

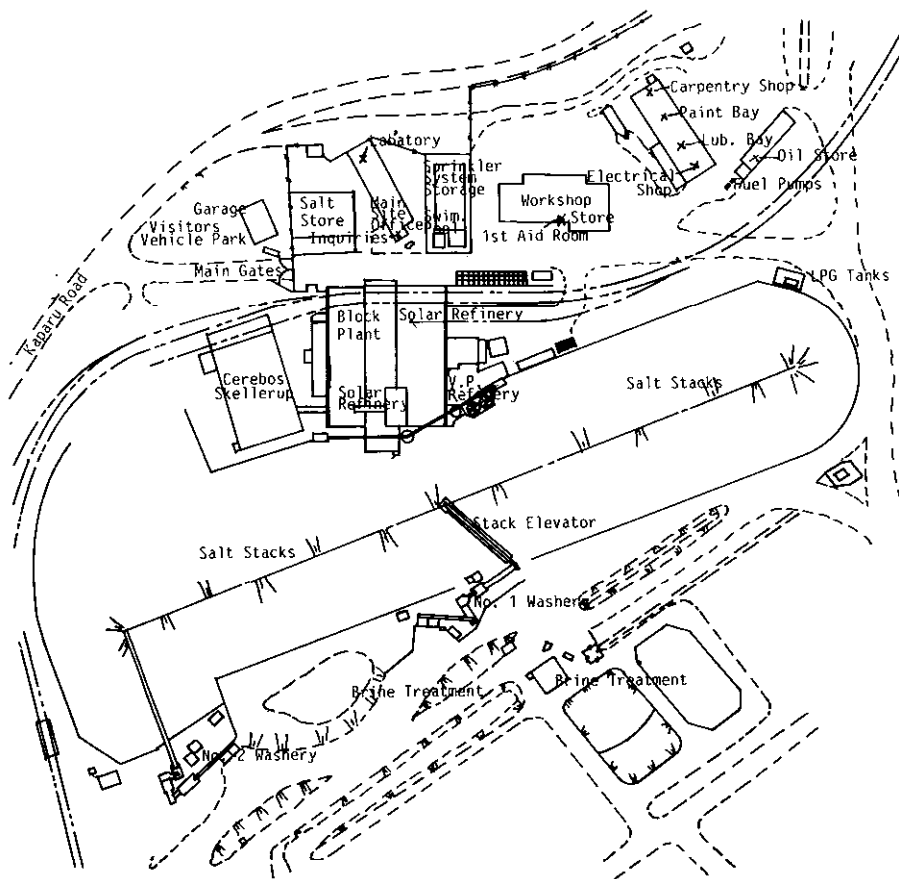
VISITORS — WELCOME

We are pleased to have your interest and hope that the attached information answers your questions.

Unfortunately we can offer guides only as set out below and we must insist that:

NO VISITORS ARE TO WALK AROUND SITE WITHOUT A GUIDE.

**Group tours are available by prior arrangement only.
For bookings please phone (03) 575 7021 during working hours**



IMPORTANCE OF SALT:

Salt is one of the essential elements. Man cannot survive without it! Other chemicals derived from salt are:—

Sodium Carbonate	Ethylene
Chloroform	Chlorate of Lime
Sodium Silicate	Sodium Bicarbonate
Trichlor Benzene	Carbon Tetrachloride
Calcium Chloride	Sodium Meta-bisulphate
Hydrochloric Acid	Chlorine
Caustic Soda	

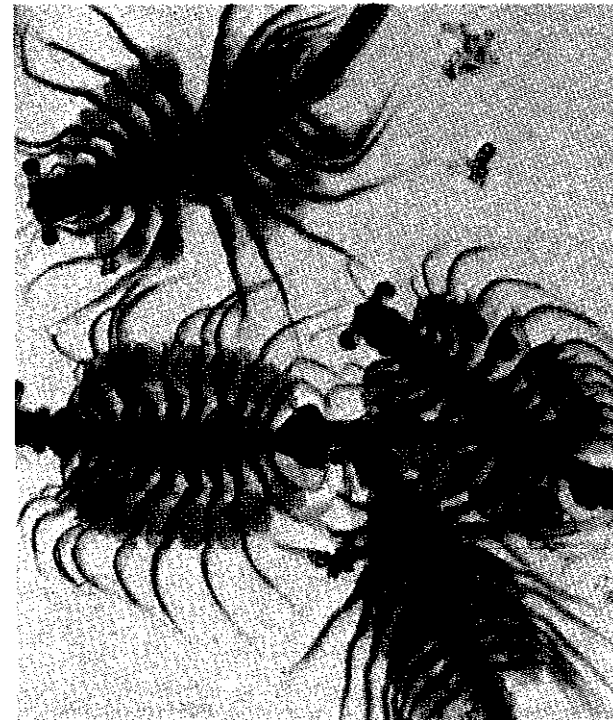
In the early days, salt was used for payment for services. Roman legionaires were paid with salt, hence the term "A man is worth his salt". The term "salary" is derived from this ancient usage.

