

1917.  
NEW ZEALAND.

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# WAIRAU RIVER COMMISSION

(REPORT OF THE); TOGETHER WITH MINUTES OF EVIDENCE

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

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## COMMISSION.

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LIVERPOOL, Governor.

To all to whom these presents shall come, and to Frank O'Brien Loughnan, Esquire, Stipendiary Magistrate, Blenheim; Frederick William Furkert, Esquire, Inspecting Engineer, Public Works Department, Wellington; Charles Rankin Vickerman, Esquire, Civil Engineer, Wellington: Greeting.

WHEREAS certain matters regarding the Lower Wairau and Spring Creek River Boards were before the Court of Appeal in the year one thousand nine hundred and fourteen, such Court holding (*inter alia*) that the proceedings showed that it was highly desirable to have one competent authority constituted for both the Spring Creek and Wairau River Districts in the general interest of the whole: And whereas a resolution was passed at a joint meeting of representatives of the following local bodies on the fifth day of January, one thousand nine hundred and seventeen—namely, Spring Creek River Board, Spring Creek Road Board, Lower Wairau River Board, Pukaka Drainage Board, Wairau Maori Drainage Board, Tuamarina River Board, Picton Road Board, Wairau Harbour Board, Blenheim Borough Council—requesting the appointment of a Commission to inquire into the question of river-conservation in the Marlborough District: And whereas it is considered desirable that an inquiry should be made into the subject-matter of the said resolution:

Now, therefore, I, Arthur William de Brito Savile, Earl of Liverpool, the Governor of the Dominion of New Zealand, in exercise of the powers and authorities conferred upon me by the Commissions of Inquiry Act, 1908, and of all other powers in any wise enabling me in this behalf, and acting by and with the advice and consent of the Executive Council of the said Dominion, do hereby appoint you, the said

FRANK O'BRIEN LOUGHNAN,  
FREDÉRIK WILLIAM FURKERT,  
CHARLES RANKIN VICKERMAN,

to be a Commission under the said Commissions of Inquiry Act, 1908, for the purpose of holding an inquiry and making a report upon the following matters, and the necessity of any legislation relating thereto :—

1. The best method of providing for the control of the Wairau River and its tributaries so as to safeguard the lands affected, and to provide for the effective control and improvement of the rivers and their banks.
2. The desirability of appointing one competent authority to control the whole of the river and its tributaries.
3. The area which should be included in such district if constituted.
4. Whether, in addition to the powers contained in the River Boards Act, 1908, the powers contained in the Land Drainage Act should also be conferred upon the Board of the proposed district, and whether any other powers in addition to those contained in the said Acts should be conferred on such Board.
5. Any other matters which may be brought before you in connection with the question of protection of land from damage by the Wairau River.

And with the like advice and consent I do further appoint you, the said

FRANK O'BRIEN LOUGHNAN,

to be Chairman of the said Commission ; and, further, I do require you to report to me your opinion as to the aforesaid matters within sixty days of the date hereof ; and, lastly, it is hereby declared that these presents are issued under and subject to the Commissions of Inquiry Act, 1908.

Given under the hand of His Excellency the Right Honourable Arthur William de Brito Savile, Earl of Liverpool, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Member of the Royal Victorian Order, Governor and Commander-in-Chief in and over His Majesty's Dominion of New Zealand and its Dependencies ; and issued under the seal of the said Dominion, at the Government House at Wellington, this twenty-fourth day of April, in the year of our Lord one thousand nine hundred and seventeen.

Approved in Council.

J. F. ANDREWS,  
Clerk of the Executive Council.

G. W. RUSSELL,  
Minister of Internal Affairs.

## REPORT.

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To His Excellency the Right Honourable Arthur William de Brito Savile, Earl of Liverpool, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Member of the Royal Victorian Order, Governor and Commander-in-Chief in and over His Majesty's Dominion of New Zealand and its Dependencies.

MAY IT PLEASE YOUR EXCELLENCY,—

Your Warrant dated the 24th April, 1917, appointed us a Commission to inquire into and to report on the following matters:—

1. The best method of providing for the control of the Wairau River and its tributaries so as to safeguard the lands affected and to provide for the effective control and improvement of the rivers and their banks.
2. The desirability of appointing one competent authority to control the whole of the river and its tributaries.
3. The area which should be included in such district if constituted.
4. Whether in addition to the powers contained in the River Boards Act, 1908, the powers contained in the Land Drainage Act should also be conferred upon the Board of the proposed district, and whether any other powers in addition to those contained in the said Acts should be conferred on such Board.
5. Any other matters which may be brought before us in connection with the question of protection of land from damage by the Wairau River.

These matters have received our most careful consideration. We now have the honour to submit to Your Excellency our report thereon.

In pursuance of Your Excellency's instructions we advertised a sitting of this Commission to be held at the Courthouse, Blenheim, at 10.30 a.m. on the 22nd May, 1917.

All the local bodies interested were represented at the sitting—viz., Spring Creek Road Board, Spring Creek River Board, Pukaka River and Drainage Board, Wairau River Board, Picton Road Board, Tuamarina River Board, Wairau Road Board, Lower Wairau River Board, Pelorus Road Board, Wairau Harbour Board, Blenheim Borough Council.

### LOCAL VISITS.

Preliminaries having been arranged, we adjourned the sitting of the Commission to the 28th May, 1917, to enable the Commission to visit the district generally, and particularly the works already carried out for protection from floods.

We spent the next five days in travelling over the district and inspecting the rivers and the protective works in existence, accompanied by representatives of the local bodies interested.

In the course of our examination of the rivers we inspected the Wairau River as far up as Branch River, and thence to the sea; the Waihopai River, the Omaka River, the Opawa River, the Tuamarina River, the Pukaka River and drain, and the Taylor River; the Fairhall, Mill, Doctor's, Spring, and many other creeks; and also the Wairau Harbour Board works, and the Wairau bar with its training-wall, also the various systems of banking.

### WITNESSES.

We again sat on the 28th, 29th, and 30th days of May, 1917, and took the evidence on oath of nineteen witnesses, a copy of whose depositions are forwarded herewith.

## PLANS.

The following plans are enclosed to illustrate the report:—

- A. General plan of the watershed of the Wairau River and its tributaries. (Scale, four miles to the inch.)
- B. General plan of the Wairau and the surrounding country. (Scale, one mile to the inch.)
- C. Plan of part of the Wairau Valley, showing boundaries of the local bodies as at present constituted.
- D. Plan showing the mouth of the Wairau Harbour, and the bar as in May, 1917.
- E. General plan of Cloudy Bay Survey District of 1880, for comparison with B.

## PHYSICAL CHARACTERISTICS.

The Wairau River rises in the Spencer and St. Arnaud Mountains, which attain to an altitude of over 7,000 ft. It has an approximate length of 108 miles, entering the sea in Cloudy Bay. It has a remarkably even fall for the last eighty miles of its course, and an exceptionally straight course until about fifteen miles from the sea. This facilitates the discharge on to the delta-plain of large quantities of shingle, which are brought into the main river by the very numerous tributaries, which have a very steep fall.

On reaching a point about twelve miles from the sea the river forms a delta, geological evidence showing that the position of the mouths of the river has varied from near the Vernon Bluff to White's Bay. At the present time the main body of the river flows down the northern side of the delta, and then takes a course to the south-west under the influence of the accumulation of shingle due to the littoral drift.

That very little water had flowed down the southern side of the delta for many years is shown by the fact that when settlement began, and up to 1860, the ground at present occupied by what is known as the Opawa River was covered with a heavy growth of manuka, scrub, and other vegetation. When the Wairau River was exceptionally high a certain amount of water found its way through this vegetation into what was then the Opawa Creek. This creek was quite small, not wider than a chain, with banks 7 ft. to 8 ft. above water-level. The water was easily crossable on foot at normal times.

The land adjoining the junction of the Tuamarina River with the Wairau, the Lower Valley of Pukaka, certain portions of Fox's Island, and the land to the west of Blenheim were swamps. These swamps acted as regulators in the time of flood, becoming filled with the overflow, and thus lessening the chances of the slightly higher and first-settled lands being inundated.

## HISTORY AND CONDITION OF PRESENT WORKS.

As settlement advanced the scrub was cleared, the first effect of which was to allow more water to escape from the Wairau River, particularly at what is known as the "Opawa breach." Further, the swamps were drained and occupied, and in their efforts to save their properties from flood the settlers began to erect stop-banks, frequently around their individual holdings, and without regard to any system or consideration of allowing the necessary waterway. In addition to the clearing of the scrub, a misguided individual cut a ditch from the Wairau River into the head of the Opawa Creek, and successive floods rushing through this opening quickly enlarged it, forming a channel 20 to 30 chains in width, carrying away many hundreds of acres of good land, and causing disastrous floods.

Realizing the gravity of the situation, the Provincial Government made costly and ineffectual efforts to close the breach, spending over £11,000 on the work. On the failure of these efforts the settlers began to build banks on both sides of the new channel of the Opawa to protect their lands. The continuous increase in the water coming down the Opawa led to destruction of parts of these banks, and the Opawa threatened to leave its channel at various points and flow into Blenheim.

The Lower Wairau River Board (constituted in 1874) decided in 1879 to close the Opawa breach. They constructed works for this purpose, but before their com-

pletion the Spring Creek River Board (constituted about 1874) obtained an injunction restraining them from proceeding with the work. Obeying the injunction, the Lower Wairau River Board ceased work, and the unfinished work had a worse effect than if no work had been done.

In consequence of the injunction the Lower Wairau River Board was compelled to look to stop-banking for protection; and in the course of time extended their stop-banks on the right bank practically from near Renwick to Morgan's Creek, and on the left bank from near the railway-line to Dillon's Point.

The Omaka River, by reason of its small fall and insufficient channel, had been a constant source of trouble to Blenheim and the lands to the west thereof. The Board therefore diverted this stream into the new Opawa channel one mile below Renwick. They further diverted the Taylor River into the old channel of the Omaka, and built stop-banks on each side where necessary to lead the water safely into the Opawa. Either owing to the increasing quantity of water carried by the Opawa or the occurrence of still higher floods, the banked channels proved inadequate, bursting at several points and doing great damage. The Board then constructed Foster's Channel in an endeavour to provide a straight course for the Opawa River from the bend below the Railway Bridge to the Wairau River north of Section 7, Block XVII, Cloudy Bay Survey District. This scheme, which had been begun without adequate investigation, was a failure.

In 1898, on the advice of Mr. Cuthbert, M.I.C.E., what is known as "Rose's overflow" was constructed, and has been of great benefit, carrying off the surplus flood-water.

In the meantime the Spring Creek River Board practically ring-fenced the whole of their area with stop-banks where bounded by the Opawa and Wairau Rivers. The effect of these banks, especially along the Opawa, caused a narrowing of the waterways, and a consequent rising of the flood-levels. To cope with this the rival Boards raised their stop-banks. In locating their banks neither Board was guided by engineering principles or practical considerations, the banks being generally placed too close to the rivers in an attempt to save land, and on the sites of the banks constructed by the original settlers. One of the results of this injudicious placing of stop-banks was frequent breach, involving great unnecessary expense. One Board estimates that it spent nearly £20,000 at one breach. Another Board has at one place constructed four different banks along one particular river-frontage.

The Pukaka Stream has its source in the high country between Tuamarina and White's Bay, and by reason of its abrupt fall is subject to sudden and severe freshets which have no relation to the general flooding of the Wairau. It flows into a swamp, and has no defined channel whereby its waters could reach the Wairau River.

About the year 1878 the Pukaka River and Drainage Board was constituted. This Board constructed works providing a channel to take the waters of the stream by a drain in a fairly direct course from its exit from the hills to the point where the Marakoka Creek enters the Wairau River. Stop-banks were built on each side of the channel, but, unfortunately, were not carried the full length, the consequence being that in time of flood the water, after reaching the end of the completely banked section, spreads over the Native reserve, causing great damage. The Board has not erected any stop-bank on its frontage to the Wairau River. The settlers have built these banks, but without assistance from or supervision by the Board. These banks are, as is the regular practice in the district, built without regard to engineering principles.

Recently this Board, owing to the Peninsula banking and the constriction of the channel causing erosion, has found it necessary to carry out some protective works on the Wairau River at Botham's Bend, three-quarters of a mile below the Railway Bridge.

In 1912 the Tuamarina River Board was constituted in order to protect a rich stretch of country at the junction of the Tuamarina and Wairau Rivers, which, lying very low, was subject to frequent floods. It has constructed a system of stop-banks which are insufficient to deal with large floods, but keep the area clear from medium floods. The great flood of last November topped these banks, bursting them in several places, crossed the railway-line, and found its way along the

foothills, bursting through a sand-ridge at Neal's (Section 45), and thence to the low-lying lands of the Pukaka district and the Maori reserve.

About the time the Tuamarina banks were erected one Smale, occupying the Peninsula, with assistance from the Spring Creek River Board, erected a bank extending from the railway-line along the right bank of the Spring Creek to a point beyond its confluence with the Wairau River. This work had the effect of stopping the flowing of the flood-waters of the Wairau River across the Peninsula, as they had been wont to do, reducing very largely the effective waterway in the river. The combination of this work with the banking of the Tuamarina River Board caused a constriction of the waterway, raising the flood-level and resulting in breaches of the banks in many places, the banking-up of the water in the Spring Creek, and materially increasing the flood damage. Realizing the danger likely to arise from this Peninsula bank, the Spring Creek River Board had in May, 1916, arranged to purchase the whole of the Peninsula in order that they might remove the banks. However, the flood of July arrived before the work was carried out, although a small cut had been made, which probably had some effect in lessening the flood-level. This bank is still in existence, and a source of danger. The small triangle below the Peninsula (Sections 84, 85, and 86) across the Wairau River is not included in any river district.

Banks erected by the owners on this land have materially contributed to the restriction of the waterway and the raising of the flood-level and consequent damage. Although the various Boards have spent large sums in maintaining their respective works, we note that they have allowed the waterways to be choked by the growth of willows, manuka, gorse, broom, and other vegetation, so that in many places, especially in the vicinity of the Peninsula, the waterway has been reduced, and in many places rendered entirely inadequate to carry off the flood-water.

One tributary of the Wairau River which is causing considerable anxiety is the Waihopai River. It is the largest tributary of the Wairau, and brings down a very large body of water, with a very sharp fall, heavily charged with detritus. It is building a fan at its junction with the Wairau River, which is causing it to deviate to the east, threatening to break into Gibson Creek and to flood the low-lying lands about Renwick, and thence to pour its waters into the Opawa.

In 1911 a considerable part of the water had actually found its way into Gibson's Creek. The Lower Wairau River Board, acting on the advice of the Government Engineer, erected several groynes at the confluence, which had entirely cut it off. The lowest and most important of these groynes was in 1916 maliciously cut by some persons unknown. Although this was immediately brought under the notice of the Board, no repairs were attempted until recently, after several minor floods had considerably enlarged the cut. The Board, now thoroughly awakened to the danger, made several unsuccessful attempts to repair the breach. Recently the stonework was very nearly completed, but, owing to failure to take reasonable precautions, a small flood has again undone their work, and the Renwick lands have been flooded. This we regard as a matter of extreme gravity, as at any time the whole river might change its course through this breach and flow via Renwick into the Opawa; and we doubt whether the present channel and bridges could carry the water of this river in flood, even if there were no flood on the other streams—viz., the Fairhall, Omaka, and Taylor.

Shortly after the construction of the groynes at the confluence of the Waihopai River, and avowedly in pursuance of the same object, and with a view to protecting the Board's reserve situate abreast of the breach, the Board erected further groynes in the vicinity of what is usually known as Conder's Bend. These, in addition to the objects stated by the Board, were said by various witnesses to have prevented the inflow of the Wairau into the Opawa to a marked extent, consequently throwing an increased amount of water into the Wairau. We are satisfied that this was the case in flood-time. Before the last of these groynes was completed the Spring Creek River Board sought to enforce the old injunction on the ground that the object of the work was to close the breach. The matter went as far as the Court of Appeal, and the case was dismissed. The Lower Wairau River Board ceased operations pending the decision of the Courts, and have not yet completed the work.

We must draw attention to the characteristic of all shingle rivers, which tend to flow alternately on their right and left banks as the shingle piles up and diverts their courses by gradually raising the whole river-bed. The result is that the Wairau may at any time flow against its left bank, following the old main channel, which must therefore be constructed and regulated to a size adequate to carry the whole of its water. On the other hand, it may swing against the right bank, as it threatens to do in more than one place at present. This tendency may at any time have the effect of forcing the whole of the water into the Opawa, which would result in a serious disaster to Blenheim and the rich lands adjacent. As the Wairau has for long tended to the left side of the delta, the time must be approaching when the direction would be reversed in the absence of works to prevent it.

Another cause of flood to Blenheim and the lands adjacent is the Taylor River and the Fairhall, Mill Creek, and Doctor's Creek, which join the Taylor above Blenheim and run in the old course of the Omaka. The old course of the Omaka was insufficient to carry this water, and even now with the stop-banks which have been erected it is doubtful whether it is large enough. The 1911 flood demonstrated this inadequacy, and the town was flooded 4 ft. deep in Market Square. It is to be noted that the banks have been raised since this flood, but the waterway, especially under the bridges, is insufficient.

A proposal has been made to divert the waters of the Fairhall and Mill Creek into the Opawa at or about the confluence of these streams, a course which we consider necessary, though the most favourable point can only be determined after further investigation.

The Tuamarina River is the only tributary of the Wairau of any importance on the left bank. It flows down the Waitohi Valley, through large swamps which fill up in flood-time, and is the cause of much flooding in its own valley and at its confluence with the Wairau. There is a small system of banks, and further work is required before the flat lands can be cultivated. It flows into the Wairau very close to the point where the channel is badly constricted, and a very small rise in the Wairau causes backing up in the Tuamarina.

#### RAINFALL.

Unfortunately our rainfall records are somewhat inadequate. Around Blenheim the normal rainfall for the last twenty years is about 30 in., for the last four years only 24 in., and as low as 19 in. in one year. Nevertheless the Wairau district has suffered more from floods—notably the floods of July and November, 1916—than for the last eighteen years. This shows how little information as to floods can be obtained from the rainfall records, as floods are due to special storms. Probably the rainfall at the headwaters of the rivers in the ranges is very much greater and more liable to sudden bursts.

#### FLOOD CHARACTERISTICS.

From the information before us, which is anything but ample, it appears that the amount of water carried by this river in proportion to its drainage area is very great. This may be accounted for by the steepness of the sides of the valleys of the river and its tributaries, together with the regular and steep fall, straightness and open nature of the channels, allowing the flood-waters to reach the head of the delta in the shortest possible time. The scantiness of the soil on the hills and the imperviousness of the rocks and the absence of forest are also contributory causes.

The high mountains encircling the watershed carry more or less snow in winter, the melting of which on a sudden change of temperature may cause a flood out of all proportion to the recorded rainfall.

In addition to the floods in the main Wairau caused by north-westerly rains, southerly rains cause floods in the lower tributaries. Floods from the mountains take longer to reach the plain than do those from the lower tributaries, so that in the event of southerly rain following northerly rain, by twelve to eighteen hours the flood-waters reach the plain simultaneously. When this occurs we have what is called an "old-man flood."

## HARBOUR.

In the early days both the Wairau and the Opawa were navigable—the Wairau up to the Ferry Bridge and the Opawa up to Blenheim. The tidal range is 3 ft. 6 in. to 4 ft. 6 in. at the entrance, and its effect is felt at Blenheim in the Opawa River, and at the Peninsula on the Wairau.

Under the influence of the weather the entrance used to shift up and down the Boulderbank within a range of two to three miles, and as a result the bar was often unworkable. When the bar was in its extreme northerly position, the course of the river being longer with no more fall, the floods, especially in the lower reaches, were intensified. The Lower Wairau River Board and those interested in shipping made attempts, more or less successfully, to open a more direct channel through the Boulderbank, sometimes at the very place where the present channel runs.

The Wairau Harbour Board (constituted in 1907), acting on engineering advice, constructed a training-wall to confine the river to a new cut which was subsequently made. This work is not yet completed, but for the past two years has had a beneficial effect on the entrance, which is now workable except in cases of very heavy weather. Witnesses state that the effect of this straight and open channel has been to reduce the flood-level by 4 ft. at Dillon's Point (the confluence of the Wairau and the Opawa) and by a lessening amount to a distance of five miles up the course of both rivers. Probably the beneficial effect is felt higher than this.

The Wairau has been gradually shoaling, and this has been accentuated by the opening of Rose's overflow, and it is no longer navigable to the Ferry Bridge. This may be due to the decreased amount of water flowing down the stream as a result of the diversion of part into the Opawa. The navigable part of the Opawa has been silting up, but it is still open for small boats up to 100 tons. The tidal flow to and from the lagoons lying between the mouth and the Vernon Bluff assists materially in keeping the entrance open, although the fullest effect is not obtained owing to constriction in the connecting channels.

There is a danger of Rose's overflow scouring out so as to absorb all the Opawa water. It would probably then become the navigable channel, but this would cut off access to the existing wharves, upon which a large expenditure has been made by the Harbour Board.

The policy of the Board is to improve the harbour and channels with a view to accommodating vessels up to 200 tons burthen. If this were done a large trade in coal and produce might be developed, to the great advantage of the district. The effect of these harbour improvements would be markedly beneficial to drainage and flood-prevention.

REFERENCE CLAUSE I.—CONTROL AND IMPROVEMENT OF WAIRAU RIVER AND TRIBUTARIES.

Without extensive surveys and the preparation of proper engineering plans it is impossible for us to indicate in detail the works necessary to give effect to the general scheme which we propose to recommend. It is to be noted that none of the local bodies are in possession of plans of the works which they have constructed, many of which works may be incorporated into the new scheme.

We consider that the channel of the Wairau should be improved so as to carry all the waters of the Wairau, as no scheme which could be devised within practical limits would ensure a proportional division of these waters between the Wairau and the Opawa. The tendency referred to before, of the river oscillating from north to south, makes this imperative. More than this, from such data as is obtainable we find that the old Opawa Channel and Rose's overflow channel are not capable of carrying safely more than the high-flood waters of the southern tributaries—viz., the Omaka, Fairhall, Mill Creek, and Taylor River.

Having regard to the necessity of making the Wairau capable of carrying all the water, there remains no valid reason why the breach should remain open. Further, in view of the extreme danger, amounting to disaster, which would ensue if the Wairau changed its course to the Opawa, as it undoubtedly might under the influence of a southerly trend, the breach must be closed at all costs.



The work required presents no difficulties. The steps we recommend to improve the main channel are—

- (a.) The clearing of all vegetation in the beds. The willows are at present causing untold damage. In view of the protection of the banks a fringe of willow may be necessary, but this must be strictly regulated.
- (b.) The extension of the works of the Harbour Board at the mouth, and the making of the same permanent. The channels connecting with the lagoon should be improved so that the full benefit of the tidal scour should be obtained.
- (c.) The enlarging of the channel to a uniform discharging-capacity, which should be capable of carrying the largest flood hitherto observed with a reasonable margin of safety.
- (d.) The work under clause (c) will necessitate the straightening of the river at the Maori Point, at the point immediately above the Ferry Bridge (Sections 84, 85, 86), and at the Peninsula.
- (e.) Portion of the existing stop-banks will require to be moved so as to allow adequate waterway, and others must be strengthened, and some raised. Some flood-gates may be necessary.
- (f.) The removal of the damaged banks at Leslie's breach and its vicinity is necessary.
- (g.) Upon the fixing of the lines of banking, all lands lying outside of them should be acquired, and all obstructions removed therefrom.
- (h.) Protective measures, including groynes, may be required to deal with erosions.

*Further Recommendations.*

- (j.) Protective works of a durable and substantial character should be erected to prevent the waters of the Waihopai from breaking into Gibson's Creek.
- (k.) From the junction of the Omaka with the Opawa to Dillon's Point the Opawa must be treated in a way similar to that recommended for the Wairau, based on the amount of water which it will have to carry.
- (l.) The Fairhall and Mill Creeks should be led into the Opawa at a site to be determined after survey, preferably below their confluence, and the necessary stop-banks and protection provided.
- (m.) The present position of the Taylor seems to us satisfactory, but careful investigation must be made to ascertain whether in all parts its discharging-capacity is adequate, and if found not to be so it must be enlarged and all obstructions removed. If the Omaka and Opawa are relieved as proposed, the dangers of the flood to Blenheim will be obviated.
- (n.) The co-operative drain should be improved so that it may be adequate to deal with all the water which enters it.
- (o.) The Pukaka main drain should be cleared and enlarged if necessary, and the stop-banks continued to its outlet. Necessary flood-gates should be provided.
- (p.) The banking on the sides of the Tuamarina must be made to conform to the amended levels and design of the works on the main river.
- (q.) We found an opinion prevailing among many of the witnesses that an overflow channel from Tuamarina to the sea would provide adequate flood-relief. We cannot recommend this, as from rough levels taken we are satisfied that an adequate channel could not be provided under an expenditure of £50,000. An examination of the ground traversed leads us to believe that the difficulties inherent to the project and the keeping of the sea mouth open are insuperable. Further, we consider it unnecessary, and detrimental to the present harbour-entrance.

There is a possibility of Rose's overflow becoming a serious source of expense. The channel should be protected in such manner as may be deemed advisable from the scouring action of the flood-waters, which may lower the level of its bottom until the whole of the Opawa flows down this channel. If, however, the Harbour

Board wishes at any time to open Rose's overflow to navigation, they should not do so without the consent of the Governor.

REFERENCE CLAUSE 2.—CONTROLLING BODY.

We have no hesitation in recommending that the control of the river should be vested in one central authority.

With regard to the Harbour Board, we consider that it should not be interfered with, except that the central authority should, with the consent of the Governor, have the right to do such works as they consider necessary in and about the rivers under the jurisdiction of the Harbour Board.

The provisions of the Harbours Act, 1908, section 148, will safeguard the interest of all parties.

REFERENCE CLAUSE 3.—AREA OF CENTRAL DISTRICT.

We recommend that the area of the central district shall include the whole of the watershed of the Wairau River and its tributaries.

REFERENCE CLAUSE 4.—POWERS OF CENTRAL AUTHORITY.

We recommend that the powers set out in the Land Drainage Acts should be conferred upon the central authority in addition to the statutory powers of River Boards, and that the election of the Board should be conducted on the system of proportional representation, and that one member of the Board be appointed by the Harbour Board.

Your Excellency's Commissioners are further of opinion that there is no Board now existing which could deal satisfactorily with this matter, nor is it likely that the proposed central authority could be expected to carry out the large and varied works recommended by us. Such works involve complicated surveys, and call for the best engineering skill. Further, works of this kind must be carried out in accordance with a definite programme, which must be controlled by the authority responsible for the design, if economy, safety, and satisfaction are to be secured. We therefore recommend that the design of the scheme and the execution thereof be carried out under the direction of the Minister of Public Works, and on completion the works be handed over to the newly constituted local body. Further, that legislation be introduced providing for the raising of a sum of money sufficient to complete the works and to give effect to our recommendations; that repayment of such sum (less such contribution as you may decide to make from the general funds of the Dominion) be secured by a rate levied on the rateable property of the new district, classified in proportion to the benefit derived from the works.

REFERENCE CLAUSE 5.

In the absence of plans and the necessary information, we are unable to make an estimate of the cost of the proposed works. We are quite satisfied that the cost will compare very favourably with the enormous losses the settlers have suffered in the past, and against a repetition of which they have no adequate protection.

We also recommend that, in view of the necessary delays incident to the preparing of the scheme and the passing of the necessary legislation, the surveys and investigations be pressed on and put in hand without delay.

We are pleased to report that the finances of all the Boards are in a very satisfactory condition, and there will be a very small liability for the new Board to take over.

Further, the large and expensive works now existing have been carried out with but very little assistance from the general funds of the Dominion.

And this our report, which has been unanimously adopted, we have the honour respectfully to submit for the consideration of Your Excellency, in obedience to the Commission addressed to us.

Given at Blenheim, under our hands and seals, this 6th day of June, 1917.

F. O'B. LOUGHNAN, Chairman of Commission.  
 F. W. FURKERT,  
 CHAS. R. VICKERMAN, } Commissioners.

## MINUTES OF EVIDENCE.

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#### ERNEST ROBINSON. (No. 1.)

SECRETARY Spring Creek River Board for last twelve years, and overseer. The banking begun by private individuals, and adopted by the Board and added to where found necessary. Groynes were put in where erosions occurred, and willows planted to protect the bank of the river and the flood-banks; the river-beds cleared of growth from time to time. Banks have been set back from the river to give more waterway at sundry places. The river-channels vary from time to time, requiring new protection-works. The Peninsula was privately owned, and banked from near the Spring Creek Railway Bridge within the last four years to the mouth of the creek. The work was done by Smale, the owner, and was subsidized with £200 from the Board, after approving the work. The effect was to back the water up the Spring Creek Stream, as there was not sufficient waterway at Botham's Bend. This caused the Spring Creek to overflow Section 50, and scour out the railway-line and flood Grovetown and the north end of Spring Creek. The Board decided to buy the property and lower the banks. Purchased in June, 1916, and banks immediately lowered in May, after agreement to purchase. We had large floods in July and November of 1916, which the river could not cope with; but there have been four small floods which would have overflowed the land but for this work. The effect has been beneficial. In 1914 the Lower Wairau River Board erected a groyne below Conder's Bend, across the Opawa River, and threw the water into the Wairau. The effect is that we have more water in the Wairau. The bank at Leslie's was carried away twice and repaired. Again it was carried away, and a new line of bank put up farther back. The bank at Matthews', west of Hillcock's Road, was broken twice by overtopping in each case. It has been repaired. The bank was broken between Hillcock's Road and Hall's. This bank was considered safe until the November flood. Between the Peninsula and the Ferry banks were topped and broken. These had never been topped before—below the bridge the banks have not been topped. Erosions have taken place in many places below the Ferry Bridge. There was no damage done by the Opawa for several years past. We erected two groynes on the Opawa within the last three years. They have been effective opposite Leary's breach. This place has given trouble for previous ten years. The July and November floods did damage to the amount of £26,000. For the last three years previous to this the damage was £8,000. The November flood was the highest for the last twelve years. At its height you could cross the Opawa on a draught horse at the Renwick Ford. The Opawa River bed was cleared of growth about eight years ago. Within twelve years we have cleared about a mile of the Wairau River bed. The growth has a tendency to block the water from getting away. Clearing would do a great deal of good. Three-quarters of the money should be spent in clearing and a quarter spent in banking. This would give a better result. A certain amount of growth is necessary to protect the stop-banks. We have had no floods since 1904 of any size until within the last three years. In the 1904 flood a coach was washed down and driver drowned on road between Ferry Bridge and Tuamarina. The effect of Smale's bank and the growth in the river-bed backed up Spring Creek, and prevented the water flowing across the Peninsula as it used to, and raised the water so as to flow over the Tuamarina banks. The July flood could have been carried by the two rivers. It was caused by a north-west rain. At the time of the November flood the Onamalutu was very high, and the Wairau was backing up into the Tuamarina Swamp. The swamp was higher than it has ever been, owing to the water being backed up by the Wairau. The Tuamarina River Board was constituted about four years ago. It has banked the river and kept it from flowing where it used to in flood-times. Stop-banks have been erected on left bank of Wairau from Tuamarina to the Ferry Bridge since 1904, and below to the Maori Pa, to

the Marakoka Bridge, commencing from the Railway Bridge. Since I have been Inspector there has been a gradual accumulation of shingle raising the flood-level. In 1914 practically the whole district was flooded. There was a break in Matthew's bank four years ago, due to rabbit-burrows. The stop-bank on the island on the Opawa side was erected after 1904; the one on the Wairau side in 1909. If all the Wairau water came down the Opawa there would be a flood over the whole district on the south side of the Wairau River and Blenheim. Something should be done to keep the whole of the Wairau waters out. Rose's overflow and the banks about town have saved Blenheim. The largest groyne above the breach (Injunction Groyne) was built early in 1914. Soon after it sank in the middle; I think the water flowed over it. It was then raised 2 ft. The flood-water has come up within 18 in. from the top. No cross-sections of the river were taken before we put the stop-banks. Clearing a part of the bed is no good to the rest of the river. We had no plans and consulted no engineers. My Board did not erect the groyne at Maher's; it was done privately by Maher.

WILLIAM SMITH. (No. 2.)

Chairman Tuamarina River Board, formed four years ago. The rating-area is £37,866 in value. The object of the Board was the banking of the Tuamarina and Wairau Rivers. With a southerly rain the Tuamarina floods the Tuamarina Village and the Waitohi Valley. When the Wairau is up the outlet is blocked. In the November flood the Wairau was up, and a southerly rain caused the Tuamarina to rise—an exceptional combination. The Wairau rises with a north-west rain, and the Tuamarina with a southerly. We have made three miles and a half of stop-bank. There were private stop-banks in existence before. The Tuamarina stop-banks have saved us from several floods. The Wairau stop-banks have only kept out small floods. We have banked the Wairau the whole length of our district's frontage. The November flood topped most of the banks and washed other parts away. It damaged the railway-line, washing two places out. The water came through the Wairau stop-bank, and followed the hills, bursting through the sand-ridge on to Neale's property, thence to the Pukaka district and to the Maori Pa. It caused great damage. The flood of 1904 acted very much as that of November, 1916, but was not so high by several feet in our district. There was little banking then. We approached the Pukaka district to include us: they refused. We did not approach the Spring Creek, as we considered its interests opposed to ours. The November, 1916, flood stood for about two days, or at least thirty-six hours. It began with north-west rain, then moderate south-easterly. We did not allow for the confining influence of the banks we erected.

ALFRED ROSE. (No. 3.)

Resides at Maori settlement. Chairman Wairau Maori Drainage District—two years established. Lived in this district all his life. Prior to Board's inception there was a bank on the Wairau River erected by the Natives with Government subsidy—about three miles. The July and November floods came over and damaged it, from river inwards, and broke in various places. It broke in and spread towards the hills and Marshlands. November flood broke in at Tuamarina, and came through Neal's on to Marshland's, and met the other water from the Wairau. In July and November the water came over our stop-bank on to our land. In November it broke through our bank before the water came down from Tuamarina across the country. The river-channel is clear of obstruction in the centre below the Ferry Bridge. Our stop-bank was erected in about 1906 or 1907—until the July flood. We are flooded also from the Pukaka. It would require two miles and a half to three miles of bank to protect us. The Pukaka floods are not so severe as the Wairau, but more frequent. There were no great floods between 1904 and 1916. Prior to 1904 we suffered often on account of having no banks. A scheme of overflow, under the hills to the sea, would, in my opinion, be a good one, and it would cut off the Pukaka waters, which get up in the southerly rains. Our land was a swamp before the Pukaka was drained, and we did very little with our land. We did not apply to be included in any other local body, because we thought our interests were adverse. I think good strong banks would protect us.

HENRY JOSEPH STACE, Jun. (No. 4.)

Resides at Marshlands. Secretary of the Pukaka River and Drainage Board, and represents the Picton Road Board. For twenty years has kept rainfall records. Average rainfall, 30 in.; last four years about 24 in.; as low as 19.6 in. one year. More floods during that period in Pukaka and Picton Road Board than during previous eighteen years. There has been a bank on Section 97, Block 12, but it has been washed out twice and rebuilt. Settlers erected their own stop-banks. The Pukaka drain was excavated from Section 8A, Block 8, to 3A, Block 12. Afterwards Natives applied, promising help, and a branch was cut from the main drain in Section 2B, Block 12, directly through to the river. Except for cutting these drains and maintaining them, the Board was doing no other work until abnormal floods in Wairau threatened to swamp the district. Since then the Board has done some river protective work on left bank at Botham's Bend. I saw the effect of the flood at Section 97. July and November floods overflowed before Tuamarina water came down behind. Waters met about the line of White's Bay Road, Sections 88 and 89, Block 12. Banks at 97 erected about one year ago. River broke through north side in November flood at approach to Renwick Bridge. At the lowest groyne above the Opawa breach the level of water in July and November floods was not more than 6 in. higher than previous floods. Water had not flowed over Section 97 for eighteen years. District has been constituted since 1878, approximately. The Board exercised no control over the erection of the banks on the Wairau River. The Board was never approached by the Maoris to extend this district to their territory. It was felt that the Maoris got better assistance from the Government if they formed themselves into a separate district, and neither the Tuamarina nor the

Maoris asked us to include them in their boundaries. The Pukaka River district has been in existence since 1878. We exercised no supervision on the erection of private banks. As far as I know, the Board did not control the erection of private banks. In putting up banks we do not consult engineers. I know the banks are sometimes in the wrong places, but the Board has not sufficient money to expend to move them or to compel them to be put up farther away from the river. *Re* overflow to White's Bay proposed: Judging by the way water percolates through, such a channel would flood all the lower ground lying towards the Maori Drainage Board district and the mouth of the river. On the proposed course we bored for water to a depth of nearly 400 ft., and found nothing but shingle and sand, and ultimately broke or bent the pipes at the full depth in loose sand. The compensation for land would be in the vicinity of £50 or £60 per acre: this refers to the channel from Tuamarina to White's Bay. Going the straightest way, the average would be about £70 per acre. I do not think it would be a cure for the floods, one reason being that the water would percolate through the lower ground, and they would be flooded in the same way; the other reason is that I do not think you could ever keep the mouth of it open, the beach being nothing but shifting shingle. As far as shipping is concerned, in the summer-time I think it would bring that to a standstill by decreasing the scour at the bar.

THOMAS JEFFRIES. (No. 5.)

Farmer, residing at Fairhall. I knew the locality where the Opawa River now enters from the Wairau River in 1858-59. The country from the Waihopai down, the banks were covered with heavy manuka. There was no opening into the Opawa from the Wairau in those days. There was a stream some distance away from the present Opawa, caused by percolation from the Wairau. You could walk across the Opawa River at the Railway Bridge with boots on. It might have been a chain wide. I was in the habit of going from Renwicktown to Onamalutu. There was no Opawa River bed in those days in crossing to that track. The Wairau River ran on the north side. The floods in those days used to take the nearest cut to the sea. 1868, 4th February, was the biggest flood we ever had: you could boat from Blenheim to Tuamarina. I worked at the breach in 1864. That breach which I refer to was the breach made by the Wairau to what is now known as the Opawa. The object of the works constructed in those days was to keep the water in the big river—that is, in the Wairau River. The works were not effective. I think it was the Provincial Government that undertook this work, and I understand the cost was about £13,000 altogether. About six or eight months ago I went to the locality where the big groyne is erected. There was no breach at that point when I first knew the river. Blenheim did not suffer from Wairau River floods in the early days, but suffered from the Omaka and what we call the Mill Creek and Taylor River. The Opawa River was a very insignificant stream before the breach, mostly due to percolation, and the floods gradually formed a channel down the Opawa.

JOHN CLERVAUX CHAYTOR. (No. 6.)

Residing in Marshlands. Came first to Marshlands in 1881, and in the district since 1860. The Pukaka River Board was formed to control the Pukaka River, flowing into a large raupo swamp extending from the banks of the Wairau River on the west to a ridge called by the Natives Tahunaroa, on which Mr Bowler's house stood. There was no watercourse through it. The main outlet was by way of Blind Creek and Schooner Creek, reaching the Wairau at Botham's Bend. In times of floods there were several overflows along the line now known as White's Bay Road—I could show you a patuna (eel-weir) in one of the overflows thence into the Native Reserve and to the Wairau. The River Board was formed in 1878. It cut a drain running through the ridge and through the swamp out into the Marakoka Creek to the White Bridge. The Wairau River affects us only in heavy floods. The record flood of the whole district was the flood in February, 1868. That flood did no permanent damage to the country like the flood of last November, 1916. I never saw the Tuamarina Road in a flood. In 1860, between Grovetown and Spring Creek Hotel, all the country up there and above that was a great deal of flax and raupo swamp practically in a rough state. The 1904 flood was practically the largest flood we have ever had at Pukaka. Robert Bell's sheep were drowned at that time. After that I got Mr. Seymour to run out a line of pegs 18 in. above the highest mark of that flood-level, and we made a bank up to it. That bank is standing now. There was a breach in it shortly after it was erected, but it protected us against the Wairau floods till the flood of last July, when the water came over the top of it. The July and November, 1916, floods came over this. I do not think that the breach could have been made before 1863. I remember the Opawa channel before the flood of 1868. Before 1863 you could walk over the Opawa at Blenheim. Fox dug a ditch and gave the water a lead into the Opawa, intending to make a boundary for his sheep. The Spring Creek Road District was for a long time known as Fox's Island. The aspect of the country was rough, and the water did not come down freely. There was no Wairau gravel at the Railway Bridge. Looking up the Wairau you could not see gravel from the Peninsula. There has been a constant accumulation of shingle in the Wairau River. Looking up the river, the gravel could not be seen standing on the Picton Road side—the river was tidal at the Railway Bridge in the seventies. The tide rose 2 ft. 6 in. at the Railway Wairau Bridge, but no tide there now—much gravel has raised the bed. My opinion is that the river should be fairly divided between the Wairau and the Opawa, but I cannot suggest a proportion. I have always noticed that when the rivers have been unfairly divided the damage by floods begins. I suggest cutting the Peninsula on the Native Reserve. I have no faith in the White's Bay channel. In the eighties there was considerable work proposed to be done by the Pukaka River Board, but I do not think there would be any possibility of keeping a channel up there (White's Bay overflow). It could not be kept open, and I do not think the bank would stand, as foundation is quicksand. I sank a well 300 ft. deep and still got sand.

## ARCHIBALD MCCALLUM. (No. 7.)

Farmer, residing in Blenheim, and Chairman of the Lower Wairau River Board. I have resided in and about the town of Blenheim since 1860. I have a recollection of what is known as the flood of 1868, the largest flood that has been known in the Wairau Plain. Until the 1868 flood we used to cross the Opawa to get to Grovetown on a plank—two-thirds of a mile above the Railway Bridge. In 1857, when my father bought his Section No. 70, this was free from floods, and all cultivated. The first flood that came over it was in 1868, and was about 3 ft. in our house. Blenheim was continually affected by floods, principally from the southern streams and a certain amount of percolation of flood-waters which came through the vegetation down the overflow from the Wairau River through the natural hollows. Our springs are affected by the Wairau. The driest side of Blenheim was the northern portion, known as the Grovetown Road end. I remember the pile-and-wire dam. In 1879 there was an injunction which prevented the work from being completed. This injunction was a bugbear to my Board for many years. It is about eleven years and a half since a groyne was erected at Conder's Bend. Banking on south of the Opawa and Rose's overflow was our principal work. Before Rose's overflow was opened there were continuous floods in the town, and Rose's overflow was the principal cause of reduction. Mr. Cuthbert, of Christchurch, advised on Rose's overflow scheme. The town in winter was always under water. Once we had eight floods in seven weeks. It is three or four years since we put the last two groynes in. We saw that unless this work was done the greater part of the Wairau would come down the Opawa. Previously the Board had erected groynes to keep the Waihopai out of Gibson's Creek and to keep it meeting the Wairau squarely, to prevent the whole of the Wairau water flowing down the Opawa. Prior to the erection of the lower groyne there was a gut some 8 or 9 chains from the original bank—right out from the Opawa. Therefore we built the groyne to confine the Wairau to its proper channel and keep it out of the Opawa. Our groyne went out just a few yards past where the water was making its waterway. We ceased when they brought proceedings. This work was assisted by the Public Works Department. The local Resident Engineer of the Public Works Department controlled the erection of that groyne, and wanted it carried out 4 chains farther. This would still not reach the water. There was, of course, at that time no water flowing round it. Our Board is perfectly satisfied with the action of that work. The 1904 flood was the second highest, and a great portion of the plain was inundated—all north of the Omaka River was flooded. South of Omaka was dry, except that the water backed up at the bar and overflowed Riverlands property. The next big flood was in 1916. The list of expenditure made up by the Clerk is, I think, correct. There is a special loan of £1,000 on the Rose's overflow district, and there is another loan of £5,000, the security being the whole of the district. In addition to the £2,000 Government grant for Rose's overflow, £3,666 has been received from the Government for the groynes and repairing damage. The main portion of that money was expended in connection with the erection of groynes. I know the Tuamarina district very well, and it has been subject to floods for a good many years, so much so that we know of two deaths on the King's highway by drowning. The photograph referred to was taken in 1875. In 1868 the course of the Opawa River followed a small stream. It took this new course in about 1879. It carried away 25 acres of my father's farm sown in oats, cutting across a loop. Before the flood in 1868 there was no shingle in the bed of the Opawa River. It burst across the loop in 1869. In reference to the erection of the last groyne put in three years ago on account of the gut, the Board feared that the whole of the river would come down into this gut. Our reason for putting it there was to turn the flood-waters into the Wairau River. There were 4 chains to go on to the groyne when the legal proceedings began. Our Board has tried to keep the middle of the stream clean. In my opinion, I have always advocated cutting through White's Bay, if possible, as there is always a great difficulty in keeping the flood-waters in the Wairau till you get to Tuamarina. The Spring Creek Board has acquired the Peninsula, and if it also acquires the land on the eastern side where the coachman was drowned, and bank back to a defined distance, it would be the better plan. I do not think it would affect the present bar; I think it would still keep open. I think the tide will always be responsible for an opening at the bar. Systematic clearing of the river-beds is not carried out. Referring to cutting the Fairhall and Mill Creek into the Opawa, our protective works in Blenheim are sometimes overcharged and the water flows over them, because of the fact of the discharge from three distinct watersheds coming through our town—the Taylor River, the Fairhall, and the Mill Creek. These in stormy times bring a considerable quantity of water down, and I think that if a diversion of those waters were made, taking two of the streams—the Fairhall and the Mill Creek—and diverting them into the Opawa River at a point about where the Fairhall Stream crosses the new Renwick Road, it would be a great advantage. I think that the dividing of those waters would protect valuable land from southerly rain floods. I think our rating-area should take in right back to the line of the hills.

## ARTHUR PENROSE SEYMOUR. (No. 8.)

Surveyor, Picton. I have known the Wairau district since 1852. I was a member of the Provincial Council since it started in 1860. I was Superintendent in 1865, 1866—served three terms. Then Executive Officer since the abolition. I know the scene of the breach. I knew what was the condition of the Wairau River at that time. The state of the river in that locality was that it was confined by what was a dense mass of good-sized scrub, manuka, and various shrubs, which contained the waters of the Wairau River in its proper channel. The settlers got firewood and fencing from this bush. The roof of my house was built of manuka taken from this bush. A portion of the flood went into the channel of the Opawa, which was then narrow with well-defined banks, and was about 1 chain wide, with scrub and fern on the banks and no sign of scour. The overflow would fill the channel. The banks might have been 7 ft. or 8 ft. high. The water flowed probably over the banks

across country generally; the overflow disappeared into the scrub. As soon as the country was cleared of this forest the river began to tear into it, and I have no doubt that as the roots rotted away the damage began to be serious. In 1861 the Provincial Council voted £2,000 for repairs at the breach; subsequently more money was voted from time to time. There was a very extensive piece of work done later. An engineer from Nelson was employed to deal with the breach, which had become very serious, and he advised the erection of a sort of cradle composed of timber crossed and recrossed, built up to a considerable height, and filled with stones; but, unfortunately, he did not provide a bottom to this cradle, with the result that it collapsed. It was above the breach a short distance. Later on there was a scheme of piles and anchored trees. Some of the piles are still to be seen. In 1914 I surveyed up the line of piles, but that line of piles is very much to the north of the present stream. It was called the "log dam." The Provincial Government spent about £11,000. £7,500 appears in Appropriation Acts; we cannot trace the other. In the early days there was a forest at Grovetown, where we used to go down to get out timber. It was flooded at times—flooded by the Wairau overflowing at the Opawa breach principally. The greater part of it at that time was flax-swamp, with little hollows through which the flood would run. These affected the road, and during my Superintendency I had posts erected so as to warn persons with their traps on the road from Grovetown to the Ferry. I think there were some on this side of Grovetown. I had them erected wherever it was necessary. The Provincial Government put a bridge up there. I think that the Wairau Plain should be controlled by one body only, and the aim of that body should be to make the Opawa and Wairau Rivers carry a fair proportion of water. I do not know much about Grovetown before the breach took place. None of the works at the breach were satisfactory. At a lower breach called "Leary's breach" a large bank was built—Seymour's bank: it was satisfactory. The groyne was built to stop all the water from reaching the Opawa, but was only partly successful. If it had not been built all the overflow of the Wairau would have gone down the Opawa. It stopped a large part of the water, which benefited all the lands as far as Blenheim. The effect of a groyne appears to me to affect the flow of the water about three times its own length—certainly not more. I did not take levels—only in 1904. There has been a great deal of shingle here. By 1917 it was all dry ground. I think it possibly had no effect except to stop that channel. It has stopped a considerable body of water. All the farms below Renwick, possibly as far as the Opawa Bridge, are benefited.

FREDERICK REDWOOD. (No. 9.)

Farmer, Spring Creek. Resided in district since 1863. I have about 330 acres now and the mill, valued at £35,000. The country was all overgrown with fern, manuka, &c. I know the Grovetown locality well. Whenever there was a big flood it used to come down the breach between Grovetown and Dodson's place. The width would be from the Opawa Bridge to Dodson's sandhill. Paul's bank starts about a mile and a half from the breach on the Opawa River. There were protective works put up by the settlers to keep the water in the channel of the Opawa. That eased a good deal of the overflow to Grovetown. More cultivation took place and more banking. The River Board came in and began to further bank and protect the Opawa. The first big flood came over my property in 1868. We were again flooded within the last two or three years, higher than ever before. The November flood went over land which had not been flooded since 1868. The last flood came from the Wairau River. The breach at Leslie's did not affect us at all. It got back into the Wairau at Pigou's. The flood backed up Spring Creek and came on to us, and also from Matthew's breach. Our place has not been flooded for fifteen years. The Spring Creek was not banked before the flood of 1904. The breach above was caused by the Opawa not taking its fair share of water. The Wairau is narrowest at Gregory's Bend. This brings more gravel down, and tends to raise the river-bed. The bed is clear for three or four miles. There is growth in the river towards Tuamarina. I suggest that the best way would be to divide the waters between the Wairau and the Opawa Rivers. If the farmers had been willing to give their land to the River Board the Board would have been able to construct the works out of their revenue. The gravel will not pass the tidal level. Smale's bank caused the water to back up in Spring Creek.

PHILIP RUSH. (No. 10.)

Residing at Grovetown; settler. Lived in Grovetown since 1848. I know it has been very subject to floods. The Wairau flowed into the Opawa at the top end of Fox's Island, and came all over the country; it used to come through by the Opawa breach. The water came from the Wairau in the direction of the Middle Road, at the top end of Fox's Island. It came down generally across the country. The country was all vegetation—viz., flax, manuka, and scrub. The Picton Road did not suffer as it does until the gravel came down the Wairau and filled it up. I put posts in from Blenheim to Grovetown; that was somewhere in the sixties. The embankment scheme was set going to limit the spread of water. It was successful until the bank broke from the Wairau River: that was in the November flood. Before the banks were built Blenheim was subject to floods. I suggest that the water should be divided and that both rivers take their share, and a relief channel cut to White's Bay. Rose's overflow is the salvation of Blenheim.

ROBERT McCARTNEY. (No. 11.)

Residing at Dillon's Point; farmer. I am the owner of Section 2. I have been sixty years in the district. The effect of the harbour-works is that the flood-waters get away very much quicker than before. I notice it by the decreased height of the flood-water and increased velocity of current—4 or 5 knots. The current is faster than a man could walk. I agree with the rest of the witnesses

that Rose's overflow has been the salvation of Blenheim. I was a member of the Lower Wairau River Board for about four years. The Opawa breach has been a menace for some years to the Town of Blenheim, Spring Creek, Grovetown, and lower Wairau. I have not seen the work which was erected. The flood in November was very much lower than previous ones at Dillon's Point. It used to top the bank, but now it is only to the foot, a difference of 4 ft. I have known it to affect the river four miles up; and the pilot who was there when the opening was made before told me that the tides went out 2 ft. lower in the river. If you took all the water out at White's Bay there would not be sufficient to keep the bar open. The tide flows into the big lagoon for two hours after high water. I have not seen the upper one. There are bars across the channel—some with only 4 in. depth of water at low tides—which obstruct the connection with the river.

ALEXANDER JAMES MACLAINE. (No. 12.)

Secretary Wairau Harbour Board. Produces statement of moneys expended upon Harbour Board works, &c. The current was roughly measured at the July flood, 1916, and it was over 12 knots—about 200 yards from the bar end of the training-wall. The Opawa channel is silting up. The same boats have been running for about fifteen or sixteen years up the Opawa. Our revenue is about £1,200, and is made up by a fourpenny rate on the tonnage of vessels inwards and outwards, and sixpenny harbour-improvement rate per ton of cargo. Largest boat is "Magic," 99 tons; "Opawa," 69 tons; "Blenheim," 80 tons. It is about three months since the "Blenheim" has been here. They draw, when loaded, about 7 ft. 4 in. to 7 ft. 10 in. If bar is good it can be worked at half-tide, and so work from Blenheim, where the tide is two hours later than at the bar.

FRANK ADAMS. (No. 13.)

Farmer, residing in the Town of Blenheim, and member of the Lower Wairau River Board. I have been a member of the Board since 1894. Prior to this date there was very little banking for Blenheim. Small banks (mostly private) had been put up. Most of the public money expended was on Seymour's bank, which is situated on the right-hand side of the Opawa, and extends from Leary's breach down to the Opawa Bridge. The Opawa was also banked up-stream from Leary's breach to Jackson's Road, and there was a bank on the Omaka diversion. From the Opawa Bridge downwards a bank came right round Riversdale, round Section 48 and part of the Town of Blenheim. This part is now cut across Section 48 into a straight line down the stream. That bank continued round to Section 47, up to about Jackson's property, where it stopped. Going farther along there was no bank on that side of the Opawa. The bank on the left side commenced near Mr. Allen's residence, and then proceeded down the left-hand side of the Opawa, following Section 47, and then round a small bank to Dillon's Point. The Foster's channel was dug about 1890. The scheme was not successful. There were some small banks on the right-hand side after the junction of the Omaka and the Opawa. They went down as far as Section 28. Some protective banks were erected on the Taylor River from south-west corner of Section 6 to High Street Bridge. A scheme was adopted—Rose's overflow with town banking—before 1898. The Board then proceeded to acquire Section 25, after we got report from Mr. Cuthbert in 1894. The loan caused us a lot of trouble; £13,000 loan was refused, also £10,000, by the ratepayers. We were able to get a special loan of £5,000—£1,000 was for Leary's breach, £1,000 for town banks, £2,000 for overflow, £1,000 for reduction of overdraft. Then we got a Government grant of £2,000. Tenders were called for the overflow scheme on the 11th June, 1898. A contract was let in 1899 for the completion of the work. We spent a lot of money—practically all our rates—on Leary's breach between 1894 and 1898. We spent money in improving the banks and making them more stable. We erected banks at Pike's, also between the Gasworks and High Street Bridge, and between High Street Bridge and Alfred Street Bridge, with the necessary flood-gates. We put banks in at the Presbyterian Church and opposite Panama House. Since then the Taylor River banks have been greatly improved. We banked the river near Springlands. The river used to come round and back over the railway-line. The next trouble was with the Taylor River, which flooded the whole Town of Blenheim in 1911 and caused a great deal of damage. The Wairau and Opawa were not very high. It eroded the banks by the Royal Hotel and Presbyterian Church, and burst all the banks. We approached the Government for assistance, and were granted £3,600. We spent a lot of money on groynes and banks in the Waihopai. The Public Works Department approved the Waihopai and Wairau groynes. [Plans produced.] I suggest that the banks from Leslie's be kept farther back to the high ground on the southern side of the Railway Bridge (Wairau); bridge lengthened; also a straight run provided for water over the Peninsula; the bed of the river to be cleared. At Kennington's Point I suggest a bank to be put back on to the high land, and let the river overflow the point (Sections 84, 85, and 86). They should also cut the Maori Peninsula. I propose to bank the Pukaka on both sides, and put flood-gates in drains connecting therewith. We would have to remove all obstructions in the Wairau River. All the water that came out of the river at Leslie's Bend with the November flood passed back into the Wairau opposite Section 97. No water came into the Wairau below Beatson's. The water on the northern side of the river went back into the Wairau just below Taha Watson's property. I do not think the harbour-works at the bar are of any practical service for the flood-relief. The Board asked Mr. Cuthbert to report on Rose's overflow before going to the ratepayers. They took no engineer's advice for general banking, nor any steps to ascertain if sufficient waterway were left. Mr. Dobson was our local engineer. He did what we wanted. We put the banks where we thought they ought to go without considering flood-flow or cross-section area. Our Board does not do much clearing of river-bed—not as much as we might do.



## ALBERT EDWARD HOPE. (No. 14.)

Launch-proprietor, residing in Blenheim. I have been running an oil-launch with mail for three years, Blenheim to Port Underwood. I have a certificate for master and engineer within restricted limits. I cross the bar about six times a week. The training-wall was built across the old bar channel, and a cut was made through the Boulderbank. For a time the bar went straight out, but the first heavy flood—the July flood—took away six piers at end of wall. The water still went out to sea through the cut. The bar shifted south towards the Bluff. In November last the flood took more of the piles away. Some of the piles went at the outside end, and also some at the inside end. The bar then went out north. Since November it has been gradually shifting north. A bank is forming on the south. Nothing but a big flood will keep the channel straight out. The shingle is travelling north. The training-wall is inside it, and a spit is forming running north. The heavy seas drive the banks up, and it is impossible to keep the gravel out. Both rivers act on the bar. A cut to White's Bay would not keep open, and it would spoil the bar for steamers. The shingle is accumulating in White's Bay and the bay is shoaling. Coming up the Opawa, there are a great number of willows near the Nelson Street Bridge and Rose's overflow, which are detrimental to the river. I know the velocity of the river in flood-time was pretty fast; it was up about 6 knots at Dillon's Point. It might go to 10 knots. The work of the bar affects the river up to about ten miles.

## EDWARD STONE PARKER. (No. 15.)

Deputy Mayor of Blenheim. I have been nine years on the Council, and eight years a member of the Lower Wairau River Board. I had one term on the Harbour Board up till last month. I suggest that the river district should be extended right up to the "Blue-gums," near the Cemetery Reserve, about four miles from the Post-office. We have had an arrangement with the River Board whereby we pay half the costs. We have been compelled to bank on both sides of the Taylor River. It has cost the Borough Council altogether some hundreds of pounds during the last ten years. I suggest that the control of the Taylor River south should be vested in the River Board. The co-operative drain has to be paid for partly by us; we pay £160 per annum. I suggest that the new Board have the same power as the Drainage Board. We cannot get rid of that liability of £160 per year. The Omaka Road Board pay half the costs. We had three disastrous floods in ten years. It was mainly the Taylor in 1911. It came over the banks in the High Street Bridge and School Bridge, broke through at the Church of England, and flooded the whole town. The River Board and the Borough Council shared the cost of the Taylor banking for two miles above the town boundary. We are endeavouring to keep the water in its channel. The River Board have bought all the land inside the banks inside the town boundary where possible. The current at the bar—November flood—was so great that the "Opawa," an 8- or 9-knot boat, could not steam against it; she made three attempts to get in. The bar widened about half a chain during the day. The Tuamarina and White's Bay scheme would, I think, block the present bar up, and I think the White's Bay scheme would have the same effect on the Wairau as Rose's overflow on the Opawa. Rose's overflow is deepening, but at low tide there is only about 2 ft. of water opposite my brother's farm, Section 11. It is impossible for steamers to come up at present by Rose's overflow.

## THOMAS PRICHARD. (No. 16.)

Builder, residing in Wairau West. I sold my farm about seven years ago—Section 37. I live at Marlboroughtown, and am well acquainted with the Opawa River and the banks between my property and the Opawa River. The water came over Prichard's bank in 1904 and broke it away at the lower part: it was 1 ft. lower there. The July flood did not touch the bank. The November flood came over the ground—1 ft. up the bank. The banks were 6 ft. to 8 ft. high. The 1904 flood was practically up to the floor of the Railway Bridge. The July and November were only small floods by comparison, as the Opawa was stopped by the groynes. The Rose's overflow since 1904 has been much more effective than it was prior to that date. Since 1904 there have been only small floods in the Opawa. My bank had to be raised not higher than the railway-line. I think both Wairau and Opawa should carry a fair share of the water.

## JOHN HENRY SUTHERLAND. (No. 17.)

Chairman Spring Creek River Board. I have resided at Grovetown practically all my life. The July and the November floods were small in the Opawa—could have risen 4 ft. to 5 ft. before being large floods. The 1904 flood topped Prichard's bank above and below the bridge. The July and November floods came just to the foot of the banks. The floods came through Grovetown from Leslie's, Matthew's, Hall's, and another breach by the railway-line. They came in a straight line to Grovetown, and into the Wairau River again at Section 11, on the north bank of Rose's overflow. The banks below Ferry Bridge to Beatson's held, but the Wairau water flowed in over them. The breach above the Ferry Bridge was inwards. In July the settlers cut the bank at Section 11 to let the Spring Creek water away, and afterwards a culvert was put in. The water lay on the land for ten days. My section is No. 36. The bank at Rose's overflow stopped the waters from Spring Creek. Beatson's Section No. 18 was under water. In my opinion the White's Bay scheme would be the best relief if workable. That would cut off the Pukaka and conserve all the Maori land. Since 1904 there have been no floods of any size in the Opawa. Rose's overflow would take the water away quickly. The Wairau water was up to the top of the front bank of Section No. 11. I think it flowed inwards to the Pa as far as Tahua Watson's, and then it flowed outwards into the river. It topped the banks and flowed inward at Section 32.

## JOHN STOREY. (No. 18.)

Farmer, residing on the north bank of the Wairau, and Chairman of the Pelorus Road Board. My Board did not attend the conference, as it had no direct community of interests. It is the desire of my Board not to be included in any rating-area. We have two large rivers—namely, the Pelorus and the Whakamarina—in our district which give us a lot of trouble. We have only one large creek—the Ara-ara—which flows into the Wairau River. A very small portion of the district is affected by the Wairau. The groyne affects our land very little. The groyne puts more water into the Wairau, and it caused the washing-away of the approach of the Wairau Bridge. A small portion was washed away in July, and the balance in November last. The road at Squire's Bend was washed away. The Onamalutu Creek was fairly high. A groyne at Rock Ferry was erected privately by Maher Bros., about the same time as the large groyne. The groyne put a little more water in some low ground, but it is poor land—800 or 900 acres, worth about £1,800. A small bridge was washed away. The rainfall at the November flood was probably the heaviest for many years.

## LEWIS GRIFFITHS. (No. 19.)

Until lately Chairman of the Wairau Harbour Board. Auctioneer and land agent. The work at the bar already done—namely, the erection of the groyne across the river and the opening of a new cut through the Boulderbank a mile and a half south of the old outlet—has been of the greatest benefit to the district from a flood-relief point of view. The old bar has absolutely closed up. I cannot say how much lower the water is at flood-time at McArtney's than it used to be, but Mr. McArtney's statement should be correct. Every settler without exception for five miles up the river has told me repeatedly that since the new cut was opened the river at their land has been much lower in flood-time than it used to be. I cannot say how far up the river this benefit would accrue, but it must be a benefit in a gradually reducing degree. My Board recognizes that the groyne or wall erected across the river at the bar must be extended later on. One of the ideas my Board has is to deepen the river right up to the wharves, and also to deepen the Wairau River up to the Ferry Bridge. The result of this would be that 200-ton boats could work the river instead of the present boats. This would allow coal to come in, and the cost would be from 10s. to 15s. per ton less to the consumers around Blenheim. It is estimated that over 6,000 tons of coal per year are used in and around Blenheim, so the saving to the community should be, at any rate, £3,000. In order to deepen the river a dredge would have to be obtained, but the Harbour Board is not financially able to do the work at the present time. As to a rating-power, it seems to me there should be no objection to the Board having a rating-power, because no rate could be levied or made without a poll of the ratepayers being taken first; and if the majority wish to be rated, why should the minority rule? There may come a time when it is in the best interests of the district that a large sum of money should be spent on the river for harbour benefit, but if no rating-power exists it will be impossible to expend the money. If it were not for the stirring-up of the rivers by the steamers travelling up and down the Opawa would ere this be 2 ft. shallower. I do not know if the wash from the steamers brings much silt into the river, but probably it does to a certain extent. The Omaka River, from its confluence with the Opawa up to the High Street Bridge, has absolutely silted up in the last twenty years. Probably it has silted up fully 2 ft. I do not think the Opawa River will go entirely down Rose's overflow. The rise and fall of the tide at the bar is from 3 ft. 6 in. to 4 ft. 6 in., and at the wharves at Blenheim it is not more than 1 ft. less. The tide does not go up to the Opawa Railway Bridge, but stops somewhere about the entrance to Rose's overflow. I think the tide will always keep the present channel open, but if the Wairau River is taken away from it the bar will, of course, not be so good. In flood-time Rose's overflow cannot carry all the water. I have seen both the channels there full, whilst the Opawa, lower down, has been at the top of the banks. There has been more water in the Opawa since the Waihopai burst through. A good flood leaves from 2 in. to 3 in. of silt behind it. If the Harbour Board is absorbed by the River Boards, I take it that accounts would be kept separate. The Wairau Harbour Board exists by a special Act—No. 24, local, 1907. The members comprise two from the Omaka, three from the Blenheim Borough, one appointed by the shippers, and two appointed by the Government. In the early days of the Board three were appointed by the Government, but this was altered some five years ago. I do not think the people in the Awatere could obtain very much benefit from the Wairau Harbour Board, but I do think that the district of the Board should be to the hilltops of the whole Wairau Plains. Mainly, the people not served by the railway would benefit by the Wairau Harbour Board. All the wharves in Blenheim belong to the Board: they cost about £17,000. If a channel were made up Rose's overflow suitable for the river-boats, and wharves were erected at the end of Riversdale, the Board's expenditure of £17,000 on the local wharves would be lost. It would be possible to go to the wharves by coming through the neck of Mr. Robert Allen's property. This would entail considerable dredging and the purchase of land, but would be a much shorter distance to Blenheim than up the Opawa River. My Board recognizes that it is possible that another bank will form outside the present cut in the Boulderbank, and run in a northerly direction. A bank has started to form on two or three occasions, but up to the present time the flood-water has always carried it away. Since the cut was opened the bar has never been blocked, and the only time boats have been unable to get into the river they have been stopped by bad weather and not by a bad bar. Three-quarters of a mile from the cut the water is 30 ft. deep. It is not 40 ft. deep until a mile and a quarter has been reached. Before the cut was made the river-boats were blocked on an average for six weeks every year. The Lower Wairau River Board did not pay anything towards the cost of the work at the bar. They promised to consider the question if it was clearly shown that the work at the bar was a benefit from a flood-relief point of view, but they are not inclined, apparently, to carry this promise out. Some of the members even

say now that our work has not been of any benefit to flood relief. Notwithstanding this, however, in previous years the Lower Wairau River Board made many attempts to make a cut through the Boulderbank exactly where the harbour made it. Private landowners in the Lower Wairau joined with the River Board. On one occasion it was cut through, and the benefit was so great that, after it closed up, the settlers particularly spent a lot of money in trying to cut it through again. Just before the Harbour Board opened the cut in the Boulderbank the Lower Wairau River Board heightened the banks around McCartney's property and others in the vicinity, making them from 4 ft. to 6 ft. high. Since the cut has been opened, however, and even although there have been some of the largest floods known in the river, the water has never been above the foot of the bank. If all the Wairau River water were taken down to White's Bay I think the present cut would not block up, but there would be a bad outlet and a bad bar. The Opawa River always flows through the town, even though it is dry where it commences from the Wairau. We would sooner have the district absolutely relieved of flood than have a river harbour. We do not want the harbour closed, as it keeps freights down; but we do want, and must have, flood relief. In my opinion, if there was merely an overflow channel to White's Bay it would always block up. I think it will be harder to keep open there than in its present position in the Boulderbank. Many acres have been formed near the rocks during late years—acres of gravel thrown up by the sea

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