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Assessment of Fish Passage within Selected Districts of the Waikato Region

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Executive summary

A significant number of indigenous freshwater fish of New Zealand are diadromous and move between freshwater and marine environments at various stages of their lifecycle (Boubee et al.1999). In-river artificial structures such as culverts, fords, diversion structures, weirs and dams can pose a barrier to fish migration when poorly designed or installed.

In-river structures in six territorial authority areas of the Waikato Region were evaluated between 2000 and 2005 for their restriction to fish passage. These areas were Thames-Coromandel, Matamata-Piako, Waikato, Waipa, Otorohanga and Franklin (the portion which falls within the Waikato region). An evaluation method adapted from Boubee et al. (1998) was used in the survey.

A total of 1,614 structures or 36% of total potential public road crossings were assessed in these six areas. Structures were assessed as to whether they were likely to restrict fish passage at high, low or most flows, or pose none or minimal restriction to fish passage.

Of the 1614 structures surveyed, 725 or 45% were not considered to pose any restriction to fish passage. 481 (30%) were considered to pose a restriction at most flows while 151 (9%) were assessed as posing a restriction at high flows and 213 (13%) were considered to pose a restriction at low flows. Of those structures assessed a combined total of 845 structures or 52% were considered to pose some form of restriction to fish passage. 44 or 3% of structures visited were not assessed for fish passage restriction.

From the survey data a ranking process was developed to prioritise surveyed structures for remediation. The variables utilised in this ranking system were: severity of fish passage restriction, distance to the sea, upstream watercourse length and percentage of upstream length in indigenous forest in conjunction with the upstream catchment area. A weighting system was then applied to these variables and a district and regional rank given to each structure.

It is hoped that by providing this priority information to the relevant roading authorities and working in conjunction with these agencies, fish passage and subsequent access of fish to upstream habitats can be improved.

It is recommended that continued work be undertaken to reduce the impact of in-river structures on the restriction of fish passage within the Waikato Region. Work should focus on the provision of ongoing advocacy, advice and assistance to staff within both regional and local authorities, consultants, roading engineers and contractors with the design, installation and remediation of appropriate waterway crossings within the Waikato Region.

1 Introduction

The freshwater fish fauna of New Zealand consists of fifty-six species. Thirty-five of these species are indigenous and most are endemic[1]; the remaining twenty-one species are introduced. Within the Waikato Region there are twenty-two species of indigenous and fourteen species of introduced freshwater fish as well as native freshwater crayfish and shrimp (Speirs 2001) (Appendix 1).

At least 18 of New Zealand's 35 indigenous freshwater fish are diadromous and move between freshwater and marine environments at various stages of their lifecycle (Boubee et al. 1999). This movement between habitats is often obligatory for completion of their lifecycle (McDowall 1990).

Migration of fish is species and life-stage specific, and occurs between marine and freshwater environments generally during spring and autumn. The species which undertake these migrations have varying swimming and climbing adaptations which affect their ability to negotiate in-river barriers such as culverts, fords, weirs, dams and diversions (Barnes 2004). The native freshwater shrimp also migrates up and down rivers, and requires passage through culverts in the same way as migrating fish. Culverts have also been shown to limit the movement of other invertebrates within streams (Blakely et al. 2006). As a result, the ability of some fish and Crustacea to move freely between freshwater and marine environments (fish passage) is a significant issue for the indigenous freshwater fauna of New Zealand (Boubee et al. 1999).

The swimming capabilities of a range of common species found in the Waikato region are outlined in Table 1.

Table 1 Swimming abilities of various New Zealand freshwater fish species (Boubee et al. 1999)

Swimming ability classification	Species
Anguilliforms • Ability to move through small spaces • Move both in and out of the water • Can respire atmospheric oxygen if skin remains damp	Shortfinned eels, Longfinned eels, Juvenile Kokopu and Koaro (to a limited extent)
Climbers • Climb wetted margins of waterfalls, rapids, spillways • Adhere to substrate using surface tension and may use pectoral or pelvic fins	Lamprey, Elvers (juvenile eels), Juvenile Kokopu species, Juvenile Koaro, Juvenile common and redfinned bullies (to a limited extent)
Jumpers • Ability to leap using wave momentum at rapids and waterfalls	Trout, Salmon, Smelt and Inanga (to a very limited extent)
Swimmers • Primarily swim to move around or past obstacles • Rely on low velocities of flow to rest • Ability to burst swim to get through small areas of high velocity water	Inanga, Smelt, Grey mullet

[1] Endemic – native and restricted to a given area (in this case New Zealand)

Although preference is given to restoring fish passage, consideration must also be given to the positive benefits of maintaining a barrier to fish passage in a given location. Trout species (Rainbow Trout *Onchorhynchus mykiss* and Brown Trout *Salmo trutta*), although valued as a sports fish, can compete with and prey on some indigenous species. The exclusion of these species by maintaining a barrier may provide a refuge for native species upstream (Taranaki Regional Council 2000). The spread of noxious fish such as Koi Carp and *Gambusia* along with other undesirable species may also be contained and limited by retaining specific barriers to fish passage in key catchments.

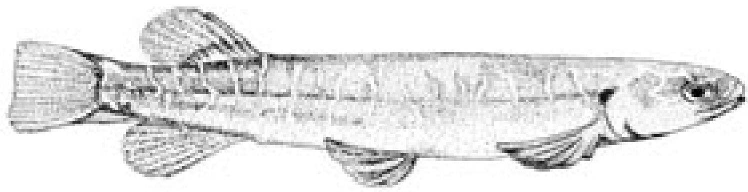

Figure 1 **Banded Kokopu - one species found in small forested streams throughout the Waikato region (Drawing by Sonia Frimmel)**

Artificial barriers to fish passage are mainly comprised of poorly designed and installed in-river structures such as culverts, fords, diversion structures, weirs and dams. Fish passage can be impeded or prevented by a structure if:

- the water velocity is too high and/or there are no resting areas provided within the barrel of the structure
- there is no low velocity zone or wetted margin provided at the water edge
- water turbulence is too great (normally the result of culverts which are too small or too steep)
- the crossing is too dark (ie: culvert is too long or too small)
- water depth within the structure is too shallow
- the substrate within the culvert is too smooth for bottom swimmers
- the bed level of the crossing is raised (ie: perched above the streambed)
- debris has been allowed to build up and has formed a weir
- scouring has occurred causing the culvert to become perched
  (Speirs and Ryan 2006)

Many in-river structures are placed at intersections where streams cross roads or farm tracks. While it is often difficult to assess fish passage in structures on private land, those structures located on public roads are easily accessible. The agencies responsible for the maintenance of structures on the public roading system are Transit New Zealand and Territorial Authorities (District and City Councils). Transit New Zealand has authority over maintaining the State Highway system while Territorial Authorities maintain all other public roads within their jurisdictional boundaries.

To begin addressing the issue of fish passage within the Waikato Region, it was considered necessary to quantify the magnitude of restriction to fish passage in key areas of the Region. Priority for the project was given to investigating those structures located on the public roading system. From this information a prioritisiation process has been undertaken that identifies and ranks structures for potential remediation.

It is hoped that by providing information to the relevant roading authorities and working in conjunction with these agencies, fish passage and subsequent access of fish to upstream habitats can be improved.

This publication follows on from a previous report which was produced from results during the earlier stages of this study:
Fish Passage at Culverts – A Survey of the Coromandel Peninsula and Whaingaroa Catchments (11/00 – 04/01). This publication can be ordered from the Environment Waikato website : www.ew.govt.nz/publications/index.htm?tehnical=33#2001.

1.1 Statutory requirements for fish passage

Legislative requirements for fish passage have been in place for in excess of 20 years and are addressed under several pieces of legislation:

Section 17 of the RMA requires every person to avoid remedy or mitigate any adverse effects on the environment resulting from an activity carried out by that person, whether or not the activity is in accordance with a rule in a plan or resource consent. This means that the owner of any structure causing an adverse effect must take the appropriate action to remedy or mitigate this effect.

Part VI, section 42 of the Freshwater Fisheries Regulations, 1983 places a requirement that all culverts and fords in natural waterways provide for the passage of fish:

> 42. Culverts and fords—
>
> (1) … no person shall construct any culvert or ford in any natural river, stream, or water in such a way that the passage of fish would be impeded, without the written approval of the Director-General ….
>
> (2) The occupier of any land shall maintain any culvert or ford in any natural river, stream, or water (including the bed of any such natural river, stream, or water in the vicinity of the culvert or ford) in such a way as to allow the free passage of fish…

In addition to the requirements above, consideration can be made of the various responsibilities placed on Regional Councils by Part II of the RMA with respect to the life supporting capacity of water and ecosystems, protection of significant habitats of indigenous fauna, the intrinsic values of ecosystems and the protection of the habitat of trout and salmon. These must all be accounted for when considering fish passage at artificial structures in waterways.

1.2 Study scope

This study aims to assess and quantify the impact of structures on public roads on native fish within selected districts of the Waikato Region.

The areas of this study have been defined using Territorial Authority boundaries found within the Waikato Region (See Figure 2). Thames-Coromandel, Matamata-Piako, Waipa, Waikato, Otorohanga and Franklin District's are the study areas where data have been collected. Franklin District spans both Environment Waikato and the Auckland Regional Council regions. For the purpose of this study, only the area of Franklin District which falls within the Waikato Region has been surveyed.

Although surveys have been undertaken in these study areas, the data collected and the subsequent results may not reflect all structures that are present on public roads within a territorial authority boundary.

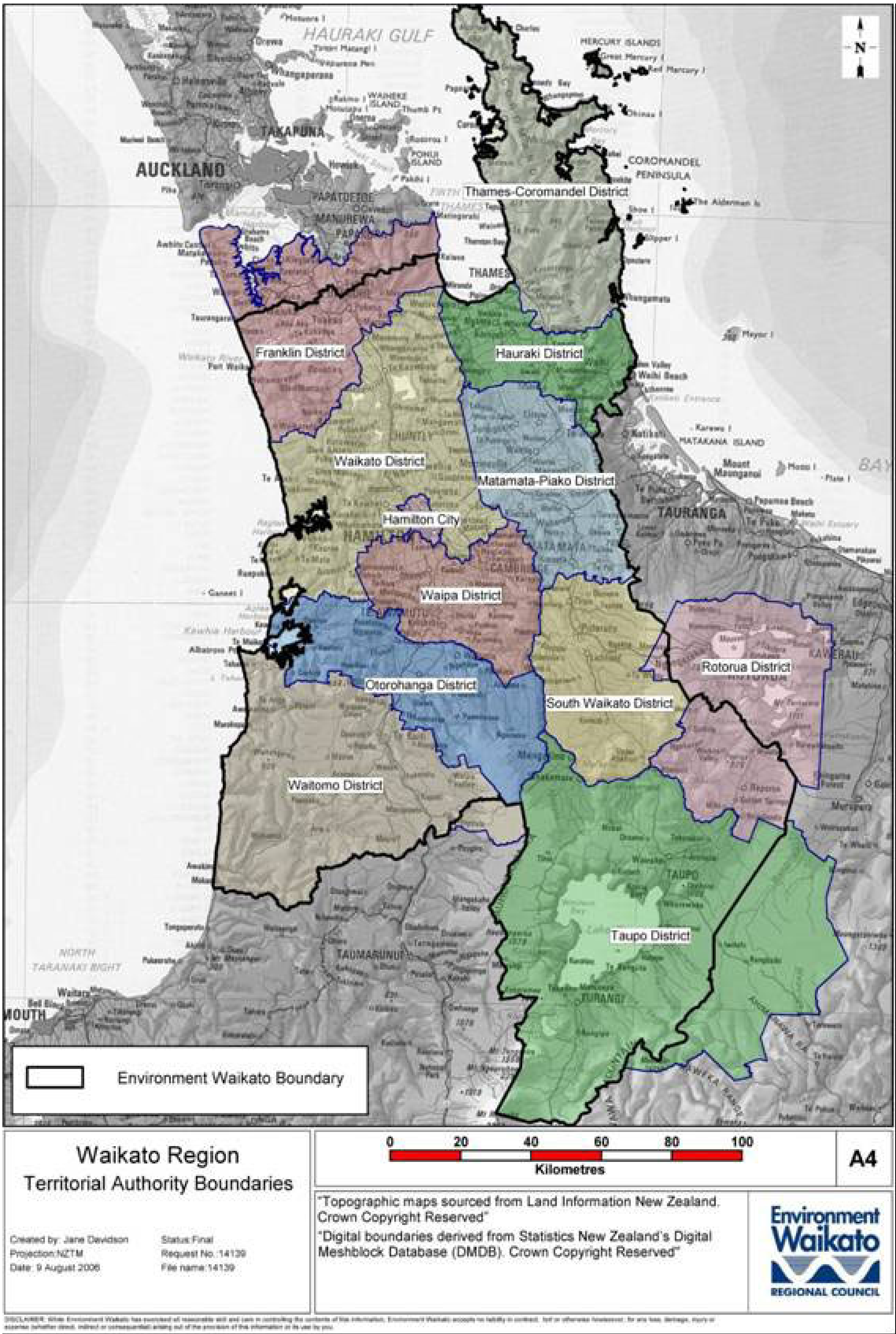

Figure 2 **Map of the Waikato region showing territorial authority boundaries**

1.3 Thames- Coromandel district

The Thames-Coromandel District covers approximately 217,200 hectares of mainland and offshore islands. On the west coast of the peninsula, small, steep and forested catchments draining into the Firth of Thames are typical. On the east coast the land comprises rolling hill country, floodplains and estuaries. Within the district, there remain large areas of regenerating and intact indigenous forest, and large areas of publicly owned land administered by the Department of Conservation. The district has 556km of coastline along the mainland and 200km of coastline on offshore islands. The Coromandel has an extensive area of largely undeveloped land with areas of beef, sheep and dairy farming and plantation forest (Thames-Coromandel District Council 2006).

The district has diverse and abundant populations of indigenous fish with over 17 species having been recorded (McDowall 1990). Fish passage remains an issue of high priority in this district given this diversity, proximity to the sea and the available upstream habitat of largely undeveloped land. The presence of a coastal ring road with steep upstream catchments has the potential to limit the movement of fish into freshwater environments only metres from the sea.

1.4 Waikato district

The Waikato District covers an area of 3,450 square kilometres. It borders Hamilton City in the south, extends to the west coast and stretches to the north of Meremere (Waikato District Council 2006). The district encompasses parts of both the Waikato and Waipa Rivers. It also includes Raglan and parts of Aotea harbour, Mount Karioi and significant peat lakes and wetlands (Waikato District Council 2004).

The Waikato District is an important area for the native fishery within the Waikato region. The presence of harbours, large river systems, wetland habitats and areas of indigenous forest provide a range of potential fish habitat. The major rivers (Waikato and Waipa) are still uninterrupted by dams in this area and allow unimpeded access to the sea. The distance from the sea throughout most of the district is less than 100 kilometres which makes much of this habitat accessible within the swimming capabilities of many native fish.

1.5 Matamata-Piako district

The Matamata-Piako District encompasses an area of 182,150 hectares of land and lies to the west of the Kaimai ranges. The Piako-Waitoa River catchment occupies a significant part of the district with the Waihou River also flowing through the district. Much of the land in this area is flat or rolling and is predominantly used for dairy farming (Matamata-Piako District Council 2005).

The Matamata-Piako District has both important native and trout fishery habitat in the Waihou, Piako and Waitoa rivers and unimpeded access to the sea through the Firth of Thames. Many of the small tributaries flowing from the Kaimai Ranges into the District have high levels of native or exotic forest cover and provide valuable fish habitat. Fish passage in this area is potentially affected by the high level of flood protection (floodgates) on both the Piako and Waihou systems.

1.6 Franklin district

The Franklin District spans both the Waikato and Auckland Regions. The area of the district which falls within the Waikato Region contains the lower reaches of the Waikato River and it’s associated wetlands, coastline along the west to south of Waikaretu, the Miranda foreshore on the Firth of Thames, and the lower catchment of the Mangatawhiri River (Franklin District Council 2000).

The Franklin District is a valuable area for the native fishery given that it includes the lower reaches of the Waikato River and associated wetlands. The protection and enhancement of this habitat for spawning of species such as Inanga (*Galaxias maculatus)* is important. Given the district's proximity to the marine environment, maintaining fish passage in large rivers as well as associated tributaries is essential.

1.7 Otorohanga district

The Otorohanga District covers a land area of 1,976 square kilometres. In the western area of the district are the harbours of Aotea and Kawhia. These harbours are surrounded by steeper hill country with a mix of pastoral farming and indigenous bush cover. The central area of the district covers the southern limit of the Waikato Basin and is predominantly rolling countryside and river plains with dairying and cropping being the main land use. The boundary in the eastern part of the district is the Waikato River with the hydro lakes of Arapuni and Waipapa. This eastern area also contains Pureora and other large tracts of indigenous and exotic forest (Otorohanga District Council 1999)

The Otorohanga District has valuable resources in regards to the native fishery. Those areas accessible from the sea include Kawhia and Aotea harbours and their associated tributaries as well as the Waipa River and its tributaries which are within the district boundaries. The Waikato River forms a boundary with the district, but areas upstream of the lowest hydroelectric dam (Karapiro) have limited fish access.

1.8 Waipa district

The Waipa District extends to the Waikato River in the east and the Waipa River on the western boundary. The district covers an area of 147,372 hectares of land (Waipa District Council 2006) and encompasses the five volcanic cones of Kakepuku, Te Kawa, Maungatautari, Maungakawa and Pirongia, over 16 nationally significant peat lakes and two hydro lakes located on the Waikato River. Land use within the district is primarily dairy farming with some sheep and beef, racing stables and horse stud farms (Waipa District Council 2004).

The eastern part of the Waipa District provides limited native fishery value due to restrictions in fish passage imposed by the lower hydroelectric dam (Karapiro) on the Waikato River. The west of the district provides access to the Waipa River and its associated tributaries which have unimpeded physical access through to the Lower Waikato River and the downstream marine environment. Some areas of the Waipa District such as Mount Pirongia have good areas of native forest with high quality potential habitat for native fish. One further limitation may be high levels of turbidity within the Waipa River which may limit some native fish entering this system.

2 Methodology

2.1 Survey techniques

In-river structure surveys have been conducted within six territorial authorities (outlined above) within the Waikato Region between December 2000 and March 2005. The study was restricted to structures located on public roads and accessible off road verges and bridges. Forestry roads were also surveyed in the Thames-Coromandel District. Structures on private land were not included in the survey.

