the University of Canterbury. In this position I have had a long involvement with the Mackenzie District Council's Lighting Ordinance. I regularly advise the Council about resource consent applications involving outside lighting, and bring to the attention of local residents the provisions of the current lighting ordinance.

As Starlight Reserve Manager, I would continue to carry out these roles of advising the Council on lighting matters, and helping to reduce the occasional occurrence of lighting ordinance infringements. I would also monitor night sky brightness from time to time, so as to ensure that our present exceptionally dark skies are maintained for the future.

I am a member of the Starlight Reserve Working Party that has drafted the application to the International Dark-Sky Association for recognition of the Aoraki Mackenzie Starlight Reserve, so I am familiar with the general requirements that a Starlight Reserve has to meet.

Yours sincerely

A. C. Gilmore

Alan Gilmore
Resident Superintendent
Mt John University Observatory
University of Canterbury
Email: alan.gilmore@canterbury.ac.nz

Executive Summary

This document is an application to the International Dark-Sky Association for a Starlight (Dark-Sky) Reserve to be recognized in the Aoraki/MtCook National Park and adjoining Mackenzie Basin in the central South Island of New Zealand. The application is presented by the Aoraki Mackenzie Starlight Working Party, a committee established in 2009 by the Mackenzie Tourism and Development Trust, a body within the Mackenzie District Council, which is the arm of local government administering this region.

The application describes the proposed boundaries of a Starlight Reserve, and presents detailed descriptions of the topography, ecosystem, settlement history, climate, land use and administration to be found in this area. It proposes two cores, the primary one at Mt John and the secondary one at Mount Cook Airport. Mt John University Observatory was established at Lake Tekapo by the University of Canterbury in 1965. After extensive site testing funded by the U.S. National Science Foundation at Tekapo and elsewhere in New Zealand, Mt John University Observatory has became the base for astronomical research. A lighting ordinance, incorporated into the Mackenzie District Plan, was enacted in 1981, and has provided lighting controls throughout most of the proposed Starlight Reserve since that time. It was one of the first such ordinances in the southern hemisphere. Two thriving astro-tourism companies are now providing night-sky tours to many thousands of tourists annually. This is a development of the last six years. We have made extensive night-sky brightness measurements during new moon since mid-2011, and show that the night sky brightness in the Mackenzie Basin and at Mt Cook is exceptionally dark by international standards. The air is also very transparent and unpolluted, making this an ideal location for stargazing. The number of perfectly clear nights at Tekapo is 21 per cent; 32 per cent of the nights are unsuitable for observing, and the remaining 47 per cent are partially clear or fully clear for part of the night, such that some observing and star gazing may be possible.

We have received the support from numerous organizations and individuals for the Aoraki Mackenzie Starlight Reserve, including the Mackenzie District Council, the Department of Conservation, the University of Canterbury, the Royal Astronomical Society of New Zealand and others. Copies of their supporting letters are attached.

In order to promote the concept of a Starlight Reserve, we are organizing an international conference in Tekapo on the benefits of a Starlight Reserve for public education and outreach and as a means of promoting tourism and astronomical research. The conference will take place in June 2012 (see www.starlight2012.org).

We are pleased to present our application for international recognition as a Starlight Reserve to the International Dark-Sky Association, in the belief that we have a truly exceptional environment, landscape and night sky of international significance to protect and to promote.

Note

This application has been compiled by Margaret Austin (Chair Starlight Reserve Working Party) with the assistance of Steve Butler (Dark Skies Group, Royal Astronomical Society of New Zealand), Professor John Hearnshaw and Dr Alison Loveridge (University of Canterbury), Ivy Au, Monique Milne, Lizzie Cook (University of Canterbury students), Alan Gilmore (superintendent of Mt John University Observatory, Lake Tekapo), Fraser Gunn (University of Canterbury and Earth and Sky Ltd). Some of the material was researched by University of Canterbury summer students (2010-2011) Julie Abbari, Rebecca Duell and Michelle Moffat.

It is acknowledged that Graeme Murray (Earth And Sky Ltd) was the driving force for the Starlight Project in 2007, when the project was first mooted.

We are grateful to the Canterbury Development Corporation and to the University of Canterbury for funding for our summer students.

IDA Application for a Starlight Reserve

1. Introduction

Lake Tekapo is located in the Mackenzie Basin situated in the centre of the South Island of New Zealand. It is a major tourism location and through route between Christchurch, Aoraki/Mt Cook National Park and Queenstown. It is the site of the Mt John University Observatory operated by the University of Canterbury, and chosen in the 1963 for the clarity and darkness of the night sky after a three-year site-testing programme. Mt John University Observatory was opened in July 1965.

The proposal to establish a Starlight Reserve in the Mackenzie Basin with the inclusion of the Aoraki/Mt Cook National Park is made in this application to the International Dark-Sky Association. The motivation for this proposal arises not only because of the strength of the ongoing astronomical research at Mt John, but also because of the growth in recent years of astro-tourism in the Mackenzie Basin at Tekapo and at Mt Cook, with two separate companies now offering night sky tours and other educational and public outreach programmes. The company at Tekapo is Earth and Sky Ltd, which works in close association with the University of Canterbury and Mt John, while at Mt Cook the Hillary Alpine Centre and Planetarium also offers sky tours through Big Sky Stargazing, a company operating from the Hermitage Hotel.

To promote the Starlight reserve concept, we have formed a Starlight Reserve Working Party (see Section 16), a committee under the Mackenzie Tourism and Development Trust with the support of the Mackenzie District Council. The Working Party was created in 2009 and has representatives from the District Council, the Mackenzie Tourism and Development Trust, the University of Canterbury and Mt John University Observatory, the Department of Conservation and the Royal Astronomical Society of New Zealand, as well as other community interests in the Tekapo area.

In making this application to the International Dark-Sky Association, we have decided to use our preferred nomenclature to apply for recognition as an International Starlight Reserve. However, we acknowledge that the IDA uses the preferred terminology of International Dark-Sky Reserve. We would ask that you regard our name, the Starlight Reserve, as synonymous with a Dark-Sky Reserve in all respects. We adopted this nomenclature, because the Starlight Initiative, working in association with World Heritage, had already used the Starlight Reserve name, and in addition we feel that ‘Starlight’ emphasizes what can be seen, rather than the ‘Dark Sky’, which emphasizes what cannot.

Members of our working party participated in Starlight Initiative Conferences at La Palma in 2007 and on Fuerteventura in 2009 in the Canary Islands. We are organizing a Third International Starlight Conference in Tekapo, for June 2012 (see Section 17).

1.1 International Dark Sky (Starlight) Reserve

The policies of the Mackenzie District Council and the Department of Conservation's Aoraki/Mt Cook Conservancy to preserve the quality of the night sky align well with the aims and objectives of the International Dark-Sky Association's International Dark Sky Reserve Programme (IDSR).

"An International Dark Sky Reserve is a public or private land possessing an exceptional or distinguished quality of starry nights and nocturnal environment that is specifically protected for its scientific, natural, educational, cultural, heritage and/or public enjoyment mission of a large peripheral area. [1]"

A lighting ordinance has been in force in the Mackenzie Basin which includes Lake Tekapo and Mt John since 1981. It was one of the first such ordinances to come into force in the southern hemisphere.

Recognition of the Aoraki Mackenzie Starlight Reserve as an IDSR will enhance the existing protection and will encourage, consolidate, and ensure the sustainability of actions already deployed; and it will enhance awareness of the values associated with Dark Skies for both residents and visitors.

The Aoraki Mackenzie Starlight Reserve will appoint a Manager whose duties will include:

- To report any infringements of the Lighting Ordinance to the Mackenzie District Council;
- To advise the Council on resource consent applications that may be made that involve outdoor lighting;
- To make occasional night sky brightness measurements to verify that dark skies are being maintained.

The initial manager will be Mr Alan Gilmore, the Superintendent of Mt John University Observatory, who resides at Mt John and has had a long experience in maintaining the lighting controls in the Mackenzie District.

In addition, an Aoraki Mackenzie Starlight Reserve Board will be established with representatives from the Mackenzie District Council, the Department of Conservation, the University of Canterbury, the Royal Astronomical Society of New Zealand and local people.

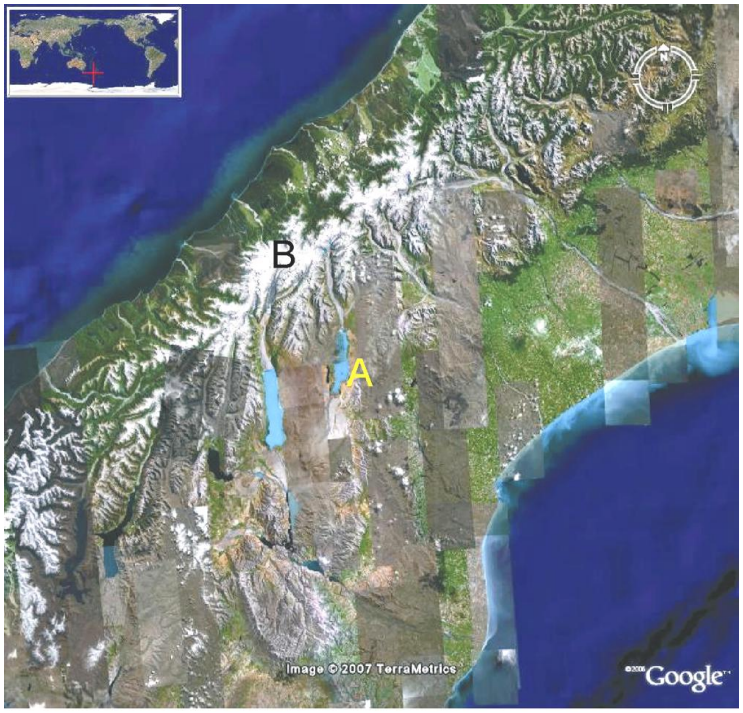
2. Introduction to the Mackenzie Basin and Aoraki/Mt Cook Regions of South Island

The proposed Starlight Reserve is located in the Mackenzie Basin in the South Island of New Zealand in an area bounded by the Southern Alps in the west and the Two Thumb Range in the east, and includes the Mackenzie Basin and the Aoraki Mt Cook National Park in the region of Canterbury. Villages are located at Lake Tekapo, Twizel and Mt Cook.

The Mackenzie has outstanding landscapes of exceptional scenic beauty with grasslands providing vistas of mountains, glaciers, lakes and rivers. The flora and fauna are of special interest with both protected and endangered species. Light pollution is very low and atmospheric transparency is excellent. For hundreds of years Maori visited the area to gather food and to observe the regular 'night visitors' in the sky.

Lake Tekapo is located close to the premier observatory in New Zealand and under one of the darkest skies in the world. Astro-tourism has attracted many people to Lake Tekapo which will soom boast an astro-feature sundial in the village centre.

Mt Cook village sits on the border between the Mackenzie Basin and the Aoraki/Mt Cook National Park of some 70,696 hectares. This great alpine park has the highest mountains and the largest glaciers in New Zealand. Aoraki/Mt Cook was formally designated a National Park in 1953 from reserves established as early as 1887 to protect the area's significant vegetation and landscape [2].



A: Lake Tekapo, B Aoraki Mt Cook National Park

Figure 2-1. Satellite- photograph showing the locations of Lake Tekapo (A) and the Aoraki/Mt Cook National Park (B).

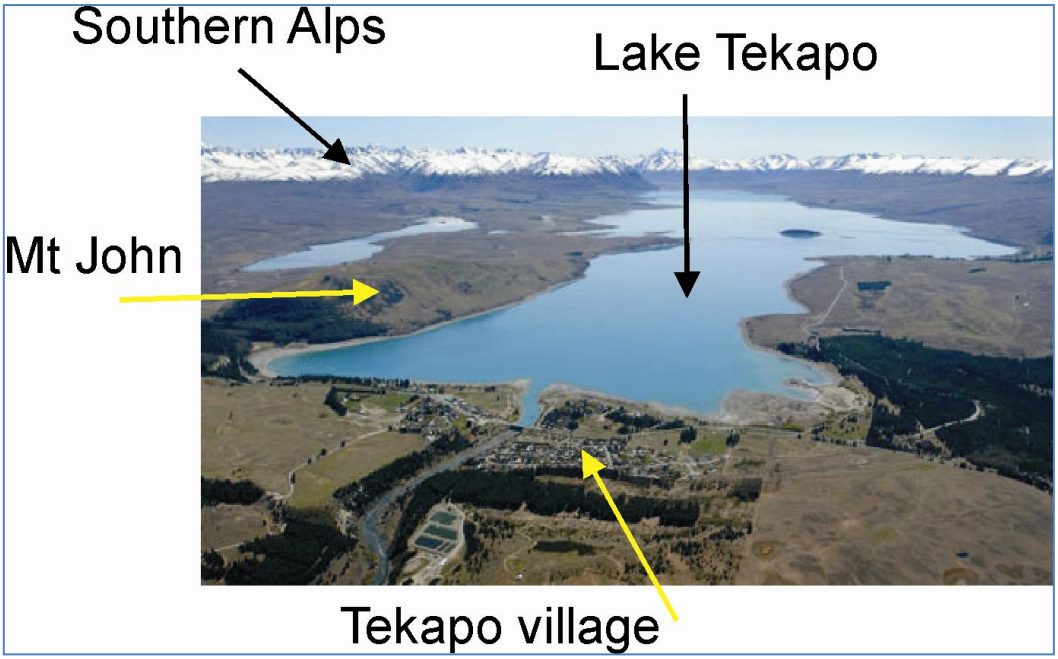


Figure 2-2. Aerial photograph showing the prominent geographic features near Tekapo taken by Fraser Gunn.

3. Proposed Boundaries of the Starlight Reserve.

The proposed Mackenzie Starlight Reserve consists of two cores, known as the primary and secondary cores, surrounded by a large peripheral region.

3.1 Primary Core: Mt John

The primary core at Mt John is located on the northern end of the Mackenzie Basin and is defined as the area above the 800-metre contour line around the base of Mt John as shown in Figure 3-1. It has been the site of the University of Canterbury's Observatory since 1965 [3]. It is home to the most southerly permanent observatory in the world and houses the MOA 1.8-m telescope, New Zealand's largest telescope. The telescopes are described in Section 9. Apart from scientific purposes, educational activities are increasing in popularity at Mt John with over 12,500 stargazing tourists in 2010 [4]. As Mt John is located in a spectacular setting with panoramic 360° views of the Southern Alps and Lake Tekapo, it is also a popular destination for visitors during the day.

Mt John is open to the public daily from 9 a.m. to 6 p.m. in summer (10 a.m. to 5 p.m in other times of the year). Day tours provide information about the history of the observatory, current research and a chance to see the telescopes. Earth and Sky operate stargazing tours after dark.

This core area has no external light fixtures and is protected by the Mackenzie District Council's lighting ordinance. These factors give Mt John an outstandingly dark sky which in turn makes it an ideal core of the Aoraki Mackenzie Starlight Reserve.

Figure 3-1. Topographic map showing the primary core boundary defined by the 800-m contour line.

3.2 Secondary Core: Mt Cook Airport

The secondary core, located at Mt Cook Airport 5 km from Mt Cook Village, is defined as the area bound by State Highway 80 (a.k.a. Mt Cook Rd), Tasman Valley Road and the Mt Cook National Park boundary (highlighted in yellow on the map below). The core has a length of 5.8 km (north-to-south) and a width of 2.6 km (east-to-west) at its widest point. As shown in Figure 3-2 below, the whole proposed core is located within Aoraki/Mt Cook National Park, where all lighting must comply with the Aoraki/Mt Cook National Park Management Plan 2004. Section 7 has details of lighting at Mt Cook Airport. Normally, the airport only operates during daytime but it is accessible at night to tourists on the Big Sky Stargazing tours.

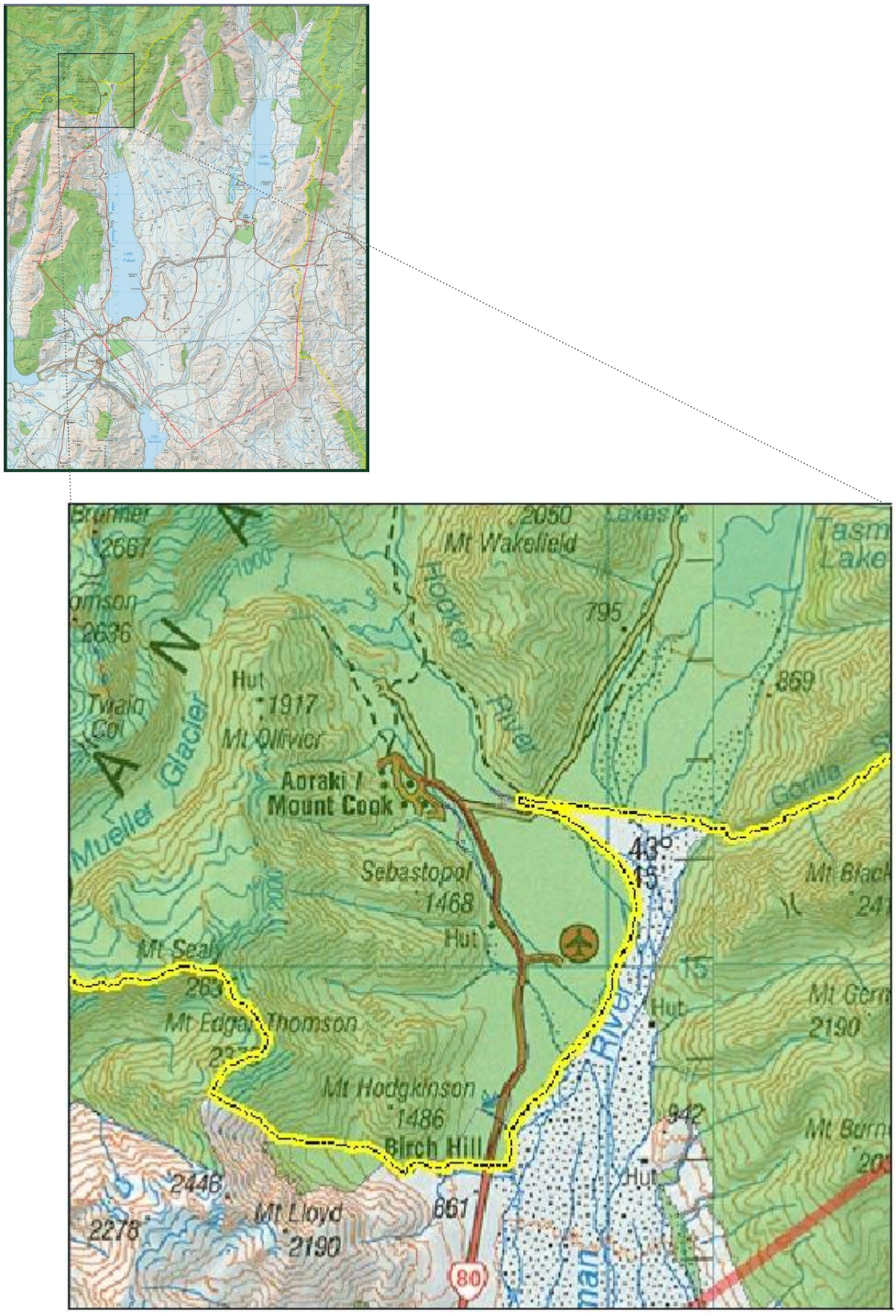


Figure 3-2. (Top left) Map of Mackenzie Basin with the area covered by the lighting ordinance outlined by the red line. **(Above)** Map showing the boundaries of the secondary core at Mt Cook Airport. The boundaries are clearly defined by State Highway 80, Tasman Valley Rd, and Mt Cook National Park's southern boundary.

3.3 Peripheral Region of Aoraki Mackenzie Starlight Reserve

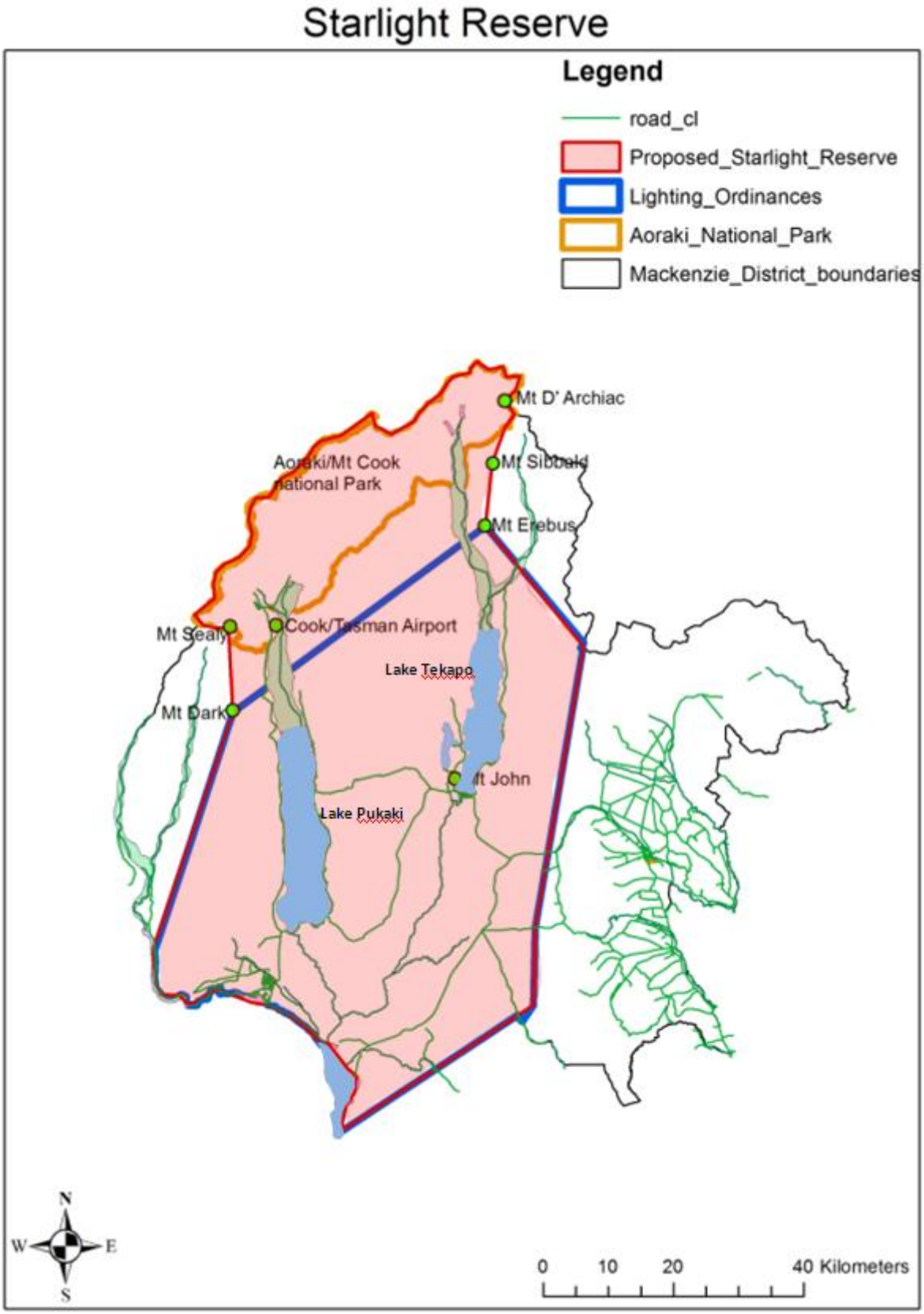


Figure 3-3. (Above) Map showing the extent of the Aoraki Mackenzie Starlight Reserve and the notable features of the Mackenzie District and beyond.

The proposed Aoraki Mackenzie Starlight Reserve is an extensive area of about 4367 km^2 that comprises of the region covered by the Lighting Ordinance, the entire Aoraki/Mt Cook National Park, and a clearly-defined area in between. The map above illustrates the boundaries of the Starlight Reserve and the locations of the two cores.

While the areas covered by Aoraki/Mt Cook National Park and the Lighting Ordinance are well defined by DOC and the Mackenzie District Council, prominent mountain peaks are used for defining the Reserve boundaries in the area between the two regions. On the north-western border of the light-restriction area, the proposed boundary extends from Mt Dark (43°44'00"S 170°04'00"E) to Mt Sealy (43°45'54"S 170°02'45"E) at the border of Aoraki/ Mt Cook National Park. On the north-eastern border, the boundaries extends from Mt Erebus (43°38'60"S 170°34'00"E) to Mt Sibbald (43°33'03"S 170°34'15"E) and to Mt D'Archiac (43°28'00"S 170°34'60"E) on the Aoraki/Mt Cook National Park boundary.

4. Basic information for the Region

4.1 Population

The population of the Mackenzie District is listed by Statistics NZ as 4000 people in 2010, including Fairlie, Tekapo and Twizel, but not Mt Cook Village [5]. The village of Fairlie is outside the proposed Starlight Reserve, to the east. The projected population for 2031 is 4050 people. There are 290 people in Tekapo and 1,080 in Twizel with little expected population growth in the next twenty years. The Mt Cook Area has a population capped at 200 which swells up to 300 in the summer, and reduces to as low as 150 in the winter.

4.2 Position of Communities

Map 4-1 shows the location of the three centres of population in the proposed Starlight Reserve, namely Lake Tekapo village at the southern end of Lake Tekapo, Twizel, just to the south of Lake Pukaki and Mt Cook village, some 10 km north of Lake Pukaki in the Aoraki/Mt Cook National Park. The original lighting ordinance zone declared by the Mackenzie District Council in 1981 was extended (in July 2011) to include Twizel [6].

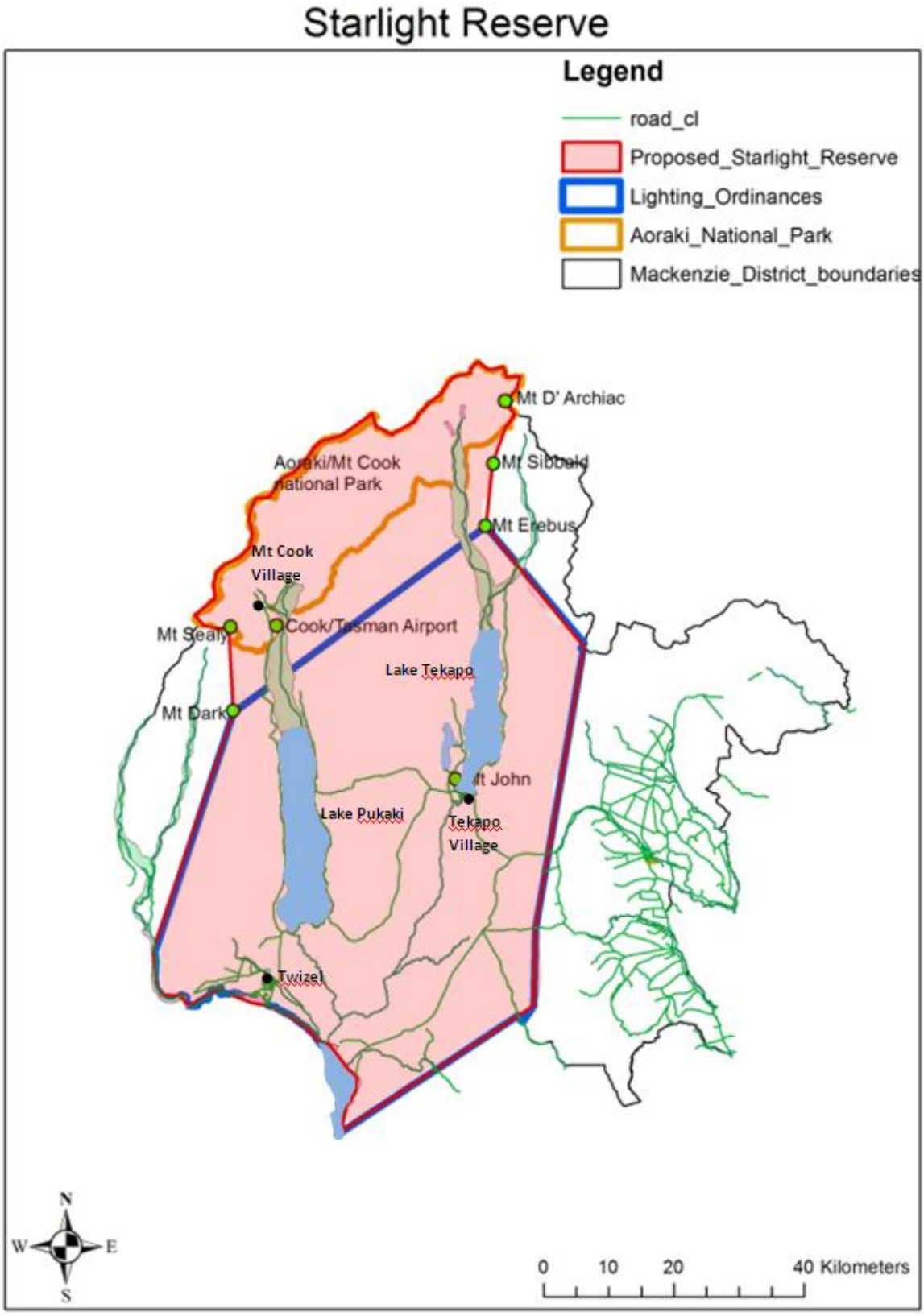


Figure 4-1. (Above) Map showing the location of the three main centres of population in the proposed Aoraki Mackenzie Starlight Reserve, namely Tekapo Village, Mt Cook Village and Twizel.

4.3 Climate (rainfall, sunshine hours, wind, temperature)

Rain
On average Tekapo village only experiences 78 rainy days a year producing an annual rainfall of 600 mm (23.6"). This increases significantly towards the Southern Alps, above the head of the lake.

Sunshine
On average Tekapo experiences 2180 sunshine hours annually which is almost 200 hours above the New Zealand average. The number of perfectly clear nights at Tekapo is 21 per cent; 32 per cent of the nights are unsuitable for observing, and the remaining 47 per cent are partially clear or fully clear for part of the night, such that some observing and star gazing may be possible.

Wind
The average wind speed throughout the year is 7km/h (4.3mph).
The highest wind speed ever recorded in New Zealand of 250km/h (155mph) was recorded on top of Mt John.

Temperature
The highest temperature recorded in Tekapo is 33.3°C (91.9°F). The average temperature in Tekapo is 8.8°C (47.84°F). The lowest temperature recorded in Tekapo is -15.6°C (3.92°F)
On average Tekapo experiences 149 ground frosts a year. Lake Tekapo experiences warm summers and very cold winters.

5. Ecosystem: Flora and Fauna

The Mackenzie Basin ecosystem has many distinctive aspects and features which are all shaped by the uniqueness of the terrain and the weather. This section includes

- an overview of the physical environment, geographical features and weather;
- the native flora and fauna; and
- current threats to the Mackenzie ecosystem and how they are being managed.

It is important to note that in New Zealand, biodiversity and natural integrity are dependent upon reducing the influence of non-native flora and fauna.

5.1 Geography

The Mackenzie Basin is the largest inter-montane land formation in New Zealand. It is a large, dry, flat area of land covered in grasses and tussocks with high snow-capped mountains. The many lakes of glacial origin, tarns and kettleholes define the character of the whole area. Pastoral farming, introduced fauna and flora and hydro-electricity developments

have altered the landscape over the last 150 years. With the arrival of Maori, approximately 800 years ago, the landscape began to undergo a process of change, converting from a mixture of forest, scrub and tussock grassland to predominantly dense tall and short tussocks [7]. This has resulted in the more sparsely covered tussock landscape present today, though essentially the landscape looks as it would have when the first Europeans arrived in the area [8].

The Mackenzie Basin experiences extremes of cold, drought and wind. It has shallow, stony, porous and infertile soil. Tough, slow growing grasses and woody plants make the most of the formidable soil. The Mackenzie has a very low risk of fire, despite the dry, drought-prone terrain [9]. This unique environment means there are a number of important ecosystems which were relatively uncommon even before the arrival of Maori and European settlers [8]. The inland alluvial surfaces, inland dune systems, kettleholes and braided rivers of the Mackenzie Basin provide the environment for these ecosystems. They are the habitats for many rare and threatened native and endemic species of flora and fauna. Notably, braided river landscapes are globally rare and the Mackenzie Basin contains the largest concentration of braided river habitat in New Zealand of approximately 20,000 ha [10].

The Mackenzie Basin is a geomorphically significant area. Many of the landforms present are the result of late Pleistocene glacial advances and retreats occurring 13,000 to 130,000 years ago [10]. A large number of geo-preservation sites exist in the area and can be found listed in the Mackenzie District Council *District Plan 2004* [11]. Several of the most important sites are situated within the proposed zone for the Starlight Reserve, as delineated by the Outdoor Lighting Ordinances. Supporting this, the *Canterbury Regional Landscape Study Review* recently identified the entire Mackenzie Basin as an Outstanding Natural Feature/Landscape (ONF/L) [12], citing the legibility of the Basin's formative glacial processes, expressed by landscape features such as moraines, rôches moutonnées, hanging valleys, terraces, fans and the glacial outwash plains.

5.2 The Fauna and Flora

The Mackenzie area is home to a number of freshwater fish species including lowland longjaw galaxias; bignose galaxias; upland longjaw galaxias; koaro; longfin eel; alpine galaxias; Canterbury galaxias; upland bully; and common bully [13]. There are also significant populations of endemic invertebrates in the Basin: knobbled weevil; robust grasshopper; small high country grasshopper; moths and butterflies; ground beetles; ground weta, and large dragon flies [14]. Birds living in the Mackenzie Basin include black stilt; black-billed gull; black-fronted tern; grey duck; southern crested grebe; eastern falcon; banded dotterel; wrybill; Caspian tern; rockwren; New Zealand pipit; South Island oystercatcher; pied stilt and kea [15]. The braided riverbed of the Tasman is home to the kakī/black stilt which is one of New Zealand's rarest birds. They are critically endangered with only around 100 birds living in the wild. Twizel has a breeding programme for the black stilt whose centre is open to the public so visitors can learn more about this threatened bird. The Mackenzie is also home to the lizard species- spotted skink, scree skink, long-toed skink, and jewelled gecko (Fig 5.1) although the latter is rarely seen [16].

Some 300 alpine plant species are found within range of the Mt Cook National Park. There are numerous species of mountain buttercup including *Ranunculus lyalli* (Fig 5.2), the daisy *Celmisia spp*. Spaniards (*Aciphylla spp)* tussock grasses, orchids, gentians and a great many small grassland species.

Figure 5-1. (Above) The Jewelled Gecko

(Right) Ranunculus lyalli, source Nigel Burkitt

5.3 Light Pollution and Invertebrates

Little is known or understood about the relationship (if any) between native invertebrates and light pollution, especially sodium street lighting. Mammalian predators are the chief risk to indigenous invertebrates and it is possible that lighting may be an advantage for visual predators such as cats, blackbirds, owls and possibly magpies that hunt for prey at dusk. Since many ground dwelling invertebrates (spiders, beetles and large ground weta) are 'negatively phototactic' it is likely communities could be fragmented by habitat change while moth mating behaviour may be disrupted by artificial light [19, 20, 21].

5.4 Threats to the eco-system

Because land in the Mackenzie is mainly leasehold or privately owned, protection and management of flora and fauna is largely out of the Department of Conservation's hands. Proposed large dairying developments and the spread of introduced species, such as wilding pines are current risks. There is a conservation area at Lake Alexandrina, but the wider Mackenzie Basin has been affected by high country pastoral farming over the last 150 years, so that conservation efforts fall upon the pastoral lease holders. Recently, Judge Jon Jackson ruled an unfair burden of environmental responsibility was placed upon farmers, especially considering a large number of tourists and New Zealanders alike have enjoyed viewing the landscape [22].

The main threats to the eco-system are introduced species of flora and fauna. The rivers are affected by didymo river weed, which inhibits the growth of native water weeds and has an effect on the river food chains.

The most common problem species in the Mackenzie are the "wilding pines" (*Pinus spp.)* as a result of wild seed dispersal. Wilding pine management involves considerable time and

effort from both DOC staff and contractors each year [23]. They thrive in the Mackenzie environment, create wind barriers and block sunlight, snow and frosts, which are essential environmental factors needed for indigenous species to flourish. Control of wilding pines is regarded as essential.

The Russell Lupin (*Lupinus polyphyllus*) is another problem plant in the Mackenzie. It is an exotic perennial plant growing up to 1.5 metres, flowering and setting seed in the summer and dying back to the stem base in winter. Russell lupins are colourful in flower but an aggressive weed which has invaded many of the braided river beds. Around Tekapo they have become a tradition, drawing visitors from far and wide, so in the local area they are not seen as a weed, but rather as an attraction to the many visitors to the area during summer [24].

Rabbits and possum are regarded as pests whose control falls largely to local farmers. Other introduced mammals are managed by DOC, with Thar having their own Management Plan, which was developed in consultation with a range of interest groups [23].

Figure 5-2. Russell Lupins in flower (wilding pines in the background) at Lake Tekapo, from: http://laketekapountouched.co.nz/

5.5 Conservation

"Project River Recovery" (PRR) was launched in 1991 and is an agreement between Meridian Energy and the Department of Conservation. Under this agreement Meridian provides the funding to mitigate the effects of the hydroelectricity developments. It aims to restore braided rivers and wetlands through weed control, research on riverbed predators,

ecological monitoring, advocacy, and the construction of new wetlands to encourage native birds to nest there [23].

Kakī/Black Stilt:

Biodiversity work is focused on the kakī/black stilt, one of the world's rarest wading birds. Once widespread in New Zealand, kakī are now confined to the braided river and wetland habitats in the Mackenzie Basin. Captive management involves collecting and incubating eggs from both wild and captive pairs, artificially incubating them until they hatch after which they are released into the wild [25]. Conservation efforts and predator control have succeeded in averting extinction and increasing kakī numbers. The next phase of the recovery programme will address the complex issues associated with managing kakī in the wild [26].

DOC staff are also involved with management of native fish, lizards, insects and plants and are often called on to provide expert advice on statutory planning matters such as District plans and Resource Management applications [23].

6. Cultural History of the region: Maori and European settlement

This section aims to show the proposed Starlight Reserve landscape in a cultural context which consists of the "combined works of nature and of man" that have developed over the history of human settlement in the area [27].

The proposed Starlight Reserve is a multifunctional one, in which the landscape is of outstanding beauty, significant biodiversity and has geologically important features. Night sky tourism is not only a significant source of income for members of the local population, but is woven into local culture in providing a point of reflection on the night sky for local people and visitors in understanding and experiencing the night sky. Critical to the quality of the experiences are the AstroCafé within the Mt John Observatory site and the planetarium at Mt Cook Village in providing access to specialized viewing of the night sky. These sites allow access to the telescopes and have experienced guides. The *Starlight Reserve Concept* document discusses starlight destinations as places where history, science, aesthetics and spirituality may be interpreted for members of the public alongside viewing of the night sky [28].

The history of Maori and Pakeha (European New Zealanders) in the Mackenzie Basin reveals its deep spiritual, economic and aesthetic importance to Aotearoa, New Zealand. Layered upon the landscape's significant history are a variety of activities that continue to weave the natural and cultural landscapes together, forming a rich sense of place. These activities include, but are not limited to, agriculture, astronomy, conservation, contemporary art, education, generation of hydro-electricity, recreation, salmon farming and tourism. The *Canterbury Regional Landscape Review*, which rates the Mackenzie Basin as an outstanding natural area, describes this layering process:

From our choices of architecture and land use to our memories of events, landscapes can tell stories of where and from whom we came and why we have responded to the physical environment in the ways we have. All landscapes are inextricably linked to historic processes [29].

6.1 Aotearoa / New Zealand

New Zealand is a young country in terms of human occupation. Maori settlement over 800 years ago was followed by European settlement some two hundred years ago. Both periods of settlement of New Zealand depended in part on knowledge, and the search for and use of knowledge of the skies above.

Maori navigators made use of their understanding of the changing night sky patterns, along with familiarity of natural patterns of clouds, winds, waves, tides and bird movements to navigate their way south from Polynesia to discover and inhabit the islands now known as Aotearoa / New Zealand. Aotearoa, the Maori name for New Zealand, is said to refer to the pattern of cloud that forms along the length of New Zealand as seen from the sea, forming Aotearoa – Land of the Long White Cloud.

In 1768 Lieutenant James Cook of the British Navy received instructions to set sail for the Pacific in order to study the passage of the planet Venus across the disc of the Sun. After viewing the transit from Tahiti on 3rd June 1769 Cook set sail for New Zealand where he observed the Transit of Mercury on the 3rd of November at Mercury Bay in the North Island of New Zealand − so named as ten days were spent there observing the transit of Mercury. During his second voyage to New Zealand the now Captain Cook and his ship the Resolution spent six weeks in the autumn of 1773 accurately fixing the geographical position of New Zealand.

6.2 Pre-1840: Maori Settlement

Three iwi (tribes), Waitaha, Ngati Mamoe, and Ngai Tahu have been associated with the Mackenzie Basin since it was first settled. Many conflicts occurred between them until Ngai Tahu became the dominant iwi, holding tribal authority over more than 80 per cent of the South Island. It is likely thse were after several migrations. [30]. The Te Ana Rock Art Centre (Timaru) website describes Ngai Tahu's relationship with the other two southern tribes in the following text:

Ngāi Tahu are an indigenous people of the South Island. We are an amalgamation of Waitaha, the first people to settle here about 700 years ago, and Ngāti Mamoe and Ngāi Tahu who migrated later from the North Island. Today we go by 'Ngāi Tahu', or sometimes 'Ngāi Tahu Whānui' which emphasizes our strands of genealogy [30].

There are numerous sites of interest to Maori in and around the Mackenzie Basin. Many of the old pa (fortresses) sites, rock paintings in caves, moa-hunting camps and ovens scattered throughout the South Island are attributed to Waitaha [33]. Wilson claimed that "prior to

European occupance [sic] the Mackenzie country was used by Maori as a hunting ground during the summer and autumn months" [34]. Originally moa (extinct, large, flightless bird weighing up to 230 kg depending on the species) were hunted and processed on-site or taken to the coast down the Waitaki River on reed canoes for drying and storage [35]. Lake Tekapo contained eels and the swamps, riverbeds, and scrub-covered flats were full of birdlife such as ducks, pukekos, wekas, kakas and pigeons.

"The Maoris made their hunting expeditions into the Mackenzie country either by way of the Waitaki valley or through the passes which were all known to them. The chief object of these trips was to lay in stores of eels and wood-hens which were cleaned, dried in the sun, or smoked, then conveyed 'down-country' for winter use… Greenstone implements have been found at Haldon Station and, at Simons Hill, the remains of 'umus' or Maori ovens can still be seen" [34].

