1886.

NEW ZEALAND.

EAST AND WEST COAST AND NELSON (MIDLAND) RAILWAY

(GENERAL REPORT OF THE ASSISTANT ENGINEER-IN-CHIEF ON THE).

Presented to both Houses of the General Assembly by Command of His Excellency.

The ENGINEER-IN-CHIEF to the Hon. the MINISTER for PUBLIC WORKS.

Public Works Office, Wellington, 27th May, 1886.

SIR,—

I have the honour to forward herewith a full report by the Assistant Engineer-in-Chief on the East and West Coast and Nelson Railway, and on the country traversed and affected by it. Four maps accompany the above report.

I have, &c.,

JOHN BLACKETT,
Engineer-in-Chief.

The Hon. the Minister for Public Works.

The ASSISTANT ENGINEER-IN-CHIEF to the ENGINEER-IN-CHIEF, Wellington.

Wellington, 7th April, 1886.

SIR,—

In accordance with your instructions, I have the honour to submit the following general report on the proposed East and West Coast and Nelson Railway, and the country it is intended to accommodate.

GENERAL.

Scope of Report.—The aim of the report is to give a correct idea of the proposed works and the present state of settlement, together with an account of the resources of the country that bear on future settlement and the prospects of the railway. Some of the information having already been published piecemeal in the numerous reports relating to the subject, I purpose, so far as statements of facts are concerned, to make this report an epitome of all that have preceded it, as well as a record of my own observations.

Former Papers.—For facility of reference, I attach hereto (Appendix A) a list of the principal reports and other documents relative to the whole question of railway communication in the northern and western districts of the Middle Island.

Fresh Explorations.—In order that I might be able to lay the whole matter before you as clearly as possible, you instructed me to make a further examination of the country. I accordingly did so, devoting seven weeks to the work, and going to every place with which I previously was not intimately acquainted. Practically, I have seen every part of the country that is calculated to contribute directly or indirectly to the support of the railway.

Maps.—This report is accompanied by a series of four sketch maps intended to elucidate the various points dealt with:—

No. 1, Settlement Map, shows where the population is located, and the lands sold and leased;
No. 2, Land Map, shows the arable flat, arable hilly, and open pastoral lands;
No. 3, Forest Map, shows the forest lands, divided into the various kinds of timber;
No. 4, Mineral Map, shows the location of the various mineral deposits.

The different boundaries shown on the maps, and areas calculated therefrom, are, of course, only approximate, extreme exactness being impossible without minute and expensive surveys. It is,

however, believed that they give a fair representation of the country, for much of the information on which they are based was procured from the Lands Department and other trustworthy sources.

RAILWAY SYSTEM PROPOSED.

Present Proposals.—After full investigation and considerable discussion, the question of routes may now be held as settled, at any rate so far as the lines in immediate prospect are concerned; and in my opinion the decisions arrived at are undoubtedly correct. The lines in immediate prospect comprise the following:—

1. A railway commencing at Springfield, in Canterbury, and proceeding by the Waimakariri Valley, Arthur's Pass, and Lake Brunner to Brunnerton, on the Grey River—a distance of 95 miles.
2. The completion of the railway along the coast from Hokitika to Greymouth—a distance of 24 miles.
3. A railway commencing at Brunnerton, and proceeding by Reefton, Inangahua Junction, and Tophouse to Belgrove, the terminus of the Nelson Railway — a distance of 154 miles.
4. A branch railway from Inangahua Junction down the Buller Valley to Westport—a distance of 27 miles.
5. A connection from Tophouse down the Wairau Valley to Blenheim, a distance of 63 miles.

Future Connections and Extensions.—In addition to the railways above enumerated the maps show further connections and extensions that may be required in the future to open up the country, and make the system complete. They are given now, so that it may be seen how far the present proposals work in with the general railway system for the Middle Island and the whole colony.

Works already Executed.—A small quantity of work has already been executed on three of the lines above referred to, viz.:—5½ miles of the Hokitika-Greymouth Railway have been finished, and 4¾ miles partly formed. On the Nelson-West Coast line, 2½ miles of formation have been finished at the Belgrove end, and ¾ mile partly done at the Brunnerton end. The expenditure and liabilities on these sections up to the 31st ultimo are,—

	£
Hokitika-Greymouth	41,839
Nelson-West Coast	28,523
Total	£70,362

On the line southwards from Blenheim the formation has been done for 4½ miles, and 3½ miles more are in progress. The expenditure and liabilities are £32,858.

Surveys.—Of the lines under the present proposals, working surveys on which contracts can be let have been prepared for the whole of the Hokitika-Greymouth Railway and a section at each end of the Nelson-West Coast line; Wai-iti to the Blue Glen, 17 miles; and Stillwater to Nelson Creek, 7½ miles. A working survey has also been made of 2¾ miles of the line south of Blenheim, beyond the point up to which the present contract extends.

Detailed preliminary surveys of a very complete description have been made of the East and West Coast line, and the heaviest portion of the main line extension by the East Coast. Similar surveys, but less in detail, have also been made of the Nelson-West Coast line, including the branch to Westport, and of the extension southwards from Blenheim as far as the Awatere River.

Reconnaissance surveys only have been made of all the other lines shown on the maps; but the information with reference to them is sufficiently complete to enable a good idea to be formed of the kind of railways that can be got, and the character of the country through which they pass. It is expected that in every case 1 in 50 gradients and 7½-chain curves can be got.

Distances.—Appendix B gives in tabular form the distances between the principal centres and other important points on the various lines under discussion. It is inserted to facilitate reference, as the numerous routes and junctions are very confusing to any one not intimately acquainted with the country.

Estimates.—The estimates of the lines of which detailed surveys have been made are submitted with considerable confidence, as they are based on actual measurement of work; but in all other cases the figures are only approximations, made by comparison with other railways. The following are the estimates of the various lines with which we are immediately concerned:—

	Miles.	£
1. East and West Coast	95	1,505,000
2. Hokitika-Greymouth, completion	24	180,000
3. West Coast and Nelson	154	1,330,000
4. Branch to Westport	27	335,000
5. Tophouse to Blenheim	63	375,000
Totals	363	£3,725,000

GENERAL DESCRIPTION OF COUNTRY.

Area.—A line has been drawn on the maps showing the boundary of the country affected by the proposed East and West Coast and Nelson Railways and the connection from Tophouse and Blenheim, the latter, as already remarked, being the most important in the several lists given above.

ERRATUM.—Page 3, line 12, *for* "7,750,000 acres," *read* "6,750,000 acres." The tables show the correct total.

On the eastern side of the main range the area simply includes the Waimakariri watershed down to the plains. It is a moot question as to what is the southern boundary on the western side, for there is no break in the general character of the country. The land was temporarily reserved from sale down to the Waiho, sixty miles south of Hokitika. I think, however, that this is too far away, so I have fixed the limit at the Poerua, thirty-five miles south of Hokitika. The eastern boundary follows the main range to Mount Franklyn, then strikes north-east to the ocean, along the watershed between the Awatere and Wairau Rivers. The northern boundary runs up the Little Wanganui to its source, then follows the watershed between the Motueka and Takaka Rivers to Mount Richards, where it strikes direct east to the sea. In the extreme north-east the area affected by the railway is assumed to terminate about midway down the Sounds.

The total area of the country that will be benefited by the proposed railways, and within the boundaries above described, is about 10,550 square miles, or 7,750,000 acres. The following table shows the general character of the country, the figures being of course approximate:—

—	Open.	Bush.	Total.
	Acres.	Acres.	Acres.
Arable flat lands	298,700	663,000	961,700
Arable hilly lands	237,800	292,800	530,600
Open pastoral lands	1,220,500	...	1,220,500
Mountainous bush lands	...	2,968,700	2,968,700
Mountain-tops and other rough country of little value ...	964,000	...	964,000
Lakes, river-beds, and other waste lands	105,000	...	105,000
Totals	2,826,000	3,924,500	6,750,500

Topography.—The main range of mountains which divides the Middle Island longitudinally extends in one unbroken chain from Otago to Nelson. The range is comparatively narrow and compact between Canterbury and Westland, but in Otago and Nelson it has numerous branch-ranges running in all directions to the sea. There is, however, one well-defined and tolerably straight backbone, parallel with the West Coast, all the way from the Haast Pass to Tophouse. These two places are respectively 1,847ft. and 2,395ft. high; but there is no other pass in the whole distance of about 240 miles that is lower than 2,870ft., and all the principal passes are within 400ft. of the same level. At Arthur's Pass—the route adopted for the East and West Coast Railway—the line crosses the range at an altitude of 2,530ft., and the lowest elevation on any of the surveyed lines—that by the Hurunui—is 2,360ft.

The portion of the main range between Canterbury and Westland has few long spurs, but there is a subsidiary range on the eastern side running parallel with the main one. It extends from the Mackenzie country to the Amuri, and all the main-range rivers run through it in precipitous gorges. There is a similar subsidiary range for a short distance on the western side—the Victoria and Brunner Mountains. It forms the watershed between the Maruia and Inangahua Rivers, and extends from the Grey to the Buller. There is also a second subsidiary range near the coast between these rivers—the Paparoa Mountains. The Maruia Plain lies between the main range and the Victoria and Brunner Mountains; and the flat country about Reefton occupies the space between the latter and the Paparoa Range. South of the Grey right down to Okarito there is no subsidiary range nor long spurs: the slopes of the main range run sharply down to the low country in a line approximately parallel with the coast.

The watershed between the Awatere and the Wairau—the boundary of the country affected by the railways—is a branch range leaving the backbone near its northern end. The main range as such terminates at Tophouse, but is continued in two principal branches: one runs north-east to the Sounds between the Wairau Valley and Tasman Bay; and the other, turning sharply westward, is lost in the mass of mountains north of the Buller. The first of these branches has a long spur, the Spooner Range, which forms the watershed between the Motueka and the Waimea Rivers. It is an insignificant feature in the topography of the country, but is important in this connection, as it determines the route of the railway from Belgrove to the Buller Valley.

The main range between Canterbury and Westland is only about twenty-five miles from the west coast, whereas it is about seventy-five miles from the sea on the opposite side. In this and the absence of lateral spurs lie the difficulty of taking a railway across the Middle Island. It is quite easy to get good gradients on the eastern side on any of the surveyed routes; but the western slope is too steep to admit of flat gradients without heavy works.

The country between the two ranges on the Canterbury side is open, but considerably broken up by hills and deep ravines. On the western side there is a long strip of low, flat country all along the coast, from the Poerua to Greymouth, and continuing up the Grey and down the Inangahua to the Buller. The strip is about 120 miles long, and varies in width from 5 to 20 miles. The country is generally flat, but interspersed with a few isolated mountains and a considerable extent of hilly land. So easy, however, is it that a railway could probably be taken all the way with not more than 30 chains of tunnelling.

There is another run of low country back from the coast, between the Teremakau and Buller, close to the main range. It goes through by the Brunner and Haupiri Lakes, and the Nancy and Mary Rivers, to the Maruia Valley; thence by the Warwick to the Matakitaki, and down that river to the Buller; also across by Lake Rotoroa to Tophouse.

With the exception of the 6 miles at its mouth the Buller River runs for the most part through a very narrow valley, gorgy in places.

The Wairau Valley is open all the way from Tophouse to Blenheim, gradually widening out from the mere breadth of the river to a well-cultivated plain, 10 miles across. Above Tophouse the Wairau flows most of the way through precipitous gorges and steep mountain-slopes.

Between Tophouse and Belgrove the country consists chiefly of high ridges running down from the main range, with narrow valleys intervening. These valleys open out to plains between Belgrove and the sea; and one of them, the Waimea Plain, is perhaps the most densely-populated rural district in New Zealand.

There is, again, a narrow strip of low country between the Paparoa Range and the sea, and continuing up the coast to the Mokihinui River.

As will be seen by the forest map, the area affected by the railway in Canterbury and in Marlborough, and that portion of Nelson between Tophouse and Tasman Bay, is mostly open country; but nearly all the western watershed in Nelson and Westland is covered with bush.

Scenery.—Much of the country within the area accommodated by the proposed railways abounds in grand and beautiful scenery—an important factor in the traffic estimates. The Otira Gorge and other places on the Hokitika Road have been so often described by pen and pencil that they are now well known both at home and abroad. The Buller, also, which is little, if anything, inferior to the Otira, has received some attention within the last four years, since the road was opened.

Practically, however, these are the only two places which have been visited by the regular sightseers, although there are many others equally attractive. I shall mention some of them.

The gorge of the Waimakariri is unique in ruggedness—one of the wildest spots in New Zealand—and there is a magnificent waterfall, beautiful peaks, and a number of small glaciers easy of access at the headwaters of the same river. The Waiho glaciers and other Alpine scenery in the neighbourhood of Okarito constitute some of the most imposing sights in the colony; and the district has another attraction in the hot springs, one of which is within 2 miles of the principal glacier. This place even now is not difficult of access. Some of the West Coast lakes are very beautiful, more particularly Kanieri, Wahapo, and Mapourika.

The whole of the upland valleys at the base of the main range abound in fine scenery—rapid streams flowing through grassy glades that are skirted with bush and backed by mountains. The Wairau Gorge, about twenty miles from Tophouse, in an accessible situation, is by some considered equal to the Otira. Last of all I should make special mention of Fox's River, which reaches the coast at Brighton. It flows through a limestone ravine of exquisite beauty and grandeur, like some of the finer reaches of the Wanganui.

Geology.—The following sketch of the geology of the area affected by the railways is prepared chiefly from the publications of the Geological Department, supplemented by my own observations.

The subsidiary range in Canterbury is composed of slates and sandstones of the earlier geological periods, flanked by other sedimentary rocks of more recent formation. The latter contain the Malvern coal-beds, pottery-clays, and other minerals. At Castlehill, between the two ranges, there occurs a small deposit of a still more recent period, containing about eight hundred acres of limestone, the same class as that at Oamaru. The flat lands in the Upper Waimakariri Valley are chiefly fans built up by streams from the mountains. Some of them are a mile or two in width, and, being generally regular in shape and covered with grass or bush, they are not always noticed.

The main range for its entire length, from Wakatipu to Cook Strait, is composed of clay-slates and schists of varying consistency. Clay-slate occurs again in a long narrow belt, extending from Reefton along the western slopes of the Brunner Mountains to Lyell, and onwards to the headwaters of the Mokihinui and Karamea. The same formation also appears on the south-eastern flank of the Paparoa Range, and in a small patch at Ross.

The main range is flanked on the western side for nearly the whole length of Westland by granite and other crystalline rocks. These rocks again form a continuous chain in the Victoria, Brunner, and Lyell Mountains, and the main ridge extending therefrom to Separation Point. At Mount Owen, near the middle of this chain, the granitic rocks branch off in a broad belt to the headwaters of the Buller, where they disappear under the slates of the main range. Granite and other crystalline rocks occur again in the top of the Paparoa Range.

According to special information kindly furnished by Dr. Hector, the principal coal-bearing formations in the area accommodated by the proposed railways occur as follows:—

1. At Greymouth, extending along the coast from Marsden to the Maukurunui Creek, and up the Grey Valley to the Arnould River.
2. At the Blackball Creek, extending northwards along the eastern slope of the Paparoa Range to the headwaters of Moonlight Creek.
3. From Reefton down the Inangahua Valley to the Buller, and across the ranges and Mount Rochfort Plateau to Ngakawau and Mokihinui.
4. In the Upper Buller watershed, extending in one direction from within five miles of Cannibal Gorge to the Owen River, and in the other from Fern Flat to Lake Rotoroa.
5. A small patch on the watershed between the Mokihinui, Karamea, and Wangapeka Rivers.
6. A small patch in the vicinity of the Kanieri Lake.
7. Between the Paparoa Range and the sea, extending along the coast from Razorback to the Buller River.
8. In the Motueka watershed, extending from Mount Owen to the Baton River.

The last three in the above list occur in newer rocks than the others, and the same formation appears also in the vicinity of Marsden and in the Upper Grey and Lower Motueka Valleys.

The Marlborough country within the area affected by the railways consists of sedimentary rocks intermediate between the clay-slates of the main range and the sand- and lime-stones of the coal-bearing formations. The low country on the West Coast consists chiefly of alluvial deposits, in terraces and river-flats, overlying papa or blue reef—a soft argillaceous sandstone. All the principal alluvial gold-diggings occur in these deposits, the papa being the bed-rock.

DESCRIPTION OF LINES.

East and West Coast Railway.

Surveys.—Most of the following particulars descriptive of this line appeared in my report of the 12th September, 1884, under the head of "Arthur's Pass Route."

As already stated, a careful detailed survey of the line has been made; consequently the information on the subject is very complete.

Except in the summit tunnel again referred to, the ruling gradient of the line as laid off is 1 in 50, and the sharpest curve is 7½ chains radius.

Route.—Commencing at Springfield Railway-station, 43 miles 66 chains from Christchurch, the East and West Coast line sweeps across an open terrace to the Kowhai Bush, and strikes the Waimakariri River near Paterson's Creek. The Waimakariri is then followed up to the Broken River, which is crossed close to the mouth and followed up to Sloven Creek. The course thence is by the Sloven Valley, St. Bernard Saddle, and Lake Sarah to the Cass. The Waimakariri is crossed near Goldney's Saddle, and followed up to the Bealey, which in turn brings the line to the main range at Arthur's Pass. The saddle is pierced by a long tunnel coming out in the Otira Gorge, near the foot of the "Zigzag." From this point the line follows the southern slopes of the Otira and Teremakau Valleys to a point near Jackson's accommodation-house, where the Teremakau is crossed. The northern bank of the river is then followed to Bruce's Paddock, after which there is a straight run to the head of Lake Brunner. The line skirts the western side of the lake to the Hohonu Creek, and, sweeping round the spur into the valley of the Arnould, follows it down to the Grey. A junction is made with the West Coast–Nelson Railway near Stillwater, 1 mile 30 chains from Brunnerton.

