Modelling Group
WATER NEW ZEALAND

Modelling Symposium

NRC Region-wide River Flood Model Three years on

Presented by
Bertrand Salmi (Water Technology)
Joseph Camuzo (Northland Regional Council)

water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa

Story Line

- Model Overview
- How we use it
- How it was challenged
  - Two examples
- How can it be refined?

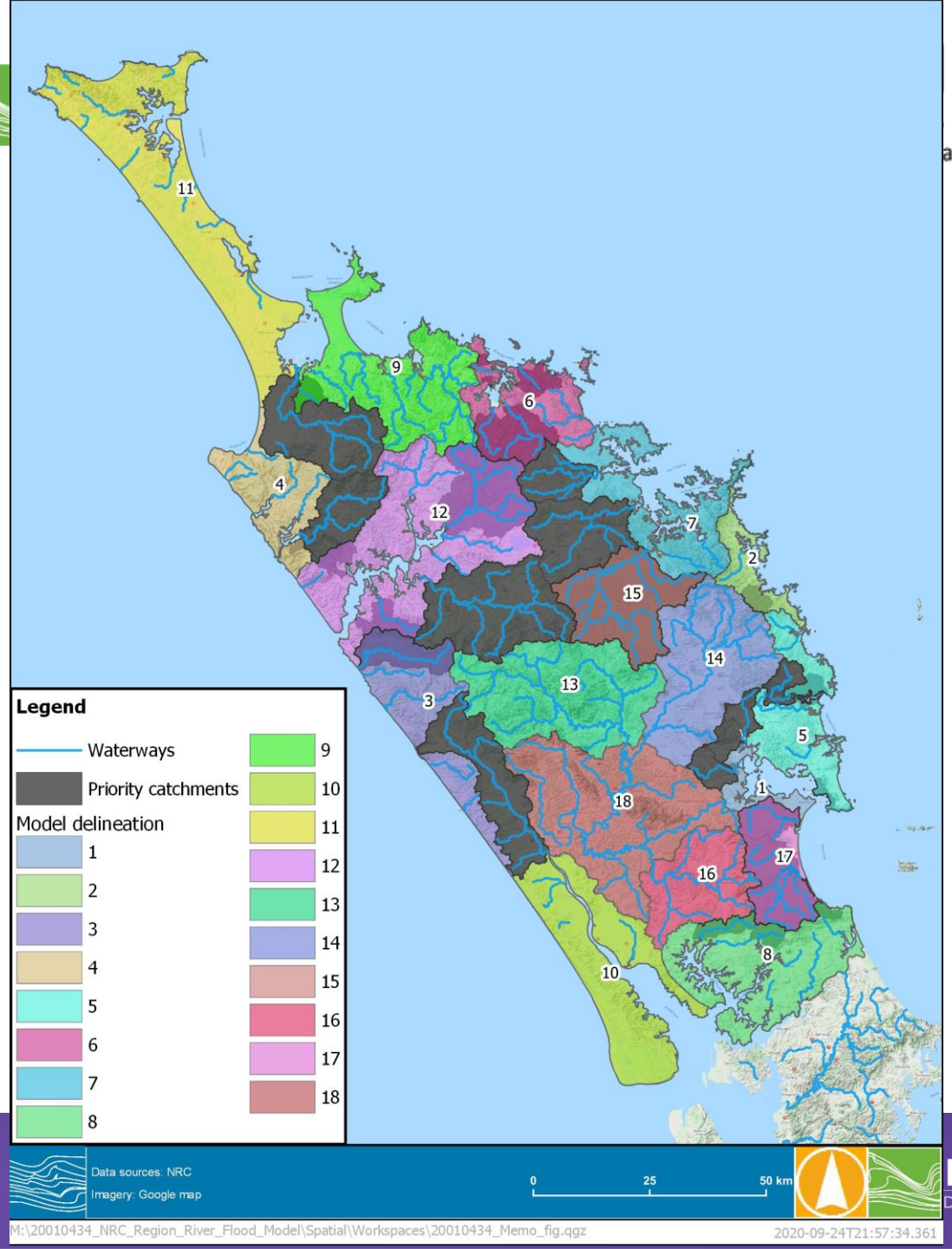
Model overview

19 Catchments

Direct rainfall model

Sub-grid-sampling (SGS)

10m with 1m SGS

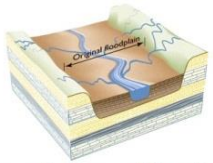


Model overview

Rainfall event generated (design event or historical)

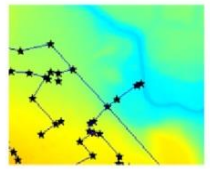
Losses Subtracted (validation to gauge or Rational Method)

Digital terrain model constructed



Catchment roughness and fraction impervious values applied

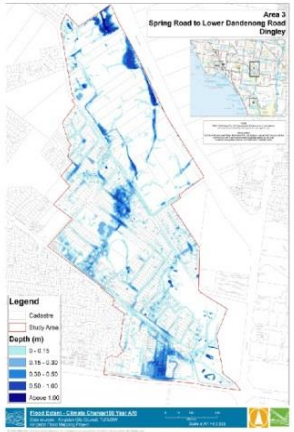
Structures added with roof area directly connected to WSUD option



Full pipe and channel network added and WSUD device directly connected

Model run

Verification to known events



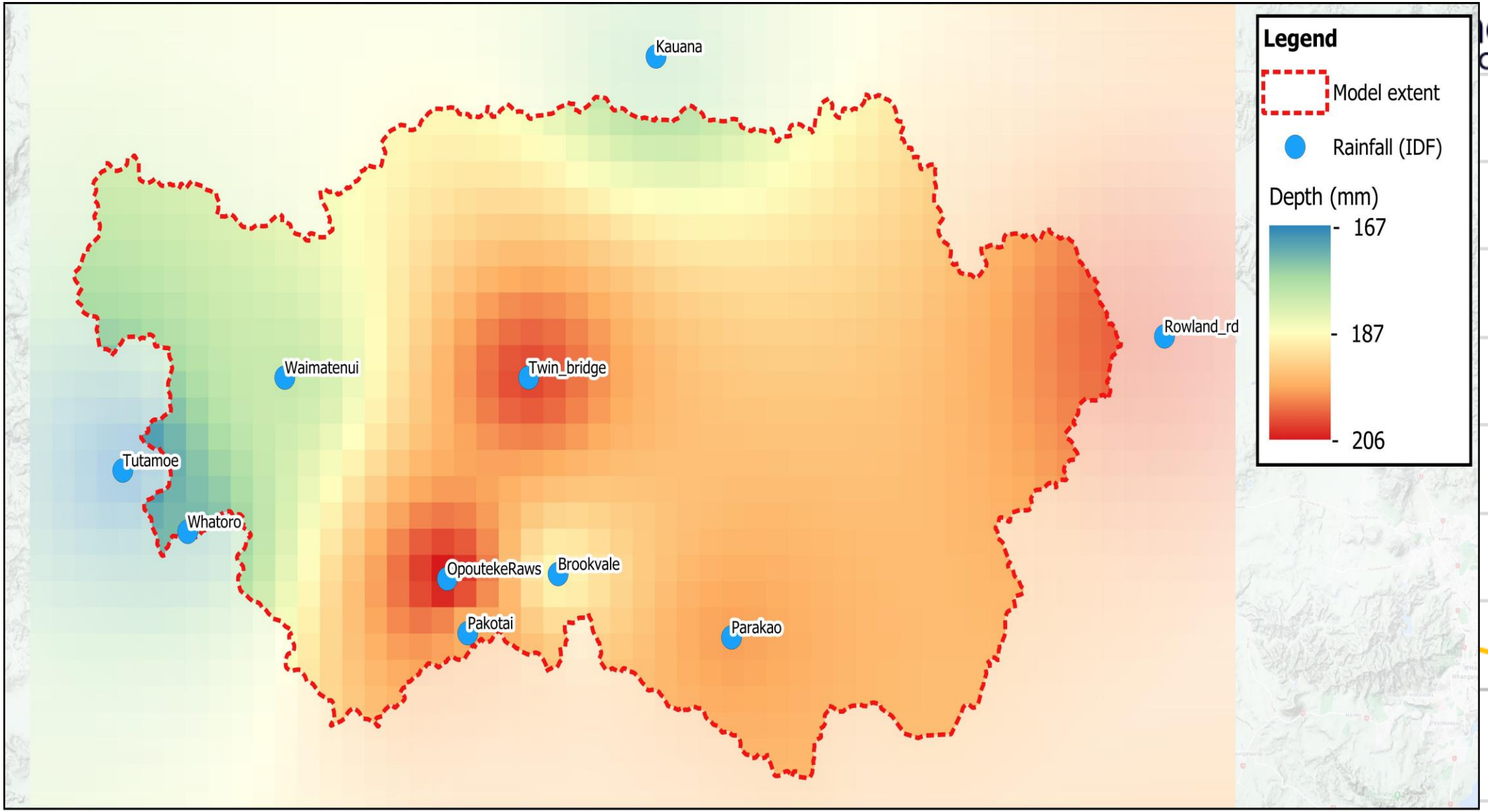
Final flood depth, velocity, water surface elevation, hazard and extent results extracted from model and mapped.

