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PART 2 - SUPPORTING INFORMATION

Section A - Statutory Framework

The statutory framework for water allocation, and for the Mangatarere catchment is as follows: the Resource Management Act 1991, the *Regional Policy Statement for the Wellington Region* and the *Regional Freshwater Plan for the Wellington Region*.

A.1 Resource Management Act 1991

The Resource Management Act 1991 (RMA) provides a statutory framework on which Regional Councils can base a water allocation plan. Section 30 of the RMA gives Regional Councils the function of being primary water management agencies. They have the responsibility for controlling the allocation of water and the setting of flow regimes.

Section 14 (3) outlines that a person may not take, use, dam or divert water unless such activities are permitted in a regional plan or by a resource consent¹.

A.1.1 Instream values

The RMA gives water managers a list of matters which must be considered when planning and allocating water. Section 5 (2)(b) of the RMA explains 'sustainable management' as *managing the use, development of..... resources in a way, or at a rate, which enables people and communities to provide for their social, economic or cultural wellbeingwhile... safeguarding the life-supporting capacity of air, water, soil, and ecosystems*. This, along with other principles in Sections 5-8 of Part II (along with *The Water Regime*, Vol 1A of the RMA), allow us to appreciate the potential range of values to be sustained, when managing the use of water from the Mangatarere catchment.

The 4 main categories of instream value (in bold below), derive from the following terms within the RMA: (Assessment of the statutory framework and consultation can identify which of these are relevant to the Mangatarere.)

Ecological values - life-supporting capacity of water and ecosystems (and soil and air), significant habitats of indigenous fauna, significant indigenous vegetation, intrinsic value of ecosystems, quality of the environment, protection of the habitat of trout and salmon

Landscape Values – natural character, legibility, aesthetic values, ephemeral values, spiritual values, popular values, outstanding natural features and landscapes, amenity values, intrinsic values of ecosystems.

Recreational Values – Includes amenity values and public access

Maori Values – relationship of Maori and their culture and traditions, as matters of national importance, regard to kaitiakitanga and the Treaty of Waitangi.

A.2 Regional Policy Framework

Two policy documents for the Greater Wellington Region, address the issue of water allocation; the *Regional Policy Statement for the Wellington Region* (RPS) and the *Regional Freshwater Plan for the Wellington Region* (RFP).

¹ The only exceptions to this are water for an individual's reasonable domestic needs, reasonable needs for an individual's animal's drinking water and firefighting needs.

A.2.1 Regional Policy Statement

The RPS is an overview document which provides the framework for managing the resources of our region in a sustainable way. Chapter 5 - *Freshwater* recognises conflicts in the allocation of water due to competing uses and values (Issue 3) and that over allocation and the demands of sustainable management are presenting challenges to water management (Issue 4).

Relevant policies in Chapter 5 cover water quality and quantity issues:

Policy 1 and 2: To manage the quantity, and maintain and protect the quality of fresh water so that it is available for a range of uses and values, and:

(1) its life supporting capacity is safeguarded; and

(2) its potential to meet the reasonably foreseeable needs of future generations is sustained; and

(3) for surface water, any adverse effects on aquatic ecosystems are avoided, remedied or mitigated.

Relevant methods include developing and applying flow regimes and safe yields based on instream habitat requirements and other factors (Method 3) and preparing location specific plans to safeguard life supporting capacity, establish minimum flows and allocate safe yields of any water body which is under pressure from competing uses (Method 4).

A.2.2 Regional Freshwater Plan

The RFP provides specific policy guidance and rules for water quantity and quality. It provides guidance on which rivers in the region should be managed for which purpose (for instance, for water supply or contact recreation). There are several policies in the RFP that give specific guidance for the management of the water resource in the Mangatarere catchment, which are as follows

1. Establishing Minimum Flows And Approaches To Water Allocation (Mangatarere catchment)

Method 8.5.5 Where practicable, obtain more information to establish desirable minimum flows and approaches to water allocation such as those used in Policy 6.2.² for the following water bodies where there is potential for water shortages to occur

2. Avoiding Effects On Trout Habitat And Managing Water Quality For Trout Fishery And Fish Spawning Purposes (Mangatarere Stream, Kaipatangata Stream³ and Beef Creek)

²Relates to minimum flows and water allocation

³This relates to downstream of the dam. Policy 5.2.5 (to manage water quality for water supply purposes) applies upstream of the dam.

Policy 4.2.14 To avoid, remedy or mitigate any adverse effects on important trout habitat in the Region, identified in Appendix 4 (includes the Mangatarere River from S27 158 240 to its confluence with the Waiohine River at S26 199 131, the Kaipatangata Stream, from the water supply dam downstream at S26150211 to its confluence with the Mangatarere at S26196154) and to Beef Creek (above its confluence with the Waiohine at S26 199 135) by:

- *Managing water quality so that Policy 5.2.3 is satisfied; and*
- *Managing the flows and levels of water bodies so that policies 6.2.1, 6.2.2, 6.2.12, and 6.2.134, whichever is (are) relevant, is (are) satisfied; and*
- *Having particular regard to offsetting adverse effects on trout habitat; and*
- *Having particular regard to maintaining the same, or similar, river bed configuration in the rivers identified.*

Policy 5.2.3 To manage water quality for trout fishery and fish spawning purposes in those rivers, or parts of rivers, identified in Appendix 4 (subject to Policy 5.2.10)

3. *Needing Enhancement Of Water Quality For Aquatic Ecosystem Purposes (Mangatarere Stream⁵)*

