Thames tsunami hazards

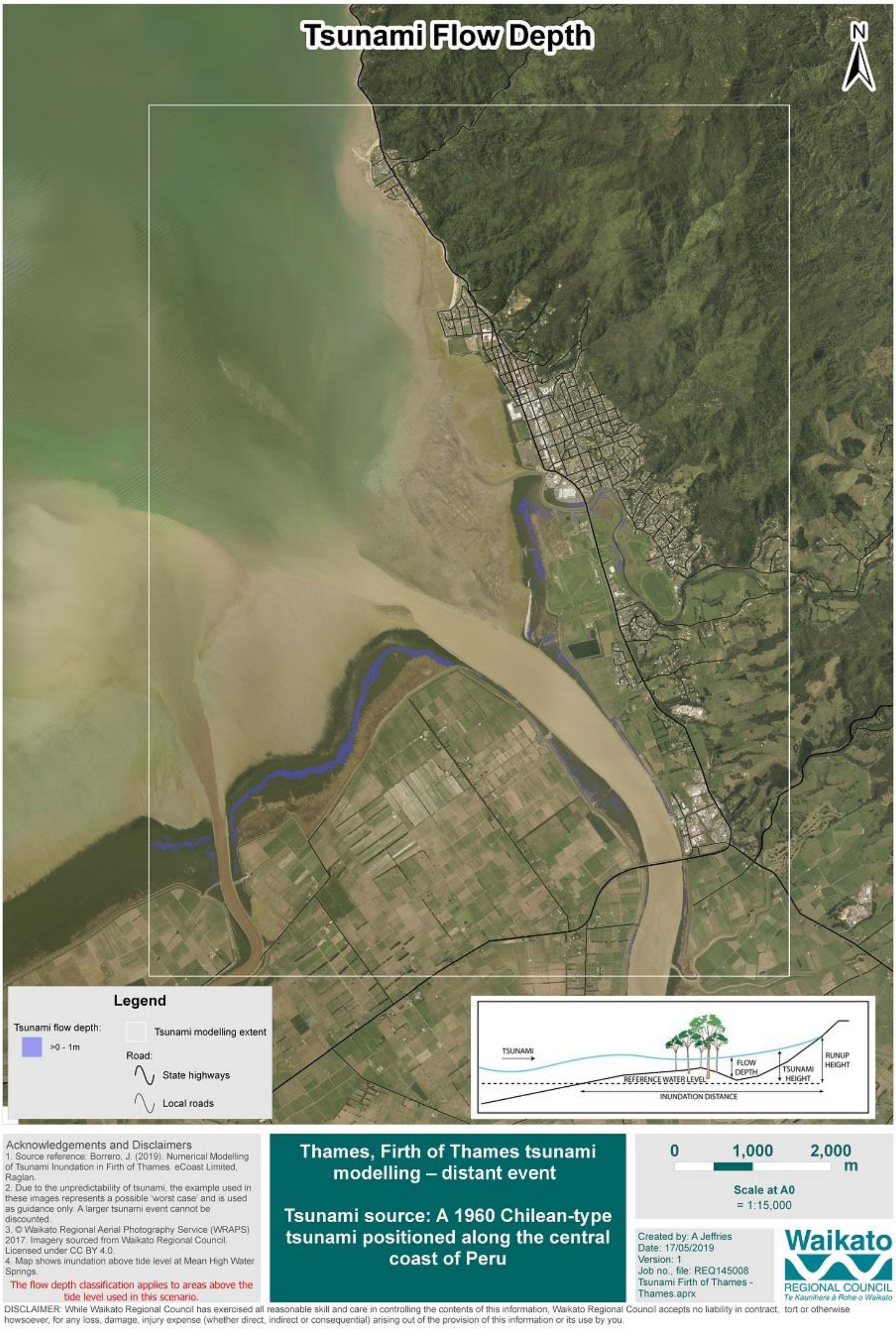

Table of Contents

Purpose

To summarise tsunami hazards information for the Thames community:

- Where do tsunami come from?
- How long do tsunami waves take to arrive in Thames from the various sources?
- What impacts do tsunami have on the community?

Source reference

This summary draws on information contained within the following technical report:

Borrero, J.C. (2018). *Numerical Modelling of Tsunami Inundation in the Firth of Thames*. eCoast Limited, Raglan.

The full report is available here:
http://www.waikatoregion.govt.nz/tsunamistrategy

What is a tsunami?

