1909.

NEW ZEALAND.

IRRIGATION IN CENTRAL OTAGO

(REPORT ON), BY MESSRS. BRUCE AND DOBSON.

Laid on the Table of the House of Representatives by Leave.

Hon. R. McKenzie, Minister of Public Works, Wellington.

Department of Lands, Wellington, 18th June, 1909.

Re *Irrigation of Central Otago.*

In accordance with Cabinet direction, and an instruction from the Right Hon. Sir J. G. Ward, I have the honour to forward for your information a copy of a very comprehensive report on the whole question of irrigation in Central Otago by Messrs. Bruce and Dobson, of the Agricultural and Public Works Departments respectively, together with a synopsis of the same which has been prepared specially for the consideration of Cabinet, and attached to which is a plan showing the several blocks referred to in the report, and the portions of the said blocks which are suitable for irrigation.

Wm. C. Kensington,
Under-Secretary.

Department of Lands, Wellington, 30th April, 1909.

In Cabinet, 25th May, 1909.

Circulate to Ministers. Vote and administration to be transferred to Public Works Department.

A. Willis,
Secretary, Cabinet.

The Right Hon. the Minister of Lands.

Re *Irrigation of Central Otago.*

The Secretary for Agriculture has forwarded me a report on the areas fit for irrigation, &c., in Central Otago, in accordance with a memo. which I wrote to him by direction of the then Minister on the 28th August, 1908, to furnish a report as to what areas in Central Otago were suitable for irrigation. This report, I find, was placed before you by Mr. Ritchie on the 6th instant, but no summation was made of that report, nor any synopsis of it conveyed to the Cabinet; so that, as the whole of the vote for the irrigation of Central Otago is borne on the Lands Department's appropriations, I am bringing the matter again before you for further decision.

On going through the report by Messrs. Bruce and Dobson, which is a very comprehensive one, and colouring up a map of the proposed irrigation of Central Otago to agree with the said report (which had not been done previously, and which will give you a comprehensive idea of the areas reported upon, together with the acreage of the various blocks), I think the following synopsis will be of considerable assistance to you in arriving at a decision in this matter :—

Earnscleugh Block.

The Earnscleugh Block, shown on the map as Block I, is divided into two parts. The portion known as "Earnscleugh Flat," opposite Alexandra, contains 5,400 acres, of which area 2,900 acres is fit for irrigation.

Blackman's Gully, another portion of this block, is well situated for fruit-growing, and extends from about 600 ft. above sea-level to an altitude of about 1,600 ft.; and about 1,500 acres of this portion could be irrigated profitably.

The total area of this block is 51,100 acres.

Clyde Block.

This is shown on map as Block II. The Clyde Block proper adjoins the Town of Clyde, and about 3,000 acres is fit for irrigation. The balance of Block II is reported as being absolutely unsuitable for irrigation. The total area is 60,600 acres.

Tiger Hill, Lauder Block.

This is shown on the map as Block III, the total area being 75,800 acres. Of this area a considerable portion is suitable for cultivation without irrigation, and there is also a block of about 35,000 acres fit for irrigation, extending from above Chatto Creek Railway-station to the Cambrians. The greater portion of this area is good agricultural land, composed of mica-schist soil with rich humus, and admirably adapted for irrigation. About 4,000 acres of this block is already irrigated, particularly so from below Tinkers to railway-line at Spottis Creek, and from Drybread to the main road at Lauder. There is a large area of flat land between Matakanui and Chatto Creek, and several table-lands between Thomson's and Lauder creeks, which are unsuitable for irrigation, owing to absence or poverty of soil in places, and the subsoil being of a cementy sandy gravel.

Ida Valley Block.

This is shown on the map as Block IV, and contains 65,200 acres. About 52,500 acres is fit for irrigation. Almost the whole of this land on the south side of the railway-line is admirably adapted for irrigation, a very large portion being first-class agricultural land, which would undoubtedly become highly productive on the application of water. The local Irrigation Committee is so convinced of the suitability of this land for irrigation and the benefits to be derived therefrom that it offers from 10s. to £2 per week per sluice-head of water for about 100 heads for six months yearly. On either side of the Upper Poolburn there is a considerable area, approximately 4,330 acres, of highly fertile land on which irrigation would be unnecessary. The Ida Valley is considered an ideal field for irrigation, and the report states that the adoption of any scheme whereby water could be obtained, even at considerable expenditure, can be confidently recommended.

Roxburgh Block.

This is marked on the map as Block V. It is a small block containing only 9,600 acres. The greater part of the soil in this block is eminently suitable for fruit-growing. Most of the orchards are well managed, and provided with water from the mountain-streams.

Cromwell Block.

This is shown on the map as Block VI, and contains about 11,400 acres. It is situated at the Kawarau Gorge, and contains about 2,870 acres suitable for irrigation, 1,000 acres of which is already irrigated. The soil is decomposed mica-schist, intermixed with rich loam, possessing an extraordinary power of endurance under cultivation. There can be no doubt as to the benefits of discreet irrigation on this class of land, which without water would be practically valueless. Immediately adjoining this land lies the Cromwell Flat of about 4,700 acres of extremely disappointing country, not suitable for irrigation.

Mount Pisa Block.

