PP2Ō Post Hydraulic Report

29 October 2018

T&T-DE-RPT-0017 AND 0005

Plain English Summary

Background:

The PP2Ō Expressway introduces a new corridor of infrastructure between the eastern Tararua Ranges and Kāpiti coastal plains to the west. Water in the district primarily flows from east to west (i.e. from the ranges to the coast).

Current infrastructure in the form of railway tracks, local roads and SH1 cause floodwater to back up east of their alignments and create localised surface flooding in large events. These current barriers are mitigated to allow flow and passage of flood water via a series of culverts and drains.

Design and construction of the PP2Ō Expressway is guided and regulated by a series of consent conditions that were set out by the Board of Inquiry (BOI) process in 2013. This process commissioned hydraulic reports covering the following:

- Modelled the pre-project situation that in a nutshell captured 'what the flood water situation in this area is like now'.
- Modelled the post-project situation based on the BOI design. This model is effectively a re-run of the pre-project situation with the new expressway in place, and captures 'what the flood water situation in this area would look like after the project'.

From these reports, objectives and conditions for final design of the expressway were set out by the BOI. These conditions require the project to meet 'neutrality' through its design.

The models that were considered by the BOI were for the:

- Ōtaki River and Mangapouri Stream,
- Waitohu Stream; and
- Mangaone Stream.

With final design of the PP2Ō Expressway now complete, a post-project Hydraulic Report has been produced and models updated to reflect the final design.

This post-project modelling report tests the final design to make sure neutrality objectives set by the BOI have been met.

Methodology for Post-Project modelling

In broad terms three models have been run:

- BOI in 2013 – taking into account predictions for a 1 in 100 year event with climate change to 2090 (specimen or consenting design)
- BOI in 2013 – updated and taking into account predictions for a 1 in 100 year event with climate change to 2130 (specimen or consenting design)
- Fletcher Construction Company (FCC) 2018 – post-project report taking into account predictions for a 1 in 100 year event with climate change to 2130 (FCC design).

International modelling for the Intergovernmental Panel on Climate Change (IPCC - www.ipcc.ch) is customised for New Zealand conditions by NIWA (www.niwa.co.nz) and this forms the basis of the science used to allow for climate change in the project flood modelling. It is widely recognised as best practice by local and central government.

The FCC 2018 models have been run for the same locations identified in the BOI reports and models:

- Ōtaki River and Mangapouri Stream,
- Waitohu Stream; and
- Mangaone Stream.

What does a 1 in 100YR event, subject to climate change prediction, look like?

- A typical day on the Ōtaki River sees peak flow running at around 30 m^3/s (cubic meters per second)
- A 1 in 2 year event sees it rise to around 900m^3/s
- A 1 in 10 year event sees it rise round 1230 m^3/s (similar in magnitude to the large local flood event in 2015)
- A 1 in 100 year event with climate change sees a large increase to 2140 m^3/s.

Historically, there is an event on record in 1955 that comes close to a 1 in 100 year event with peak flow recorded at 2320m^3/s and the next biggest occurred in 2005 when flow hit 1550m^3/s.

Results

Key themes in the final design of the PP2Ō Expressway include a series of bridges and very large culverts to ensure we meet the BOI neutrality objectives. These help to avoid increasing existing flow and velocity levels in very large flood events.

Overall, the post-project model results are showing the final design has achieved neutrality with the BOI objectives or an improvement (i.e. reduced flood levels) in most areas and a slight increase in other localised areas. In effect, some areas downstream that currently flood in large events will no longer flood, and a number of areas already under water in very large events will now be under a little more water.

Simply described, the report shows that in a very large event (1 in 100 years taking into account climate change predictions) areas already prone to flooding will continue to flood.

The following plans provide a snap shot of the situation post-project in a 1 in 100 year event with climate change for:

- Ōtaki River and Mangapouri Stream,
- Waitohu Stream; and
- Mangaone Stream.

Yellow showing no change and that neutrality with the BOI objectives has been achieved.

Green showing areas where an improvement (i.e. reduced flood levels) to the current situation can be expected.

Red showing where an increase of more than 100mm in a 1 in 100 year event plus climate change can be expected (note, under the current district hazard plans these areas would appear as yellow and already subject to flooding).