Levels.—The East and West Coast line commences at a level of 1,260ft. at Springfield, and rises, with very few downward gradients, to 2,040ft. at St. Bernard's Saddle. Thence to the Waimakariri there is a fall, with long undulations, to 1,800ft., the level at the crossing, after which the rise right to the main range is almost without interruption, the level at the summit being 2,530ft. The descent westward begins at the eastern end of the tunnel, and continues for about seventeen miles, till the Teremakau River-bed is reached, at a level of 690ft. After this comes a gradual fall to 300ft. along the shores of Lake Brunner, a rise to 480ft. opposite the foot of the lake, and finally a fall to 100ft. at the terminating point in the Grey Valley.

Gradients and Curves.—On the eastern side of the range there are a number of 1-in-50 gradients, some of them combined with sharp curves; but they are all in favour of the traffic from the West Coast, which will, of course, be much heavier than that from the east. There are three inclines of 1 in 50, with flat curves, against the heavy traffic, their aggregate length being 2¼ miles. They can, however, be eliminated at a very small cost; and the same remark applies to two similar inclines three-quarters of a mile long in the Teremakau Valley, on the western side Leaving out the long incline on the western slope of the main range, there is no necessity to have any gradient steeper than 1 in 60 against the heavy traffic, and at a moderate outlay the ruling gradient might be still further reduced—say, to 1 in 65 or 70. This would concentrate all the heavy gradients into one place, which is a very great desideratum, for the incline is far enough away from Brunnerton and long enough to be a locomotive stage in itself. Auxiliary power can therefore be used to the best advantage.

The incline on the western side of the main range has a continuous gradient of 1 in 50 for fourteen miles, in combination with 7½-chain curves, and it cannot be materially improved at anything like a reasonable cost.

In order to get better places to enter, and a level piece for the commencement of an alternative line over the summit, the gradient of the long tunnel at Arthur's Pass was increased to 1 in 44. This, on a straight line, is quite as easy as the 1-in-50 on 7½-chain curves in the open. Still, if considered desirable, the 1-in-44 can be made into 1 in 50 without materially increasing the work.

Works.—The rough country on the East and West Coast Railway commences soon after leaving Springfield; but there are no special works in the first five miles except a large viaduct and heavy earthworks at the crossing of the Kowhai. The line strikes the Waimakariri Gorge at the 6th mile, and from thence to the Sloven Valley, at the 14th mile, the country is very difficult, and the works exceptionally heavy. From Sloven Creek to the head of the Bealey, a length of thirty miles, the works are very light: there are only two heavy cuttings on the whole distance. The Arthur's Pass summit tunnel is nearly 3¼ miles long, and the works on the western incline are exceedingly heavy. The remainder of the line from the Teremakau to Brunnerton runs through very easy country. With the exception of a few small cuttings near Lake Brunner, and a short tunnel in the Arnould Valley, there are no works worth mentioning.

Altogether there are twenty-four tunnels on the East and West Coast line, of the aggregate length of 5 miles 30 chains 7 yards: eleven on the eastern side, 1 mile 35 chains 20 yards; the summit tunnel, 3 miles 16½ chains; and twelve on the Westland side, 57 chains 20 yards. One of the tunnels on the eastern side is 24 chains long, and there are three between 15 and 20 chains; but all the others on the line are 11 chains and under.

The bridging also forms a considerable item. In addition to ordinary stream and river bridges, there are fourteen iron viaducts over 50ft. in height, the total length of which is 72 chains.

Cost.—Including the small section, 1 mile 30 chains, between Stillwater and Brunnerton, partly made, the total length of railway to make between the two coasts of the Island is ninety-five miles.

The estimated cost, including rolling-stock and all other charges necessary to complete the line, is £1,505,000—say £15,900 a mile.

Difficulties of Construction.—In my report of 1879 I pointed out the difficulties of construction and excessive cost of maintenance on this railway, particularly at the crossing of the main range. The detailed surveys that have since been made show the difficulties of construction to be considerably less than was anticipated—not so much in cost as in the superiority of the line obtainable. It was then supposed that a fairly-workable locomotive-railway could not be got at anything like a reasonable cost; and the estimates were based on gradients of 1 in 7 with stationary engines, or 1 in 15 with central rails, as at the Rimutaka. The best locomotive-gradient calculated on was 1 in 33, and even this was not supposed to be obtainable at Arthur's Pass.

As already stated, the ruling gradient on the latest surveys is 1 in 50, with 7½-chain curves, which is the same as on the Middle Island main line. Comparing this with other railways throughout the colony, we have,—

	Gradients.	Curves.
Auckland–Mercer	1 in 40 ...	12 chains.
Napier–Woodville	1 in 45 ...	7 "
Wanganui–New Plymouth	1 in 35 ...	5 "
Wellington to Rimutaka Summit	1 in 35 ...	5 "

Some of the locomotives already in the colony will pull 100 tons paying load up the Arthur's Pass incline as it is now laid out.

Although small when compared with some of the Alpine tunnels that have been constructed in Europe within the last few years, the Arthur's Pass tunnel is a heavy piece of engineering for a new country. It is of great length, inclines all in one direction, and large quantities of water are likely to be met with—a combination of circumstances that can only be met by a liberal expenditure. Beyond this, however, the difficulties are not serious. There has of late years been a great improvement in the art of tunnelling, and the streams in the vicinity afford ample water-power for machinery, so, considering its magnitude, I have no doubt the work could be done in a reasonable time and at a reasonable cost. Four and a half miles of the St. Gothard Tunnel were pierced by machinery at the rate of a mile and a third per annum.

Maintenance.—With reference to the maintenance of the East and West Coast Railway: In the Waimakariri Gorge it will always be very heavy, for the line in many places cuts into loose sidling ground that slopes a long way up the ranges. The best remedy for this evil is tunnelling, which should be resorted to if the slips become excessive. I have no doubt there will be considerable trouble with slips in the Otira during construction and for some time thereafter; but I do not think it will be a cause of heavy expenditure permanently, for on the West Coast, where there is so much rain, the steepest slopes quickly get covered with vegetation.

Hokitika–Greymouth Railway.

This line does not call for a very minute description. It extends along the coast between the two towns named. Practically, the railway is level throughout, and the curves are very easy. With the exception of about 22 chains of expensive bridging at the Arahura and Teremakau, there are no works on the line worth mentioning.

The length of the railway is 23¾ miles, of which 5½ miles are finished, and 4¾ miles more partly formed. The expenditure and liabilities to date are £41,839, and the estimate to complete is £180,000; which gives a total of, say, £220,000—equal to about £9,170 per mile.

West Coast–Nelson Railway.

Route.—This line commences at Brunnerton, the present terminus of the Greymouth–Brunnerton Railway, and follows the Grey Valley right up to the watershed between that river and the Inangahua, near Reefton. The saddle is pierced by a short tunnel, and the valley of the Inangahua followed down to the confluence of that river with the Buller, at which point the branch from Westport joins. The Buller is next followed up on the southern bank to the Mangles, and thence on the northern bank to the watershed near Tophouse. A descent is then made to Belgrove by the Big Bush, Blue Glen, Ray Saddle, and the Wai-iti Valley.

Surveys.—As already stated, there is only an ordinary preliminary survey of the railway from Nelson Creek to Tophouse. It is, however, sufficiently in detail to give a fair idea of the line and works, including the 2½ miles already formed. A contract section has been made of nineteen and three quarter miles out of the twenty-seven between Tophouse and Belgrove, and an ordinary preliminary survey of the remainder.

Alignment and Levels.—The survey of the portion between Brunnerton and Hope Junction having been made in 1874, when the standard was lower than at present, there are a considerable number of 1-in-40 gradients, with 6-chain curves. These are, however, quite unnecessary, for the sections in many of these places show practically a surface-line. Gradients of 1 in 65 or 70, with 7½-chain curves, can easily be got all the way from Brunnerton to Tophouse; and there is no necessity to adopt curves anything so sharp as this on the portion between Brunnerton and the Inangahua Landing.

As there is a fall of 1,940ft. over irregular country in the twenty-seven miles between Roundell Saddle, near Tophouse, and Belgrove, the 1-in-50 gradients, with 7½-chain curves, cannot be avoided at anything like a reasonable cost. This is, however, the only long incline on the whole line, and it is in favour of any heavy traffic that comes from the west. Furthermore, the incline is not continuous, as at the Otira, there being several breaks in it—the largest stretch of 1 in 50 is about 6½ miles.

Commencing at Brunnerton at a level of 61ft. above the sea, the West Coast–Nelson line rises by easy stages to about 750ft. at the Inangahua watershed, the summit of the saddle being 150ft. higher. After this comes a fall to about 200ft. at the Inangahua Junction, and a rise to 2,380ft. at Tophouse, and finally a fall to 452ft. at Belgrove.

Works.—From Brunnerton to the Inangahua Landing, a distance of fifty-three miles, the country is remarkably favourable to railway-construction. With the exception of the river-bridges and the small tunnel at the Inangahua saddle above referred to, the works are exceptionally light. From the Landing to Junkers—ten miles—the ground is more broken; still, there is no serious difficulty: but from Junkers to the Maruia, a distance of fifteen miles, the works are exceptionally heavy. The Buller runs all the way in a narrow gorge; so the railway must be scarped out of the solid rock, carried in tunnels through spurs, or supported by retaining-walls, as best suits the configuration of the ground. This portion of the railway closely resembles the Taieri Gorge on the Otago Central, or the Manawatu on the Woodville–Palmerston line. The most important work is a tunnel, 33 chains long, through a spur opposite the Lyell.

From the Maruia right to the summit, near Tophouse—forty-seven miles—there are no difficulties to contend with, and thirty miles of the distance is very easy. Although this railway rises to within 150ft. of the highest altitude on the East and West Coast line, there is no tunnel at the summit, the ground does not admit of it, being more of a table-land than a saddle.

The last section—that from Tophouse to Belgrove—also contains very heavy works. Although the country is open and the slopes easy, there are a number of ridges and sharp spurs to cross at right angles, which make grading difficult. The heaviest work of any kind is a tunnel, 43 chains long, at the head of the Blue Glen; and there are three viaducts, from 80ft. to 110ft. high, and 18 chains total length.

So far as can be ascertained from the preliminary sections, the West Coast and Nelson Railway will have twenty-four tunnels, of the aggregate length of 3 miles 33 chains. Of these, however, only nine are more than 12 chains long.

In addition to smaller structures of the same kind, there are thirty river-bridges and viaducts —150 chains. The total length of railway to make from Brunnerton to Belgrove is 154 miles: this includes the 1 mile 30 chains at the Brunnerton end partly made, and common to both this and the East and West Coast lines; also, the 2½ miles formed at the Belgrove end.

Cost.—The estimated cost, made up, not from detailed measurements, but by comparison with other railways, is £1,330,000—equal to £8,640 per mile.

Westport to Inangahua Junction.

A trial survey for this railway has been made on each side of the Buller; but the line on the north side is preferred. The surveys, particularly that on the north side, are very complete.

The line simply follows up the river-bank to a point about a mile above the Inangahua Junction; then crosses to join the West Coast and Nelson Railway.

The ruling gradient is 1 in 50, and the sharpest curve 7 chains; but this can easily be made 7½. For the first six miles from Westport the ground is level and the work light; but after that, all the way to the Junction, the ground and works are exactly as described for the portion of the West Coast–Nelson between Junkers and the Maruia. The river is all gorgy, and, as a consequence, the works are exceptionally heavy. In addition to a large amount of rock-cutting, there are six small tunnels, of the aggregate length of 54 chains, and 41 chains of bridging.

The length of the line is twenty-seven miles, and the estimated cost £335,000—equal to, say, £12,400 per mile.

Tophouse to Blenheim.

There has only been a reconnaissance survey of the line between Tophouse and Blenheim, but the country is all open and regular, so it is quite sufficient to give a fair idea of the kind of railway obtainable.

There will be some little difficulty in getting good gradients at the upper end of the line, near Tophouse, but nine-tenths of the distance is through remarkably easy country. There are only two river crossings worth mentioning, and the formation works generally will be very light, mainly surface forming.

The length of the line is 63 miles, and the estimated cost £375,000—equal to, say, £6,000 a mile.

PRESENT SETTLEMENT.

Disposal of Lands.—Map No. 2 shows the position of the various lands in the country affected by the proposed railways, and the following table gives their approximate areas:—

—	Leased.	Sold.	Crown Lands.	Total.
	Acres.	Acres.	Acres.	Acres.
Canterbury	246,800	16,200	298,280	561,280
Westland	...	59,300	1,012,060	1,071,360
Western Nelson	...	102,800	3,007,600	3,110,400
Northern Nelson	102,300	497,900	313,080	913,280
Marlborough...	296,000	384,600	413,580	1,094,180
Total	645,100	1,060,800	5,044,600	6,750,500

Population.—Map No. 1 shows how the country accommodated by the proposed railways is settled. The information as to the population is given on the authority of the Registrar-General, who kindly accelerated the compilation of the recent census returns for this purpose.

As may be gathered from the figures on the map, by far the greater portion of the settlement is on the coast. With the single exception of Reefton there is no large centre of population anywhere inland; and even on the coast the people are mainly congregated between Ross and the Grey, and again at the Buller.

Including the City of Nelson and the Town of Blenheim, the total population in the area affected by the railways amounts to 51,648; and of this number 9,015 are in Marlborough, on the connecting line between Tophouse and Blenheim.

It is, in the first instance, only intended to make the East and West Coast and Hokitika–Nelson lines. Their combined length is 300 miles. Dividing the population by this we have 142 persons to the mile. But it would not be fair to take this area only as a basis of traffic, for the East and West Coast Railway has the populous districts of Canterbury to draw upon. There is a population of 97,000 within a radius of 60 miles of Springfield, the point where the railway debouches on the plain. As it is difficult to determine what proportion of this population would be served, it is better to leave the East and West Coast line out of the calculation altogether. Taking the population served by the Hokitika–Nelson line, which is easily ascertained, and dividing it by the distance, gives 202 persons to the mile of railway.

Comparing these numbers with those in other parts of the colony, where there are no large cities, we find that on the New Plymouth–Foxton Railway there are 209 persons to the mile, and on the Napier–Woodville line 242 persons. In the whole of south Otago as far north as Clutha there are 120 persons to the mile of railway. It should also be borne in mind that in the case of Nelson and the West Coast the population is taken before the line is made; whereas the other districts have enjoyed the benefits of railway communication for some years.

Taking the four counties on the western side of the watershed, which it is proposed to connect with the rest of the colony by rail, the state of the population is shown by the following:—

——	1871.	1874.	1878.	1881.	1886.
Westland	10,781	9,820	11,606	10,246	10,170
Grey	8,275	8,204	7,767	7,483	8,750
Inangahua ... }	4,711	4,886	2,970	2,927	3,152
Buller ... }			3,557	3,558	5,248
Totals	23,767	22,910	25,900	24,214	27,320

Pastoral Settlement.—In proportion to its extent the pastoral settlement within the area affected by the railways is very small. This is easily accounted for—the prevalence of bush. As already shown, there are only about 1,750,000 acres of open grass country out of a total of 6,750,000. There are 7 runs in the Waimakariri watershed, carrying about 93,000 sheep. With the exception of a few hundreds here and there among the settlers, and a small flock at Lake Brunner—about 10,000 in all—there are no sheep on the western side of the range.

The latest returns show that there are about 102,000 sheep in the districts between the Upper Buller and Nelson, and about 282,000 between Tophouse and Picton. The above figures give a total of 487,000 sheep in the country accommodated by the proposed railways.

There are a few good herds of cattle on the West Coast, in the country south of Hokitika and the river-beds and upland valleys near the main range; but they are not nearly sufficient for the local demand, which is mainly supplied from Canterbury and Wanganui. The settlers in the vicinity of Nelson and Blenheim rear considerable numbers of cattle; but comparatively few of them find their way to the western markets—they are mostly absorbed by the adjoining towns. Altogether there are between thirty and thirty-five thousand head of cattle within the area affected by the railways, the half of which are on the West Coast.

Agricultural Settlement.—From the point where the East and West Coast Railway leaves the Canterbury Plains, at the 5th mile, to Belgrove, the end of the West Coast–Nelson line, there is no agricultural settlement worth mentioning, and cultivation only begins on the connection between Tophouse and Blenheim, within ten miles from the latter place. In 1885 the total area of land under crop in the four western counties was only 2,121 acres.

Oats for horse-feed is grown at Castlehill, and again in small isolated patches on the West Coast; but the quantity hitherto produced is very small—in no way approaching the local demand. In 1885 there were only 1,408 acres of oats grown in the western counties, the greater portion of which would probably be cut for oaten hay. The local demand is therefore met almost entirely by supplies from outside.

A few grazing and dairy farms have been reclaimed from the forest, more particularly in the valleys of the Hokitika, Arahura, Grey, and Buller Rivers. Vegetables and ordinary fruits grow well in all parts of the country, and of late years have been extensively cultivated.