Model overview

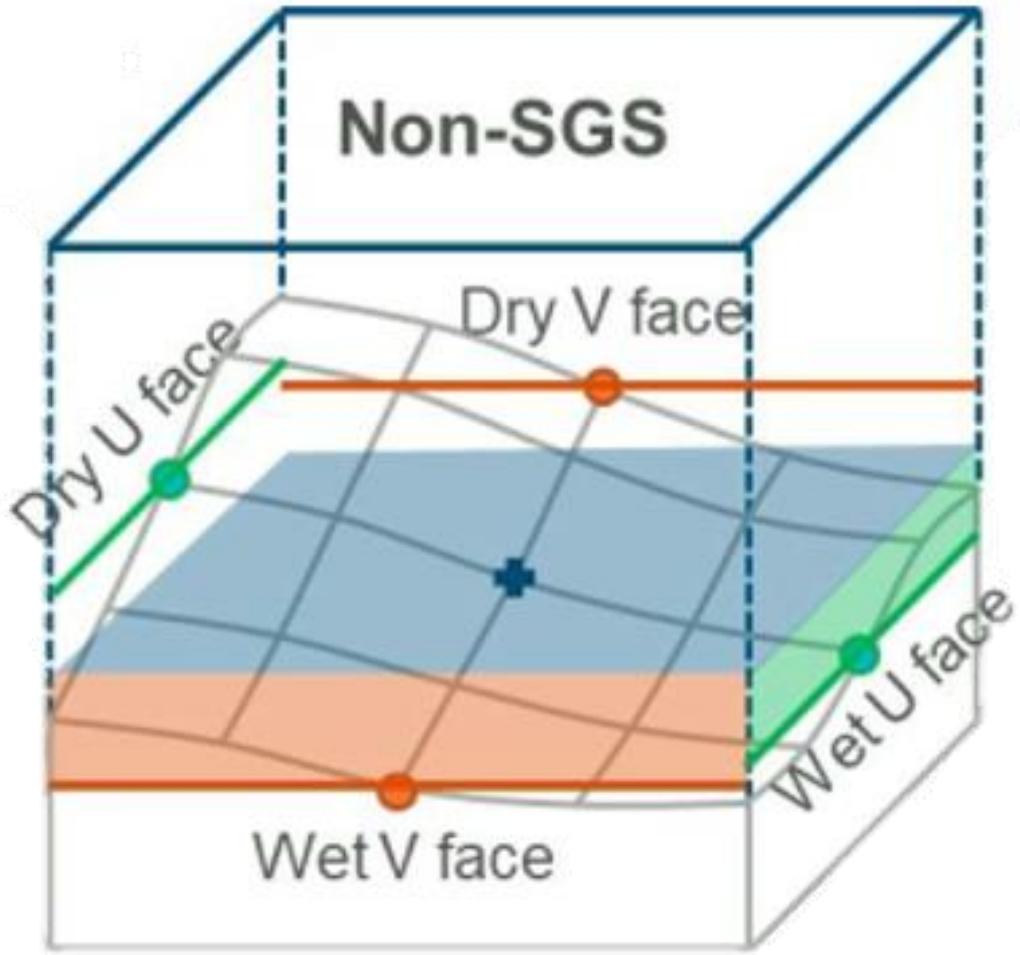
Design Hyetographs

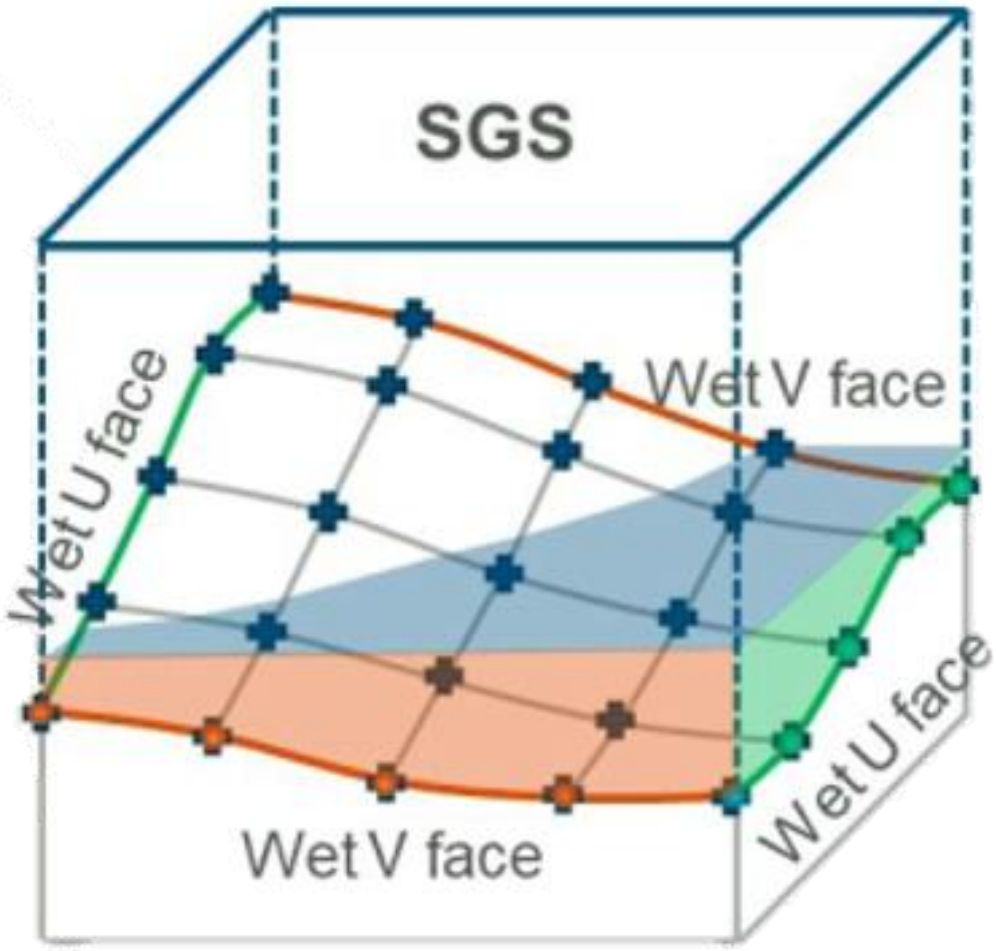
- HIRDS V4 standard hyetograph was recommended by Macky & Shamseldin (2020)

