ACCOUNTING FOR FUTURE DEVELOPMENTS IN LARGE SCALE 2D MODELLING – A DIFFERENT APPROACH

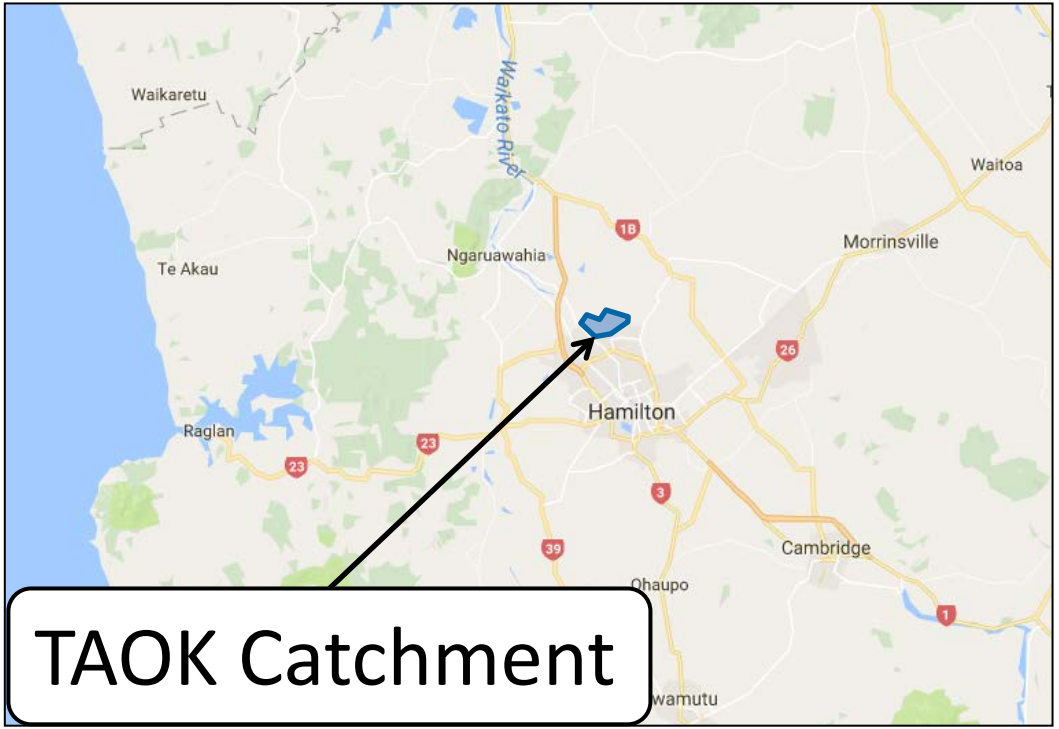
AECOM

Hamilton City Council
Te kaunihera o Kirikiriroa

Introduction

- Te Awa O Katapaki (TAOK) is a developing catchment in the north of Hamilton City.

- A 2D flood model of the catchment was built by AECOM for Hamilton City Council in 2013.