Mining Settlement.—Hitherto the mainstay of the West Coast has been mining—first alluvial-gold-digging, and latterly quartz-reefing and coal-mining. As the ordinary alluvial ground became exhausted large hydraulic claims were taken up, and since 1871 the quartz reefs of Reefton and Lyell have yielded considerable quantities of gold, and given employment to a large number of people. Coal-mining has also of recent years become a large and permanent industry.

The ordinary diggers are scattered all about the country in small lots; there is scarcely an old diggings anywhere on which an odd man or two cannot be found earning a living. Although in most cases the present condition of things is a mere shadow of the past, there is ample proof everywhere that no one need be unemployed if the surplus labour could only be applied to gold-digging in this way.

After the large sluicing claims at Kumara, Ross, and Humphrey's Gully, the principal alluvial diggings at present in active operation are Rimu, Waimea, Maori Creek, Nelson Creek, Barrytown, and Charleston. The quartz reefs in operation are all situated at Reefton, Boatman's, Lyell, and Mokihinui. Coal is mined at Reefton for local demands; but the principal seats of the industry are Greymouth and Westport, where a large export trade is carried on with all parts of the colony.

Other Industries.—Leaving out the commercial interests which depend on the producing-power of the country, the only other industry on the West Coast that requires special notice is sawmilling. Some years since, when there was more direct communication with Melbourne, a small export trade in timber was established, and before railways were carried into other timber districts there was a large trade coastwise. All this outside trade has fallen off greatly of late years, and now the industry is confined to the local market and an occasional shipment to the East Coast. According to Mr. Kirk, there are at present about 18 saw-mills of various capacities at work on the West Coast; but they are not all working full time. The total yearly output is estimated at 5,500,000 superficial feet, and they give employment to about 150 men.

LAND.

Pastoral Land.

Area.—As shown on Map No. 2, and hereinbefore mentioned, the open pastoral lands affected by the proposed railway are estimated at 1,220,500 acres. This does not include either of the following: lands now used for pasture which can be converted into arable land, mountain-tops and other waste lands of little or no value, rough forest lands which may become fit for pasture at some remote time, when the bush is cleared.

Character.—The character of the ordinary pastoral country in Canterbury, Marlborough, and Nelson is much the same as in other parts of the Middle Island—open tussock lands, affording good pasture in the river-flats, but getting gradually poorer as higher levels are reached. There is a great similarity in most of the river-beds throughout the Middle Island. The Waiho on the west side of the range is little different from the Rangitata on the east, and the head-waters of the Grey are much the same as the head-waters of the Hurunui. There is little or no vegetation on the mountain-tops, where the snow lies long in winter, and some of the steeper slopes and shingle-slips are in the same condition. The mountains in Marlborough and Nelson are not so steep as the Canterbury ones; consequently they carry the good pasture further up, particularly on the northern side.

The ordinary pasture-lands above referred to are not capable of much improvement. Surface-sowing might be resorted to with advantage in a few isolated spots, but, as a rule, the present vegetation is the best that the country will give.

On the western side of the range there are a number of small patches of open country, shown on the maps as arable land, which are at present used for pasture. They amount in the aggregate to about 100,000 acres, and are of two classes—upland valleys and river-flats, and the pakihis of the lowlands. Bruce's paddock, on the Teremakau, and the Ahaura and Addison's Flats are examples of the latter. The upland valleys have generally very good soil, and give rich pasture. I have never seen finer cattle nor more of them on any natural pasture than I saw this summer on Mr. Macgregor's station in the Tutaki Valley. The pasture on the pakihis is generally poor. The land is very patchy: clay, shingle, and loam predominate in turns; but, even in the latter case, some of the essentials of good soil seem to be wanting.

As already stated, no account is taken herein of rough bush country which may ultimately become pasture lands. Ordinary hill-sides that are denuded of forest sometimes become very bare and sterile, particularly in the poorer upland districts, where mountain-birch has grown; but in some of the lower ranges, where limestone predominates, grass will grow on the steepest slopes. An instance of this occurs in the Buller Valley, below the Inangahua Junction. Under those circumstances some of the rough bush country may in time become pasture lands.

Agricultural Land.

There is no subject connected with the proposed railways which has evoked so much discussion as the character of the land on the West Coast. I shall therefore endeavour to give all the bearings of the question.

Area.—Map No. 1 shows the arable land in the country affected by the proposed railways, divided, irrespective of quality, into two classes—namely, arable flat lands and arable hilly lands. The following table, computed under my directions, gives their approximate areas:—

——	Flat.	Hilly.	Total.
	Acres.	Acres.	Acres.
1. Canterbury	34,400	6,800	41,200
2. Westland	269,300	202,000	471,300
3. Western Nelson	482,800	90,500	573,300
4. Northern Nelson	98,200	152,500	250,700
5. Marlborough	77,000	78,800	155,800
Totals	961,700	530,600	1,492,300

West Coast.—The report of the Railway Commission of 1880 has a statement attached showing the acreage and description of land served by and calculated to contribute traffic to each line of railway. The agricultural lands on certain lines and sections within the area we are now dealing with are given as follows:—

	Acres.
1. Nelson–Foxhill	87,000
2. Belgrove–Brunnerton	427,350
3. East and West Coast	652,090
4. Westport–Ngakawau	18,960
Total	1,185,400

I have no means of making an exact comparison between these two statements; but the Commissioners' total ought to agree roughly with the first four items in my statement, which amount to 1,336,500 acres. With reference to the East and West Coast Railway, a special line is inserted in the schedule to the Commissioners' report, giving the area within two miles of the proposed railway. The agricultural land is given at 84,000 acres.

As regards the Nelson–West Coast line, Mr. Calcutt, in 1873, estimated the land fit for settlement between Belgrove and Brunnerton at 213,750 acres—156,000 being forest and 57,750 open land. In 1872 Mr. A. D. Dobson, C.E., reported that 222,000 acres were fit for settlement. About the same time Mr. Thomas Mackay estimated the quantity that can be utilized at 261,000 acres, but limited the agricultural land to 51,000 acres. Going still further back—to 1868—we find an estimate by the late Mr. Wrigg, C.E., of 152,000 acres of flat land within the area proposed to be given to the company that would construct the line.

The third item in my statement, which corresponds with the former estimates just quoted, is so near them that it may be taken as correct. In fact, I believe that all the quantities given by me are as close an approximation as can be obtained without an expensive survey.

Canterbury.—As shown by the preceding table, agricultural land specially benefited by the proposed railways within the Canterbury district is of limited extent. It is nearly all situated in the Waimakariri watershed, between the main and subsidiary ranges. The soil generally is good, being composed of sediment from the fans previously referred to, or light loam overlying limestone. Out of the total of 40,000 acres above given, fully 30,000 acres are good even land, capable of cultivation; the remainder is rough, and lying at exceptionally high levels. This is an objection urged against all the country in the Waimakariri basin: even the good land just mentioned ranges from 1,500 to 2,000 above sea-level. Wheat has never, to my knowledge, been tried; and it is supposed that it will not grow at these high altitudes. I am not sure that this is the case. Wheat grows well up to 2,000ft. in the interior of Otago; and, although there is more rain in the Waimakariri Valley, I think the summer is sufficiently hot and dry to ripen any grain crops. There is, however, no doubt as to the suitableness of the country for oats, grass, and root crops.

Nelson and Marlborough.—The low-lying lands on the Wairau and Waimea plains are very fertile and well cultivated, but they get poor as higher levels are reached. The Wairau Valley gets very shingly about the Waihopai, and still further up the stones are imbedded in stiff clay, which grows little but manuka scrub. The valleys on the Nelson side are flatter, and consequently do not change so much, but they terminate abruptly against the steeper mountain-slope.

There is a considerable extent of flat land in the upper Buller, near Tophouse. A small portion is swamp, which makes good land when drained. The remainder is a shingly plain, covered with tussock and manuka, with occasional patches of better land.

Valuations.—As already shown, there is not much difficulty in determining the quantity of land on the West Coast over which the plough can pass when the bush is cleared off; but it is a different thing as regards its quality, capabilities, and value. Mr. Calcutt says, "Taking, therefore, the piece of country as a whole, and viewing it from an agricultural and pastoral point of view, it is not, in my opinion, adapted for the permanent settlement and support of a large number of people." In my report of 1879 I said, "So far as my judgment goes I can corroborate all that Mr. Calcutt says as to the indifferent character of the land and its limited area."

If we look at the matter from an Otago and Canterbury point of view, as I have no doubt Mr. Calcutt did, and as I certainly did myself, there is no occasion to alter or modify these opinions even after such a long lapse of years. The most zealous advocate of the railways does not claim that the West Coast is suited for rapid settlement by an agricultural population. But, if the forest lands of the North are taken as the standard, and an allowance made for a gradual settlement of the country as the timber is utilized, the land must be assumed as of some considerable value. In Otago and Canterbury the plough can be put direct into the tussock, and a good crop of wheat got the first year; and at the time my report was written the profit on that first crop was more than the price of the land. In the bush lands of the North farms are hewn laboriously out of the forest, and it generally takes ten or fifteen years before the plough can be used. Of course the land has not been unproductive all this time: there is in most cases some return from the timber to commence with, and grazing begins from the first year.

In this lies the whole question as regards the value of the West Coast lands: Can they be reclaimed and settled in the way adopted in other bush districts throughout the colony? After remarking that certain localities would, no doubt, grow excellent grass if cleared, and that the climate seemed quite unsuitable for the raising of grain, the East and West Coast Railway Commission of 1883 said with reference to this subject, "The most important feature in considering the West Coast as a farming district undoubtedly is the dense forest with which the whole country is covered. The present cost of felling and burning the bush is out of all proportion to the value of the land when cleared; and, owing to the humidity of the climate, underscrub and rushes soon appear unless the land is ploughed."

On the supposition that it would be sold during the construction of the railway, Mr. Wrigg in 1868 valued the 152,000 acres of flat land he found between Nelson and Cobden at £3 10s. an acre—equal to £380,000. The Westland Railway League in 1879 valued 65,000 acres of bush land within two miles of the East and West Coast line at £5 an acre; and 100,000 acres more within five miles at £3 an acre—£625,000 for 165,000 acres. This is the estimated value after the railway is made. Mr. Mueller, Chief Surveyor and Commissioner of Crown Lands for Westland, in his evidence before the Railway Commission of 1880, endorsed these figures both as regards quantity and value.

Looking at it, as he expressly said, solely from an agricultural and pastoral point of view, Mr. Calcutt valued the settlement land between Nelson and Greymouth in the hands of the Crown—202,340 acres—at £137,340; and he estimated that the value would be increased to about £290,000 by the construction of the railway.

Mr. Thomas Mackay, in his evidence before the Railway Commission of 1880, said that Mr. Calcutt had under-estimated the increase due to the making of the railway, and that 50,000 acres of forest land in the Buller watershed would alone be worth £500,000 when the railway is made.

This indicates the correct way of estimating these forest lands: their real value is the price of the natural crop of timber that is on them, added to their capacity for producing artificial crops when the timber is removed. What these amount to is a difficult question to answer, so much depends on the market that is opened up for the timber and the facilities that are provided for bringing it to that market, as well as on the subsequent outlet for agricultural produce.

Capabilities.—It is admitted on all sides that the climate of the West Coast is not suited for the growth of grain. With the exception of a small plot in the Buller Valley, I am not aware of wheat having ever been grown even as an experiment, and I question if it will ever be grown in quantity till the climate is completely changed by the denudation of the forest lands. It does not, of course, follow herefrom that the country is altogether unfit for settlement. Some of the finest districts in New Zealand, where the land is richest, are unsuited for growing wheat. As for grass and root crops, I see no reason why they should not grow as well on the West as on the East Coast.

The rapid growth of rushes on cultivated land, which is frequently mentioned as a serious evil, does not seem much worse than in many other districts throughout the colony where the drainage is defective. I saw very little of it south of Ross, where the soil is porous. The rapid vegetation of this and all other kind on the West Coast is not due so much to the excessive rainfall and the number of rainy days as to the mildness of climate and the long retention of the moisture by the all-prevailing forest. The mildness of the West Coast climate is evinced by the luxuriance of the semi-tropical vegetation, and the altitude to which it rises. In the eastern watershed nothing but the hardiest beech is seen at high levels; but the range is no sooner crossed than pines and other delicate plants are met with. Young rimu and kahikatea grow quite freely in the open on the West Coast, a thing unheard of in the south-eastern provinces of the Middle Island. The North Island rata is quite common at Westport, and nikau palms grow on the exposed seashore as far south as Barrytown.

With reference to the rainfall on the West Coast as compared with other bush districts throughout the colony, unfortunately the records are not sufficiently numerous to enable a correct comparison to be made; but Hokitika is believed to be no wetter than some parts of the country round the base of Mount Egmont, and Westport is very much on a par with Woodville.

Classification.—In the previous tables no account is taken of the quality of the land; and, in consequence of the density of the bush, the frequent changes in the character of the country, and the absence of cultivation, anything like a correct classification is impossible. I, however, submit the following rough approximation as regards the arable lands on the West Coast:—

	Acres.
Quality No. 1	100,000
Quality No. 2	350,000
Quality No. 3	300,000
Quality No. 4	294,600
Total	1,044,600

No. 1 represents the alluvial lands south of Ross, and other river-flats of smaller area, such as the Four-River Plain, on the Buller.

No. 2 includes the ordinary low-lying forest country and the better kind of hilly lands.

No. 3 is ordinary hilly country and terraces, and other lands of similar character.

No. 4 represents the poorer class of pakihis and the rougher hilly lands.

As my report of 1879 dealt mainly with the railway between the two coasts and northward from Christchurch, the through communication from Hokitika to Nelson was not considered; consequently no notice was taken of the lands south of Hokitika. It is, however, quite fair to notice them now in connection with the present proposals, for they undoubtedly affect and are affected by any extensive system of railways terminating at Hokitika. How far south this effect operates is a moot question, to which I have already referred.

The alluvial lands south of Ross are undoubtedly good, and decidedly the best on the West Coast. They begin at the Waitaha, and continue in a narrow strip with more or less intermission right down to the Otago boundary. The land is schist alluvium, like Inch Clutha, or the Taieri Plain. The best portions are covered, not with heavy timber, but with flax and light scrub-ribbonwood—koromiko, and other shrubs indicative of good land. And not only is the land good, but it is easily cleared. The only drawback is its comparatively small extent and remoteness from the railway. I came across a few small patches of the same quality of schist land at the Poerua Lake, Upper Grey Valley, and several other places north of Hokitika. The character of the soil was readily noticeable by the luxuriance of the vegetation and its peculiar character.

The next best land on the West Coast is the ordinary alluvial found on all the rivers in more or less quantities. There is a considerable breadth in the Hokitika and Arahura Valleys, and narrower strips and patches in the Grey and Buller. Particularly good patches also occur on the eastern side of Lake Brunner, and at the confluence of the Kopara and Ahaura Rivers. The latter are only covered with scrub.

The second quality of land in the preceding schedule is generally covered with dense forests, growing in soft ground, with a considerable depth of vegetable matter overlying a shingly or sandy subsoil. There is always a deep layer of peat where the smaller pines grow.

The third quality is chiefly terrace land—dense forests growing in peaty soil overlying clay on cemented shingle, which in turn lies on the sandstone reef.

Some of the land in the fourth class finds a parallel in the moors of Ireland and Scotland. Addison's Flat, between Westport and Charleston, is almost a *fac-simile* of a Highland deer-forest. The general impression is that these lands are good for nothing; but I do not think so. I am of opinion that a moderate expenditure would make them fair pasture lands. Some of the pakihis contain very poor land—shingle imbedded in stiff clay, that only grows stunted manuka scrub. A large amount of labour and capital must be expended on them before they can be called good land. The flats at Ahaura and Squaretown are samples of these poorer pakihis.

FORESTS.

General Description.

There is as much unanimity about the value of the West Coast forests as there is diversity of opinion about the value of the land. All authorities agree in considering them a large item in the assets of the colony, more particularly as the wetness of the climate prevents their destruction by fire.

Extent.—There is comparatively little forest lands in Canterbury, Marlborough, and Northern Nelson within the area accommodated by the proposed railways, but to all intents and purposes the whole of the western watershed is continuous bush. In fact, all the west coast of the Middle Island, from end to end, is one immense forest.

The preceding tables give the total quantities of bush and open country in the area we are dealing with, and the accompanying map shows their relative positions and the different kinds of the predominating timbers. Subdivided the quantities appear as follows:—

——	Beech.	Pine.	Mixed.	Total.
	Acres.	Acres.	Acres.	Acres.
Canterbury	76,700	...	...	76,700
Westland	40,900	453,700	227,100	721,700
Western Nelson	1,699,000	193,700	462,400	2,355,100
Northern Nelson	221,900	...	187,300	409,200
Marlborough	169,800	...	192,000	361,800
Totals ...	2,208,300	647,400	1,068,800	3,924,500

In estimating forest lands it is difficult to know how much should be allowed for scrub and inferior timber. Taking it, however, at 50 per cent., the quantity of timber-producing bush in the country affected by the railways will stand, in round numbers, thus:—

——	Beech.	Pine.	Mixed.	Totals.
	Acres.	Acres.	Acres.	Acres.
Canterbury	40,000	...	...	40,000
Westland	20,000	230,000	110,000	360,000
Western Nelson	850,000	100,000	230,000	1,180,000
Northern Nelson	110,000	...	90,000	200,000
Marlborough	80,000	...	100,000	180,000
Totals ...	1,100,000	330,000	530,000	1,960,000

Beech Forests.

