



# ENVIRONMENTAL MANAGEMENT GROUP

## Technical report

INTERNAL



SAFEGUARDING YOUR ENVIRONMENT + KAITIAKI TUKU IHO



### Paritua/Karewarewa Stream - Hydrology

Oct 2007  
EMI 0730  
HBRC Plan Number 3992



## Environmental Management Group Technical Report

Internal

Environmental Science Section/Environmental Regulation Section

---

# Paritua/Karewarewa Stream - Hydrology

---

Prepared by:  
Rob Waldron – Hydrology Data Analyst  
Ian Lilburn – Compliance Officer  
Larry Withey – Team Leader – Environmental Information  
Sven Exeter – Consents Officer

Reviewed by:  
Graham Sevicke-Jones, Manager – Environmental Science

Approved:  
**Murray Buchanan**, Group Manager – Environmental Management

Reviewed: \_\_\_\_\_

Oct 2007  
EMI 0730  
HBRC Plan Number 3992



## **EXECUTIVE SUMMARY**

This report outlines the history, physical context and present conditions of the Paritua/Karewarewa Stream.

The Paritua/Karewarewa Stream is a tributary of the Karamu Stream. The channel of the Paritua/Karewarewa Stream flows through areas of unconfined and confined aquifers, and in some reaches, loses water to the unconfined aquifer.

Over the last 150 years of settlement, the channel has become highly modified, accompanied with land drainage and loss of extensive wetland areas. The Napier earthquake of 1931 altered land levels resulting in the joining of the Paritua and Karewarewa streams. During the summer months the stream ceases to flow with dry areas appearing first about the Bridge Pa area. Dry areas can extend upstream for approximately a kilometre depending on conditions. Continuous flow still occurs upstream of Washpool Station during these summer months.

A minimum flow within this part of the Karamu Catchment has been set, but no allocatable volume. During the irrigation season, the Paritua/Karewarewa Stream is often under ban. There are nine existing consents to take water from the stream and its main tributary, the Ongaru Drain.

The stream supports aquatic ecosystems which house migratory fish species such as inanga. This report identifies other potential more detailed studies of the stream and its interaction with the groundwater resource, to assist in assessing future surface and groundwater take applications.

## TABLE OF CONTENTS

|             |  |           |
|-------------|--|-----------|
| <b>1.0</b>  | <b>INTRODUCTION .....</b>                        | <b>1</b>  |
| 1.1         | Purpose .....                                    | 1         |
| 1.2         | Aims .....                                       | 1         |
| 1.3         | Scope .....                                      | 1         |
| <b>2.0</b>  | <b>CATCHMENT .....</b>                           | <b>3</b>  |
| 2.1         | Stream .....                                     | 3         |
| 2.2         | Geology and Soils.....                           | 6         |
| 2.3         | Aquifers .....                                   | 9         |
| <b>3.0</b>  | <b>HISTORY.....</b>                              | <b>11</b> |
| 3.1         | Early History .....                              | 11        |
| 3.2         | Upper Paritua Stream .....                       | 11        |
| 3.3         | Lower Paritua and Karewarewa Stream.....         | 13        |
| <b>4.0</b>  | <b>FISH DISTRIBUTION .....</b>                   | <b>14</b> |
| <b>5.0</b>  | <b>CULTURAL IMPORTANCE .....</b>                 | <b>15</b> |
| <b>6.0</b>  | <b>HYDROLOGY.....</b>                            | <b>16</b> |
| <b>7.0</b>  | <b>EXISTING CONSENTS .....</b>                   | <b>23</b> |
| 7.1         | Paritua Vineyards Ltd Frost Protection Take..... | 23        |
| <b>8.0</b>  | <b>POLICY .....</b>                              | <b>24</b> |
| <b>9.0</b>  | <b>CONCLUSION.....</b>                           | <b>26</b> |
| <b>10.0</b> | <b>OPTIONS FOR FUTHER INVESTIGATIONS .....</b>   | <b>27</b> |
| <b>11.0</b> | <b>ACKNOWLEDGEMENTS.....</b>                     | <b>28</b> |
| <b>12.0</b> | <b>REFERENCES .....</b>                          | <b>29</b> |

### APPENDIX 1

### APPENDIX 2

## 1.0 INTRODUCTION

### 1.1 Purpose

This report examines the Paritua/Karewarewa Stream. This report is to:

- provide background information on the area to assist consent staff with renewal and re-issuing of current and new surface water consents
- provide a summary of the historical and current hydrological conditions, and
- provide a summary of the ecological value.

### 1.2 Aims

- To detail the history, as far as it is verifiable, of the use and changes to the stream.
- To establish the physical context of the stream and present conditions.
- To provide discussion and analysis on the state of the stream.

### 1.3 Scope

Hawke's Bay is divided into consent 'renewal' areas and stream management zones<sup>1</sup> to better manage water resources and increase efficiency in the consent process. This report examines the Paritua/Karewarewa Stream, which lies in the Turamoe Road Stream Management Zone as shown in Figure 1.

---

<sup>1</sup> 'Stream management zone' refers to the reaches of a river and/or its tributaries governed by a single minimum flow site.



## 2.0 CATCHMENT

### 2.1 Stream

The Paritua/Karewarewa Stream is located in the Karamu catchment as shown in Figure 2. The Paritua Stream rises in the limestone hills of the Raukawa and drains an area of former wetland crossed by Valley Road. It flows through the Te Tua and Washpool stations (Glazebrook property) where the channel was modified in the early 1970's during development of the Glazebrook irrigation race. On leaving Washpool station the Paritua Stream flows across the Ngatarawa valley to Bridge Pa. The stream loses water in this reach and will often dry naturally at the Raukawa Road bridge at Bridge Pa. During the dry summer months, the stream can often dry between Raukawa Road bridge and approximately 1km upstream of the bridge and up to approximately 1.5km downstream (go to Section 6.0 for more detail).

Below the Raukawa Road bridge the name of the stream changes to the Karewarewa. The Karewarewa Stream commonly gains in flow from the aquifer downstream of the bridge. In the area upstream of Pakipaki, the Karewarewa Stream flows across former wetland from where it gathers additional flow, before joining the Awanui Stream (one of three main tributaries to the Karamu Stream). It is the largest tributary to the Awanui stream, but regularly falls below its statutory minimum flow as measured at Turamoe Road.

Figure 3 shows the locations of all HBRC monitoring sites on the Paritua/Karewarewa system. While descending down through the system, the catchment areas for the following sites are:

- Paritua Stream at Water Wheel - 51km<sup>2</sup>
- Paritua Stream at Raukawa Road - 108km<sup>2</sup>
- Karewarewa Stream at Paki Paki - 120km<sup>2</sup>
- Karamu Stream at Floodgates - 467km<sup>2</sup>

Figure 2. The Karamu Catchment Map

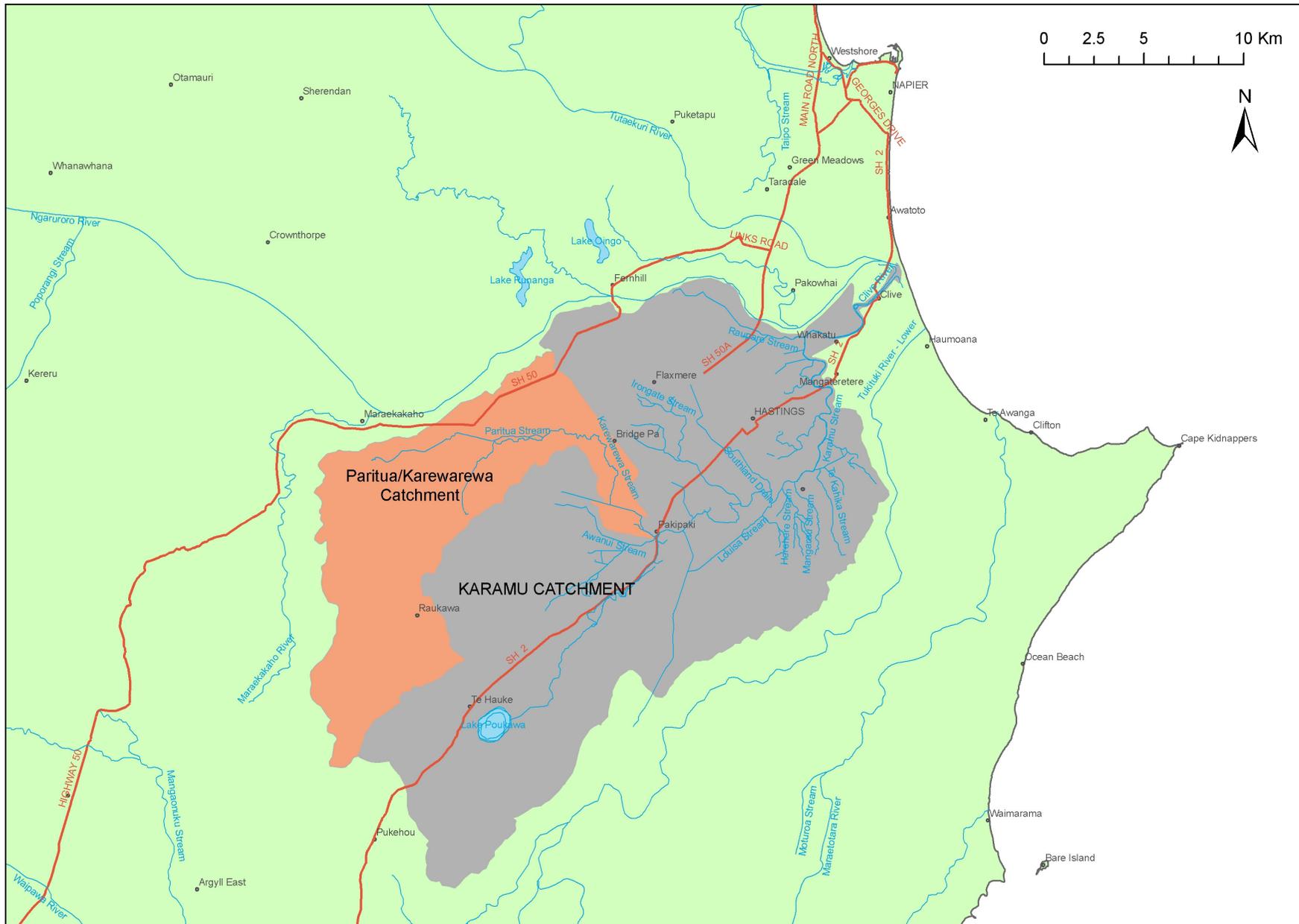
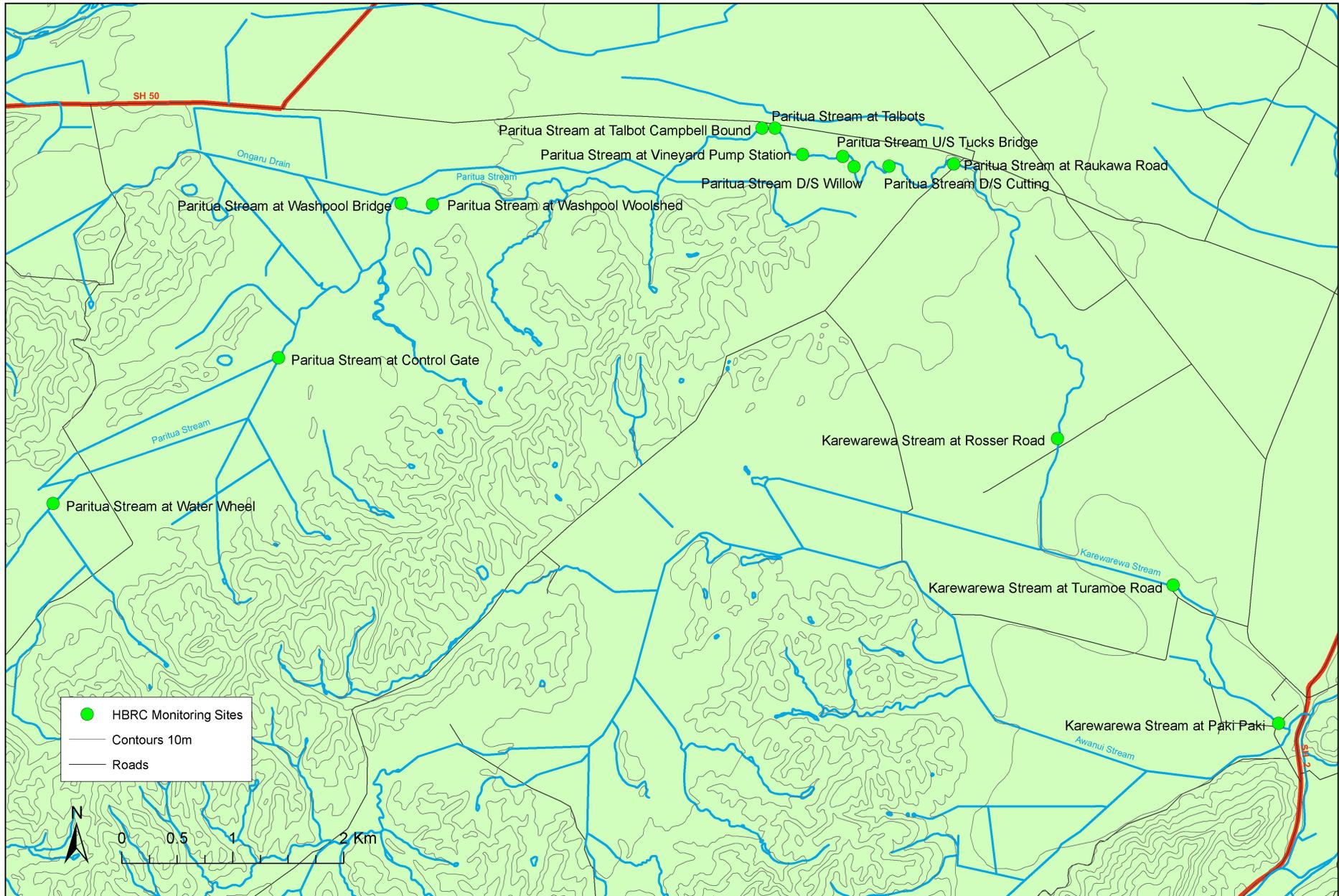


