

**CLIVE RIVER DREDGING REVIEW**  
**DRAFT REPORT**

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**A REPORT TO HAWKE'S BAY REGIONAL COUNCIL**

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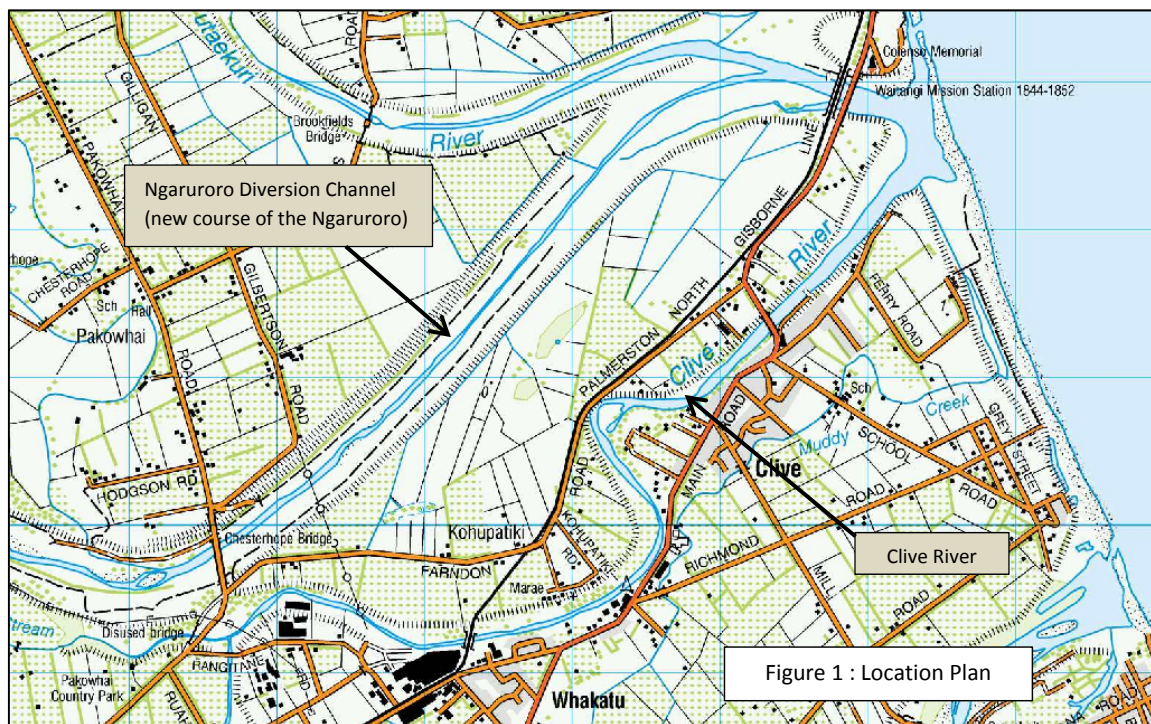
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## 1. Background

The Clive River occupies what was previously the last 7 km of the Ngaruroro River. The Ngaruroro was diverted from this channel to bypass the town in 1969. The upstream diversion point was in the vicinity of the Chesterhope Bridge. Since then, the 'old' channel of the Ngaruroro (the current Clive River) only carries water from the Karamu and Raupare Stream catchments.



The diversion was constructed to better manage the flood risk in and around Clive township. It has been successful in doing this and over the years has probably prevented what would otherwise have been millions of dollars worth of damage to land, businesses and property. However the reduction in flow down the old river channel has also meant that there is no longer the same flushing-through of sediments down the old channel as there was prior to the diversion. As a result there has been a build-up of sediment on the bed of the river – making the river shallower (and at low tide, narrower) than it would have been prior to the 1969 diversion.

The majority of the sediment on the bed of the river is believed to originate from the Ngaruroro / Tutaekuri Rivers which back-flow into the Clive River via the Waitangi Estuary when these rivers are in flood. There will also be sediment coming down into the Clive from the Karamu / Raupare catchment area upstream.

The shallow condition of the channel hinders the use of the river for the various water sports that take place there. The river is used for rowing (as a base for the Hawke's Bay Rowing Club), waka excursions, waka-ama, kayaking, water-skiing, wake-boarding, jet-skiing, surf lifesaver

training, canoe polo training, triathlon training and other water sports. As the river gets shallower, in between dredgings, these activities become increasingly difficult outside high tide.

The shallow depth also means that rafts of aquatic weed (cuttings from the operation of the weed-boat working upstream on the Karamu) are more likely to strand in the lower Clive River. These weed mats are a further obstacle to rowers, paddlers and other recreational users and can cause an odour problem if the weed becomes firmly stuck there and decays over the summer months.

The shallowness of the river has been recognised as a problem for recreational users since at least 1983 (14 years after the Ngaruroro diversion was completed) when the Hawke's Bay Catchment Board, with the support of the three local authorities<sup>1</sup>, commissioned a study to investigate the sedimentation and to try and find a long term solution.

It was as part of these investigations that the first post-diversion cross-sectional survey of the river was carried out. The surveys have since been repeated in 1992, 1995 and 1997. The initial (1983) survey found that in the lower 1000 metres of the Clive River the bed of the river had risen by between 0.2m and 1.0m (varying along and across the channel) in the 14 years since the 1969 diversion.

It was assumed at the time of the initial survey, and subsequent report<sup>2</sup> published in 1986 (refer Appendix 1), that the trend of sedimentation would continue. However it is interesting to find that in the later surveys (1992, 1995 and 1997) there is in fact no evidence of a continuing trend (refer to Appendix 2). This suggests that after an initially rapid period of sedimentation, immediately following the diversion, a new equilibrium level was eventually established – a process that took no more than 14 years, and was probably complete within 10 to 12 years of the diversion. Thereafter, from 1983 through to 1997 (another 14 years, leading up to the first dredging), the surveys show little overall change in bed-level along the river.

The 1986 Catchment Board report recommended dredging the channel and the construction of a weir across the mouth of the Clive River to maintain a constant water level (to be set at R.L. 10.5 metres)<sup>3</sup>. The report envisaged that the area upstream of the weir would then be developed as a rowing course with a minimum water depth of 2 metres.

This recommendation was not carried through. However, by the mid-1990's the idea of dredging the river was once again gaining traction, and in 1997, after securing the necessary resource consents, the first dredging occurred.

On the occasion of this first dredging a total of 1,700 metres of channel (by mostly 70 metres wide) was excavated using a cutter-suction dredge. The up-river end of the dredged channel

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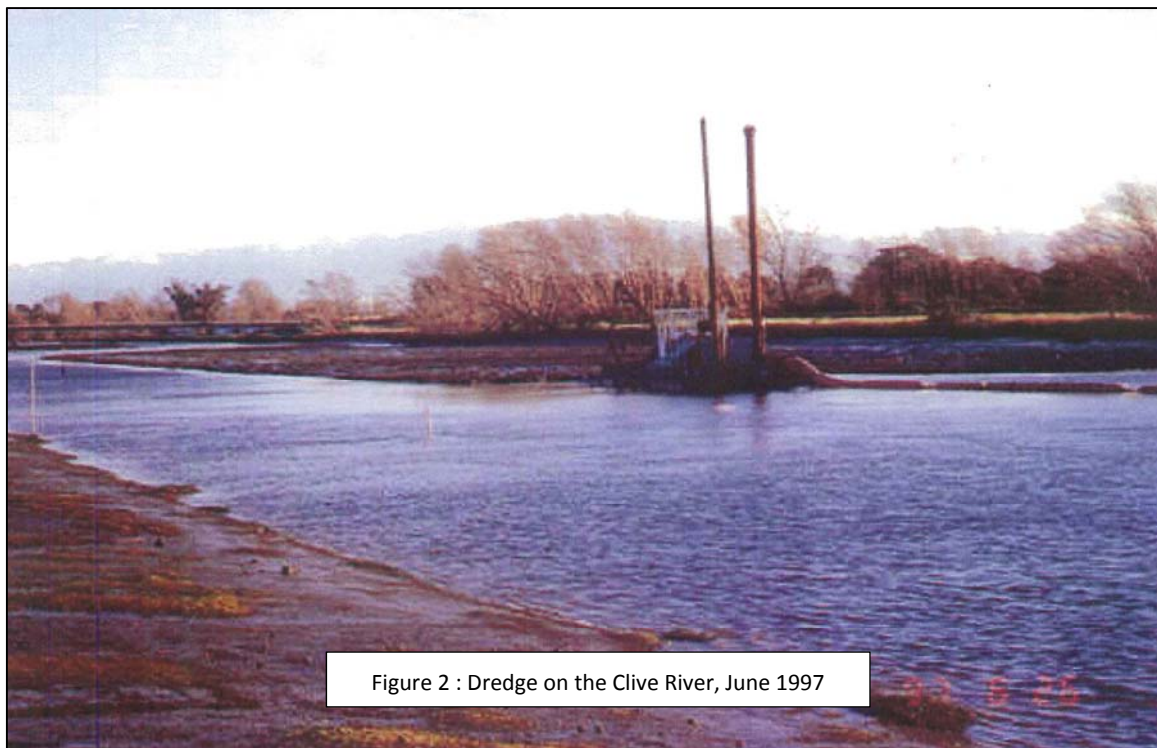
<sup>1</sup> Napier City Council, Hastings City Council and Hawke's Bay Borough Council.