Beech—or, as it is more commonly called, birch—constitutes the greater portion of the forest. It is the only timber on the Canterbury side, and north of the Ahaura it occupies all the country except a belt along the coast and narrow strips in some of the river-beds. The three beeches best known to commerce as red, black, and silver beech—*Fagus fusca, F. solandri,* and *F. menziesii*—are all found.

Fagus solandri—also known indifferently as entire-leaved, black-heart, white, and Oxford birch—occupies the greater portion of the Waimakariri watershed and the higher ridges in the northern districts. At high levels it merges into a variety known only to botanists—*Fagus cliffortioides,* or mountain-beech. The Oxford birch is comparatively small, seldom exceeding 35ft. or 40ft. in

length, and 2ft. 6in. in diameter, and considerably smaller on the higher levels. Of late years this timber has been extensively used for sleepers in Canterbury. It is much given to warping and cracking, so is quite unsuitable for joiner-work; but it stands well in the ground.

Fagus fusca.—Next to kauri, *Fagus fusca*—called indifferently red, black, brown, and tooth-leaved birch—is perhaps the most important timber in New Zealand. It is strong, straight-grained, and durable, and of large scantling and in long lengths. It is scarcely suitable for fine joiner-work, being hard and easily split, and given to excessive shrinking and warping if not particularly well seasoned. It, however, answers well in house-framing, and is particularly well adapted for railway-sleepers and engineering works generally. It is also a good substitute for oak and English beech in staves for casks and tubs.

There is a curious belt of *Fagus fusca* in the Upper Waimakariri, referred to in Mr. Kirk's report of November last. It is from 5 to 10 chains wide, with *F. solandri* on each side, its lower edge being 5 or 10 chains from the lower edge of the bush. The belt extends practically from the Bealey to the Esk. It contains trees up to 3ft. diameter and 30ft to 40ft. long in the trunk. The timber is good, but many of the trees are hollow, having long passed their maturity.

With the exception of occasional clumps of *menziesii* all the low-lying birch forest in Westland and Nelson is *Fagus fusca.* On the East and West Coast Railway the birch is first met with near the confluence of the Otira and Teremakau. There is a considerable patch here, and another on the north side of the Teremakau, at the entrance to the Paddock. It next appears in quantity mixed with pines between Lake Brunner and the Ahaura, and after that there is practically nothing but birch forest all the way to Nelson, and, in a less degree, right on to the Sounds.

The birch in the Teremakau is not very large: trunks up to 4ft. diameter are occasionally seen, but the average is not more than 2ft. 6in. or 3ft., the length of trunk being from 40ft. to 60ft. The heavy timber begins about Nelson Creek, and continues all the way to the Buller watershed, wherever the soil is favourable. The popular impression that birch grows on very poor land is only correct as regards the upland varieties, that affect a stiff clayey hillside. The largest *Fusca* grows in the valleys, where the soil is best. Birch trees up to 4ft. diameter and 80ft. or 90ft. in the trunk are quite common through the long stretch of country I have mentioned, and trees of still larger dimensions are frequently met with. I measured one in the Upper Grey 24ft. 8in. girth, 7ft. from the ground. This tree grows on one of the patches of schist soil I have previously referred to. There was a large number of trees in the same locality up to 5ft. diameter, and from 80ft. to 100ft. long in the trunk. One which had fallen alongside the track was 110ft. long in the trunk, 4ft. diameter at the base, and 12in. at the top.

An important point in connection with the birch forests on the West Coast is that the trees are of all ages, from year-old seedlings to hoary giants, long past maturity. I travelled through a remarkable patch of comparatively young trees in a valley near the Clarke River. They seldom exceeded 2ft. diameter at the base, but were of great height and perfectly straight. One cut down in making the track measured 80ft. long in the trunk by 21in. diameter at the base and 12in. at the top, the total length of the tree being 120ft. It was quite small when compared with hundreds standing round. Many of them only 18in. diameter at the base were 120ft. long in the trunk.

Silver Birch.—Silver birch *(Fagus menziesii)*—known also as red and white birch—is a far less important timber than *Fagus fusca.* The tree is not nearly so large nor straight, and the timber is neither strong nor durable. On the other hand, it is suitable for joiner-work, even of the finer kinds, being smooth-grained and soft, and not liable to excessive shrinking or warping. It also answers well for the light kind of cooper-work. The timber is, however, comparatively little used in any part of the colony.

Silver birch has no special habitat, but grows in small clumps and individual trees all through the beech forest shown on the map. There is a patch at the Blackwater, on the opposite side of the Teremakau from Kumara, and several in the Upper Grey, Inangahua, Maruia, Matakitaki, and Buller. The trees are seldom more than 3ft. in diameter and 40ft. or 50ft. long in the trunk, the average size being considerably less.

Pine Forests.

There is no forest of pine wood north of Teremakau. Numerous bushes and clumps almost exclusively pine are met with, and the timber is found in considerable quantities mixed with beech, but there is nothing that can be called a forest in its more comprehensive sense. On the other hand, there is practically no timber but pine south of the Teremakau. I did not see a single beech-tree of any description right down to Okarito, and I understand it is the same for fifty miles further south.

Totara.—Totara, probably the most valuable of the New Zealand pines, is not plentiful in the area accommodated by the proposed railways. In the extreme north of Nelson and the Sounds there is a fair sprinkling among the other trees; but, with the exception of two or three patches in the Buller and Grey basins, and a few smaller clumps and isolated trees at long intervals, there is practically no totara from Belgrove to Ross. From the Mikonui southwards totara in small quantities and of small size appears among the scrub on the richer river-flats, but it is too insignificant to notice. The only valuable totara bush that I heard of on the West Coast is on the south bank of the Wanganui, where there is about three square miles of good timber, fifty-feet piles being obtainable.

Matai.—The next best pine—matai—is also comparatively rare in the country under discussion. It only grows in very small clumps and individual trees among the other pines. Practically the Pelorus Valley is the only place where this timber has a commercial significance. The trees there run up to 4½ft. in diameter and 50ft. long in the trunk; but on the West Coast they seldom exceed 3ft. in diameter and 40ft. in the trunk. Matai has a high reputation for durability on the West Coast, but is not thought so much of in Nelson.

Miro.—Miro occurs occasionally in small clumps and individual trees in the Nelson District, but practically it does not appear in the western forests. I only saw a few dozen specimens in all my travels.

White Pine.—Kahikatea—generally called white pine in the South Island—is the second most plentiful of the pine family within the area accommodated by the proposed railways. In Nelson and Marlborough it constitutes probably about one-half of the marketable timber in the mixed bush, and on the western side of the range there are large quantities dispersed in clumps all through the pine forests. In the aggregate, however, it only occupies a mere fraction of the western pine forests: they are composed chiefly of rimu.

White pine affects low swamp ground, and the richer river-flats. The trees grow closer together and are taller in the swamps, but attain a greater girth in drier ground. Some remarkable patches of tall, thin trees occur in the Arahura and Grey Valleys and other low-lying places. The trunks are perfectly straight and nearly cylindrical, and the branches spread very little. Poles 90ft. and 100ft. long, and from 12in. to 18in. diameter at the base, are readily procurable. White pine frequently grows to a diameter of 5ft. and over, but these trees are seldom so tall as the smaller ones. Sawing-timber is generally about 3ft. diameter and 40ft. to 50ft. long in the trunk.

The East and West Coast Railway first strikes white-pine bush after crossing the Teremakau. There is a considerable quantity here, and at Lake Brunner, a few miles further on, and again in the Arnould Valley. The Nelson line and Westport branch run right through considerable-sized patches at short intervals. One of the best occurs near the Inangahua Junction, and there are several other good ones further up and down the Buller. There are also large patches close to the line in the Grey and Inangahua Valleys, and nearly all the river-flats south of Greymouth contain white pine in greater or less quantities.

Rimu.—Next to *Fagus fusca,* rimu occupies by far the greatest area in the forests under consideration. It occupies a considerable percentage of the mixed bush in Nelson and Marlborough, and is the all-prevailing timber in the western pine woods. South of the Teremakau there is rimu everywhere, and frequently for miles nothing else.

The timber is always good, sound, straight, and of large dimensions, and the trees grow very closely together. There are specially fine tracts around Lake Brunner and south of the Mikonui. The timber is particularly good at the latter place. The trees attain an extreme height of from 120ft. to 150ft., and about 3ft. diameter at the base. One lying alongside the track measured 140ft. over all: the trunk was 90ft. long, by 2ft. 9in. at the base and 1ft. 3in. at the top. Another in the same position measured 85ft. in the trunk; it would square 12in. for this length. In Nelson and Marlborough rimu grows to 5ft. diameter, but the trees are not so high as in Westland. Like *fusca,* the rimu on the West Coast is of all ages. In a large tract between Marsden and Maori Creek the trees are about 100ft. high, but only 18in. in diameter at the base.

Kawaka and Silver Pines.—The next most important timbers in Westland are the two smaller pines, kawaka and silver pine. They are all small trees, ranging from 30ft. to 45ft. high and 1ft. 6in. to 2ft. 6in. diameter. Kawaka is somewhat larger than the others; but the trunk tapers very much, so it does not yield more timber. Although the trees are small, and occurring only in small quantities, these timbers are very valuable on account of their durability in all situations. The silver pines also give beautiful furniture-woods. These small pines are dispersed all through the mixed forests of the West Coast, particularly on the margin of swamps. Sometimes the kawaka climbs the spurs of the ranges, as at the Lyell.

Yield of Timber.—Referring to the yield of timber in the Westland pine forests, Mr. Kirk, in his report of November last, says, "The average quantity of timber per acre is very high on the flats and lower levels, and may be estimated at 40,000 superficial feet for red and white pine. Near Lake Brunner several acres of red, white, and black pine gave over 80,000 superficial feet to the acre. Mr. Malfroy informed me that he had recently purchased 300 acres near Hokitika which would average fully 70,000ft. per acre for the entire block."

Mr. Kirk averages the yield of all the Southland bushes at 25,000, and that of the Pelorus bush at 15,000 superficial feet per acre. Occasional patches of bush that would yield from 60,000ft. to 80,000ft. have been met with in Southland and the Pelorus, but Westland is the only place in the South Island where such heavy bush exists in large quantities. I had the number of trees worth sawing counted on three separate acres near Arahura: they ranged from 65 to 85 per acre, the average being 73. Similar information obtained from seven places in Southland shows the number of trees on the acre to range from 8 to 32, the average being 20. At Catlin's River the number is estimated at 16, and in the Pelorus at 17.

Mixed Bush.

The mixed and pine forests in the area accommodated by the proposed railways contain the usual proportion of less important timbers. The only ones of this class deserving special notice are rata, kamai, and tawa. Both the northern and southern ratas are found. The former goes down the coast as far as Razorback, and the latter is scattered all over the forests. The southern rata is plentiful at Kumara, where it is used for firewood—a deplorable waste, this being the best wheelwright-wood in New Zealand.

There are two kinds of kamai—*Weinmannia racemosa,* the one known by that name in other parts of the Middle Island; and native lilac—*Quintinia serrata.* They are locally known as red and white birch. The former, which is very plentiful, grows to 3ft. diameter and 30ft. or 40ft. long in the trunk. It furnishes timber much given to warping and splitting, but very durable. It is now extensively used in Southland for railway-sleepers. The bark of kamai is one of the most valuable in the colony for tanning. Its use hitherto for this purpose has been restricted solely by the difficulty of getting a supply. The lilac is a much smaller tree than the kamai, and is not a durable timber.

Tawa is essentially a North Island tree. It only appears in the Middle Island in the Pelorus district. It is a small tree, furnishing soft, even-grained timber, suitable for joiner- and cooper-work.

MINERALS.

There is no district in New Zealand that contains anything like so much mineral wealth as the one traversed by the proposed East and West Coast and Nelson Railway. The land has some value, present and prospective, even to those who think least of it; and the forests are admitted on all sides to be exceedingly valuable: but the minerals are of far greater importance than land and forest together. From Nelson all down the West Coast to Otago there is scarcely twenty miles in which minerals of some economic value have not been discovered. In many cases the discoveries are little more than indications; but it is fair to assume therefrom that workable deposits are likely to be met with sooner or later. The great drawback in following up these discoveries is the difficulty of prospecting the mineral country, which is generally very rough and covered with dense wet bush. On the other hand, what are now hindrances will ultimately become aids to mining. The rough country covered with bush and teeming with water furnishes two of the greatest desiderata—timber and water-power. Up till now the only minerals known to exist in workable quantities are gold, coal, iron, copper, and antimony.

Gold.

Location and Extent of Mining.—The very existence of the West Coast as a field for settlement of any kind is due entirely to the presence of gold. The accompanying Map No. 4 shows that auriferous ground is widely dispersed all over the country affected by the proposed railways, and, as already stated, gold-digging and -mining is equally well diffused. It must not, however, be assumed that payable gold-fields on a large scale exist wherever the yellow colour appears on the map. It is impossible to classify the auriferous country; and, although gold is still found in all the places shown, the richer ground in many of the larger diggings has long since been worked out.

With the exception of the larger sluicing claims at Ross, Humphrey's, and Kumara, nearly all the alluvial digging is carried on by private parties of miners working their own claims.

Regarded as a basis of speculation at which fortunes are made in a day quartz-reefing on the West Coast has seen better days, but viewed as a steady industry it is now on a more satisfactory footing than ever it was. Reckless speculation has ceased, and a large number of men are engaged in legitimate mining, getting fair returns. There are at present seven dividend-paying claims at Reefton, Boatman's, Lyell, and Mokihinui.

The machinery at some of the larger mines, both alluvial and quartz, is of the most improved description, and the works are carried on in a scientific and business-like manner; but in many cases the appliances are imperfect, so the best results are not obtained.

The best way of showing the location and extent of gold-mining in the districts affected by the proposed railways is to give the returns of miners and mining machinery. The following are the figures as regards the West Coast for the year just ended:—

Number of Miners employed during the Year ending 31st March, 1886.

Locality.	Alluvial Miners.		Quartz-miners.		Totals.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
Inangahua	116	240	300	..	416	240	656
Ahaura	350	233	..	..	350	233	583
Charleston	220	..	..	..	220	..	220
Westport	157	5	45	..	202	5	207
Lyell	50	30	130	..	180	30	210
Murchison	120	8	20	..	140	8	148
Waimea and Stafford	375	205	..	..	375	205	580
Totara	329	81	6	..	335	81	416
Hokitika and Kanieri	476	124	..	..	476	124	600
Kumara	400	25	..	..	400	25	425
Greymouth	322	268	..	..	322	268	590
Arnold	450	95	..	..	450	95	545
Greenstone	100	50	..	..	100	50	150
Okarito	65	..	..	..	65	..	65
Totals	3,530	1,364	501	..	4,031	1,364	5,395

Machines employed in Alluvial and Quartz-mining for the Year ending 31st March, 1886.

Locality.	Machinery employed in Alluvial Mining.												Machinery employed in Quartz Mining.							
	Puddling Machines.	Whims.	Whips or Pulleys.	Sluices, Toms, and Sluice-boxes.	Water-wheels.	Hydraulic Hose.	Pumps.	Dredges.	Quicksilver and Compound Cradles.	Derricks.	Stamp-heads crushing Cement.	Boring Machines.	Steam-engines employed winding, crushing, &c. No.	Steam-engines employed winding, crushing, &c. Aggregate h.p.	Crushing Machines.	Stamp-heads.	Water-wheels.	Whims.	Whips or Pulleys.	Buddles or Berdans.	Approximate Value of all Mining Plant and Machinery
																					£
Inangahua ..	..	..	..	..	..	..	..	..	..	..	..	..	12	228	18	285	15	2	3	55	124,580
Charleston ..	..	..	..	80	3	70	..	..	50	..	13	..	..	..	..	5	..	..	..	..	3,000
Lyell	..	..	..	23	14	..	1	..	..	..	..	..	..	..	4	45	3	..	..	..	11,000
Murchison ..	..	..	..	45	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,200
Westport ..	..	..	..	46	6	27	..	..	..	..	..	..	..	..	2	20	2	..	..	..	7,000
Ahaura	..	..	..	500	2	350	1	..	..	3	..	..	..	..	..	..	..	..	..	..	6,800
Waimea and Stafford	..	..	1	1,000	2	230	1	..	..	..	..	..	..	..	..	..	..	..	..	..	4,000
Totara	..	..	8	40	3	40	6	..	..	..	..	..	5	220	..	..	..	..	..	..	14,000
Hokitika and Kanieri	..	2	40	70	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2,500
Greymouth ..	..	..	..	1,800	1	356	25	..	40	..	..	8	..	..	..	..	..	..	..	..	5,000
Arnould	..	..	..	882	6	118	..	1	..	..	..	..	3	33	..	..	..	..	..	..	2,596
Kumara	..	8	20	70	2	55	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5,000
Goldsborough ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Greenstone ..	..	..	..	1,000	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,500
Okarito	..	..	..	50	3	..	3	..	..	..	..	1	..	..	..	..	..	..	..	..	..
Totals ..	..	10	69	5,606	69	1,310	37	1	90	3	13	9	20	481	24	355	20	2	3	55	188,176

Present Position of Gold-mining.—The permanence of the West Coast gold-mines is an important factor in estimating the prospects of the railways, and, like the value of the lands, it is a subject on which there is a great diversity of opinion. There has been nothing like a large rush since 1876, when the Kumara field was opened out. We have therefore had seven or eight years of normal working. The following tables show the state of the gold-mining industries on the West Coast during that period—the last seven years:—

Yield of Gold.