Model Purpose

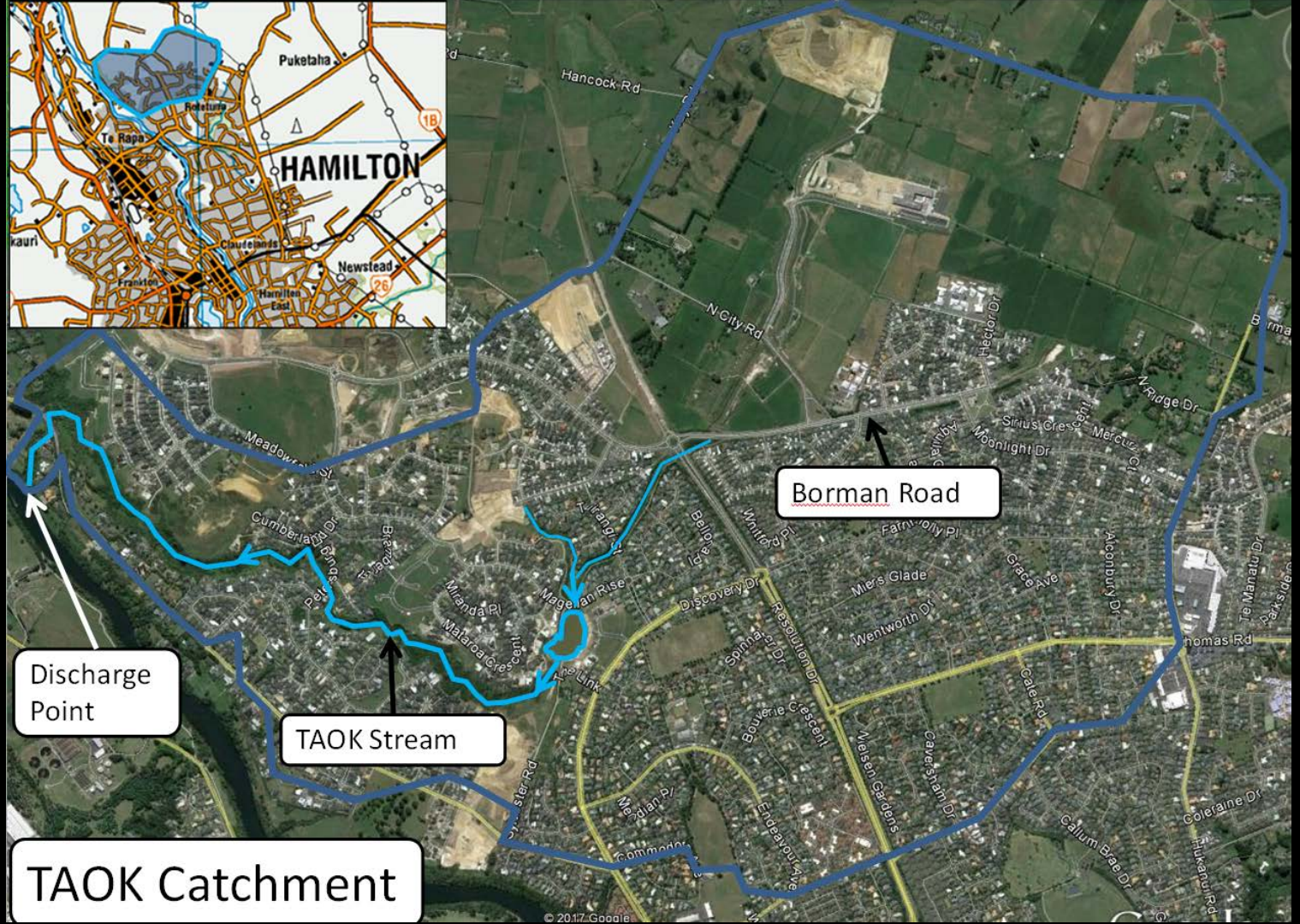
1. To identify existing flood hazards.
2. To identify flood hazards that may result from development.
3. To inform options to mitigate flood hazards.

Model Build

- The flood model used a 2m grid generated from LiDAR, coupled with a 1D pipe network.

- Three development scenarios were run:
  - Existing development (ED)
  - Existing development plus climate change (ED+CC)
  - Maximum probable development plus climate change (MPD+CC)

- The 1% AEP 24hr nested rain event was used for flood assessment.


Puketaha
Rotokauri
Te Rapa
HAMILTON
Claudelands
Frankton
Hamilton East
Newstead
Hancock Rd
N City Rd
Borman Road
Discharge Point
TAOK Stream
TAOK Catchment
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Modelling Changes to Landform

- LiDAR from 2008 was used to build the model.
- The ED model had a 2013 baseline.
- LiDAR was therefore changed to represent most developments which occurred between 2008 and 2013 for the ED model.
- For the MPD model, LiDAR was modified to reflect all future development where designs could be obtained from developers.

Initial Flood Map

Model Issues

- Surfaces supplied by developers did not integrate well with LiDAR. This created unrealistic storage and disconnected some overland flow paths.
- Due to these limitations, the model could not be used to assess whether flooding of property would increase as a result of development in all areas.
- In addition, no allowance in the modelling method was made for the effects of attenuation devices (a known limitation with the original model brief).

Options

To resolve these issues the following options were considered:

1. Fix the grid layer to accurately represent future development.
2. Use a “lumped hydrology” method in HEC-HMS to represent outflows from the developing area.

