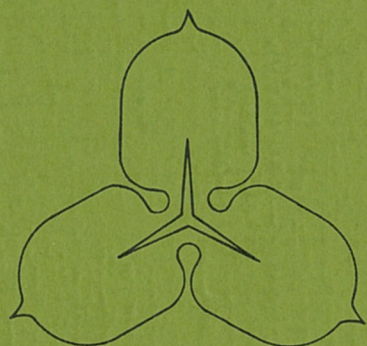


# BOTANY DIVISION DSIR



# REPORT

BOTANICAL RECONNAISSANCE OF THE AWARUA PLAIN  
INVERCARGILL

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BOTANY DIVISION, DSIR

JANUARY 1974

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SUMMARY

Agricultural development has greatly reduced the peat mire on the Awarua Plain. 5200 ha of these peatlands remains as Crown land and it is recommended that this be reserved and added to the Awarua Plain Reserve.

These peat swamplands contain a large variety of species which are under considerable threat from fire and drainage for agricultural development. Maintenance of the water table is essential if these areas are to survive. A species list is appended.

Plant Communities

Leptospermum scrub  
peat swamp  
sand dune  
lagoon marsh  
podocarp forest

# BOTANICAL RECONNAISSANCE OF THE AWARUA PLAIN INVERCARGILL

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## Location

The Awarua Plain is situated about 18 km south-east of Invercargill. It originally consisted of a mire covering an area of 40 000 ha extending eastwards from the coast between Invercargill and Bluff. The original plain has been reclaimed for agricultural purposes and dissected by roads. The largest remaining portion is 5,200 ha under the ownership of Crown Land (see map).

## Reason for Assessment

The Awarua Plain lies immediately to the north-west of the Waituna Lagoon. The latter was examined by Mr G. Kelly (Botany Division, DSIR) during a brief visit in 1967 and he recommended the conservation of the lagoon, shingle banks, mudflats and a 1,500 ha portion of mire, but indicated the probable value of the adjoining area of the Awarua Plain. The recommendations were used as a basis for establishing the Waituna Lagoon Reserve and the present assessment is to establish the value of the mires of the remaining portion of Crown Land as a supplement to the existing reserve.

## Previous Assessment

The general assessment of mires in South Otago by Cockayne (1958) was probably made about 1913, when he commented upon the 'remarkable number of high-montane plants contained in them' although situated at sea-level. The conclusion was supported by a list of species, making special mention of *Danthonia raoulii* growing on *Sphagnum-Gleichenia*. Crosby-Smith (1927) prepared a brief account of the vegetation of the Plain, initiated as a record of the 'ecological character' as the area was 'being drained and put under cultivation'. His paper lists 60 species of plants but the 'Plain' was far in excess of the present limits. Two members of the Botany Division (Dr Moar and Miss Mason) collected peat from the Plain in 1952 and listed species in their sampling sites, being part of a general study of aquatic and swamp plants and vegetation during a journey to Otago and Southland. Cranwell (1953) refers to the 'remarkable Awarua Bog' in her 'Outline of New Zealand Peat deposits', while Martin (1960) lists the Cryptogamic flora of the Plain and again draws attention to the rapid replacement of the bogs by arable land. Kelly (1968) briefly describes the portion of bog to be incorporated into the Waituna Lagoon Reserve but concludes better areas might still be found lying east of the Awarua Bay Road.

## Method of Survey

A brief visit of one day was made to the fringes of the Plain during January 1974, accompanied by Drs Wardle & Johnson (Botany Division, DSIR) and Messrs Elcock and Barberel (District Field Officer, Crown Lands and Scientific Reserves Ranger, respectively of Lands and Survey, Invercargill). A list of species compiled during the visit is appended to the report.

Subsequent work has been confined to two weeks field inspection, including a search of the relevant files at Lands & Survey, Invercargill. Entry to the Crown Lands was made at various points from the boundary for a distance of 5-8 km. Field information has been supplemented by a crude map of vegetation derived from aerial photography of 1952 and 1968, and an hours flight over the Plain from Invercargill airport.

