

# Implications of further HWRRP minimum flow review deferral on ecological values

HW Zone Committee Meeting, 16 October 2017

Graeme Clarke, Jeanine Topélen, Ned  
Norton, Kimberley Dynes, Suzanne  
Gabites and Hamish Graham

# Summary of results

Continuing to delay implementing the HWRRP minimum flows for all consented users has the following environmental implications:

- i. Potentially significant negative implications for salmon migration in both rivers but particularly in the Waiau River;
- ii. Slightly negative implications for:
  - The risk of potential mouth closure in both rivers, but more so in the Waiau River
  - Jetboat passage in both rivers
  - Riverbed bird nesting and feeding in the Hurunui River
- iii. Negligible effect on:
  - Nuisance periphyton growth
  - Riverbed bird nesting and feeding in the Waiau River
  - Groundwater quality.
- iv. No effect on sediment transport and geomorphology

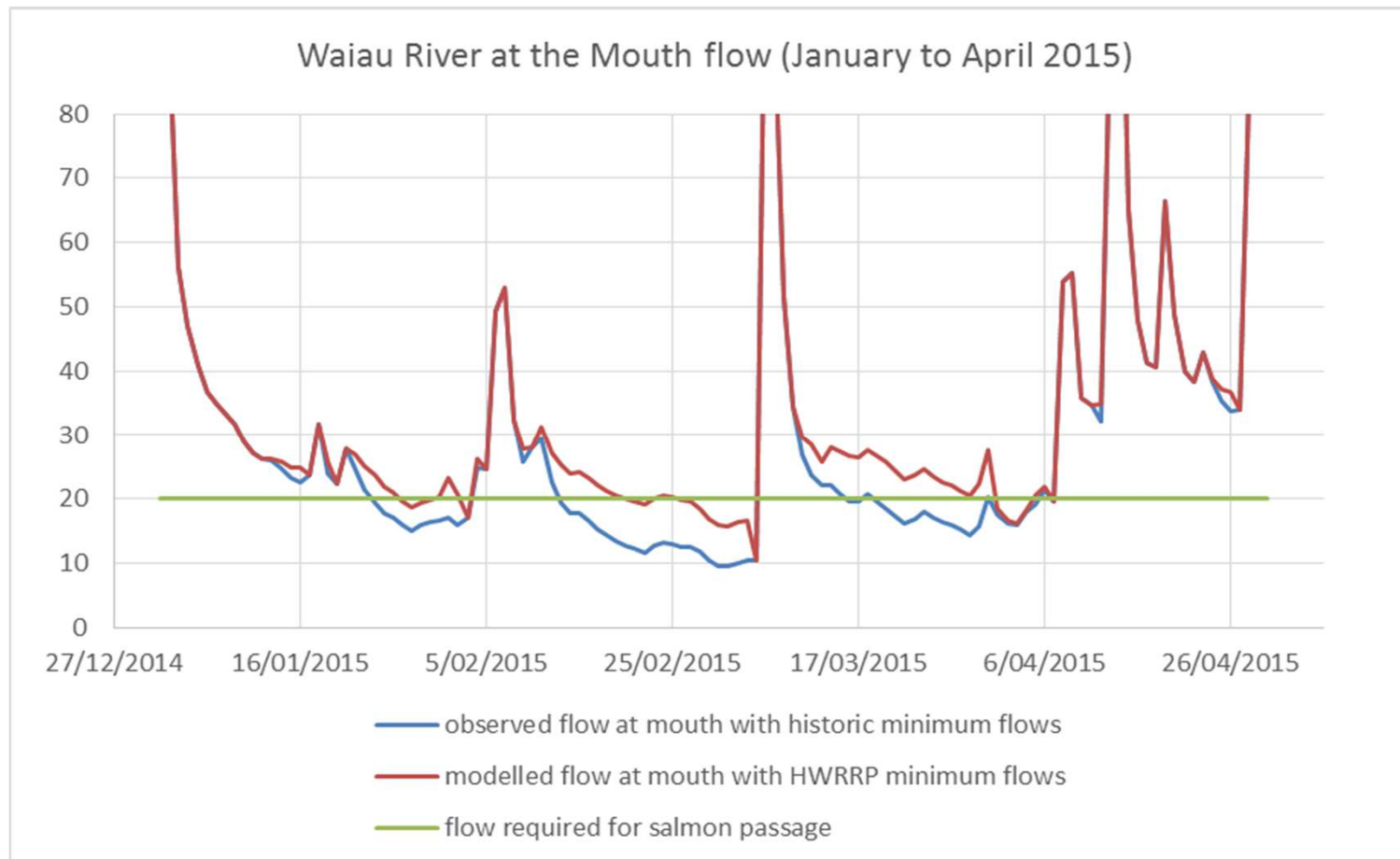
# Environmental implications of continuing to delay consent review

## Approach:

- Assessed hydrological data (measured and modelled (AIC)) to describe what river would have looked like had new regime been in place
- Used plan evidence and related material to describe risks and implications for the environmental values identified
- The simulated flows, and hence the assessment, does not take into account any changes that may occur with the piping of the AIC irrigation scheme.

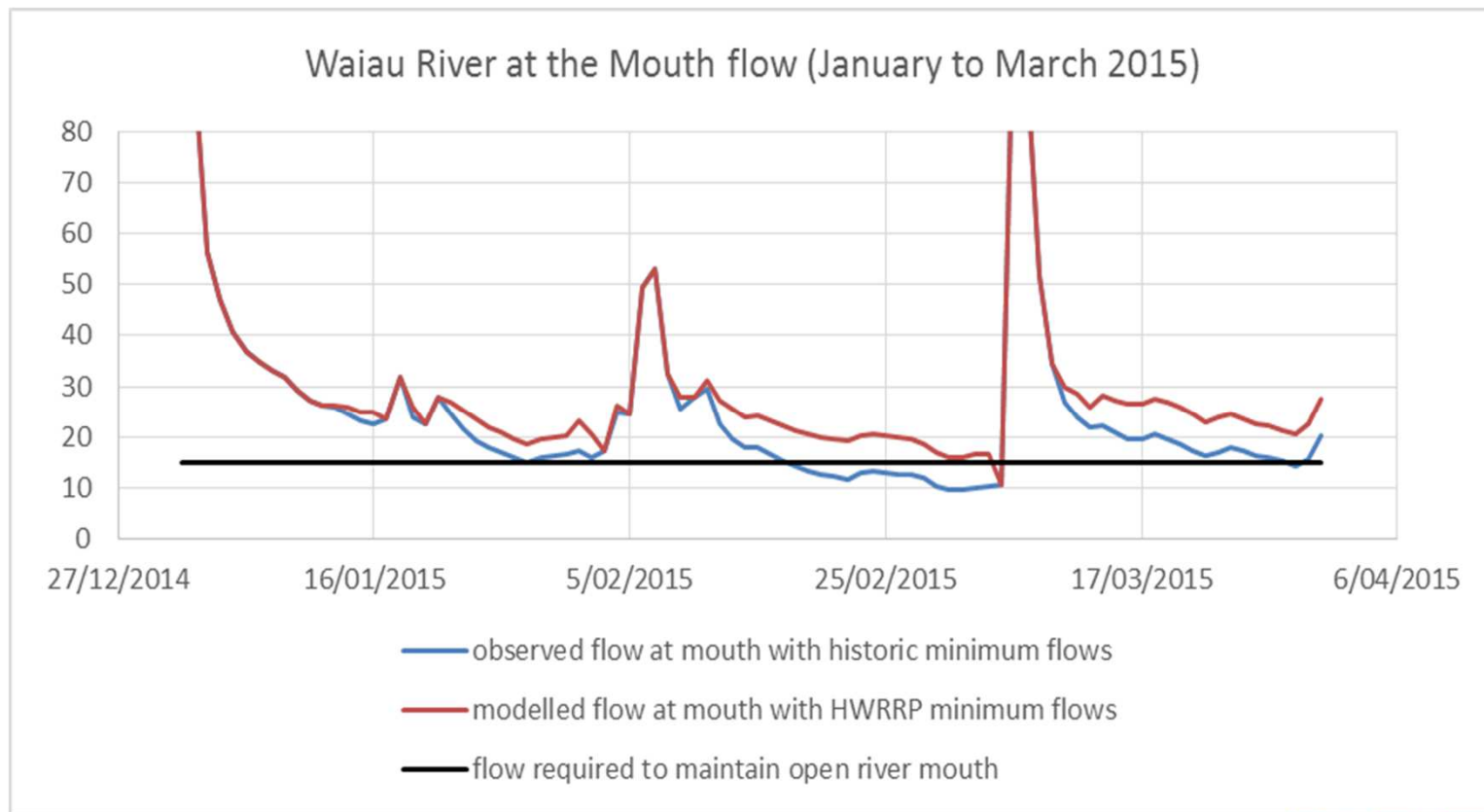
# Salmon migration - Waiau

- Historic flow regime increases the frequency and duration of periods flows are below critical threshold for salmon migration
- Effects are only significant in dry years



