Greater Heretaunga and Ahuriri Land and Water Management Collaborative Stakeholder (TANK) Group

TANK

Meeting 28: 27 April 2017

HAWKE'S BAY REGIONAL COUNCIL

Karakia

HAWKE'S BAY REGIONAL COUNCIL

Karakia

Ko te tumanako

Kia pai tenei rā

Kia tutuki i ngā wawata

Kia tau te rangimarie

I runga i a tatou katoa

Mauriora kia tatou katoa

Āmine

Agenda

9:30am	Notices, meeting record
9:45am	Summary of science from March TANK meeting
10.30am	Recap of benefits to river from restricting GW takes
11.00am	Raupare flow augmentation scheme
12:00pm	GW modelling • Stream depleting zones for specific waterways • Augmentation
1:00pm	LUNCH
1:30pm	Discussion and direction on groundwater regime
2:30pm	On-farm economic assessment methodology
3:15pm	**COFFEE BREAK**
3:30pm	Working group updates
4:00pm	**CLOSE MEETING**

HAWKE'S BAY
REGIONAL COUNCIL

Meeting objectives

1. Agree a management regime for stream depleting groundwater takes for the purpose of further modelling.

2. An understanding of the methodology being used to assess on-farm economic impacts.

Engagement etiquette

- Be an active and respectful participant / listener
- Share air time – have your say and allow others to have theirs
- One conversation at a time
- Ensure your important points are captured
- Please let us know if you need to leave the meeting early

HAWKE'S BAY
REGIONAL COUNCIL

Ground rules for observers

- RPC members are active observers by right (as per ToR)
- Pre-approval for other observers to attend should be sought from Robyn Wynne-Lewis (prior to the day of the meeting)
- TANK members are responsible for introducing observers and should remain together at break out sessions
- Observer’s speaking rights are at the discretion of the facilitator and the observer should defer to the TANK member whenever possible.

HAWKE'S BAY REGIONAL COUNCIL

Meeting Record – TANK Group 27

- Matters arising
- Action points

HAWKE'S BAY REGIONAL COUNCIL

Action points

ID	Action item	Person	Status
27.1	HBRC to bring back the new NOF swimmability tables to the TANK Group for consideration	Anna M-S	Date tbc
27.2	Refer the list of potential guest speakers to the Engagement Working Group for consideration in light of the revised work programme.	Drew	WIP
27.3	HBRC to add another column in the table of naturalised flows for the Ngaruroro Water User Group who are on water takes subject to low flow bans.	Jeff S	WIP
27.4	HBRC to consider default policies to manage flow in tributaries to complement what we find for the main stem.	Mary-Anne	WIP
27.5	Plot rain events upstream of Fernhill and identify whether they are responsible for increased river flow after bans were enforced.	Hydrologists	WIP
27.6	HBRC to report back to the TANK Group on its current policy on river mouth maintenance (i.e. what triggers opening river mouth using diggers)	Thomas	WIP
27.7	HBRC to organise an expert to present to the Group on RHYHABSIM and fish habitat levels of protection.	Thomas	Possibly 14 June
27.8	HBRC to bring back more information on the sustainability of the current level of abstractions, particularly in light of climate change.	Jeff S	WIP
27.9	HBRC to present the findings from a water aging study of the aquifer.	Iain M	Date tbc

Discussion and Agreement sought from TANK Group

For the purpose of further modelling do you agree/disagree;

Effects of water takes on spring fed streams are best managed by;

- Reducing effects of takes by flow augmentation (i.e not by restrictions on takes)

because

- Stream depletion zones for individual streams cannot be determined
- Zones of pumping impact for individual takes cannot be established
- Accounting for the cumulative impact of all takes is important

HAWKE'S BAY REGIONAL COUNCIL

GROUNDWATER

Hydrology Team

HAWKE'S BAY
REGIONAL COUNCIL

Stream Depletion Modelling: Summary of Science

TANK Collaborative Stakeholder Group
Meeting 28

Dr. Jeff Smith

Outline of Presentation:

1. Reason for focus on stream depletion
2. Summary of science to date
3. Introduction to sessions this morning
4. Climate change projections

HAWKE'S BAY
REGIONAL COUNCIL

1. Reason for stream depletion modelling

Stream Depletion modelling

- Allocation?
- Cease take rules?
- Artificial recharge?
- Augmentation?
- Other management?
- Which streams/rivers?

Surface water flow management

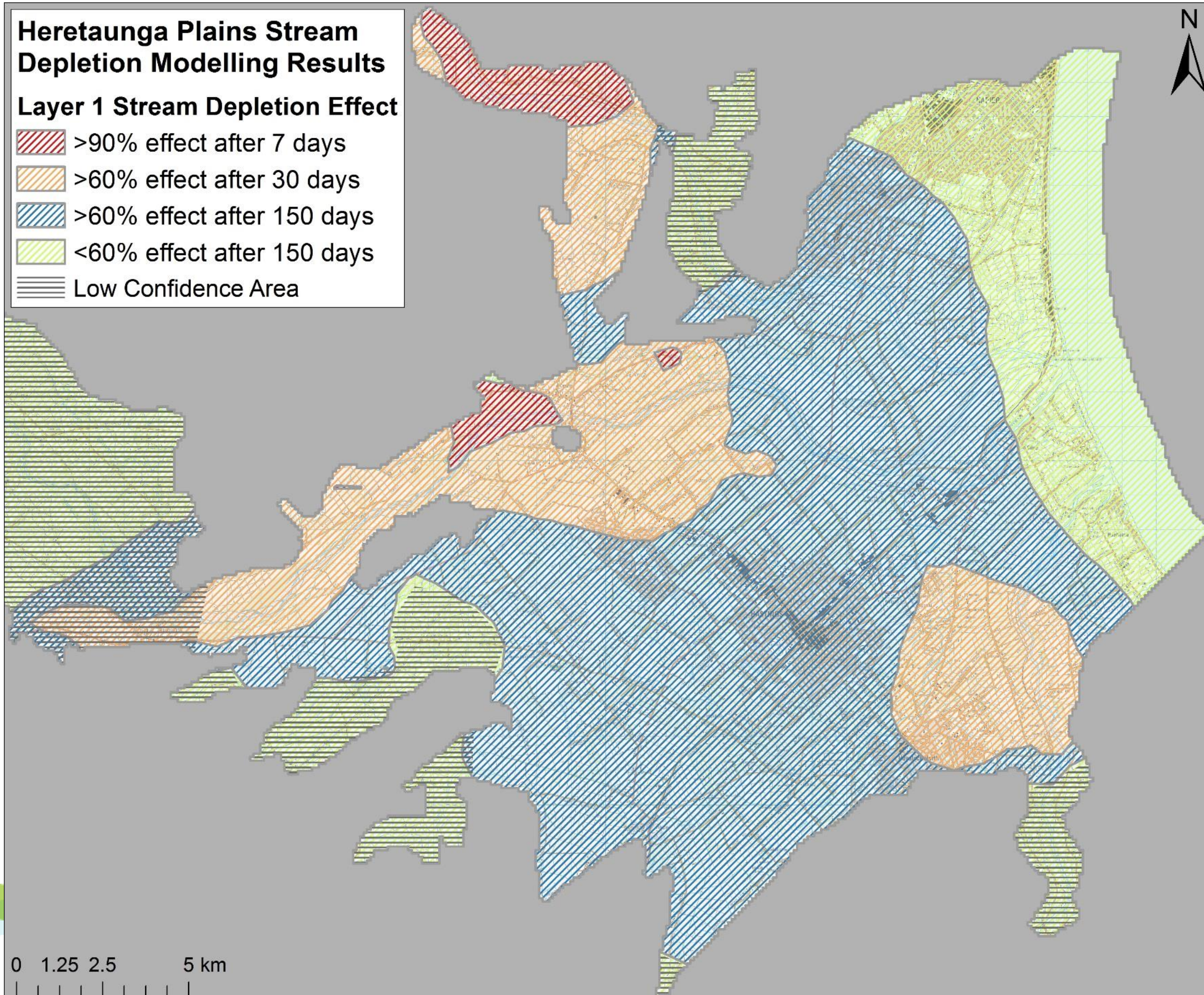
- Stream depleting groundwater takes
- Surface water abstractions
- Allocation(s)
- Flow regulation

Groundwater sustainability and allocation

HAWKE'S BAY
REGIONAL COUNCIL

2. Recap of stream depletion modelling

Meeting 26: Stream Depletion Modelling

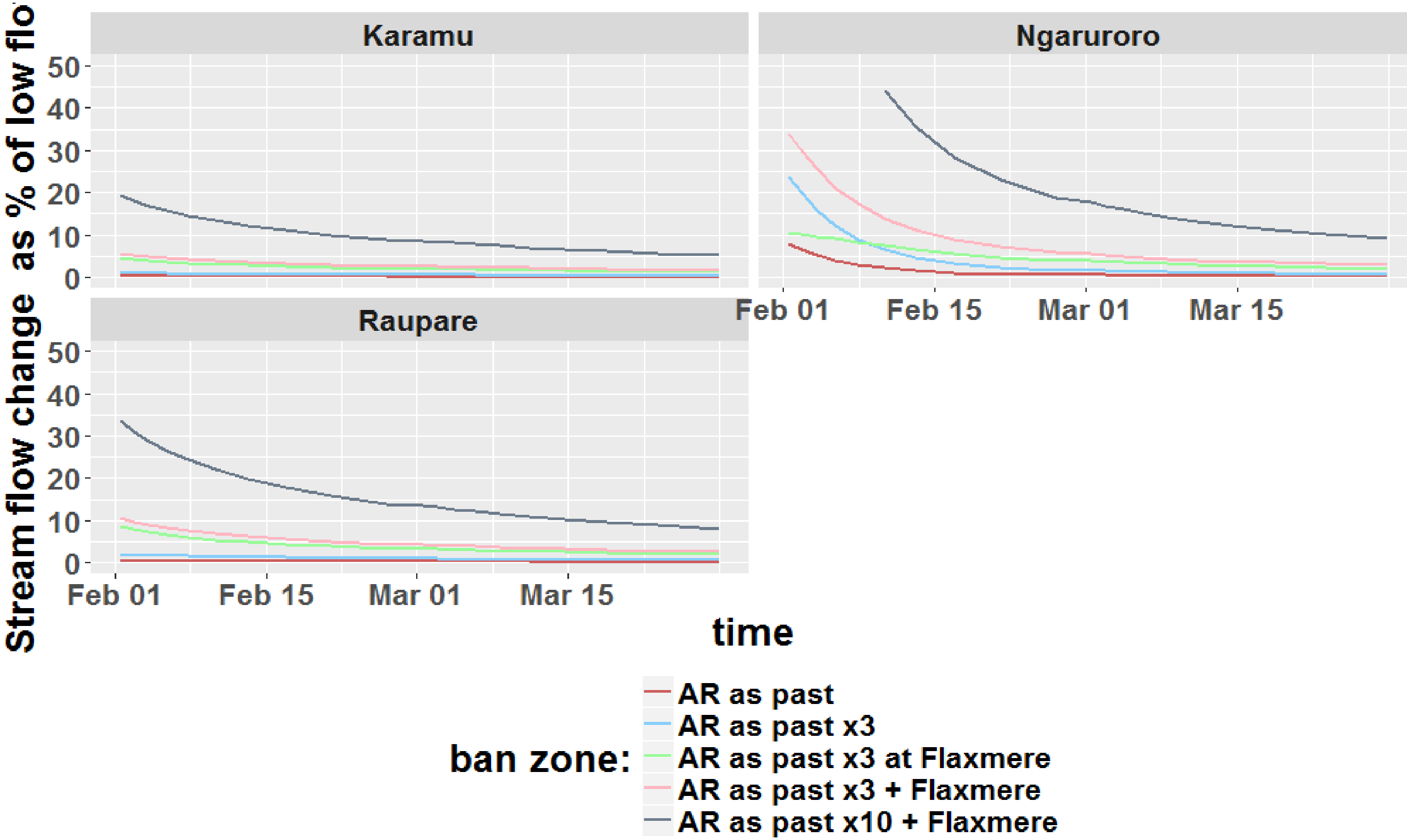


Meeting 27: More stream depletion modelling

1. Effectiveness of pumping bans on river flows
2. Other Mitigation options:
   a. Artificial recharge
   b. Stream augmentation

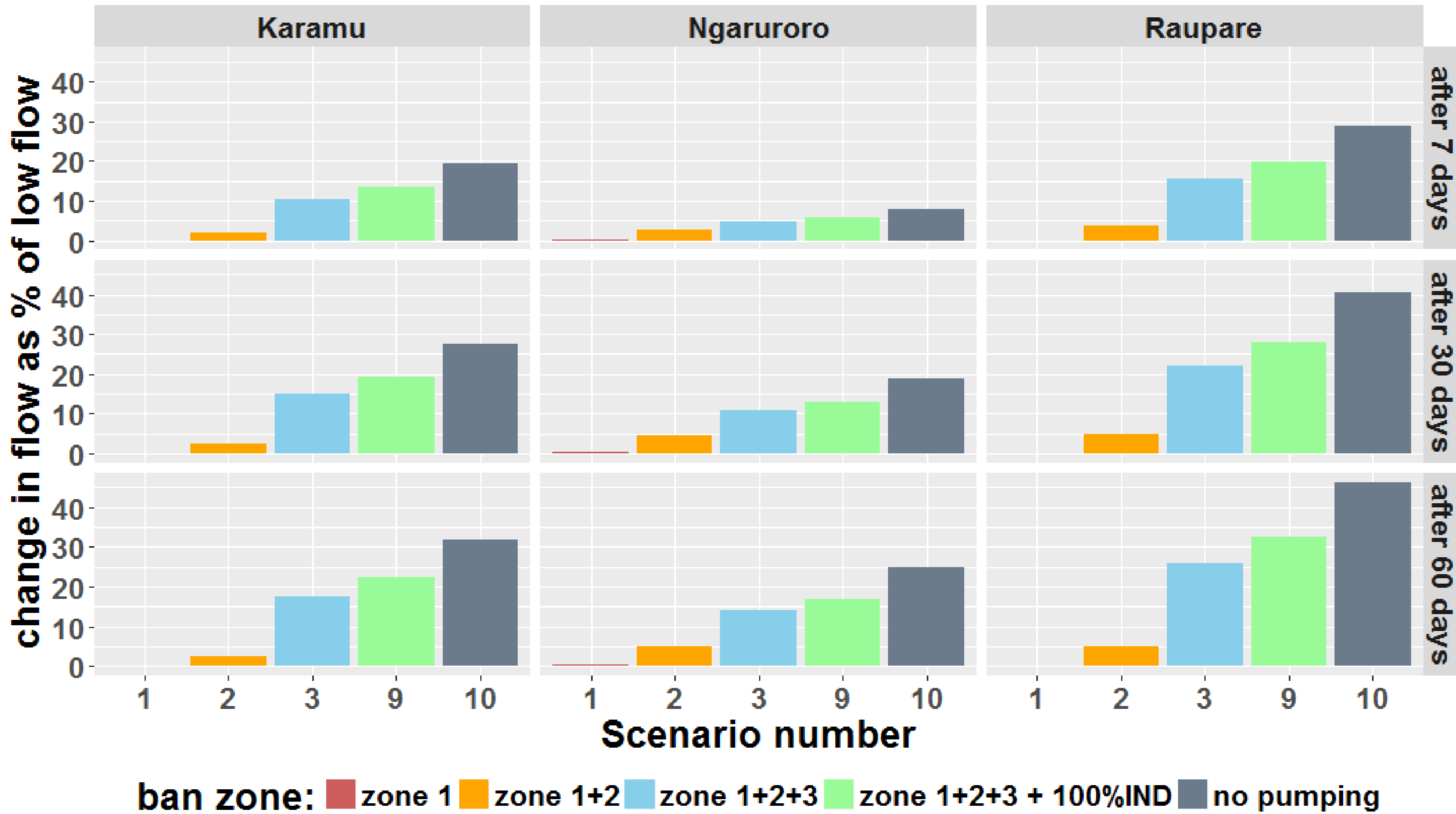
HAWKE'S BAY
REGIONAL COUNCIL

Artificial recharge conclusions

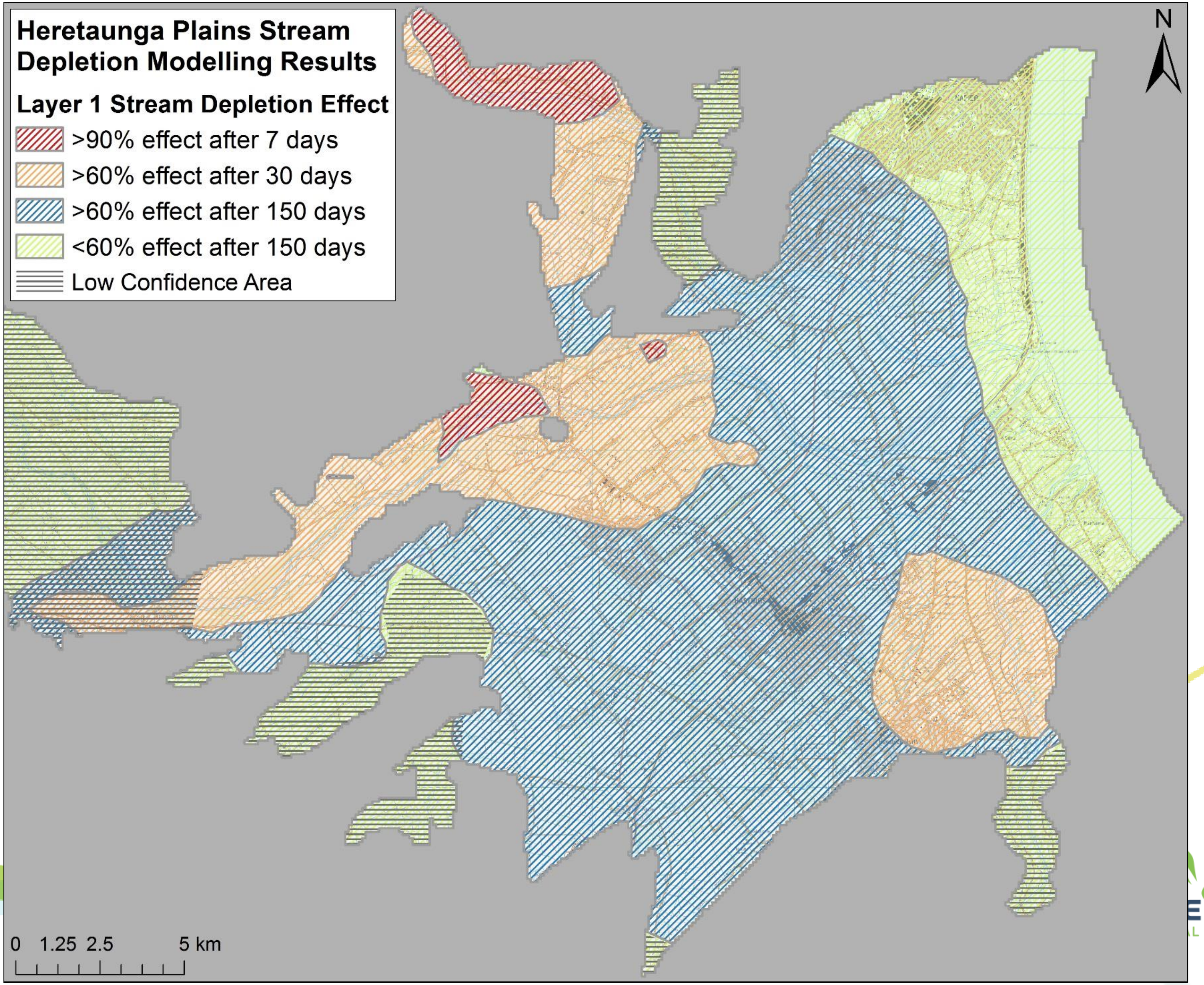


HAWKE'S BAY
REGIONAL COUNCIL

Groundwater ban scenario results :



Need to identify zones for individual streams



Meeting 27 – Science shows that:

- Artificial recharge examples were insufficient for mitigating stream depletion
- Pumping restrictions for irrigation takes were somewhat effective, if applied <u>throughout</u> Zones 1, 2 and 3

HAWKE'S BAY REGIONAL COUNCIL

Reasons for considering lowland streams separately from Ngaruroro and Tutaekuri Rivers:

- augmentation from groundwater is unlikely to be practical for large rivers
- flow requirements for low-gradient streams are based on oxygen availability (c.f. habitat)

HAWKE'S BAY REGIONAL COUNCIL

- Next steps were to:
  - identify stream depletion sub-zones for managing individual lowland streams
  - Investigate efficacy of augmentation

3. What to expect later this morning

- Intention was to identify stream depletion sub-zones for lowland stream flow management
    - Modelling shows this isn't realistic
- Most takes have small effects, but the combined stream depletion is large

zone	total effect L/s after 150 days of pumping
allzones	2084.7
Karamu	211.5
Ngaruroro	1048.7
Raupare	93.9

HAWKE'S BAY REGIONAL COUNCIL

3. What to expect later this morning

- Attention turning to managing cumulative stream depletion effects
- Jerf is reporting how the Twyford Irrigators Group uses flow augmentation to mitigate stream depletion in the Raupare Stream
- Pawel – modelling augmentation to mitigate stream depletion throughout the Heretaunga Plains

HAWKE'S BAY REGIONAL COUNCIL

Heads up – Pawel's work

1. Stream depletion zones could not be identified
2. Stream Augmentation is a viable option for managing of some streams
3. A tool was developed for this investigation
   - Could be used for managing cumulative impacts of pumping on stream depletion

4. Climate Change Projections

TANK Stakeholder Group has asked:

What does climate change mean for the TANK Plan Change?

4. Climate Change Projections

Need to know for modelling scenario predictions

HAWKE'S BAY
REGIONAL COUNCIL

Climate Change Projections

IPCC (2013) representative concentration pathways (RCPs):

RCP2.6 = Mitigation. Assumes international intervention that reduces emissions. CO_2 concentrations peak at 440 ppm by the year 2040 and decline thereafter

RCP4.5 = Stabilisation. Assumes international management. CO_2 concentrations would stabilise to approximately 540 ppm by the year 2100

RCP6.0 = Stabilisation. CO_2 concentrations 670 ppm by 2100, but not yet stabilised

RCP8.5 = Business as usual. Very high CO_2 concentrations to 950 ppm by 2100 and increasing thereafter

HAWKE'S BAY REGIONAL COUNCIL

Climate Change Projections

IPCC (2013) representative concentration pathways (RCPs):

RCP2.6 = Mitigation. Assumes international intervention reduces emissions. CO_2 concentrations peak at 440 ppm by the year 2040 and decline thereafter

RCP4.5 = Stabilisation. Assumes international management. CO_2 concentrations would stabilise to approximately 540 ppm by the year 2100

RCP6.0 = Stabilisation. CO_2 concentrations 670 ppm by 2100, but not yet stabilised

RCP8.5 = Business as usual. Very high CO_2 concentrations to 950 ppm by 2100 and increasing thereafter

HAWKE'S BAY REGIONAL COUNCIL

Climate Change Projections

- 16 Global Climate Models (GCMs) available for RCP6.0 scenario
- NIWA has chosen 6 GCMs for downscaling to New Zealand Regional Climate Models (RCMs = 5km grid)

- RCM bias correction by Aqualinc Research for TANK catchments – 26 years (2015 – 2041)
- 2015 – 2041 captures the cycle of this TANK plan change