- Different durations - 1 hour, 6 hour, 12 hour and 24 hour duration for each catchment


Kauana
Rowland_rd
Waimatenui
Twin_bridge
Tutamoe
Whatoro
OpoutekeRaws
Brookvale
Pakotai
Parakao
Legend
Model extent
Rainfall (IDF)
Depth (mm)
167
187
206
Data sources: NRC
Imagery: Google Map
0
5
10 km
M:\20010434_NRC_Region_River_Flood_Model\Spatial\Workspaces\20010434_Validation_report_fig.qgz
2021-02-17T10:41:08.570

Model overview





Model overview - Limitations

- Pipes/Culverts generally not modelled
- Only 3000 culverts/pipes were burned in the HE-DEM data
- Bathymetry of waterways not necessarily captured:
  - Models likely under-estimate conveyance capacity of the major channels
- Antecedent conditions accounted for in adopted parameters
  - Sensitivity analysis shows that model is somewhat robust to these
- Tidal boundaries - static

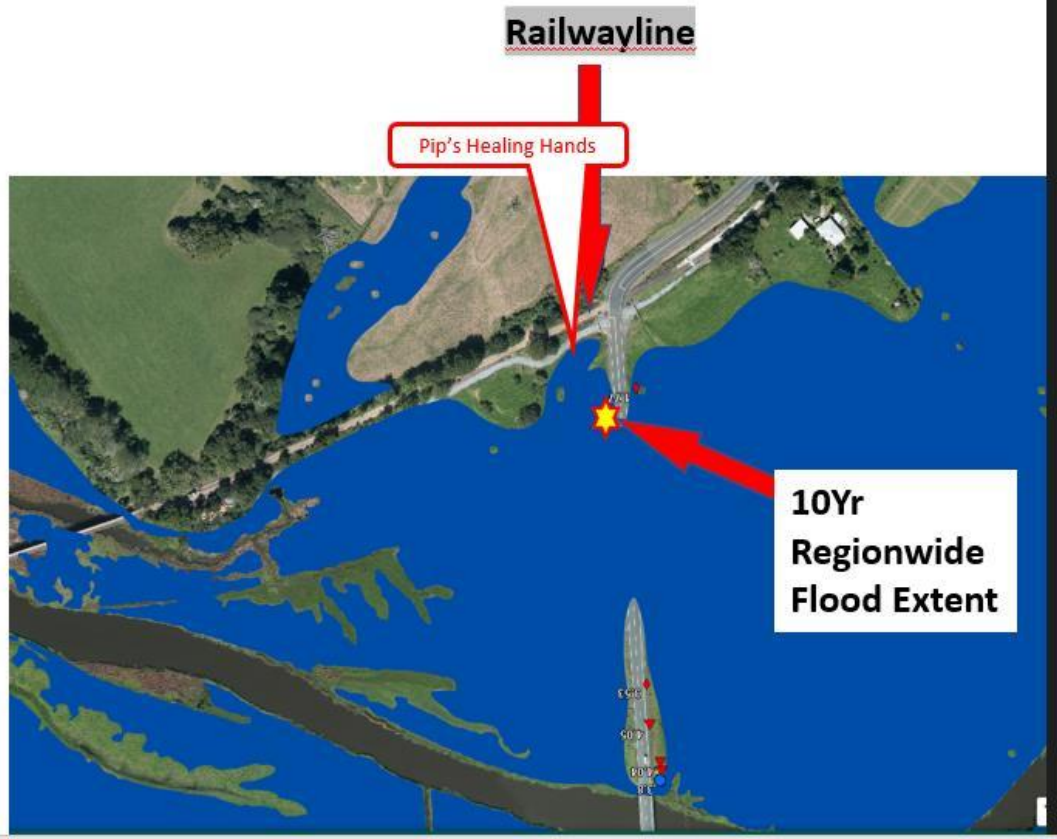
Model overview - Limitations

- Model was peer- reviewed – no fatal flaws
- Calibration results demonstrate the difficulty in developing large scale catchment scale models to meet all the calibration performance measures specified by NRC
- NRC/WT are aware of limitations of model – clearly need to communicate purpose and limits of model outputs

What can it be used for

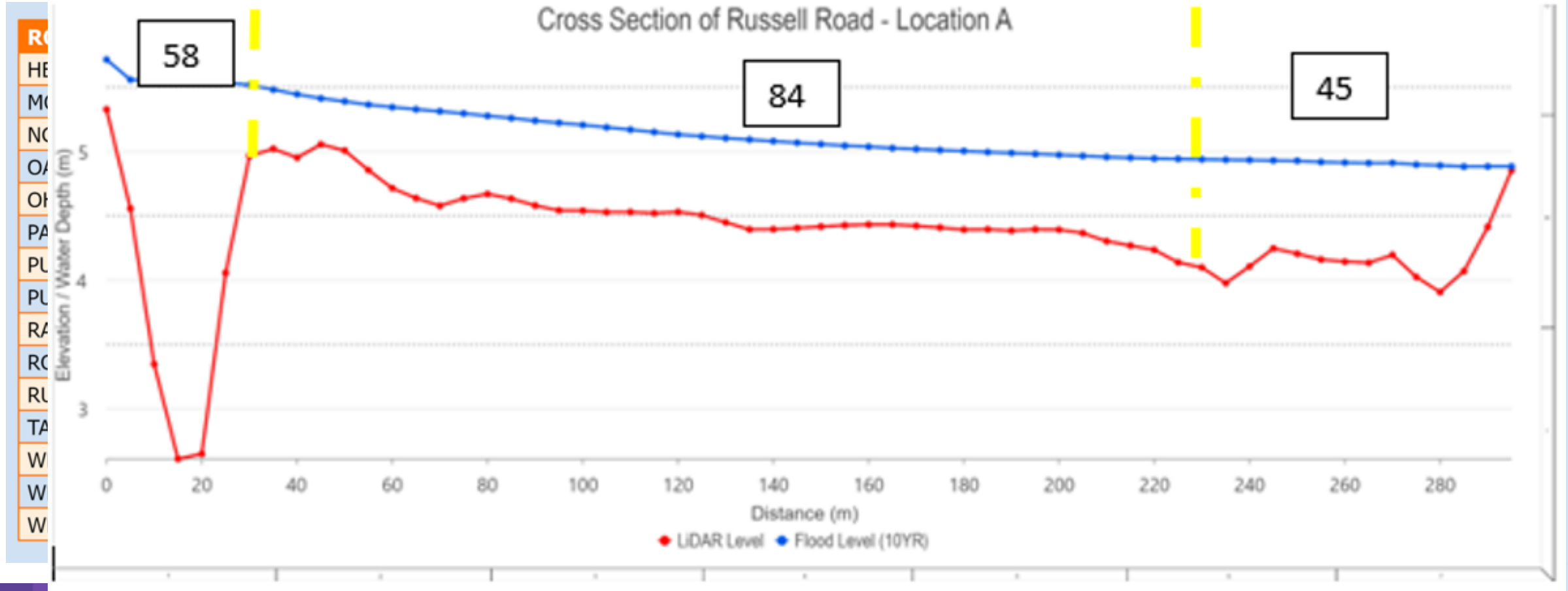
- Resource consent
- Identifying Applicable Flood Levels
- Option Prioritization
- Good basis for model refinement