McIntyre notes the importance of the area for acquiring hard quartzitic rock known as 'silcrete' or 'quartzite'. This "was used for making large cleavers and knives; porcellanite was used for smaller knives" [35]. Ram Island (Take Karaka), now known as Motuariki, in the middle of Lake Tekapo abounded with weka and kiore (a rat) and was once the home of the ancestors of Arowhenua (Tekapo's sub-tribe). "Such was the reputation of Tekapo as a mahika kai [food source] that people came from as far away as Kaiapoi, several hundred kilometres to the north, to trade for food" [36]. The Kāi Tahu Ki Otago Natural Resource Management Plan 2005 notes in its discussion of cultural landscapes in the Waitaki catchments (including the Mackenzie Basin) that, "*The value attached to the land is evident from the fact that every part of the landscape was known and named… every hillock, streamlet and valley*" [37].

6.3 Maori astronomy

Whilst *astronomy*, considered a scientific discipline, and *astrology*, considered to be folklore, are two different things in Western thought, they are often intertwined and interdependent in Maori culture. In order to memorize, make sense of, and pass on precise astronomical knowledge, it was often woven into stories which adopted the mythical nature of astrology. The following descriptions may therefore overlap at times, although care has been made to try to use the exact terms as found in the various literature sources.

It is noted that Maori used astronomy in everyday practices such as food gathering and planting, and that they believed the stars governed their good or bad fortune, or general mood as astronomy was embedded in almost everything Maori did [38, 39]. This is confirmed by literature and by no means confined to the past - on the contrary, it is still relevant today.

In Waitaha, traditional knowledge of the stars was as important as any other knowledge.

"They long held that every child should have a song of the geography of the land sung to them during their infancy…Now moko, you must learn the rituals and concepts of the stars and all of the things that help us move in and around the world that we understand" [39].

Songs and stories, string patterns (mahi whai) were created for different constellations and used as a teaching tool to pass on the astronomical knowledge [40]. These string patterns are similar to those that Pakeha 'play' with as children, manipulating a continuous piece of string (tied in a circle) into various symmetrical patterns with their fingers. However Maori did not practise this as a child's game, rather the various patterns resembled specific constellations full of meaning and were taught by adults.

It is known that when Maori went to the area to hunt and gather food, stars were significant. Best states "an old saying is, 'When Matariki [Pleiades] is seen, then game is preserved'; for it marked the season when such food-supplies have been procured and preserved in fat in certain vessels" [41]. He also claims Ngai Tahu say that: "women awaited the appearance of Rigel and regarded intently its aspect. If when it appeared above the horizon its rays were directed towards the south, then an inclement season followed; products of field, forest, and sea would suffer. If directed to the northward, then a fair season followed; all products were plentiful, floods were not, and merely desirable rains fell" [41]

It can be inferred that observing the stars was an integral part of the journey to Tekapo to gather up winter supplies. This is confirmed by other authors, "these mahinga kai cycles were locked into this great harvesting and planting maramataka [Maori Lunar Calendar], where the patterns of the stars and the weather were all noted" [39].

6.4 Mythology, Cosmology and Night Sky

Maori mythology is very much centred on the creation of land, water bodies, and sky, attributing spiritual qualities to them. In this way, what we would call 'the landscape' includes the sky and is not merely physical, but cultural also. Myths provide messages as to how people should live, so the landscape, imbued with messages, tells people how to live. Aoraki/Mt Cook, visible from many parts of the Mackenzie Basin, is the ancestor of Ngai Tahu and contains many powerful messages. There are many important landscape features of the Mackenzie District that also form part of Maori mythology. For instance each lake has a story and these are listed in the Mackenzie District Council Plan 2004. The story of Aoraki is told in any important document to do with the area from tourist websites to resource management plans:

The Maori legend of Mt Cook is the story of Aoraki and his three brothers. They were the sons of Rakinui (the Sky Father) and were on a voyage around Papatuanuku (the Earth Mother) when disaster struck and they became stranded upon a reef. The voyagers climbed on to the top side of the canoe and after a time the south wind froze them and turned them into stone. Their canoe became the South Island (Te Waka o Aoraki is the oldest name for the South Isand) and Aoraki who stood tallest of the brothers is now seen as the majestic Aoraki Mt Cook with the Southern Alps as his brothers and other members of this crew [43].

Mountains, lakes and sky are interwoven in Maori mythology. As one Maori proverb says, "by the forest vines Earth and Sky were bound together. In the Maori creation story, before

the time of light, the primal parents Earth and Sky lay together in darkness, bound by vines. They were thrust apart, light came to earth and life as we know it evolved" [44]. This brief study of Maori history and culture in relation to the area of the Starlight Reserve indicates that the night sky is an integral part of its entire natural and cultural landscape.

6.5 Ngai Tahu and Management of the Night Sky in the Mackenzie Basin

A starlight reserve may be defended by the purpose and principles of sections 5, 6 and 8 of the Resource Management Act in that Starlight may be defined as a "natural resource" s.5(1), and s.5(2) which state that natural resources should be protected in a way that "enables people and communities to provide for their social, economic, and cultural well being". Under these sections protecting the starlight is essential to the continuing practice of mahinga kai (traditional food gathering). Furthermore, s.6(e) considers "the relationship of Maori and their culture and traditions with their ancestral lands…and other Taonga [treasures]" and s6(f) states one of the criteria for assessing "outstanding natural features and landscapes" to be "its value to tangata whenua [people of the land]". Both Maori astronomy and mahinga kai may be protected under s.6(g) "The protection of recognized customary activities". Finally, s.8 takes "into account the principles of the Treaty of Waitangi" and encourages co-management of natural resources [46]. Some areas of the Mackenzie Basin have a special significance which should be taken into account when considering a Starlight Reserve. The Department of Conservation acknowledges the special relationship of Ngai Tahu and the Tōpuni status over Aoraki/Mt Cook.

The local Runanga for the Mackenzie Basin is Arowhenua with a Marae based in Temuka. Mackenzie District Council's *District Plan* 2004 details the Council's "Recognition of the importance of the relationship of the tangata whenua [people of the land/indigenous people], their culture and traditions, with their ancestral lands, waters and sites, in the management of these resources within the District" [47]. The plan includes controls over light pollution in the Mackenzie District that are detailed in the Natural Heritage Case Study. The District Plan also lists statutory acknowledgements and areas in accordance with Section 220 of the Ngai Tahu Claims Settlement Act 1998: Mt Cook, Lake Pukaki, Lake Takapo (Tekapo), Te Ao Marama (Lake Benmore), and Whakarukumoana (Lake Mcgregor). These are areas in which the Council must be sensitive to the values and policies of Te Runaka o Arowhenua and in which the quality of the light would be especially important.

6.6 History after 1840: Pakeha Settlement

Pakeha (New Zealander of European descent) history and values have also played pivotal roles in the shaping of the landscape, and the following is a brief outline of this history.

European travellers were first told about the Mackenzie Basin by Maori in the 1830s and 1840s but it was not visited until James Mackenzie used the area to move sheep from Canterbury to Otago [48]. James Mackenzie is an important figure in the area's folklore, and a monument marks the top of the pass he used to enter the basin. The Mt Cook Mackenzie i-site website refers to him in this way:

The Mackenzie Country is named after New Zealand's most famous outlaw: James Mackenzie, a sheep rustler who, along with his sheep dog Friday, was accused of sheep stealing. He was finally captured in 1855 in the company of a thousand stolen sheep, and after a series of escapes and increasing illness, he was released in 1856 and promptly disappeared forever [43].

Later J. H. C. Sidebottom who had captured Mackenzie swiftly applied for the leasehold of almost all the Basin for sheep grazing. He was soon followed by others and by the mid 1860s all the land had been taken up in a dozen runs mostly by folk from Christchurch, mid-Canterbury or Nelson. Ferries were set up on the Tekapo, Pukaki and Ohau Rivers by the 1870s but travel was extremely slow; bullock trains were often used and road building was difficult because of the extremes in weather [35].

During the period of early settlement Maori were active in pursuit of their rights to justice which in recent times the Waitangi Tribunal has attempted to redress. The inexperience of the early run holders led to a lot of environmental damage, particularly soil erosion caused by burning tussock, overgrazing and the introduction of rabbits which reached plague proportions by the 1880s. During the 1860s there came an "invasion of Highland and Lowland Scottish shepherds…a heaven-sent blessing to the struggling run-holders" [34]. The Scots drew the run-holders' attention to better farming practices and were consequently often hired to manage the stations and "in many cases, this canny Scotsman finally acquired the run himself" [34]. Farming in this fragile ecosystem required a conservative approach and considerable local knowledge. A disastrous snowfall in 1895 also led to heavy stock losses but in following years reserves of winter feed were increased. Rapid change in land-ownership was also considered to be a cause of environmental degradation.

Raising Merino sheep for wool remains the prime industry of the settlers of the Mackenzie District. In the 1940s soil conservation became an important issue which was addressed by the formation of the High Country Committee and later the Land Act 1948, which confirmed the land would remain leasehold and set conditions on its management. There is more information about runs and the 1948 Land Act in Section 14. Land Ownership and Administration.

6.7 Tourism, Hydro-Electricity and Farming

Poor environmental practices led to the appointment of a ranger, Frank Huddleston, in the mid-1880s. He purchased 30 acres (c. 12 ha) of land near the base of Mueller Glacier and built the first Hermitage hotel, "believed to have been a small cob building" [35]. This was later sold to the Mt Cook-Hermitage Company, which also ran its own coach service between Fairlie and the Hermitage. It took a visitor three days to travel from Timaru to Mt Cook. Later exotic game animals, such as chamois and Himalayan Thar, were introduced to attract wealthy hunters. In 1935 an airstrip was built, which is now the site of the proposed second core for the Starlight Reserve [35].

Irishman Creek and the Hamilton Jet

Another successful enterprise to have come from the Mackenzie country was the invention of the renowned Hamilton Jet. Hamilton owned a station at Irishman Creek and the first private hydro-electricity was generated on this run from 1927 [49]. In the late 1930s he began an experimental engineering workshop there. Despite the difficult logistics of being 40 miles from the nearest railhead and down a road that was often impassable during winter, Hamilton's team proved efficient enough to compete with imported machinery. Loader dozers, scrapers, road graders and other earth-moving machinery were manufactured there. During the 2nd World War the factory also produced munitions [34]. After the war the factory was relocated to Christchurch and the original premises devoted principally to experiment. From this back-yard tinkering developed an invention that would revolutionize the marine industry – the Hamilton Jet. Since those early days there have been several modifications to the original design. "Hamilton Jet is highly successful and exports almost all of its production to more than 45 countries world-wide" [50].

The Hydro-electric Schemes

Production of hydro electricity has had a major impact on the landscape of the Mackenzie Basin. Construction of the first dam on the Waitaki River began in 1928 and the Upper Waitaki Scheme stage commenced in 1938. By the 1980s the scheme had expanded to five power stations, on Lakes Ohau, Pukaki and Tekapo, followed by the construction of Lake Ruataniwha. The greatest visual impact may be from the connections between the dams "and a system of connecting canals now cross the Mackenzie Country like turquoise highways − ribbons of blue on the scorched brown earth" [39]. The schemes raised the lake levels of Pukaki, Tekapo and Ohau and have had an ongoing impact on river levels. A large area of the basin will not be developed because it is designated as flood plain.

Salmon Farms

Salmon has been farmed in the hydro canals in the Mackenzie Basin since 1992. There are three commercial operations and a smokehouse in Twizel. "Salmon is a big part of life in Twizel…I don't think I have been to a barbecue where salmon wasn't served" said Graham Hughes of the Twizel Events and Information Centre in 2005. One of the salmon farms is on the main highway south of Tekapo and is a favourite stop for both domestic travellers and well-informed foreign tourists. Clientele can point to their preferred choice of live salmon to have it fished out, cleaned and filleted on the spot. They can also choose from pre-prepared smoked salmon or sashimi for very reasonable prices. The Mt Cook Alpine Salmon Farm uses the "clear alpine waters of the Lake Tekapo hydro canal" and claims to be the "highest such farm in the world" [51].

Figure 6-2. Mt Cook Alpine Salmon Farm. Retrieved from: http://www.waymarking.com/waymarks/WM8K9F_HIGHEST_Salmon_Farm_in_the_World_Mackenzie_District_New_Zealand

Salmon and many other fish are known to be light sensitive. During a full moon they are less likely to be active at night, whether breeding or migrating, as opportunities for predators are greater. Farmed salmon may be safer from predators; however, sockeye salmon are one of the two species of salmon found in the lakes and rivers that are popular with anglers. The extension and continued enforcement of the Lighting Ordinance are appropriate for the efficacy of salmon farming and to protect the region's natural fisheries.

6.8 Contemporary Developments

Pastoral Farming and Landscape:
In the Mackenzie Basin pastoral farming is significant for local employment, with tourism following closely. Sheep and cattle stations still cover hundreds of hectares. Popular accounts of the area emphasize the iconic status of the sheep and dogs. Poor returns for sheep farming meant that the numbers of rabbits had expanded again in the 1990s to the extent that some runs were uneconomic. At this period the spread of Hieracium (hawkweed), an unproductive introduced species of weed, became perceptible. The release of Rabbit Calicivirus or RCD (a virus illegally introduced to New Zealand) reduced the pressure from rabbits in the short to medium term. However, rabbit numbers are again increasing.

Today some agricultural production has turned to *value added* products such as the high fashion garments of Icebreaker whose profile is increasing in international markets; an important part of their marketing is the allusion to the romance of the high country.

In recent years the Benmore Irrigation Scheme has allowed the fattening of dairy cattle between Ruataniwha and Omarama and landscape change has made steady inroads in the

south of the Mackenzie Basin using huge irrigation systems [48]. This has not been without controversy, owing to the amount of water required to support irrigation in an area renowned for extremely low rainfall and declining lake levels and the change in the appearance of the tussock grasslands.

As discussed earlier, the land in the Mackenzie Basin is generally used for grazing stock, whether it is sheep or cattle. The farming industry may be unconcerned about light pollution affecting their production, and with intelligent lighting, modern farming practices pose little or no threat to a Starlight Reserve. Historical and current agricultural activities in the area contribute to the sense of place that the local people have living in a rural area. Therefore, agriculture too is an important part of the cultural landscape.

Water Management:
Whilst the production of hydro-electricity from the Southern Lakes may appear to have nothing to do with the cultural landscape, it is part of the history of development in New Zealand and is clearly presented in this way in the visitor centre at Lake Pukaki. Water is a scarce resource in this area, and recently has been used for irrigation as well as electricity generation. There is wide public interest in the expansion of irrigation due to awareness of issues of sustainability and the importance of New Zealand's "clean green image".

6.9 Cultural Activities in the Basin and Starlight Reserves

Contemporary Art and Conservation

The beautiful vistas of the Mackenzie country have long been the subject of landscape paintings and photography. Many notable artists including Austen Deans, Grahame Sydney and Michael Sass have used the Mackenzie country as a subject or influence in their artwork, (see Figure 6-3). A website called *The far-away hills: South Canterbury's Heritage preserved by artists who painted in the Mackenzie* contains nearly 30 twentieth century artists and is not complete [52]. Esther Hope was a notable mid-twentieth century artist who also contributed the concept for the Church of the Good Shepherd.

Figure 6-3. Southern Light by Michael Sass. Retrieved from: http://www.michaelsassartist.com/southernlight

Fraser Gunn is a photographic artist who not only captures stunning images of the landscape around Lake Tekapo, but also produces colourful images of nebulae, the southern aurora and other astronomical phenomena from the Mt John Observatory. He has produced some spectacular and iconic images of the Church of the Good Shepherd, on the shore of Lake Tekapo, against a background of starry skies.

Figure 6-4. Photograph of the Matariki (Seven Sisters) taken by Fraser Gunn in the Mackenzie Basin.

Capturing the night sky above the Mackenzie Basin in artistic form has likely been practised for hundreds of years. Although some oral tradition has been lost, making the Mackenzie Basin rock art difficult to interpret, it is highly likely that some of the drawings inscribed the movements of certain stars or constellations. "The elders looked into the heavens and marked the various star houses into the landscape, normally into rock overhangs or scribed into the sides of caves. If the star movements indicated that devastation was approaching, they would scribe the star message onto small tablets of clay, and fire them in the umu ukurangi" [36].

Art − be it indigenous rock art, contemporary landscape paintings, or astrophotography − is a tangible expression of the aesthetic, spiritual and cultural values that are layered over its subject. The Mackenzie Basin and the sky above it are deeply imbued with these values that are shared by both Maori and Pakeha.

7. Night sky quality

The Mackenzie Basin has the clearest, darkest and the most spectacular night sky in New Zealand. Owing to the high number of clear nights throughout the year, the stability and transparency of the atmosphere in the area and its unique dark skies, the Mackenzie region is internationally recognised as one of the best sites for viewing and researching the southern sky. The Magellanic Clouds (satellite galaxies to the Milky Way that are invisible to the northern hemisphere) can be seen continuously throughout the year. Apart from its favourable climatic conditions and geographic advantages, the on-going efforts of the local authorities and the residents in enforcing the lighting ordinance in the past 30 years have made the Mackenzie Basin an ideal candidate for an International Dark Sky Reserve.

7.1 Brightness measurements of night sky.

Night-sky brightness (NSB) is a direct measure of the night sky quality. Ideally, the night sky should be completely unpolluted by artificial lighting and has minimal brightness.

A comprehensive sky quality survey of the cores and the peripheral region in the Mackenzie Basin was untaken in 2011. The assessment of the NSB involved the measurement of the sky brightness using portable light-sensing devices called the Sky Quality Meter over a seven-month period beginning in June 2011.

A **B**

Figure 7-1. (Left) the Sky Quality Meter, SQM, with the light sensor located on the side of the near-infrared filter next to the display. **(Right)** SQM-L (SQM with a lens). While the SQM averages sky brightness over 25% to 50% of the visible sky, the SQM-L has a field of view of about 20° in diameter.

The meters are made by Unihedron and they have been calibrated by Pierantonio Cinzano [53], who has shown that their spectral response is a broad band centred on 550 nm, but with full-width half maximum response limits from 380 to 640 nm. The brightness measurements are close to the Johnson V band in visual magnitudes per square arc second, even though the response is broader than the Johnson V band. The Sky Quality Meter (SQM) is a device that instantaneously measures the brightness of the night sky in units of magnitude per arc second square (mag arcsec^{-2}), the international unit for sky brightness measurements. The SQM was selected for sky brightness measurements because of its portability (approximately the size of a deck of playing cards operating on a 9V battery) and its ease of use. As shown the images above, two SQMs of different models (SQM and SQM-L) were used. While both models are sensitive only to a narrow cone of sky directly in front of its sensor, the half width at half maximum (HWHM) of the SQM sensitive light cone is 42° and that of the SQM-L is 10° [54]. The narrow angular sensitivities of the SQMs reduce the chance for the NSB measurements to be affected by direct illumination from surrounding lightings and scattered light.

The NSB measurements were made by holding the SQM overhead with the sensor side of the SQM orientated along the zenith. All measurements were acquired after sunset in the absence of the moon (before moonrise and after moonset).

A summary of the SQM measurements collected in the survey is summarised in Table 7-1 below (refer to Appendix C for the complete SQM data set).

	Primary Core		Secondary Core	Peripheral Regions		
	Mt John (Main Car Park)	Mt John (South Car Park)	Mt Cook Airport	Lake Alexandrina	Mt Cook Village	Tekapo Village
Darkest (mag arcsec^{-2})	21.80	21.65	21.48	21.82	21.66	21.89
Brightest (mag arcsec^{-2})	21.22	21.21	21.33	21.49	20.96	20.61
Average (mag arcsec^{-2})	21.67	21.51	21.40	21.66	21.36	21.39

Table 7-1. Night sky brightness measurements of the Mackenzie Basin. The difference in brightness of each magnitude corresponds to a factor of approximately 2.5.

The lighting survey found that the average NSB level of the primary core at Mt John was 21.67 mag arcsec^{-2} at the main car park and 21.51 mag arcsec^{-2} at the south car park, while an average of 21.40 mag arcsec^{-2} was recorded at Mt Cook Airport (the secondary core).

At locations surrounding the cores, an average of 21.36 and 21.39 mag arcsec^{-2} were recorded in Mt Cook Village and Tekapo Village, respectively. Although these values indicate slightly brighter skies than those at the cores, it is important to note that these measurements were acquired in populated centres. Away from the villages, no reading taken within the proposed Starlight Reserve boundaries had a NSB value brighter than 21.20 mag arcsec^{-2}.

According to the Light Pollution Handbook, the practical minimum of the natural background radiation is 21.60 mag arcsec^{-2} [55]. The data from the sky quality assessment indicated that the night sky qualities at the proposed cores in the Mackenzie basin are comparable to that of the natural unpolluted night sky.

The nomogram in Figure 7-2 [56] below compares the night sky quality of the proposed Aoraki Mackenzie Starlight Reserve in magnitudes per arc second squared to other assessment schemes. Sky brightness measurements of 21.67 and 21.51 mag arcsec^{-2} at the primary core correspond to a Bortle class of 2, representing a virtually pristine night sky. Should the application of the Aoraki Mackenzie Starlight Reserve be successful, the intention is to maintain a sky quality measurement program based at Mt John to make regular assessments on the night sky quality in the IDSR.

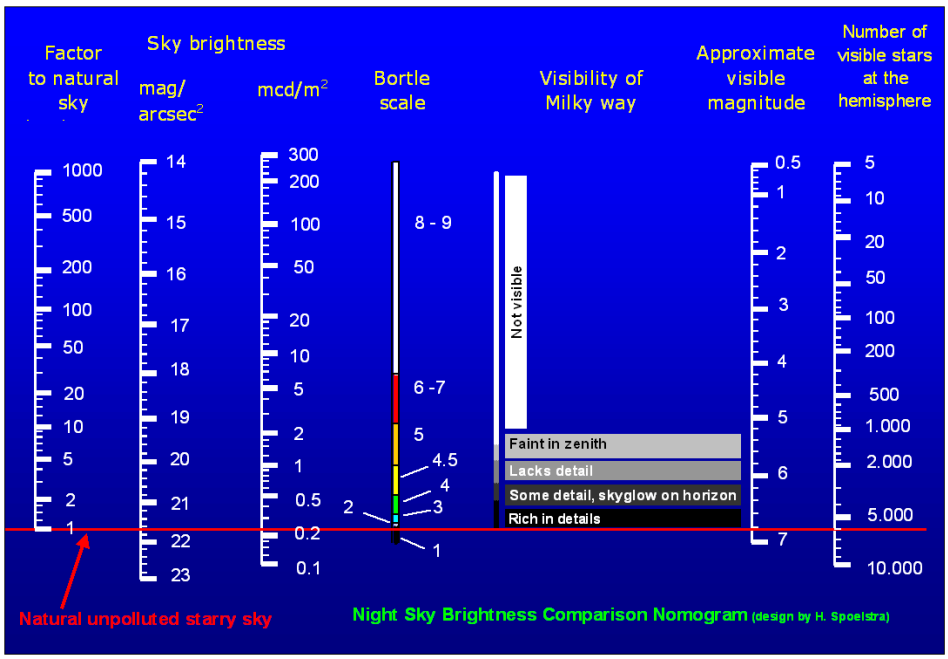


Figure 7-2. Nomogram comparing the different assessment scales of night sky quality. The horizontal red line represents the sky quality of the natural unpolluted moonless sky, with values of 21.60 mag arcsec^{-2} and a Bortle class of 2 (Figure from Dark Sky Awareness website).

To further demonstrate the excellent sky quality of the Mackenzie Basin, the photos below show the wide array of visible sky phenomena captured by professional astro-photographer Fraser Gunn in the Mackenzie Region.

Figure 7-3. (Above) Photograph of the Aurora Australis (Southern lights) with Mt John in the foreground taken near Tekapo on 27 September 2011.

Figure 7-4. (Top Left) Photograph of the southern lights taken from the top of Mt John on 24 March 2007.
(Top Left) Photograph of the southern lights and the Church of the Good Shepherd taken at Lake Tekapo.
(Centre) Photograph of the Milky Way taken in the Tekapo area.
(Bottom Left) Photograph of the Milky Way with the Large and Small Magellanic Clouds viewed from top of Mt John, visible on cloudless nights throughout the whole year.
(Bottom Right) Photograph of the Large and Small Magellanic Clouds taken from the top of Mt John.

Figure 7-5. (Top) Photograph of the Orion Nebula taken from the top of Mt John.
(Centre) Photograph of the Tarantula Nebula taken from the top of Mt John.
(Bottom) Photograph of the Horse-head Nebula taken from the top of Mt John.

7.2 Light Pollution

Outdoor lighting is an indispensible element of modern civilised societies for safety, recreation, and decorating purposes. However, poorly designed lighting systems and excessive illumination levels can lead to a huge waste of energy and a range of undesirable environmental impacts.

According to the International Dark-Sky Association, light pollution refers to any "adverse effect of artificial lighting including sky glow, glare, light trespass, light clutter, decreased visibility at night, and energy wasted" [57]. It is a form of environmental degradation where excessive artificial outdoor lightings such as street lamps, neon signs and illuminated signboards, affect the natural environment and the ecosystem. The wasted light emitted directly upwards or reflected upwards from poorly-designed artificial light sources can be scattered by clouds, fog, and pollutants suspended in the atmosphere. The night sky is thus obscured with an orange haze, resulting in a reduction of the number of visible stars caused by the decrease in the light contrast.

Light pollution can be significantly reduced by using fully-shielded lights that direct light onto the target area and prevent it from escaping upwards and sideways. Mt John Observatory has had excellent co-operation from residents, businesses and developers in ensuring that all lightings in the Tekapo area comply with the Mackenzie District Council District Plan. To educate residents on the prevention of light pollution, the Mackenzie District Council provides all new home owners and building developers with lighting guidelines. This handout is included in Appendix F. Below are two photos of Tekapo Village taken with a Canon EOS 7D camera at around 11 pm from the summit of Mt John.

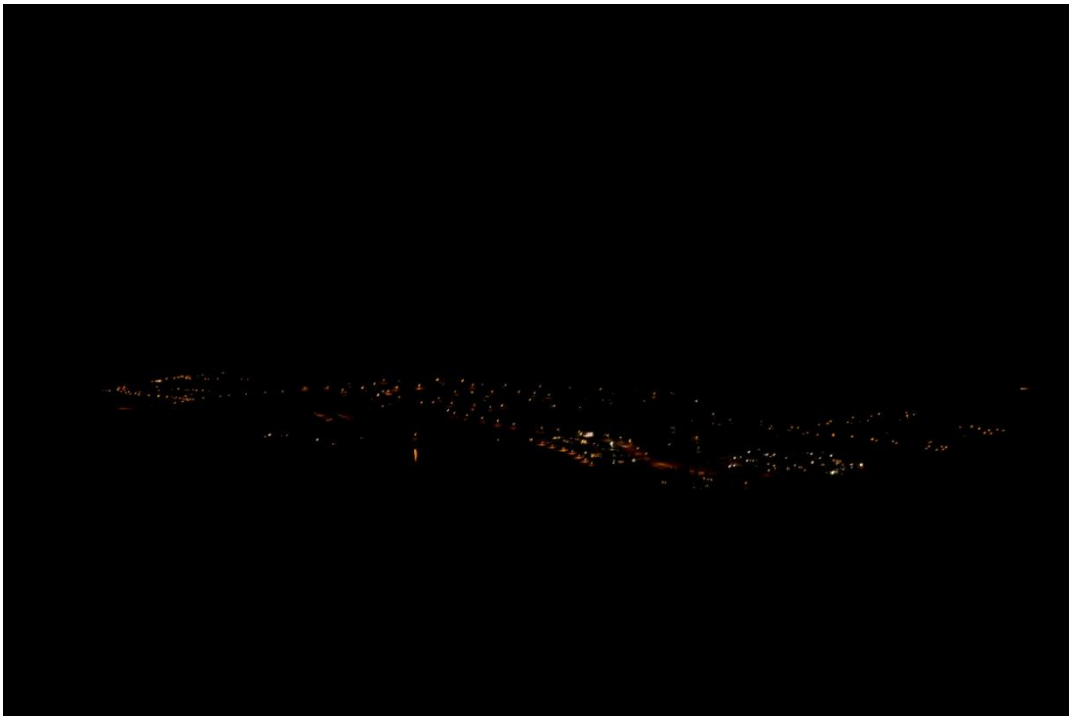


Figure 7-6. (Top) Photograph showing the night view of Tekapo Village observed from the top of Mt John on 9 December 2011 (exposure time of one second).

Figure 7-7. (Top) Night view photograph of Tekapo Village taken with the same settings as the photograph above with an exposure time of five seconds.

The two photographs above demonstrate that in spite of the close proximity, the upward light spill from Tekapo Village has no significant impact on the night sky quality of Mt John. From the first photograph taken with an exposure of one second, the light from Tekapo is indirect and appears very faint. Even when the exposure is increased to five seconds, the second photograph shows that all lighting in the Village is well shielded and directed downwards to prevent light pollution.

7.3 Outdoor Lighting

Mt John:

There are no outdoor lighting fixtures on Mt John. Only portable torches are used for lighting at night. All vehicles are instructed to dim their headlights to parking lights around the summit area.

Mt Cook Airport:

As Mt Cook Airport normally only operates during daytime, there is no outdoor lighting at night.

Tekapo Village:

Tekapo Village is located within the Mackenzie District. As such, all outdoor lighting is regulated and monitored by the Mackenzie District Council. The Lighting Ordinance covers

the whole Tekapo area and beyond, so all luminaires in the village are required by law to be shielded and filtered to reduce ultra-violet/blue light emission. Because light of shorter wavelengths, such as blue light, are two to four times more detrimental to the night sky quality than yellow light, the installation of mercury vapour, incandescent and fluorescent lamps are discouraged in the area. Most lighting fixtures in Tekapo Village are low pressure sodium (LPS) lamps which emit a near-monochromatic wavelength, consisting of two close spectral lines of 589.0 and 589.6 nm, in the yellow range.

The following table shows the quantities and descriptions of all the different types of street lighting fixtures in Tekapo Village. The comprehensive list of street lighting in Tekapo Village and the corresponding luminaire specifications are enclosed in Appendix B.

Location	Type of Lamp	Make/Model	Lamp Make	Quantity
Yard at End of Allan Street	2×30 watts fluorescent	GEC	OSRAM	2
Village Centre Car park	2×55 watts sodium vapour	Gough/GL 600	OSRAM	1
Community Hall	2×30 watts fluorescent	GEC	OSRAM	2
School	2×30 watts fluorescent	GEC	OSRAM	2
General Street Lighting	35 watts low pressure sodium	Gough/GL 500	OSRAM	46
	2×30 watts fluorescent	GEC	OSRAM	6
	55 watts sodium vapour	GEC/Kowhai 100	OSRAM	9
	4×400 watts high pressure sodium	GEC	OSRAM	2

Table 7-2. List of the numbers of different types of luminaires in Tekapo Village.

Lighting technologies are constantly improving and over the past several years, there has been increasing popularity and interest in LED light installations in the fight against light pollution.

Currently, all new subdivisions in the township of Tekapo are illuminated by fully cut-off LPS bollards. To improve the efficiency and the lifetime of the luminaires, the Mackenzie District Council is now reviewing the retrofitting of approximately 80 LPS bollards with LED (light-emitting diodes) lamps. Rapidly evolving LED lighting technologies have surpassed the energy efficiency of traditional lighting such as high-pressure sodium and metal-halide lights. Apart from a reduction in energy consumption, LED lights can also be controlled (dimmed) in ways that older fixtures cannot. In contrast to most traditional light sources, LED lights provide highly directional light rather than emitting light in all directions. These beam patterns can be finely adjusted to focus light only on areas where it is useful, increasing the overall system efficiency and further decreasing light pollution.

7.3.1 Street Lighting in Tekapo Village

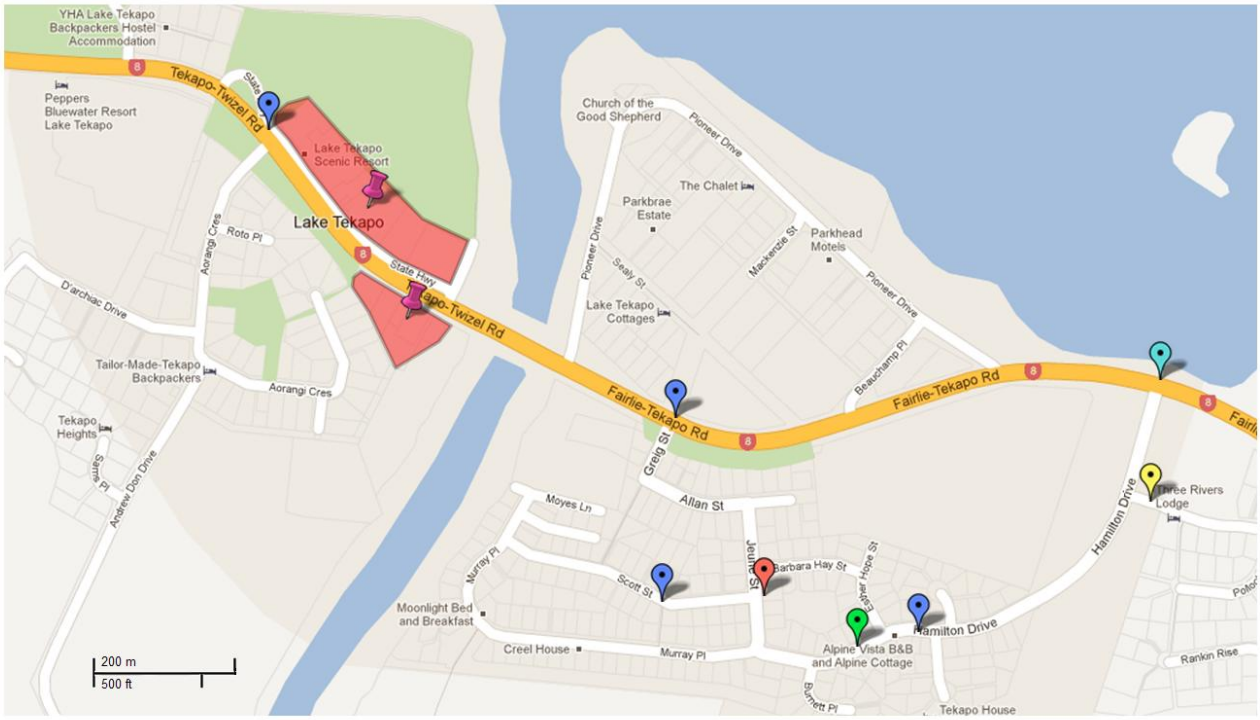


Figure 7-8. Map Showing the locations of different types of lighting in Tekapo Village. The different coloured markers represent different types of lighting as discussed in the section below.

The markers in the map above show the locations of all the different types of street lighting found in Tekapo Village. There are five main types of street lighting, all managed by the Mackenzie District Council. The area highlighted in red is the main village centre where lighting is maintained by individual businesses so a comprehensive list of all lighting fixtures in the area their specifications is impractical and impossible to obtain. However, a series of photographs showing all lighting in the business centre is included in the following section.

According to the IDA, all luminaires should ideally be full cut-off, which means that the luminarie must have a light distribution where the candela per 1000 lamp lumens does not numerically exceed 2.5% at an angle of 90 degrees above nadir, and 10% at a vertical angle of 80 degrees above nadir [64].

Despite the manufacturer's claim of downward light distributions (Appendix B), the GEC 4×400W high-pressure and the Gough G/L 500 35W luminaires have a drop lens underneath and are mounted on an up-tilted bracket. The drop lens hanging below the edge of the lamp casing could internally reflect light upwards, resulting in upward light spill. The tilted bracket means that lamp is not mounted parallel to the ground, resulting in a potentially more scattered light distribution than required.

Gough 35 Watts Low-Pressure Sodium

Locations: Along Fairlie-Tekapo Rd, Scott St and part of Hamilton Dr, Murray Place.

The majority of the streets in Tekapo Village are lit by the Gough G/L 500 35W low-pressure sodium lamps. The light distribution measurements in the manufacturer's catalogue (see Appendix B) show that the luminaire effectively confines all light within 160°, eliminating all upward spillage.

Figure 7-9. (Above) Photograph of the G/L 500 luminaires along Fairlie-Tekapo Rd (a.k.a. S.H. 8) at night. Notice that the light is primarily shone onto a small area directly underneath each lamp, which is an indication of good lighting design.

GEC 4×400 Watts High-Pressure Sodium

Location: Jeune St

Figure 7-10. This luminaire has the same housing as the above model but the type of lighting is replaced with four high-pressure sodium lamps. It has similar light distribution to the luminaire above.

GEC 55 Watts Sodium Vapour

Locations: part of Hamilton Dr.

Figure 7-11. There are several luminaires of this model erected in Tekapo Village. The image on the left shows that the light tube is well shielded on all four sides to direct light downwards.

Low Pressure Sodium Bollards

Location: Mt John Village Subdivision

Figure 7-12. The Mt John Village Subdivision is lit by the 9-finned Windsor Heritage Bollard lights. These bollards have been tested and verified by the staff at Mt John Observatory staff to comply with the requirements of the Observatory.

Gough 2×55 Watts Sodium Vapour

Location: part of State Highway 8 near Village Centre

Figure 7-13. There is a single street lamp of this model in the whole Tekapo Village. The image on the left shows that all light at or above the horizon is shielded. All downward light exits through a flat window where it is directed at a small area with minimal scattering.

7.3.2 Other Types of Outdoor Lighting in Tekapo Village

Apart from street lighting, the external lighting outside the shops in the main Village Centre is also a major potential source of light pollution. However, these luminaires are required to be switched off by 11 pm so they do not pose a significant threat to the scientific and stargazing activities on Mt John Observatory.

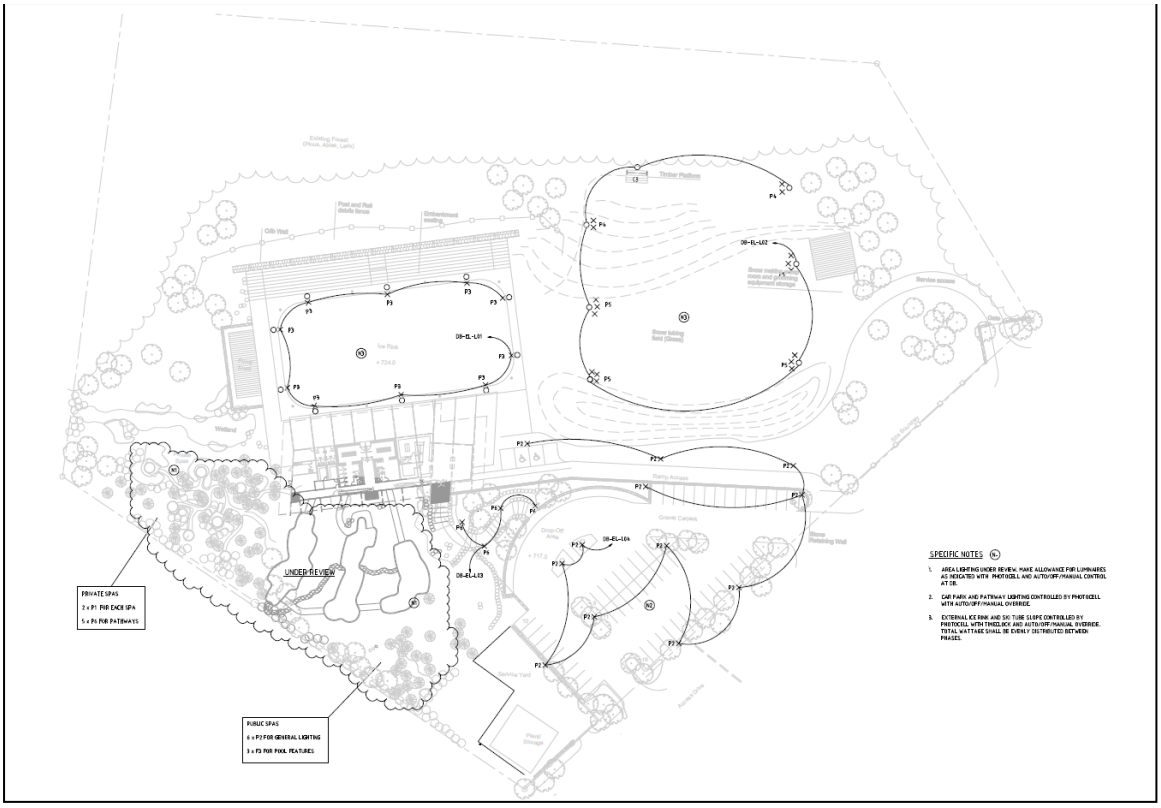
Another significant source of lighting at Tekapo Village is the outdoor lighting at the Tekapo Alpine Springs Winter Park on the western end of Tekapo Village. Of special concern are the 450 W pole-mounted metal halide floodlights installed at the ice rink. Although these luminaires are UV-shielded and full cut-off to produce zero upward light output, observations with the eye indicated some reflection of light off the ice into the air and surroundings.

The operators of Tekapo Alpine Springs Winter Park have demonstrated considerable commitment in reducing light pollution while at the same time balancing their own business interests. One good example is the use of the less desirable metal halide lamps, which have relatively higher colour rendering index than the monochromatic low pressure sodium lamps. With a very poor colour rendering of effectively 0 rating, low pressure sodium lamps cause little interference to the night sky and are considered an ideal light source for minimal light pollution. However, when the rink is used as an ice skating rink or an ice hockey venue at night, the use of low pressure sodium lights would cause team uniform and skin colour distortion, making it unsuitable for team-sports and photography.

A compromise was made by the owners of the Tekapo Alpine Springs Winter Park that allows quality photography while minimising light pollution. The metal halide lamps were adjusted to the minimum brightness required for recreational ice hockey. While international standards suggest a light level of 300 lux, the ice rink at Tekapo was reduced to an average of 50 lux. In addition, the owners have agreed to no illumination of the ice rink between the hours of 11:00 pm and 6:00 am as outlined in their resource consent application (please refer to Appendix B). As the astronomical activities at Mt John primarily take place after dark, the operating time restrictions of the luminaires should minimise the impact of light pollution.

Figure 7-14. (Above) Photograph of the full cut-off flood lights around the ice rink at the Tekapo Alpine Springs winter Park. All lights are required to be switched off between11 pm and 6 am**.**

(Below) the different types of lighting in Tekapo Alpine Springs Winter Park. The labels correspond to the different luminaire types as described in the Table 7-3 (see enlarged map in Appendix C).



Type	Rating (W)	Description	Manufacturer	Image
P2	1 x 150W MH	Post top luminaire with IP65 rating on 8 m pole.	Legend Classic	
P3	1 x 450W MH (UV)	Pole mount cut-off luminaire with zero UWLR. 10m pole and 0º tilt. Comes complete with 450W Venture UV-shield lamp. Pole shall be rigid type.	Ruud VFT 450	
P4	2 x 450W MH (UV)	Pole mount cut-off luminaire with zero UWLR. 15m pole with bracket for dual luminaires 60º apart and with 0º tilt. Comes complete with 450 W Venture UV-shield lamps. Pole shall be rigid type.	Ruud VFT 450	
P5	3 x 450W MH (UV)	Pole mount cut-off luminaire with zero UWLR. 15m pole with bracket for 3No. luminaires 60º apart and with 0º tilt. Comes complete with 450 W Venture UV-shield lamps. Pole shall be rigid type.	Ruud VFT 450	
P6	1 x 35W MH	Bollard	LSI Hyperion Bollard HYPR-35MH-G12-ELBLK-DT	

Table 7-3. (Above) Descriptions and images of the different types of external lighting at Tekapo Alpine Springs Winter Park.