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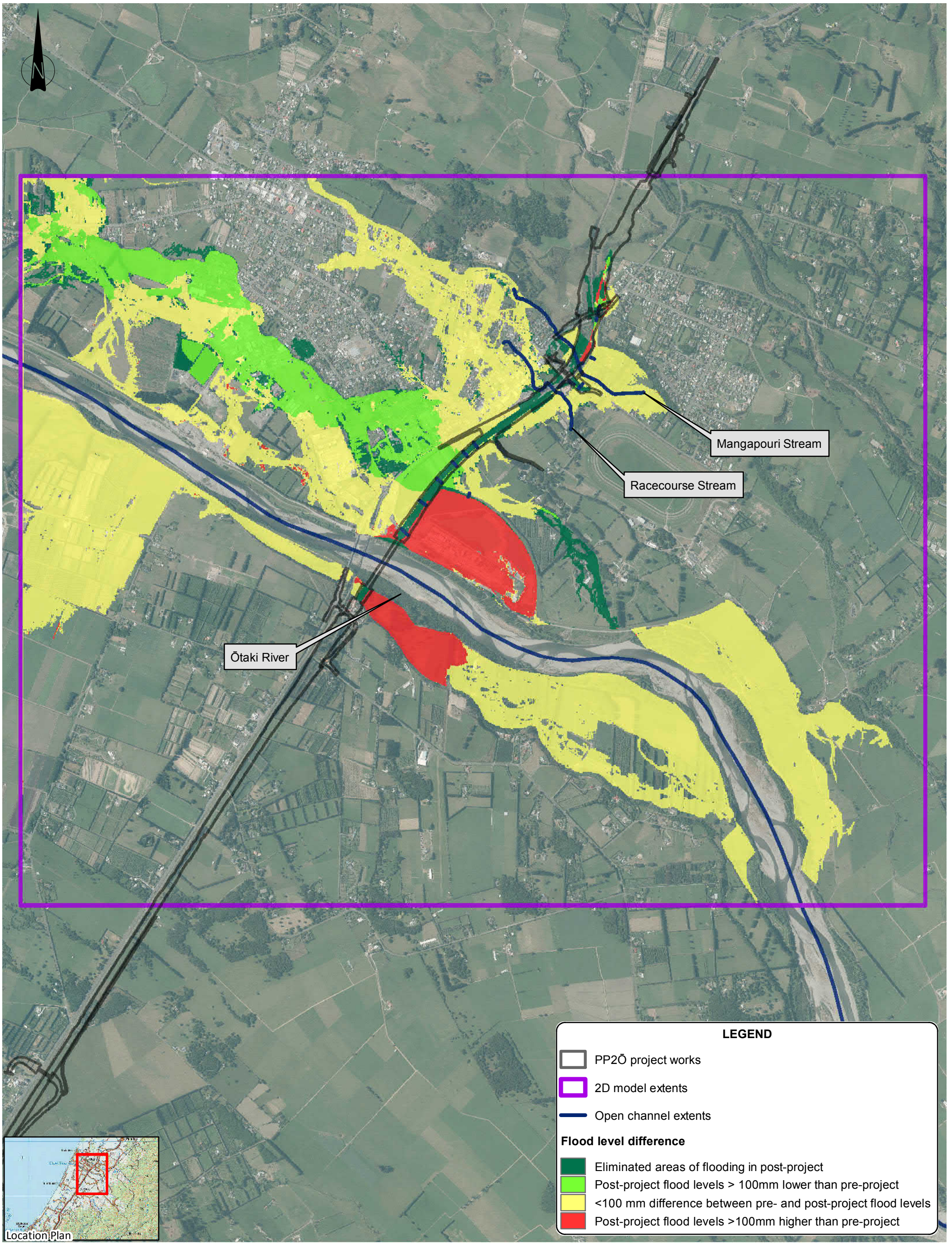

Notes:
- Aerial photograph sourced from Greater Wellington Regional Council and licensed for re-use under the Creative Commons Attribution 3.0 New Zealand licence.
- All levels are New Zealand Vertical Datum 2009.
- The flood modelling presented in this figure has been completed for the purposes of the Detailed Design and Construction Phase of PP2Ō "the Project", and may not be suitable for other uses. Model results may not be accurate outside the area of interest for the Project.

