Arthur Marble Recharge Zone – cease take review

29 July 2016

tasman district council

Outcomes from last meeting - TWS

- There should be a cease take for the AMA Recharge (TWS) to protect ecological values in times of severe drought
- Rationing step not practical at springs as the recession is too quick (days)
- The cease take should be measured at TWS main spring – not justifiable at Fish Creek Spring
- The TWS cease take should not apply to takes in the Upper Takaka River as there is a poor correlation between river flows and spring flows
- The TWS cease take should apply to all takes that do not have their own regime based cease takes
    - Ie Middle Takaka and Upper Takaka Tributaries – eg Waitui takes

- Remaining issue - what level should the cease take at TWS be? and where it should apply?

Outcomes from last meeting – Upper Takaka

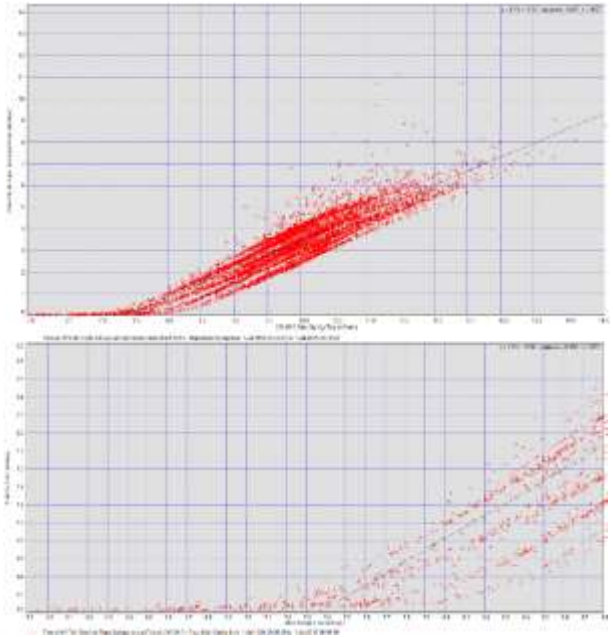
- Staff recommend use of 7day statistics and instantaneous flows - rather than 1day and average statistics
  - Managing ecological impacts from lowest flows
  - For consistency with other areas
  - Allows for additional allocation

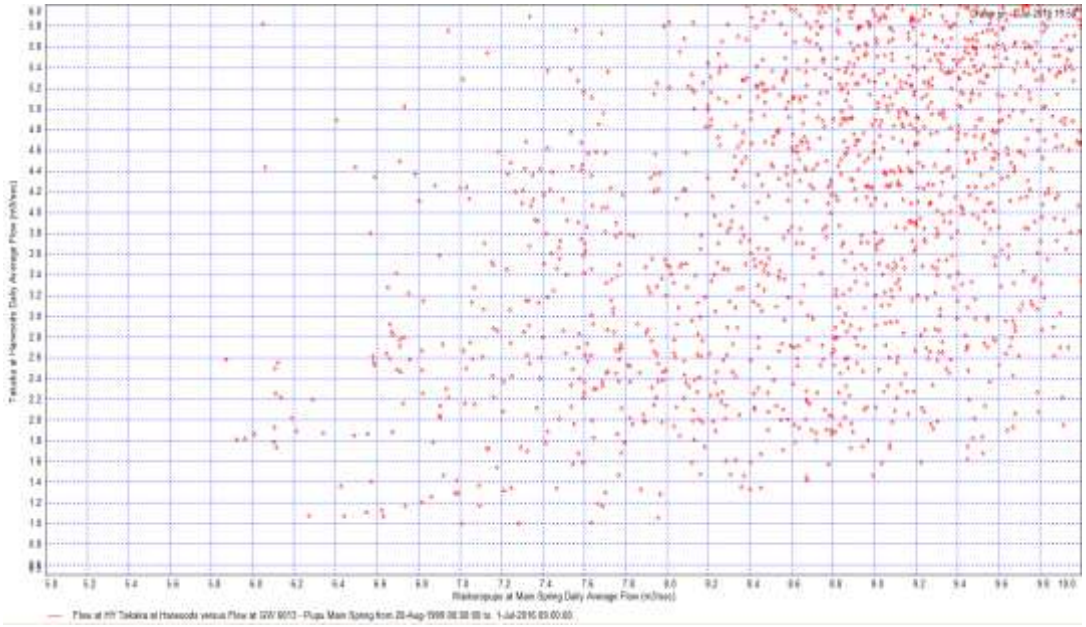
- Remaining Issue - concern from irrigators about security of supply in the 70:15 regimes for Upper Takaka
  - 3 options to consider

Outcomes from last meeting – Fish Creek Springs

- A cease take at Fish Creek Springs is not justifiable:
  - There is a poor correlation between Takaka River flows and the spring flows
  - Allocation influence on drying of Fish Creek will be avoided by a cease take at the main spring of at least 6100 l/s - proposed triggers are above this
  - The security of supply based on Fish Creek flows is significantly lower than a trigger at the main spring

    Eg for 2009-10 drought:
    - TWS MALF (7660 l/s) would have resulted in 24.5 days consecutive cease take
    - Fish Creek MALF (665 l/s) would have resulted in 61 days consecutive cease take
  - There is poor justification for benefits against costs - ie no measurable effect on flow protection and ecological values, against a poorer security of supply





Remaining questions – AMA Recharge: TWS

- At what level should the cease take at TWS be and where should it apply
  - Protect minimum flows and ecological values
  - What security of supply to provide
  - Be justifiable in terms of benefits and costs
  - Be practical for implementation and compliance monitoring

- Several options for cease take trigger level at TWS
  - All options are expected to protect ecological values of TWS
  - Interim 90:10 regime: minimum flow of 90% of MALF = 6895 l/s OR
  - Previously discussed cease take: minimum flow of 100% of MALF = 7661 l/s OR
  - Provision of similar security of supply (Nov-Apr) as existing Upper Takaka takes: minimum flow of 96% of MALF = 7350 l/s

~60:10 – existing Upper Takaka

Upper Takaka Status Quo -1657 l/s

Takaka at Harwoods Data record: 1975 - 2015	Flow (l/s)		Days Below Flow (l/s) Per Hydrological Year (August to July)															
			1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Based on 15min interval instantaneous flows																			
Cease Take 1657 l/s - Minimum Flow		Average:																	
Cease Take - number of days below (total)	1657	7.8	0.0	0.5	0.0	0.0	0.0	0.2	22.0	2.8	18.6	9.2	21.8	7.2	0.0	12.3	4.2	10.6	23.5
Cease Take - # of times > 3 days in a row below 1657 l/s	1657	2 times	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Cease Take - longest consecutive # days below 1657 l/s	1657	2 years	0	0	0	0	0	0	0	0	0	0	5 days	0	0	0	0	4.5 days	0
Cease Take - # of times > 5 days in a row below 1657 l/s	1657	1 time	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Cease Take - longest consecutive # days below 1657 l/s	1657	1 year	0	0	0	0	0	0	0	0	0	0	5 days	0	0	0	0	0	0
Cease Take - # of times > 1 day in a row below 1657 l/s	1657	29 times	0	0	0	0	0	0	6	0	2	1	4	1	0	4	1	5	5
Cease Take - longest consecutive # days below 1657 l/s	1657	9 years	0	0	0	0	0	0	2 days	0	2 days	1 day	4 days	1 day	0	1 day	1 days	4 days	2 days
Cease Take - # of times > 12 hours in a row below 1657 l/s	1657	111 times	0	1	0	0	0	0	14	2	14	8	16	3	0	11	3	13	26
	1657	11 years																	

