

To the Commission for the Environment

COMMENTS ON N.Z. ELECTRICITY DEPARTMENT'S
ENVIRONMENTAL IMPACT REPORT ON THE
PROPOSED DIVERSION OF THE WILBERFORCE RIVER
INTO LAKE COLERIDGE

BY

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CONTENTS

Page

1. Sea-run quinnat salmon spawning in the upper Wilberforce.
2. Spawning habitat.
3. Loss of surface flow in the Wilberforce below the proposed diversion.
4. Water allocation.
5. "Compensation" flow.
6. Length of the proposed Wilberforce diversion bank.
7. Silt accumulation behind the Wilberforce and Harper diversion banks.
8. Loss of fish from Lake Coleridge through the proposed canal system.
9. Drainage of the Glenthorne Swamp.
10. Summary.

Comment from Fisheries Management Division (F.M.D.), Ministry of Agriculture and Fisheries, Christchurch on:-

ENVIRONMENTAL IMPACT REPORT - NEW ZEALAND ELECTRICITY DEPARTMENT
PROPOSED DIVERSION OF THE WILBERFORCE RIVER INTO LAKE COLERIDGE,
OCTOBER 1975.

1. SEA-RUN QUINNAT SALMON SPAWNING IN THE UPPER WILBERFORCE

1.1 Aerial surveys by helicopter on May 6 and May 30 1975 of the Wilberforce river, from its confluence with the Rakaia River upstream to about Fang Hut (S65:884058) produced the following information:

Wilberforce River	Number of salmon sighted	
	6.5.75	30.5.75
(a) Rakaia to Little Goat Hill	31	2
(b) Lower Goat Hill system	81	37
(c) Upper Goat Hill system	62	27
(d) Above Little Goat Hill	20	-
(e) Glenthorne system	58	18

1.2 As a measure of the relative importance of the Wilberforce system to sea-run quinnat salmon production in the entire upper Rakaia system, no great significance should be attached to the actual numbers of fish recorded, since:

- (a) not all the fish present would have been seen;
- (b) it is not known what these numbers represent in terms of a high, low, or average spawning year. (Long-term surveys, correlated with similar surveys of the remainder of the upper Rakaia system would yield this information. The Wilberforce has not been regularly included in the spawning surveys carried out by

Fisheries Research Division. However, it may be possible to relate these two surveys to other surveys done in 1975, when the latter have been analysed and made available for examination by Fisheries Research Division);

(c) the difference in numbers between the two surveys indicates the survey of May 6 was probably made after the peak of spawning activity.

1.3 These observations show that salmon spawning extends to about Fang Hut - above that point the river bed material becomes too rough for spawning.

1.4 Observations also show that spawning activity above Little Goat Hill is as significant as that below, and that the Glenthorne system (waters issuing from the swampy area below Castle Hill) is comparable to the two permanent water streams at Little Goat Hill.

1.5 Conclusion

The May surveys confirm and reinforce the comments made earlier and reported in the environmental impact report, that is:

(a) the Wilberforce River, from Little Goat Hill upstream to about Fang Hut, is utilised by sea-run quinnat salmon for spawning and juvenile production, and,

(b) the existing river flows in this area provide not only access for salmon, but are an essential part of the spawning activity.

2. SPAWNING HABITAT

2.1 Spawning activity was observed within the main river channels, in minor side channels and in permanent streams rising from spring seepages on the flats, along the riverbed edges.

2.2 An important observation was the extensive use of the minor side channels for spawning, particularly those which seeped out of the riverbed gravels and had been stable long enough for vegetation (tussock, other grasses, matagouri, etc.) to become well established along their margins. They offer greater opportunity for successful spawning and juvenile production than the unstable main river channels, but would be diminished by reduced river flows and channelisation consolidating the meandering river flows into the single channel as proposed by the N.Z.E.D.

2.3 Conclusion

Quinnat salmon spawning in the Wilberforce River is not confined solely to the stable, permanent spring-fed streams, such as Goat Hill Stream, but takes place in the main river channels and in the minor side channels. The minor side channels provide valuable, and favourable, spawning conditions and would be adversely affected by the N.Z.E.D. proposal.