The difficulty of site access and survey was stressed in Mr Kelly's original report (1967 unpublished), where he concluded a helicopter would be desirable for future survey due to the flatness, variability and instability of the terrain. However, tentative enquiries on helicopter hire produced an estimate of \$126 per hour. Instead a light aircraft was chartered at \$40 per hour, enabling me to gain a final impression of the whole area and to take a series of photographs across the Plain.

### Survey

Previous investigators have stressed the value of the Awarua Plain and the need for conservation of its flora. Therefore, my work has been confined to an assessment of the present value of the fragment of the Plain within the Crown Lands in relation to variation in time and space.

The vegetation of the Awarua Plain is dependent on the water table being maintained at or near to the surface of the peat. Open water is found within the meandering system of creeks, and in the irregular-shaped tarns. The creeks flow in the general direction of north-east to south-west, but drain either into Muddy Creek at the south-east of the Plain or via the Mokotua Stream in the north-west. The creeks are fringed by swampy ground running parallel to them containing Phormium tenax and raised tussocks of Carex secta, with small but numerous plants of Juncus sp. and Scirpus sp.

The tarns may contain open water or have varying quantities of vegetation infilling them. Those nearer the sea have a more varied flora than the more northerly ones which may be merely water-filled hollows in the peat. The banks are usually cliffed above the water level. Tarns situated near grid ref 460830 are virtually impossible to locate from the ground due to the general cover of dense Leptospermum scrub growing to a height of 4 m. The open water may contain Sphagnum, with Juncus species around the margin but zones of Dracophyllum, Phormium and Calorophus occupy the region up to the start of Leptospermum scrub. Several hides have been erected on the margins of tarns by shooters, and their use was evidence from spent cartridge cases and decoy ducks.

Sphagnum may grow submerged in open water, as a continuous carpet over waterlogged ground or forming raised mounds of yellow-green amongst a mixture of Calorophus/Gleichenia. It may completely infill the smaller tarns, especially in the north-eastern portion of the Crown Land. The raised Sphagnum is frequently covered by Drosera binata and Drosera spathulata.

There is a definite zonation of plants dependent on the level of the water table. Leptospermum is intermixed with Calorophus; Sphagnum and Gleichenia at levels slightly higher and drier than pure Sphagnum. Dead plants of Gleichenia stand out as patches of silver-grey on slightly lower-lying areas. The dome shaped mounds of Donatia novae-zelandie are probably restricted to a zone of Calorophus/Leptospermum. They grow to a height of 40 cm above the surface and individual plants may contain tufts of Calorophus, Gleichenia and Pentachondra, but the latter may completely cover a dead plant.

Leptospermum occupies three distinct zones generally over the area of the Plain. The lowest level has already been described and the growth

is normally less than 30 cm high. Bushes up to 1 m in height form mixtures with Dracophyllum, Gleichenia and Calorophus, but they are intermixed with diseased or dead plants of Leptospermum. Dense scrub is virtually pure, except for an occasional plant of Dracophyllum and grows to a height of 4 m. Large plants of Leptospermum are frequently dead towards the northern limit of the Plain, forming thickets of silver-grey stems or a tangle of broken material over a botanically sterile surface of peat.

### Management

The diversity of vegetation of the Plain is dependent on the maintenance of the water table at or above the surface of the peat. Artificial lowering of the water table is a major factor in the continual and widespread deterioration noted as long ago as 1927. The northern portion of the Plain appears to be at a higher and drier level. Fire is the other major hazard of the Plain, destroying the Leptospermum growing on the higher levels and scorching the peat surface to the north although large areas of scrub remain undamaged towards the sea. This may be due to disease and subsequent death, with associated fire risk, rather than due solely to fire damage. The northern portion of the Plain has suffered from repeated firing and patches of tall Leptospermum scrub are a rarity and even the Donatia hummocks have been killed. The burned surface is recolonised by Pteridium aquilinum and occasionally by clusters of 50 or more spikes of Thelymitra.

