1894.
NEW ZEALAND.

NORTH ISLAND MAIN TRUNK RAILWAY

(REPORT OF MR. LESLIE REYNOLDS, C.E., ON TRIAL SURVEY OF DEVIATIONS ON THE MARTON-ELTHAM SECTION).

Laid on the Table, by Permission of the House, by the Hon. Mr. Seddon.

Public Works Office, Wellington, 29th August, 1894.

North Island Main Trunk Railway.

Memorandum for Hon. Minister for Public Works.

SURVEYS having been made by Mr. Leslie H. Reynolds, C.E., with the object of ascertaining the nature and extent of works that would be required for improving the grades and curves on portions of the constructed main line of railway between Marton and the junction of the surveyed Ngaire line at Eltham Station, on the Wellington–Waitara Railway, I have the honour to forward Mr. Reynolds's report herewith for your information.

WILLIAM H. HALES,
Engineer-in-Chief.

Public Works Department, Wellington, 27th August, 1894.

North Island Main Trunk Railway.—Trial Survey, Deviations Marton–Eltham Section.

Memorandum for the Engineer-in-Chief.

I HAVE the honour to submit to you the following report upon the recent survey and investigations in connection with proposed deviations on the Marton–Eltham Section, North Island Main Trunk Railway, with a view to easing the heavy grades and sharp curves which exist between Turakina and Waitotara:—

The key-plan, Drawing No. 1, accompanying this report indicates the general direction and extent of proposed deviations, and also gives a comparison of the grades and curves of proposed deviations with those of the present line.

There are in connection with this report five sets of plans, comprising longitudinal sections and alignment of the deviations of the Wangaehu and Brunswick divisions of the survey (twenty sheets), and plans of cross-sections for these two divisions (twenty-one sheets), also the key-plan above referred to.

In this report I deal with the survey in four sections—namely, the "Wangaehu Section," extending from Matarawa to Turakina; the "Brunswick Section," from Aramoho to the bridge crossing Goat Valley Stream; the "Kai-Iwi–Okehu Section"; and the "Nukumaru–Waitotara Section." Complete trial-survey plans and estimates have been made of the Wangaehu and Brunswick Sections. Of the other two sections I was only enabled to make a reconnaissance survey, and therefore report on them approximately.

WANGAEHU SECTION.

The proposed deviation leaves the present line at Matarawa Station, and traverses the Matarawa Valley for a distance of 3 miles 45 chains, with ascending gradients—in the first mile of from 1 in 110 to 1 in 440, and in the remaining 2 miles 45 chains of from 1 in 95 to 1 in 100. From this point there is a level stretch of 26 chains, and then the grade descends towards the Wangaehu River at the rate of 1 in 70, 1 in 95, and 1 in 550, the length of the 1-in-70 grade being 2 miles 54 chains. On leaving the Wangaehu River the proposed line proceeds across the Wangaehu Flat for 27 chains on the level; then rises over the Ruatangata Ridge at the rate of 1 in 75 for 77 chains, and 1 in 80 for 80 chains. The line would then descend to Turakina with gradients of 1 in 70 for a distance of 63 chains, 1 in 75 for 72 chains, and 1 in 88 for 16 chains, the last 12

chains into Turakina Station being level. The following table will show the various grades and lengths in this section :—

Gradients.	Ascending.	Descending.	Totals.
	M. ch.	M. ch.	M. ch.
1 in 70	...	3 37	3 37
1 in 75	0 77	0 71	1 68
1 in 80	1 0	...	1 0
1 in 88	...	0 16	0 16
1 in 95	1 45	0 30	1 75
1 in 100	1 0	...	1 0
1 in 110	0 45	...	0 45
1 in 165	0 25	..	0 25
1 in 176	0 8	..	0 8
1 in 440	0 10	...	0 10
1 in 550	...	0 25	0 25
Level	0 miles 79 chains		0 79
Total length	... .		11 68

The general direction of this deviation is inland of the present line, the greatest deviation being at Wangaehu, where the distance from the existing line would be about one mile and three-quarters. This would necessitate the removal of the Wangaehu Station this distance inland.

Baker's Crossing, a flag-station of little importance, lying between Fordell and Wangaehu, would be eliminated by this deviation.