This is shown on map as Block VII, the total area being 40,300 acres. From Lowburn this block follows the foothills to Luggate, thence along that stream to its junction with the Clutha River. A good deal of irrigation has been done in this block, but there is evidence that rapid percolation would render any comprehensive scheme of irrigation impracticable. The area of land fit for irrigation is only about 4,740 acres, which includes some 500 acres already irrigated.

Luggate-Glendhu Block.

This is marked on map as Block VIII, the total area being 32,500 acres. This land, generally speaking, is purely pastoral, and the soil of poor quality. About 2,900 acres is suitable for irrigation, and 600 acres of this area has already been irrigated.

Hawea Block.

This is shown on the map as Block IX, and the total area is 48,500 acres. It is situated around the Town of Newcastle. The area marked on map as being suitable for irrigation contains about 6,870 acres, the greater portion being the Hawea Flat, which possesses a rich soil, eminently suitable for high-class farming, and excellent results are already being obtained without the aid of irrigation, but this land would be rendered much more profitable if water was obtainable when required. The balance of the block is purely pastoral country.

Tarras Block.

This is marked on the plan as Block X, and the total area is 80,000 acres. It is situated between Sandy Point and the head of the Lindis Downs near Grumbling Gully, thence along the foothills of the Dunstan Range. There is about 25,740 acres fit for irrigation. If sufficient water for irrigation purposes could be provided it would materially assist settlement and assure the prosperity of a number of small grazing-runs when the country comes to be subdivided.

Gibbston Block.

This area is shown on the map as Block XI, the total area being only 2,200 acres. It is situated about midway between Cromwell and Arrowtown. About 1,120 acres is fit for irrigation, of which some 200 acres has already been irrigated. The soil and contour of the ground are especially good, and the benefits of skilful irrigation are even now clearly demonstrated.

Maniototo Block.

This is shown on the plan as Block XII, the total area being no less than 170,100 acres. This plain extends from the Taieri Gorge at Linburn to Kyeburn. About 108,700 acres is situated on the south-west side of the railway-line, and of this area about 87,000 acres is fit for irrigation. Where under cultivation, the soil of the Maniototo Plains absorbs and responds readily to moisture, and when irrigated with discretion this large area is capable of being transformed into a highly fertile expanse, eminently adapted for grain-growing and the raising and fattening of stock. There is also an area of about 3,000 acres near Wedderburn where irrigation might be profitable.

Roughly speaking, the total area fit for irrigation, after deducting the land already irrigated, is 222,000 acres. The report thus shows conclusively that nearly a quarter of a million acres will be benefited by irrigation. On the attached map I have also shown by a firm red line the Otago Central Railway opened to Clyde, and by dotted red line its position when extended to the southern shore of Lake Hawea. The whole of the work done up to the present time is that of taking levels by the officers of the Public Works Department, and a report thereon will no doubt be presented with the Public Works annual report to Parliament. This, together with the very valuable report by Messrs. Bruce and Dobson, shows the work done up to date.

The question for your consideration is this: The carrying-out of the irrigation-works (if Government decides that they shall be carried out) must rest with the Public Works Department, who, I believe, have already secured the services of a competent engineer. I would therefore recommend that the appropriation in future for this work be entered on the Public Works appropriations, and the work placed entirely under the charge of the Public Works Department. A good portion of this land is more or less in private hands, and some portions of it are occupied by runs. Portions are National Endowment lands as follows: In Blocks II and III such portions of these blocks as are not private property are within the National Endowment area; also a small part of the southern portion of Block XII is National Endowment.

Therefore, with your approval, no portion of the funds intended to be appropriated for irrigation-works will be entered on this year's estimates of the Lands Department—that is, we practically close our account, so far as Central Otago irrigation is concerned, on the 31st March, 1909.

I notice on Cabinet minute the instruction "Circulate to Ministers." I propose, after you have considered my general report, to have the whole of it copied, and a copy supplied to each Minister.

There is also another Cabinet instruction to pay a bonus of £50 to Messrs. Bruce and Dobson. I presume the Agricultural Department will pay Mr. Bruce from its own funds, and also that the Public Works Department will pay the bonus to Mr. Dobson, as, if my suggestions are carried out, there will be no sum this year to the credit of irrigation-works, Central Otago, on the Lands Department estimates to which these two amounts could be charged.

Wm. C. Kensington, Under-Secretary.

Department of Agriculture, Division of Live-stock and Agriculture.
Dunedin, 22nd March, 1909.

Chief Inspector of Stock, Wellington.

Re *Irrigation in Central Otago.*

Re your wire of 13th instant, "Where would Inspector Bruce and Mr. Dobson recommend experiments being made, and to what extent, for testing purposes?"—

After making a further inspection, and going fully into the question of water-supply, Mr. Dobson and I are of opinion that the Clyde racecourse would be very suitable for testing purposes, and for more convenient reference I quote from my report *re* same: "I consider this an ideal field for experimental work, being quite close to Clyde Railway-station. It contains about 100 acres, more or less, of fairly good land, somewhat deficient in humus, but admirably adapted for experimental irrigation. Taken in conjunction with the adjoining land, which is considerably lighter, being similar to other areas in Central Otago, notably the Cromwell Flat, it should assist in determining whether irrigation could be profitably adopted or not. I should recommend for your consideration the practicability of obtaining a sufficient water-supply for experimental purposes on this block. Adjoining the Clyde racecourse there is a holding of some 60 acres which, I am informed, has been under irrigation for about forty years. On the best of the soil the results appear to have been highly satisfactory, but it is observable that on reaching the lighter soil the water disappears. Possibly the experimental work may demonstrate that the cultivation and ploughing-down of leguminous crops would aid nitrification, and thus extend the irrigable area."

