



## Urban Flood Mapping and Stormwater Management Planning: A Case Study in Napier

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### ABSTRACT

Napier City Council (NCC) engaged Stantec's Modelling Team to undertake a stormwater master planning (SWMP) to represent its hydrological and hydraulic systems, assess flooding damages, and recommend flood mitigation options. The SWMP informs Napier's 30-Year Infrastructure Strategy and other aspects of the Stormwater Activity Management Plan. The outputs from the study were used for the stormwater expenditure elements of the Long Term Plan (LTP). Subsequently, both the hydraulic model and activities identified within the SWMP have been used for assisting NCC's with growth assessments, structure plans and responding to requests generated by the Government's Infrastructure Acceleration Fund announced in March 2021.

Napier's stormwater infrastructure<sup>5</sup> comprises storm pipes, overland conveyance routes, detention ponds, open drainage channels, culverts, outfalls, flood gates and many rising mains and stormwater pumping stations. The model, built/developed by Stantec, is extremely large for an urban stormwater model, covering an area of over 5,000 ha, and includes 165km of pipe and 235km of open drainage channels. The SWMP was awarded in January 2020 with a draft delivery of just six months.

Stantec used DHI MIKE FLOOD to conduct a 2D integrated stormwater modeling exercise and create flood mapping for various return periods. The area is seismically active and experienced a devastating earthquake in 1931, meaning much of the infrastructure now located at or below mean sea level, creating significant challenges in managing stormwater during large inundation events. Development of the SWMP flood mitigation measures accounted for anticipated climate change and sea level rise impacts on a 100-year timescale. Mitigation measures to address future development intensification and new residential communities were also investigated and climate change adaptation strategies, such as retreating from areas where land is expected to be permanently inundated below sea level, were also explored. Ultimately, green infrastructure and volume retention measures were recommended to complement traditional grey infrastructure in the flooding mitigation strategy. The total stormwater system improvements

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<sup>5</sup> Modelled values in brackets



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(capital expenditure) recommended over the initial mitigation horizon of 30 years is projected to be approximately NZ\$401.8M<sup>6</sup>.

Two months following submission of the model and SWMP, Napier was struck by an intense rainfall event which saw 420% of the average monthly precipitation fall in just 24 hours, exceeding a 250-year return period on some durations. The observed flooding locations provided valuable new data for the model validation. Although the event largely confirmed the model-predicted locations, it did identify areas for model improvement, such as additional survey and incorporating newer LiDAR datasets. Ultimately though, the event reinforced that the primary activities within the master plan are required to as part of Napier's long-term stormwater management strategy.

The scale, intricate nature of the stormwater system, and timescales presented significant challenges to overcome. Furthermore, the scope of works was an evolving document, and key decisions were made during the project, such as establishing levels of service, mechanism for solution prioritisation, and recommendations for future planning rules. This presentation will give an overview of the project and focus on the key modelling complexities and how they were overcome.

## Keywords

Modelling for an uncertain future, modelling to support outcomes, climate change and extreme events:

#stormwater, #modelling, #master planning, #urban planning, #DHI Mike Food, #flooding, #long-term plan, #strategy, #stormwater infrastructure

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<sup>6</sup> In 2020 NZD



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1. Abstract Guidelines
  - Abstracts submitted must be between 300 – 500 words, excluding title and authors.
  - Abstracts must use the template above
  - Font used should be Times New Roman or Arial size 11.
  
2. Call for Abstracts closes 4pm, Tuesday 31<sup>st</sup> January 2023 and submitted to [Katrina Guy](#)
  
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  - Wider applicability
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  - Relevance to the current state of the industry
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  - If accepted into the programme, you will only have to submit a presentation. No paper is required.
  - Final presentation will be due by **28<sup>th</sup> February 2023**
  
5. Presentation
  - Powerpoint 16:9
  - Slide Pack will be attached shortly