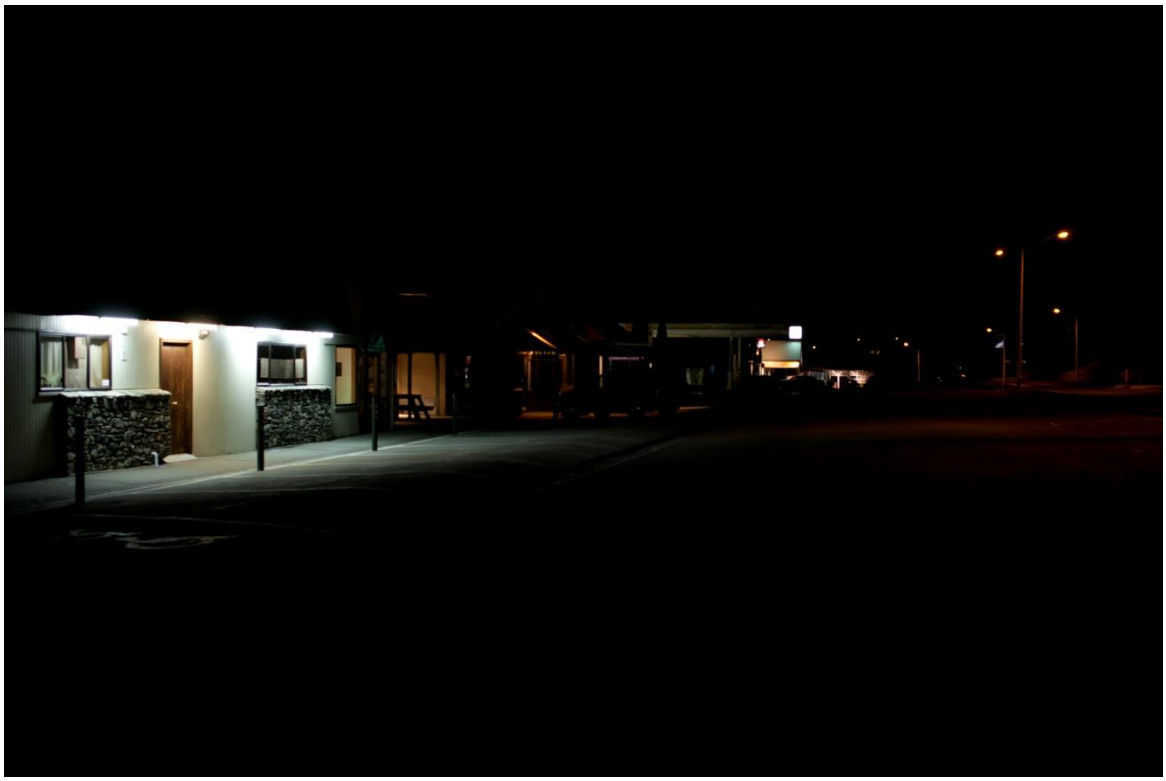


Figure 7-15. (Above) Photograph of the lighting on the western side of Tekapo Village Centre. Most lights in the Centre are switched off before 11 pm.**.**

(Below) Photograph of the eastern side of Tekapo Village Centre. The photo shows that all lighting is positioned underneath the roofs to prevent upward spillage. The lit sign in the middle should by law be turned off before 11 pm each night.

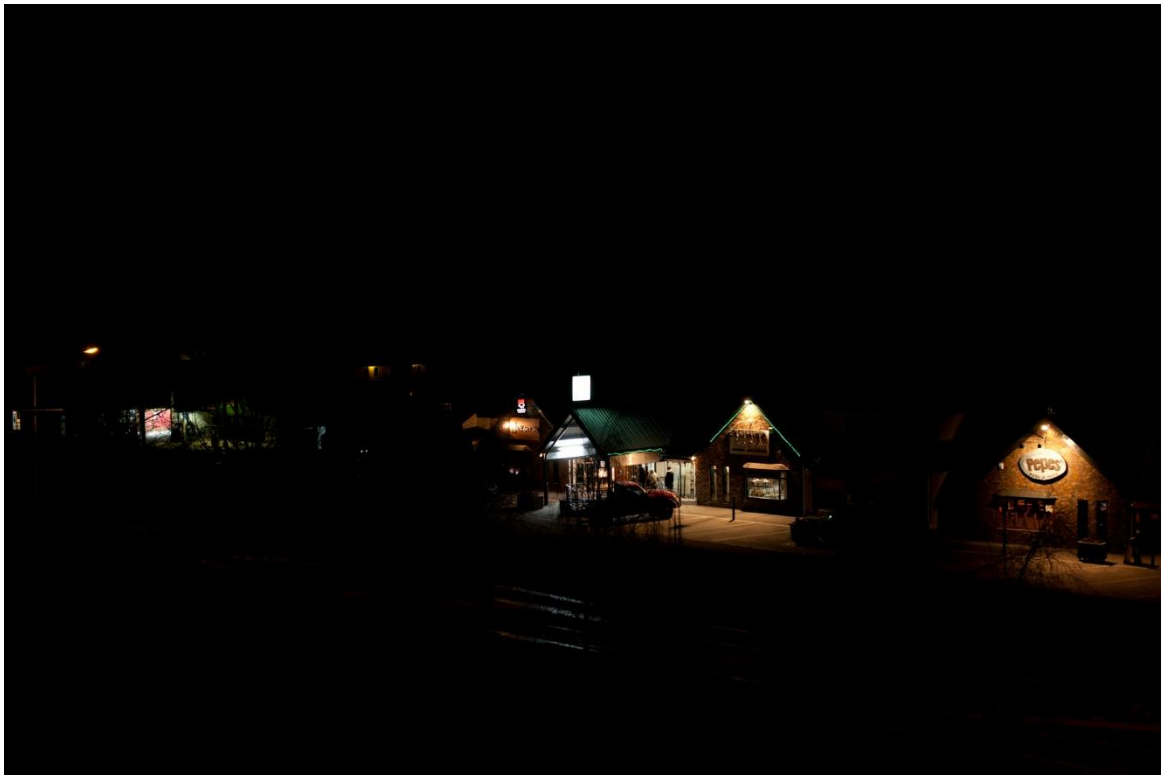


Figure 7-16. (Above) Photograph of the exterior lighting near the entrance of Godley Hotel on eastern side of Tekapo Village Centre

(Below) Photograph of the Challenge Service Centre opposite the Village centre. The photo shows that all lighting is positioned underneath the roofs to prevent upward spillage. The lit sign in the middle is normally turned off before 11 pm each night.

7.3.3 Lighting Case Study: Mt John Village Subdivision

Figure 7-17A. Photograph of original non-compliant 5-finned

In mid 2003, the western side of Mt John Village subdivision was installed with 5-fin Kendelier bollards, as pictured on the left. However, this design was deemed "totally unsuitable" as street lighting for use in Mt John Observatory's dark sky region. The wide spacing between the fins resulted in significant light spillage in all directions over a large angle and a large fraction of direct light was projected upwards. Furthermore, as the bollards were at eye level for car drivers, glare from the horizontal light spill was a potential hazard for motorists and pedestrians.

The Kendelier bollards were switched on briefly in July 2003 and then quickly switched off following complaints from neighbouring properties. A few months later, another lighting company called Windosor Heritage presented the Riga bollard design, which was then evaluated by the University of Canterbury to be compliant to the Mt John Observatory's requirements.

Figure 7-17B. Photographs of the new bollard design during the day **(Left)** and turned on at night **(Right)**.

A prototype of the new bollard design (see figure 7-17B on right) was inspected at Mt John Observatory on 01 March 2004. The bollard was redesigned with downward-pointing fins and additional top conical shielding to eliminate upward spill. The prototype demonstrated that light was primarily directed downward with no direct horizontal light emission. An important feature in the new design is the additional clear cylindrical shield around the lamp.

Figure 7-17C. Photograph of installed new Windsor Heritage Rigabollard.

The new Windsor Heritage Riga bollard design was assessed and tested to conform to the lighting requirements of the Mackenzie District Council and to the needs of Mt John Observatory to maintain the dark sky quality of the region. To further reduce light polluation, the Riga design was improved to include nine fins.

Since the approval of the revised 9-fin Riga bollard design (Figure 7-17C on the left) they have been implemented with LPS lamps around Mt John Village subdivision to replace the inferior Kendelier bollards.

Mt Cook Village:

Mt Cook Village is located 4 km away from Mt Cook Airport, the secondary core of the proposed Mackenzie Starlight Reserve. Due to its proximity to the core, well-designed outdoor lighting is essential for the preservation of dark skies at the Village.

Mt Cook Village lies within Mt Cook National Park, where all lighting is managed by the Department of Conservation (DOC). According to DOC's Aoraki/Mt Cook National Park Management Plan 2004,

> "*All lighting will be required to shed light downwards and minimise light spill into the wider National Park; to avoid affecting people's night vision and to minimise any detraction from the natural dark values of the Village's setting within the park.*"

The Mt Cook community also plays an active part in protecting the night sky and energy conservation. The Mt Cook Village Community Plan states:

> "*By 2019, street lighting will have been upgraded to modern technology that provides good lighting that minimises upward light spill and electricity consumption."*

7.3.4 Street Lighting in Mt Cook Village

The table below shows the quantities and descriptions of all the different types of street lighting fixtures in Mt Cook Village. Refer to Appendix B for a comprehensive list of street lighting in Mt Cook Village.

Function	Type of Lamp	Make/Model	Luminance Flux (lm)	Quantity
Street Lights	12 watts LED (electricity-powered)	Solar Bright/SR PL01 240V	7.5	9
Street Lights	12 watts LED (solar-powered)	Solar Bright/SR SL01 Solar	7.5	2
Roadside Bollards	20 watts fluorescent	Solar Bright	4.5	14
Pathway Bollards	20 watts fluorescent	Solar Bright	4.5	21
Visitor Centre Bollards	20 watts fluorescent	Solar Bright	4.5	10
Pathway Bollards	1 watt LED	Solar Bright	90	21

Table 7-3. List of quantities of different types of lighting in Mt Cook Village.

There are four main types of street lighting in Mt Cook Village grouped strategically around the area. The different coloured markers on the map below represent the different types of lighting fixtures found in various parts of the Village. All existing street lighting in Mt Cook Village is supplied by a Christchurch lighting company, Solar Bright Limited and installed within the last three years. All lighting specifications of the lighting fixtures are included in Appendix B for the reader's interest.

Ideally, all outdoor lighting in Mt Cook Village should have a full cut-off design [58] that prevents upward light spill. It is important to note that although the 12 W street lights (solar as well as electric powered) are well shielded by the metal casing above, the drop lens or glass window underneath could potentially scatter light cover a large angle. These luminaries can easily be converted to full cut-off by replacing the drop lens with a flat glass window.

Map of all Street Lighting in Mt Cook Village

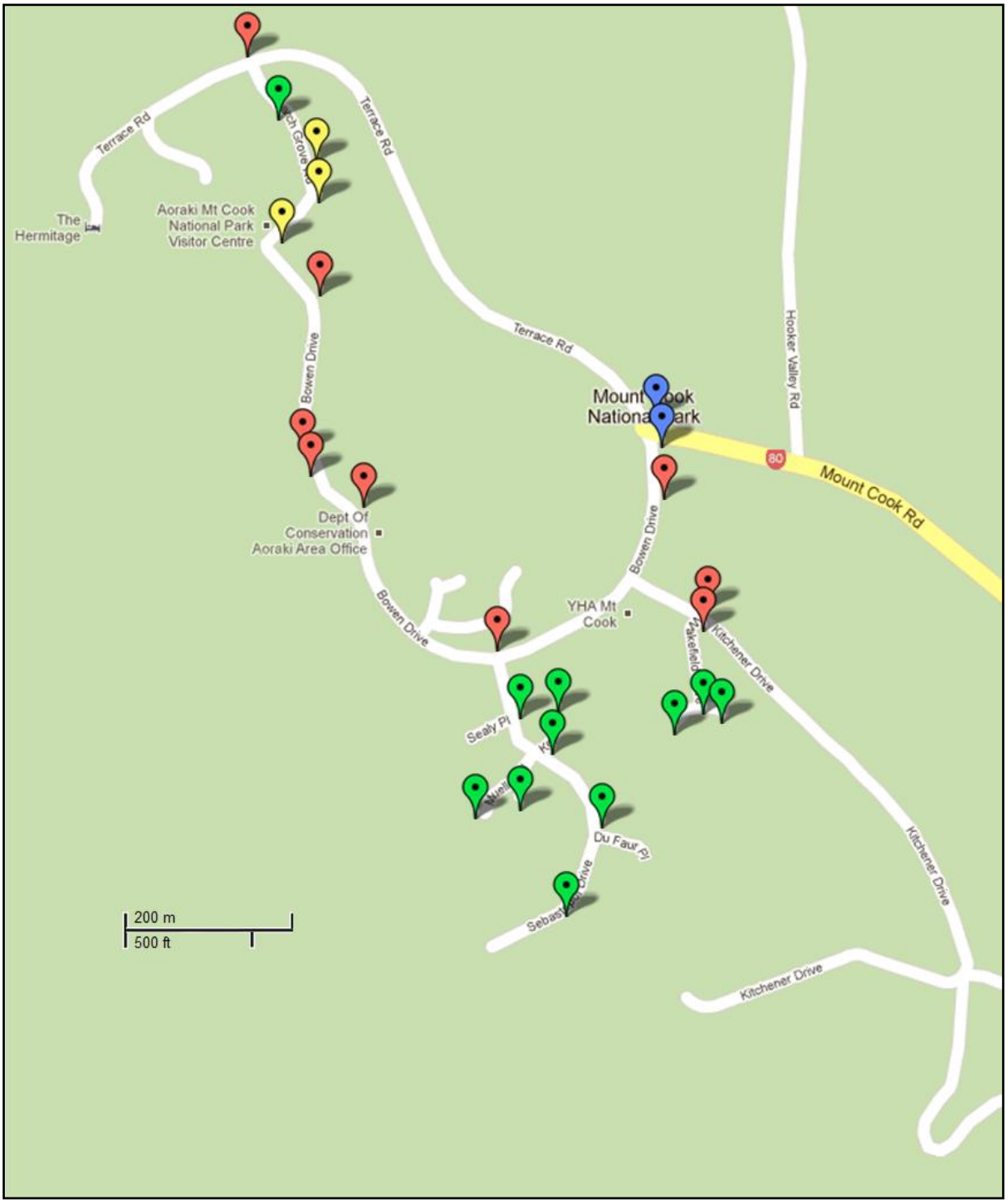


Figure 7-18. Map showing the positions of different types of street lighting in Mt Cook Village. The different colour markers correspond to the different models of luminaires as discussed in the following section.

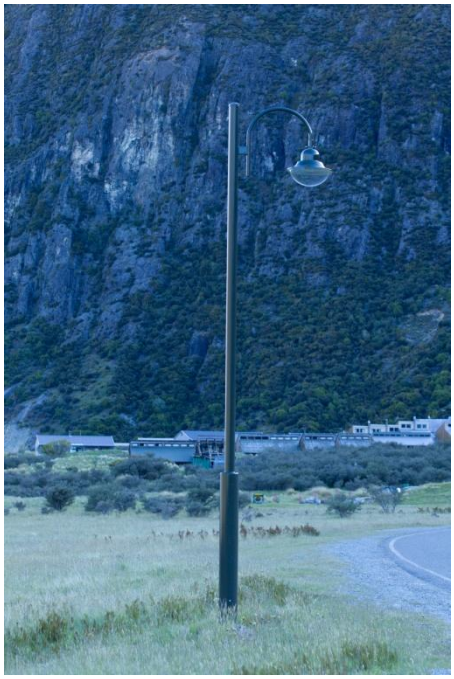
12 Watts LED Solar-Powered Streetlights

Locations: Intersection of State Highway 80 and Bowen Drive

There are two solar-powered Solar Bright SRSL 01 street lights installed near the entrance of Mt Cook Village. These fixtures are fitted with an E27 LED lamp (see Appendix B) that is shielded from above.

Figure 7-19. (Left-most) Photograph of whole luminaire. **(Left)** Close-up photograph of the lamp well hidden within the shielding to prevent light spill. (**Below**) Photograph of whole luminaire lit at night, note that the light is directed downwards.

12 Watts LED Electricity-Powered Streetlights



Locations: Along Bowen Drive

There are nine electricity-powered Solar Bright SRPL 01 streetlights fitted with E27 LED lights along Bowen Drive.

Figure 7-20. (Left) Photograph of whole luminaire. **(Top)** LED light bulb well confounded with the shielding.

Figure 7-21. (Above) Photograph of streetlight viewed at night taken with an exposure time of one second.

20 Watts Fluorescent Roadside Bollards

Figure 7-22. (Top) Photograph of road-side bollard.
(Right) Close-up of bollard.

1 Watt Finned-LED Roadside Bollards

Figure 7-23. (Above) Photograph of the road-side bollard with fins taken at night.
(Above Right) Close-up of the bollard showing the finned design for reduction upward light spill.

Figure 7-24. (Above) Photograph of the finned road-side bollard taken at night. Notice how the light is well confined to a small area around the bollard

7.3.5 Other Types of Outdoor Lighting in Mt Cook Village

Apart from street lights, other sources of light in Mt Cook Village include the pathway bollards along the footpath from Hermitage Hotel to Mt Cook Visitor Centre and other external lights from buildings in the Village.

Figure 7-25. (Above) Photograph of footpath bollards taken at night. Note the small area lit by each bollard along the path, indicating that light is being focused downwards onto the footpath where it is required and not wasted as light spill.
(Below) Photograph showing the external lighting near the entrance of the Hermitage Hotel.

State Highway 8 (segment within proposed Starlight Reserve):

The lighting along State Highway 8 is regulated and maintained my NZTA (New Zealand Transport Agency). The comprehensive list of lighting fixtures including the manufacturer's catalogue is enclosed in Appendix B.

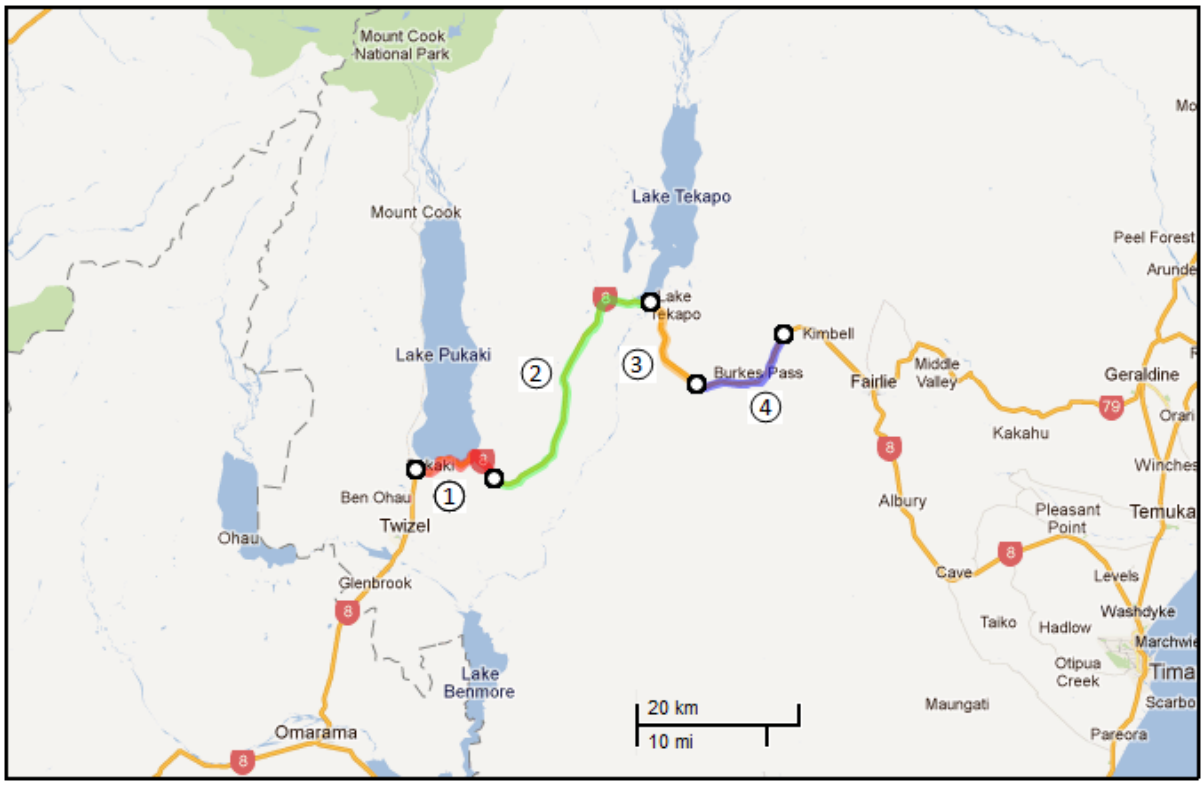


Figure 7-26. (Above) Map showing the different types of road lighting used along four segments of State Highway 8 in the Mackenzie District.

①

Type of Lamp	Light Make	Model	Quantity
1×35 watts low pressure sodium	Gough	GL 500	2
2×55 watts sodium vapour	Gough	GL 600	16

②

Type of Lamp	Light Make	Model	Quantity
1×35 watts low pressure sodium	Gough	GL 500	10
2×55 watts sodium vapour	Gough	GL 600	3

③

Type of Lamp	Light Make	Model	Quantity
1×35 watts low pressure sodium	Gough	GL 500	6

④

Type of Lamp	Light Make	Model	Quantity
2×30 watts low pressure sodium	No record	No record	4
1×150 watts sodium vapour	No record	No record	1

Twizel Township:

Twizel is the largest town in the Mackenzie District with a population of 1017 and located at a distance of 55 km from Mt Cook Airport. The area covered by the Lighting Ordinance has been recently been extended to include the township of Twizel in July 2011. The following table lists all the street lighting in Twizel, please refer to Appendix B for the comprehensive list. Other types of exterior lighting in Twizel are documented in the photographs in the following section. It is important to note that the township of Twizel is not in direct line-of-sight from either the Mt John or the Mt Cook Airport cores.

Location	Type of Lamp	Make	Model	Quantity
General Street Lighting	35 watts low pressure sodium	Gough	GL 500	324
	70 watts high pressure sodium	Gough	GL 500	16
	70 watts S.O.N	Gough	GL 500	15
	30 watts fluorescent	Gough	GL 500	2
	150 watts high pressure sodium	Gough	GL 700	13
	4×400 watts high pressure sodium mushroom	GEC	Unknown	15
	400 watts mercury vapour	GEC	Unknown	1

Table7-4. (Above) Table showing numbers of different models of street lighting along State Highway 8.

Figure 7-27. Photograph of the general Gough G/L 500 street lighting in Twizel, taken at Mackenzie Drive by Fraser Gunn (exposure time one second).

Figure 7-28. (Above and Below) Photographs of the exterior lighting at Twizel's Village Centre shopping mall taken with exposure time of one second, by Fraser Gunn.

7.4 Future Management for Outdoor Lighting in the Starlight Reserve

The local authorities and the residents in the proposed Starlight Reserve are commited to preserving the night sky quality in the region. One such example is The Lake Tekapo Community Board, which is constantly reviewing new lighting technology especially in relation to the use of LED lighting. According to the MDC, the Community Board is currently seeking suitable LED bulbs to replace the LPS bollards around Tekapo. It is also regularly reviewing the number of bollards in the residential areas to ascertain whether their numbers could be reduced without raising safety concerns. The Lake Tekapo Community Board also has a policy to eventually replace all older overhead lighting in the residential areas with bollard lighting. This will not only result in further reduction in light spill and reflection, but also provide a common type of lighting throughout all residential areas.

We are aware that not all the street lights in the three communities within the proposed Starlight Reserve are full cut-off lights, in which all light shining above the horizontal has been eliminated.

The Gough G/L 500 35W low-pressure sodium luminaires are the most common type of street light in all three centres of population. Although low pressure sodium is favoured for lighting close to astronomical observatories and in a Starlight Reserve, we acknowledge that the actual street lights used are not full-cutoff. To be full-cutoff they must be mounted parallel to the ground, and not have a lens hanging below the bottom edge of the lamp housing. The issue with the lens is that light is internally reflected back up into the sky, especially with the lamp mounted on an up-tilted outreach arm.

The Gough 2×55 watts Sodium Vapour shown could be classed as a full-cutoff lamp except that it is again mounted at an angle above horizontal. Unfortunately the NZ Transit Authority persists with this luminaire for main highways around the country.

In the Aoraki/Mt Cook Village the 12 W LED electricity-powered streetlights are also not full-cutoff because of the drop lens underneath. These may be classed as partial cutoff.

In our Starlight Reserve management plan, the gradual replacement of existing luminaires for full cut-off models will be requested. Fortunately the pollution of the night sky from our street lighting is at present minimal, and the issue is to preserve it this way with better lighting in future.

8. The Lighting Ordinance

The Lighting Ordinance applies to a large area in the Mackenzie Basin around Lake Tekapo and Mt John Observatory. It was first enacted in 1981 following negotiations between the Mackenzie District Council and the Department of Physics and Astronomy of the University of Canterbury. The Ordinance is one of the first such ordinances to protect the night sky to be

enacted in the southern hemisphere (possibly the first). It was modelled on the Tucson Arizona lighting ordinance of 1972 which was one of the world's first ordinances for protecting observatory sites. See http://www.newrules.org/environment/rules/light-pollution/light-pollution-tucsonpima-county-az.

At the time of the initial implementation of the lighting ordinance, the Department of Physics and Astronomy at the University of Canterbury manufactured about two dozen light shields for the fluorescent street lights that were in use at that time in part of Tekapo village. These were installed by the District Council and ensured that no light shone above the horizontal. This type of light has however been progressively phased out and new street lights are predominantly low pressure sodium.

The lighting ordinance in the Mackenzie Basin was written into the Mackenzie District Plan and enacted through the Town and Country Planning Act of 1977. Later, and after some revision, it came into force under the Resource Management Act (1991). Section 12, entitled '*Signs, outdoor lighting and aerial distractions*' (revised in October 2011) of the Mackenzie District Plan 2004 is the latest version of the ordinance. It is available on-line on the Mackenzie District Council's website and attached in Appendix A.

The lighting ordinance controls all aspects of outdoor lighting over a large area centred on Mt John Observatory. The rationale of the ordinance is explicitly: *Viewing of The Night Sky - maintenance of the ability to undertake effective research at the Mt John University Observatory and of the ability to view the night sky* [6]. And also: The ability to view the night sky is a valuable amenity of the District and it is appropriate that this is maintained. The policy is: To avoid unnecessary light pollution of the night time sky in the Mackenzie Basin area, so as not to adversely affect the astronomical, astrophysical and atmospheric research at Mt John University Observatory or people's ability to view the night sky [6].

The observatory is therefore fortunate that for 30 years it has enjoyed the support of the Mackenzie District Council to maintain dark skies in the Mackenzie Basin for both research and for public enjoyment and education, and that this support has been enacted in New Zealand law for three decades.

The lighting ordinance covers the types of external lighting allowed, light shielding, light filtering, the times at which external floodlighting may be switched on at night and it specifies an extensive area which is protected by the ordinance. This area is very approximately 60 km north-south and 40 km east-west and covers about 1800 square kilometers. Within this area there are three inhabited settlements: Lake Tekapo village, with a population of 330; Twizel with a population of 1000 and Mt Cook village population 234 (its lighting ordinance is managed by DOC).

In order to ensure maximum compliance with the Lighting Ordinance, the Mt John Observatory has produced an information sheet for Tekapo Village residents and other residents of the wider Mackenzie Basin. This information sheet is sent automatically by the

District Council to all those seeking to build a new home or alter their home, or undertake any type of construction work that might require external lighting. See Appendix F for a copy of this information sheet.

See Appendix A for copy of the Mackenzie District Lighting Ordinance.

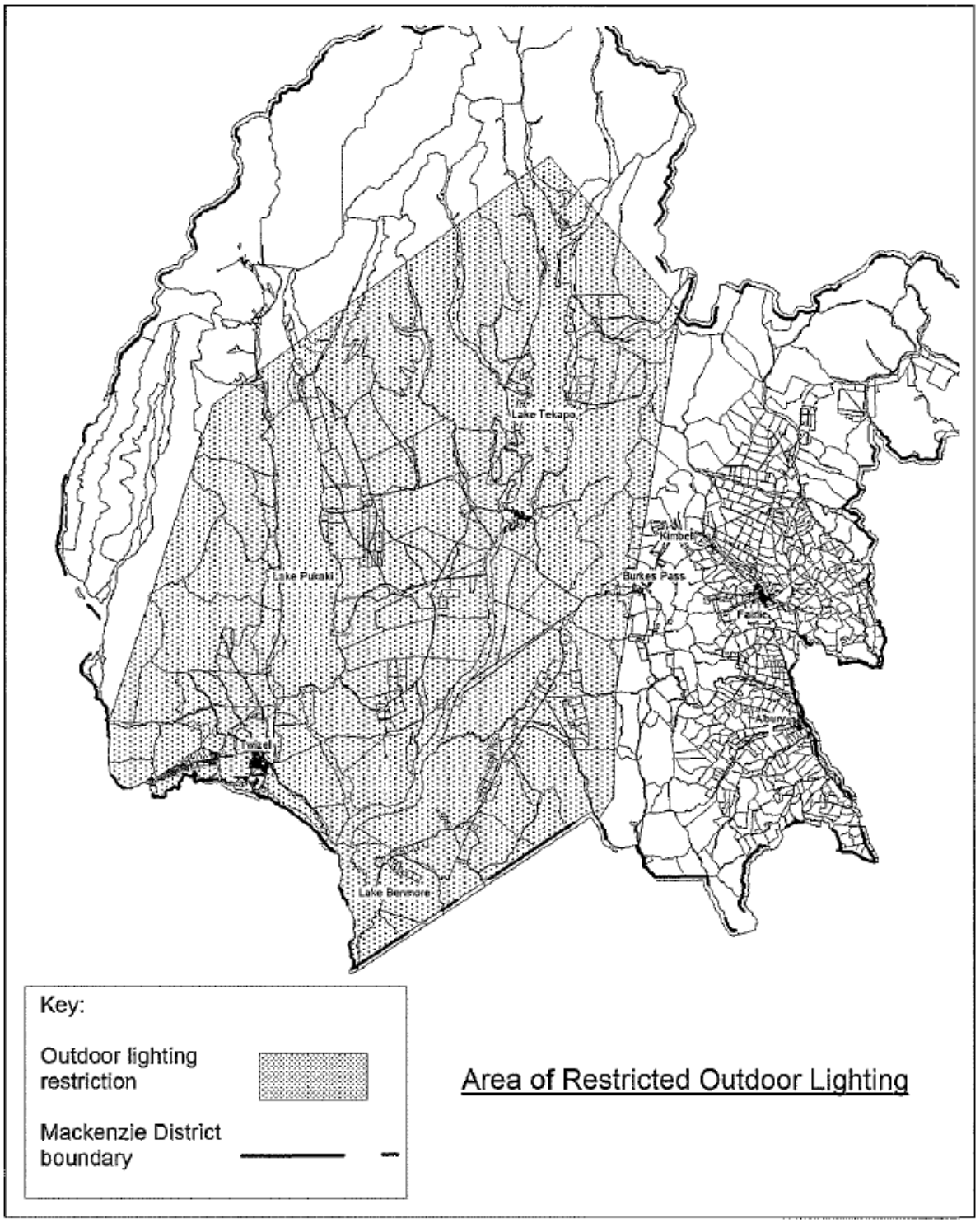


Figure 8-1 The area of the original Lighting Ordinance from 1981-2011. The zone was extended to the south-west so as to include the township of Twizel in July 2011.

9. Mt John University Observatory

9.1 A brief history of Mt John Observatory

In 1960 the University of Pennsylvania received a grant from the U.S. National Science Foundation to survey New Zealand to find the best site for an astronomical observatory. Pennsylvania wanted to establish a southern station and New Zealand was much further south than the established observatories in Australia, South America and South Africa. So from here more of the southern sky was continuously visible throughout the year.

Figure 9-1. Photograph of Comet Hyakutake in 1996 with one of the research telescopes in the foreground taken at the summit of Mt John, photo Alan Gilmore.

Among the criteria for an observatory site were: a large number of clear nights, a dark sky not polluted by artificial light from any nearby town or city, a site reasonably close to power and water supplies and main roads and not too far from a major city. The site survey began in 1961. It was organized by Mr Frank Bateson, a New Zealand amateur astronomer internationally respected as the Director of the Variable Star Section of the Royal Astronomical Society of N.Z. From geographical and weather information Bateson selected potential sites in the Bay of Plenty, Nelson, Marlborough, the Mackenzie Country and Central Otago. Between 1961 and 1963, with much help from local authorities and individuals, various sites were occupied so sky conditions could be continuously monitored. By 1963 it was clear that Mt John provided the best conditions, all things considered. The University of Pennsylvania made an agreement with the University of Canterbury to jointly develop the site, thus providing a city base in Christchurch. The observatory was officially opened on 10 July 1965.

The observatory's early instruments were astronomical cameras, provided by Pennsylvania, and telescopes lent by Bateson. They were housed in buildings largely constructed by volunteer labour from the South Canterbury district. In 1970 the 60cm (24inch) Optical Craftsmen (the 'OC') telescope was installed.

Five years later a second 60cm telescope made by Boller and Chivens (the 'B&C') was erected. During these years some of the original University of Pennsylvania staff moved to the University of Florida so it too became part of the consortium. However, from about 1975 the contribution and interest of the U.S. partners waned as their senior staff retired. The Observatory now operates entirely as a field station of the University of Canterbury's Department of Physics and Astronomy.

In 1969 the U.S. Air Force built a satellite tracking station on Mt John south of the university observatory. The USAF also funded the sealed road up the mountain and a water supply from Lake Tekapo. Prior to this the Observatory had depended on rainwater or tanker supplies brought up a rough track. The tracking station employed a large staff for following the positions of US and Soviet satellites.

Figure 9-2. Photograph of the clear starry sky taken in Mackenzie Basin by Alan Gilmore.

The USAF tracking station closed in 1982 as new imaging technology made it redundant and the building passed to the New Zealand government. Canterbury University now leases the building and has modified it, adding a large dome to the north end to house its one-metre telescope. The 'One Metre building', as it is generally called, accommodates visiting staff and observers. It also houses an upper atmosphere experiment that measures wind and air temperature 100 km above the ground, part of an international study.

The One-Metre McLellan reflector was built in the University of Canterbury's workshops and was installed at Mt John in February 1986. It is used for a wide variety of astronomical research, most of it in stellar astrophysics: the study of stars and their evolution. In 2001 a large 'fibre fed' spectrograph made at Canterbury was installed, greatly enhancing the telescope's capabilities.

Since 1996 a consortium of New Zealand and Japanese researchers have run a joint programme on the B&C telescope. It is called the MOA project from Microlensing Observations in Astrophysics and involves Auckland, Massey, Victoria and Canterbury universities on the NZ side, and Nagoya University in Japan. Following a grant from the

Japanese government a 1.8-metre telescope was installed at Mt John in 2004. It will continue the microlensing work, watching many millions of stars for changes in brightness. In 2003 the MOA team discovered a Jupiter-size planet orbiting a star several thousand light-years away.

As services to the local community the Observatory hosts Vodaphone cell-phone antennae and a FM repeater for National Radio. On a pillar near the summit is a GPS station run by the Institute of Geological and Nuclear Sciences and the Survey Department of Otago University. It is the base station for measuring bending of the South Island around the Alpine Fault.
A webcam gives hourly updates of the region's weather.

Earth & Sky, a Tekapo company, now runs daytime tours of the Observatory. In 2005 they planned to install a 40-cm telescope for public viewing in the '16-inch' dome. Since Mt John was established, the village of Lake Tekapo has grown, so increasing night sky brightness has become a concern. Mackenzie District Council ordinances require that all outside lights be full cut-off so that no light shines upward into the sky. The new subdivision developers are installing observatory-friendly, low-pressure sodium lighting.

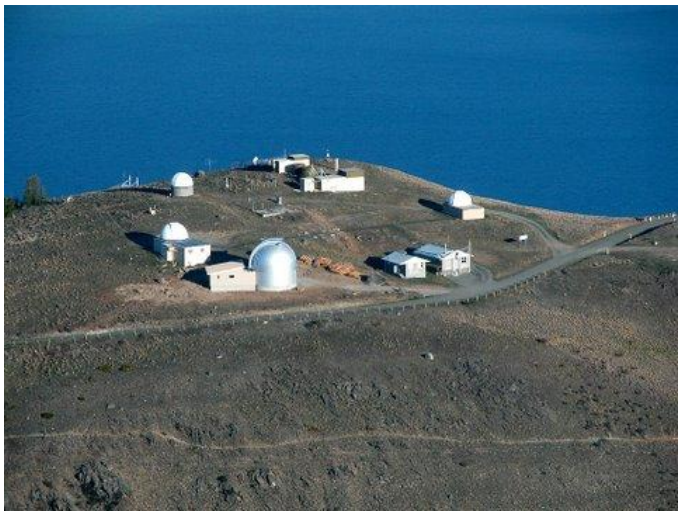


Figure 9-3 (Left) Aerial photograph of Mt John University Observatory with Lake Tekapo in the background. Photo: Tim Rayward (Air Safaris).

(Bottom) Telephoto image of Mt John with Mt Cook and the Southern Alps in the background. Mt Cook is about 50 km behind Mt John. Photo Fraser Gunn.

9.2 Present day research at Mt John

There are four principal telescopes at Mt John:

i. **The 1-metre McLellan Telescope**

The optics of this 1.00-metre Dall-Kirkham reflecting telescope were polished by optical engineers from the DSIR's Physics and Engineering Laboratory (now Industrial Research Ltd). The mechanical and electronic work was done by Physics Department workshop staff in Christchurch. First light was in 1986 March.

The principal instrument on this telescope is the Hercules (High Efficiency and Resolution Canterbury University Large Echelle Spectrograph) high resolution fibre-fed vacuum echelle spectrograph. It was commissioned in 2001 and was the world's first vacuum echelle spectrograph for observations of stellar spectra. Hercules was designed and built in the Department of Physics and Astronomy at the University of Canterbury. It is used for precise observations of stellar velocity, principally for a programme to discover extrasolar planets by the Doppler technique, for observations of binary stars, for observations and analysis of pulsating variable stars and for observations of the interstellar medium.

The 1-metre McLellan telescope is also used for research on Near-Earth Asteroids and comets, by direct CCD imaging, in order to make astrometric measurements to determine their orbital parameters.

ii. **The 0.6-metre Optical Craftsmen Telescope**

This 0.61-metre reflecting telescope was completely refurbished by Physics Department technical staff in 1979. The cassegrain focus is at f/16. Because of the fork mounting, only the direct camera and the photometers can be used on the Optical Craftsman Telescope. The telescope is normally reserved for photometry.

In late 1991 the telescope was completely upgraded with new stepper motor drives and computer control, including automated dome setting.

From 2008 to 2010 the telescope was fully automated in collaboration with the American Association for Variable Star Observers (AAVSO) for the purpose of automated CCD photometry of southern variable stars.

iii. **The 0.6-metre Boller & Chivens Telescope**

This 0.61-metre reflecting telescope was purchased in 1975 and has a cassegrain focus at f/13.5. The Japanese-New Zealand MOA project (Microlensing Observations in Astrophysics) used this telescope for several years from 1996. MOA replaced the

telescope's drive motors by stepper motors under computer control, and also commissioned an alternative secondary mirror providing an f/6.25 cassegrain focus.

Today the Boller and Chivens telescope is partly used for follow-up observations in the MOA microlensing project and partly for showing the night sky to astro-tourists, in association with Earth and Sky Ltd.

iv. The MOA 1.8-m Telescope

In 2002, Prof. Yasushi Muraki from Nagoya University obtained a large grant from Monbusho (Ministry of Education, Science, Sports and Culture, Government of Japan) to place a 1.8-m telescope at Mt John dedicated to the MOA (Microlensing Observations in Astrophysics) project. The telescope optical design was from New Zealander, Andrew Rakich. A wide-field prime-focus alt-az survey telescope was chosen, and Nagoya University built a huge CCD camera with ten 2k × 4k chips (80 million pixels). The field of view is as much as two square degrees, though presently there are plans to make this even larger. The new MOA telescope was built by Nishimura in Kyoto, installed at Mt John in late 2004, commissioned during 2005 and was fully operational during the 2006 bulge season.

The MOA project is an outstandingly successful collaboration between scientists in New Zealand and Japan aimed at discovering extrasolar planets using the gravitational microlensing technique. The MOA project has had an involvement in all the extrasolar planet discoveries that have used this technique since the first discovery in 2003.

The MOA project began in 1995 as a collaboration between astronomers in several New Zealand universities and Nagoya University in Japan. The project leaders were Assoc. Prof. Phil Yock in Auckland and Prof. Yasushi Muraki in Nagoya. The aim was to detect extrasolar planets or other dark massive objects (such as black holes in the Galactic halo) using microlensing. MOA involves about two dozen astronomers in New Zealand and Japan. Initially observations were on the 60-cm B&C telescope at Mt John Observatory, equipped with a large CCD camera.

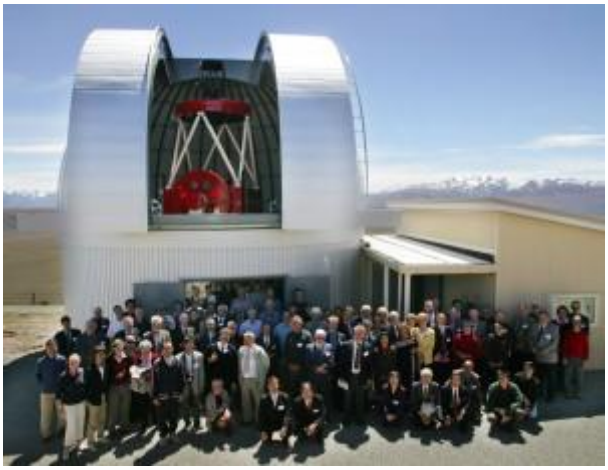


Figure 9-4. Opening of the MOA 1.8-m telescope at Mt John Observatory, 1 December 2004.

Figure 9-5. The MOA 1.8-m alt-az wide-field prime focus telescope at Mt John (photo John Hearnshaw).