A tsunami is a series of water waves most commonly caused by seafloor earthquakes. Tsunami waves are different to wind-generated waves in that they are a transfer of energy, and usually travel a lot further inland than wind-generated waves.

Where do tsunamis come from?

Tsunamis caused by seafloor earthquakes occur most commonly around tectonic plate boundaries, particularly around the Pacific 'Ring of Fire'. Tsunamis can also occur along undersea fault lines that lie just offshore, whether associated with a plate boundary or not.

Thames has three primary sources of tsunami:

- 'Local source' from the Kerepehi Fault
- 'Regional source' from the Tonga-Kermadec Trench just off East Cape
- 'Distant source', most commonly from large earthquakes in South America.

An overview of the tsunami sources, wave arrival times and potential inundation in Thames is provided in the following pages.

Further information

Further general information about tsunami hazards is available at:
http://www.waikatoregion.govt.nz/tsunami

THAMES COROMANDEL DISTRICT COUNCIL

Work to identify tsunami hazards on the Coromandel Peninsula west coast and Firth of Thames is a joint initiative between Thames Coromandel District Council and Waikato Regional Council.

Waikato REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

Local source tsunami from the Kerepehi Fault

The Kerepehi Fault

A large earthquake along the offshore portion of the Kerepehi Fault is thought to be capable of generating a tsunami. The size of tsunami waves and their arrival time at Thames depends largely upon the size and position of the earthquake event.

Figure 1 shows the five fault segments considered in the technical report. Of the five faults considered, a magnitude (Mw) 7.1 earthquake rupturing along 16km of segment 'D2' has the largest potential impact on the Thames community. This scenario is considered the 'maximum credible event' for Thames from the Kerepehi Fault.

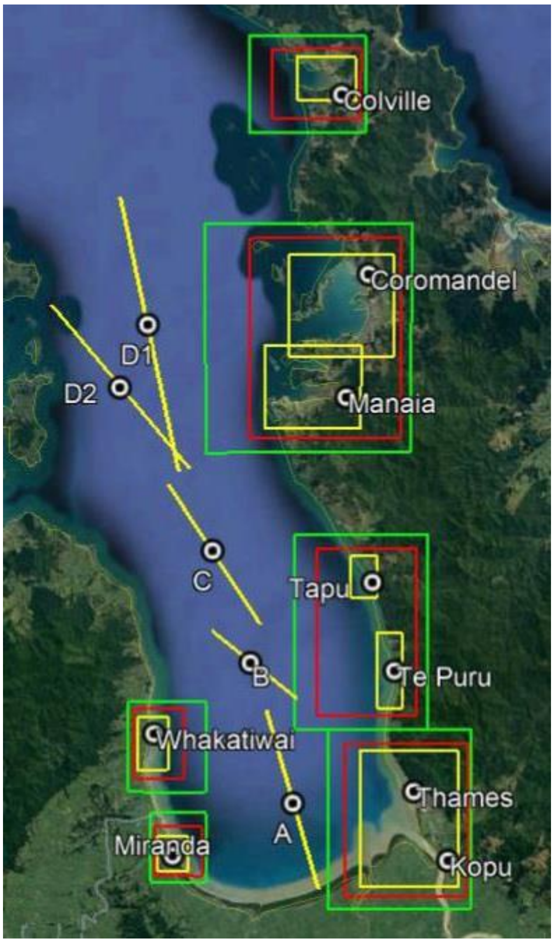

Figure 1: The five Kerepehi Fault segments considered within the technical report

How long does it take for local source waves to arrive at Thames?

Assuming a maximum credible earthquake along segment 'D2', Figure 2 shows that:

- Water levels drop slowly before rising quickly about 50 minutes following the earthquake, and reach a peak of around 0.65m above the existing water level around 90 minutes following the earthquake
- The third wave is the largest, and water levels drop quickly after the third wave, then continue to rise and fall rapidly for at least six hours due to on-going wave arrivals.