At Fordell, the proposed site for new station is by road, about one mile and a half from existing one. This site, lying in the Matarawa Valley, is about 240ft. below the top of the ridge upon which Fordell is situated, and the traffic from Fordell, and inland by the main traffic road (No. 2 line), would have to descend to the valley by the somewhat steep branch road which now exists. On the other hand, however, this site would suit admirably the inland traffic which now reaches Fordell by this branch road.

The construction of this section, owing to the rough, broken country, will of necessity be somewhat expensive, tunnelling and bridging entering largely into the cost. Of the former item there are 86 chains, the tunnel piercing the Wangaehu Hill being 69 chains in length, and the other two, at 9 miles 74 chains and 10 miles 45 chains, being 12 chains and 5 chains respectively. The combined length of the bridges is 720ft.; that crossing the Wangaehu River being 400ft. and that for the Turakina River 320ft. Both of these bridges are estimated for 80ft. iron spans with cylinder piers.

The length of the Wangaehu deviation between Matarawa and Turakina is by traverse 11 miles 68 chains, and the distance by the present route is 14 miles 28 chains; thus the proposed deviation on this section would shorten the distance between these two stations by two miles and a half.

The estimated cost of this deviation is £128,150, at the rate of £10,972 per mile.

Brunswick Section.

The survey of this section diverges from the present line about three-quarters of a mile from Aramoho, and again joins it at the bridge crossing Goat Valley Stream.

The gradient ascends from the point of divergence near Aramoho for a distance of 4 miles 63 chains at the rate of 1 in 70, then falls away to the junction at the bridge crossing Goat Valley Stream with a gradient of 1 in 90 to 1 in 146.

The following table shows the lengths of the various grades :—

Gradients.	Ascending.	Descending.	Totals.
	M. ch.	M. ch.	M. ch.
1 in 70	4 63	...	4 63
1 in 90	...	0 75	0 75
1 in 120	...	1 0	1 0
1 in 143	...	0 30	0 30
1 in 146	...	0 20	0 20
Level	0 miles 22 chains		0 22
Total length	... ...		7 50

The general direction of the deviation is inland of the present line; its greatest detour is about one mile and a half from existing line, and occurs almost abreast of Brunswick Station (flag-station). The proposed site for new station is about three-quarters of a mile from the present station, but situated in the Goat Valley would be much better adapted to the requirements of inland traffic, and would be close to the Western Road, which taps the interior.

The earthworks in connection with the construction of this section for the first three miles, and for about 20 chains on the Goat Valley side of the tunnel, will be heavy, the second mile being abnormally so, as the line here crosses the mouths of the smaller gullies running into the main gully, necessitating heavy embankments.

In this mile it also crosses the main gully, and would require an embankment of 60ft. in height for about 4 chains. At this point the main road (Brunswick line) would have to be deviated for a distance of about 30 chains, and its level raised on the siding to give convenient height for a through bridge.

The tunnel piercing the Brunswick hill occurs at 4 miles 16 chains, and is 28 chains in length. There are several small bridges crossing creeks, but none of any magnitude.

The total length of this deviation is by traverse 7 miles 50 chains, including easing to 1-in-70 grade of about 30 chains of existing line near Aramoho. The distance by the present line between the same points is 5 miles 18 chains, the deviation thus giving an excess mileage of 2 miles 32 chains.

I surveyed a 1-in-50 grade for this deviation, the mileage of which is only about 50 chains in excess of the existing line, but, finding that the tunnelling and earthworks would be as heavy as for the 1-in-70 grade, I discarded consideration of it for this report. This line was pegged, and complete survey of it is contained in the field-books.

The estimated cost of the Brunswick deviation is £64,980, at the rate of £8,664 per mile.

For a distance of about 15 chains after crossing the bridge, Goat Valley Stream, the present gradient is 1 in 44. The bridge, however, has lately been raised 3ft., and this additional height would, in conjunction with a small amount of filling, reduce this gradient to below 1 in 50.

Kai-Iwi–Okehu Section.