To enable accurate coverage of all structures a combination of techniques was used.
Known structures and potential sites of stream/river crossings were identified using topographic maps (NZMS 260 series). Asset maps were also provided by Ernslaw One and Carter Holt Harvey forestry in the Thames-Coromandel District. Both of these processes were supplemented in the field by visual identification of potential sites.

The process of collecting the data was to drive accessible public roads and look for culvert crossings. If appropriate they were assessed with the standard form (Appendix 2) which has been modified from Boubee (1988). Ephemeral waterways and stormwater structures were not included in this work. There was no minimum or maximum size restriction on structures surveyed.

A hand held Global Positioning System unit (GPS) (Garmin 12 XL) was used to provide a New Zealand Grid bearing (Easting and Northing). A digital camera was used for photographing the inlet and outlet of all structures surveyed. A gauge board with a metal spike at its base was used for measurement of diameter, water outlet, sediment depth, as well as height and undercut on those culverts that were perched. Each culvert was numbered and the number recorded in the photographs by way of a small whiteboard.

2.1.1 Variation of survey technique - 2005

The fundamental methods of survey techniques have remained the same through the entire survey time. The development of palm pilot technology enabled data to be collected directly into an IPAC hand-held computer during 2005. The existing evaluation sheet was developed into an electronic format and GPS locations were collected by a linked GPS unit making use of blue tooth technology. Data were downloaded from the IPAC directly into the corporate database. The use of this technology reduced the time required for completing field sheets and data entry into the corporate database.

2.1.2 Data storage

Information from the survey has been entered into a purpose built attachment (Culverts) to Environment Waikato's corporate database system (Located). Photographs taken at each structure have also been entered into the corporate photograph database (Media) which in turn is linked to the Located database.

3 Results and discussion

3.1 Severity of passage restriction

The primary measure of reporting is based around the assessed severity of fish passage restriction. The four categories are:

None or minimal: where the structure poses no significant barrier to the upstream or downstream passage of fish likely to be found in the stream within the normal range of flow conditions.

Figure 3 **Culverted ford with none or minimal restriction to fish passage - culvert barrels are offset at different heights to allow for changes in flow**

Low flow only: where the structure poses a barrier to the passage of most fish likely to be found in the stream, but where this barrier is only present at low flow conditions.

Figure 4 **Box culvert – likely to pose a barrier to fish passage at low flows due to lack of water coverage on culvert base**

High flow only: where the velocity in the structure is likely to increase and become unnavigible by the majority of fish in the stream during high flows (generally where the structure is over half full at normal flows)

Figure 5 **Culvert considered to restrict fish passage at high flows (culvert barrel is over half full at normal flows)**

Most flow conditions: where the structure poses a significant barrier to the passage of fish likely to be found in the stream at most of the normal range of flow conditions.

Figure 6 **Precast culvert with perched concrete apron and barrel which are both likely to restrict fish passage at most flows**

Figure 7 **Culvert assessed as restriction to fish passage at most flows – significantly perched and undercut barrels**

How representative the water flow was during inspection was taken into account when assessing the presence or severity of any fish passage restriction.

3.2 Regional results

The regional results are presented as a summary of the 6 districts that were incorporated in the survey. As an indication of how these results relate to the total available habitat and survey sites, information has been generated on the potential number of crossings between road and waterway within the 6 areas surveyed. GIS has been used to generate this information.

The following spatial information was used to generate these data:

- Number of points where streams and rivers cross public roads GIS_ALL.REC_WATERCOURSE, GIS_ALL.CRS_ROAD

In these six districts, a total of 1,614 structures were assessed compared to 4,543 points where streams and rivers cross public roads (generated using GIS). This equates to 36% of the potential available crossing points being assessed in these 6 districts. This information generated by the GIS will include crossings where bridges are present which have not been assessed in this study. This comparative figure (36%), may slightly underestimate the percentage of structures assessed comparative to the total crossings available.

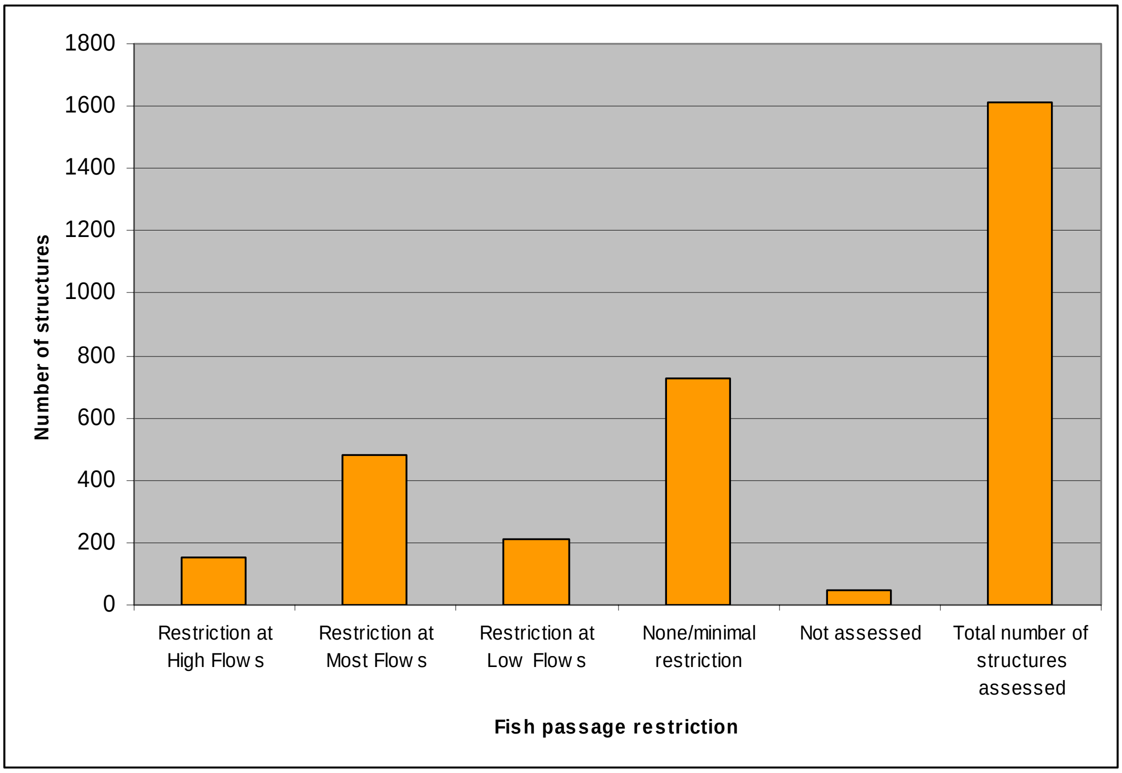

Figure 8 **Number of structures assessed by fish passage restriction - combined total of 6 territorial authorities**

Figure 8 illustrates the combined fish passage restriction of the 6 areas combined. Of the 1614 structures surveyed in the study, 725 or 45% were not considered to pose any restriction to fish passage. 481 or 30% were considered to pose a restriction at most flows while 151 (9%) were assessed as posing a restriction at high flows and 213 (13%) were considered to pose a restriction at low flows. Of those structures assessed, a combined total of 845 structures or 52% were considered to pose some form of restriction to fish passage. 44 or 3% of structures surveyed were not assessed for fish passage restriction.

3.3 District results

The potential number of crossings between roads and waterways have also been generated by district and this data are presented in Table 2. Franklin district data reflects only that part of the area which falls within the Waikato region.

Table 2 **Summary of data by district**

District	Total number of structures assessed	Number of points where streams and rivers cross roads	% of structures surveyed (assessed versus number of points)
Franklin District	210	480	43.7
Matamata-Piako District	282	811	34.7
Otorohanga District	133	563	23.6
Thames-Coromandel District	367	779	47.1
Waikato District	403	1245	32.3
Waipa District	219	665	32.9
Total	1614	4543	35.5

In both Franklin and Thames-Coromandel, the number of structures surveyed compared to the GIS generated number of crossing points was more than 40%. In Matamata-Piako, Waikato and Waipa the number of structures compared with the number of points was between 32 and 35%. Otorohanga District was comparatively poorly represented with only 24% of structures surveyed compared to the results from the GIS.

The following series of graphs represent the survey results by district. Data are presented as the assessed severity of fish passage restriction.

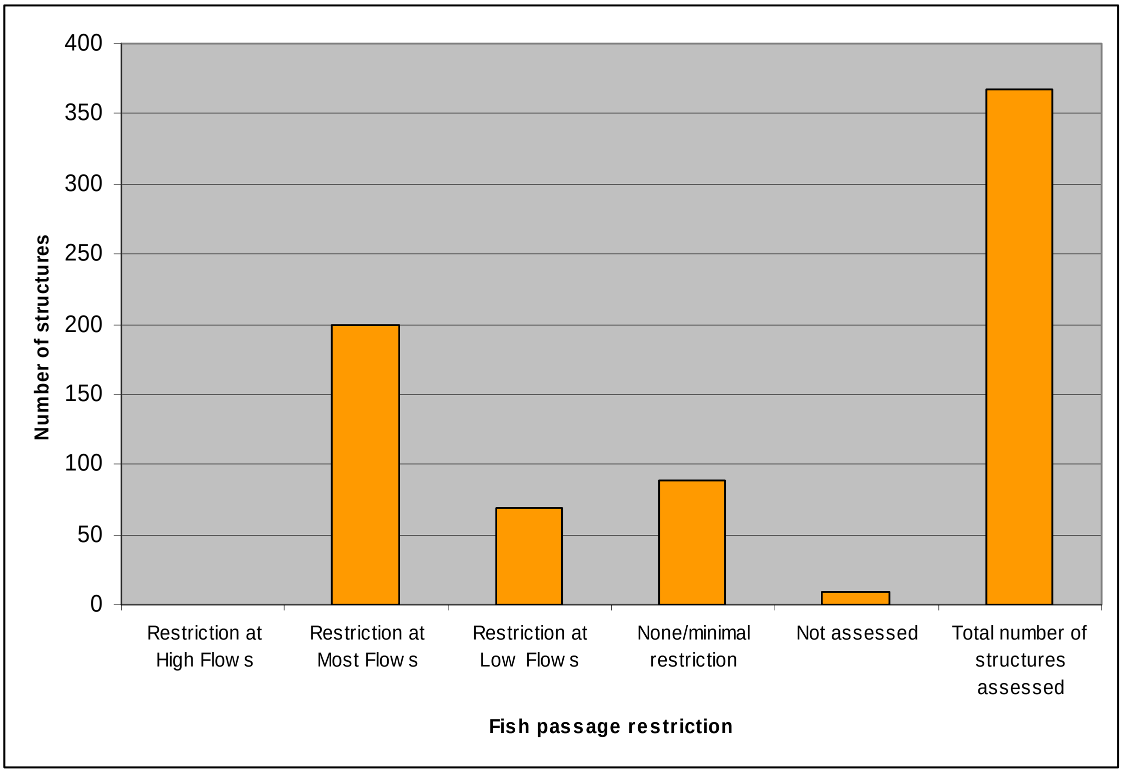

Figure 9 **Thames-Coromandel District - number of structures assessed by fish passage restriction**

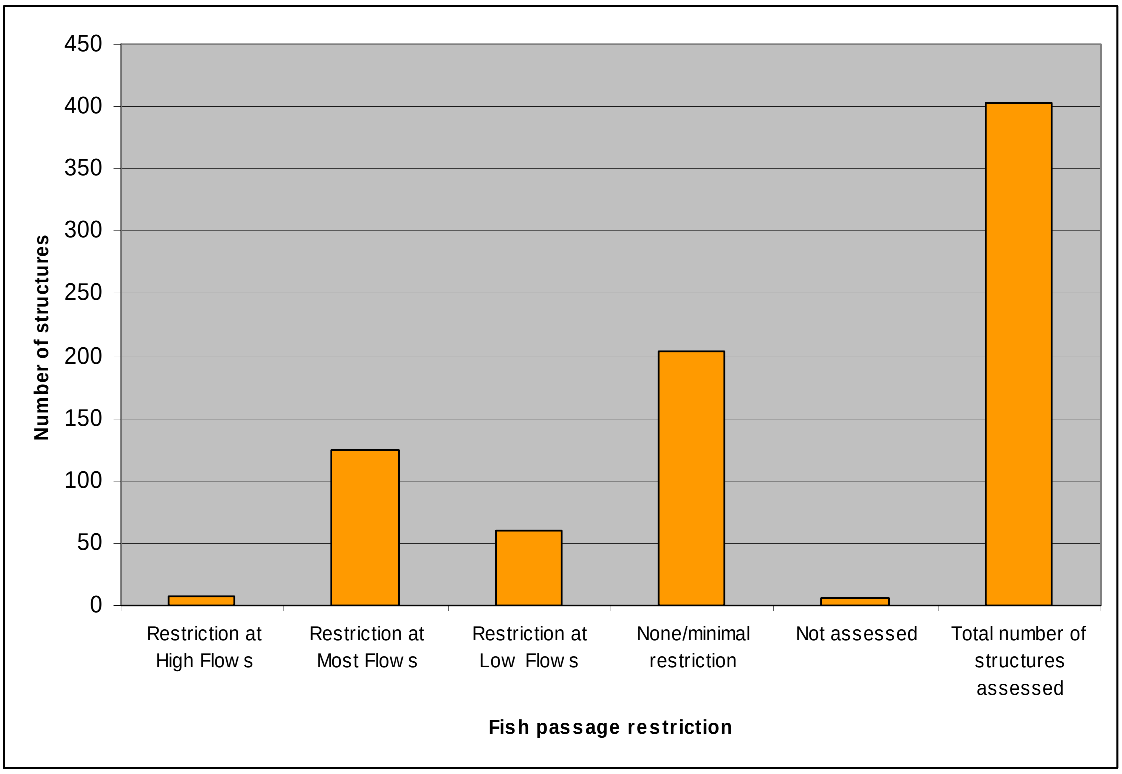

Figure 10 **Waikato District – number of structures assessed by fish passage restriction**

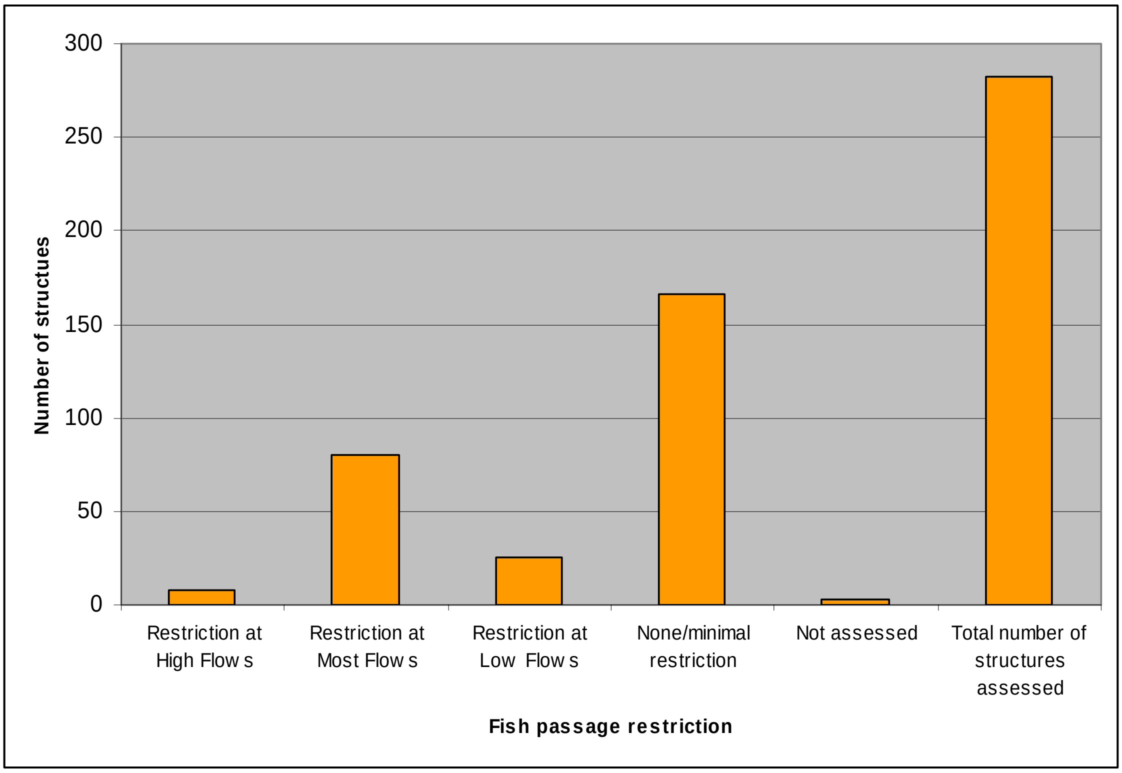

Figure 11 **Matamata-Piako District - number of structures assessed by fish passage restriction**

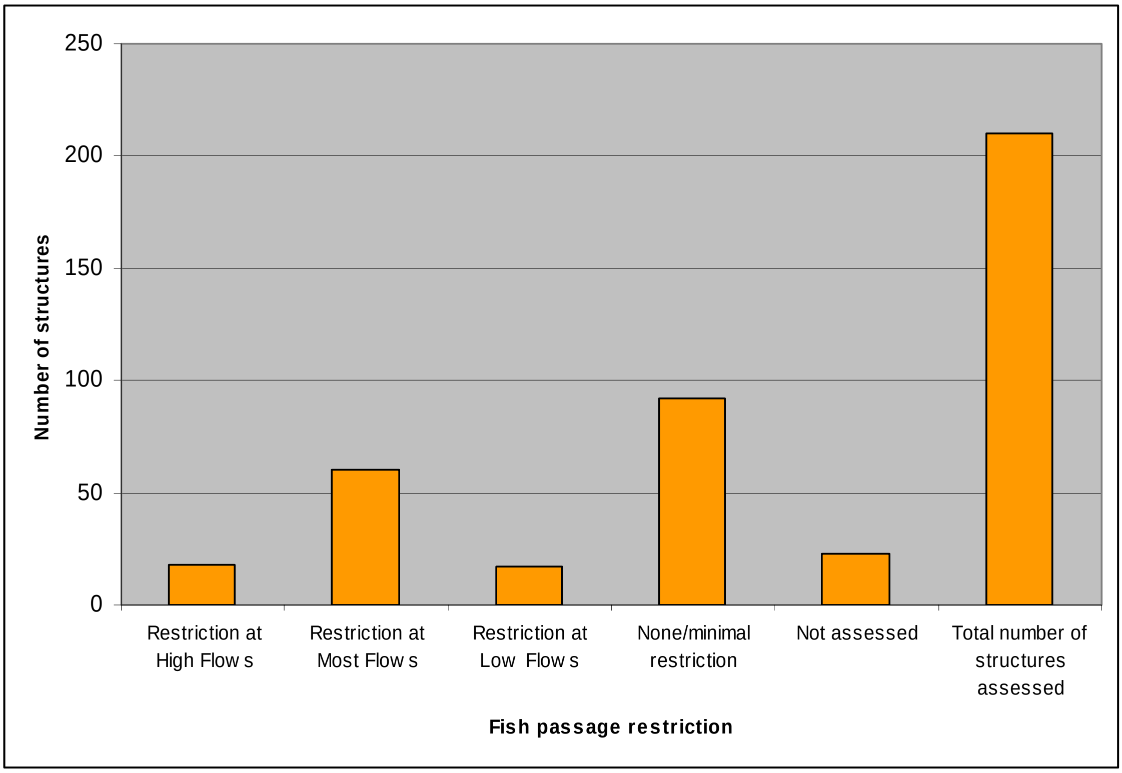

Figure 12 **Franklin District - number of structures assessed by fish passage restriction**