<sup>2</sup> Reference: Hawke's Bay Catchment Board (January 1986) *Lower Clive River Development*. AM 86/01 HBRC plan no. 1886.

<sup>3</sup> Approximately 0.5m above mean sea level.



was 450 m upstream of the Clive bridge. The lower end was about 120m short of the outlet from Muddy Creek. The dredging lowered the bed of the river to achieve a channel depth of 0.75m at low tide. The work was largely funded by HBRC, but with some funding also provided by Hastings District Council.



At the time of this first dredging it was hoped that the newly-dredged channel would last for at least another 30 years (this being more or less the time period between when the Ngaruroro diversion had been created, and 1997). We have now seen that this assumption was incorrect and that it took only about 10 years for the river to silt up again. In hindsight this was probably not such a surprising outcome, given the previous pattern of sedimentation following the diversion of the Ngaruroro in 1969.

The re-silting of the river prompted calls for a further dredging and a decision was made to do so. Resource consents for the re-dredging were obtained in 2007 and the dredging itself took place in 2009. This time a somewhat reduced area of about 1,500 metres of channel (by 60 metres wide) was dredged – again to provide a minimum depth of 0.75m at low tide. The downstream end was also near Muddy Creek but at the upstream end finished not far above the HB Rowing Club launching ramp (about 250m up from the bridge). The whole of this second dredging was entirely funded by HBRC.

## 2. The Issue for HB Regional Council

When the Regional Council first became involved in the Clive River Dredging in 1997, and agreed to pay the majority of cost of the work, the assumption at the time, as we have seen, was that this work would last for another 30 years before having to be repeated. It is now recognised that this assumption was incorrect. The first dredging lasted only about 10 years and the second (2009) dredging is looking likely to only remain effective for about the same period of time. Four years have passed since the 2009 dredging and there are already signs that the river is once again filling up with sediment.

We now recognise that this pattern also fits with the longer historical observations of sedimentation following the 1969 river diversion in the period from 1969 to 1983.

The greater-than-expected frequency of dredging obviously brings with it a greater-than-originally-expected cost. The most recent (2009) dredging cost \$400,000<sup>4</sup> and there is clearly a big difference to the Council if this has to be done once every 10 instead of once every 30 years. Furthermore, whereas there was at least some financial assistance from Hastings District Council for the 1997 dredging, the 2009 dredging was fully-funded by the Regional Council, and there are no indications that anyone else will be stepping forward in future to assist with the cost of the work.

The other change is that whereas in the past it was been assumed that the sedimentation of the river would be a constant on-going process (that is, always getting steadily worse), it now appears that the pattern of sedimentation is characterised by an initially fairly rapid in-fill, after which the bed of the river settles into a new constant equilibrium. This means that although the condition of the river for recreational activity is certainly much improved by the dredging (and the value of this improvement should not be understated), if the dredging was stopped altogether, the majority of the existing users would still be able to operate on the river as they had done in the period of at least 14 years prior to 1997 when the first dredging occurred.

In these changed circumstances, and with a new understanding of the process of sedimentation in the Clive River, it is appropriate that the Council should review what is being achieved by the dredging programme; whether it is really delivering value for money to regional rate-payers; and whether it should be continued. It is also appropriate to consider, for the amount of money that is spent on dredging, whether there might be some other more cost-effective and enduring solutions to satisfy the demand for sheltered open-water recreation, competition and training areas, either at Clive or elsewhere within range of the main urban centres of the Heretaunga Plains. Providing answers to these questions is the aim of this report.

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<sup>4</sup> This was the cost of the dredging itself. With other associated costs (surveying and consents) the total cost would have been nearer \$500,000.



### 3. The Costs and Benefits of Dredging

#### 3.1 Costs

At an assumed cost of \$400,000 per dredging, and with dredging carried out on a 10-yearly cycle, the current average cost per annum is 40,000 a year, or about \$110/day (365 days/year).

#### 3.2 Benefits

The 'benefit' from this expenditure is greater opportunity for use of the river for a variety of recreational activities including rowing; kayaking; and waka ama; jet-skiing and wake-boarding / water-skiing; triathlon training; canoe-polo; power-boating; and launching of small recreational fishing boats. It also allows the river to be used for recreational and commercial waka-rides.

The degree of benefit that the dredging provides to these various users of the river will differ from group to group. For some users (specifically the waka rides) the on-going dredging of the Clive River is likely to be the difference between whether this activity can continue on the river into the future or not. The waka is a long, slow-turning craft with a 0.5m draft, and therefore has little tolerance of shallow water and is not easy to shift once grounded. If there was no further dredging it is likely that the waka would eventually have to leave the Clive River and return to the harbour at Ahuriri where it was originally located, or find some other base.

The next most reliant on dredging will be the motorised craft, including water-skiers, jet-skiers and wake-board riders. In the absence of dredging, once the sediment returned, they would only be able to operate on the river around high tide and would have to time their activities accordingly. That was the situation prior to the first dredging in 1997. It meant, in effect, that the Clive River was out of bounds for these motorised activities for a significant part of each day. The jet-skiers would still be able to launch and operate on the main Waitangi Estuary at these times, although without the use of the Clive River the total area of open water available to them would be more or less halved at low tide.

The rowers, waka ama and canoeists also benefit from the dredging and are by far the largest group overall. Unlike the waka and the motorised craft they would still be able to operate on the river, at all stages of tide, even if there was no further dredging. But without dredging they would have much less freedom of movement on the river; an increased risk of grounding at low tide; more risk of colliding with weed mats; and more problems with odour in the summer from the decaying rafts of weed. The dredging of the channel also gives more space and a greater reliability to river conditions for rowing regatta and other such events. In the absence of a dredged channel it would be a struggle to get sufficient width and length of river with adequate depth, at low tide, to run multi-lane side-by-side racing events. The improved river conditions may also have benefits for club recruitment. The Rowing Club claim that since the dredging their membership, and use of the river generally, has significantly increased. Although recent New Zealand successes in international rowing will have also been an important factor in the



increased popularity of rowing over this period it is entirely possible that the more usable condition of the river will have helped to cement that growth in membership.

The remaining users are the swimmers, triathletes, water-polo teams, etc. For these groups the dredging is probably no more than a welcome a convenience – particularly in regard to the improvement to summer water quality due to the reduced amount of stranded decaying weed. However unlike the other users this group has the choice of going elsewhere for training, such as the Pandora Pond or Waitangi Estuary, if conditions on the Clive River are unsuitable. The same goes for recreational fishing boats. None of these users are solely reliant on the Clive.

### 3.3 Quantification of Benefits

We estimate that across all of these users groups, over the main 6-month summer period (October – March, inclusive) there will be a 7-day average of about 130 individual uses<sup>5</sup> of the river per day. Over the 3 months in the shoulder period (Sept and April-May) there will be perhaps 60 users per day. In the remaining 3 months of winter we assume the use of the river will be negligible. If so then altogether that equates about to 27,700 (say 28,000) individual uses of the river per annum.