What can it be used for Validation July 2022

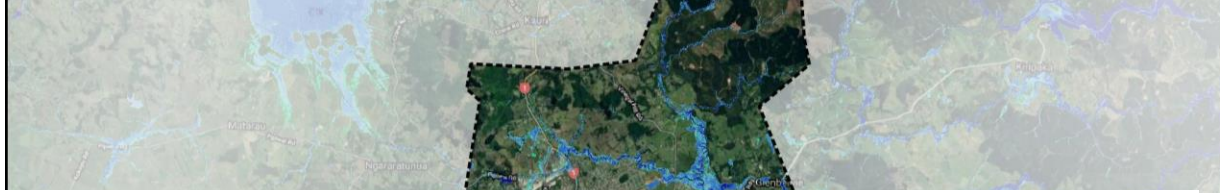


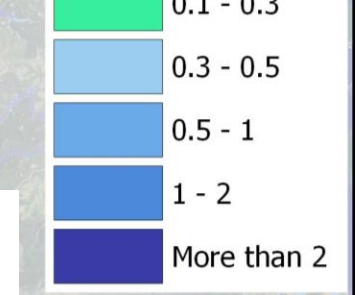
How we use it
Option Prioritization

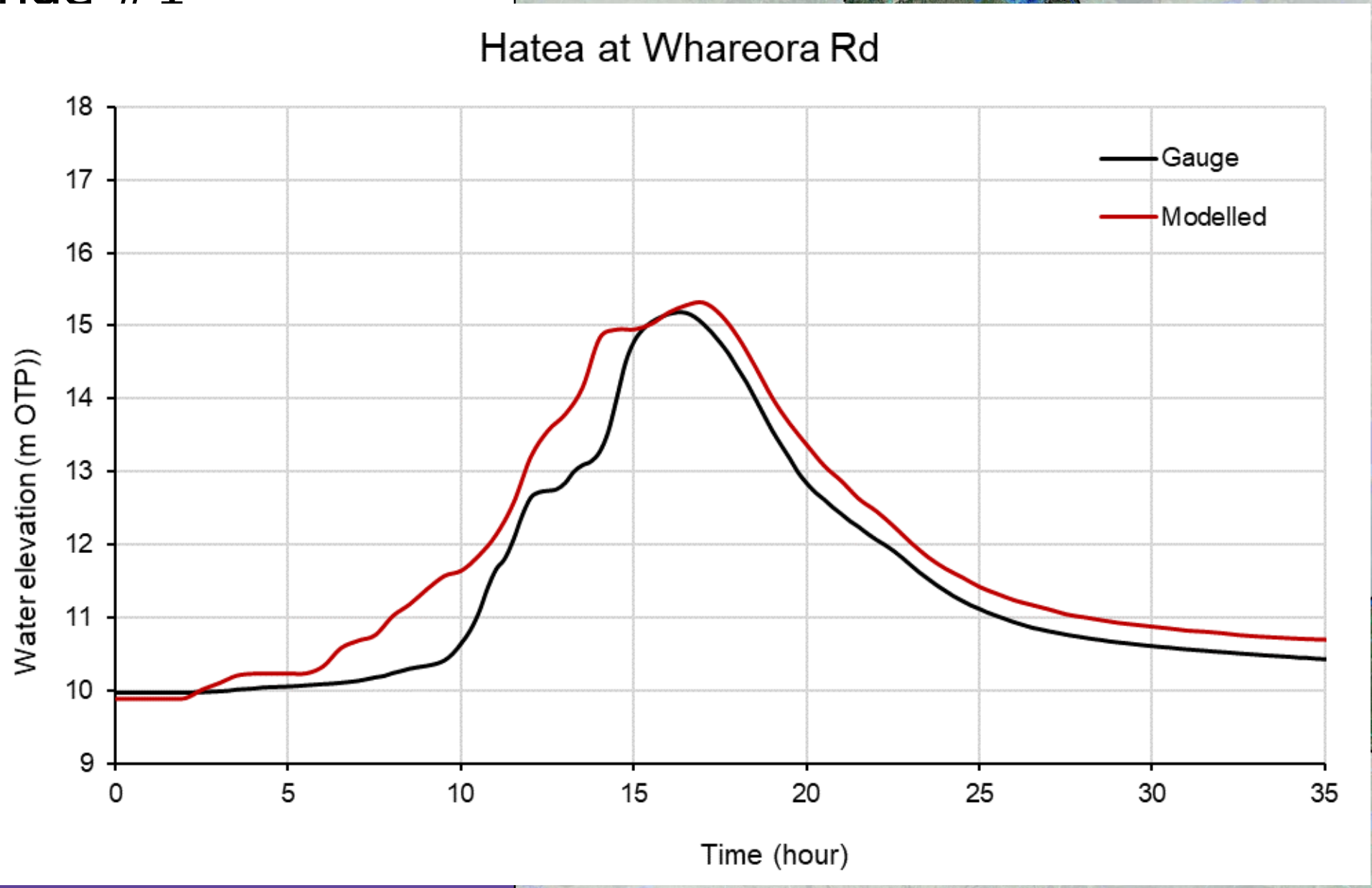
ROAD NAME	TOTAL ROAD LENGTH (m)	TOTAL ROAD LENGTH IN HAZARD ZONE (m)	PERCENTAGE ROAD IN HAZARD ZONE (%)
HELENA BAY RD	213.96	97.26	45.46
MOKAU RD	384.6	202.23	52.58
NGAHAU BAY RD	1786.9	17.16	0.96
OAKURA RD	2326.93	44.94	1.93
OHAWINI RD	1560.53	866.1	55.5
PAPAKAURI RD	362.5	43.26	11.93
PUKAPUKA RD	977.64	99.84	10.21
PUNARUKU RD	920.51	318.85	34.64
RAWHITI ROAD (SOUTH)	6904.66	55.54	0.8
ROCKELL RD	7020.13	49.3	0.7
RUSSELL RD (CTL)	28375.68	1817.93	6.41
TAIWA RD	336.99	20.42	6.06
WEBB RD	5276.43	689.89	13.07
WHANANAKI NORTH RD	183.39	10.01	5.46
WHANGARURU NORTH RD	10155.15	108.72	1.07