——	1879.	1880.	1881.	1882.	1883.	1884.	1885.
	£	£	£	£	£	£	£
Alluvial gold	470,871	505,958	419,881	425,653	378,217	377,217	361,985
Quartz-gold...	100,190	69,300	90,090	94,325	88,935	69,300	109,340
Totals ... £	571,061	575,258	509,971	519,978	467,152	446,517	471,325

Number of Miners Employed.

——	1879.	1880.	1881.	1882.	1883.	1884.	1885.
Alluvial-miners	6,497	6,886	7,633	7,332	6,986	5,924	5,344
Quartz-miners	447	476	479	499	834	563	563
Totals	6,944	7,362	8,112	7,831	7,820	6,487	5,907

Value of Machinery Employed.

——	1879.	1880.	1881.	1882.	1883.	1884.	1885.
	£	£	£	£	£	£	£
Alluvial-mining ... } Quartz-mining ... }	107,370	114,179	113,450	127,630	158,536	182,980	186,280

These tables show that, while alluvial mining is on the decline, quartz-reefing has not only held its own, but made a slight advance. The Mokihinui reefs appeared in the returns for the first time last year; and in all probability the Owen reefs will appear next year.

Permanence of Gold-mining.—With reference to the permanence of alluvial mining, the ordinary river-diggings are undoubtedly coming to an end; but the hydraulic workings in gravel and cement terraces will last many years. So also will the beach workings, which afford employment to small parties all along the coast.

In his evidence before the East and West Coast Railway Commission in 1883, Mr. Gordon, Inspecting Engineer for Mines, estimated that the hydraulic workings at Kumara would last twenty or thirty years. Mr. Thomas Bailie, of Westport, before the same Commission, said, "I do not think Addison's Flat will be any worse than now for the next thirty or forty years."

In 1882 the Public Works Department investigated this question as regards the Ross and Ahaura districts, with the following results: The ground near Ross was expected to last twenty-five years; 150 acres on Callaghan's Creek was estimated to give employment to seventy men for thirteen years; and 500 acres on the Ahaura to seventy-five men for thirty-five years. In the two latter cases only about half the auriferous ground was taken as workable. This indicates one of the great difficulties in predicting the future of hydraulic gold-mining on the West Coast. There are large areas of auriferous ground all over the country which will not pay to work now, but which will become payable as greater facilities are provided for working them. Although at present on the decline, it is quite possible that the yield of alluvial gold on the West Coast will be as great in twenty-five years as it is now.

So far as quartz-reefing is concerned, there is little doubt as to the permanency of the industry, and the general impression is that it is only in its infancy. As a rule, the West Coast reefs are not particularly rich, but there are many of them, and they contain large quantities of stone which will pay for working with improved appliances and better means of communication.

Auriferous quartz, of different degrees of richness, has been found at various places in the slate formation all along the ranges from the Little Grey to Mokihinui. Referring to the quartz reefs near Reefton, Mr. Patrick Brennan, in his evidence before the Railway Commission of 1880, said, "There are seventeen miles of country, as the reefs run, which have been proved to be payably auriferous." In a paper recently sent to the Colonial Exhibition in London Mr. Gordon says, "The quartz reefs have been traced, containing payable gold, through a belt of country extending from the Big River to the Mokihinui River, a distance of about fifty-five miles."

The mineral map hereto attached shows the position of these and other known quartz reefs on the West Coast. It will be seen that there is a remarkable regularity in the belt of quartz-bearing country above referred to. The paying reefs at Reefton, Boatman's, Lyell, and Mokihinui are all on this line. For the reasons already given this belt of country has never been thoroughly prospected. It is known to contain a large number of quartz reefs more or less auriferous, particularly on the section between Boatman's and the Lyell—a very rough piece of country, exceedingly difficult to prospect.

The Owen Reefs are on another belt of slate—the one that flanks the main range. Quartz reefs have been found in it at Wangapeka, the Tiraumea River, Lake Brunner, the Taipo River, and the head-waters of the Arahura, the latter being in close proximity to the reefs at the head of the Wilberforce, on the Canterbury side. Quartz reefs have also been found near Ross and Lake Kanieri, and on the south-eastern flanks of the Paparoa Mountains. In fact, all the schist and clay-slate rocks on the West Coast give everywhere indications of quartz reefs. To what extent these reefs are auriferous, and whether it will pay to work them, are questions that the future only can solve. For the present it is fair to assume that quartz-mining has every prospect of becoming a permanent industry on the West Coast.

Coal.

So far as its prospects are concerned, coal-mining on the West Coast bears the same relation to gold-digging that the timber industry bears to agriculture—there is no uncertainty about it.

Extent of Coal-mining.—There is no industry within the area accommodated by the proposed railways which has made such satisfactory progress during recent years as coal-mining. The increase in the population of the West Coast since the former census is due entirely to the development of the mines at Westport and Greymouth.

The growth and magnitude of the industry are shown by the following tables:—

Output of Coals.

—	1879.	1880.	1881.	1882.	1883.	1884.	1885.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Greymouth	52,679	46,835	50,719	63,053	86,074	97,357	140,182
Westport	3,860	4,772	24,198	48,544	38,297	80,196	78,009
Reefton	2,232	3,101	2,002	2,827	3,533	1,331	2,151
Mokihinui	...	500	...	...	...	...	275
Totals ...	58,771	55,208	76,919	114,424	127,904	178,884	220,617

Number of Men Employed.

—	1879.	1880.	1881.	1882.	1883.	1884.	1885.
Greymouth	89	106	110	146	223	215	335
Westport	29	39	76	153	170	225	273
Reefton	14	15	12	16	22	9	11
Mokihinui	...	5	...	...	...	...	31
Totals ...	132	165	198	315	415	449	650

The mines at Greymouth were the first to be opened out; and a considerable trade had been established prior to 1879. The total output up till December, 1878, was estimated at 117,400 tons. The Westport mines were of no importance till 1881. As already stated, these are the only two places on the West Coast where coal is raised in quantity for transmission to other parts of the colony. The Reefton mine only supplies the local demand.

There are three large mines at Greymouth and two at Westport; but one at each of these places is not yet in complete working order: the other three have been in full operation for several years. There are six small mines at Reefton and one each at Westport and Greymouth. The Mokihinui coalfield is just opening up; it will not, however, be of much importance till connected by rail with Westport.

The mines at Westport and Greymouth yield bituminous coal of the best description, suitable for the highest purposes both as steam-coal and in manufactures. The Westport coal is particularly good for steam, and that from Greymouth is believed to be unexcelled anywhere for making gas—it makes 25 per cent. more than the best Newcastle. Some of the smaller seams at Reefton are bituminous; but the majority are glance- or pitch-coals of the Kaitangata class. They are deficient in gas, but make good steam-coal, and for household purposes are probably superior to bituminous coal.

Extent of Coalfields.—The aspect of affairs as regards the coal deposits on the West Coast and their relation to the railways is considerably altered since my report of 1879 was written. Speaking from the best information then available I said, "It should be pointed out that the main deposits occur in a narrow belt along the sea-coast, which entails the maximum length of carriage right across the country. Coal has been discovered in small quantities up the Buller Valley to within forty-five miles from Nelson, and this has been urged as a reason for the construction of a railway in that direction. But the deposits are small, and, according to the geological map, there is not much likelihood of a large coalfield being found in that or any other locality many miles from the coast at the Grey or Buller—at any rate, in the vicinity of the direct lines across the country." It will be seen from the accompanying map that, instead of being confined to a narrow strip along the coast, as above stated, the bulk of the coal-formations is in the interior.

In a previous section of this report I enumerated the coal-bearing formations within the area affected by the proposed railway so far as yet determined. There are eight separate though scarcely distinct fields, containing in the aggregate about 1,250 square miles. The two classes of coal —bituminous and non-bituminous—are found in different proportions in all the fields; but the only extensive tracts of the latter, as yet known, are situated in the upper Inangahua basin, around Reefton, and along the coast near Brighton. It must not, however, be assumed that coal exists continuously all over the extensive area above given: it is the area of the coal-producing formations, not of the coal-beds they contain. In the present state of our information it is quite impossible to give even an approximate estimate of the coal-beds. The country is in many places very rough and densely bushed, and no survey has been made; so any estimate would be little more than a random guess. A portion of the Westport field has been accurately surveyed, and found to contain about 140,000,000 tons of coal; and the present coal leases at Brunnerton and Blackball are calculated to contain 62,000,000 tons of workable coal.

Greymouth.—The Greymouth coalfield is admirably placed for the transmission of coal both by sea and land. It is only about eight miles by rail from Greymouth, where a good harbour is in course of construction; and the proposed East and West Coast Railway terminates in the middle of the field. At present some little inconvenience is experienced in getting the coal across the Grey by a horse-bridge taking one truck only at a time; but another bridge is in contemplation, and ultimately, I have no doubt, there will be a railway on both sides of the river. The thickness of the coal-seams at present worked at the Grey is from 8ft. to 16ft.

Blackball.—The Blackball coalfield is practically an extension of the Greymouth one. The coal is the same quality and the seams of much the same thickness. There are no mines on this field yet, but arrangements are now being made to open one.

Reefton.—There is a seam in one of the Reefton mines 21ft. thick; but the usual thickness is from 6ft. to 11ft. The mines are accessible, and easily worked.

Westport.—Although so far apart, the Westport mines are really in the same field as the Reefton ones. The Westport mines are not so favourably situated as those at the Grey, being on the top of a plateau 1,800ft. above the sea. The coal is lowered down steep inclines by wire ropes—a somewhat cumbersome and expensive arrangement. Doubtless a more convenient method of getting the coal to the sea-level will be adopted when the mines are further developed. A locomotive railway will possibly be got to some of the mines. The Koranui mine is working in a seam 7ft. to 10ft. thick, and the Banbury mine is one of 16ft.

There is practically no outlet for the Westport coal except by sea. The distance to Nelson and Picton—156 and 188 miles respectively—will always be a barrier to its transmission by rail; but there will be great facility for shipping at Westport when the harbour is finished.

Mokihinui.—The Mokihinui mines are situated at the northern end of the great field that runs obliquely across the country from Reefton. They have not yet been fully developed, but one mine has been opened out on a 4ft. seam. So far as facility of working is concerned the mine is favourably situated on a low level near the sea; but, as already stated, there is at present a difficulty in getting the coal to a market.

Upper Buller.—The coalfield in the Upper Buller is a comparatively recent discovery—at any rate, as regards its extent. The first official notice of it is in memoranda submitted to the Railway Extension Commission of 1883 by Dr. Hector, who had a special survey made for the Commission—a detailed report and plan by Mr. Cox is given. They show that an extensive area of coal-bearing formation exists in a favourable position for working and distributing coal. Dr. Hector says, "The great advantage that will follow the opening-up of coal and other mineral deposits at the summit-level

of such a line is very obvious, as the heavy freights would be downhill in all directions, whether to Canterbury, Cook Strait, or the West Coast."

The extent of the coal-beds in the Upper Buller field has not, of course, been ascertained; but several outcrops of high-class bituminous coal have been discovered. There is a seam at Glenroy 2ft. thick, three seams near Murchison 3ft., 4ft., and 6ft. thick respectively, and one or two near Lake Rotoroa, thickness unknown. The analysis of the coal from the three first-mentioned of these seams has shown it to be quite equal to that from the Greymouth and Westport mines. The distance along the proposed railways from the middle of the Upper Buller coalfield to important centres is as follows: Westport 55, Nelson 90, Blenheim 104, and Picton 122 miles.

Karamea Watershed.—Beyond the fact that it yields good bituminous coal, and that the country is very inaccessible, there is very little known about the patch of coal-formation on the watershed between the Mokihinui, Karamea, and Wangapeka Rivers.

Kanieri.—The Kanieri coalfield is the smallest in the list, but the coal is bituminous and of excellent quality. The great drawback is that the seam is quite vertical, which makes it difficult to work. Experts are, however, of opinion that it will yet be found lying flat. The field is easy of access, and the seam runs from 2ft. to 8ft. thick.

Paparoa Range.—The coal-formation between the Paparoa Range and the sea is the largest in area of any on the West Coast; but none of the coal has been worked, and the country is not in the direct line of settlement. As a coalfield, therefore, it has not received much attention, and our information regarding it is somewhat meagre. Practically, all that we know is that coal of various qualities is dispersed at different levels all over a very wide area.

Upper Motueka.—The last coalfield in the list is the large one in the Motueka watershed, between Mount Owen and the Baton River. It is situated high up among the ranges, in a somewhat inaccessible situation, and far out of the main line of communication. Beyond the fact that there is a wide extent of country producing good bituminous coal, our information on the subject is not very complete. When the time comes for opening out the field it will be best done by a railway running up the Motueka Valley.

Prospects of Coal Industries.—It is quite unnecessary to consider the question of the permanency of the West Coast coalfields; it is admitted on all sides. What we want to consider is how best to dispose of our enormous supplies. The following table shows the demand and supply of coal for the whole of New Zealand during the past seven years:—

	Demand.			Supply.	
	Consumption within the Colony.	Exported.	Total Demand.	Raised in the Colony.	Imported.
	Tons.	Tons.	Tons.	Tons.	Tons.
1879	382,099	7,195	389,294	231,218	158,076
1880	416,200	7,021	423,221	299,923	123,298
1881	460,598	6,626	467,224	337,262	129,962
1882	503,609	4,245	507,854	378,272	129,582
1883	538,132	7,172	545,304	421,764	123,540
1884	622,921	6,354	629,275	480,831	148,444
1885	638,894	2,371	641,265	511,063	130,202

As shown by the table, the coal-mines of New Zealand depend almost entirely on the home consumption, which has hitherto been more than sufficient to absorb the supply. It is evident, however, that the home market is not sufficient to cause anything like a proper development of the industry, no matter how rapidly the colony may progress, or how much local manufactures are extended. Furthermore, the nature of our trade with New South Wales enables the imported coal to compete with the native product in all the larger centres. The New Zealand steamers have less cargo offering from Sydney than New Zealand; consequently they can carry coal at very low freight.

All these circumstances point to the necessity for finding a market for the New Zealand coal outside the colony. I believe that the only real difficulty in the way is the West Coast harbours, and that a large export trade will spring up so soon as vessels of large draught can come in. For gas purposes the Greymouth coal is worth about 2s. 6d. per ton more than Newcastle; and this opens the door to all the colonies that have no coal of their own. With improved means of transport, I see no reason why New Zealand coal should not compete all round, and for all purposes, with the coal from New South Wales. The amount of coal imported into Victoria, South Australia, and Tasmania during 1884 was over 600,000 tons; and these are not the only markets open to the New Zeal and coal if it can only be supplied cheap enough. Including the colonies just mentioned, it is estimated that the demand for coal in the southern seas and other places commanded by New Zealand is over 4,000,000 tons per annum, of which Newcastle only supplies about 1,700,000, the remainder being obtained from England. This shows that the possibilities of the coal industries on the West Coast are very great.

Other Minerals.

As already stated, a great variety of minerals have been found in greater or less quantities all the way down the West Coast, from Cook Strait to Otago. Nelson possesses a wonderful assortment. So also does Reefton and the Paringa district. The latter is, however, outside the area immediately affected by the railway.

Iron.—The only places within the area where iron-ore has been found are Dun Mountain, Riwaka, Baton River, and Reefton. But just outside the area, at Mount Peel, and further north, at Parapara, there are immense deposits of hematite, which ultimately will be of great value. Again, south of the area, in the Paringa district, there are three or four places in which iron-ores occur. Iron-sand has been found near Hokitika, and in the Motueka, Wairau, and Buller Valleys. Except in the case of the hematite deposits, which have been surveyed, we have no definite information with reference to the iron-ores in the country accommodated by the proposed railways.

Copper.—Copper has been found at the Dun Mountains, Roding River, and other places in Nelson, and again near Reefton, and on the Hokitika and Wanganui Rivers. Copper-mines have been in operation for some time at Roding River, and smelting-works have recently been built. There is every prospect of the industry being a success.

Antimony.—Antimony is worked on a somewhat extensive scale outside the area affected by the railways in Endeavour Inlet, and considerable deposits of the ore have been found within the area near Reefton, Brunnerton, and Barrytown.

Lead.—Lead has been found at Wangapeka, Roding River, Cannibal Gorge, Reefton, Mount Rangitoto, and in the Grey Valley. Workable lodes are believed to exist.

Zinc and Tin.—Zinc-ores have been found at Reefton and Mount Rangitoto, and tin at Reefton, Kanieri, and the Browning River, all in small quantities.

Building Stone.—A hard sandstone suitable for building is found in the Waimakariri Gorge, on the East and West Coast Railway, and again, associated with limestone, in the Grey Valley. The Buller Valley contains a great variety of good building-stone, from granite down to soft sand- and lime-stone.

As already stated, there is a considerable deposit of soft limestone at Castlehill, on the East and West Coast Railway, the distance from Christchurch being about 64 miles. It is of the same class as the Oamaru stone, but somewhat more compact and less porous. It contains 50 per cent. of carbonate of lime and 30 per cent. of silica. There would, I have no doubt, be a considerable market for the stone in Christchurch; but there will be considerable difficulty in getting it to the railway. It lies seven miles off the line, up the Broken River, and the intervening ground is very rough for either a road or railway; an easier route can, however, be got by going further round.

There is a great variety of excellent building-stone on Fox's River, both sand- and lime-stones. I have never seen finer anywhere. At present they are far from any of the proposed lines, but ultimately they will be utilized.