Destruction of peat by fire occurs only on the higher and drier areas, but this would tend to lower the surface towards the underlying water table and revert the plant life towards that of a wetter condition.

Drainage of agricultural reclamation is obviously the major factor influencing the future value of the Plain as an area of ecological interest. The present internal management is a negative one as the unreclaimed peat is considered of no agricultural value, being unfit for grazing by stray cattle. The reclamation value of the wetter areas is considered to be low, requiring considerable expenditure on drainage before use as pasture. There is evidence of former attempts to reclaim the north-eastern corner of the Crown Land, but the only remains are a series of ditches, broken fences and a continuous cover of Calorophus.

The boundary of the Crown Land is an artificial one where reclamation work has replaced the original vegetation of the drier areas by pasture for cattle. Extensive systems of ditches up to 2 m in depth are spreading towards the boundary of the Crown land, where some have been constructed within the past months, especially in the east. I view the latter with concern as they will eventually fringe the portion of mire included in the Waituna Lagoon Reserve. Rapid deterioration of the natural vegetation of drained land occurs within 6 months of ditching as water gushes from the sponge-like peat which contracts by 1.5 m. This was observed on land immediately to the east of the Plain, where Messrs Henderson have recently constructed deep ditches. Tarns were dust dry, raised Sphagnum was either dead or concave, Donatia hummocks were dead, and wetland species had disappeared. Swamplands fringing the Awarua Bay Road were deteriorating through drainage parallel to the road, with the death of Carex secta tussocks and decreased vigour of Phormium tenax.

Active reclamation work has been in progress in the south-east for seven years by Messrs Henderson (ditching, flailing, burning, reseeding and the possible use of superphosphate); in the north-east by Mr Stephenson for 12 years (drainage, tilling and reseeding); in the west extending eastwards from Halls Road (ditching and destruction of Leptospermum scrub.)

## Stratigraphy

Martin (1960) made general observations on the stratigraphy of the Plain, based on the exposed surfaces within drainage ditches. A layer of 2-2.5 m of peat overlay white gravel, but in certain instances the peat was reduced to a thin layer. The present drainage activities along the eastern fringes of the Crown Land reveal a depth of 2 m of peat overlying the white layer. Several distinct layers of Leptospermum stems were embedded in the peat, varying locally in depth and separation, but including fire-damaged material at 1.5 m. The stems were generally confined within a zone of 0.5 to 1.5 m below the surface. Trunks of a diameter of 40 cm were lying on reclaimed pasture, but examples in situ with the drainage ditches were less than 20 cm.

## Recommendation

The econological interest of the mire within the Crown Land is beyond doubt due to the examples of alpine flora within it. However, the only criteria of present quality is comparison with the portion of swampy-bog already included in the Waituna Lagoon Reserve. The latter would appear to be the finest remaining portion of the Plain, but forms only a small portion of the whole. The problem therefore is to decide upon the size of a viable unit of swampy bog where the boundary is arbitrary and reclamation by drainage is encroaching from every direction.

According to New Zealand botanists, the Awarua mire appears to be the best remaining example of its kind in the country and I therefore recommend retention of the whole block of Crown Land as a single conservation unit. Although my examination was not exhaustive and the appended list of plants is incomplete, it is clear that diversity of interest increases towards the south and especially on the west side of the Awarua Bay Road, where there is also a fine example of tussock grassland.

While an arbitrary line extending due east to Halls Road could be taken as a northern limit to the area of prime botanical interest, this would be dangerous as many of the creeks originate north of this line. Also, it is necessary to retain an area large enough to provide its own buffer against changes resulting from the development of surrounding farmlands. The present boundary of the Crown Land on the Plain is about 56 km. In the future, local adjustment of this boundary could be contemplated, when there is better understanding of the water regime, and when an inventory of the regional and national extent of this type of wetland permits a final appraisal of the needs of conservation.