Figure 3. Paritua/Karewarewa Stream Site Map



## 2.2 Geology and Soils

The Paritua/Karewarewa Stream starts in the Raukawa Hills, and flows over a mixture of coarse and fine sediments in its upper reaches, and predominantly coarse sediments in its lower reaches below Raukawa Road (see Figure 4). These sediments are made up of a mixture of sand, silt, gravel and pumice deposits (see Figure 5).

According to Griffiths (2001), Hawke's Bay's Heretaunga Plains have been built up over 250,000 years from sediments deposited in a marine basin. Most sediment comes from the Kaweka and Ruahine Ranges, carried by the Ngaruroro, Tutaekuri and Tukituki rivers. The Ngaruroro carried the biggest volume of sediment and filled the central and southern areas.

The parent materials of the Heretaunga Plains were deposited in a complex way, by either air or water. Loess and volcanic ashes are found around the edges of the plains as Aeolian deposits. The Loess was deposited more than 14,000 years ago and the volcanic ashes more than 10,000 years ago. Fine sand blown out of the river beds form sand dunes on the plains, evident in the Ngatarawa and Maraekakaho areas. Alluvium forms most of the Heretaunga plains (Griffiths, 2001).

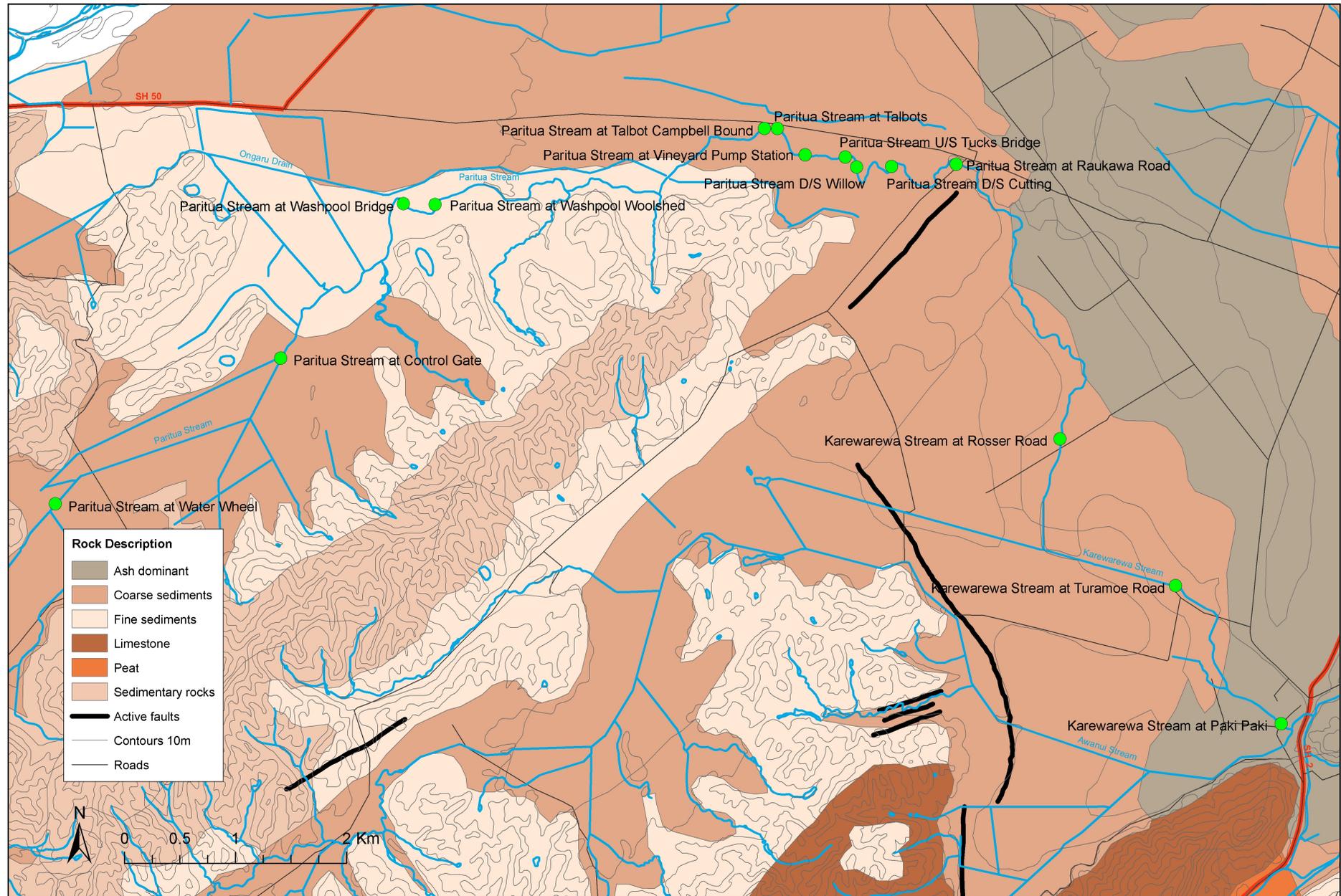
Rivers such as the Ngaruroro deposited red metal gravels mainly in the Ngatarawa area after loess deposition ended 14,000 years ago. These gravels were later covered by alluvium from both loess and volcanic ash (Griffiths, 2001).

In the middle to upper reaches of the Paritua, the stream flows over a variety of soils, including the Poporangi, Ngatarawa, Havelock, Takapau and Irongate soils. At Raukawa Road and below where the stream becomes the Karewarewa, it passes over the Hastings, Flaxmere, Pakipaki, Omahu, Turamoe, Te Awa and Oamaru soils, before joining the Awanui Stream.

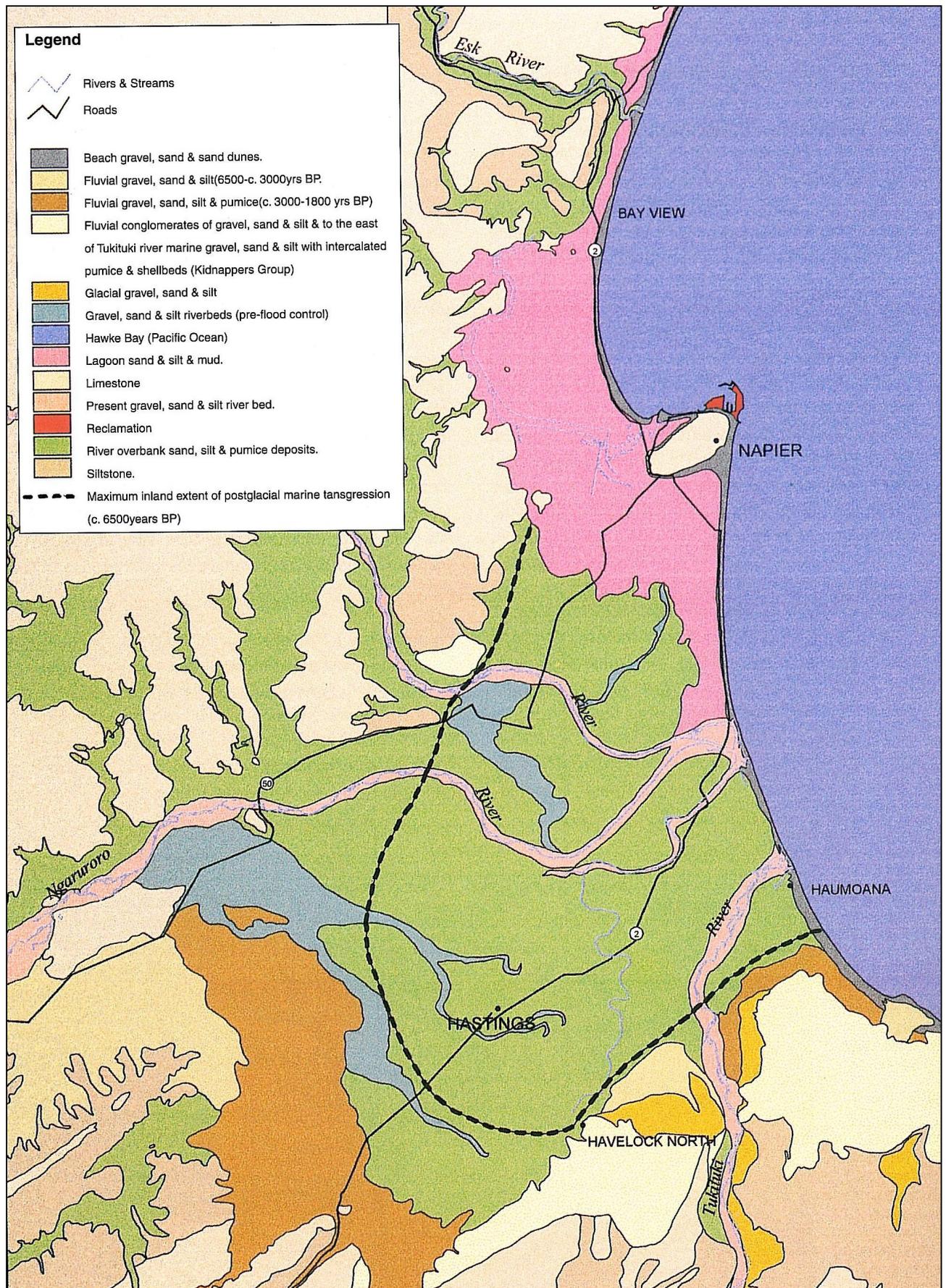
Before the Taupo eruption of 150 AD, the Ngaruroro River changed its course from the south to the north of Roy's Hill (Griffiths, 2001). More recently as a result of the largest historical flood in the Ngaruroro River in 1867, the river changed its course from the south of Hastings to the north, as it is today. Its former bed is now occupied by the Awanui and Karamu streams (David & Brown, 1997).