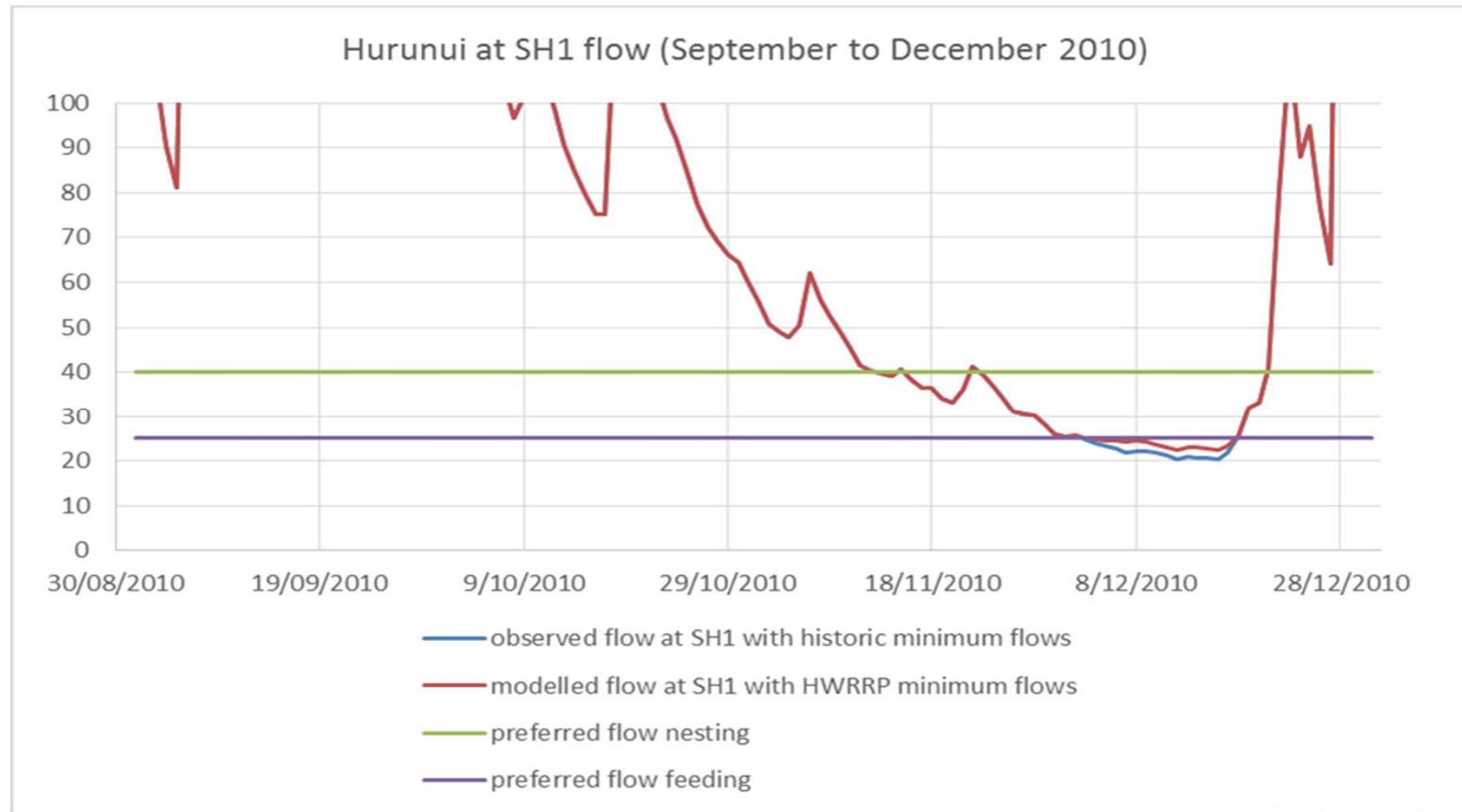
# Mouth closure potential - Waiau

- Historic flow regime increases the potential for Waiau River mouth closure
- Effects are most significant in January to March



# Bird nesting- Hurunui

- Historic flow regime exacerbates the frequency and duration of periods flows are below critical threshold for bird nesting
- Effects are relevant in September to December



# Jet boating

- Preferred flows Waiau River: 15 – 30m<sup>3</sup>/s
- Preferred flows Hurunui River: 10 – 45m<sup>3</sup>/s
- Under the historic flow regime the frequency and duration of flows preferred for jet boating is less than under the HWRRP regime, particularly at low flows

# Summary of results

Continuing to delay implementing the HWRRP minimum flows for all consented users has the following environmental implications:

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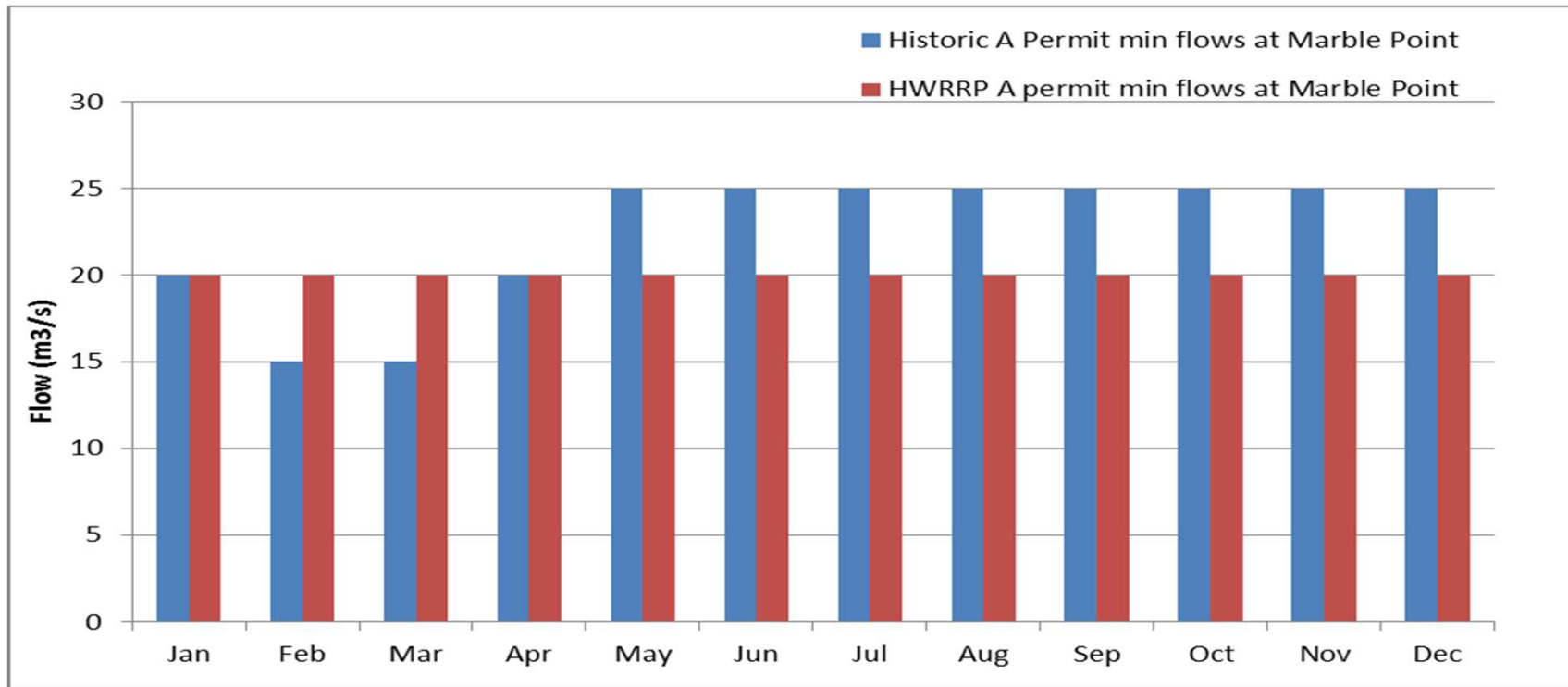


# Questions to be answered

- 1. What are the new HWRRP minimum flows compared to historic consent minimum flows?
- 2. What proportion of current consents are already on the HWRRP minimum flows?
- 3. What are the environmental implications of continuing to delay implementing the HWRRP minimum flows for all consented users?
- 4. What are the costs, for irrigators who are not already on the HWRRP minimum flows, of moving to those minimum flows?