When recalled from the field to prepare this report I was engaged upon the survey of this section, and had got as far with it as to decide upon the direction of a route and to obtain approximately the gradient and length of deviation necessary. No levels were run over this section, but the approximate heights were obtained from reconnaissance observations, and I am enabled from the data obtained to give an approximate idea of the length, gradients, and cost of construction between Kai-Iwi and Okehu.

The length of this deviation would be about 4¾ miles, and the distance by the present line is practically the same. The general direction is inland of the present line. The existing line after leaving Kai-Iwi strikes seaward and rises to the summit of the ridge dividing the Okehu and Kai-Iwi Valley with a gradient of 1 in 40 for 71 chains, and then falls away at the rate of 1 in 38 for 67 chains; from this point it again rises to the Okehu Station with an inclination of 1 in 46½ for 1 mile 20 chains.

The proposed deviation, instead of mounting the summit, would, after leaving Kai-Iwi with an ascending gradient of 1 in 70, pierce the ridge by a tunnel of 30 chains in length, and fall away to the Okehu Valley at the rate of 1 in 75, and rise again to the Okehu Station with an inclination of 1 in 70.

In order to obtain a 1-in-70 grade from Kai-Iwi it would be necessary to take off from the present line some 40 chains before reaching Kai-Iwi, and keep further up the Kai-Iwi Valley than at present. This would necessitate the removal of the Kai-Iwi Station for a distance of about 30 chains inland from its present site, and also from the traffic road, but access to the station would be very easy.

The removal of the station for the distance quoted would place it on a higher level, from 10ft. to 15ft. above the present site, and the extra chainage gained would permit of a 1-in-70 grade up to and piercing the ridge.

With a 1-in-50 gradient the deviation could start from the present station, but the length of tunnel would be the same as that required for the easier grade. There would, however, be a saving in construction up to the tunnel of about £7,000, as the present line could be utilised as far as the bridge crossing the Kai-Iwi Stream, whereas the line for 1-in-70 grade would diverge, as above stated, some 40 chains before reaching Kai-Iwi Station.

The cost of this deviation, with a maximum gradient of 1 in 70, approximately estimated from reconnaissance survey, would be about £50,000, at the rate of £10,526 per mile.

Nukumaru–Waitotara Section.

With regard to this section I have very little data to go upon, as I was only able to make a cursory examination of the locality.

The length of this deviation would probably be about three miles and a half, being an excess mileage of about 40 chains over the existing line.

I should judge that the best point for deviating from the existing line would be in the vicinity of Nukumaru Lake, and, after holding to the low ground to the left for about half a mile, the route should strike off to the right, cutting under the present line, and enter a bushed gully which falls away towards Waitotara Flat. It should keep on the right sidling of the gully, and, upon reaching the mouth, make a detour up the Waitotara Valley, still keeping to the sidling for about half a mile. From this point it could pass on to a long low ridge or hill which runs far out into the Waitotara Flat, terminating about three quarters of a mile inland of the present Waitotara Station; thence its location to the present station would be easy.

It would be necessary either to move the present bridge crossing the Waitotara River about half a mile up stream, or to construct a new one at this point. It is very probable that the present station would require extensive alterations, or removal for a few chains, to meet the requirements of the deviation.

I conclude that the cost of this deviation would be about £28,000, at the rate of £8,000 per mile. This estimate is based upon a 1-in-60 gradient, as I am doubtful if an easier grade could be obtained without necessitating much heavier construction.

General Remarks.

The maximum gradient of the present line between Bonny Glen and Turakina is 1 in 50, but there are two or three sharp curves near Turakina which I understand cause considerable inconvenience to heavy traffic. I examined this portion of the line, and consider that, with a small amount of work, a great improvement could be effected, or, if thought desirable, the mile containing the 1-in-50 gradient, and these sharp curves, could be reduced to 1 in 60 or 65 at a cost of about £3,500.

In surveying these deviations I have endeavoured to keep as near to the existing line as possible, and, with the exception of Fordell, no station of any importance would be affected by the deviations.

With regard to the curves throughout the length of deviations surveyed, they are generally easy, nothing sharper than 10 chains radii being introduced.

The country generally is subject to land-slips, particularly in the vicinity of Fordell, but as a rule they are not deep, being the surface of from 1ft. to 3ft. in depth overlying the marine clays or papa rock. I have especially studied to keep clear of treacherous ground, and do not consider that any danger from this source need be apprehended.

Traces of ballast appear along the route, but not in large quantities. It might, however, be plentiful although not showing on the surface.

The total length of the deviations considered in the four sections between Turakina and Waitotara is practically 27¾ miles, giving an excess mileage of, say, 30 chains over the present line. These deviations would reduce all gradients steeper than 1 in 50 over the entire distance between Marton and Eltham (according to Public Works records of the line as constructed).

The prices upon which these estimates are based are supplied by the Public Works Department, and the total cost of proposed deviations compiled from the estimates herein given is £271,130.

I have, &c.,

Leslie H. Reynolds.

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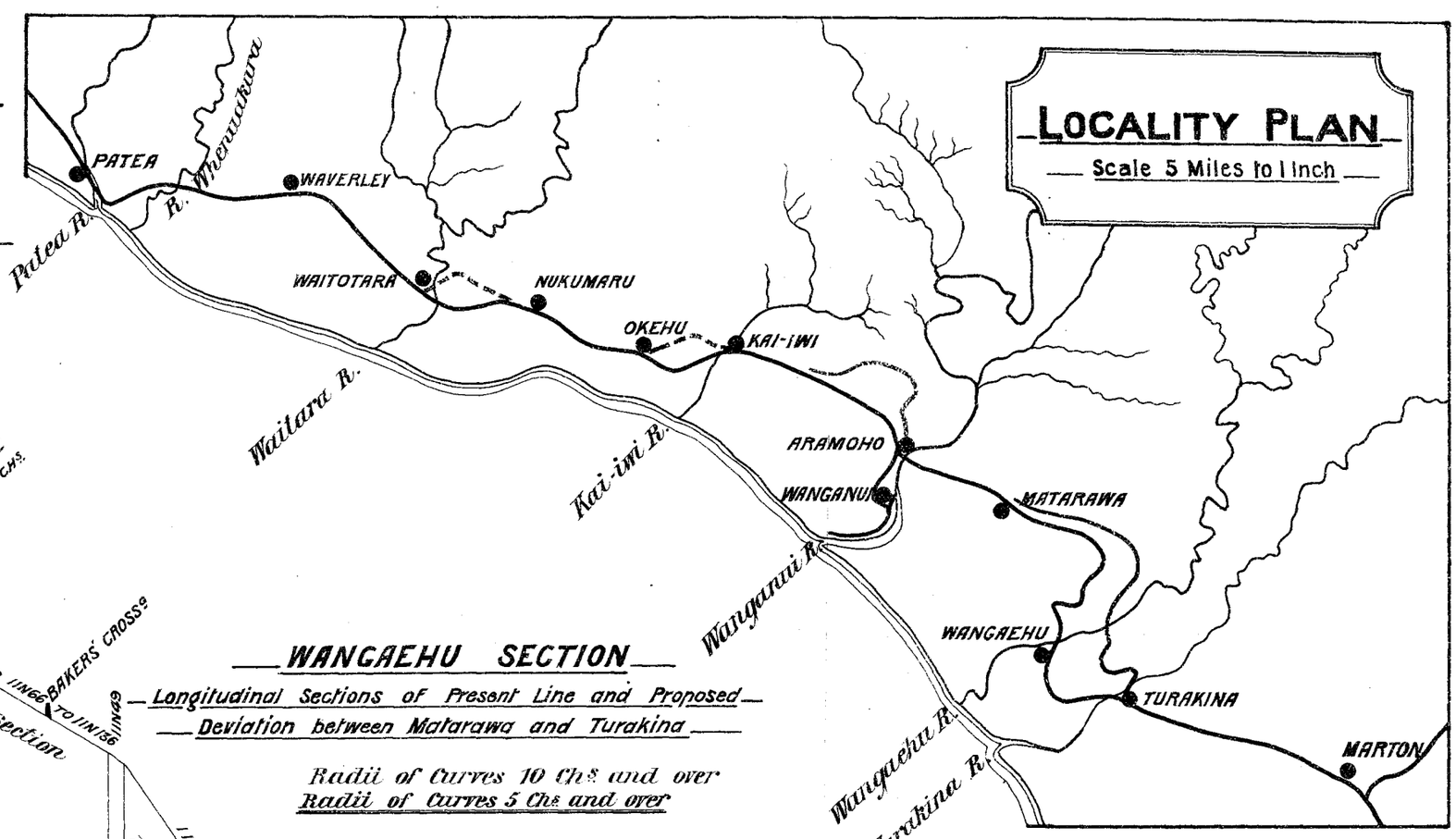
N.I. MAIN TRUNK RLY

MARTON-ELTHAM DEVIATIONS

Plan to accompany Report by Leslie H. Reynolds

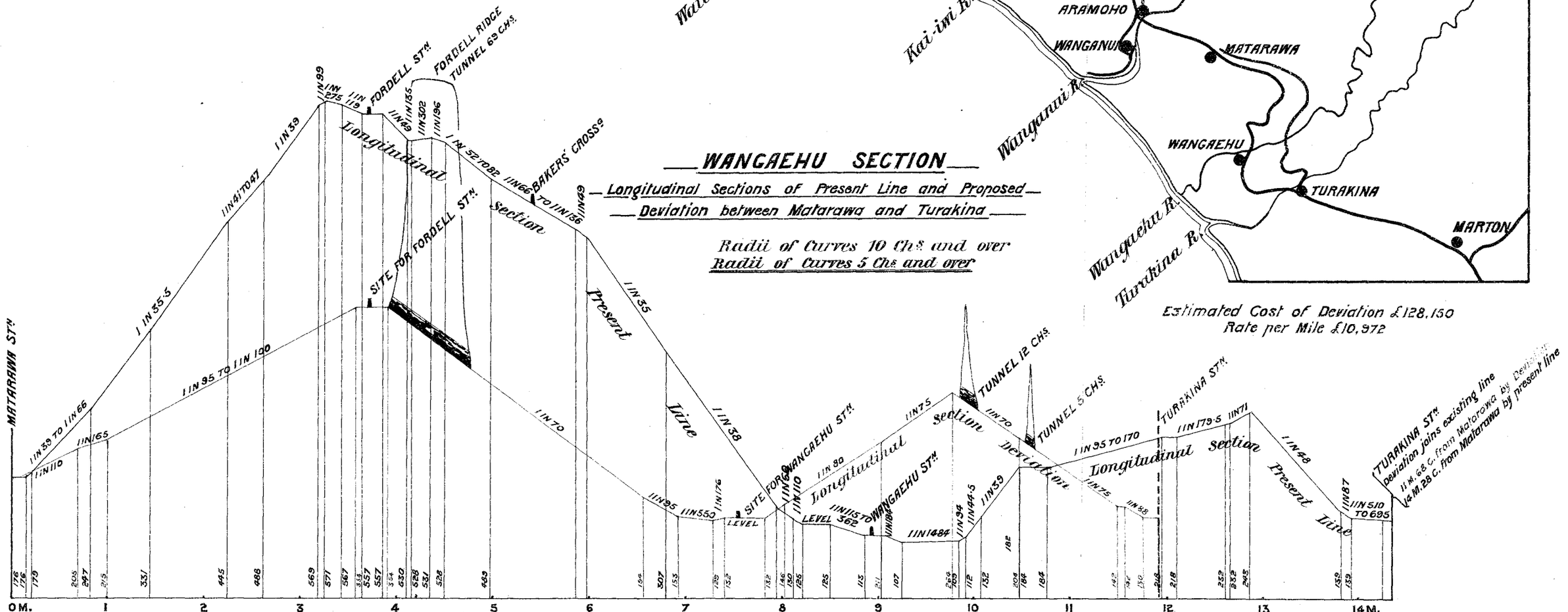
Dated 27th Aug. 1894



WANGAEHU SECTION

Longitudinal Sections of Present Line and Proposed Deviation between Matarawa and Turakina