Uplift in the Heretaunga plains associated with the 1931 earthquake, resulted in the joining together of the originally separate Paritua and Karewarewa streams, as they are seen today.

**Figure 4. Paritua/Karewarewa Rock Description Map**



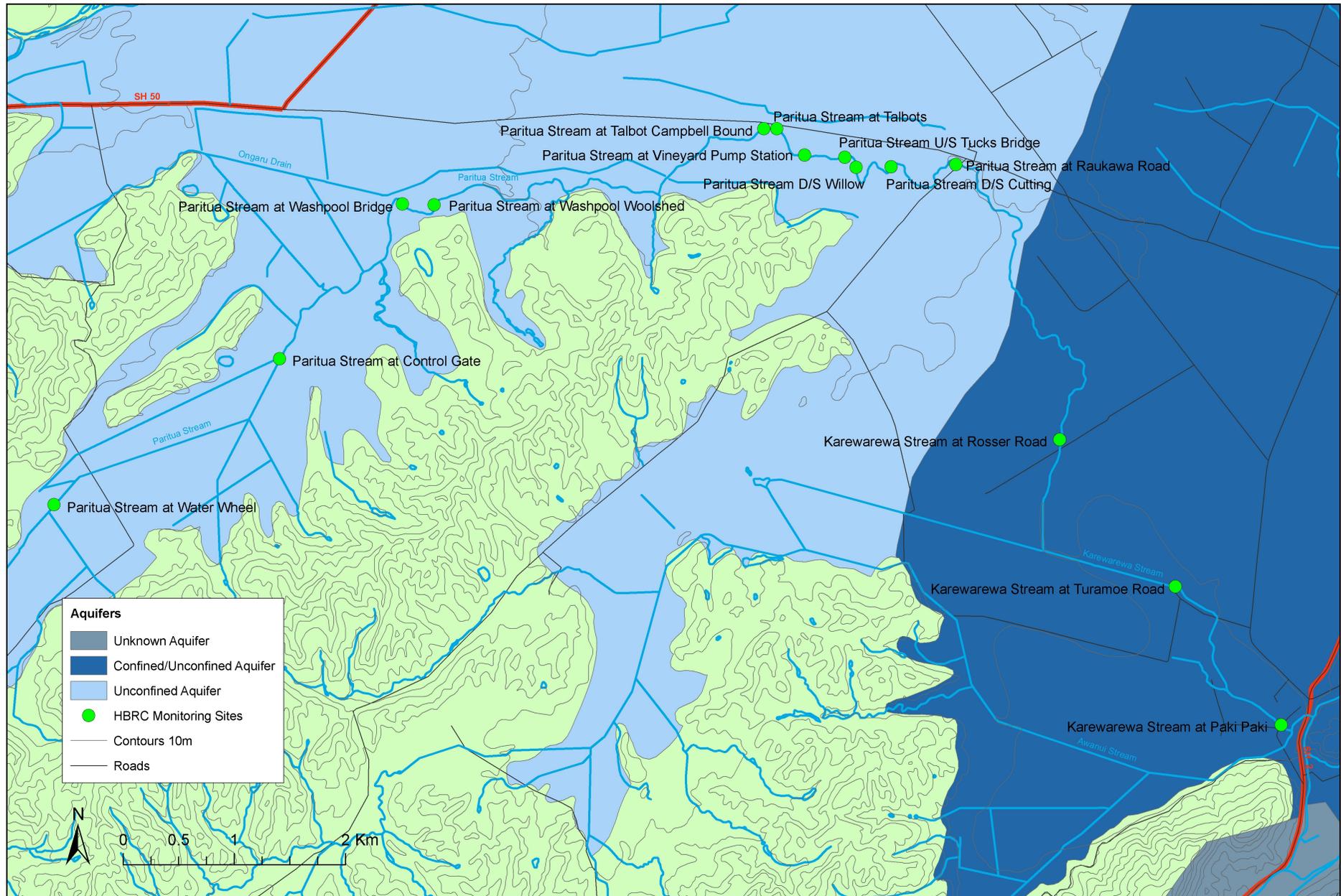
**Figure 5. Geological Map of the Heretaunga Plains (Dravid & Brown, 1997)**



### **2.3 Aquifers**

Unconfined Ngatarawa Valley data indicates groundwater surface water interaction in the form of losses from stream to ground. From approximately 1.5km downstream of the Raukawa Road bridge and upstream of the bridge, the aquifer in this area is classified as unconfined. The area approximately 1.5km upstream of Rosser Road and downstream, has an aquifer classified as confined/unconfined. Figure 6 shows the location of aquifers in the area.

Figure 6. Paritua/Karewarewa Stream Aquifer Map



## **3.0 HISTORY**

### **3.1 Early History**

The Paritua/Karewarewa Stream is a part of the Karamu Stream system on the Heretaunga Plains. At Pakipaki, the stream flows into the Awanui.

Prior to 1931 the Karewarewa and Paritua existed as separate streams joining below Bridge Pa with the Karewarewa rising to the west of Roys Hill. In the 1931 earthquake the land shifted and the Karewarewa ceased to flow. Its old course can be seen in a line of tree stumps as they cross Ngatarawa Road as it runs from SH50 to the Bridge Pa airfield (Heke, n.d. pers. comm.). Since the 1931 earthquake, Karewarewa is the name given to the lower part of the stream below the Raukawa Road bridge at Bridge Pa. Above the bridge the stream is called the Paritua Stream.

The Karewarewa and Paritua catchments have been considerably modified particularly in the mid 1900's as the land was developed mainly for pastoral farming. Stream realignment occurred and drainage channels were constructed, particularly in the area above Washpool Station where the flat land was swampy (Glazebrook, M. August 2007, pers. comm.).

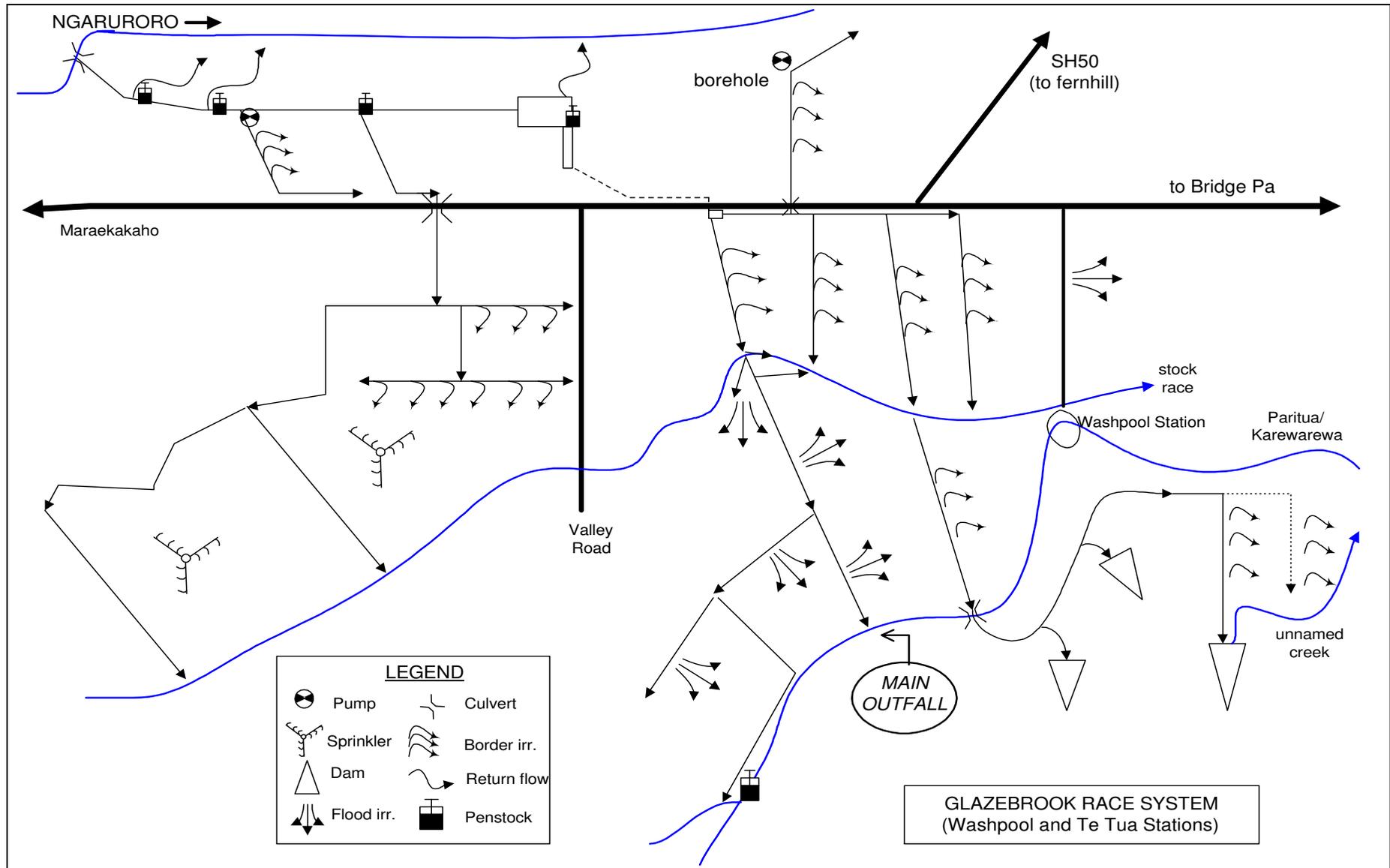
### **3.2 Upper Paritua Stream**

In the late 1960's and early 1970's Derek Glazebrook contoured the flat land of what is known today as Te Tua and Washpool Stations, to facilitate border dyke irrigation (Glazebrook, M. August 2007, pers. comm.). This involved construction of a series of water races that allowed water to be taken by gravity feed from the Ngaruroro River to irrigate flat land of these two properties. Water would flow over the land, irrigating pasture, with the surplus water at the end of the paddocks flowing into the Paritua Stream. This was a consented activity (HKB680033 and HKB680034), granted in 1968 and for a take of 30 cusecs (equivalent to 850 l/s). These consents expired in 1974 and were renewed as consents HKB740056 and HKB740057. Both consents have expired and been renewed at appropriate times, the latest being in 1997. A plan of the Te Tua and Washpool Station's border dyke and irrigation system is included in Figure 7.