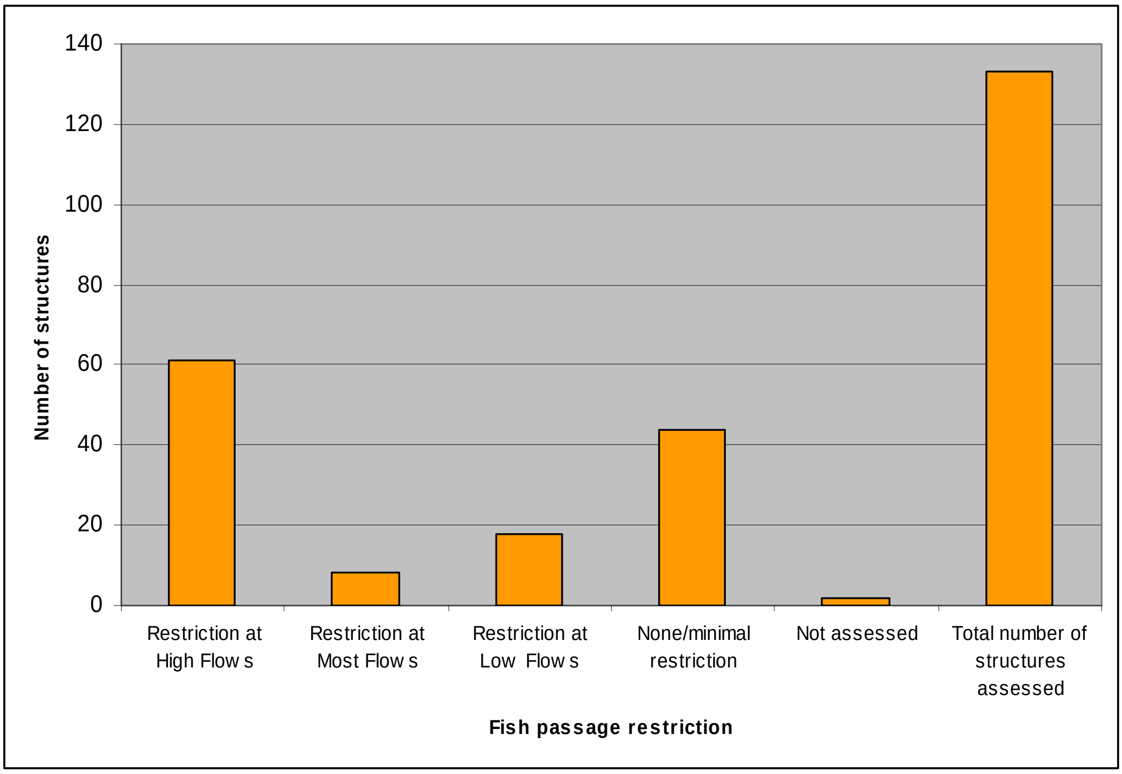

Figure 13 **Otorohanga District - number of structures assessed by fish passage restriction**

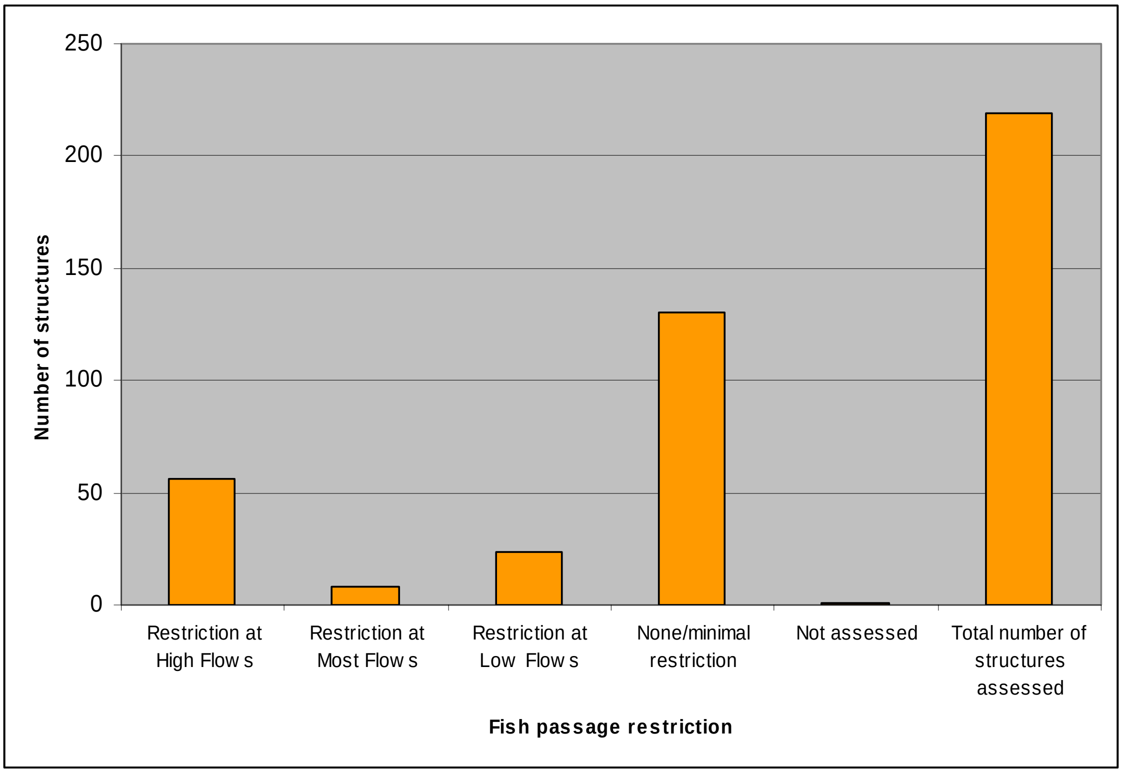

Figure 14 **Waipa District - number of structures assessed by fish passage restriction**

3.4 Prioritisation for remedial works

After the identification of structures within the study sites, a process of prioritisation was used to highlight which structures would provide the greatest gains if remediated. The priority list was developed on a regional scale and within each Territorial Authority.

3.4.1 Ranking process

The prioritisation and ranking process used for this exercise is based on information collected in the field and the GIS data available at the time of analysis. This ranking is seen as indicative and should be used with consideration of the limitations outlined below (3.4.2).

The ranking dataset is only for structures deemed restrictive to fish passage at low, high or most flow conditions, as these are considered the type most in need of remediation (culverts with none/minimal restriction on fish passage were not ranked, nor were those that had no fish passage restriction recorded).

When determining final priorities, the perch height and undercut also need to be taken into account (these factors were not considered in the ranking process described below). Other considerations that need to be taken into account are whether structures have downstream barriers which can't be remediated (ie: floodgates, dams, waterfalls), or whether remediation may allow access to alien fish species (inclusive of trout) that would not otherwise be present.

The culvert ranking information is based on data extracted from the culvert database in April 2006.

3.4.1.1 Methodology of ranking and GIS layers used

For the ranking prioritisation the following steps were undertaken. All those structures which were assessed to pose none/minimal restriction to fish passage were removed from the analysis. Those structures located >100km from the sea were also removed (other than Waipa District where structures >200km from the sea were removed).

Ranking

Culvert barrier rating

1 = barrier at high flows
2 = barrier at low flows
3 = barrier at most flows

Weighting of 5

Distance <100km (or <200 km for Waipa) from the sea (km)

1 = >50
2 = 11-50
3 = 0-10

Weighting of 4

Upstream network length (km)

1 = 0-10
2 = 11-50
3 = >50

Weighting of 3

% Upstream catchment forest cover

1 = 0-10
2 = 10-50
3 = >50

Weighting of 2

No other road culverts upstream or downstream
(that have a barrier rating of low flows or most flows)

1 = >1
2 = 1
3 = 0

Weighting of 1

Priority is therefore set by:
Sum of (Culvert score x 5) + (Distance score x 4) + (Upstream networks score x 3) + (Upstream forest cover score x 2)

Range of scores = 15-45

The scores were then priority ranked for the whole Region and by District. A priority ranking of a low number represented sites which have higher scores generated using this ranking process. These sites with the lowest number priority (eg: 1) are the highest priority for remedial action. For the purpose of ranking, the presence or absence of road culverts downstream was not included in the scoring system because it was not clear how many had been surveyed.

Those structures which pose a barrier at most flows are considered to be a greater issue and of a higher priority due to their greater impact on fish passage. Perch height and undercut of these structures must also be taken into account when looking at remedial options. The viability of remedial works may be influenced by the size of both the perch and the undercut of these structures.

3.4.2 Data limitations:

There are a number of **limitations** that must be considered in regard to the culvert ranking dataset when using this information:

- The dataset is limited to publicly accessible roads and does not include all structures present. It does not include structures on private land.
- The assessment of each structure is subjective and assumes an 80% correct assessment rate.

- The Regional ranking is for those structures assessed within the scope of this project. Not all Territorial Authorities were included in the project.
- Given the age of these data – some structures may have been affected by weather events and deteriorated, and may in fact now rank higher in this system.
- Alternatively, some structures may have been remediated since data were collected and may in fact now rank lower in this system or not at all.
- These data are provided as a guideline only – it is recommended that a fishery and/or hydrological survey be conducted before any **major** work is undertaken on remedial measures at any of these structures.

- Geographical locations are accurate to ± 50 m (1:50000 scale) unless otherwise indicated.
- The provision of these data does not resolve any legislative requirements by any operating authority.

3.5 Ranking process results

Those structures which ranked in the priority process are presented in Figure 15. Data are presented by district.

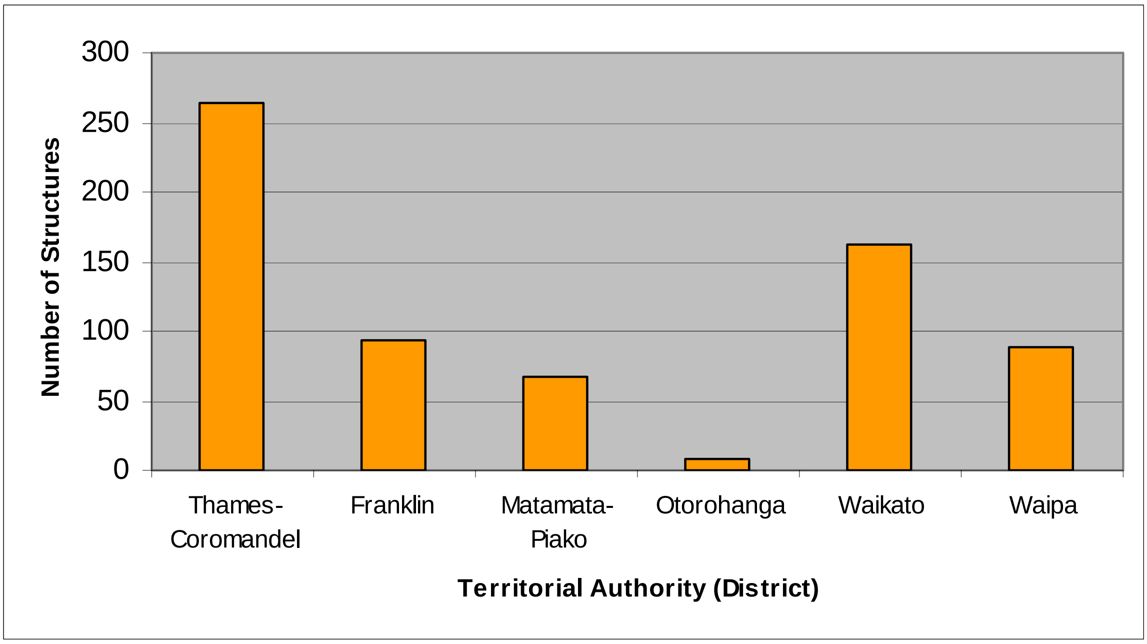

Figure 15 Number of culverts by Territorial authority resulting from application of ranking system

After removal of structures assessed to pose none/minimal fish passage restriction, structures not assessed and structures >100km from the coast (>200km from the coast in Waipa), 685 of the 1614 structures (42%) surveyed were prioritised following the ranking system (Table 3). The relative percentage of ranked structures compared with the total surveyed in each district is also represented.

Thames-Coromandel had the highest percentage of ranked structures followed by Franklin, Waikato, Waipa, Matamata-Piako and finally Otorohanga district.

Table 3 **Number of structures ranked within each district**

District	Total ranked structures	Total structures surveyed	% of ranked versus total structures surveyed
Thames Coromandel District	264	367	72
Franklin District	94	210	45
Matamata-Piako District	68	282	24
Otorohanga District	8	133	6
Waikato District	163	403	40
Waipa District	88	219	40
Total	**685**	**1614**	

Figure 16 illustrates the ranked structures by level of fish passage restriction. The majority of structures which featured in the ranking system were those considered to be a barrier at most flows. This was reflected in 5 of the 6 areas assessed. Waipa District was the exception with the majority of ranked structures considered to be a barrier at high flows.

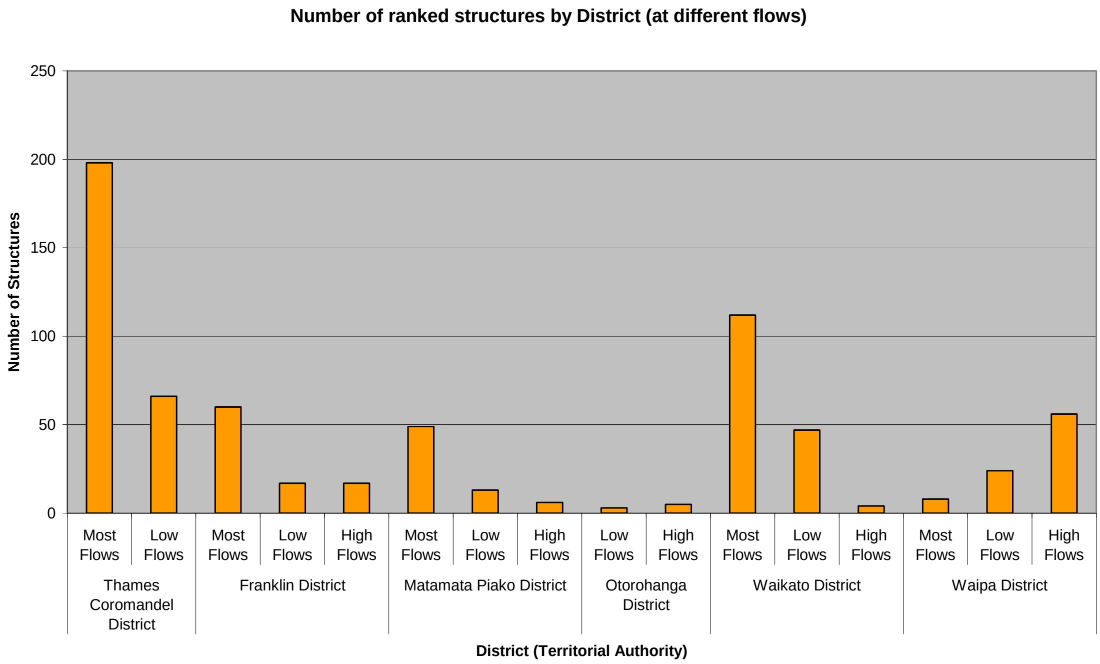

Figure 16 **Number of structures which resulted from applying ranking system by District and by fish passage restriction**

4 Management implications

Thirty six percent of possible structures in the study area (as ascertained by GIS analysis) were assessed during this study. Despite this low percentage and limitation, it is still applicable to report that potential habitat access by diadromous fish within the Waikato region is affected by in-river structures. Key areas of concern in regards to fish passage are the Thames-Coromandel and Waikato Districts although this does not negate the importance of structures within other districts.

The results of this project indicate that continued liaison between regulatory authorities and roading authorities is required to increase knowledge of the native fishery and the importance of providing fish passage at structures. It is also imperative this knowledge be passed to construction staff both within the authorities themselves and their contractors.

The results of the ranking and prioritisation process have been supplied to the relevant local authorities to provide them with guidance on those structures which are the most important in their Districts to remediate for restoration of fish passage. These results can be incorporated into maintenance schedules and help Territorial authorities meet their obligations.

A guideline providing information on best practice when installing waterway structures has been designed to assist regional and local authorities, consultants, roading engineers and contractors with the design and installation of appropriate waterway crossings within the Waikato Region. These guidelines have already been widely distributed amongst Territorial authorities to support the results of this project and provide guidance on new structure installation. The guidelines have also been widely distributed amongst Environment Waikato staff to assist in best practice both in the field and promote knowledge of best practice within the resource consent process.

This publication is available from the Environment Waikato website at no charge. See: http://www.ew.govt.nz/publications/technicalreports/tr0625.htm

It is strongly recommended that this guide be used when installing new waterway structures as it takes into consideration fish passage issues. It is easier, more cost effective and requires less maintenance to install an appropriate and well designed structure that will allow for fish passage than it is to remediate a poorly designed and installed structure at a future date. It is also important to monitor key sites for changes after storm events which may also require remedial works.

Consideration must be given to other priorities within Environment Waikato but relative to available resources, additional work on this project could include:

- Information workshops with Territorial authorities and Transit New Zealand for exchange of ideas, discussion of best practice and provision of assistance
- Information workshops with relevant groups within Environment Waikato to promote best practice. Investigate potential for Environment Waikato staff to utilise assessment procedure used in this study to highlight potential fish passage issues after flood events or due to erosion at structures
- Provision of information to roading contractors on the importance of fish passage and ways to assist in it’s provision during the course of their work
- Liaise and work with pre-cast culvert manufacturers in supporting designs which allow for unimpeded fish passage

5 References

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Waikato District Council, 2006: *Waikato District Council Long-term Council Community Plan 2006-2016.*

Appendix 1 Fish and large Crustacea of the Waikato Region

Common Name (Maori Name)	Scientific Name
NATIVE FISH	
Yelloweyed mullet (Aua)	*Aldrichetta forsteri*
Shortfinned eel (Hao)	*Anguilla australis*
Longfinned eel (Kuwharuwharu)	*Anguilla dieffenbachii*
Australian longfinned eel	*Anguilla reinhardtii*
Torrentfish (Papamoko)	*Cheimarrichthys fosteri*
Giant kokopu (Kokopu)	*Galaxias argenteus*
Koaro	*Galaxias brevipinnis*
Dwarf galaxias	*Galaxias divergens*
Banded kokopu (Para)	*Galaxias fasciatus*
Inanga	*Galaxias maculatus*
Shortjawed kokopu	*Galaxias postvectis*
Lamprey (Piharau)	*Geotria australis*
Black mudfish	*Neochanna diversus*
Giant bully	*Gobiomorphus gobioides*
Upland bully	*Gobiomorphus breviceps*
Common bully (Pako)	*Gobiomorphus cotidianus*
Bluegill bully	*Gobiomorphus hubbsi*
Redfinned bully	*Gobiomorphus huttoni*
Cran's bully	*Gobiomorphus basalis*
Grey mullet (Kanae)	*Mugil cephalus*
Common smelt (Ngaoire)	*Retropinna retropinna*
Black flounder	*Rhombosolea retiaria*
INTRODUCED FISH	
Catfish	*Ameiurus nebulosus*
Goldfish	*Carassius auratus*
Grass carp	*Ctenopharyngodon idella*
Koi carp	*Cyprinus carpio*
Mosquitofish	*Gambusia affinis*
Rainbow trout	*Onchorhynchus mykiss*
Perch	*Perca fluviatilis*
Sailfin molly	*Poecilia latipinna*
Guppy	*Poecilia reticulata*
Brown trout	*Salmo trutta*
Brook char	*Salvelinus fontinalis*
Rudd	*Scardinius erythropthalmus*
Tench	*Tinca tinca*
Swordtail	*Xiphophorus helleri*
CRUSTACEA	
Freshwater crayfish (Koura)	*Paranephrops planifrons*
Shrimp (Patiki)	*Paratya curvirostris*

Appendix 2 Evaluation sheet

FISH PASSAGE EVALUATION SHEET FOR INSTREAM STUCTURES

Date:………………………………. **Monitoring Officer:** …………………………

Site Number:…………………….. **Authorisation Number:** ……………………

NZMS 260: Map No:…………….. **Spatial Locator Method** Low order GPS Survey (If other please state)

Co-ordinates: (GPS) E…………………………. N……………………………

Site Address:…………………………………………………………………………….

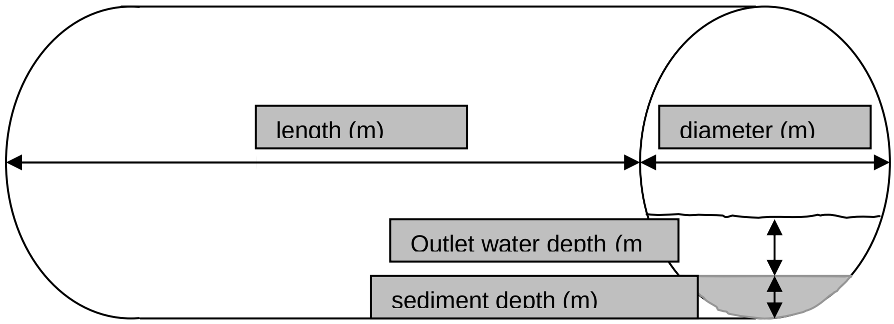
Stream Name:…………………… **River System (Catchment)**:………………………
(Please refer DOC# 742989 for naming convention/methodology)

Culvert Description: Culvert Concrete Slab Ford with…….Culverts

Concrete Slab Ford without Culverts

Culvert type: Pipe Box Arch Ford

Culvert Materials: Concrete Steel (Corrugated Iron) Galvanised Steel Plastic



Culvert cross section :

Inlet FLAT POOLED PERCHED

Outlet FLAT POOLED PERCHED

For perched culverts provide an estimate of water fall (for multiple culverts note maximums only):

Height (m)………… Undercut length (m)…………

Likely severity of fish passage restriction

None/Minimal Low flows Most flows High flows

Stream attributes

Stream bed level
Above culvert invert level Same as culvert invert level Below culvert invert level

Stream width
Narrower than culvert inlet width Same as culvert inlet width

Wider than culvert inlet width

Stream gradient
Flatter than culvert gradient Same as culvert gradient

Steeper than culvert gradient

Stream alignment
Straight in and out of culvert Straight in and curved out of culvert

Curved in and straight out of culvert

Bed material
Mud%……….. Silt%………. Sand%………. Pebbles%…….. Cobbles%……..

Boulders%……….

Water flow during inspection:
Low Normal High

Other attributes

Bank Erosion at Culvert Ends	Y	N	NA
Downstream Barriers	Y	N	NA
Upstream Barriers	Y	N	NA

Photos

INLET ……….

OUTLET ……….

Other comments:

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

Appendix 3 List of ranked structures by district

LOCATED KEY	SITE ID	INSPECTION DATE	LENGTH (m)	DIAMETER (m)	UNDERCUT LENGTH (m)	PERCHED HEIGHT (m)	FISH PASSAGE RESTRICTION	INLET Cross - Section	OUTLET Cross - Section	CONSTRUCTION MATERIAL	MAP REFERENCE	REGION RANK	DISTRICT RANK
Thames Coromandel District													
1856.1	236	27/11/2000	4	0.5	0.5	0.6	Most flows		Perched	Concrete	T12:466-553	164	107
234.17	237	27/11/2000	8	1.2	0.2	0.2	Most flows		Perched	Galvanised Steel	T12:473-557	76	57
234.18	238	27/11/2000	15	1.2	0.2	0.1	Most flows		Perched	Concrete	T12:457-544	76	57
234.19	240	27/11/2000	4	0.25	0.1	0.1	Most flows		Perched	Concrete	T12:450-529	15	15
234.20	241	27/11/2000	10	0.8	0.2	0.15	Most flows		Perched	Concrete	T12:443-521	164	107
234.21	242	27/11/2000	15	1.2	0.1	0.4	Most flows		Perched	Concrete	T12:444-513	164	107
447.2	243	27/11/2000	4	0.45	0	0.15	Most flows		Perched	Concrete	T12:428-498	76	57
1019.2	245	27/11/2000	7	2	0.05	0.1	Most flows		Perched	Concrete	T12:411-472	98	67
234.24	246	27/11/2000	4				Most flows		Perched	Concrete	T12:407-466	1	1
962.4	247	27/11/2000	5	0.5	1	0.3	Most flows		Perched	Steel	T12:345-514	5	5
962.5	248	27/11/2000	3	0.75	0.3	0	Most flows		Perched	Concrete	T12:350-516	5	5
1577.2	249	28/11/2000		1			Most flows	Flat	Flat	Concrete	T12:340-529	35	27
790.1	250	28/11/2000	20	1	0.1	0.5	Most flows		Perched	Concrete	T12:346-565	35	27
1175.9	254	28/11/2000	3	0.3	0.8	0.8	Most flows		Perched	Concrete	T11:349-607	5	5
681.1	255	28/11/2000	8	0.75	0.3	1	Most flows		Perched	Concrete	T11:321-679	164	107
1857.1	257	28/11/2000	3	6	0.3	0.5	Most flows		Perched	Concrete	T11:326-700	20	17
1814.1	258	28/11/2000	8	1	0.1	0.2	Most flows		Perched	Concrete	S11:293-717	98	67
1556.3	261	28/11/2000	6	1.2	0.2	0.4	Most flows		Perched	Concrete	T11:324-850	164	107
1599.1	262	28/11/2000	15	2	0.1	0.5	Most flows		Perched	Concrete	T11:313-821	35	27
1571.1	265	29/11/2000	8	0.6	1	0.4	Most flows		Perched	Concrete	T12:342-550	35	27
1569.2	266	29/11/2000	10	1	0.1	0.1	Most flows		Perched	Concrete	T12:347-571	35	27
1105.6	273	30/11/2000	10	1	0.3	0.2	Most flows		Perched	Concrete	T11:353-866	20	17
1105.7	274	30/11/2000	10	1	0.3	0.3	Most flows		Perched	Concrete	T11:355-865	20	17
1105.9	277	30/11/2000		1.5	0.5	0.5	Most flows		Perched	Concrete	T11:372-836	164	107
1595.1	279	30/11/2000	6	1	0.5	0.5	Most flows		Perched	Concrete	T11:409-792	76	57
1597.2	281	1/12/2000	6	0.5	0.2	0.8	Most flows		Perched	Concrete	T11:435-796	164	107
1594.1	282	1/12/2000	8	1.8	0.2	0.5	Most flows		Perched	Concrete	T11:448-791	35	27
935.2	284	5/12/2000	8	0.7	0.3	0.5	Most flows		Perched	Concrete	T10:543-940	35	27
1163.1	285	5/12/2000	12	1.5	0.5	1	Most flows		Perched	Concrete	T10:557-954	35	27
1593.1	286	5/12/2000	12	1.6	0.1	0.1	Most flows		Perched	Concrete	T10:541-932	98	67
1593.2	287	5/12/2000	3	1.5	0.1	0.5	Most flows		Perched	Concrete	T10:545-921	35	27
1756.1	289	5/12/2000	10	3	0.3	0.5	Most flows		Perched	Concrete	T10:347-903	35	27
1241.6	290	5/12/2000	10	1.6	0.2	0.5	Most flows		Perched	Concrete	T10:386-909	35	27
1776.1	292	6/12/2000	12	1	1	0.5	Most flows		Perched	Concrete	T11:535-884	35	27
42.7	300	6/12/2000	5	0.8	0.1	1	Most flows		Perched	Concrete	T11:429-866	76	57
42.3	302	6/12/2000	6	0.8	0.5	0.5	Most flows		Perched	Concrete	T11:433-853	164	107
42.19	303	6/12/2000	10	1	0.5	0.3	Most flows		Perched	Concrete	T11:433-853	164	107
813.4	304	6/12/2000	10	0.85	0.3	0.3	Most flows		Perched	Concrete	T10:436-949	20	17
813.5	306	6/12/2000	6	2	0.5	1	Most flows		Perched	Concrete	T10:426-950	20	17
1241.2	307	6/12/2000	5	0.8	0.1	0.2	Most flows		Perched	Concrete	T10:406-903	20	17
1241.12	308	6/12/2000	12	1	0.2	0.5	Most flows		Perched	Concrete	T10:391-906	5	5
1549.1	310	8/12/2000	10				Most flows	Pooled	Pooled	Concrete	T10:317-913	98	67
267.2	313	8/12/2000	6	2	0.2	0.8	Most flows		Perched	Concrete	T10:304-949	35	27
1575.1	314	8/12/2000	6	0.2	0.5	2	Most flows		Perched	Concrete	S10:192-164	35	27
797.1	315	8/12/2000		3	1	2	Most flows		Perched	Concrete	S10:191-184	98	67
1251.1	320	8/12/2000	7	0.7	0.2	0.2	Most flows		Perched	Concrete	S10:202-141	35	27
1525.5	324	8/12/2000	7	0.8	0.2	0.3	Most flows		Perched	Concrete	S10:224-122	98	67
1525.6	325	8/12/2000	7	1	1	1.5	Most flows		Perched	Concrete	S10:227-122	98	67
1525.7	326	8/12/2000	7	1	0.1	0.5	Most flows		Perched	Concrete	S10:230-120	35	27
916.1	327	8/12/2000	7	2	0.1	0.5	Most flows		Perched	Concrete	S10:233-118	35	27
1525.8	328	11/12/2000	8	0.45	0.3	0.5	Most flows		Perched	Concrete	S10:237-118	98	67
1525.9	329	11/12/2000	8	1	0.5	0.8	Most flows		Perched	Concrete	S10:238-116	98	67

LOCATED KEY	SITE ID	INSPECTION DATE	LENGTH (m)	DIAMETER (m)	UNDERCUT LENGTH (m)	PERCHED HEIGHT (m)	FISH PASSAGE RESTRICTION	INLET Cross - Section	OUTLET Cross - Section	CONSTRUCTION MATERIAL	MAP REFERENCE	REGION RANK	DISTRICT RANK
Thames Coromandel District													
1525.12	332	11/12/2000	10	1	0.2	0.3	Most flows		Perched	Concrete	S10:249-110	35	27
86.3	338	11/12/2000	6	1	0.05	0.05	Most flows		Perched	Concrete	S10:299-049	164	107
86.4	339	11/12/2000	6	0.8	0.8	0.8	Most flows		Perched	Concrete	S10:298-049	164	107
111.2	340	12/12/2000	10	0.8	0.3	2	Most flows		Perched	Concrete	T10:343-932	35	27
155.6	341	12/12/2000	7	0.2	0.1	1	Most flows		Perched	Concrete	T10:354-949	164	107
155.7	342	12/12/2000	8	0.4	0.5	1	Most flows		Perched	Concrete	T10:353-952	98	67
155.8	344	12/12/2000	6	1	0.5	1	Most flows		Perched	Concrete	T10:368-975	98	67
1816.1	345	12/12/2000	10	1	0.1	0.1	Most flows		Perched	Concrete	T10:384-005	35	27
1816.2	346	12/12/2000	8	0.8	0.1	0.3	Most flows		Perched	Concrete	T10:383-013	35	27
1542.1	349	13/12/2000	16	1.3	0.2	0.3	Most flows		Perched	Concrete	S10:297-169	35	27
1542.2	350	13/12/2000	14	1	0.2	0.3	Most flows		Perched	Concrete	S10:295-174	35	27
628.2	352	13/12/2000	8	0.8	0.1	1	Most flows		Perched	Concrete	T10:306-161	5	5
1506.1	353	13/12/2000	10	2	0.1	0.5	Most flows		Perched	Concrete	T10:314-161	98	67
1136.4	354	13/12/2000	20	1	2	5.5	Most flows		Perched	Concrete	T10:325-116	35	27
1136.5	355	13/12/2000	6		0.2	0.3	Most flows		Perched	Galvanised Steel	T10:333-104	35	27
9.2	356	13/12/2000	8	1	0.3	0.5	Most flows		Perched	Concrete	T10:315-089	35	27
9.3	357	13/12/2000	8	0.7	0.2	0.3	Most flows		Perched	Concrete	T10:312-081	35	27
875.1	358	14/12/2000	12	2	2	0.5	Most flows		Perched	Galvanised Steel	S10:285-964	98	67
877.1	359	14/12/2000	8	1.8	1	0.5	Most flows		Perched	Concrete	S10:284-966	35	27
875.2	361	14/12/2000	10	1	0.1	0.2	Most flows		Perched	Concrete	S10:277-971	164	107
1537.1	362	14/12/2000	14	1.2	0	2	Most flows		Perched	Concrete	S10:277-979	98	67
1537.4	365	14/12/2000	20	1.4	1	1	Most flows		Perched	Concrete	S10:278-987	164	107
1257.7	368	14/12/2000	8	1.6	0.2	1.5	Most flows		Perched	Concrete	T11:478-691	35	27
1257.8	369	14/12/2000	4.5	0.4	1	2	Most flows		Perched	Concrete	T11:472-688	1	1
4.3	370	14/12/2000	20	1	0.5	1.5	Most flows		Perched	Concrete	T11:454-677	76	57
1522.1	371	17/12/2000	8	0.6	0.2	0.5	Most flows		Perched	Concrete	T11:580-746	164	107
196.6	372	17/12/2000	14	2	0.2	0.6	Most flows		Perched	Concrete	T11:580-749	164	107
148.2	374	17/12/2000	12	0.8	0.1	0.1	Most flows		Perched	Concrete	T11:602-807	98	67
89.4	376	17/12/2000	10	1.8	9.9	0.5	Most flows	Perched	Perched	Concrete	T11:585-804	98	67
89.5	377	17/12/2000	12	1	0.1	0.8	Most flows		Perched	Concrete	T11:587-799	98	67
250.6	379	19/12/2000	14	1.2			Most flows		Perched	Concrete	T12:410-448	297	195
1062.3	380	19/12/2000	14	1.2	0.2	0.5	Most flows		Perched	Concrete	T12:576-530	164	107
1062.4	381	19/12/2000	14	1	0	2	Most flows		Perched	Concrete	T12:564-518	345	218
1660.1	383	20/12/2000	10	1.2	0.3	0.3	Most flows		Perched	Concrete	T12:493-464	164	107
20.1	384	20/12/2000	30	3		0.1	Most flows		Perched	Concrete	T12:493-459	164	107
940.16	385	20/12/2000	4	1.5	0.1	0.4	Most flows		Perched	Concrete	T12:556-544	345	218
940.17	386	20/12/2000	6	1	0.1	0.5	Most flows		Perched	Concrete	T12:538-520	345	218
940.18	387	20/12/2000	8	0.8	0.2	0.5	Most flows		Perched	Concrete	T12:540-521	15	15
940.19	389	20/12/2000	4	8	0.2	0.3	Most flows		Perched	Concrete	T12:536-492	345	218
940.20	391	21/12/2000	10	1.65	0.3	0.5	Most flows		Perched	Concrete	T12:601-556	164	107
146.2	393	21/12/2000	12	1	0.2	0.1	Most flows		Perched	Concrete	T12:635-574	164	107
145.1	394	21/12/2000	12	3	3	1	Most flows		Perched	Galvanised Steel	T12:637-577	164	107
1176.1	400	21/12/2000	8	1.8	0	0.2	Most flows		Perched	Concrete	T11:530-726	164	107
940.22	404	21/12/2000	14	0.8	0.5	1	Most flows		Perched	Concrete	T12:610-569	3	3
1271.12	408	19/03/2001	10	0.8	0.05	0.1	Most flows		Perched	Concrete	T12:636-379	164	107
1271.7	411	19/03/2001	15	3		0.4	Most flows		Perched	Concrete	T12:609-360	5	5
1312.11	421	23/03/2001	20	0.5			Most flows	Pooled	Pooled	Concrete	T12:628-454	164	107
1505.1	427	23/03/2001	16	0.6	0.1	0.2	Most flows		Perched	Concrete	T12:645-495	164	107
1507.1	429	23/03/2001	12	2	1.2	0.6	Most flows		Perched	Concrete	T12:661-526	164	107
1101.3	432	23/03/2001	8	0.3	0	0.4	Most flows		Perched	Concrete	T12:657-533	164	107
977.2	434	23/03/2001	17	0.3	0	0.1	Most flows		Perched	Concrete	T12:637-486	98	67
977.1	435	23/03/2001	10	5.5		0.1	Most flows		Perched	Concrete	T12:633-491	98	67
977.3	436	23/03/2001	16	0.4	0	1.1	Most flows		Perched	Galvanised Steel	T12:633-491	98	67
56.5	437	30/03/2001	15	0.5	0	0.1	Most flows		Perched	Concrete	T12:601-520	345	218