10. Tourism Activity

10.1 Introduction to Tourism in the Mackenzie and at Aoraki/Mount Cook

Tourism is a large and important industry in New Zealand, pumping $NZ8 billion annually into the nation's economy, but it is especially so in the Mackenzie Basin and Aoraki Mt Cook areas [59]. Tourists come to New Zealand for the majestic landscapes and breathtaking scenery of which Mackenzie and Aoraki Mt Cook arguably have some of the best examples. The Lord of the Rings films helped to cement the New Zealand landscape in peoples' minds as something remarkable and mysterious. However, after the scenery, tourists are attracted to the types of activities that make that most of the landscape, interacting with the land, waterways and seas. New Zealand has also become a prime destination for thrill-seekers and the so called "adventure tourism". Further, New Zealand's unique Maori culture attracts tourists who are keen to learn more about New Zealand's indigenous peoples.

The Mackenzie attracted more than 450,000 visitors in 2010 and provided employment for approximately 30 per cent of the population there. In addition to astro-tourism, activities in

the area include climbing, tramping, boating, fishing, skiing, rock-art tours, golf, ice-skating and Alpine flightseeing. They all exploit the unique aesthetic beauty of the natural landscape. Aoraki /Mt Cook attracts experienced mountaineers from all over the world and offers snow sports, personalised tours, kayaking and adventure. There is a ski field and lodge at Lake Ohau which provides a range of recreational activities. Ice-skating is a popular winter activity at Lake Tekapo with facilities at the Alpine Springs Spa and Winter Park Hot Pools. The lakes, mountains, braided rivers and valleys are a popular base for tramping, boating, hunting and fishing (trout and salmon), and in summertime camping. Scenic flights operate at Lake Tekapo and Aoraki Mt Cook to give tourists a bird's eye view of the mountains, glaciers and lakes. There are also extreme sports, such as heli-biking and gliding [54]. The Department of Conservation is responsible for maintaining thirty two huts, five swing bridges and 150 km of track within the Mackenzie to support these activities.

The Church of the Good Shepherd is a major tourist attraction at Lake Tekapo. It was built in 1935, looks out over the Lake Tekapo and is built from stones found within a five mile radius of the site with the stones left in their natural condition. The Church is still a regular place for worship, weddings and reflection today. It is clear that the natural landscape is what draws people to the area to participate in the various outdoor recreational activities and therefore recreation may be viewed as part of the cultural landscape of the area.

Twizel is a major fishing and water sports destination with lakes, rivers and the hydro-canals, as well as a world-standard rowing course at the man-made Lake Ruataniwha. It is at Twizel where visitors can see the endangered black stilt and learn about the Department of Conservation's efforts to save it. Film location tours for the "Lord of the Rings" site are available from Twizel.

10.2 Accommodation in the Mackenzie

Accommodation at Lake Tekapo includes Backpackers, Farmstays, Homestays and Holiday Homes, Motels and Hotels and there are three bars, three cafes, a fast food outlet and three restaurants providing New Zealand, Chinese, Japanese and Italian cuisines.

Aoraki Mt Cook village has lodges, motels, chalets, holiday parks and backpackers and importantly the Hermitage Hotel with stunning views of Aoraki Mt Cook (www.hermitage.co.nz). Five restaurants cater for all tastes and budgets.

A range of accommodation and food outlets are also available in Twizel.

Figure 10-1. Aoraki/Mt Cook Park, photo: The Mt Cook Hermitage

Figure 10-2. Tramping in Aoraki/Mt Cook National Park, photo: The Hermitage Hotel

Figure 10-3. Tramping at Mt John, photo: Earth and Sky website

Figure 10-4. Mackenzie Alpine Horse Trekking, photo: Tekapo Tourism website

Figure 10-5. Exploring the glaciers, photo: The Hermitage Hotel

Figure 10-6. The Hermitage Hotel, photo: The Hermitage Hotel

11. Astro-Tourism in the Region

Figure 11-1. Stargazing at Mount John, from: Fraser Gunn
http://earthandskynz.com/earthandsky/homepage_jp/homepage_jp.html

Astro-tourism is becoming an increasingly important aspect of tourism in the Mackenzie. The Japanese market is already well established as "a recent survey in Japan showed that 72 % of people listed star gazing as the main reason they wanted to visit New Zealand" [60]. As the rest of the world is losing sight of the night sky, astro-tourism is a way for New Zealand businesses to capitalize on the natural beauty of the sky above, educate tourists and visitors about the seriousness of light pollution and to inspire people to take an interest in space with a passion that is only achieved by seeing the sky in its full brilliance.

Lake Tekapo and Mt John

Astro-tourism in the Mackenzie was first established in 1993 by Hideyuki Ozawa and was called *Tekapo Tours*. Ozawa, who is originally from Japan, started the tours to show other people, mostly from Japan, the brilliance of the night sky in Tekapo. The tours were popular and Ozawa was able to establish a small observatory at Cowan's Hill (just on the eastern edge of Tekapo village) with a 14-inch telescope mounted in an Ash dome. In 2004, Hideyuki Ozawa and Graeme Murray joined forces to form *Earth and Sky Ltd* to support the Nagoya University in establishing the MOA project on Mt John through the University of Canterbury. A contract was then in turn negotiated granting them astro-tourism rights to Mt John.

Mt John offers a unique opportunity to view the Southern Cross constellation, to find the south celestial pole, and to listen to traditional stories around Orion, Scorpius, the Pleiades and Taurus. Viewing the surface of the Moon, Saturn's rings and Jupiter's moons never fail to inspire. Enthusiastic guides provide commentary in English and Japanese. *Earth and Sky Ltd* offer both day and night tours to Mt John Observatory and also shorter tours to Cowan's Hill observatory where binoculars, small telescopes and a 14-inch computerised Dobsonian telescope along with a trained astronomy guide are on hand.

The Day Tours allow visitors to see a fully operational research facility and view the telescopes, search for stars and planets in the daytime, become aware of the environment, learn about the history and enjoy the panoramic view of the Mackenzie and surrounding mountains. Families and school groups are particularly welcome.

The Night tours are very popular. The general plan for a tour is as follows:

i. Guests meet at Earth and Sky headquarters in Tekapo village and are fitted with appropriate warm clothing.

ii. A short bus trip gives the tour guides a chance to explain what the visitors will be seeing that night. Half-way up Mt John the bus headlights are turned right down so guests can experience the darkness around them.

iii. At the top, guests are led to the Astro-Café to see a multi-media presentation which helps to prepare them for what they are soon to see and it is also important to explain what the different nightscape features are for people who have little or no astronomical knowledge.

iv. The actual star gazing occurs just outside the Astro-Café. There are several small telescopes (16-inch, 11-inch and 9.25-inch apertures) here for guests to look through. There is also someone on hand to help with astro-photography (using the visitors' own digital cameras secured on a driven equatorial mount).

v. If either of the 60-cm research telescopes are free, visitors are able to look through them to reveal views of Jupiter's moons or saturns rings.

Earth and Sky offer the following night-tour options to suit the time of the year, requirements of visitors, price and children:

- Mt John Sunset Tour;
- Mt John Twilight Tour;
- Mt John Night-time Observatory Tour
- Mt John Family Tour with a chance to see the MOA 1.8m telescope in school holidays

Figures 11-2 (Below). Stargazing at Mt John, from: Earth and Sky website

The tours can be quite emotional for many tourists. Some of the guests express a sense of loss for the night sky, which they are missing in their home town/country, while others are exhilarated by what they see, or are overtaken by curiosity about the observatory equipment. Comments from *Earth and Sky's* guest book:

"Thank you for an absolutely incredible evening tour. The sky was breath-taking – we literally saw a myriad of stars. The guides were superb too. So thanks for an amazing trip."

"Andrew is to be acknowledged for his superb customer care! Thanks so much for your help with astrophotography."

"A bit of heaven on Earth!"

"On the clearest of nights, we saw just how small we are! Amazing :)"

"Learnt a lot! From the amazing guides"

Tekapo Starlight also offers night-time tours with Freidl Hale focusing on exploring the universe with the unaided eye and providing expert knowledge [61].

Figure 11-3 (above). The Astro-Café with Lake Tekapo in the background, from: http://earthandskynz.com/earthandsky/astro_cafe_jp/astro_cafe_jp.html

Figure 11-4 (Above). Cowan's Hill Observatory, from: Earth and Sky website

Figure 11-5. Tourists looking at the Earth and Sky 16-inch Meade telescope and dome, as seen from the Astro-Café, photo: Monique Milne.

11.2 Mt Cook Village

At Mt Cook Village the astro-tourism experience begins at the *Sir Edmund Hillary Alpine Centre* (located in the Hermitage Hotel building) with the southernmost planetarium in the world. This digital theatre planetarium was opened in 2008 and plays movies and features throughout the day and into the evening for the benefit of guests and visitors to the Village. Such entertainment is a welcome activity when the weather is inclement, as it often is at Mt Cook Village. Tourists can purchase a pass to see all the movies or individual tickets. Aoraki/Mt Cook, Sir Edmund Hillary, astronomy and space entertainment are featured. The Planetarium has a fully interactive, digital platform which allows the centre to offer the latest information on the stars in real time.

The *Big Sky Star Gazing* tours [62] begin with an interactive trip through Earth's sky, the solar system, the galaxies and the whole known universe at the Planetarium. The experience is controlled from a computer and the guide provides the commentary and descriptions, all of which adds to the overall experience of the tourists.

Figure 11-6. The Denis Callesen Theatre Planetarium, photo: The Hermitage Hotel

Following the movie experience, guests are driven to Mt Cook Airport to view the night sky which is the site of the proposed secondary core of the Starlight Reserve. This is an ideal flat land location in the middle of the valley to view the Southern Cross unimpeded by the mountains. Guests are wrapped up warmly in puffa jackets which help to ensure they can fully engage with and enjoy the experience.

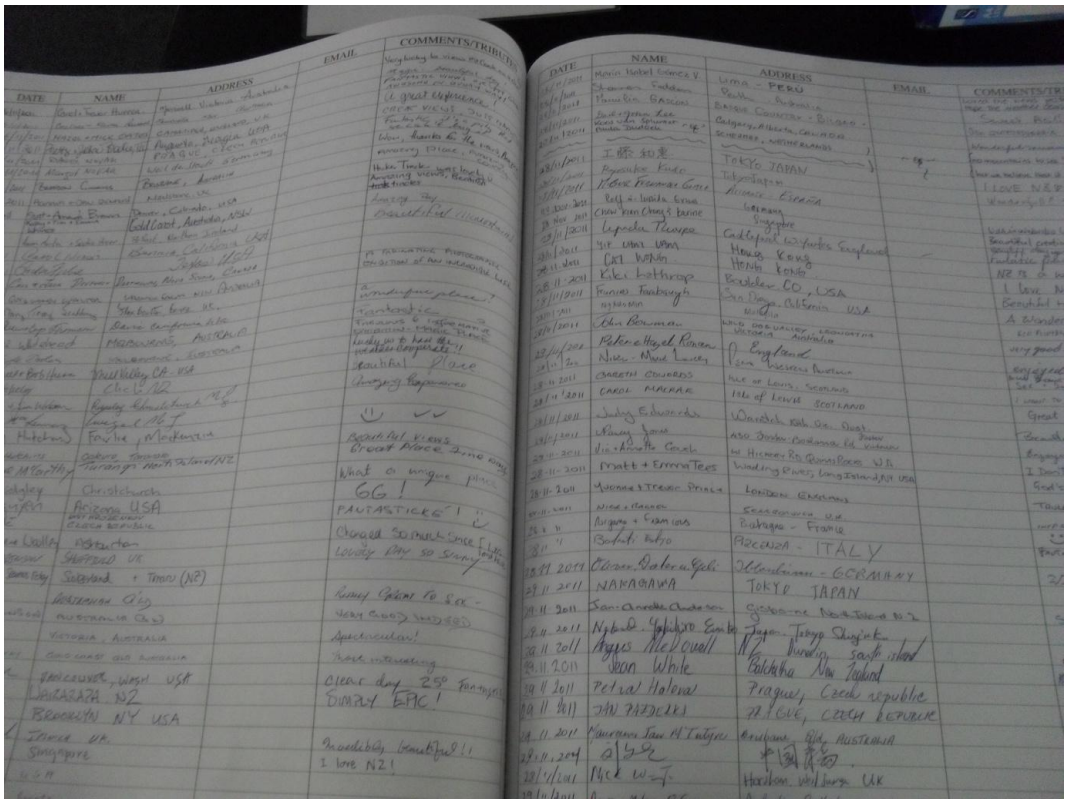


Figure 11-7. The Sir Edmund Hillary Alpine Centre Guest Book, photo: Monique Milne

The Hermitage Hotel plans to acquire bigger telescopes and build a second planetarium at the airport with facility to serve tea, coffee and hot chocolate. There is definitely scope for development and extension of what is already an impeccable tourist experience.

The average tour at Mt Cook is two hours in duration with the maximum number of guests per tour guide being 25. Guides use laser pointers to help point out the constellations. Special attention is given in June to Matariki (Pleiades) and its importance to Maori culture and traditions. Tours are also tailored to the preferences of Japanese tourists who prefer not to look through telescopes and to view the stars with the naked eye.

Figure 11-8. Astro-tourism during the twilight at Mt John with Comet McNaught in 2007; photo: Fraser Gunn

Twizel

Twizel's *Star Gazing Tours* is the newest astro-tourism venture in the Mackenzie District. Tours are run either on private land or behind the Mackenzie Country Inn Hotel. Tours focus on exploring the universe with the unaided eye. However, high quality binoculars and laser pointers are on offer to help with this [63].

Comments from *Star Gazing Tours'* Customers [64]

"Awesome experience to see this many celestial bodies so clearly. Wonderful commentary with a powerful laser beam with a 15 mile reach that looks like it touches these stars. Very educative presentation!" Olice H, Embry Phd, USA

"Elayne with her laser pointer gave us an hour of night sky clarity and information. Her knowledge of the heavens was Steven Hawkins like. The number of stars, the Milky Way, the southern star, Sirius was impressive. I even reclined in the paddock for 180 degrees view!" Rita Worth, CANADA

"Very enjoyable night. Elayne's knowledge of the cosmos was impressive. I haven't seen that many stars in a very long time." Jesse Kendall & Lori Wojnarek USA

12. Educational opportunities arising from a Starlight Reserve

12.1 Education Opportunities for the General Public

As a result of astro-tourism tours the general public are introduced astronomical equipment, solar-system features, stars, constellations, telescopes and astro-photography. The general public also have free access to the Astro-Café at Mt John Observatory during the day.

At Mt Cook Village the digital planetarium offers a huge scope for education including real-time data, documentary-style movies and space-travel software. The Sir Edmund Hillary Alpine Centre is a dedicated education facility which integrates astronomy and mountaineering in both historical and present day contexts.

All astro-tourism tours in the Mackenzie discuss light pollution with tourists as that is necessary to explain what makes the skies in the Mackenzie so exceptional for viewing night sky. With the tours people are being informed and inspired at the same time.

12.2 School-Aged Education

Astronomical systems are included at all levels of the New Zealand Science curriculum. With this in mind Earth and Sky regularly cater to school groups by providing a wide range of interesting and informative contexts for students, offering an interactive and hands-on approach to their learning. With the assistance of Earth and Sky's astronomy guides a school visit focuses on one of the three programmes "Our Solar System", "Stars and Constellations" or "Earth and Beyond". Earth and Sky also runs a competition for students called *National Astronomy Speech Competition* which requires students to make a three minute video speech on any astronomical topic and then upload to YouTube [65]. There is opportunity for further developing the education programmes.

The Department of Conservation is funded by the Ministry of Education to provide *Learning Experience Outside the Classroom* (LEOTC) at Mt Cook Village. In 2010 some 2000 students had lessons in biology and astronomy. The Sir Edmund Hillary Centre is keen to see educational opportunities further developed and are enthusiastic supporters of LEOTC.

12.3 University Education

Astrophysics is an important teaching and research pursuit at the University of Canterbury with Mt John Observatory being the focus for undergraduate teaching, post-graduate students and academic staff. Mt John has an accommodation facility and students have access to the telescopes for research and learning. The facilities are used by other New Zealand and overseas students (see Section 9.2). The University of Canterbury website has information regarding tertiary education opportunities in astronomy
http://www.phys.canterbury.ac.nz/research/mt_john/index.shtml.

13. Land ownership and administration

13.1 Townships

There are three townships in the proposed starlight reserve area; Tekapo, Mt Cook Village and Twizel. Mt Cook Village is administered by the Department of Conservation (see section 15.6) whilst Tekapo and Twizel fall under the authority of the Mackenzie District Council [6].

13.2 Mount John Observatory

Mt John University Observatory is on crown land and leased from the government. The lease includes the summit of Mt John, the road, which is a private road maintained by the University of Canterbury, and a small grassed area at the bottom of the road where the Mt John road meets the Godley Peaks Rd, a public highway (leading to Glenmore and Godley Peaks sheep stations). The surrounding land is freehold land belonging to Mt John Station. Part of the University of Canterbury's lease stipulates that the University must provide day-time access to Mt John and this attracts more than 40,000 visitors annually. The University's Mt John Lease runs for 33 years staring from January 1st 1997.

13.3 Crown Land

The vast majority of land situated within the proposed Starlight Reserve area is or once was in Crown Pastoral Leases. This land has been leased to run holders by the Crown for pastoral grazing since the 1850s and is administered by the Central Government Department *Land Information New Zealand* (LINZ) [66]. Pastoral leases are usually held for 33 years with the perpetual right of renewal. The Crown imposes a number of restrictions upon the use of land, the main being that the land can only be used for grazing. Since 1998, individual run holders have been able to enter into a Tenure Review process which allows them to gain freehold title to areas of productive land leased from the Crown. The remaining land not converted to private ownership is usually transferred to the Department of Conservation (DOC) for management. Under the pastoral lease system, run holders have been relatively restricted in the type of agricultural and development activities they can undertake on the land. This has resulted in the general appearance of the landscape remaining relatively unchanged for the past 100 years or so [67].

13.4 Administration of Freehold Land

As run holders gain private ownership of land via Tenure Review, they are free to undertake a much wider range of activities. Consequently, concerns have been raised that these activities will change the face of the basin and impact on the natural values of the land. Tenure review has resulted in some changes to the Mackenzie Basin landscape over the last ten years or so which some sectors of the community find undesirable [68]. This will undoubtedly continue, although the rate of this change is contestable. However, freehold land falls under the administration of the Mackenzie District Council which has the power to control activities such as:

- Erection, relocation, or demolition of structures, buildings, network utilities and signs;
- Commercial activities;
- Earthworks;
- Use of hazardous substances;
- Planting, trimming or removing vegetation;
- Subdivision of land [6]

This power is bestowed upon local government by the 1991 Resource Management Act which was created during a time of increasing concerns over sustainability issues. The Act gives local and regional governments responsibility for the management of resources in their locality to "promote the sustainable management of natural and physical resources [6]." Further information is provided in Section 15.

In a recent environment court judgement, Judge Jon Jackson stated that there was a desire to see greater recognition of conservation in the Mackenzie Basin confirming that it is an “outstanding natural landscape” which should be protected for future generations [67]. The Judge was concerned though that an unfair burden of conservation and management is placed upon farmers in the area [69].

13.5 The Land Tenure Review Process

Land tenure review is a legal process empowered by the 1998 change to the 1948 Land Act which is administered by LINZ. It is a voluntary process and the final decision must be agreed upon by both the leaseholder and the Crown.
The process involves:

- An application to LINZ by the leaseholder (the leaseholder is invited to make an application which they can decline to accept);
- Consultation involves parties such as; DOC, Fish and Game New Zealand and iwi (tribes), as well as the Crown and the farmer. Public submissions are called for;
- Preparation of a final proposal by LINZ. Both parties must agree on the final settlement.

The main aim of Government was to achieve a clean split between conservation land and production land [70].Twenty nine of the thirty eight properties in the Mackenzie have or will be converted from Crown Ownerhsip to a mixture of private ownership and conservation land in the near future.

14. Environmental Protection

14.1 The New Zealand Environment

The environment dominates or influences nearly every aspect of New Zealand life. There is a growing understanding that our environment is not only our iconic wilderness and rural areas, but also the urban areas where most people live and work.

Increasingly, New Zealanders are taking action to conserve the environment for future generations in ways that protect our economic well-being, social systems, and cultural wealth.

We frequently use images of our natural scenery and rural heritage to present New Zealand to the rest of the world. New Zealand is recognised internationally for its stunning landscapes, forests, and valuable agricultural and horticultural land.

The environment is vital to our economic well-being. Our land- and sea-based primary production and tourism sectors both rely on New Zealand's 'clean and green' reputation, generating about 17 per cent of New Zealand's gross domestic product.

14.2 Environmental Legislation and Governance

Management of natural resources in New Zealand is governed by several statutes, in particular the Resource Management Act 1991, Local Government Act 2002, and the Conservation Act 1987.

Environmental governance in New Zealand is shared between central government and local government. Iwi (Maori) authorities, industry groups, community interest groups, and non-government organisations also play a role in managing the environment.

Regional councils as well as unitary authorities (councils that combine the functions of a territorial authority and a regional council) are responsible for developing regional plans and policy statements under the Resource Management Act. Their powers cover:

- *managing freshwater, groundwater, and coastal water*
- *conserving the soil*
- *allocating and managing geothermal energy*
- *controlling the discharge of contaminants to air, land, and water*
- *managing the foreshore, water column, and seabed, including implementing controls on aquaculture in coastal waters.*

The Resource Management Act requires territorial and unitary authorities to manage these functions through district plans.

14.3 Resource Management Act 1991 (2011) - RMA

The approach to environmental management under the RMA is centred on the concepts of sustainable and integrated management of resources. Environmental management is mainly achieved through the statement of overall goals in the Act itself, the establishment of a hierarchy of policy statements and plans, the granting of resource consents and the provision of mechanisms for enforcement.

At a regional level policy statements are compulsory and regional plans are optional, with the exception of a regional coastal plan District plans must be prepared at a territorial authority level.

District plans are generally required to be 'not inconsistent' with regional plans, district and regional plans are required to 'give effect to' regional policy statements, and all these documents are in turn required to 'give effect to' national policy statements (see Figure 14-1). This helps to promote consistency and integration.

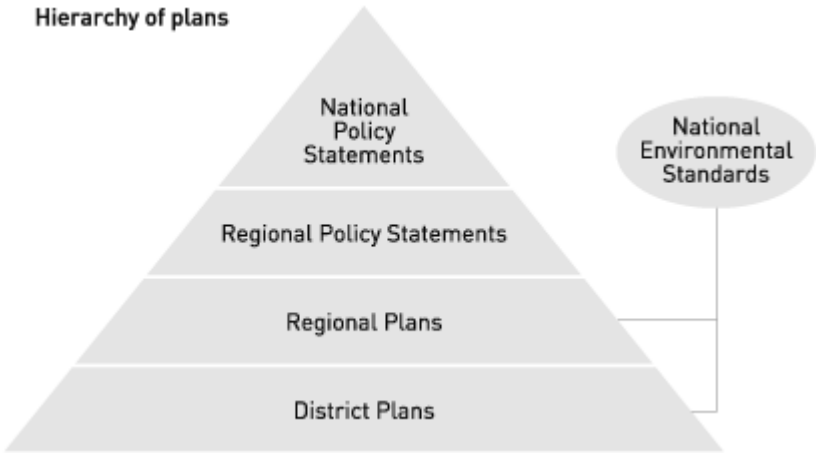


Figure 14-1. Resource Management Framework

The RMA focuses on managing the effects of activities rather than regulating the activities themselves. The RMA adopts an enabling approach which seeks only to intervene where activities are likely to result in unacceptable environmental impacts. This approach has the advantage of focusing on the reduction of environmental impacts.

The overriding purpose of the RMA *is 'to promote the sustainable management of natural and physical resources'*. This is defined in section 5(2) as meaning:

'managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while -

> *(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*

(b) Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and

(c) Avoiding, remedying or mitigating any adverse effects on the environment.'

Consultation

Enabling people and communities is an important part of managing the environment under the RMA. Consultation with members of the public is embedded within the plan preparation process to ensure that all views and values are considered.

As a result of public input the Mackenzie District Council has included protection of the night sky as a value in its District Plan.

Objective 2 - Viewing Of The Night Sky

Maintenance of the ability to undertake effective research at the Mt John University Observatory and of the ability to view the night sky.

Reasons

· Mt John is a unique facility of local, national and international level and needs to be protected to ensure effective astronomical, astrophysical and atmospheric research can continue.

· The ability to view the night sky is a valuable amenity of the District and it is appropriate that this is maintained.

Policy 2A

To avoid unnecessary light pollution of the night time sky in the Mackenzie Basin area, so as not to adversely affect the astronomical, astrophysical and atmospheric research at Mt John University Observatory or people's ability to view the night sky.

Explanation and Reasons

· As for Objective 2 (above)

· An increase in the amount of unnecessary outdoor lighting will adversely affect the ability for effective research to be undertaken at the Mt John University Observatory and the ability to view the night sky.

Implementation Methods

· Limits on type, use and time areas are lit

· Requirements regarding shielding and filtering of all outdoor lighting

Environmental Results Anticipated

The following are the anticipated environmental results of the District Plan policies and rules on outdoor lighting:

· Minimal adverse effects of outdoor lighting on research undertaken at the Mt John University Observatory.

· Avoidance of unnecessary light pollution in the Mackenzie Basin.

· Preservation of the ability to view the night sky.

Activities

The RMA groups activities into six categories: permitted, controlled, restricted discretionary, discretionary, non-complying and prohibited. Rules in regional and district plans determine which category an activity will fall into. Resource consents are required for controlled, restricted discretionary, discretionary and non-complying activities.

Activity - Outdoor Lighting

The Mackenzie District Plan allows for outdoor lighting as a permitted activity provided that it meets the requirements of the Lighting Ordinance enclosed in Appendix A.

14.4 Local Government Act 2002

As well as having day-to-day responsibility for environmental management under the Resource Management Act, Local Government is also responsible for community well-being, including environmental well-being, under the Local Government Act 2002.

The Local Government Act is intended, among other things, to encourage communities to address all four aspects of sustainability: social, economic, environmental, and cultural well-being, in the present and for the future. Communities identify the outcomes they desire in each area, and these form the content of a long-term council community plan. These plans integrate the vision and goals for councils and their communities to work towards.

A long-term council community plan does not override plans created under the Resource Management Act or other statutory documents. However, it is expected that all council activities, including those required under other Acts, will contribute to achieving community outcomes.

14.5 Conservation Act 1987

The Conservation Act 1987 was developed to promote the conservation of New Zealand's natural and historic resources. It also established the Department of Conservation (DOC).

Some key functions of DOC under the Conservation Act are to:

- *manage land, and natural and physical resources, held under the Conservation Act*
- *advocate the conservation of natural and physical resources*
- *promote the benefits of conservation of natural and physical resources*
- *preserve (as far as practicable) all indigenous freshwater fisheries, and protect recreational fisheries and freshwater habitats*
- *foster recreation and allow tourism on conservation land, to the extent that use is not inconsistent with the conservation of any natural or historic resource.*

The New Zealand Department of Conservation (DOC) manages approximately one third of the land in this country as well as marine reserves, on behalf of all New Zealanders.

The Conservation Act 1987, the National Parks Act 1980 and the Reserves Act 1977 set out how DOC should look after this land, water, and vegetation, and the living things that inhabit it,.

In a manner similar to that prescribed under the RMA, the Conservation Act provides a framework of management policies, strategies and plans for the management of Conservation Land (see Figure 14-2).

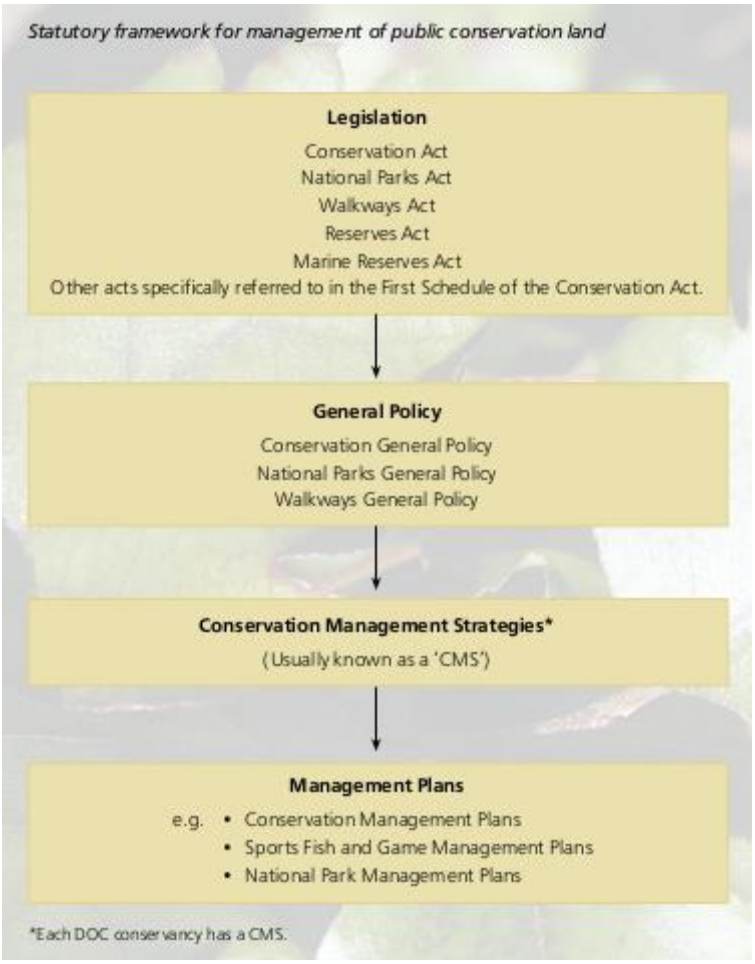


Figure 14-2. Conservation Management Framework

Section 4 of the RMA allows for Management Plans created under the Conservation Act to fill the role of District Plans under the RMA.

As the statutory land manager of the Aoraki / Mt Cook National Park, which includes the Aoraki / Mt Cook Village, The Department of Conservation has prepared a National Park Management Plan along with a Community Management Plan for the village. Each of these documents provides protection for the quality of the night sky over the Park.

6.2.1 Building and Architectural Standards

• *new buildings should incorporate energy conservation within their design and be designed to eliminate all forms of uncontrolled waste, noise pollution or light spill to the surrounding Village and Park;*

6.2.9 Services

5. All lighting will be required to shed light downwards and minimise light spill into the wider National Park; to avoid affecting people's night vision and to minimise any detraction from the natural dark values of the Village's setting within the Park.

A starlight reserve may be defended by the purpose and principles of sections 5, 6 and 8 of the Resource Management Act in that Starlight may be defined as a "natural resource" s.5(1), and s.5(2) which state that natural resources should be protected in a way that "enables people and communities to provide for their social, economic, and cultural well being". Under these sections protecting the starlight is essential to the continuing practice of mahinga kai (traditional food gathering). Furthermore, s.6(e) considers "the relationship of Maori and their culture and traditions with their ancestral lands…and other Taonga [treasures]" and s6(f) states one of the criteria for assessing "outstanding natural features and landscapes" to be "its value to tangata whenua [people of the land]". Both Maori astronomy and mahinga kai may be protected under s.6(g) "The protection of recognized customary activities". Finally, s.8 takes "into account the principles of the Treaty of Waitangi" and encourages co-management of natural resources [46].

15. Work of the Starlight Working Party

A number of significant events led to the establishment of the Aoraki Mackenzie Starlight Reserve Working Party. Conscious of its commitment to the 1981 Lighting Ordinances as part of its agreement with the University of Canterbury when the Observatory was established on Mt John, the Mackenzie District Council included "maintaining the ability to view the Night Sky" in its Tekapo Vision statement 2002-2003. This led local people to initiate interest in the possibility of a "*Park in the Night Sky"* and the establishment of the Working Party in collaboration with the Mackenzie Tourism and Development Board. The members of the Working Party were drawn from the Local District Council, the University of Canterbury, Tourism interests, the Department of Conservation, Local farmers, the Royal Astronomical Society NZ and an independent Chair (Margaret Austin) was appointed.

At its annual meeting in Durban in 2005 the World Heritage Committee of UNESCO adopted a resolution to explore an initiative on "*Astronomy and World Heritage as a means to promote nominations which recognise and celebrate achievements in Science."* The National Commission for UNESCO in New Zealand, the University of Canterbury, Astronomers and the Working Party responded to this challenge and began to develop a proposal for a "Park in the Night Sky" with support from the Royal Society of NZ, the Royal Astronomical Society of NZ, UNESCO NZ, the Mackenzie Tourism and Development Trust and subsequently also from the Prime Minister of New Zealand as Minister of Tourism.

The Mackenzie group actively participated in the World Heritage meeting in Christchurch in 2007 drawing attention to its initiative to "Keep our Starlight Burning Bright". Presentations have been made at the invitation of the Coordinator of the Starlight Initiative at conferences in La Palma on the Canary Islands in 2007 and 2009. A Case Study for the Lake Tekapo Starlight Reserve was submitted to the March 2009 International Workshop and Expert Meeting on "Starlight Reserves and World Heritage" at Fuerteventura. The Chair attended the Launch of the International Year of Astronomy at UNESCO, Paris in January 2009 and

made a presentation at the Symposium which followed the launch. The International Astronomical Union (IAU) and the International Council on Monuments and Sites (ICOMOS) collaborated to produce the Thematic Study to clarify the significance of Astronomical Heritage with a Chapter on the "*Windows of the Universe"* to which New Zealand contributed as one of four Case Studies. The Thematic Study was presented at the World Heritage meeting in Brasilia 2010 and has subsequently been disseminated through the UNESCO Website. Then in November 2010 the Chair held a 2-day workshop at UNESCO in Paris to follow up on the Thematic Study and to plan for the future.

Over the last two years the Aoraki Mackenzie Working Party has continued to promote the area as a Starlight Reserve. It has engaged with the University of Canterbury through its Summer Scholarship Programme (2011 and 2012) to explore the potential for recognition and to identify opportunities for education and outreach, astro-tourism, cultural perspectives of astronomy and astro-photography in addition to the on-going astronomical research programmes at the Observatory.

The outcome of the Working Party's deliberations has led to a decision to apply to the International Dark-Sky Association for recognition as an International Dark Sky Reserve during 2012.

16. The Third International Starlight Conference, 11-13 June 2012.

The Third International Starlight conference will be held 11-13 June 2012 at Lake Tekapo, and will provide a forum to highlight the benefits of a Starlight Reserve. It is being organized to coincide with the application to the International Dark Sky Association for a Starlight Reserve to be recognized in the Mackenzie Basin and Aoraki/Mt Cook regions of New Zealand.

The conference will be the third in a series, following meetings in La Palma in April 2007 and on Fuerteventura in March 2009. It will address themes concerning

- the defence of the quality of the night sky,
- the right to observe the stars, the heritage of starlight,
- the issues of light pollution, the protection of observatory sites,
- the benefits of public outreach in astronomy and
- the cultural aspects of visual astronomy.

We will also discuss the concept, implementation and benefits of Starlight Reserves as a means of protecting the night sky, and the progress towards such reserves made in the document entitled "Heritage sites of astronomy and archaeoastronomy in the context of the UNESCO World Heritage Convention: a Thematic Study", which was produced under the aegis of the IAU (International Astronomical Union) and ICOMOS (International Council on

Monuments and Sites), with Clive Ruggles and Michel Cotte as editors. The Thematic Study was presented to the World Heritage Convention in Brasilia in July 2010.

In addition, several radio astronomers have pointed out that the issues of radio-frequency interference have much in common with issues of light pollution. We will therefore expand the topics under discussion to RFI and the development of radio-astronomy in New Zealand, especially the selection of radio-quiet sites. This is topical as New Zealand may participate with Australia in the Square Kilometre Array (SKA) radio-astronomy project.

Earlier Starlight meetings were held at La Palma in April 2007 and in Fuerteventura (both in the Canary Islands) in March 2009. The New Zealand meeting will continue the progress made at these earlier meetings.

16.1 Topics to be covered at the Starlight conference:

- Role and purpose of a Starlight Reserve
- Public education and outreach at a Starlight Reserve
- Starlight Reserves and astro-tourism
- The Starlight Declaration (2007) and the right to see the stars
- Light pollution and light pollution controls through lighting ordinances
- The dark sky park movement, including science-based park management and related visitor experiences
- Integrating starlight protection with protection for the landscape, ecology and biosphere
- Radio astronomy and radio frequency interference (RFI); radio-quiet zones and RFI mitigation; the selection of sites in NZ for radio-astronomy
- Starlight Reserves as a protection for astronomical research
- Cultural aspects of stars and starlight in civilization and society
- The role of the World Heritage Committee and other bodies (International Dark Sky Association, International Union for the Conservation of Nature, government departments, local government etc) in regulating and operating Starlight Reserves

The conference will be a multidisciplinary meeting, and contributions will be welcome that not only include scientific and technical aspects of starlight, but also on themes which are educational, cultural, environmental, aesthetic, legal or political. It is hoped to include astro-tourism, Maori astronomy and public outreach through star-gazing. The relationship between stars and the ecology of the nocturnal biosphere will also be discussed.

17. Letters of Support

The following Section is a selection of letters of support for the proposed Aoraki Mackenzie Starlight Reserve.

Rt Hon Jim Bolger- **Chair of Mt Cook Alpine Salmon, Former Prime Minister of New Zealand**

Jim Boult- **Chief Executive of the Christchurch International Airport and Former Deputy Charmain of Tourism New Zealand**

Dr. Garth Carnaby- **President of the Royal Society of New Zealand (RSNZ), MNZM, FRSNZ** and Dr. Di McCarthy- **Chief Executive of RSNZ, ONZM**

Dr. Rod Carr- **Vice- Chancellor of the University of Canterbury**

Rt Hon Helen Clark- **Former Prime Minister of New Zealand, ONZ, S SI**

Tim Hunter- **Chief Executive of Christchurch amd Canterbury Tourism**

Alastair Morrison- **Director-General of New Zealand Department of Conservation**

Dame Jenny Shipley- **Chairman of Genesis Energy and Former Prime Minister of New Zealand**

Peter Townsend- **Chief Executive of Canterbury Employers' Chamber of Commerce**

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The Board of Directors
International Dark Sky Association
3225 North First Avenue
Tuscon, Arizona 85719-2103

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NEW ZEALAND INNOVATORS

Dear Board of Directors

The Mackenzie District was the focus of major hydro-electricity developments in the 1970s on the Waitaki River which led to the cutting of a canal connecting Lakes Tekapo and Pukaki. This canal is now the location of a large and successful Salmon farming operation supplying high quality Salmon for the domestic and international markets. It attracts numerous visitors to the fishery and has an impressive record for maintaining water quality and at the same time contributing to economic growth and employment within the Mackenzie District.

The Mackenzie District Council supported by the Mackenzie Sustainability Forum have been at the forefront in ensuring the District is protected from Light Pollution so that the Observatory at Mt John can operate unhindered for scientific research as well as provide a Dark Sky experience for the very large numbers of people from New Zealand and Overseas who visit Tekapo, Mt John and Aoraki/Mt Cook annually.

The astronomers from the University of Canterbury are part of a worldwide network making observations and identifying new planets which is attracting interest among professional and amateur astronomers alike. The potential to increase astro-tourism and to attract people from all over the world to the pristine environment and grandeur of the landscape cannot be over-estimated. The enthusiasm of current visitors for the night-time experience they enjoy is recorded in their comments following visits to Mt John and Aoraki/Mt Cook . I am also aware of the importance of astronomy for navigation, agriculture and food gathering in the cultural heritage of Aotearoa New Zealand. The opportunity to improve public awareness of the stars and the importance of controlling light pollution is becoming more and more significant for those whose skies prevent a view of the firmament.

I am very pleased indeed to endorse and support the application of the Aoraki Mackenzie Starlight Reserve for recognition by the International Dark Sky Association as a Starlight Reserve.

Yours sincerely

Rt. Hon. J Bolger ONZ
Chair, Mt Cook Alpine Salmon
Former Prime Minister of New Zealand

Christchurch International airport Limited

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Christchurch 8544, New Zealand
Telephone (+64 3) 358 5029
Facsimile (+64 3) 353 7730
christchurchairport.co.nz

13 December 2011

Board of Directors
International Dark Sky Association
3223 North First Avenue
Tuscon, Arizona 85719-2103
USA

Dear Directors

Christchurch International Airport Limited (CIAL) is the principal airport of the South Island of New Zealand. Approximately 90% of the international visitors to the South Island enter through our airport.

CIAL is 75% owned by the City of Christchurch and as such our responsibilities lie not only in achieving a commercial return for our shareholders but in playing our part in growing tourist numbers to the region and to the whole of the South Island. CIAL is known as New Zealand's Tourism Gateway. It is also beginning to be known as a Gateway to the Stars.

This last reference relates to the outstanding "sky-scapes" visible throughout the South Island but specifically in the centre of the South Island in the Mckenzie Country area around Tekapo and Mount Cook. The clarity of New Zealand's night sky generally is very good but in this particular area it is unique.

Since New Zealand is well known for its clean environmental image it is natural, International Dark Sky Association recognition will attract significant international attention and tourists to the South Island and the Mackenzie district.

CIAL has identified the night landscape of the Mckenzie Country area as one of the very significant tourism attractions in our area going forward. We are delighted to note that the municipality in the area has moved to protect the sky cape through light controls.

We very much support the nomination of the area concerned as a first International Dark Sky Reserve in the Southern Hemisphere and look forward to the designation in the future.

These comments are made in my position as CEO of CIAL but in addition I note my background as a previous Deputy Chairman of Tourism New Zealand (the government controlled tourism marketing body) and as a participant in the tourism industry for 30 years.

Yours sincerely

Jim Boult
Chief Executive

the ROYAL SOCIETY of NEW ZEALAND
TE APĀRANGI

16 January 2012

The Board of Directors
International Dark Sky Association
3225 North First Avenue
Tuscon, Arizona 85719-2103
United States of America

Dear Directors

On behalf of the Royal Society of New Zealand, we are very pleased indeed to endorse and fully support the application of the Aoraki Mackenzie Starlight Reserve for recognition by the International Dark Sky Association as a Starlight Reserve.

The Royal Society of New Zealand has followed the initiative with interest, and has provided tangible support as the project has developed. We are very honoured to have been involved in this way and believe that recognition of the Aoraki Mackenzie Starlight Reserve would become a national treasure of huge international significance. The Royal Astronomical Society of New Zealand is a recognised and valued constituent organisation of the Royal Society of New Zealand.

At the launch of the International Year of Astronomy in 2009, our colleague Martin Lord Rees, Astronomer Royal and the then President of the Royal Society London acknowledged "*The Night Sky is one part of our environment we have shared with all cultures in all periods of human history*". It is therefore most appropriate to ensure that those areas of the world with pristine night skies with the ability to view the milky way should be protected and preserved for all humanity.

With kind regards

Dr Garth Carnaby MNZM FRSNZ
President

Dr Di McCarthy ONZM
Chief Executive

Dr Rod Carr, Vice-Chancellor
Tel: +64 3 364 2495
Email: rod.carr@canterbury.ac.nz

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

12 January 2012

The Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

Dear Board of Directors

More than forty years ago the University of Canterbury conducted a nationwide investigation in New Zealand to determine the best location for a proposed Observatory in conjunction with the University of Pennsylvania. Mount John, located above Lake Tekapo, was the site chosen for the quality of the Night Sky and the incidence of clear nights for astronomical observation. The Observatory was officially opened in 1965. Since then the University has had a leading role in astrophysics in New Zealand, establishing networks with others around the world. Examples of this leadership include the successful discovery in 2003 of a Jupiter-size planet orbiting a star several thousand light years away and membership of the Southern Africa Large Telescope collaboration.