The area recommended contains about 280 acres, which could be extended if necessary. When in that district we learned that the Alexandra Borough Council would, on the completion of its water-supply from another source, probably be in a position to supply water from its Chatto Creek race. After visiting this race, ascertaining its capacity, and the possibilities of its commanding the area referred to, we interviewed the Mayor of Alexandra, who informed us that immediately the new works are completed his Council would be pleased to enter into negotiations for the leasing of three sluice-heads of water for irrigation purposes. The obtaining of water from this source would obviate the necessity for much expenditure in building reservoirs, constructing expensive water-races, &c., and has therefore much to commend it. A short race of perhaps two or three miles in length would convey water from the Chatto Creek race, and we recommend that a survey be made of the locality before negotiations are entered into. There is every reason to believe that fruit, tomatoes, &c., could be profitably cultivated on the greater portion of this land, while if experimental work is extended to the poorer and shingly portions, and conducted as suggested, the capabilities of similar areas, notably Cromwell and Earnscleugh Flat, concerning which different opinions will doubtless be expressed, would be demonstrated. With a view to testing the larger areas for agricultural purposes, we revisited the upper end of Ida Valley, principally to ascertain whether water could be obtained from the Bonanza Race, owned by the Mines Department. After making inquiries we found that there was little likelihood of obtaining sufficient, if any, water from this source. In any case the success of irrigation on this class of land has already been sufficiently demonstrated, and, furthermore, its isolated position would render experimental farming undesirable. With a view to conducting agricultural experiments in Central Otago, instead of undertaking any costly scheme to provide water for experimental irrigation, we would suggest co-operation with some farmer owning suitable land with water-rights, and there conduct field experiments, both irrigation and dry farming.

Observation leads us to the conclusion that there is much to be learned with respect to dry farming in Central Otago, and if the process were thoroughly investigated and demonstrated, it might to some extent supersede the present agitation for costly irrigation-works.

We are also of opinion that the question of obtaining artesian water from the lower strata of Central Otago is worthy of consideration.

J. L. Bruce,
J. H. Dobson.

Department of Agriculture
(from the Inspector in charge of the Otago Districts),
Dunedin, 22nd January, 1909.

E. Clifton, Esq., Chief Inspector of Stock
and Director of Experimental Farms, Wellington.

Irrigation of Central Otago.

In response to your memorandum of the 4th September requesting me to locate the areas of agricultural land in Central Otago which could be profitably irrigated, I have now the honour to submit the following report:—

Fully recognising the importance of irrigation not only to the arid districts directly, but ultimately to the State, and the responsibility unreservedly intrusted to my individual judgment, I decided to approach this subject purely from a commercial standpoint, it being no part of my duty either to extol or decry the land beyond concisely stating the qualities pertaining to the several blocks inspected.

I was accompanied throughout the inspection by Mr. J. H. Dobson, engineer in charge of the irrigation surveys in Central Otago, who rendered valuable assistance not only in the field, but by computing the areas located by me, in addition to defining and illustrating same on the map which accompanies this.

In support of the opinions expressed, samples of soil have been freely taken and submitted to the Department's Chief Chemist, Mr. B. C. Aston, whose analyses are herewith appended.

NOTE.

(*a.*) For analyses of soils, see Chief Chemist's report appended.
(*b.*) Areas fit for irrigation, marked pink on map herewith.
(*c.*) Areas fit for cultivation without irrigation, marked deep red on map.
(*d.*) Total area fit for irrigation, and not at present irrigated, appended.

EARNSCLEUGH BLOCK.

Earnscleugh Flat is situated on the right bank of the Clutha River, and extends from opposite Clyde to near Alexandra, containing about 5,400 acres.

It is composed entirely of river-gravels, covered with a sheet of soil varying from nothing to several feet in depth. Of this area about 2,900 acres is fit for irrigation, the balance being shingle, and in many places destitute of soil.

There is abundant evidence that water would percolate rapidly through this formation without producing any appreciable benefit, even were it applied in enormous quantities. Where top soil is present it is so very friable that on the application of water it at first readily transforms into a puddle, with the result that ultimately stunted rushes make their appearance instead of luxuriant vegetation.

On the area referred to as being suitable for irrigation the soil is fine decomposed schist, with a fair admixture of humus, and responds well to cultivation. A portion of this land (about 700 acres) has been irrigated for years, and is capable of better cultivation than obtains at present.

BLACKMAN'S GULLY.

This is a beautifully situated valley for fruit-growing, extending from Earnscleugh Flat, which is about 600 ft. above sea-level, to an altitude of possibly 1,600 ft. It consists of isolated basins intersected by rocky ridges, and contains possibly 500 acres of fine sandy loam, lying with a northerly aspect and well sheltered.

Although this beautiful valley would no doubt respond well to irrigation, its irregular surface configuration and steepness would necessitate the exercise of great care in the application of water to obviate undue seepage to the detriment of the lower basins.

Hand-cultivation would have to be largely depended upon, much of the land being too steep for the use of modern appliances. This would be likely to make hill orchards prohibitive under the present conditions of labour, even were a sufficient supply of water available at a nominal cost, which in this case it would not be.