LOCATED KEY	SITE ID	INSPECTION DATE	LENGTH (m)	DIAMETER (m)	UNDERCUT LENGTH (m)	PERCHED HEIGHT (m)	FISH PASSAGE RESTRICTION	INLET Cross - Section	OUTLET Cross - Section	CONSTRUCTION MATERIAL	MAP REFERENCE	REGION RANK	DISTRICT RANK
Thames Coromandel District													
56.6	438	30/03/2001	26	0.6	0.2	0.7	Most flows		Perched	Concrete	T12:598-519	345	218
1062.5	439	30/03/2001	22	0.5			Most flows		Perched	Concrete	T12:592-517	297	195
1062.6	440	30/03/2001	14	1.3		3.5	Most flows		Perched	Concrete	T12:592-515	297	195
1062.7	441	30/03/2001	30	1	0.5	0.6	Most flows		Perched	Concrete	T12:580-523	297	195
144.3	444	30/03/2001	15	1.1	0.1	0.6	Most flows		Perched	Concrete	T11:633-647	164	107
144.4	445	30/03/2001	25	0.65	0	3	Most flows		Perched	Concrete	T11:633-651	164	107
144.5	446	30/03/2001	17	0.7	0.1	0.2	Most flows		Perched	Concrete	T11:631-653	164	107
144.6	447	30/03/2001	16	0.5	0	1	Most flows		Perched	Concrete	T11:630-653	164	107
812.1	448	30/03/2001	15	1.8	1	1.5	Most flows		Perched	Concrete	T11:635-666	164	107
1818.1	449	30/03/2001	17	1.7	0	0.1	Most flows		Perched	Concrete	T11:595-694	345	218
25.4	451	30/03/2001	8	1.1	0.5	2	Most flows		Perched	Concrete	T11:614-722	345	218
1321.10	452	30/03/2001	14	0.6	0	0.2	Most flows		Perched	Concrete	T11:584-721	164	107
1321.11	453	6/04/2001	12	0.6		0.5	Most flows		Perched	Concrete	T11:538-730	164	107
224.2	454	6/04/2001	8	1.3	0.01	0.2	Most flows		Perched	Concrete	T11:518-720	3	3
224.3	455	6/04/2001	10	0.9	0.1	0.5	Most flows		Perched	Concrete	T11:521-707	164	107
224.4	456	6/04/2001	11	1	0.1	0.7	Most flows		Perched	Concrete	T11:537-688	5	5
224.5	457	6/04/2001	10	0.9	0.2	0.4	Most flows		Perched	Concrete	T11:525-692	164	107
209.3	458	6/04/2001	11	2	0.3	0.2	Most flows		Perched	Galvanised Steel	T11:462-781	164	107
209.4	459	6/04/2001	9	1	0.1	0.2	Most flows		Perched	Concrete	T11:455-778	5	5
209.6	461	6/04/2001	6	0.6	0.4	0.35	Most flows		Perched	Concrete	T11:448-775	35	27
705.1	464	6/04/2001	8	5	0.5	1.7	Most flows		Perched	Galvanised Steel	T11:468-758	164	107
704.6	465	6/04/2001	9	0.9	0.8	0.45	Most flows		Perched	Concrete	T11:462-754	5	5
1257.10	469	6/04/2001	13	0.8	0.2	0.6	Most flows		Perched	Concrete	T11:502-707	164	107
1145.6	471	28/03/2001	3.6	0.37		0.06	Most flows		Perched	PVC	T12:634-404	98	67
821.4	473	9/04/2001	24	0.6	0.6	0.5	Most flows		Perched	Concrete	T11:571-770	98	67
821.5	474	9/04/2001	20	0.7	0.2	0.5	Most flows		Perched	Concrete	T11:567-773	164	107
821.7	476	9/04/2001	15	0.5	0.2	0.3	Most flows		Perched	Concrete	T11:562-791	98	67
1520.1	477	9/04/2001	17	1.1	0.8	0.5	Most flows		Perched	Concrete	T11:559-793	98	67
91.2	478	9/04/2001	15	1.5	0.4	0.25	Most flows		Perched	Concrete	T11:553-805	98	67
89.6	480	9/04/2001	20	0.8	0.8	0.8	Most flows		Perched	Concrete	T11:582-787	164	107
943.2	481	9/04/2001	22	0.8	0.4	0.3	Most flows		Perched	Concrete	T11:619-751	164	107
1257.11	482	9/04/2001	17	1.3	0.3	0.25	Most flows		Perched	Concrete	T11:493-703	164	107
864.6	483	9/04/2001	5	0.3	0	0.02	Most flows		Perched	Concrete	T11:492-686	148	101
864.4	484	9/04/2001	6	1	0.1	1	Most flows		Perched	Concrete	T11:489-687	148	101
864.5	485	9/04/2001	16	0.8	0	0.8	Most flows		Perched	Concrete	T11:492-705	164	107
1504.1	486	9/04/2001	10	0.3	0.1	0.5	Most flows		Perched	Concrete	T11:493-736	164	107
169.5	488	6/06/2001	20	0.4			Most flows	Pooled	Pooled	Concrete	T12:514-312	76	57
1819.1	489	6/06/2001	6	0.4	0.2	0.45	Most flows		Perched	Concrete	T12:514-313	164	107
169.8	491	6/06/2001	6	0.6	0.2	0.25	Most flows		Perched	Concrete	T12:496-311	164	107
1858.1	496	6/06/2001	16	3.2	0.05	0.55	Most flows		Perched	Concrete	T12:472-313	297	195
169.7	497	6/06/2001	10	1.2	0.2	0.1	Most flows		Perched	Concrete	T12:469-313	345	218
1797.2	510	6/06/2001	4	0.6	0.3	0.3	Most flows		Perched	Concrete	T12:466-358	164	107
1797.3	511	6/06/2001	3	0.6	0.2	0.4	Most flows		Perched	Concrete	T12:471-365	164	107
1476.2	515	7/06/2001	6	1	0.2	0.15	Most flows		Perched	Concrete	T12:618-429	98	67
1476.3	516	7/06/2001	9	0.4		0.3	Most flows		Perched	Concrete	T12:629-433	164	107
1505.5	519	7/06/2001	12	1	2.5	2	Most flows		Perched	Concrete	T12:612-450	164	107
1312.19	520	7/06/2001	9	0.8	0.2	0.2	Most flows		Perched	Concrete	T12:603-445	345	218
1312.18	521	7/06/2001	9	1.2	0.2	0.4	Most flows		Perched	Galvanised Steel	T12:599-442	345	218
1312.17	522	7/06/2001	18		0	0.4	Most flows		Perched	Concrete	T12:597-439	76	57
1804.1	524	7/06/2001	7	0.5	0.1	0.2	Most flows		Perched	Concrete	T12:589-442	148	101
1804.2	525	7/06/2001	11	0.6	0.25	0.5	Most flows		Perched	Concrete	T12:589-441	148	101
1804.6	526	7/06/2001	10		0.3	0.7	Most flows		Perched	Concrete	T12:574-434	297	195
1804.5	528	7/06/2001	8	0.6	0.2	0.5	Most flows		Perched	Concrete	T12:559-408	297	195
1804.8	531	7/06/2001	10	3	0.5	0.7	Most flows		Perched	Concrete	T12:580-430	148	101

LOCATED KEY	SITE ID	INSPECTION DATE	LENGTH (m)	DIAMETER (m)	UNDERCUT LENGTH (m)	PERCHED HEIGHT (m)	FISH PASSAGE RESTRICTION	INLET Cross - Section	OUTLET Cross - Section	CONSTRUCTION MATERIAL	MAP REFERENCE	REGION RANK	DISTRICT RANK
Thames Coromandel District													
1505.6	532	7/06/2001	7	0.5	0.1	0.2	Most flows	Flat	Perched	Concrete	T12:616-450	164	107
1822.2	536	12/06/2001	20	1.5	0.2	0.5	Most flows		Perched	Concrete	T12:376-446	98	67
531.6	544	12/06/2001	4	1	0.2	0.4	Most flows		Perched	Concrete	T12:420-410	148	101
526.5	546	12/06/2001	14	1		0.35	Most flows		Perched	Concrete	T12:432-393	345	218
168.8	550	14/06/2001	13	0.6	0.1	0.3	Most flows		Perched	Concrete	T11:581-603	345	218
168.6	552	14/06/2001	12	0.8	0.1	0.5	Most flows		Perched	Concrete	T11:577-602	345	218
168.5	553	14/06/2001	7	0.5	0.02	0.17	Most flows		Perched	PVC	T11:574-601	345	218
168.4	554	14/06/2001	9	0.5	0	2	Most flows		Perched	Concrete	T11:572-600	297	195
113.9	555	14/06/2001	16	0.7	0.2	0.6	Most flows		Perched	Concrete	T12:637-562	164	107
113.8	556	14/06/2001	20	1.3	0.05	0.05	Most flows		Perched	Concrete	T12:635-559	164	107
146.5	557	14/06/2001	11	0.5	0.3	0.3	Most flows		Perched	Concrete	T12:650-570	164	107
146.3	558	14/06/2001	10	0.9	0	0.7	Most flows		Perched	Concrete	T12:648-569	164	107
146.4	559	14/06/2001	15	0.5	0.2	0.2	Most flows		Perched	PVC	T12:648-575	164	107
113.5	562	14/06/2001	12	1.3	0.1	0.5	Most flows		Perched	Concrete	T12:632-551	164	107
1101.4	565	14/06/2001	16	2	0.2	0.3	Most flows		Perched	Concrete	T12:648-542	164	107
1101.5	566	14/06/2001	16	0.7	0	0.5	Most flows		Perched	Concrete	T12:651-536	164	107
113.6	568	14/06/2001	10	0.5	0.1	0.5	Most flows		Perched	Concrete	T12:633-556	164	107
1241.11	572	19/06/2001		1.1	0.2	0.1	Most flows		Perched	Concrete	T10:400-901	164	107
1623.1	575	19/06/2001	8	2.2	0.4	0.3	Most flows		Perched	Galvanised Steel	T10:407-954	98	67
660.10	578	19/06/2001	12	1	0.3	0.6	Most flows		Perched	Concrete	T11:420-880	164	107
660.15	579	19/06/2001	12	0.5	0.2	0.1	Most flows		Perched	Concrete	T11:418-879	164	107
660.14	580	19/06/2001	10	1.1	0.1	0.12	Most flows		Perched	Concrete	T11:417-879	164	107
660.16	582	20/06/2001	15	0.9		0.6	Most flows		Perched	Concrete	T11:414-876	5	5
660.17	583	19/06/2001	5			0.7	Most flows		Perched		T11:414-872	164	107
660.13	586	19/06/2001	9	1.5	0.2	0.5	Most flows		Perched	Concrete	T11:407-862	98	67
42.11	587	19/06/2001	11	0.8	0.1	0.5	Most flows		Perched	Concrete	T11:429-864	76	57
42.14	589	19/06/2001	12	0.8			Most flows		Perched	Concrete	T11:431-862	164	107
42.5	592	19/06/2001	6	0.7	0.2	0.2	Most flows		Perched	Concrete	T11:436-851	164	107
42.17	593	20/06/2001	5	0.65			Most flows		Pooled	Concrete	T11:437-848	164	107
42.18	594	19/06/2001	12	1.3	0.2	0.3	Most flows		Perched	Concrete	T11:438-845	98	67
42.16	595	19/06/2001	8	1.2	0.3	0.5	Most flows		Perched	Concrete	T11:433-861	164	107
1105.11	602	20/06/2001	4.5		0.2	0.44	Most flows		Perched	Concrete	T11:371-840	20	17
1105.12	603	20/06/2001	13	0.3	0.5	2.5	Most flows		Perched	Concrete	T11:370-827	164	107
1105.13	604	20/06/2001	12	0.5	1	3	Most flows		Perched	Concrete	T11:369-826	164	107
1105.14	605	20/06/2001	12	0.5	0.5	1.5	Most flows		Perched	Concrete	T11:367-826	164	107
32.3	607	20/06/2001	15	1		0.5	Most flows		Perched	Concrete	T11:341-847	164	107
196.5	611	9/04/2001	11	0.9	0.1	0.3	Most flows		Perched	Concrete	T11:574-752	164	107
677.4	814	19/03/2001	13.5	1.1	0.01	0.15	Most flows		Perched	Concrete	T12:634-371	164	107
709.6	295	6/12/2000	8	1			Low flow only		Pooled	Galvanised Steel	T11:462-879	429	235
42.2	297	6/12/2000	10	1	0.5	0.5	Low flow only		Perched	Concrete	T11:427-882	297	195
42.8	298	6/12/2000	10	0.6	0.1	0.5	Low flow only		Perched	Concrete	T11:426-876	297	195
42.9	299	6/12/2000	10	0.5			Low flow only	Pooled	Pooled	Concrete	T11:428-869	429	235
42.10	301	6/12/2000	12	0.8			Low flow only	Pooled	Flat	Concrete	T11:430-862	297	195
813.1	305	6/12/2000	3.5	0.6	0.3	0.5	Low flow only		Perched	Concrete	T10:428-951	164	107
1304.17	309	6/12/2000	12	1.6	0	0.05	Low flow only		Perched	Concrete	T11:451-894	429	235
102.1	318	8/12/2000	8	0.6			Low flow only		Pooled	Concrete	S10:197-149	269	185
622.1	321	8/12/2000		0.5	0	0.05	Low flow only		Perched	Concrete	S10:203-137	269	185
1525.4	323	8/12/2000	7	0.8			Low flow only	Flat	Flat	Concrete	S10:216-131	429	235
1525.11	331	11/12/2000	9	0.8	0.4	1	Low flow only		Perched	Concrete	S10:247-110	269	185
1525.13	333	11/12/2000	6	1	0.1	0.1	Low flow only		Perched	Concrete	S10:252-107	269	185
1257.5	366	14/12/2000	8	0.75	0.2	0.1	Low flow only		Perched	Concrete	T11:483-697	20	17
181.2	373	17/12/2000	12	1	0.2	0.3	Low flow only		Perched	Concrete	T11:596-764	534	261
89.3	375	17/12/2000	14	0.3	0.1	0.3	Low flow only		Perched	Concrete	T11:578-816	429	235
250.5	378	19/12/2000	12	1.2			Low flow only	Flat	Pooled	Concrete	T12:402-442	486	260

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Thames Coromandel District													
1257.9	399	21/12/2000	4		0.2	0.5	Low flow only		Perched	Concrete	T11:486-704	20	17
129.1	401	21/12/2000	6	0.4	0.3	0.3	Low flow only		Perched	Concrete	T11:534-817	324	208
938.23	403	21/12/2000	12	1.6	0.2	0.5	Low flow only		Perched	Concrete	T11:631-606	429	235
1271.8	410	19/03/2001	9	1.1			Low flow only		Flat	Concrete	T12:620-374	429	235
1271.11	412	19/03/2001	7	0.6			Low flow only	Flat	Flat	Concrete	T12:614-369	98	67
1271.13	413	19/03/2001	21	1			Low flow only	Pooled	Flat	Concrete	T12:638-378	324	208
1817.1	418	19/03/2001	45	0.8			Low flow only	Pooled	Flat	Galvanised Steel	T12:659-458	429	235
1145.3	419	23/03/2001	12	5			Low flow only	Pooled	Flat	Concrete	T12:638-413	324	208
1024.1	420	23/03/2001	12	2.2			Low flow only	Flat	Flat	Concrete	T12:636-418	324	208
1312.4	425	23/03/2001	21	0.45			Low flow only		Pooled	Concrete	T12:626-470	76	57
1312.15	426	23/03/2001	21	0.5			Low flow only		Pooled	Concrete	T12:632-484	429	235
1505.3	431	23/03/2001	16	0.4			Low flow only		Pooled	Concrete	T12:660-532	429	235
1101.6	433	23/03/2001	13	1.5			Low flow only		Pooled	Galvanised Steel	T12:657-536	429	235
25.3	450	30/03/2001	5	0.8	0	0.01	Low flow only		Perched	Concrete	T11:595-716	534	261
704.8	468	6/04/2001	10	0.6	0	0.3	Low flow only		Perched	Concrete	T11:474-761	429	235
1504.2	487	9/04/2001	8	0.4		0.2	Low flow only		Perched	Concrete	T11:499-744	429	235
234.25	492	27/11/2000	8	1.2	0.1	0.2	Low flow only		Perched	Concrete	T12:473-557	297	195
631.3	494	19/03/2001	15	2			Low flow only		Flat	Concrete	T12:638-396	429	235
1312.16	523	7/06/2001	17			0.6	Low flow only		Perched	Concrete	T12:594-442	345	218
1804.3	530	7/06/2001	11	3	0	0.2	Low flow only		Perched	Concrete	T12:580-430	345	218
234.26	534	12/06/2001	8	0.8			Low flow only	Pooled	Pooled	Concrete	T12:382-454	20	17
1822.1	535	12/06/2001	13	2	0	0.05	Low flow only		Perched	Concrete	T12:379-448	324	208
1788.1	539	12/06/2001	10	1.2		0.2	Low flow only		Perched	Concrete	T12:394-420	429	235
526.2	545	12/06/2001	7	2.5		0.1	Low flow only		Perched	Concrete	T12:428-397	534	261
168.7	551	14/06/2001	8	0.8		0.06	Low flow only		Perched	Concrete	T11:579-604	534	261
113.7	560	14/06/2001	13	0.7			Low flow only	Pooled		Concrete	T12:634-558	429	235
113.3	563	14/06/2001	13	0.4	0	0.2	Low flow only		Perched	Concrete	T12:629-549	429	235
1624.2	573	20/06/2001	3.5			0.1	Low flow only		Perched	Concrete	T10:417-953	324	208
1624.1	576	19/06/2001	8	0.6			Low flow only		Pooled	Concrete	T10:420-951	429	235
1169.3	577	19/06/2001	10	1.3			Low flow only	Pooled		Concrete	T11:418-895	429	235
660.11	581	19/06/2001	12	0.5	0	0.45	Low flow only		Perched	Concrete	T11:415-877	98	67
660.6	585	19/06/2001	4	0.6			Low flow only		Pooled	Concrete	T11:405-854	98	67
709.7	596	20/06/2001	6	0.6			Low flow only		Pooled	Concrete	T11:467-862	269	185
709.3	597	20/06/2001	13	0.7			Low flow only	Flat	Flat	Concrete	T11:465-865	324	208
709.8	599	20/06/2001	5	0.7			Low flow only		Pooled	Concrete	T11:459-865	324	208
625.2	610	14/06/2001					Low flow only				T12:653-555	429	235