The University has worked closely with the Mackenzie District Council which put in place the current Lighting Ordinances in 1981 to ensure the quality of the Night Sky and protection from Light Pollution.

The University wishes to support the nomination of the Lake Tekapo Aoraki/Mt Cook region for recognition as a Starlight Reserve by the International Dark Sky Association. We believe that the potential for further research, for educational outreach which enhances public awareness, for astro-tourism, cultural understanding, photography and art in an accessible and unique destination is unparalleled.

Yours sincerely

Dr Rod Carr
Vice-Chancellor

P.O. Box 52-083,
Kingsland,
Auckland 1352,
New Zealand.

7 January 2011

Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

Dear IDA Board of Directors,

It is with a sense of great satisfaction that I endorse the application of the Mackenzie Starlight Reserve for recognition by the International Dark Sky Association. I know the Mackenzie District very well indeed and have been briefed on this project since its inception over the last six years. The Mt John Observatory is the premier Observatory in New Zealand in a District which had the foresight to establish Lighting Ordinances to protect the night sky from light pollution some thirty years ago. Such is the significance of the project in the District, I understand that Aoraki/ Mt Cook and Twizel have sought to have the Ordinances extended to include these villages.

I am reminded of the statement in the La Palma Starlight Declaration 2007 which says "An unpolluted Night Sky that allows the enjoyment and contemplation of the firmament should be considered an inalienable right of humankind equivalent to all other environmental, social and cultural rights." I am also conscious of how few of the world's people actually see and experience the night sky and believe the endeavours of the International Dark Sky Association are critical to preserving and protecting the Night Sky wherever it is possible to do so. The Mackenzie District in the South Island of New Zealand is one such location in a unique and pristine environment. It is ideal for professional and amateur astronomy, astro-tourism, education and photography as well as appreciation of the cultural importance of the celestial cycles for Maori navigation, planting and harvesting.

I wish the Working Party every success in its application for Dark Sky Reserve Status at the highest level.

Yours sincerely,

Helen Clark

Rt Hon Helen Clark

Former Prime Minister of New Zealand 1999-2008

Christchurch
& Canterbury Tourism

7 December 2011

Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

Dear IDA Board of Directors

I write on behalf of Christchurch and Canterbury Tourism to support recognition of the Mackenzie Basin as a Gold Tier Status Dark Sky Reserve.

By day this region of New Zealand is a majestic place of awe inspiring mountains and lakes and by night offers the most stunning display of extra-terrestrial majesty that is increasingly being enjoyed and marvelled by international visitors from across the world.

The Mackenzie Basin provides a perfect set of meteorological and geographical conditions to provide an outstanding starlight reserve. Being a high plateau away from coastlines offers a very high incidence of clear skies. With an extremely low population within the region and a local government and community determination to set very strict conditions over the use of artificial lighting at night, the entire area around Mt John and the Lake Tekapo settlement offers what we believe is one of the most perfect environments in the world for stargazing and observation of astronomical phenomena.

Using the Mt John facility the stargazing operator Earth and Sky now in its 7th year of operation hosts more than 13,000 visitors per year. The stargazing experience has become a key reason for international visitors to over-night in Lake Tekapo and has provided a significant boost to employment and the local tourism economy. Increasingly we are finding that international visitors from northern hemisphere who have never experienced a dark sky are overwhelmed and delighted by what this special part of New Zealand has to offer. Tour operators in Japan now feature night sky products as a highlight feature of holiday packages to New Zealand as a key selling feature and point of difference.

We are proud of what the Mackenzie Basin community have achieved in pursuit of excellence in creating a world class visitor experience and encourage the International Dark Sky Association to acknowledge the quality of the dark sky experience in the Mackenzie Basin through confirmation of a Gold Tier Dark Sky Reserve status. Such an accolade would help us attract many more citizens of the world to our region to experience a dark sky experience that is memorable, humbling and uplifting for the human soul.

Yours sincerely

Tim Hunter
CHIEF EXECUTIVE

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DOCDM898150

Department of Conservation
Te Papa Atawhai

20 January 2012

The Board of Directors
International Dark-Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
UNITED STATES OF AMERICA

Dear IDA Board Members

The New Zealand Department of Conservation supports the establishment of the Aoraki / Mackenzie Starlight Reserve in recognition of the importance and value of protecting the natural night environment.

The New Zealand Department of Conservation's vision is that New Zealand is the greatest living space on Earth. By "living space" we mean our natural physical environment and the people, plants and animals that it supports.

It is a vision that connects people and nature and emphasises the link between healthy natural environments and the cultural, social, spiritual and economic wellbeing of people.

The objectives of the International Dark Sky Reserve programme align well with the Department's vision and work. A New Zealand Government- funded programme: Learning Experience Outside the Classroom includes study of the night sky and the benefits of Starlight Reserves.

Supporting the objectives of an International Dark Sky Reserve, the Department's Management Plan for the Aoraki/Mount Cook National Park, which is a part of the Te Wāhipounamu - South West New Zealand World Heritage Area, requires that "All lighting will be required to shed light downwards and minimise light spill into the wider National Park; to avoid affecting people's night vision and to minimise any detraction from the natural dark values of the Village's setting within the Park".

I commend the establishment of the Aoraki/Mackenzie Starlight reserve to you.

Yours sincerely

Alastair Morrison
Director-General
New Zealand Department of Conservation

National Office
Conservation House, PO Box 10-420, 18-32 Manners Street, Wellington 6011
Telephone 04-471 0726, Fax 04-381 3057

12 December 2011

The Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

RE: The Lake Tekapo Aoraki/Mt Cook Starlight Reserve Working Party and the pursuit of recognition of a Starlight Reserve in the Mackenzie Basin, New Zealand from the International Dark-Sky Association

I write at the request of Margaret Austin, Chair of the Lake Tekapo Aoraki/Mt Cook Starlight Reserve Working Party, to provide my support for the declaration of a starlight reserve in the Mackenzie Basin, New Zealand. The goal of preserving, protecting and promoting the night sky in the area covered by the Mackenzie District Council Lighting Ordinances including Tekapo, Aoraki/Mt Cook and Twizel is a worthwhile pursuit.

Genesis Energy, a major energy generator and retailer in New Zealand, has recently purchased significant generation in the Mackenzie Basin in close proximity to the Mt John Observatory. It is important to Genesis Energy that these assets can continue to be viable and efficient for the benefit of New Zealanders and, whilst this is the case, we also seek to be an active member of the communities within which we generate and are very pleased to be able to support other activities that build a vibrant community.

As a neighbour of the Mt John Observatory, we see the benefits to the Mackenzie Basin of a protected night sky, firstly for the protection of the night sky as a place where people can come and view the sky without interference from human development, but secondly to the development of the Mackenzie Community. Such a night sky status will provide much opportunity for tourism development and community growth. Such a status will put the Mackenzie Basin on the world map.

My own personal values and the values of Genesis Energy of respect, drive, support and imagine align with those of the Lake Tekapo Aoraki/Mt Cook Starlight Reserve Working Party. I commend the Lake Tekapo Aoraki/Mt Cook Starlight Reserve Working Party on their pursuit and wish them the very best.

Yours sincerely

Dame Jenny Shipley.
Chairman, Genesis Energy
Former Prime Minister of New Zealand

Building mainland business

CANTERBURY EMPLOYERS' CHAMBER OF COMMERCE

22 December 2011

Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

Dear Board of Directors,

The Canterbury Employers' Chamber of Commerce is pleased to support the pursuit of the recognition of the Mackenzie Starlight Reserve as the first Southern Hemisphere Dark Sky Reserve. The Employers' Chamber has 3000 companies as members in the top half of the South Island of New Zealand and is well aware of the important contribution tourism, eco tourism and potentially astro-tourism make to our South Island economy.

We consider the concept of "the gateway to the stars" being a significant and useful addition to tourism in the South Island. The multi-faceted contribution resulting from this initiative, including astronomical research, educational opportunities for young and old, understanding the cultural significance of astronomy for Maori, geology and astrophotography are all of significance.

We wish the proposers of the Mackenzie Starlight Reserve every success in their application to the International DarkSky Association in Tucson January 2012 so that the proposal can be comprehensively evaluated and progressed.

Yours faithfully

Peter R Townsend
Chief Executive
Canterbury Employers' Chamber of Commerce

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New Zealand

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Appendix A: Copy of the Mackenzie District Lighting Ordinance

SECTION 12 - SIGNS, OUTDOOR LIGHTING AND AERIAL DISTRACTIONS

Introduction

Signs

The purpose of signs and other forms of outdoor advertising is to provide information to the general public and to attract trade and business. The nature of information which is conveyed includes: availability of goods and services, notice of forthcoming events, directions to traffic and pedestrians, and identification of particular sites or premises. Signs are important within the district for the information they provide. However, there is the possibility that signs and other forms of outdoor advertising may have adverse environmental effects, particularly on visual amenities, and may conflict with traffic and pedestrian safety in the District.

The standards of visual amenity vary between different parts of the District, and are generally defined by the range and nature of land uses in an area. Those areas which are perceived as having a consistent and uncluttered visual amenity, such as the residential or rural areas, are more susceptible to the potential adverse effects of signage. In contrast in areas where the visual amenity is more diverse, such as commercial or industrial areas, the potential adverse effects of signs are limited by the existing mix of visual elements. In addition, different areas of the District have variable needs for signs. In commercial and industrial areas signs are necessary and accepted features, as they attract customers to the business, and allow the easy identification of a site. Because of the range in needs and the visual sensitivity of different parts of the District, consideration needs to be given to different standards for signage in different areas.

Outdoor Lighting

Outdoor lighting is required by the people of the District for a variety of reasons. These reasons include street and road lighting, private residential lighting, outdoor advertising, security lighting in business and residential areas, search lights, illumination of recreational lighting, decoration or display of public amenities and air traffic control. Lighting on private property can spill onto neighbouring land and roads causing annoyance, and in some cases, danger particularly if the light is intense. In addition an abundance of outdoor lighting can adversely affect people's ability to view the night sky and affect the ability for effective research to be undertaken at Mt John University Observatory.

Aerial Distractions

Aerial Distractions are those activities which are visible from the highway visual protection corridor and include such activities as laser light displays, searchlights, helipads, and associated aircraft movements, advertising blimps, bungy jumping and hang-gliding and similar types of leisure activities. These activities can adversely affect motorist's attention if not appropriately controlled.

Issues

The following are the resource management issues relevant to signs, advertising, aerial distractions and outdoor lighting in Mackenzie District. The objectives and policies which address these issues are then referred to. Finally when the Council intends to implement the objectives

and policies associated with the issue by means other than District Plan Rules, these means are listed.

Issue 1 - Signs, Aerial Distractions and Traffic Safety

Description

The potential adverse effects of signs, aerial distractions or outdoor advertising on traffic safety include:

- distraction of drivers' attention due to inappropriateness of the location, design, size, or type of sign or aerial distraction.
- poor location or design of sign or aerial distractions causing impulsive driver action, such as stopping or sudden turning movements without giving adequate warning signals.
- confusion caused by accumulation of too many signs in one area.

These effects have their greatest impact on roads such as arterial routes and State Highways where the potential for traffic accidents is greater because of the larger volumes of traffic regularly using these roads. All signage situated within a State Highway is subject to bylaw controls of Transit New Zealand. In addition as State Highways and roads are designated for their transportation purpose, signs and other activities which have purposes related to the road are permitted as of right as an integral part of the road.

Because of the concerns of the roading authorities to maintain a high level of traffic safety and efficiency, roading signs are generally well designed and cause little or no problems in terms of driver distraction. However other signs on or near roads do have the potential to endanger road users as mentioned above. In addition poorly constructed signs could endanger public safety.

Relevant Objectives and Policies

- Objective 1, Policy 1A and Policy 1C

Issue 2 - Maintaining the Amenity of Areas Within the District

Description

The need for controls on signs and outdoor lighting in the District is important to ensure that the potential visual effects of these do not adversely affect the amenity of the District. Because of their different characteristics, residential and rural areas are more susceptible than commercial and industrial areas to the potential impacts of signs and glare from lighting. Therefore different forms of control are required to maintain and enhance the visual amenity of different areas.

Relevant Objectives and Policies

- Objective 1, Policy 1B and Policy 1D

Issue 3 - Maintaining the Ability to View the Night Sky

Description

The type, nature and location of lighting can adversely affect people's ability to view the night sky. This issue is of great significance in Mackenzie District due to the existence of the Mt John University Observatory.
Due to its latitude and longitude Mt John is a unique facility at both the local, national and international level. Light pollution in the skies around Mt John increases the "noise" in observation; limits the observation of faint objects; and restricts the range of astrophysical and atmospheric physics research which can occur at Mt John. The ability to clearly view the night sky is also an amenity of the District. Consequently if these values and the value of Mt John for research purposes is to be maintained, outdoor lighting in the vicinity of the observatory needs to be limited.

Relevant Objectives and Policies

- Objective 2, Policy 2A

Signs, Aerial Distractions And Outdoor Lighting - Objectives And Policies

Objective 1 - Outdoor Lighting Aerial Distractions And Signs

Outdoor Lighting, Signs and Aerial Distractions which avoid or mitigate adverse effects on public safety, convenience, and the visual amenity of the District.

Reasons

- Because signs provide information and can add colour and vibrancy to places it is desirable to limit signs only to the extent that is compatible with public safety, convenience, access and the maintenance of amenity in certain areas.
- Because Outdoor Lighting is required for reasons such as road lighting, security and general amenity at night it is desirable to limit outdoor lighting only to the extent necessary to avoid unwanted glare and illumination and traffic hazards being created.
- Because some activities create an aerial distraction it is desirable to limit these activities so that they minimise distraction to drivers.

Policy 1A - Traffic Safety

To prevent the display of signs, aerial distractions or outdoor lighting which may adversely affect traffic safety by causing confusion or distraction to, or obstructing the views, of motorists or pedestrians.

Explanation and Reasons

- As for Objective 1
- It is appropriate that the location, size and design of signs, the control of aerial distractions and the intensity of outdoor lighting be controlled to minimise the potential for driver distraction and dangerous driving.
- Signs with minimum wording ensure the effectiveness of signs.

Implementation Methods

- Signs on or over roads
- Signs obstructing views, resembling signals, confusing materials
- Verandah signs
- Minimum distance between signs
- Minimum visibility
- Minimum letter size
- Minimum distance from pedestrian crossing or intersection
- Minimum distance from curve
- Signs on parked vehicles
- Discretionary activity signs
- Maximum intensity of outdoor lighting
- Directing outdoor lighting away from roads
- Discretionary Activity - Aerial Distractions
- Exercising control over signs and advertising within the road reserve as the road controlling authority.

Policy 1B - Amenity Controls

To prescribe standards controlling the number, size, location and nature of signs and the intensity and direction of light spillage in different areas of the District, in accordance with the character and amenity of the areas and the community's desire to maintain and/or enhance that character or amenity.

Explanation and Reasons

- As for Objective 1
- It is desirable that the character and amenity of rural and residential areas in particular be maintained and remain essentially non-commercial. As signs are indicative of commercial activity it is therefore appropriate to limit the number, type and location of signs in residential and rural areas, and to limit some signs in business areas which are not characteristic of these areas eg, sky signs.
- Lighting spill onto neighbouring properties can be of concern in areas where people live. In residential areas in particular where there is limited separation between houses there is potential for light and glare nuisance for neighbours. It is appropriate therefore to control where outside light is directed and in residential areas to limit the intensity of lighting.
- Lake Tekapo is unique in that few towns have such a beautiful natural setting. Signage has a large role to play in ensuring the appearance of the town does not detract from the surroundings.

Implementation Methods

- Compliance of signs with height and setback controls
- Limit on roofs and above veranda signs
- Sandwich boards
- Limits on sign size, number and height
- Direction of outdoor lighting
- Limits on intensity of lighting in Residential Zones
- District Council Bylaws on signs.

Policy 1C - Sign Construction

To ensure all signs are constructed and placed in a manner which does not pose danger to property or people.

Explanation and Reasons

- As for Objective 1
- Any danger to people or property posed by signs should be avoided.

Implementation Methods

- Requirements on construction, fixing, placing and maintenance of signs - 1d & 4e
- District Council Bylaws on signs.

Policy 1D - Public Places Etc

To limit commercial advertising in or over public places or attached to utilities, community facilities or public reserves, unless they are signs necessary for direction, public information or public safety, or are within Business Zones.

Explanation and Reasons

- As for Objective 1
- Controls on the number and size of signs on public facilities and land is necessary to maintain the non-commercial character of these amenities.

Implementation Methods

- Limits on number, size and type of signs on public and commercial facilities

Environmental Results Anticipated

The following are the anticipated environmental results of the District Plan policies and rules on signs and outdoor lighting:

- Adequate signage to convey the information necessary for the social, economic and cultural welfare of the community.
- Minimal adverse effects of outdoor advertising and lighting on traffic and pedestrian safety including the avoidance of the potential for drivers to be distracted.
- Maintenance and enhancement of the visual amenity of the residential, rural and business areas of the District.
- Signage which effectively conveys its message to the public.
- Avoidance of nuisance light spillage onto neighbouring properties.

Objective 2 - Viewing Of The Night Sky

Maintenance of the ability to undertake effective research at the Mt John University Observatory and of the ability to view the night sky.

Reasons

- Mt John is a unique facility of local, national and international level and needs to be protected to ensure effective astronomical, astrophysical and atmospheric research can continue.

- The ability to view the night sky is a valuable amenity of the District and it is appropriate that this is maintained.

Policy 2A

To avoid unnecessary light pollution of the night time sky in the Mackenzie Basin area, so as not to adversely affect the astronomical, astrophysical and atmospheric research at Mt John University Observatory or people's ability to view the night sky.

Explanation and Reasons

- As for Objective 2
- An increase in the amount of unnecessary outdoor lighting will adversely affect the ability for effective research to be undertaken at the Mt John University Observatory and the ability to view the night sky.

Implementation Methods

- Limits on type, use and time areas are lit
- Requirements regarding shielding and filtering of all outdoor lighting

Environmental Results Anticipated

The following are the anticipated environmental results of the District Plan policies and rules on outdoor lighting:

- Minimal adverse effects of outdoor lighting on research undertaken at the Mt John University Observatory.
- Avoidance of unnecessary light pollution in the Mackenzie Basin.
- Preservation of the ability to view the night sky.

SIGNS, OUTDOOR LIGHTING, AND AERIAL DISTRACTIONS RULES

1 General Requirements For All Signs And Aerial Distractions

1.a All signs shall comply with the height and setback requirements for the zone in which they are located.

1.b No sign shall be attached to a tree.

1.c No sign shall be erected or allowed to remain on or near a road which will:

i obstruct the line of sight of any corner, bend, intersection or vehicle crossing.
ii obstruct, obscure or impair the view of any traffic sign or signal.
iii resemble or be likely to be confused with any traffic sign or signal.
iv use reflective materials.
v revolve or otherwise move so as to cause a danger to pedestrians.
vi give rise to excessive levels of glare to a hazardous degree.
vii obstruct the flow of traffic on footpaths or roadways.

1.d All signs shall be constructed, fixed and placed in a manner so they do not pose a danger to property or people. This shall be the responsibility of the sign owner and the owner of the building or land on which the sign is placed.

1.e Advertising blimps or captive balloons shall not be flown.

1.f All signs shall be maintained in good order and shall not become unsightly or dangerous.

1.g Any sign and/or support structures which has become redundant shall be removed.

2 Signs Permitted In All Zones

The following signs shall be **Permitted Activities** in all zones subject to compliance with the **General Requirements for All Signs** in Rule 1.

2.a Traffic signs, including tourist and motorist service signs and all other signs erected on State Highways by Transit New Zealand, or signs denoting the street name or the street number of premises or the location of a timetable or other details of a public utility or facility.

2.b Composite destination signs erected at town entrances located within 2 kilometres of the Residential Zone on land other than the road reserve.

2.c Signs indicating the name of the District at the entrances to the District and being constructed with natural, local materials.

2.d A sign not exceeding one square metre for any public purpose or in connection with and on the same site as any utility, community facility or public reserve.

2.e Off site signs erected at a turn-off from a road, other than a state highway, where

i The signs relate to sites which do not adjoin that road.

ii The sign contains no more than 5 fingerboard signs grouped on a single upright post of the dimensions set out in Appendix F.

2.f Any sign forming part of an Information Kiosk.

3 Temporary Signs

Temporary signs for the activities specified below are permitted in all zones, provided:

- they are not listed in Rule 14 (Discretionary Activities) below, and
- they comply with the following standards:

3.a All signs must be removed within 7 days following the completion of the activity advertised and may not be established for a period longer than:

- Temporary signs advertising elections – 2 months
- Temporary signs advertising school, sporting club or church centennials or jubilees – 365 days
- Temporary signs advertising cultural, religious, educational, community or sporting events – 90 days
- Temporary signs advertising the sale or auction of real estate or during construction of a building located on the site of the activity – duration of the sale or construction period
- Temporary signs advising of stock movement – duration of the activity

3.b All signs shall have a maximum area of 5.8m^2.

3.c All signs shall comply with the standards for permitted signs within the zone they are located other than maximum area and the number of words or characters.

3.d All signs shall comply with Rule 1 General Requirements for all Signs.

4 Signs Over Roads

Signs on, under or attached to verandas and/or signs attached to buildings which extend over roads shall comply with the requirements of the District Plan for signs in the zone in which the associated building is located.

5 Signs In Business Zones

(Village Centre, Service, Industrial, Tourist, Tourist G and Travellers Accommodation Zone)

Signs are permitted in Business Zones, provided

- they are not listed in Rule 14 (Discretionary Activities) below, and
- they comply with the following standards:

5.a signs on buildings shall not exceed the highest point of the roof or be placed outside the profile of the roof.

5.b signs attached to but under street verandas shall be:

i no closer than 2.5 metres to the footpath below.
ii be at least 1.5m away from any other under verandah sign.

5.c street verandas fascia signs shall:

i be no closer than 2.5 metres to the footpath below.
ii be positioned such that they do not obstruct parked vehicles.

5.d signs above verandas but attached to the verandah shall not be more than 1.2m above the top of the verandah and shall be setback at least 500mm from the fascia line.

5.e Signs attached to a structure or the face of a building shall not project more than:

i 50mm onto or over the public place if the sign is less than 2.5m above the public place.
ii 150mm onto or over the public place if the sign is 2.5m or more above the public place.

5.f "A" frame, sandwich board, or other forms of moveable footpath or roadside signage shall:

i have a maximum visible sign area of 0.6m^2.
ii be located where the sign causes no danger or inconvenience to pedestrians, particularly those who are visually impaired.
iii be limited to two signs per business premises in all business zones.
iv be no higher than 1m.
v be located outside the premises they refer to.

5.g Lake Tekapo Village Centre

Notwithstanding the above, signs in the Lake Tekapo Village Centre Zone shall also comply with the following standards:

i There shall be no freestanding signs, other than those permitted on 5f above (refer Rule 14 Discretionary Activities)
ii Signs shall comply with the following area limits:

Frontage of Premises	Maximum Total Area of Signs
Less than 7.5m	2.5m^2
7.5m to 15m	4.0m^2
15m or greater	8.0m^2

5.h Single or double sided community information signboards advertising local facilities and attractions and community events and information, which comply with the following standards:

i. Maximum sign area on each side – 3m^2
ii. Maximum height – 3 metres
iii. Setback from roads – 10 metres

5.i All signs shall be located as close as practicable to the entrance of the premises to which they relate.

5.j All signs shall comply with Rule 1 **General Requirements for all Signs**.

6 Signs In Residential Zones

In addition to the signs permitted in Rule 2, signs in Residential Zones, other than those listed in Rule 14 below, shall be **Permitted Activities** provided they comply with all of the following standards:

6.a With the exception of retail premises signs:

i shall be limited to a single externally facing sign for each road frontage, advertising a lawful use of the site, located on the site on which it occurs and advertising only services, products or events available or occurring on the site.
ii shall not be placed more than 3 metres above ground level or be higher than the eaves of a building to which they relate, whichever is the lesser.
iii shall not exceed 1.0 square metre in area for each site.
iv shall have the following minimum lettering heights:
- 150mm for the main message
- 100mm for the property name
- 75mm for the secondary message

6.b All signs shall comply with Rule 1 **General Requirements for all Signs**.

6.c Signs for retail premises shall be a **Controlled Activity** in relation to their number, size, location and design.

6.d Signs for visitors accommodation in the Residential 2 zone:

i Shall not exceed 2.0 square metres in area
ii Shall not exceed 2 metres in height
iii Shall not be artificially illuminated.

7 Signs In Rural Zones, Rural-Residential Zones and Opuha Dam Zone

In addition to signs permitted in Rule 2, signs in Rural zones, Rural-Residential zones and the Opuha Dam Zone, other than those listed in Rule 14 below shall be **Permitted Activities**, provided they comply with all of the following standards:

7.a Signs advertising the residential, home occupation, or farming use of a site which do not exceed 1.0 square metre.

7.b Signs, relating to commercial, community, recreational, industrial, service, or visitor accommodation activity which is permitted by the Plan or by resource consent, subject to compliance with the following standards:

i Minimum distance between signs - 80m
ii Minimum visibility of sign - 250m
iii Minimum lettering height shall be:
- 300mm for the main message
- 200mm for the property name
- 150mm for the secondary message

iv Minimum distance from intersection or pedestrian crossing - 200m

v Minimum distance from curve with advisory speed and/or chevron signing - 200m
vi Maximum total area of signs - 3 square metres per site
vii No signs shall be permitted in the Lakeside Protection Areas identified on the Planning Maps.
viii All commercial signs (other than signs of the Department of Conservation) adjoining State Highways shall be made up of colours consistent with the Mackenzie District Council Colour Palette for the appropriate locality.
ix Department of Conservation signs must comply with the National sign system of the Department of Conservation.

7.c There shall be no off-site signs other than those provided for in Rule 3 (temporary signs) and Rule 2e (Off-site Signs).

7.d All signs shall comply with Rule 1 General Requirements for all Signs.

7.e Additional rules for signs visible from State Highways:

i Signs shall have clear, concise messages that are easily read and assist drivers to locate accesses and activities on land adjacent to state highways;
ii Free-standing signs shall have a maximum of six words and/or symbols with a maximum of 40 characters;
iii Free-standing signs shall be located as close a practicable to the entrance to the land to which the sign relates;
iv Signs shall be no less than 15 metres from an official traffic sign or traffic signal.

8 Signs in Recreation and Open Space Zones

(Recreation A, Recreation P, Open Space Heritage and Open Space Glentanner Zones)

In addition to the signs permitted in Rule 2, the following signs in Recreation and Open Space Zones, other than those listed in Rule 14 below, shall be Permitted Activities:

8.a A single sign at each entrance denoting the name of a reserve or recreation area, with an area not exceeding 1.0m².

8.b Signage identifying community amenity or recreational facilities, other recreational facilities, community services, heritage features, any other publicly accessible natural or physical resources or any other activity permitted by the rules in this Plan, provided the following standards are met:

i A maximum sign area not exceeding 3m²
ii Free standing signs shall have a maximum height above ground level of 3 metres
iii Signs attached to buildings shall not exceed the highest point of the roof or be placed outside the profile of the roof.
iv All signs shall be located as close as practicable to the entrance to the premises to which they relate.
v All signs shall have the following minimum lettering heights:
- 150 mm for the main message
- 100mm for the property name
- 75mm for the secondary message

8.c All signs shall comply with Rule 1 General Requirements for all Signs.

8.d There shall be no off site signs other than those provided for in Rule 3 (temporary signs) and Rule 2.e (off site signs).

9 Signs in Airport Zones

In addition to the signs permitted in Rule 2, signs in Airport Zones, other than those listed in Rule 14 below, shall be Permitted Activities provided they comply with all of the following standards:

9.a One single or double sided sign with a maximum area of 5.8m² indicating the name of the airport, erected as close as practicable to the main entranceway to the airport.

9.b Any sign advertising a lawful use of a site, which complies with the following standards:

i Signs on buildings shall not exceed the highest point of the roof or be placed outside the profile of the roof.

ii Free standing signs shall not exceed a height of 3.5 metres above natural ground level and each individual free standing sign shall have a maximum area of 3m².

iii All signs shall be located as close as practicable to the entrance of the premises to which they relate.

iv "A" frame, sandwich board or other forms of moveable signage shall:

- Have a maximum visible sign area of 0.6m²
- Be limited to 2 signs per business premises
- Be no higher than 1 metre
- Be located within the site boundaries of the premises they refer to
- Not be located where they cause a danger or inconvenience to pedestrians
- Not be located within 3m of an internal road intersection
- Not be located within 20 metres of the legal boundary of a State Highway

9.c Signs within the Pukaki Airport Zone shall have the following maximum areas:

Frontage of Premises	Maximum Total Area of Signs
Less than 7.5m	3m²
7.5m to 15m	6m²
Greater than 15m	9m²

9.d Directional signs may be erected by the airport controlling body within the airport boundaries denoting the location of activities and operators within the airport, subject to the following standards:

- Free standing signs shall comply with all area, height and location standards specified in 9.b above.
- Fingerboard signs may be erected at internal road intersections other than the State Highway denoting activities and/or operators where the signs direct visitors to activities that do not adjoin that road.

9.e Notwithstanding 9.b above, any sign which is directed at traffic on the State Highway shall also comply with the following standards:

i The minimum height above natural ground level shall be 1.5 metres
ii Minimum visibility of sign shall be 250 metres
iii Minimum lettering height shall be:
- 300mm for the main message
- 200mm for the property name
- 150mm for the secondary message

iv Minimum distance from intersection of a State Highway with other public road or pedestrian crossing - 200m
v Minimum distance from curve with advisory speed and/or chevron signing - 200m
vi All commercial signs shall be made up of colours consistent with the Mackenzie District Council Colour Palette for the appropriate locality.
vii Signs shall have clear, concise messages that are easily read and assist drivers to locate accesses and activities on land adjacent to State Highways.
viii Free-standing signs shall have a maximum of six words and/or symbols with a maximum of 40 characters.
ix Free-standing signs shall be located as close a practicable to the entrance to the land to which the sign relates.
x Signs shall be no less than 15 metres from an official traffic sign or traffic signal.

9.f All signs shall comply with Rule 1 General Requirements for all Signs.

9.g No signs shall be permitted in the Lakeside Protection Areas identified on the Planning Maps.

9.h There shall be no off site signs other than those provided for in Rule 3 (temporary signs) and Rule 2.e (off site signs) and 9.d (airport directional signs).

10 Signs in the Pukaki Village Zone

In addition to the signs permitted in Rule 2, signs in the Pukaki Village Zone, other than those listed in Rule 14 below, shall be Permitted Activities provided they comply with all of the following standards:

10.a One single externally facing sign at each road frontage advertising a lawful use of the site, located on the site on which is occurs and advertising only services, products or events available or occurring on the site, and complying with the following standards:

i A maximum sign area not exceeding 1m²
ii Free standing signs shall have a maximum height above ground level of 3 metres
iii Signs attached to buildings shall not exceed the highest point of the roof or be placed outside the profile of the roof.
iv All signs shall be located as close as practicable to the entrance to the premises to which they relate.
v All signs shall have the following minimum lettering heights:
- 150 mm for the main message
- 100mm for the property name
- 75mm for the secondary message

vi The colours used on all signs shall be colours consistent with the Mackenzie District Council Colour Palette for the Twizel area.

10.b All signs shall comply with Rule 1 General Requirements for all Signs.

10.c No signs shall be permitted in the Lakeside Protection Areas identified on the Planning Maps.

10.d There shall be no off site signs other than those provided for in Rule 3 (temporary signs) and Rule 2.e (off site signs).

11 Signs in the Special Travellers Accommodation Zone (STAZ) and Ruataniwha Rowing Zone (RRZ)

In addition to the signs permitted in Rule 2, signs in the Special Travellers Accommodation Zone and Ruataniwha Rowing Zone, other than those listed in Rule 14 below, shall be Permitted Activities provided they comply with all of the following standards:

11.a One single or double sided sign advertising an activity on a site, which is permitted by the Plan or by resource consent, which complies with the following standards:

i A maximum sign area not exceeding 2m²

ii Free standing signs shall have a maximum height above ground level of 3 metres

iii Signs attached to buildings shall not exceed the highest point of the roof or be placed outside the profile of the roof.

iv All signs shall be located as close as practicable to the entrance to the premises to which they relate.

v All signs shall have the following minimum lettering heights:

- 150 mm for the main message
- 100mm for the property name
- 75mm for the secondary message

vi All signs shall be located as close as practicable to the entrance to the activity to which they relate.

vii All signs shall be constructed from honest materials.

viii Signs in Tekapo STAZ shall be in colours consistent with the Lake Tekapo Colour Palette (as indicated in the Lake Tekapo Design Guide in Appendix P)

11.b All signs shall comply with Rule 1 General Requirements for all Signs.

11.c There shall be no off site signs other than those provided for in Rule 3 (temporary signs) and Rule 2.e (off site signs).

12 Outdoor Lighting

12.a In the area shown on the Outdoor Lighting Restriction map attached to these Rules, all outdoor lighting shall be a Permitted Activity provided it complies with all of the following Standards:

i Shielding: All outdoor lighting shall be shielded from above in such a manner that the edge of the shield shall be below the whole of the light source.

ii Filtration: All outdoor lighting shall have a filter to filter out the blue or ultraviolet light, provided the light source would have more than 15% of the total emergent energy flux in the spectral region below 440nm. The filters used must transmit less than 10% of the light at any wavelength less than

440nm. This therefore includes, but is not limited to, fluorescent, mercury vapour and metal halide lamps.

iii No person shall illuminate or display the following outdoor lighting between 11.00pm and sunrise in the designated area:
a. searchlights.
b. illumination of any public recreational facility.
c. outside illumination for aesthetic purposes of any building by floodlight.
d. any outdoor illumination in which light is produced by high-pressure sodium, metal halide, mercury vapour lighting or fluorescent lighting, unless these lamps were installed prior to 1 January 1979 in the Business or Residential Zones in Lake Tekapo or 1 March 1986 in all other zones.

iv All fixed exterior lighting shall be directed away from adjacent roads, Lake Ruataniwha and properties.

12.b Except as provided for in Rule 12a above, all outdoor lighting shall be a Permitted Activity provided all fixed exterior lighting is directed away from adjacent properties and roads.

13 Aerial Distractions

Notwithstanding compliance with other District Plan rules, the following activities shall not be permitted activities where they establish, partly establish or are visible within the highway protection corridor associated with a state highway illustrated in Diagram 1 attached to these rules.

- Laser light displays
- searchlights
- helipads and associated aircraft movements
- advertising blimps
- bungy jumping
- hang gliding and similar types of leisure activities.

14 Discretionary Activities - Signs, Outdoor Lighting And Aerial Distractions

14.a In the area shown on the Outdoor Lighting Restriction map outdoor lighting which does not meet all of the Standards in Rule 12a shall be a Discretionary Activity.

14.b In all zones, the following signs are Discretionary Activities for which a resource consent must be obtained from the Council:

i Any sign listed as Permitted Activity which exceeds any of the stated area, height, lettering, number, locational, timing or illumination standards.

ii The following signs with the potential to adversely affect traffic safety:
a. Signs affixed to vehicles or trailers, and parked in a public place, road, public property or private property so as to be visible from a public place. This does not apply to advertising painted, or

attached directly onto vehicles or trailers and incidental to the primary use of that vehicle or trailer unless the advertising gives directions to premises or specifies the cost of goods or services.

b. Flashing signs with lights or illumination which flashes, moves, rotates, varies in intensity, colour or size, and all other advertising devices of this nature.

c. Moving signs which visibly move, revolve, rotate to, create an optical illusion of movement, or change colour, whether by electrical or other means, and all other advertising devices of this nature.

iii All signs on footpaths other than those listed as Permitted Activities in Rule 5e and 5f above.

iv All forms of off-site signage, billboards, and hoardings, except temporary signs provided for in Rule 3 and off-site signs provided for in Rule 2e.

v Community information signboards in all zones other than Business Zones.

14.c In all zones the following activities which establish, partially establish or are visible within the highway protection corridor of a state highway as illustrated in Diagram 1 attached to these rules shall be a Discretionary Activity:

- laser lights
- searchlights
- helipads and associated air movements
- advertising blimps
- bungy jumping, and
- hand gliding and similar types of leisure activities.

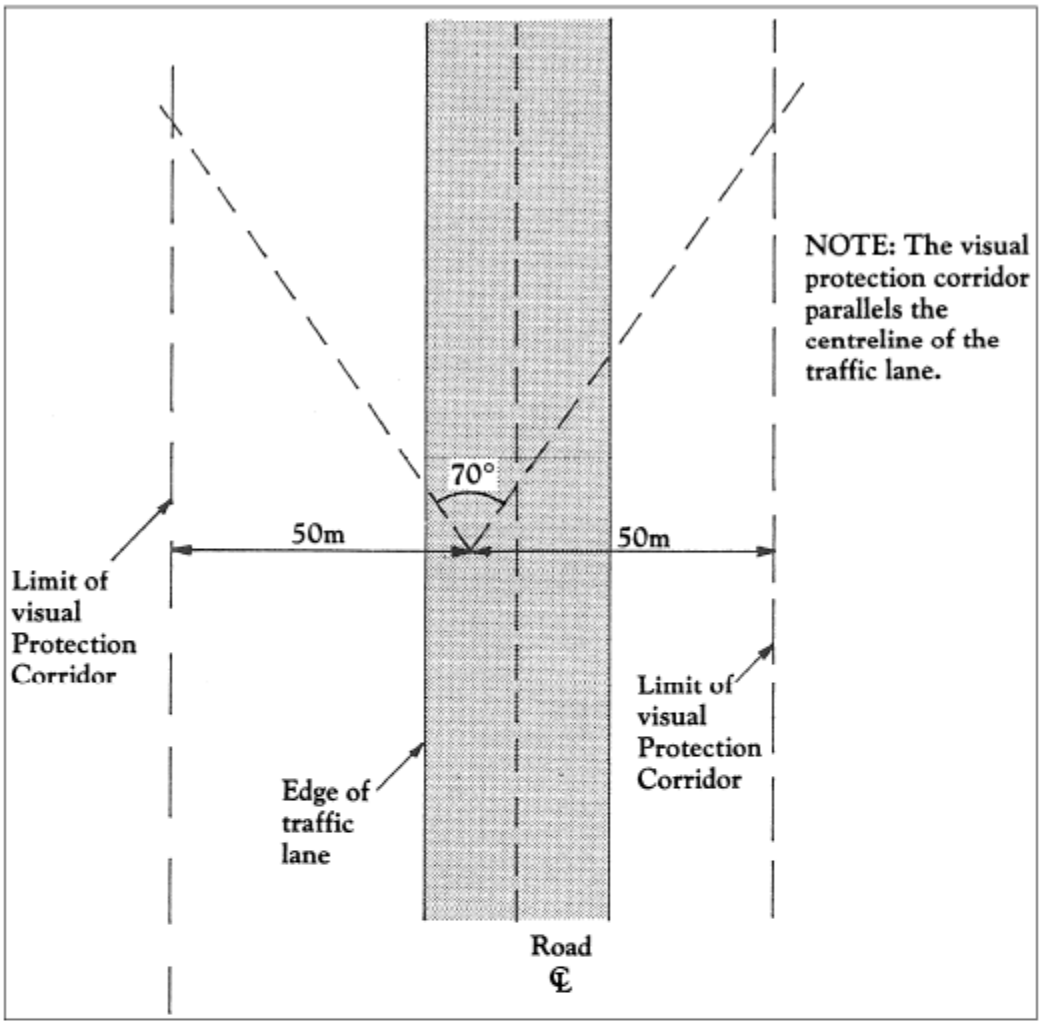
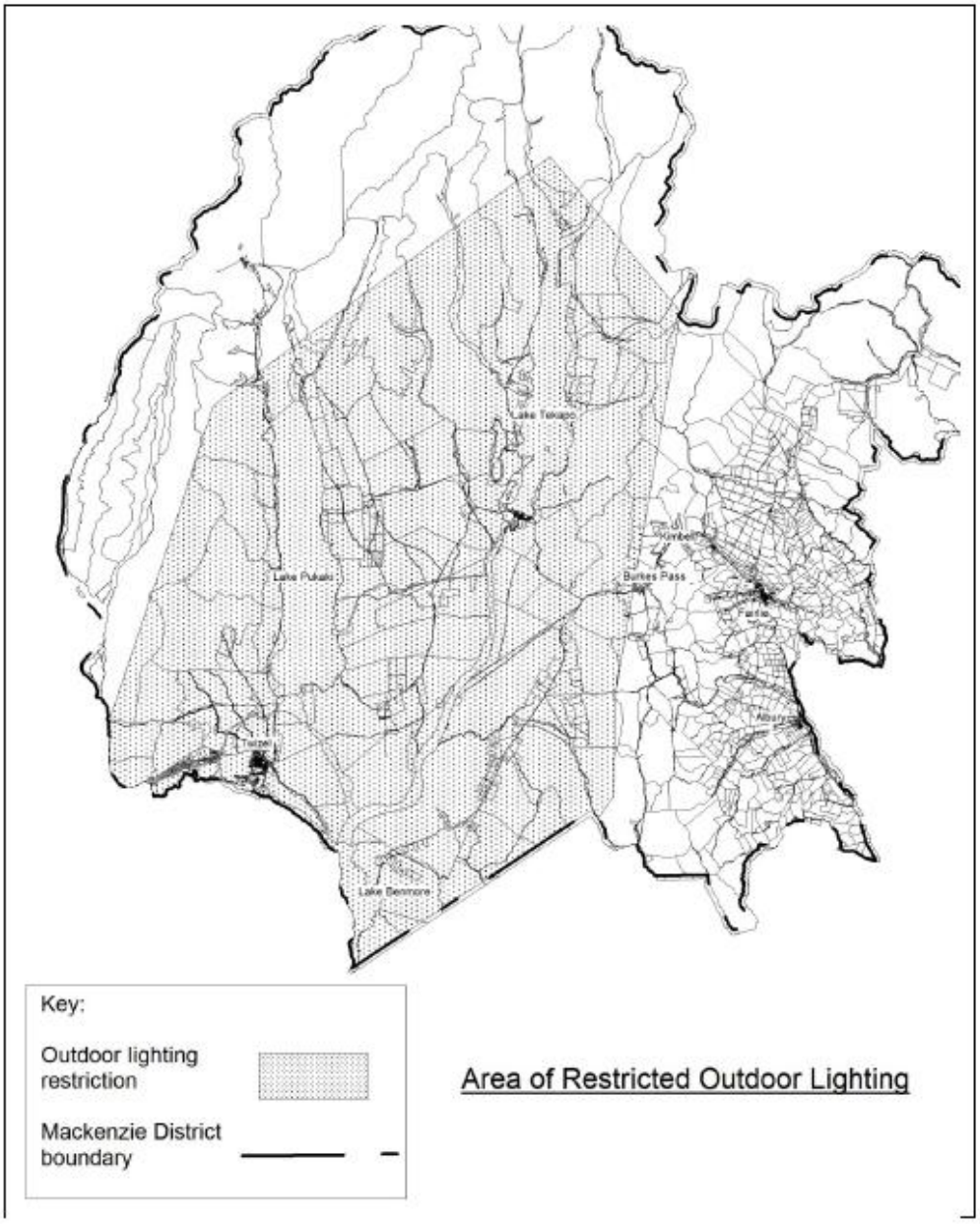


Diagram 1 – Visual Protection Corridor
Diagram not to scale


Lake Tekapo
Lake Pukaki
Burkes Pass
Lake Benmore
Key:
Outdoor lighting restriction
Mackenzie District boundary
Area of Restricted Outdoor Lighting

ASSESSMENT MATTERS - RESOURCE CONSENTS

15 Signs

15.a When considering an application for signs which are a discretionary activity the Council shall give consideration to the potential adverse effects on traffic safety, the visual amenities of the locality, and if applicable the need for such signage in addition to the permitted signage of the zone.