An ‘individual use’ is in this case assumed to be a single person going to the river to recreate (row, paddle, swim or drive) on the water and get out again. If the same person comes back again later in the day – for example if they are doing both morning and evening training – then that second training visit is treated as a separate ‘individual use’. Most of the individual uses are in fact likely to be the same people returning to the river day after day (given that the rowing club, waka ama and kayakers, with about 200 members between them, probably make up at least 70% of the total use). The actual number of individual ‘users’ per annum is likely to be less than 1,000.

In regard to the differing degrees of benefit for the 28,000 individual uses per annum:

- An estimated 10% (users of the waka) will be entirely reliant on the dredging – at least if the waka is to remain stationed on the Clive River. Without continued dredging the waka would have to locate elsewhere.
- An estimated 10% (the users of motorised craft) will be benefitting from being able to use the river through all phases of the tide, whereas without dredging they would be unable to use the river for about 4 hours a day (2 hours either side of the day-time low tide).

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<sup>5</sup> The estimate of 130 users a day assumes about 30 rowers training each weekday morning and evening (60 in total) plus 10 waka-ama training each day (morning *or* evening); another 20 incidental users through the day; plus an allowance for higher all-day use on weekends (assume 200/day). We also allow for an average of 2 x waka trips a week @ 36 participants per ride. These estimates are derived from a sample of morning and evening user-counts (Dec 2012), club membership figures, and interviews.





- An estimated 70% (rowers, waka ama and canoeists) will be benefitting from improved river conditions, including greater freedom of movement, less risk of grounding or collision with weed mats, less problem with odour from rotting weed, and more room for competition events, if dredging continues. They are not, however, entirely prevented from continuing with their use of the river if the dredging is discontinued.
- The remaining 10% (swimmers, canoe water polo and casual boaties) will be appreciative of the improvement in the condition of the river but would readily move to another site if conditions on the river were unsatisfactory.

### 3.4 Overall Benefit / Cost

The overall benefit/cost of the dredging can be calculated in a number of ways. As a crude measure it may be calculated as the number of individual uses per annum versus the annualised cost of the dredging itself. On this basis, if there are indeed 28,000 individual uses per annum, and the cost of dredging the river is \$40,000 per annum, then the cost-to-usage ratio would be around \$1.43 per use.

That is, for every individual use of the dredged section of river, the cost of providing the improved (dredged) environment is currently about \$1.43 for each time that a person gets on the water<sup>6</sup>.

As a further refinement on this assessment we can account of the differing degrees of benefit from dredging among the various user groups. This acknowledges that even without dredging it would still be feasible for most existing users to continue to operate on the river. The benefits, therefore, are not so much the difference between whether or not these activities can continue, but rather are measured as incremental improvements in the extent and quality of the river surface upon which these activities occur.

To factor this into our assessment of the benefits of dredging we have attempted to apply a weighting to the degree of benefit for each of the main categories of user group. The suggested weightings, the reasons for those weighting, and the resulting figures, are as set out in the table below:

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<sup>6</sup> This is based on existing use. If use of the river increases, then the per-use cost reduces.



**Table 1 : Benefit Weighting**

<b>Activity</b>	<b>Approx Uses per annum</b>	<b>Notional weighting of benefit, and reasons for weighting</b>	<b>Weighted benefit (uses per annum)</b>
Waka rides	2,000	90% : Waka rides would cease on the Clive if dredging discontinued (meaning 100% loss) but relocation to Ahuriri would be possible (therefore reduced to 90% weighting).	1,800
Motorised craft	2,000	30% : Based on the difference in time (daytime hours) that motorised craft are able to spend on the water as a result of the dredging.	600
Rowers & paddlers	22,000	30% : Reflecting a qualitative improvement in rowing and paddling conditions and probable improvement in membership.	6,600
Others	2,000	10% : Casual users can go elsewhere. They are not reliant on the dredging	200
<b>Totals</b>	<b>28,000</b>		<b>9,200</b>

The weightings that we have used in the table are not necessarily the only possible weightings. Other interpretations are possible. We would suggest, however, that they are a reasonable estimation of the degree of benefit (measured as usage of the river) provided by the dredging for the various groups.

In this case the results from the table give a 'weighted benefit' of 9,200 uses per annum. That is assumed to be, in effect, the incremental value of the dredging over and above the use and enjoyment that users of the Clive River would get from the river if the river was left in an un-dredged condition. The incremental benefits will be a greater use of the river (more people and more time on the water) and better quality of conditions on the river for day-to-day recreational activities. The figure of 9,200 uses per annum may be thought of as representing both the extra people using the river as a result of the dredging plus the extra 'quality' of experience for each individual use.

Translated again into dollar figures, that benefit (9,200 additional uses per annum), divided into the cost of the dredging (\$40,000 per annum), gives a weighted cost-to-usage ratio of \$4.35 per use.

#### 4. Comparison with Expenditure on Other Recreation Facilities

To put the cost-to-usage ratio for dredging (un-weighted value of \$1.43, or weighted value of \$4.35 per use) into perspective we have applied a similar analysis to other forms of Council-subsidised maintenance of recreational facilities. The comparisons that we have chosen are sports fields (rugby and soccer) and regional cycling trails.

The purpose of this analysis is to see how expenditure on maintenance dredging on the Clive River compares with expenditure on other types of recreational facilities versus the amount of use that those facilities receive. The analyses are as follow:

##### 4.1 Comparison with Spending on Sports Fields

The cost of maintaining an average rugby or soccer field is around \$140 a week (\$7,400 a year<sup>7</sup> / \$20 a day). That expenditure covers the costs of mowing, control of weeds, re-grassing, irrigation and line-marking.

If the field is a rugby field, but with some other incidental use (e.g. for summer athletics, marching, cricket) then the average use of that field is estimated to be around 6,500 individual uses per year.

This estimate assumes a 20-week rugby season with 7 games per week<sup>8</sup> (involving 15 players, 2 substitutes and 1 coach per side) plus 2 x training sessions per week involving 20 players and coaches. That gives a sub-total of 5,080 'individual uses' for rugby over the course of a season. The remaining 1,420 individual uses per annum are assumed to be other users of the field over the remainder of the year.

6,500 individual uses, divided into an annual maintenance cost of \$7,400 for the field, comes to \$1.13 per individual use – of which about \$0.85 per individual use is District or City Council subsidy<sup>9</sup>.

If the field is a soccer field then according to Central Football<sup>10</sup> the use would be somewhat lighter. Their estimate of use of a typical Council soccer field – for both junior and senior games – is around 3 games per week, with training carried out elsewhere. If so, and assuming 11 players, 2 substitutes and 1 coach per side, that comes to 1,680 individual uses per season. Allowing for another 1,420 incidental uses of the ground through the rest of the year (as for rugby, above), that would give a total of 3,100 individual uses of a soccer field over the course of a year.

<sup>7</sup> Cost estimate provided by C. Hosford, Parks & Properties Asset Manager, Hastings District Council.

<sup>8</sup> Estimate of games per week is based on pers. comm. Hawke's Bay Club Rugby.

<sup>9</sup> This assumes that the ground fees paid by 2 x rugby teams are contributed to the maintenance of each field. In Napier City the charge for each team is \$920 per 20-week season. If so, the remaining maintenance cost (covered by the Council) is \$5,560 per field.

<sup>10</sup> Telephone interview 6/12/2012.



This 3,100 individual uses, divided into an overall maintenance cost of \$7,400, comes to \$2.39 per individual use. The District or City Council share of that cost (once ground fees have been paid, and assuming that each field gets the equivalent of the fees from 2 x teams) would be around \$1.78 per individual use.

In summary, therefore, the rate-payer cost for maintenance of sports fields for rugby and soccer in Hawke's Bay would be around \$0.85 - \$1.78 per use, depending on the code. There is no weighting applied to these figures. The maintenance does not provide just an incremental benefit – if there was no maintenance of the fields there would be no sport.

#### 4.2 Comparison with Spending on Cycleways

The other chosen comparison is with the cost of maintenance of regional cycleways. There are presently around 180 km of cycleways in Hawke's Bay. The current budget for maintenance of the network, provided by the Regional Council, is \$150,000 per year (equivalent to \$410/day).

