Appendix C

A: Consent history and development of minimum flow recommendations

The Consents operating in this sub-zone are listed in Table 1:

Table 1: Current Consents in the Raparapawai sub-zone

Consent holder	Consent number	Purpose	Source	Daily maximum volume (m^3/day)	(m^3/s)
Rapawai Trust (Harris)	103550	irrigation	surface	1,440	0.017
Cammock	103705	irrigation	surface	1,500	0.017
Verwaayen	103549	irrigation	surface	1,680	0.019
Corner Dairies	104799	stock drinking, dairy wash-down and domestic	surface	118	0.001
Terry	104972	stock drinking and dairy wash-down	surface	45	< 0.001
Terry	104979	stock drinking and dairy wash-down	surface	22.4	< 0.001
Sub-total				**4,805.4**	**0.056**
Cammock & McKenzie*	6403	irrigation	bore	1,476	0.017
Total				**6,281.4**	**0.073**

* This take is from a well and has previously been considered to be a groundwater take and therefore is not included in the surface water allocation for this sub-zone. Pumping tests are being carried out but the data is unavailable to date. Consent for "renewal" of this take is currently lodged with Horizons. Should this take be shown to be a riparian take (and therefore part of the surface water allocation), the Consent application will be assessed as a non-complying activity under the POP recommendations.

The three surface water takes for irrigation were "renewed" in 2003. The Consents were granted for a term of 3 years. The Decision document stated "*The short term will allow time for **horizons.mw** to undertake low flow gaugings of the Raparapawai Stream. However she [Team leader consents] points out that there is no guarantee that the abstraction volume and rate will be available from the Raparapawai Stream beyond the term of this consent.*"

The Consents granted in 2003 included minimum flow conditions based on the flow monitoring site at Manawatu at Hopelands. This was the first time these takes had had minimum flow requirements in their Consents.

There is a well-documented paper trail relating to the uncertainty around available allocation in the Raparapawai Stream. This includes the technical reports and Consent Decisions in

2003 and the subsequent water resource assessment (Roygard *et al*., 2006) and Consent documents relating to re-consenting in 2006.

Prior to the establishment of the Raparapawai at Jacksons Road flow monitoring site, the Manawatu at Hopelands flow monitoring site was used as a proxy for the application of minimum flow restrictions on the Raparapawai Stream.

The Upper Manawatu Water Resources Assessment (WRA) undertaken by Horizons in 2006 (Roygard *et al*., 2006) contained recommendations for the Raparapawai, including minimum flows based on the Raparapawai at Jacksons Rd monitoring site. These changes to minimum flows are summarised in Table 2.

The minimum flow recommendation was determined using Instream Flow Incremental Methodology (IFIM) (Hay & Hayes, 2005). The water resource assessment recommended using the flow monitoring site at Raparapawai at Jacksons Rd, as this linked the irrigation takes to the flows in the actual stream from which the water is being abstracted. The Proposed One Plan (POP) as notified carried through the recommendations of the water resource assessment of a minimum flow of 0.074 m^3/s and an allocation limit of 0.024 m^3/s (2,074 m^3/day) for the Raparapawai Stream.

The transition from the allocation framework prior to the WRA is discussed in Section 5.4 Pg 308 of the WRA. It states: "*Existing consents will be incorporated into the new water allocation framework at the time when consents expire and new consents for these abstractions are sought. In the case of the consents in the over allocated catchments the 'renewals' of consents are recommended to be treated as outlined in the following sections. Any consented volumes surrendered, lapsed or not renewed will only be made available for reallocation up to a level where the zone or sub-zone (including those downstream) are considered fully allocated and fit within the overall allocation limit for the Upper Manawatu*." (Roygard *et al*., 2006).

Specifically, in relation to the Raparapawai Stream it states: "*This catchment is over allocated. The consents for continuation of the currently consented abstraction volumes (maximum daily rate) will be renewed. The 'renewed' consents will be subject to the minimum flow based on the Raparapawai flow recorder site, which will provide a greater level of environmental protection than the current minimum flow restrictions for these takes which are based on the mainstem flow site Manawatu at Hopelands*." (pg. 309 Roygard *et al*., 2006).

These recommendations were implemented in 2006. Consents were granted consistent with these recommendations and the recommended common catchment expiry date and review dates. (Section 5.3.1, pg 308, Roygard *et al*., 2006).

In consultation with the Ruahine River Care Irrigators Group and Wellington Fish & Game Council, Horizons undertook a review of the minimum flows and core allocation limits in the Raparapawai and Oruakeretaki Streams. This is fully documented in the report titled *Raparapawai and Oruakeretaki Minimum Flow Review 2008* (Hurndell *et al*., 2008). This report incorporated additional information relating to flow, water abstraction measurements and instream surveys. This new information included reanalysis of the IFIM study completed in these catchments by the Cawthron Institute (Hay & Hayes, 2007). This report includes comparisons of a range of scenarios for water allocation in these catchments, including assessments of the frequency of minimum flows.

The recommendations for the Oruakeretaki Stream have been implemented via consent "renewals". These recommendations have also been carried through to the recommendations to the POP.

The implementation of the revised recommendations for the Raparapawai Stream is more problematic because of the current level of allocation in this catchment. The Raparapawai is a relatively small stream with a 1-day Mean Annual Low Flow (MALF) of 0.044 m^3/s, or 44 L/s. The total consented irrigation abstractions equal 120% of the MALF. Typically the recommended allocation limits for streams in the Manawatu-Wanganui Region are in the order of 20-30% of MALF.

While the recommended minimum flows are lower than those recommended previously, a consequent reduction in core allocation limit is associated with these recommendations. Implementing the recommended minimum flow while the current level of allocation exists would have little effect on the frequency of the occurrence of flows experienced by existing consent holders.

The updated recommendations to the Proposed One Plan included changes to the core allocation limit for the Raparapawai Water Management Sub-zone, decreasing this to 0.015 m^3/s or 1,296 m^3/day. This is significantly lower than the current allocation in this zone, which is 7,865 m^3/day.

Horizons officers have identified in their evidence that the allocation regime for the Raparapawai requires careful consideration (see Section 42A Report of Dr Roygard pg. 50, para 86).

B: Manawatu at Hopelands minimum flow restriction versus Raparapawai at Jacksons Rd

Following the review of the minimum flow for the Manawatu at Hopelands flow monitoring site, the minimum flow recommendation has been changed to a single minimum flow of 2.980 m^3/s. Prior to this, many consents with minimum flows linked to the Hopelands site were required to reduce abstraction by 50% at flows below 3.4 or 3.3 m^3/s, and completely cease abstraction at flows of 2.7 or 2.5 m^3/s (see pages 81 & 82, Roygard *et al*., 2006). If the water abstraction consents in the Raparapawai Water Management Sub-zone were to be managed using a minimum flow restriction on the Manawatu at the Hopelands flow recorder, the relevant minimum flow would be 2.980 m^3/s, as recommended by the WRA (Roygard *et al.*, 2006).

Surety of supply analysis on this minimum flow (including the current allocation in the catchment above the monitoring site) indicates that the minimum flow of 2.980 m^3/s at the Manawatu at Hopelands flow monitoring site would be likely to occur on 21 days per year on average and up to a maximum of 74 days per year (Table 19, pg. 45, S42A Report of Raelene Hurndell).

By comparison, the minimum flow of 0.033 l/s (70% habitat retention) at the Raparapawai at Jacksons Rd flow monitoring site, at the recommended level of core allocation[1], is likely to occur on 6 days per year on average, and on up to 18 days per year (Table 17, pg. 43, S42A Report of Raelene Hurndell).

By comparison, the minimum flow of 0.033 l/s (70% habitat retention) at the Raparapawai at Jacksons Rd flow monitoring site, at the current level of allocation[2] for surface water irrigation of 4,620 m^3/day, is likely to occur on 20 days per year on average, and on up to 64 days per year (Table 17, pg. 43, S42A Report of Raelene Hurndell).

[1] The notified core allocation limit was 0.024 m^3/s and this was changed to 0.015 m^3/s in the evidence of Raelene Hurndell to incorporate the findings of Hurndell *et al*. (2008). The recommended core allocation limit of Hurndell *et al*. (2008) was 30% of MALF (0.044 m^3/s), which equates to 0.013 m^3/s (1140 m^3/day). This was rounded to 0.015 m^3/s, which equates to 1,296 m^3/day (as recommended in supplementary evidence). Surety of supply calculations in Hurndell *et al*. (2008) used the value of 0.013 m^3/s. These surety of supply numbers are utilised in this report.

[2] Surety of supply calculations in Hurndell *et al*. (2008) used 4,620 m^3/day as the level of current allocation. As shown in table in this report, current allocation in 2010 is 4,805.4 m^3/day

Further information on these surety of supply calculations and similar calculations for other scenarios are presented in Hurndell *et al*. (2008).

Table 2: Summary of the consent history for irrigation abstractions in the Raparapawai Water Management Sub-zone from 2003

Consent holder	Consent number	Consent commence date	Consent end date	Term	Telemetered data record available from:	Daily maximum volume (m^3/day)	Maximum instantaneous rate (24 hrs) (m^3/s)	Maximum instantaneous rate (consented) (L/s)	Flow monitoring site	Minimum flow restriction (m^3/s)
Rapawai Trust (Harris)	101242	4/4/2003	1/5/2006	~ 3 years	n/a	1,440	0.017	16.6	Manawatu at Hopelands	< 3.3
								8.3	Manawatu at Hopelands	> 3.3
								0	Manawatu at Hopelands	> 2.5
Rapawai Trust (Harris)	103550	31/08/06	1/5/2016	~10 years	14 Sept 2006	1,440	0.017	16.7	Raparapawai at Jacksons Rd	< 0.074
								0	Raparapawai at Jacksons Rd	> 0.074
Cammock	101270	4/4/2003	1/5/2006	~ 3 years	n/a	1,500	0.017	15	Manawatu at Hopelands	< 3.3
								7.5	Manawatu at Hopelands	> 3.3
								0	Manawatu at Hopelands	> 2.5
Cammock	103705	31/8/2006	1/5/2016	~10 years	31 Aug 2006	1,500	0.017	17.4	Raparapawai at Jacksons Rd	< 0.074
								0	Raparapawai at Jacksons Rd	> 0.074
Verwaayen	101208	4/4/2003	1/5/2006	~ 3 years	n/a	1,680	0.019	19.4	Manawatu at Hopelands	< 3.3
								9.7	Manawatu at Hopelands	> 3.3
								0	Manawatu at Hopelands	> 2.5
Verwaayen	103549	31/8/2006	1/5/2016	~10 years	31 Aug 2006	1,680	0.019	19.4	Raparapawai at Jacksons Rd	< 0.074
								0	Raparapawai at Jacksons Rd	> 0.074

References

Hay, J., Hayes J. (2007). Instream Flow Assessment for the Upper Manawatu River and Tributaries: additional Analyses (with Addendum). Prepared for Horizons Regional Council. Cawthron Report No. 1029. 83p.

Hurndell, R., Watson, B., & Roygard, J. (2008). Raparapawai and Oruakeretaki Minimum Flow Review 2008: Technical report to support policy development, Report No. 2008/EXT/939.

Roygard, J., Watson, J. & Clark, M. (2006). Water Allocation Project Upper Manawatu Catchment: Water Resource Assessment – allocation limits and minimum flows: Technical report to support policy development, Report No. 2006/EXT/864.