% of time flow is above cease take trigger 1657 l/s (based on data from 1975-2016, Nov-Apr inclusive) 95.9%

~96:10 - AMA Recharge at TWS

Te Waikoropupu Springs

GW 6013 Data - 1999 to 2016	Flow (l/s)		Days Below Flow (l/s) Per Hydrological Year (August to July)															
			1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Based on 15min interval instantaneous flows																			
Cease Take 7350 l/s (Level: 14820 mm)		Average:																	
Cease Take - number of days below (total)	7350	7.7	0.0	20.0	0.0	0.0	2.5	1.0	58.0	0.0	0.0	0.0	28.5	0.0	0.0	0.0	4.5	2.5	14.0
Cease Take - # of times > 3 days in a row below 7350 l/s	7350	4 years	0	2.0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	1.0
Cease Take - longest consecutive # days below 7350 l/s	7350	7 times	0	10.5 days	0	0	0	0	30 days	0	0	0	18.5 days	0	0	0	0	0	14 days
Cease Take - # of times > 5 days in a row below 7350 l/s	7350	4 years	0	2	0	0	0	0	2	0	0	0	1.0	0	0	0	0	0	1.0
Cease Take - longest consecutive # days below 7350 l/s	7350	6 times	0	10.5 days	0	0	0	0	30 days	0	0	0	18.5 days	0	0	0	0	0	14 days
Cease Take - # of times > 1 day in a row below 7350 l/s	7350	7 years	0	20	0	0	2	0	28	0	0	0	21	0	0	0	3	1	13.0
Cease Take - longest consecutive # days below 7350 l/s	7350	88 times	0	10 days	0	0	2 days	0	28 days	0	0	0	18 days	0	0	0	1 day	1 day	13 days

Duration (for all record):

Flow was greater than 7350 l/s 97.8% of the time between August 1999 and August 2016 (all year)

Flow was greater than 7350 l/s 95.9% of the time between August 1999 and August 2016 (Nov-Apr incl)

Remaining questions – AMA Recharge (TWS)

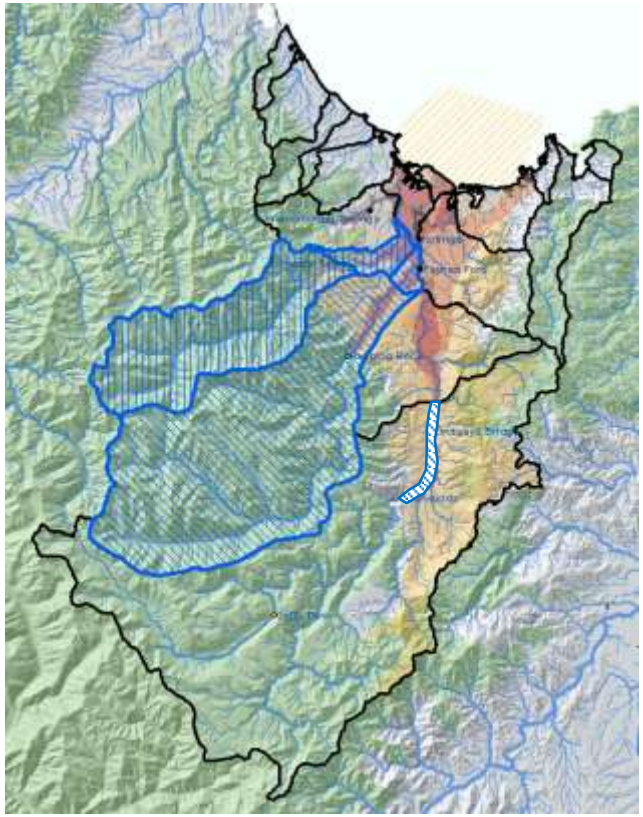
Option	Regime	Cease Take Trigger	Minimum flow protected*	Security % above Nov-April	Security No. of CT/yrs >3day	Security No. of cease takes/yrs >5day
1	90:10	6895 l/s	6895 l/s* (90% of MALF)	98.0%	8 CT in 4 of 17yrs	5 CT in 4 of 17yrs
2	96:10	7350 l/s	7350 l/s* (96% of MALF)	95.9%#	7 CT in 4 of 17yrs	6 CT in 4 of 17yrs
3	100:10	7661 l/s	7661 l/s* (100% of MALF)	93.6%	15 CT in 8 of 17yrs	13 CT in 7 of 17yrs
4	90:10	None	No specific minimum flow Some flow protected via contributing regime triggers (Upper Takaka main stem and Waingaro Zones)	~100% no cease take where no catchment regime	No cease take where no catchment regime	No cease take where no catchment regime

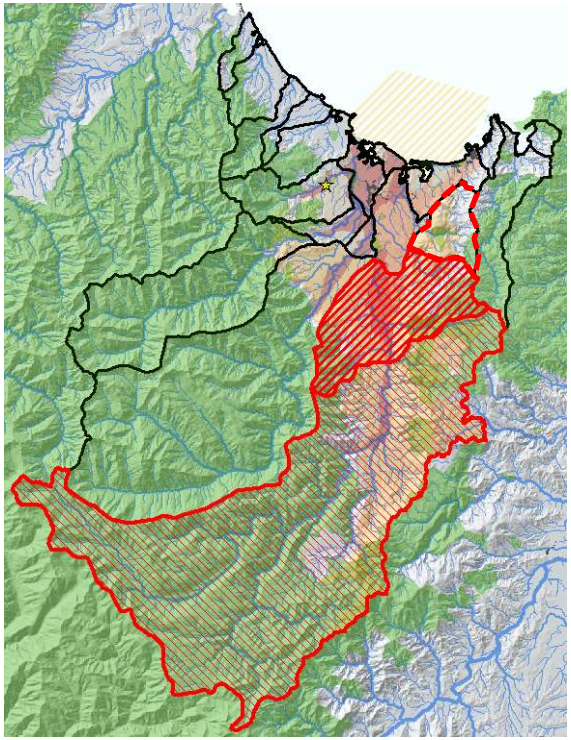
* As trigger site is below takes the Cease Take Trigger equals the flow being protected
# to be consistent with existing Upper Takaka take security of supply

Where should TWS cease take apply?