During the period 1968 to 1997, Mike Glazebrook was requested by the Hawkes Bay Catchment Board, to divert water not used from the consented takes into the Paritua Stream during summer months, for the purpose of augmenting stream flows (Withey, L. August 2007, pers. comm.). The renewal of these consents in 1997 (WP971373T and WP971315T) incorporated a maximum weekly allocation. This resulted in no 'surplus' water being available to supplement flows in the Paritua Stream. However, the stream was still being supplemented by the by-wash water from the border dyke irrigation.

Since the early 2000's Te Tua and Washpool Stations have gradually been converting from border dyke irrigation to much more water efficient centre pivot systems. Washpool Station still operates a small section of border dyke irrigation. These conversions have also reduced supplement flows in the Paritua.

Figure 7. Glazebrook Race System Diagram (when border dyke system was operational).



### 3.3 Lower Paritua and Karewarewa Stream

The area of land immediately above the Raukawa Road Bridge has been farmed by the Campbell's since 1929. Present farmer Malcolm Campbell indicated (Campbell, M. August 2007, pers. comm.), that in the 1950's, the Paritua Stream about the Raukawa Road went dry for extended periods, possibly for 6 to 8 months of the year. The flow would usually stop before Christmas and not restart until the second or third decent rain in autumn. The flow would cease about 1.5km to 2km below Raukawa Road and extend above Raukawa Road for some distance, depending on the summer conditions. This is further supported by comments from Mike Glazebrook, where Mike recalls Derrick Glazebrook leasing the block of land immediately below the Raukawa Bridge in the 1950's and consequently not being able to graze stock on that block, as there was no water in the Karewarewa Stream during summer for stock water.

During these periods where the flow would cease at Raukawa Road, the Karewarewa Stream would typically begin to flow again upstream of Rosser Road. In the late 1960's and up to ~2002 the flows would cease for only short periods and then only in a dry summer. During this period the Hawkes Bay Catchment Board would often contact Mike Glazebrook and request he direct surplus water from the Ngaruroro take he held, directly into the Paritua stream to augment flows (Withey, L. August 2007, pers. comm.). In renewing of the water take consents in 1997, a maximum weekly volume was allocated to the take based on crop irrigation requirements. This meant that any direct contribution of flow into the Paritua Stream ceased, as all water taken is now used for irrigation. The later conversion of the border dyke to centre pivot irrigation system also reduced the indirect contribution of flow to the stream. Anecdotally both Malcolm Campbell (Campbell, M. August 2007, pers. comm.) and Mike Glazebrook (Glazebrook, M. August 2007, pers. comm.) commented that the flow regime we are seeing today is by and large what they observed prior to the construction and use of the border dyke flood irrigation developed in the late 1960's.

In 1998 Malcolm Campbell straightened a portion of the Paritua Stream on his property to better utilise his land. A resource consent (WP980372D) was applied for retrospectively and subsequently granted for this cutting. During the excavation of the new channel, Regional Council staff were on hand. At this time there was a 'good flow' at Raukawa Road bridge, estimated to be about 200l/s (Edmondson, G. August 2007, pers. comm.). When the flow was diverted through the new cut, all this flow was lost into the streambed over the length of the cut. Several truckloads of fine material were immediately dumped into the cutting to seal the bed of the stream, and the flow was restored at the Raukawa Bridge.

## 4.0 FISH DISTRIBUTION

The Paritua/Karewarewa Stream provides habitat for inanga (whitebait), smelt, eels, and goldfish and spawning substrate for trout during winter (HBRC, 2004).

Minimum flows for sites in the Karamu catchment were set in 1990, based on work done by Porter and Cairns (1990). This work involved the assessment of fish habitats for native and introduced species in streams in the catchment, including the Karewarewa. The results are summarised in the Te Karamu report (HBRC, 2004).

Prior to 2004 there is limited information on the environmental values of the Paritua Stream. In 2004, reaches of the stream (at the site Paritua Stream at Washpool Woolshed) were fished by electric fishing and spotlighting methods. These surveys on the Paritua Stream identify populations of both migratory and non-migratory fish.

Fish identified in the NIWA fish database were:

- Long fin eel
- Inanga
- Upland bully
- Crans bully
- Goldfish

Species such as inanga, and longfin eel need to move downstream and out to sea during their life cycle. This downstream movement takes place in autumn and the young return in spring. This pattern is broken in the Paritua Stream by the prolonged drying of the lower Paritua Stream and the Karewarewa Stream. There are fewer longfin eels today because of the loss of wetland habitat and over harvesting by commercial fishing since the 1960's (DOC, n.d.). Today both traditional and commercial gathering of eels in the Paritua are affected by the drying of the stream and the existing fishing pressure. Because the stream dries rapidly, it is likely to be responsible for fish kills of migrating species (Stansfield, B. October 2007, pers. comm.).

Inanga adults migrate downstream to spawn in autumn, in the grassy margins at the estuary mouth. The Clive River is a favoured spawning ground. The young hatchlings move to sea before returning as a significant proportion of the catch of whitebait species. Inanga are subject to the same fishing pressures as the longfin eel, but are also more vulnerable. Like the longfin, they are important as food for the community, since inanga are often the major catch species of the whitebait fishery.

Both the upland bully and Crans bully live their whole lives in freshwater and do not need to migrate to the sea as part of their life cycle. They occur well inland in many river systems, but are also found close to the coast. Both species will tolerate a variety of habitats from stoney bed rivers to weedy streams (NIWA Science, 2005).

To ensure unimpeded migration and movement of fish species a continuous flow of water is desirable. While it is acknowledged that a continuous flow does not always occur in the Paritua Stream, a likely result of modification of the stream environment since European settlement, the effect on population numbers and recruitment has not been demonstrated. Habitat quality is generally poor in the lower reaches of the Paritua and Karewarewa Stream as it flows through farmland, orchards and vineyards, however the middle reaches are shaded and offer good habitat for native fish species (HBRC, 2004).

The data available from the NIWA fish database for the Paritua/Karewarewa Stream dates from 2004. Using the 'Point Fish Click' model developed by Massey University, it was also possible to predict what native fish are likely to occur in the stream, that were not recorded in the 2004 surveys. Fish species with a high probability (95%<) of being present, are the common bully and short fin eel.

## **5.0 CULTURAL IMPORTANCE**

The Karamu catchment encompasses a number of significant waahi tapu, marae and historic pa/kainga sites, which reflect a long history of occupation and use of the rich resources within the area by Maori (HBRC, 2004).

The Paritua/Karewarewa stream passes by the Korongata Marae and Mangaroa Marae. The hapu of these marae are Ngati Poporo and Ngati Rahunga (Ngati Kahungunu Iwi Incorporated, n.d.), which are part of the Ngati Kahungunu ki Heretaunga tribal division. Ngati Kahungunu are the third largest tribal group in New Zealand (Te Ara, 2007).

The Karamu system which includes the Paritua/Karewarewa Stream, were and in parts remain culturally important to Maori for many reasons, including being a food resource, providing habitat for watercress, eels and inanga (HBRC, 2004).

Today iwi (and the Department of Conservation) are concerned about the loss of indigenous biodiversity in the wider Karamu system, both for its intrinsic value and for the provision of food and resources (HBRC, 2004).

## 6.0 HYDROLOGY

Developing sound flow measurement records on small lowland streams is difficult in Hawke's Bay. Streams such as the Raupare Stream and the Karamu Stream will often be influenced at low flows by rapid weed growth. The weed growth raises the water level even as flows fall, creating a variable stage-flow relationship.

On the Karewarewa Stream, the Turamoe Road flow site was maintained between November 1978 and April 1990. The site was difficult to gauge due to the canal like nature of the stream, and weed growth in the summer months. This made it difficult to accurately rate the site and produced an unreliable flow record, but it can be used as an indicator of change. Table 1 summarises flow statistics for the site. It is monitored every year for low flows, and has a minimum flow of 75l/s but has no set allocatable volume of water (RRMP, 2006).

**Table 1. Karewarewa Stream at Turamoe Road Flow Statistics**

| Statistic                           | Flow l/s              | Specific Yield l/s/km <sup>2</sup> |
|-------------------------------------|-----------------------|------------------------------------|
| Mean                                | 459.6                 | 3.6                                |
| Q <sub>50</sub> (7 day moving mean) | 234.8                 | 1.9                                |
| Q <sub>95</sub> (7 day moving mean) | 72.2                  | 0.57                               |
| Maximum                             | 23631.6               | 187.4                              |
| Maximum (7 day moving mean)         | 9677.8                | 0.1                                |
| Minimum                             | 2.1                   | 0.016                              |
| Minimum (7 day moving mean)         | 6.4                   | 76.747                             |
| MALF (7 day moving mean)            | 81.8                  | 0.65                               |
| Catchment Area                      | 126.1 km <sup>2</sup> |                                    |
| Years of Record                     | 13 (4 complete)       |                                    |

To gain a better understanding of natural flows through the system, a water level recorder was established in 2004 at Paritua Stream at Control Gate, upstream of Washpool Station. This also proved difficult to rate, particularly at low flows, when it is affected by a backwater-condition-created effect from weed growth downstream. In February 2007 the recorder site was switched to approximately 2 km further upstream to Paritua Stream at Water Wheel. This is just above Valley Road where a weir forms a control on the Paritua Stream. This site is considered 'rateable' and should provide future reliable low flow information.

To help understand the hydraulics of the Paritua/Karewarewa system, a series of concurrent gaugings have been made over the years at a number of points in the catchment. Further gaugings are being carried out that will link the new recorder site to the downstream sites. This is to gain a better understanding of the hydraulics of the system and to enable correlations to be developed between other sites in the system.

Figures 8 and 9 show concurrent gaugings between sites on the Paritua/Karewarewa system. The sites are in descending order (left to right) starting from the top of the system (see Figure 3 in Section 2.1). The pattern of loss and recovery is easily seen over a range of flows. The graphs show the flow loss that occurs between the Paritua Stream at Washpool sites and Paritua Stream at Raukawa Road. The average percentage of flow loss between the Paritua Stream at Washpool sites and Paritua Stream at Raukawa Road is 77.8% and the greatest loss of 205l/s occurred on the 15-Nov-05 (see Table 2).