Challenge #1
Whar

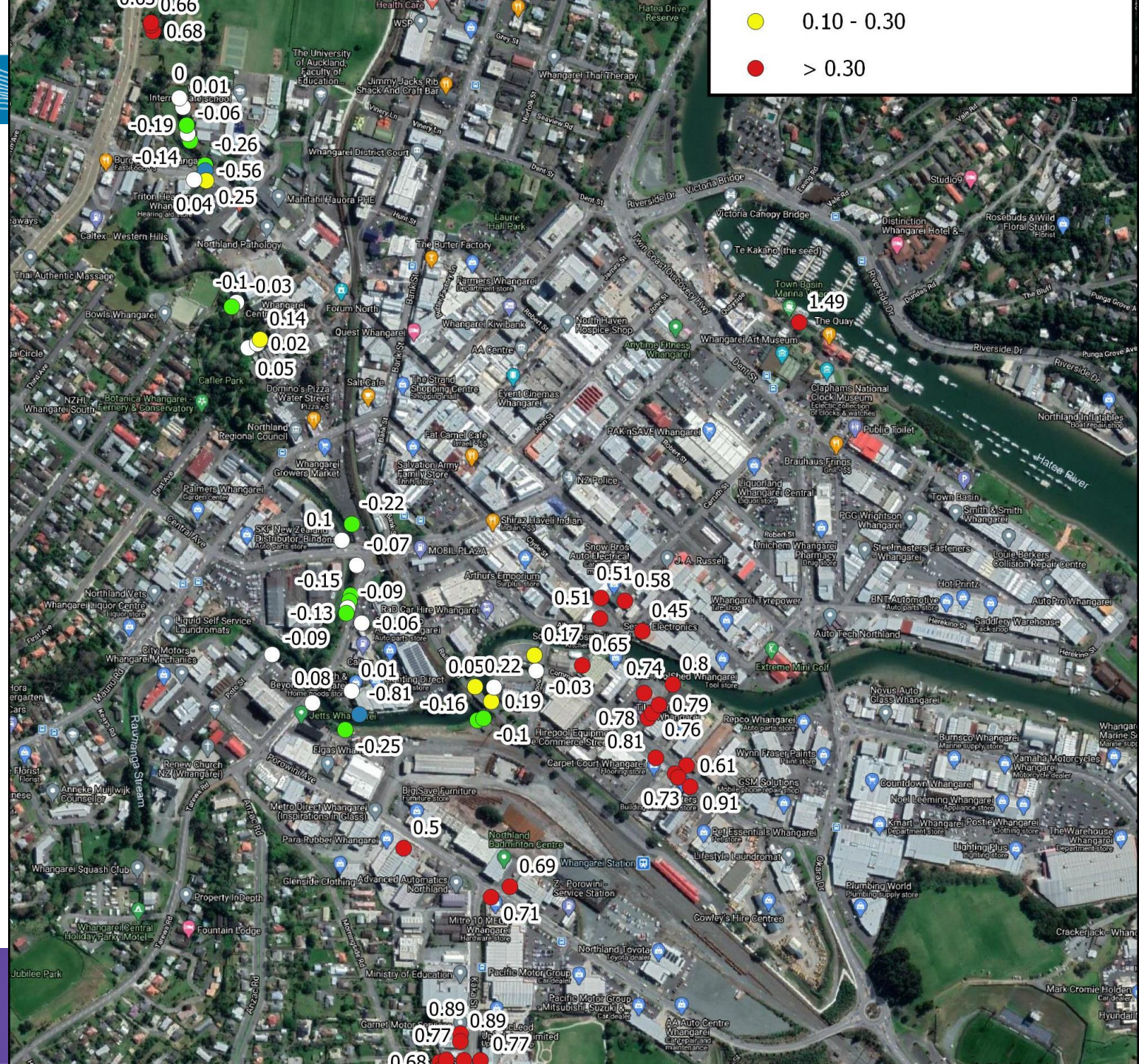




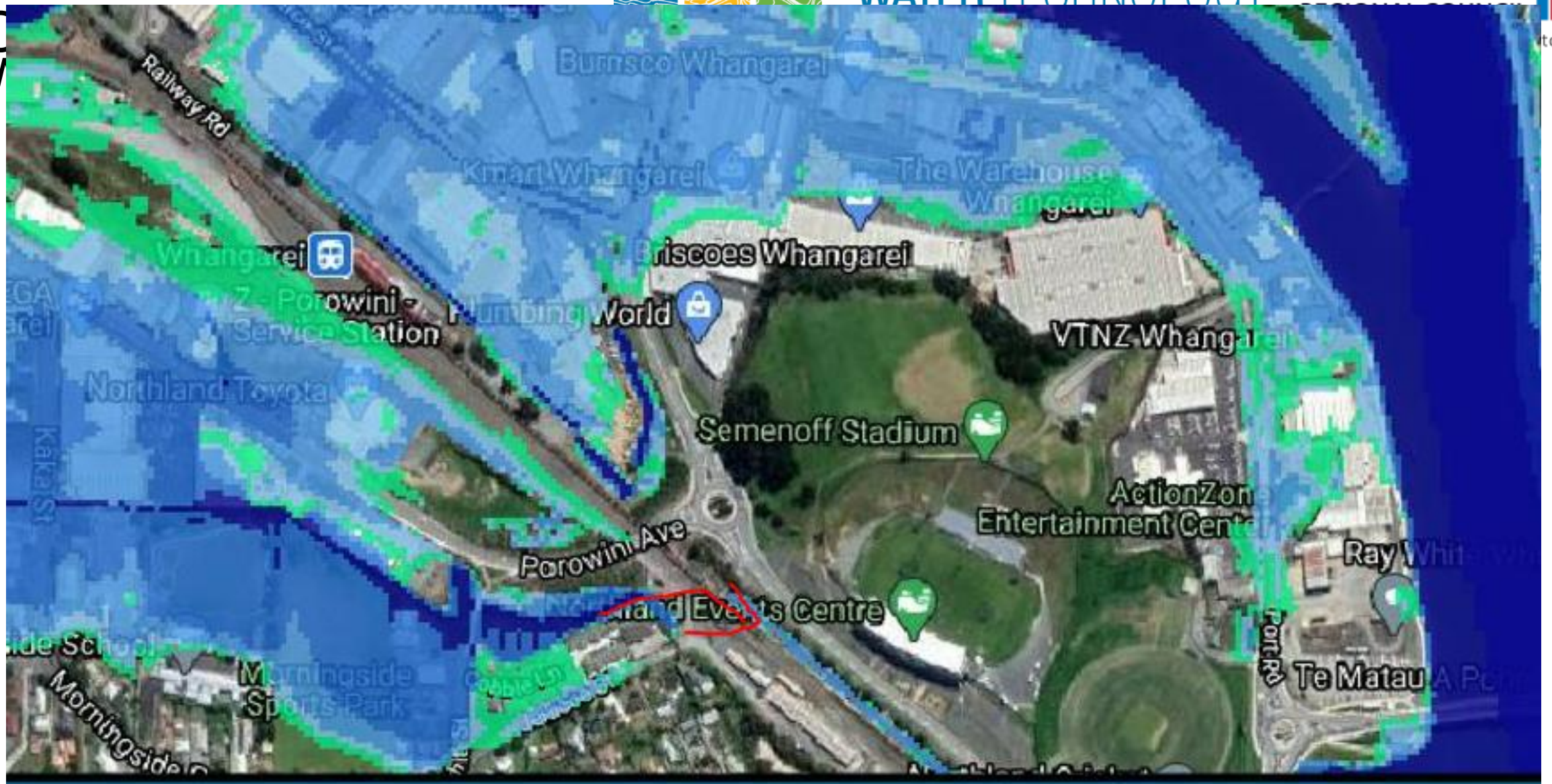


Model

Challenge #1
Whangarei Catchment



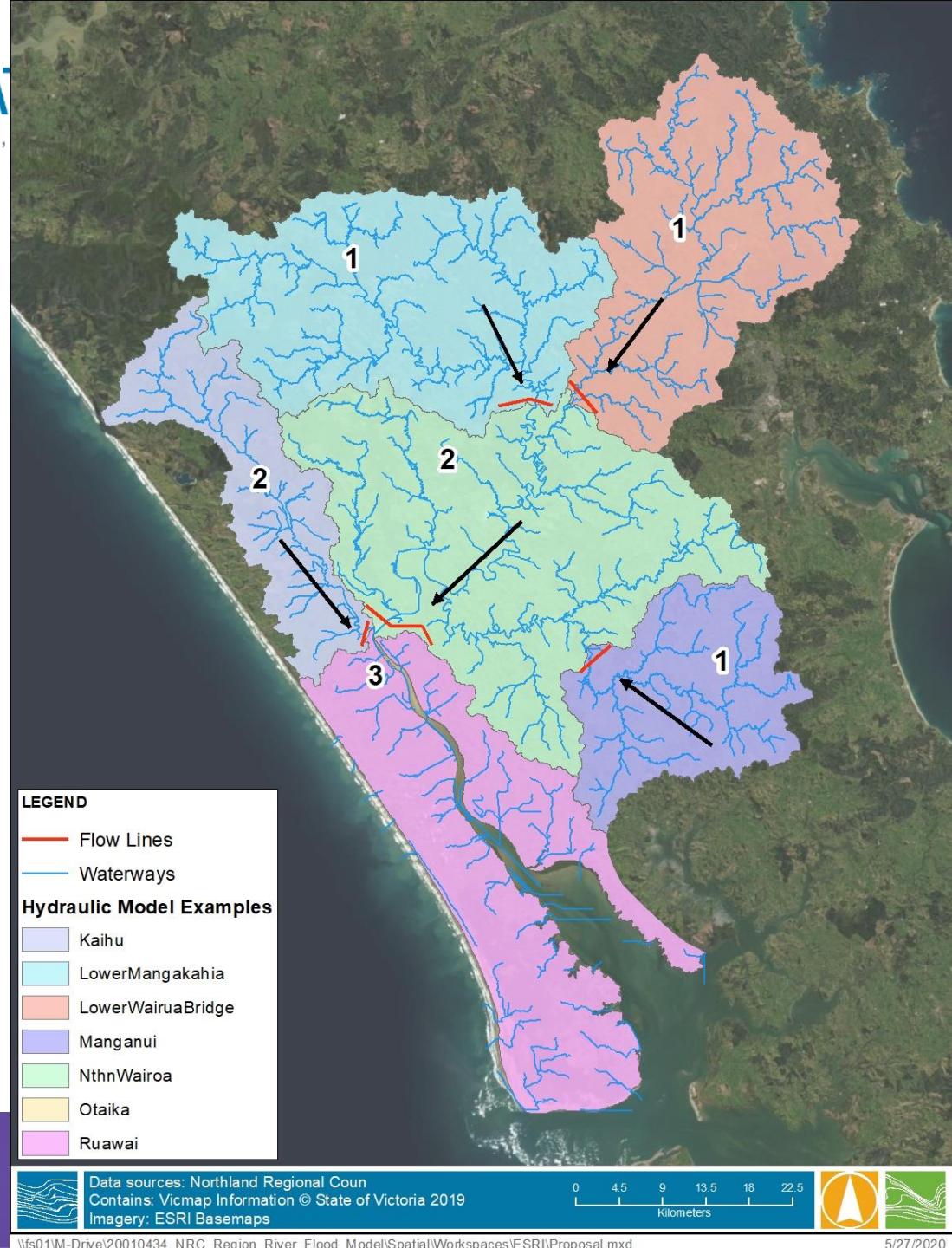
C
W


Railway Rd
Burnsco Whangarei
Kmart Whangarei
The Warehouse
Whangarei
Briscoes Whangarei
World
VTNZ Whangarei
Semenoff Stadium
ActionZone
Entertainment Centre
Porowini Ave
Events Centre
Ray White
Te Matau
Port Rd