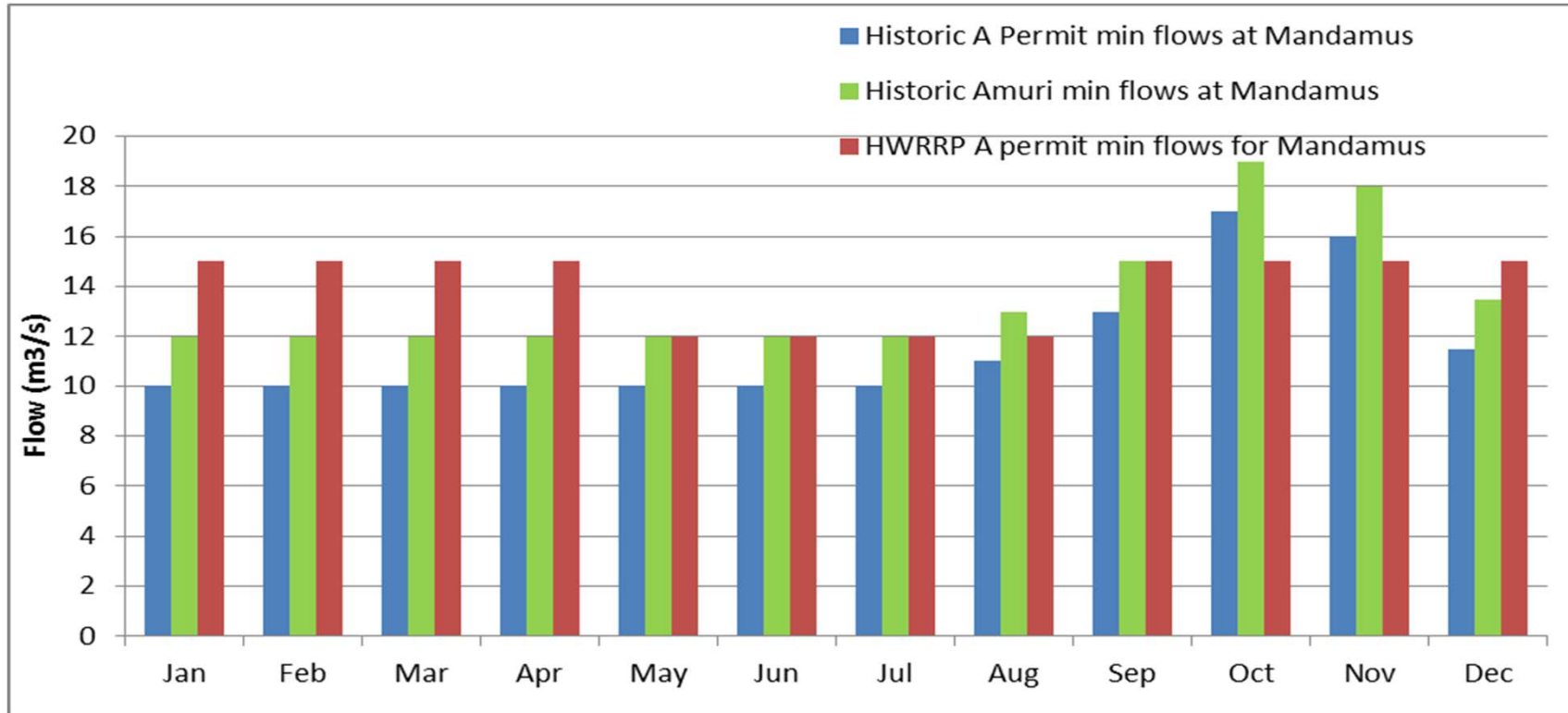
An initial estimate to answer question 4 is provided in the next agenda paper by Andrew Barton, AIC.

# 1. New HWRRP minimum flows compared to historic consent minimum flows



Historic and HWRRP minimum flows for the Waiau River at Marble Point

# 1. New HWRRP minimum flows compared to historic consent minimum flows



Historic and HWRRP minimum flows for the Hurunui River at Mandamus

## 2. Consents already on HWRRP minimum flows

### For the Waiau River catchment:

- Approximately 6 m<sup>3</sup>/s of A Block allocation (29 consents) currently have conditions requiring the HWRRP minimum flows, out of approximately 17 m<sup>3</sup>/s (66 consents) – Waiau River main stem A Allocation Block only.
- Of the 37 consents not yet attached to HWRRP minimum flows there are 22 consents that are due to expire by the end of 2020 and so will be given conditions requiring to meet HWRRP minimum flows if and when they are renewed.

## 2. Consents already on HWRRP minimum flows

### For the Hurunui River catchment:

- Approximately 300 L/s of A Block allocation (5 consents) currently have conditions requiring the HWRRP minimum flows, out of a catchment total allocation of approximately 7.5 m<sup>3</sup>/s (40 consents)- Hurunui River main stem A Allocation Block only.
- Of the 35 of consents not yet attached to HWRRP minimum flows there are 21 consents that are due to expire by the end of 2020 and so will be given conditions requiring to meet HWRRP minimum flows if and when they are renewed.

### 3. Environmental implications of continuing to delay consent review

- Fish habitat and migration
- Mouth closure potential
- Nuisance periphyton growth
- Jet boating
- Riverbed bird nesting and feeding



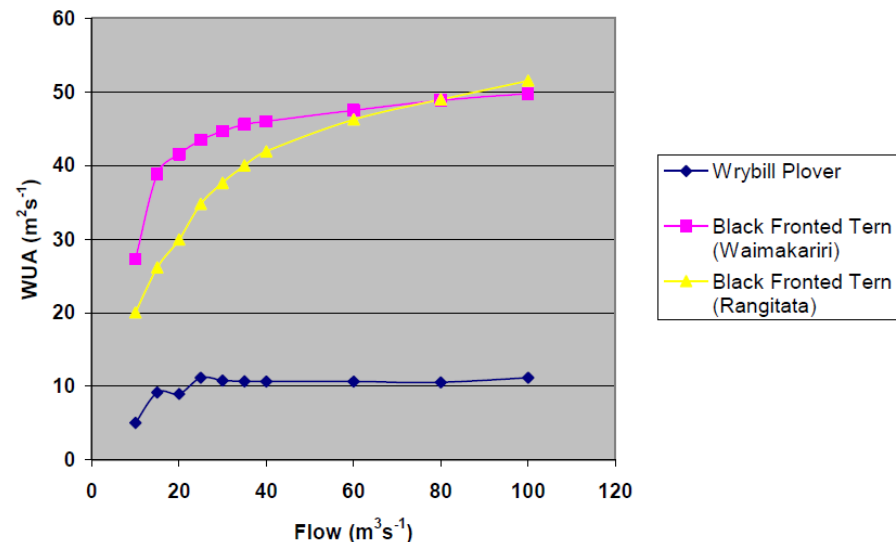
### 3. Environmental implications of continuing to delay consent review

- Fish passage (January to April)

flow > 20m<sup>3</sup>/s (Waiau River)

flow > 15m<sup>3</sup>/s (Hurunui River)

- Changes in Weighted Usable Area (WUA)



### 3. Environmental implications of continuing to delay consent review

- Mouth closure potential

flow required to maintain open river mouth for both Waiau and Hurunui Rivers :  
 $15\text{m}^3/\text{s}$

### 3. Environmental implications of continuing to delay consent review

- Nuisance periphyton growth

affected by changes in Fre2 and Fre3, which will be unaffected by changes in A block minimum flows

### 3. Environmental implications of continuing to delay consent review

- Jet boating

Preferred flows Waiau River: 15 – 30m<sup>3</sup>/s

Preferred flows Hurunui River: 10 – 45m<sup>3</sup>/s

### 3. Environmental implications of continuing to delay consent review

- Riverbed bird nesting and feeding

Preferred flow for bird nesting  $40\text{m}^3/\text{s}$

Preferred flow for feeding  $25\text{m}^3/\text{s}$

(for both Waiau and Hurunui Rivers)

### 3. Environmental implications of continuing to delay consent review

- Amuri Irrigation's piping project

Overall return flows to both rivers are expected to decrease and the effects to be greater and more noticeable in the Waiau River based on information from AIC.