Policy 5.2.9 To manage the quality of the fresh water of the rivers, or parts of rivers, identified in Appendix 7 (Water Bodies With Water Quality Identified As Needing Enhancement) so that water quality is enhanced to satisfy the purposes identified in the Appendix (subject to Policy 5.2.10) Appendix 7 includes the Mangatarere Stream - both above and below the oxidation pond discharge from S26 199 131 to S26 234 214 (this spans from confluence to just north of Andersons Line) and states it is for aquatic ecosystem purposes

Minimum flow is described in the RFP as follows:

The minimum flow is a guide that provides an indication of flows in the stream that will:

- *Safeguard the life-supporting capacity of ecosystems;*
- *Meet the needs of future generations; and*
- *Provide for adequate water quality.*

Under most circumstances, the flows in the stream should not fall below the minimum flow. However, in low flow conditions, streams may occasionally drop below the minimum flows even if no water is abstracted.

⁴ relates to minimum flows and water allocation

⁵ from the confluence with the Waiohine to north of Andersons Line

The RFP also includes the following guidance pertaining to general water allocation processes, which have been taken into account during this water allocation process:

Policy 4.2.29 *To recognise the needs of existing lawful users of fresh water by:*

- *Allowing existing users to upgrade progressively their environmental performance values where improvements are needed to meet the provisions of the Plan; and/or*
- *Giving priority to existing users over new users at locations where the demand for the use of water is greater than that resource can sustain.*

Policy 4.2.31 *To ensure that the processes for making decisions relating to the management of freshwater is fair and transparent. In particular, to ensure that as far as practicable, all interested people and communities have the opportunity to be involved in the freshwater resource management processes, including significant resource consents.*

Policy 6.2.2 *To manage the flows in rivers and streams not identified in Policy 6.2.1 by having regard to :*

- *The significance of natural, amenity, and tangata whenua values; and*
- *The scale/magnitude of any adverse effects on natural, amenity and tangata whenua values; and*
- *The reversibility of any adverse effects on natural, amenity and tangata whenua values*

Method 8.1.3 *Liaise with tangata whenua over water resource issues in the Region, including water quality and quantity, and the use of river and lake beds.*

Section B – Summary of 2001 Consultation

Summary of Consultation 2001		
Organisation	Main Value of Stream	Comments
Carterton District Council	Out-of-Stream + Recreation	<ul style="list-style-type: none"> Wish to maintain takes for public water supply (Kaipaitangata), the Carrington water race and keep options open for further takes Popular for swimming, fishing, eeling and canoeing
Department of Conservation	Ecology	<ul style="list-style-type: none"> Headwaters relatively unmodified with significant ecological values/habitats for native fish (mudfish and dwarf galaxias) - recognise this Minimum flows should provide for instream values To avoid water pollution during low flow, new discharge applications to be refused and existing discharges suspended for the period Holistic approach including riparian management and advocacy of efficient water use and water storage
Consent holders/ farmers /local residents	Out-of-Stream + Recreation + Ecology	<ul style="list-style-type: none"> Economic value of water resource Recreation including swimming, picnicking (Belvedere Rd bridge), trout and eel fishing; Swimming not possible when dry in parts Minimum flow to protect water quality and recommend riparian management Protection of ecological values should be balanced against landowner rights, flooding risk and financial benefits of irrigation Discharges and takes to be controlled to support high level of water quality Some thought water quality was improving whilst others thought quality lower in summer when flow low and stock have access
Rangitaane o Wairarapa	Maori + Ecology	<ul style="list-style-type: none"> Improve water quality, quantity and the instream habitat for indigenous flora and fauna Concern over mixing with water from other catchments, landfill leachate, sewage discharge 'Healthy rivers - healthy people' and encouragement of riparian management
Forest and Bird	Ecology	<ul style="list-style-type: none"> Minimise water takes – use alternative sources and encourage efficient water use Recreational use important although must not affect water quality adversely Water races can be beneficial in ecological terms Encourage riparian planting, discourage stock access to stream, improve landuse practise, to lessen impact on ecology Concern over effect of discharges
Fish and Game	Recreation (fishing)	<ul style="list-style-type: none"> Important spawning/recruitment habitat, locally significant brown trout fishery; low flows effect habitat for fish Minimum flow must be determined using ecologically sound methods – concerned WAIORA inappropriate Provide for instream values; habitat for fish and macroinvertebrates, recreation and realistic needs of out-of-stream users Recommend riparian enhancement as quality affected by landuse – dairying, stock damage, runoff Advocate efficient water use and storage
Fish and Game Association, Wairarapa	Recreation (fishing) + Ecology	<ul style="list-style-type: none"> Major trout spawning river and significant fishery Quality and quantity must support existing flora and fauna year round to maintain fishery No impediments to fish passage

Section C– Flow Regime Options Proposed in Draft Plan

As part of consultation in October 2003, several flow regime options were put forward for consideration. Two options for each reach were proposed.

Feedback indicated the options involving a stepdown or additional trigger flow were preferred. Therefore this final plan has chosen Upper Reach Option 2 and Lower Reach Option 1. Below is a summary of the options, as they were presented for consideration at the draft stage.

Upper Reach

Upper Reach Options 1 and 2 do not allow any further water allocation above the existing consented level.

- Option 1 requires all takes to cease when the flow in the stream falls below 125 l/s.
- Option 2 uses an additional trigger flow whereby takes are restricted to 50% when the stream falls below 160 l/s, and are then suspended completely when the flow falls below 125 l/s.