THE BRINE SHRIMP

The brine shrimp — sometimes called the brine worm and scientifically known as *Artemia salina* — prefers to live in sea-water so saturated with salt that it would kill any other form of marine life. Experiments have established that the shrimp is happiest in brine containing about a hundred grams of salt to five hundred millilitres of water.

The movements of this tiny creature are graceful and vigorous — it swims on its back, its feet being in constant motion and its course being directed by means of its long tail.

Its colour is pink to red and millions of shrimps and their brownish-coloured eggs gather in corners of the salt ponds. They have a beneficial effect on salt making by grazing on the algae and sealing the pond bottoms. The brine shrimp is always found at well-established salt-works and has appeared at Lake Grassmere by natural means, without any attempt to introduce it artificially.



THE SOURCES OF SALT

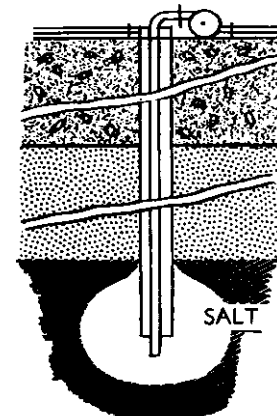
There are four main sources of salt:

SEA-SALT is obtained by evaporating the water from ocean brine. The evaporation is done in large shallow ponds in places where natural evaporation greatly exceeds rainfall. This is the method used at Lake Grassmere.

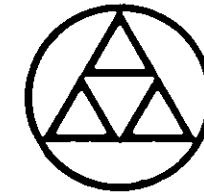
ROCK-SALT is usually mined in much the same way as coal. Great beds of salt are buried under the earth in several countries, particularly Central Europe and Russia. The largest European deposit is at Cracow in Poland.

BRINE-WELL-SALT is produced by sinking a well — similar to an oil-well — into the rock-salt deposit. Fresh water is forced down to dissolve the salt and the saturated salt-water is then pumped to the surface, and the salt recovered by evaporation.

LAKE-SALT comes mainly from Australia and the United States where there are several saline lakes from which salt is made in the same way as sea-salt.



Section of a brine-well.



DOMINION SALT LTD
LAKE GRASSMERE MARLBOROUGH NEW ZEALAND



EARLY DAYS AT LAKE GRASSMERE . . .

Above: The back-breaking task of harvesting 1500 tons of salt with shingle-forks in 1954.

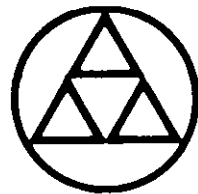
Middle: A light railway system was introduced in the 1950s to convey harvested salt to the washery and stockpile; it continued in use until 1963.



Today, using modern equipment, up to 6,000 tonnes per day can be harvested.



SALT FOR NEW ZEALAND



DOMINION SALT LTD
LAKE GRASSMERE, MARLBOROUGH

SALT PRODUCTION AT LAKE GRASSMERE

HISTORICAL:

Construction of the Salt Works at Lake Grassmere, Marlborough, was commenced in 1943 under wartime difficulties through the initiative of the late Mr George W. Skellerup — a Christchurch businessman whose enterprise had earlier led to the formation of the Christchurch-based rubber firm bearing his name.

LOCATION:

Lake Grassmere had features necessary for a Solar Saltworks:

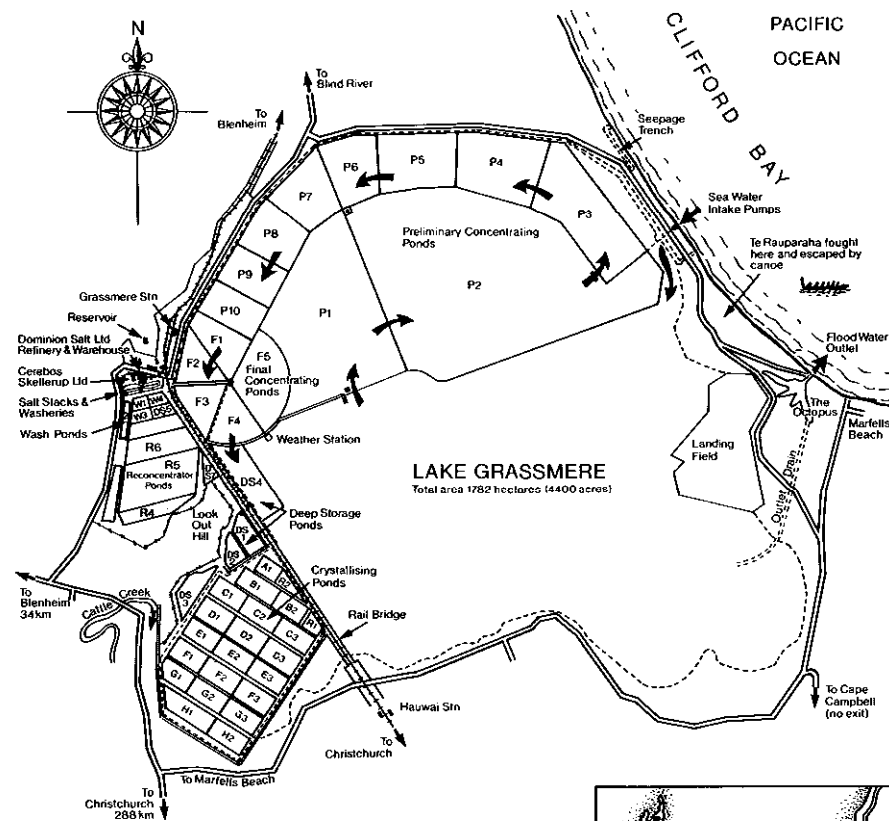
- A large area of flat land, with impervious soils, located on the coast.
- A readily available area unsuitable for any other use.
- The lowest rainfall region of New Zealand.
- Marlborough is noted for its sunshine. In addition, Lake Grassmere frequently experiences strong drying north-westerly winds during the summer months. (Sun and wind give rise to high evaporation rates.)

The total area for solar salt production at Lake Grassmere is approximately 1,416 hectares. This area is divided up as follows:—

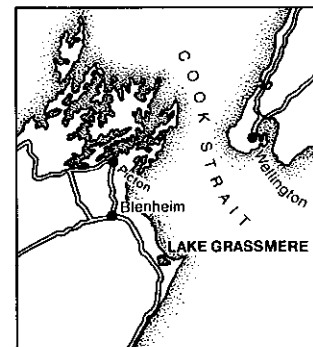
<i>Main Lake (not stopbanked)</i>	688 hectares — used for concentration of incoming seawater to roughly twice seawater's salt content.
<i>10 Concentrating Ponds</i>	486 hectares — used for step-by-step brine concentration.
<i>5 Final Concentrating Ponds</i>	81 hectares — used to bring brine up to saturation strength.
<i>4 Deep Storage Ponds</i>	20 hectares — used for winter storage of strong brines, held at depths of 3 to 5 metres.
<i>22 Crystallizing Ponds</i>	93 hectares — salt is deposited on the bottom of these ponds during the summer.
<i>Re-Concentrating Ponds</i>	40 hectares — used for bringing rain-diluted brine back to saturation strength.
<i>Wash Brine Ponds</i>	8 hectares — used for washing salt during harvest and for rewashing stockpiled salt during refining.

SEAWATER:

Seawater contains just over 2.5% of sodium chloride and also significant amounts of other salts. All but one of these salts are more soluble than sodium chloride. Thus as water is evaporated calcium sulphate deposits first, mainly in the concentrating area. Then when 90% of the original seawater has evaporated, sodium chloride commences to deposit. When about half the total sodium chloride has deposited (in crystallizers) as a result of further evaporation, the concentration of the more soluble salts in the crystallizer brine has increased to a level where these commence to deposit along with the sodium chloride. Unless the brine is discarded at this point, an impure salt would be harvested, contaminated particularly by magnesium and sulphate. This brine is known as "bitterns".



The main lake covers some 700 hectares (1700 acres) and is used for concentrating sea-water to about twice its normal salt content. Ten concentrating ponds produce step-by-step brine concentration, and five final concentration ponds bring the brine up to the required strength. The four deep-storage ponds hold strong brines through the winter at depths up to 35 metres. Salt is deposited on the bottom of the crystallizing ponds during summer. The reconcentrating ponds are used for bringing rain-diluted brine back to saturation strength. The wash ponds are for washing salt during harvest and for rewashing stockpiled salt during refining.