- Groundwater

A noticeable effect on groundwater quality is unlikely.

- Sediment Transport and Geomorphology

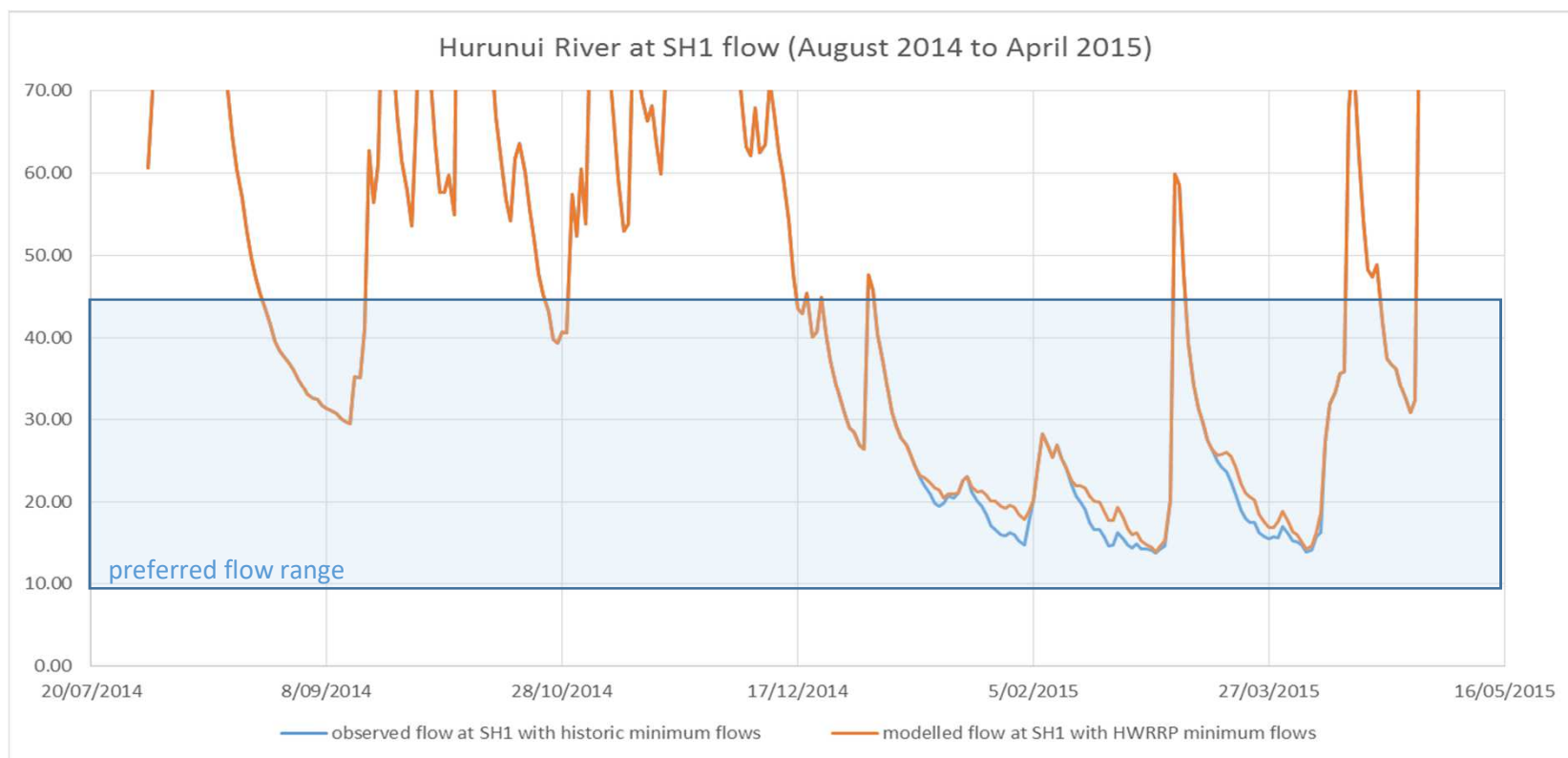
Effects will be insignificant on these factors.

# Summary of results

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# Environmental values

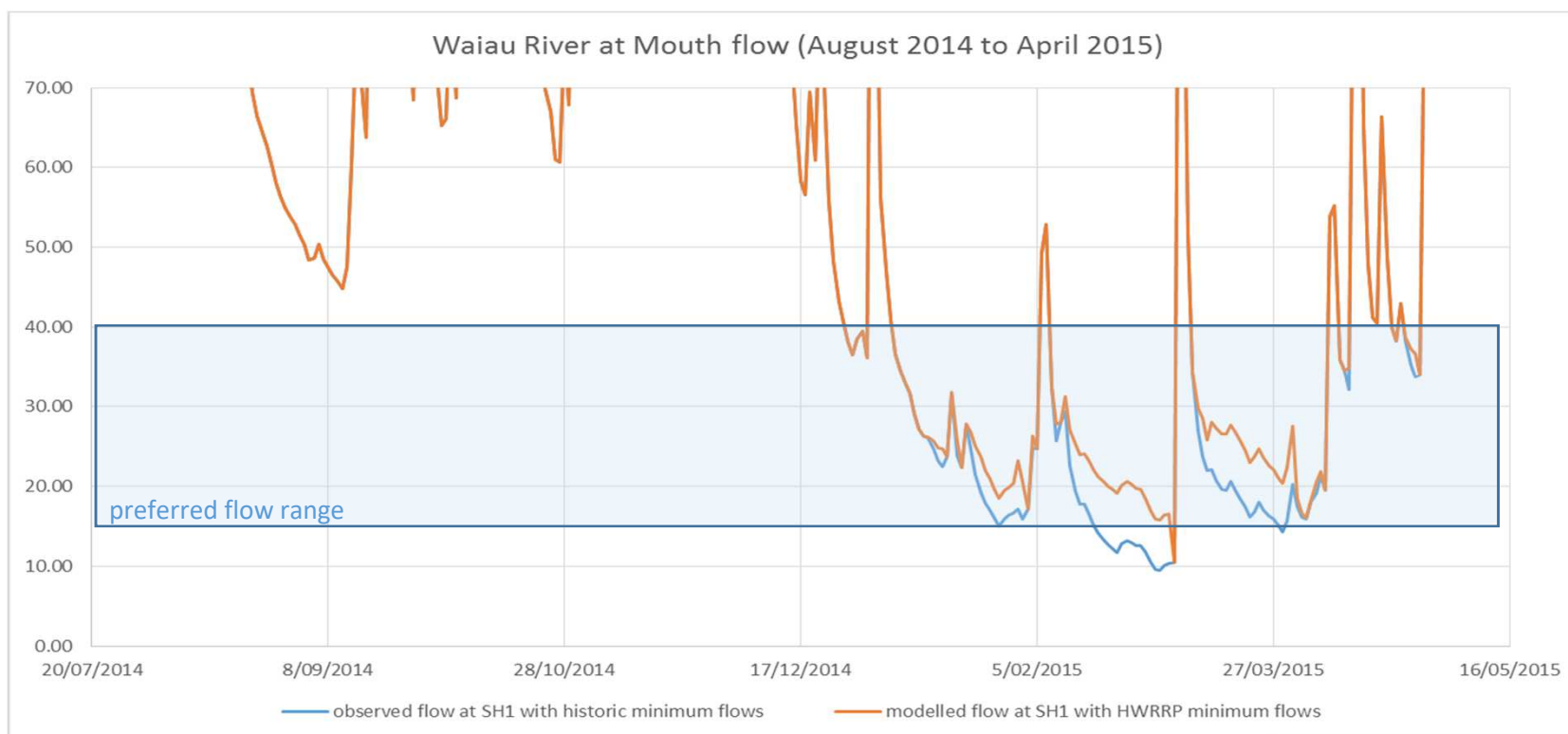
Flows in the Hurunui River at SH1 for August 2014 to April 2015 compared to preferred flow range incorporating all environmental values.