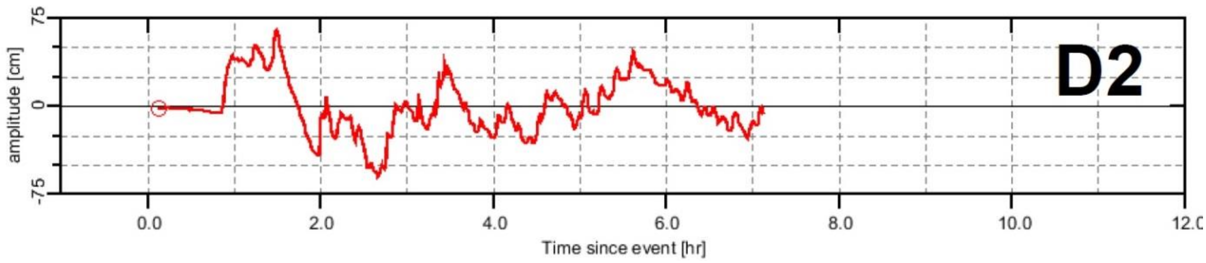

Figure 2: Wave arrival times and inundation levels from segment 'D2'

Inundation maps: impact of local source tsunami waves on Thames

Figures 3, 4, 5, 6 and 7 (overleaf) show the potential inundation from a maximum credible earthquake on segment 'D2' of the Kerepehi Fault. It is important to note that the maps:

- Assume wave arrival at Mean High Water Springs (the highest level that spring tides reach on average over a period of time)
- Only show inundation of land areas that are normally above sea level.

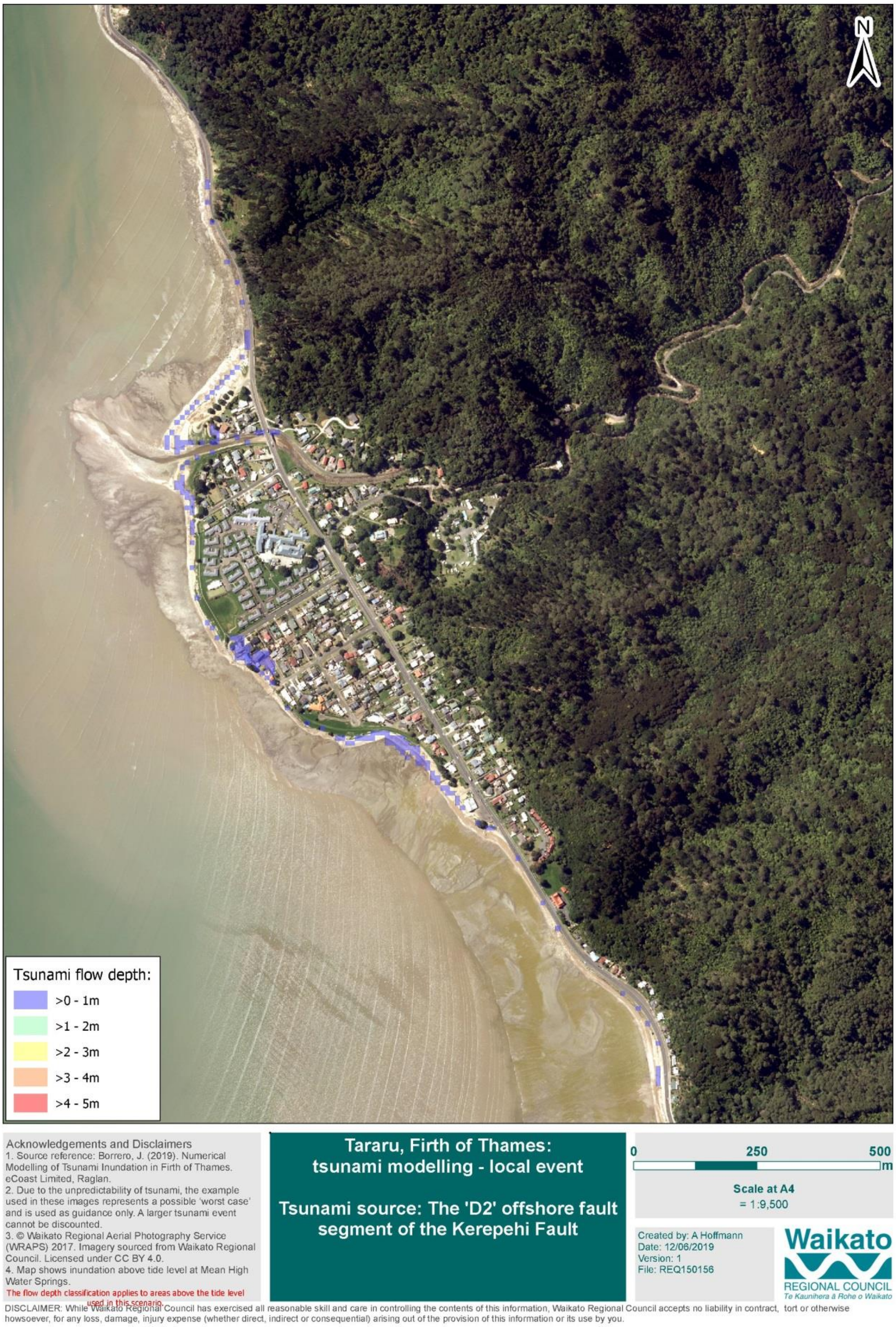

Figure 3: Tararu

Kerepehi Fault potential inundation from a maximum credible earthquake on segment 'D2'