15.b The particular matters to be considered with respect to general traffic safety, are:

i the extent to which the signs may cause an obstruction to driving sight distances, traffic signs or signals, or unnecessarily intrude into a driver's field of view.

ii the potential adverse effects of the proposed sign on driver's concentration under all possible weather conditions.

iii the potential adverse impact of the sign on drivers who may have epilepsy or other similar medical conditions.

iv the extent that any sign resembles a traffic control sign or signal, or may make a traffic control sign or signal difficult to discern, with respect to both colour and shape, when considered from all possible driving angles. This includes signs which:

- resemble in shape and/or coloration an official traffic control sign or signal, and may accordingly confuse motorists when in the vicinity of an intersection or other potential traffic hazard;
- provide a confusing or dominating background, which could reduce the clarity or effectiveness of a traffic sign or signal;
- invite drivers to turn, but are sited in such proximity to the vehicle entrance that there is no time to signal, slow down and turn safely;
- contain reflectors, and therefore have the potential to be confused with traffic control signs or signals at night.

15.c The other general matters which may be considered are:

i the visual impact of the sign and its potential effects on the amenities of the locality.

ii the potential of the sign to adversely effect public health and safety, or to reduce public convenience.

iii the likely cumulative planning effect of allowing the sign to be erected.

iv the need to impose conditions relating to the location, design and appearance of the sign and the period for which it may be erected, or operated.

16 Outdoor Lighting

The particular matters to be considered concern:

16.a The type and use of outdoor lighting proposed.

16.b Type of illumination - illumination which has little or no emission at short wavelengths and single, monochromatic emission of low sodium pressure lights is preferable to fluorescent lights or the continuum emission of high-pressure sodium or incandescent bulbs.

16.c The total power of lamps.

16.d Proposed location with respect to distance from the observatory.

16.e Duration, time and frequency of proposed lighting.

16.f Whether it is proposed to shield lights to prevent light shining directly above the horizontal.

16.g Whether it is proposed to filter out blue or ultraviolet light.

16.h The effect of the proposal on research activity carried out at Mt John Observatory.

17 Aerial Distractions

17.a Whether there would be a reduction in road safety standards on the adjacent state highway

17.b Whether the activities would cause surprise to motorists

17.c Whether the activity is typical of activities normally expected to be located within this corridor.

Appendix B: Catalogue of all Exterior Lighting and Manufacturer's Catalogues

Comprehensive List of Street Lighting in Tekapo Village

Road Name	Intersects	Lantern Make	Lantern Model	Lamp Model
	old m.o.w yard of end of Allan St	Gec		2x30 w fluorescent
	old m.o.w yard of end of Allan St	Gec		2x30 w fluorescent
	in alley way on intersection of Grieg St and Allan St	Gough	G/L 500	35w l.p sodium
	in alley way on intersection of Grieg St and Allan St	Gough	G/L 500	35w l.p sodium
	corner of Allan St and Grieg St	Gough	G/L 500	35w l.p sodium
	village centre carpark west end	Gough	G/L 500	2x55w sodium vapour
Allan St		Gough	G/L 500	35w l.p sodium
Allan St		Gough	G/L 500	35w l.p sodium
Allan St	corner of Allan St and Jeune St	Gough	G/L 500	35w l.p sodium
Aorangi Cres	outside firSt house on left in Aorangi Cres	Gec		2x30 w fluorescent
Aorangi Cres	outside school	Gec		2x30 w fluorescent
Aorangi Cres	outside community hall	Gec		2x30 w fluorescent
Aorangi Cres	opposite Andrew Don Rd	Gec		2x30 w fluorescent
Aorangi Cres	outside no 38	Gec		2x30 w fluorescent
Aorangi Cres	pole no 6	Gec		2x30 w fluorescent
Aorangi Cres	opposite Bill Apes Lane	Gec		2x30 w fluorescent
Aorangi Cres		Gec		2x30 w fluorescent
Aorangi Cres		Gec		2x30 w fluorescent
Barbara Hay St	first pole on left in Barbara Hay St coming from Jeune St	Gec	Kowhai 100	55w sodium vapour
Barbara Hay St		Gec	Kowhai 100	55w sodium vapour
Bill Apes Lane	only pole in lane	Gec		35w l.p sodium
Burnett Place		Gec	Kowhai 100	55w sodium vapour
Burnett Place		Gec	Kowhai 100	55w sodium vapour
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd	refer to Plan	Gough	G/L 500	35w l.p sodium
Domain Rd		Gough	G/L 500	35w l.p sodium
Dwyer Place	corner of Dwyer Place and Hamilton Dr	Gough	G/L 500	35w l.p sodium
Dwyer Place	end of Dwyer Street	Gough	G/L 500	35w l.p sodium
Grieg St	refer to Plan	Gough	G/L 500	35w l.p sodium

Esther Hope St		Gec	Kowhai 100	55w sodium vapour
Hamilton Dr	intersection of Hamilton Drive and Murray St	Gec	G/L 500	35w l.p sodium
Hamilton Dr		Gec	Kowhai 100	55w sodium vapour
Hamilton Dr		Gec	Kowhai 100	55w sodium vapour
Hamilton Dr	opposite O'neill Place	Gough	G/L 500	35w l.p sodium
Hamilton Dr	opposite Dwyer Place	Gough	G/L 500	35w l.p sodium
Hamilton Dr		Gough	G/L 500	35w l.p sodium
Hamilton Dr		Gough	G/L 500	35w l.p sodium
Hamilton Dr		Gec	Kowhai 100	55w sodium vapour
Jeune St	corner of Jeune St and Allan St	Gough	G/L 500	35w l.p sodium
Jeune St	middle pole of 3 in Jeune St	Gec		4x400w H.P Sodium Mushroom
Jeune St	opposite end of Scott St	Gec		4x400w H.P Sodium Mushroom
Murray St		Gec		35w l.p sodium
Murray St		Gec		35w l.p sodium
Murray St		Gec		35w l.p sodium
Murray St		Gec		35w l.p sodium
Murray St		Gec		35w l.p sodium
Murray St		Gec		35w l.p sodium
Murray St		Gec		35w l.p sodium
Murray St		Gec		35w l.p sodium
Murray St		Gec		35w l.p sodium
Aorangi Cres	behind community hall in green area	Gec		2x30 w fluorescent
O'neill Place	first pole on right in O'neill Place	Gough	G/L 500	35w l.p sodium
O'neill Place		Gough	G/L 500	35w l.p sodium
O'neill Place		Gec	Kowhai 100	55w sodium vapour
Roto Place		Gec		35w l.p sodium
S.H.8	opposite entrance to Domain Ave	Gough	G/L 500	35w l.p sodium
S.H.8	S.H.8 refer to Plan	Gough	G/L 600	2x55w sodium vapour
S.H.8	S.H.8 beside entrance to village car park (west)	Gough	G/L 600	2x55w sodium vapour
S.H.8	S.H.8 opposite Westend village centre carpark	Gough	G/L 600	2x55w sodium vapour
S.H.8	opposite Shell garage	Gough	G/L 500	35w l.p sodium
S.H.8	refer to Plan	Gough	G/L 500	35w l.p sodium
S.H.8	refer to Plan	Gough	G/L 500	35w l.p sodium
S.H.8	opposite bakery	Gough	G/L 500	35w l.p sodium
S.H.8	refer to Plan	Gough	G/L 500	35w l.p sodium
S.H.8	refer to Plan	Gough	G/L 500	35w l.p sodium
S.H.8	S.H.8 opposite Westend village centre carpark	Gough	G/L 600	2x55w sodium vapour
S.H.8	opposite Aorangi Cres	Gough	G/L 500	35w l.p sodium
S.H.8	outside Challege garage	Gough	G/L 500	35w l.p sodium
S.H.8	beside fire Station (eastern	Gough	G/L 500	35w l.p sodium

	side)			
S.H.8	westside of Tekapo spillway	Gough	G/L 500	35w l.p sodium
S.H.8	eastside of Tekapo spillway	Gough	G/L 500	35w l.p sodium
S.H.8	opposite Pioneer Drive	Gough	G/L 500	35w l.p sodium
S.H.8	refer to Plan	Gough	G/L 500	35w l.p sodium
S.H.8	corner of S.H.8 and Grieg St	Gough	G/L 500	35w l.p sodium
Scott St		Gec		35w l.p sodium
Scott St		Gec		35w l.p sodium
Scott St		Gec		35w l.p sodium
Scott St		Gec		35w l.p sodium
Scott St		Gec		35w l.p sodium
Sealy St	corner of Sealy St and Alexander St	Gough	G/L 500	35w l.p sodium
Sealy St		Gough	G/L 500	35w l.p sodium
Sealy St		Gough	G/L 500	35w l.p sodium

Full Size Map of Tekapo Township with Street Lighting Information Overlaid

Resource Consent Application RM060062 – Recreational Facility – Lakeside Drive, Lake Tekapo – Zermatt Holding Ltd

The Council hereby grants consent RM060062, for the provision of a recreational facility incorporating a new ice rink, hot pools, day spa, snow making area and hire shop building, subject to the following conditions:

1. **The development shall proceed in accordance with the plans, information and further information submitted with the application and entered into Council records as RM060062, including the Landscape Master Plan dated January 2007, Drawing No. CD01, Revision A.**

2. **Luminaires shall be mounted so that there is zero upward light output.**

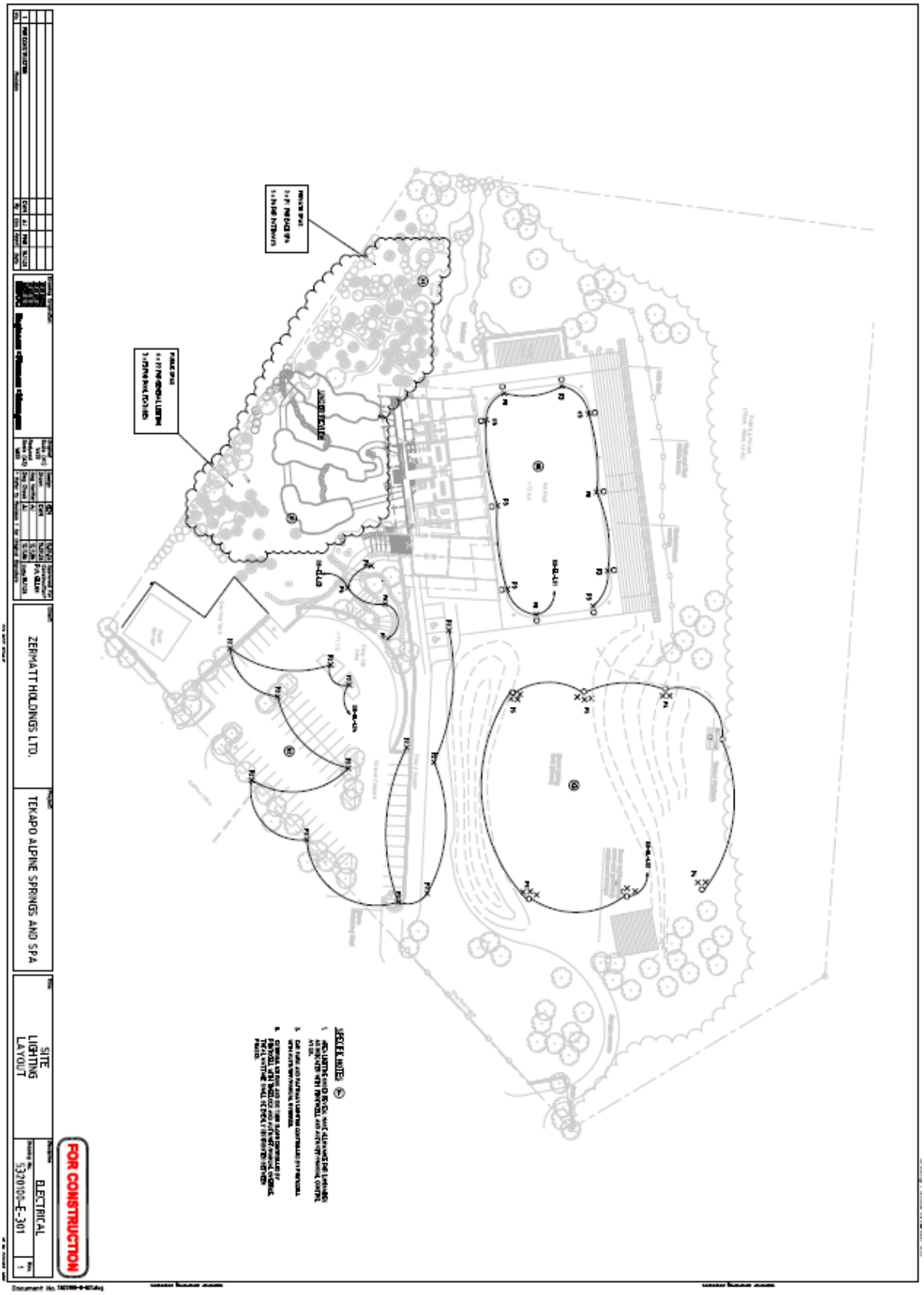
3. **The facility shall have an Operating and Maintenance manual that contains lamp specifications for replacement lamps. The specifications shall be for those lamps that are outlined in the Lighting Plan submitted with this application, unless otherwise approved by the Mackenzie District Council Planning and Regulation Manager.**

4. **No illumination of the skating rink or toboggan slope shall occur between the hours of 11.00pm and 6.00am.**

5. **Engineering plans for a water supply connection and reticulation shall be submitted to the Mackenzie District Council's Asset Manager for approval prior to the commencement of construction. This system shall comply with the following:**
    a. **Water supply reticulation shall be in accordance with SNZ PAS 4509:2003 "New Zealand Fire Service Fire Fighting Water Supplies Code of Practice", and in particular shall meet the code requirements with regard to fire fighting flows, running pressure and the spacing of hydrants.**
    b. **A water meter and valve assembly shall be installed on the water supply main at the boundary of the property. The valve assembly shall include a high hazard backflow preventer. This shall be installed above ground in an insulated cabinet and shall be certified annually with results submitted to the Council for monitoring purposes.**

6. **Engineering plans for a sewage system connecting to the Council's reticulated services shall be submitted to the Mackenzie District Council's Asset Manager for approval prior to the commencement of construction. The applicant shall provide for proposed upstream contributing flows in the calculations and design of this system (to be provided as part of the engineering approval).**

Full Size Map of the Tekapo Alpine Springs Winter Village



Comprehensive List of Street Lighting in Mt Cook Village

Road Name	Intersects	Lantern Make	Lantern Model	Lamp Model
	In green area between Maryburn Rd and Sefton St opposite Tasman Rd	Gough	G/L 500	35w l.p sodium
	In green area between Maryburn Rd and Sefton St opposite Tasman Rd	Gough	G/L 500	35w l.p sodium
		Gough	G/L 500	35w l.p sodium
	In alley way between Pukaki Pl and Mckenzie Drive	Gough	G/L 500	35w l.p sodium
	In alley way between Pukaki Pl and Mckenzie Drive	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Green area between Cass Cres and Sefton St	Gough	G/L 500	35w l.p sodium
	Green area between Cass Cres and Sefton St	Gough	G/L 500	35w l.p sodium
	Alley way between Mt cook Rd and Mary burn Rd opposite school	Gough	G/L 500	30w fluorescent
	Green area between Cass Cres and Fraser St	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre) spiked lighting fixture			
	In alley way between Mt cook Rd and Mary burn Rd opposite school	Gec		30w fluorescent
	Alley way opposite Godley St across to Mt cook Rd	Other:		70 w it.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p

				sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to Plan (town centre)			70w h.p sodium
	Refer to Plan (town centre)			70w h.p sodium
	Refer to Plan (town centre)			70w h.p sodium
	Refer to Plan (town centre) not in use			
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Green area between Fraser Cres and Sealy St	Gough	G/L 500	35w l.p sodium
	Green area between Fraser Cres and Sealy St	Gough	G/L 500	35w l.p sodium
	Green area between Sefton St Hopkins Rd and Fraser Cres	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Green area between Cass Cres and Fraser St	Gough	G/L 500	35w l.p sodium
	Corner Mt cook Rd and Tasman Rd	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to Plan (town centre)	Gough	G/L 500	35w l.p sodium
	Green area between Sefton St Hopkins Rd and Fraser Cres	Gough	G/L 500	35w l.p sodium
Bendrose Pl	On boundary of no 3 and no 5 Bendrose Pl	Gough	G/L 500	35w l.p sodium
Bendrose Pl	On boundary of no 9 and no 11 Bendrose Pl	Gough	G/L 500	35w l.p sodium
Bendrose Pl	Outside no 8 Omahau Cres - on Bendrose Rd Pl	Gough	G/L 500	35w l.p sodium
Braemar Place	17m from boundary of 47 Braemar Place	Gough	G/L 500	35w l.p sodium
Braemar Place		Gough	G/L 500	35w l.p sodium
Braemar Place		Gough	G/L 500	35w l.p sodium
Braemar Place		Gough	G/L 500	35w l.p sodium
Cass Cres		Gough	G/L 500	35w l.p sodium
Cass Cres	Up Driveway to 27 ,29,31 Cass Cres	Gough	G/L 500	35w l.p sodium
Cass Cres		Gough	G/L 500	35w l.p sodium
Cass Cres		Gough	G/L 500	35w l.p sodium
Cass Cres	Corner of Cass Cres and Mackenzie Dr	Gough		35w l.p sodium
Cass Cres		Gough	G/L 500	35w l.p sodium

Cass Cres	Corner Cass Cres and Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Cass Cres		Gough	G/L 500	35w l.p sodium
Cnr Wairepo Rd, Ruataniwha Rd		Gough	G/L 500	35w l.p sodium
Dobson Pl	On cnr off Jollie Rd and Dobson Pl opp boundary of no 46 and no 44 Jollie Rd	Gough	G/L 500	35w l.p sodium
Dobson Pl	Opp no 3 Dobson Pl	Gough	G/L 500	35w l.p sodium
Dusky Pl	Boundary no 11 and no 13	Gough	G/L 500	35w l.p sodium
FalStone cr	On cnr of Jollie Rd and Falstone Cres outside no 40 Jollie Rd	Gough	G/L 500	35w l.p sodium
FalStone cr	On boundary of no 17 and no 15 Falstone Cres	Gough	G/L 500	35w l.p sodium
FalStone cr	Outside no 15 Falstone Cres on bend	Gough	G/L 500	35w l.p sodium
FalStone cr	Outside no 11 Falstone Cres on bend	Gough	G/L 500	35w l.p sodium
FalStone cr	On cnr of 43 Jollie Rd and Falstone Cres	Gough	G/L 500	35w l.p sodium
FalStone cr	On boundary of no 23 and no 21 FalStone Cres	Gough	G/L 500	35w l.p sodium
FalStone cr	On boundary of no 5 and no 3 Falstone Cres	Gough	G/L 500	35w l.p sodium
Fraser Cres		Gough	G/L 500	35w l.p sodium
Fraser Cres		Gough	G/L 500	35w l.p sodium
Fraser Cres		Gough	G/L 500	35w l.p sodium
Fraser Cres	Outside Green area opposite 18 Fraser Cres	Gough	G/L 500	35w l.p sodium
Fraser Cres		Gough	G/L 500	35w l.p sodium
Fraser Cres	Outside Green area beside 19 Fraser Cres	Gough	G/L 500	35w l.p sodium
Fraser Cres	Cnr of Fraser Cres and Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Fraser Cres		Gough	G/L 500	35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd	Corner of Len Cairn Rd and Wolds Place	Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gec		35w l.p sodium
Glen cairn Rd		Gough	G/L 500	35w l.p sodium
Glen lyon Rd	Opp Numsveil Rd on Glen Lyon Rd	Gough	G/L 500	35w l.p sodium
Glenbrook Cres	On boundary of no 19 and 21 Glenbrook Cres	Gough	G/L 500	35w l.p sodium
Glenbrook Cres	Outside no 18 Simons but on Glensbrook Cres	Gough	G/L 500	35w l.p sodium
Glenbrook Cres	5m north of boundary of no 1 Glenbrook Cres	Gough	G/L 500	35w l.p sodium
Glenbrook Cres	On boundary of no 17 and no 19 Glenbrook Cres	Gough	G/L 500	35w l.p sodium
Glenbrook Cres	By boundary of no 7 and no 9 Glenbrook Cres	Gough	G/L 500	35w l.p sodium

Glenbrook Cres	15 metres south east of boundary of no 1 Glenbroook Cre	Gough	G/L 500	35w l.p sodium
Glenbrook Cres	By boundary of no 17 and no 15 Glenbrook Cres	Gough	G/L 500	35w l.p sodium
Godley Street		Gough	G/L 500	35w l.p sodium
Godley Street		Gough	G/L 500	35w l.p sodium
Godley Street		Gough	G/L 500	35w l.p sodium
Godley Street		Gough	G/L 500	35w l.p sodium
Godley Street		Gough	G/L 500	35w l.p sodium
Godley Street		Gough	G/L 500	35w l.p sodium
Hallewell Rd	On boundary of no 7 and no 5 Hallewell Rd	Gough	G/L 500	35w l.p sodium
Hallewell Rd	2m south of boundary of no 29 and no 31 Hallewell Rd	Gough	G/L 500	35w l.p sodium
Hallewell Rd	On boundary of no 21 and no 23 Hallewell Rd	Gough	G/L 500	35w l.p sodium
Hallewell Rd	On boundary of no 15 and no 13 Hallewell Rd	Gough	G/L 500	35w l.p sodium
Hopkins Rd		Gough	G/L 500	35w l.p sodium
Hopkins Rd		Gough	G/L 500	35w l.p sodium
Hopkins Rd		Gough	G/L 500	35w l.p sodium
Hopkins Rd		Gough	G/L 500	35w l.p sodium
Hopkins Rd		Gough	G/L 500	35w l.p sodium
Hopkins Rd		Gough	G/L 500	35w l.p sodium
Hopkins Rd		Gough	G/L 500	35w l.p sodium
Hunter Cres	On boundary of no 5 and no 3 Hunter Cres	Gough	G/L 500	35w l.p sodium
Hunter Cres	Opp no 16 and by Green area boundary	Gough	G/L 500	35w l.p sodium
Hunter Cres	On cnr Jollie Rd and Hunter Cres	Gough	G/L 500	35w l.p sodium
Hunter Cres	On cnr Jollie Rd and Hunter Cres	Gough	G/L 500	35w l.p sodium
Hunter Cres	Outside no 11 Hunter Cres	Gough	G/L 500	35w l.p sodium
Huxley Pl	On boundary of no 15 and no 13 Huxley Pl	Gough	G/L 500	35w l.p sodium
Irishman Drive	70 metres west of pole 4	Gough	G/L 500	70w s.o.n
Irishman Drive	53 metres east of pole 12	Gough	G/L 500	70w s.o.n
Irishman Drive	65 metres west of pole 5	Gough	G/L 500	70w s.o.n
Irishman Drive	Beside padmount transformer e35	Gough	G/L 500	70w s.o.n
Irishman Drive	65 metres east of pole 10	Gough	G/L 500	70w s.o.n
Irishman Drive	66 metres east of pole 11	Gough	G/L 500	70w s.o.n
Irishman Drive	65 metres west of pole 1	Gough	G/L 500	70w s.o.n
Irishman Drive	57 metres west of pole 2	Gough	G/L 500	70w s.o.n
Irishman Drive	65 metres west of pole 3	Gough	G/L 500	70w s.o.n
Irishman Drive	50 metres south of pole 13	Gough	G/L 500	70w s.o.n
Irishman Drive	60 metres south of pole 14	Gough	G/L 500	70w s.o.n
Irishman Drive		Gough	G/L 500	70w s.o.n
Irishman Drive	46 metres west of pole 6	Gough	G/L 500	70w s.o.n
Irishman Drive	54 metres east of pole 8	Gough	G/L 500	70w s.o.n
Irishman Drive	47 metres east of pole 9		G/L 500	70w s.o.n
Jollie Rd	22 metres north of Ruataniwha Rd centre line	Gough	G/L 500	35w l.p sodium
Jollie Rd	On boundary of no 49 and no 47 Jollie Rd	Gough	G/L 500	35w l.p sodium
Jollie Rd	On boundary of no 23 and no 21 Jollie	Gough	G/L 500	35w l.p sodium
Jollie Rd	On boundary of no 57 and no 55 Jollie	Gough	G/L 500	35w l.p sodium

	Rd			
Jollie Rd	3 metres west of boundary of no 3 Jollie Rd and green area	Gough	G/L 500	35w l.p sodium
Jollie Rd	Opp no 28 Jollie Rd by cnr Huxley Pl			35w l.p sodium
Jollie Rd	On boundary of no 45 and no 43 Jollie Rd	Gough	G/L 500	35w l.p sodium
Jollie Rd	Outside no 13 Jollie Rd	Gough	G/L 500	35w l.p sodium
Jollie Rd	On boundary of no 31 and no 29 Jollie Rd	Gough	G/L 500	35w l.p sodium
Jollie Rd	Outside no 35 Jollie Rd	Gough	G/L 500	35w l.p sodium
Jollie Rd	On boundary of no1 Jollie Rd and 88 Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On cnr of Hallewell Rd and Mackenzie Dr outside no 46 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside Church St on Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 66 and no 68 Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 220 Mackenzie Dr by corner of Rhoboro Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	21 metres east of no 322 boundary	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 38 Colonial motels	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On cnr of Hallewell Rd and Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 58 and no 60 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	89 meters north west of pole no 2 opp East St approx	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside Parklans touriSt park on Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	89 metres north west of pole no 1 outside Motor inn	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 82 and no 84 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside 134 Mackenzie Dr by corner of Godley St	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 150 and no 148 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 232 and no 234 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 264 and no 266 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 276 and 278 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 284 and no 286 Mackenzie Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 176 and no 178 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 304 and no 306	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 128 Mackenzie Dr on corner of Mackenzie Dr and Tekapo Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 144 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	58 metres from centre line Mackenzie Dr in Green area walkway	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Twin reaches down r.o.w 297 Mackenzie Dr 72 metres nth of pole no 65	Gough	G/L 500	35w l.p sodium

Mackenzie Dr	36 metres from centre line of Mackenzie Dr in Green area walkway	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	20 metres west of centre line of Nunsveill Rd			
Mackenzie Dr	Opp Fraser Cres	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside Aspen court motels ,no 10 Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 158 and no 160 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Slightly opp Fraser cesc on Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 70 and no 72 Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 240 Mackenzie Dr by cnr of Totara Drive	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 297 and 295 Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	62 metres from the centre line of Mackenzie Dr in Green area walkway	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Opp no 189 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 254 and no 256 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr		Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 32 Mackenzie Dr on cnr of Dusky Pl	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Opp 219 Mackenzie Dr on cnr Braemar Pl	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On cnr of mackenzie Dr and Ostler Rd 14 metres from the centre line of Ostler Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On cnr of Mackenzie Dr and Jollie Rd outside no 88 Mackenzie Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 246 and no 248 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 22 and no 24	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On cnr of Ruataniwha Rd and Mackenzie Dr outside Shell servce Station	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 94 and 96 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 294 and no 292 Mackenzie Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 312 and 314 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 124 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 136 and no 138 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 168 and 166 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 184 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Opp boundary or no 195 and no 197 Mackenzie Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 216 and no 218 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	42 metres north west of pole no 3 by cnr of Simons St and Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 322 Mackenzie	Gough	G/L 500	35w l.p sodium

	Drive			
Mackenzie Dr	Outside no 174 Mackenzie Dr by corner of Tekapo Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 86 Mackenzie Dr on cnr of Mackenzie Dr and Jollie Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 118 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 212 Mackenzie on corner or Irishmans Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Opp boundary of no 314 and no 316 Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Opp boundary no 322 and corner Green area on mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary of no 16 and Green area walkway	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	On boundary or no 102 and Green area on Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	16 metres west of Glen Cairm Rd centre line	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 260 Mckenzie Dr by cnr of Rata Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Opp no 261 Mackenzie Dr on cnr of Ohau Rd	Gough	G/L 500	35w l.p sodium
Mackenzie Dr	Outside no 300 Mackenzie Dr by cnr of Omahau Cres	Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Maryburn Rd	On corner of Mary burn Rd and Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Maryburn Rd		Gough	G/L 500	35w l.p sodium
Mcauley Place		Gough	G/L 500	35w l.p sodium
Mcauley Place		Gough	G/L 500	35w l.p sodium
Mt cook lane	1St pole in Mt cook lane on right hand side	Gough	G/L 500	35w l.p sodium
Mt cook lane		Gough	G/L 500	35w l.p sodium
Mt cook lane	Back section on right hand side of Mt cook lane	Gough	G/L 500	35w l.p sodium
Mt cook Rd		Gough	G/L 500	35w l.p sodium
Mt cook Rd		Gough	G/L 500	35w l.p sodium
Mt cook Rd		Gough	G/L 500	35w l.p sodium
Mt cook Rd		Gough	G/L 500	35w l.p sodium
Mt cook Rd		Gough	G/L 500	35w l.p sodium
Mt cook Rd		Gough	G/L 500	35w l.p sodium
Mt cook Rd	Opposite centre for catchment ecology	Gough	G/L 500	35w l.p sodium
Ohau Rd	By northern end of combined services car park	Gough	G/L 500	35w l.p sodium
Ohau Rd	By southern end of combined services car park	Gough	G/L 500	35w l.p sodium
Ohau Rd	Directly outside sombined services	Gough	G/L 500	35w l.p sodium
Ohau Rd	On cnr of Te kohai Rd - Ohau Rd	Gough	G/L 500	35w l.p sodium
Ohau Rd	On boundary of WhiteStone yeaRd and	Gough	G/L 500	35w l.p sodium

	Maori pa.			
Omahau Cres	Outside no 300 Mackenzie Dr on Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	On boundary of no 41 and corner section - opp no 64 Omahau	Gough	G/L 500	35w l.p sodium
Omahau Cres	On boundary of no 35 and no 37 Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	On boundary of no 27 and no 29 Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	Opp boundary of no 4 and no 6 Omahau	Gough	G/L 500	35w l.p sodium
Omahau Cres	On boundary of no 15 and no 17 Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	On boundary of no 7 and no 9 Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	49 metres south west of pole no 1 opp no 2 Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	On boundary of no 39 and 41 Omahau	Gough	G/L 500	35w l.p sodium
Omahau Cres	Outside no 37 - opp boundary of no 54 and no 56 Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	Outside no 23 Omahau Cres opp boundary of no 34 and no 36 Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	On boundary of no 21 and no 23 Omahau Cres	Gough	G/L 500	35w l.p sodium
Omahau Cres	Outside no 17 Omahau on bend	Gough	G/L 500	35w l.p sodium
Ostler Rd	43 metres east of Benmore Pl centre of Rd	Gough	G/L 500	35w l.p sodium
Ostler Rd	15 metres east of Wairepo Rd ,centre lines	Gough	G/L 500	35w l.p sodium
Ostler Rd	Outside motor inn - 21 metres west of Benmore Pl centre of Rd	Gough	G/L 500	35w l.p sodium
Ostler Rd	16 metres west of Mckenzie Drive centre line	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	Opp alStom	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	100 metres west of pole no 10	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	opp rex millar engineering	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	130 metres west of pole no 8	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	11 metres west of South St centre line	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	opp twizel recreation and hire	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	138 metres west of pole no 15 opp alpine induStries gateway	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	92 metres west of pole no14	Gec		4x400w H.P Sodium

				Mushroom
Ostler Rd	41 metres west of pole 7	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	On cnr of Ostler and Ohau Rds	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	130 metres west of pole no 11	Gec		4x400w H.P Sodium Mushroom
Ostler Rd	Opp high country auto services	Gec		4x400w H.P Sodium Mushroom
PreSton Pl		Gough	G/L 500	35w l.p sodium
PreSton Pl	25 metres west off Hallewell Rd centre line on PreSton Pl	Gough	G/L 500	35w l.p sodium
PreSton Pl	On boundary of no 5 and Green area walk way	Gough	G/L 500	35w l.p sodium
PreSton Pl	In green area - 47 metres west of pole no2	Gough	G/L 500	35w l.p sodium
Pukaki Pl		Gough	G/L 500	35w l.p sodium
Pukaki Pl		Gough	G/L 500	35w l.p sodium
Pukaki Pl		Gough	G/L 500	35w l.p sodium
Pukaki Pl		Gough	G/L 500	35w l.p sodium
Rata Rd	adj no 39 Rata Rd	Gough	G/L 500	35w l.p sodium
Rata Rd	On cnr of Rata Rd and Mackenzie Dr	Gough	G/L 500	35w l.p sodium
Rata Rd	Opp no 5 Rata Rd - on corner	Gough	G/L 500	35w l.p sodium
Rata Rd	Outside no 26 Rata Rd	Gough	G/L 500	35w l.p sodium
Rata Rd	11 metres from boundary of no 56 by cnr	Gough	G/L 500	35w l.p sodium
Rata Rd	Outside no 52 Rata Rd opp Geenarea walk way	Gough	G/L 500	35w l.p sodium
Rata Rd	opp no 57 Rata Rd	Gough	G/L 500	35w l.p sodium
Rata Rd	On boundary of no 44 and no 46 Rata Rd	Gough	G/L 500	35w l.p sodium
Rata Rd	On boundary of no 18 and no 20 Rata Rd	Gough	G/L 500	35w l.p sodium
Rata Rd	Opp no 7 Rata Rd - on cnr	Gough	G/L 500	35w l.p sodium
Rata Rd	Outside no 52 Rata Rd opp no 70	Gough	G/L 500	35w l.p sodium
Rata Rd	On boundary of no 10 and no 12 Rata Rd	Gough	G/L 500	35w l.p sodium
Rata Rd	Outside no 26 Rata Rd 9 metres away from boundary of no 28	Gough	G/L 500	35w l.p sodium
Rata Rd	Outside no 32 - opp no 49 Rata Rd	Gough	G/L 500	35w l.p sodium
Ruataniwha Rd	Opp Jollie Rd on Ruataniwha Rd St/l control point	Gough	G/L 500	35w l.p sodium
Ruataniwha Rd	37 metres west of pole no1	Gough	G/L 500	35w l.p sodium
Ruataniwha Rd	On cnr of Ruataniwha Rd and s.h.8	Gough	G/L 500	35w l.p sodium
Ruataniwha Rd	81 metres west of pole no3	Gough	G/L 500	35w l.p sodium
Ruataniwha Rd	36 metres west of pole no2 cnr Wairepo Rd and Ruataniwha Rd	Gough	G/L 500	35w l.p sodium
Ruataniwha Rd	Opp boundary of no 11 and no 15 Ruataniwha Rd	Gough	G/L 500	35w l.p sodium
Ruataniwha Rd	Opp boundary of no 3 and no 5 Ruataniwha Rd	Gough	G/L 500	35w l.p sodium
S.H.8	On s.h.8 opp Ruataniwha	Gough	G/L 500	35w l.p sodium
S.H.8	On s.h.8 opp Ostler Rd	Gough	G/L 500	35w l.p sodium

S.H.8	On s.h.8 opp Glenlyon	Gough	G/L 500	35w l.p sodium
S.H.8	62 metres west of pole 3 s.h.8 on Ostler Rd	Gough	G/L 500	35w l.p sodium
Sealy St	In green area opp no 10 Sealy St	Gough	G/L 500	35w l.p sodium
Sealy St	Outside 30 Fraser Cres on Sealy St	Gough	G/L 500	35w l.p sodium
Sealy St		Gough	G/L 500	35w l.p sodium
Sealy St		Gough	G/L 500	35w l.p sodium
Sealy St		Gough	G/L 500	35w l.p sodium
Sealy St		Gough	G/L 500	35w l.p sodium
Sefton St		Gough	G/L 500	35w l.p sodium
Sefton St		Gough	G/L 500	35w l.p sodium
Sefton St		Gough	G/L 500	35w l.p sodium
Sefton St		Gough	G/L 500	35w l.p sodium
Sefton St		Gough	G/L 500	35w l.p sodium
Sefton St		Gough	G/L 500	35w l.p sodium
Sefton St		Gough	G/L 500	35w l.p sodium
Sefton St		Gough	G/L 500	35w l.p sodium
Simons St	Opp Glenbrook Cres on Simons St	Gough	G/L 500	35w l.p sodium
Simons St	On cnr of Simons St and Ruataniwha Rd	Gough	G/L 500	35w l.p sodium
Simons St	On cnr of Simons St and Halliwell Rd	Gough	G/L 500	35w l.p sodium
Simons St	On boundary of no11 and no 9	Gough	G/L 500	35w l.p sodium
Simons St		Gough	G/L 500	35w l.p sodium
Simons St	Outside no 3 Simons St opp Glensbrook Cres	Gough	G/L 500	35w l.p sodium
Simons St	Opp no 24 Simons St	Gough	G/L 500	35w l.p sodium
Simons St	On boundary of no 37 and Green area walk way	Gough	G/L 500	35w l.p sodium
South St	60 metres north from centre line of Ostler Rd	Gec		4x400w H.P Sodium Mushroom
South St	33 metres north of pole 2	Gec		4x400w H.P Sodium Mushroom
Tasman St	Corner of Tasman Rd and Pukaki Place (police Station side)	Gough	G/L 500	35w l.p sodium
Tasman St	Corner Mckenzie Drive and Tasman Rd	Gough	G/L 500	35w l.p sodium
Tasman St	Outside Tophut bottle Store	Gough	G/L 500	35w l.p sodium
Tasman St	Outside medical centre	Gough	G/L 500	35w l.p sodium
Tasman St		Gough	G/L 500	35w l.p sodium
Tasman St	Beside carpark entrance to High country lodge on Tasman Rd	Gough	G/L 500	35w l.p sodium
Tasman St	Corner Tasman Rd and Pukaki Place (town side)	Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium

Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive		Gough	G/L 500	35w l.p sodium
Tekapo Drive	On boundary of 59 Tekapo Drive	Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr	In section (13 totara Drive) beside green area	Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr	Opposite green area on Totara Drive towards Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Totara Dr	On boundary of lots 1040+1073	Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr		Gough	G/L 500	35w l.p sodium
Totara Dr	On cornr of Totara Drive and Mackenzie Drive	Gough	G/L 500	35w l.p sodium
Wairepo Rd	60 metres north of pole no 5		G/L 500	35w l.p sodium
Wairepo Rd	80 metres north of pole no6	Gec		400w m/v
Wairepo Rd	On cnr of Ostler and Wairepo Rds	Gough	G/L 500	35w l.p sodium
Wairepo Rd	37 metres north of pole no1	Gough	G/L 500	35w l.p sodium
Wairepo Rd	Outside mtn. Chalets 56 metres north of pole no 4	Gough	G/L 500	35w l.p sodium
Wairepo Rd	83 metres north of pole 2	Gough	G/L 500	35w l.p sodium
Wairepo Rd	opp DOC HQ	Gough	G/L 500	35w l.p sodium
Wolds Place	Only light in Street	Gec		35w l.p sodium

Comprehensive List of Street Lighting and Map showing their Locations along State Highway 8

Displacement	Bracket Height	Lamp Make	Lamp Model	Light Make	Light Model
SH08-RS73					
4922m	6.6	OSRAM	2x30W sodium vapour	Unknown	
4957m	7.2	OSRAM	2x30W sodium vapour	Unknown	
5002m	6.6	OSRAM	2x30W sodium vapour	Unknown	
5049m	6.5	OSRAM	150W sodium hp	Unknown	
5094m	6.7	OSRAM	2x30W sodium vapour	Unknown	
5 Rows					
6					

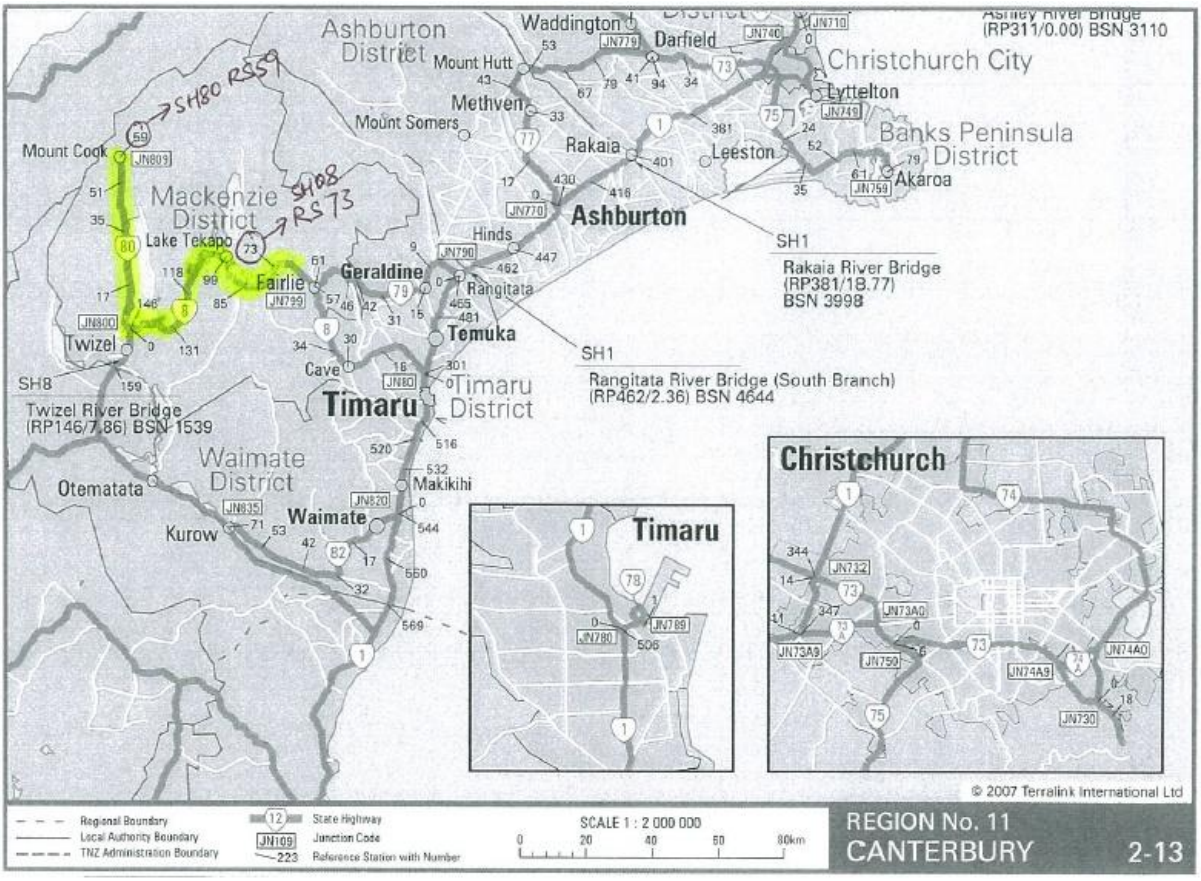
Displacement	Bracket Height	Lamp Make	Lamp Model	Light Make	Light Model
SH08-RS85					
13333m	12	OSRAM	1x35W sodium lp	Gough	GL500
14086m	7.7	OSRAM	1x35W sodium lp	Gough	GL500
14124m	7.9	OSRAM	1x35W sodium lp	Gough	GL500
14171m	7.9	OSRAM	1x35W sodium lp	Gough	GL500
14219m	7.8	OSRAM	1x35W sodium lp	Gough	GL500
14263m	6.8	OSRAM	1x35W sodium lp	Gough	GL500
6 Rows					
7					