Radii of Curves 10 Chs and over
Radii of Curves 5 Chs and over

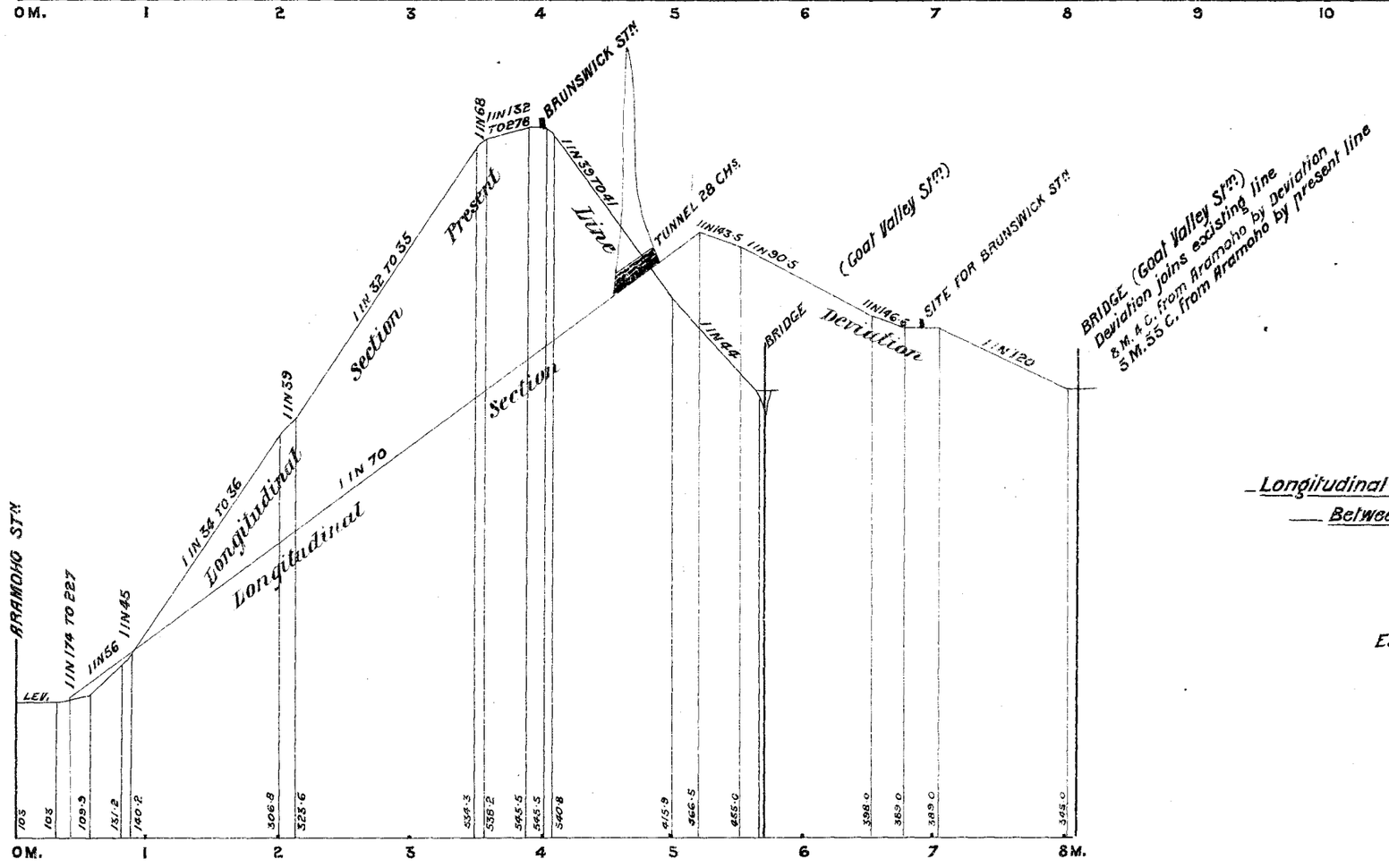


Estimated Cost of Deviation £128,150
Rate per Mile £10,972

BRUNSWICK SECTION

Longitudinal Sections of Present Line and Proposed Deviation Between Aramoho and Bridge, Goat Valley Stream