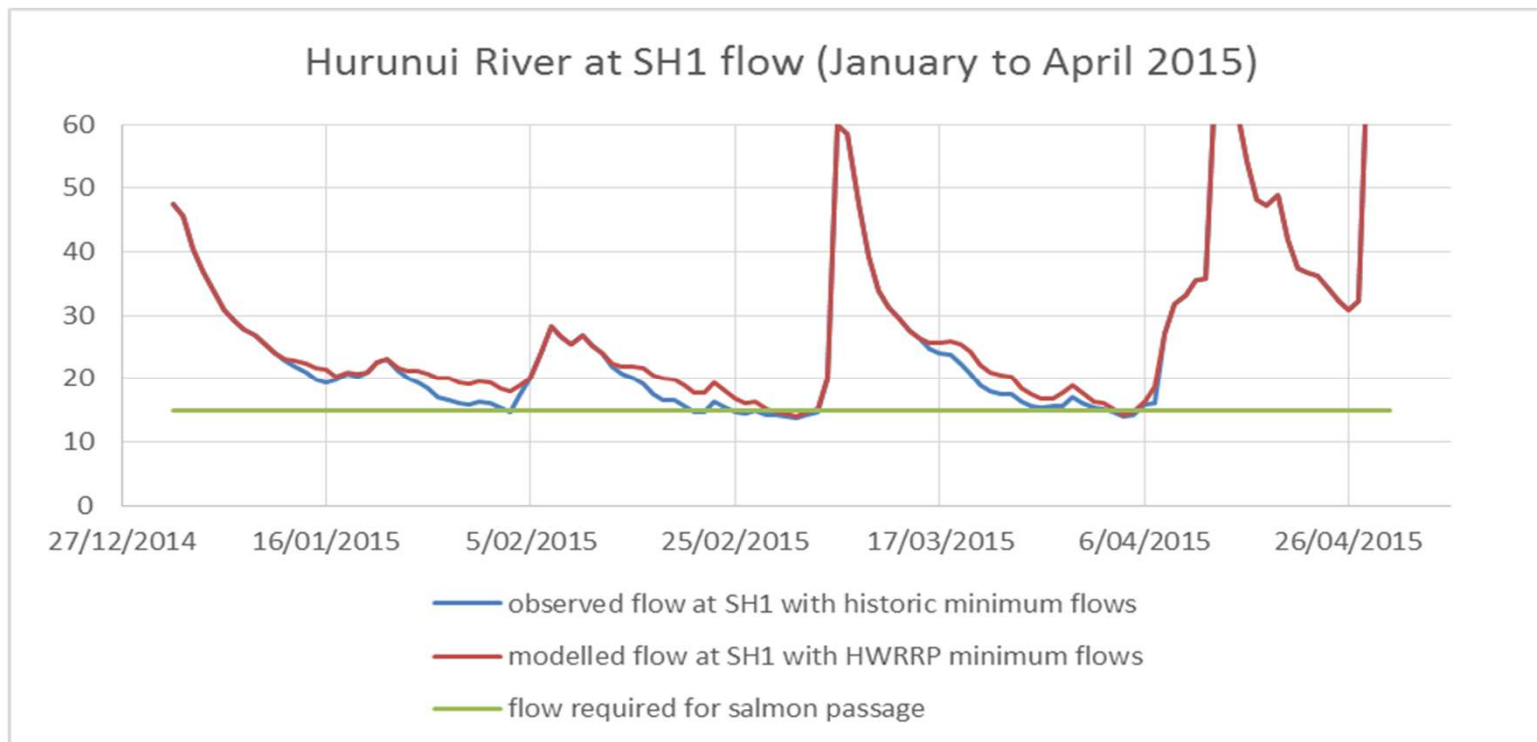
# Environmental values

Flows in the Waiau River at the Mouth for August 2014 to April 2015 compared to preferred flow range incorporating all environmental values.



# Salmon migration

- Historic flow regime increases the frequency and duration of periods flows are below critical threshold for salmon migration
- Effects are only significant in dry years



# Salmon migration

Total and maximum consecutive days with flows below 15 m<sup>3</sup>/s between January and April in the Hurunui River at SH1.

Water Year	Days below 15m <sup>3</sup> /s (observed/with historic minimum flows)	Days below 15m <sup>3</sup> /s (modelled/with HWRRP minimum flows)	Maximum number of consecutive days below 15m <sup>3</sup> /s (observed/with historic minimum flows)	Maximum number of consecutive days below 15m <sup>3</sup> /s (modelled/with HWRRP minimum flows)
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	15	6	9	4
2015	0	0	0	0
2016	0	0	0	0

# Salmon migration

Total and maximum consecutive days with flows below 20 m<sup>3</sup>/s between January and April in the Waiau River at the Mouth.

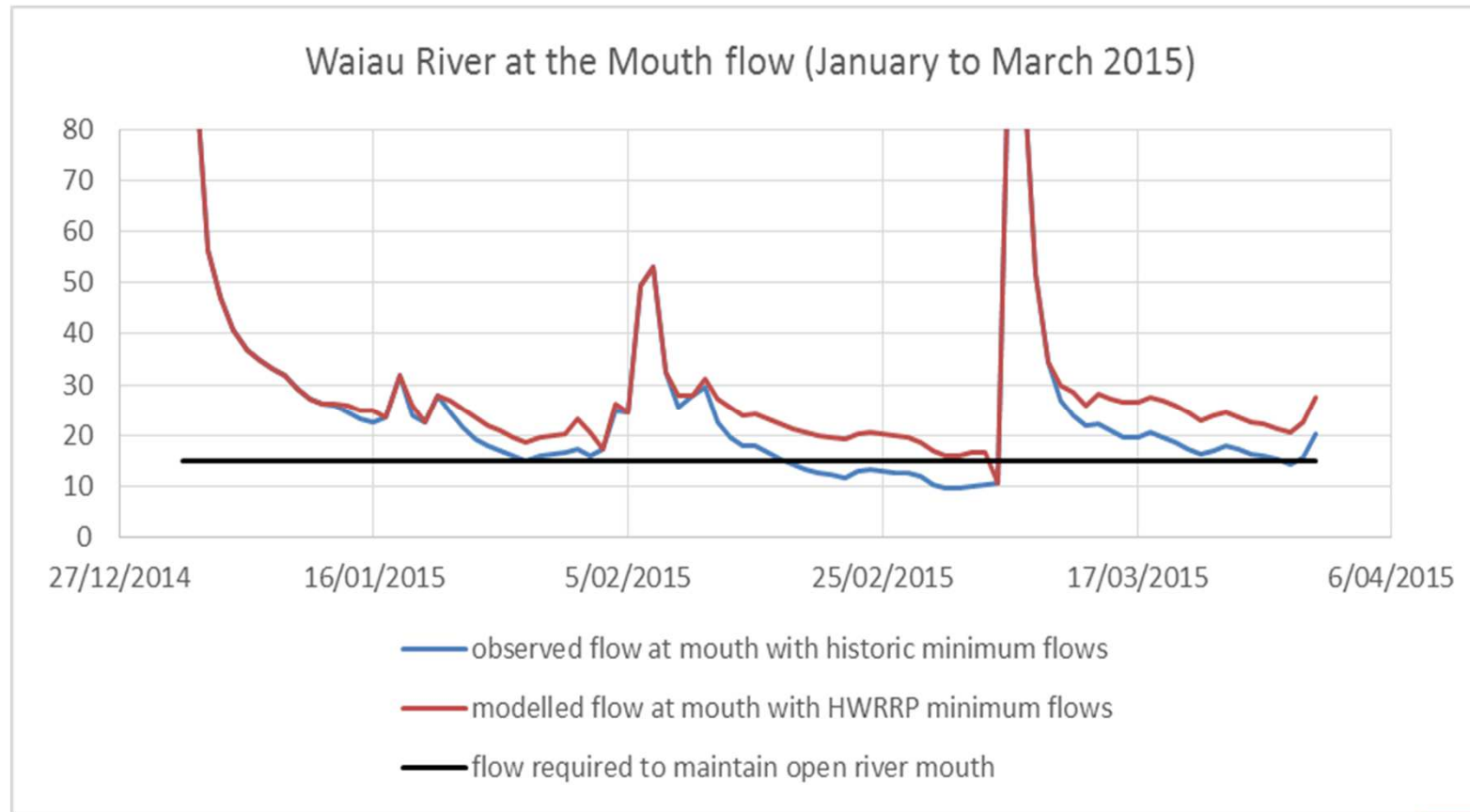
Water Year	Days below 20m <sup>3</sup> /s (observed/with historic minimum flows)	Days below 20m <sup>3</sup> /s (modelled/with HWRRP minimum flows)	Maximum number of consecutive days below 20m <sup>3</sup> /s (observed/with historic minimum flows)	Maximum number of consecutive days below 20m <sup>3</sup> /s (modelled/with HWRRP minimum flows)
2010	0	0	0	0
2011	0	0	0	0
2012	20	0	18	0
2013	5	0	3	0
2014	53	21	22	9
2015	8	0	5	0
2016	0	0	0	0