Displacement	Bracket Height	Lamp Make	Lamp Model	Light Make	Light Model
SH08-RS99					
75m	7.5	OSRAM	1x35W sodium lp	Gough	GL500
120m	7.7	OSRAM	1x35W sodium lp	Gough	GL500
180m	8	OSRAM	1x35W sodium lp	Gough	GL500
255m	7.9	OSRAM	1x35W sodium lp	Gough	GL500
295m	7.8	OSRAM	1x35W sodium lp	Gough	GL500
340m	7.8	OSRAM	1x35W sodium lp	Gough	GL500
375m	12	OSRAM	1x35W sodium lp	Gough	GL500
430m	7.9	OSRAM	1x35W sodium lp	Gough	GL500
480m	7.3	OSRAM	1x35W sodium lp	Gough	GL500
540m	9.9	OSRAM	2x55W sodium vapour	Gough	GL600
610m	9.9	OSRAM	2x55W sodium vapour	Gough	GL500
640m	9.9	OSRAM	2x55W sodium vapour	Gough	GL500
729m	7.9	OSRAM	1x35W sodium lp	Gough	GL500
13 Rows					
14					

Displacement	Bracket Height	Lamp Make	Lamp Model	Light Make	Light Model
SH08-RS146					
8230m	9	OSRAM	1x35W sodium lp	Gough	GL500
8408m	11	OSRAM	2x55W sodium vapour	Gough	GL600
8449m	11	OSRAM	2x55W sodium vapour	Gough	GL600
8489m	11	OSRAM	2x55W sodium vapour	Gough	GL600
8529m	11	OSRAM	2x55W sodium vapour	Gough	GL600

	8545m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	8570m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	8595m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	8612m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	8628m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	9039m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	9056m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	9080m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	9106m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	9122m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	9139m	11	OSRAM	2x55W sodium vapour	Gough	GL600
	10540m	11	OSRAM	1x35W sodium lp	Gough	GL500
	17 Rows					
	18					

Map showing the approximate locations of the street lights



Comprehensive List of Street Lighting in Twizel

RoadName	Intersects	LanternMake	LanternModel	LampModel
	In Green area between Maryburn rd and Sefton st opposite Tasman rd	Gough	G/L 500	35w l.p sodium
	In Green area between Maryburn rd and Sefton st opposite Tasman rd	Gough	G/L 500	35w l.p sodium
		Gough	G/L 500	35w l.p sodium
	In alley way between Pukaki pl and Mckenzie drive	Gough	G/L 500	35w l.p sodium
	In alley way between Pukaki pl and Mckenzie drive	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Green area between Cass cres and Sefton st	Gough	G/L 500	35w l.p sodium
	Green area between Cass cres and Sefton st	Gough	G/L 500	35w l.p sodium
	Alley way between Mt cook rd and Mary burn rd oppisite school	Gough	G/L 500	30w fluro
	Green area between Cass cres and Fraser st	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	gough	G/L 500	35w l.p sodium
	Refer to plan (town centre) spiked lighting reature			
	In alley way between Mt cook rd and Mary burn rd opposite school	gec		30w fluro
	Alley way opposite Godley st across to Mt cook rd	Other:		70 w it.p sodium
	Refer to plan (town centre)	gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	150w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	150w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium

	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	70w h.p sodium
	Refer to plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)	Gough	G/L 700	150w h.p sodium
	Refer to plan (town centre)			70w h.p sodium
	Refer to plan (town centre)			70w h.p sodium
	Refer to plan (town centre)			70w h.p sodium
	Refer to plan (town centre)not in use			
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Green area between Fraser cres and Sealy st	Gough	G/L 500	35w l.p sodium
	Green area between Fraser cres and Sealy st	Gough	G/L 500	35w l.p sodium
	Green area between Sefton st Hopkins rd and Fraser cres	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Green area between Cass cres and Fraser st	Gough	G/L 500	35w l.p sodium
	Corner Mt cook rd and Tasman rd	Gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	gough	G/L 500	35w l.p sodium
	Refer to plan (town centre)	Gough	G/L 500	35w l.p sodium
	Green area between Sefton st Hopkins rd and Fraser cres	Gough	G/L 500	35w l.p sodium
Bendrose pl	On boundry of no 3 and no 5 Bendrose pl	Gough	G/L 500	35w l.p sodium
Bendrose pl	On boundry of no 9 and no 11 Bendrose pl	Gough	G/L 500	35w l.p sodium
Bendrose pl	Outside no 8 Omahau cresc - on Bendrose rd pl	Gough	G/L 500	35w l.p sodium
Braemar place	17m from boundry of 47 Braemar place	Gough	G/L 500	35w l.p sodium
Braemar place		Gough	G/L 500	35w l.p sodium
Braemar place		Gough	G/L 500	35w l.p sodium
Braemar place		Gough	G/L 500	35w l.p sodium
Cass cresc		Gough	G/L 500	35w l.p sodium
Cass cresc	Up driveway to 27 ,29,31 Cass cres	Gough	G/L 500	35w l.p sodium
Cass cresc		Gough	G/L 500	35w l.p sodium
Cass cresc		Gough	G/L 500	35w l.p sodium
Cass cresc	Corner of Cass cres and Mckenzie dr	Gough		35w l.p sodium
Cass cresc		Gough	G/L 500	35w l.p sodium
Cass cresc	Corner Cass cres and Mckenzie drive	Gough	G/L 500	35w l.p sodium

Cass cresc		Gough	G/L 500	35w l.p sodium
Cnr Wairepo rd and Ruataniwha rd		Gough	G/L 500	35w l.p sodium
Dobson pl	On cnr off Jollie rd and Dobson pl opp boundry of no 46 and no 44 Jollie rd	Gough	G/L 500	35w l.p sodium
Dobson pl	Opp no 3 Dobson pl	Gough	G/L 500	35w l.p sodium
Dusky pl	Boundry no 11 and no 13	Gough	G/L 500	35w l.p sodium
Falstone cr	On cnr of Jollie rd and Fallstone cres outside no 40 Jollie rd	Gough	G/L 500	35w l.p sodium
Falstone cr	On boundry of no 17 and no 15 Falstone cresc	Gough	G/L 500	35w l.p sodium
Falstone cr	Outside no 15 Falstone cresc on bend	Gough	G/L 500	35w l.p sodium
Falstone cr	Outside no 11 Falstone cresc on bend	Gough	G/L 500	35w l.p sodium
Falstone cr	On cnr of 43 Jollie rd and Falstone cresc	Gough	G/L 500	35w l.p sodium
Falstone cr	On boundry of no 23 and no 21 Falstone cresc	Gough	G/L 500	35w l.p sodium
Falstone cr	On boundry of no 5 and no 3 Falstone cresc	Gough	G/L 500	35w l.p sodium
Fraser cres		Gough	G/L 500	35w l.p sodium
Fraser cres		Gough	G/L 500	35w l.p sodium
Fraser cres		Gough	G/L 500	35w l.p sodium
Fraser cres	Outside Green area opposite 18 Fraser cres	Gough	G/L 500	35w l.p sodium
Fraser cres		Gough	G/L 500	35w l.p sodium
Fraser cres	Outside Green area beside 19 Fraser cres	Gough	G/L 500	35w l.p sodium
Fraser cres	Corner of Fraser cres and Mckenzie dr	Gough	G/L 500	35w l.p sodium
Fraser cres		Gough	G/L 500	35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd	Corner of Len cairn rd and Wolds place	gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium
Glen cairn rd		gec		35w l.p sodium

Glen cairn rd		Gough	G/L 500	35w l.p sodium
Glen lyon rd	Opp Numsveil rd on Glen lyon rd	Gough	G/L 500	35w l.p sodium
Glenbrook cresc	On boundry of no 19 and 21 Glenbrook cresc	Gough	G/L 500	35w l.p sodium
Glenbrook cresc	Outside no 18 Simons but on Glensbrook cresc	Gough	G/L 500	35w l.p sodium
Glenbrook cresc	5m north of boundry of no 1 Glenbrook cres	Gough	G/L 500	35w l.p sodium
Glenbrook cresc	On boundry of no 17 and no 19 Glenbrook cresc	Gough	G/L 500	35w l.p sodium
Glenbrook cresc	By boundry of no 7 and no 9 Glenbrook cresc	Gough	G/L 500	35w l.p sodium
Glenbrook cresc	15 metres south east of boundry of no 1 Glenbroook cresc	Gough	G/L 500	35w l.p sodium
Glenbrook cresc	By boundry of no 17 and no 15 Glenbrook cresc	Gough	G/L 500	35w l.p sodium
Godley street		Gough	G/L 500	35w l.p sodium
Godley street		Gough	G/L 500	35w l.p sodium
Godley street		Gough	G/L 500	35w l.p sodium
Godley street		Gough	G/L 500	35w l.p sodium
Godley street		Gough	G/L 500	35w l.p sodium
Godley street		Gough	G/L 500	35w l.p sodium
Hallewell rd	On boundry of no 7 and no 5 Hallewell rd	Gough	G/L 500	35w l.p sodium
Hallewell rd	2m south of boundry of no 29 and no 31 Hallewell rd	Gough	G/L 500	35w l.p sodium
Hallewell rd	On boundry of no 21 and no 23 Hallewell rd	Gough	G/L 500	35w l.p sodium
Hallewell rd	On boundry of no 15 and no 13 Hallewell rd	Gough	G/L 500	35w l.p sodium
Hopkins rd		Gough	G/L 500	35w l.p sodium
Hopkins rd		Gough	G/L 500	35w l.p sodium
Hopkins rd		Gough	G/L 500	35w l.p sodium
Hopkins rd		Gough	G/L 500	35w l.p sodium
Hopkins rd		Gough	G/L 500	35w l.p sodium
Hopkins rd		Gough	G/L 500	35w l.p sodium
Hopkins rd		Gough	G/L 500	35w l.p sodium
Hunter cresc	On boundry of no 5 and no 3 Hunter cresc	Gough	G/L 500	35w l.p sodium
Hunter cresc	Opp no 16 and by Green area boundry	Gough	G/L 500	35w l.p sodium
Hunter cresc	On cnr Jollie rd and Hunter cresc	Gough	G/L 500	35w l.p sodium
Hunter cresc	On cnr Jollie rd and Hunter cresc	Gough	G/L 500	35w l.p sodium
Hunter cresc	Outside no 11 Hunter cesc	Gough	G/L 500	35w l.p sodium
Huxley pl	On boundry of no 15 and no 13 Huxley pl	Gough	G/L 500	35w l.p sodium

Irishman drive	70 metres west of pole 4	Gough	G/L 500	70w s.o.n
Irishman drive	53 metres east of pole 12	Gough	G/L 500	70w s.o.n
Irishman drive	65 metres west of pole 5	Gough	G/L 500	70w s.o.n
Irishman drive	Beside padmount transformer e35	Gough	G/L 500	70w s.o.n
Irishman drive	65 metres east of pole 10	Gough	G/L 500	70w s.o.n
Irishman drive	66 metres east of pole 11	Gough	G/L 500	70w s.o.n
Irishman drive	65 metres west of pole 1	Gough	G/L 500	70w s.o.n
Irishman drive	57 metres west of pole 2	Gough	G/L 500	70w s.o.n
Irishman drive	65 metres west of pole 3	Gough	G/L 500	70w s.o.n
Irishman drive	50 metres sounth of pole 13	Gough	G/L 500	70w s.o.n
Irishman drive	60 metres south of pole 14	Gough	G/L 500	70w s.o.n
Irishman drive		Gough	G/L 500	70w s.o.n
Irishman drive	46 metres west of pole 6	Gough	G/L 500	70w s.o.n
Irishman drive	54 metres east of pole 8	Gough	G/L 500	70w s.o.n
Irishman drive	47 metres east of pole 9		G/L 500	70w s.o.n
Jollie rd	22 metres north of Ruataniwha rd centre line	Gough	G/L 500	35w l.p sodium
Jollie rd	On boundry of no 49 and no 47 Jollie rd	Gough	G/L 500	35w l.p sodium
Jollie rd	On boundry of no 23 and no 21 Jollie	Gough	G/L 500	35w l.p sodium
Jollie rd	On boundry of no 57 and no 55 Jollie rd	Gough	G/L 500	35w l.p sodium
Jollie rd	3 metres west of boundry of no 3 Jollie rd and green area	Gough	G/L 500	35w l.p sodium
Jollie rd	Opp no 28 Jollie rd by cnr Huxley pl			35w l.p sodium
Jollie rd	On boundry of no 45 and no 43 Jollie rd	Gough	G/L 500	35w l.p sodium
Jollie rd	Outside no 13 Jollie rd	Gough	G/L 500	35w l.p sodium
Jollie rd	On boundry of no 31 and no 29 Jollie rd	Gough	G/L 500	35w l.p sodium
Jollie rd	Outside no 35 Jollie rd	Gough	G/L 500	35w l.p sodium
Jollie rd	On boundry of no1 Jollie rd and 88 Mackenzie drive	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On cnr of Hallewell rd and Mackenzie dr outside no 46 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside Church st on Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 66 and no 68 Mackenzie drive	Gough	G/L 500	35w l.p sodium

Mackenzie dr	Outside no 220 Mackenzie dr by corner of Rhoboro rd	Gough	G/L 500	35w l.p sodium
Mackenzie dr	21 metres east of no 322 boundry	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 38 Colonial motels	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On cnr of Hallewell rd and Mackenzie drive	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 58 and no 60 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	89 meters north west of pole no 2 opp East st approx	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside Parklans tourist park on Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	89 metres north west of pole no 1 outside Motor inn	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 82 and no 84 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside 134 Mackenzie dr by corner of Godley st	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 150 and no 148 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 232 and no 234 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 264 and no 266 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 276 and 278 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 284 and no 286 Mackenzie rd	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 176 and no 178 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 304 and no 306	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 128 Mackenzie dr on corner of Mackenzie dr and Tekapo dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 144 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	58 metres from centre line Mackenzie dr in Green area walkway	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Twin reaches down r.o.w 297 Mackenzie dr 72 metres nth of pole no 65	Gough	G/L 500	35w l.p sodium
Mackenzie dr	36 metres from centre line of Mackenzie dr in Green area walkway	Gough	G/L 500	35w l.p sodium
Mackenzie dr	20 metres west of centre line of Nunsveill rd			
Mackenzie dr	Opp Fraser cresc	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside Aspen court motels ,no 10 Mackenzie drive	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 158 and no 160 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Slightly opp Fraser cesc on Mackenzie dr	Gough	G/L 500	35w l.p sodium

Mackenzie dr	On boundry of no 70 and no 72 Mackenzie drive	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 240 Mackenzie dr by cnr of Totara drive	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 297 and 295 Mackenzie drive	Gough	G/L 500	35w l.p sodium
Mackenzie dr	62 metres from the centre line of Mackenzie dr in Green area walkway	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Opp no 189 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 254 and no 256 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr		Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 32 Mackenzie dr on cnr of Dusky pl	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Opp 219 Mackenzie dr on cnr Braemar pl	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On cnr of mackenzie dr and Ostler rd 14 metres from the centre line of Ostler rd	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On cnr of Mackenzie dr and Jollie rd outside no 88 Mackenzie rd	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 246 and no 248 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 22 and no 24	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On cnr of Ruataniwha rd and Mackenzie dr outside Shell servce station	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 94 and 96 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 294 and no 292 Mackenzie rd	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 312 and 314 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 124 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 136 and no 138 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 168 and 166 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 184 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Opp boundry or no 195 and no 197 Mackenzie rd	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 216 and no 218 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	42 metres north west of pole no 3 by cnr of Simons st and Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 322 Mackenzie drive	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 174 Mackenzie dr by corner of Tekapo dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 86 Mackenzie dr on cnr of Mackenzie dr and Jollie rd	Gough	G/L 500	35w l.p sodium

Mackenzie dr	Outside no 118 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 212 Mackenzie on corner or Irishmans dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Opp boundry of no 314 and no 316 Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Opp boundry no 322 and corner Green area on mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry of no 16 and Green area walkway	Gough	G/L 500	35w l.p sodium
Mackenzie dr	On boundry or no 102 and Green area on Mackenzie dr	Gough	G/L 500	35w l.p sodium
Mackenzie dr	16 metres west of Glen Cairm rd centre line	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 260 Mckenzie dr by cnr of Rata rd	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Opp no 261 Mackenzie dr on cnr of Ohau rd	Gough	G/L 500	35w l.p sodium
Mackenzie dr	Outside no 300 Mackenzie dr by cnr of Omahau cres	Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Maryburn rd	On corner of Mary burn rd and Mackenzie drive	Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Maryburn rd		Gough	G/L 500	35w l.p sodium
Mcauley place		Gough	G/L 500	35w l.p sodium
Mcauley place		Gough	G/L 500	35w l.p sodium
Mt cook lane	1st pole in Mt cook lane on right hand side	Gough	G/L 500	35w l.p sodium
Mt cook lane		Gough	G/L 500	35w l.p sodium
Mt cook lane	Back section on right hand side of Mt cook lane	Gough	G/L 500	35w l.p sodium
Mt cook rd		Gough	G/L 500	35w l.p sodium
Mt cook rd		Gough	G/L 500	35w l.p sodium
Mt cook rd		Gough	G/L 500	35w l.p sodium
Mt cook rd		Gough	G/L 500	35w l.p sodium
Mt cook rd		Gough	G/L 500	35w l.p sodium
Mt cook rd		Gough	G/L 500	35w l.p sodium
Mt cook rd	Opposite centre for catchment	Gough	G/L 500	35w l.p sodium

	ecology			
Ohau rd	By northern end of combined services car park	Gough	G/L 500	35w l.p sodium
Ohau rd	By southern end of combined services car park	Gough	G/L 500	35w l.p sodium
Ohau rd	Directly outside sombined services	Gough	G/L 500	35w l.p sodium
Ohau rd	On cnr of Te kohai rd - Ohau rd	Gough	G/L 500	35w l.p sodium
Ohau rd	On boundry of Whitestone yeard and Maori pa.	Gough	G/L 500	35w l.p sodium
Omahau cresc	Outside no 300 Mackenzie dr on Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	On boundry of no 41 and corner section - opp no 64 Omahau	Gough	G/L 500	35w l.p sodium
Omahau cresc	On boundry of no 35 and no 37 Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	On boundry of no 27 and no 29 Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	Opp boundry of no 4 and no 6 Omahau	Gough	G/L 500	35w l.p sodium
Omahau cresc	On boundry of no 15 and no 17 Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	On boundry of no 7 and no 9 Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	49 metres south west of pole no 1 opp no 2 Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	On boundry of no 39 and 41 Omahau	Gough	G/L 500	35w l.p sodium
Omahau cresc	Outside no 37 - opp boundry of no 54 and no 56 Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	Outside no 23 Omahau cres opp boundry of no 34 and no 36 Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	On boundry of no 21 and no 23 Omahau cresc	Gough	G/L 500	35w l.p sodium
Omahau cresc	Outside no 17 Omahau on bend	Gough	G/L 500	35w l.p sodium
Ostler rd	43 metres east of Benmore pl centre of rd	Gough	G/L 500	35w l.p sodium
Ostler rd	15 metres east of Wairepo rd ,centre lines	Gough	G/L 500	35w l.p sodium
Ostler rd	Outside motor inn - 21 metres west of Benmore pl centre of rd	Gough	G/L 500	35w l.p sodium
Ostler rd	16 metres west of Mckenzie drive centre line	gec		4x400w H.P Sodium Mushroom
Ostler rd	Opp alstom	gec		4x400w H.P Sodium Mushroom
Ostler rd	100 metres west of pole no 10	gec		4x400w H.P Sodium Mushroom
Ostler rd	opp rex millar engineering	gec		4x400w H.P Sodium Mushroom
Ostler rd	130 metres west of pole no 8	gec		4x400w H.P Sodium Mushroom
Ostler rd	11 metres west of South st centre line	gec		4x400w H.P Sodium Mushroom
Ostler rd	opp twizel recreation and hire	gec		4x400w H.P Sodium Mushroom

Ostler rd	138 metres west of pole no 15 opp alpine industries gateway	gec		4x400w H.P Sodium Mushroom
Ostler rd	92 metres west of pole no14	gec		4x400w H.P Sodium Mushroom
Ostler rd	41 metres west of pole 7	gec		4x400w H.P Sodium Mushroom
Ostler rd	On cnr of Ostler and Ohau rds	gec		4x400w H.P Sodium Mushroom
Ostler rd	130 metres west of pole no 11	gec		4x400w H.P Sodium Mushroom
Ostler rd	Opp high country auto services	gec		4x400w H.P Sodium Mushroom
Preston pl		Gough	G/L 500	35w l.p sodium
Preston pl	25 metres west off Hallewell rd centre line on Preston pl	Gough	G/L 500	35w l.p sodium
Preston pl	On boundry of no 5 and Green area walk way	Gough	G/L 500	35w l.p sodium
Preston pl	In green area - 47 metres west of pole no2	Gough	G/L 500	35w l.p sodium
Pukaki pl		Gough	G/L 500	35w l.p sodium
Pukaki pl		Gough	G/L 500	35w l.p sodium
Pukaki pl		Gough	G/L 500	35w l.p sodium
Pukaki pl		Gough	G/L 500	35w l.p sodium
Rata rd	adj no 39 Rata rd	Gough	G/L 500	35w l.p sodium
Rata rd	On cnr of Rata rd and Mackenzie dr	Gough	G/L 500	35w l.p sodium
Rata rd	Opp no 5 Rata rd - on corner	Gough	G/L 500	35w l.p sodium
Rata rd	Outside no 26 Rata rd	Gough	G/L 500	35w l.p sodium
Rata rd	11 metres from boundry of no 56 by cnr	Gough	G/L 500	35w l.p sodium
Rata rd	Outside no 52 Rata rd opp Geenarea walk way	Gough	G/L 500	35w l.p sodium
Rata rd	opp no 57 Rata rd	Gough	G/L 500	35w l.p sodium
Rata rd	On boundry of no 44 and no 46 Rata rd	Gough	G/L 500	35w l.p sodium
Rata rd	On boundry of no 18 and no 20 Rata rd	Gough	G/L 500	35w l.p sodium
Rata rd	Opp no 7 Rata rd - on cnr	Gough	G/L 500	35w l.p sodium
Rata rd	Outside no 52 Rata rd opp no 70	Gough	G/L 500	35w l.p sodium
Rata rd	On boundry of no 10 and no 12 Rata rd	Gough	G/L 500	35w l.p sodium
Rata rd	Outside no 26 Rata rd 9 metres away from boundry of no 28	Gough	G/L 500	35w l.p sodium
Rata rd	Outside no 32 - opp no 49 Rata rd	Gough	G/L 500	35w l.p sodium
Ruataniwha rd	Opp Jollie rd on Ruataniwha rd st/l control point	Gough	G/L 500	35w l.p sodium
Ruataniwha rd	37 metres west of pole no1	Gough	G/L 500	35w l.p sodium
Ruataniwha rd	On cnr of Ruataniwha rd and s.h.8	Gough	G/L 500	35w l.p sodium
Ruataniwha rd	81 metres west of pole no3	Gough	G/L 500	35w l.p sodium
Ruataniwha rd	36 metres west of pole no2 cnr Wairepo rd and Ruataniwha rd	Gough	G/L 500	35w l.p sodium
Ruataniwha rd	Opp boundry of no 11 and no 15 Ruataniwha rd	Gough	G/L 500	35w l.p sodium

Ruataniwha rd	Opp boundry of no 3 and no 5 Ruataniwha rd	Gough	G/L 500	35w l.p sodium
S.H.8	On s.h.8 opp Ruataniwha	Gough	G/L 500	35w l.p sodium
S.H.8	On s.h.8 opp Ostier rd	Gough	G/L 500	35w l.p sodium
S.H.8	On s.h.8 opp Glenlyon	Gough	G/L 500	35w l.p sodium
S.H.8	62 metres west of pole 3 s.h.8 on Ostler rd	Gough	G/L 500	35w l.p sodium
Sealy st	In green area opp no 10 Sealy st	Gough	G/L 500	35w l.p sodium
Sealy st	Outside 30 Fraser cres on Sealy st	Gough	G/L 500	35w l.p sodium
Sealy st		Gough	G/L 500	35w l.p sodium
Sealy st		Gough	G/L 500	35w l.p sodium
Sealy st		Gough	G/L 500	35w l.p sodium
Sealy st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Sefton st		Gough	G/L 500	35w l.p sodium
Simons st	Opp Glenbrook cresc on Simons st	Gough	G/L 500	35w l.p sodium
Simons st	On cnr of Simons st and Ruataniwha rd	Gough	G/L 500	35w l.p sodium
Simons st	On cnr of Simons st and Halliwell rd	Gough	G/L 500	35w l.p sodium
Simons st	On boundry of no11 and no 9	Gough	G/L 500	35w l.p sodium
Simons st		Gough	G/L 500	35w l.p sodium
Simons st	Outside no 3 Simons st opp Glensbrook cresc	Gough	G/L 500	35w l.p sodium
Simons st	Opp no 24 Simons st	Gough	G/L 500	35w l.p sodium
Simons st	On boundry of no 37 and Green area walk way	Gough	G/L 500	35w l.p sodium
South st	60 metres north from centre line of Ostler rd	gec		4x400w H.P Sodium Mushroom
South st	33 metres north of pole 2	gec		4x400w H.P Sodium Mushroom
Tasman st	Corner of Tasman rd and Pukaki place (police station side)	Gough	G/L 500	35w l.p sodium
Tasman st	Corner Mckenzie drive and Tasman rd	Gough	G/L 500	35w l.p sodium
Tasman st	Outside Tophut bottle store	Gough	G/L 500	35w l.p sodium
Tasman st	Outside medical centre	Gough	G/L 500	35w l.p sodium
Tasman st		Gough	G/L 500	35w l.p sodium
Tasman st	Beside carpark entrance to High country lodge on Tasman rd	Gough	G/L 500	35w l.p sodium
Tasman st	Corner Tasman rd and Pukaki place (town side)	Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium

Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive		Gough	G/L 500	35w l.p sodium
Tekapo drive	On boundry of 59 Tekapo drive	Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr	In section (13 totara drive) beside green area	Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr	Opposite green area on Totara drive towards Mackenzie drive	Gough	G/L 500	35w l.p sodium
Totara dr	On boundry of lots 1040+1073	Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr		Gough	G/L 500	35w l.p sodium
Totara dr	On cornr of Totara drive and Mackenzie drive	Gough	G/L 500	35w l.p sodium
Wairepo rd	60 metres north of pole no 5		G/L 500	35w l.p sodium
Wairepo rd	80 metres north of pole no6	gec		400w m/v
Wairepo rd	On cnr of Ostler and Wairepo rds	Gough	G/L 500	35w l.p sodium
Wairepo rd	37 metres north of pole no1	Gough	G/L 500	35w l.p sodium
Wairepo rd	Outside mtn. Chalets 56 metres north of pole no4	Gough	G/L 500	35w l.p sodium
Wairepo rd	83 metres north of pole 2	Gough	G/L 500	35w l.p sodium
Wairepo rd	opp d.o.c h.q	Gough	G/L 500	35w l.p sodium
Wolds place	Only light in street	gec		35w l.p sodium

GL600 Road and Area Lighting Luminaire

BETACOM

The GL600 is an economical luminaire designed for main road (Category V) and area lighting.

Repeatable optical performance is achieved through the use of precision optical assemblies. The lamp position can easily be changed from "semi-cut off" to "cut off" as required. An aeroscreen version is also available.

The GL600 also incorporates a removable gear tray facilitating easier installation and maintenance. The removable gear tray also future proofs the product by allowing it to adopt new lamp technologies as they become available.

- Precision optical assembly
- Removable control gear tray
- Tilt adjustment
- Corrosion resistant
- Accepts spigot sizes from 43mm to 61mm O.D.
- Aeroscreen version (optional)

Applications
• Category V Roads (Motorways, Main & Intermediate Roads and Intersections)
• Area and Security Lighting

Available Configurations
HPS: 100W, 150W, 250W
MH: 100W, 150W, 250W
SOX: 2 x 55W

BETACOM

GL500 Road & Area Lighting Luminaire

The GL500 is manufactured in New Zealand to the AS/NZS 1158.6 standard. It is a proven performer in both Australian and New Zealand environments.

The luminaire incorporates a unique removable control gear module facilitating easier installation and maintenance. The removable control gear module also future proofs the product by allowing it to adopt new lamp technologies as they become available.

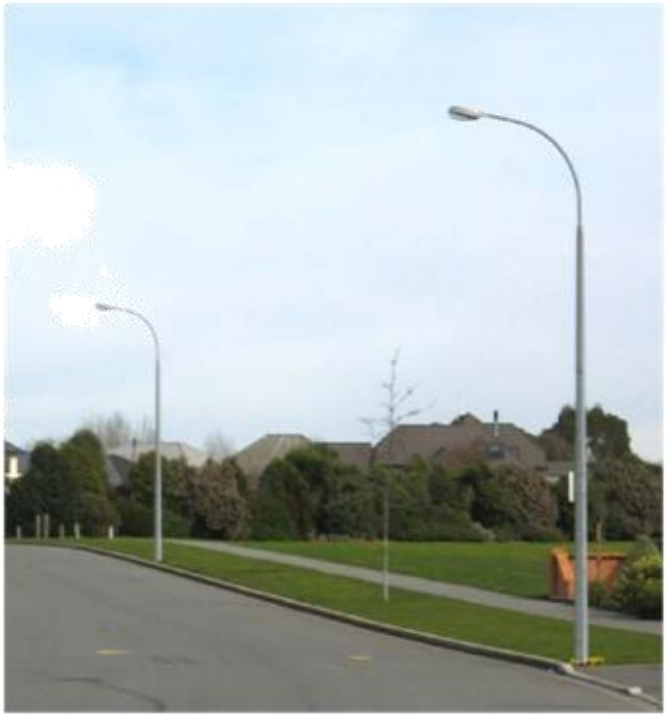
The GL500 provides proven reliability and offers reduced total cost of ownership over the life of the luminaire.

Typical applications

- Road Lighting to Category P and V4 levels.
- Car parks and Security Lighting
- Cycle and Pathways (special version available)
- Industrial Areas

Key Features

- Removable control gear module
- Acrylic and high impact acrylic visors
- Precision optical assembly
- Corrosion resistant
- Variety of colours (optional)
- Pole top adaptor (optional)
- Light control relay (optional)



Lamp Configurations
HPS: 50W, 70W, 100W
MH: 35W, 70W, 100W
CosmoPolis: 45W, 60W √
CFL: 11W, 22W, 42W, 57W √
SOX: 18W, 26W, 35W
MV: 50W, 80W, 125W

Installation
Accepts spigot sizes from 25mm to 44mm O.D.

Materials

- **Head Casting: High pressure diecast from LM4 corrosion resistant aluminium.**
- **Visor: Available in UV stabilized clear acrylic and high impact acrylic.**
- **Fasteners: All fasteners, clips, hinges and bolts are made from aluminium or stainless steel.**
- **Reflectors: Precision hammered aluminium, electro-chemically polished.**
- **Mounting Clamp: Stainless steel.**

Quality System
Betacom operates an externally audited and registered quality system that complies with AS/NZS/ISO 9001:2000.

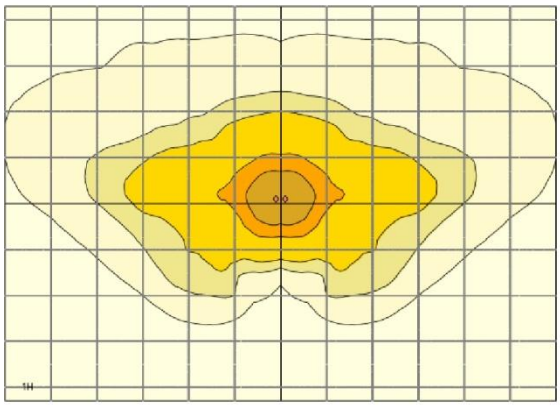
Photometric Data
All photometric data is produced in our own independently audited and accredited Photometric Laboratory. Betacom's laboratory is accredited by IANZ (International Accreditation New Zealand).

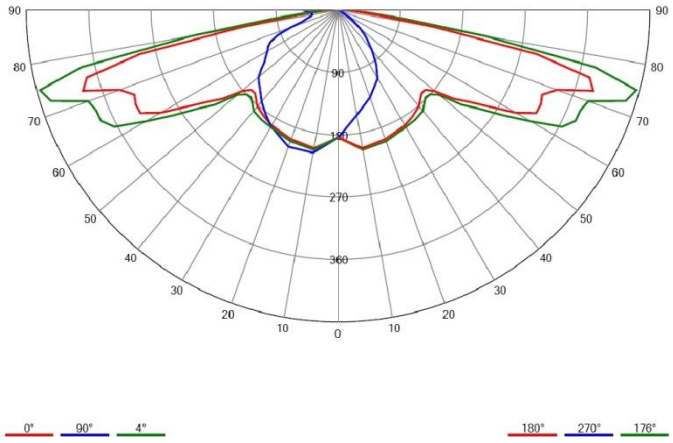
Lighting Design Service
Betacom provides a comprehensive lighting design service. This service is available free of charge to our customers. Designs are provided in accordance with AS/NZS 1158.1.1 and AS/NZS 1158.3.1.

Now available with Philips CosmoPolis energy saving lamp technology

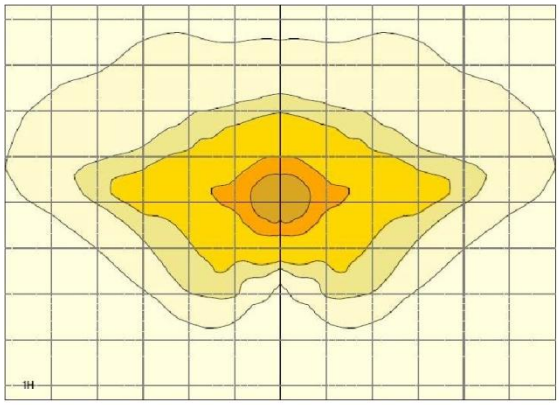
Light Distributions

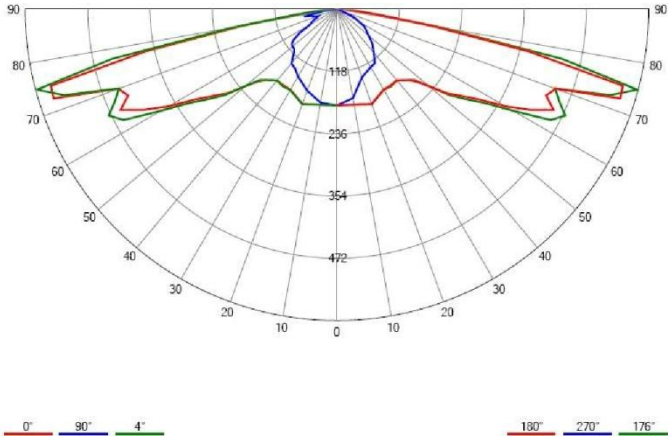
GL500 with 70W SON/T Lamp





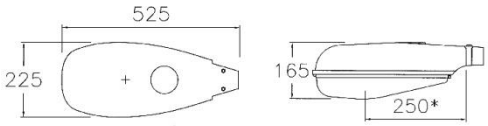
GL500 with 60W CosmoPolis Lamp





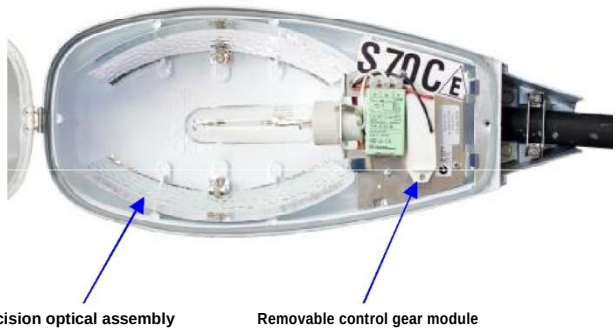
Photometric Data
Detailed isolux diagrams and spacing tables are available on request.
Photometric data is also available in IES and CIE formats.

Dimensions



*** Distance—spigot end to luminaire optical centre.**

Horizontal projected area = 0.07m^2
Coefficient of drag = 0.64



BETACOM

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ORNATE SOLAR STREET LIGHT > SPENCER RANGE
Model No > SRSL 01 Solar Standard Light

Description > Commercial Grade 5mm Double and Single Curved Arm Steel Pole with corrosion resistance coating. Uses E27 self-ballasted LED lamp, surround 2mm Clear polycarbonate lens.

Technical Specifications SOLAR>

MOUNTING	Surface or In-ground	
CONSTRUCTION	5mm Steel	
BODY COLOUR	Optional depends on quantity	
SHADE MATERIAL	2mm Polycarbonate	
SHADE COLOUR	Clear	
VOLTAGE	12v	
WATTAGE	6W, 9W, 12W	
SOLAR PANEL	50W – 80W round or square optional extras	
SOLAR PANEL LIFE	20 yrs	
BATTERY AMP	65ah – 120ah	
BATTERY LIFE	8 yrs	
LAMP COLOUR	White or Amber	
LAMP SOURCE	LED	
LAMP LIFE	50,000 hrs (approx 11 years)	
LAMP BASE	E27	
HEIGHT	4200mm – 5000mm Optional depends on quantity	
DIAMETER	75mm	
BASE DIAMETER	Optional square housing for battery	
SWITCHED	Automatic on/off	
LIGHT DISTRIBUTION (NO REFLECTORS)	12m diameter based on 12W Measurement without reflectors this will be better once tested with	
LIGHT FLUX	Ic (Lux) based on White 12W	13 tbc
	Ie (Lux) based on White 12W	4 tbc
	Iav (Lux) based on White 12W	8 tbc
MANUFACTURES WARRANTY	12 months on parts only NZ Made	
APPLICATIONS	Road Car park Driveway Cycle/Footpaths Any 'P' Cat Area	
WATER PROOFING – IP RATING	IP65	
Price – 1 to 5 off Price – larger quantities	- from $3,750 to $5,000 plus gst, delivery (cages) - POA	

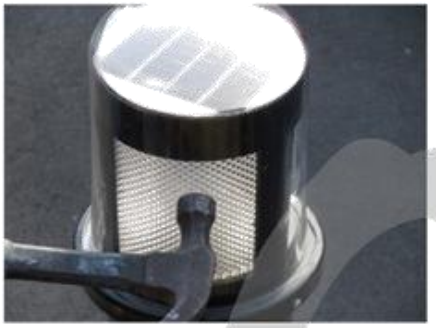
ORNATE STREET LIGHT > SPENCER RANGE
Model No > SR PL 01 240v Standard Light


Description > Commercial Grade 5mm Double and Single Curved Arm Steel Pole with corrosion resistance coating. Uses E27 self-ballasted LED lamp, surround 2mm Clear polycarbonate lens.

Technical Specifications POWER>

MOUNTING	Surface or In-ground	
CONSTRUCTION	5mm Steel	
BODY COLOUR	Optional depends on quantity	
SHADE MATERIAL	2mm Polycarbonate	
SHADE COLOUR	Clear	
VOLTAGE	230v	
WATTAGE	6W, 9W, or 12W	
LAMP COLOUR	White or Amber	
LAMP SOURCE	LED	
LAMP LIFE	50,000 hrs (approx 11 yrs)	
LAMP BASE	E27	
HEIGHT	4200mm Optional depends on quantity	
DIAMETER	75mm	
BASE DIAMETER	Optional square housing for fuse/control gear	
SWITCHED	No switch on/off	
LIGHT DISTRIBUTION (NO REFLECTORS)	Based on 12W Upto 15m diameter Measurement without reflectors this will be better once tested with	
LIGHT FLUX	Ic (Lux) based on White 12W	15 tbc
	Ie (Lux) based on White 12W	5 tbc
	Iav (Lux) based on White12W	10 tbc
MANUFACTURERS WARRANTY	12 months on parts only NZ Made	
APPLICATIONS	Road Car park Driveway Cycle/Footpaths Any 'P' Cat Area	
WATER PROOFING – IP RATING	IP65	
Price - 1 to 5 Price – larger quantities	- from $ 2000 to $4250 plus gst , delivery (cages) - POA	

BOLLARD > SPENCER RANGE
Model No > SRSB03




Description > Commercial Grade Solar Power 5mm Steel Bollard with corrosion resistance coating. Uses E27 self-ballasted LED lamp, surround 6mm diffused U.V stabilised polycarbonate lens.