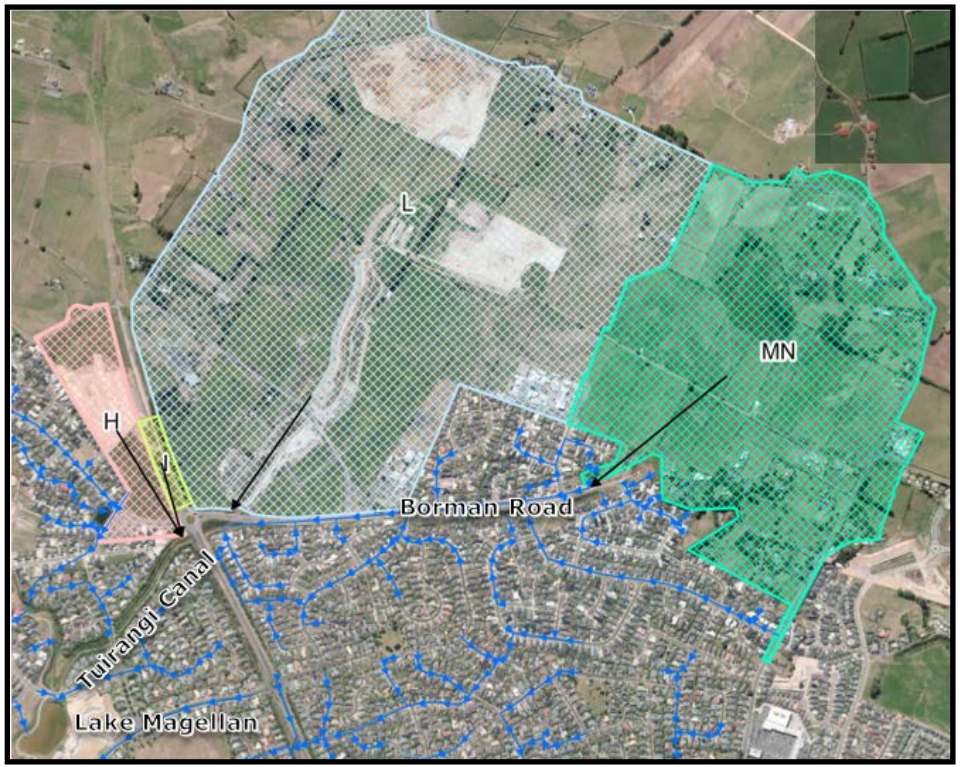
Lumped Hydrology Method

The “lumped hydrology” method was selected as:

- Modelling of the developing area was already underway for a separate project in HEC-HMS.
- It required far less time than modifying the 2D grid layer.
- The effects of attenuation could be accounted for.

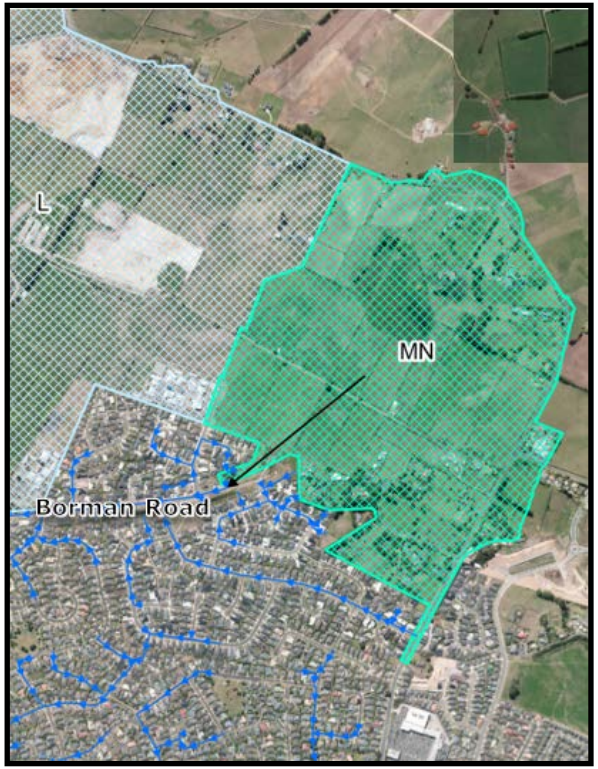
HEC-HMS Modelling

- HEC-HMS was used to model catchments H, I, L and MN.
- Outflow hydrographs from the HEC-HMS model were then plugged into the 2D model downstream of each catchment.