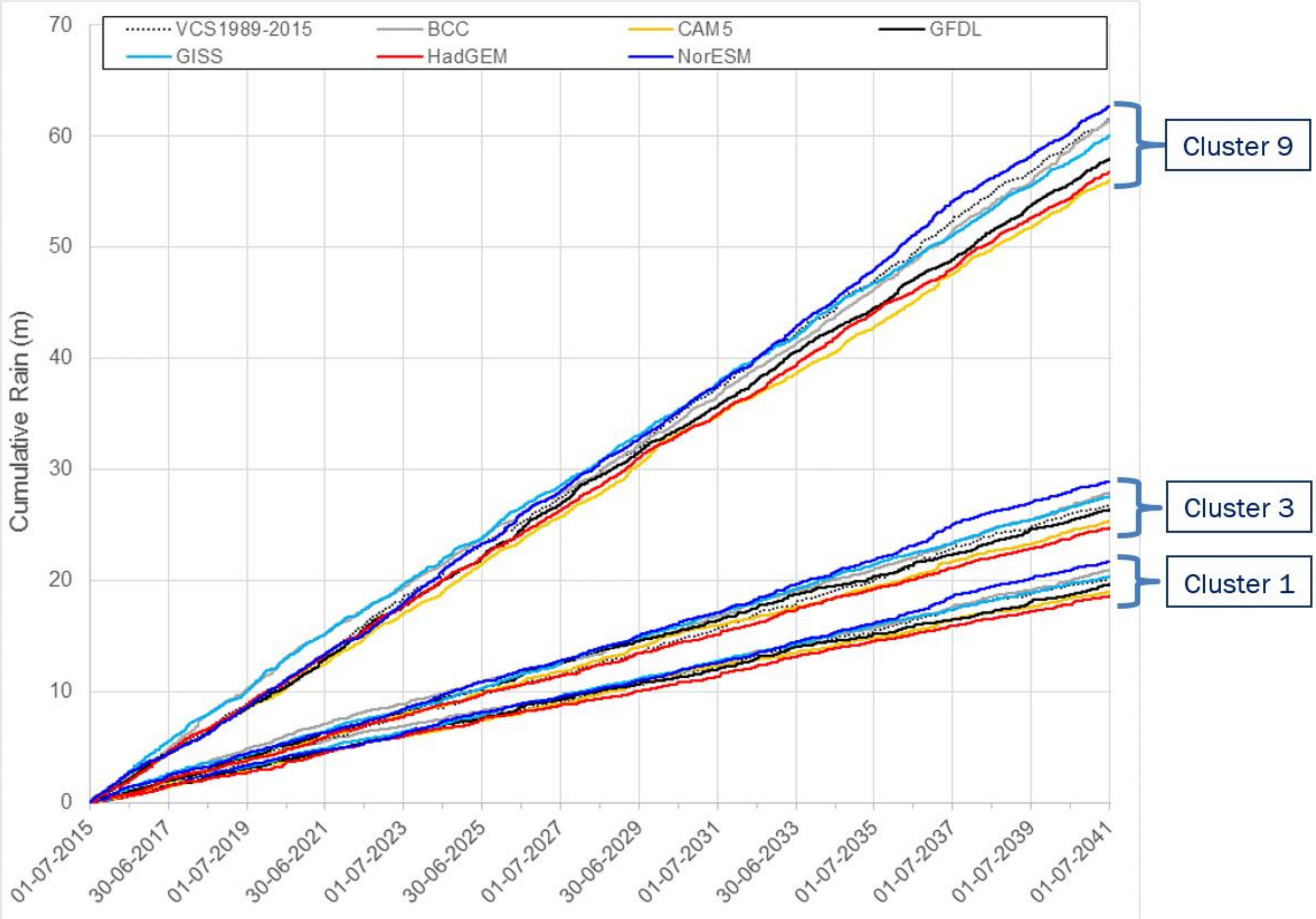
HAWKE'S BAY
REGIONAL COUNCIL

HAWKE'S BAY
REGIONAL COUNCIL

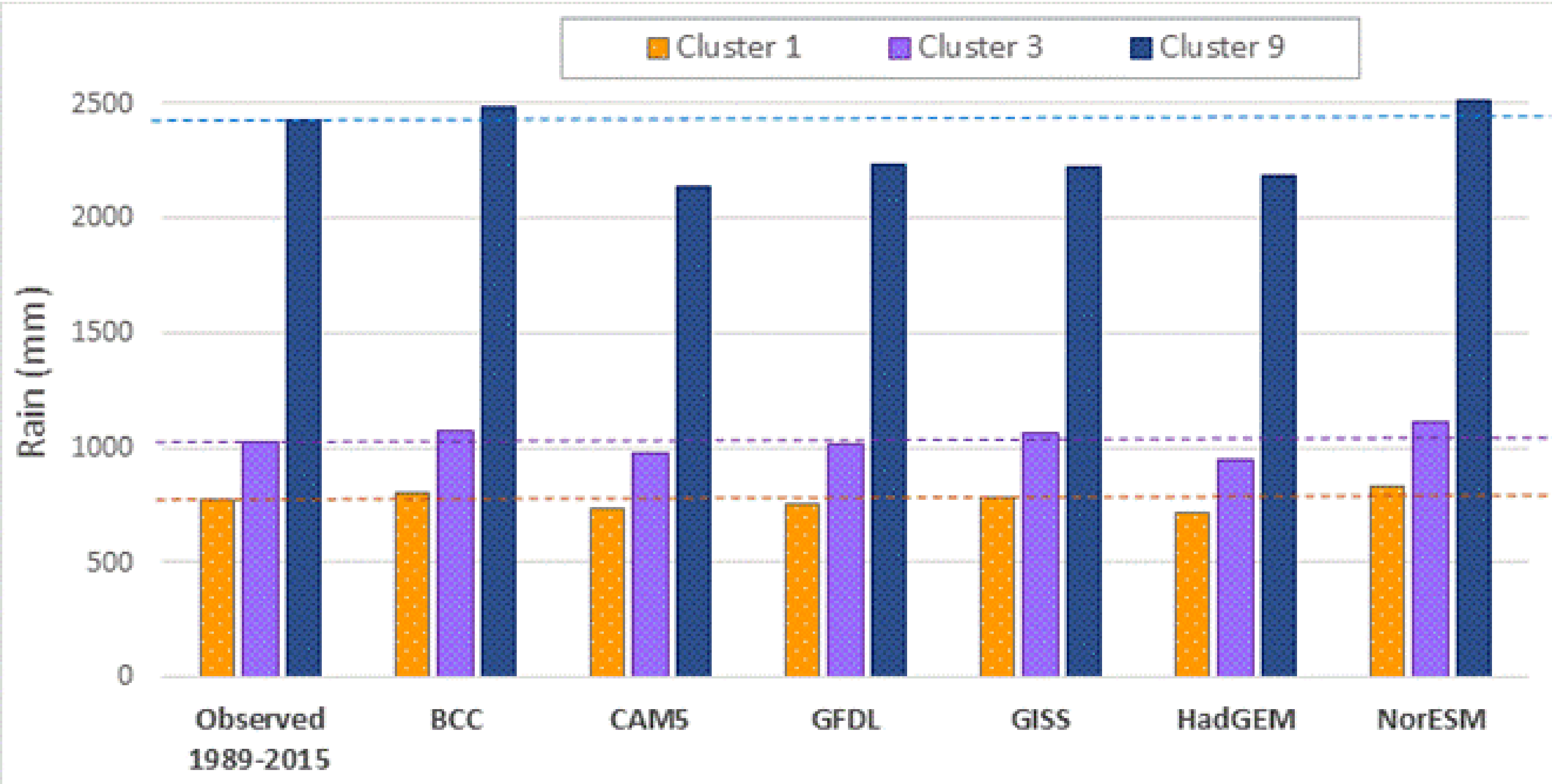
Climate Change Projections

- Three sub-catchment clusters chosen for analysis
- Projections reported for **Rainfall** and Potential **Evaporation** (PE) within each cluster
- Comparisons with previous 26 years (1989 – 2015)

Cumulative **Rainfall** Projections

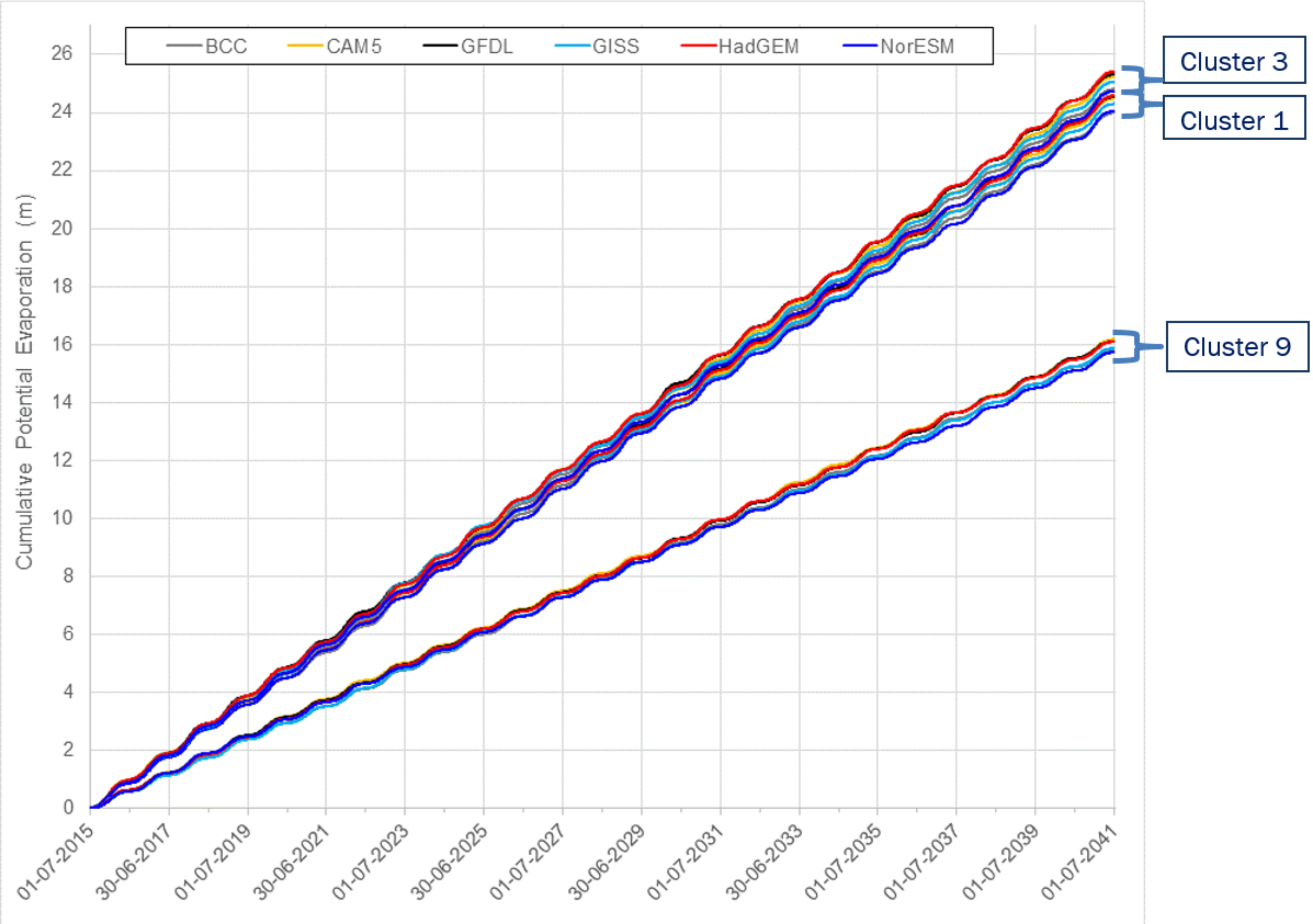


Annual average **Rainfall** Projections

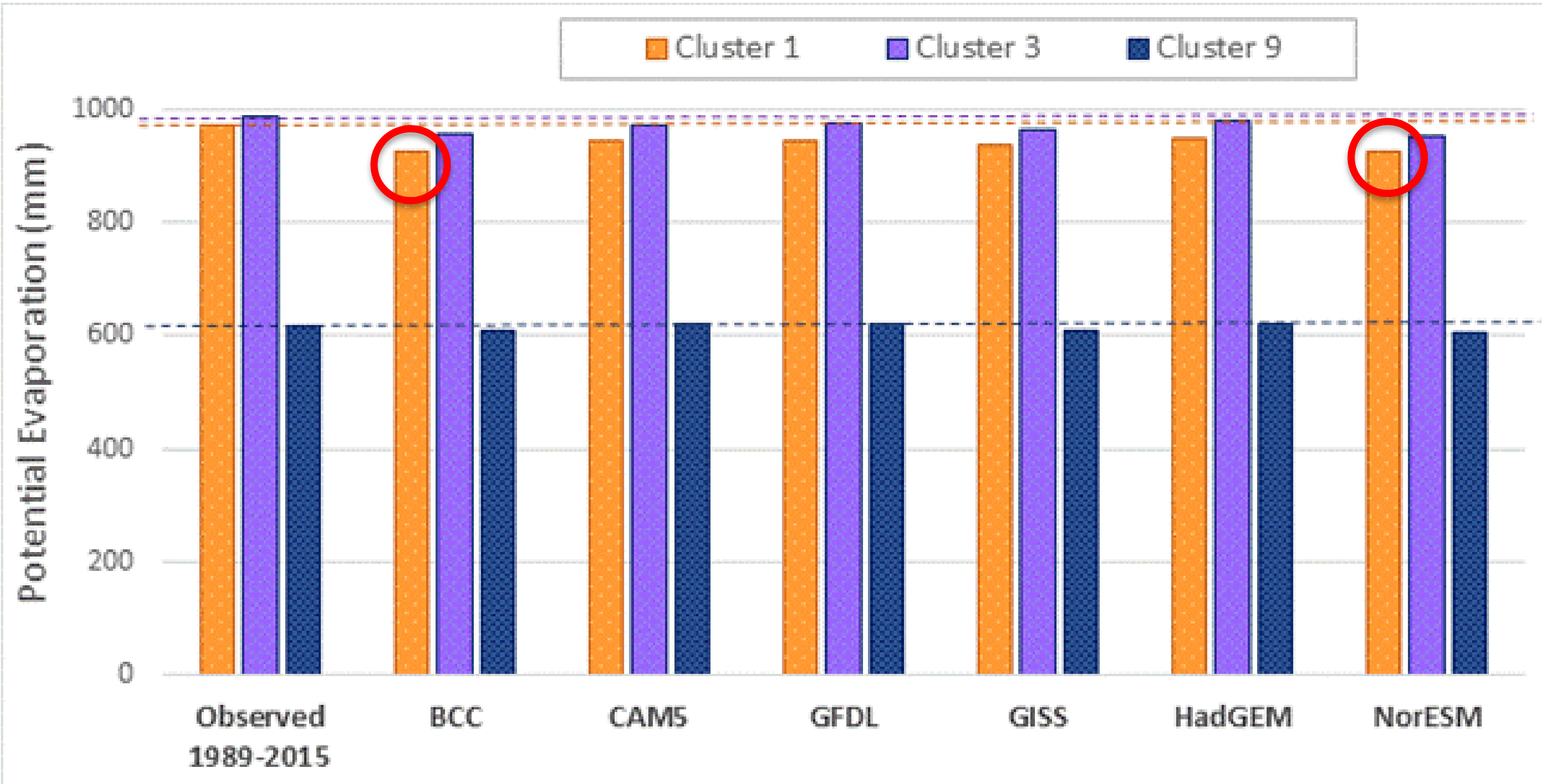


No statistically significant differences between historic data and climate change projections

Cumulative **Evaporation** Projections



Annual average **Evaporation** Projections



= statistically significant differences between historic data and climate change projections

MfE (June 2016) report on Climate Change

New Zealand Government

Page 30:

Marlborough.

ii. Annual precipitation changes are small in many places, partly due to inter-model variability, but also to seasonal compensation, eg, in Hawke's Bay, models predict an increase in summer rainfall but a decrease in winter.

iii. The largest projected changes in precipitation occur on the West Coast in the winter season

Climate Change Projections for New Zealand

Atmospheric projections based on simulations undertaken for the IPCC 5th Assessment

HAWKE'S BAY
REGIONAL COUNCIL

Conclusions

- Considerable uncertainty with climate change projections
- Statistically no significant difference between historic 26-year rainfall/evaporation and almost all 26-year climate change projections
- Historic data are considered valid for future scenario modelling within this TANK planning cycle
- Future plan reviews/changes should revisit updated climate change projections

Decision from Group

Do you agree climate change projections are not significant enough to influence decisions for this plan change?

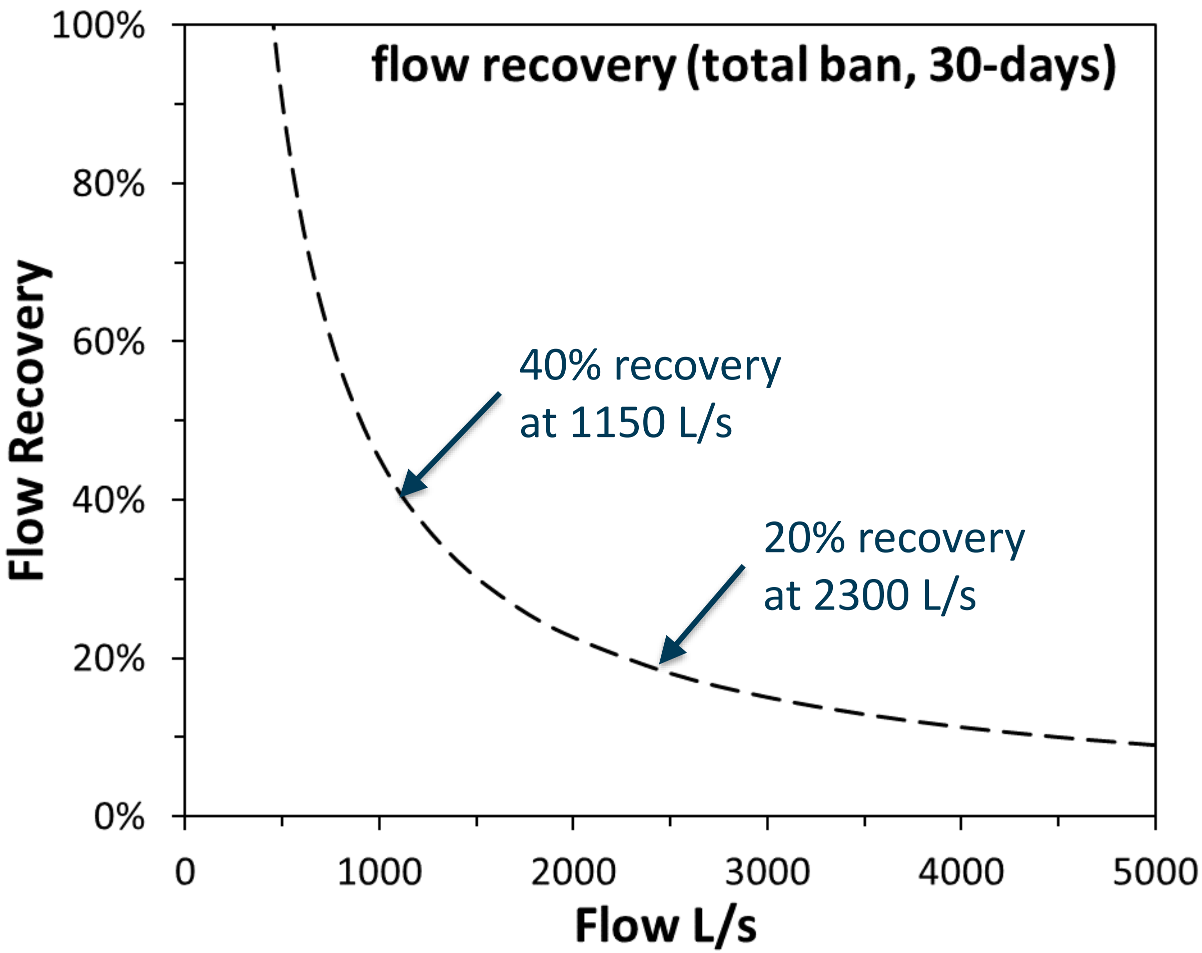
HAWKE'S BAY REGIONAL COUNCIL

Recap on benefits to river of restricting groundwater takes

Thomas Wilding

HAWKE'S BAY
REGIONAL COUNCIL

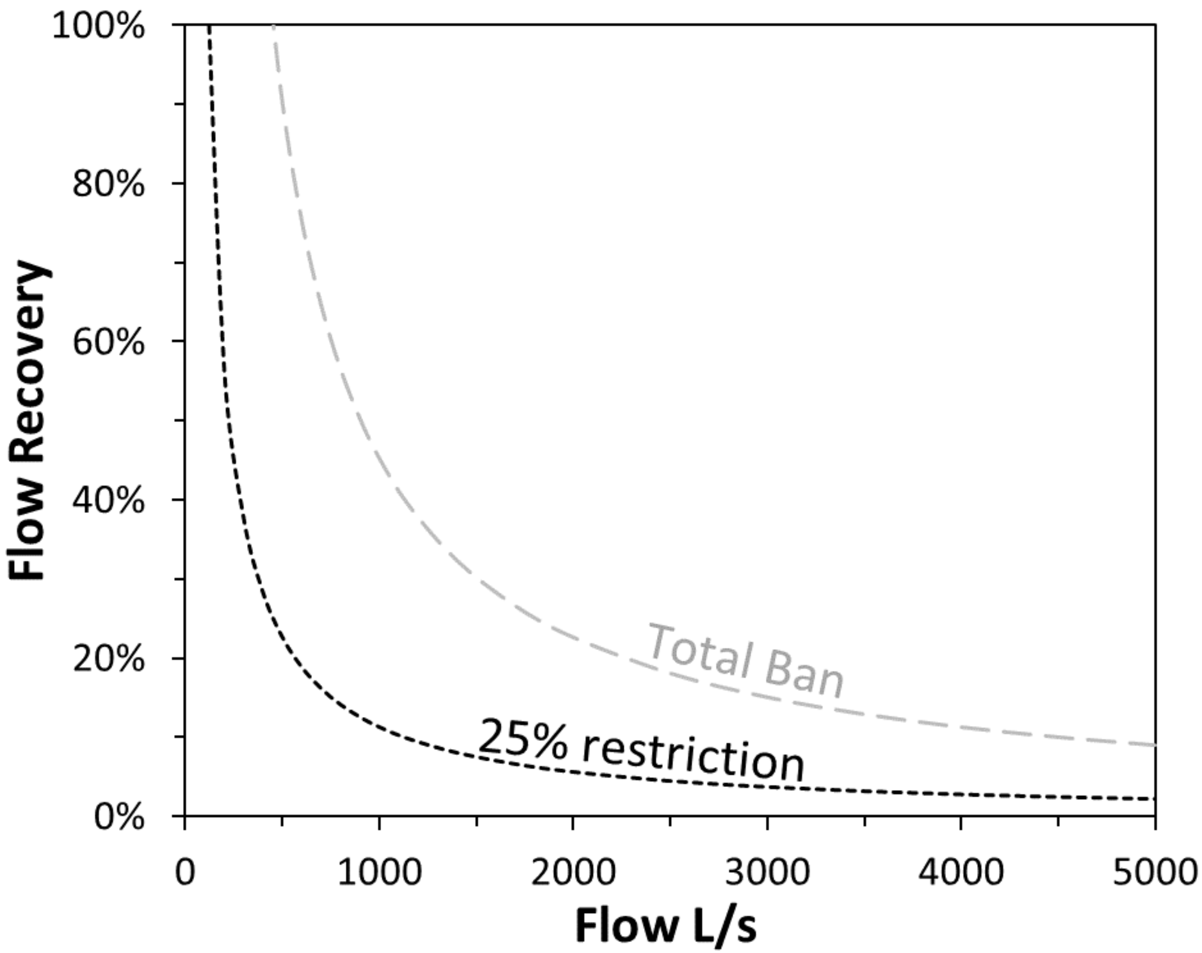
Ngaruroro:
Little flow recovery from total ban for everyone



Flow recovery as a percent of river flow after 30 days total ban for zone 1, 2, 3, + industrial + municipal

HAWKE'S BAY REGIONAL COUNCIL

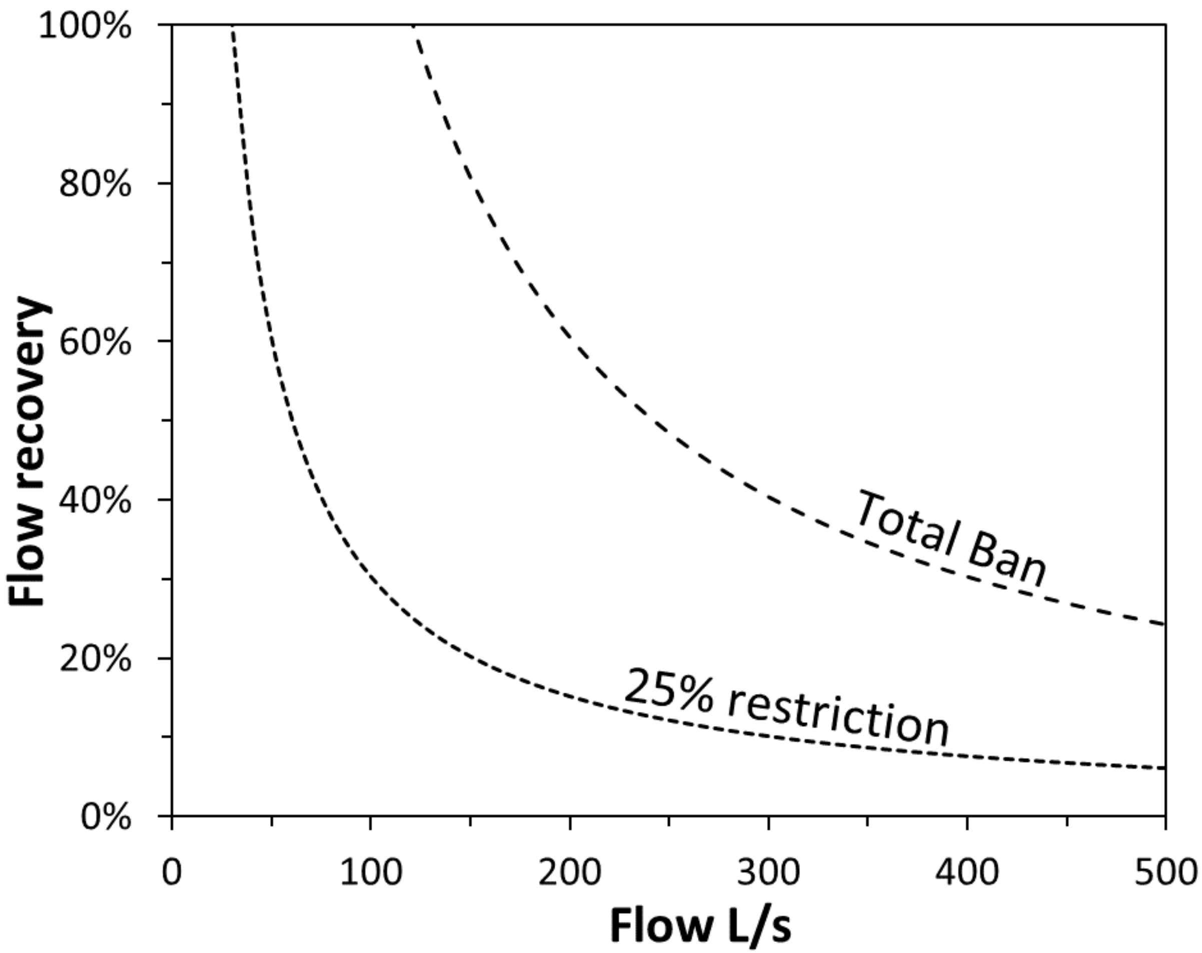
Ngaruroro:
Partial restriction even less effective



Flow recovery as a percent of river flow after 30 days of 25% reduced use for zone 1, 2, 3, + industrial + municipal

HAWKE'S BAY REGIONAL COUNCIL

Raupare (spring-dominated)
Much greater flow recovery from total ban



Flow recovery as a percent of river flow after 30 days restriction for zone 1, 2, 3, + industrial + municipal

HAWKE'S BAY REGIONAL COUNCIL

Sort out the spring streams first, then return to Ngaruroro flows

	Ngaruroro	Spring streams
Impact on flow	Small	higher
Consequence	Less habitat for *some* species	Less oxygen for *all* species
Physical validation	No	Yes
Biological impacts	Unknown	Observed
Interactions investigated	None	Shade, aquatic plants

HAWKE'S BAY REGIONAL COUNCIL

We can decide how to achieve limits

AVOID

e.g. allocation limits, staged reductions

REMEDY

e.g. flow augmentation (from wells, dams, etc.)

MITIGATE

e.g. riparian shading

Summary

- Recommend focus on spring-dominated streams – for now.
- Why? Bigger impact on springs and better knowledge of instream consequences.
- We can set draft limits => draft remedies => draft mitigation.

HAWKE'S BAY REGIONAL COUNCIL

Follow Up Points

Didn't we already **agree to use torrentfish as RHYHABSIM target species for Ngaruroro**? **- NO**

- There was consensus on inanga (lowland trib.) and tuna (upland trib.), but not on torrentfish (Ngaruroro) *[URL]*
- Perf. measure discussion was broader than flow target

What are the Flow requirements for koura - LOW

- Koura prefer zero velocities. They can tolerate up to 0.4 m/s if provided cover. Therefore flow requirements are less than fast-water fish.