# Changes in WUA

Summary of weighted usable area changes predicted if the HWRRP minimum flow and allocation regime is implemented. (+ increase in habitat, - reduction in habitat, +/- minimal or no change likely, ? effects uncertain)

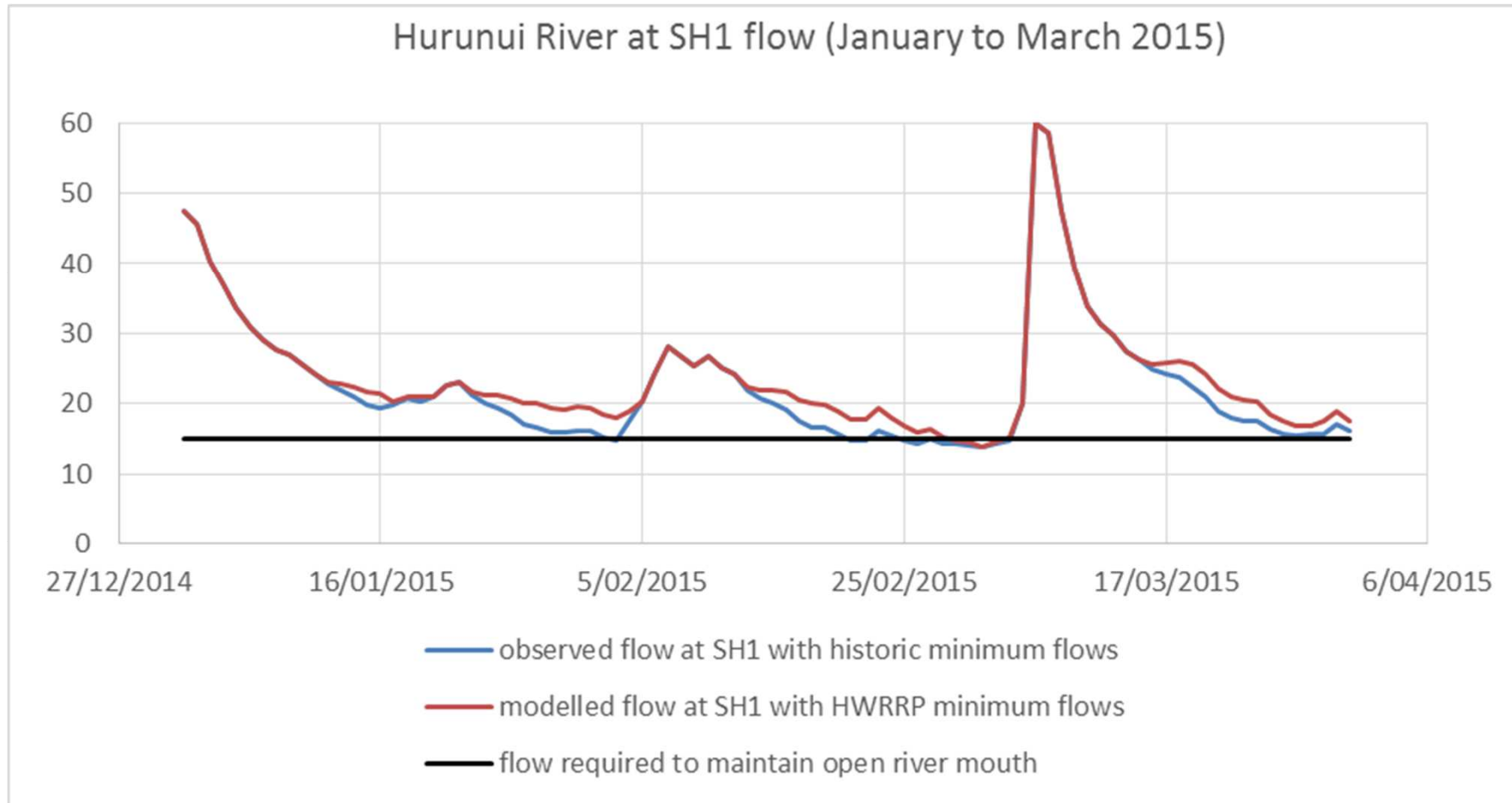
	Salmon fry	Juvenile salmon	Salmon angling	Salmon holding	Torrentfish	Juvenile trout	Adult trout	Small long fin eels	Large longfin eels	Small shortfin eels	Large shortfin eels	Deleatidium	Invertebrate food	Black fronted tern	Wrybill
<b>Hurunui River</b>	+	+/-	+	+	-	+/-	-	+	+	+	+	+	-	+	+
<b>Waiau River</b>	+	+	+	+	+	?	?	+	?	+	+	+	+	+	+

# Mouth closure potential



Observed and modelled flows for the Waiau River at Marble Point from January to March 2015. The black line is the flow required to maintain an open river mouth.

# Mouth closure potential



Observed and modelled flows for the Hurunui River at SH1 from January to March 2015. The black line is the flow required to maintain an open river mouth.

# Nuisance periphyton growth

Frequency of Fre2 and Fre3 flushing events in the Waiau River at the Mouth between 2010 and 2016

<b>Water Year</b>	<b>Observed Fre2 events (with historic minimum flows)</b>	<b>Modelled Fre2 events (with HWRRP minimum flows)</b>	<b>Observed Fre3 events (with historic minimum flows)</b>	<b>Modelled Fre3 events (with HWRRP minimum flows)</b>
<b>2010</b>	9	9	11	11
<b>2011</b>	9	9	6	6
<b>2012</b>	11	11	10	10
<b>2013</b>	11	11	12	12
<b>2014</b>	8	8	6	6
<b>2015</b>	9	9	6	6
<b>2016</b>	10	10	8	8

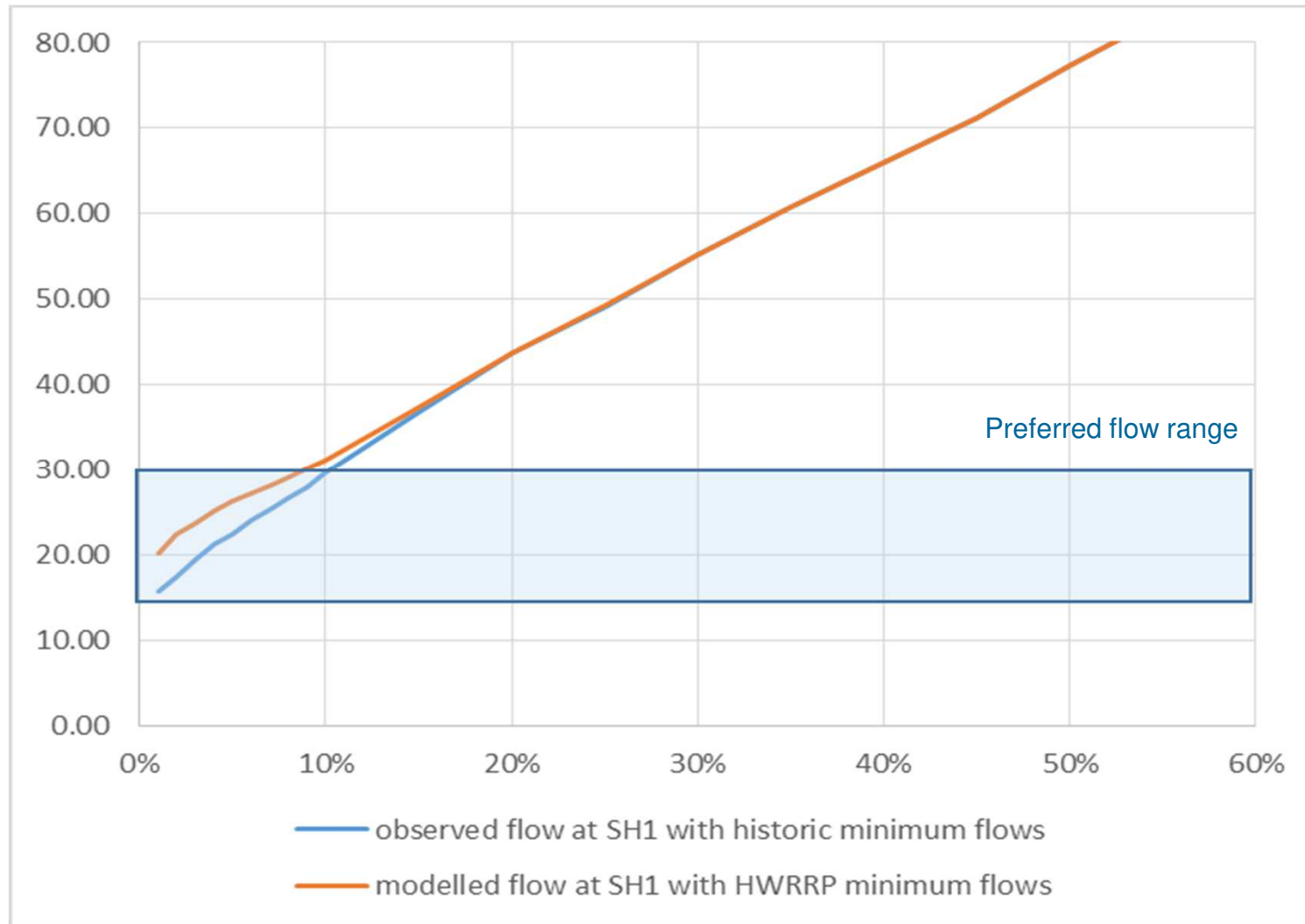


# Nuisance periphyton growth

Frequency of Fre2 and Fre3 flushing events in the Hurunui River at SH1 between 2007 and 2016 (water years)