There are also several small areas in the vicinity of Conroy's Gully similarly situated, and to which the above conditions would apply.

This country is all included in the Earnscleugh pastoral runs, the lease of which does not expire for some thirteen years.

At Bald Hill Flat there is an area of about 1,700 acres which could be profitably irrigated were a sufficient supply of water obtainable.

CLYDE BLOCK (II).

This extends from the Clyde Commonage along the foot of the Dunstan Range to Chatto Creek, reaching to the Manuherikia River, and thence along the Clutha River to Clyde, of which area approximately 3,000 acres is fit for irrigation. There is a belt of fertile soil, averaging about a mile in width, along the foot of the hill from near Clyde to Chatto Creek. Owing to its irregular surface form, and to its being intersected with outcrops of gravel, it cannot be described as lending itself well for irrigation, and I am of opinion that there is sufficient natural seepage from the mountain to make farming profitable, especially in growing winter feed for stock.

There is a small expanse of fertile soil below Moutere Station, another at Springvale, and a third towards the Manuherikia River, but of no appreciable extent.

CLYDE RACECOURSE.

I am informed that this land was reported upon some years ago by the Department's Pomologists as being suitable for fruit-culture provided a sufficient supply of water could be obtained. I consider this an ideal field for experimental work, being quite close to Clyde Railway-station. It contains about 100 acres, more or less, of fairly good land, somewhat deficient in humus, but admirably adapted for experimental irrigation. Taken in conjunction with the adjoining land, which is considerably lighter, being similar to other areas in Central Otago, notably the Cromwell Flat, it should assist in determining whether irrigation could be profitably adopted or not.

I should recommend for your consideration the practicability of obtaining a sufficient water-supply for experimental purposes on this block.

Adjoining the Clyde Racecourse there is a holding of some 60 acres which, I am informed, has been under irrigation for about forty years. On the best of the soil the results appear to have been highly satisfactory, but it is observable that on reaching the lighter soil the water disappears. Possibly experimental work may demonstrate that the cultivation and ploughing-down of leguminous crops would aid nitrification, and thus extend the irrigable area.

The balance of the Clyde Block is ridgy table-land, composed of high-level sandstone gravel lying over clay, varying in depth from a few inches to possibly 100 ft. or more.

There is direct evidence that this country is absolutely unsuitable for irrigation. It puddles readily where there is any top soil, grows rushes, and is so porous that it absorbs an unlimited quantity of water. This is clearly demonstrated on McArthur's farm, and is also proved by the seepage from the Alexandra Water-race.

Galloway Flat.

Where good soil from the higher levels has been deposited round the ends of the gullies, as is commonly the case in districts examined by me, irrigation is highly remunerative, but immediately the water extends beyond the limits of the good soil it disappears into the shingle. Irrigation has been carried on here for years; but, notwithstanding the strenuous exertions of Mr. Alexander Gunn, manager of Galloway Station, aided by a liberal water-supply, the area that is capable of being irrigated does not increase.

Tiger Hill, Lauder Block (III).

This area extends from Chatto Creek, along the foot of the Dunstan Range, to Dunstan Creek, near St. Bathan's, and thence along the Manuherikia River to Chatto Creek.

The fertile belt referred to as extending from Clyde along the Moutere faces continues along the whole length of the foothills to Dunstan Creek, varying in width from one to two miles or more. Of this, a considerable area is capable of cultivation without irrigation. This block contains a large area of land, approximately 35,000 acres, fit for irrigation, extending from a mile above Chatto Creek Railway-station to Cambrians, facing the Manuherikia River and Dunstan Creek.

The greater portion of this area is good agricultural land, composed of mica-schist with rich humus, and is admirably adapted for irrigation. About 4,000 acres of this block is already irrigated, particularly so from below Tinkers to near the railway-line at Spottis Creek, and from Drybread to the main road at Lauder. The benefits of irrigation, where applied with discretion, are certainly phenomenal, while, on the other hand, harmful results are noticeable from continual flooding and negligence.

There is a large area of flat land between Matakanui and Chatto Creek, commonly known as the Matakanui Flat, in addition to several table-lands situated between Thomson's and Lauder creeks, which, although apparently lending themselves well for irrigation, are unsuitable because of the absence of soil in some places and the poverty of the soil in other places, the subsoil being a cementy sandy gravel.

Mr. John Wilson, of Lauder, who has had such practical experience of irrigation, has lately constructed a race to one of these table-lands, with the intention of liberating the sludge from Tinkers diggings, for experimental purposes. The result of this experiment should be most interesting, inasmuch as it will demonstrate the effect of an abundant water-supply on poor land where the shingle is sufficiently impervious to permit the water to distribute itself before disappearing under the surface. The sludge from Tinkers contains a considerable amount of decomposed schist and humus, and should, unlike most tail-race deposits, have a beneficial effect. Should this experiment prove a success, similar treatment could be supplied to the Matakanui Flat. At the same time the fact must not be overlooked that the irrigation of this class of land is only practicable where an abundant supply of sludge-water can be obtained at a nominal cost, as at best such land is only fit for grazing purposes.

Ida Valley Block (IV).