- Staff recommend TWS cease take NOT apply to:
  - Anatoki Zone – as losses to groundwater, but no link to TWS flows*
  - Waingaro Zone – as only 8% (6% ±6%) of flows estimated to affect TWS flows*
  - Upper Takaka Zone (main stem takes) – as poor correlation between river flows and spring flows and TWS cease take would stop irrigators benefitting from Cobb fluctuations
  - Local regime cease takes will still apply in each zone

**Flow contribution research: GNS 2001, Edgar 1998, Mueller 1993*

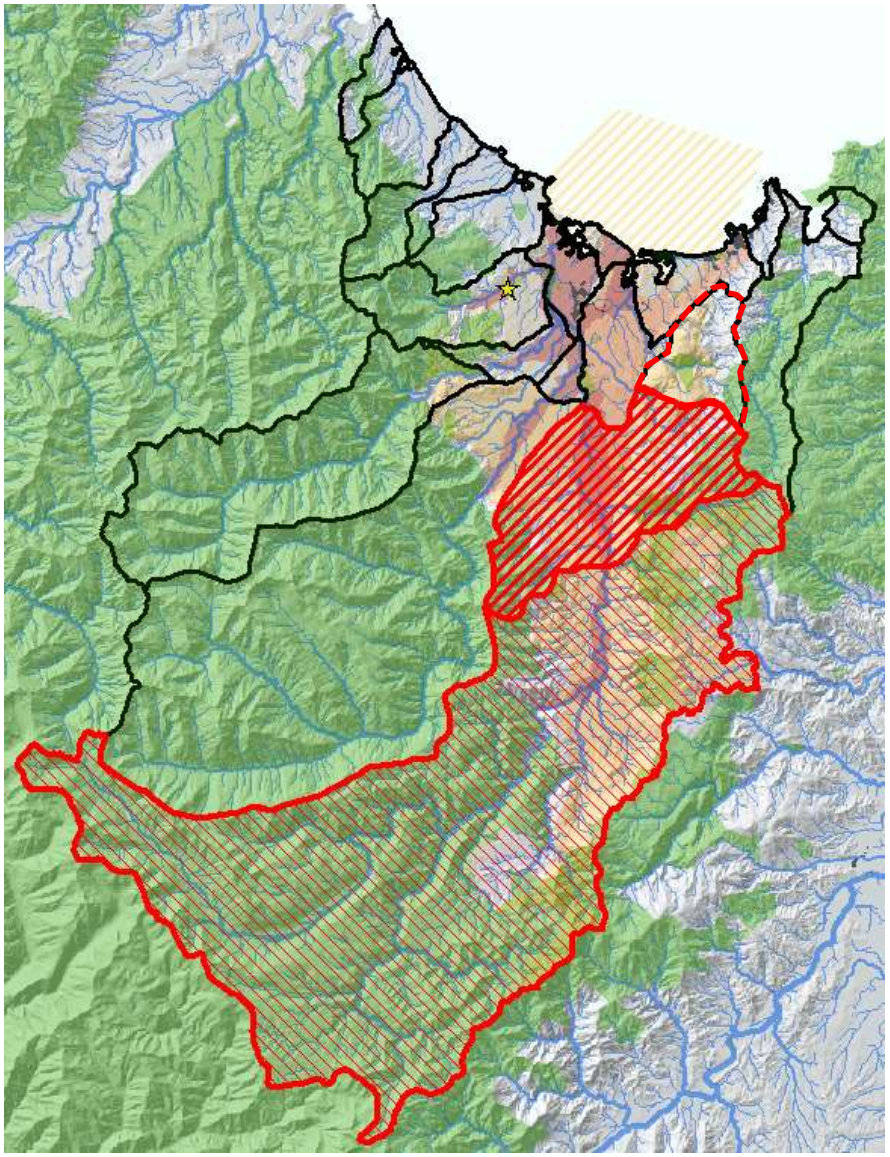




- Staff recommend TWS cease take applies to:
  - Existing and new takes in the Middle Takaka Area (GW + SW)
  - Existing takes from tributaries in the Upper Takaka Area (eg Waitui)
  - Groundwater takes from the unconfined AMA not covered by a local regime
- These takes do not have local regimes with cease take
- Recommending all new takes in this area are from AMA – ie no new surface water takes

Summary – AMA and TWS

- Options 1-3 (90, 96, 100%) expected to protect ecological values
- Option 2 (96%) will provide a similar security of supply as the current Upper Takaka takes
  - For takes in the tributaries in Upper Takaka area and takes in the Middle Takaka area (red in map)
- Upper Takaka (mainstem) Zone, Waingaro and Anatoki all managed through their respective regimes



Remaining questions – Upper Takaka (river)

- Irrigators have expressed concern with security under the 70:15 regime
- There are several options for managing existing takes:
  - 1. Use the 70:15 regime and cease take trigger (2023 l/s) for all takes - existing and new
    - Protects a minimum flow of 70% of 7d-MALF (1666 l/s)
  - 2. A+B tiered approach:
    - Existing takes (A takes) grandfathered to current allocation/cease take (1657 l/s) (60:10)
      - Protects a minimum flow of ~60% of 7d-MALF (1417 l/s)
    - New takes (B takes) (up to 15%MALF allocation limit) uses the 70:15 cease take trigger
      - Protects a minimum flow of 70% of 7d-MALF (1666 l/s)
  - 3. A(modified)+B tiered approach:
    - Existing takes (A takes) have higher cease take than currently (1900 l/s) (~70:10)
      - Protects a minimum flow of 70% of 7d-MALF (1666 l/s)
    - New takes (B takes) (up to15%MALF allocation limit) uses the 70:15 cease take trigger
      - Protects a minimum flow of 70% of 7d-MALF (1666 l/s)
- Considerations: Upper Takaka is an unusual river due to the Cobb influence
  - Ecological effects are not as readily linked to flows as with other rivers
  - Users can be cut off regularly, but typically only for short periods of time