A3 SCALE 1:20,000

0 200 400 600 800 1,000 Meters

NZ TRANSPORT AGENCY WAKA KOTAHI

Peka Peka to Ōtaki Expressway

DRAWN	KBBB	May.18
CHECKED	DMK	May.18
APPROVED	TSRF	May.18
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SCALE (AT A3 SIZE)	1:20,000	
PROJECT No.	85985.0070	

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PEKA PEKA TO ŌTAKI EXPRESSWAY

Ōtaki-Mangapouri Model Results Comparison

Post-Project minus Pre-Project Water Levels - 1% AEP CC2130

FIGURE No. Figure 61.1

Rev. 0

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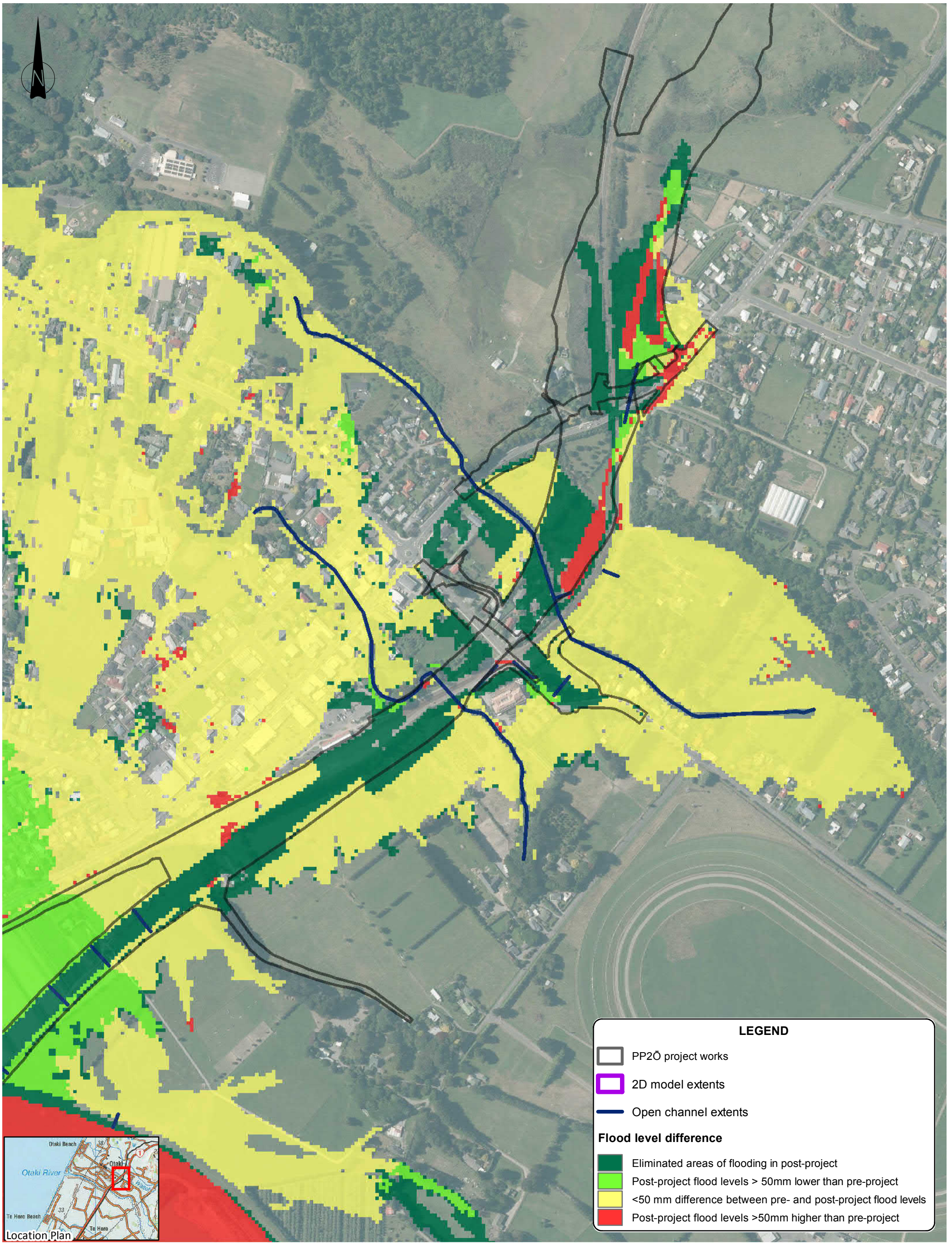

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A3 SCALE 1:5,000

0 40 80 120 160 200 Meters

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Peka Peka to Ōtaki Expressway

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APPROVED	TSRF	May.18
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PROJECT No.	85985.0070	