Lower Reach

- Option 1 has a similar approach to Upper Reach Option 2, where all takes are restricted to 50% when the stream falls below 125 l/s, and then suspended completely when the flow falls below 90 l/s. This Option does not allow any further allocation from this Reach.
- Option 2 does allow further allocation of 50 l/s. However, all takes are suspended completely when the stream falls below 125 l/s.

Summary of Proposed Flow Regime Options			
Reach	Minimum Flow at Which All Takes Will Be Restricted to 50%	Minimum Flow at Which All Takes Will Cease	Core Allocation – Amount of Water Which Can be Taken Above the Minimum Flow
Upper - Option 1	None	125 l/s	To be set at the existing quantity of consented water allocation
Upper - Option 2	160 l/s	125 l/s	As above
Lower - Option 1	125 l/s	90 l/s	As above
Lower - Option 2	None	125 l/s	A further 50 l/s in addition to the existing consented quantity

Section D - Water Quality and Ecology

D. 1 Background

Since 1997 regular water quality and ecological monitoring has been carried out in the Mangatarere Stream at the SH2 bridge (Part 1, Figure 1), as part of the State of the Environment (SOE) Rivers Monitoring Programme. Regular monitoring is also carried out up and downstream of the discharge from the Carterton oxidation ponds.⁶

Data from the SOE monitoring in the Lower Reach of the Mangatarere catchment indicates that water quality and ecological health of this stream has declined significantly since 1997 and that the stream is currently moderately polluted. The most prominent trends include significant increases in plant available nutrient concentrations and significant declines in macroinvertebrate community health.

A full copy of the *Water Quality and Ecosystem Health of the Mangatarere River* report (Greater Wellington, 2002) can be obtained from Greater Wellington Regional Council.

Please refer to Section H Glossary for all terms.

D. 2 Physical Water Quality

Water temperatures⁷ in the Mangatarere at the SH2 bridge have been recorded at up to 17.2°C and may frequently exceed 20°C, the temperature at which sensitive macroinvertebrate species such as mayflies and stoneflies are adversely effected⁸. In general, spawning of trout and native fish species is adversely affected by temperatures exceeding 25°C, although feeding may reduce at lower temperatures.

The Mangatarere shows significant seasonal patterns in water clarity and turbidity (again monitored at the SH2 bridge). The water is clearest and least turbid during the summer and least clear and most turbid during winter. This seasonal variation is strongly correlated to catchment runoff.

The following nutrient levels were found for the Mangatarere, relative to the recommended levels in the *Australian And New Zealand Guidelines For Fresh And Marine Water Quality*⁹:

- The median dissolved oxygen (DO) level is 94.9% of saturation compared to the minimum trigger level of 98% of saturation¹⁰. The instream flora and fauna health and hence life-supporting capacity becomes adversely effected as DO levels reduce below 98%;
- The median level of Dissolved Reactive Phosphorus (DRP) is almost 10 times greater than the recommended maximum level of 10mg/m³;
- The median nitrate level is 3.5 times higher than the recommended maximum level of 444 mg/m³; and
- The median ammonia level is approximately 4 times the level for lowland rivers¹¹ of 21mg/m³.

⁶ Effluent from these oxidation ponds is discharged into the Mangatarere at a point approximately 2km upstream of the Waiohine confluence, Figure 1

⁷ monthly spot readings

⁸ Quinn & Hickey, 1990

⁹ ANZECC, 2000

¹⁰ For slightly disturbed aquatic ecosystems

D. 3 Microbiological Water Quality

The Mangatarere Stream shows no seasonal patterns in faecal coliform concentration. Levels have decreased significantly since 1997 at an average rate of 53/100ml/yr. A large proportion of this decline appears to have occurred since 1999. This corresponds with the installation of mechanical aerators in the Carterton oxidation ponds. No exceedances of the ANZECC 2000 *Escherichia coli* guidelines for safe recreational use have been recorded to date.

D. 4 Ecology

Algal biomass accrual in the Mangatarere is limited for most of the year by frequent freshes. Despite high nutrient concentrations and long accrual periods during summer, cover of periphyton filaments and mats at SH2 rarely exceeds 30% of the streambed.

Macroinvertebrate Community Index (MCI) and Semi-Quantitative Macroinvertebrate Community Index (SQMCI) values for the Mangatarere have declined from indicating “good water quality” in 1997, to “possible mild pollution” in 1998-1999 and “possible moderate pollution” in 2000-2001.

This decline in MCI scores reflects a number of changes in the macroinvertebrate community including a decline in the number of Ephemeropteran (mayfly), Plecopteran (stonefly) and Trichopteran (caddisfly) taxa (known as EPT taxa). EPT taxa, particularly mayflies, are considered to be sensitive to organic pollution. There has also been a considerable increase in the abundance of taxa that are tolerant of organic pollution since 1997. The abundance of these taxa in stony streams is considered indicative of environmental stress.

Brown trout and eels are common along the length of the Mangatarere Stream. Some inanga have been caught near the SH2 bridge, while bullies have been found in the Upper Reach and specifically at the Mangatarere Valley Road bridge¹². NIWA reported the presence of torrentfish (*Cheimarrichthys fosteri*) and upland bully (*Gobiomorphus breviceps*) in the upper reaches of the Mangatarere in 1981¹³.

The Upper Reach of the Mangatarere is an important trout spawning area and is popular amongst anglers during the early part of the fishing season. Fish numbers have been reported to decrease later in the summer due to low flows and high temperatures¹⁴.

¹¹ The lowland River Environmental Classification was selected because the area below the Gorge site meets the criteria for this category

¹² Wellington Acclimatisation Society, 1988

¹³ NZFWFD

¹⁴ Wellington Acclimatisation Society, 1998

Section E - Low Flow Hydrology

E.1 Background

A full copy of the *Mangatarere Low Flow Hydrology* report (Greater Wellington, 2002) can be obtained from Greater Wellington Regional Council.