The level of use of the cycleway network is increasing but at the moment is estimated to be around 40,000 uses per year. If so, that equates to a current cost of \$3.75 per individual use – all of which is fully funded by HB Regional Council.

No weighting is applied to this figure. The cycle network is fully reliant on on-going maintenance.

#### 4.3 Overall Comparison

A summary of the preceding analysis is presented in the table below.

Recreation Facility Maintenance	Maintenance cost per use	Council share
Clive River Dredging	\$1.43 or \$4.35 weighted	\$1.43 (100%)
Rugby Field Maintenance	\$1.13	\$0.85 (75%)
Soccer Field Maintenance	\$2.39	\$1.78 (74%)
Cycling track Maintenance	\$3.75	\$3.75 (100%)

The table shows that, as a crude comparison, the cost of maintenance dredging on the Clive River, relative to the amount of use of the river, is similar to the costs and overall usage of other council-subsidised sports-related maintenance work. The amount of expenditure on dredging, relative to the number of users, is comparable to what is spent on sports fields, and is less than what is spent on the regional cycle network.

There is, however, an important difference in this comparison, as we have discussed: Whereas the maintenance of sports fields and cycling trails is essential to the continuation of these activities (that is, without it, these activities would eventually cease), the same can not be said for maintenance dredging on the Clive. If the dredging stopped, most of the existing



recreational use would continue, notwithstanding that the condition of the river for these activities would not be as good.

The cost of the 'incremental' benefit we have estimated, as per the earlier discussion, to be more in the order of \$4.35 per use. If so, and even allowing for a reasonably wide margin of error, that would place the benefit/cost of the maintenance dredging significantly below the benefit/cost for maintenance of sports fields – although in about the same ball-park as the benefit/cost for maintenance of the regional cycleways.

#### **4.4 Overall Assessment of Value for Money**

We conclude that, overall, the maintenance dredging of the Clive River delivers a similar value for money for ratepayers as the does maintenance expenditure on the regional cycle network.

A key difference is that, now the cycle network has been built, there is no option but to continue to maintain it. If maintenance is discontinued it will eventually become unusable. The dredging of the Clive, on the other hand, is more of a discretionary spend. Most of the existing users of the river will be able to 'make do' even if the river is not dredged, notwithstanding that it clearly makes a significant difference to the quality of the recreational experience on the river if regular dredging is carried out. That in turn helps to promote and encourage water sports in the region, attract new members to the various water-sport clubs, and encourage excellence and participation in these sports.

We are able to say, therefore, that spending on the dredging can be justified. But it must also be recognised as a discretionary spend. In short: if the Council feels that it has sufficient discretionary funds available to carry out further dredging, then there is reasonable justification for that expenditure. This is in the context of similar levels of spending versus benefit on the regional cycling network. It is also consistent with the practice of local government (though more usually territorial local authorities rather than regional council) subsidisation of recreational facilities such as sports grounds. But the high cost and non-essential nature of the dredging suggests that this should not be a spending item that is 'taken for granted' by the Council at the end of each dredging cycle if funds are limited at that time.

#### **4.5 User Contributions**

A further and final consideration is whether it would be appropriate to require some level of contribution from the river users themselves toward the dredging programme. The clubs have in the past made no payment toward the cost of the dredging.

It may be unreasonable to expect a future contribution since the clubs would not be the exclusive beneficiaries. In these circumstances all other non-affiliated users would effectively 'free-load' on the improved river conditions. On the other hand it is primarily the clubs who demand the dredging as it allows them the flexibility to use the river across the full range of



tides. Non-affiliated users will gladly have the improvements but for the most part are likely to be content even if no dredging occurs.

The charging of a share of the cost to the clubs would not be dissimilar to the charging of fees to rugby and soccer clubs for the maintenance of sports fields. It would also be similar to the common requirement among grants agencies that clubs receiving grants are generally required to carry out their own partial fund-raising. This demonstrates to the grants agency that the need is sufficiently serious that the clubs are prepared to put up some of their own money.

A requirement on the main user groups to put forward even a small (say 2%) contribution to the cost of the dredging would be consistent with this approach.

## **5. Assessment of Alternatives**

### **5.1 No Further Dredging**

In the absence of any further dredging on the Clive River there would continue to be a progressive build-up of sediment over the next four to six years, with the river eventually settling into a condition similar to what it was in the 14 or so years prior to the first dredging in 1997.

The river at that time provided adequate but less-than-ideal conditions for rowing. It also allowed motorised water sports for only a few hours a day around high tide. Outside that period, either side of low tide, the conditions became increasingly difficult due to the narrowing and shallowing of the channel. There were also more serious problems than now with stranded weed in the river due to the shallower river conditions, causing physical obstructions to rowing boats and other vessels, as well as odour.

The same problems would apply to the kayakers and waka if there was no further dredging.

The very large waka (Nga Tukemata O Kahungunu) has a draft of 0.5 metres and would eventually be unable to operate in shallow water. The waka was not present on the river prior to 1997 and, because of the shallow water conditions, would not have been able to operate on the river at that time. It has only been there since the dredging programme started, and can only practically remain on the river if the programme continues.

The jet-skiers and wake-boarders would be restricted to boating only for a period of time around high tide – as was the situation for the jet-skiers and water-skiers prior to 1997.

For Clive residents neighbouring the river there would be a return to more odour coming off the river in the summer from decaying weed – although for others there would be some relief from the reduction in noise. Prior to 1997 there was only ever power-boat noise around the high tide. Afterwards, when the dredging had been completed, the noise could continue for the whole of the day. Some submissions were received on this point during the 2007 consent



process for the re-dredging. These submitters welcomed the shallower river conditions and wanted to keep the river this way because of the implication of less power-boat activity on the water, regardless of any nuisance from odour.

Overall, use of the river would probably decline if there was no further dredging. Representatives of the Rowing Club interviewed for this study claim that since the 1997 dredging the use of the river has more or less trebled. This seems too high, and can not be verified, though it is probably true that use of the river has increased to some extent over this period. If so, and if this is at least partly due to the dredging, then it would be not unreasonable to suppose that a drop in membership could occur over time if the dredging was discontinued.

## 5.2 Relocation to Another Site

An alternative to further dredging would be to leave the river as it is and relocate some or all of the existing recreational activities to another site where less maintenance is required. The ten-yearly \$400,000 cost of dredging could go a long way toward covering the costs of relocation of existing facilities if a suitable site was available.

The options that have been considered are as follow:

### ***(i) Relocate to the Ngaruroro (the Diversion Channel)***

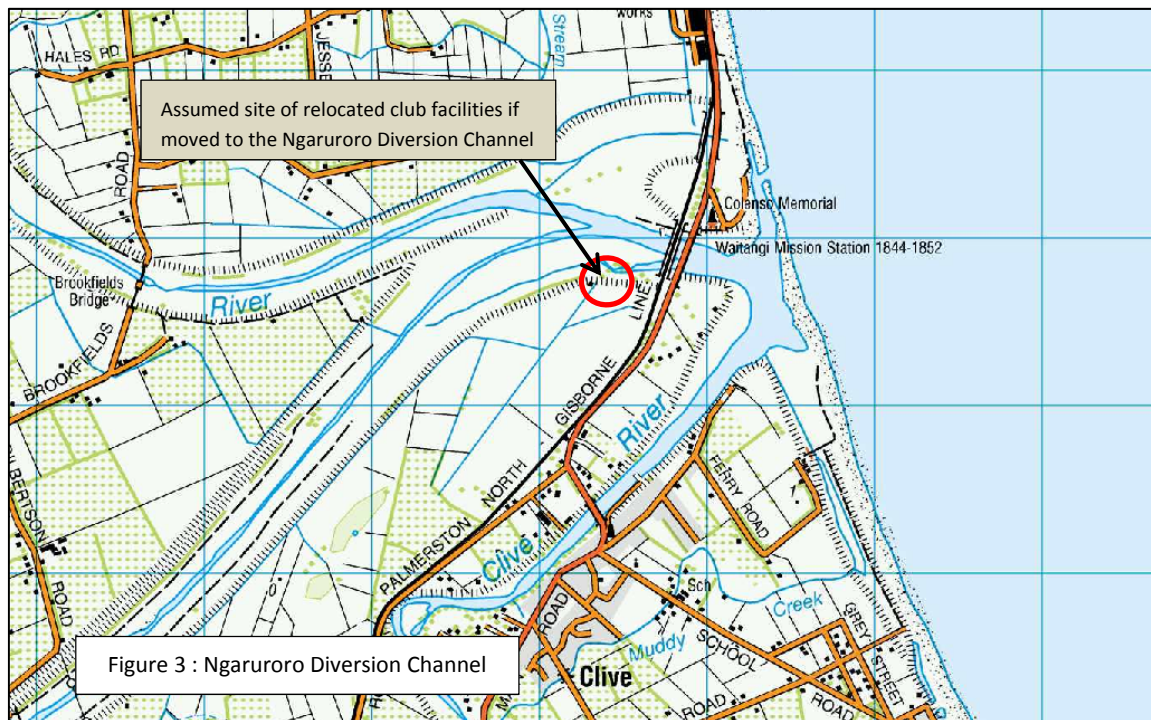
An immediate difficulty with relocating to the Ngaruroro diversion channel (what is now the main channel of the Ngaruroro) would be to find a safe and conveniently accessible place to relocate the various club facilities onto. Vehicle access would be a significant problem. The north bank of the river has no existing road access and the south bank (the Clive side of the river) can only be safely accessed off Farndon Road, near the Chesterhope Bridge. It would then be necessary to drive about 5 kilometres down the river (along or beside the stopbank) to get to what is probably the only point on this lower section of the Ngaruroro where it would be feasible to establish a boathouse and launching facilities.