In 1998, upstream of the Raukawa Road bridge, the Paritua Stream was straightened (detailed in Section 3.3). A cutting was made through which the Paritua Stream was diverted. Two stream gauging runs were carried out on the lower Paritua Stream in 2005 in an attempt to quantify water

losses affecting the stream after the diversion of the stream. The results of these two gauging runs are incorporated in Figure 9. Along with the results of all gauging runs, the runs indicate there are losses all the way down the Paritua stream from Washpool Station, with losses about the area of the cut similar to areas immediately above and below.

Figure 8. Paritua/Karewarewa Concurrent Gauged Flows 1972-1998

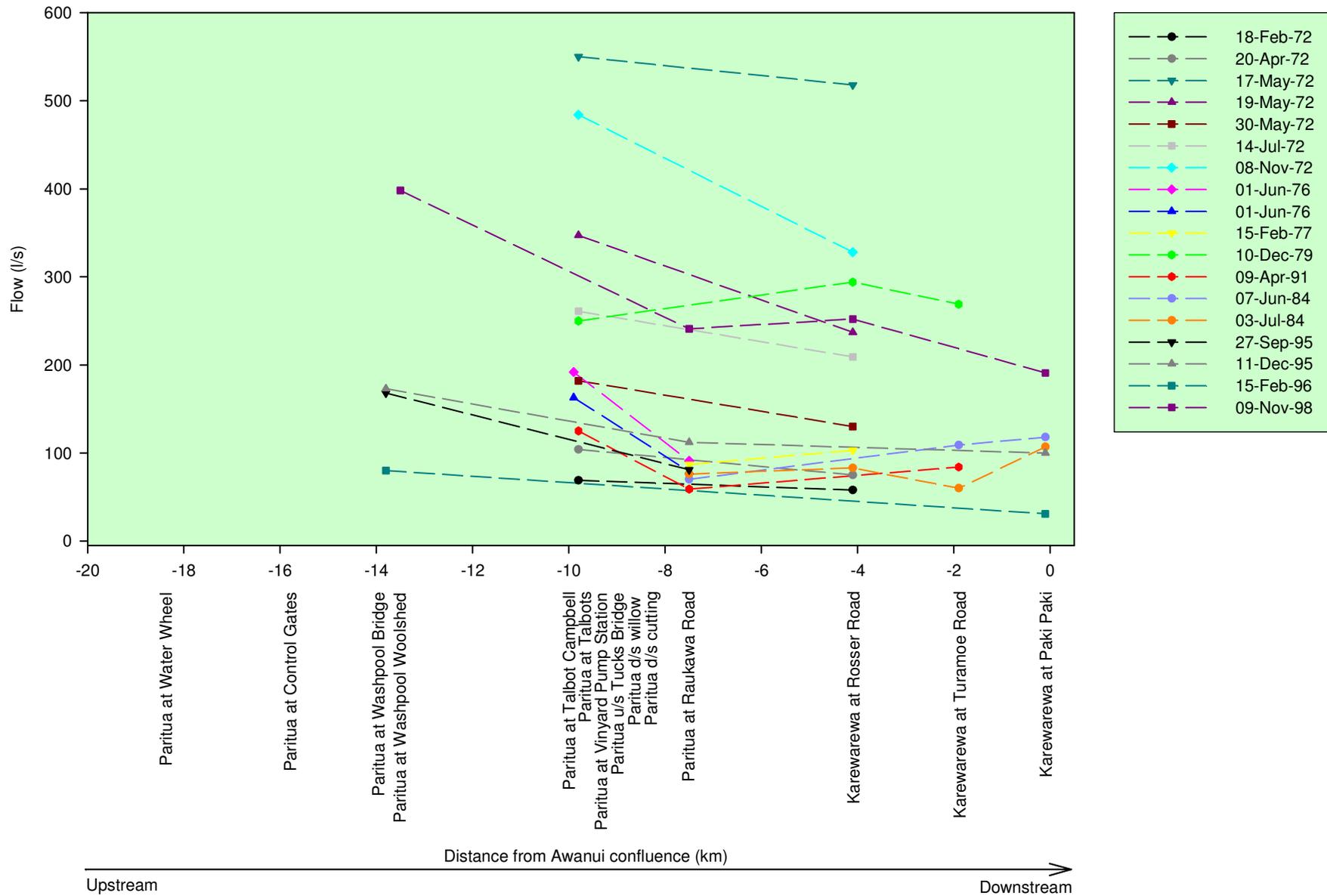
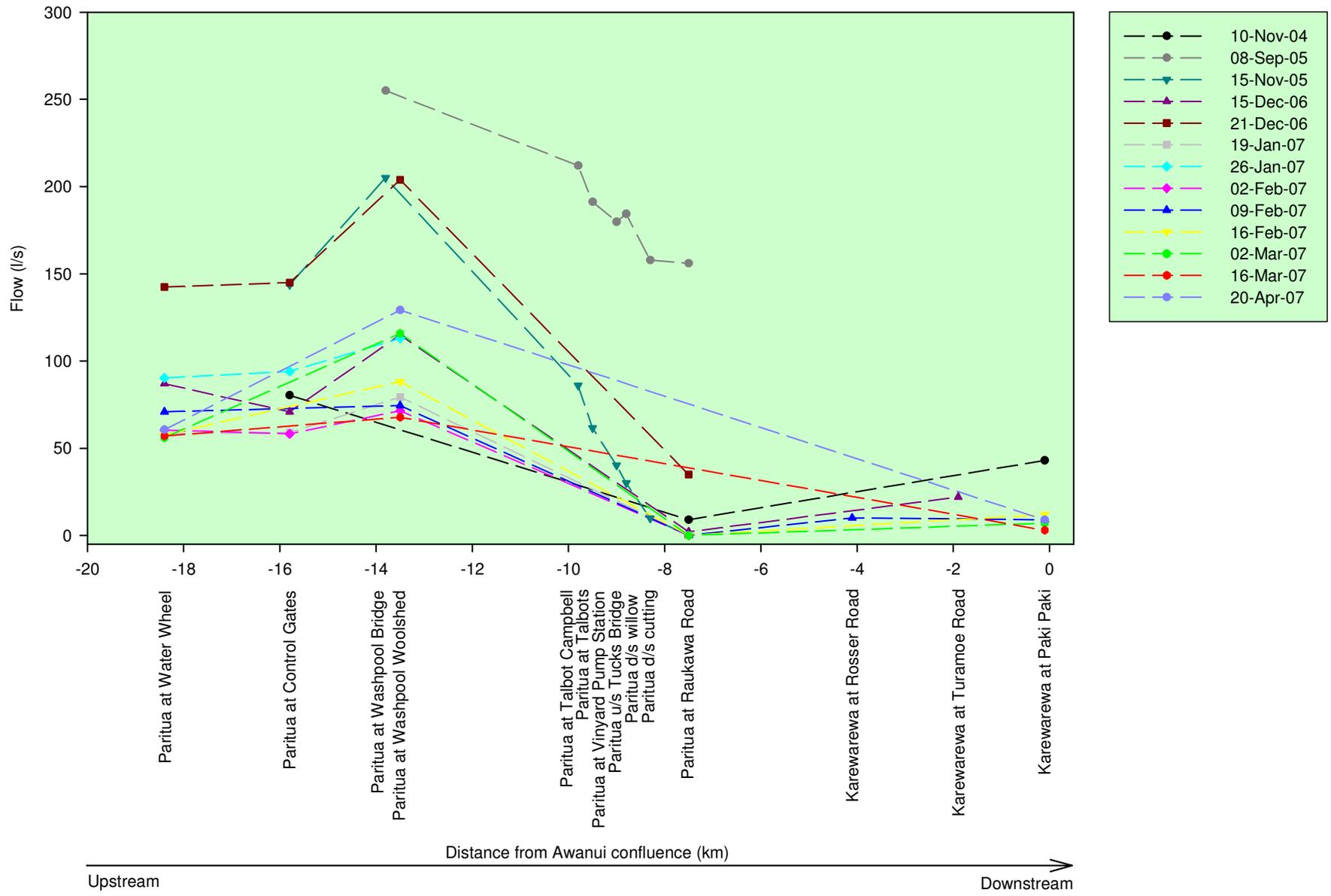


Figure 9. Paritua/Karewarewa Concurrent Gauged Flows 2004-2007



**Table 2. Flow Loss in The Paritua Stream**

| Date      | Paritua at Washpool Bridge | Paritua at Washpool Woolshed | Paritua at Raukawa Road | Loss of Flow l/s              | % Loss of Flow |
|-----------|----------------------------|------------------------------|-------------------------|-------------------------------|----------------|
|           | Flow l/s                   | Flow l/s                     | Flow l/s                |                               |                |
| 27-Sep-95 | 168                        |                              | 81                      | 87                            | 51.8           |
| 11-Dec-95 | 173                        |                              | 112                     | 61                            | 35.3           |
| 14-Aug-02 | 638                        | -                            | 471                     | 167                           | 26.2           |
| 08-Sep-05 | 255                        | -                            | 156                     | 99                            | 38.8           |
| 15-Nov-05 | 205                        | -                            | 0                       | 205                           | 100            |
| 15-Dec-06 | -                          | 114.9                        | 2                       | 112.9                         | 98.3           |
| 21-Dec-06 | -                          | 203.9                        | 35                      | 168.9                         | 82.8           |
| 19-Jan-07 | -                          | 79.3                         | 0                       | 79.3                          | 100            |
| 02-Feb-07 | -                          | 71.5                         | 0                       | 71.5                          | 100            |
| 09-Feb-07 | -                          | 74.4                         | 0                       | 74.4                          | 100            |
| 16-Feb-07 | -                          | 88.2                         | 0                       | 88.2                          | 100            |
| 02-Mar-07 | -                          | 115.8                        | 0                       | 115.8                         | 100            |
|           |                            |                              |                         | <b>Average % Loss of Flow</b> | <b>77.8</b>    |

Between Raukawa Road and Rosser Road, in which parts during summer months frequently run dry, there is a small amount of groundwater fed flow which comes back into the system, with an average increase of 11l/s (see Table 3). To quantify this better, further work on the whole Paritua/Karewarewa system combined with natural flow record from the upstream recorder, would be required to help understand the extent of these losses and gains.

**Table 3. Flow Increase in The Paritua Stream**

| Date                            | Paritua at Raukawa Road | Karewarewa at Rosser Road | Increase of Flow l/s |
|---------------------------------|-------------------------|---------------------------|----------------------|
|                                 | Flow l/s                | Flow l/s                  |                      |
| 15-Feb-77                       | 87                      | 103                       | 16                   |
| 03-Jul-84                       | 76                      | 83                        | 7                    |
| 09-Nov-98                       | 241                     | 252                       | 11                   |
| 09-Feb-07                       | 0                       | 10                        | 10                   |
| <b>Average Increase of Flow</b> |                         |                           | <b>11</b>            |

The frequent drying of the Paritua/Karewarewa has limited the availability of water for out of stream use. Table 4 shows the irrigation ban statistics for the Karamu Stream catchment. The Karewarewa Stream with its minimum flow of 75l/s, has been subject to the most time on irrigation ban (57% of time over the last 13 irrigation seasons<sup>2</sup> in the Karamu catchment and the Hawke's Bay region). This is followed closely by the Awanui Stream (35% of time over the last 13 irrigation seasons). The installation of the new recorder site at Paritua Stream at Water Wheel, should produce a flow record that will assist in identifying any trends.