~60:10

Upper Takaka Status Quo -1657 l/s

Takaka at Harwoods Data record: 1975 - 2015	Flow (l/s)		Days Below Flow (l/s) Per Hydrological Year (August to July)															
			1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Based on 15min interval instantaneous flows																			
Cease Take 1657 l/s - Minimum Flow		Average																	
Cease Take - number of days below (total)	1657	7.8	0.0	0.5	0.0	0.0	0.0	0.2	22.0	2.8	18.6	9.2	21.8	7.2	0.0	12.3	4.2	10.6	23.5
Cease Take - # of times > 3 days in a row below 1657 l/s	1657	2 times	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Cease Take - longest consecutive # days below 1657 l/s	1657	2 years	0	0	0	0	0	0	0	0	0	0	5 days	0	0	0	0	4.5 days	0
Cease Take - # of times > 5 days in a row below 1657 l/s	1657	1 time	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Cease Take - longest consecutive # days below 1657 l/s	1657	1 year	0	0	0	0	0	0	0	0	0	0	5 days	0	0	0	0	0	0
Cease Take - # of times > 1 day in a row below 1657 l/s	1657	29 times	0	0	0	0	0	0	6	0	2	1	4	1	0	4	1	5	5
Cease Take - longest consecutive # days below 1657 l/s	1657	9 years	0	0	0	0	0	0	2 days	0	2 days	1 day	4 days	1 day	0	1 day	1 days	4 days	2 days
Cease Take - # of times > 12 hours in a row below 1657 l/s	1657	111 times	0	1	0	0	0	0	14	2	14	8	16	3	0	11	3	13	26
	1657	11 years																	

% of time flow is above cease take trigger 1657 l/s (based on data from 1975-2016, Nov-Apr inclusive) 95.9%

70:15

Upper Takaka FLAG Trigger - 70% MALF & 15% Allocation

Takaka at Harwoods Data record: 1975 - 2015	Flow (l/s)		Days Below Flow (l/s) Per Hydrological Year (August to July)															
			1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Based on 15min interval instantaneous flows																			
Cease Take 2023 l/s (Min Flow + Allocation)		Average:																	
Cease Take - number of days below (total)	2023	15.8	0.0	12.5	0.0	6.3	10.1	9.6	37.4	11.2	31.5	18.9	33.3	14.6	0.0	18.7	6.2	18.1	40.0
Cease Take - # of times > 3 days in a row below 2023 l/s	2023	6 years	0	1.0	0	0	0.0	0	0.0	0	1.0	1	1.0	0	0	0	0	1	2
Cease Take - longest consecutive # days below 2023 l/s	2023	7 times	0	4.5 days	0	0	0.0	0	0	0	4 days	3 days	5 days	0	0	0	0	4.8 days	4 days
Cease Take - # of times > 5 days in a row below 2023 l/s	2023	1 year	0	0	0	0	0	0	0	0	0	0	1.0	0	0	0	0	0	0
Cease Take - longest consecutive # days below 2023 l/s	2023	1 time	0	0	0	0	0	0	0	0	0	0	5 days	0	0	0	0	0	0
Cease Take - # of times > 1 day in a row below 2023 l/s	2023	56 times	0	5	0	0	2	1	7	1	5	3	8	3	0	4	2	6	9
Cease Take - longest consecutive # days below 2023 l/s	2023	13 years	0	3 days	0	0	2 days	1 day	2 days	1 day	3 days	2 days	4 days	2 days	0	1 day	1 day	4 days	3 days
Cease Take - # of times > 12 hours in a row below 2023 l/s	2023	264 times	0	16	0	4	10	9	32	11	36	17	27	13	0	19	5	20	45
	2023	14 years																	

% of time flow is above cease take trigger 2023 l/s (based on data from 1975-2016, Nov-Apr inclusive) 92.6%

~70:10

Upper Takaka Status Quo plus current abstractions - 1900 l/s

Takaka at Harwoods Data record: 1975 - 2016	Flow (l/s)		Days Below Flow (l/s) Per Hydrological Year (August to July)															
			1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Based on 15min interval instantaneous flows																			
Cease Take 1900 l/s		Average:																	
Cease Take - number of days below (total)	1900	12.7	0.0	8.6	0.0	2.5	6.0	4.0	32.5	8.0	27.8	15.0	29.5	12.5	0.0	16.5	5.5	15.2	32.2
Cease Take - # of times > 3 days in a row below 1900 l/s	1900	6 times	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	3
Cease Take - longest consecutive # days below 1900 l/s	1900	4 years	0	0	0	0	0	0	0	0	4 days	0	5 days	0	0	0	0	4.8 days	4 days
Cease Take - # of times > 5 days in a row below 1900 l/s	1900	1 time	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Cease Take - longest consecutive # days below 1900 l/s	1900	1 year	0	0	0	0	0	0	0	0	0	0	5 days	0	0	0	0	0	0
Cease Take - # of times > 1 day in a row below 1900 l/s	1900	45 times	0	3	0	0	2	1	6	0	4	1	5	2	0	4	1	5	11
Cease Take - longest consecutive # days below 1900 l/s	1900	12 years	0	1 day	0	0	2 days	1 day	2 days	0	3 days	1 day	4 days	1 day	0	1 day	1 day	4 days	2 days
Cease Take - # of times > 12 hours in a row below 1900 l/s	1900	202 times	0	10	0	0	6	5	27	8	30	11	20	11	0	14	4	17	39
	1900	13 years																	

% of time flow is above cease take trigger 1900 l/s (based on data from 1975-2016, Nov-Apr inclusive) 93.7%

Remaining questions – Upper Takaka (river)