Northland Toyota
Service Station
Plumbing
Kaka St
Morningside
Sports Park

Challenge # 2
Wairoa River

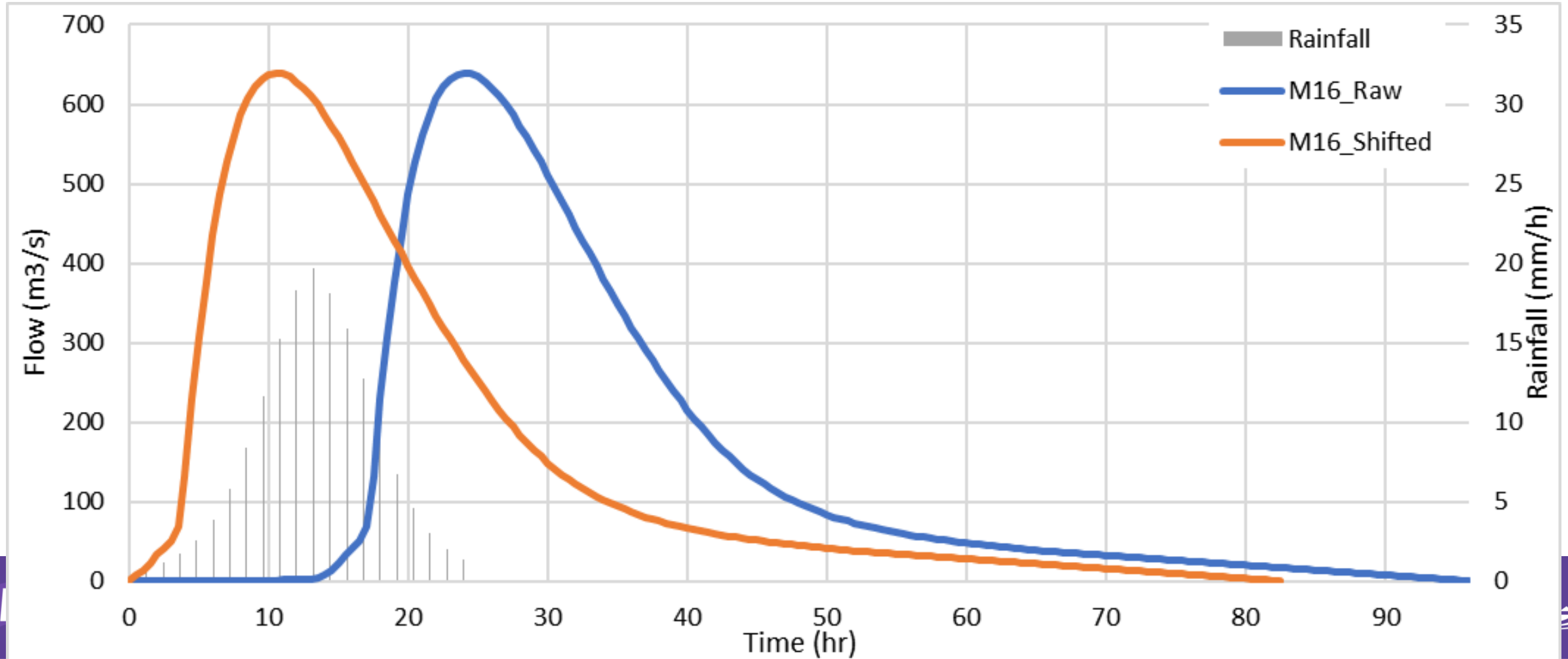
- Overall catchment modelled as separate catchments
  - M18 has inflows from catchments M13, M14 and M16

- Model lacks some granularity:
  - Hikurangi Swamp
  - Kaihu River (not modelled as part of the region-wide project)
  - Bathymetry of Wairoa River not captured