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Waikato District													
1946.4	1946.4	10/01/2005	8	0.35	0.25	0.76	Most flows	Flat	Perched	Concrete	R14:720-985	164	48
1231.40	2518	4/02/2005	14	1	0	0	Most flows	Flat	Perched	Concrete	S14:253-839	489	135
1900.2	3013	16/12/2004	24	0.65	0.75	0.28	Most flows		Perched	Concrete	S14:915-927	345	102
1906.1	3020	16/12/2004	28	1		1	Most flows	Flat	Perched	Concrete	R14:839-904	98	27
1906.6	3035	17/12/2004	15	0.7	0.3	2	Most flows	Pooled	Perched	Concrete	R14:834-958	345	102
1906.7	3036	17/12/2004	18	1.1	0.18	0.35	Most flows	Pooled	Perched	Concrete	R14:833-959	345	102
1923.7	3043	20/12/2004	14	1	0.7	0.15	Most flows	Perched	Perched	Concrete	R14:806-923	345	102
1923.6	3044	20/12/2004	14	0.7	0.6	0.1	Most flows	Flat	Perched	Concrete	R14:789-920	345	102
1923.5	3045	20/12/2004	14	0.7	0.55	0.15	Most flows	Flat	Perched	Concrete	R14:776-917	345	102
1923.3	3047	20/12/2004	25	0.7	0.45	0.12	Most flows	Pooled	Perched	Concrete	R14:767-914	345	102
1921.3	3052	22/12/2004	15	0.36	0.33	0.58	Most flows	Flat	Perched	Concrete	R13:816-003	489	135
1911.1	3055	22/12/2004	27	1	0.1	0.2	Most flows	Flat	Perched	Concrete	R14:813-967	345	102
1911.2	3056	22/12/2004	13	0.8	0	0.18	Most flows	Flat	Perched	Concrete	R14:810-969	345	102
1910.3	3063	10/01/2005	12	0.45	0.1	0.12	Most flows	Flat	Perched	Concrete	R14:799-868	76	16
1927.1	3072	10/01/2005	12	1	0.17	0.24	Most flows	Flat	Perched	Concrete	R14:689-986	164	48
1948.5	3085	11/01/2005	11	0.4	0.15	0.28	Most flows	Flat	Perched	Concrete	R14:778-978	345	102
1948.6	3086	11/01/2005					Most flows		Perched		R14:783-980	269	72
1916.6	3102	13/01/2005	12	0.5	0.2	0.15	Most flows	Pooled	Perched	Concrete	S13:928-053	489	135
325.10	3113	13/01/2005	28	1.3	0.3	0.1	Most flows	Flat	Perched	Concrete	S14:951-996	489	135
325.11	3115	13/01/2005	25	1.8	0	0.2	Most flows	Flat	Perched	Concrete	S14:962-997	489	135
325.8	3117	14/01/2005	28	1.5			Most flows	Flat	Pooled	Concrete	S13:987-013	489	135
1909.1	3123	17/01/2005	16	0.4	0.25	0.08	Most flows	Flat	Perched	Concrete	R15:752-679	345	102
1950.1	3125	17/01/2005	12	0.45	0.02	0.21	Most flows	Flat	Perched	Concrete	R15:696-634	164	48
1952.1	3128	17/01/2005	8	0.7	0.3	0.18	Most flows	Flat	Perched	Concrete	R15:717-645	76	16
1939.2	3130	17/01/2005	22	0.9	0.18	0.22	Most flows	Flat	Perched	Concrete	R15:748-658	164	48
1939.3	3131	17/01/2005	14	2	0.28	0.21	Most flows	Flat	Perched	Concrete	R15:749-658	164	48
1939.4	3136	18/01/2005	16	1.3	1	0.95	Most flows	Flat	Perched	Concrete	R15:745-662	164	48
1936.2	3138	18/01/2005		0.45	0.03	0.08	Most flows	Flat	Perched	Concrete	R15:785-613	76	16
1936.3	3139	18/01/2004	13	0.7	0.05	0.11	Most flows	Flat	Perched	Concrete	R15:780-605	20	3
1936.4	3140	19/01/2005	12	1.4	0.04	0.12	Most flows	Flat	Perched	Concrete	R15:792-621	98	27
1917.1	3142	19/01/2005	6	1.5	0.38	0.45	Most flows	Flat	Perched	Concrete	R15:810-597	164	48
1902.2	3145	19/01/2005	12	1.5			Most flows			Concrete	R15:750-594	98	27
1925.1	3149	19/01/2005	17	1	0.1	0.37	Most flows	Flat	Perched	Concrete	R15:721-627	164	48
1929.1	3151	20/01/2005	8	1.4			Most flows	Perched	Perched	Concrete	R14:796-714	164	48
1929.2	3152	20/01/2005	8	1	0.08	0.12	Most flows	Flat	Perched	Concrete	R14:794-724	164	48
1930.1	3155	20/01/2005	14	1			Most flows	Flat	Perched	Concrete	R14:885-728	148	43
1866.1	3173	23/09/2003	18	0.6	0.1	0.15	Most flows	Flat	Perched	Concrete	T14:300-809	489	135
413.13	613	29/03/2001	11	0.5	0.1	0.2	Most flows		Perched	Concrete	R14:896-744	76	16
413.14	614	29/03/2001	11	0.3	0	0.3	Most flows		Perched	Concrete	R14:896-746	76	16
413.8	615	29/03/2001	8	0.5	0.1	0.5	Most flows		Perched	Concrete	R14:895-750	76	16
413.10	617	29/03/2001	10	0.8	0.1	0.5	Most flows		Perched	Concrete	R14:895-757	76	16
413.16	620	29/03/2001	12	1.2	0.15	0.25	Most flows		Perched	Concrete	S14:901-731	345	102
238.2	623	29/03/2001	16	1.5	0.2	0.8	Most flows		Perched	Concrete	R15:758-688	345	102
238.4	624	29/03/2001	16	1	0.01	0.05	Most flows		Perched	Concrete	R15:762-690	345	102
238.3	625	29/03/2001	16	0.3	0.3	0.2	Most flows		Perched	Concrete	R15:763-692	345	102
632.4	626	29/03/2001	20	0.6	0	0.45	Most flows		Perched	Concrete	R14:788-723	164	48
1518.2	628	29/03/2001	6	0.5	0.3	0.5	Most flows		Perched	Concrete	R14:826-754	164	48
1746.1	630	5/04/2001	25	1	0.5	1.5	Most flows		Perched	Concrete	S14:911-725	345	102
1746.2	631	5/04/2001	21	0.5	0.2	1	Most flows		Perched	Concrete	S14:910-725	345	102
1746.3	632	5/04/2001	4	0.3	0.2	0.5	Most flows		Perched	Concrete	S14:910-725	345	102

LOCATED KEY	SITE ID	INSPECTION DATE	LENGTH (m)	DIAMETER (m)	UNDERCUT LENGTH (m)	PERCHED HEIGHT (m)	FISH PASSAGE RESTRICTION	INLET Cross - Section	OUTLET Cross - Section	CONSTRUCTION MATERIAL	MAP REFERENCE	REGION RANK	DISTRICT RANK
Waikato District													
413.17	633	5/04/2001	22	0.5	0.2	1.5	Most flows		Perched	Concrete	S14:902-726	345	102
413.6	634	5/04/2001	16	0.3	0.1	0.5	Most flows		Perched	Concrete	S14:900-726	76	16
1718.6	635	5/04/2001	20	1	0.15	0.3	Most flows		Perched	Concrete	R14:899-726	76	16
1718.4	636	5/04/2001	4	0.5	0.4	0.5	Most flows		Perched	Concrete	R14:899-725	345	102
1247.19	642	5/04/2001	24	1.6	0.2	0.3	Most flows		Perched	Concrete	R14:864-721	98	27
1247.14	645	5/04/2001	13	1.5	0.5	0.25	Most flows		Perched	Concrete	R14:853-726	98	27
1172.1	648	24/04/2001	20	2.5	0.2	0.1	Most flows		Perched	Galvanised Steel	R14:708-736	35	5
1255.1	649	24/04/2001	16	0.6	0.6	3	Most flows		Perched	Concrete	R14:702-735	35	5
1844.1	650	24/04/2001	25	1	0.1	2	Most flows		Perched	Concrete	R14:693-739	35	5
737.1	651	24/04/2001	10	1	0.2	0.8	Most flows		Perched	Concrete	R14:878-729	345	102
1516.1	653	24/01/2001	7		1	1.5	Most flows		Perched	Concrete	R14:673-725	98	27
1515.1	654	24/04/2001	15	0.7	0.1	0.5	Most flows		Perched	Concrete	R14:665-716	98	27
1843.1	655	24/04/2001	14	0.7	0.3	2.5	Most flows		Perched	Concrete	R14:656-700	35	5
1513.2	656	24/04/2001	15	0.7	0.2	1.5	Most flows		Perched	Concrete	R15:655-696	35	5
1839.1	658	24/01/2001	10	1	0.9	1	Most flows		Perched	Concrete	R15:658-685	98	27
1839.2	659	24/04/2001	10	1	0.5	0.7	Most flows		Perched	Concrete	R15:658-681	35	5
1511.1	660	24/04/2001	9	1	0.4	0.6	Most flows		Perched	Concrete	R15:657-671	98	27
1508.3	663	24/04/2001	15	1	0.4	0.4	Most flows		Perched	Concrete	R15:670-658	98	27
1511.2	666	24/04/2001	12	2	0	0.15	Most flows		Perched	Concrete	R15:711-684	164	48
1446.5	669	24/04/2001	9	1.2	0.05	0.1	Most flows		Perched	Concrete	R15:715-693	98	27
1446.6	670	24/04/2001	10	1	0.15	0.15	Most flows		Perched	Concrete	R15:715-698	98	27
1685.1	673	26/04/2001	9	0.7	0.15	0.15	Most flows		Perched	Concrete	R14:738-723	164	48
1446.2	676	26/04/2001	10	1.2	0.05	0.2	Most flows		Perched	Concrete	R14:715-703	35	5
1446.3	677	26/04/2001	4	0.5	0.1	0.6	Most flows		Perched	Concrete	R14:715-703	35	5
1005.2	681	26/04/2001	16	0.5	0.7	0.1	Most flows		Perched	Concrete	R15:734-694	164	48
989.2	683	26/04/2001	12	2.3	0.2	0.2	Most flows		Perched	Concrete	R15:736-690	98	27
989.3	684	26/04/2001	15	0.6	0.1	0.25	Most flows		Perched	Concrete	R15:737-689	164	48
989.4	685	26/04/2001	16	0.3	0.1	0.2	Most flows		Perched	Concrete	R15:740-688	164	48
616.3	694	26/04/2001	12	2.1	0.1	0.05	Most flows		Perched	Galvanised Steel	R14:841-793	98	27
1247.32	705	4/05/2001	10	0.6	0.2	0.3	Most flows		Perched	Concrete	R15:886-685	15	1
1247.31	711	4/05/2001	23	0.7	0.2	0.35	Most flows		Perched	Concrete	S14:900-707	297	83
1746.5	715	4/05/2001	4	0.4	0.1	0.35	Most flows		Perched	Concrete	S14:908-705	148	43
1746.9	719	7/05/2001	12	2.3	0.6	0.3	Most flows		Perched	Concrete	S14:915-705	345	102
1746.10	720	7/05/2001	15	0.4	0.1	0.5	Most flows		Perched	Concrete	S14:916-706	297	83
1746.11	721	7/05/2001	10	0.65	0.04	0.1	Most flows		Perched	Concrete	S14:920-707	297	83
1746.13	723	7/05/2001	10	0.5	0.3	0.3	Most flows		Perched	Concrete	S14:919-708	297	83
1247.27	731	10/05/2001	20	0.4	0.2	0.5	Most flows		Perched	Concrete	R14:887-945	269	72
1247.28	732	10/05/2001	19	0.3		0.5	Most flows		Perched	Steel	R14:887-945	269	72
1247.30	733	10/05/2001	13	1.2	0.4	1	Most flows		Perched	Concrete	R14:889-938	269	72
1451.1	734	10/05/2001	19	5		0.6	Most flows		Perched	Galvanised Steel	R14:890-935	269	72
1707.2	738	10/05/2001	12	1.6	0.5	1.5	Most flows		Perched	Concrete	R14:876-911	164	48
1167.11	739	10/05/2001	14	0.5	0.2	2.5	Most flows		Perched	Concrete	R14:876-910	297	83
1451.7	742	11/05/2001	22	0.6	0.3	0.3	Most flows		Perched	Concrete	S14:906-938	345	102
1451.6	743	11/05/2001	17				Most flows		Flat	Concrete	S14:902-934	269	72
1451.5	744	11/05/2001	18	0.7	0.1	0.9	Most flows		Perched	Concrete	S14:901-934	269	72
1451.4	745	11/05/2001	21	0.4	0.1	0.4	Most flows		Perched	Concrete	S14:900-934	269	72
1247.22	750	11/05/2001	20	0.6	0.2	0.4	Most flows		Perched	Concrete	R14:869-899	35	5
1247.21	751	11/05/2001	17	0.6	0.2	0.6	Most flows		Perched	Concrete	R14:869-896	345	102
1696.1	752	11/05/2001	25	1.6	0.1	0.15	Most flows		Perched	Concrete	R14:868-892	35	5
1247.17	756	11/05/2001	26			1	Most flows		Perched	Concrete	R14:857-870	35	5

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Waikato District													
1167.13	761	11/05/2001	20	0.3	0.1	0.2	Most flows		Perched	Concrete	R14:852-854	15	1
1634.4	769	14/05/2001	14	1.3	0.4	0.2	Most flows		Perched	Concrete	R14:739-790	164	48
1634.5	770	14/05/2001	13	0.4	0.13	0.2	Most flows		Perched	Concrete	R14:738-793	164	48
1634.6	771	14/05/2001	11	2	0.4	0.1	Most flows		Perched	Concrete	R14:736-794	164	48
1642.2	773	14/05/2001	6	0.3	0.05	0.11	Most flows		Perched	Concrete	R14:769-805	164	48
1641.3	777	14/05/2001	10	0.3	0.01	0.4	Most flows		Perched	Concrete	R14:806-838	164	48
246.8	785	14/05/2001	15	0.4	0.1	0.2	Most flows		Perched	Concrete	R14:821-846	164	48
202.10	796	17/05/2001	13	0.4	0.08	0.2	Most flows		Perched	Concrete	R14:835-956	345	102
202.13	802	17/05/2001	20	0.3	0.6	0.45	Most flows		Perched	Concrete	R14:837-916	98	27
202.4	803	17/05/2001	16	0.6	0.68	0.5	Most flows		Perched	Concrete	R14:838-912	98	27
1056.5	836	24/04/2001	12	1.5	0.2	0.2	Most flows		Perched	Concrete	R15:703-669	297	83
1056.6	837	24/04/2001	20	1.5	0.1	0.5	Most flows		Perched	Concrete	R15:706-671	297	83
1936.1	1936.1	18/01/2005	8	0.8	0	0.02	Low flow only	Flat	Pooled	Concrete	R15:788-616	324	92
1231.21	2498	26/01/2005	16	1	0	0	Low flow only	Flat	Flat	Galvanised Steel	S14:277-743	566	151
1231.25	2502	26/01/2005	14	2	0	0	Low flow only	Flat	Flat	Galvanised Steel	T14:316-784	575	152
1231.30	2508	4/02/2005	16	1	0	0	Low flow only	Flat	Flat	Concrete	S14:261-782	575	152
1231.31	2509	4/02/2005	12	1	0	0	Low flow only	Flat	Flat	Concrete	S14:269-776	575	152
1231.34	2512	4/02/2005	14	1	0	0	Low flow only	Flat	Flat	Concrete	S14:279-804	575	152
1231.36	2514	4/02/2005	18	1	0	0	Low flow only	Flat	Flat	Concrete	S14:259-808	563	150
1231.37	2515	4/02/2005	16	1	0	0	Low flow only	Flat	Flat	Concrete	S14:249-813	575	152
1906.2	3028	17/12/2004	24	1			Low flow only	Pooled	Pooled	Concrete	R14:838-909	324	92
1906.5	3034	17/12/2004	14	0.4	0	0.05	Low flow only	Pooled	Perched	Concrete	R14:837-955	534	142
1921.4	3053	22/12/2004	14	1.5	0	0.25	Low flow only	Flat	Perched	Concrete	R13:818-029	575	152
1948.2	3070	10/01/2005	16	1.5			Low flow only	Flat	Pooled	Concrete	R14:712-940	324	92
1943.2	3079	11/01/2005	8	0.9			Low flow only	Flat	Flat	Concrete	R14:743-841	429	128
1916.5	3101	12/01/2005	8	0.5			Low flow only	Flat	Flat	Concrete	S13:922-042	575	152
1234.4	3109	13/01/2005	13	1.1	0	0.05	Low flow only	Flat	Perched	Concrete	R14:898-974	575	152
205.3	3134	17/01/2005	14	1.8			Low flow only	Flat	Flat	Concrete	R15:773-644	324	92
1917.2	3143	19/01/2005	10	2			Low flow only	Flat	Flat	Galvanised Steel	R15:799-592	20	3
1901.1	3148	19/01/2005	12	1	0.1	0.04	Low flow only	Perched	Perched	Concrete	R15:729-618	324	92
1926.1	3153	20/01/2005	12	2			Low flow only	Flat	Flat	Concrete	R14:811-723	429	128
413.4	612	29/03/2001	12	0.3			Low flow only		Pooled	Concrete	S14:901-734	297	83
413.15	621	29/03/2001	12	2			Low flow only	Flat	Flat	Galvanised Steel	S14:900-728	534	142
1518.1	627	29/03/2001	7.5	1.1			Low flow only		Pooled	Concrete	R14:822-754	429	128
1247.26	640	5/04/2001	21	0.8		0.05	Low flow only		Perched	Concrete	R14:878-720	76	16
1399.2	643	5/04/2001	13	1.8			Low flow only	Pooled	Flat	Concrete	R14:774-741	324	92
1513.1	657	24/04/2001	10	0.7			Low flow only			Concrete	R15:659-689	269	72
1508.2	664	24/04/2001	8	1	0.1	0.3	Low flow only		Perched	Concrete	R15:670-651	324	92
1446.4	667	24/04/2001	12	0.6	0.05	0.15	Low flow only		Perched	Concrete	R15:714-691	324	92
857.4	671	26/04/2001	17	0.6	0.1	0.1	Low flow only		Perched	Concrete	R14:738-748	429	128
1446.10	680	26/04/2001	15	0.5	0	0.2	Low flow only		Perched	Concrete	R15:728-692	429	128
1247.7	699	4/05/2001	12.5	0.45			Low flow only	Pooled	Pooled	Concrete	R15:886-663	148	43
1735.1	700	4/05/2001	12	0.3			Low flow only		Pooled	Concrete	R15:883-664	534	142
1247.10	703	4/05/2001	10	1	0	2	Low flow only		Perched	Concrete	R15:886-672	148	43
1247.11	704	4/05/2001	10	0.7			Low flow only		Pooled	Concrete	R15:887-681	148	43
1247.12	709	4/05/2001	9	0.3			Low flow only		Pooled	Concrete	R15:890-691	269	72
257.1	713	4/05/2001	15	2			Low flow only	Flat	Flat	Galvanised Steel	R14:887-711	534	142
1746.6	716	4/05/2001	18	1			Low flow only	Pooled	Flat	Concrete	S14:908-705	345	102
1746.12	722	7/05/2001	9	2.5			Low flow only		Pooled	Galvanised Steel	S14:925-710	534	142
1718.1	727	7/05/2001	24	1			Low flow only		Pooled	Concrete	R14:883-733	534	142