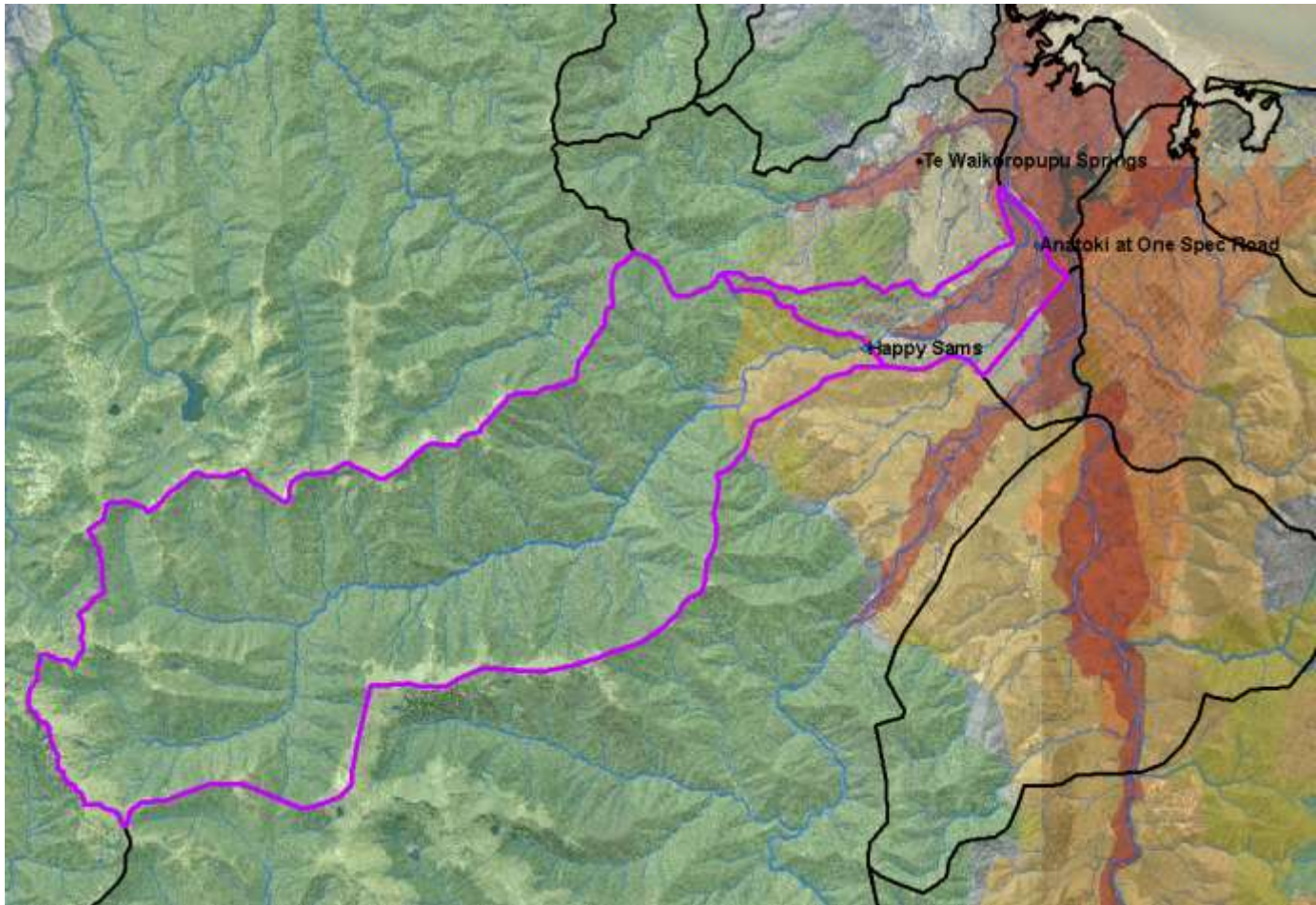
Option	Regime	Cease Take (CT) Trigger	Minimum flow protected	Security % above Nov-April	Security % of years with CT>3days	Security % of years with CT>5days
1	**70:15** (all takes)	2023 l/s	1666 l/s (70%)	92.6%	7 CT in 6 of 17yrs	1 CT in 1 of 17yrs
2	**A+B (70:15)**					
	[status quo] A = 60:10	1657 l/s	1417 l/s (60%)	95.9%	2 CT in 2 of 17yrs	1 CT in 1 of 17yrs
	B = 70:15 (remainder)	2023 l/s	1666 l/s (70%)	92.6%	7 CT in 6 of 17yrs	1 CT in 1 of 17yrs
3	**A(mod)+B (70:15)**					
	A(mod) = 70:10	1900 l/s	1666 l/s (70%)	93.7%	6 CT in 4 of 17yrs	1 CT in 1 of 17yrs
	B = 70:15 (remainder)	2023 l/s	1666 l/s (70%)	92.6%	7 CT in 6 of 17yrs	1 CT in 1 of 17yrs

Questions?

tasman district council

Anatoki – 90:10 Allocation Regime

- Protects a minimum flow of 90% of MALF at Happy Sams of 1940 l/s
- Provides an allocation limit of 10% of MALF at One Spec Road of 171 l/s
  - Rationing step at 100% of MALF at Happy Sams at 2111 l/s
  - Cease take at 95% of MALF at Happy Sams at 2026 l/s
  - Rationing and cease take applies to all groundwater and surface water takes in zone
- Anatoki River loses water to groundwater, but research shows no correlation to flows at Te Waikoropupu Springs



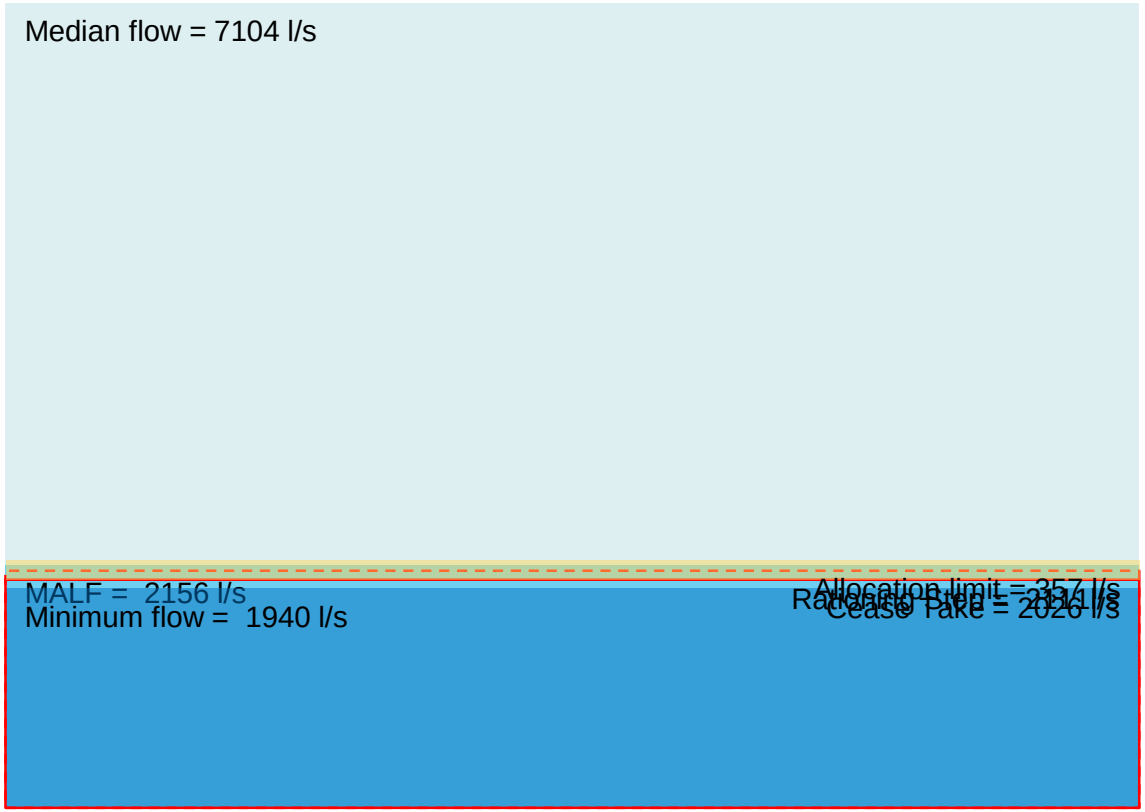
Anatoki – 90:10 Allocation Regime

Happy Sams statistics:

Median flow = 7104 l/s

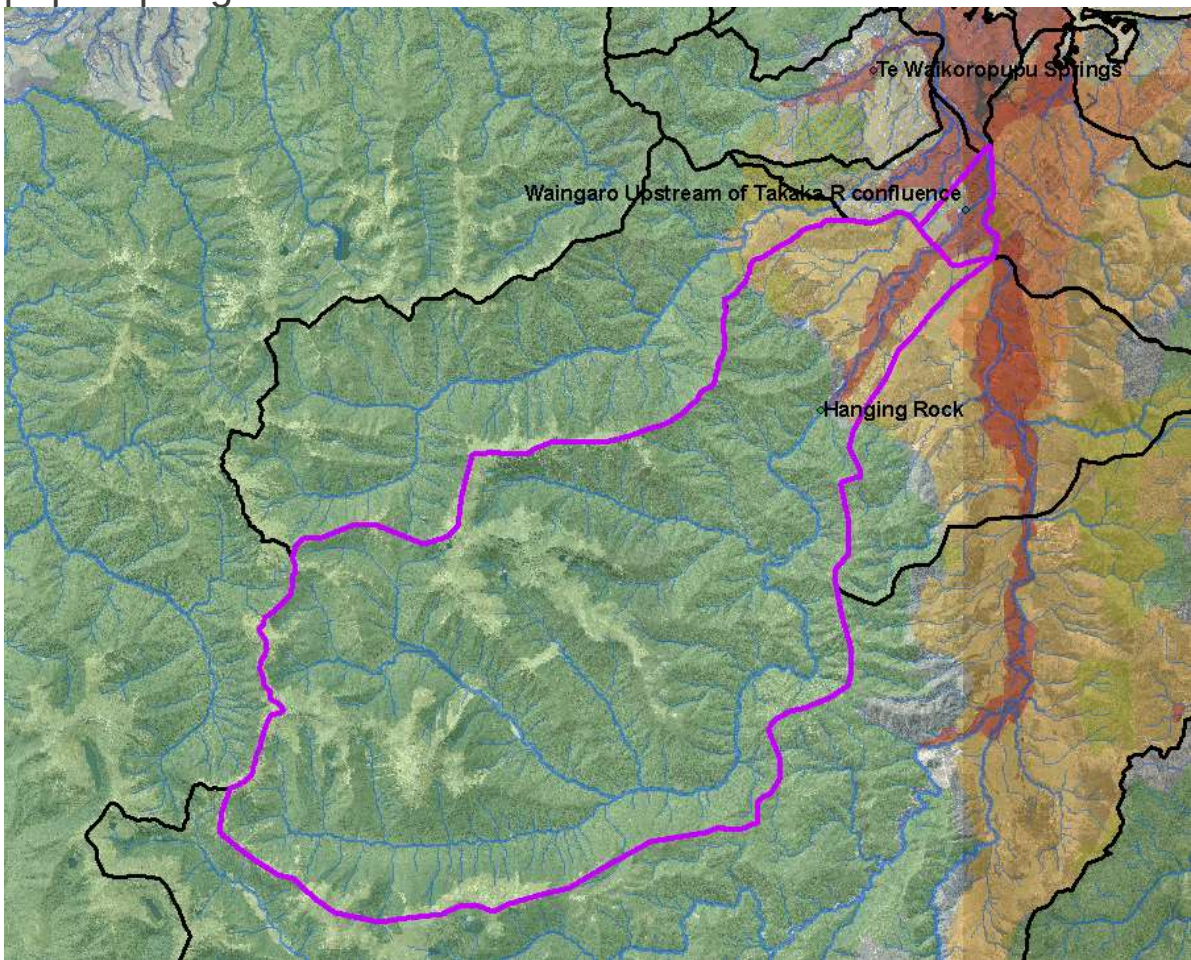
(half of measured flows above and below this)

MALF = 2156 l/s



Waingaro – 80:20 Allocation Regime

- Protects a minimum flow of 80% of MALF at Hanging Rock of 2868 l/s
- Provides an allocation limit of 20% of MALF at U-S confluence site of 550 l/s
  - Rationing step at 100% of MALF at Hanging Rock at 3418 l/s
  - Cease take at 90% of MALF at Hanging Rock at 3143 l/s
  - Rationing and cease take applies to all groundwater and surface water takes in zone
- Waingaro River loses an estimated average of 8% (0-12%) of water to groundwater that contributes flow to Te Waikoropupu Springs



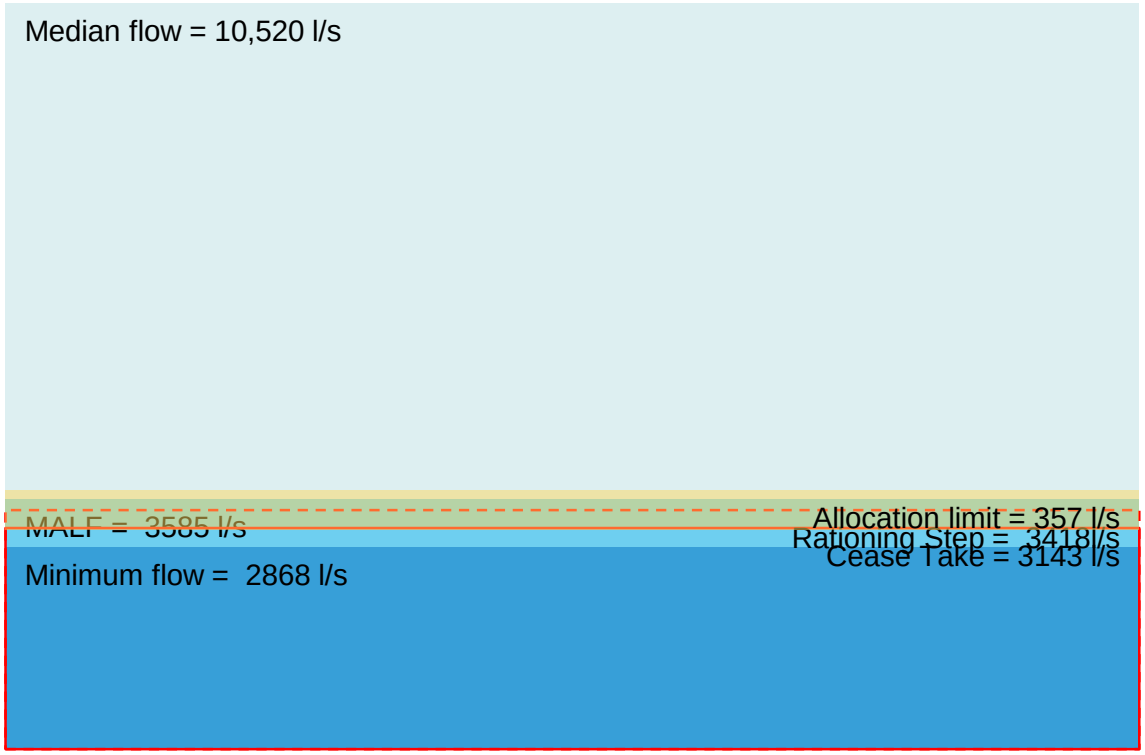
Waingaro- 80:20 Allocation Regime

Hanging Rock statistics:

Median flow = 10,520 l/s

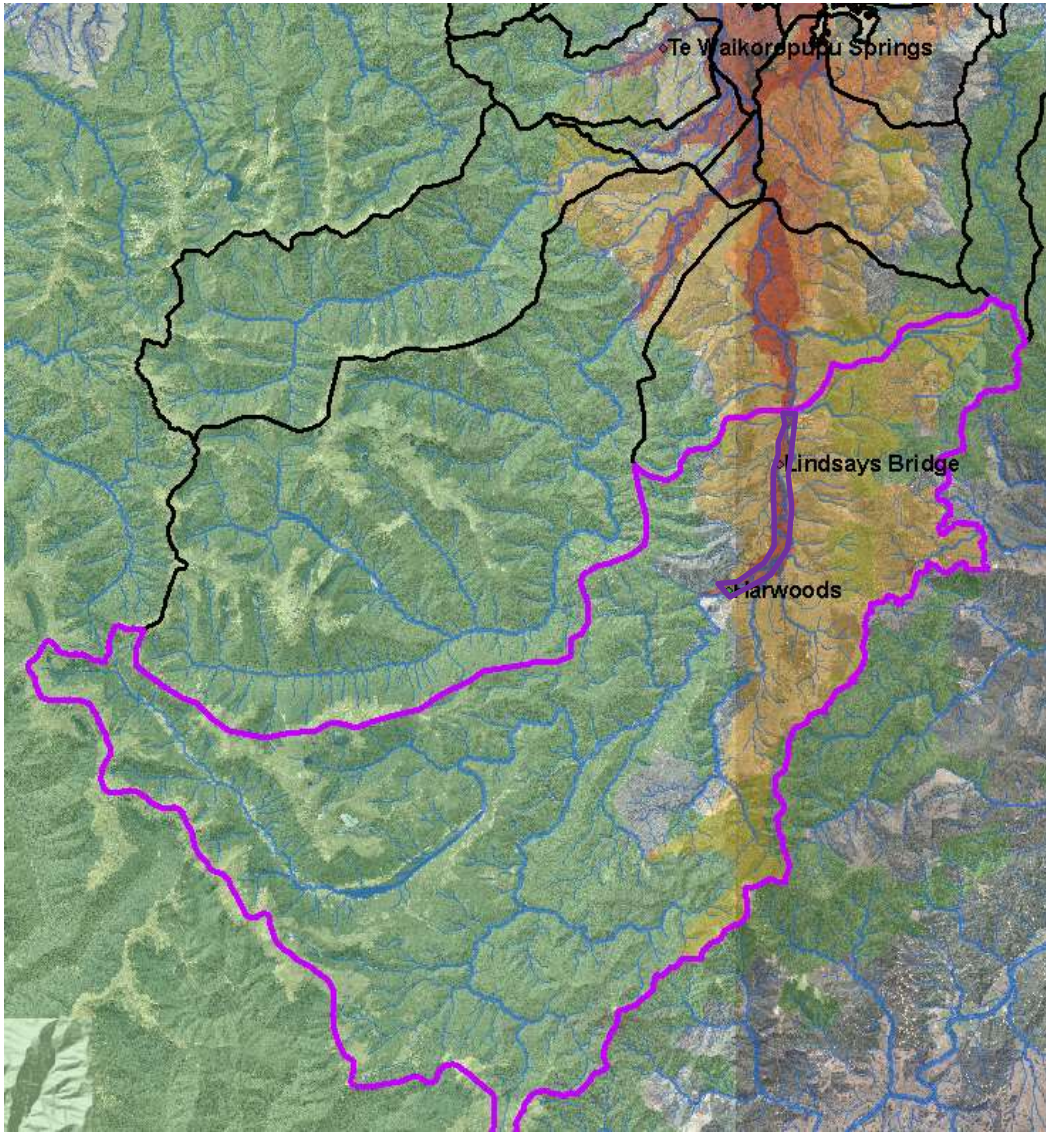
(half of measured flows above and below this)

MALF = 3585 l/s



Upper Takaka – 70:15 Allocation Regime

- Protects a minimum flow of 70% of MALF at Harwoods of 1666 l/s
- Provides an allocation limit of 15% of MALF at Harwoods of 357 l/s
  - Cease take at 85% of MALF at Harwoods at 2023 l/s
  - Cease take applies to all Takaka River main stem surface water takes in zone
- Takaka River (upper and middle areas) loses up to 100% of flows to groundwater depending on conditions, and an estimated 47-55% of water contributes to flows at Te Waikoropupu Springs
- However there is a poor correlation between Upper Takaka River flows and spring flows
- Concern from irrigators over security of supply under this regime