<sup>2</sup> November to April inclusive

The natural flow losses in the Paritua Stream and the restrictions on water use in the Karewarewa Stream will continue to have impacts on downstream users of these streams (Karewarewa and Awanui Streams) as sources of irrigation water, irrespective of any effects on fish distribution as described in Section 4.0 of this report. Further data is required to enable an analysis of the interaction between surface water and groundwater. Any future changes to the allocatable volumes and minimum flows on the Paritua/Karewarewa system would be drawn from this.

**Table 4. Karamu Catchment Irrigation Ban Statistics**

| River/Stream                    | Site               | Minimum Flow (l/s) | No. of Days Banned During Irrigation Season (Nov-Apr) |          |          |          |          |          |          |          |          |          |          |          |          | Total No. of Days Banned | % Banned of 13 Irrigation Seasons |
|---------------------------------|--------------------|--------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------------|-----------------------------------|
|                                 |                    |                    | 94/95   | 95/96    | 96/97    | 97/98    | 98/99    | 99/00    | 00/01    | 01/02    | 02/03    | 03/04    | 04/05    | 05/06    | 06/07    |                          |                                   |
| Karewarewa                      | Turamoe Road       | 75                 | 46  |          |          | 103      | 75       | 93       | 169      | 181      | 181      | 14       | 181      | 113      | 181      | 1337                     | 57                                |
| Awanui                          | The Flume          | 120                | 46  | 7        |          | 115      | 68       | 75       | 161      | 3        | 100      |          | 105      | 65       | 83       | 828                      | 35                                |
| Awanui                          | Paki Paki Culvert  | 35                 | 74  |          |          | 116      | 68       | 57       | 61       |          | 52       | 8        | 63       | 22       | 105      | 626                      | 27                                |
| Poukawa                         | Douglas Road       | 20                 | 104   |          |          | 96       |          | 60       | 99       | 10       | 79       |          | 63       | 29       |          | 540                      | 23                                |
| Mangateretere                   | Napier Road        | 100                | 60  | 35       |          | 125      | 44       | 70       | 91       |          |          |          |          |          |          | 425                      | 18                                |
| Irongate                        | Clarke's Weir      | 100                | 70  |          |          | 92       | 10       | 49       | 37       |          | 36       |          | 70       |          | 56       | 420                      | 18                                |
| Karamu                          | Floodgates         | 1100               | 56  |          |          | 61       | 10       | 35       | 41       |          | 34       | 8        | 63       | 7        | 46       | 361                      | 15                                |
| Louisa                          | Te Aute Road       | 30                 | 49  |          |          | 4        | 3        |          |          |          |          |          | 56       |          |          | 112                      | 5                                 |
| Ongaru                          | Wenley Road Bridge | 5                  | 19  |          |          |          | 3        |          |          |          | 36       |          | 41       |          |          | 99                       | 4                                 |
| <b>Number of Affected Sites</b> |                    |                    | <b>9</b>  | <b>2</b> | <b>0</b> | <b>8</b> | <b>8</b> | <b>7</b> | <b>7</b> | <b>3</b> | <b>7</b> | <b>3</b> | <b>8</b> | <b>5</b> | <b>5</b> |                          |                                   |

NB. Ban continued outside of irrigation season for Turamoe Road. Total No. of days banned: 01/02=221, 02/03=182, 04/05=195, 06/07=226

## 7.0 EXISTING CONSENTS

There are 9 surface water abstractions from the Karewarewa and Paritua Streams and the Ongaru Drain catchment, (see Table 5). A number of shallow wells are located within 400 metres of the Paritua and Karewarewa Streams that are not currently tied to the Minimum Flow at Turamoe Road. Three groundwater take consents are expiring in 2007 and have been identified as medium to high risk of depleting the Karewarewa or Paritua Stream using the Larking (2004) risk assessment method (see Appendix 2). These groundwater takes may be having an effect on the Karewarewa or Paritua Streams but the effect has not been quantified using any stream depletion analysis such as the Hunt or Jenkins methods. Another 54 wells from 50 resource consents in the area expiring at latter dates have been identified as medium to high risk to deplete the Karewarewa and Paritua Streams, Ongaru Drain or any drains and tributaries in the catchment using the Larking (2004) risk assessment method.

**Table 5. Karewarewa-Paritua Stream & Ongaru Drain Consented Surface Water Takes.**

| Consent                                    | Client                                | Purpose   | L/s  | m <sup>3</sup> /week | Minimum Flow Condition                                   |
|--|---------------------------------------|---|------|----------------------|--|
| WP010564T<br>Expires 2013                  | Grieve K & P                          | to take water from a dam in the Ongaru Drain by means of a 150 mm intake pipe to irrigate 22 hectares of process crops  | 16   | 4400                 | No – but the outflow from dam must be above 4 L/s        |
| WP030165T<br><br>WP030100M<br>Expires 2038 | Oban Station                          | to dam approximately 106,000m <sup>3</sup> of water in an unnamed tributary of the Ongaru Drain with an earth dam approximately 300 metres long and 6 metres high, and to undertake any activity associated with the dam structure<br>to take water stored in a dam to irrigate 12 hectares of pasture and 28 hectares of process crops | 22   | 10,000               | No   |
| WP980303T<br>Expires 2013                  | Reynolds J L                          | to take water from the Karewarewa Stream to irrigate 15 hectares of crops and pasture   | 10   | 4,536                | Yes – Karewarewa Stream at Turamoe Road 75 L/s           |
| WP990194T<br>Expires 2013                  | Agnew J R & J A & Rosenberg B J       | to take water from the Ongaru Drain to irrigate 35.55 hectares of crops and pasture   | 18   | 6,825                | Yes – Ongaru Drain at Wenley Road Bridge 5 L/s           |
| WP030352T<br>Expires 2018                  | Paritua Vineyards, Sileni Estate/ J V | to take water from the Paritua Stream to frost protect 110 hectares of viticulture  | 1100 | -                    | Yes - any taking that occurs downstream of Weir #3 shall |
| WP980289Ta<br>Expires 2013                 | Kittow A J & S F                      | to take water from two sites on the Paritua stream by means of a pipe and pump to irrigate 20 hectares of crops and pasture   | 6    | 3750                 | No   |
| WP020160Ta<br>Expires 2013                 | Stewart A W & D M                     | to take water from well no. 3729 ( 200 mm diameter) to irrigate 7.5 hectares of viticulture   | 5    | 1,786                | Yes – Karewarewa Stream at Turamoe Road 75 L/s           |
| WP990020Ta<br>Expires 2013                 | Stewart A W & D M                     | to take water from the Paritua Stream to spray irrigate 2.5 hectares of pasture   | 31   | 1,714                | Yes – Karewarewa Stream at Turamoe Road 75 L/s           |
| WP020431T<br><br>WP960197M<br>Expires 2021 | Rotoma Station Trust                  | to take water from a dam on a tributary of the Paritua Stream to irrigate 20.0 hectares of pasture<br>to maintain an existing 6 metre earth dam in the headwaters of the Mangarotai Stream to provide a supply of water for stock and irrigation purposes   | 16   | 6500                 | No   |

### 7.1 Paritua Vineyards Ltd Frost Protection Take.

On 18 July 2003, consent WP030352T was issued to Paritua Vineyards Ltd, Sileni Estate Ltd, JV Lyons, CD & CM Howell Partnership to take water from the Paritua Stream to frost protect 110 hectares of viticulture. A diagram of the system is shown in Figure 10 (Appendix 1).

The consent required a series of weirs to be constructed in the stream for the purpose of accurately monitoring flows when water was to be taken. Prior to any take, water is released from Glazebrook's dam (which draws water by gravity feed from the Ngaruroro River) to augment the stream flows. The rate of the take must be such that the original base flow prior to the release of water is not decreased. If flows in the stream are greater than 500l/s, stream augmentation is not required as long as there remains a flow of no less than 500l/s after the take.

## 8.0 POLICY

The Hawke's Bay Regional Resource Management Plan (RRMP) has been operative since 28 August 2006. Under the RRMP the Council has policies to ensure the maintenance of water quantity for the sustainability of aquatic ecosystems. Allocatable volumes are assigned to stream management zones (mapped in Figure 1 Section 1.3, and in Schedule VII of the RRMP), and are calculated so that when a river is fully allocated, the ability to take water, exists for users for more than 5% of summer 'low flow periods'. The policy also seeks to avoid any significant adverse effects of water takes, uses, damming, or diversion on other lawfully established activities (Policy 38). The policies are provided to give guidance to decision making in resource consents, however policy does not have the effect of rules that require conditions to be met.

The Karewarewa Stream has a minimum flow of 75l/s measured at Turamoe Road as stated in Table 9 of Policy 73 in the RRMP (see Appendix 2). This minimum flow also needs to be considered for the Paritua Stream as it is in the Karewarewa Stream - Turamoe Road stream management zone. However an allocatable volume for the Karewarewa Stream at Turamoe Road has yet to be set. This is because when applying a 7-day Q95 minimum flow the allocatable volume would equate to zero. Instead of assigning an allocatable volume of zero an allocatable volume was not set as it was considered that more scientific work was necessary to determine an allocatable volume, possibly based on a lower Q value. However the lowering of the Q value would require a policy change of the RRMP.

The RRMP includes the Regional Policy Statement (RPS). Policy 39 provides decision-making criteria when allocating water from rivers. Where the demand for water within a stream management zone is greater than the allocatable volume as a result of a consent application for a new activity, a consent will not be issued except if it is feasible that it be subject to higher cut-off level than that specified in Table 9. This is provided so that any such additional allocations will not have any adverse effect on other lawfully established takes, nor any other significant adverse environmental effect. As such there is the option to introduce higher cut-off levels for the Karewarewa and Paritua Streams. However it must be noted that Policy 39 gives preference to the renewal of existing resource consents, where it can be demonstrated that the allocation is still required. According to the Resource Management Act (RMA) 1991 (s.104, 2a), with regard to renewals, the value of the investment to the existing consent holder must be considered.

Policy 39 also states, where over-allocation still exists, to reduce the allocation on a pro-rata basis except that where the consent holder has been advised (e.g. in the consent document) that the water allocated may no longer be available for allocation at the time of consent renewal, in which case the consent may not be renewed. The implementation of Policy 42 (to allocate surface water for irrigation on the basis of crop water requirements) in the renewal process, encourages the efficient use of the water resource and may result in reductions in the allocation which in turn assists in meeting the aims of Policy 39.