SALT MAKING SEASON:

The salt making season is of six months duration, commencing in early October. At this time, the crystallizing ponds are filled with saturated brine (transferred from winter deep storage ponds) to a depth of up to 350mm.

Seawater is pumped into the main Lake continuously throughout the summer months, at a rate reaching a peak of 40 tonnes per minute. As the seawater increases in strength, due to evaporation, it is pumped from the main Lake into a series of concentrating ponds where further evaporation takes place. The resulting brine reaches saturation point (i.e. salt crystals start forming), in the final concentrating ponds. The saturated brine is then pumped directly into the crystallizers.

The sun and wind at Lake Grassmere evaporate some 510mm of water from saturated brine during the six month salt making season. The comparative figure for evaporation of fresh water is 1180mm.

Salt is deposited in the form of a hard crust underneath the brine on the bottom of the crystallizing ponds. The salt crust thickness may vary from 25mm to 75mm when harvested, depending on evaporation and particularly the rainfall encountered during the summer. The spent brine, or "bitterns", is pumped out to sea when the crystallizing ponds are drained for harvesting during March and into April. The yearly average rainfall is 610mm, 250mm of which normally falls during the salt making season and 50mm during the harvesting period.

The damaging effect of heavy or persistent rain on the salt crust is lessened by draining rain-diluted brine from the crystallizing ponds for re-concentration or disposal to waste.

HARVEST:

Harvesting usually begins by early March and can last for four to six weeks, during which time the salt crust is lifted from the bottom of the ponds by harvesting machinery, transported to two washing plants where it is washed in brine before stacking in 20 metres high piles. A day's harvest may exceed 6,000 tonnes.

Salt, harvested since 1953 on a commercial basis, in total now exceeds 1.9 million tonnes.

SALT STACK:

The stacks of salt, which, in recent years have contained 100,000 tonnes of salt, are readily visible by day and night from the Blenheim-Christchurch main highway. The salt piles are floodlit at night to provide light for operators loading salt into refinery and bagging plants.

It is necessary to hold large stacks of salt to counter the fluctuations in annual salt production. Salt production is highly dependent on the amount of rainfall, and as a result annual harvests have ranged from a nil harvest in 1986 to a maximum yield of 130,000 in 1998.

WINTER OPERATION:

Winter evaporation is low and is normally greatly exceeded by winter rainfall, making it impossible to concentrate brine or deposit salt. Therefore, saturated brine is held in deep storage ponds (3 to 5 metres deep) to avoid dilution by rain, while all other brines held in shallow ponds are significantly diluted. During winter, maintenance work is carried out on the ponds, machinery and vehicles, while the year-round activity of bagging and loading out salt for the New Zealand market continues.

PROCESSING:

Nearly 40,000 tonnes is treated by combinations of rewashing, crushing, drying and screening processes before being packed in small bags containing 25 or 50kg or large bulk bags containing 1-1.2 tonnes of salt.

The biggest part of the production of the Refinery is used by the New Zealand Freezing Industry for treatment of hides and skins.

Part of the Refinery's fine salt production is supplied to the adjacent packing plant of an associate company which supplies almost all of New Zealand's requirement for domestic grades of salt — in plastic bags and containers in sizes ranging from 250gm to 12.5kg. Free-flowing and iodizing agents are mixed into this salt before packing.

IMPORTS:

New Zealand's consumption of salt now exceeds 120,000 tonnes per annum, much of which is imported by the Dominion Salt Companies. Pure Dried Vacuum (PDV) salt is also being produced by our Lake Grassmere and Mount Maunganui refineries for a range of user industries from food processing to dyeworks; sausage skins to butter and cheese; water treatment to paper industry.

SALT BLOCKS:

Also produced on the site is a range of salt-based stock lick blocks for farm animals. After mixing minerals and trace elements, a measured quantity is pressed at over 20,000 kPa to produce hard 20kg blocks for supply to South Island and lower North Island farmers.



PINK COLOURATION OF CERTAIN PONDS AT LAKE GRASSMERE:

Visitors to Lake Grassmere frequently ask why the brine in some ponds looks a pink colour. The colour is due to the presence of extremely large numbers of a microscopic unicellular algae organism. Normally algae are green, but when existing in concentrated brine, haematochrome (a red pigment) is formed in the organism giving it a pink or reddish appearance. Algae and bacteria are the organisms responsible for the pinkish-red tinge (from which the Red Sea gets its name).