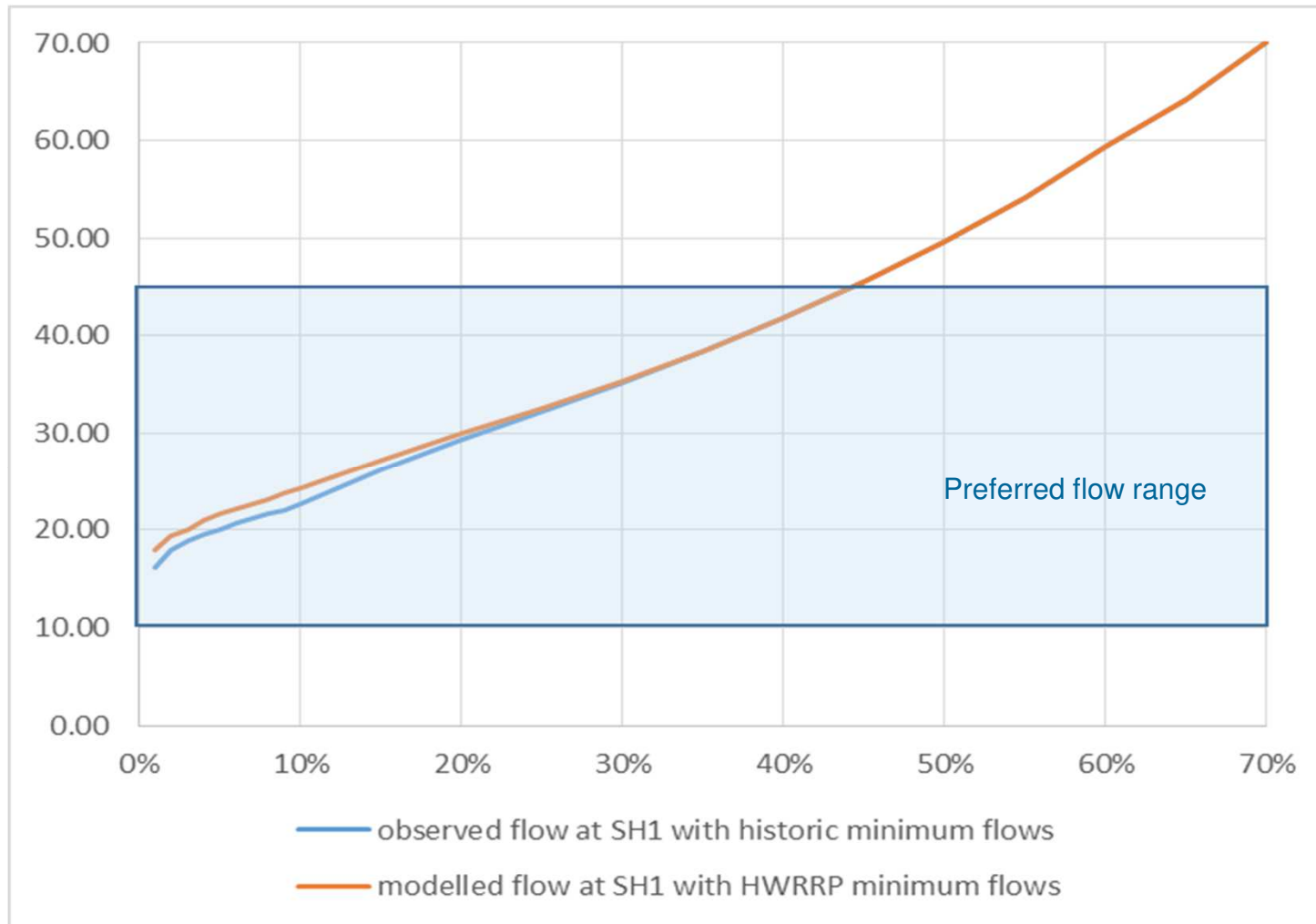
<b>Water Year</b>	<b>Observed Fre2 events (with historic minimum flows)</b>	<b>Modelled Fre2 events (with HWRRP minimum flows)</b>	<b>Observed Fre3 events (with historic minimum flows)</b>	<b>Modelled Fre3 events (with HWRRP minimum flows)</b>
<b>2007</b>	4	4	2	2
<b>2008</b>	11	11	8	8
<b>2009</b>	8	8	6	6
<b>2010</b>	9	9	7	7
<b>2011</b>	9	9	4	4
<b>2012</b>	8	8	8	8
<b>2013</b>	11	11	9	9
<b>2014</b>	6	6	5	5
<b>2015</b>	5	5	4	4
<b>2016</b>	9	9	6	6

# Jet boating



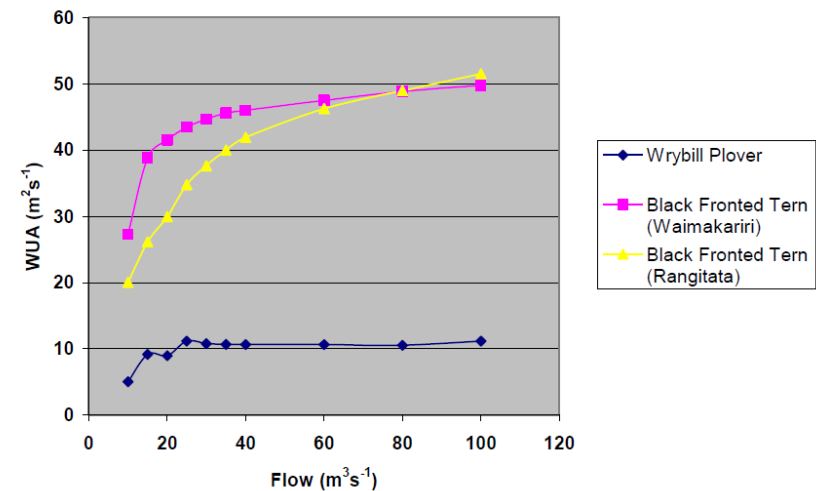
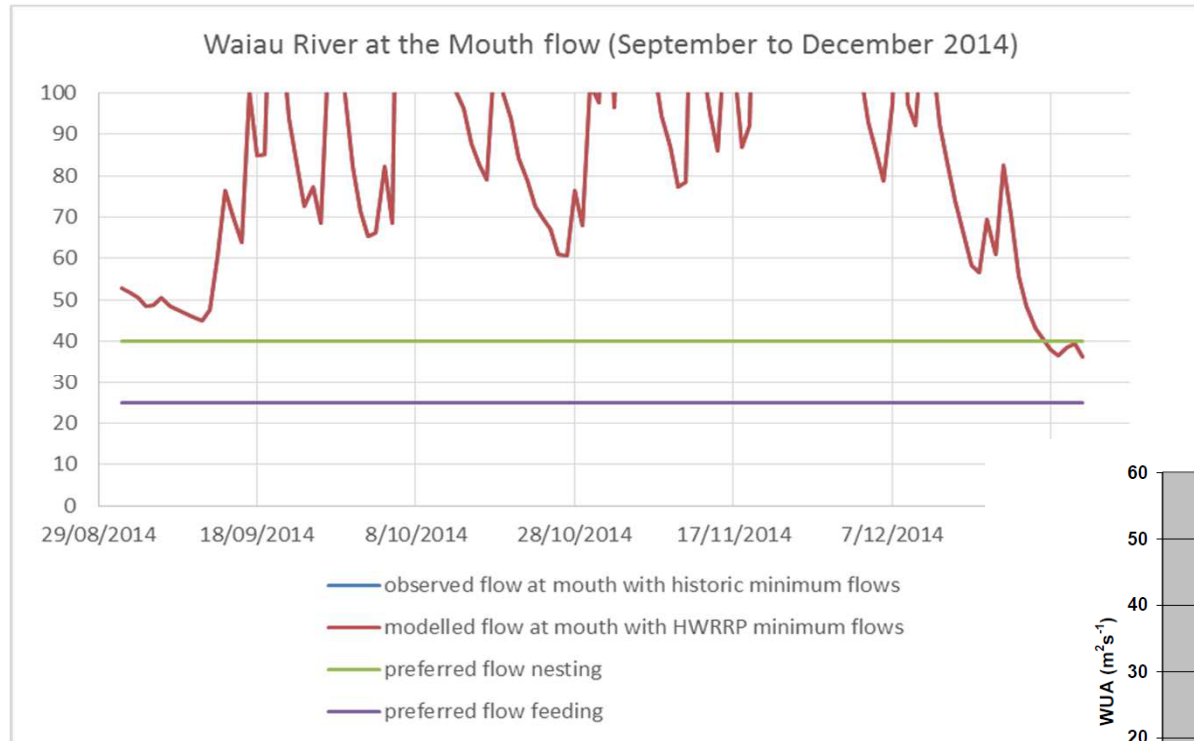
Flow duration curves for the Waiau River at the Mouth (1 July 2010 to 30 June 2017) with preferred flow range for jet boating