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Waikato District													
1707.3	737	10/05/2001	4	1	0.1	0.01	Low flow only		Perched	Concrete	R14:876-911	429	128
1451.2	746	11/05/2001	20	0.7			Low flow only	Flat	Flat	Concrete	R14:895-935	534	142
1247.20	753	11/05/2001	20	0.7	0.1	0.06	Low flow only		Perched	Concrete	R14:867-887	269	72
1826.2	754	11/05/2001	28	1.4			Low flow only	Flat	Flat	Galvanised Steel	R14:866-882	534	142
1690.1	760	11/05/2001	19	0.6	0.01	0.05	Low flow only		Perched	Concrete	R14:851-851	76	16
1634.1	766	14/05/2001	7	0.4	0.005	0.01	Low flow only		Perched	Concrete	R14:744-788	324	92
1447.2	774	14/05/2001	14	3			Low flow only		Pooled	Concrete	R14:777-832	429	128
246.3	780	14/05/2001	10	0.5		0.05	Low flow only		Perched	Concrete	R14:798-869	297	83
202.3	789	14/05/2001	13	1	0.002	0.1	Low flow only		Perched	Concrete	R14:849-884	324	92

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Matamata-Piako District													
750.27	109	5/12/2001	18	1.8	0.1	0.2	Most flows	Flat	Perched	Concrete	T13:313-149	345	3
750.29	112	1/01/2001	20	1.8	0.2	0.8	Most flows		Perched	Concrete	T13:304-143	345	3
1831.1	115	5/12/2001	22	1	0.15	0.5	Most flows	Flat	Perched	Concrete	T13:309-099	345	3
1249.66	117	6/12/2001	18	2	0.05	0.5	Most flows	Flat	Perched	Concrete	T13:355-077	345	3
750.35	121	6/12/2001	12	2.5	0.05	0.4	Most flows	Perched	Perched	Concrete	T13:317-004	489	20
1832.1	123	6/12/2001	8	5	0	0.4	Most flows	Flat	Perched	Concrete	T13:314-033	471	16
1831.2	124	6/12/2001	17.5	1	0.05	0.1	Most flows	Perched	Perched	Concrete	T13:309-094	345	3
750.37	125	6/12/2001	20	0.6	0.05	0.15	Most flows	Flat	Pooled	Concrete	T13:308-073	345	3
750.38	126	6/12/2001	15	1.2		0.5	Most flows	Perched	Perched	Concrete	T13:309-071	345	3
750.39	127	10/12/2001	13	1.8	0.05	1	Most flows	Flat	Perched	Concrete	T13:310-062	489	20
750.41	129	10/12/2001	20	0.5	0.4	0.4	Most flows	Flat	Perched	Concrete	T14:302-989	489	20
750.42	130	10/12/2001	20	2	0	0.3	Most flows	Perched	Perched	Concrete	T14:329-978	429	14
1249.71	149	11/12/2001	20	2	0.3	0.4	Most flows	Flat	Perched	Steel	T14:479-811	489	20
1249.72	150	11/12/2001	10	0.2	0	0.3	Most flows	Flat	Perched	Concrete	T14:483-833	489	20
1249.74	152	11/12/2001	20	0.7	0.15	0.1	Most flows	Flat	Perched	Concrete	T14:477-853	489	20
754.16	175	13/12/2001	11.5	1	0.5	0.5	Most flows	Flat	Perched	Concrete	T14:426-722	345	3
754.19	179	13/12/2001	15	0.8	0.1	0.3	Most flows	Flat	Perched	Concrete	T14:418-725	269	1
754.12	180	13/12/2001	11	0.6	0.05	0.15	Most flows	Flat	Perched	Concrete	T14:426-768	324	2
752.4	186	13/12/2001	12	0.9	0.05	0.2	Most flows	Flat	Perched	Concrete	T14:455-769	489	20
754.3	187	13/12/2001	25	1.3	0.1	0.5	Most flows	Flat	Perched	Steel	T14:438-761	489	20
754.4	188	13/12/2001	20	0.8	0	0.3	Most flows		Perched	Concrete	T14:469-761	489	20
754.5	189	14/12/2001	19	0.8	1	0.4	Most flows	Flat	Perched	Concrete	T14:414-792	489	20
754.9	193	14/12/2001	30	0.6	1.5	2.5	Most flows	Flat	Perched	Steel	T14:421-735	345	3
754.10	194	14/12/2001	30	1	3.04	0.4	Most flows	Flat	Pooled	Concrete	T14:420-774	489	20
754.13	195	14/12/2001		1	0.8	1	Most flows	Flat	Perched	Concrete	T14:423-754	471	16
1111.11	200	17/12/2001	18	0.75	0	0.4	Most flows	Flat	Perched	Concrete	T14:422-883	489	20
750.15	214	17/12/2001	27	0.8	0.1	2	Most flows	Flat	Perched	Concrete	T14:414-884	489	20
750.16	215	17/12/2001	14	0.45	0.1	0.5	Most flows	Flat	Perched	Concrete	T14:426-881	489	20
750.23	222	20/12/2001	13	1	0.2	0.4	Most flows	Flat	Perched	Concrete	T14:403-848	489	20
750.24	223	20/12/2001	12	0.65	0	0.7	Most flows	Flat	Perched	Concrete	T14:387-842	489	20
1043.3	224	20/12/2001	20	0.8	0	0.5	Most flows	Flat	Perched	Concrete	T14:374-828	489	20
376.2	3162	30/09/2003	15	0.6			Most flows	Pooled	Perched	Concrete	T14:301-000	489	20
1866.2	3166	23/09/2003	21	0.5	1.3	2	Most flows	Flat	Perched	Concrete	T14:304-819	489	20
1866.5	3171	29/03/2003	19	1	0.1	1.5	Most flows		Perched	Galvanised Steel	T14:311-829	489	20
1409.10	43	29/11/2001	18	0.6	0.15	0.6	Most flows	Flat	Perched	Concrete	T14:587-881	489	20
1409.11	44	29/11/2001	18	0.4	0.05	0.2	Most flows	Flat	Perched	Concrete	T14:587-881	489	20
1409.15	47	29/11/2001	17	1.2	0	0.4	Most flows	Perched	Perched	Concrete	T14:579-903	489	20
1409.16	48	29/11/2001	20	1	1	1	Most flows	Flat	Perched	Steel	T14:576-905	489	20
1828.2	55	30/11/2001		3	0	0.5	Most flows	Flat	Perched	Concrete	T13:500-010	429	14
1829.1	59	30/11/2001	15	6	0.05	0.4	Most flows	Flat	Perched	Steel	T13:510-014	345	3
1215.5	71	3/12/2001	15	1	0.15	0.8	Most flows	Flat	Perched	Concrete	T14:571-960	489	20
1252.4	80	4/12/2001	10	0.8	0	0.45	Most flows	Flat	Perched	Concrete	T13:466-121	489	20
1409.36	81	4/12/2001	7	2	0.1	0.65	Most flows	Flat	Perched	Concrete	T13:469-119	489	20
1231.19	825	26/09/2003	15	1.5	0	0.5	Most flows		Perched	Concrete	T14:315-893	489	20
1231.20	826	26/09/2003	25	1			Most flows	Flat	Flat	Concrete	T14:322-895	489	20
1830.3	83	4/12/2001	14		0.1	0.5	Most flows	Flat	Perched	Concrete	T13:477-103	489	20
750.49	850	1/10/2003	18				Most flows	Pooled	Perched	Concrete	S13:296-018	471	16
1832.2	851	1/10/2003	16	1			Most flows	Pooled	Perched	Concrete	S13:293-025	345	3
1832.3	852	1/10/2003	4	5	0.2	0.5	Most flows	Flat	Pooled	Concrete	S13:291-030	471	16
1111.10	133	10/12/2001	14	0.9	0	0.1	Low flow only	Flat	Perched	Concrete	T14:381-954	575	52

LOCATED KEY	SITE ID	INSPECTION DATE	LENGTH (m)	DIAMETER (m)	UNDERCUT LENGTH (m)	PERCHED HEIGHT (m)	FISH PASSAGE RESTRICTION	INLET Cross - Section	OUTLET Cross - Section	CONSTRUCTION MATERIAL	MAP REFERENCE	REGION RANK	DISTRICT RANK
Matamata-Piako District													
433.9	148	11/12/2001	14	1.2	0	0.1	Low flow only	Perched	Perched	Concrete	T14:492-801	575	52
751.9	172	13/12/2001	17	2		0.4	Low flow only	Flat	Perched	Concrete	T14:452-739	566	51
750.44	176	13/12/2001		1		0.02	Low flow only	Flat	Perched	Concrete	T14:425-721	534	50
750.14	213	17/12/2001	15	0.75	0.05	0.05	Low flow only	Perched	Perched	Concrete	T14:389-884	575	52
750.20	219	17/12/2001	60	1.6		0.4	Low flow only	Perched	Perched	Concrete	T14:369-862	575	52
1232.10	234	8/01/2002	12	2.2		0.5	Low flow only	Pooled	Perched	Concrete	S14:298-867	575	52
1232.11	235	8/01/2002	10	1.3			Low flow only	Pooled	Flat	Steel	S14:299-864	575	52
403.2	50	29/11/2001	28	0.5	0.2	0.1	Low flow only	Flat	Perched	Concrete	T14:561-937	575	52
1409.22	57	30/11/2001	13	0.8	0.1	0.1	Low flow only	Flat	Perched	Concrete	T14:512-991	575	52
1409.25	64	3/12/2001	20	1	0.1	0.2	Low flow only	Flat	Perched	Concrete	T14:540-988	575	52
750.46	829	26/09/2003	12	1.5			Low flow only	Flat	Pooled	Concrete	T14:361-897	575	52
1865.1	830	26/09/2003		1			Low flow only	Pooled	Pooled	Concrete	T14:380-898	575	52
1088.2	146	11/12/2001	8.5	1.2			High flow only	Flat	Pooled	Concrete	T14:494-782	609	63
1249.70	147	11/12/2001	19	0.5			High flow only	Flat	Flat	Concrete	T14:510-790	614	65
750.17	216	17/12/2001		0.8			High flow only	Flat	Flat	Concrete	T14:391-854	614	65
1232.8	232	8/01/2002	25	0.6			High flow only	Flat	Pooled	Concrete	S14:279-870	614	65
1409.26	65	3/12/2001	20				High flow only	Pooled	Pooled		T14:542-986	610	64
750.45	828	26/09/2003	14	0.6			High flow only	Pooled	Pooled	Concrete	T14:360-894	614	65

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Otorohanga District Council													
658.7	1169	8/12/2004	12	1			Low flow only	Flat	Flat	Concrete	R15:802-496	20	1
21.2	1170	8/12/2004	8	1			Low flow only	Flat	Flat	Concrete	R15:723-515	429	3
994.3	1171	9/12/2004	8	0.5	0.2	0.05	Low flow only	Flat	Perched	Concrete	R15:801-435	76	2
641.2		8/12/2004	10	1	0.2	1	High flow only	Flat	Perched	Concrete	R15:891-495	597	6
658.4		8/12/2004	10	1	0.2	0.3	High flow only	Flat	Perched	Concrete	R15:837-514	597	6
658.5		8/12/2004	12	0.5	0.1	2	High flow only	Flat	Perched	Concrete	R15:851-529	597	6
658.6		8/12/2004	10	0.5	0.1	0.2	High flow only	Flat	Perched	Galvanised Steel	R15:797-487	563	5
36.3		8/12/2004	12	0.5	0.1	0.1	High flow only	Flat	Perched	HDPE Plastic	R16:796-342	471	4

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Franklin District Council													
457.2	1034	29/10/2003	12	0.3			Low flow only	Pooled	Pooled	Concrete	R13:782-055	563	76
1131.224	1113	30/11/2004	13	1			Low flow only	Flat	Flat	Concrete	R12:736-301	534	65
1131.226	1115	30/11/2004	12	2			Low flow only	Flat	Flat	Concrete	R13:712-293	534	65
1131.229	1119	30/11/2004	13	0.5			Low flow only	Flat	Flat	Concrete	R13:672-265	429	40
453.14	867	3/10/2003	16	0.7			Low flow only	Perched	Pooled	Concrete	S12:066-458	575	83
460.29	889	7/10/2003	20	2			Low flow only	Flat	Pooled	Concrete	R12:879-370	575	83
460.16	905	13/10/2003	9.5	1.5			Low flow only	Pooled	Pooled	Concrete	S12:926-420	566	77
796.5	912	13/10/2003	18	1			Low flow only	Flat	Flat	Concrete	S12:980-451	575	83
1283.13	933	15/10/2003	22	0.5			Low flow only	Pooled	Pooled	Concrete	R12:851-399	534	65
1086.41	944	16/10/2003	20	1			Low flow only	Pooled	Flat	Concrete	R12:806-406	534	65
1086.43	947	16/10/2003	11	2			Low flow only	Pooled	Pooled	Concrete	R12:818-418	534	65
1086.50	954	16/10/2003	12	0.5			Low flow only	Flat	Pooled	Concrete	R12:821-391	534	65
11.9	969	17/10/2003	10	1.5			Low flow only	Pooled	Pooled	Concrete	R12:708-360	534	65
11.10	975	20/10/2003	14	0.6			Low flow only	Flat	Pooled	Concrete	R12:673-357	534	65
11.12	977	20/10/2003		0.5		0.05	Low flow only	Pooled	Perched	Concrete	R12:675-336	534	65
41.20	982	20/10/2003	11	1.2			Low flow only	Pooled	Pooled	Concrete	R12:643-361	534	65
44.14	994	21/10/2003	15	0.2			Low flow only	Pooled	Flat	Concrete	R12:599-313	534	65
44.21	1002	22/10/2003	18	0.4	0.3	0.1	Most flows	Pooled	Perched	Concrete	R12:620-355	345	15
1132.47	1008	22/10/2003	10				Most flows	Pooled	Pooled		S12:915-331	345	15
441.7	1009	24/10/2003	14	3	0.05	0.15	Most flows	Flat	Perched	Galvanised Steel	R13:827-064	297	11
1132.49	1012	23/10/2003	18	0.5		0.15	Most flows	Pooled	Perched	Concrete	S13:914-299	269	6
1132.54	1017	23/10/2003	16	1	1	1	Most flows	Pooled	Perched	Concrete	R13:870-277	489	57
1132.55	1019	23/10/2003		1			Most flows	Pooled	Pooled	Concrete	R13:880-255	489	57
1132.56	1020	23/10/2003	15	4		0.2	Most flows	Pooled	Perched	Concrete	R13:890-235	429	40
276.2	1021	23/10/2003	20	2	0.5	0.2	Most flows	Pooled	Perched	Galvanised Steel	R13:895-234	429	40
666.5	1022	23/10/2003	19	0.4	0.3	0.2	Most flows	Pooled	Perched	Concrete	R13:861-229	489	57
353.2	1028	24/10/2003	22	1	1	1	Most flows	Pooled	Perched	Concrete	R13:786-109	489	57
353.4	1030	24/10/2003	15	0.5		1	Most flows	Pooled	Perched	Concrete	R13:789-109	429	40
353.5	1033	29/10/2003	12	3			Most flows	Pooled	Perched	Galvanised Steel	R13:787-058	471	46
572.3	1037	29/10/2003	12	0.3	0.3	0.5	Most flows	Pooled	Perched	Concrete	R13:787-061	429	40
1404.3	1041	29/10/2003	16	0.4	0.3	0.15	Most flows	Flat	Perched	Concrete	R13:722-048	345	15
665.9	1134	6/12/2004	20	1			Most flows	Flat	Flat	Concrete	R13:791-235	297	11
612.14	1150	6/12/2004	10	2.5			Most flows	Flat	Flat	Galvanised Steel	R13:821-280	345	15
1283.17	1283.2	16/10/2003					Most flows		Perched		R12:797-373	345	15
894.5	864	2/10/2003	12	1.6	0.2	0.05	Most flows	Pooled	Perched	Concrete	S12:086-437	489	57
453.13	866	3/10/2003	14	0.6	0.5	0.3	Most flows	Pooled	Perched	Concrete	S12:062-453	489	57
453.16	869	3/10/2003	16	1.5	0.2	0.1	Most flows	Pooled	Perched	Concrete	S12:074-468	489	57
453.17	870	6/10/2003	24	0.6			Most flows	Pooled	Perched	Concrete	S12:083-475	471	46
453.18	871	6/10/2003	12	1	1	0.15	Most flows	Pooled	Perched	Concrete	S12:089-482	471	46
453.19	872	6/10/2003	14	1.2	0.3	0.2	Most flows	Flat	Perched	Concrete	S12:092-485	471	46
161.2	874	6/10/2003	6	0.6	0.2	0.2	Most flows	Flat	Perched	Concrete	S12:115-509	20	1
161.3	875	6/10/2003	5	0.5			Most flows	Pooled	Pooled	Concrete	S12:121-514	20	1
552.3	880	6/10/2003	13	0.6			Most flows	Flat	Pooled	Concrete	S12:138-447	164	3
128.8	882	6/10/2003	17	2	0.5	0.7	Most flows	Flat	Perched	Concrete	S12:125-452	164	3
128.9	883	7/10/2003	11	1	0.3	0.05	Most flows	Pooled	Perched	Concrete	S12:116-448	164	3
1132.29	887	7/10/2003	31	1	0	0.2	Most flows	Pooled	Perched	Concrete	R12:828-345	345	15
460.7	890	8/10/2003	20	1.5	0.4	0.2	Most flows	Pooled	Perched	Concrete	S12:924-341	345	15
264.2	893	8/10/2003	10	0.5	0.4	0.4	Most flows	Pooled	Perched	Concrete	S12:009-420	471	46
264.3	894	8/10/2003		0.8	0.1	0.2	Most flows	Pooled	Perched	Concrete	S12:998-411	471	46
460.28	897	8/10/2003		1.5	0.3	0.1	Most flows	Pooled	Perched	Concrete	S12:985-425	471	46