Access is not feasible directly off the highway because of the road hazard, when turning in and out of the site, and because of the need to pass through an uncontrolled rail crossing. The chances of a serious accident, either on the highway, or at the rail crossing, would be too high to consider this direction of approach.

The likely site (see Figure 3) would be next to the dead-end channel that branches off the Ngaruroro and joins the main river just above the rail bridge. With some extension, widening and on-going maintenance the dead-end channel could probably be used to provide a safe launching place and corridor for getting between a relocated boat shed and the Waitangi Estuary. It is assumed that the boat shed and club house would be located beside the channel, either on or next to the stop-bank.



Sites upstream of this location are generally too far from the river (typically 200m from the stopbank to the river edge) and/or exposed to the risk of flooding; and/or too shallow at low flow.



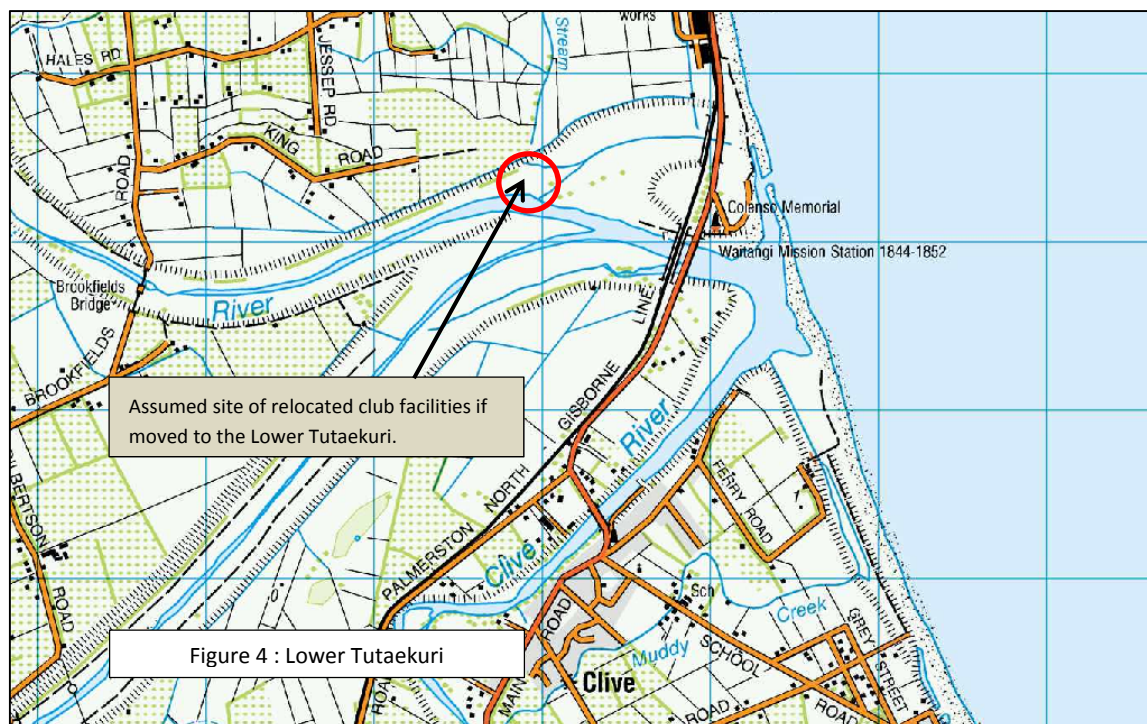
A permanent relocation of the rowing facilities, kayakers, waka ama etc to this site would enable boats to launch directly into the Waitangi Estuary where there are not the same problems as there are on the Clive River with shallowness or rafts of weed. The Clive River would still be accessible most of the time.

We suggest, however, that overall there would be little to gain in moving to this site. Apart from the cost of the move there would be significant challenges and costs associated with trying to develop road access. There would also be a greater exposure to risk of vandalism at this more remote site. Furthermore, the Waitangi Estuary is not as sheltered as the Clive. It is likely that if the rowing etc was moved to the lower Ngaruroro, the Clive would still be the preferred place to practice, notwithstanding the shallower conditions on the river if no further dredging occurs.



**(ii) Relocate to the Lower Tutaekuri**

The northern bank of the lower Tutaekuri would be another possibility as an alternative site for the clubrooms and boating facilities but suffers from similar problems as the lower Ngaruroro.



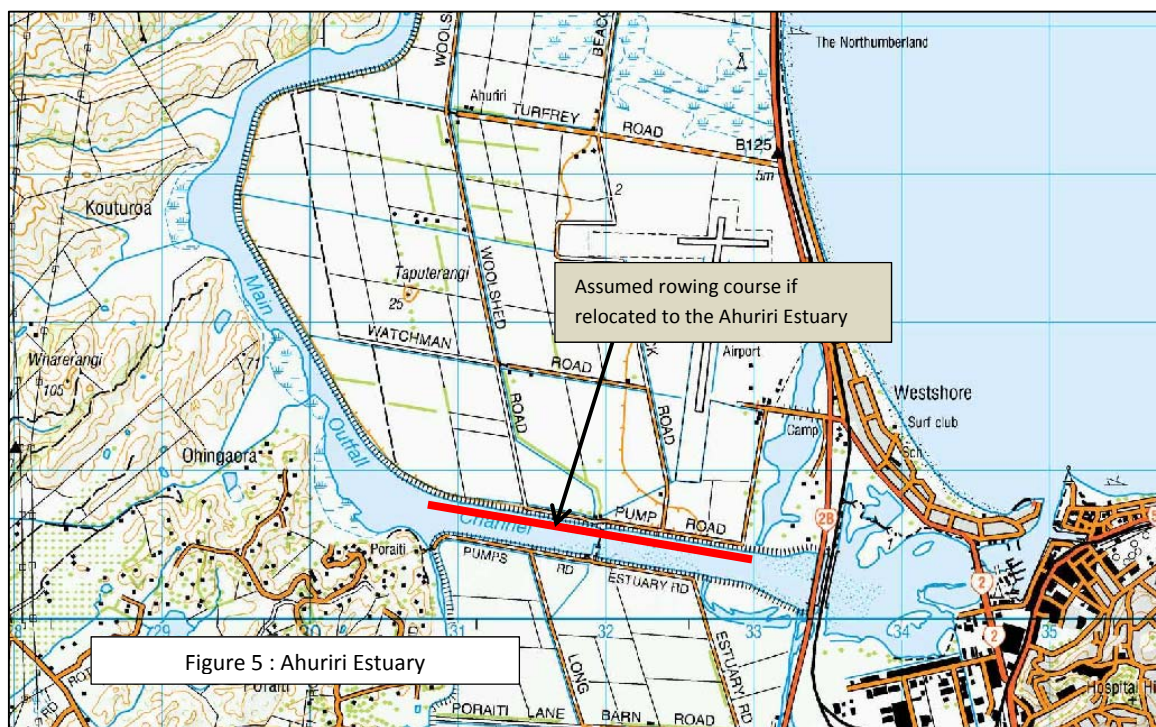
Again, road access would be difficult. The choices are to either extend by about 800m and improve the existing vehicle access that currently leads to the remote-control aero club or, more radically, develop the 'paper' un-formed section of McLeod Road (off Awatoto Road). These would both be expensive options.