NZ TRANSPORT AGENCY

PEKA PEKA TO ŌTAKI EXPRESSWAY

Ōtaki-Mangapouri Model Results Comparison

Post-Project minus Pre-Project Water Levels - 1% AEP CC2130

FIGURE No. Figure 61.2

Rev. 0

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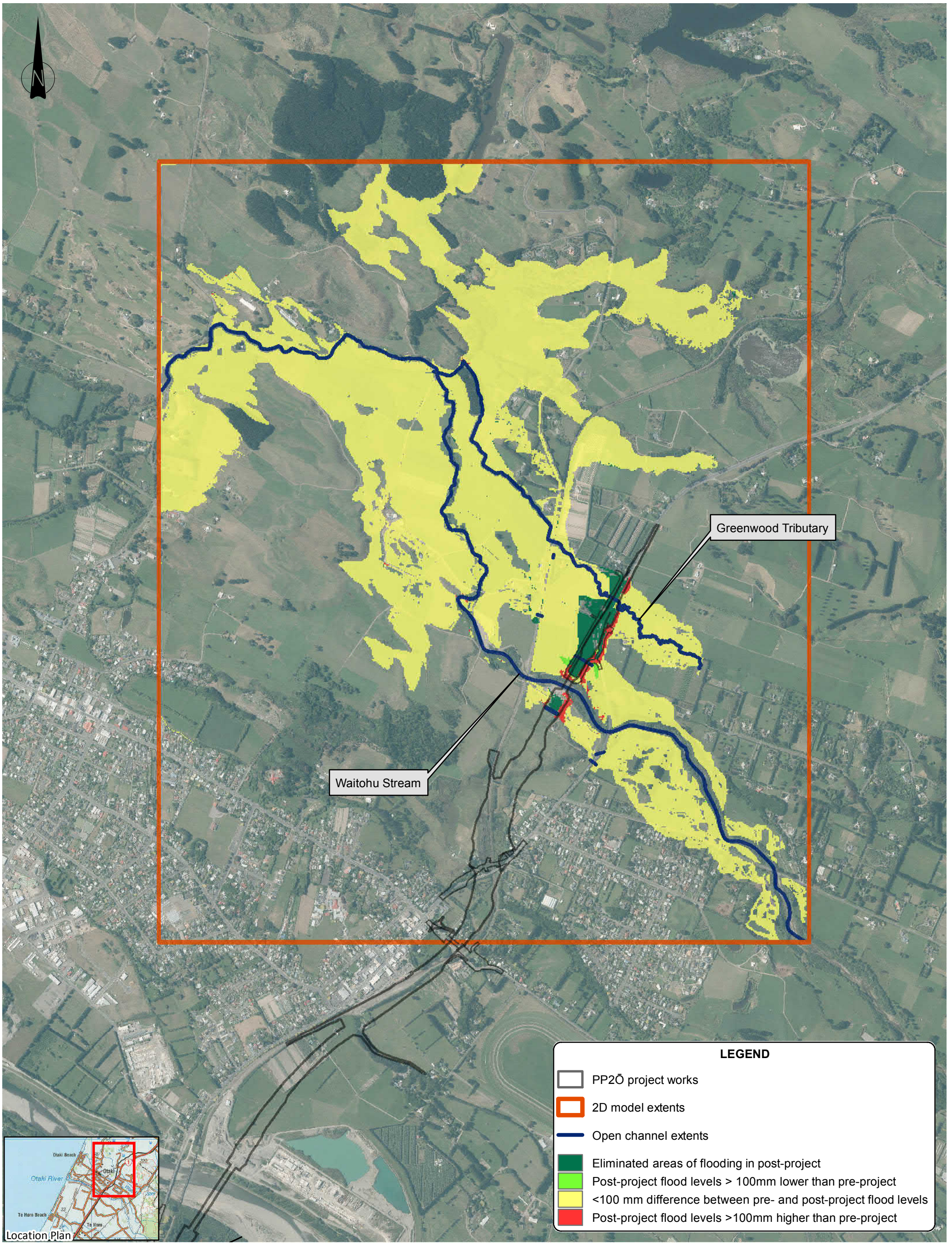

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A3 SCALE 1:15,000

0 0.2 0.4 0.6 0.8 1 (km)