Technical Specifications SOLAR

MOUNTING	Surface or In-ground	
FACE TYPE	Diffuser	
CONSTRUCTION	5mm Steel	
BODY COLOUR	Optional depends on quantity	
SHADE MATERIAL	6mm UV Stabilised Polycarbonate	
SHADE COLOUR	Prismatic Diffuser	
VOLTAGE	6v	
WATTAGE	1W	
SOLAR PANEL	2.5W	
SOLAR PANEL LIFE	20 yrs	
BATTERY AMP	7ah	
BATTERY LIFE	5 yrs	
LAMP COLOUR	White or Amber	
LAMP SOURCE	LED	
LAMP LIFE	50,000 hrs (approx 11 years)	
LAMP BASE	E27	
HEIGHT	1000mm Optional depends on quantity	
DIAMETER	163mm	
BASE DIAMETER	170mm	
SWITCHED	No switch on/off	
LIGHT DISTRIBUTION (NO REFLECTORS)	2.5m diameter Measurement without reflectors this will be better once tested with	
LIGHT FLUX	Ic (Lux)	10 tbc
	Ie (Lux)	6 tbc
	Iav (Lux)	8 tbc
MANUFACTURES WARRANTY	12 months on parts only NZ Made	
APPLICATIONS	Driveway Footpaths Markers Any Low Level Lighting Area	
WATER PROOFING – IP RATING	TBC - IP65 or IP66	
Price – 1 to 5 off Price – larger quantities	- $1250.00 ea plus gst, delivery and cages - POA	

450 Watt Pulse Start Lamp

UNIFORM® PULSE START METAL HALIDE LIGHTING SYSTEMS

65072
DATA SHEET

VENTURE® LIGHTING

UNIFORM®
PULSE START METAL HALIDE LIGHTING SYSTEMS

MP 450W/BU/UVS/PS/740

GENERAL Characteristics

Lamp Type	MH Pulse Start Single Ended
ANSI Code	M144/O
Bulb Shape	ED37
Base Type	Mogul (EX39)
Bulb Finish	Clear
Rated Life	30000 hours
Operating Position	Base Up ±15°
Dimming	50% Rated Power

ELECTRICAL

Lamp Watts	450
Lamp Oper. Voltage (Nom.)	135

SUSTAINABILITY

Recycling Program	Smartpac® 800-451-2606
Picograms Hg per Mean Lumen Hour	51
MR-Credit 4 Reduced Mercury in Lamps	1 LEED point
EISA 2007 Compliant	Yes

PHOTOMETRIC

Initial Lumens	47000
Scotopic Lumens (S/P 1.7)	80000
Lumens Per Watt	104
Lamp Lumen Depreciation (LLD)	.86 (86%) @ 8000 hours
Correlated Color Temperature	4000K
Chromaticity Coordinates (CIE-x,y)	.385 .390
Color Rendering Index (CRI)	68

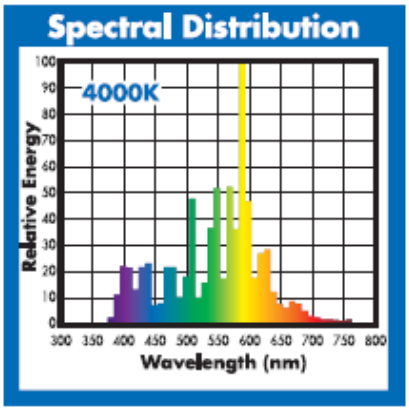
NOTES

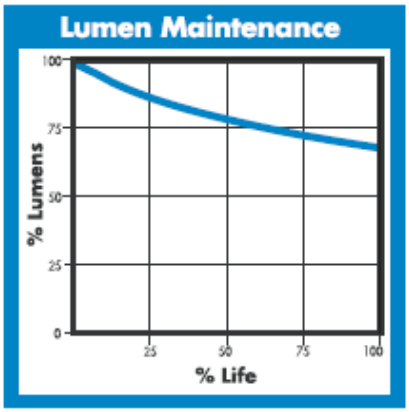
Lamp performance ratings published in this data sheet are based on operation with approved electronic ballasts. Performance of position-rated lamps outside of their tolerances will result in poor performance. UV Shield eliminates nearly all UV emissions, reducing color fading and lens yellowing. Minimum Starting Temperature: -40°C/°F. To calculate nighttime Scotopic lumens, multiply the lumen rating by the S/P ratio. **LEED V3, MR CREDIT 4: Sustainable Purchasing - Reduced Mercury in Lamps is awarded 1 point for projects which at least 90% of all mercury-containing lamps purchased during the performance period comply and meet the target for mercury content of 90 picograms per lumen-hour or less.

PHYSICAL

Bulb Diameter	4.6" (120mm)
Max. Overall Length (MOL)	11.5" (292mm)
Light Center Length (LCL)	7.0" (178mm)
Effective Arc Length	43.6 mm
Max. Base Temperature (°C)	230
Max. Bulb Temperature (°C)	450
Socket Pulse Rating (KV)	4
Luminaire Type	Open / Enclosed Rated

Dia. = 4.6" (120mm)
MOL = 11.5" (292mm)
LCL = 7.0" (178mm)
Base = Mogul (EX39)





(800) 451-2606
or (440) 248-3510
Fax: (800) 451-2605
10295 Philipp Parkway
Streetsboro, Ohio 44241 USA
E-mail: venture@adlt.com
VentureLighting.com

THIS LAMP CONFORMS TO FEDERAL STANDARD 21 CFR 1040.30

Warning: This lamp can cause skin burn and eye inflammation from shortwave ultraviolet radiation if outer envelope of the lamp is broken or punctured. Do not use where people will remain for more than a few minutes unless adequate shielding or other safety precautions are used. Lamps that will automatically extinguish when outer envelope is broken or punctured are commercially available.

This Product is Recyclable Through Smartpac®

Revision: 9/12/2011 # 1968-14

VLU09255140710

Appendix C: Measurements of Sky Brightness using Sky Quality Meters

	Mt John (Main Car park)		Mt John (South Car Park)		Mt Cook Airport		Lake Alexandrina		Mt Cook Village		Tekapo Village	
	SQM-L	SQM	SQM-L	SQM	SQM-L	SQM	SQM-L	SQM	SQM-L	SQM	SQM-L	SQM
21-Jun	21.58	21.60										
	21.43	21.72										
	21.42	21.55										
	21.41	21.67										
	21.42	21.50										
30-Jun	21.62	21.55	21.53	21.48								
	21.51	21.56	21.45	21.36								
	21.53	21.41	21.36	21.38								
	21.54	21.48	21.31	21.37								
	21.45	21.45	21.21	21.34								
	21.47	21.61	21.37	21.58								
	21.22	21.53	21.44	21.59								
	21.28	21.53	21.21	21.54								
	21.23	21.55	21.42	21.65								
	21.44	21.58	21.46	21.52								
5-Jul	21.54	21.65					21.50	21.57			21.58	21.44
	21.51	21.63					21.53	21.55			21.52	21.45
	21.50	21.50					21.51	21.53			21.51	21.44
	21.50	21.46					21.53	21.57			21.49	21.45
	21.50	21.52					21.60	21.55			21.51	21.42
22-Aug											20.97	21.30
											20.94	21.23
											20.99	21.29
											20.88	21.23
											20.87	21.27
30-Aug											20.68	20.83
											20.67	20.90
											20.66	20.78
											20.61	20.85
											20.69	20.80
20-Sep	21.80	21.80										
	21.69	21.71										
	21.73	21.69										
	21.72	21.69										
	21.65	21.73										
22-Oct											22.01	21.89
											21.75	21.65
											21.72	21.70

						21.72	21.63
						21.70	21.67
						21.62	21.76
						21.77	21.67
						21.75	21.63
						21.74	21.64
						21.74	21.64
18-Nov							
				21.69	21.74	21.66	21.60
				21.67	21.72	21.74	21.45
				21.73	21.71	21.67	21.49
				21.70	21.69	21.66	21.55
				21.85	21.70	21.60	21.51
				21.69	21.68		
				21.69	21.65		
				21.68	21.65		
				21.80	21.73		
				21.82	21.69		
				21.77	21.66		
				21.80	21.66		
				21.78	21.68		
				21.76	21.55		
				21.69	21.52		
				21.69	21.55		
				21.81	21.50		
				21.71	21.49		
30-Nov							
						21.11	21.11
						21.17	21.01
						21.16	20.98
						21.16	20.97
						21.24	20.97
						21.34	21.28
						21.30	21.14
						21.37	21.18
						21.32	21.19
						21.37	21.20
						21.33	20.97
						21.32	20.96
						21.35	21.14
						21.33	21.13
						21.30	21.24
						21.39	21.52
						21.54	21.52
						21.52	21.46
						21.53	21.45
						21.48	21.46
						21.53	21.66
						21.60	21.61
						21.59	21.58

									21.52	21.57
									21.56	21.60
									21.56	21.56
									21.57	21.60
									21.56	21.51
									21.53	21.53
									21.55	21.54
10-Dec			21.47	21.47						
			21.53	21.48						
			21.48	21.53						
			21.55	21.46						
			21.45	21.56						
17-Dec	21.76	21.70	21.67	21.71						
	27.74	21.68	21.62	21.70						
	21.74	21.64	21.62	21.66						
	21.67	21.71	21.79	21.69						
	21.71	21.69	21.74	21.72						
17-Jan					21.13	21.42				
					21.40	21.33				
					21.40	21.36				
					21.40	21.44				
					21.48	21.37				

Appendix D: Weather statistics for Mt John

Mt John is one of the best places in New Zealand for quality night sky observation. Located at a distance of over 80 km from the nearest major city of Timaru and at an elevation of 1027m, Mt John's night sky is almost free of air and light pollution.

D-1.Weather Conditions

The large number of clear nights at Mt John (68% of nights suitable for astronomical observation) makes it an ideal site for star gazing and research. Figure 1 below shows the number and percentages of photometric, partly photometric, spectroscopic and unusable night skies recorded at the summit of Mt John between 1992 and 2007. A photometric night sky is defined as a clear and cloudless sky while partly photometric refers to skies with the presence of clouds but has little impact on photometric measurements. A spectroscopic sky is mostly covered with clouds but spectroscopic measurements can still be made. An unusable night sky is completely overcast and is unusable for astronomical observations.

The data in the Figure D-1 is illustrated in Figure D-2. Between 1992 and 2007, an average of 67.7% of night time was suitable for night sky observation compared to 32.3% that were unusable.

Sky Quality	Photometric		Partly photometric		Spectroscopic		Unusable	
Year	Hours	Percent	Hours	Percent	Hours	Percent	Hours	Percent
1992	73	20	47	13	80	22	166	45
1993	63	17	61	17	75	21	166	45
1994	66	18	59	16	95	26	145	40
1995	73	20	61	17	105	28	126	35
1996	72	20	77	21	104	28	113	31
1997	79	22	84	23	86	24	116	32
1998	97	27	74	21	71	19	123	34
1999	90	25	43	12	105	28	117	34
2000	66	18	84	23	104	28	112	32
2001	76	21	73	20	109	30	107	29
2002	56	15	69	19	136	37	104	29
2003	94	26	80	22	80	22	111	30
2004	61	17	79	22	82	22	144	39
2005	53	14	70	19	116	32	126	35
2006	86	23	61	17	102	28	116	32
2007	86	23	75	21	95	26	109	30
Average	74.4	20.8	68.6	19.8	96.6	27.1	125.1	32.5

Figure D-1. Table of the average number of hours and percentage of different sky qualities recorded at Mt John between 1961 and 1990.

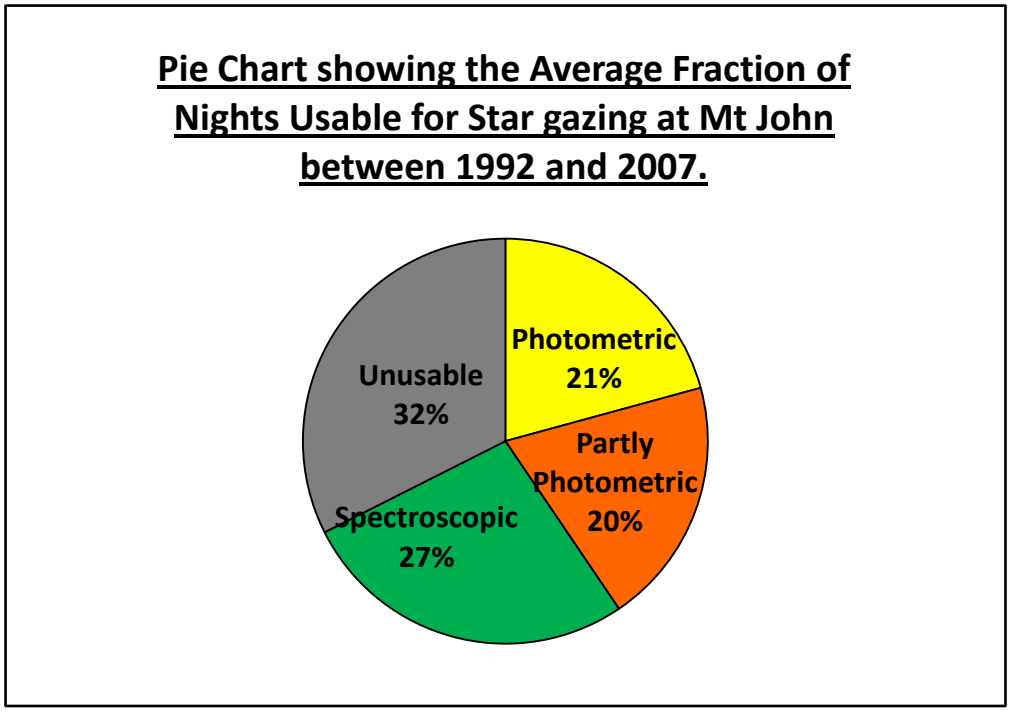


Figure D-2. Graph of the proportions of different sky qualities recorded at Mt John between 1961 and 1990.

D-2. Temperature

Mt John experiences mild temperature fluctuations over the year ranging from a mean maximum temperature of 13.5°C in the months of January and February to a mean minimum of 1.4°C in July. The average daily temperature range is 11.1°C in summer (December to February) and 6.7°C in winter (June to August).

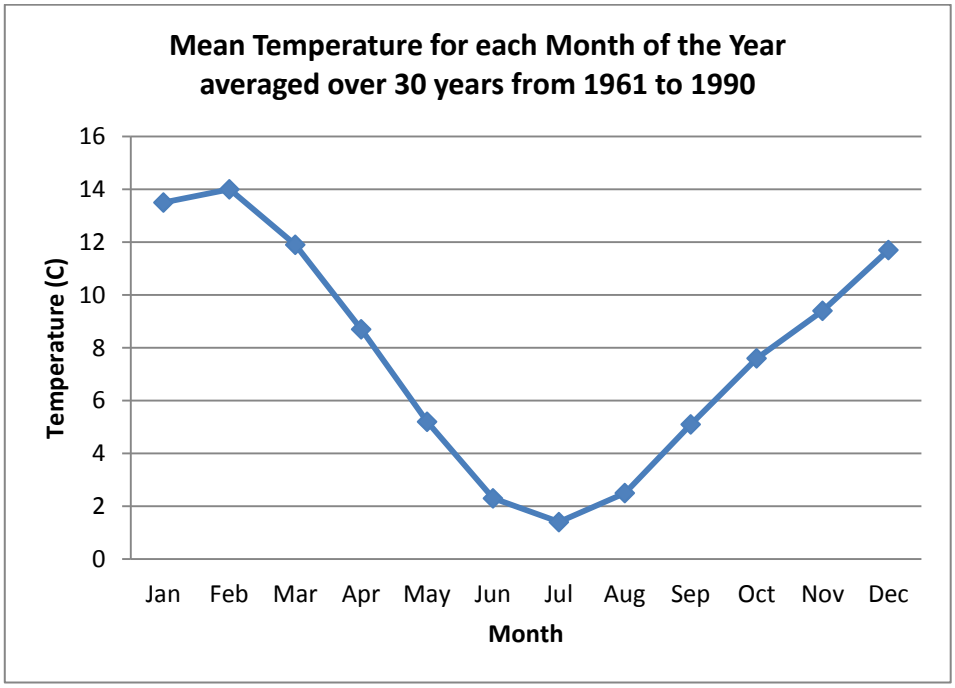


Figure D-3. Graph of average temperature month-by-month at Mt John from 1961-1990.

D-3. Humidity

Mt John has a low relative humidity by New Zealand standards. The annual average relative humidity at Mt John is 64% and it ranges between an average of 58% in spring and 70% in July, as illustrated in Figure D-4. The low humidity levels at Mt John in comparison to a national average of 79% (ranging from 72.7 to 85.5%) provide further ideal conditions for astronomical observations. As water vapour in the air effectively absorbs and scatters light, the amount of light refraction is a function of humidity. Low relative humidity reduces the twinkling and blurring of stars, thus improving the quality of astronomic observations.

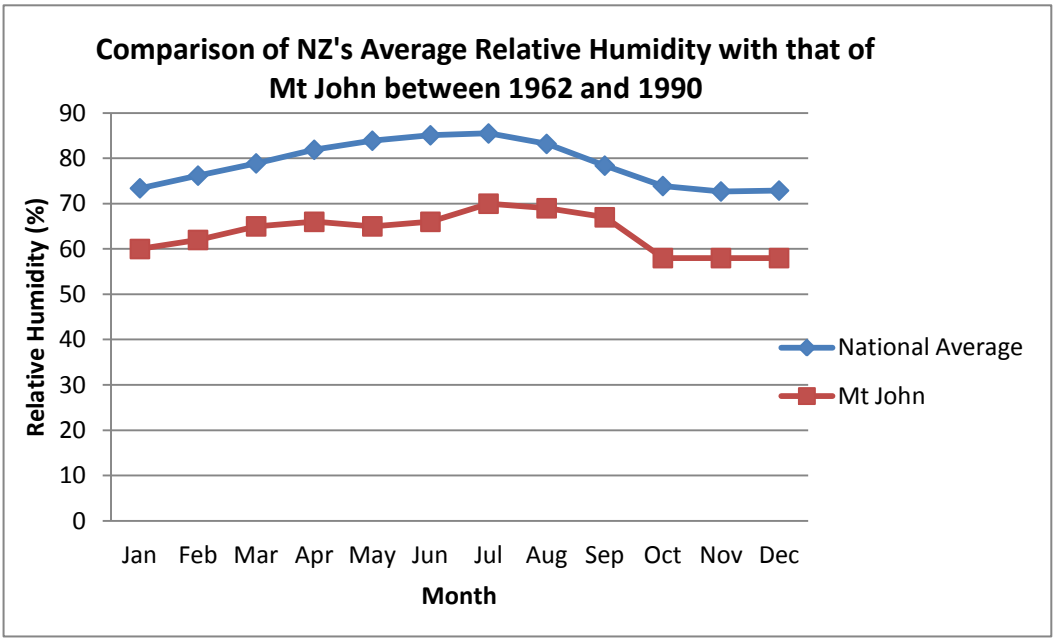


Figure D-4. Graph comparing New Zealand's overall relative humidity and the humidity recorded at Mt John between 1962 and 1990.

Appendix E: Copy of Information Sheet on Exterior Lighting sent to all those undertaking New Construction in the Zone covered by the Lighting Ordinance

The Mackenzie Country is unique in having the clearest and darkest skies in New Zealand. Many tourists visit the region to see the night sky's natural beauty. Mt John Observatory was sited here in the 1960s after a nation-wide search for the best skies for astronomical research.

What makes our night sky unique is its clarity and the absence of 'light pollution'. Light pollution is wasted light shining upward. It brightens the sky, and hides the stars, the Milky Way, the aurora and the other faint natural lights. In cities one cannot see the Milky Way, only the brightest stars. We do not want this to happen in the Mackenzie Country.

To help protect the sky environment the Mackenzie District Plan includes restrictions on outside lighting. It requires that all outside lights be covered to prevent upward spill of light. All outside lights are required to filter out blue and violet light. Subdivision developers, the Mackenzie District Council and New Zealand Transport Agency have made great efforts to comply with the plan. They have installed low-pressure sodium street lighting that illuminates only the streets. These efforts to protect the night sky will be wasted if homeowners ignore the lighting ordinances.

It is essential that home builders keep outside lights to minimum. This means lighting up only those areas that need to be lit, and only when they need to be lit. Neighbours do not want your lights shining in their eyes. Nor do they like the stars being hidden by light shining into the sky.

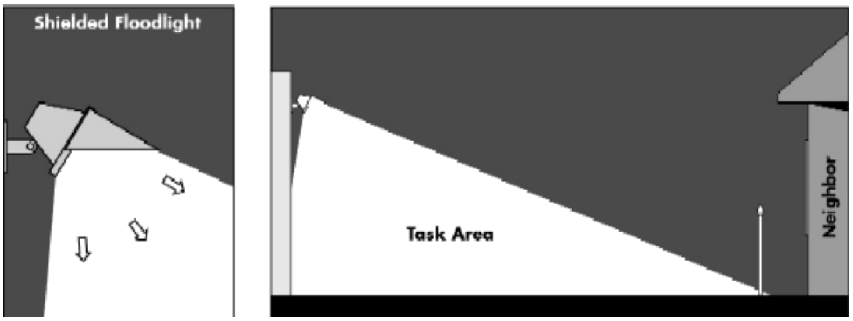
Sky-friendly outside lighting is improving all the time, so it's not easy to recommend specific companies or brands. However all sky-friendly and energy-conserving lights have common features:

- Good lights shine downward, where the light is needed. No light is spilled upward or horizontally.
- Good lights are on only when needed.
- Good lights contain little blue or violet light and no ultra-violet light. These 'short-wavelength' colours scatter in the sky much more than yellow and red. Standard fluorescent lights and high-pressure sodium lights are bad as they make a lot of blue light. Mercury vapour lights are the worst; much of their power goes into ultra-violet light. Even when lights are pointed downward, a sizeable fraction reflects into the sky.

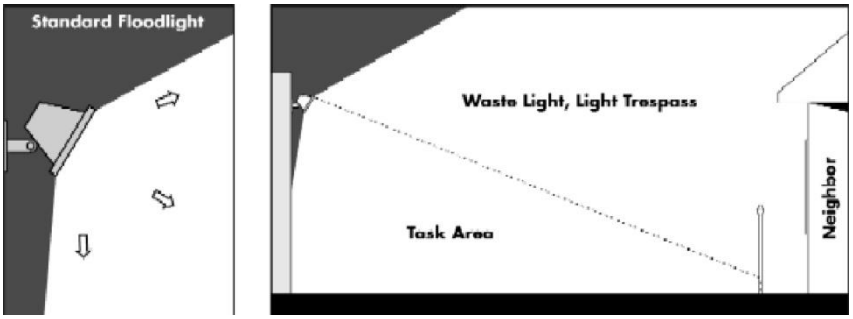
Bad outside lights throw light in all directions. They light up the neighbourhood and the sky. The cheap so-called 'security lights' are an example of really bad lighting. They blast light out from the 'secure' place and dazzle anyone looking into the area. The harsh shadows they make are ideal for crooks to lurk in. Good security lights provide a shadow-free illumination and don't shine in onlookers' eyes.

The recent innovation of garden lighting is most unwelcome in the Mackenzie; not the little solar-powered lights, but the bright mains-fed lights. The worst garden lights illuminate not just the garden but the neighbourhood and the sky. Garden lights that stay on all night

waste electricity while adding to light pollution.



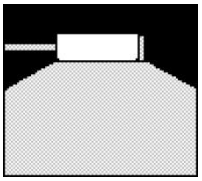
If you need to light an outside area then shield the light so only the 'task area' is illuminated. The lighted area should not extend past your boundary. The light should only be on when needed.



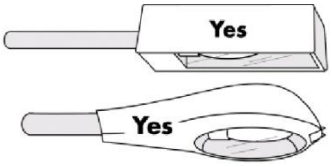
Unshielded lights waste light and power while annoying the neighbours and lighting up the sky.

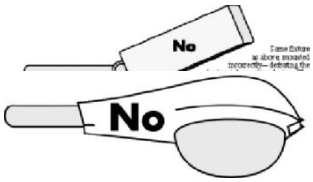
Diagrams from the RASNZ's Dark Sky webpage, see www.rasnz.org.nz.

The webpages of the International Dark Sky Association (IDA) and the Royal Astronomical Society of New Zealand (RASNZ) have much good advice on outside lights and light fixtures. The following general advice on wall-mounted lights comes from IDA Information Sheet 143. For more see www.darksky.org and www.rasnz.org.nz.

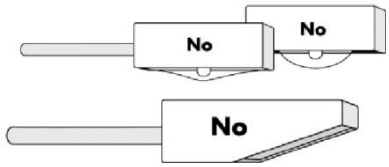


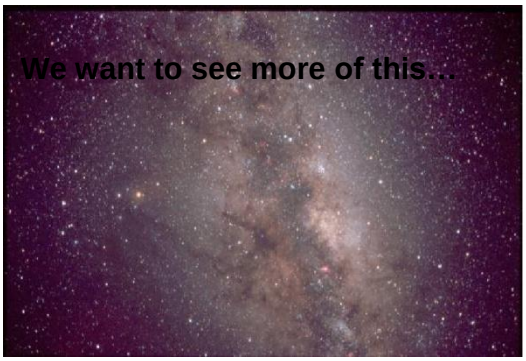
Good lights have shades that cover the light from above down to below horizontal. The glass is flat so that it doesn't scatter any light upward.





Bad lights allow their light to escape horizontally and upward. This happens if the light source protrudes below the shade; the shade is tilted; or the light has a protruding glass cover. The glass cover scatters the light.





Prepared for the Mackenzie District Council by Alan Gilmore, Resident Superintendent, Mt John Observatory of the University of Canterbury; alan.gilmore@canterbury.ac.nz.

Appendix F: Press and Media

ニュージーランドの空は見ていて飽きることがない。例えば朝、ピンク色に染まった朝焼けの空がどんどん色を変え、抜けるような青空に変わってゆく。どかんと大きな空を悠々と流れてゆく雲はまるで生きているようで、マオリ人がこの国をアオテアロア（白く長い雲がたなびく国）と名付けたのは、雲の美しさに圧倒されたのではないか、と勝手に想像してしまう。そして一日の終わりを告げる穏やかなオレンジ色の夕暮れ。だが、本当に面白くなるのはここからだ。

ニュージーランドの夜空の凄さをどう言えば想像してもらえるだろう。空の黒と星の白が半々に見えるといえば見当をつけていただけるだろうか。私は数年前まで、この国でパイロット養成のインストラクターをしていたのだが、ボランティアでお客様に星の話をしているうちに星案内の方が本職になってしまった。もう何年も同じ星空を見ているのに、いまだに仕事中は宇宙船を操縦して銀河旅行の案内をしているような気分になる。ふわりと体が浮かんで、天の川の真横を飛んでゆくような感覚。手を伸ばせば星にさわれそうな迫力。それくらい、ニュージーランドの星空は凄いのである。

ニュージーランドの夜空が「凄い」ワケ

ここでちょっと自慢をさせていただきたい。世界各地に星の名所はたくさんあるが、ニュージーランド南島のレイク・テカポには世界最南の天文台、マウントジョン天文台がある。つまりここは世界でもっとも南の空を観測する条件を備えた場所なのだ。

南緯44度にあるレイク・テカポでの
周極星（1年中沈まない星）の範囲

ニュージーランドは南緯35度から47度と、南極の近くに位置しているため、南島はもちろん北島でも南十字星が1年中観測できる。例えば北島のオークランドは南緯37度にあり、南十字星が一番低い時でも7度の高さで観測できるのだ。

同じ緯度に位置する国は南米やアフリカにもあるが、旅行代金やアクセスを考えると、日本の旅行者にはニュージーランドの方が行きやすい。またお隣のオーストラリアは、内陸に広大な砂漠があるため空気中の塵が多く、空気の透明度ではニュージーランドに劣る。つまり見える星の数が違うのだ。では究極の選択で南極はというとブリザードが多く、天候が安定しない。ニュージーランドは南半球の星を見る条件を満たした国だといえるだろう。

世界最南の天文台を開設する際、同じく南島のネルソンやテアナウなども候補地として挙げられていたが、調査の結果、レイク・テカポに造られることになった。何と言っても、ここはニュージーランド一の晴天率を誇るだけあって雲が少ない。しかも人口約200人の小さな町なので明かりもないに等しい。そして空気の透明度が高く、標高5000－6000mと同レベルを保っているなどの好条件が揃っていたのである。

空気の透明度は地形や天候と密接に結びついている。南島ではタスマン海から吹く西風がサザンアルプスの西側で雲をつくり雨を降らせる。ここで水分を落とした乾燥した空気は山脈を越えてレイク・テカポのあるマッケンジー盆地に流れ込み、湿度の低い晴れた夜を作り出している。空気が乾燥していればモヤや霧も発生しにくいので、より星が見えるというわけだ。

南の空の星を観測するのに最適なレイク・テカポ。
写真：ニュージーランド政府観光局

Japanese Feature Article talking about the night sky in Tekapo.

The figure (top left) depicts the Southern Cross constellation.

Otago Daily Times ADVERTISING FEATURE

Easter Holiday & Events Guide

See the most beautiful scenery in the world and beyond . . .

MT John Observatory sits 300m above the township of Lake Tekapo. It's the southernmost research observatory, operated by the University of Canterbury astronomy and physics department.

New Zealand's largest research telescope, known as the Moa, is housed on the site. The acronym stands for Microlensing Observations in Astrophysics and the telescope's purpose is to search for distant planets in deep space. This important research programme is run in association with Nagoya University, Japan.

Every clear evening, the small astro-tourism company Earth and Sky operates stargazing tours from Mt John, using telescopes to assist the public to view objects in space. The focus is on education and promoting the science of astronomy. The mountain is open daily from 9am to 5pm and day tours of the observatory are availably daily from 10am to 4pm. The Astro Cafe, which is situated on the summit is a most worthwhile visit; the Lonely Planet guide refers to it as "possibly the best place on the globe for a cafe". The cafe offers some of the best local produce and coffees available in the region, not to mention spectacular views. For more info or to book a stargazing tour visit www.earthandsky.co.nz or call (03) 680-6960.

10 REASONS TO VISIT THE MACKENZIE COUNTRY

Peppers Bluewater Resort

Bounded by the spectacular landscapes of the Southern Alps, Peppers Bluewater Resort offers a stunning glacial escape. Just two-and-a-half hour's scenic drive from Christchurch, this serene 5-star resort is perfect for a relaxing getaway.

Lake Tekapo, 0800 275 373
www.peppers.co.nz/bluewater

Earth & Sky, Mt John Observatory

Explore the spectacular southern night sky with knowledgeable astronomy guides at Mt John Observatory. Visit the Astro Cafe for an all-day breakfast, home-made cakes, plus teas, coffees and smoothies. Mt John - a must do - day and night, at Lake Tekapo.

Lake Tekapo, 03 680 6960
www.earthandsky.co.nz

Alpine Springs

Set in the stunning surrounds of Mt John and Lake Tekapo, Alpine Springs offers three hot pools, an international-sized ice rink, day spa, cafe and snow-tubing park. With something for everyone, this holiday retreat is perfect for the whole family.

Lake Tekapo, 0800 2 ELEVATE
www.alpinesprings.co.nz

Ski The Tasman with Alpine Guides

Extraordinary skiing for ordinary skiers. This all-accessed ski adventure offers two epic runs down NZ's longest glacier – the mighty Tasman. Enjoy ice caves, scenic flights and a picnic, and best of all, the experience is suitable for intermediate skiers.

Mt Cook Alpine Village, 03 435 1834
www.SkiTheTasman.co.nz

Mt Dobson Ski Field

This friendly ski field delivers higher and drier natural snow, with an excellent mix of terrain that will challenge all skiing and snowboarding abilities. Check out the triple chair at our great commercial field and enjoy the relaxed atmosphere.

Fairlie
www.mtdobson.co.nz

Mackenzie Country Inn

Featuring natural stone, stunning mountain views and expansive lawns, Mackenzie Country Inn is the ultimate place to chill. Set among five ski areas, six lakes and a plethora of activity options and adventures, paradise has surely been found.

Twizel, 0800 500 869
www.mackenzie.co.nz

Dark skies earn starring role in tourism

Kim Newth

A DARK night and a sky full of stars is poised to be our latest tourism drawcard.

Canterbury University astronomer Dr William Tobin believed many European and North American visitors were coming here to view our night skies, as many parts of Europe and the US were literally aglow with light, making star-gazing difficult.

"Visitors often comment on how beautifully dark the skies are and in addition we have the Milky Way and the Magellanic Cloud that they don't have in the northern hemisphere. The southern sky is magnificent when it's a clear night."

Auckland Astronomical Society president Roger Feasey said the New Zealand tourism industry was just starting to realise the potential of catering to stargazers.

"It's already big business in the outback places of America, in Arizona and Nevada. Motels and hotels advertise as dark sky centres. They have telescopes to hire.

"People are starting to consider those options in New Zealand," Feasey said.

Hideyuki Ozawa is offering tours of the night sky in the Mackenzie District. After beginning tours at Lake Tekapo seven years ago, he now also operates from Mount Cook and Twizel. Over summer, up to 80 people a week stargaze with Ozawa.

"This is probably the best place in New Zealand for observing stars and the number of people coming is increasing, particularly over summer," said Ozawa.

"We get a mixture of people through – Japanese, Germans, Taiwanese, from Europe, Asia and the United States.

"We show them objects in the southern sky and have our own telescope and dome."

With Mount John Observatory in the area, the Mackenzie District Council has taken steps to ensure its night sky will remain brilliant by ordering street and other lighting to reflect downwards.

Astronomy magazines regularly promote global dark sky tourism destinations. Tour companies are currently touting for customers to view a solar eclipse in Zimbabwe in June.

Tobin said it was important New Zealand protected its dark skies.

He has lobbied the Department of Conservation to consider how this might be done.

"Many lights being put up are appalling. Some lighting engineers will tell you people like to see sparkle, but I'm not convinced."

FIRST RESORT

Margaret Agnew explores the different aspects of Tekapo by day and by starry, starry night.

I have been blind, but now I see, and it took stumbling around in the pitch dark on top of Mt John to open my eyes.

Previously, any visits to Lake Tekapo have been of the fleeting, pitstop-on-the-way-to-somewhere-else variety. Exploring the beautifully sited Church of the Good Shepherd in an obvious thing to do from different angles, at different times of the day and night.

We arrived late Friday at Peppers Bluewater Resort, which meant we were pretty much ready for dinner and bed, especially the tired two-year-old.

We opened the door to our lakeside room, well, small apartment really (complete with two heat-pumps, two TVs, a DVD player, a balcony, and a fully equipped kitchen) to discover a sunset-serene mountain-laced view of Lake

Before we even get near a telescope, the celestial show is spectacular.

both the quilts and the glass spic of the shower in the surprising tu colour. It may not have the tourist of Wanaka or Queenstown, but nothing lacklustre about this Mo Country lake.

Even better for weary travell a pre-schooler, the portacot has been assembled and made up w blankets.

Dinner at the resort's re Rakinui, is a surprisingly upmo

MT JOHN OBSERVATORY

Alan Gilmore, Mt John Observatory

A aerial view of the Mt John Observatory showing the 1m telescope dome and accommodation block in the foreground. Lake Alexandr the left and Lake Tekapo on the right, looking north.

Lela Kilmarth and Alan Gilmore

I might stay up all night for a gig like this

FANCY the idea of working at night and sleeping during the day?

It's not that unusual these days, I suppose, with all manner of business operations needing to run around the clock. I'm sure one gets used to it.

In my first job in this country, with the New Zealand Press Association in Wellington a decade ago, we had a so-called "graveyard shift" on the newsdesk, from 11.30pm to 6.30am, when the first day worker made an appearance.

Staffers were rostered on to this shift for a full seven days, though fortunately only once every three or four months. So for a period of seven hours each night, that person effectively ran the entire operation of the New Zealand newspaper industry's national news agency. It primarily

Grant Shimmin

attacks and included taking a story from our correspondent in London about how he'd been sent a parcel containing white powder. I think he dictated it from the street outside the office while the contents were checked out, though the delivery turned out to be harmless.

The point, though, getting back to my question at the start, is that I found working that shift incredibly difficult, because I just couldn't get used to having a full length sleep in the day. My kids were young, there was constant

Celestial sight: It may not reproduce too well on newsprint, but this is a picture of the Southern Cross and thousands of other stars.

telescopes owned by the Universities of Canterbury and Nagoya housed near its summit, before, but only during the day. You can't legitimately get up there

dollar telescopes on the mountain, it took a while for our eyes to adjust. While that was happening, our guide quickly switched on a powerful laser pointer and started

from the university were analysing what it captured. In such settings are major scientific discoveries now made.

On top of the hill, where one of the country's most fortunately located coffee shops is, others were waiting to share their passion for the stars and planets.

A telescope was set up, from which we caught memorable glimpses of Saturn and its rings and various constellations, though some thin cloud did hamper the best views.

And then, for the really keen photographers among us, the highlight for me. I've tried to photograph stars, without much marked success, but on Mt John they have a tracking mount, on which one's camera can be installed and made to move at t same speed, 15 degrees an hour our planet is turning.

4 TIMARU HERALD Friday, August 20, 2010

MACKENZIE

www.timaruherald.co.nz

Tekapo top tourist spot

Katarina Filipe
katarina.filipe@timaruherald.co.nz

Two Tekapo tourism operators have won awards in this year's Traveller-Voted Awards.

The awards are run by website Rankers.co.nz, which allows the public to post rankings and reviews of attractions around New Zealand.

More than 4000 businesses qualified for this year's awards, with Tekapo's Air Safaris and Earth and Sky Mt John Observatory named scenic flights winner and scenic attraction winner, respectively.

Earth and Sky Mt John Observatory general manager Margaret Munro said staff were "rapt" with the award, which was their first award ever.

"We have been working hard to promote the star-gazing tours that we have been running and we're seeing great results. We are very, very happy."

Air Safaris founder and chief executive Richard Rayward said the award was a "real bonus".

"We are delighted that the enjoyment and satisfaction we ourselves gain from flying visitors over our alpine areas has provided an experience they have rated so highly with their own reaction and appreciation.

"The team at Air Safaris takes great pride in the operation, and in providing a top product, this recognition is a real bonus."

Cymen Crick, Rankers.co.nz co-owner, said from the past year the site's database had attracted more

From that, winners were selected in about 40 categories.

Mr Crick's business partner, Nick Morrison, said the pair ran a sea-kayak operation for many years, but decided to sell up and start the website in 2007 as they sensed it to be "the way of the future".

[illegible] now had more than 20,000 [illegible], with reviews.

[illegible]'s a huge resource for New [illegible] holidaymakers and over-[illegible]itors. Access to this and [illegible] free on the Rankers.co.nz [illegible]r Crick said.

[illegible]'s an old saying, 'No-one is [illegible]onest than the customer'," [illegible]rrison said. "Well, these [illegible]come from the voice of the

[illegible]website offers a section for [illegible]ort of traveller, as well as [illegible]'s' tips.

[illegible]ick said the pair were advo-[illegible]e New Zealand tourism, and the awards were part of that. "We're proud of them and our role in celebrating the winners and high achievers. We're innovators in the new medium, and Rankers.co.nz is already New Zealand's largest travel review website.

"We just look forward to growing the site, hearing from people or, better still, meeting up," Mr Morrison said.

Meanwhile, Tekapo's Alpine Springs and Spa has been named one of 34 finalists in the 2010 Tourism Industry Awards.

This year's finalists were selected by assessors representing a wide range of industry leaders and specialists.

The winners will be chosen by a panel of judges and announced at a celebration event in Auckland on October 14, attended by Prime Minister and Minister of Tourism John Key.

First win: Earth and Sky Mt John Observatory won the scenic attraction award in this year's Traveller-Voted Awards. Photo: SUPPLIED

Flying high: Air Safaris won the scenic flights award in this year's Traveller-Voted Awards. Photo: SUPPLIED

star SIGNS

ON A MAGIC NIGHT IN THE MIDDLE OF WINTER, FERGUS BLAKISTON GOES STAR GAZING AND WONDERS WHY.

On a blanket in the cooling sand you and your friend agreed that the stars were so many there they seemed to overlap...
– 10,000 Maniacs, *The Painted Desert*

winter playground

Destination Tekapo

Pinholes in the curtain of night

Star light, star bright,
The first star I see tonight,
I wish I may, I wish I might,
Have the wish I wish tonigh

scape this winter
n absolute style

LUEWATER RESORT, LAKE TEKAPO
per night in a Two Bedroom View Villa

Researching the stars

Astro-tourism

Earth and Sky Limited
PO Box 112
Lake Tekapo 7945
T (03) 680 6960
F (03) 680 6956
E morg@earthandsky.co.nz

Lake Tekapo

Sanctuary for the stars

Online press about Mackenzie Starlight Reserve bids: both Darksky and World Heritage

Clear skies of the Mackenzie Country
http://www.stuff.co.nz/travel/new-zealand/3417313/Clear-skies-of-the-Mackenzie-Country

Beat Piracy a tall order
http://www.stuff.co.nz/timaru-herald/opinion/727729/Beating-piracy-a-tall-order

Sky park will give Tekapo a starring role
http://www.stuff.co.nz/timaru-herald/news/726286/Sky-park-will-give-Tekapo-a-starring-role

Starlight, star bright
http://www.stuff.co.nz/timaru-herald/1393091/Starlight-star-bright

Tourism rise astonishing
http://www.stuff.co.nz/timaru-herald/news/4310713/Tourism-rise-astonishing

Margaret Austin – the key UNESCO figure behind NZ's world heritage starlight reserve hopes
http://www.infonews.co.nz/news.cfm?id=49088

World night-sky reserve bid at Tekapo seeking government backing
http://www.infonews.co.nz/news.cfm?l=1&t=0&id=39308

Mackenzie Country
http://www.nzgeographic.co.nz/issue-94/mackenzie-country

Mackenzie Country: Starry starry night
http://www.nzherald.co.nz/travel/news/article.cfm?c_id=7&objectid=10751166

Tekapo sky pushes for heritage status
http://tvnz.co.nz/national-news/tekapo-pushes-night-sky-bid-2451576

First step in night sky heritage bid
http://www.odt.co.nz/the-regions/north-otago/81858/first-step-night-sky-heritage-bid

Starlight reserve plan clears first hurdle
http://www.odt.co.nz/regions/central-otago/119515/starlight-reserve-plan-clears-first-hurdle

Prsitine dark sky in the spirit of pure New Zealand
http://www.scoop.co.nz/stories/CU1003/S00276.htm

NZ bid to secure Ttekapo as a world night sky reserve needs to move fast with Government support
http://www.voxy.co.nz/national/nz-bid-secure-tekapo-world-night-sky-reserve-needs-move-fast-government-support/5/7813

World-first stargazing for Tekapo
http://tvnz.co.nz/travel-news/world-first-stargazing-tekapo-2446132

NZ working party formed to help world night sky reserve bid at Tekapo
http://www.voxy.co.nz/national/nz-working-party-formed-help-world-night-sky-reserve-bid-tekapo/5/13620

Brightening up the night's sky by powering down the town's lighting
http://www.3news.co.nz/Tekapo-brightening-up-the-nights-sky-by-powering-down-towns-lighting/tabid/423/articleID/90220/Default.aspx

New Zealand town wants to be the world's first 'Starlight Reserve'
http://www.foxnews.com/story/0,2933,489782,00.html

Southern skies: a starlight national park in the sky?
http://kiwitravelwriter.wordpress.com/2009/07/14/southern-skies/

Beautiful starry night sky, to whom does it belong to? ~ Questions the "Starlight Reserve" raises (this article is very thorough and gives a good over view)
http://www.thinktheearth.net/thinkdaily/report/2010/05/rpt-51.html#page-1

Star light, star bright –Let's keep it that way
http://www.3news.co.nz/Star-light-star-bright---lets-keep-it-that-way/tabid/1160/articleID/169112/Default.aspx

New Zealand's "Park in the Sky"
http://intelligenttravel.nationalgeographic.com/2009/02/10/new_zealands_park_in_the_sky/

Weekend Diversion: Protecting the night sky
http://scienceblogs.com/startswithabang/2011/09/weekend_diversion_protecting_t.php