The ground around the site, near the river, would need to be raised to bring it above flood level (unless the club rooms were built on the existing stop bank, about 100 metres from the river). This would be an added expense and could potentially interfere with existing flood protection works.

The site itself would probably be satisfactory as a base for rowing etc – though, again, it would not be as sheltered or as safe for rowing and paddling activity as staying on the comparatively gentle waters of the Clive. The currents are substantially faster and there are cross-currents where the Tutaekuri and Ngaruroro Rivers meet. There is also a greater exposure to wind. The Clive (with or without dredging) would probably still be the naturally preferred site.

### ***(iii) Relocate to the Ahuriri Estuary***

Road access to the Ahuriri Estuary outfall channel would be possible – either via Watchman Road, on the northern side of the estuary (although the safety of the intersection between Watchman Rd and the Expressway would be a concern). Another option, with Napier City Council approval, would be to develop access from the southern side of the outfall channel, through the Lagoon Farm.



To make the outfall channel suitable for rowing it would need to be dredged to create a sufficiently deep and sufficiently wide rowing course. A 70 metre wide rowing course would occupy about a third of the total width of the channel and would probably be excavated along the northern side. There would be sufficient room for a straight 2.5 kilometre course to be formed between the railway bridge and the first major bend in the outfall channel. Once established there would be no further need for maintenance dredging. There is a negligible sediment build-up in the outfall channel. This is apparent from the continued evidence of borrow-pits, visible under water and within the channel, where fill was excavated after the 1931 earthquake to build the existing stop banks. These have not filled back in with sediment since they were excavated 80 years ago.

The status of the estuary outfall channel as a wildlife area and the sensitivities relating to this would, however, be a significant constraint on the creation of a rowing course at this site. It is highly likely that there would be strong opposition to any alteration to the channel and the introduction of people into this area (rowers, kayakers, waka ama). This would be perceived as likely to 'disturb' the wildlife and cause harm. Although the reality of these impacts could be

debated, a long and expensive resource consent application process, with a large body of opposition, would be likely.

A further issue is that, even if the Ahuriri Estuary outfall channel could be shown to be suitable for rowing and paddling, it would be too much to expect that motorised craft (jet-boats and jet-skis) might also be allowed. Therefore, as a site, it would still only realistically provide an alternative recreational area for non-motorised craft. It would not be a solution for all existing users of the Clive River.

Another issue is whether the 2.5 km straight racing course would actually be sufficient. As a race course it would be a distinct improvement on the existing racing options on the Clive River and Waitangi Estuary. But for general training purpose it may be too short. At Clive, if river conditions are suitable, there is at least the option for rowers to carry on into the Waitangi Estuary and from there up the Ngaruroro River as far as the overhead cables below the Chesterhope Bridge. The return trip back to the club house is about 14 kilometres.

Creating the same length of extended training area in the Ahuriri Estuary would require an additional 4.5km of dredging up into the narrower and more reedy areas of the upper outfall channel (for which it would be even more difficult to obtain the necessary resource consents).

An alternative would be to deviate to an entirely separate purpose-made channel, running parallel to the existing channel, along the western edge of the Landcorp Farm. It is, however, assumed that this would not be favourably looked upon by Landcorp as it would have an obvious impact on this corner of the farm.

The cost of excavating the channel would be covered if the underlying material is extractable gravel but not covered (and very expensive) if the underlying material is silt.

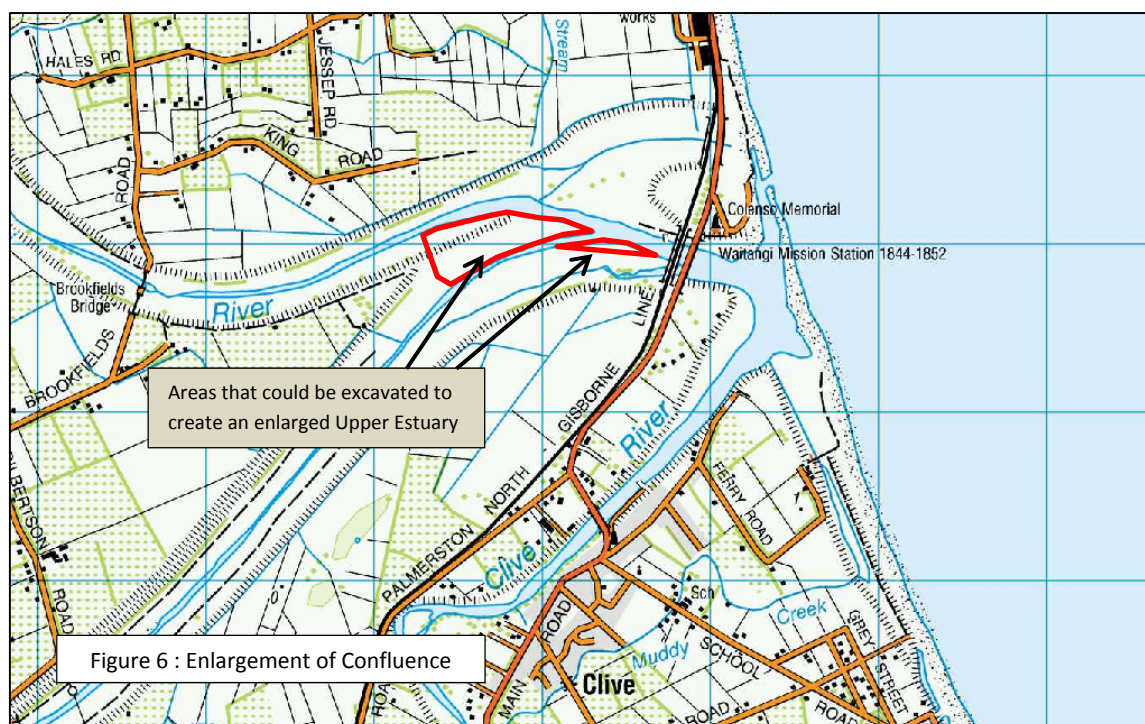
It is also unclear what effect a second channel would have on the hydrology and through-flow of water in the existing channel and whether this would have an adverse effect on water quality in either branch.

Overall this option has some attractions but, on balance, is likely to be simply too difficult to proceed with on account of restrictions surrounding use of the Ahuriri Estuary and possible impacts on wildlife. There is a high probability that applications for dredging a channel up the side of the estuary would not succeed. There would also be a high cost attached to the consent process.



#### ***(iv) Enlargement of the Ngaruroro / Tutaekuri Confluence***

A further option, as an alternative to dredging the Clive River, would be to enlarge the confluence of the Ngaruroro and Tutaekuri Rivers to create a new open water area at the head of the Waitangi Estuary. This would involve excavating, and cutting down to at least 1 metre below water level, the triangular piece of land just above the current junction, on the river side of the stop banks. An estimated 170,000m<sup>2</sup> of extra open water area (800m long and 280m wide) would be created if this triangle was removed. Space could also potentially be created by cropping the southern bank of the Ngaruroro.



This option has been considered on and off in the past. What makes it potentially attractive is that the material is good quality river silt, which has uses in the contracting industry, and therefore could be excavated and taken away by contractors, for their use, free of charge.

A problem at the moment is that there is currently no great demand for silt. Small amounts are still being excavated from along the banks of the Ngaruroro River but there would not be enough of an existing demand to make a serious impact on this area at the Ngaruroro / Tutaekuri junction. It may be some years before this changes.

It is also uncertain how long the excavation would remain effective. Once the silt has been excavated it may just start silting up again.