## BIBLIOGRAPHY

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- Cranwell L.M. (1953): An outline of New Zealand Peat Deposits. 7th Pacific Sci. Congress 5, 186-208.
- Kelly, G.C. (1967): Proposal for a wetland reserve adjacent to the Waituna Lagoon, Toetoes Bay, Southland. (Internal publication of Botany Div. DSIR)
- Martin, W. (1960): The cryptogamic flora of the Awarua Plains. Trans. R. Soc. N.Z. 88, 161-7.

SPECIES LIST

Grid references are from S181/182, and are approximate.  
Adventive species are marked with asterisks.

Specimens from the Awarua Plain deposited with the herbarium at  
DSIR Christchurch

20.2.74 at 450850

Luzula sp.  
Luzula sp.  
Blechnum procerum  
Blechnum minus  
Gleichenia microphylla  
Oreobolus pectinatus  
Celmisia gracilentata  
Pernettya macrostigma  
Dracophyllum longifolium  
Carpha alpina  
Notodanthonia sp.  
Calorophus minor  
Baumea tenax  
Baumea huttonii  
\*Agrostis stolonifera  
Leptospermum scoparium  
Pentachondra pumila  
Cyathodes juniperina  
Juncus pallidus  
Carex appressa  
Scirpus sulcatus  
Nertera depressa  
Thelymitra sp.  
Sphagnum sp.  
Centella uniflora  
Coprosma sp.  
Haloragis micrantha  
Dicranoloma  
Drosera binata  
Pterostylis  
Drosera pygmaea  
Donatia novae-zelandiae  
Gentiana saxosa  
Senecio sp.

21.2.74 at 450900 and easwards

Lycopodium ramulosum  
Scirpus aucklandicus  
Gnaphalium lanatum  
Hierochole sp.  
Herpolirion sp.  
\*Cerastium sp.  
Dacrydium bidwillii  
\*Sagina sp.  
\*Senecio vulgaris  
Senecio sp.  
Histiopteris incisa

8.3.74 at 500850

\*Glyceria maxima  
Hebe sp.

\*Mentha piperita  
Juncus sp.  
\*Juncus bufonius  
Carex secta  
Lepidosperma australe  
Cassinia sp.

Species identified during visit to Awarua Plain and Waituna Lagoon  
with Drs Wardle and Johnson.

10.1.74 at 610830 on disturbed shingle

Juncus pallidus  
Leptocarpus similis  
Carex sp.  
\*Lotus uliginosus  
\*Ulex europaeus  
Phormium tenax  
\*Trifolium repens  
Hydrocotyle tripartita  
\*Hypochaeris radicata  
Juncus articulatus  
\*Agrostis tenuis  
\*Anthoxanthum odoratum  
\*Prunella vulgaris  
Acaena sp.  
\*Holcus lanatus  
\*Rumex acetosella  
\*Cirsium arvense  
Agropyron scabrum  
\*Festuca arundinacea  
\*Agrostis stolonifera  
\*Bromus mollis

10.1.74 at 610830 on sand/shingle

\*Ammophila arenaria  
Macrocystis sp.  
\*Calystegia soldanella  
Festuca littoralis  
\*Dactylis glomerata  
Scirpus nodosus  
Poa laevis  
Dichelachne crinita  
Agropyron scabrum  
Coprosma acerosa  
Agrostis billardieri

10.1.74 at 610830 lining track

\*Plantago lanceolata  
\*Trifolium pratense  
\*Plantago major  
\*Lolium perenne

10.1.74 at 610830 in fore dunes

Senecio sp.  
Acena sp.  
\*Rumex crispus



10.1.74 at 610830 in wetland behind dunes

\**Juncus articulatus*  
\**Festuca arundinacea*  
*Eleocharis acuta*  
*Glossostigma elatinoides*  
\**Myriophyllum* sp.  
\**Myosotis caespitosa*