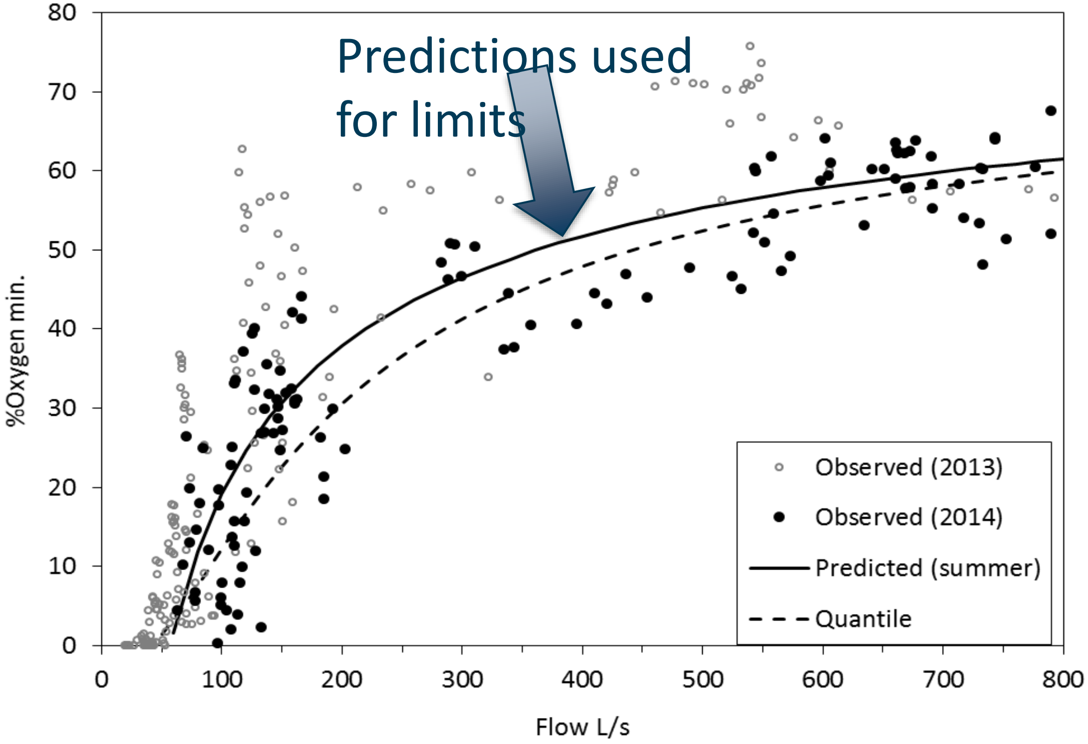
Does **river mouth closure** restrict fish numbers **- UNLIKELY**

- Closure does occur, but typically only lasts a few hours (*Vince Byrne*).
- Not long enough to limit the fish population.

HAWKE'S BAY REGIONAL COUNCIL

Less flow => less Oxygen

Seasonal plant growth changes the oxygen-flow response



- Awanui Stream – comparing model predictions (black line) to observed oxygen (training circles; validation dots)

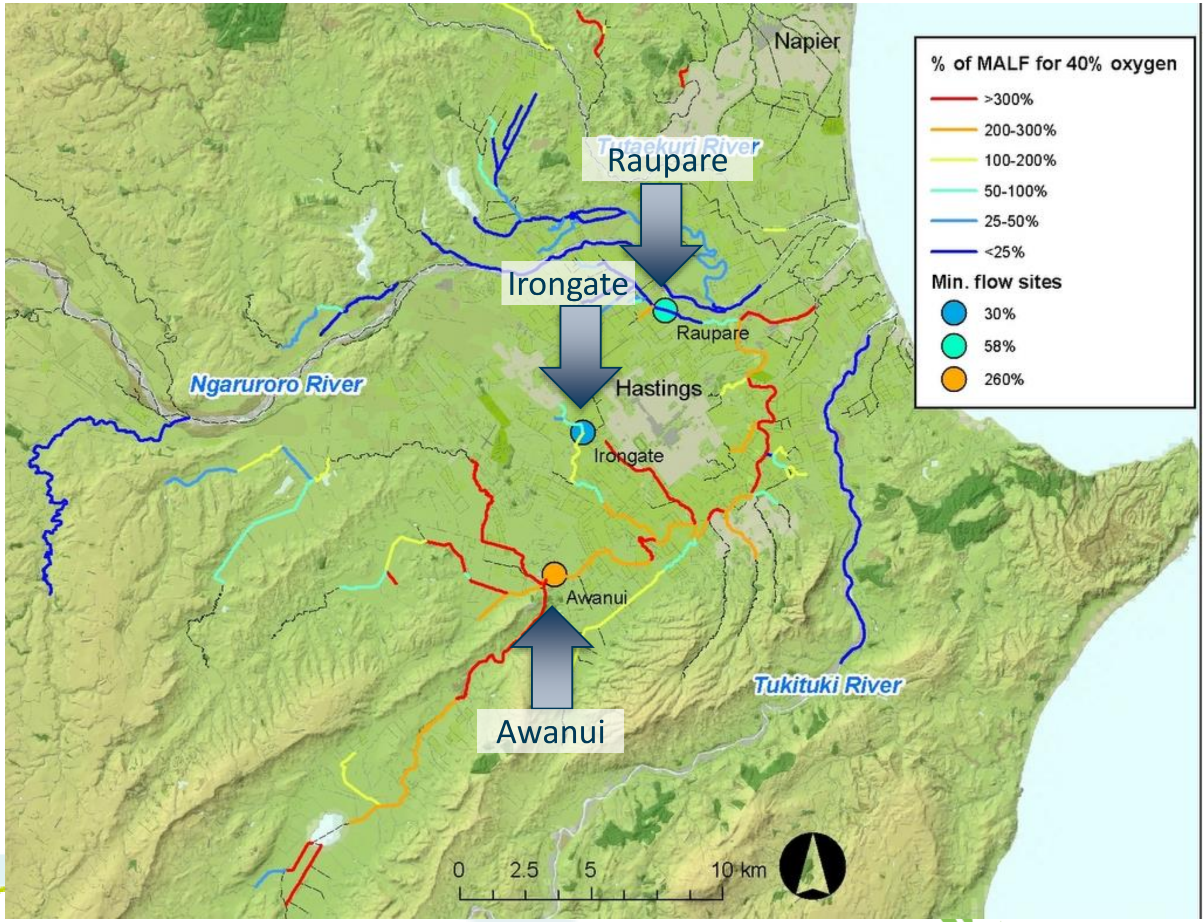
We can choose oxygen limits

Oxygen attribute	60%	40%	(velocity 0.04 m/s)
Indicator	invertebrate MCI	Health of adult native fish	Fish survival / aquatic plant health
Restriction Regime	Ban or Staged Reduction		

HAWKE'S BAY
REGIONAL COUNCIL

We can decide where we set flows

Three sites investigated compared to more than 20 existing ban sites

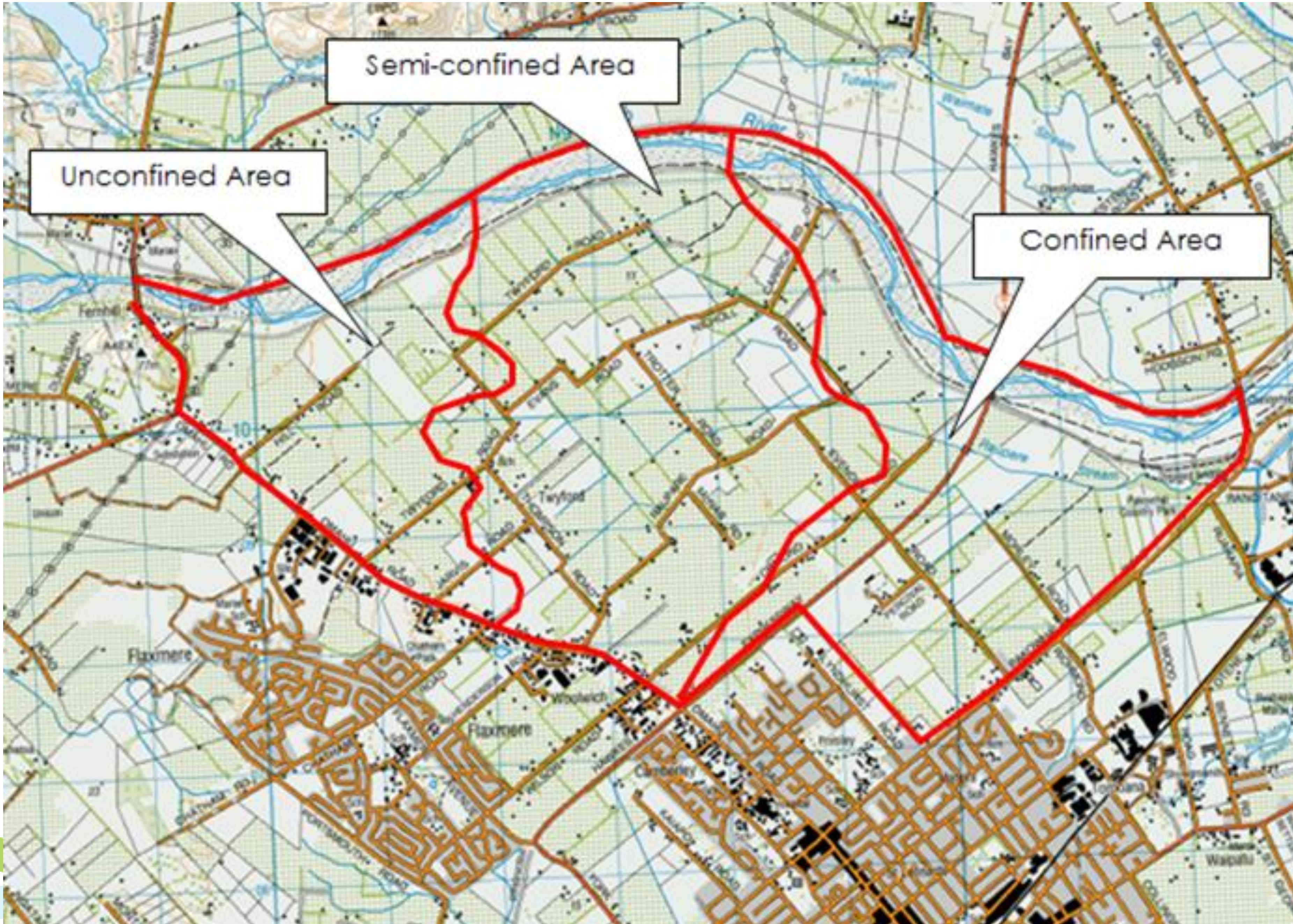


HAWKE'S BAY REGIONAL COUNCIL

Semi-Confined Global Consent Augmentation of the Raupare

Jerf van Beek

HAWKE'S BAY
REGIONAL COUNCIL

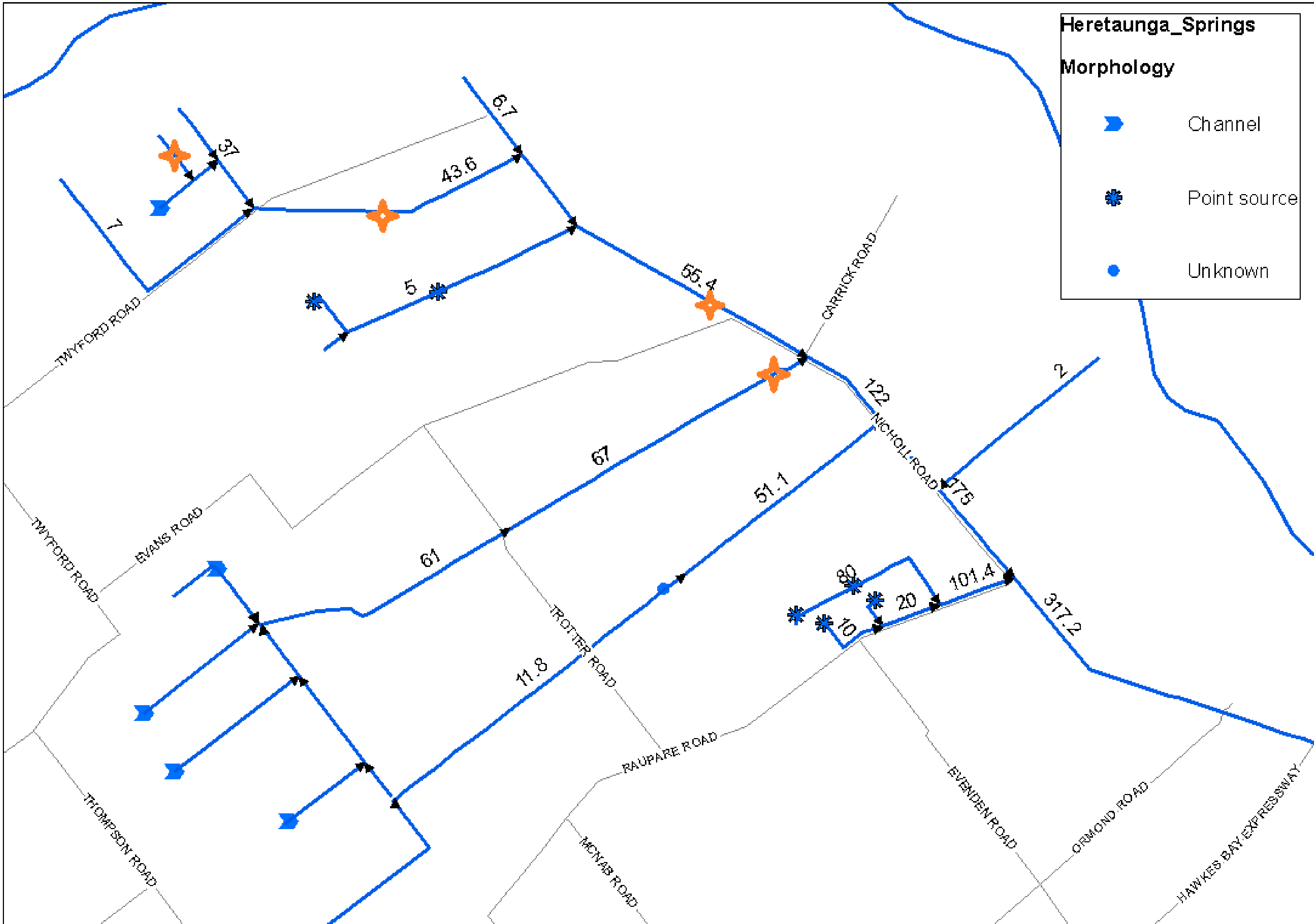

Semi-confined Area
Unconfined Area
Confined Area
Flaxmere

Who is involved?

- 46 Wells measured on WaterSense web tool.
- This is 65% of the land area in the Semi-Confined zone.
- All but 2 people in the Twyford area are in TIG.

Who pays and who benefits?

- Every one who is a member of TIG Pays a per hectare levy
- Everyone benefits
- Not everyone is in the Global Consent
- Working on naturalised flow.

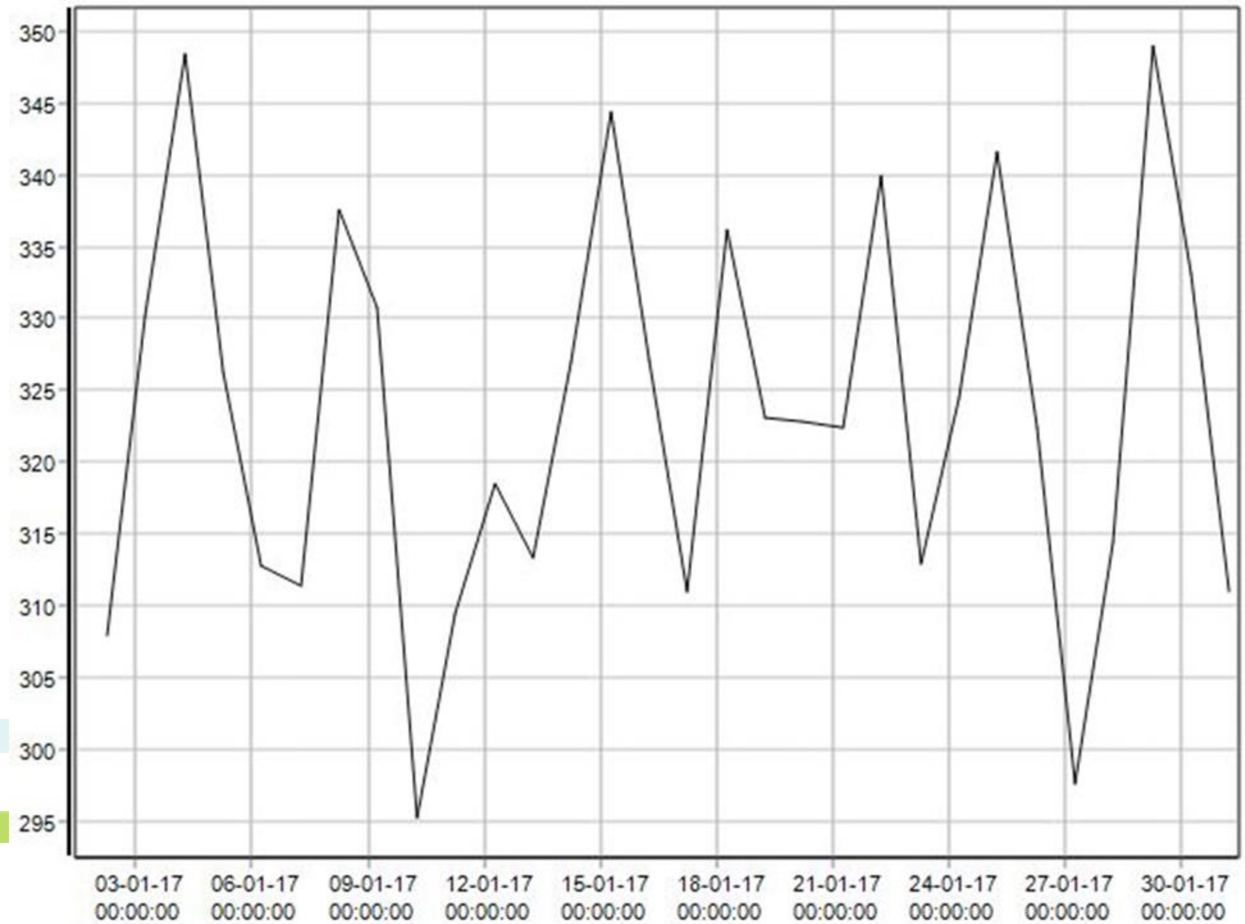


Heretaunga_Springs
Morphology
Channel
Point source
Unknown
6.7
37
43.6
7
5
55.4
CARRICK ROAD
TWYFORD ROAD
122
NICHOLL ROAD
2
175
67
51.1
61
EVANS ROAD
TWYFORD ROAD
80
20
101.4
10
317.2
TROTTER ROAD
11.8
RAUPARE ROAD
EVENDEN ROAD
ORMOND ROAD
HAWKES BAY EXPRESSWAY
THOMPSON ROAD
MCNAB ROAD

How we augment

Using the daily mean flow from the HBRC website as a trigger

Example of Daily mean flow in January



HAWKE'S BAY
REGIONAL COUNCIL

Augmentation at Bostocks M6

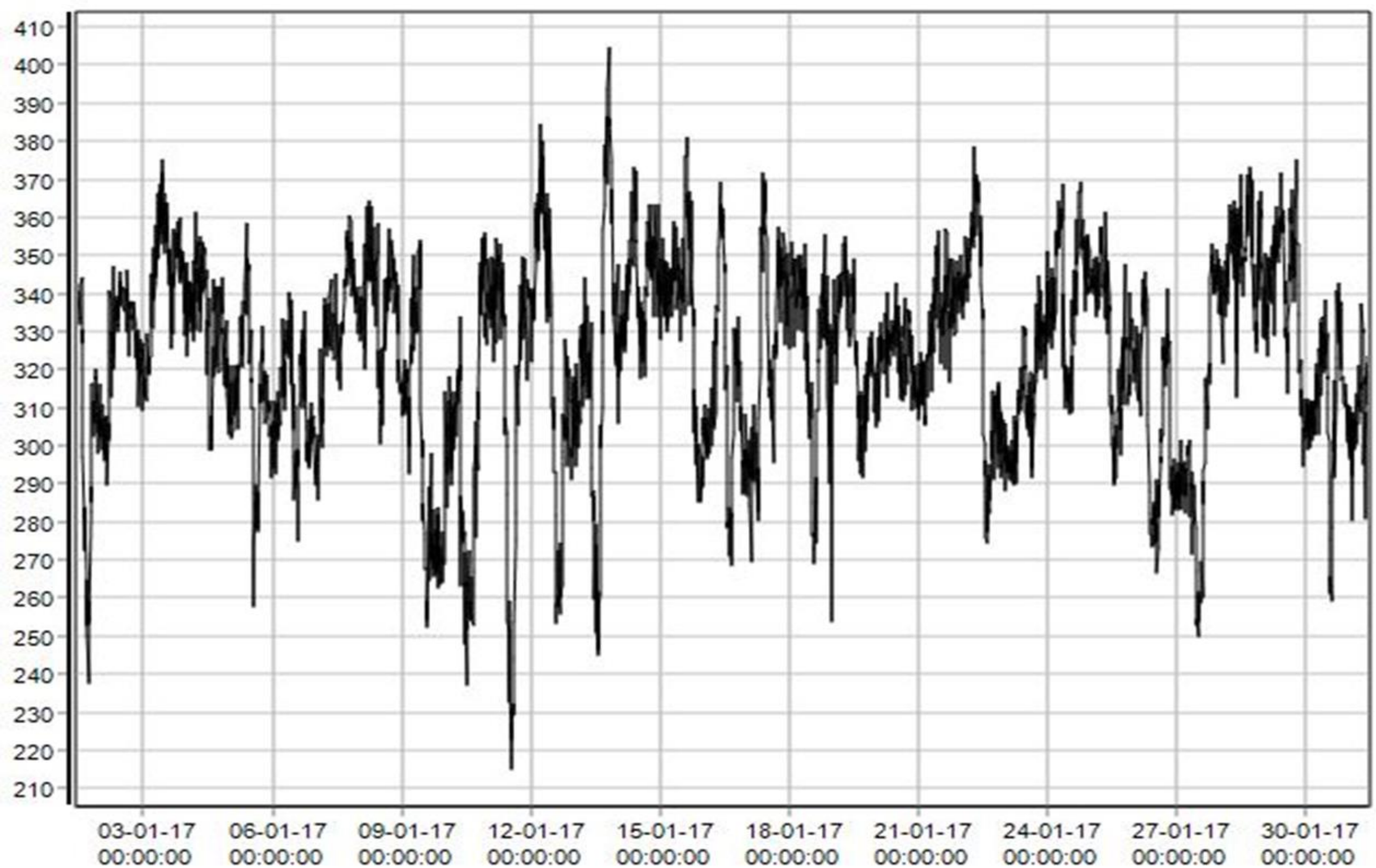
HAWKE'S BAY
REGIONAL COUNCIL

Global Consent conditions

- 80% plus Disolved Oxygen in the augmented water
- Not to be more than 3 degrees warmer
- Not to damage the stream bed

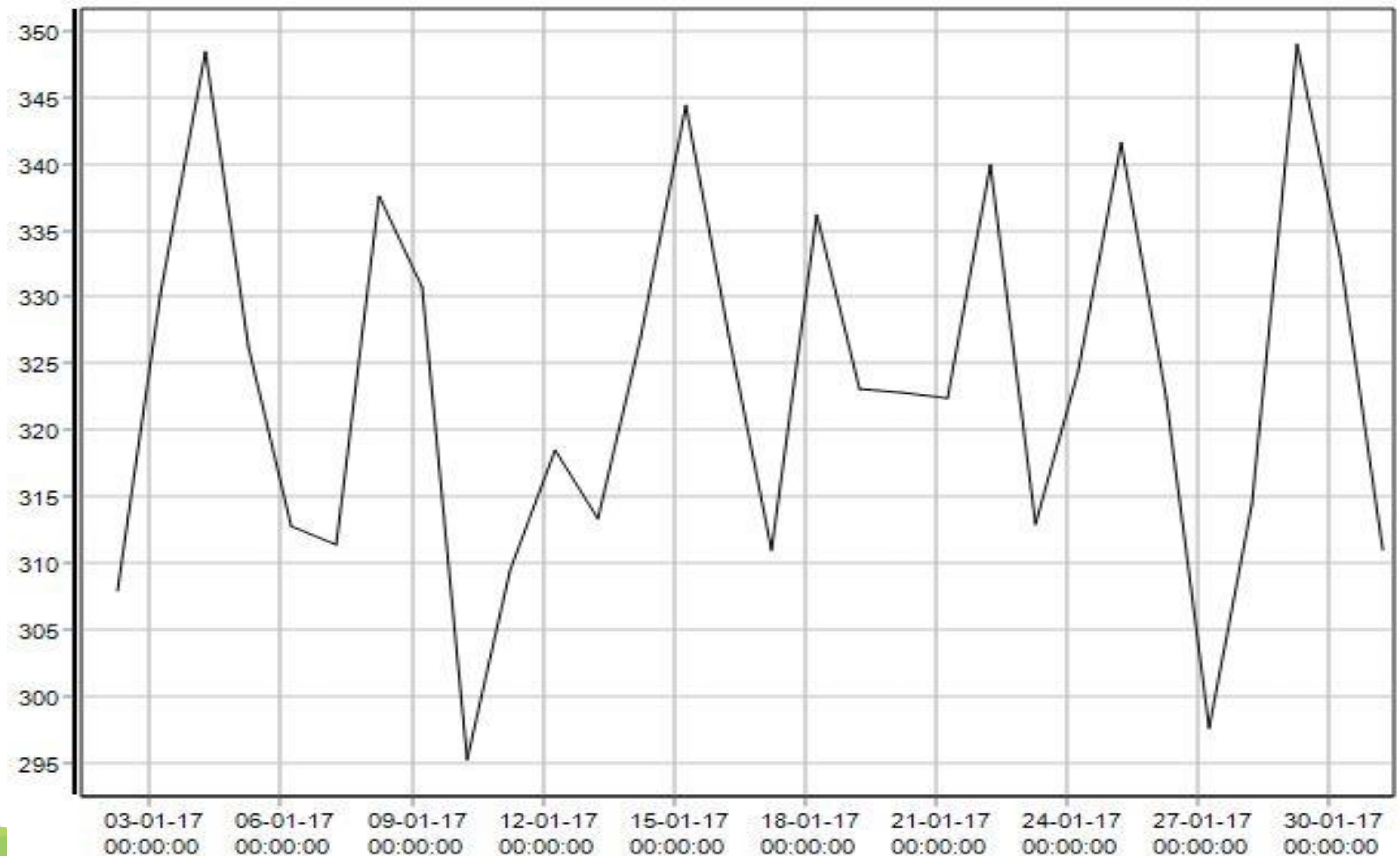
HAWKE'S BAY
REGIONAL COUNCIL

Raupare flow in January



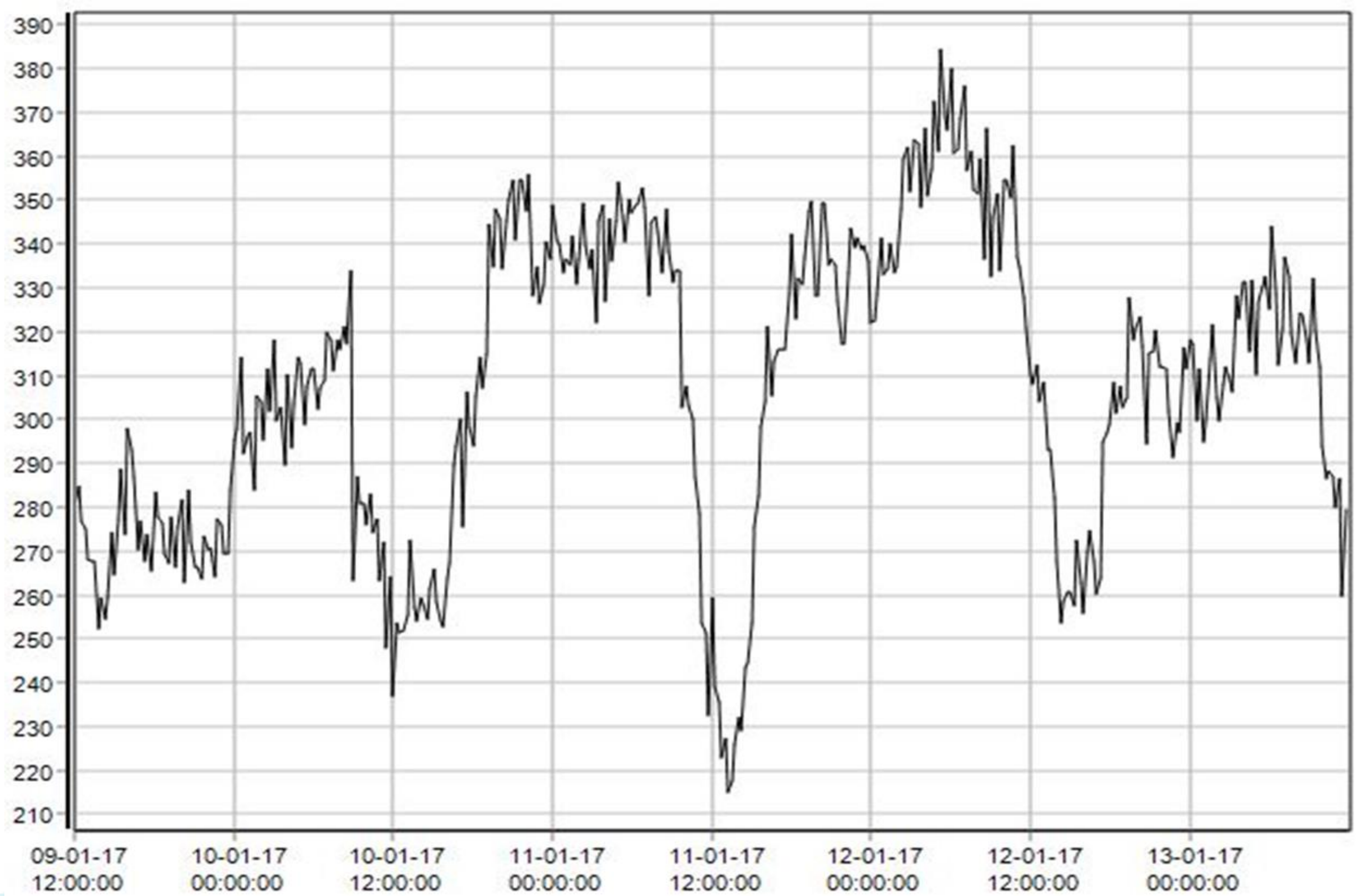
HAWKE'S BAY
REGIONAL COUNCIL

Daily mean flow in January



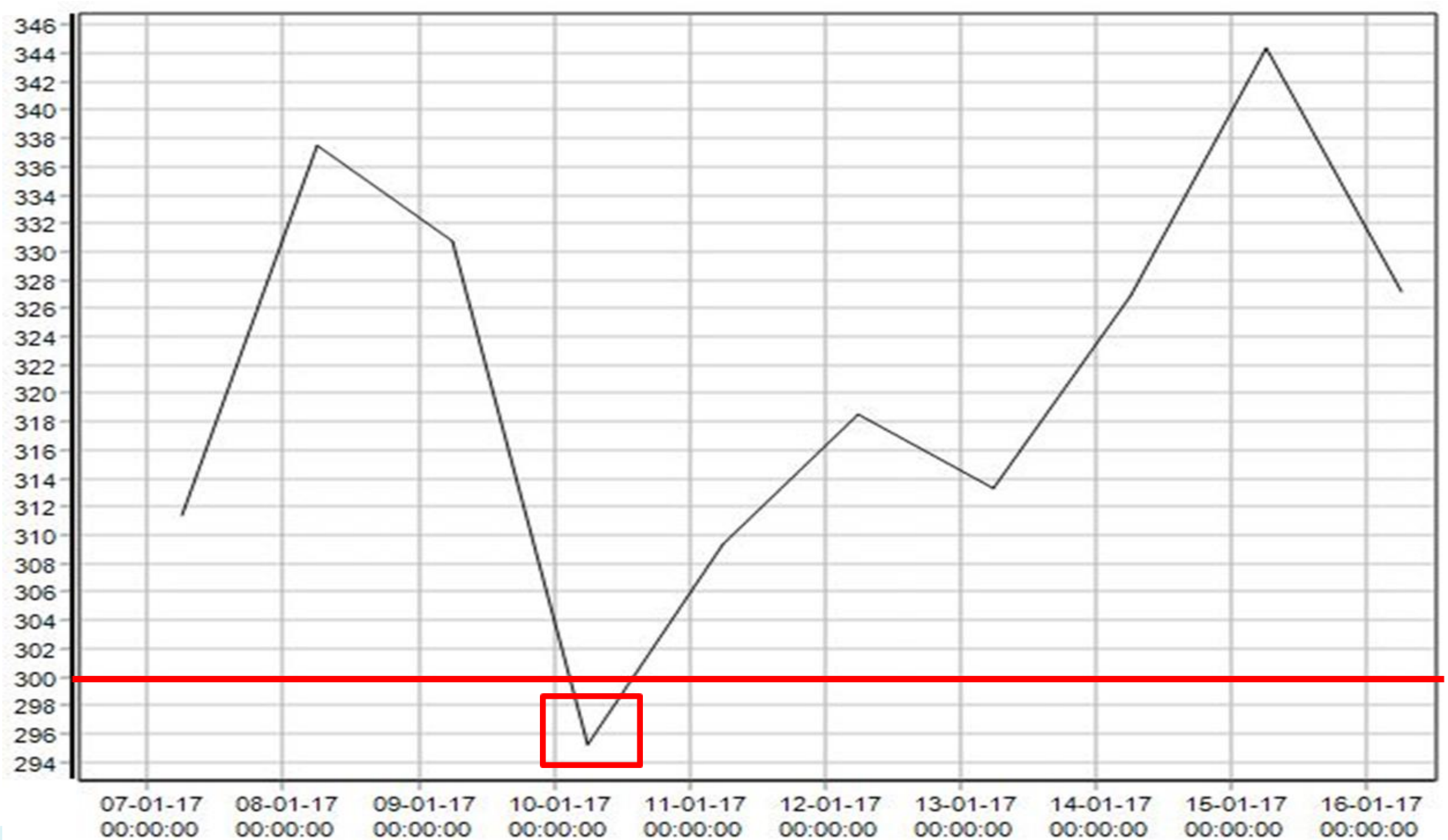
HAWKE'S BAY REGIONAL COUNCIL

Raupare flow 11th January



HAWKE'S BAY
REGIONAL COUNCIL

Raupare mean flow 11th of January

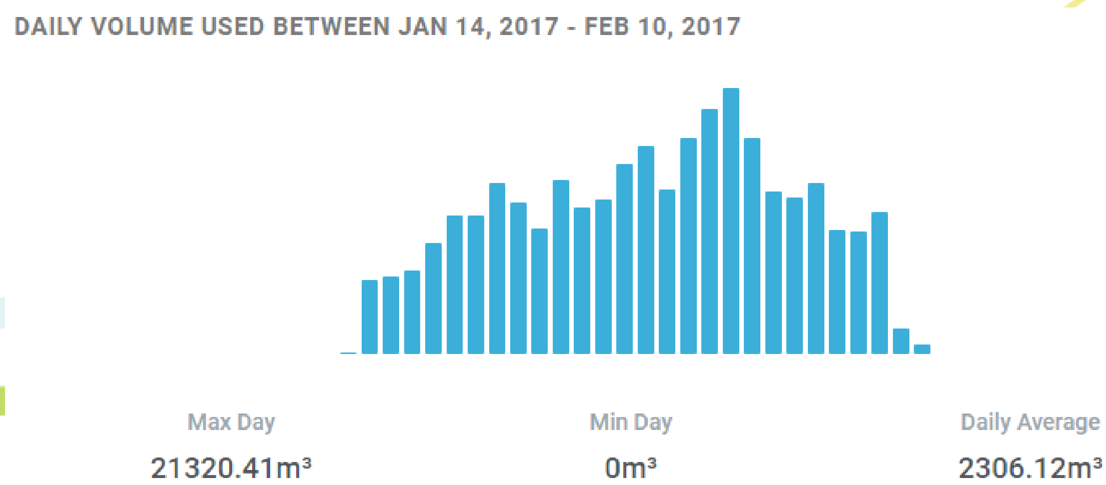


HAWKE'S BAY
REGIONAL COUNCIL

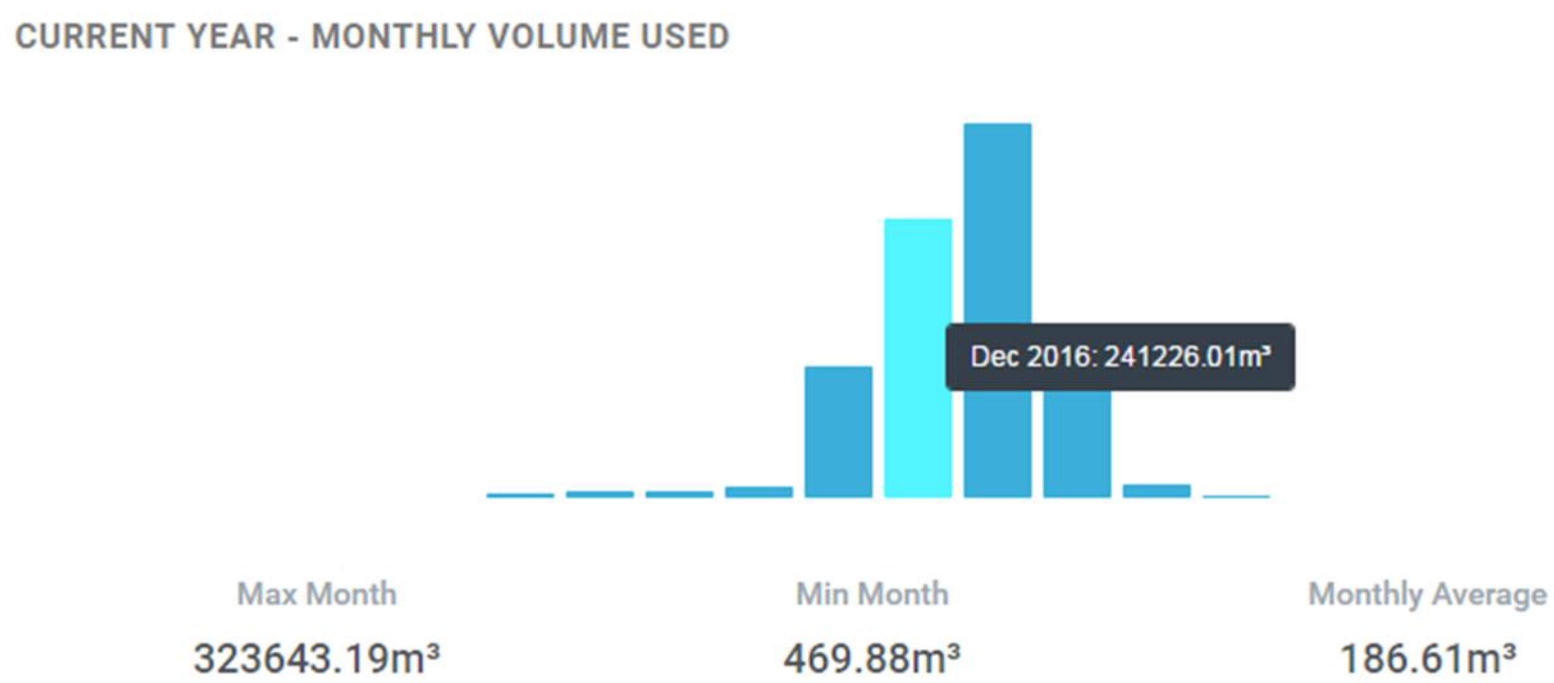
Global use for entire season

45% of total water was used

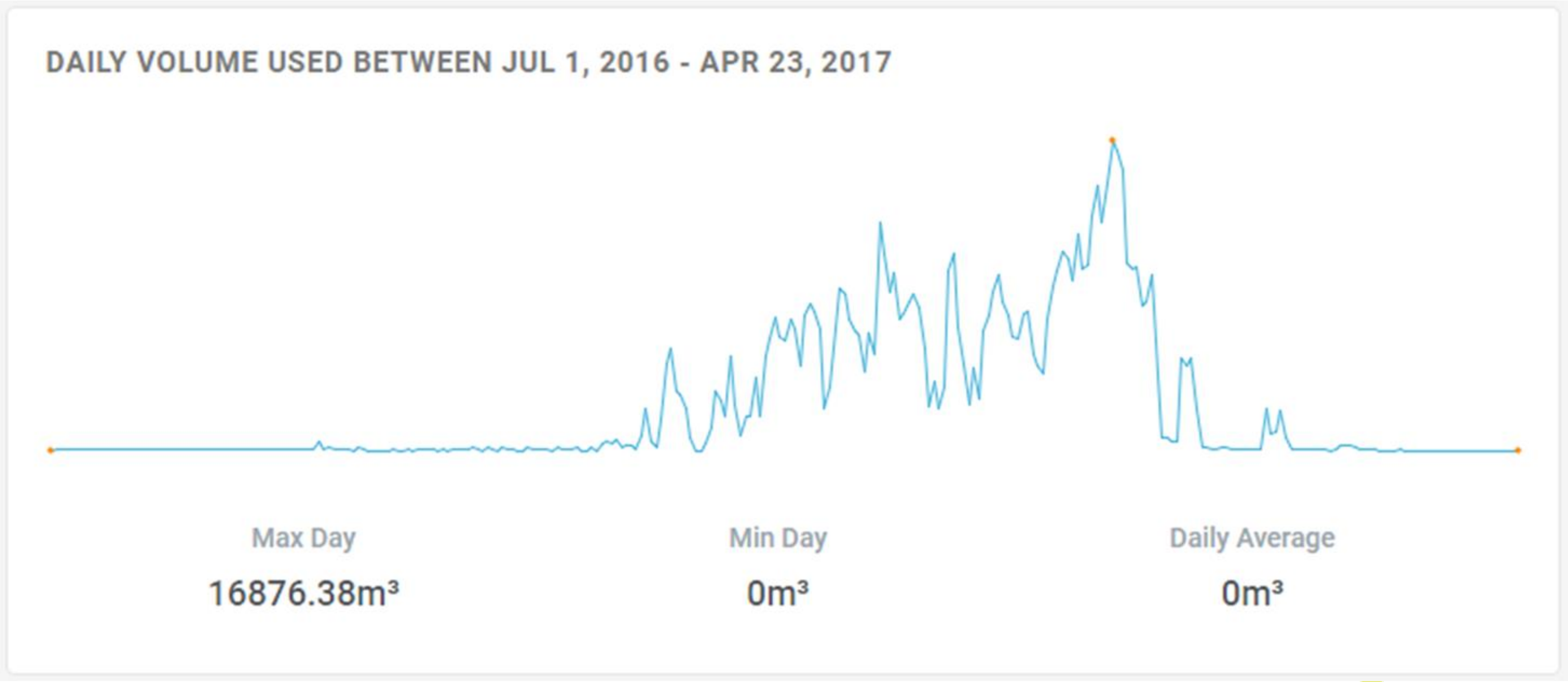
The highest usage period reached approximately 59.8% of the 28 day limit



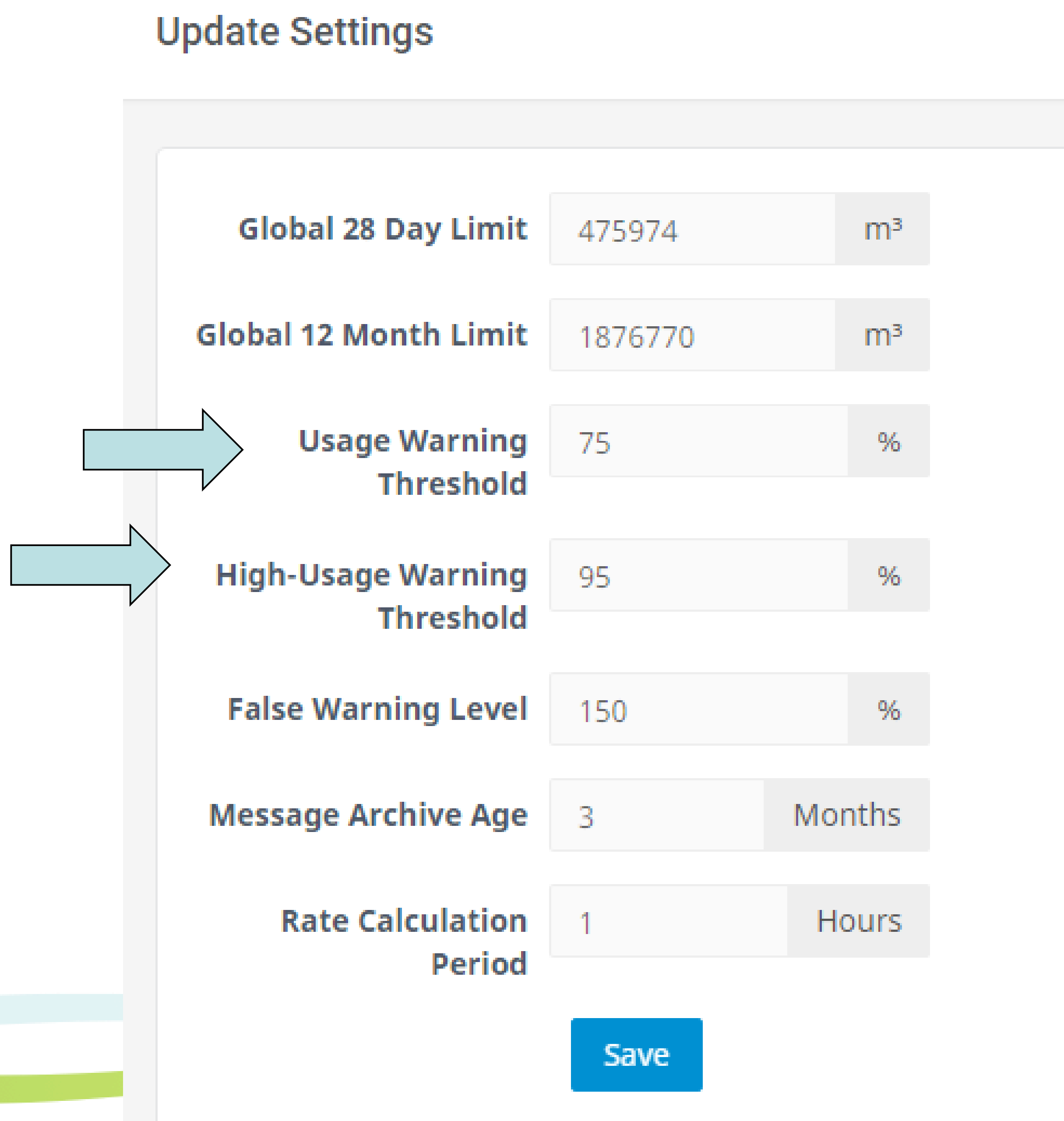
January was the highest usage



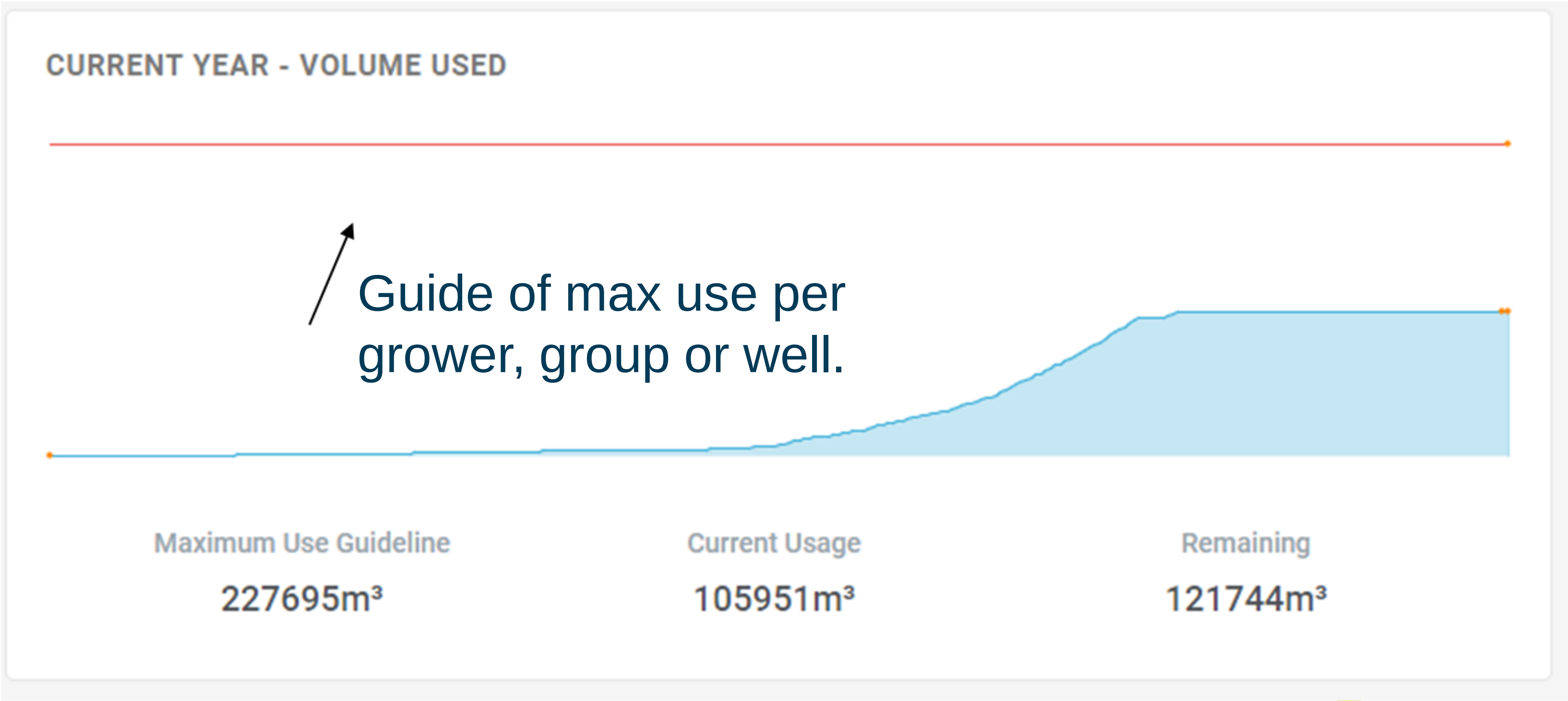
Year to date- usage pattern



Warnings


Update Settings
Global 28 Day Limit
475974
m³
Global 12 Month Limit
1876770
m³
Usage Warning Threshold
75
%
High-Usage Warning Threshold
95
%
False Warning Level
150
%
Message Archive Age
3
Months
Rate Calculation Period
1
Hours
Save

Maximum use guideline



What about the Un-Confined zone Global consent

HAWKE'S BAY
REGIONAL COUNCIL

Augmentation to other waterways

- feasibility and potential challenges
- Mangateretere, Karamu, Moteo Valley etc.

HAWKE'S BAY
REGIONAL COUNCIL

Questions?

HAWKE'S BAY
REGIONAL COUNCIL

TANK stakeholder meeting 2017-04-27

Stream depletion for individual streams and stream augmentation

Presented by Pawel Rakowski

HAWKE'S BAY
REGIONAL COUNCIL

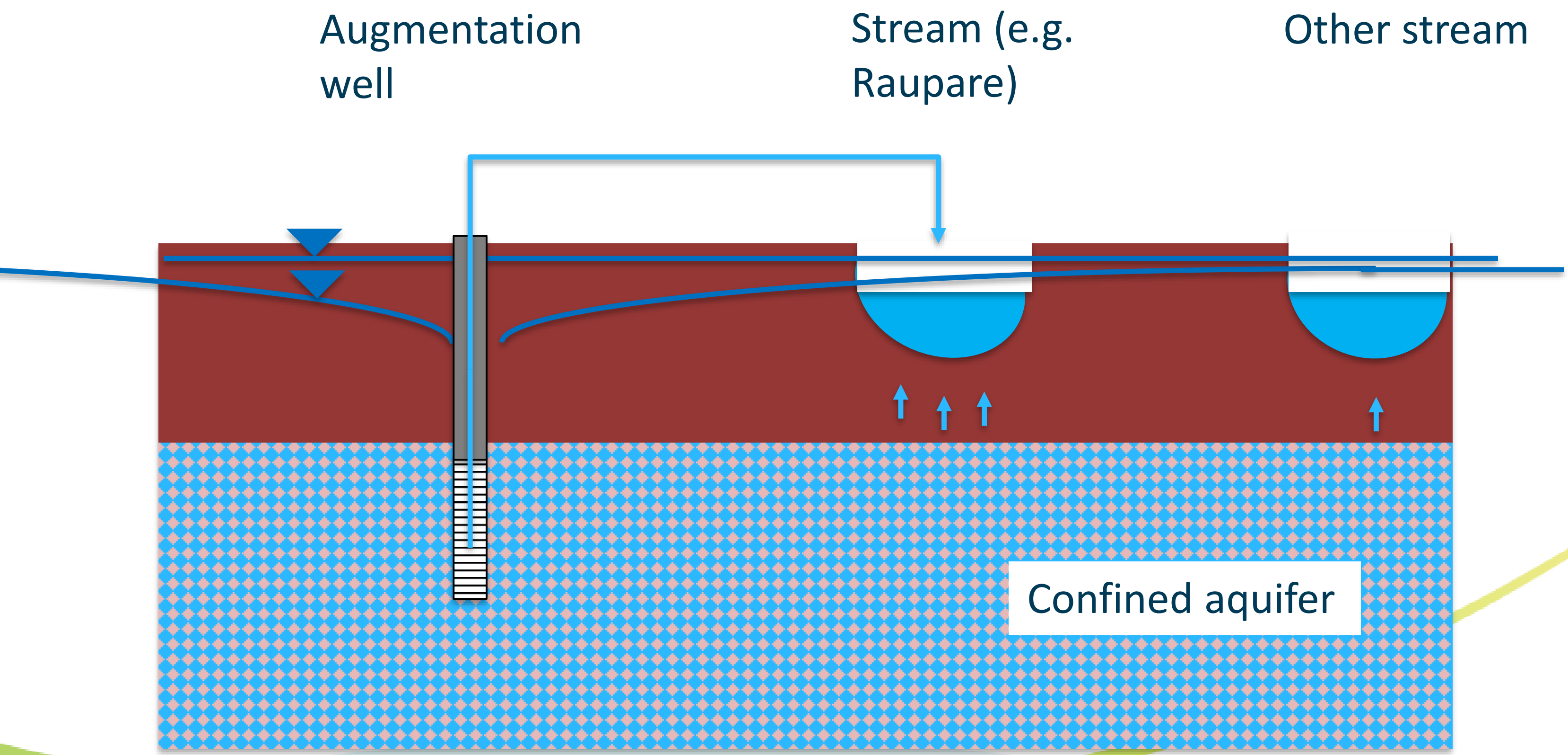
Outline of the presentation

1. Stream Augmentation scenario
2. Stream depletion zones for individual streams (didn't work)
3. Zones of actual impact of pumping and cumulative impact (didn't work)
4. Possible management of cumulative impact

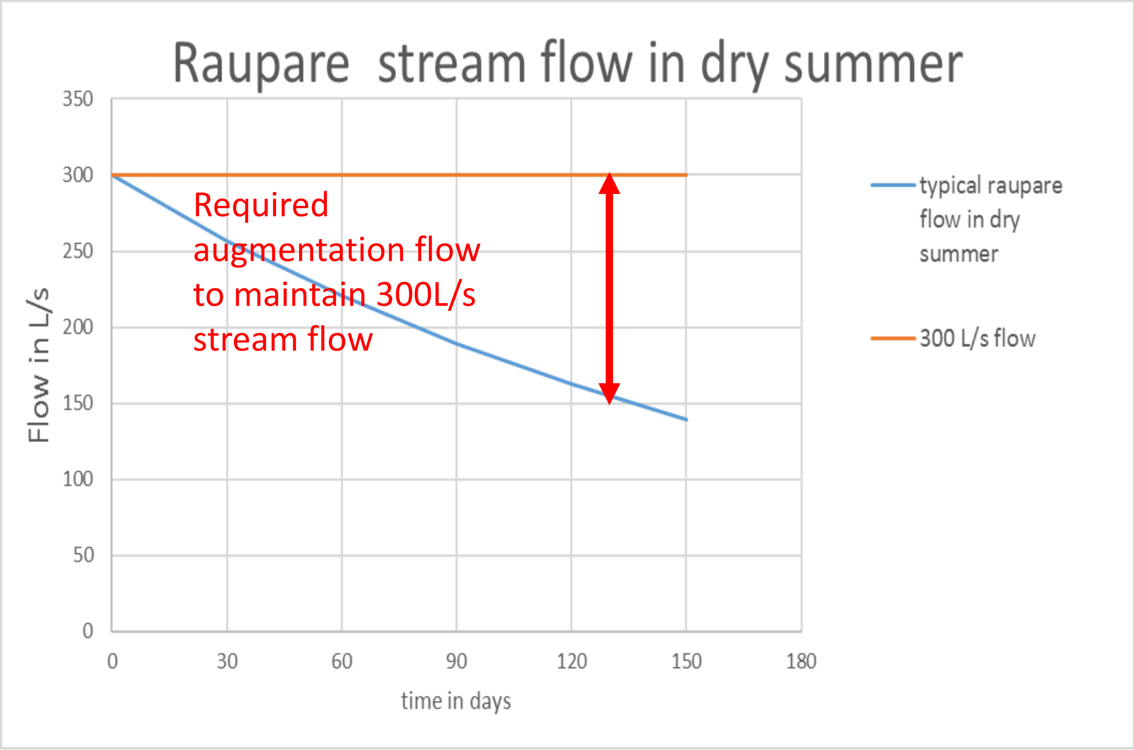
HAWKE'S BAY REGIONAL COUNCIL

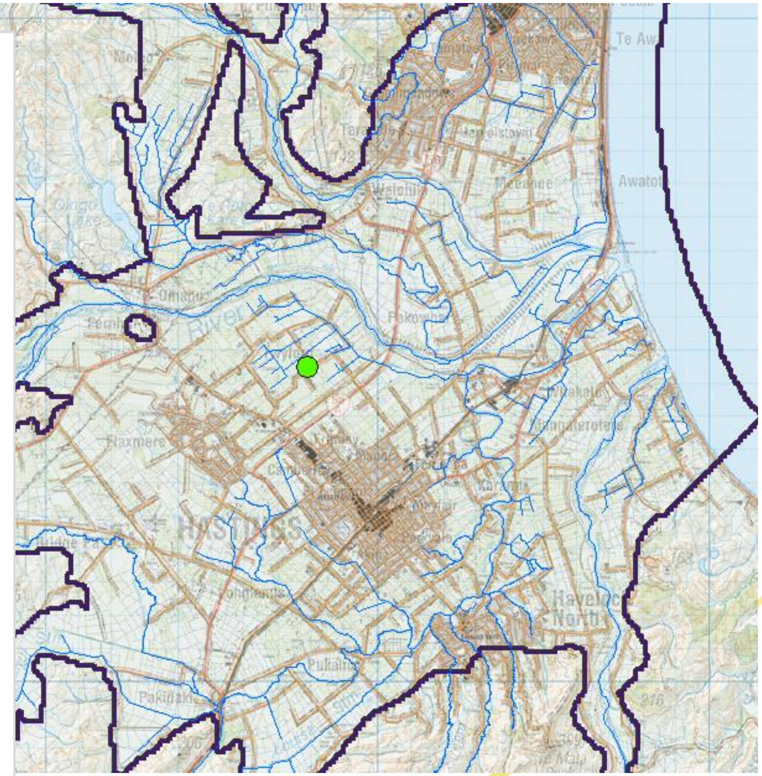
Stream augmentation

- Pumping groundwater to the streams during dry periods



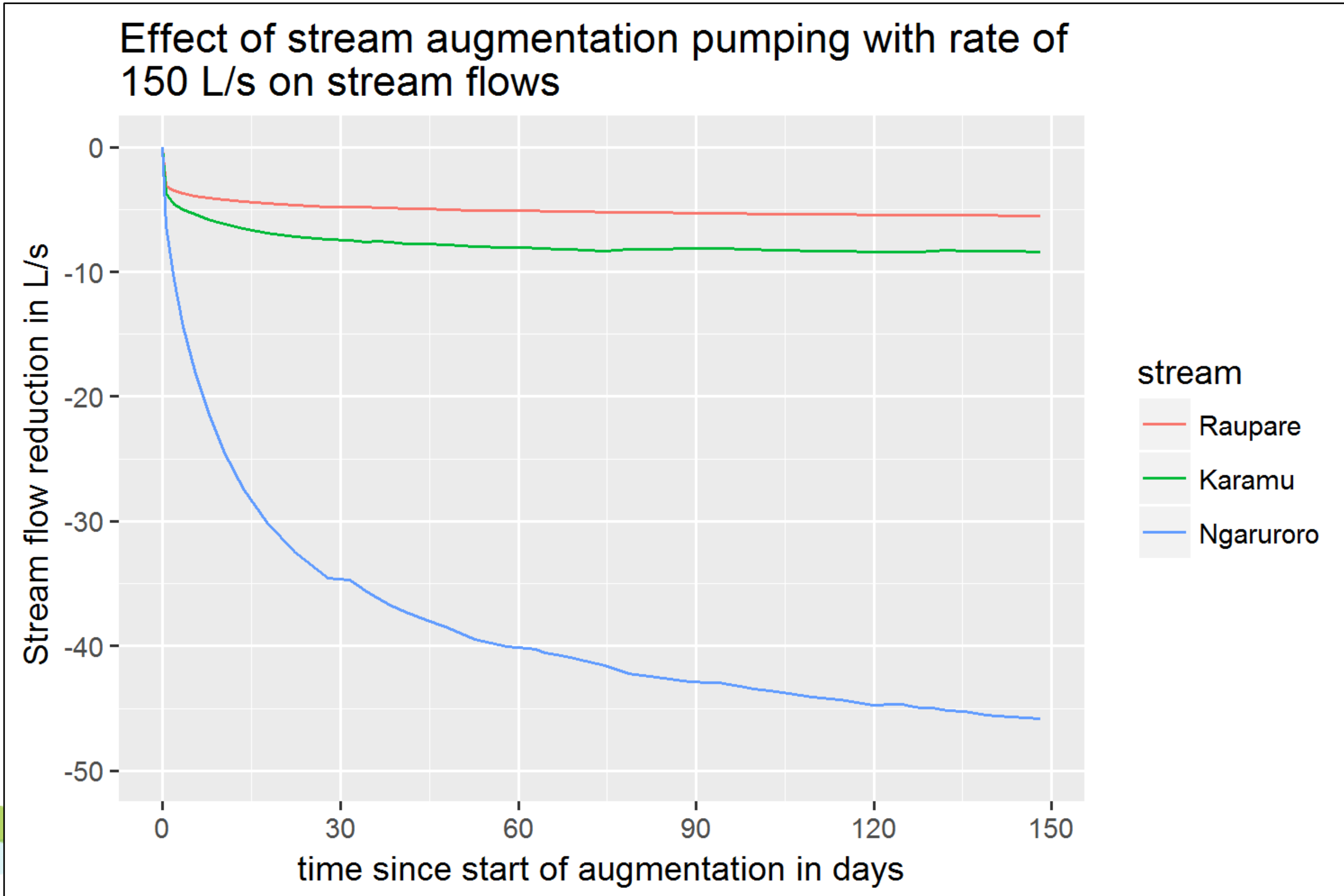
Stream Augmentation Scenario





- Pumping well in Raupare area
- Pumping rate 150 L/s
- Calculate effect of this additional pumping on stream flow in selected streams including Raupare

Stream Augmentation



Outcome of Augmentation scenario

- Positive effect for the augmented stream
- Small negative effect for other streams
- Negative effect for Ngaruroro river may be acceptable (35 L/s effect for flow of 2000 L/s)
- Potentially a viable mitigation option, if benefit to spring fed streams outweighs negative effect in larger rivers

HAWKE'S BAY
REGIONAL COUNCIL

Stream depletion zone per stream

Purpose:

- Identify which streams are potentially most affected by stream depletion
- Identify protection/ban zones for individual stream
- Which streams should trigger restrictions

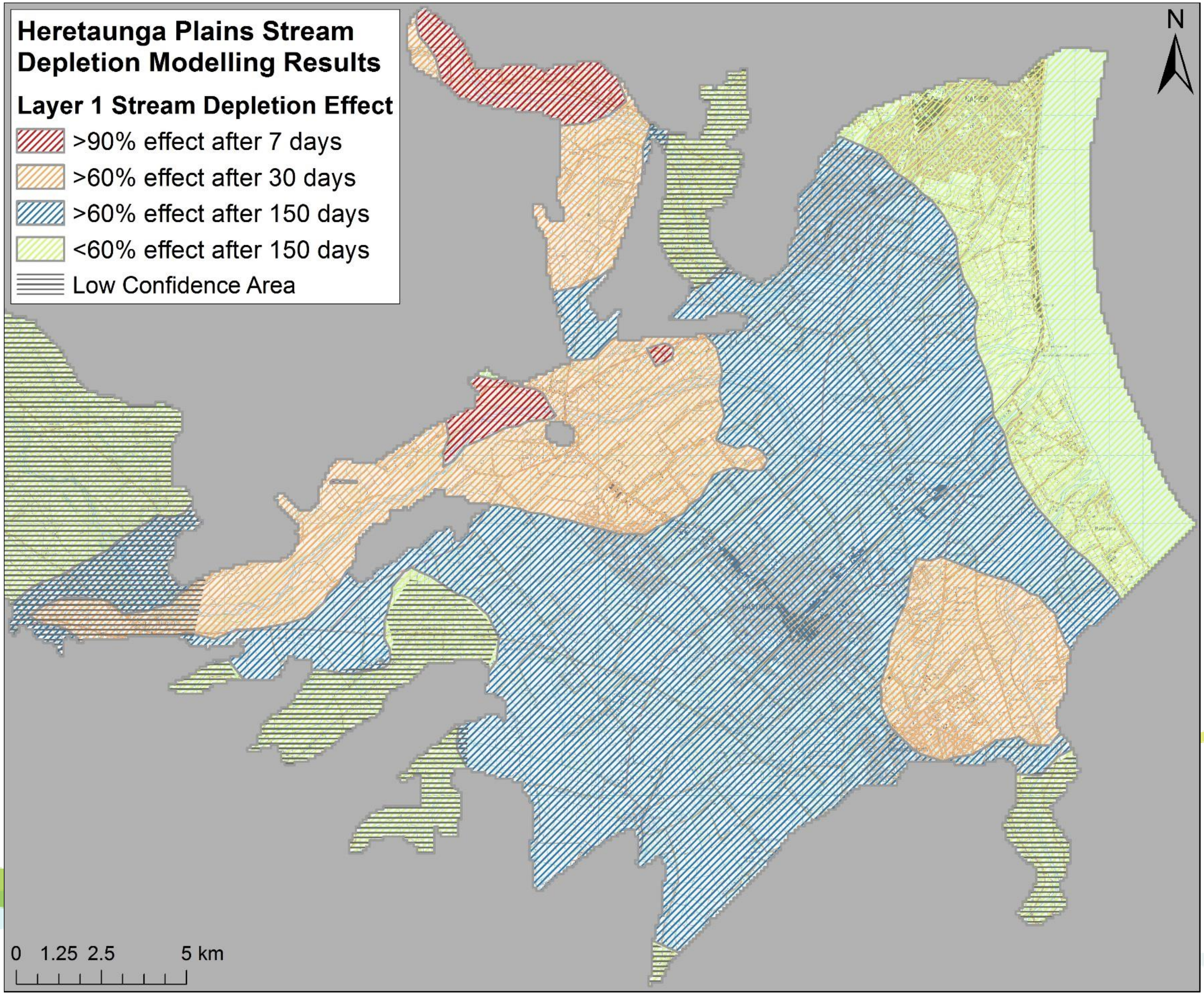
HAWKE'S BAY
REGIONAL COUNCIL

Stream depletion zone per stream

Method:

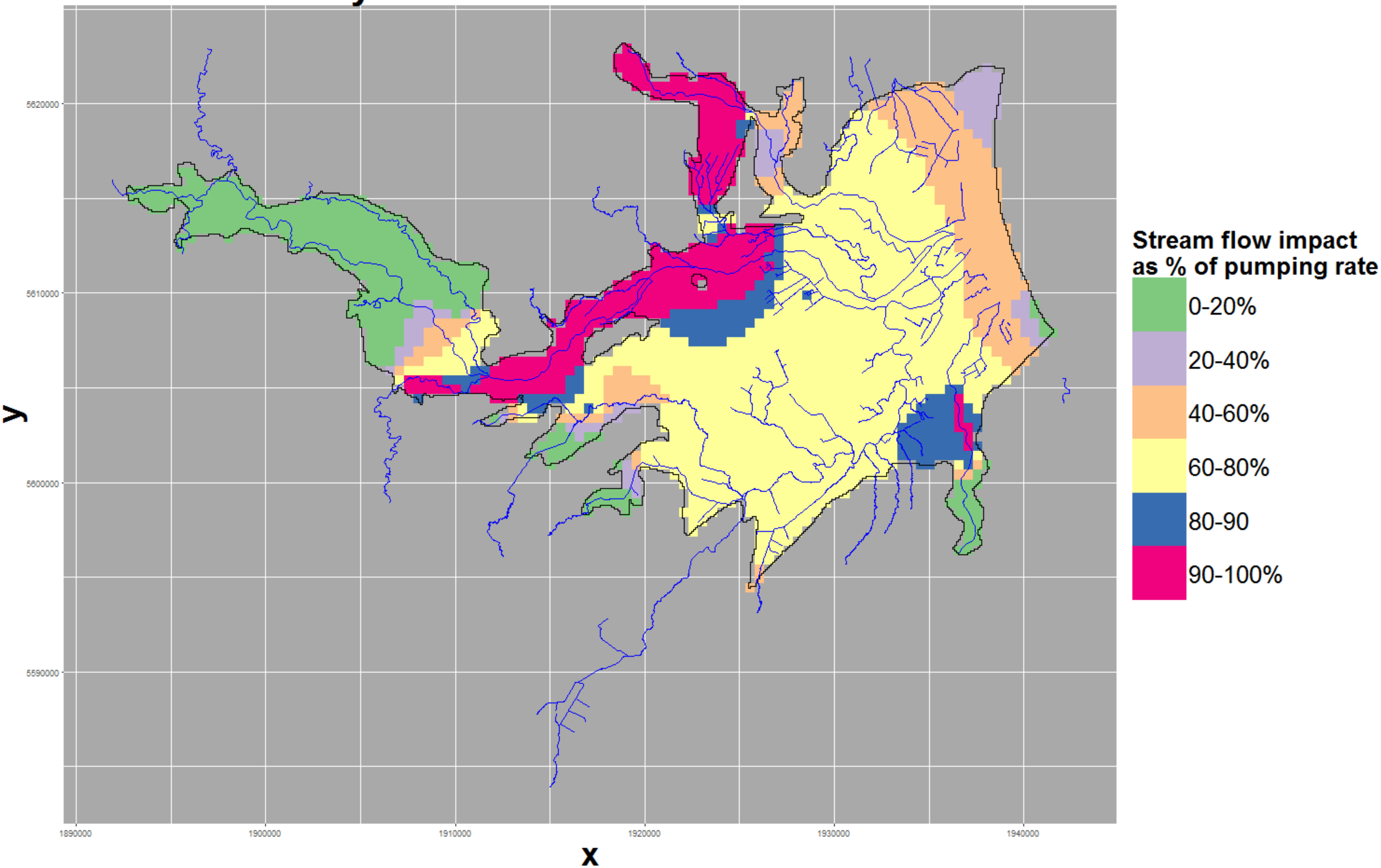
- Test effects of pumping from **individual** wells on stream flow of selected streams.
- Many thousands of locations tested.
- Result is how much stream flow declines in response to groundwater pumping
- Result as % of pumping rate
- Results are converted to a contour map
- Contour maps can be converted to zones

Stream depletion zones for all streams

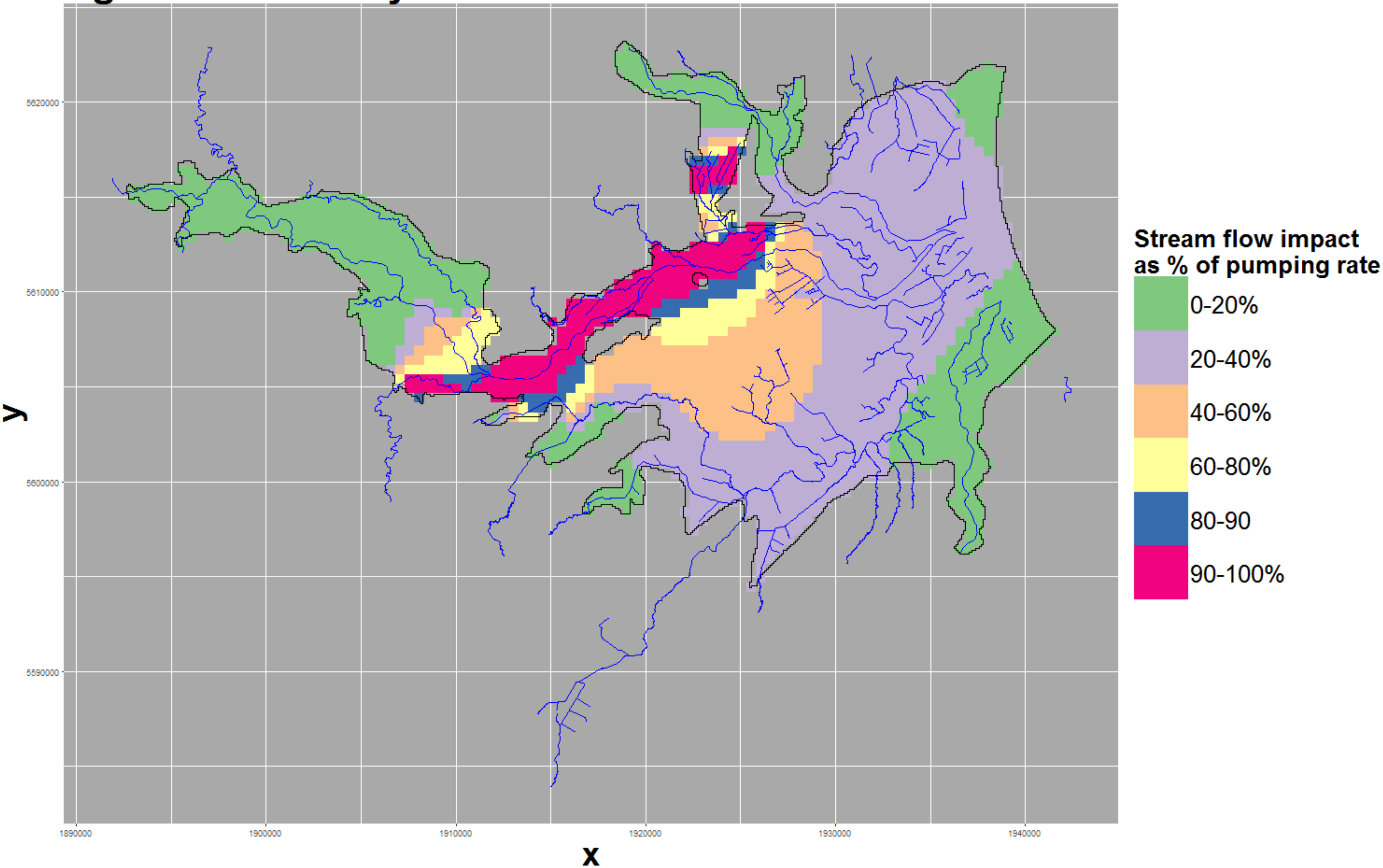


HAWKE'S BAY REGIONAL COUNCIL

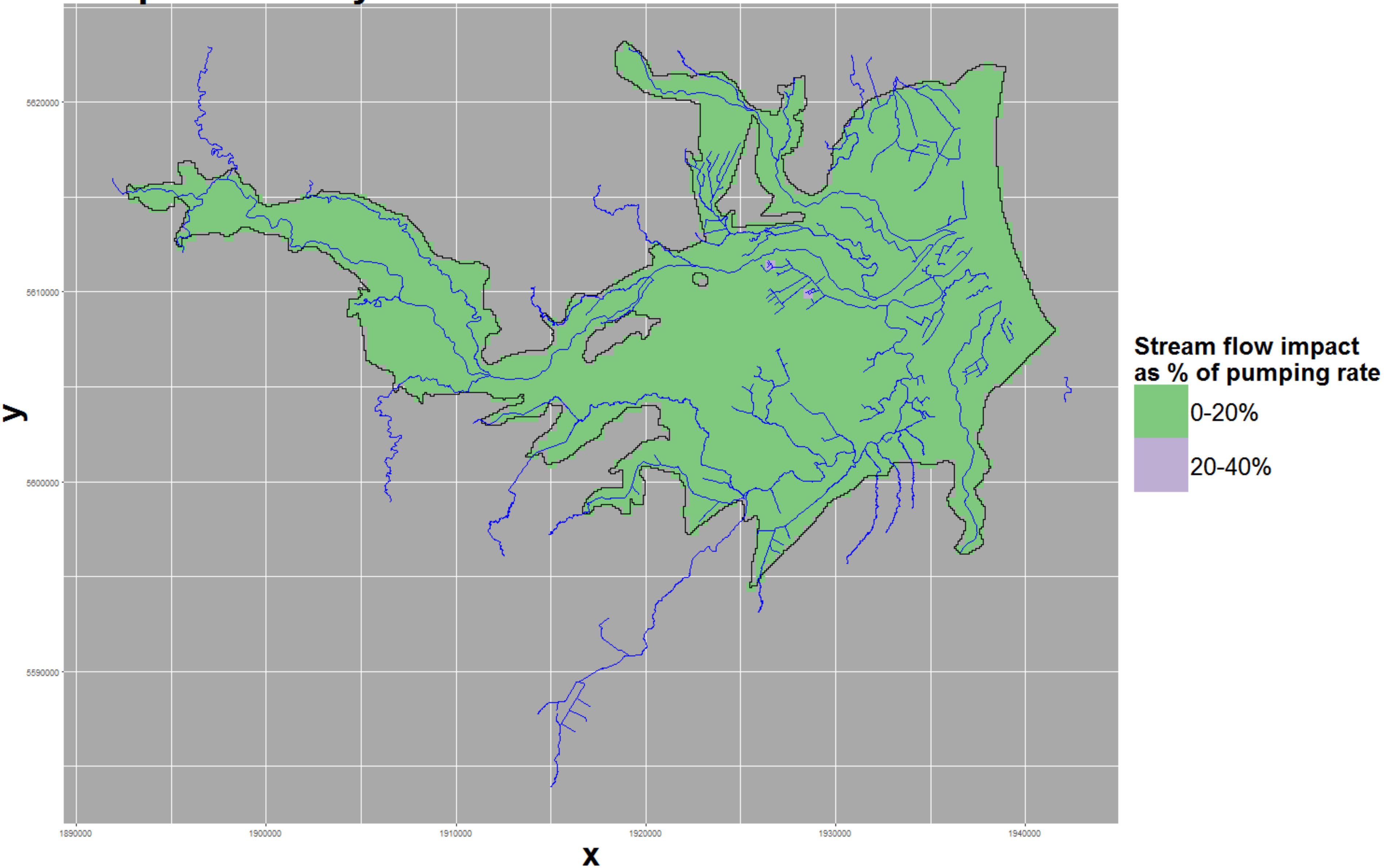
allzones 150 days



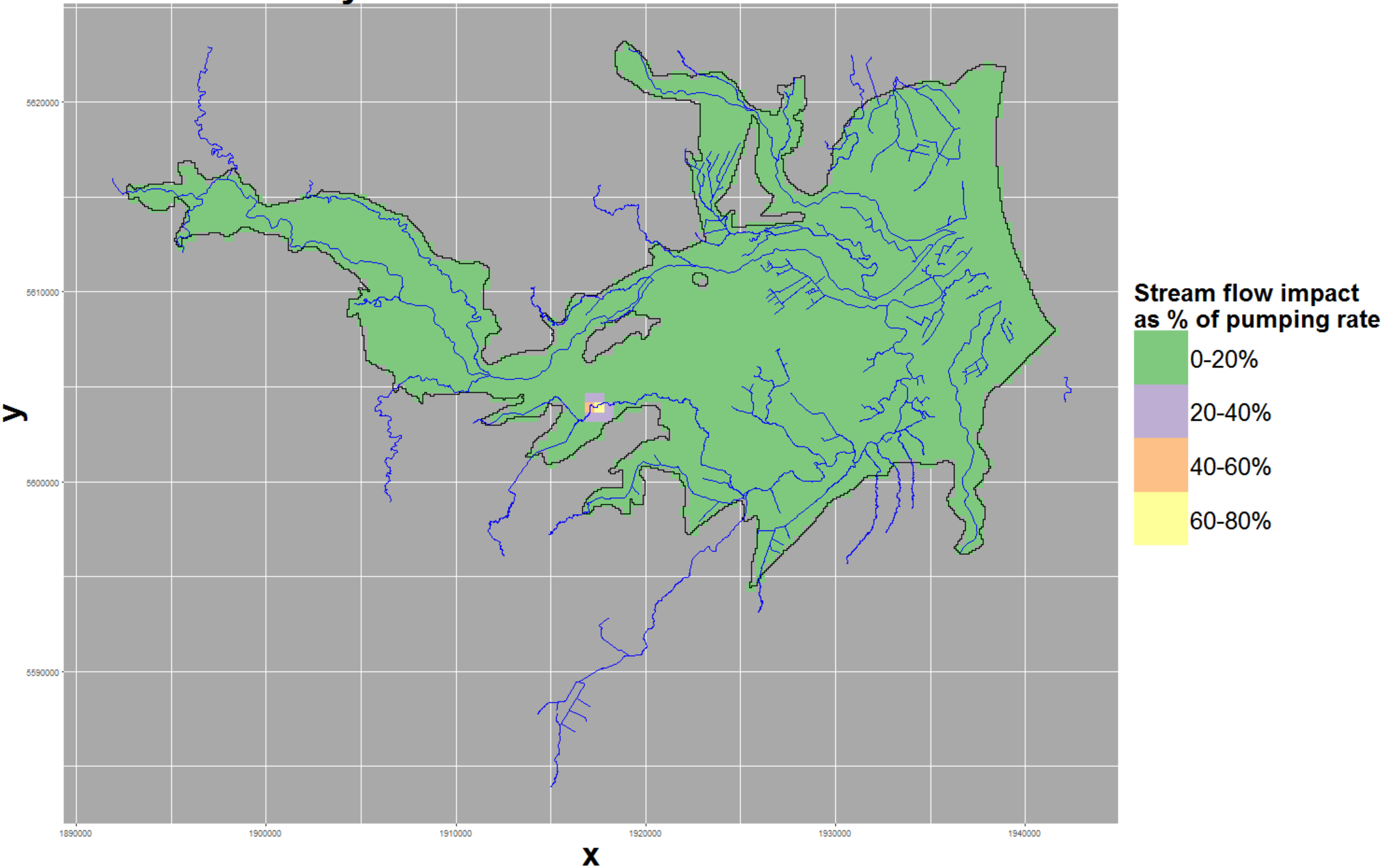
Ngaruroro 150 days



Raupare 150 days



Karamu 150 days



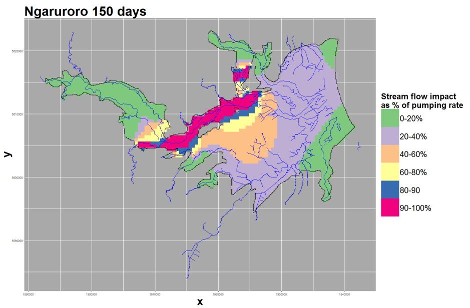
Summary of findings:

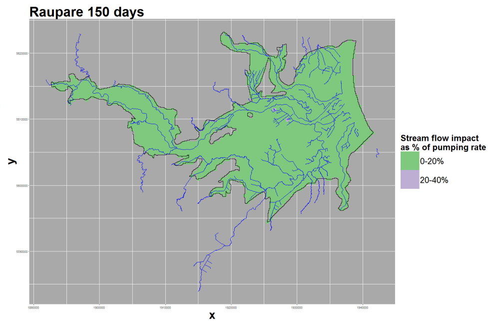
- Stream depletion zones for spring fed streams (Karamu and Raupare) cannot be established using Tukituki PC6 criteria, because individual effect is too small but…
- The method does not consider cumulative pumping effects
- Cumulative effects can be calculated in a next stage using actual pumping rates
- Cumulative effects can be large, even if individual % of depletion is small
- The actual cumulative effect on the stream, as % of actual stream flow can be large, if flow in the stream is small (e.g. Raupare stream)

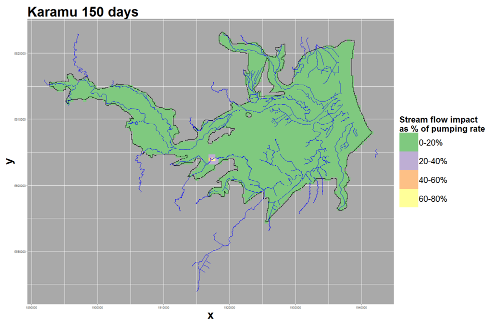
HAWKE'S BAY
REGIONAL COUNCIL

Actual pumping impact distribution

Stream depletion zones for individual streams

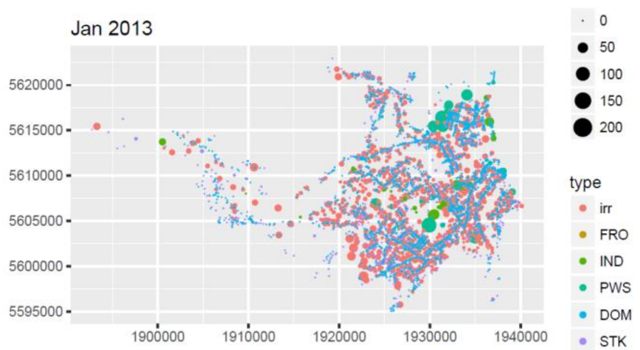




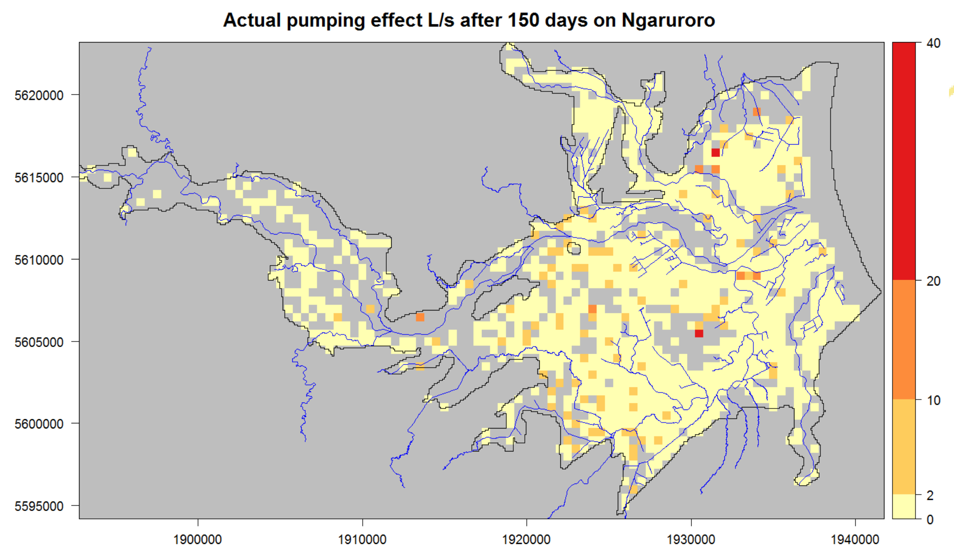


+

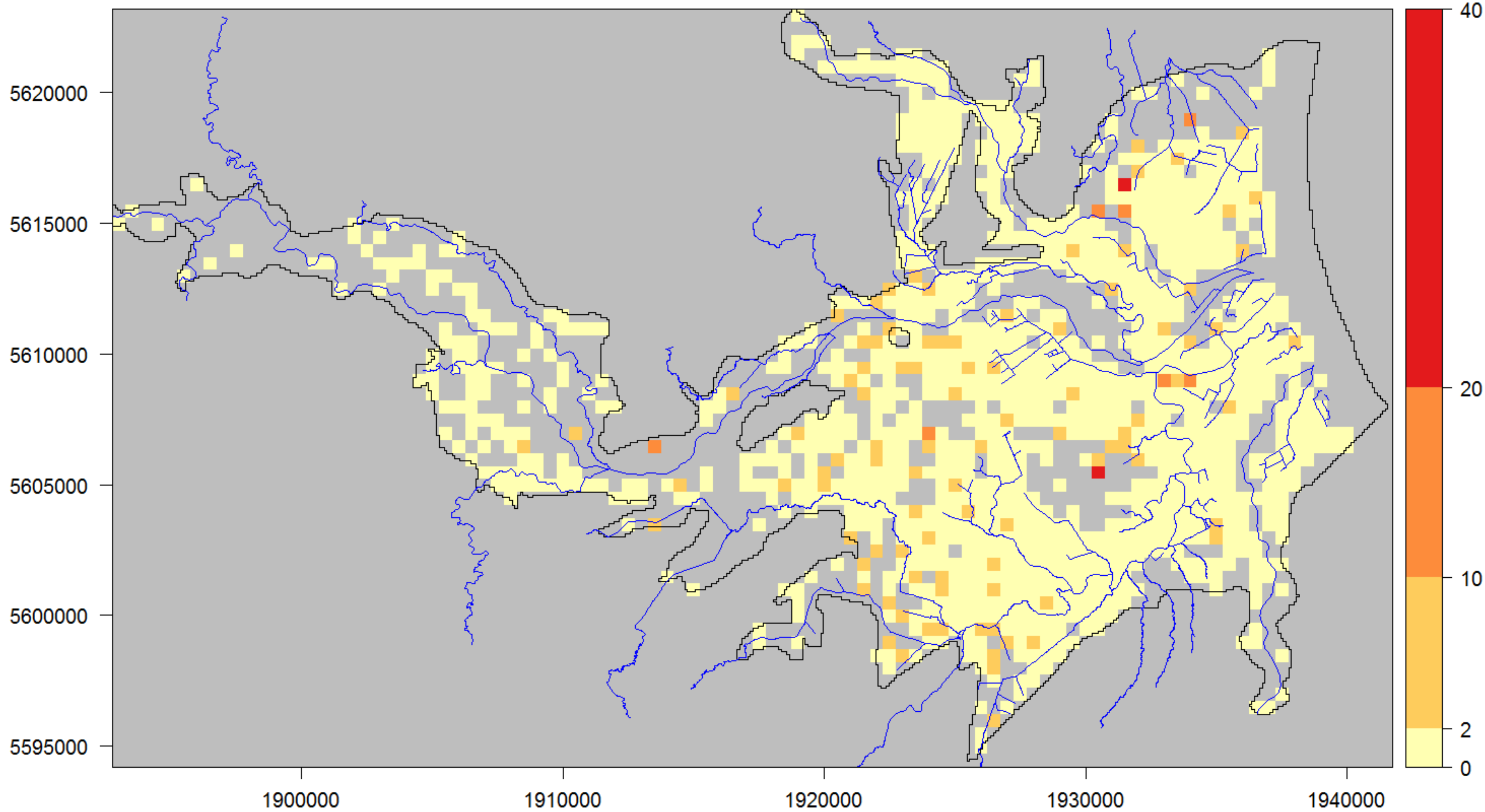
Actual pumping from groundwater wells



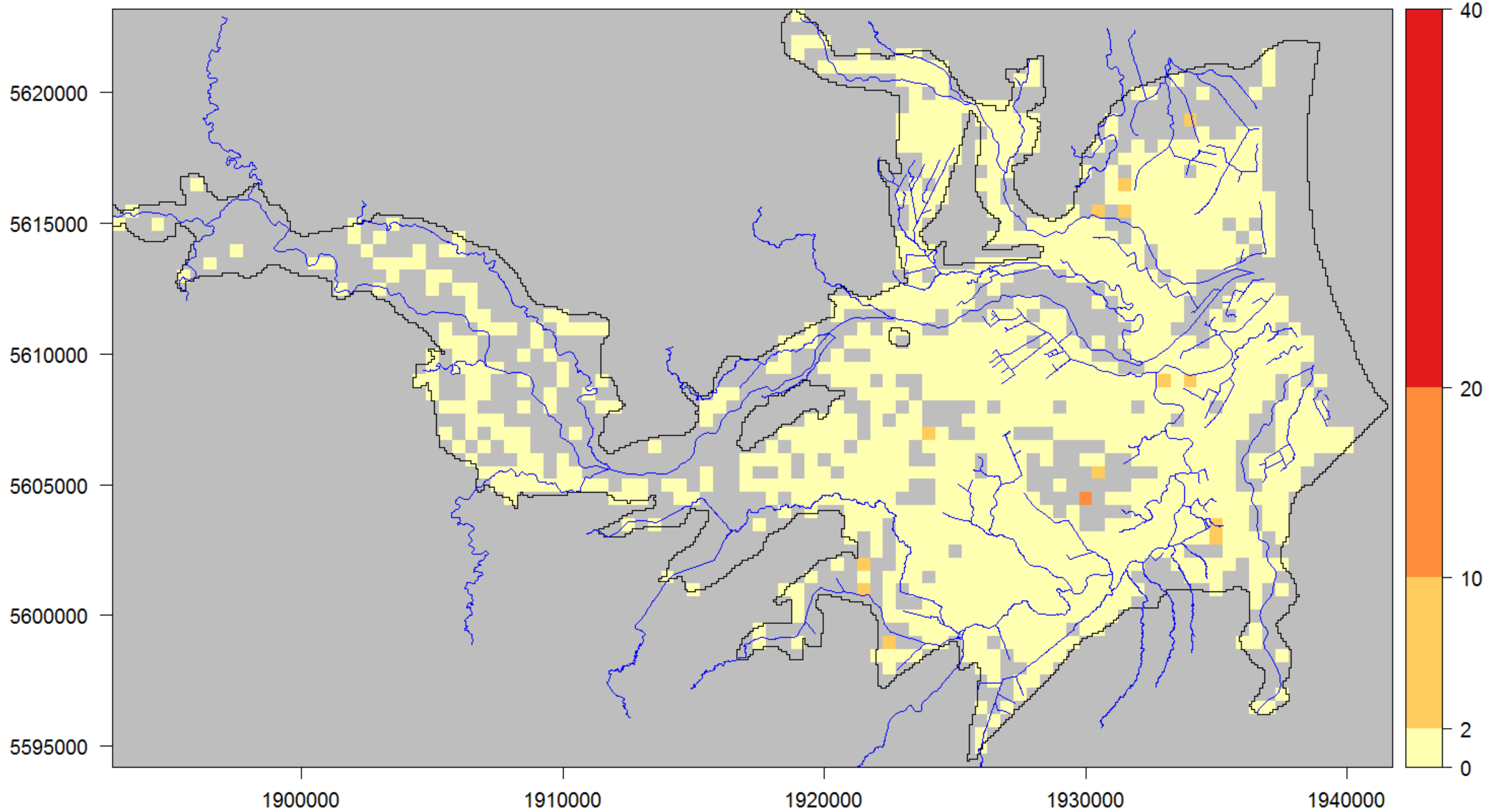
= Actual pumping impact

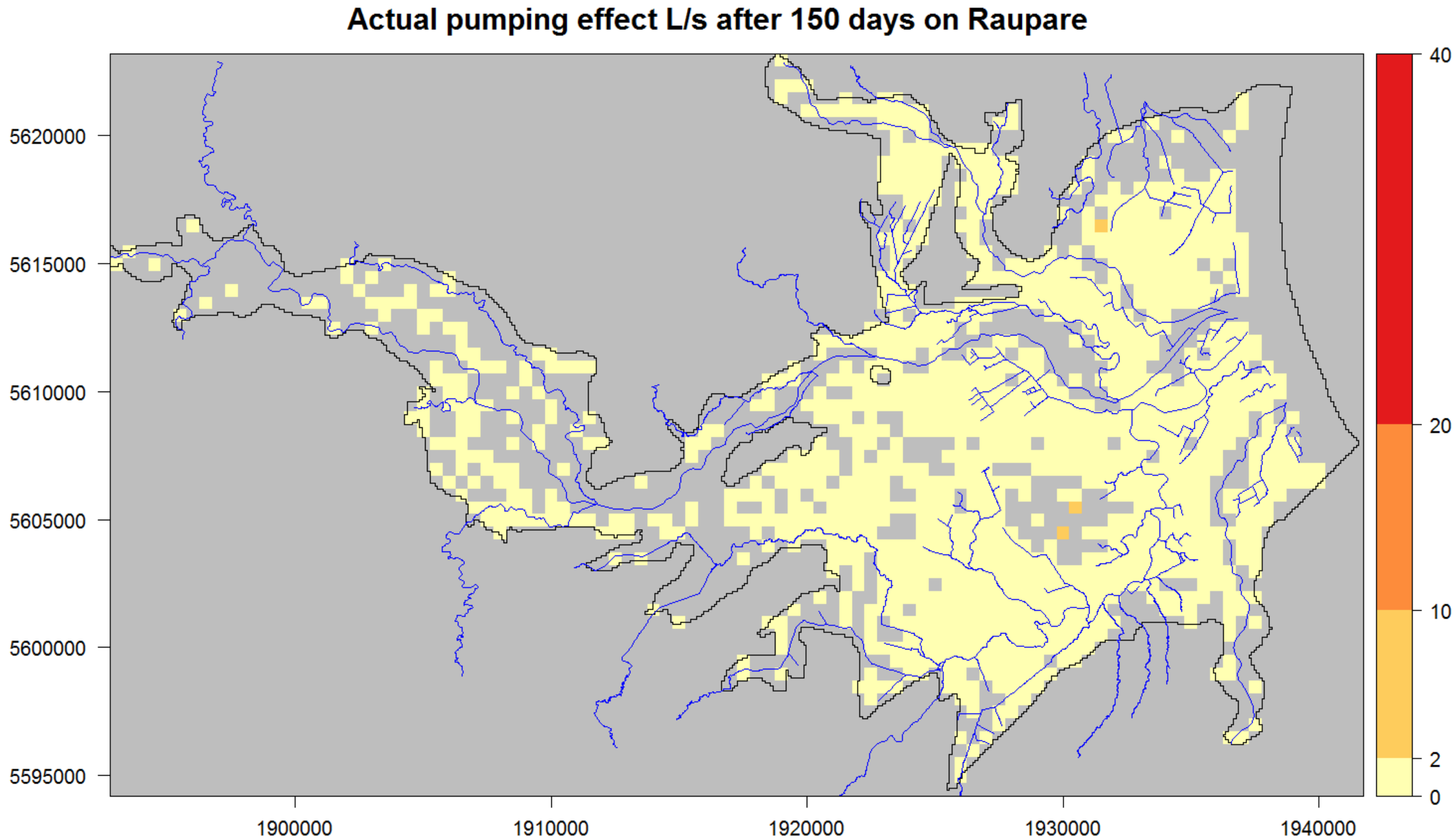


Actual pumping effect L/s after 150 days on Ngaruroro



Actual pumping effect L/s after 150 days on Karamu





Actual pumping effect L/s after 150 days on Raupare
5620000
5615000
5610000
5605000
5600000
5595000
1900000
1910000
1920000
1930000
1940000
40
20
10
2
0

Actual pumping impact distribution - findings

- Distribution of actual effects cannot be used to help define zones … no obvious zones can be seen
- Most takes have very small individual effect
- The combined effect is significant

zone	total effect L/s after 150 days of pumping
allzones	2084.7
Karamu	211.5
Ngaruroro	1048.7
Raupare	93.9

HAWKE'S BAY REGIONAL COUNCIL

Possible management option

~~Stream depletion zones for individual streams~~
~~Zones of actual pumping effect~~

Methodology to estimate effect of:

- Combined effect of groundwater abstraction
- Effect of abstraction from individual wells

on:

- Individual streams and rivers

Response functions

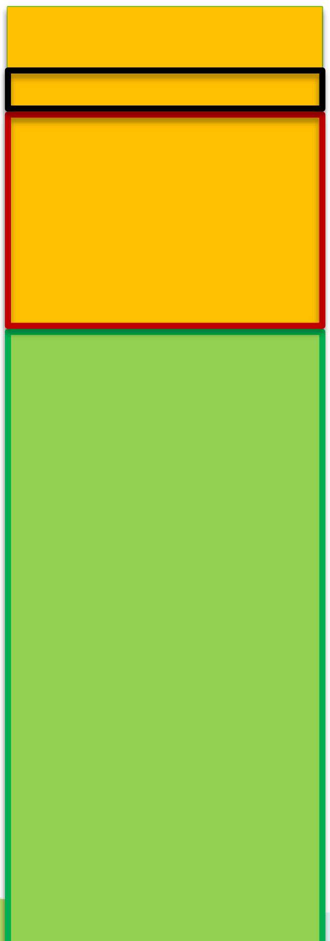
HAWKE'S BAY
REGIONAL COUNCIL

Response function

- Sensitivity of stream flows to groundwater pumping
- Established using a model
- Model is no longer required for estimating effects of pumping on streams
- For **individual wells,** the effect of pumping on flow per stream can be calculated
- For **groups of takes** (e.g. irrigation wells), the total cumulative effect on flow in streams can be calculated
- Cumulative effect of all wells
- The calculation could be automated for use by consents officers or the public (e.g. consent applicants), using a web interface

How can this be used for management

e.g. Ngaruroro river flow



- Natural flow (e.g. 1 in 20 years dry year)

(e.g. summer 2012/2013)

- Target minimum stream flow

(e.g. based on habitat or oxygen etc)

- Target maximum acceptable stream depletion

(for all groundwater takes)
= target maximum allocation

- Calculate current stream depletion

Using response function

- Compare current depletion with target depletion *(is there any freeboard)*
- Calculate any additional depletion with new wells *(e.g. during consenting process)*

HAWKE'S BAY REGIONAL COUNCIL

Example

	flows in L/s				
	QminNat	QminAcept	maxAceptDepl	QDeplActual	QDeplFree
	minimum naturalised flow for worst case condition	**agreed minimum acceptable flow in the river for worst case condition**	**calculated maximum stream depletion**	**calculated current stream depletion**	**depletion freeboard**
Ngaruroro	2200	1000	1200	1000	200
	worst case condition has to be defined	this has to be agreed	Calculation: QminNat - QminAccept	calculated using response function, after what time, which takes, actual or allocated	Calculation: maxAceptDepl – QDeplActual could be used to see if there is additonal water available

Requirements

- Establishing target maximum
- Decide what kind of conditions (e.g. 1 in 20 years minimum flow)

HAWKE'S BAY
REGIONAL COUNCIL

Summary

1. Stream Augmentation is a viable option for managing of some streams
2. Stream depletion zones for individual stream cannot be established
3. Zones of actual impact of pumping cannot be established
4. Possible management of cumulative impact of pumping on stream depletion

HAWKE'S BAY
REGIONAL COUNCIL

Thank you

HAWKE'S BAY REGIONAL COUNCIL

HAWKE'S BAY
REGIONAL COUNCIL

Discussion and direction sought on GW regime

Breakout and plenary discussion

HAWKE'S BAY
REGIONAL COUNCIL

Discussion and Agreement sought from TANK Group

For the purpose of further modelling do you agree/disagree;

Effects of water takes on spring fed streams are best managed by;

- Reducing effects of takes by flow augmentation (i.e not by restrictions on takes)

because

- Stream depletion zones for individual streams cannot be determined
- Zones of pumping impact for individual takes cannot be established
- Accounting for the cumulative impact of all takes is important

HAWKE'S BAY REGIONAL COUNCIL

An understanding of the methodology being used to assess on-farm economic impacts

AgFirst

Jonathan Brookes, Leander Archer & Lochie MacGillivray

April 2017

HAWKE'S BAY REGIONAL COUNCIL

Parts 1a 1b: Determine Heretaunga Plains water allocation and nutrient loss mitigation impacts

Part 2: Determine Pastoral Nutrient loss mitigation impacts

AgFirst into two main teams with QA and environmental support from others when required.

- Parts 1a & 1b managed by AgFirst HB (Horticultural specialists) with some subcontracting.
- Part 2 AgFirst Pastoral (Pastoral specialists)

Concept

1. Build a series of base models that represent agricultural and horticultural systems in the TANK catchment
2. Run various mitigation and water allocation scenarios across the base models to determine the impact variance
3. Scale the base models and scenarios impacts in order to represent the entire catchment impacts in economic and social returns.

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Concept continued

4. The base models represent averaged resources and inputs for an a typical farm/orchard/vineyard.
5. The base model farms won't represent the mitigation impacts on an individual farm, only the region as a whole

AGFIRST

HAWKE'S BAY
REGIONAL COUNCIL

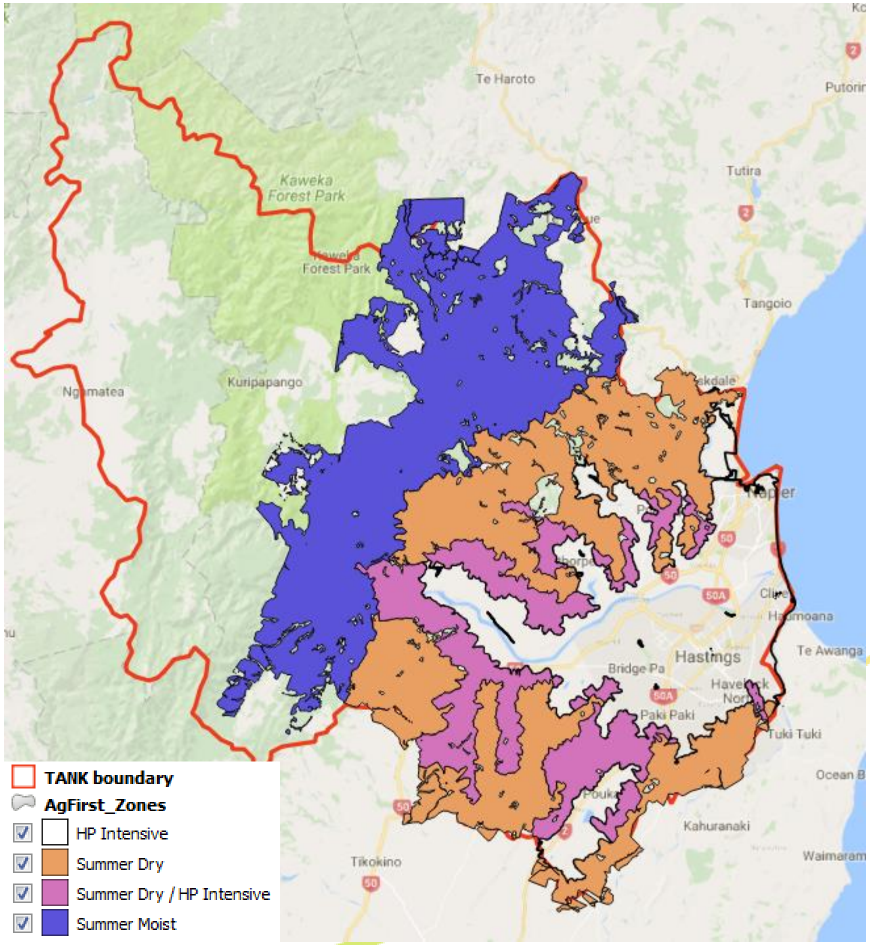
Models

1. **Pastoral**

   Three broad zones (geospatially defined), Sheep and Beef and Dairying

2. **Heretaunga**

One zone , Pipfruit, Summer Fruit, Kiwifruit, Grapes and Vegetable crops



AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

AGFIRST

HAWKE'S BAY
REGIONAL COUNCIL

Crop budget progress

Crop	Data collected from industry
Pipfruit	Yes
Summerfruit	Yes
Kiwifruit	No
Grapes	In progress
Vegetables: Squash, Onion, Peas & beans/ Sweetcorn, winter pasture	Yes

- Data has mostly been collected
- Next steps are:
  - Combine individual grower data into a 'model farm'
  - Confirm N and P inputs to each crop (average practice)
  - Send model farm summaries around our grower contributors for feedback

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Vegetable Model Farm

This has come out of a long process of consultation and discussion.

Crops chosen on land area, sensitivity to curtailments and econor … ffects (beyond farm g…

Crop	Input (water, nutrient)	On farm Value	Destination
Onions	High	High	Export
Squash	Med	Med	Export
Peas, Beans and Sweetcorn	Low	Low/Med	Process
Other	Mod	Mod	Mostly Process

Other → Beetroot, tomatoes, carrots..

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Vegetable Model Farm

Model Farm	ha	%
Onions	31.5	15%
Squash	63.0	30%
Peas & Beans	31.5	15%
*Sweet Corn	31.5	15%
**Other	52.5	25%
Total effective	210.0	100%
Headlands & infrastructure	9	5%
Total Land area	**219**	

Awaiting one large grower's information to finalise.
*Uses peas and beans SPASMO modelling
**Not modelled in SPASMO

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Climate and Soils

One climate station showing 17 years of climate data will be used

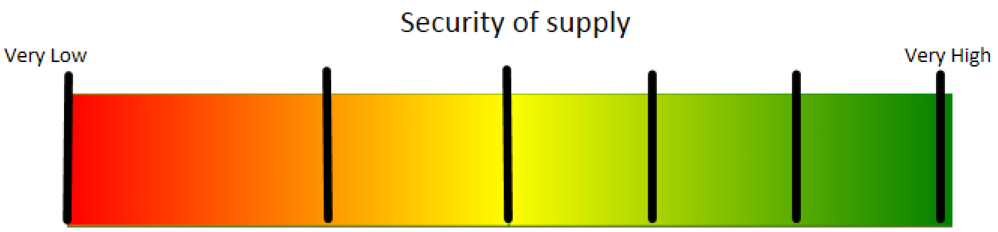
14 soil types will be modelled for each crop. Soils with similar effects on yield outcomes will be grouped by AgFirst for reporting.

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Irrigation management scenarios

The current situation, and two alternative options will be reported on
How we model the current and alternative situations is in discussion.
The current concept is to model a range of situations along the continuum of security of supply (high to low).
We are looking at data from the 14 current low flow points to find their place on this continuum.
Stepwise options will be modelled.



AGFIRST

HAWKE'S BAY
REGIONAL COUNCIL

Size and Quality

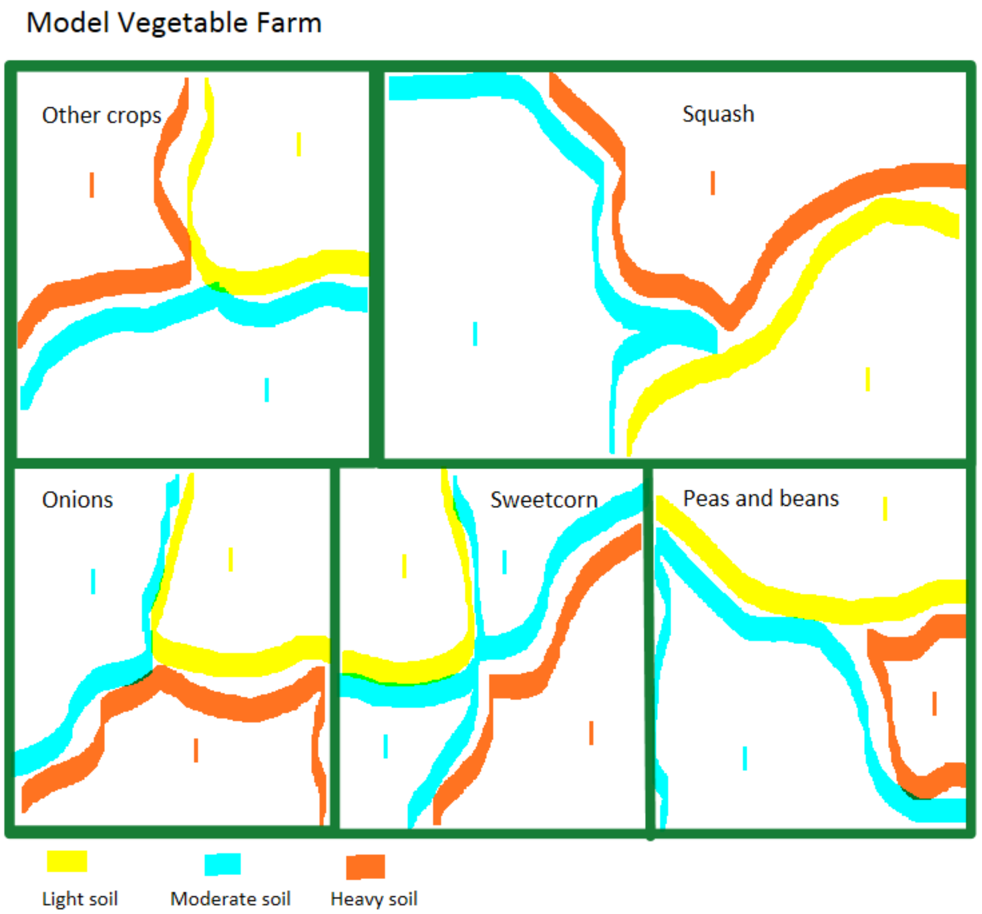
SPASMO will give us change in dry matter due to water deficits occurring in each scenario.
We are now working on how size and quality is affected by levels of water deficit for each modelled crop.

AGFIRST

HAWKE'S BAY
REGIONAL COUNCIL

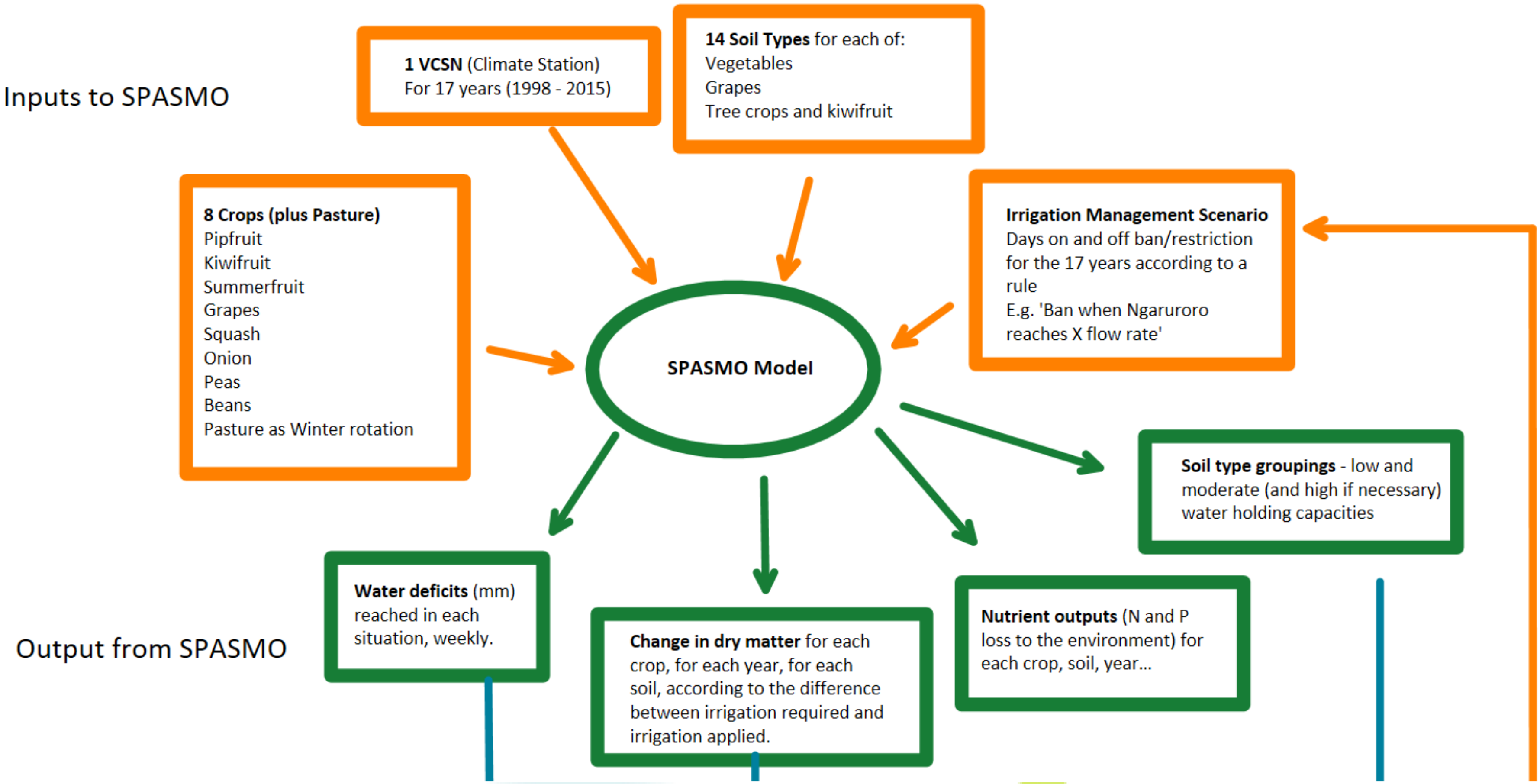
Output

For each crop, year, soil type and irrigation management scenario, we get an EBIT, N and P loss.
We then weight these by the soil type and crop proportions of our model farm
The model farm EBIT is then scaled up by multiplying to the total area of that farm type in TANK
We end up with a comparison of how different levels of security of supply impact the economy and nutrients to farm gate.

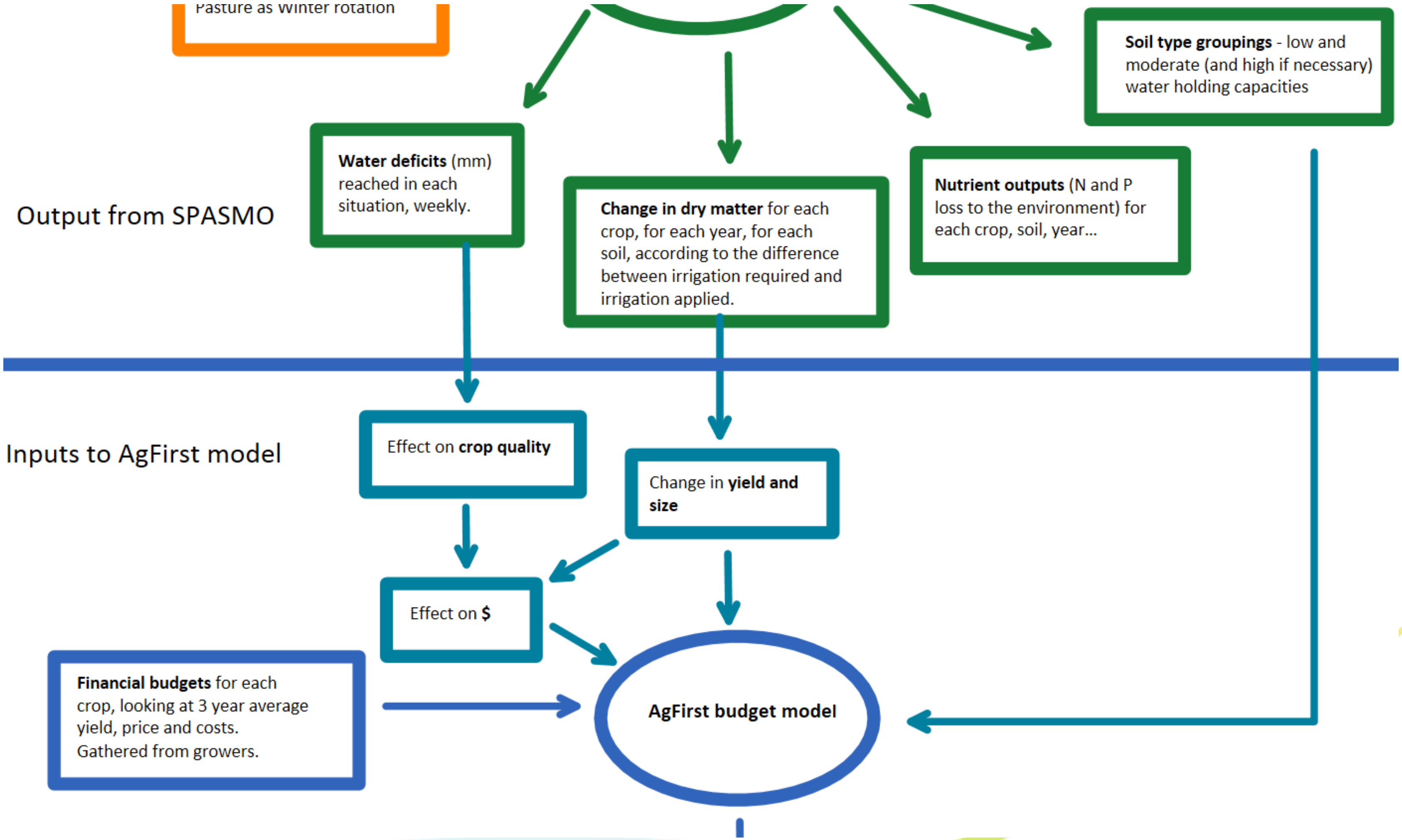


HAWKE'S BAY REGIONAL COUNCIL

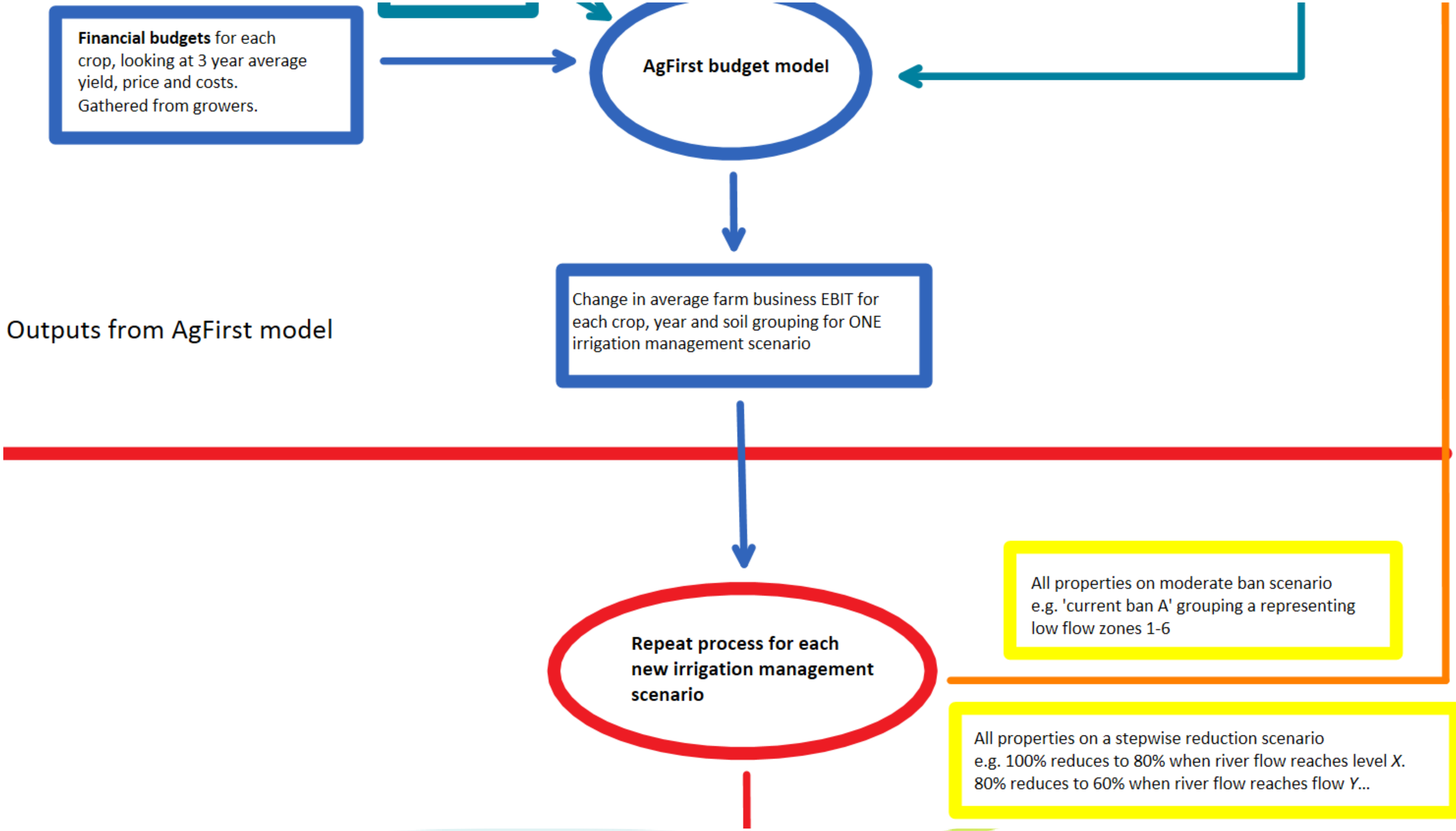
Putting it all together

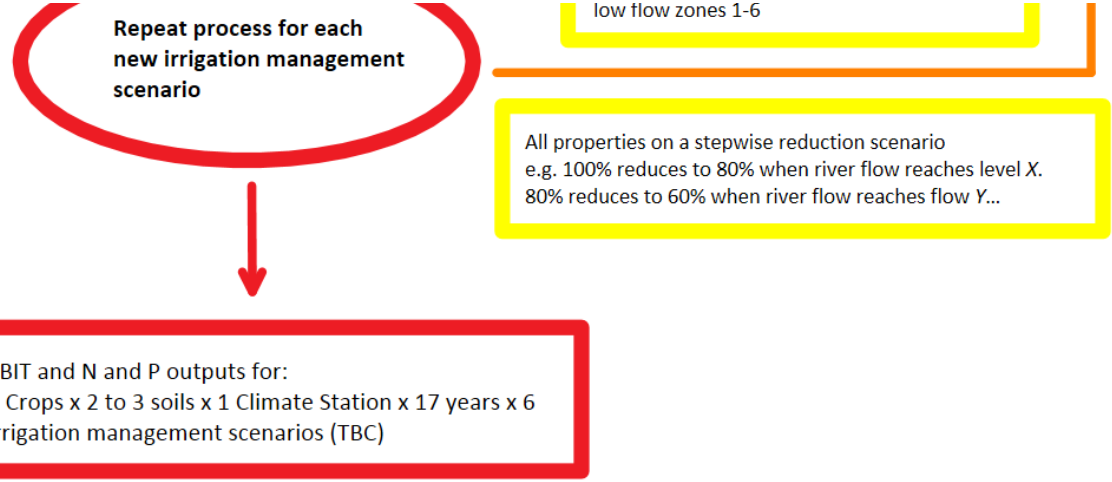


HAWKE'S BAY
REGIONAL COUNCIL



HAWKE'S BAY
REGIONAL COUNCIL


Financial budgets for each crop, looking at 3 year average yield, price and costs. Gathered from growers.
AgFirst budget model
Outputs from AgFirst model
Change in average farm business EBIT for each crop, year and soil grouping for ONE irrigation management scenario
Repeat process for each new irrigation management scenario
All properties on moderate ban scenario e.g. 'current ban A' grouping a representing low flow zones 1-6
All properties on a stepwise reduction scenario e.g. 100% reduces to 80% when river flow reaches level *X*. 80% reduces to 60% when river flow reaches flow *Y*...



= 1632 to 2448 budgets.
Each one shows one crop on one soil group, in one climate year, on one ‘low flow rule’ and one water allocation.
This results in a dry matter production and nutrient output from SPASMO (yield), and then AgFirst must calculate a change in size and include other quality effects to alter $/kg.
Adding one more ‘ban scenario’ increases the number of budgets by hundreds. We need to choose these wisely to enable AgFirst to interpret the sheer volume of data.

HAWKE'S BAY REGIONAL COUNCIL

Pastoral Country update

Pastoral Country Model Summary

- **Objective**

1. Use Overseer to produce **nitrogen and phosphorous** outputs for the modelled land uses within the Pastoral Country section of the TANK Catchment. At least three scenarios
2. Design a robust model to evaluate the current, (and mitigated) **sediment outputs** from the Pastoral Country. At least three sediment mitigation scenarios.