Furthermore, in order for rowers and paddlers to get to this new area of open water they would still need to come down through the Clive River, including passing through the shallowest section of the river where the Clive runs into the Waitangi Estuary. This option is therefore still

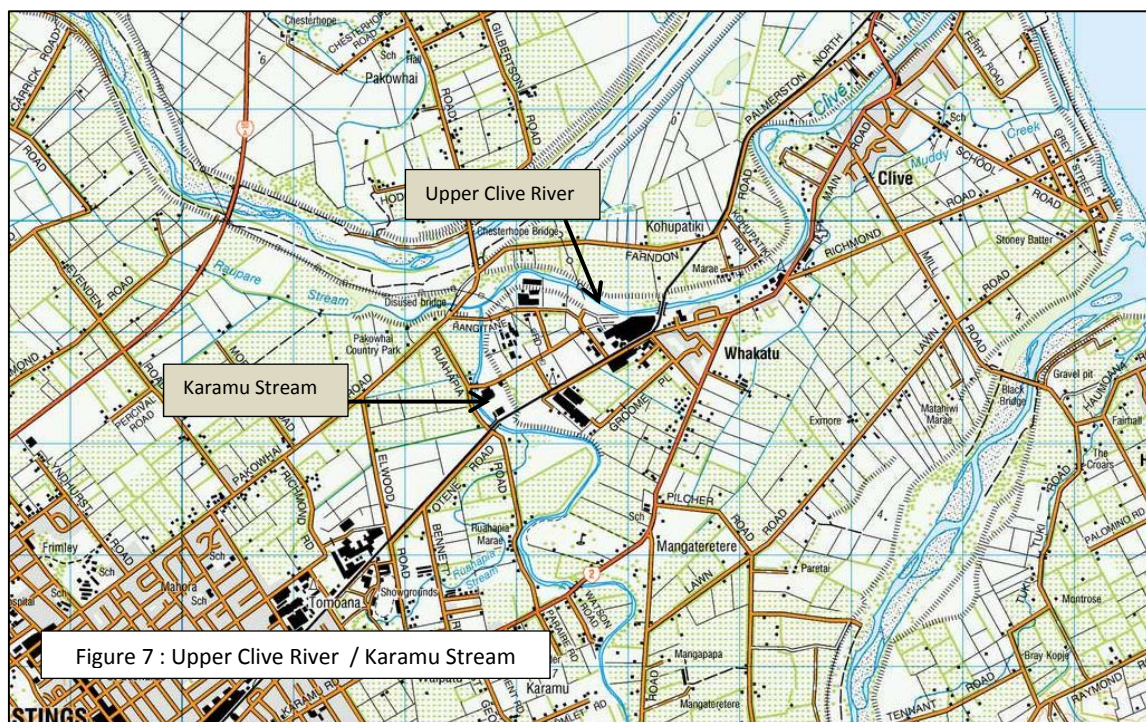
involves living with the existing constraints of the Clive for most day-to-day training. The enlarged area would mostly be utilised by this group only for extended training and for competition events.

It would, however, be a significant improvement and alternative site for be jet-skiers and wake-boarders. The resulting width of channel would be ideal for laps and circuits. If the whole of the triangular point at the junction of the two rivers was able to be removed, and kept in that condition, it would provide an open-water recreation area of similar size to the main body of the existing Waitangi Estuary and largely compensate for loss of opportunity on the Clive.

Overall, we consider that the enlargement of the upper Waitangi Estuary would be helpful, but only as a supplement rather than a replacement to the Clive River. Even with this enlarged area most of the day-to-day morning and evening training activity for rowers and paddlers would still happen on the Clive.

**(v) Excavate a Course on the Upper Clive River / Karamu Stream**

The Karamu Stream upstream of Clive township would not be wide enough for an alternative rowing course, at least not for conventional side-by-side rowing, although it could possibly work as a training course and for pursuit racing<sup>11</sup>. It would not provide a solution for motorised recreational craft.



<sup>11</sup> Better known as 'bump' racing. Bump races are a style of racing where rowing boats pursue one another, where the boat in front must keep ahead of the boat behind.

There is, furthermore, uncertainty over the rate of re-sedimentation that could be expected in the upper Karamu if the stream channel was in fact widened and deepened. It is possible that an excavation of the channel would last no longer, or not a lot longer, than dredging the Clive.

The only (anecdotal) information that we have on sedimentation in the upper Clive River and Karamu Stream is from the owner and operator of the waka-rides and from the people at Kohupatiki Marae. The owner of the waka says he has observed in recent years a build-up of sediment immediately above where the waka is moored which has the appearance of a drift of sediment that has worked its way downstream. Similarly, in the river next to Kohupatiki Marae, which is about 3.5km upstream from the Clive bridge, the people at the marae have observed a build-up of sediment. Whereas there was formerly a gravel bed in this part of the river, prior to the diversion, the bed is now soft sediment (overlying the gravel) with a covering of aquatic plants. There have been no cross-sectional surveys of this upper part of the river so it is not possible to establish if there is any sort of on-going trend or whether, as in the lower river, a new equilibrium level has been established.

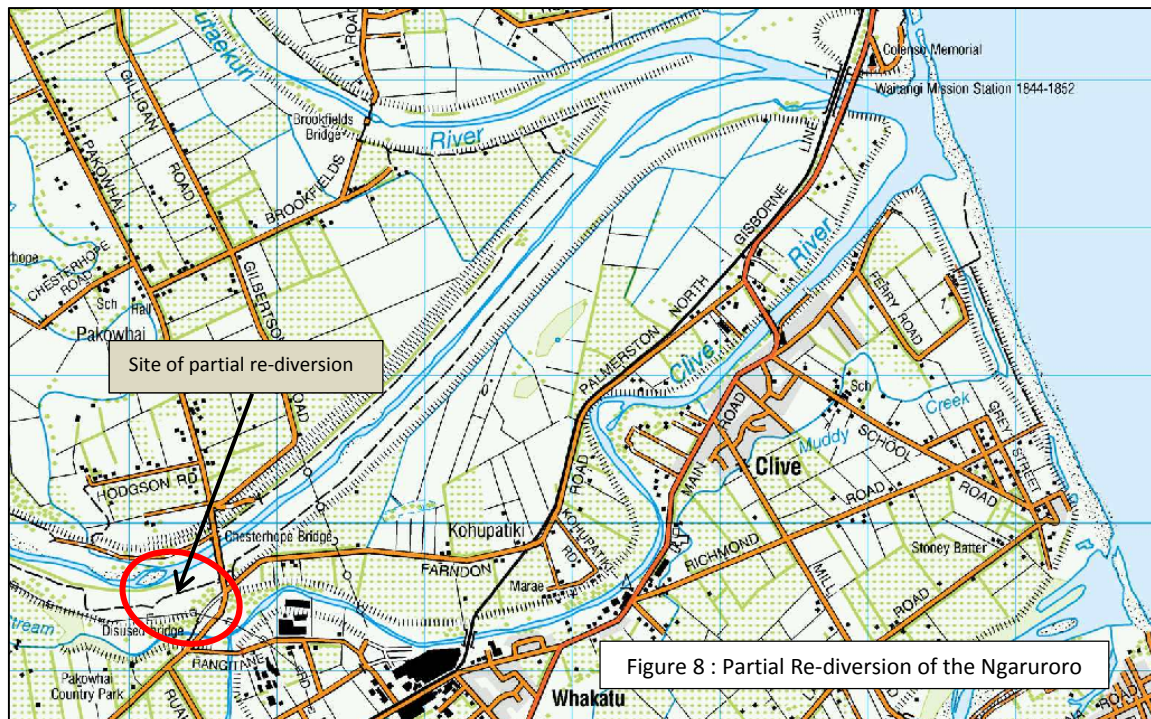
The observations suggest, however, that deepening and widening of the Upper Clive / Karamu Stream would probably not be a long term low-maintenance alternative to the existing recreational area on the lower Clive River, even if it was an attractive and workable solution for river users, as the sediment would most likely eventually return.