Marble.—Marbles are found within the area affected by the railways at Mount Arthur, Riwaka Range, and Maruia. Many of them are fine-grained and of good colour. Unfortunately, some of the best are difficult to get at. The deposit on the Maruia is very large: there are two varieties, one blue-veined and the other pure white. The rock seems to be moderately solid, but I cannot say what size of blocks are obtainable; and the same remarks apply to all the other marble deposits: their quality cannot be judged without quarrying into them.

Mineral Springs.—There are six or seven hot springs known on the West Coast, situated on the Maruia, Wanganui, and Waiho Rivers. I do not think the properties of these springs have been fully investigated; but the last-named is already resorted to by invalids. There are several cold mineral springs near Lake Ianthe and at other places on the West Coast.

FUTURE PROSPECTS.

The main object of this report is to give a description of the proposed railways and the resources of the country they traverse. That has now been done; but it is necessary to consider further how far the railways will promote the development of these resources, and how much these resources will contribute to the success of the railways.

East and West Coast Railway.

Traffic Estimates.—Various traffic-estimates have from time to time been made for the East and West Coast Railway. In 1879 the Westland Railway League estimated the revenue at £168,910, and the working expenses at £126,683. Apparently this was considered too high even by others who were equally interested, for an estimate made by the Canterbury Railway League in 1882 gave the revenue at £134,375. In 1882 Mr. O'Connor estimated the revenue at £139,650, and the working expenses at £97,020. The balance—£42,630—gave a return of 2½ per cent. on £1,700,000, the cost of the whole line from Rolleston to Brunnerton as then estimated. In 1883 Mr. Maxwell, on quantities furnished by the East and West Coast Railway Commission, calculated the revenue at £120,000; but he showed no profit whatever, the working expenses being estimated to absorb the whole of the revenue. In a letter to the Commissioners Mr. Maxwell says this is accounted for by the nature of the traffic—that coal, agricultural produce, and live stock, which will constitute the bulk of the traffic on this line, are carried on the New Zealand Railways at unremunerative rates. He, however, expected that the line would pay with increasing traffic, and that when the revenue reached £240,000 the profit would be £75,000. The Commissioners do not expressly endorse these views of the General Manager, but in effect they do so; for their report does not give any estimate of the actual return on the capital—it simply says that full interest cannot be hoped for in less than ten years.

From the above it seems that the whole question of the railway paying is narrowed down to the cost of working. Under ordinary circumstances a revenue of £120,000 would leave £40,000 clear profit: this is equal to nearly 2¾ per cent. on the cost of the line. The railway authorities say that in this case there is nothing left for profit. As I have had no practical experience in the working of the railways I will not venture an opinion on the subject, but will leave the matter at this point, and simply indicate the way in which I think traffic will develop.

So far as quantities are concerned, there is very little difference between the estimates of the Railway Commission and those of the Canterbury League. The Commission takes 70,000 tons of coal, 21,000 tons of general merchandise and agricultural produce, and 15,000,000 superficial feet of timber; the League's figures for these articles are 75,000, 20,000, and 12,000,000 respectively.

In my report of 1879 I also estimated in a general way that the East and West Coast Railway would barely pay working expenses. Viewing the subject "entirely from a professional and commercial point of view," I came to the conclusion that there was little prospect of a direct return from the railway, and that the collateral advantages were not commensurate with the enormous expenditure involved. I shall now consider these conclusions in the light of the conditions at present existing. A period of seven years having elapsed, all the surroundings of the question are, of course, considerably altered, and the prospects of the railway improved.

Improvements in Gradients.—As already noticed, the professional aspect of the case is greatly changed by the result of the detailed surveys made since 1879. Instead of an Alpine railway worked by Fell locomotives or stationary engines, which would carry a small traffic at a high cost, we have now a line that can be worked by ordinary locomotives, equal in carrying capacity to the best railway in the colony. Although the capital cost is somewhat increased, there can be no comparison as to ultimate results. The additional interest to be met is more than balanced by the saving in working expenses.

Traffic Data.—In 1878 the total consumption of Newcastle coal in Canterbury was 53,615 tons, and of seaborne timber of the ordinary market kinds 6,000,000 superficial feet. On this basis I took the coal-traffic on the East and West Coast Railway at 40,000 tons, and the timber at 3,000,000ft.

These figures are, of course, far too low for 1886, but they are also too low for any year since 1880, the demand in Canterbury for these commodities being greatly in excess of what could be anticipated. The following table shows what it has been for the last five years:—

Coal.

	1881.	1882.	1883.	1884.	1885.
	Tons.	Tons.	Tons.	Tons.	Tons.
Landed at Lyttelton	58,194	56,583	66,429	96,523	80,169
Landed at Timaru	9,197	10,952	10,445	8,881	13,265
Totals	67,391	67,535	76,874	105,404	93,434

Timber.

	1881.	1882.	1883.	1884.	1885.
	Sup. Feet.	Sup. Feet.	Sup. Feet.	Sup. Feet.	Sup. Feet.
Landed at Lyttelton	19,675,774	20,941,450	13,496,469	12,013,624	11,917,886
Landed at Timaru	2,439,176	3,222,267	1,869,464	1,922,291	1,769,192
Brought by rail from Southland ...	2,569,900	1,917,900	1,998,700	2,079,700	1,993,100
Totals	24,684,850	26,081,617	17,364,633	16,015,615	15,680,178

In addition to the above the annual consumption of coal in Canterbury includes about 15,000 tons from the local mines at Malvern, and a few hundred tons that find their way from Kaitangata to Timaru. The local bushes also supply 1,500,000 superficial feet of timber and 13,000 tons of firewood.

Passenger-traffic.—The Commission of 1883 estimated the passenger-traffic on the East and West Coast Railway at £10,000; but Mr. Maxwell thought this out of proportion to the goods-traffic, and increased the amount to £20,000. Independently of these considerations, I think that the tourist-traffic will be considerable with such a large population as Christchurch to draw upon.

Agricultural-traffic.—As already indicated, the traffic from agricultural settlement on the heavier bush-lands will be of slow growth if the land is not cleared faster than the timber is required. The highest consumption of timber calculated on will not clear more than 1,000 acres per annum. It is possible, however, that as the population increases it may pay to clear land near the large centres, even though the timber is not all sold. On the alluvial flats south of Hokitika, where the land is good and the bush light, settlement will undoubtedly take place so soon as the country is opened up by roads.

Timber-traffic.—The timber-traffic on the East and West Coast Railway is sure to be large. The line strikes good bush at Lake Brunner, 117 miles from Christchurch; so I have no doubt the greater portion of the Canterbury timber trade will be commanded by Westland. The Southland timber now comes as far north as Ashburton, 300 miles from the forest. At this rate the Westland timber would go as far south as Dunedin: but the Southland timber has the advantage there; consequently the former can only go to the Waitaki, where, as regards carriage, the two supplies meet on equal terms. Another point in favour of the Westland timber industry is the superior character of the bush. In consequence of the large yield, it can be produced at the minimum cost—Mr. Kirk says, not exceeding 4s. per 100ft., and possibly less if the mills could be kept fully employed.

Kauri is largely used in the South for ordinary building purposes. According to Mr. Kirk, the supply of this timber is rapidly giving out. We must therefore depend more on the other pines; and rimu, which is so plentiful in Westland, is the best substitute for kauri.

As for the more durable timbers, totara—the one hitherto most used—is also getting scarce and dear. It must be replaced by birch, by far the most plentiful timber on the West Coast. I have no doubt the greater portion of the sleepers for the Middle Island railways will be of this timber. 100,000 sleepers per annum are taken on the Hurunui–Bluff lines for maintenance, and the requirements for construction during the last five years have averaged about 85,000. The two together make about 4,316,000 superficial feet.

The question of exporting timber from New Zealand bears to some little extent on the prospects of the East and West Coast Railway. I do not think it will pay to send ordinary building-timber to England in competition with the supplies from the Baltic and North America; but it is possible that a small trade in furniture-woods might be established, and there is said to be a large market on the Continent of Europe for cask-staves, for which birch is suitable. A small quantity of timber was exported from Westland to Melbourne when the communication was more direct; but for some years it has entirely ceased. It is probable, however, that the trade will revive when the harbours are made and direct communication resumed.

Taken altogether, it is clear that the timber trade of the West Coast has every prospect of becoming an important industry, and that it will contribute largely to the revenues of the East and West Coast Railway.

Mineral-traffic.—Although gold-mining of one kind or another is bound to be a permanent industry on the West Coast, we cannot anticipate such an expansion as will materially affect the prospects of the railway. Beyond augmenting the general traffic, it will not contribute much to the revenue.

As already indicated, I am clearly of opinion that the main strength of the West Coast lies in its coalfields, and that, directly and indirectly, this is the source from whence the railway-traffic will chiefly come. The direct traffic in coal will, however, be very small when compared with the indirect traffic that must ultimately accrue from the development of the coal industries. The railway will, no doubt, carry all the coal consumed in Canterbury, and possibly supply steamers at Lyttelton. The line ends in the middle of a coalfield, the coal goes direct from the mine into the truck, and thence to the consumers, thereby saving two handlings. This secures the whole of the Canterbury traffic to the railway: but that is all; coal cannot be carried by rail to the large centres further south, nor exported by way of Lyttelton. There is, however, no such limit to the possibilities of the indirect traffic, and anomalous though it may appear this traffic is augmented by the construction of the harbours.

Effect of Harbours.—Hitherto we have all looked on the West Coast harbours as antagonistic to the East and West Coast Railway. I believe this view is not correct—that they are really the complements of each other. Without the harbours the coalfields will never be properly developed; and the development of the coal industries is necessary for the success of the railway. On the other side, the railway is a factor in developing the mines. With a large population on the West Coast mining coal and carrying on an extensive export trade, it is immaterial to the railway whether all that coal is carried or not. The general traffic, which pays better, would increase in proportion to the population.

Summing-up.—To sum up the traffic prospects of the East and West Coast Railway: The Royal Commission in 1883 estimated the receipts at £120,000. Since then there has been a substantial increase in the population of the West Coast through the growth of coal-mining alone. That industry is capable of great expansion, and so also is the timber trade, which carry with them an increase of settlement generally. I think, therefore, that it would be fair to calculate that the railway revenue of the colony would be increased by fully £120,000 by the construction of the East and West Coast Railway. But, for the reason previously given, I am not in a position to say how much of this is profit.

West Coast–Nelson Railway.

There has been no detailed traffic-estimate made for the Nelson–West Coast line since 1868, when the late Mr. Wrigg estimated the balance of receipts over expenditure at about £10,000. It is more difficult to give an idea of the probable traffic on this line than on the one between the two coasts. There will be a considerable through-traffic between Greymouth and Reefton, and between Westport and Reefton; also, a fair amount for intermediate places on the Greymouth–Reefton section: but it is not easy to predict what will be the nature and extent of the traffic on other parts of the line.

Until the coalfields in the Upper Buller are opened out, there will be no mineral-traffic worth mentioning; when this takes place, Blenheim and Nelson will be supplied from these fields; and, under exceptionally favourable conditions for working the mines, coal for export may possibly be sent to Nelson and Picton.

The passenger-traffic on the Nelson–West Coast Railway will be considerable, particularly when the connection is made between Tophouse and Blenheim. This will be the direct route from Wellington to the West Coast. Westport can be reached in thirteen hours, and Greymouth in fourteen hours. The Rotoroa and Rotoiti Lakes and the gorges of the Wairau and Buller will also attract large numbers of sightseers.

RECAPITULATION.

I shall now briefly summarize the leading points of the report and the principal conclusions arrived at.

1. The route adopted for the East and West Coast and Nelson Railway is the best available, and it fits in with the future railway system of the colony.

2. The alignment and levels of the railways are equal to those on the Middle Island main line, and the engineering difficulties are confined to the crossing of the main range and the gorges of the Waimakariri and Buller.

3. After being almost stationary for a long time, the population of the West Coast has begun to increase through the development of the coal industries.

4. There is a considerable extent of arable land on the West Coast; but the principal resources of the country are timber and minerals. Most of the good land is covered with dense forest, so it cannot be settled rapidly.

5. The forests are of great extent and value, and many of them are favourably situated as regards a market for the timber.

6. The West Coast contains a great variety of minerals; but gold and coal are the only ones as yet found in quantity and worked.

7. Alluvial gold-digging will last for many years, but there is no prospect of new fields. Quartz mining is a permanent industry, capable of considerable extension.

8. The coalfields on the West Coast are of very great extent, and yield first-class coal, and the coal-mining industry is capable of enormous expansion.

9. The East and West Coast Railway will probably yield a revenue of £120,000; but the net return cannot be estimated.

Conclusion.

In making this report I have endeavoured to give a full description of the proposed railways and the country affected by them, and to show the bearing that the resources of the country have on the prospects of the lines, estimating the future by the past and present. I regret that the report is of unusual length: my excuse is the importance of the subject.

Four maps, a list of papers referring to the railways, and a table of distances are hereto appended.

I have, &c.,
W. N. Blair,
Assistant Engineer-in-Chief.

APPENDIX A.

FORMER PAPERS.

Date.	From	To	Subject.	Reference.
31 Mar., 1868	Henry Wrigg ..	His Honor the Superintendent, Nelson	Report on proposed railway from Nelson to Cobden, with branch to Westport	Nelson Provincial Government *Gazette* of 23 April, 1868.
5 July, 1873	T. Calcutt ..	Hon. Minister for Public Works	Report on lands proposed to be set aside for railway from Foxhill to Greymouth	Parliamentary paper, 1873, E.–8.
Not dated ..	O. Curtis and others	Government ..	Memorandum on Mr. Calcutt's report *re* lands for railway from Foxhill to Greymouth	1873, E.–8A.
Not dated ..	O. Curtis and others	Government ..	Memorandum asking Government to continue line from Foxhill to junction of Owen and Buller	1873, E.–8A.
20 April, 1874	Engineer in Chief ..	Hon. Minister for Public Works	Forwarding, with remarks, Mr. Browning's report on survey between Hokitika and Malvern	1874, E.–3. Appendix D.
31 Mar., 1874	J. S. Browning ..	Engineer-in-Chief ..	Report on survey for railway from Hokitika to Malvern *viâ* Browning's Pass	1874, E.–3, Appendix D. Enclosure.
1 Aug., 1874	J. Rochfort ..	Engineer-in-Chief ..	Report on survey for railway Foxhill to Brunnerton	1875, E.–3., Appendix A., Enclosure 2.
1 Aug., 1875	Engineer-in-Chief ..	Hon. Minister for Public Works	Report on Mr. Foy's survey from Canterbury to the West Coast	1875, E.–4.
21 Dec., 1874 6 Mar., 1875	T. M. Foy ..	Engineer-in-Chief ..	Reports on surveys *viâ* Hope Saddle, Amuri Pass, and Hurunui routes	1875, E.–4., Enclosures 1 and 2.
5 Aug., 1875	Engineer-in-Chief ..	Hon. Minister for Public Works	Report on Mr. Foy's surveys to connect Nelson and Picton with North Canterbury	1875, E.–4., No. 2.
30 June, 1875	T. M. Foy ..	Engineer-in-Chief ..	Report on surveys to connect Nelson and Picton with North Canterbury	1875, E.–4., Enclosure to No. 2.
28 April, 1875	Premier (London)..	Colonial Secretary..	Proposals, first by Mr. Handyside, afterwards by company, for constructing railway Nelson to Cobden	1875, E.–4A.
22 June, 1876	T. M. Foy ..	Engineer-in-Chief ..	Report on survey from Amberley to Blenheim *viâ* Hurunui and Kaikoura, also branch to West Coast	1876, E.–1., Appendix A., Enclosure 1.
22 June. 1876	T. M. Foy ..	Engineer-in-Chief ..	Report on survey from Blenheim to Nelson *viâ* Rai Valley	1876, E.–1., Appendix A., Enclosure 2.
1 July, 1878	Engineer-in-Charge, Middle Island	Hon. Minister for Public Works	Report on surveys, East and West Coast and Northern Railways	1878, E.–1. Appendix E.
22 Jan., 1877 24 Oct., 1877 26 July, 1878	T. M. Foy ..	District Engineer, Hokitika	Report on surveys for routes of railway lines in northern districts of the Middle Island	1878, E.–8 and E.–8A.
21 June, 1879	Engineer-in-Charge, Middle Island	Hon. Minister for Public Works	Report on proposed railways in the northern districts of the Middle Island	1879, E.–1., Appendix K.
28 Dec., 1880	G. Thornton and J. R. Browne	Promoters East and West Coast Railway	Report on Ada Pass route ..	*Lyttelton Times*, 8th January, 1881.
12 April, 1881 13 May, 1881	C. Y. O'Connor ..	Engineer-in-Charge Middle Island	Report on inspection of Ada Pass route and generally *re* route *viâ* Reefton	*Lyttelton Times*, 26th May, 1881.
30 May, 1881	G. Thornton ..	Promoters East and West Coast Railway	Reply to Mr. O'Connor's report..	*Lyttelton Times*, 31st May, 1881.
1881	Engineer-in-Charge, Middle Island	Hon. Minister for Public Works	Annual Report. *Re* urveys *viâ* Whitcombe and Mathias Passes, &c.	1881, D.–1., page 44.
16 Jan., 1882	Canterbury Chamber of Commerce Commissioners	Promoters East and West Coast Railway	Report on prospects of line ..	1883, D.–2A., page 22.
1882	Royal Commission —J. Fulton, D. Pollen, J. T. Thomson	Report	Middle Island railway extension	1883, D.–2.
30 Dec., 1882	C. Y. O'Connor ..	Royal Commissioners	Report on proposed lines Christchurch to Picton and Christchurch to Nelson, with branches to West Coast	1883, D.–2., Appendix No. 2.
1883	Royal Commission —W. R. Russell, J. G. Wilson, C. N. Bell	Report	Report on proposed lines between Canterbury and West Coast	1883, D.–2A.
1883	Canterbury and Westland Members	Government ..	Correspondence *re* proposed surveys East and West Coast Railways	1883, D.–2B.
12 Sept., 1884	Assistant Engineer-in-Chief	Engineer-in-Chief ..	Report on various routes after detailed surveys finished	1884, Sess. II., D.–5.