This block commences at the Poolburn Gorge, and extends along the foot of Ruggedy Ridge to its junction with Rough Ridge, which it follows to above the Oturehua Railway-station. Thence it stretches to the mouth of the Idaburn Gorge, along the Naseby – St. Bathan's Road to Hill's Creek, following the foot of the Blackstone Hills Range to Poolburn Gorge, and comprising approximately 60,330 acres, of which area about 52,500 acres is fit for irrigation.

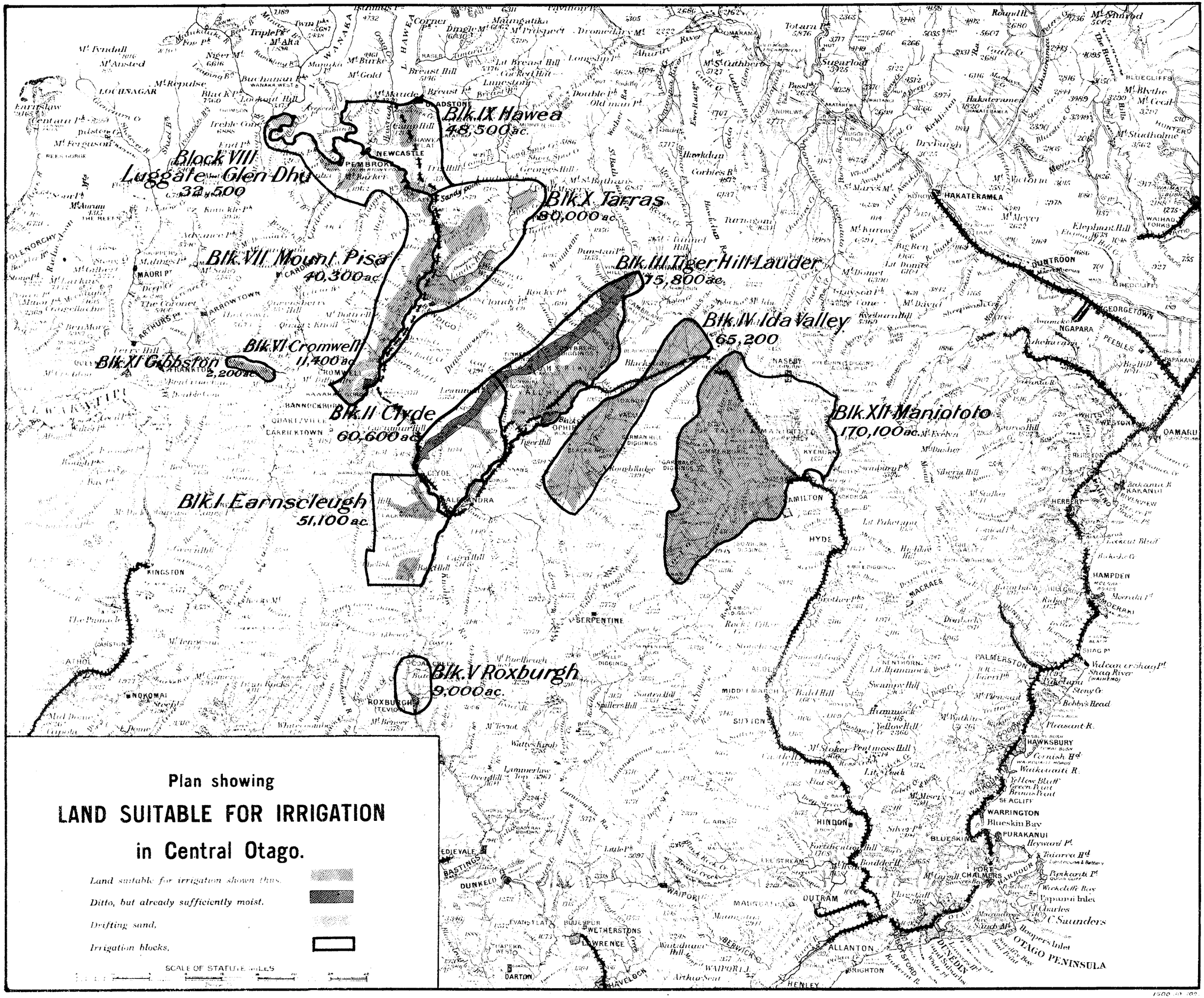
Almost the whole of the land on the southern side of the railway-line is admirably adapted for irrigation, a very large proportion being first-class agricultural land, which would undoubtedly become highly productive on the application of water. There is conclusive evidence that even the lighter soils here would respond well to irrigation, in some places to an almost incredible degree.

The local Irrigation Committee, composed exclusively of *bona fide* farmers, is so convinced of the suitability of its land for irrigation and the benefits to be derived therefrom, that it has submitted through its secretary, Mr. A. Armstrong, a proposal signed by fifty-eight farmers in Ida Valley, offering sums varying from 10s. to £2 a week per sluice-head of water for about a hundred heads for six months yearly. List herewith attached.

With better cultivation and the closer settlement which would consequently follow, no doubt a higher price could be paid for the water, of which a much larger quantity would in time be required, while the value of the land would be proportionately enhanced.

On the northern side of the railway-line the land is somewhat irregular, portions of it being shingle drift from the adjoining mountains, with a shallow covering of top soil of inferior quality.

The Hill's Creek end is at rather a high altitude (about 2,000 ft.) above sea-level, and inclined to be cold and sour. Along the foot of the Blackstone Hill Range, and extending towards Ida Valley Railway-station, the soil improves, and should no doubt benefit from irrigation.