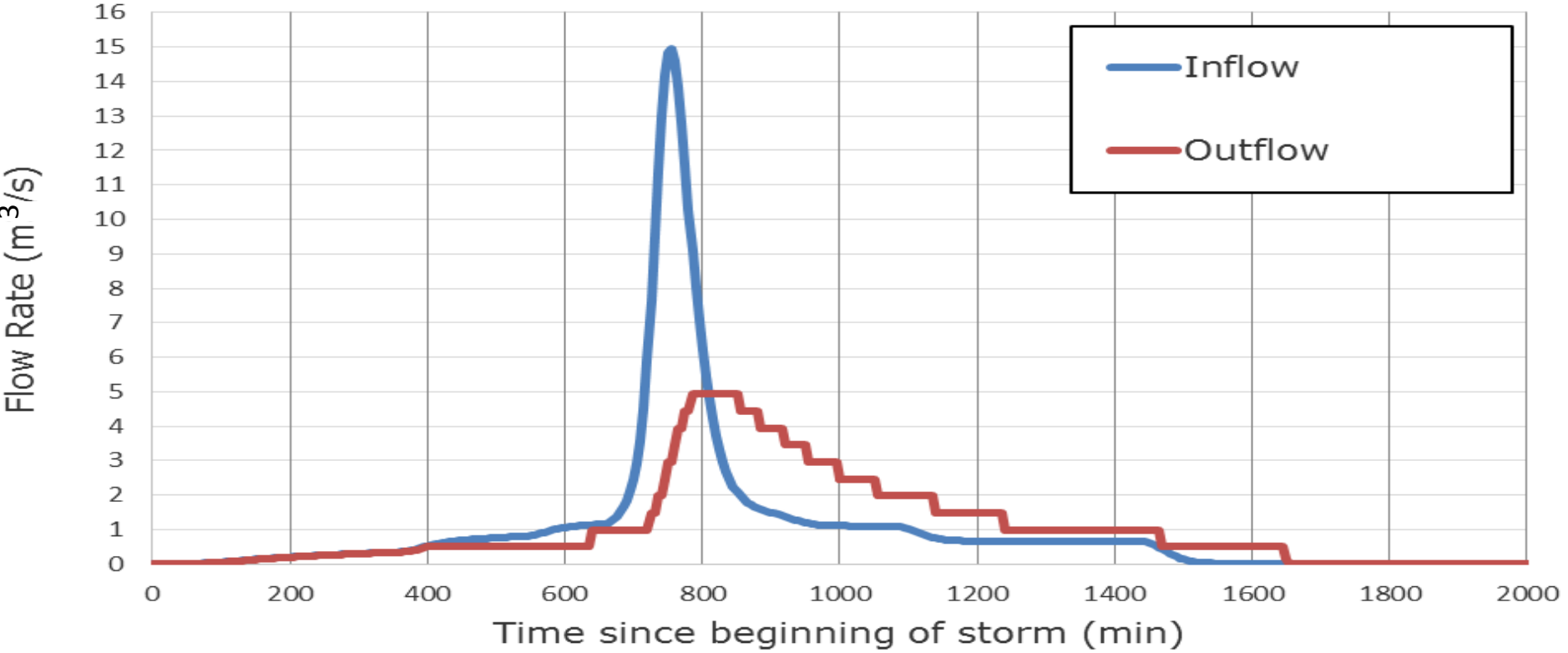


HEC-HMS Results For Catchment MN

- Initial results suggested flooding was likely downstream of sub-catchment MN.
- Attenuation of the 1% AEP event for sub-catchment MN was therefore simulated in excel, producing a modified hydrograph.
- Both raw and attenuated hydrographs were used as inputs to the 2D model to assess the possible effect of attenuation.



Sub-catchment MN Attenuated Hydrograph



Results

- Flood depth maps of the ED, MPD CC and MPD CC attenuated storm events were produced.
- These maps show flooding downstream of developing areas but not within developing areas.
- Developers will carry out their own stormwater assessments at a subdivision level.


Existing Development
Sub-catchment MN
Maximum Probable Development With Climate Change
Sub-catchment MN
Maximum Probable Development With Climate Change and Attenuation
Sub-catchment MN

Conclusion

- It is important to determine the effects of development on downstream flooding.
- Where landform will substantially change, using lumped hydrology is a quick, flexible way to simulate runoff from these catchments.
- This method also allows for the simulation of attenuation.

So What?

- As a result of using this method in the TAOK catchment, Council was able to provide a strong justification for requiring attenuation of the 1% AEP storm event in sub-catchment MN.
- The original model did not provide sufficient justification to make this decision.
- Stormwater devices in this sub-catchment are being designed to a 1% AEP level of service.