APPENDIX B.

TABLE OF DISTANCES.

East and West Coast Railway.

—		Christchurch.	Rolleston.	Springfield.	Cass.	Arthur's Pass.	Upper Teremakau.	Lake Brunner.	Stillwater.	Brunnerton.	Greymouth.	Lower Teremakau.	Kapitea.	Hokitika.
Christchurch ..	Miles	..	14	43¾	71¼	88¾	108½	116¾	137	138½	145½	155	159	169½
Rolleston ..	"	14	..	29¾	57¼	74¾	94½	102¾	123	124½	131½	141	145	155½
Springfield ..	"	43¾	29¾	..	27½	45	64¾	73	93½	94½	101¾	111½	115½	125½
Cass	"	71¼	57¼	27½	..	17½	37¼	45½	65¾	67	74¼	83¼	87¾	98
Arthur's Pass ..	"	88¾	74¾	45	17½	..	19¾	28	48½	49½	56¾	66¼	70¼	80½
Upper Teremakau..	"	108½	94½	64¾	37¼	19¾	..	8¼	28½	29¾	37	46½	50½	60¾
Lake Brunner ..	"	116¾	102¾	73	45½	28	8¼	..	20½	21½	28¾	38¼	42¼	52½
Stillwater ..	"	137	123	93½	65¾	48¼	28½	20¼	..	1¼	8½	18	22	32½
Brunnerton ..	"	138½	124½	94½	67	49½	29¾	21½	1¼	..	7¼	16¾	20¾	31
Greymouth ..	"	145½	131½	101¾	74¼	56¾	37	28¾	8½	7¼	..	9½	13½	23¾
Lower Teremakau	"	155	141	111¼	83¾	66½	46½	38¼	18	16¾	9½	..	4	14¼
Kapitea	"	159	145	115¼	87¾	70¼	50½	42¼	22	20¾	13½	4	..	10¼
Hokitika	"	169½	155½	125½	98	80½	60¾	52½	32½	31	23¾	14¼	10¼	..

West Coast–Nelson Railway.

Hokitika to Nelson.

—		Hokitika.	Greymouth.	Brunnerton.	Stillwater.	Ahaura.	Reefton.	Inangahua.	Lyell.	Murchison.	Tophouse.	Belgrove.	Nelson.	Wellington.
Hokitika ..	Miles	..	23¾	31	32¼	43½	68¾	89½	96¼	115¾	157½	184½	206½	322½
Greymouth ..	"	23¾	..	7¼	8½	19¾	45	65¾	72½	92	133¾	160¾	182¾	298¾
Brunnerton ..	"	31	7¼	..	1¼	12½	37¾	58½	65¼	84¾	126½	153½	175½	291½
Stillwater ..	"	32¼	8½	1¼	..	11¼	36½	57¼	64	83½	125¼	152½	174¼	290¼
Ahaura	"	43½	19¾	12½	11¼	..	25¼	46	52¾	72¼	114	141	163	279
Reefton	"	68¾	45	37¾	36½	25¼	..	20¾	27½	47	88¾	115¾	137¾	253¾
Inangahua ..	"	89½	65¾	58½	57¼	46	20¾	..	6¾	26¼	68	95	117	233
Lyell	"	96¼	72½	65¼	64	52¾	27½	6¾	..	19½	61¼	88¼	110¼	226¼
Murchison ..	"	115¾	92	84¾	83½	72¼	47	26¼	19½	..	41¾	68¾	90¾	206¾
Tophouse ..	"	157½	133¾	126½	125¼	114	88¾	68	61¼	41¾	..	27	49	165
Belgrove ..	"	184½	160¾	153½	152¼	141	115¾	95	88¼	68¾	27	..	22	138
Nelson	"	206½	182¾	175½	174¼	163	137¾	117	110¼	90¾	49	22	..	116
Wellington ..	"	322½	298¾	291½	290¼	279	253¾	233	226¼	206¾	165	138	116	..

West Coast–Nelson Railway.

Hokitika to Picton.

—		Hokitika.	Greymouth.	Brunnerton.	Stillwater.	Ahaura.	Reefton.	Inangahua.	Lyell.	Murchison.	Tophouse.	Blenheim.	Picton.	Wellington.
Hokitika ..	Miles	..	23¾	31	32¼	43½	68¾	89½	96¼	115¾	157½	220½	238½	296½
Greymouth ..	"	23¾	..	7¼	8½	19¾	45	65¾	72½	92	133¾	196¾	214¾	272¾
Brunnerton ..	"	31	7¼	..	1¼	12½	37¾	58½	65¼	84¾	126½	165¾	207½	265½
Stillwater ..	"	32¼	8½	1¼	..	11¼	36½	57¼	64	83½	125¼	188¼	206¼	264¼
Ahaura	"	43½	19¾	12½	11¼	..	25¼	46	52¾	72¼	114	177	195	253
Reefton	"	68¾	45	37¾	36½	25¼	..	20¾	27½	47	88¾	151¾	169¾	227¾
Inangahua ..	"	89½	65¾	58½	57¼	46	20¾	..	6¾	26¼	68	131	149	207
Lyell	"	96¼	72½	65¼	64	52¾	27½	6¾	..	19½	61¼	124	142	200
Murchison ..	"	115¾	92	84¾	83½	72¼	47	26¼	19½	..	41¾	104¾	122¾	180¾
Tophouse ..	"	157½	133¾	126½	125¼	114	88¾	68	61¼	41¾	..	63	81	139
Blenheim ..	"	220½	196¾	165¾	188¼	177	151¾	131	124	104¾	63	..	18	76
Picton	"	238½	214¾	207½	206¼	195	169¾	149	142	122¾	81	18	..	58
Wellington ..	"	296½	272¾	265½	264¼	253	227¾	207	200	180¾	139	76	58	..

West Coast–Nelson Railway.

Westport to Nelson and Picton.

—		To Nelson.								To Picton.		
		Westport.	Inangahua.	Lyell.	Murchison.	Tophouse.	Belgrove.	Nelson.	Wellington.	Blenheim.	Picton.	Wellington.
Westport ..	.. Miles	..	27¾	34½	54¼	95¾	122¾	144¾	260¾	158¾	176¾	234¾
Inangahua	.. „	27¾	..	6¾	26½	68	95	117	233	131	149	207
Lyell ..	.. „	34½	6¾	..	19¾	61¼	88¼	110¼	226¼	124¼	142¼	200¼
Murchison	.. „	54¼	26½	19¾	..	41½	68½	90½	206½	104½	122½	180½
Tophouse	.. „	95¾	68	61¼	41½	..	27	49	165	63	81	139
Belgrove ..	.. „	122¾	95	88¼	68½	27	..	22	138	..	..	..
Nelson ..	.. „	144¾	117	110¼	90½	49	22	..	116	..	..	..
Wellington	.. „	260¾	233	226¼	206½	165	138	116	..	..	..	..
		To Picton.										
Blenheim	.. „	158¾	131	124¼	104½	63	..	..	..	..	18	76
Picton ..	.. „	176¾	149	142¼	122½	81	..	..	..	18	..	58
Wellington	.. „	234¾	207	200¼	180½	139	..	..	..	76	58	..

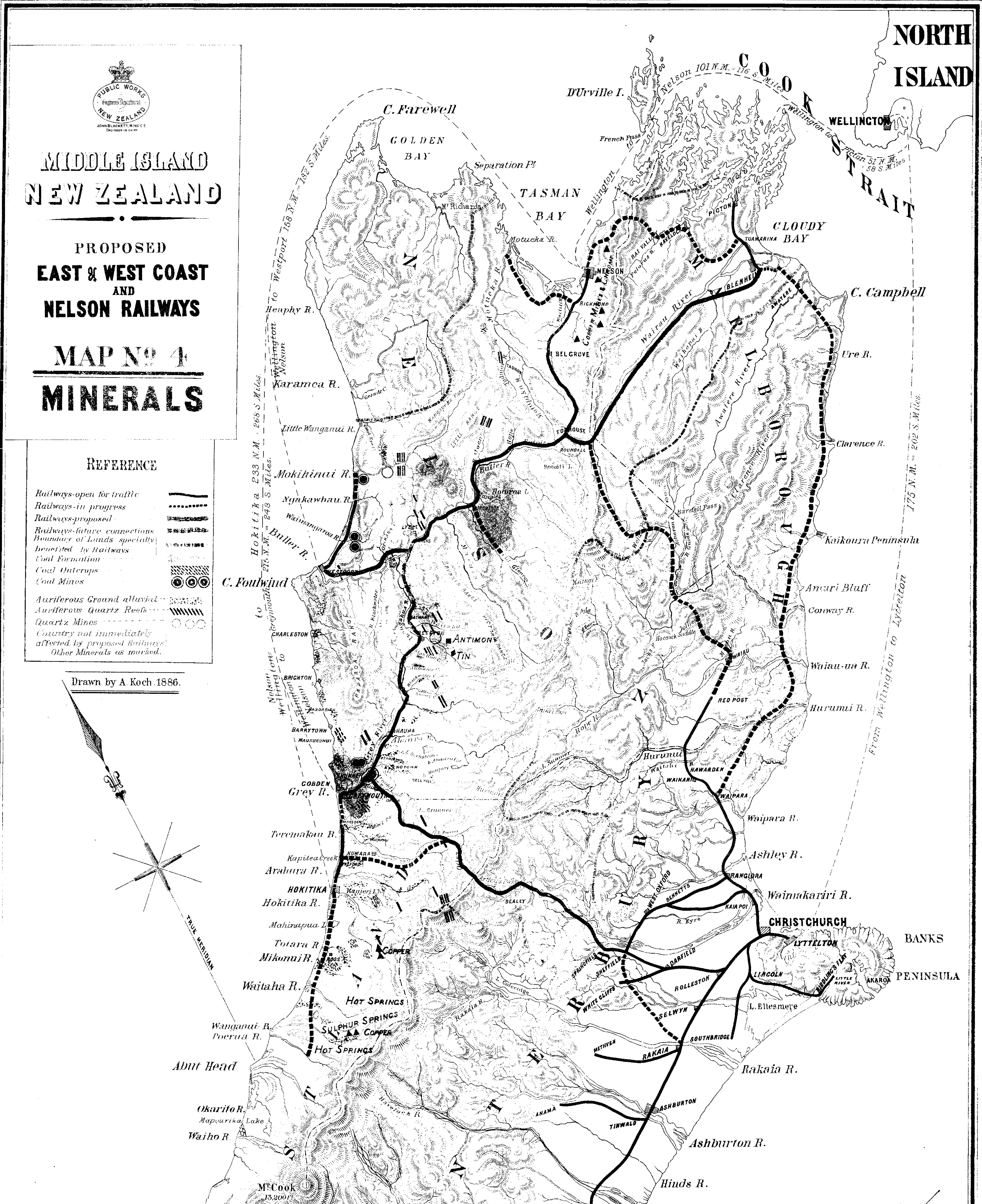
Various Lines and Combinations.

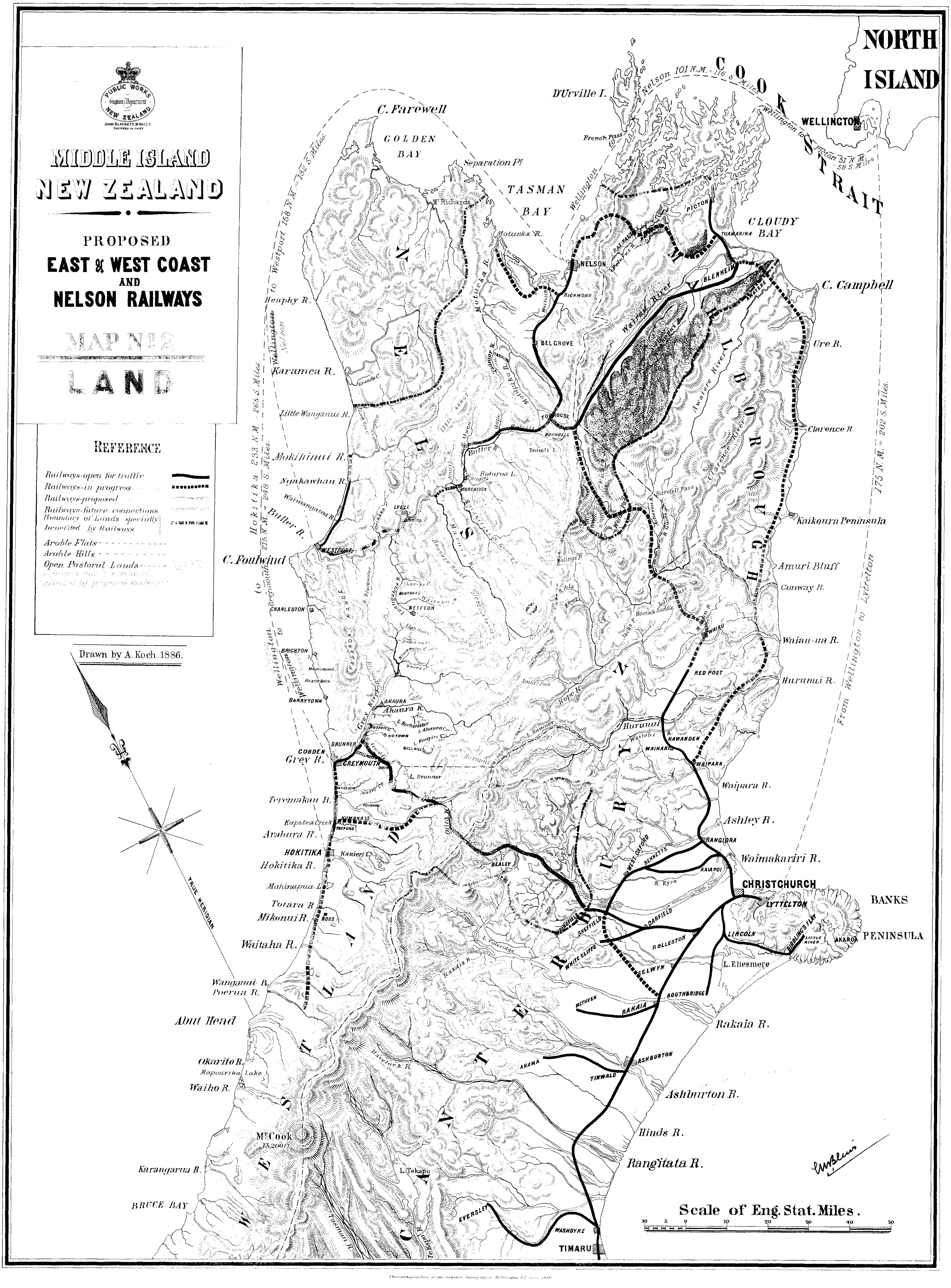
Christchurch to Hokitika, by Teremakau Junction	145¾	miles.
„ Greymouth, „	149	„
„ Reefton direct, by Stillwater Junction	173½	„
„ Westport direct, „	222	„
„ Nelson, by Stillwater and Tophouse	311¼	„
„ „ by inland route	213	„
„ „ by coast route and Tophouse	299	„
„ „ „ Rai Valley	259	„
„ Picton, by Stillwater and Tophouse	343¼	„
„ „ by inland route	245	„
„ „ by coast route	205	„
Rakaia to Greymouth direct	132½	„
„ by Rolleston	152¾	„
Hokitika to Picton, by Nelson and Rai Valley	286½	„
„ Westport	117¼	„
Greymouth to Westport	93½	„
Reefton to Westport	48½	„
Nelson to Picton, by Tophouse	130	„
„ by Rai Valley and Tuamarina	80	„

Distances by Sea.