Figure 4: Thames North

Kerepehi Fault potential inundation from a maximum credible earthquake on segment 'D2'

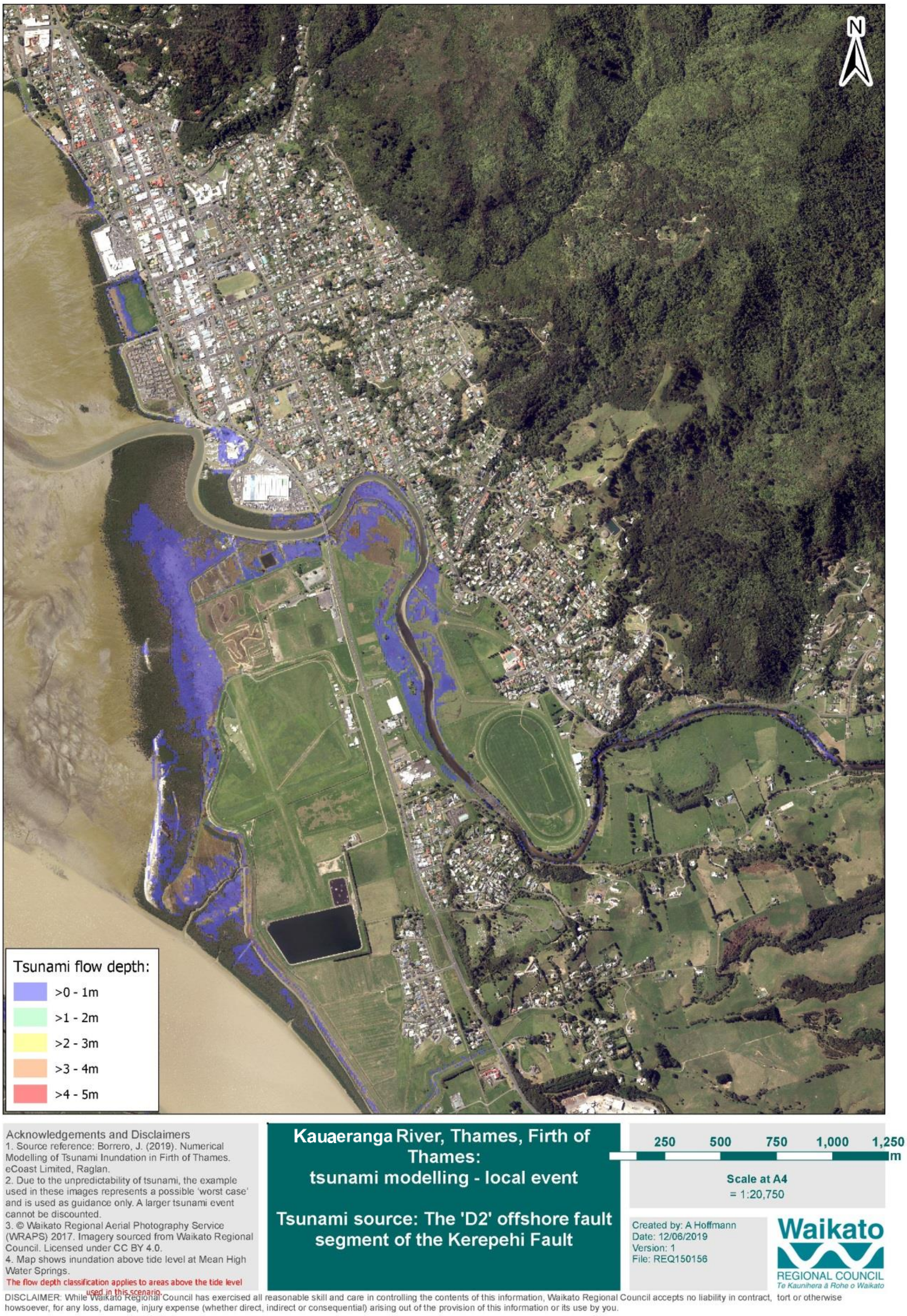

Figure 5: Kauaeranga River

Kerepehi Fault potential inundation from a maximum credible earthquake on segment 'D2'

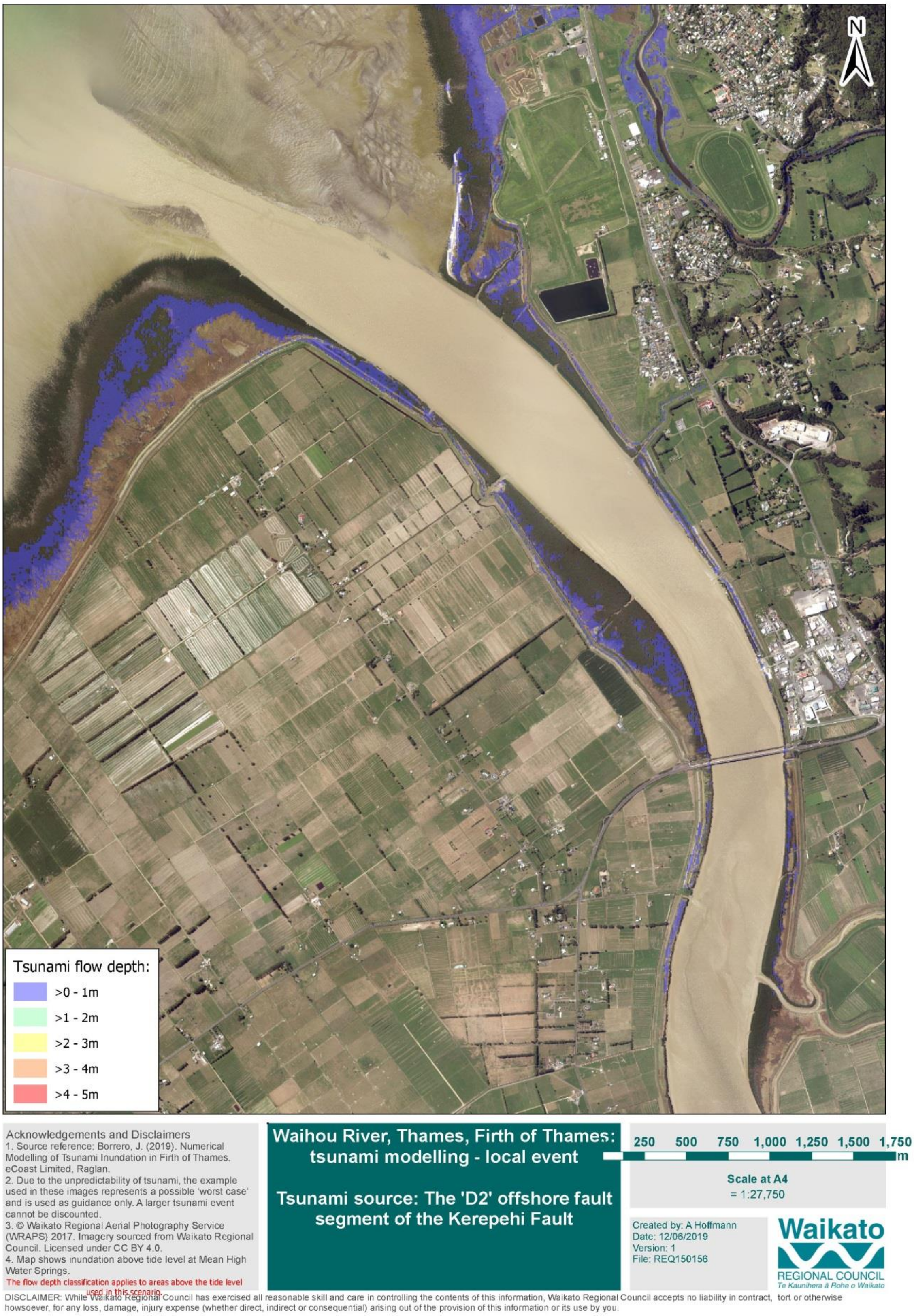

Figure 6: Waihou River
Kerepehi Fault potential inundation from a maximum credible earthquake on segment 'D2'