E.1.1 Catchment Area and Rainfall

The Mangatarere catchment is described in Figure 1, Part 1. It is approximately 160 km² in area. Most of the water in the Mangatarere is derived from the Tararua Ranges. Annual rainfall in the main Tararua Ranges varies between 3000 and 7000mm. The average annual rainfall in the foothills of the catchment is approximately 2900mm. In the open farmland, the annual rainfall is 2100mm (at Phelps).

E.1.2 Flow Information Available

A continuous flow-recording site was established in 1998, in what is now the Mangatarere Gorge Environmental Monitoring Site (referred to as the 'Gorge site') (Figure 1, Part 1). A number of flow gaugings for the last 30 years are available to compliment the relatively short continuous flow record.

E.2 Low Flow Statistics

A synthetic flow record for the Mangatarere was constructed in 1996. No continuous flow or stage record existed for the Mangatarere Stream prior to this. The synthetic record was constructed by correlating flows recorded on the Atiwhakatu Stream, north of the Mangatarere catchment, with actual flows gauged on the Mangatarere at the Gorge site¹⁵.

This synthetic record has been used to derive low flow statistics for the Mangatarere Stream. Therefore the results given are approximations only.

E.2.1 Flow Distribution

Flow-duration curves show the percentage of time a river equals or exceeds a particular flow. Table E1 provides flow duration data for the synthetic Mangatarere flow record at the Gorge Site.

%	0	1	2	3	4	5	6	7	8	9
40	1338	1296	1259	1222	1189	1154	1121	1085	1051	1016
50	983	949	917	886	856	828	801	775	755	733
60	710	696	674	655	638	618	603	586	570	554
70	541	527	510	495	480	467	453	439	427	413
80	399	386	373	360	346	333	320	306	291	277
90	262	249	234	221	206	197	183	166	148	127
100	61	-	-	-	-	-	-	-	-	-

¹⁵ Redvers, G. 1996: Mangatarere Water Resource – A flow correlation with the Atiwhakatu.

The example in bold shows that flows at the Mangatarere at the Gorge site are above 467 l/s for 75% of the time, and above 696 l/s for 61% of the time.
 From this table, it is also possible to calculate the number of days on average that the flow is below a certain level. For the example used above, the flow on average, is below 467 l/s, for $365 * (1 - 0.75) = 91.25$ days.

E.2.2 Frequency Analysis

Frequency analysis is used to determine the statistical significance of an extreme low flow occurring. It tells us how often, on average, we can expect a particular low flow to occur.

Low flow frequency figures were calculated using the computer package EVAN¹⁶. Table E2 summarises the results.

Return Period (Yrs)	1 day	7 day	14 day	28 day
MALF	168	-	-	-
2.33	138	161	201	283
5	109	127	154	205
10	93	108	127	163
20	81	94	108	131
100	62	70	77	80

Period analysed 20th September 1977 to 31st December 1995. The example in bold shows that a flow (averaged over one day) of 93 l/s should occur, on average, every 10 years, or that a flow (averaged over fourteen days) of 154 l/s should occur, on average, every 5 years.

E.2.3 Concurrent River Flows

To determine the relative volumes and locations of the inputs and losses to the Mangatarere system, a set of concurrent gaugings have been conducted on the Mangatarere over the last 10-15 years, during the low flow season. These are summarised on Table E3 and presented on Figure E1. Figure E2 shows the results from the 1997 run¹⁷.

Table E3/Figure E1 show significant flow gains on the Mangatarere Stream during low flows periods overall, between the Gorge site and SH2. Large gains from the tributaries and recharge from the groundwater, cause these increased flows.

The reduction in flow between the Gorge Site and Anderson's Line (recorded during the 2003 gauging season, Figure 3 in Part 1) could be attributed in part to the take for the Carrington water race¹⁸. During the 2003 gauging season it was confirmed that the Mangatarere frequently runs dry for some distance between Anderson's Line and Belvedere Road bridge, prior to this only an anecdotal record was available. This may relate to seasonal groundwater levels, which affect the flow in the Mangatarere Stream. In late summer, when groundwater levels are lower, more water is likely to be transferred from surface to groundwater systems. This results in reduced stream flows, particularly in areas where the underlying gravels are deepest.

A large increase in flow was noted between Dalefield Road and SH2.

¹⁶ Event Analysis

¹⁷ Undertaken on 20 May 1997

¹⁸ occurs below the Mangatarere Gorge Environmental Monitoring Site, Figure C1

Table E3 Concurrent Flow Gaugings (l/s) On The Mangatarere Stream 1973-2003									
Date	Gorge Site	Mangatarere Valley Road	Andersons Line	Belvedere Road Bridge	Brooklyn Road	Dalefield Road	SH2	Confluence with Waiohine	Comments
7/2/73	61	-	-	38	-	-	-	-	-
8/2/79	140	143	-	25	-	81	290	422	-
28/1/85	114	252	-	43	-	43	57	253	-
18/1/93	-	-	-	672	-	1018	-	-	-
4/2/93	-	-	-	978	-	1417	-	-	-
24/1/97	756	809	829	1057	1003	1551	2176	-	No irrigation. 21 l/s take for CDC* water race
20/5/97	248	221	229	253	294	488	839	-	No irrigation. 67 l/s take for CDC water race
21/3/00	469	-	-	270	-	-	725	-	-
28/2/01	167	-	-	71	-	-	275	-	-
5/3/01	221	-	-	72	-	-	-	-	-
6/3/03	268	-	150	165	-	234	515	-	-
14/3/03	321	-	226	278	-	303	628	-	-
21/3/03	220	-	73	77	-	127	348	-	-
27/3/03	187	-	20	50	-	70	273	-	156 l/s take for CDC w/r
4/4/03	325	-	214	243	-	290	514	-	-
10/4/03	230	-	103	115	-	164	425	-	135 l/s take for CDC w/r
Average	266	356	230	275	649	482	589	338	