There could be scope for experimentation, however. The people at Kohupatiki Marae have indicated that they would be interested in trying out a bulldozer in the river bed (during a summer dry period) to excavate down and deepen the channel opposite the marae. They envisage that the bed sediments would be pushed to the sides of the river to narrow the channel. It would be interesting to see what effect this has on flows in the river, and on aquatic weed growth, and how long it remains effective. The people at the marae are also interested to see whether digging down to expose the original gravel improves the habitat for flounder (patiki). There would be some temporary adverse impacts on the river as a result of this in-channel excavation work but the river would recover. Care would particularly be needed to avoid or mitigate effects on whitebait spawning areas along the river banks.



### ***(vi) Partial Re-Diversion of the Ngaruroro***

A further possible alternative solution (or supplementary solution) would be to re-divert a portion of the flow in the Ngaruroro River back to the Clive River to increase the through-flow of water down the Clive. By increasing the flow rate in the river the intention would be to counter or at least partly counter sedimentation and cut-weed accumulation in the Clive River and therefore reduce the need for future dredging. The scheme would also be separately intended to improve water quality in the Clive River in the hope that this would benefit the environment for flounder and other aquatic life.



If this scheme went ahead a connection through to the Ngaruroro diversion channel would be created where the original diversion was made in 1969 (now the site of the Pakowhai Country Park, just upstream of Chesterhope Bridge). The connecting channel would need to pass under the stop-bank and have a flood gate fitted. It would either run all the way from the active Ngaruroro river channel, to divert surface water directly from the river, or run alongside the river and divert subsurface water into a feeder canal.

Recent modelling suggests, however, that the scheme would not be successful. The results of the modelling, by HBRC hydrologists, shows that even with the introduction of the additional flow to the Clive River (at both high input and low input) the increased flow in the river would not be enough to mobilise bed sediments and thereby counter the sedimentation trend. If so, the re-division would not have the desired effect.

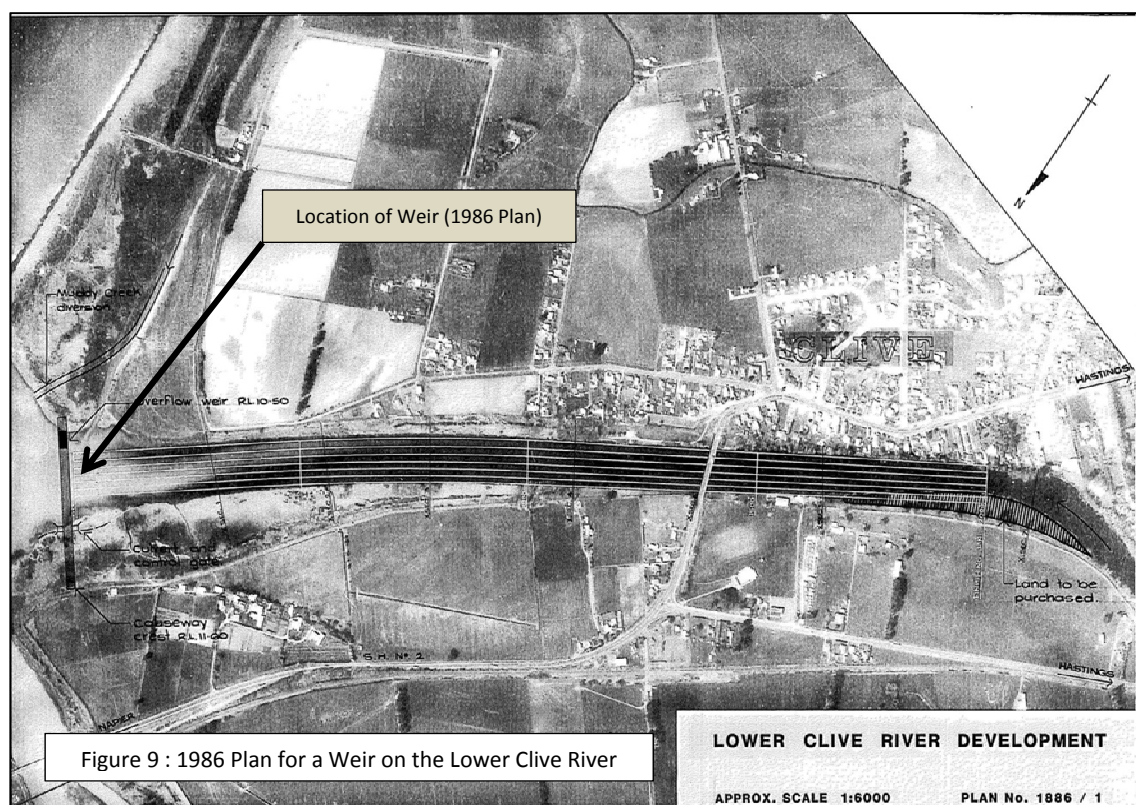
Another potential problem with this option is that by diverting water from the Ngaruroro to the Clive River there could be an adverse effect on the Ngaruroro itself. The withdrawal of water

from the Ngaruroro will mean lower water levels in that river, which could have its own adverse ecological consequences. It may also have the effect of actually reducing, rather than increasing, the amount of usable water for rowers and waka-ama since the Ngaruroro diversion channel up as far as the overhanging wires (just downstream of the Chesterhope Bridge) is part of the wider training circuit. A removal of water from this section of river could make the upper parts of the circuit no longer navigable.

For these reasons the re-diversion option is not likely to be viable. It would be an expensive project, with negligible improvements for the Clive River, and possibly adverse consequences for the Ngaruroro.

### ***(vii) Weir Across the Mouth of the Clive River***

The last of the alternative options is an option originally put forward in the 1986 Catchment Board report on the Clive River. That is to dredge the Clive River and try and keep the bed of the river at that level through the installation of a weir across the mouth of the river where it enters the Waitangi Estuary.



The 1986 concept was to build the weir so that it maintained a permanently high water level in the Clive River and prevented the back-flow of flood waters from the Ngaruroro via the estuary.

This concept would now be unlikely to succeed, partly because of the effect that a permanently fixed water level would have, or would be likely to have, on the ecology of the Clive River



(including effects on whitebait spawning areas). It would also probably present a barrier to the movement of rafts of weed from the Clive River out into the estuary and from there out to sea. Furthermore, it is not entirely certain that it would actually prevent or even substantially reduce sedimentation in the Clive. In order for the weir to have this effect it would probably need to be fitted with some kind of manually-operated flood gate to block off the back-flow of flood waters from the Waitangi Estuary when the Ngaruroro and Tutaekuri are in flood.

Lastly, with a weir across the river, the passage of boats (including rowing boats) in and out of the Clive River would probably be restricted if not prevented altogether. This would exclude a large part of the existing training circuit across the Waitangi Estuary and up the Ngaruroro River.

For these reasons, the option of building a weir across the river is not likely to succeed.

## 6. Overall Conclusions

From the preceding analysis we conclude:

1. We can find no workable alternative to the Clive River as a site for sheltered open-water recreation activity within the Heretaunga Plans area. Nor are we able to find an enduring alternative technical solution other than dredging.
2. The costs of dredging, relative to the amount of use of the river and the incremental benefits obtained from it, are comparable to existing per-user expenditure on the regional cycling network (though more costly per user than maintenance of conventional sports fields). The costs of on-going maintenance dredging can therefore be justified on relative terms. Expenditure on dredging would also be consistent with other local and regional government subsidisation of maintenance of sports facilities in general.
3. There is, however, a key difference with the dredging: Although maintenance dredging significantly improves the condition of the river for recreation activities, for the majority of users, including rowers, waka ama and canoeists, it is not essential to the continuation of their sport. For at least 14 years prior to the first dredging in 1997, over which time the level of the river bed remained fairly constant, existing users were still able to 'make do' with an un-dredged channel. If there was no further maintenance dredging the river bed would return to about this same level, and stay there. This suggests that the dredging programme is more of a discretionary, rather than essential, spending item. There is no doubt that it has benefits for users of the river but those benefits need to be compared and prioritised alongside other Council spending demands.



**APPENDIX 1**

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**1986 HB CATCHMENT BOARD  
SUMMARY REPORT ON CLIVE RIVER**

**APPENDIX 2**

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**CROSS-SECTIONAL SURVEYS OF THE  
CLIVE RIVER (1983, 1992, 1995 & 1997)**