10.1.74 at 610830 on shingle slope behind fore dune

\**Erica lusitanica*  
\**Ulex europaeus*

10.1.74 at 600830 at back of Lagoon

\**Lupinus arboreus*  
\**Ulex europaeus*  
*Phormium tenax*  
*Cortaderia* sp.  
*Deschampsia caespitosa*  
*Drosera binata*

10.1.74 at 600830 sand-mud with *Leptocarpus*/*Phormium* marsh

*Juncus* sp.  
\**Juncus bufonis*  
\**Anthoxanthum odoratum*  
\**Holcus lanatus*  
*Leptocarpus similis*  
*Phormium tenax*  
*Carex virgata*  
*Cotula coronopifolia*

10.1.74 at 600830 in mixed marsh

*Gunnera prorepens*  
*Polytricha delpha*  
\**Hypochaeris radicata*  
*Pernettya macrostigma*  
*Celmisia* sp.  
*Mentha cunninghamii*  
*Gleichenia circinata*  
*Cyathodes juniperina*  
*Pteridium aquilinum*  
*Blechnum capense*  
*Scirpus nodosus*

10.1.74 at 430850 in mire

*Drosera binata*  
*Drosera stenopetala*  
*Calorophus minor*  
*Gleichenia circinata*  
*Leptospermum scoparium*  
*Sphagnum* sp.  
*Donatia novae-zelandiae*  
*Pentachondra pumila*  
*Lycopodium ramulosum*  
*Dracophyllum longifolium*

Baumea (2 species)  
Gentiana grisebachii  
Acaena sp.  
\*Hypochaeris radicata )  
\*Holcus lanatus ) in drainage ditch  
Blechnum sp. )

10.1.74 at 520900 in mature woodland

Podocarpus dacrydioides  
Dacrydium cupressinum  
Podocarpus spicatus  
Podocarpus ferrugineus  
Weinmannia racemosa  
Griselinia littoralis  
Coprosma rotundifolia  
Pseudowintera colorata  
Parsonsia heterophylla  
Blechnum minus  
Blechnum discolor  
Polystichum vestitum  
Fuchsia perscandens  
Microlaena avenacea  
Neomyrtus pendunculata  
Asplenium flaccidum  
Melicytus lanceolatus  
Erechtites minima