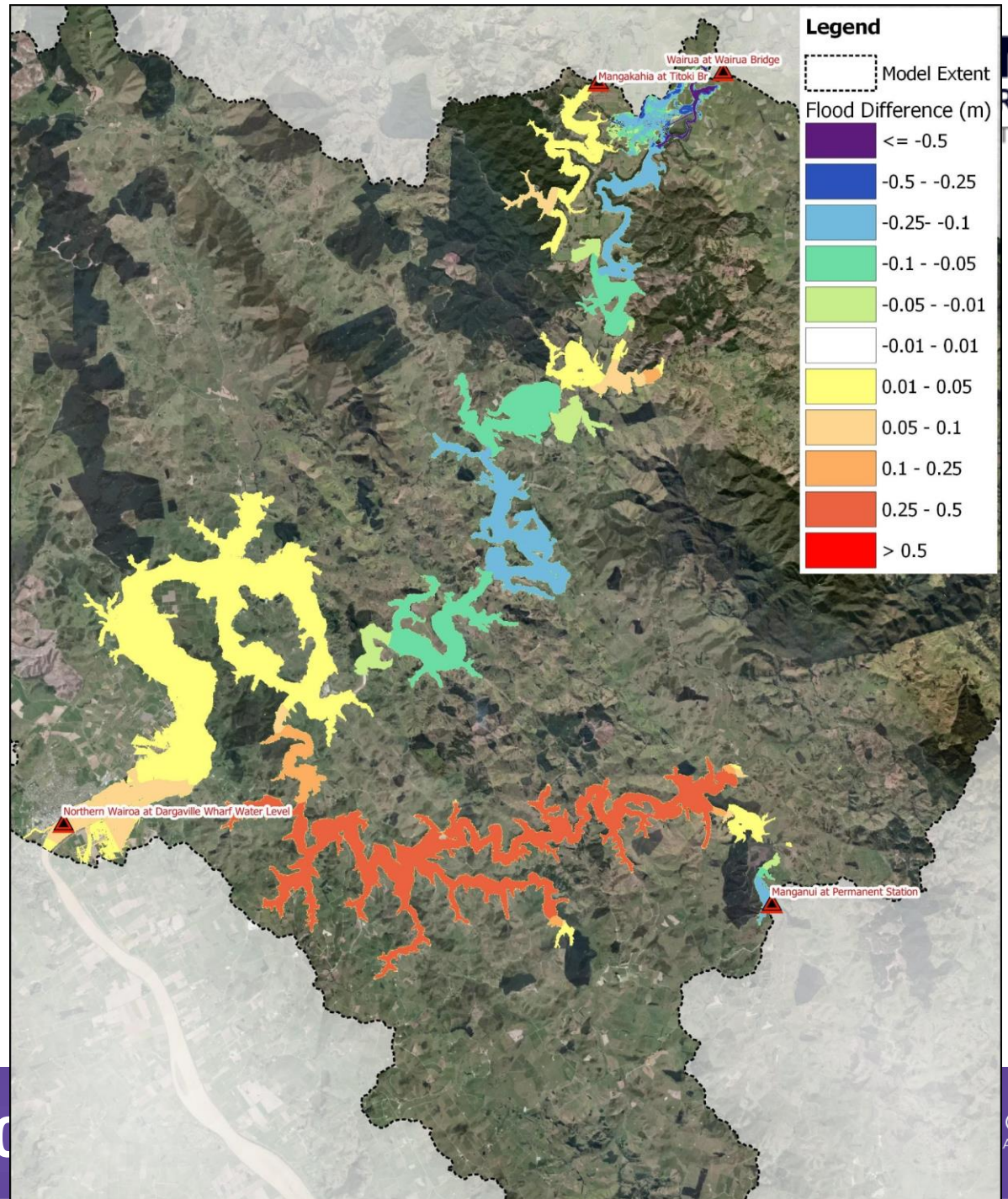


Challenge # 2
Wairoa River

Model assumes the storm occurs in M18 and the contributing models at the same time