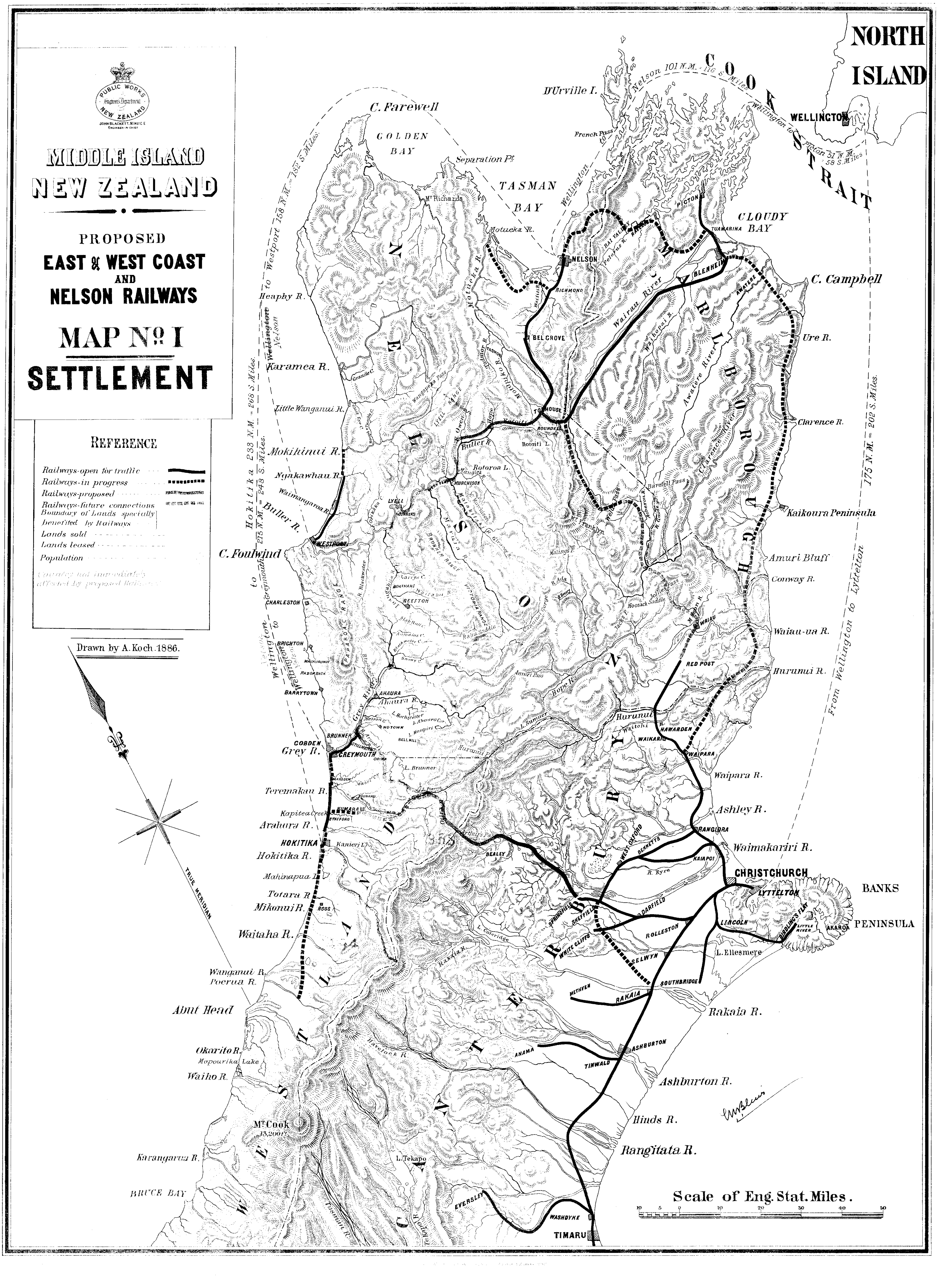
	Nautical Miles.	Statute Miles.
Lyttelton to Wellington	175	202
Picton to Wellington	51	58
Picton to Nelson	85	98
Wellington to Nelson direct	101	116
Nelson to Westport	158	182
Westport to Greymouth	63	72

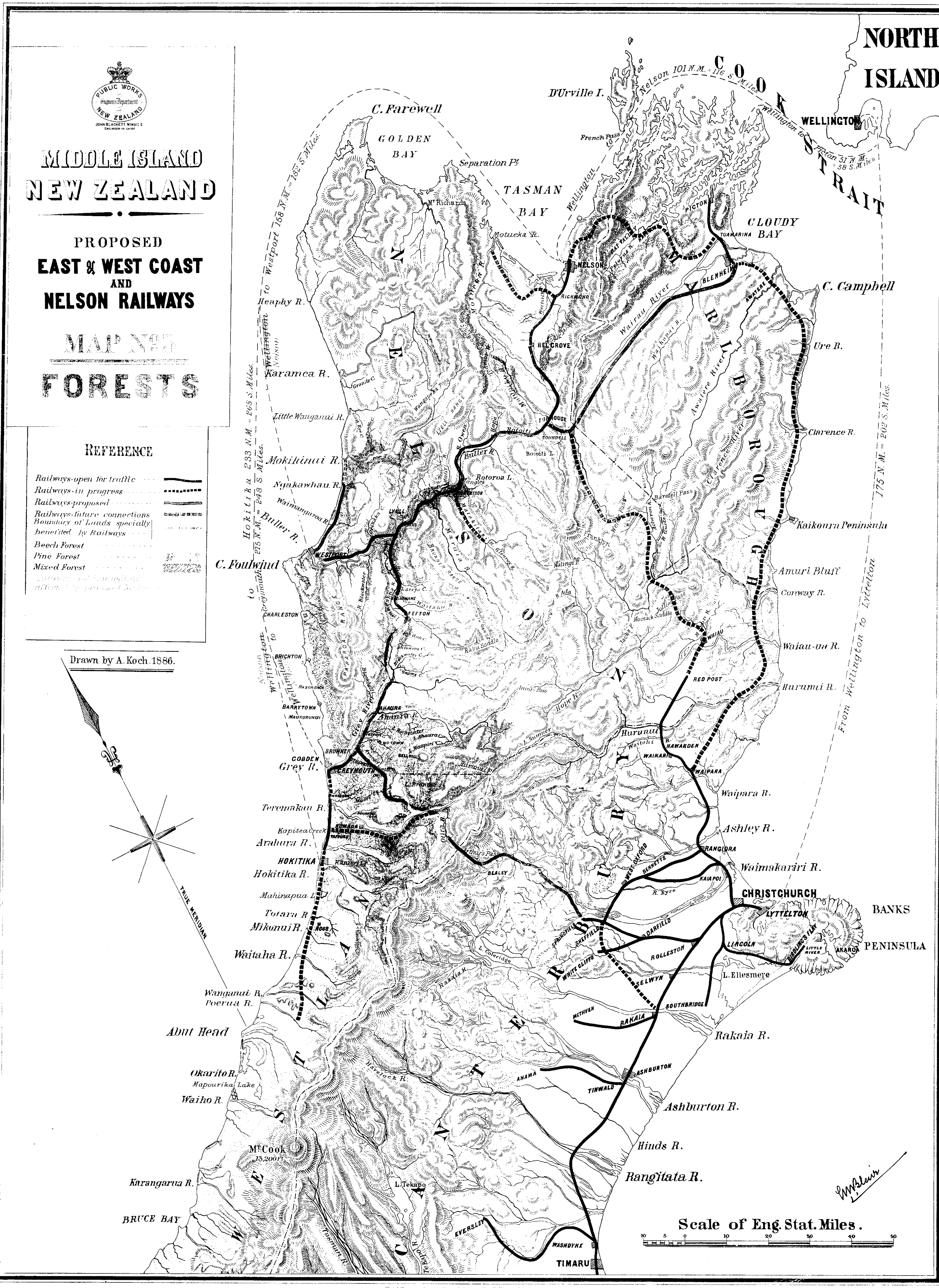
By Authority: George Didsbury, Government Printer, Wellington.—1886.


PUBLIC WORKS
Engineers Department
NEW ZEALAND
JOHN BLACKETT, M.INST.C.E.
ENGINEER IN CHIEF
MIDDLE ISLAND
NEW ZEALAND
PROPOSED
EAST & WEST COAST
AND
NELSON RAILWAYS
MAP No 4
MINERALS
REFERENCE
Railways-open for traffic
Railways-in progress
Railways-proposed
Railways-future connections
Boundary of Lands specially benefited by Railways
Coal Formation
Coal Outcrops
Coal Mines
Auriferous Ground alluvial
Auriferous Quartz Reefs
Quartz Mines
Country not immediately affected by proposed Railways
Other Minerals as marked.
Drawn by A. Koch. 1886.
TRUE MERIDIAN
NORTH ISLAND
WELLINGTON
COOK STRAIT
D'Urville I.
French Pass
Nelson 101 N.M. = 116 S. Miles
Wellington to Picton 51 N.M. = 58 S. Miles
C. Farewell
GOLDEN BAY
Separation Pt
TASMAN BAY
Motueka R.
NELSON
RICHMOND
BELGROVE
PICTON
CLOUDY BAY
TUAMARINA
BLENHEIM
C. Campbell
Wairau River
Awatere River
Ure R.
Clarence R.
Kaikoura Peninsula
Amuri Bluff
Conway R.
Waiau-ua R.
Hurunui R.
Waipara R.
Ashley R.
Waimakariri R.
CHRISTCHURCH
LYTTELTON
BANKS
PENINSULA
AKAROA
LINCOLN
ROLLESTON
SELWYN
SOUTHBRIDGE
L. Ellesmere
DARFIELD
SHEFFIELD
SPRINGFIELD
WHITE CLIFFS
KAIAPOI
RANGIORA
WAIPARA
WAIKARI
HAWARDEN
RED POST
WAIAU
Hurunui
Barefell Pass
Hossack Saddle
Jollies Pass
METHVEN
RAKAIA
Rakaia R.
ASHBURTON
TINWALD
ANAMA
Ashburton R.
Hinds R.
Rangitata R.
EVERSLEY
WASHDYKE
TIMARU
L. Tekapo
Wellington to Westport 158 N.M. = 182 S. Miles
Wellington to Hokitika 233 N.M. = 268 S. Miles
175 N.M. = 202 S. Miles
From Wellington to Lyttelton
Heaphy R.
Karamea R.
Little Wanganui R.
Mokihinui R.
Ngakawhau R.
Waimangaroa R.
Buller R.
WESTPORT
C. Foulwind
CHARLESTON
BRIGHTON
BARRYTOWN
COBDEN
GREYMOUTH
Grey R.
Teremakau R.
KUMARA
Kapitea Creek
Arahura R.
HOKITIKA
Hokitika R.
Mahinapua L.
Totara R.
Mikonui R.
Waitaha R.
Wanganui R.
Poerua R.
Abut Head
Okarito R.
Mapourika Lake
Waiho R.
Mt Cook
13,200 ft
Karangarua R.
BRUCE BAY
Buller R.
Rotoiti L.
Rotoroa L.
TOPHOUSE
ANTIMONY
TIN
COPPER
HOT SPRINGS
SULPHUR SPRINGS
BEALEY
AHAURA
Mt Richards
NELSON
MARLBOROUGH
CANTERBURY
WESTLAND
Scale of Eng. Stat. Miles.
10 5 0 10 20 30 40 50



Photolithographed at the General Survey Office, Wellington N.Z. June 1886


PUBLIC WORKS
Engineer's Department
NEW ZEALAND
JOHN BLACKETT, M.INST.C.E.
ENGINEER-IN-CHIEF
MIDDLE ISLAND
NEW ZEALAND
PROPOSED
EAST & WEST COAST
AND
NELSON RAILWAYS
MAP No. I
SETTLEMENT
REFERENCE
Railways-open for traffic
Railways-in progress
Railways-proposed
Railways-future connections
Boundary of Lands specially benefited by Railways
Lands sold
Lands leased
Population
Drawn by A. Koch. 1886.
TRUE MERIDIAN
NORTH ISLAND
WELLINGTON
COOK STRAIT
Nelson 101 N.M. = 116 S. Miles
Wellington to Picton 51 N.M. = 58 S. Miles
Wellington to Westport 158 N.M. = 182 S. Miles
Hokitika 233 N.M. = 268 S. Miles
275 N.M. = 248 S. Miles
175 N.M. = 202 S. Miles
From Wellington to Lyttelton
C. Farewell
GOLDEN BAY
Separation Pt
TASMAN BAY
D'Urville I.
French Pass
CLOUDY BAY
C. Campbell
NELSON
RICHMOND
BEL GROVE
PICTON
TUAMARINA
BLENHEIM
Wairau River
Awatere River
Clarence River
Ure R.
Clarence R.
Kaikoura Peninsula
Amuri Bluff
Conway R.
Waiau-ua R.
Hurunui R.
Heaphy R.
Karamea R.
Little Wanganui R.
Mokihinui R.
Ngakawhau R.
Waimangaroa R.
Buller R.
C. Foulwind
WESTPORT
CHARLESTON
BRIGHTON
BARRYTOWN
REEFTON
LYELL
MURCHISON
TOPHOUSE
ROUNDELL
Rotoiti L.
Rotoroa L.
AHAURA
BRUNNER
COBDEN
Grey R.
GREYMOUTH
Teremakau R.
KUMARA
Kapitea Creek
Arahura R.
HOKITIKA
Hokitika R.
Mahinapua L.
Totara R.
Mikonui R.
ROSS
Waitaha R.
Wanganui R.
Poerua R.
Abut Head
Okarito R.
Mapourika Lake
Waiho R.
Mt. Cook 13,200 ft.
Karangarua R.
BRUCE BAY
L. Tekapo
RED POST
WAIAU
HAWARDEN
WAIKARI
WAIPARA
Waipara R.
Ashley R.
RANGIORA
Waimakariri R.
KAIAPOI
WEST OXFORD
BENNETTS
BEALEY
Arthurs Pass
CHRISTCHURCH
LYTTELTON
BANKS PENINSULA
AKAROA
LITTLE RIVER
BIRDLING'S FLAT
LINCOLN
L. Ellesmere
SPRINGFIELD
SHEFFIELD
DARFIELD
ROLLESTON
WHITE CLIFFS
SELWYN
SOUTHBRIDGE
METHVEN
RAKAIA
Rakaia R.
ANAMA
ASHBURTON
TINWALD
Ashburton R.
Hinds R.
Rangitata R.
EVERSLEY
WASHDYKE
TIMARU
NELSON
MARLBOROUGH
CANTERBURY
WESTLAND
Scale of Eng. Stat. Miles.
10 5 0 10 20 30 40 50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ENGINEER-IN-CHIEF
MIDDLE ISLAND
NEW ZEALAND
PROPOSED
EAST & WEST COAST
AND
NELSON RAILWAYS
MAP No. 5
FORESTS
REFERENCE
Railways-open for traffic
Railways-in progress
Railways-proposed
Railways-future connections
Boundary of Lands specially benefited by Railways
Beech Forest
Pine Forest
Mixed Forest
Drawn by A. Koch. 1886.
TRUE MERIDIAN
NORTH ISLAND
WELLINGTON
COOK STRAIT
Nelson 101 N.M. = 116 S. Miles
Wellington to Picton 51 N.M. = 58 S. Miles
Wellington to Westport 158 N.M. = 182 S. Miles
Wellington to Hokitika 233 N.M. = 268 S. Miles
Wellington to Greymouth 215 N.M. = 248 S. Miles
175 N.M. = 202 S. Miles
From Wellington to Lyttelton
D'Urville I.
French Pass
C. Farewell
GOLDEN BAY
Separation Pt.
TASMAN BAY
Motueka R.
Mt. Richards
NELSON
RICHMOND
BELGROVE
PICTON
TUAMARINA
CLOUDY BAY
BLENHEIM
C. Campbell
Wairau River
Waihopai R.
Awatere River
AWATERE
Ure R.
Clarence R.
Clarence River
Kaikoura Peninsula
Amuri Bluff
Conway R.
Waiau-ua R.
Hurunui R.
Heaphy R.
Karamea R.
Granite C.
Wangapeka Pass
LYELL RANGE
Little Wanganui R.
Mokihinui R.
Ngakawhau R.
Waimangaroa R.
Buller R.
LYELL
WESTPORT
C. Foulwind
CHARLESTON
BRIGHTON
RAZORBACK
BARRYTOWN
MAUKURUNUI
PAPAROA RANGE
Grey River
AHAURA
Ahaura R.
BRUNNER
COBDEN
Grey R.
GREYMOUTH
L. Brunner
Teremakau R.
Kapitea Creek
KUMARA
Arahura R.
HOKITIKA
Hokitika R.
Kaniere L.
Mahinapua L.
Totara R.
Mikonui R.
ROSS
Waitaha R.
Wanganui R.
Poerua R.
Abut Head
Okarito R.
Mapourika Lake
Waiho R.
Mt. Cook 13,200 ft.
Karangarua R.
BRUCE BAY
TOPHOUSE
Rotoiti
ROUNDELL
Rotoiti L.
Rotoroa L.
Tangles
Buller R.
R. Owen
Hope
Maruia R.
BRUNNER RANGE
Larrys C.
REEFTON
Inangahua R.
Rahu Saddle
Mt. Franklyn
Barefell Pass
Acheron R.
Malings P.
R. Ada
Jollies Pass
Hoosack Saddle
Jacks P.
WAIAU
RED POST
Amuri Pass
Hope R.
L. Sumner
Hurunui
Waitohi R.
HAWARDEN
WAIKARI
WAIPARA
Waipara R.
Ashley R.
RANGIORA
Otira R.
Arthurs Pass
BEALEY
WEST OXFORD
BENNETTS
KAIAPOI
Waimakariri R.
R. Eyre
CHRISTCHURCH
LYTTELTON
BANKS PENINSULA
LINCOLN
BIRDLINGS FLAT
LITTLE RIVER
AKAROA
SPRINGFIELD
SHEFFIELD
DARFIELD
WHITE CLIFFS
ROLLESTON
L. Coleridge
SELWYN
L. Ellesmere
SOUTHBRIDGE
METHVEN
RAKAIA
Rakaia R.
ANAMA
ASHBURTON
TINWALD
Ashburton R.
Havelock R.
Hinds R.
Rangitata R.
L. Tekapo
Tekapo R.
EVERSLEY
WASHDYKE
TIMARU
NELSON
MARLBOROUGH
WESTLAND
CANTERBURY
Scale of Eng. Stat. Miles.
10 5 0 10 20 30 40 50