3. LOSS OF SURFACE FLOW IN THE WILBERFORCE BELOW THE PROPOSED DIVERSION

3.1 The discovery by gaugings of a substantial upwelling flow in the Wilberforce at Little Goat Hill is interesting but not surprising. The sub-surface water in a more than a 4

kilometre-wide, highly permeable, alluvial riverbed could not avoid being forced to the surface by both a falling gradient, and the sudden "pinching" into about a 0.4 km width, between the impermeable features of Mt Oakden and Little Goat Hill.

- 3.2 The upwelling flow cannot be considered as "extra" water, since it is part of the natural regime of this river. It follows that the surface flow appearing at this point is dependent on the cumulative input of water into the upper catchment. If the input is reduced, by diversion of $30 \text{ m}^3/\text{sec}$ surface flow upstream, this loss must be reflected in the "output" from Little Goat Hill downstream. (This is shown in the gauging records we have seen; when the flow is low at the proposed diversion site, it is correspondingly low at Little Goat Hill, or the lower gauging site at Woolshed Hill.
- 3.3 As a result of the diversion, in times of low flow, the Wilberforce will contribute less water to the upper Rakaia system, from the point of diversion down to the Lake Coleridge power station discharge.
- 3.4 During natural low-flow periods, the reach of the Wilberforce between the diversion intake and Little Goat Hill, will have severely reduced surface flows.
- 3.5 Conclusion

In natural low-flow conditions, the diversion of substantial amounts of the upper Wilberforce flow will:-

- (a) aggravate the situation which sometimes occurs in the upper Rakaia system where the adult salmon upstream migration is delayed until adequate

flows resume;

- (b) eliminate some, and reduce other areas of the valuable minor side channel spawning zones, which depend on near-surface, intergravel seepage flow;
- (c) hamper adult salmon access up the Wilberforce, particularly beyond Little Goat Hill, and reduce the areas available for sea-run quinnat salmon production.

The upwelling flows at Little Goat Hill and below, do not compensate for the loss of water by diversion - they are a natural phenomenon, integral in the flow regime of the river.

4. WATER ALLOCATION

- 4.1 The environmental impact report refers to "allocation" of water. This "allocation" appears to be one determined by the N.Z.E.D.
- 4.2 The allocation and management of the Rakaia River water resource is the responsibility of the North Canterbury Regional Water Board.
- 4.3 The Board has established a water allocation and management plan for the Rakaia. It provides for the allocation of water below the Rakaia Gorge bridge between October and March (the irrigation season). It does not specifically provide for the allocation of water above the gorge bridge.
- 4.4 Conclusion

The allocation of water from the Wilberforce River, for any purpose, is a matter for public discussion, then for determination by the regional water board, who recommend

an allocation plan to the National Water and Soil Authority.

The "multiple-use" concept is not particularly evident here - first electricity generation, perhaps some benefit for future irrigation needs, and what is not required for these, is left for the natural functions of the river.

5. "COMPENSATION" FLOW

- 5.1 N.Z.E.D. suggest a $3 \text{ m}^3/\text{sec}$ bypass flow as an initial consideration for "compensation water". The notion of "compensating" for removing water by not taking all that could be taken, is an intriguing one - perhaps the term has some other meaning in engineering parlance.
- 5.2 The $3 \text{ m}^3/\text{sec}$ flow, suggested as a residual by-pass flow, is substantially less than the lowest natural flow at the proposed weir site, as shown in the limited gauging data we have seen.
- 5.3 Such a reduced flow will result in extended, unnatural, low-flow periods below the weir site. The report does not present any flow duration curve which would enable an assessment to be made of the level and probable duration of modified low flows.
- 5.4 It is strongly suspected that the $3 \text{ m}^3/\text{sec}$ "compensation" flow will be inadequate for fisheries needs for reasons already given, and
- (a) the probability that much of this flow will disappear into the gravel substrate before reaching Little Goat Hill. (This probability is supported by what is happening now below the Harper Diversion; the

known loss of surface flow in the Opihi River, in low-flow periods, between the Levels Plains irrigation scheme intake and the junction with the Temuka River; and the natural seasonal habit of the Selwyn River to flow, disappear and flow again.

It is a common characteristic of the shingle Canterbury rivers, and there is no reason to believe the Wilberforce, under severely reduced surface flows, would behave differently, as N.Z.E.D. themselves state in (b) below).

- (b) the doubt expressed by N.Z.E.D. that a continuous surface flow below the weir site could not be maintained "unless the volume is substantial" and a bulldozer used to (create) maintain a single channel of water;
- (c) because in the single channel proposal, the valuable minor side channels could be destroyed, with spawning concentrated into the unstable main channels which are extremely vulnerable to damage by floods (i.e. if the frequent bulldozer disturbance which will take place does not, in itself, render the environment unfit for fish).

5.5 Assuming that seepage flows did emerge downstream from the proposed gravel diversion bank (as is possible, although no-one, including F.H.D., will clearly know what will happen until the full bank is built and the results observed over a variety of flows) and salmon entered them, it is inevitable that the bulldozing activities will cut some of these flows off, stranding the fish present. The bulldozing operations will probably range backwards and forwards over 4-5 km² of riverbed, with the need to

capture and control wandering flows for diversion or channel maintenance being the primary concern. Even with the best of intentions it does not seem possible that severe ecological change or damage (of which the above is an example), could be avoided, or effectively minimised, by the very nature of the operation.

5.6 Conclusion

A reduction in flow of the Wilberforce, between the proposed weir site and Little Goat Hill, below the natural low flow when salmon are migrating, or spawning, will be detrimental.

It would seem at this time that the $3 \text{ m}^3/\text{sec}$ bypass flow is inadequate for fisheries needs.

Should the proposal proceed, and a bypass of the suggested $3 \text{ m}^3/\text{sec}$ be all that is available, and a continuous surface flow below the weir not result from it, it would be better not to attempt the collection of the water into a single channel, but to leave the lower channels which may remain, undisturbed.

6. LENGTH OF THE PROPOSED WILBERFORCE DIVERSION BANK

6.1 The proposed length of this bank is one kilometre.

According to Map 2 in the report the width of the riverbed at this point is also about one kilometre. A line has been drawn to indicate the position of the bank and this scales out at about 0.7 km. Although the bank is shown as angled upstream towards its outer end it is clear that its length will be sufficient to extend over the major part of the riverbed.

- 6.2 It seems that the bank is intended to block off the part of the riverbed where the major river channels normally occur, i.e. towards the Castle Hill side.
- 6.3 We doubt whether it would be practical to bypass "residual" flows around the far end of the bank with any constancy, especially when flows are sufficient to cause channel changes, but are insufficient to breach the bank. Surplus water seems more likely to bypass the bank via the overflow weir proposed near the intake to the canal. This is conceded in the report in the reference to "one year" floods.
- 6.4 The flow bypassed around the end of the bank is therefore likely to originate from the minor channels rising on the western side of the river valley - from Kakapo, Kiwi and Moa Streams - and may well have no direct surface connection with the channels taking water from the upper Wilberforce catchment which tend to flow more towards the eastern side of the valley.
- 6.5 If this is the case, the principal "compensation" or bypass flow to provide fish access upstream towards Fang Hut will come from the floodway control weir by the canal intake and salmon migrating upstream would need to be able to pass over this weir.
- 6.6 Conclusion

The proposed Wilberforce diversion bank is not a "small" bank, as suggested in the report; it is an almost complete obstruction of the natural course of the river.

The suggested provisions for the mitigation of its likely effect on the fishery at certain times, seems to depend

on the efficiency of design concepts (which cannot be proven until the bank is constructed), and on the reliability of frequent bulldozer maintenance and correction of situations as they develop. Implementation of these measures will rest with N.Z.E.D.

If the principal "compensation" or bypass flow is derived from water passing over the floodway control weir, consideration will have to be given to the provision of fish pass facilities in this structure to ensure fish access upstream.

7. SILT ACCUMULATION BEHIND THE WILBERFORCE AND HARPER DIVERSION BANKS

- 7.1 It is stated in the report that silt and other material will be deposited behind these banks as a result of bedload movement, and that this material will be flushed downstream in the event of the banks being breached by floods.
- 7.2 Instead of the steady, natural movement of material downstream by the river, this abrupt flushing of a mass of material could, if salmon and redds were present, smother redds or physically damage the fish, or contribute to the accelerated scouring out of the channels, destroying their fisheries value.
- 7.3 The possible effects of material, particularly the finer suspended matter, being transported through the canal system into Lake Coleridge have been discussed. We are not convinced that the steps proposed to control this are adequate. Over the long-term, (many years) the accretion of this material by the lake must result in undesirable changes in the quality of its ecosystem.

The present Harper diversion, and its constantly enlarging shingle delta, indicate what could happen.

7.4 Conclusion

Possible silt accumulation as a result of the proposed scheme is a cause for serious fisheries concern.

8. LOSS OF FISH FROM LAKE COLERIDGE THROUGH THE PROPOSED CANAL SYSTEM

- 8.1 Our view on this aspect of the proposals has not changed. It is a major problem for the lake fishery.
- 8.2 While N.Z.E.D. concede that fish loss by migration is more than a possibility, we do not concede that it is up to the fisheries interests to prove the extent of this loss before any steps are "justified" in preventing it. The works contemplated, which will cause the problem, are proposed by N.Z.E.D. and it is up to them to show that their proposals will not have this result. They have not yet done so.
- 8.3 It is not possible, with the staff and resources available, either to the North Canterbury Acclimatisation Society, or the Ministry, to mount the investigative effort that would be necessary. Apart from this consideration, the passage of fish through the canal system would be unobtrusive and only occasionally detectable by direct observation. There would be no barrier, such as at the Harper gates to cause them to accumulate so that they would be obvious. The problems involved in trapping the proposed canal, to accurately determine fish movement, are immense and could not be seriously contemplated.

8.4 Conclusion

N.Z.E.D. must consider this problem more intently and bring forward proposals which will not allow fish to migrate out of the lake and be lost to the fishery.

Suggestions as to how this might be accomplished were made in our original comments, but do not seem to have been fully considered. There may be other methods. It is a matter which must be resolved before these proposals proceed.

9. DRAINAGE OF THE GLENTHORNE SWAMP

9.1 The surveys show that salmon make use of the stable, permanent flows issuing from the swampy area. The number of fish observed in May was of a similar order to that of the two Goat Hill systems.

9.2 Conclusion

Any work involved in the construction of the upper canal system which reduces the flows produced in this area, or which modifies the stream system as fish habitat, would be detrimental to salmon and trout production.

10. SUMMARY

10.1 Fisheries Management Division views the N.Z.E.D. proposal to divert the Wilberforce River into Lake Coleridge with grave concern, because of the serious effect it will probably have on the sea-run quinnat salmon environment in the Wilberforce River.

10.2 In low-flow years the reduced Wilberforce flow, contributing less to the upper Rakaia flow, will aggravate passage problems for upstream migrating salmon adults.

- 10.3 As presented, the proposal will result in a loss of fish from the Lake Coleridge fishery.
- 10.4 The environmental problems associated with the proposal require considerably more investigation and evaluation than has been possible within the time period of the proposal. The proposal itself appears to be an oversimplified engineering exercise, put together with a minimum of "hard" information.
- 10.5 The proposal is a relatively minor one in the overall scheme of power development, but its local environmental impact is major. Because of this a more searching appraisal of many aspects is necessary.
- 10.6 The use of the Wilberforce water resource for power generation may well be its most beneficial use, in the Nation's interest. This is not for us to judge. But we question whether the urgency to provide additional generation capacity, as claimed in the report, is sufficient justification for the proposal to proceed without adequate measures being taken to limit the severe impact it will have on the fisheries environment.