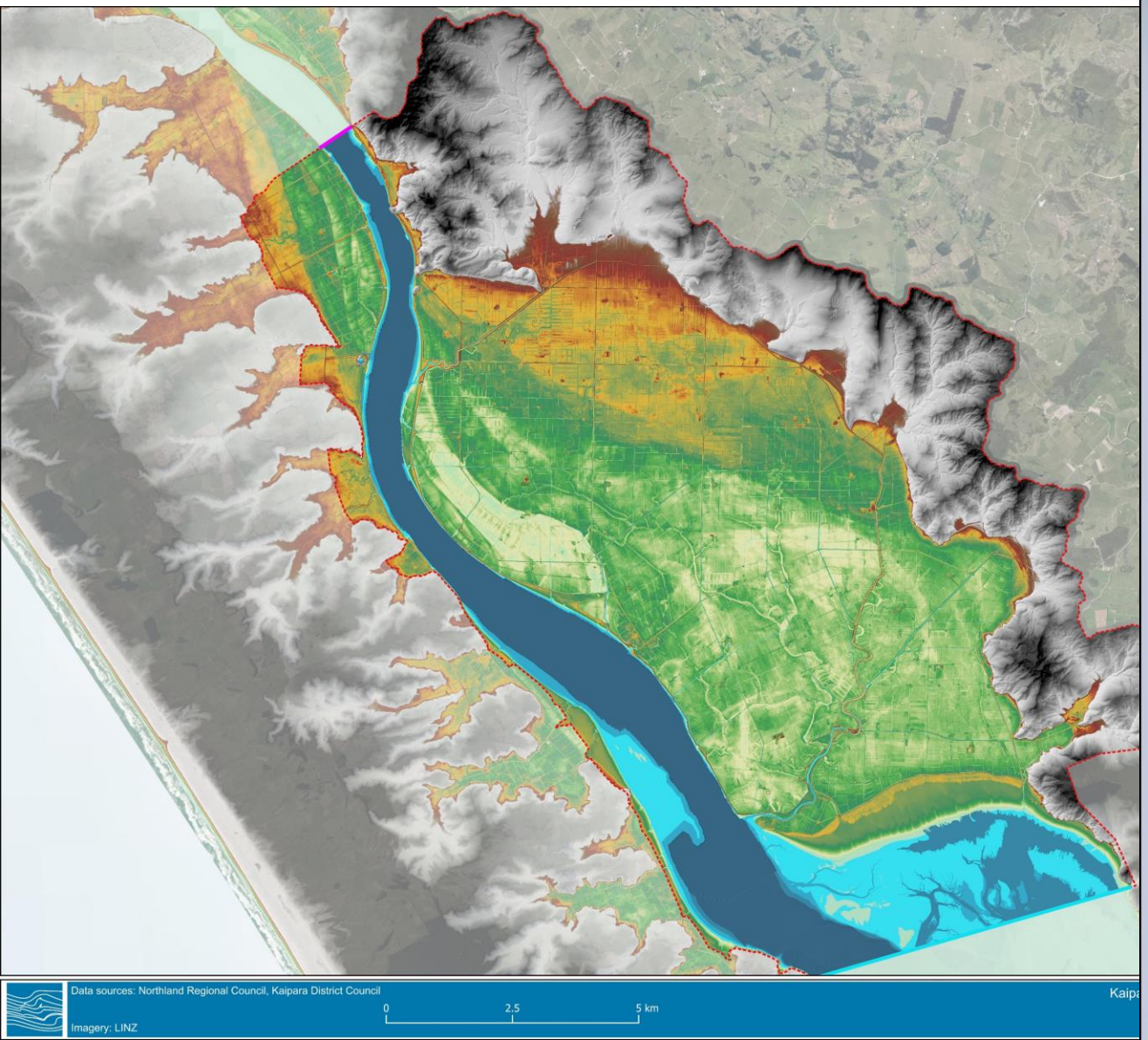


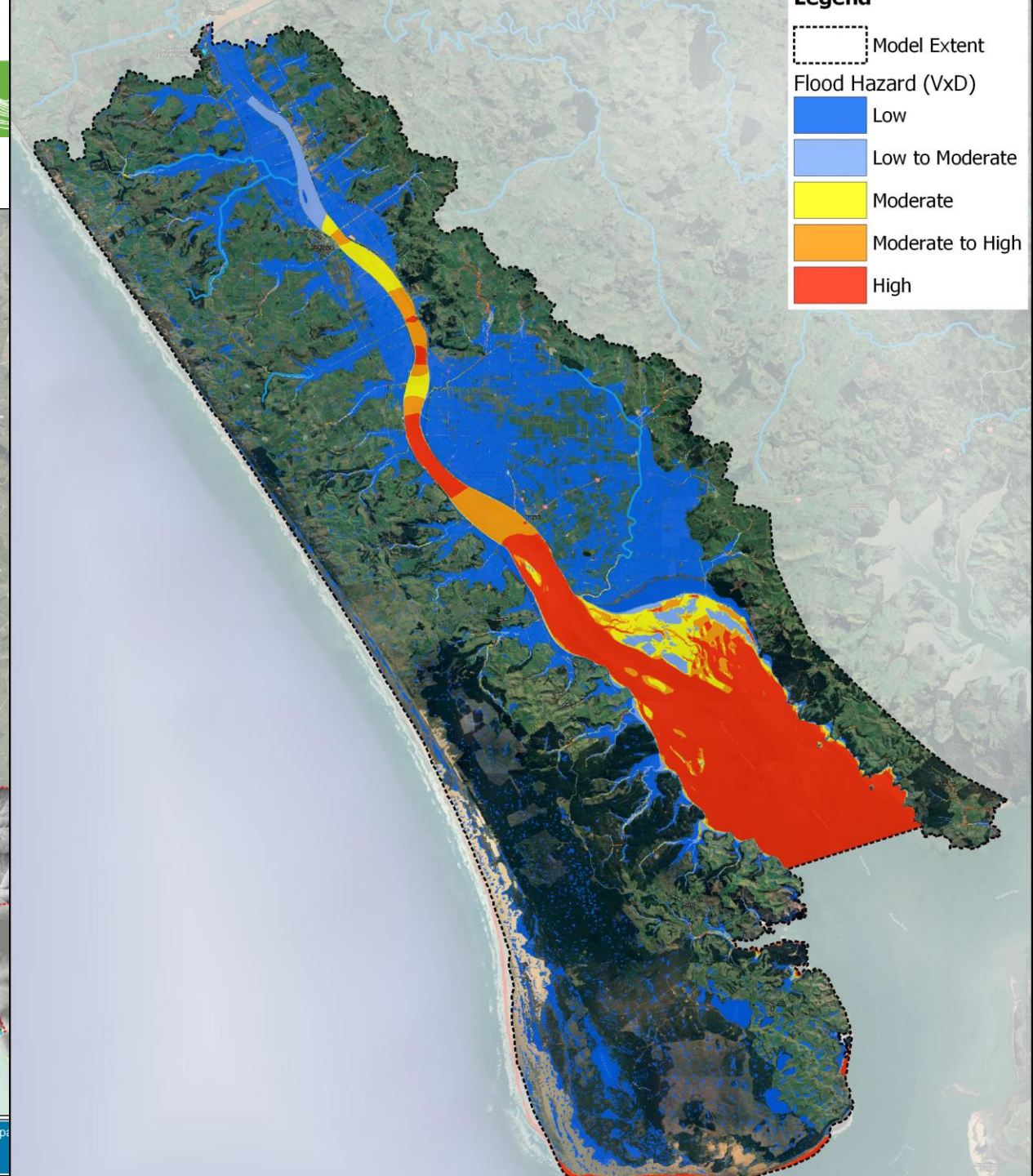
Challenge # 2
Wairoa River

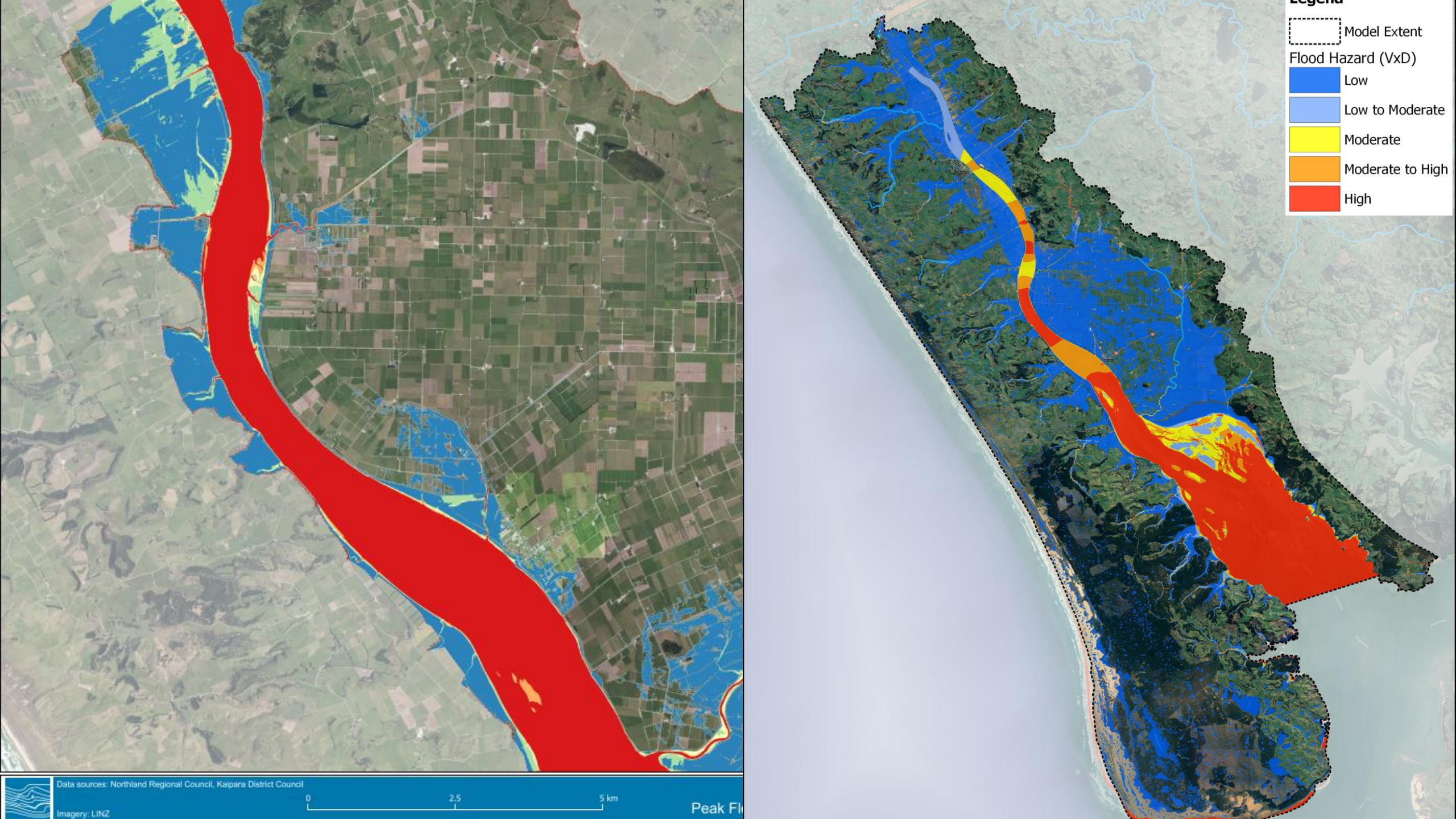


Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

How can it be refined?






Legend
Model Extent
Flood Hazard (VxD)
Low
Low to Moderate
Moderate
Moderate to High
High
Data sources: Northland Regional Council, Kaipara District Council
Imagery: LINZ
0
2.5
5 km
Peak Fl

Conclusions

- Like every model, the region-wide models have limitations
- Model compared well to recent events
- Significant limitations in urban catchments
- Good basis for model refinement

Modelling Group
WATER NEW ZEALAND

Modelling Symposium

Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

Thank you!
Questions? Patai?

Bertrand.salmi@watertechnology.co.nz
josephc@nrc.govt.nz

water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa