

Defining a biophysical framework for Freshwater Management Units of the Ruamahanga Whaitua

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Outline

- What are Freshwater Management Units (FMUs)?
- An example – introducing a method and terminology
- An example - applying the method to the Ruamahanga Whaitua

What are FMUs?

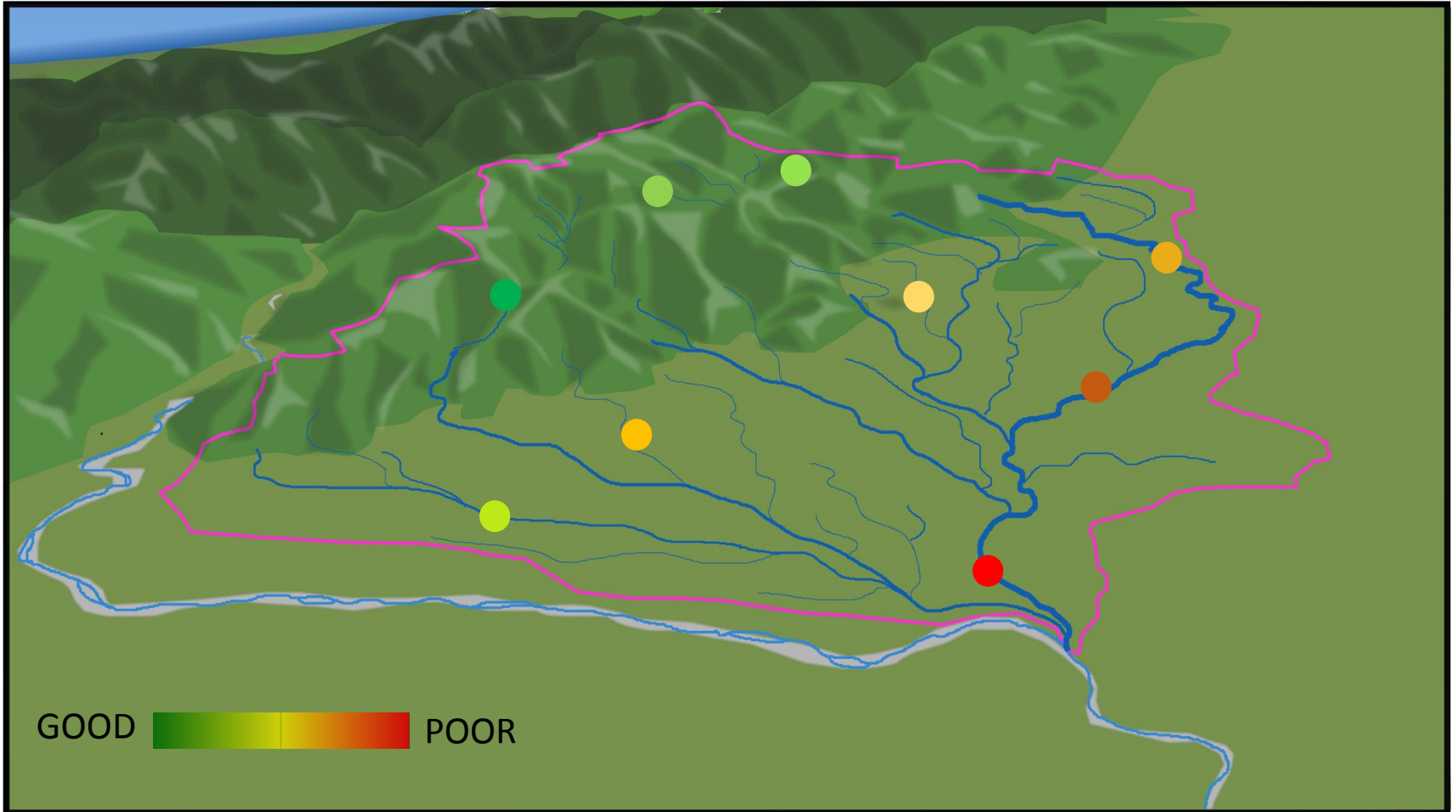
- NPS-FM definition of FMU:
 - *“a water body, multiple water bodies, or any part of a water body determined by a regional council at the appropriate spatial scale for setting freshwater objectives and limits and for freshwater accounting and management purposes”*
- NOTE:
 - Values and objectives apply to the **water body** (i.e a section of river, a lake, an estuary etc)
 - management and limits apply to its **catchment** (the upstream area that drains to the water body)

Proposed approach: A Bio-physical classification

- ASSUMES:
 - Water bodies with similar natural catchment characteristics are likely to:
 - Have similar states (e.g. water quality)
 - Have similar values (e.g. fishing, swimming, irrigation) and associated objectives
 - Respond in similar ways to pressures/change/management
- Provides a transparent and justifiable starting point for defining FMUs
 - Later on, can easily incorporate sites of special interest, social, cultural &/or economic considerations

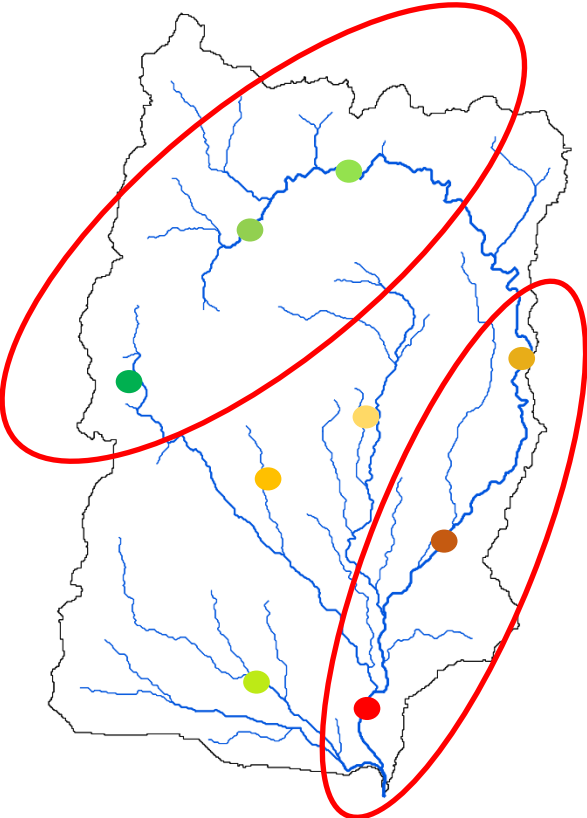
An example – “fictitious”

Can you see any patterns in the observed water quality in relation to the catchment characteristics?

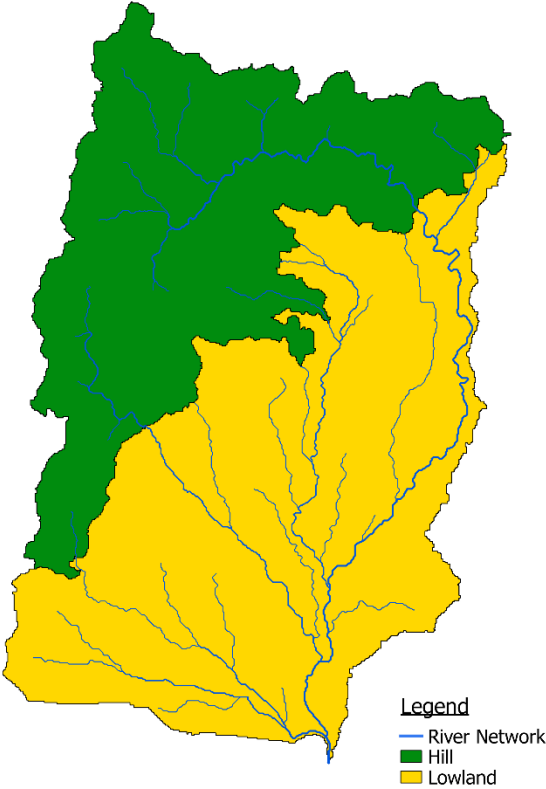


Looking for patterns between water body (river) state and catchment characteristics

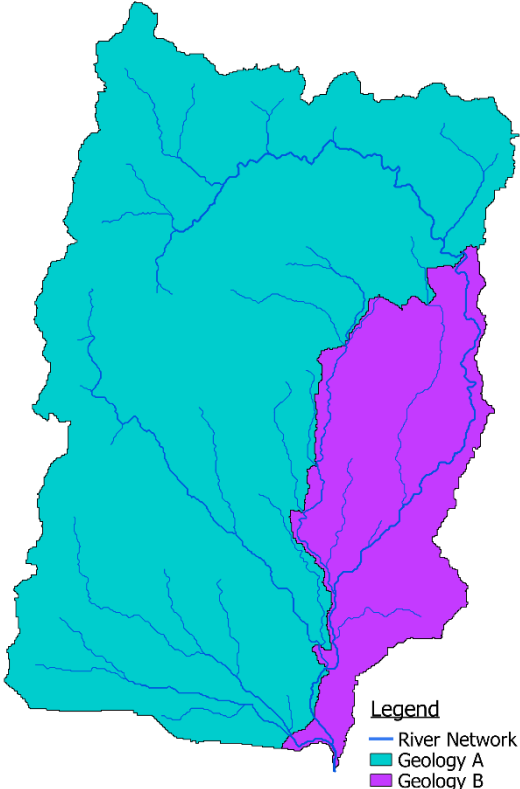
Monitoring of Water Quality



Catchment Steepness

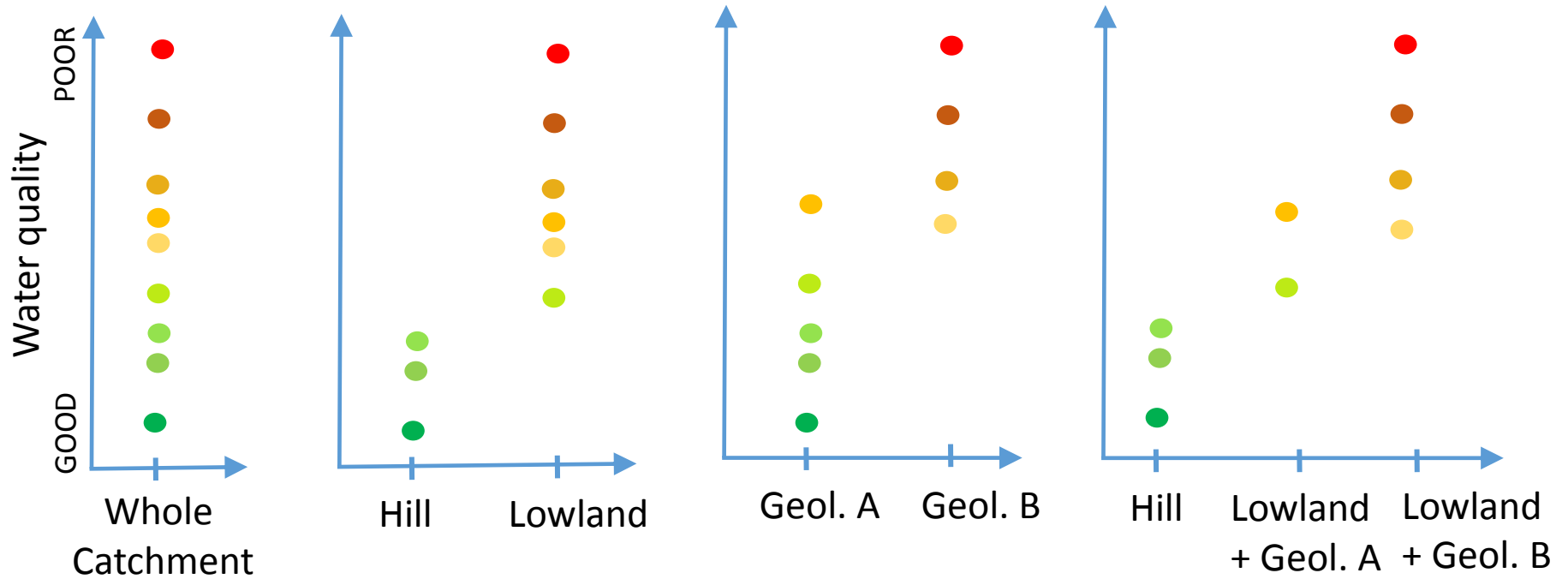


Catchment Geology

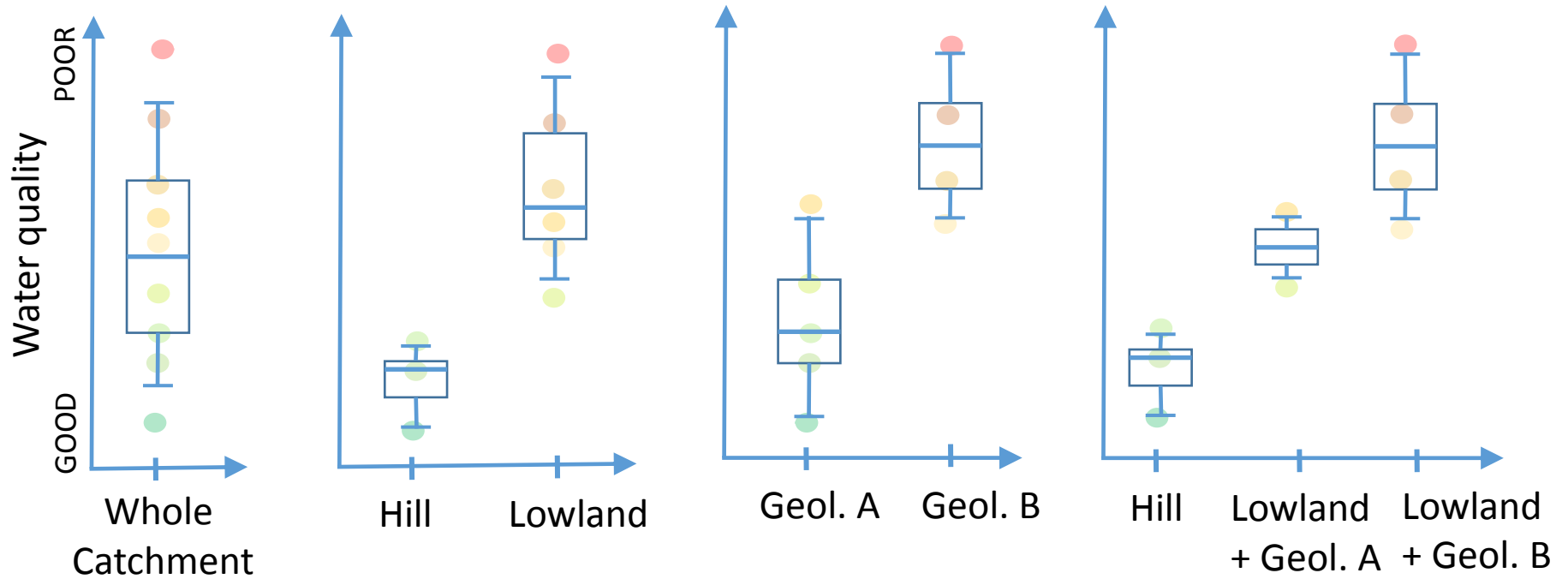


GOOD  POOR

Can catchment characteristics explain differences in biophysical state?

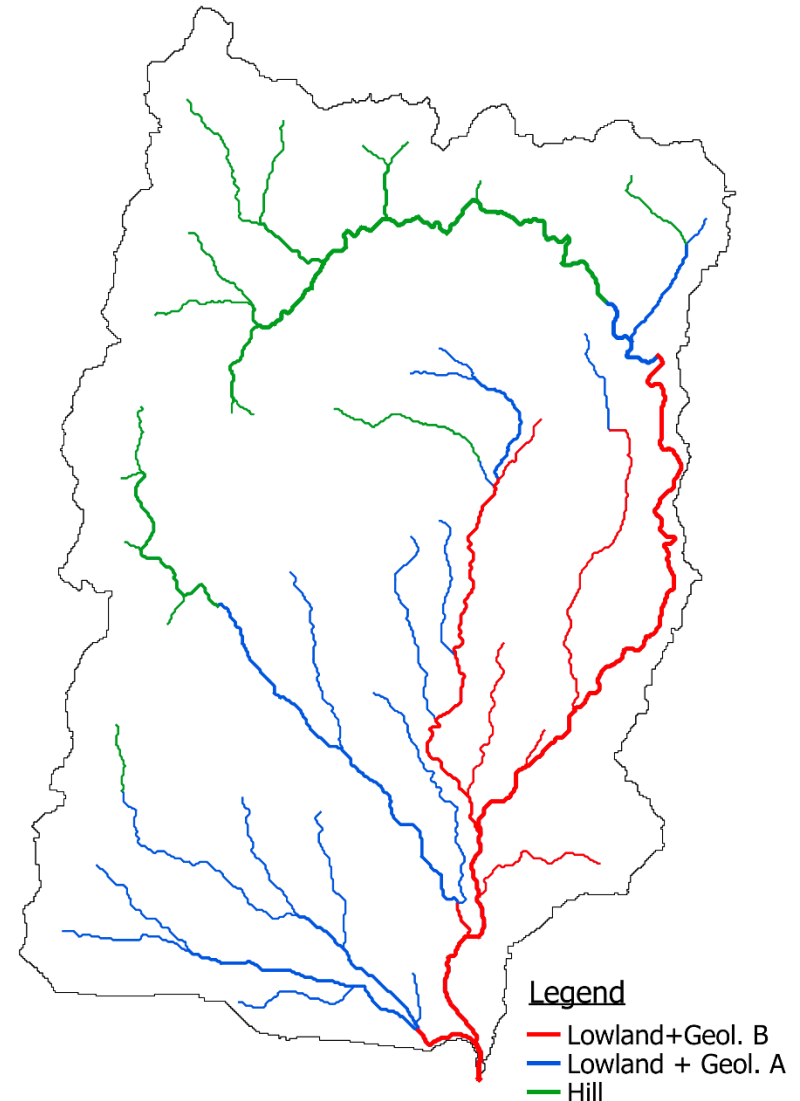


Can catchment characteristics explain differences in biophysical state?



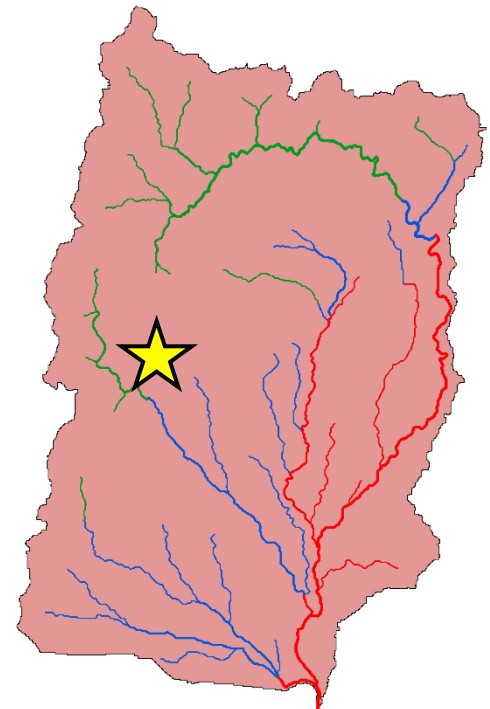
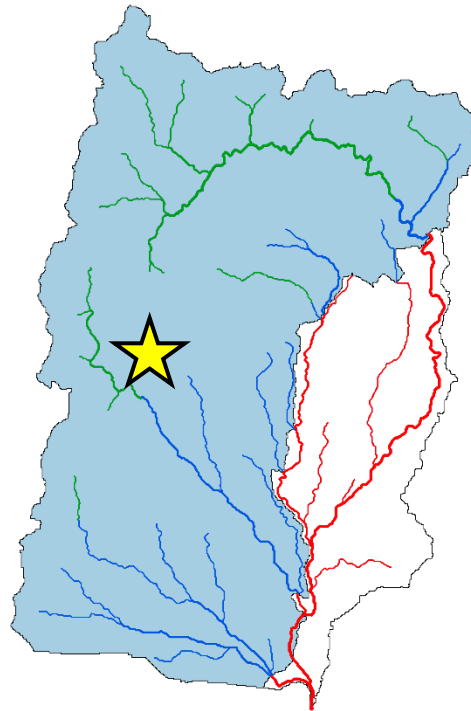
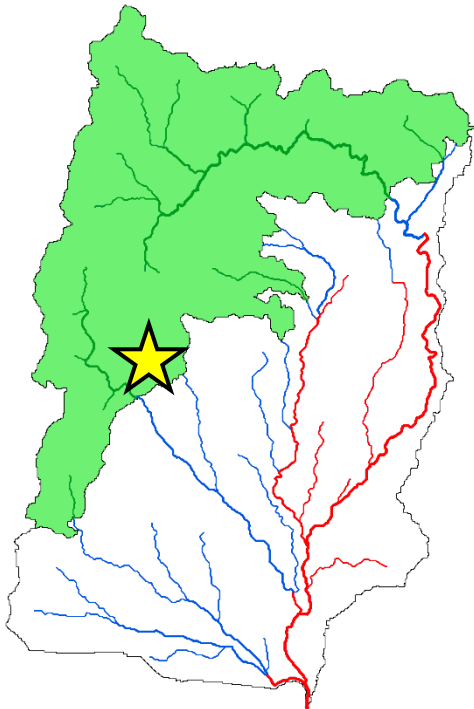
Management Classes

- A management class is a grouping of similar **water bodies** (i.e. river sections) e.g.



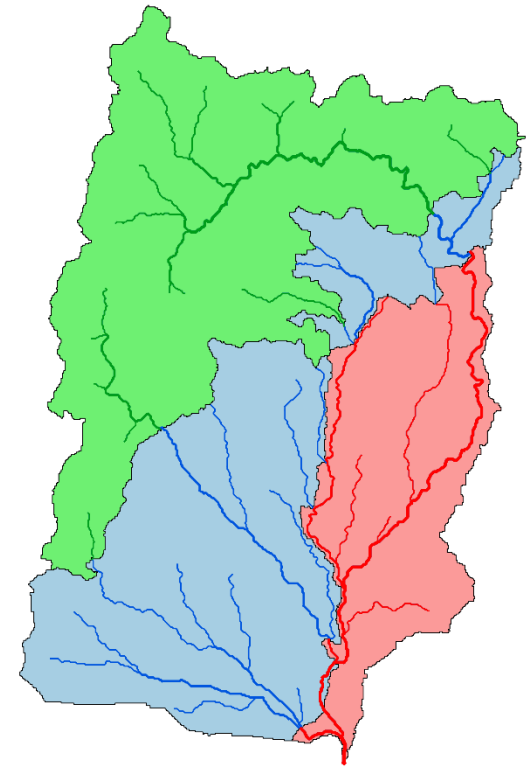
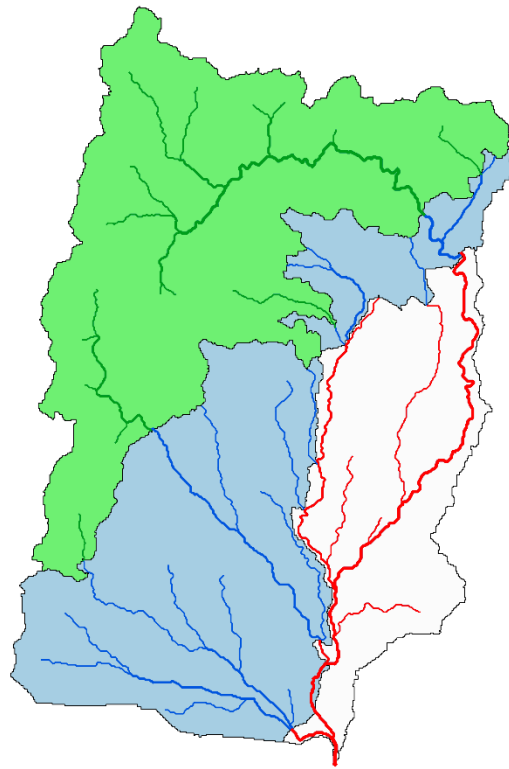
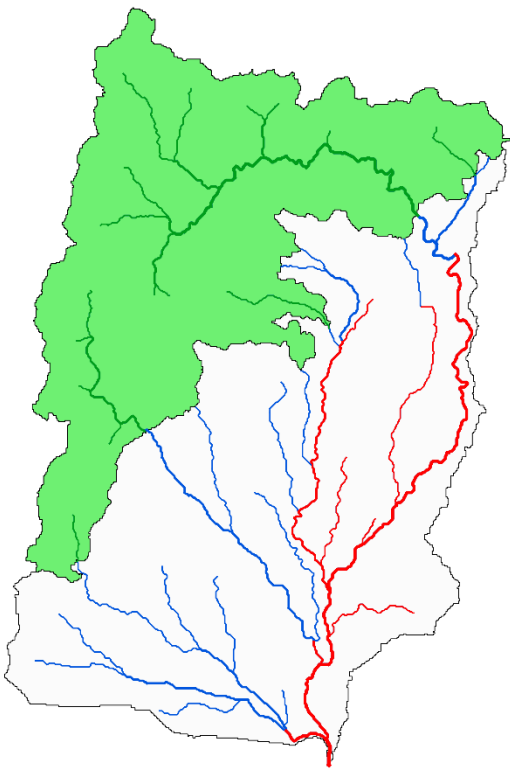
Management Zones

- Land areas that drain to a management class
- One zone for each class. Potentially many zones for a given location.



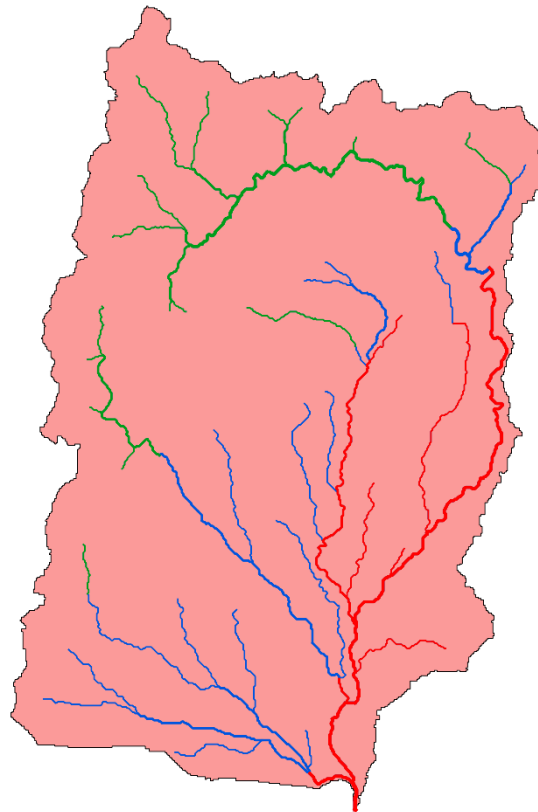
Example FMUs (1)

- Assume objectives:
 - Green – A band, Blue – B Band, Red – C Band
 - To achieve this management regimes most restrictive in Green>Blue>Red zones



Example FMUs (2)

- Assume objectives:
 - Green, Blue, Red – PRISTINE
 - To achieve this management regime the same across all zones



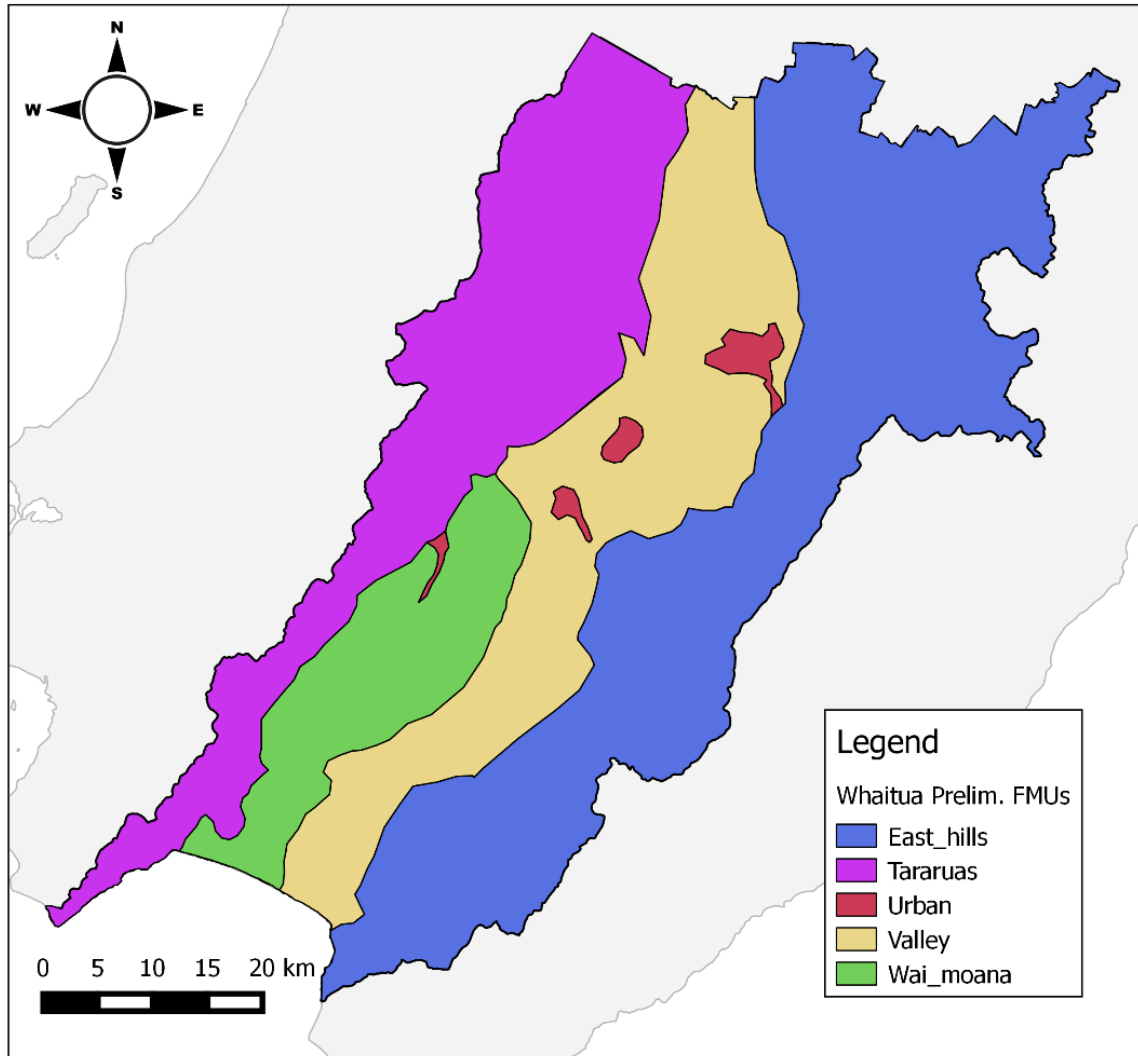
Any Questions?

- Is everyone comfortable with the terminology?
 - Management class
 - Management Zone
 - FMU
- Does it make sense that how management zones are “stacked” to form FMUs will depend on the objectives and management regimes defined by the Whaitua committee?

Application to Ruamahanga

- Applied same principles
- Complicating factors:
 - Many different biophysical states and objectives
 - Sparse monitoring network
 - Managing for both water quality and quantity

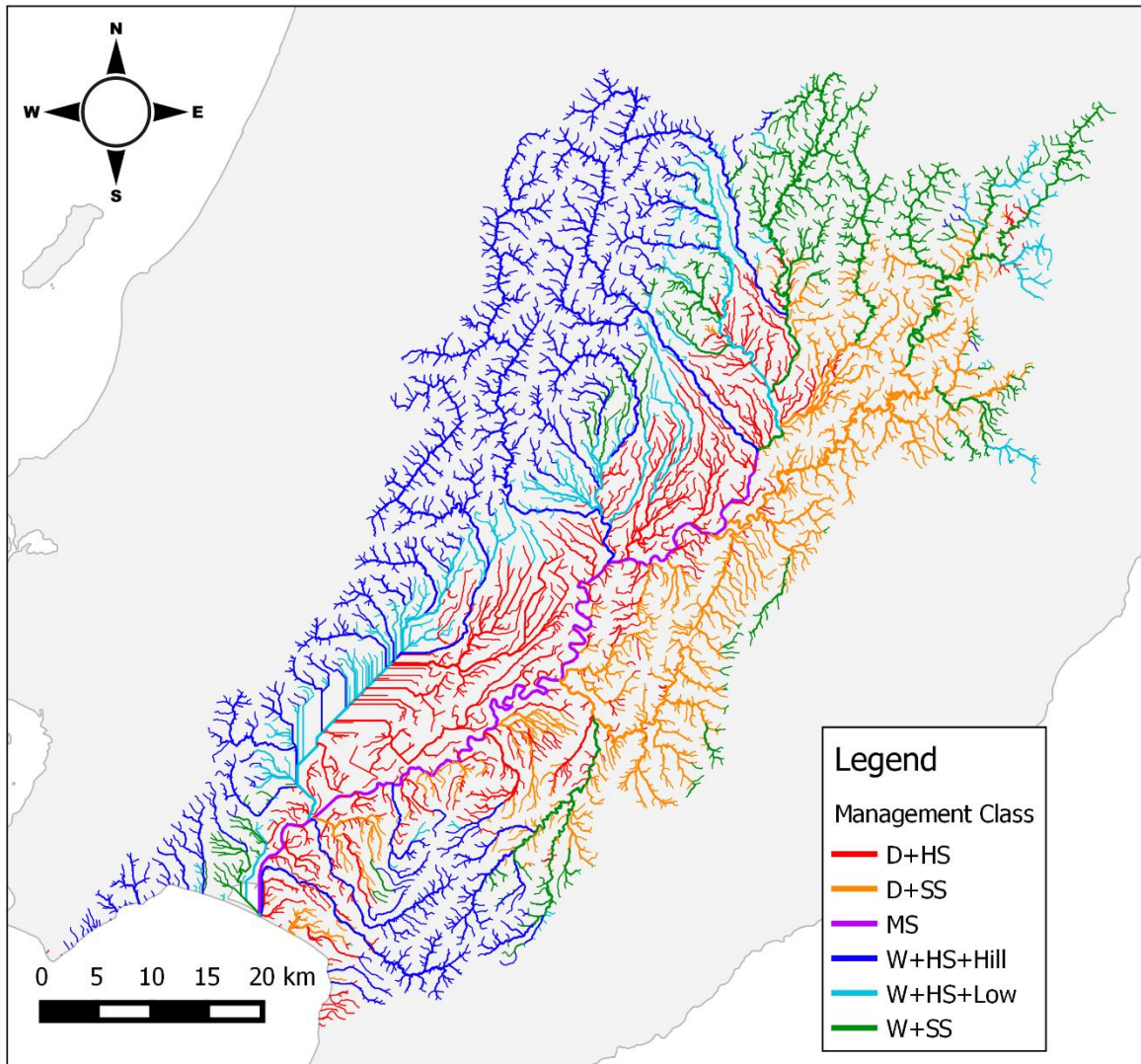
Whaitua Preliminary FMUs



Application to the Ruamahanga

- Collected together information about:
 - Topography, Geology, Rainfall, Temperature, Flow magnitude
- Compared catchment characteristics to observed or predicted state:
 - Water Quality:
 - Chemical: $\text{NO}_3\text{-N}$, TN, DRP, TP, $\text{NH}_4\text{-N}$
 - Bacterial : E. coli
 - Ecological: Periphyton, MCI, QMCI
 - Clarity
 - Water Quantity:
 - Water supply reliability
 - Fish habitat response to change in flow

Management Classes – water quality



Rainfall:

W - Wet

D - Dry

Geology:

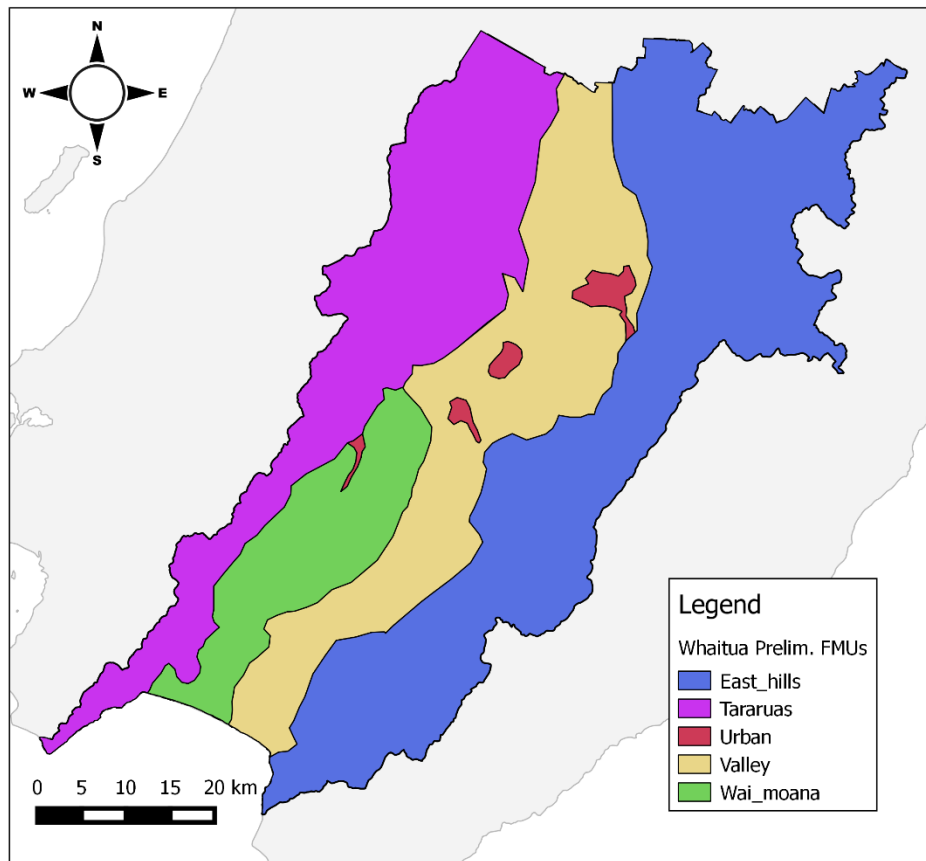
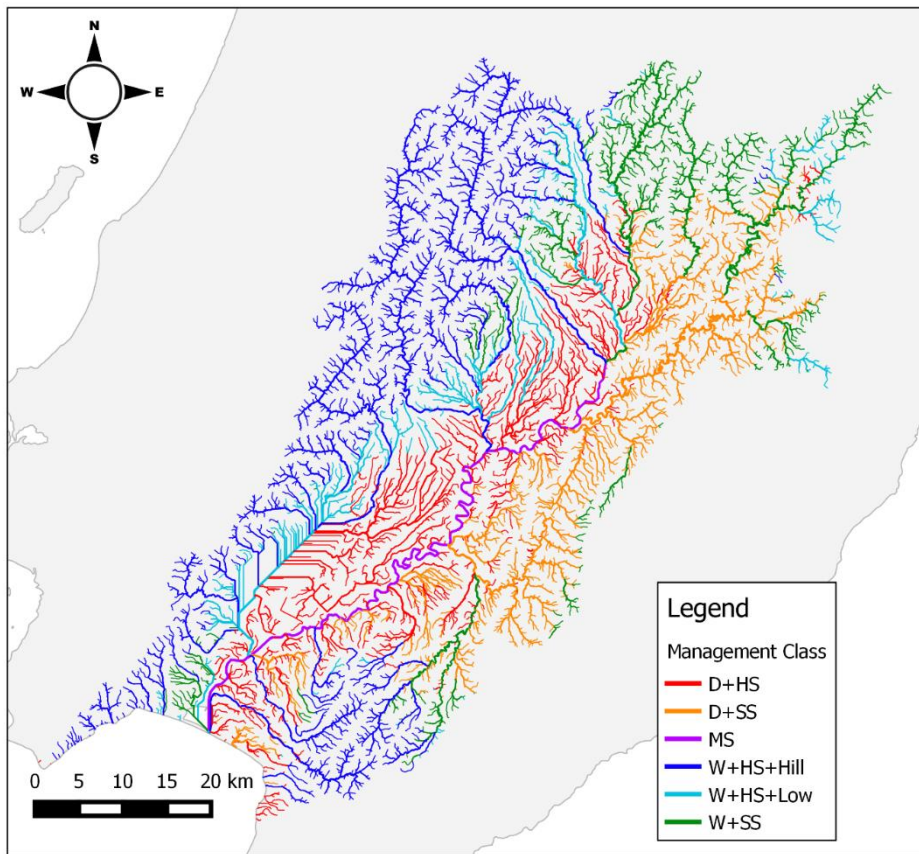
HS – Hard Sedimentary

SS – Soft Sedimentary

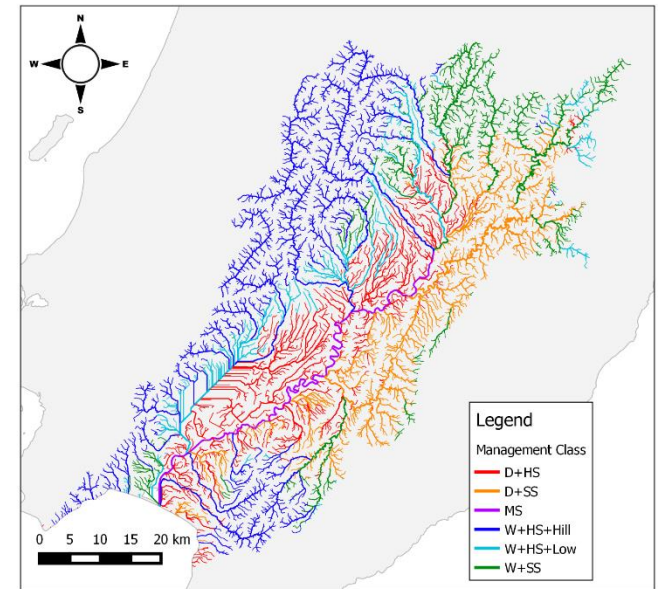
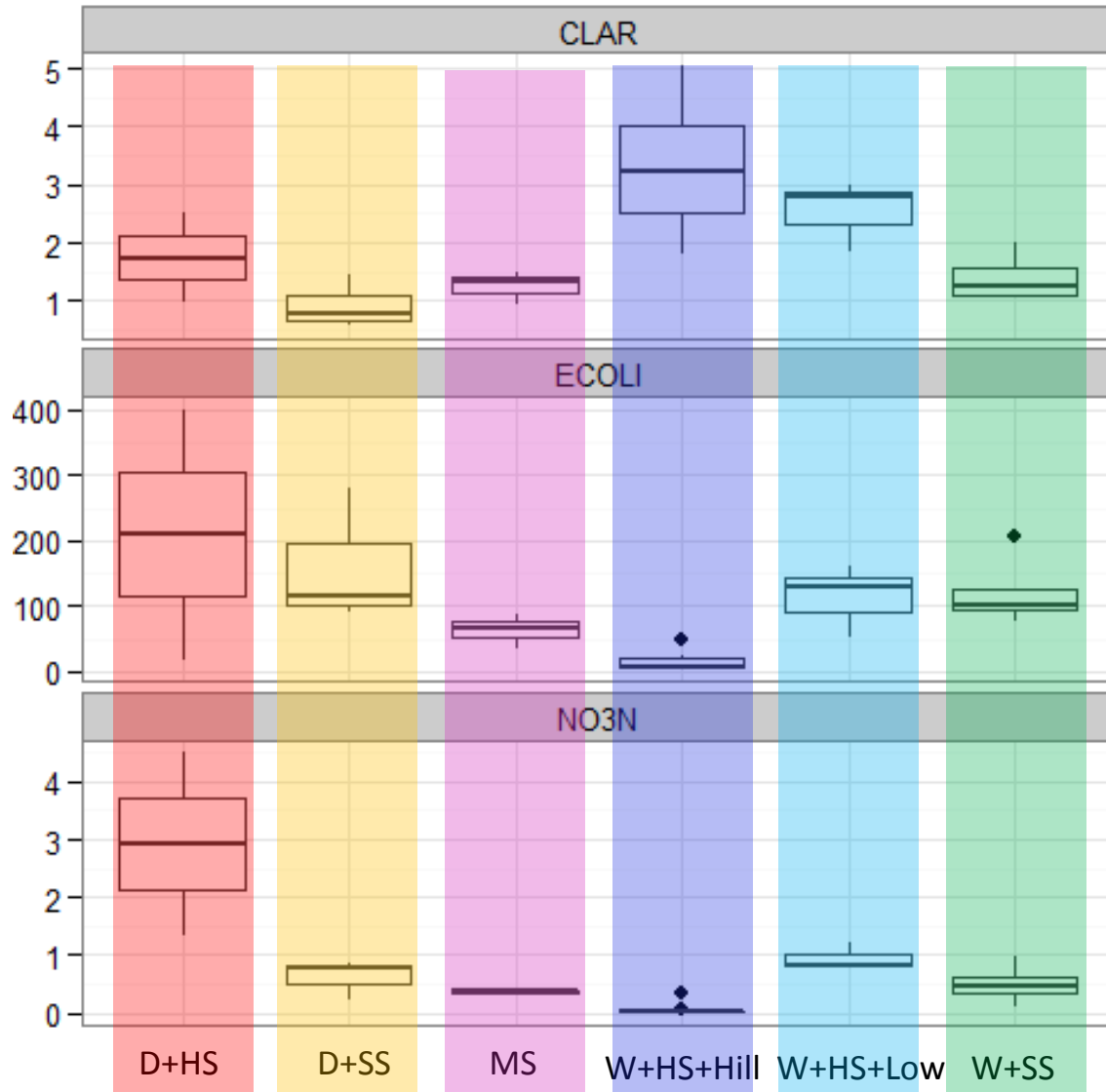
Slope:

Hill – Upstream $>17^\circ$ slope

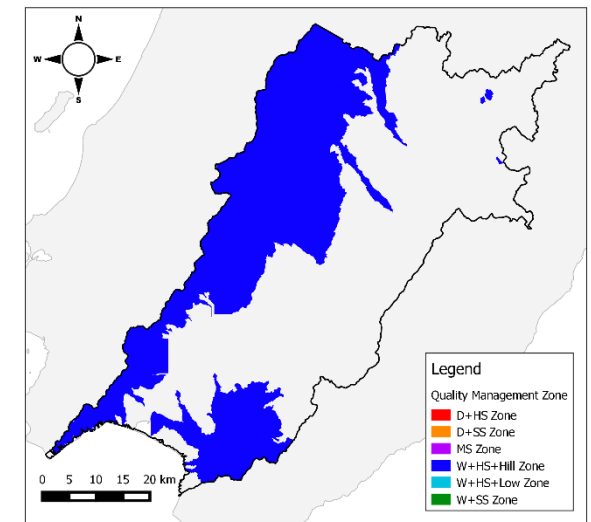
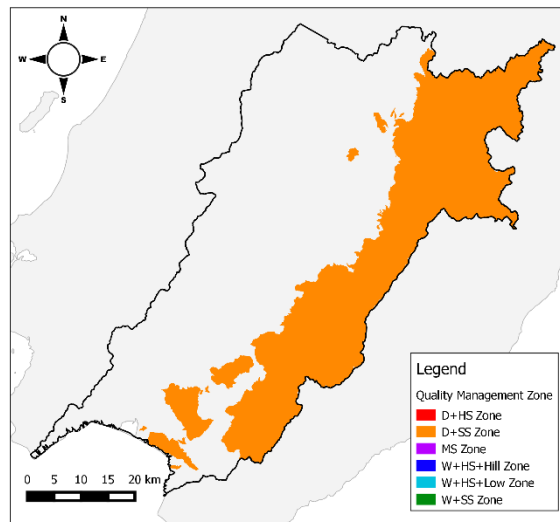
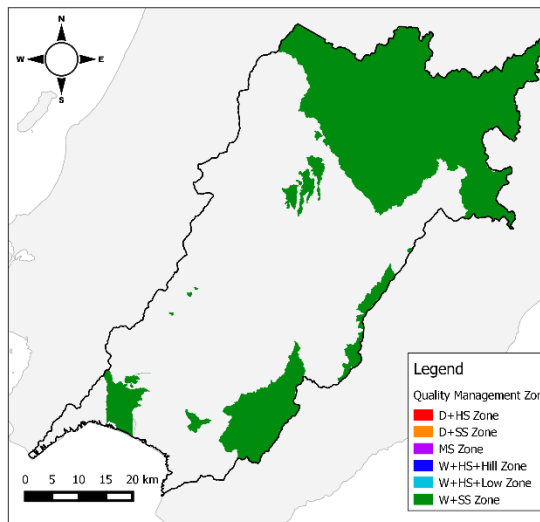
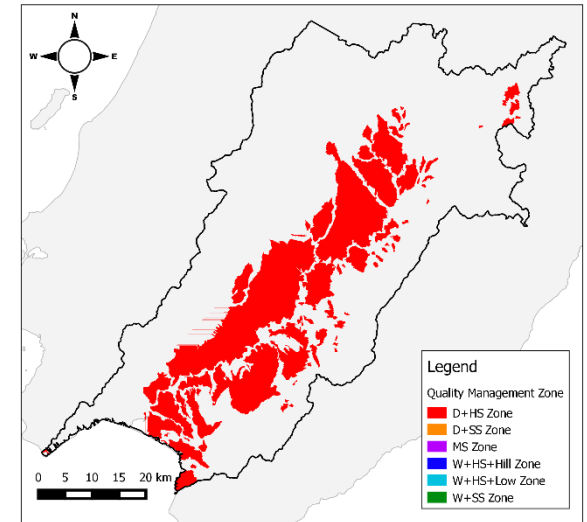
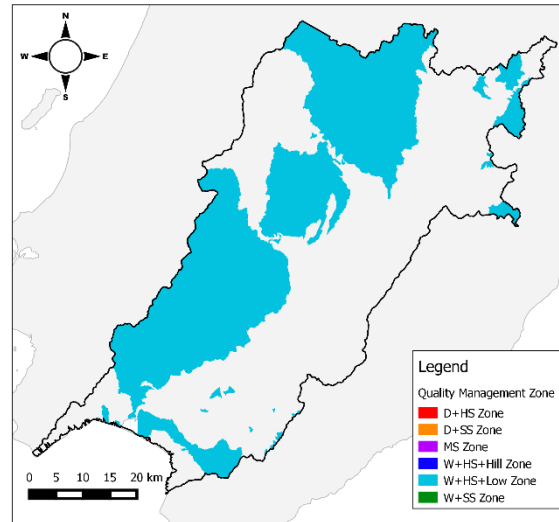
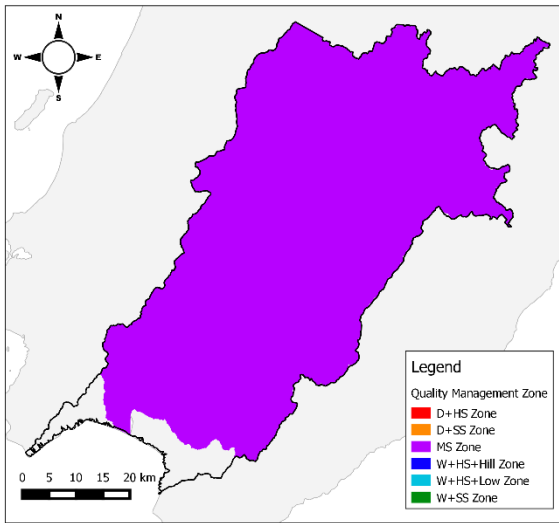
Low – Upstream $<17^\circ$ slope



Variation in water quality by management classes



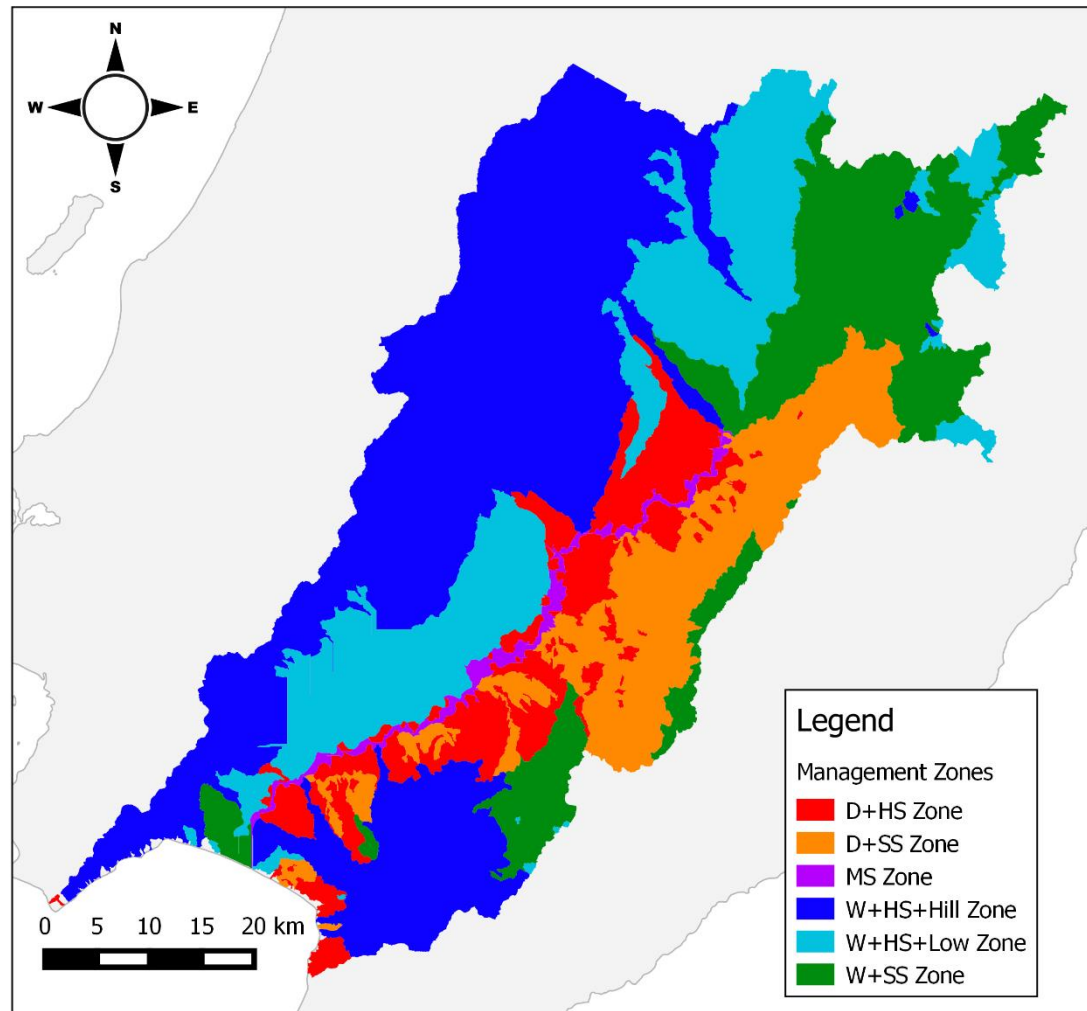
Management Zones (quality)



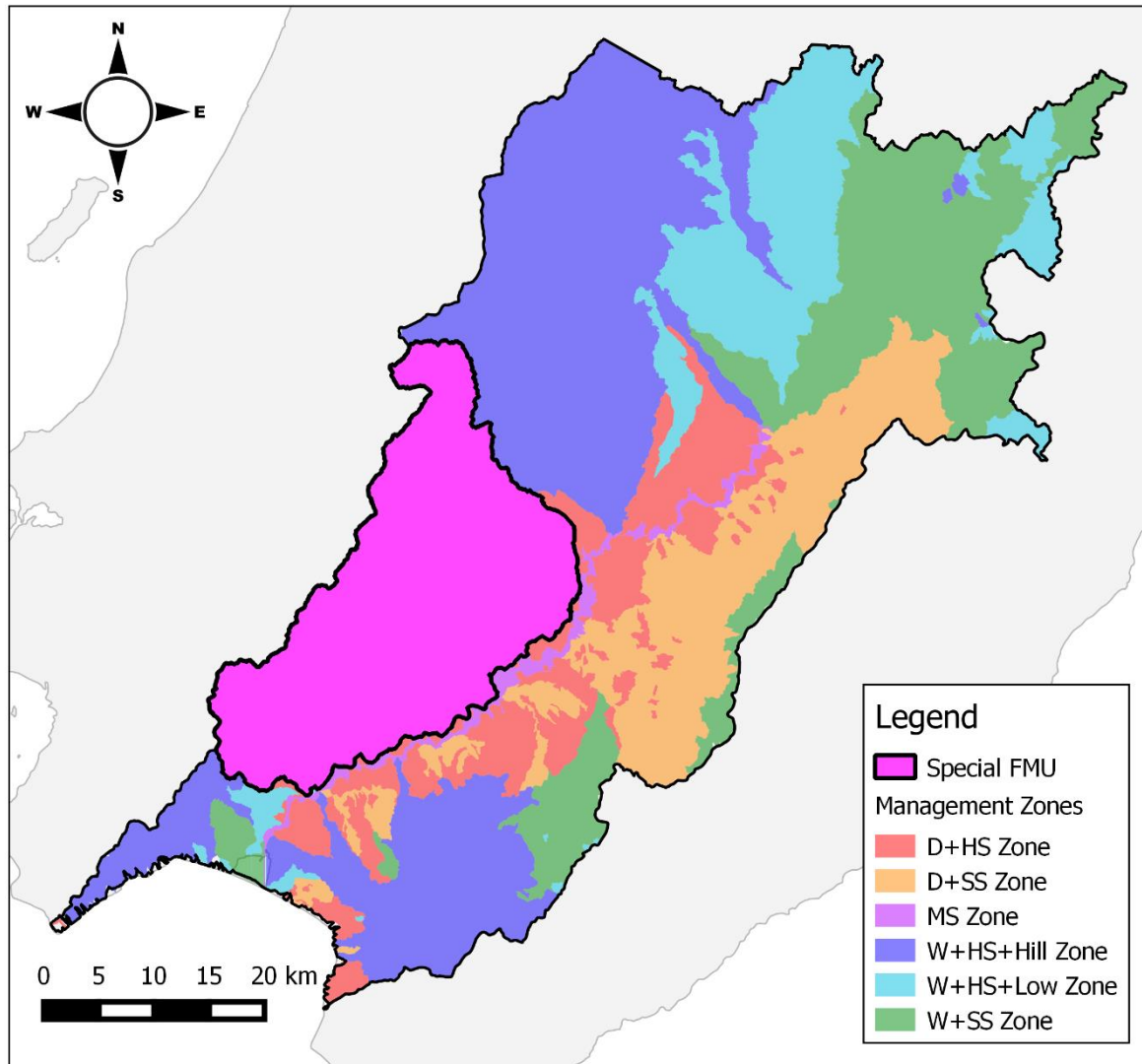
Example objectives

- Gave each class an overall water quality score
- Use the score to rank the classes
- Assume that the classes with higher water quality would have more stringent objectives, hence associated management zones with more restrictive management regimes
- RANKING: (from highest WQ to lowest)
 - $W+HS+HILL > W+HS+LOW > W+SS > D+HS > D+SS$
 - MS kept separate

Example water quality FMUs



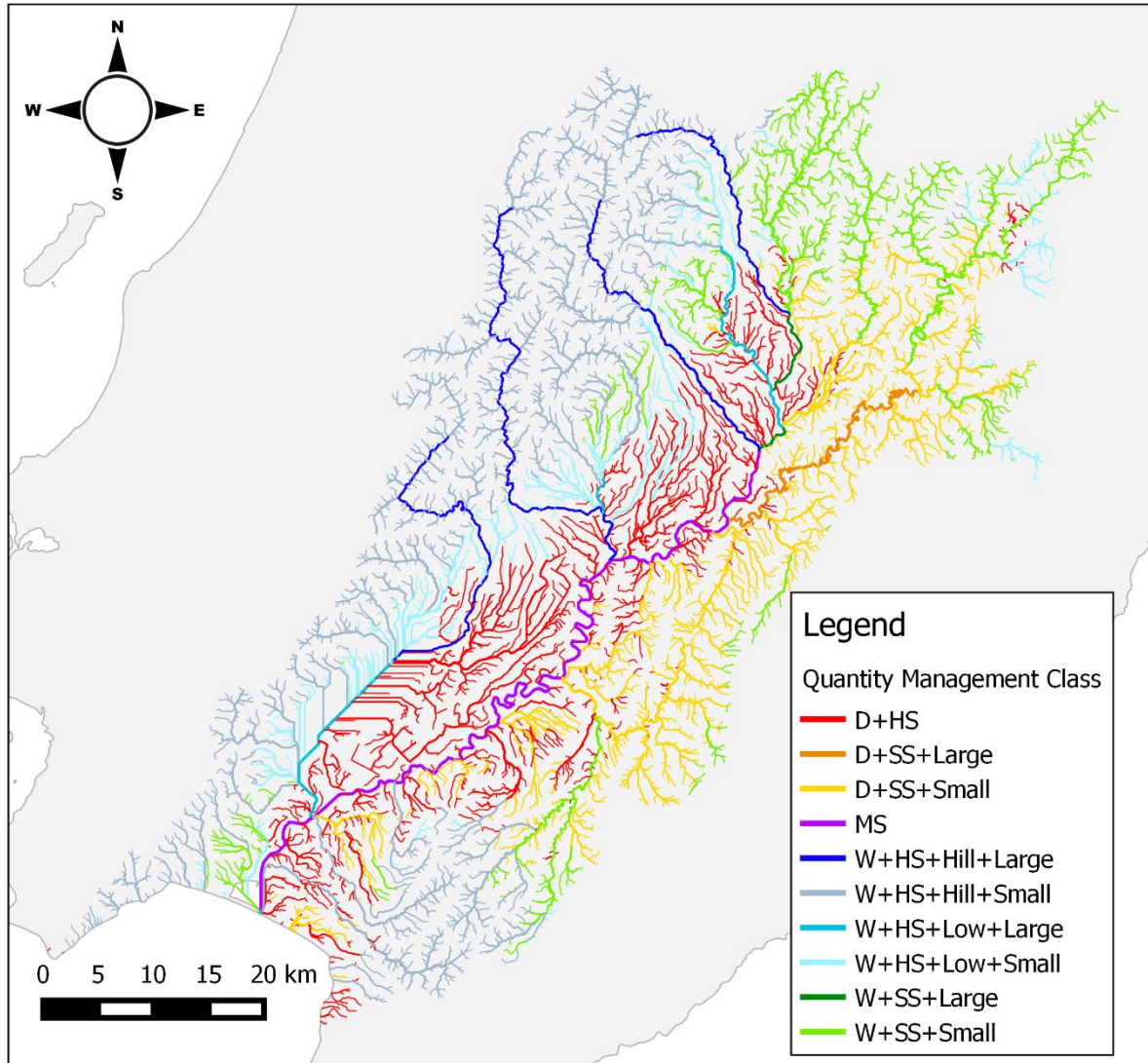
Special FMUs



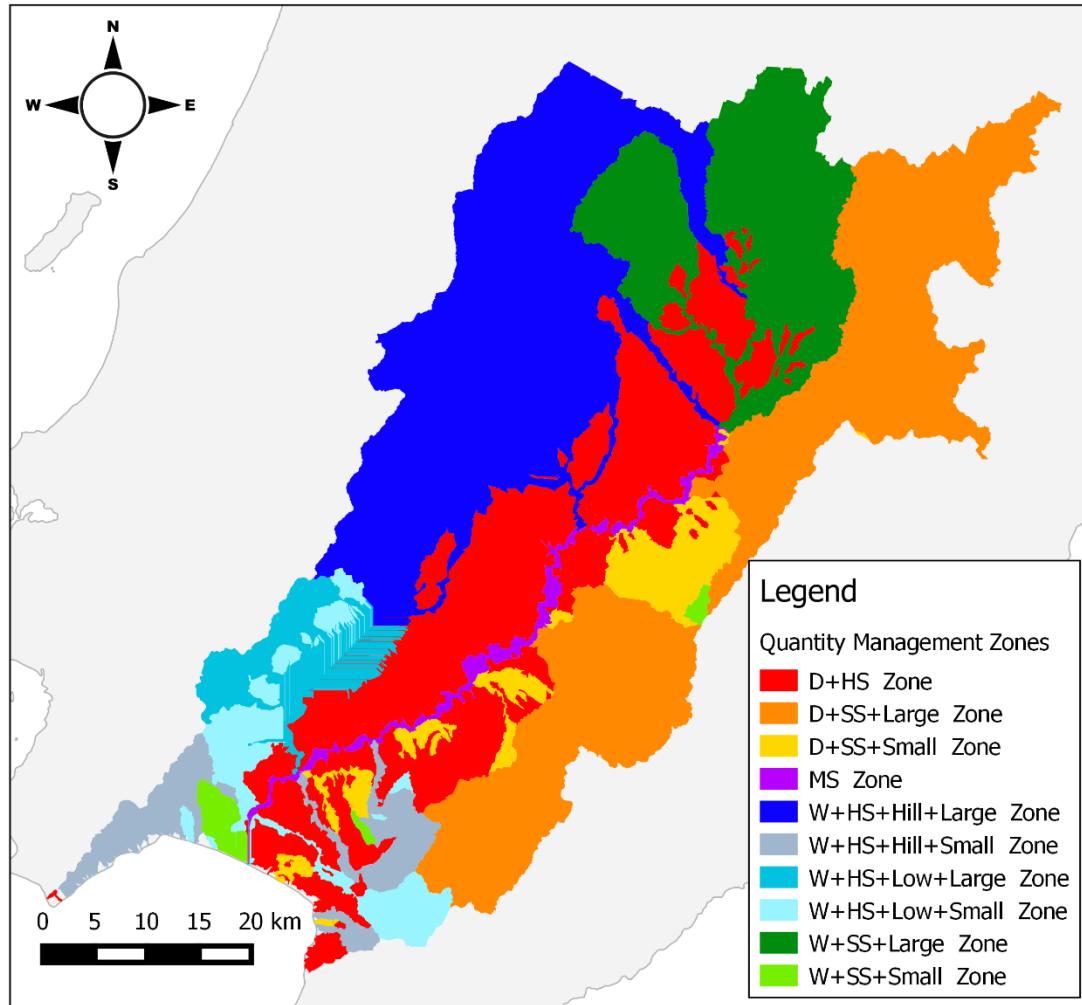
Water quantity classes

- Followed the same process as for quality classes, but looked at variability in :
 - Hydraulic Fish Habitat
 - Water Supply Reliability
- Variation in fish habitat also required river size to be included in classification

Management Classes - quantity



Example Management Zones - quantity



Summary

- Presented a bio-physical approach to developing FMUs
- Approach is based on:
 - **Management Classes**
 - **Management Zones** (LEGO BLOCKS)
- FMUs are developed by stacking the lego blocks
 - HOW you stack the blocks depends on **management class objectives**, and **management regimes** (e.g. limits and other actions) in each **management zone**
 - Objectives and management regimes will ultimately be defined by the Whaitua committee
- Special areas can be introduced as special FMUs
- Other types of information (i.e. other biophysical attributes, social, cultural, economic factors) can easily be incorporated into this framework

Next steps

- Look at how the management zones line up with what we know about groundwater
- Iteration to refine zones as objectives, management regimes, policy requirements/constraints, modelling outputs are considered

Thank you

- Questions? Comments?

Extra Slides

Management Zones - quantity