10.1.74 at 410810 on andy/shingle near shore

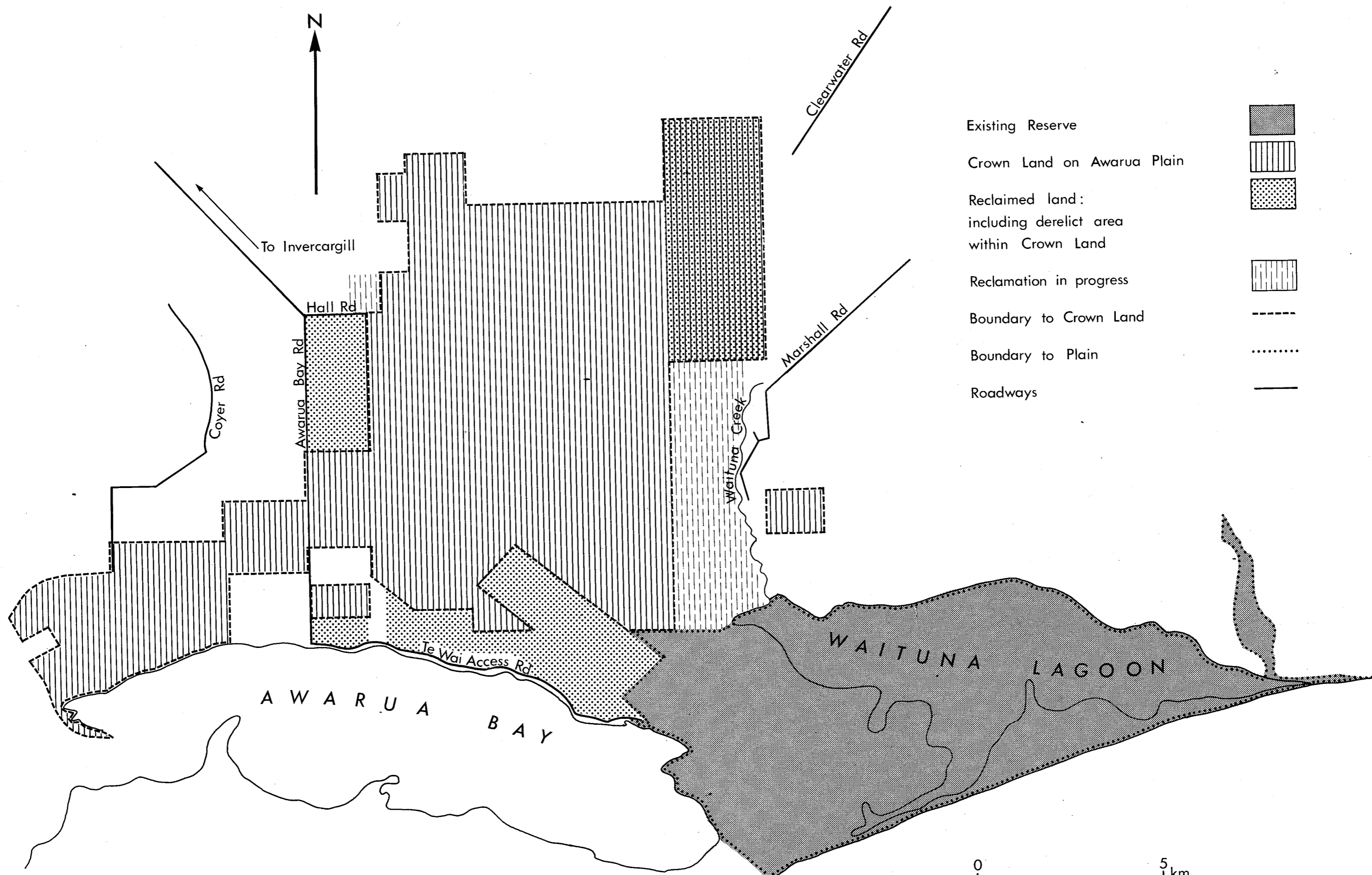
Cyathodes fraseri  
\*Anthoxanthum odoratum  
\*Hypochaeris radicata  
Acaena sp.  
Gentiana sp.  
Notodanthonia sp.  
Pteridium aquilinum  
Celmisia gracilentata  
Coprosma brunnea  
Coprosma repens  
Cladonia sp.  
Poa laevis  
Pimelea sp.

10.1.74 at 410810 in red tussock adjacent to previous site

Acaena  
\*Anthoxanthum odoratum  
\*Cirsium arvense  
\*Holcus lanatus  
\*Rumex acetosella  
Hydrocotyle novae-zelandiae

10.1.74 at 410810 by roadside

Leptospermum scoparium  
Phormium tenax  
\*Hypochaeris radicata  
Pteridium aquilinum  
Dracophyllum sp.



To Invercargill

Clearwater Rd

Marshall Rd

Coyer Rd

Hall Rd  
Awarua Bay Rd

Waituna Creek

Te Wai Access Rd

A W A R U A  
B A Y

W A I T U N A  
L A G O O N

- Existing Reserve
- Crown Land on Awarua Plain
- Reclaimed land:  
including derelict area  
within Crown Land
- Reclamation in progress
- Boundary to Crown Land
- Boundary to Plain
- Roadways

0 5 km

INCHES  
METRIC

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

Extent of agricultural land in 1968  
*Leptospermum* scrub  
 Wetter areas of *Sphagnum*, *Phormium*, *Carex*  
*Calorophus*, *Gleichenia* and stunted *Leptospermum*  
 Boundary of Crown Land  
 Creeks  
 Tarns

R  
 W  
 S  
 Blank area

Vegetation boundary drawn from 1968 vertical aerial photographs  
 and superimposed on mosaic prepared from 1952 photographs.  
 Map reference: N Z M S 1. S 181/182

0 500 1000 m