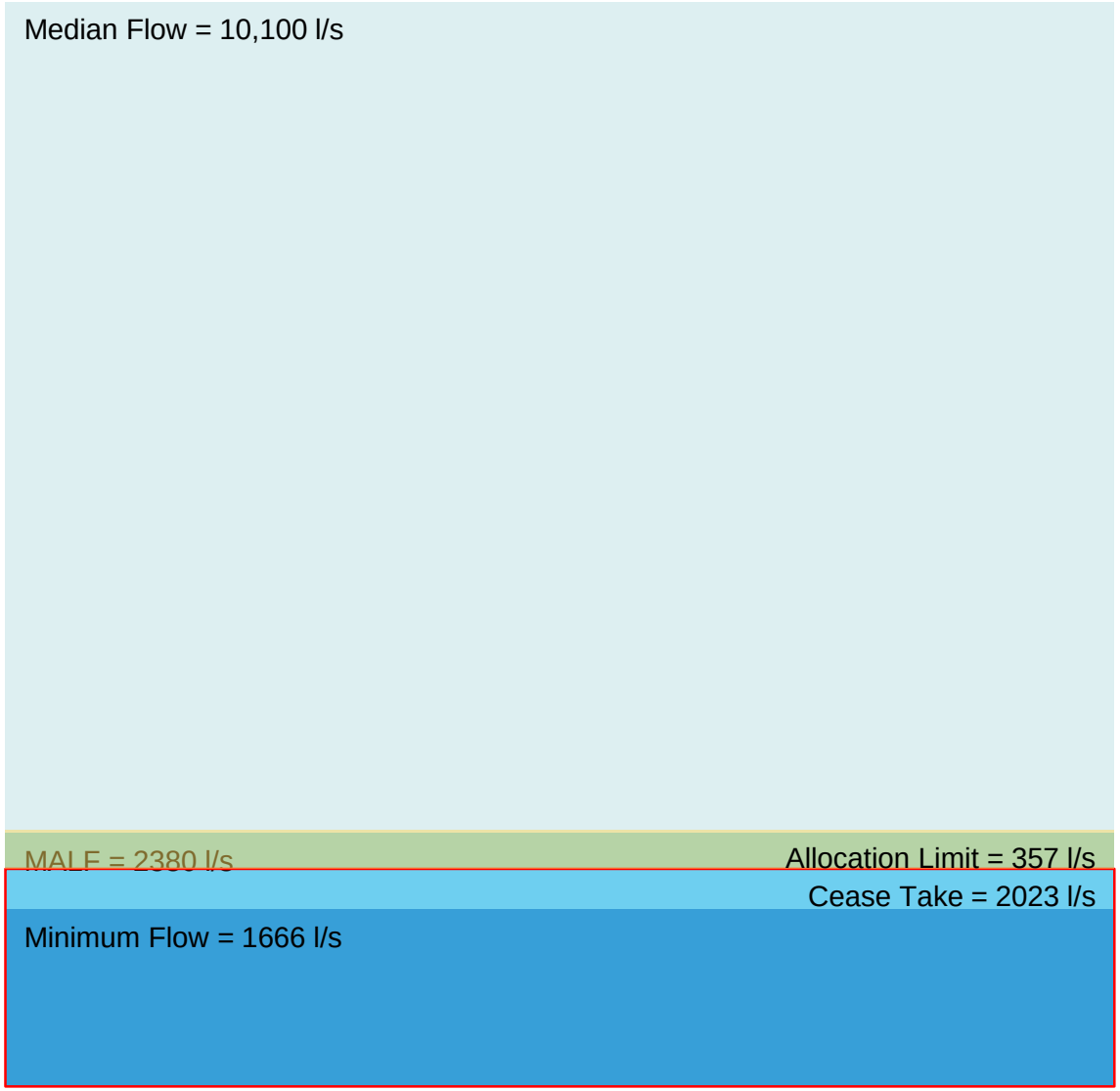
Upper Takaka (main stem) 70:15 Allocation Regime

Harwood statistics:

Median flow = 10,100 l/s

(half of measured flows above and below this)

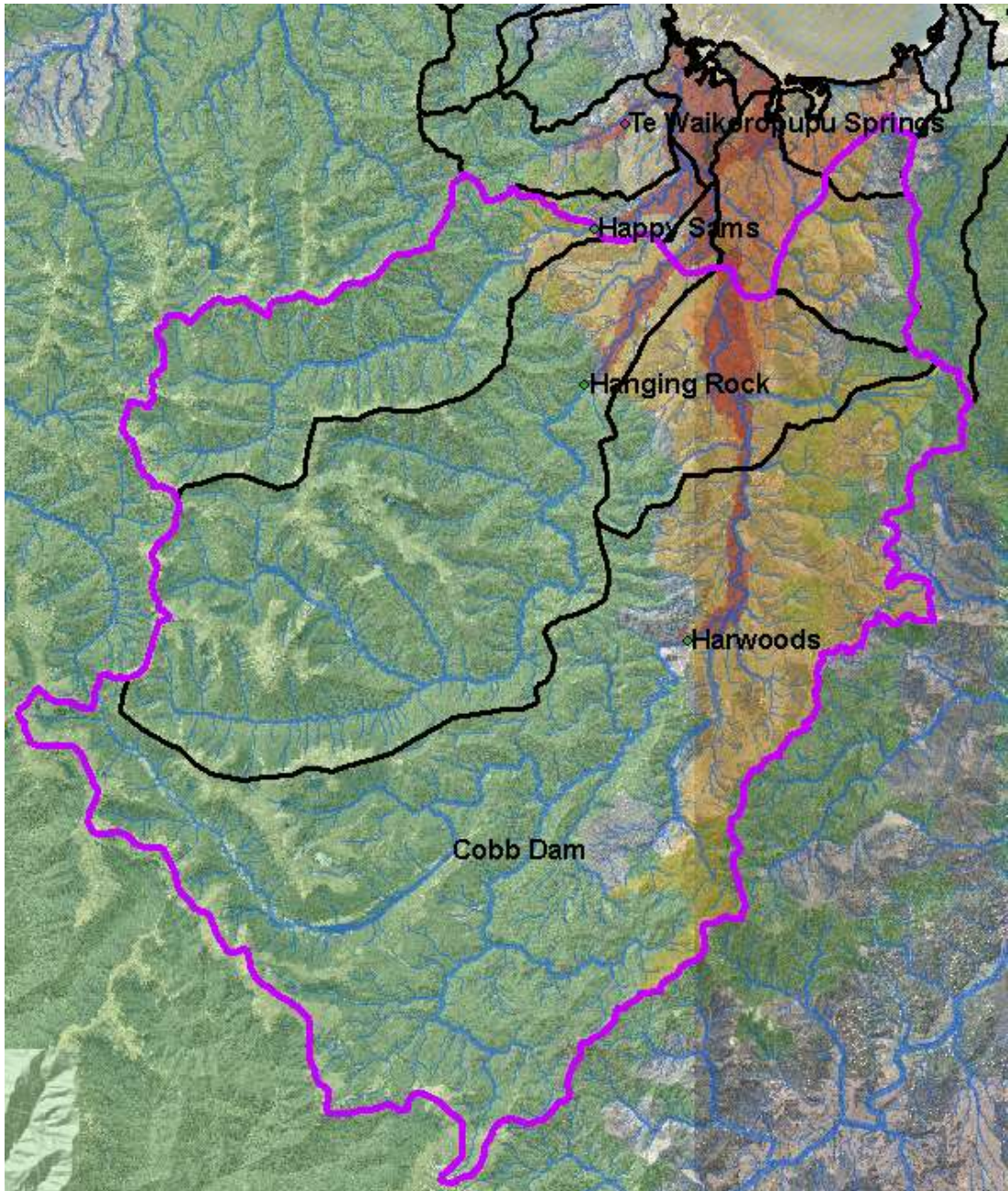
MALF = 2380 l/s



AMA Recharge – 90:10 Allocation Regime (to date)

- Because the measurement site (TWS) is below all the takes the cease take level is the flow protected
- Protects a minimum flow of 100% of MALF at main spring of 7661 l/s
- Provides an allocation limit of 10% of MALF at main spring of 766 l/s
  - Cease take at 100% of MALF at main spring at 7661 l/s (to be reviewed)

- Concern over validity of applying cease take to all takes in the recharge zone
- Several options



AMA Recharge – 90:10 Allocation Regime

TWS statistics:

Median flow = 9940 l/s

(half of measured flows above and below this)

MALF = 7661 l/s