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Franklin District Council													
460.11	900	13/10/2003	8	0.8	0.5	0.5	Most flows	Flat	Perched	Concrete	S12:948-413	345	15
460.15	904	13/10/2003	5	0.6	0.5	0.05	Most flows		Perched	Concrete	S12:925-420	471	46
460.18	914	14/10/2003	13	0.6		0.5	Most flows	Flat	Perched	Concrete	S12:985-434	471	46
460.23	923	14/10/2003		1.2	0.3	0.5	Most flows	Pooled	Perched	Concrete	R12:896-377	345	15
460.27	927	15/10/2003	9	1.5	0.2	0.15	Most flows	Flat	Perched	Concrete	R12:895-399	489	57
460.20	928	15/10/2003	16	0.4	0.5	1	Most flows	Pooled	Perched	Concrete	R12:897-353	297	11
1283.12	932	15/10/2003		0.4			Most flows	Flat	Pooled	Concrete	R12:840-390	345	15
1132.32	956	17/10/2003		0.5		0.15	Most flows	Flat	Perched	Concrete	R12:799-389	297	11
1132.34	958	17/10/2003	8	2	0.3	1	Most flows	Perched	Perched	Concrete	R12:774-386	345	15
1132.35	959	17/10/2003	12	1.5	0.05	0.15	Most flows	Pooled	Perched	Concrete	R12:768-378	345	15
1131.206	961	17/10/2003	11	0.5	0.6	0.4	Most flows	Pooled	Perched	Concrete	R12:719-342	269	6
1131.207	962	17/10/2003	4	0.4		1	Most flows	Pooled	Perched	Concrete	R12:703-323	345	15
1131.208	964	17/10/2003	10	0.4	0.4	0.4	Most flows	Pooled	Perched	Concrete	R12:718-352	269	6
11.7	967	17/10/2003	14	1			Most flows	Pooled	Perched	Concrete	R12:704-374	269	6
11.8	968	17/10/2003	16	0.2			Most flows	Pooled	Perched	Concrete	R12:703-370	269	6
11.13	970	20/10/2003	11	0.4		0.15	Most flows	Flat	Perched	Concrete	R12:671-324	345	15
41.18	979	20/10/2003	12	0.8			Most flows	Pooled	Perched	Concrete	R12:667-372	345	15
41.19	981	20/10/2003	16	0	0.15	0.15	Most flows		Perched	Concrete	R12:638-363	345	15
1132.37	985	21/10/2003	21	2.5	0.7	0.7	Most flows	Pooled	Perched	Concrete	R13:641-271	345	15
1132.40	988	21/10/2003	22	0.3	0.2	0.15	Most flows		Perched	HDPE Plastic	R13:629-275	345	15
1132.41	989	21/10/2003		0.4			Most flows	Pooled	Perched	Concrete	R13:618-282	345	15
1132.42	990	21/10/2003	14	0.4	0.1	0.3	Most flows		Perched	Concrete	R13:611-287	345	15
1132.59	991	21/10/2003	15			0.2	Most flows	Pooled	Perched		R13:614-290	345	15
1132.43	992	21/10/2003		0.4	0.2	0.2	Most flows	Flat	Perched	Concrete	R12:617-319	345	15
44.15	995	21/10/2003	15	0.5	0.5	0.3	Most flows	Pooled	Perched	Concrete	R12:620-342	345	15
44.17	998	22/10/2003	12	0.8	0.2	0.1	Most flows	Flat	Perched	Concrete	R12:634-347	345	15
44.18	999	22/10/2003	15	1.2	0.5	0.6	Most flows	Pooled	Perched	Concrete	R12:622-345	345	15
1131.222	1111	1/12/2004	12	1.5		1	High flows only	Perched	Perched	Concrete	R12:778-318	597	86
1131.227	1116	30/11/2004	12	3	0.1	0.3	High flows only	Flat	Perched	Concrete	R13:702-286	571	80
1131.230	1120	30/11/2004	10	2.5	0.2	0.3	High flows only	Flat	Perched	Concrete	R13:660-248	471	46
1904.1	1125	30/11/2004	13	3	0.1	0.1	High flows only	Flat	Perched	Galvanised Steel	R13:643-181	486	56
1139.2	1127	30/11/2004	13	3		0.2	High flows only	Flat	Perched	Galvanised Steel	R13:643-145	429	40
665.8	1133	6/12/2004	10	0.5	0.1	0.1	High flows only	Flat	Perched	Concrete	R13:788-244	610	93
1928.1	1139	6/12/2004	18	2	0.3	0.6	High flows only	Flat	Perched	Concrete	R13:672-245	571	80
1131.234	1140	6/12/2004	14	1	0.2	0.1	High flows only	Flat	Perched	Concrete	R13:739-294	597	86
1131.237	1143	6/12/2004	12	1	0.1	0.2	High flows only	Flat	Perched	Concrete	R13:769-294	597	86
1131.242	1148	6/12/2004	12	0.5		0.2	High flows only	Flat	Perched	Concrete	R13:793-292	597	86
1132.30	888	7/10/2003		0.8			High flows only	Pooled	Pooled	Concrete	R12:822-347	566	77
460.8	891	8/10/2003	18	1.2			High flows only	Flat	Pooled	Concrete	S12:926-341	597	86
460.9	898	8/10/2003	15	0.4			High flows only	Flat	Pooled	Concrete	S12:988-424	610	93
1283.10	930	15/10/2003	15	0.5			High flows only	Pooled	Flat	Concrete	R12:837-373	566	77
1132.58	941	16/10/2003	10	0.7			High flows only	Pooled	Pooled	Concrete	R12:787-364	597	86
1086.49	953	16/10/2003	10	0.5			High flows only	Pooled	Pooled	Concrete	R12:821-390	597	86
1132.33	957	17/10/2003	12	0.5			High flows only	Pooled	Pooled	Concrete	R12:769-365	571	80

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Waipa District													
870.16	2238	16/12/2004	18	3	0	0	Most flows	Flat	Flat	Galvanised Steel	S15:967-599		1
734.4	2223	15/12/2004	20	2	0	0	Most flows	Flat	Perched	Galvanised Steel	S14:965-712		2
1008.10	2233	16/12/2004	14	1	0	0	Most flows	Perched	Flat	Concrete	S15:972-624		3
438.43	2278	21/12/2004	14	1	0	0	Most flows	Flat	Perched	Concrete	S15:205-544		4
429.5	2199	14/12/2004	12	1	0	0	Most flows	Flat	Perched	Concrete	S15:053-647		7
438.3	2244	16/12/2004	14	1	0	0	Most flows	Flat	Perched	Concrete	S15:078-557		7
438.52	2294	21/12/2004	20	1	0	0	Most flows	Flat	Pooled	Concrete	S15:235-561		7
294.4	2363	5/01/2005	12	1	0	0	Most flows	Flat	Perched	Concrete	T15:396-565		7
488.14	2322	22/12/2004	16	3	0	1	High flows only	Flat	Perched	Concrete	S15:255-624		22
1888.1	2371	5/01/2005	20	3	0	0	High flows only	Flat	Perched	Galvanised Steel	T15:385-452		22
417.35	2491	26/01/2005	18	2	0	0	High flows only	Flat	Flat	Concrete	S14:240-701		22
1216.2	2357	23/12/2004	20	1	0	0	High flows only	Flat	Perched	Concrete	T15:364-559		25
1177.4	2362	5/01/2005	12	2	0	0	High flows only	Flat	Perched	Concrete	T15:383-557		25
1071.3	2193	14/12/2004	10	2	0	1	High flows only	Flat	Perched	Concrete	S15:023-692		38
1071.7	2200	15/12/2004	15	1	0	0	High flows only	Flat	Perched	Concrete	S15:033-671		38
379.5	2213	15/12/2004	16	1	0	0	High flows only	Flat	Perched	Concrete	S15:007-589		38
1191.4	2216	15/12/2004	18	1	0	0	High flows only	Flat	Perched	Concrete	S15:018-598		38
222.18	2225	16/12/2004	12	2	0	1	High flows only	Flat	Perched	Concrete	S15:951-653		38
222.20	2227	16/12/2004	16	1	0	0	High flows only	Perched	Perched	Concrete	S15:947-652		38
1008.11	2234	16/12/2004	14	1	0	0	High flows only	Flat	Perched	Concrete	S15:971-626		38
1008.12	2235	16/12/2004	14	1	0	0	High flows only	Flat	Perched	Concrete	S15:977-626		38
870.15	2237	16/12/2004	14	1	0	0	High flows only	Flat	Perched	Concrete	S15:986-615		38
270.8	2250	20/12/2004	12	1	0	1	High flows only	Flat	Perched	Steel	S14:065-721		38
571.8	2329	22/12/2004	16	1	0	1	High flows only	Flat	Perched	Concrete	S15:166-688		38
160.8	2355	23/12/2004	14	1	0	1	High flows only	Flat	Perched	Concrete	T15:337-543		38
411.35	2377	5/01/2005	12	2	0	0	High flows only	Perched	Flat	Concrete	T15:329-472		38
384.7	2207	15/12/2004	16	1	0	0	High flows only	Flat	Perched	Concrete	S15:030-598		51
438.35	2270	20/12/2004	12	2	0	0	High flows only	Flat	Perched	Concrete	S15:160-565		51
438.38	2273	20/12/2004	12	2	0	0	High flows only	Flat	Perched	Concrete	S15:174-550		51
1103.4	2344	23/12/2004	10	3	0	0	High flows only	Flat	Flat	Concrete	T15:371-648		51
438.26	1303	21/12/2004	18	1	0	0.05	High flows only	Flat	Perched	Concrete	T15:307-510		55
268.3	2288	21/12/2004	12	1	0	1	High flows only	Flat	Perched	Concrete	S15:293-479		55
268.4	2289	21/12/2004	12	1	0	0	High flows only	Flat	Perched	Concrete	S15:291-471		55
213.3	2302	21/12/2004	14	1	0	1	High flows only	Flat	Perched	Concrete	S15:297-518		55
160.9	2356	23/12/2004	10	1	0	0	High flows only	Flat	Perched	Concrete	T15:341-549		55
1244.2	1087	29/11/2004	18	2	0.2	0.4	High flows only	Flat	Perched	Galvanised Steel	T15:388-410		60
818.17	1094	29/11/2004	14	0.5		0.1	High flows only	Perched	Flat	Concrete	S15:172-465		60
402.2	1096	1/12/2004	15	1	0.1	0.1	High flows only	Flat	Perched	Concrete	S15:086-476		60
402.5	1099	1/12/2004	10	0.5	0.1	0.1	High flows only	Flat	Perched	Concrete	S15:072-484		60
402.6	1100	1/12/2004	14	0.5	0.1	0.1	High flows only	Flat	Perched	Concrete	S15:072-481		60
384.5	2205	15/12/2004	12	1	0	0	High flows only	Flat	Perched	Galvanised Steel	S15:043-600		60
1191.41	2241	16/12/2004	12	1	0	0	High flows only	Flat	Perched	Concrete	S15:029-576		60
818.19	2246	16/12/2004	14	1	0	0	High flows only	Flat	Perched	Concrete	S15:071-524		60
429.8	2253	20/12/2004	16	1	0	0	High flows only	Flat	Perched	Concrete	S15:093-671		60
438.37	2272	20/12/2004	10	1	0	0	High flows only	Flat	Perched	Concrete	S15:173-573		60
411.31	2286	21/12/2004	12	1	0	1	High flows only	Flat	Perched	Concrete	S15:186-495		60
1070.10	2292	21/12/2004	18	1	0	0	High flows only	Flat	Perched	Concrete	S15:224-552		60
438.54	2296	21/12/2004	18	1	0	0	High flows only	Flat	Perched	Concrete	S15:245-550		60
213.2	2301	21/12/2004	12	1	0	1	High flows only	Flat	Perched	Concrete	S15:292-519		60
438.60	2313	22/12/2004	12	1	0	0	High flows only	Flat	Perched	Concrete	T15:300-541		60

LOCATED KEY	SITE ID	INSPECTION DATE	LENGTH (m)	DIAMETER (m)	UNDERCUT LENGTH (m)	PERCHED HEIGHT (m)	FISH PASSAGE RESTRICTION	INLET Cross - Section	OUTLET Cross - Section	CONSTRUCTION MATERIAL	MAP REFERENCE	REGION RANK	DISTRICT RANK
Waipa District													
438.61	2314	22/12/2004	12	1	0	0	High flows only	Flat	Perched	Concrete	T15:308-545		60
438.62	2315	22/12/2004	12	1	0	0	High flows only	Flat	Perched	Concrete	T15:302-543		60
438.63	2316	22/12/2004	10	1	0	0	High flows only	Perched	Perched	Concrete	T15:311-526		60
438.65	2318	22/12/2004	16	2	0	0	High flows only	Flat	Perched	Concrete	S15:282-554		60
230.19	2338	23/12/2004	14	1	0	0	High flows only	Flat	Perched	Concrete	T14:381-706		60
230.20	2339	23/12/2004	20	2	0	0	High flows only	Flat	Perched	Galvanised Steel	T15:383-687		60
1103.3	2340	23/12/2004	10	2	0	1	High flows only	Flat	Perched	Concrete	T15:388-669		60
230.21	2341	23/12/2004	16	1	0	0	High flows only	Flat	Perched	Galvanised Steel	T15:358-687		60
230.27	2348	23/12/2004	18	1	0	0	High flows only	Flat	Perched	Concrete	T15:399-629		60
1177.3	2361	5/01/2005	16	1	0	0	High flows only	Flat	Perched	Concrete	T15:373-560		60
1292.3	2365	5/01/2005	14	2	0	0	High flows only	Flat	Perched	Galvanised Steel	T15:404-546		60
1292.4	2366	5/01/2005	16	1	0	0	High flows only	Flat	Perched	Concrete	T15:419-538		60
377.3	2368	5/01/2005	16	1	0	0	High flows only	Flat	Perched	Concrete	T15:422-495		60
1888.2	2372	5/01/2005	12	1	0	0	High flows only	Perched	Flat	Concrete	T15:387-455		60
438.55	2297	21/12/2004	16	1	0	0	Low flow only	Flat	Flat	Concrete	S15:257-536		4
571.6	2327	22/12/2004	16	2	0	0	Low flow only	Flat	Flat	Concrete	S15:145-645		6
1191.32	2189	14/12/2004	10	2	0	0	Low flow only	Flat	Flat	Concrete	S14:016-723		11
1191.33	2190	14/12/2004	13	2	0	0	Low flow only	Flat	Flat	Concrete	S14:008-712		11
1071.5	2195	14/12/2004	12	1	0	0	Low flow only	Flat	Perched	Concrete	S15:030-676		11
379.6	2214	15/12/2004	10	3	0	0	Low flow only	Flat	Flat	Galvanised Steel	S15:007-588		11
398.11	2249	20/12/2004	12	1	0	0	Low flow only	Flat	Flat	Concrete	S14:086-725		11
1071.9	2256	20/12/2004	12	2	0	0	Low flow only	Flat	Flat	Concrete	S15:033-693		11
488.5	2306	22/12/2004	10	1	0	0	Low flow only	Flat	Flat	Concrete	S15:268-600		11
488.13	2321	22/12/2004	16	1	0	0	Low flow only	Flat	Perched	Concrete	S15:248-621		11
571.4	2323	22/12/2004	12	1	0	0	Low flow only	Flat	Perched	Concrete	S15:172-631		11
411.36	2378	5/01/2005	12	2	0	0	Low flow only	Flat	Perched	Concrete	T15:327-474		11
438.57	2299	21/12/2004	10	1	0	0	Low flow only	Flat	Flat	Concrete	S15:262-549		21
1132.63	1086	29/11/2004	15	0.5		0.2	Low flow only	Flat	Perched	Galvanised Steel	T15:411-433		25
707.7	1090	29/11/2004	40	2		0.1	Low flow only	Flat	Perched	Concrete	S15:264-413		25
818.16	1091	29/11/2004	10	2		0.1	Low flow only	Flat	Perched	Steel	S15:231-428		25
402.3	1097	1/12/2004	14	1	0.05	0.05	Low flow only	Flat	Perched	Concrete	S15:082-475		25
402.7	1101	1/12/2004	13	0.5			Low flow only	Flat	Flat	Concrete	S15:073-478		25
222.23	2230	16/12/2004	14	2	0	0	Low flow only	Flat	Flat	Concrete	S15:937-623		25
429.9	2257	20/12/2004	14	1	0	0	Low flow only	Flat	Perched	Concrete	S15:054-646		25
438.46	2281	21/12/2004	12	1	0	0	Low flow only	Flat	Flat	Concrete	S15:218-525		25
488.6	2307	22/12/2004	10	1	0	0	Low flow only	Flat	Flat	Concrete	S15:269-586		25
230.23	2343	23/12/2004	10	1	0	0	Low flow only	Flat	Flat	Concrete	T15:321-661		25
1292.2	2364	5/01/2005	14	1	0	0	Low flow only	Flat	Flat	Concrete	T15:402-550		25