Blk.IX Hawea
48,500ac.
Blk.VIII Luggate-Glen Dhu
32,500
Blk.X Tarras
80,000ac.
Blk.VII Mount Pisa
40,300ac.
Blk.III Tiger Hill-Lauder
75,800ac.
Blk.IV Ida Valley
65,200
Blk.VI Cromwell
11,400ac.
Blk.XI Gibbston
2,200ac.
Blk.II Clyde
60,600ac.
Blk.XII Maniototo
170,100ac.
Blk.I Earnscleugh
51,100ac.
Blk.V Roxburgh
9,000ac.
Plan showing
LAND SUITABLE FOR IRRIGATION
in Central Otago.
Land suitable for irrigation shown thus.
Ditto, but already sufficiently moist.
Drifting sand.
Irrigation blocks.
SCALE OF STATUTE MILES
OTAGO PENINSULA

Statement showing the Amount of Irrigable Land in the Ida Valley District, with Names of Holders, Quantity of Water each will take, and Amount per Head they are willing to pay.

Name of Holder.	Area of Irrigable Land held.	Number of Heads of Water required.	Amount willing to pay per Head per Week.	Length of Time Water will be required for Year.
	Acres.		£ s. d.	
W. R. Nevill	1,200	3	1 0 0	6 months.
C. Aston	400	2	1 0 0	6 ,,
W. Stuart	200	1	1 0 0	6 ,,
J. J. Dundass	100	1	1 0 0	6 ,,
Mary Gavan	50	1	1 0 0	6 ,,
William Brady	200	1	1 0 0	6 ,,
William McBreen	500	2	1 0 0	6 ,,
Peter Anderson	200	1	1 0 0	6 ,,
A. F. McIntosh	700	2	1 0 0	6 ,,
Arthur Wilson	1,400	3	1 0 0	6 ,,
Alexander Purvis	1,200	2	1 0 0	6 ,,
Malcolm Isbister	416	2	1 0 0	6 ,,
B. Flannery	300	1	..	..
D. Sinnamon	316	2	1 0 0	5 months.
Robert Love	320	1	1 0 0	6 ,,
Thomas Flannery	500	2	1 0 0	6 ,,
W. K. McIntosh	600	2	1 0 0	6 ,,
Thomas Anderson	300	1	1 0 0	3 ,,
Anne J. Sinnamon	303	1	1 0 0	6 ,,
M. E. Sinnamon	600	2	1 0 0	6 ,,
Thomas Nevill	400	2	1 0 0	3 ,,
James Nevill	300	2	1 0 0	3 ,,
Mrs. Macdonald	500	2	1 0 0	3 ,,
D. Isbister	1,200	2	1 0 0	6 ,,
James Davidson	1,500	2	1 0 0	6 ,,
Donald Nicholson	1,300	3	1 0 0	6 ,,
Charles Brown	600	3	1 0 0	6 ,,
Matthew McKnight ..	400	2	1 0 0	4 ,,
Frederick McKnight ..	300	2	0 15 0	3 ,,
E. Hayes and Sons ..	30	1	0 10 0	3 ,,
J. Scott	1,000	2	2 0 0	Dec. to March.
James W. Armstrong ..	1,400	3	1 0 0	Oct. to March.
John Noone	500	1½	1 0 0	Oct. to Feb.
W. F. Dundass	1,200	2½	3 0 0	Oct. to March.
John Meade	130	1	1 0 0	5 months.
Thomas P. Beck	305	1	1 10 0	Oct. to March.
John Sloan	400	2	1 0 0	
James McNaughton ..	255	2	1 0 0	,,
F. Noone	600	1½	1 10 0	,,
Patrick Scott	900	2	1 10 0	,,
James Black	900	2	1 10 0	,,
George E. C. Roberts ..	500	2	1 10 0	,,
Daniel Francis	500	2	1 10 0	,,
Alfred Arthur	1,600	4	1 0 0	,,
James McKnight, jun. ..	100	1	1 0 0	Oct. to April.
J. T. Wilson	400	2	1 0 0	Oct. to March.
W. Macdonald	950	2	1 0 0	,,
Margaret Beck	200	1½	1 0 0	Nov. to Feb.
Mrs. McLennan	400	1	..	..
Charles Lockhart	400	2	1 0 0	Nov. to Feb.
Robert McKeeman ..	1,000	2	1 0 0	,,
Henry Agnew	400	1	1 0 0	Nov. to March.
William Hickey	19	..	..	..
William Turnbull	360	1	1 0 0	Nov. to March.
Patrick McDevitt	700	1	1 0 0	,,
Henry Armitage	400	1	1 0 0	Oct. to Feb.
R. Johnstone	400	1	1 0 0	Oct. to March.
Peter McDonald	800	2	1 10 0	,,
Total area ..	32,954			

There is a considerable area (approximately 4,330 acres) of highly fertile land on either side of the upper Poolburn on which irrigation would be unnecessary, as it derives sufficient moisture from the lateral subterranean seepage from the Poolburn and Dunsdale Creek.

I consider Ida Valley an ideal field for irrigation, and can with confidence recommend the adoption of any scheme whereby water could be obtained, even at a very considerable expenditure, so long as the land was not loaded beyond its producing-power.

Roxburgh Block (V).