NZ TRANSPORT AGENCY WAKA KOTAHI

Peka Peka to Ōtaki Expressway

DRAWN	KBBB	May.18
CHECKED	DMK	May.18
APPROVED	TSRF	May.18

ARCFILE Fig73_1_Wai_DiffPlotPostvsPre100mm_100yrCC.mxd

SCALE (AT A3 SIZE) 1:15,000

PROJECT No. 85985.0070

NZ TRANSPORT AGENCY

PEKA PEKA TO ŌTAKI EXPRESSWAY

Waitohu Model Results Comparison

Post-Project minus Pre-Project Water Levels - 1% AEP CC2130

FIGURE No. Figure 73.1

Rev. 0

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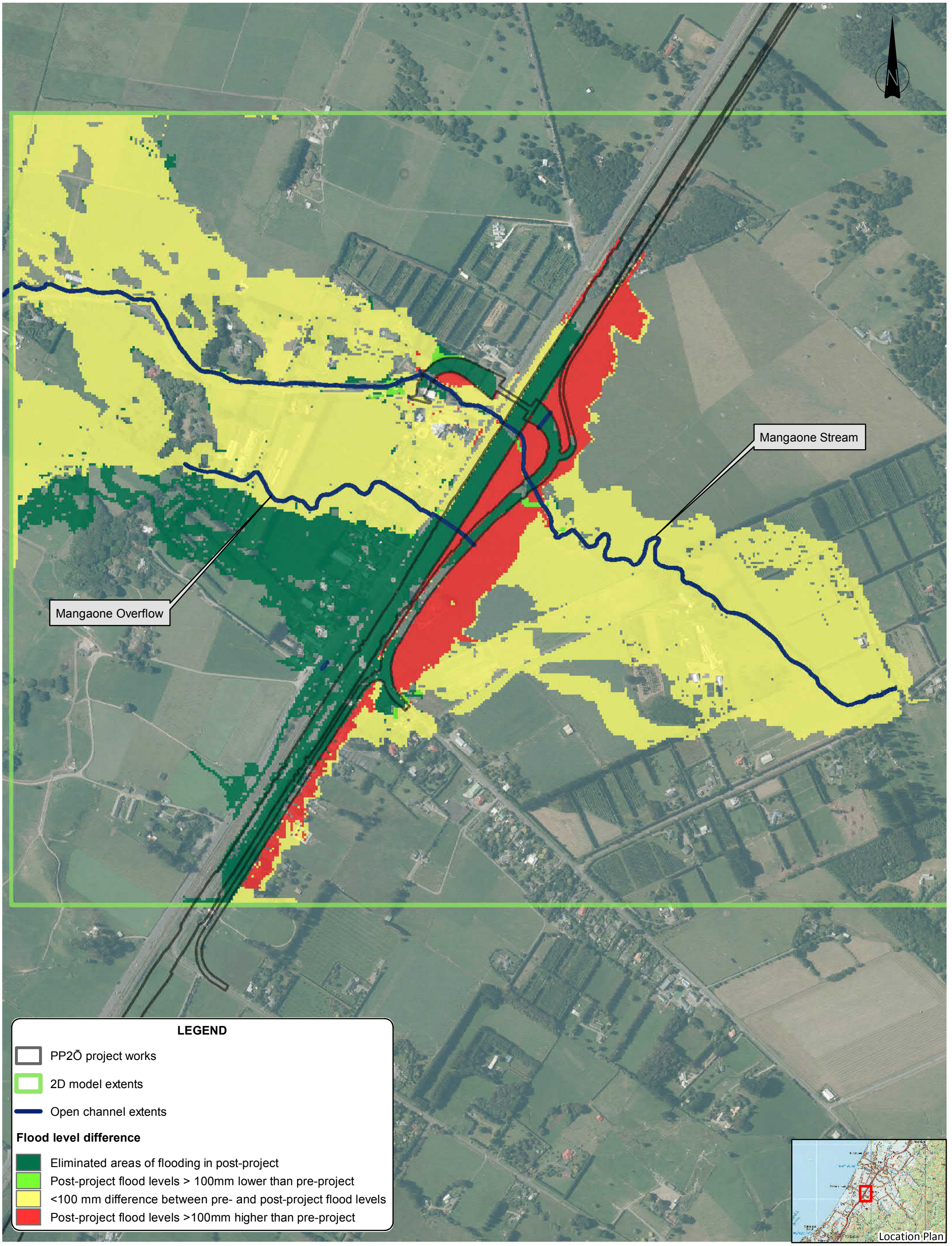

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A3 SCALE 1:7,500

0 100 200 300 400 500 Meters

NZ TRANSPORT AGENCY WAKA KOTAHI

Peka Peka to Ōtaki Expressway

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APPROVED	TSRF	May.18
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SCALE (AT A3 SIZE)	1:7,500	
PROJECT No.	85985.0070	

NZ TRANSPORT AGENCY

PEKA PEKA TO ŌTAKI EXPRESSWAY

Mangaone Model Results Comparison

Post-Project minus Pre-Project Water Levels - 1% AEP CC2130

FIGURE No. Figure 77.1

Rev. 0