Policy 39 also seeks to encourage the use of alternative water sources, where demand is greater than the allocatable volume, as a result of a change in minimum flow for a stream management zone. The use of Ngaruroro River water via the Glazebrooks system, to augment flows in the Paritua/Karewarewa Stream, is an alternative water source, however as the Ngaruroro River itself is over-allocated, this option for new uses is limited.

Policy 44 seeks to protect the Heretaunga Plains Aquifer recharge in order to maintain the long-term viability of the aquifers. Policy 44 recognises the importance of aquifer recharge to the sustainable management of the Heretaunga Plains aquifer. The establishment of minimum flows on contributing rivers takes into account the need to adequately provide for the recharge of groundwater. Hence it is important that any surface water takes from the Paritua and Karewarewa Streams requiring a resource consent are evaluated against minimum flow restrictions not only to

consider in stream ecological values and downstream users, but also groundwater takes as the streams lose water to the unconfined aquifer, some of which may enter the Heretaunga Plains Aquifer.

The policies also seek to protect surface water bodies from the effects of any shallow 'groundwater' takes from unconfined or semi-confined aquifers. Policy 43 states that taking of shallow groundwater within 400 metres of a river, lake or wetland as measured from the edge of the bed will be treated as if it were a direct take unless the extent to which the groundwater will deplete water in the surface water body has been assessed using an appropriate scientific procedure. In that case the effects on surface water are assessed on that basis and the 57 wells that are located within 400 metres of the Karewarewa and Paritua Streams and their tributaries need to be treated as direct surface water takes.

Policy 43 also states that any taking of shallow groundwater beyond 400 metres may require an assessment of effects in the river, lake or wetland if the scale of the take, the groundwater flow direction, and the transmissivity and storativity characteristics of the aquifer indicate interaction is likely to occur; in which case it may be treated as if it were a direct take. Any take from the unconfined aquifer in this area has the potential to be treated as a surface water take under these provisions. The consequence for the groundwater, take is that it may be subject to cut-off when the surface water body meets its recognised minimum flow. Given that the Karewarewa Stream is frequently in ban during the summer, this raises the issue of security of supply to existing groundwater users.

The objectives and policies of the RRMP are implemented through regulation by the rules set out in Chapter 6 of the RRMP. Any surface water take requiring a resource consent is a discretionary activity (Rule 55). Whether or not the Council grants consent will depend upon how consistent the proposed activity is with provisions of the RMA and the objectives and policies set in the RRMP, and the 'Decision-Making Criteria' contained in the various policies in the RRMP.

Surface water users in the Paritua/Karewarewa Stream catchment are subject to the same rules as any other surface water users in Hawkes Bay. Yet some areas are under more stress than others, generally due to more development or the cumulative effects of water takes, or different climatic and geological factors. When considering applications made under Rule 55 in the Paritua/Karewarewa catchment, there is discretion to ascertain whether or not a surface water take can be granted, based on known information for the area, such as the minimum flow of 75l/s for the Karewarewa Stream measured at Turamoe Road.

## 9.0 CONCLUSION

- The Paritua/Karewarewa system is a small stream of local importance.
- The Paritua/Karewarewa stream is the largest tributary of the Awanui stream (one of the three main tributaries of the Karamu Stream).
- Catchment hydrology is complex with losses to the unconfined aquifer of the Ngatarawa valley, in particular between Raukawa Road and the Woolshed on Te Tua Station.
- The stream is highly modified along its length (by a number of structures, removal of wetland areas through drainage and by bed alterations).
- Glazebrook's earlier border dyke irrigation system augmented stream flows in the Paritua/Karewarewa until conversion to the centre pivot irrigation system started in the early 2000's.
- Stream flow in the Paritua was also augmented by surplus water from Glazebrook's consented takes, at the request of the Regional Council during the period 1968 to 1997. This has stopped since the renewal of these consents in 1997.
- The stream provides habitat for a number of native and non-native fish, and although fish populations have been, and continue to be under threat from commercial fishing and loss of wetland habitat, the drying of the stream has no proven effects on fish populations and recruitment.
- It is important culturally for local communities (including Maori) as a source of eels, whitebait and watercress.
- The gauged flow record for the Paritua/Karewarewa system, shows that the Paritua Stream since records started in the 1970's, has experienced a reduction in flow between Washpool Station and Raukawa Road. The Paritua at Raukawa Road has been frequently recorded with zero flow.
- The gauged flow record, indicates the losses about the area of the cut made in 1998, are similar to areas immediately above and below the cut.
- The frequent drying of the Paritua/Karewarewa has limited the availability of water for out of stream use.

## 10.0 OPTIONS FOR FUTHER INVESTIGATIONS

Consider:

- undertaking further studies of the hydrology of the area and the ecological values of the existing waterways
- undertaking a review of the regulatory framework, as it relates to the water allocation methodology for this area, including consideration of different Q values, and the social, cultural, economic and environmental values
- monitoring fish populations in the stream, to see if the present condition of the stream or any future changes made to the stream will affect populations
- the relationship between the Paritua/Karewarewa system and the wider Karamu system to identify the value of this part to the wider Karamu Catchment
- conducting a groundwater-surface water interaction study to determine sustainable groundwater and surface water allocations
- requiring aquifer tests on any new groundwater consent applications from the unconfined aquifer to determine possible stream depletion effects, and
- conducting a study on potential water demand in the area in order to determine how much water could be required including the implication of climate change.

## 11.0 ACKNOWLEDGEMENTS

The authors would like to thank the following people for their help with this report:

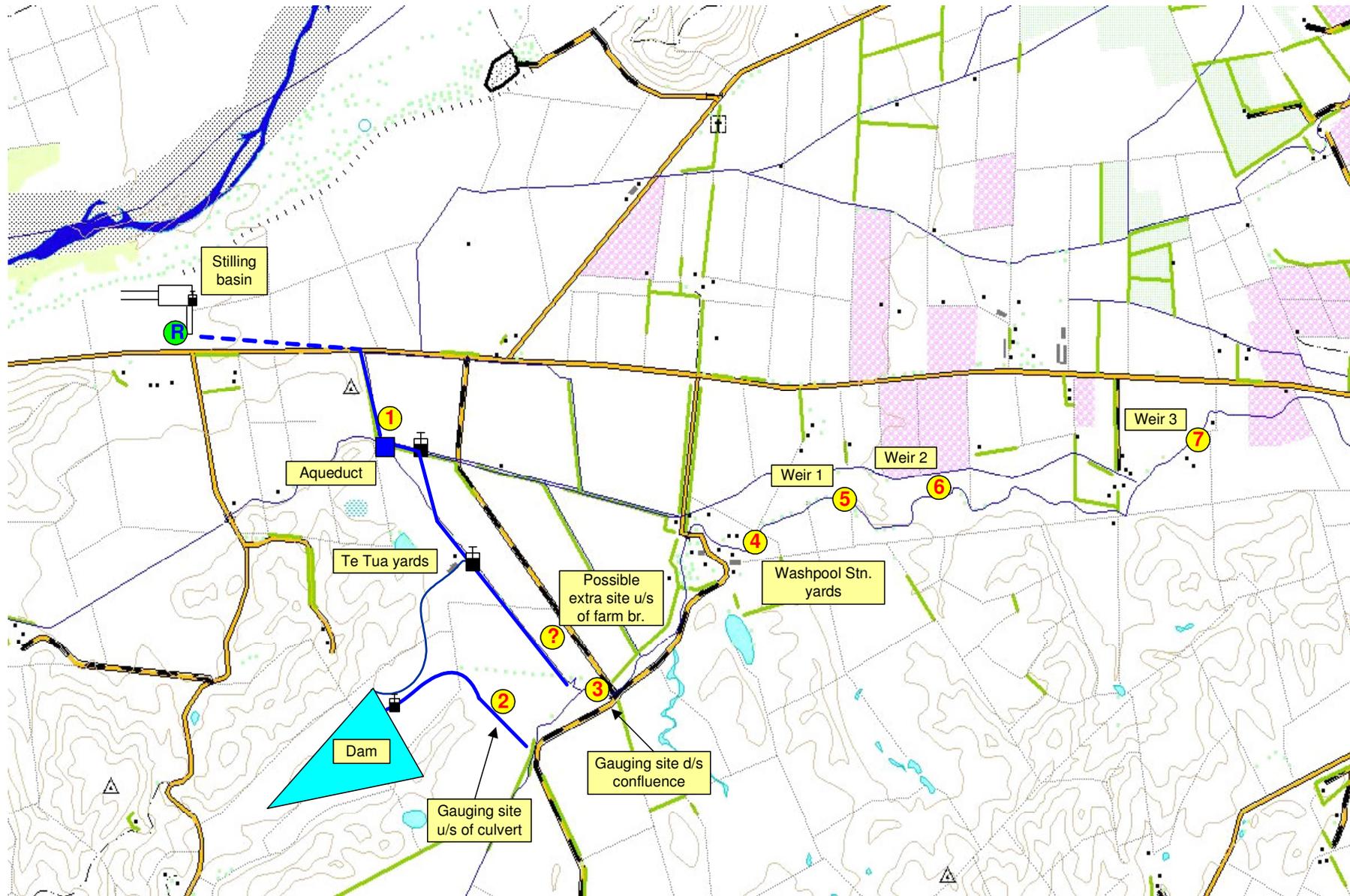
- Andrew Curtis (Land Management Officer)
- Anna Madaraz-Smith (Coastal Quality Scientist)
- Brett Stansfield (Surface Water Quality Scientist)
- Darryl Lew (Manager Environmental Regulation)
- Emma O'Neill (Senior Planner)
- Geoff Wood (Former HBRC Surface Water Quantity Scientist) - For help of notes written on the Paritua/Karewarewa system
- Simon Stokes (Former HBRC Land Management Officer)
- Cover Photo by Ian Lilburn (Compliance Officer)

## 12.0 REFERENCES

- Department of Conservation (DOC) n.d., *Facts about native fish*, Viewed 23 October 2007, <http://www.doc.govt.nz/templates/page.aspx?id=33212>.
- Dravid, PN & Brown, LJ 1997, *Heretaunga Plains Groundwater Study - Volume 1: Findings*, Hawke's Bay Regional Council & Institute of Geological and Nuclear Sciences.
- Griffiths, E 2001, *Soils of the Heretaunga Plains - a guide to their management*, Grifftech & Hawke's Bay Regional Council.
- Hawke's Bay Regional Council 2004, *Te Karamu - Catchment Review and Options for Enhancement*, Environmental Management Group Technical Report.
- Hawke's Bay Regional Council 2006, *Hawke's Bay Regional Resource Management Plan (RRMP)*, Environmental Management Group Technical Report, Operative 28 August 2006.
- Ngati Kahungunu Iwi Incorporated n.d., *Ko te Iwi - Our People*, Viewed 18 October 2007, <http://www.kahungunu.iwi.nz/index2.html>.
- Larking, R 2004, *Groundwater Development in the Ruataniwha Consents Zone*, Environmental Management Group Technical Report.
- NIWA Science 2005, *NIWA Atlas of New Zealand Freshwater Fishes*, Viewed 17 October 2007, <http://www.niwascience.co.nz/rc/freshwater/fishatlas/fishfinder>.
- Porter, SE & Cairns, IH 1990, *Minimum low flows: Karamu Stream Catchment*, Agenda Item: Hawke's Bay Regional Council - Planning and Policy Standing Committee, 11 July 1990.
- Te Ara 2007, *The Encyclopedia of New Zealand - Maori New Zealanders*, Viewed 24 October 2007, <http://www.teara.govt.nz/NewZealanders/MaoriNewZealanders/NgatiKahungunu/1/en>.