This is a limited area of fertile land situated towards the southern end of the arid region, and it lies chiefly on the right bank of the Clutha River, with a northerly aspect, sloping beautifully from the hill-foot to the river.

The soil is of excellent quality, and has proved eminently suitable for fruit-growing. The many orchards here are evidently managed with skill and ability, and most of them are already provided with water from the mountain-streams. Some of the owners have not so far found it necessary to irrigate this land, and those interviewed by me all agree that if judgment is not exercised in the application of water the result is liable to be disastrous both to soil and fruit.

Cromwell Block (VI).

From the Kawarau Gorge this follows the foothills to Lowburn, thence extends along the Clutha River to its junction with the Kawarau, whence it stretches to the gorge of that river.

There is a narrow belt of highly fertile soil extending along the foothills, containing about 2,870 acres suitable for irrigation, and of this area about 1,000 acres is already irrigated. The soil is decomposed mica-schist, intermixed with rich loam, possessing an extraordinary power of endurance under cultivation. One farmer, Mr. James Ritchie, informed me that a portion of his land had produced seventeen successive crops of oats without manure, and that there is still no signs of its productiveness abating, the last crop yielding over sixty bushels per acre. His method of cultivation has been to crop and fallow alternately for a period extending over thirty-five years.

There can be no doubt as to the benefits of discreet irrigation on this class of land, which, without water, would be practically valueless.

As frequently happens, the fertile soil terminates abruptly a short distance from the foot of the range, and here this is conspicuously the case.

Immediately joining this land lies the Cromwell Flat, which embraces approximately 4,700 acres of extremely disappointing country. About half of this area, and what would otherwise have been the best portion of it, is now covered with drifting sand. The greater portion of the balance is very flat, with a slight top soil of poor quality over a shingle-bed of great depth. The soil improves towards the racecourse, but even here it is intersected by belts of shingle which would absorb enormous quantities of water, possibly without any appreciable benefit for a long period.

Some years ago the irrigation of a portion of this flat was attempted by private enterprise at a very considerable cost, and, from indications still visible, it had been directed with much skill. The settler who so courageously attempted to convert this barren waste into a fertile plain was, so he informed me, compelled to abandon the scheme and ultimately to pay a small sum to be relieved of his interest in the property. He is still, however, of the opinion that, were the whole of the Roaring Meg River diverted to Cromwell Flat, it would in time restore vegetation over a large portion of it.

It seems to be that the only feasible method of dealing with this flat is to provide water under pressure, to be applied by hose directly to the plants. Such a scheme, however, could only be adopted in small orchards, and even then its success would be doubtful.

Mount Pisa Block (VII).

From Lowburn this follows the foothills to Luggate, thence extending along that stream to its junction with the Clutha River. Between Lowburn and Mount Pisa homestead there are several small areas of first-class soil. In some instances as much as 200 acres is to be found in one continuous stretch, with unimportant shingle-beds intervening. This is exceptional, and, taken generally, owing to the presence of shingle, possibly not more than 20 per cent. of the area marked on the map could be considered suitable for profitable irrigation. It is worthy of note, however, that on this block the soil, even where sparsely distributed over or through the shingle, is fine decomposed mica-schist, responding readily to water; but unfortunately the absorption is so great, apart from the close proximity to the river, which is at a much lower level, that it would be impossible to saturate the lower strata, even were the water-supply unlimited.

The several areas now irrigated (about 450 acres) are most alluring, dotted as they are through this arid valley; but, as already stated, there is evidence that rapid percolation would render any comprehensive scheme of irrigation impracticable.

Between Mount Pisa homestead and Luggate several small areas have been irrigated with some success where the soil is more or less suitable; but the conditions generally are not conducive to any elaborate scheme of irrigation.

The area of irrigable land in this block is estimated at 4,740 acres.

Luggate-Glendhu Block (VIII).

From Luggate Stream this follows the hill-foot, by Mount Barker, to Glendhu, thence extending along the east side of Lake Wanaka to the outlet of the Clutha River. This block may be described as purely pastoral land, the soil generally being of poor quality, and, excepting small areas at Luggate and Mount Barker, there is practically no land fit for expensive cultivation.

Of the areas marked on the map as suitable for irrigation (approximately 2,900 acres), about 600 acres is already being so treated; but irrigation on this class of land can only be made profitable when an abundant supply of water is obtainable at a nominal cost.

Hawea Block (IX).

From the outlet of the Clutha River this block follows the foothills to Lake Hawea, thence extending along the hill-foot, on the northern side of the Hawea settlement, to Sandy Point.

The areas marked on the map as being suitable for irrigation contain approximately 6,870 acres, the greater portion being the Hawea Flat, which possesses a rich soil, eminently suitable for high-class farming. By judicious cultivation excellent results are already being obtained without the aid of irrigation. At the same time there can be no doubt that this fertile plain could be rendered safer and more profitable if water were obtainable when required.

The balance of this block is poor pastoral country, much of it being river-shingle, almost destitute of soil.

Tarras Block (X).

This block includes the Lindis Valley, stretching from Sandy Point to the head of the Lindis Downs near Grumbling Gully, thence extending along the foothills of the Dunstan Range, below the Lowburn punt. It contains approximately 25,740 acres fit for irrigation.

This land presents features seldom met with, inasmuch as it embraces at least four distinct conditions—(*a*) land of quality and texture fit for irrigation, and so situated as to be commanded by available water; (*b*) land fit for irrigation, which cannot be commanded by water; (*c*) land suitable for agriculture without irrigation; (*d*) land unfit for irrigation under all conditions.

The belt of land suitable for irrigation, situated on the left bank of the Lindis River, is worthy of special mention, extending as it does for a distance of about thirteen miles between the northern slopes of the Dunstan Range and the Lindis River. It would be provided with sufficient water for irrigation, materially assist settlement, and at the same time assure the prosperity of a number of small grazing-runs, when the country comes to be subdivided.

Gibbston Block (XI).

This small expanse is situated on the right bank of the Kawarau River, about midway between Cromwell and Arrowtown, and contains approximately 1,120 acres of land fit for irrigation, of which some 200 acres is already irrigated. The soil and contour of the ground are especially good, and the benefits of skilful irrigation are even now clearly demonstrated.

There is also a small area of good land at Waitiri, but from there towards the Cromwell Gorge the small river-flats, which were formerly covered with rich soil, have been destroyed by gold-mining.

Maniototo Block (XII).

This plain extends from the Taieri Gorge at Linburn to Kyeburn, and contains approximately 266 square miles.

Of this area some 108,700 acres is situated on the south-western side of the railway-line, and of these about 87,000 acres is fit for irrigation. The balance comprises (*a*) land which cannot be commanded by water, (*b*) land with irregular surface-configuration, and (*c*) isolated shingle-belts.

The soil is decomposed mica-schist overlying fine gravel intermixed with soil and clay. The greater portion of this land is deficient in humus, and where it has not been cultivated both the soil and the subsoil are extremely hard. Cultivation and the ploughing-down of leguminous crops, aided by a liberal supply of water, should materially assist in remedying this.

Where under cultivation the soil of the Maniototo Plain absorbs and responds readily to moisture, and there is conclusive evidence that when irrigated with discretion this large area is capable of being transformed into a highly fertile expanse, eminently adapted for grain-growing and the raising and fattening of stock.

On the north-eastern side of the railway-line the soil and its surface-configuration are very irregular, and may be described as pastoral country containing isolated areas of fairly good agricultural land, suitable for mixed farming without irrigation.

Over the major portion of this area the under-stratum is shingle drift from the Mount Ida Range, intersected with gullies and flats over which there is but a thin covering of inferior soil.

About Wedderburn, however, there is approximately 3,830 acres in one block, and several smaller patches in other places, where irrigation might be made profitable; but, owing to the smallness of these blocks and their scattered positions the cost of procuring water would be too great to be remunerative.

Summary.

While engaged inspecting the various blocks of country reported upon, I came in contact with the members of several irrigation leagues, and many other persons similarly interested, and a good opportunity was thus afforded of noting the general opinion on the important subject of irrigation, which, epitomized, is "Give us water for irrigation, and the future of Central Otago is assured."

Where the soil is suitable and the natural conditions favourable I am of the opinion that irrigation, properly applied, will probably do all that is claimed for it. In the course of my inspection I could not help noticing that some of the essentials of good farming are in many instances conspicuously absent in Central Otago. With or without irrigation the average farmer

has much to learn, or, at any rate, to put into practice, before the best results can be obtained from the soil. The most casual observer cannot but note the lack of thoroughness generally prevalent in the methods of agriculture. In many cases nothing approaching a reasonable attempt is made to pulverise the soil, the surface being left uneven and rough, thus permitting the moisture to escape instead of being retained in the soil to support vegetation, as it would were more thorough cultivation adopted.

In several instances where irrigation has been adopted the results are harmful, in so far as, through neglect to remove surplus water by drainage, the soil is becoming sour; and unless this is remedied, the land will become a barren moorland of rushes instead of thriving fields of grain or profitable orchards. Scarcity of labour has doubtless much to do with this, although negligence on the part of some owners is noticeable. It is not unusual to find a small family attempting alike the cultivation, stock-work, and every duty pertaining to a large holding containing perhaps several hundred acres of good agricultural land, without the aid of any hired labour, which, even were it desired, is not obtainable. Under such conditions irrigation could not be rendered profitable.

The question naturally arises whether, with land capable of being highly fertile, but now lying practically idle, the State should not encourage the adoption of more modern methods of agriculture, including irrigation, by instituting a series of field experiments in Central Otago, a large area of which can only attain its full productiveness by the aid of irrigation. On the other hand, it must be emphasized that irrigation can only become profitable by thorough cultivation, involving the employment of much labour directed with skill and intelligence.

Any scheme to provide an adequate water-supply for a large area must necessarily be expensive, entailing a fairly substantial price for water, apart from the cost of distribution to the farmer. I am informed by several trustworthy persons of long experience that the cost of distributing water, attending to water-races, &c., is not less than 10s. per acre yearly over the area treated. Add to this amount, say, £1 per week for each sluice-head of water used, and, assuming that a head of water, under favourable conditions, will irrigate 100 acres, the land becomes burdened to the extent of £1 per acre annually.

In my opinion, irrigation in this country can only be adopted with advantage where the land is sufficiently fertile to produce the best results, and where the occupier is prepared to pursue a regular system of cultivation. The irrigation of purely pastoral country can only be rendered remunerative when an unlimited supply of water is obtainable at a low cost—a condition seldom likely to pertain to the arid regions of Central Otago.

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