# Jet boating



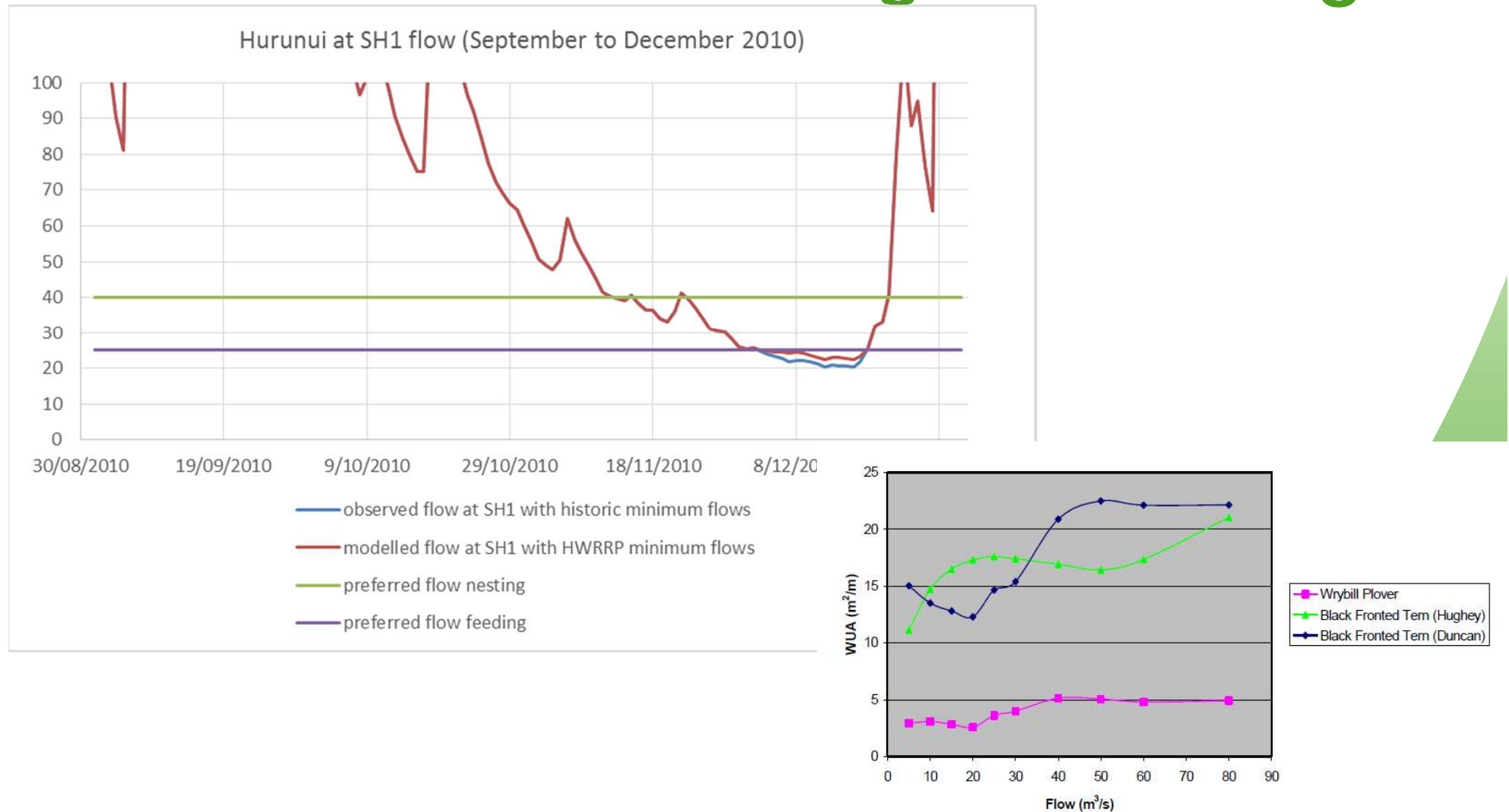
Flow duration curves for the Hurunui River at SH1 (1 July 2007 to 30 June 2017) with preferred flow range for jet boating

# Riverbed bird nesting and feeding



Observed and modelled flows in the Waiau River at the Mouth September to December 2014 compared to optimum flows for river bird nesting and feeding.

# Riverbed bird nesting and feeding



Observed and modelled flows in the Hurunui River at SH1 for September to December 2010 compared to optimum flows for river bird nesting and feeding.

# Riverbed bird nesting and feeding

Days below optimum flow for nesting and feeding in the Waiau River at the Mouth

September to December	Sum of days below 40m3/s (observed)	Sum of days below 40m3/s (modelled)	Max of consecutive days below 40m3/s (observed)	Max of consecutive days below 40m3/s (modelled)	Sum of days below 25m3/s (observed)	Sum of days below 25m3/s (modelled)	Max of consecutive days below 25m3/s (observed)	Max of consecutive days below 25m3/s (modelled)
2010	13	13	11	11	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0
2013	3	3	2	2	0	0	0	0
2014	5	5	5	5	0	0	0	0
2015	14	14	8	8	3	3	3	3
2016	0	0	0	0	0	0	0	0

# Riverbed bird nesting and feeding

Days below optimum flow for nesting and feeding in Hurunui River at SH1

(September to December)	Sum of days below 40m <sup>3</sup> /s (observed)	Sum of days below 40m <sup>3</sup> /s (modelled)	Max of consecutive days below 40m <sup>3</sup> /s (observed)	Max of consecutive days below 40m <sup>3</sup> /s (modelled)	Sum of days below 25m <sup>3</sup> /s (observed)	Sum of days below 25m <sup>3</sup> /s (modelled)	Max of consecutive days below 25m <sup>3</sup> /s (observed)	Max of consecutive days below 25m <sup>3</sup> /s (modelled)
2007	57	57	31	31	17	17	13	13
2008	12	12	9	9	0	0	0	0
2009	11	11	4	4	0	0	0	0
2010	36	36	28	28	15	14	15	14
2011	9	9	5	5	0	0	0	0
2012	31	31	19	19	0	0	0	0
2013	22	22	13	13	0	0	0	0
2014	25	25	15	15	0	0	0	0
2015	41	41	19	19	4	4	4	4
2016	5	5	4	4	0	0	0	0

# Groundwater

- The minimum flow sites are in locations where the Hurunui and Waiau rivers are flowing as a single channel
- By the time surface flows reach areas where groundwater occurs, there is a change in the stage-discharge relationship
- In areas of groundwater occurrence there is a greater channel wetted perimeter than at the minimum flow sites



# Groundwater

- Based on the limited groundwater level data available it takes larger flow changes than those described above to impact groundwater levels (and consequently groundwater quality)
- AIC irrigation race network is converting from open race to a piped network
- This conversion will reduce recharge to the groundwater system
  - lowering groundwater levels and impacting groundwater quality due to the reduction of high quality alpine river water
- The magnitude of this effect will be greater than that of implementing the HWRRP minimum flows