## **APPENDIX 1**

Figure 10. Paritua Frost Protection System Diagram



## **APPENDIX 2**

**REFERENCE LIST OF RELEVANT OBJECTIVES AND POLICIES FOR THE HAWKE'S BAY REGIONAL RESOURCE MANAGEMENT PLAN (AUGUST, 2006) AND RELEVANT RULES FOR SURFACE WATER AND GROUND WATER TAKES**

**Summary of relevant Objectives & Policies for surface water and groundwater takes**

| <b>Objective</b> | <b>Page</b> | <b>Policies</b>                            | <b>Pages*</b> |
|------------------|-------------|--|---------------|
| Objective 23     | 55          | 23, 24, 25, 26, 27, 29, 30, 31, 32, 33     | 56 - 60       |
| Objective 24     | 55          | 23, 25, 26, 27, 28, 30                     | 56 - 60       |
| Objective 25     | 61          | 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44 | 62 - 67       |
| Objective 26     | 61          | 34, 36, 38                                 | 62 - 63       |
| Objective 27     | 61          | 45, 46, 47, 48, 49                         | 67 - 68       |
| Objective 41     | 104         | 73, 74                                     | 104 - 106     |
| Objective 44     | 110         | 77, 78                                     | 110 - 111     |

\*Page numbers for the RRMP

**Relevant rules**

| <b>Rule</b>  | <b>Activity</b>  | <b>Classification</b>   | <b>Conditions/Standards/Terms</b>   |
|--|--|-------------------------|---|
| <p><b>53<br/>Minor<br/>takes &amp;<br/>uses of<br/>ground<br/>Water</b></p> <p><i>Refer<br/>POL<br/>24, 33, 77</i></p> | <p><b>The take and use of<br/>groundwater,<br/>excluding the take<br/>and use of<br/>groundwater from<br/>the water<br/>management<br/>zones shown in<br/>Schedule VI.</b></p> | <p><b>Permitted</b></p> | <p>a. The total volume taken shall not exceed 20 m<sup>3</sup>/d per property<sup>50</sup> (other than for aquifer testing, for which the volume of take is not restricted).</p> <p>Note that:</p> <ul style="list-style-type: none"> <li>• The take and use of water for reasonable domestic needs<sup>51</sup>, stock drinking purposes and fire fighting, including from locations within the groundwater management zones in Schedule VI is not required to be included in this measurement.</li> <li>• When the permitted activity limit of 20 m<sup>3</sup> per day is exceeded a consent is required for the total take.</li> </ul> <p>b. The rate of take shall not exceed 10 l/s</p> |

<sup>50</sup> For the purposes of this Plan the term 'property' refers to one or more allotments as contained on a single certificate of title, and also includes all adjacent land that is in the same ownership.

<sup>51</sup> Refer to Glossary for definition of "reasonable domestic needs".

| Rule   | Activity  | Classification          | Conditions/Standards/Terms   |
|--|---|-------------------------|--|
|  |   |                         | <p>(other than aquifer testing, for which the rate of take is not restricted).</p> <p>c. The take shall not adversely affect any lawfully established efficient groundwater take<sup>52</sup>, or any lawfully established surface water take, which existed prior to commencement of the take unless written approval is obtained from the affected person.</p> <p>d. The take shall not adversely affect any wetland<sup>53</sup>.</p> <p>e. A backflow prevention device shall be installed in circumstances where there is the risk of contaminants flowing down a bore used for taking groundwater, into a groundwater aquifer.</p>   |
| <p><b>54</b></p> <p><b>Minor takes &amp; uses of surface water<sup>54</sup></b></p> <p><i>Refer POL 35, 43</i></p> | <p><b>The take and use of surface water, except from the following catchments, as shown in Schedule Via:</b></p> <ul style="list-style-type: none"> <li>• <b>Maraekakaho Stream to confluence with Ngaruroro River.</b></li> <li>• <b>Ahuriri Estuary catchment including Taipo Stream catchment.</b></li> <li>• <b>Awanui Stream (including Poukawa Stream and Lake Poukawa</b></li> </ul> | <p><b>Permitted</b></p> | <p>a. Except for takes occurring for a period of less than 4 weeks, the total volume taken shall not exceed 20 m<sup>3</sup>/d<sup>55</sup> per property; (or per work site where the activity relates to the take and use of water for the maintenance of road reserves) nor shall the total volume exceed the reasonable needs of the user, whichever is the lesser.</p> <p>b. For takes occurring for a period of less than 4 weeks within any 90 day period, the total volume taken by any person shall not exceed 200 m<sup>3</sup> per 7 day period.</p> <p>c. The rate of take shall not exceed 10% of the instantaneous flow<sup>56</sup> at the point of take.</p> <p>d. The intake velocity shall not exceed 0.3 m/s.</p> <p>e. The activity shall not adversely affect any wetland.</p> |

<sup>52</sup> For the purposes of this Plan, “efficient taking” of groundwater means abstraction by a bore which penetrates an aquifer from which water is being drawn at a depth sufficient to enable water to be drawn all year (i.e. the bore depth is below the range of seasonal fluctuations in groundwater level), with the bore being adequately maintained, of sufficient diameter and screened to minimise drawdown, with a pump capable of drawing water to the land surface.

<sup>53</sup> For the purpose of this Plan the term “wetland” does NOT include:

- wet pasture land
  - artificial wetlands used for wastewater or stormwater treatment
  - farm dams and detention dams
  - land drainage canals and drains
  - reservoirs for fire fighting, domestic or municipal water supply
  - temporary ponded rainfall
  - artificial wetlands.

<sup>54</sup> The taking of water for an individual’s reasonable domestic needs and the reasonable needs of an individual’s animals drinking water is not restricted by this rule.

<sup>55</sup> When the permitted activity limit of 20 m<sup>3</sup> per day is exceeded, a consent is required for the total take.

<sup>56</sup> “Instantaneous flow” refers to the rate of river flow at the time of measurement.

| Rule   | Activity  | Classification       | Conditions/Standards/Terms   |
|--|---|----------------------|--|
|  | <p>catchments) to confluence with Karamu Stream.</p> <ul style="list-style-type: none"> <li>• Louisa Stream to confluence with Karamu Stream.</li> <li>• Papanui Stream.</li> <li>• Lake Tutira and catchment.</li> <li>• Herehere Stream.</li> <li>• Mangaroa Stream.</li> <li>• School Stream.</li> <li>• Karituwhenua Stream.</li> <li>• Te Waikaha Stream.<sup>3</sup></li> </ul> |                      | <p>f. The take shall not adversely affect any lawfully established efficient groundwater take, or any lawfully established surface water take, which existed prior to commencement of the take unless written approval is obtained from the affected person.</p> |
| <p><b>55</b></p> <p><b>Other takes &amp; uses of surface &amp; ground-water</b></p> <p><i>Refer POL 26-32, 36-43, 73, 77</i></p> | <p><b>The take and use of surface water or groundwater, except as provided for by Rules 53 or 54.</b></p>   | <p>Discretionary</p> |  |

**Table 9 from the RRMP - Minimum Flow and Allocatable Volumes for Specified Rivers**

| <b>River name</b>         | <b>Minimum Flow Site Name</b> | <b>Minimum Flow (l/s)</b> | <b>Allocatable Volume (m<sup>3</sup>/week)</b> | <b>Map Reference</b> |
|---------------------------|-------------------------------|---------------------------|--|----------------------|
| Awanui Stream             | At The Flume                  | 120                       | 0  | V21:357613           |
| Awanui Stream             | At Paki Paki Culvert          | 35                        | 0  | V21:351608           |
| Esk River                 | At Shingle Works              | 1,400                     | 355,018  | V20:432945           |
| Esk River                 | At SH2                        | 1,100                     |  | V20:438939           |
| Irongate Stream           | At Clarks Weir                | 100                       | 0  | V21:367666           |
| Kahahakuri Stream         | At Onga Onga Road Bridge      | 200                       | 17,250   | U22:096357           |
| Karamu River              | At Floodgates                 | 1,100                     | 18,023   | V21:427708           |
| Karewarewa River          | At Turamoe Road               | 75                        | -  | V21:341622           |
| Louisa Stream             | At Te Aute Road               | 30                        | 0  | V21:410625           |
| Maharakeke Stream         | At Station Road               | 140                       | 0  | U23:041255           |
| Makaretu Stream           | At Watson Reach               | 170                       | 53,827   | U23:924270           |
| Mangateretere Stream      | At Napier Road                | 100                       | 0  | V21:438659           |
| Maraekakaho River         | At Taits Road                 | 100                       | 5,443  | V21:170668           |
| Maraetotara River         | At Te Awanga Bridge           | 220                       | 30,971   | W21:520661           |
| Ngaruroro River           | At Fernhill Bridge            | 2,400                     | 956,189  | V21:330729           |
| Nuhaka River              | At Valley Road                | 80                        | 41,731   | X19:225329           |
| Ongaru Drain              | Wenley Road                   | 5                         | 0  | V21:234653           |
| Papanui Stream            | At Middle Road                | 45                        | 0  | V22:278433           |
| Porangahau Stream         | At Oruawhoro Road             | 50                        | -  | U23:977259           |
| Pouhokio Stream           | At Allens Bridge              | 80                        | -  | V22:498441           |
| Poukawa Inflow            | Site No. 1 (d/s dam)          | 10                        | 0  | V22:282504           |
| Poukawa Inflow            | Site No. 1a (u/s dam)         | 10                        | 0  | V22:285502           |
| Poukawa Inflow            | Site No. 6                    | 3                         | 0  | V22:266478           |
| Poukawa Stream            | At Douglas Road               | 20                        | 0  | V22:298533           |
| Raupare Stream            | At Ormond Road                | 300                       | 83,844   | V21:398713           |
| Te Waikaha Stream         | At Mutiny Road                | 25                        | -  | V22:361572           |
| Trib. of Kauhauroa Stream | (Taylors)                     | 5                         | 0  | X19:970397           |
| Tukipo Stream             | At SH 50                      | 150                       | 0  | U22:948324           |
| Tukituki River            | At Red Bridge                 | 3,500                     | 1,407,751                                      | V22:466581           |
| Tukituki River            | At Tapairu Road               | 1,900                     | 492,307  | V22:183312           |
| Tutaekuri River           | At Puketapu                   | 2,000                     | 928,972  | V21:357812           |
| Tutaekuri-Waimate         | At Goods Bridge               | 1,200                     | 367,114  | V21:384751           |
| Waimaunu Stream           | At Duncans                    | 10                        | 15,304   | X19:229300           |
| Waipawa River             | At Waipawa (SH2)              | 2,300                     | 342,317  | V22:163337           |