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Pastoral Zones

A function of natural resources…slope, soil, climate

Sets

Typical farm natural resources

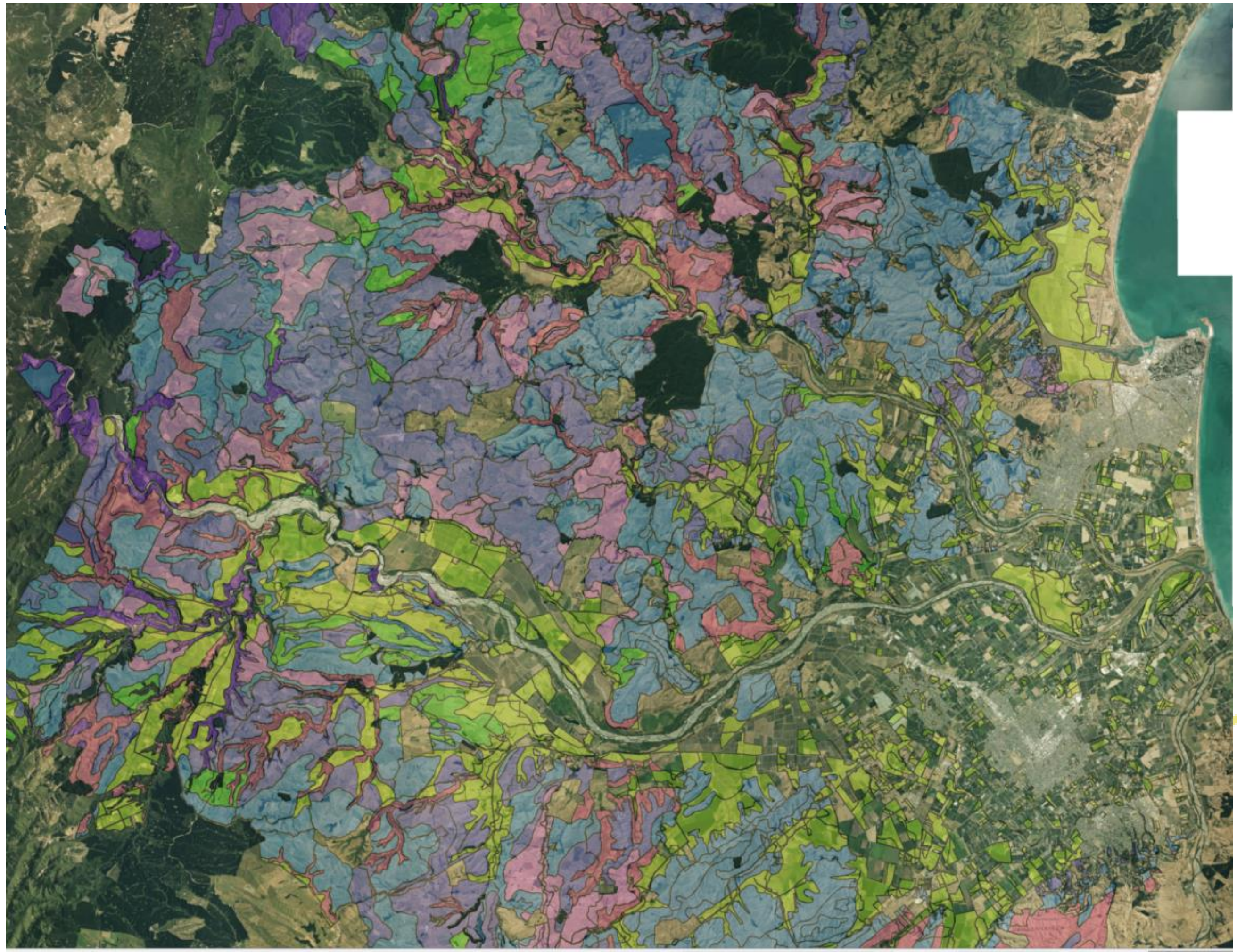
Basic Farm system

Production

AGFIRST

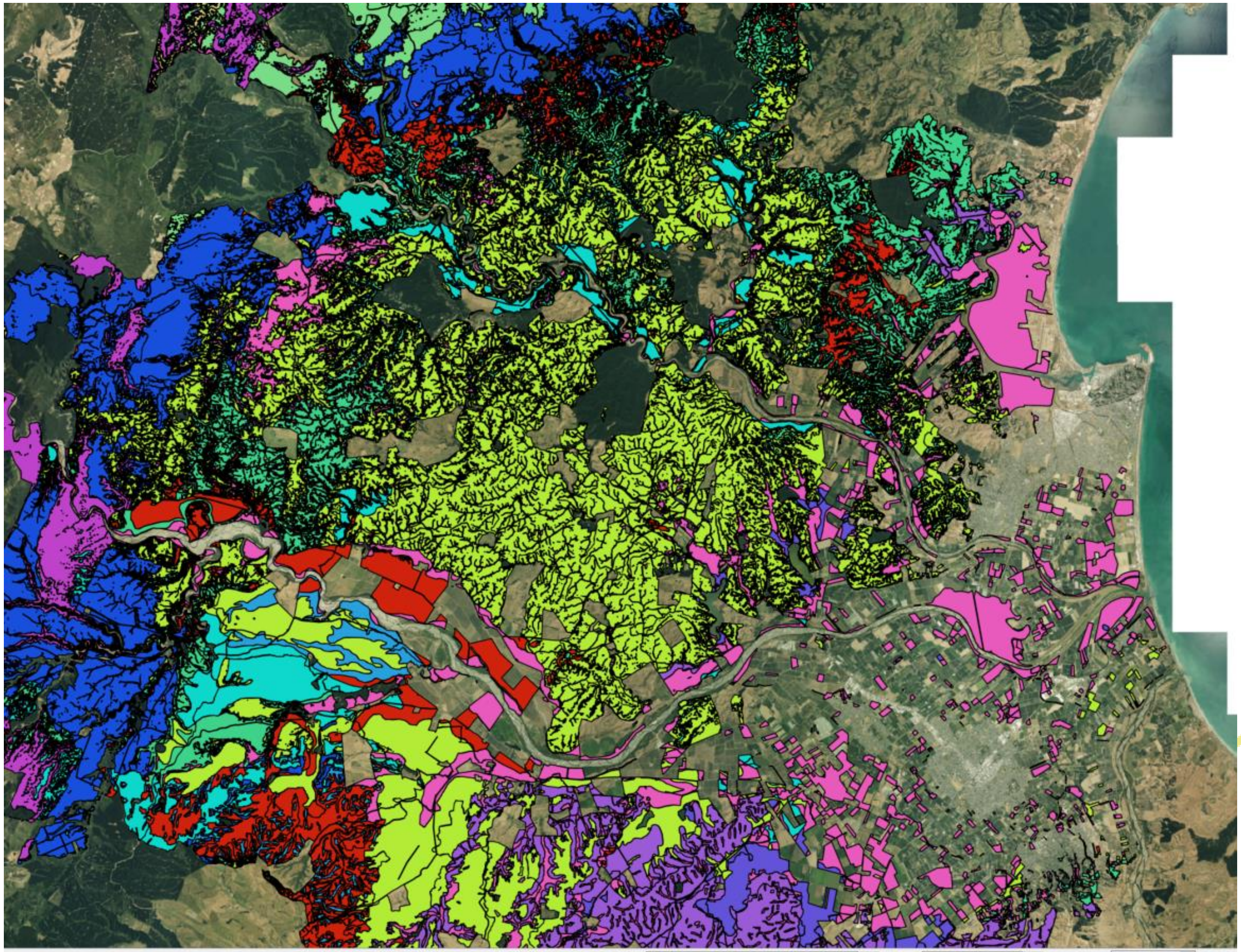
HAWKE'S BAY REGIONAL COUNCIL

Pastoral



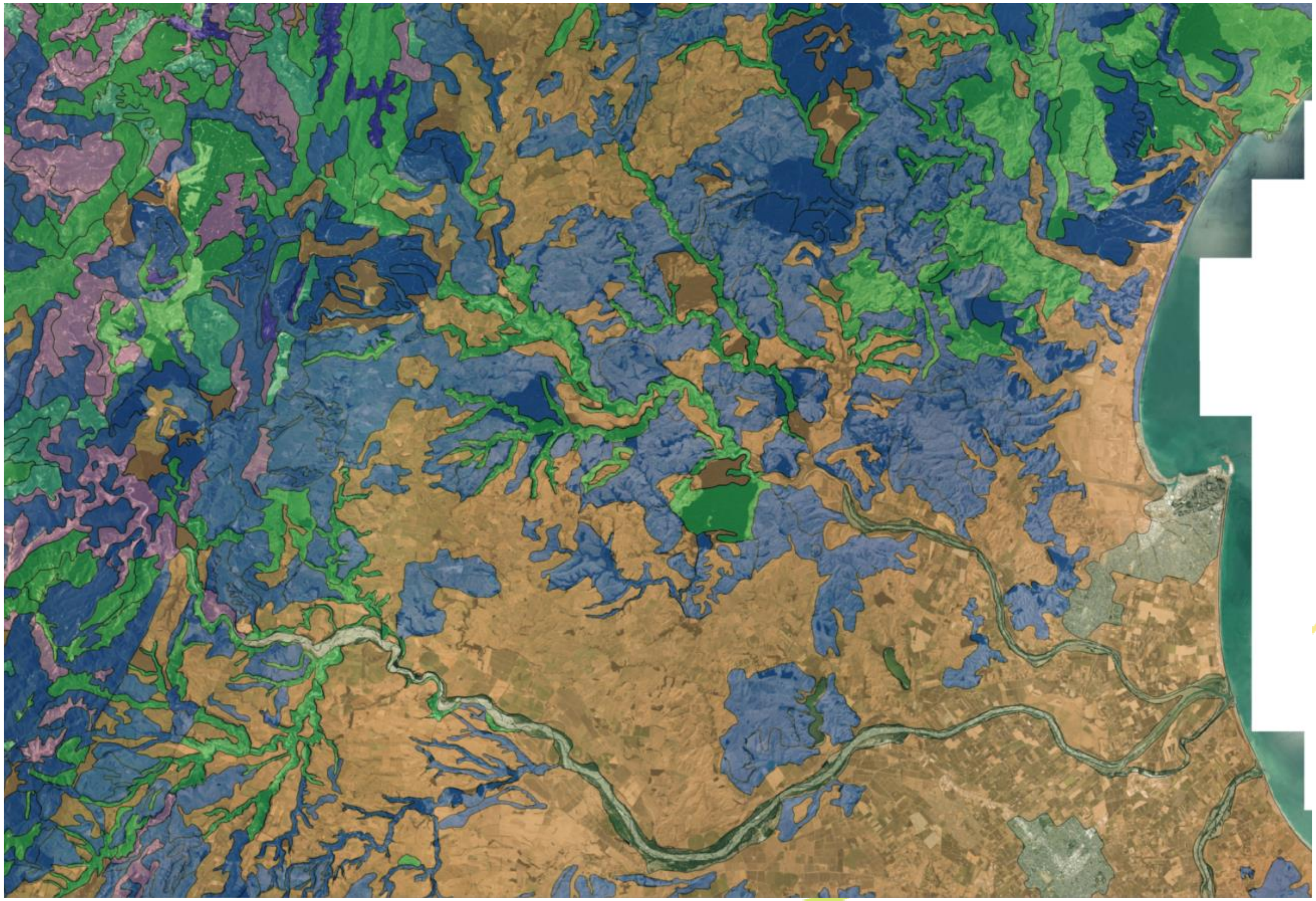
Pastoral

Soils



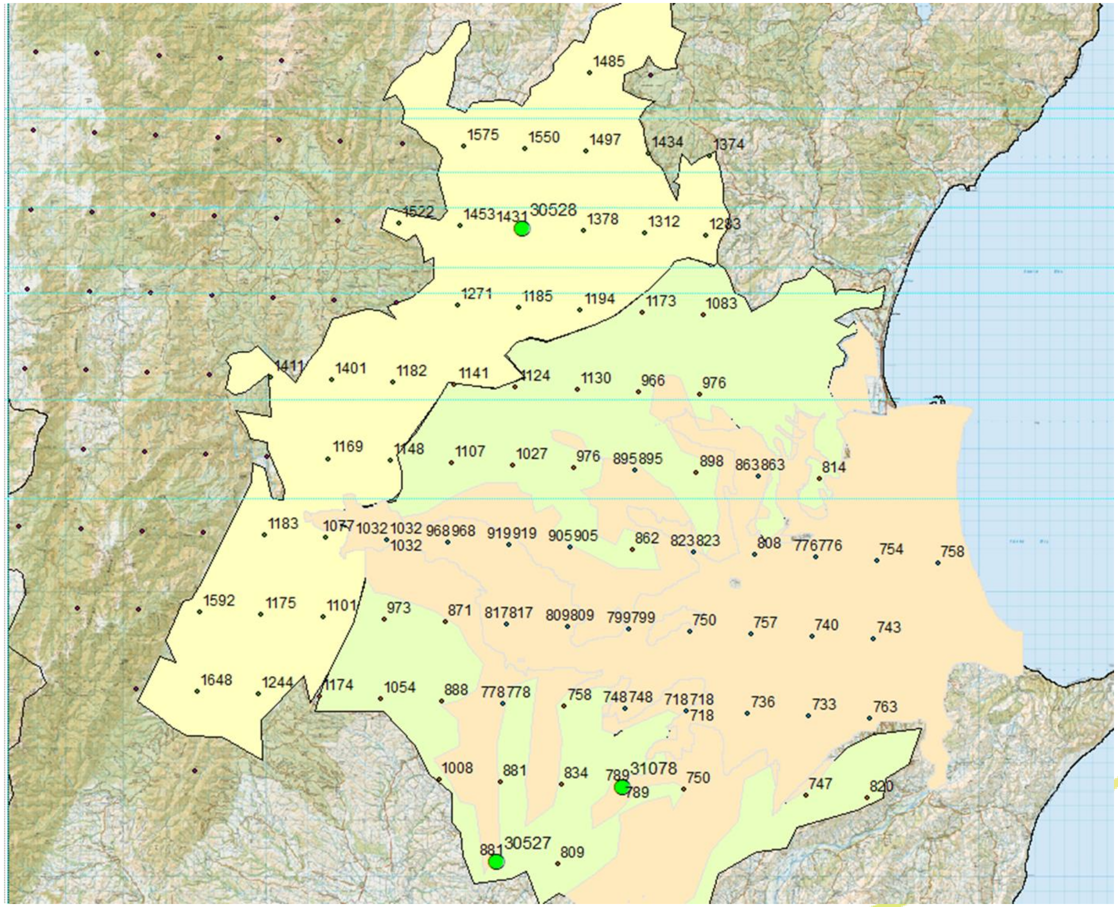
Pastoral

Erosion



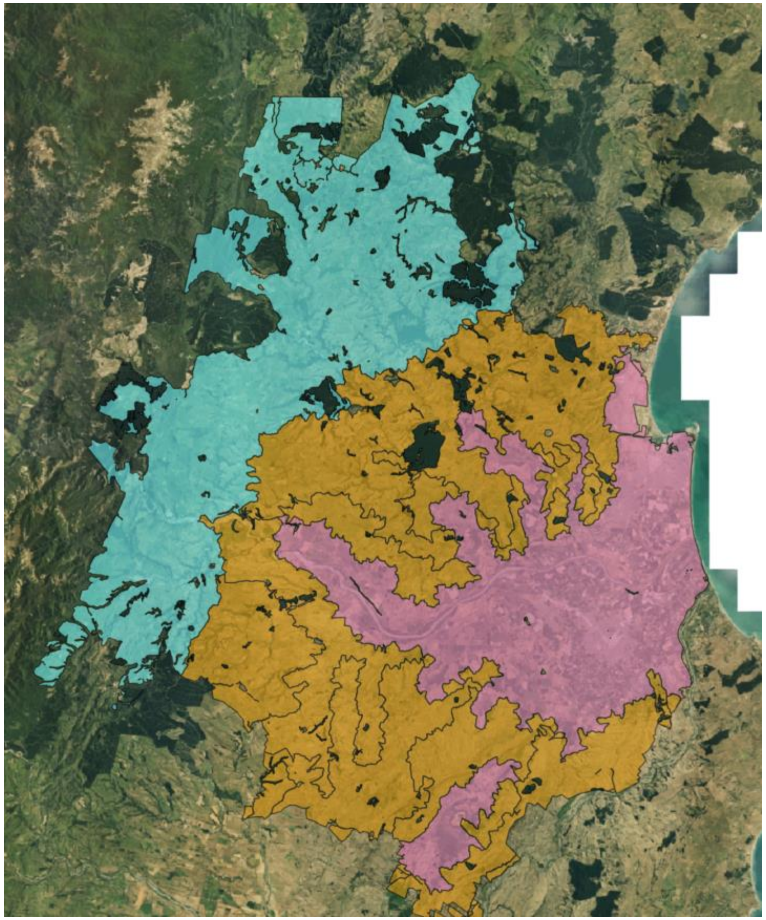
Pastoral

Climate



Pastoral

Climatic Zones



Establish Base models

- Five Models
  - Summer Moist (greater than 1200mm rainfall)
  - Summer Dry (< 1200mm, breeder store some finishing)
  - Intensive (finishing farms esp over winter)
  - Scale Restricting Summer Dry/ Intensive (previous
    as Part Time) , <200 ha
  - Dairy

Pastoral Sheep and Beef Dairying breakdown

	Summer Moist (S &B)	Summer Dry (S & B)	Scale Restricting (S & B)	Intensive (S & B)	Dairying
Total area (ha)	52,002	52,008	8,243	28,349	7,015
Number of Farms	103	108	86	61	12
Average size (total ha)	520	486	108	480	465
Average size (effective ha)	**446**	**449**	**97**	**452**	**400**
Total sheep	2,880	2,514	412	5,355	
Total cattle	314	321	95	570	1,215

AGFIRST

HAWKE'S BAY
REGIONAL COUNCIL

Pastoral Slope breakdown

	Summer Moist (S &B)	Summer Dry (S & B)	Part Time (S & B)	Intensive (S & B)	Dairying
0-3 degree slope	7%	8%	18%	**70%**	**24%**
4- 7 degree slope	4%	2%	8%	2%	13%
8-15 degree slope	**18%**	7%	6%	2%	**48%**
16 -20 degree slope	**25%**	**22%**	**26%**	4%	12%
21 -25 degree slope	**26%**	**45%**	**36%**	18%	3%
26- 35 degree slope	12%	16%	5%	3%	
36 -42 degree slope	8%				

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Pastoral Soil Orders

Soil Type	Summer Moist	Summer Dry	Scale Restricted	Intensive	Dairy
Allophanes	**33%**	6%	2%	1%	**44%**
Gleys	8%	11%	12%	**45%**	4%
Browns	6%	11%	9%	7%	3%
Pumice	**16%**				**39%**
Pallic	**25%**	**55%**	**49%**	27%	10%
Melanic		15%	**23%**	8%	
Recents	12%	2%	4%		
Organic		0%	2%	**11%**	
	100%	100%	100%	100%	100%

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Pastoral

All models Financial

		Sheep and Beef					Sheep & Beef Weighted Average	Dairying
		Summer Moist	Summer Dry	Intensive	Scale Imeded	Total		
Total Area (ha)		53,512	52,472	29,286	9,252	144,523		5,398
Number of Farms		103	108	61	86	358		12
Total area		*520*	*486*	*480*	*108*			450
Effective area		*446*	*449*	*452*	*97*			400
							$ per Farm	
Total $	**Gross Farm Income**	419,266	348,739	732,843	117,362		378,896	2,332,096
	Farm Working Expenses	300,989	285,579	560,398	91,724		290,271	1,482,829
	EBIT	118,277	63,160	172,445	25,638		88,625	849,267

Total GFI $163 mill pa

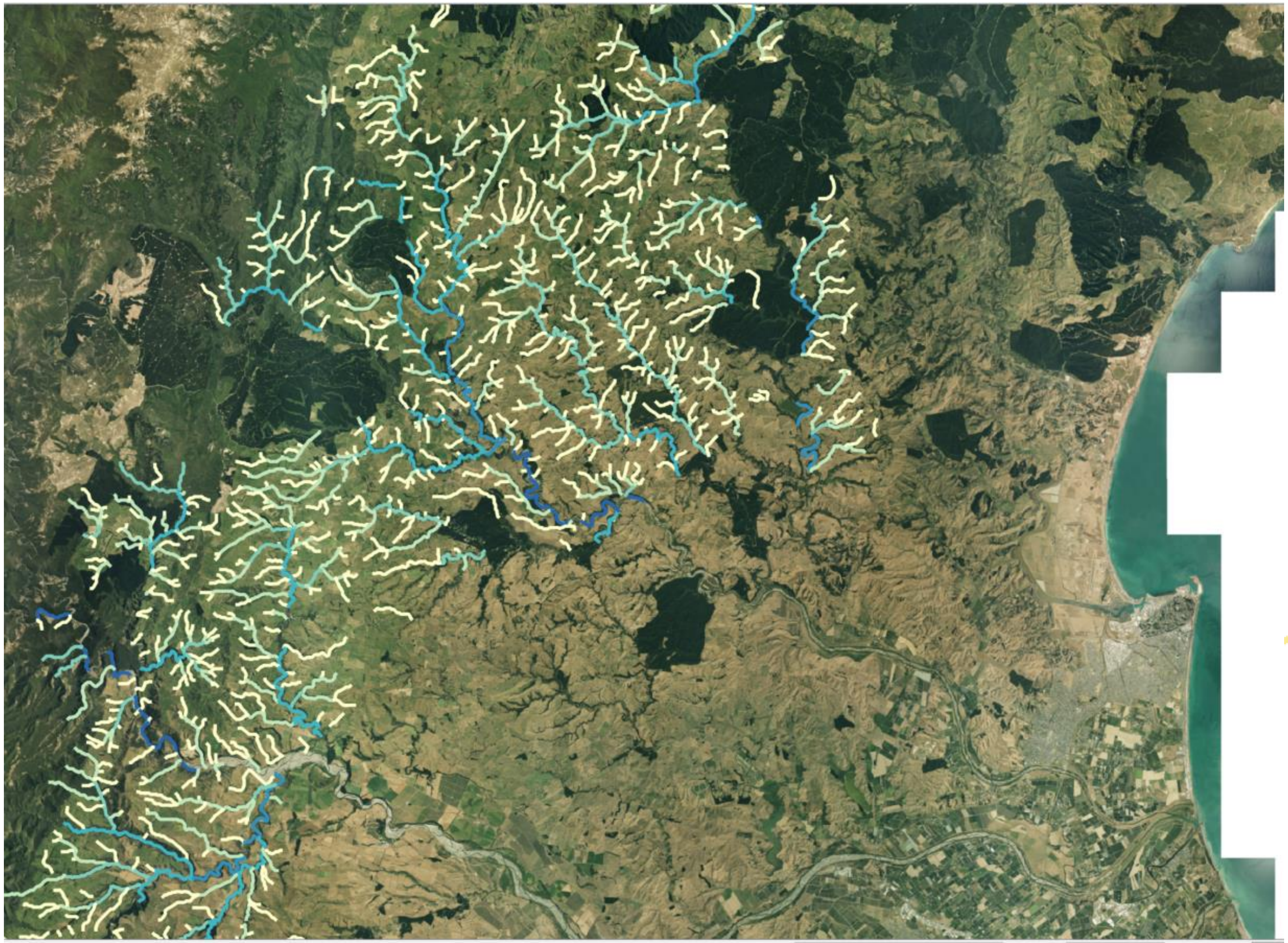
EBIT $42 mill pa

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Pastoral

Stream and River Orders
Summer Moist Zone



AGFIRST

HAWKE'S BAY
REGIONAL COUNCIL

Stock Proof Fencing in TANK Catchment 2nd-6th order

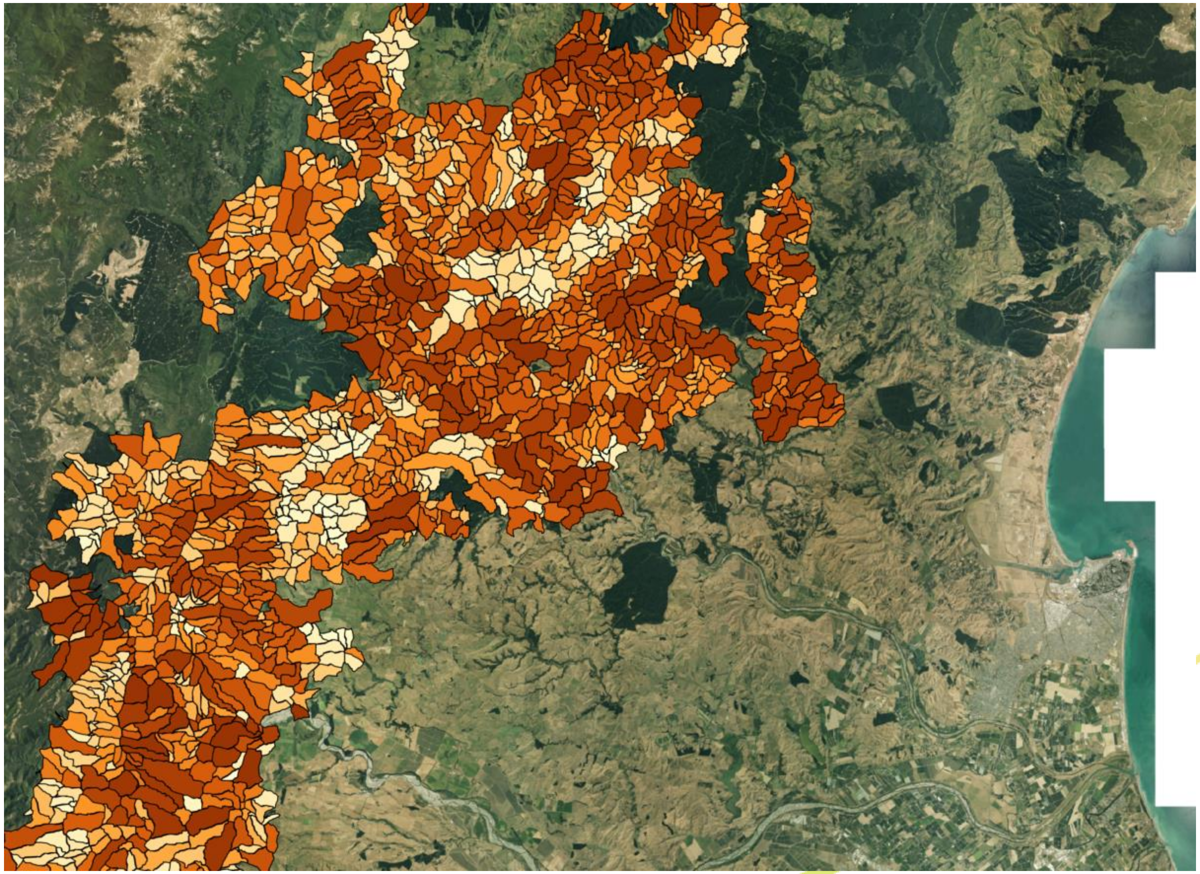
TANK Catchment River fencing categories					
		Through Zone		**Through Farmland only**	
Zone	Fencing category	River length (kms)	Category %	**length**	**%**
Summer Moist					
	Excellent	165	37%	**2**	**2%**
	Good	169	38%	**15**	**13%**
	Fair	88	20%	**65**	**59%**
	Poor	28	6%	**28**	**25%**
		450	100%	**110**	**100%**
Summer Dry					
	Excellent	52	15%	**1**	**1%**
	Good	109	31%	**16**	**9%**
	Fair	100	29%	**73**	**42%**
	Poor	88	25%	**86**	**49%**
		350	100%	**176**	**100%**
HP Intensive					
	Excellent	177	44%	**95**	**34%**
	Good	101	25%	**75**	**27%**
	Fair	67	17%	**62**	**22%**
	Poor	55	14%	**49**	**18%**
		399	100%	**282**	**100%**
Total river length		**1198 kms**		**568 kms**	

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Pastoral

SEDNET – Summer Moist Erosion on a Total basis

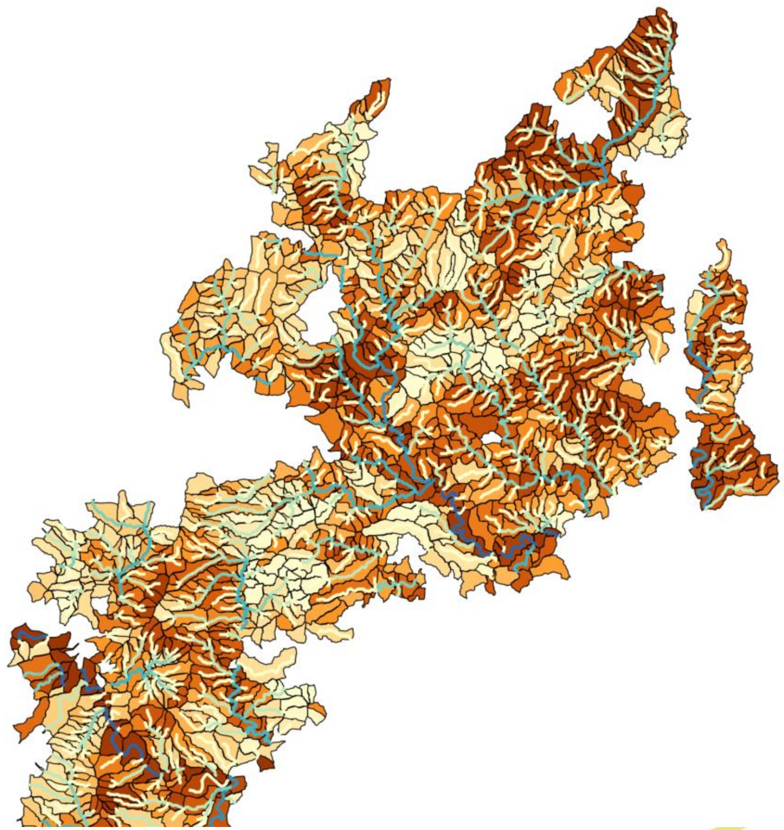


AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Pastoral

SEDNET – Summer Moist
Erosion on a M2 basis with
Stream overlay



AGFIRST

HAWKE'S BAY
REGIONAL COUNCIL

Sednet derived erosion source

Erosion source	Percent of total
Landslide	70%
Earth Flow/ other	1%
Surface	13%
Bank	16%
Total	**100%**

HAWKE'S BAY REGIONAL COUNCIL

Sednet derived benefits of riparian fencing

Summer Moist Zone	Total sediment loss	% gain from current
Current loss	28,494	
25% increase in riparian fencing	23,146	18.8%
50% increase in riparian fencing	17,797	37.5%

HAWKE'S BAY
REGIONAL COUNCIL

Fencing Requirement for Summer Moist Model

	Length of fenced streams*
Excellent	20
Good	130
Fair	590
Poor	250
Total	**990**

* Stream order 2 -6

Nutrient losses to Water from Overseer version 6.2.3

Model	N losses to water kgs/ha/yr	P losses to water kgs/ ha/yr
Summer Moist	14	1.5
Summer Dry	15	0.9
Scale Restricting	16	0.7
HP Intensive	11	0.3
Dairy	62*	1.9*

* Still to be ground truthed

AGFIRST

HAWKE'S BAY REGIONAL COUNCIL

Verbal updates from Working Groups

- Engagement
- Economic Assessment
- Stormwater
- Wetlands/Lakes
- Mana whenua

HAWKE'S BAY REGIONAL COUNCIL

Next meeting – 30 May 2017

1. ~~**Clive River management options**~~

1. **Plan Change Outline** (MAB/Mana Whenua Group)

2. **Possible further GW modelling** (Jeff/Pawel)

3. **Surface water takes**
   - flow management regime options (Jeff/Rob W)
   - Assess outputs according to values/attributes (MAB)

HAWKE'S BAY REGIONAL COUNCIL

Closing Karakia

Nau mai rā

Te mutu ngā o tatou hui

Kei te tumanako

I runga te rangimarie

I a tatou katoa

Kia pai to koutou haere

Mauriora kia tatou katoa

Āmine

HAWKE'S BAY REGIONAL COUNCIL