Figure E1 Concurrent Flows Gaugings (l/s) on the Mangatarere Stream 2003

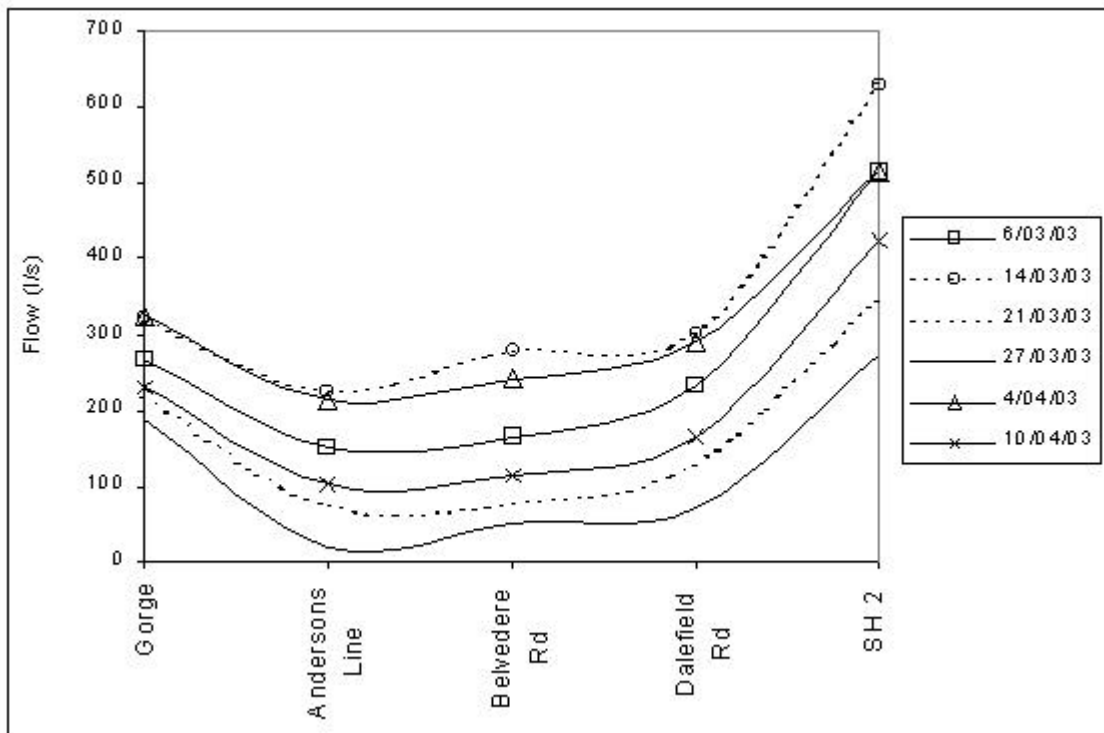
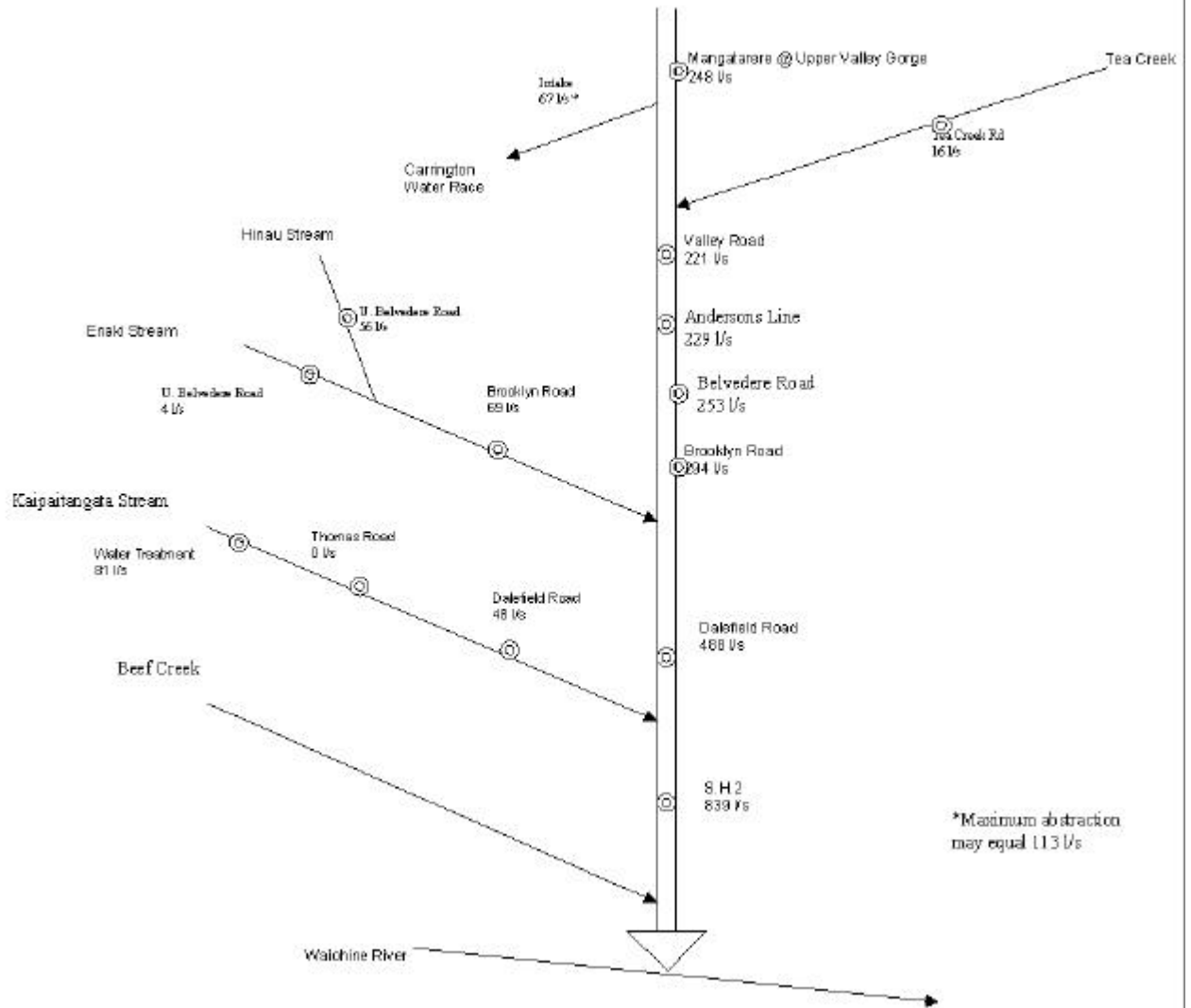