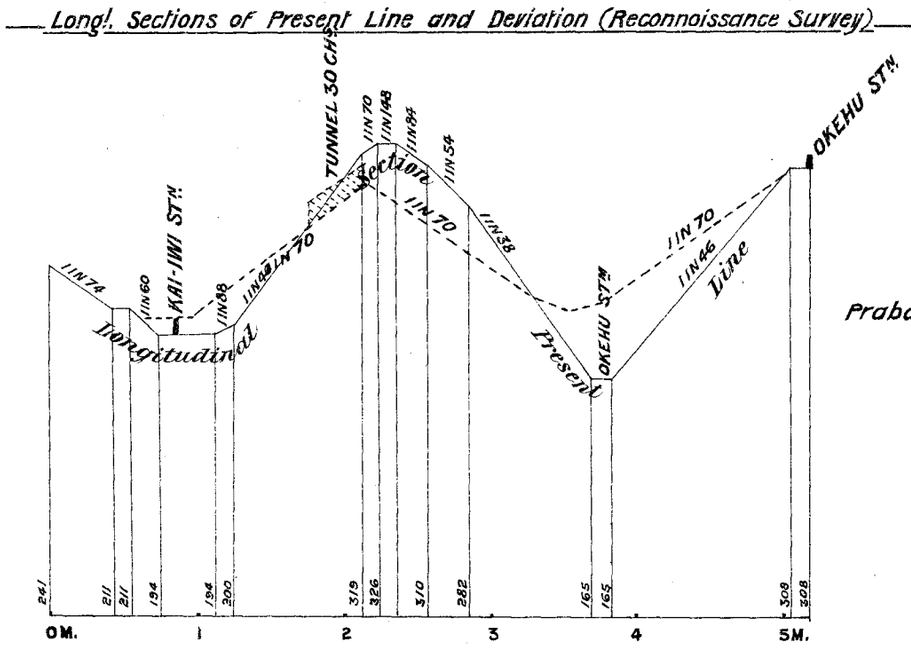
Radii of Curves 10 Chs and over
Radii of Curves 6 Chs and over



Estimated Cost of Deviation £64,980
Rate per Mile £8,664

KAI-IWI OKEHU SECTION

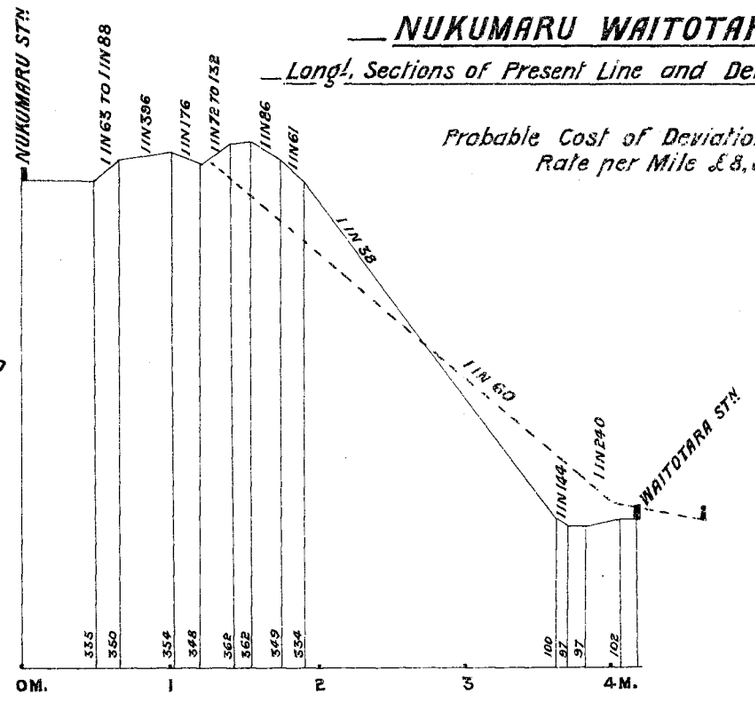
Long!. Sections of Present Line and Deviation (Reconnoissance Survey)



Probable Cost of Deviation £50,000
Rate per Mile £10,526

NUKUMARU WAITOTARA SECTION

Long!. Sections of Present Line and Deviation (Explored)



Probable Cost of Deviation £28,000
Rate per Mile £8,000

Total Estimated Cost of Deviations £271,130

COPY of P.W.D. 17296

Horizontal Scale 1 Mile to 1 Inch
Vertical do. 100 Ft. " " "