Figure E2 Mangatarere Catchment – Inputs & Losses (1997)



Section F - Low Flow Modelling

F.1 IFIM & WAIORA

A number of models are available that can be used to establish minimum flows to support the Instream Management Objective (IMO). Two models that were used on the Mangatarere were:

- IFIM (Instream Flow Incremental Method); and
- WAIORA (Water Allocation Impacts on River Attributes).

Both give guidance on establishing minimum flow requirements using habitat modelling, but use slightly different approaches.

IFIM is nationally recognised as a robust method of determining instream habitat requirements. It uses descriptions of the preferred habitats of fish and invertebrates and hydraulic modelling of river flow to predict changes in available instream habitat with changes in flow. It uses habitat suitability curves to describe relative habitat quality, ranging from zero (unsuitable) to one (optimum).

WAIORA is still in its development stage. However, it has potential to be a valuable tool in tracking changes in instream habitat requirements based on various abstraction levels, and introduces more environmental variables in making its assessment.

It is undergoing further calibration and development by NIWA and may be used in low flow management of the Mangatarere and other Wairarapa streams in the future. However it is not considered robust enough yet, for use in streams outside the Auckland region where it was developed.

As IFIM is not generally considered suitable for small streams, it is useful to be able to compare values derived from both models, and therefore both were used in investigating instream habitat. Similar values were produced by both models.

IFIM was however chosen as the appropriate tool for determining flow regime options for the Mangatarere, as WAIORA is still in its early stages.¹⁹ In addition, IFIM is based on fish and aquatic invertebrate habitat and as identified in Section 3, the IMO relates to trout habitat and aquatic ecosystem. IFIM also recommended slightly more conservative minimum flows than WAIORA did, which ensures greater protection for the IMO.

In summary, both IFIM and WAIORA showed the Upper Reach has the highest minimum flow requirements for instream habitat. The existing allocation level in this Reach may be too high, whilst the Lower Reach could potentially support further allocation without compromising those requirements.

¹⁹ Furthermore, consultation showed Wellington Fish and Game Council had concerns over the use of WAIORA.

A full copy of the following reports (all Greater Wellington, 2002) can be obtained from Greater Wellington Regional Council: *Instream Habitat Assessment for the Mangatarere River*, *WAIORA Report for Mangatarere River* and *WAIORA Verses IFIM for the Mangatarere River*.

F.2 The '2/3s' Rule

IFIM does not define a minimum flow in litres per second, or the amount of habitat loss that is acceptable. It only provides information on changes in habitat at different flows. To determine a suitable minimum flow, a decision must *first* be made regarding the minimum amount of habitat that must be maintained, or the amount of habitat loss that is acceptable. Rules of thumb frequently used to do this include retaining 2/3s of the habitat (whether it be for fish, insects or food producing habitat) at MALF, or alternatively 30% of the Weighted Useable Area(WUA)²⁰.

To the best of current knowledge, the 2/3s Rule has been adopted in this plan to satisfy the principal issues relating to water allocation in the catchment. However, there is some concern over its use²¹. Whilst we acknowledge it is an arbitrary value, there is no methodology available at the moment to select an alternative proportion of MALF.

As mentioned in Part 1 Section 1.6, revision of the WAP may be considered, as other studies become available. Such studies currently taking place, involving the Mangatarere, include the WAIORA study, the MfE Low Flow Study and the Massey University Low Flow Study. The outcome of this work may provide more opportunity to consider whether an alternative to the 2/3s rule is appropriate.

It has been suggested that for smaller rivers, the minimum flow be based on a minimum amount of habitat equivalent to that exceeded by 85% of the national survey rivers at their mean annual low flow, rather than using the 2/3s rule²². However, although the Mangatarere Stream is a small stream, this guideline was not used for this plan.²³

F.3 IFIM Methodology

During autumn 2002, an IFIM study was carried out on selected reaches of the Mangatarere river between the Gorge site and the confluence with Beef Creek. The purpose was to determine the actual habitat suitability over a range of flows for fish species and the food producing habitat, and to deduce at what minimum flows, fish habitat is protected without restricting water use too much. Analysis of the different life cycle of brown trout habitat, food producing habitat, longfin and shortfin eels, upland bullies, torrentfish and inanga were modelled.

Each cross section profile was surveyed, water velocities measured, and visual estimates made of the substrate composition. Flow and water level measurements were made to establish a relationship between flow and water level. The IFIM model was then used to predict water level, velocity and habitat suitability at other flows.

²⁰ These rules of thumb were originally put forward in Jowett, 1993.

²¹ *Flow Guidelines for Instream Values*, MfE 1998, Section 12.3.3

²² Jowett I.G. 1993: *Minimum Flow Assessments for Instream Habitat in Wellington Rivers*. NIWA, June 1993.

²³ This is discussed in *Instream Habitat Assessment for the Mangatarere River* (Wellington Regional Council, 2002)

A habitat preference curve was produced for each fish species. All species habitat curves declined towards zero as flow diminished. It was found that the optimum flow varies significantly with the species being considered and that generally, the flow requirements were greatest in the Upper Reach and least in the Lower Reach. It also found that relationships between habitat and flow showed food producing and adult brown trout habitats optimum flow were the highest amongst all species examined.

F.4 Habitat Modelling and Minimum Flows

IFIM’s habitat suitability curves are expected to give the most accurate information upon which to make minimum flow decisions. They indicate that habitat availability declines towards zero once flows drop below MALF. Therefore, decisions on appropriate minimum flows are based on flows that maintain an acceptable percentage of the habitat available at MALF, which as mentioned above, is proposed to be 2/3s in this plan.

As the relationship between habitat and flow showed food producing and adult brown trout habitats optimum flow were the highest amongst all species examined, the minimum flows for the Mangatarere Stream have been based on retaining 2/3s of the food producing habitat at MALF²⁴ (Table F1). As a consequence of using this basis, other species and their food sources are provided for.

Table F1 Habitat Modelling at MALF using IFIM					
Where	MALF (l/s)	Width (m)	Depth (m)	Velocity (m/s)	Minimum Flow (l/s)
Gorge Site	168	8.492	0.206	0.101	129 ²⁵
Belvedere Rd Bridge	150	6.908	0.145	0.163	122 ²⁶
SH2	557	9.703	0.198	0.290	380

The IFIM and habitat methods have been used to derive the above minimum flow values that can maintain enough habitat for brown trout, native species and their food source. These minimum flows will protect the IMO while still allowing some out-of-stream water use, as outlined in Part 1 Section 4.

²⁴ Based on the findings of the 100 Rivers Study (Biggs, et al, 1990): Rivers whose natural flows provided excellent trout habitat had more than 60% of their area providing ‘food and space’ habitat for adult brown trout. By ensuring that 2/3 (or 66%) of the WUA that is available at MALF is available at the minimum flow adequate habitat should be provided for trout while still allowing some water abstraction (Jowett, 1993).

²⁵ a flow of 0.129 l/s or less occurs 1 % of the time at the Gorge-0.093 l/s is lowest flow on record

²⁶ This figure is rounded up to 125 for the flow regime options in Part 1 Section 4.

Section G - Current Allocation

G.1 Upper Reach

Consent No.	Consent Holder	Location	Use	Current Take Size (l/s)	Notes
WAR 010202	CDC	Mangatarere stream	Carrington Water race	113	Have applied to increase to 200 l/s
WAR 010098	McFadzean	Well adjacent to Mangatarere stream	Irrigation	18.9	No increase
WAR 010370	Reid	Bore adjacent to Mangatarere stream	Irrigation	17.2	No increase
WAR 000298	Smith	Well adjacent to Mangatarere stream	Irrigation	26.5	No increase
WAR 010181	Doull	Tail race of Carrington water race	Irrigation	21.5	No increase ¹
WAR 020050	CDC	Kaipaitangata Stream	Public water supply	80	Current consent granted
WAR 950155	Fairbrother	Kaipaitangata Stream	Sub-surface irrigation	3	Current consent granted
WAR 010193	Hull	Enaki & Hinau Streams	Irrigation	8	Take size reduced
WAR 980187	Smith	Beef Creek	Irrigation	12	Application pending
Total Existing Allocation		278.6l/s for Upper Reach, 175.6l/s for Mangatarere Stream alone			
Total Requested Allocation		353.6l/s for Upper Reach, 262.6l/s for Mangatarere Stream alone			

¹ This activity is likely to be covered under the Carrington water race consent, hence it is not considered as part of the existing allocation

Three of the allocations listed in Table G1 are from wells/bores adjacent to the Mangatarere Stream. Given the proximity of these wells/bores to the stream (less than 50m) and that surface water flow is affected by groundwater in this area, these takes are classified as surface water takes under this plan.

Note that all consents²⁷ have expired and replacement consent applications have been lodged, but remain on hold until the proposed Plan Change process is complete, as mentioned in Part 1 Section 1.1.

In summary, the majority of existing consent holders wish to maintain their existing allocations. Carterton District Council has applied to increase their allocation for the Carrington water race from 113 l/s to 200 l/s (when the flow at the Gorge site is greater than 300 l/s).

G.2 Lower Reach

Consent No.	Consent Holder	Location	Use	Current Take Size (l/s)	Notes
WAR 010310	Hodder	Mangatarere Stream	Irrigation	7.2	No increase
WAR 010043	Pearce	Mangatarere Stream	Irrigation	6.3	No increase
WAR 010170	McLennan	Mangatarere Stream	Irrigation	26.25	No increase
Total Existing and Requested Allocation from the Lower Reach					39.75l/s

²⁷ except those for the Kaipaitangata Stream

Section H - Glossary

Abstraction***	Means the activity of taking water from a water body
Catchment*	The land area that contributes to a river's flow
Contaminant**	Includes any substance (including gases, liquids, solids and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat – (a) when discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or (b) when discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.
Core Allocation	The amount of water that can be taken out of a river above the minimum flow.
Discharge**	Includes emit, deposit, and allow to escape.
DO*	Dissolved oxygen; oxygen dissolved in the water
DoC	Department of Conservation
DRP	Dissolved Reactive Phosphorus
Effect**	... Unless the context otherwise requires, the term "effect" includes: (a) Any positive or adverse effect; and (b) Any temporary or permanent effect; and (c) Any past, present, or future effect; and (d) Any cumulative effect which arises over time or in combination with other effects - regardless of the scale, intensity, duration, or frequency of the effect, and also includes - (e) Any potential effect of high probability; and (f) Any potential effect of low probability which has a high potential impact.
Environment**	Includes - (a) Ecosystems and their constituent parts, including people and communities; and (b) All natural and physical resources; and (c) Amenity values; and (d) The social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by those matters.
Flow Regime*	A description of flow magnitude over time
Fresh	A rapid temporary rise in the stream discharge and level caused by heavy rains or rapid melting snow and ice.
Freshwater***	Means all water except coastal water and geothermal water.
Groundwater***	Means water beneath the land surface contained in interconnected pores in the saturated zone.
Habitat***	Means the environment in which a particular species or group of species lives. It includes the physical and biotic characteristics that are relevant to the species concerned.
IFIM	Instream Flow Incremental Methodology – It is a computer based model that quantifies the amount of fish habitat with different flow levels in a river, by predicting water depths and velocities at different flows.
Indigenous***	In relation to species means plants and animals found naturally in New Zealand.

Instream Management Objective*	The objective which promotes the sustainable management of an instream value
Kaitiakitanga***	Means the exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources, and includes the ethic of stewardship.
l/s	Litres per second
Low flow*	The actual flows in a river occurring during the dry season of the year ²⁸
Macroinvertebrate	An aquatic invertebrate retained by a 0.5mm sieve and including insects, snails, worms and Crustacea.
Mahinga kai***	Means an area where Maori traditionally gathered food/food sources
MALF	Mean Annual Low Flow
Mauri***	The life essence present in things as a result of their being imbued with that character.
MCI	Macroinvertebrate Community Index. This is a biotic index based around invertebrate tolerances to organic enrichment of stony streams.
MfE	Ministry for the Environment
Minimum Flow***	The minimum flow is a guide that provides an indication of flows in the stream that will: <ul style="list-style-type: none"> • Safeguard the life-supporting capacity of ecosystems • Meet the needs of future generations; and • Provide for adequate water quality Under most circumstances, the flows in a stream should not fall below this. However in low flow conditions, streams may occasionally drop below the minimum flows even if no water is abstracted.
NIWA	National Institute of Water and Atmospheric Research
Non point source discharge***	Means diffuse discharges of contaminants to air, water and land which are not attributable to an individual site or activity.
Periphyton	A group of organisms in aquatic environments specialised to live on and exploit much larger (usually inert) surfaces. Groups of organisms include fungi, bacteria, protozoa, and algae.
Point source discharge***	Discharges of contaminants from a single or identifiable source.
Reach*	A stretch of river with similar characteristics, often defined by upstream and downstream tributaries, or significant geological controls, or bed controls
RFP	Regional Freshwater Plan for the Wellington Region
Riffle*	Shallow part of river where water flows brokenly
Riparian	Land that adjoins or directly influences, or is influenced by, a body of water
River**	Means a continually or intermittantly flowing body of freshwater; and includes a stream or modified watercourse; but does not include any artificial watercourse.
RPS	Regional Policy Statement for the Wellington Region
SQMCI	Semi-Quantitative Macroinvertebrate Community Index – See MCI
Stream***	Has the same meaning as in the interpretation of river in the RMA
Supplementary Allocation	This is where water can be harvested at higher flows when the core allocation is fully taken.
Surface Water***	Means the water in rivers, lakes and wetlands.

²⁸ Smakhtin, 2001 *Low Flow Hydrology: A Review*. Journal of Hydrology 240 (2001) 147-186.

Tangata whenua***	In relation to a particular area, means the iwi, or hapu, that holds mana whenua over that area.
Tikanga Maori***	Means Maori customary values and practices.
Tributaries	A stream, river or glacier that feeds another larger one.
Waahi tapu***	Means sacred site; defined locally by the hapu and iwi, which are the kaitiaki for the waahi tapu.
WAIORA	Water Allocation Impacts on River Attributes, also Maori word for health/fountain. It is a computer package that can assist resource managers to predict the impact of changes in low flow on river ecology.
Water body**	means fresh water or geothermal water in a river, lake, stream, pond, wetland, or aquifer, or any part thereof, that is not located within the coastal marine area.
WUA	Weighted Usable Area – The total area of suitable habitat across a reach (or group of cross-sections)

Definitions sourced from:

- * *Flow Guidelines for Instream Values*, Mfe, 1998
- ** The Resource Management Act 1991
- *** *Regional Freshwater Plan for the Wellington Region*, 1999

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Wellington Regional Council 2002 *Wairarapa Municipal Oxidation Ponds – Water Quality Monitoring Report 1999-2001* Technical report no. 01/10