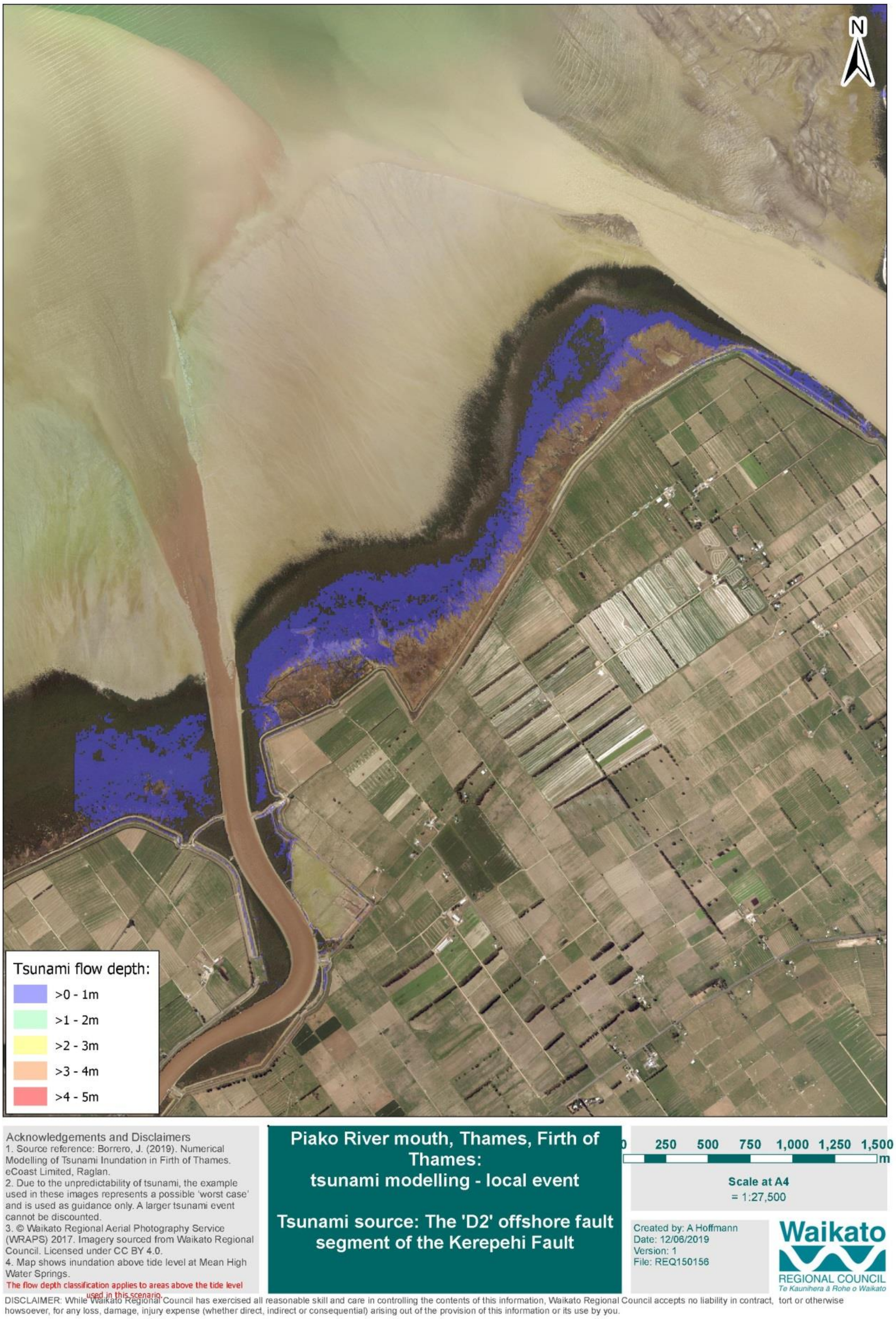

Figure 7: Piako River mouth

Kerepehi Fault potential inundation from a maximum credible earthquake on segment 'D2'

Regional source tsunami from the Tonga-Kermadec Trench

The Tonga-Kermadec Trench

The Tonga-Kermadec Trench is a subduction zone at a convergent tectonic plate boundary, where the Pacific Plate is being subducted underneath the Australian Plate. A large earthquake along the Tonga-Kermadec Trench to the north-east of New Zealand represents the most significant near-source tsunami threat for the Eastern Coromandel Peninsula, but will also affect the Firth of Thames, including Thames.

The technical report considers that a magnitude (Mw) 8.9 earthquake rupturing along a 450km segment of the Tonga-Kermadec Trench just off East Cape to be a 'maximum credible event' (see Figure 8). This event is similar to the Tohoku earthquake and tsunami that occurred in Japan in 2011.

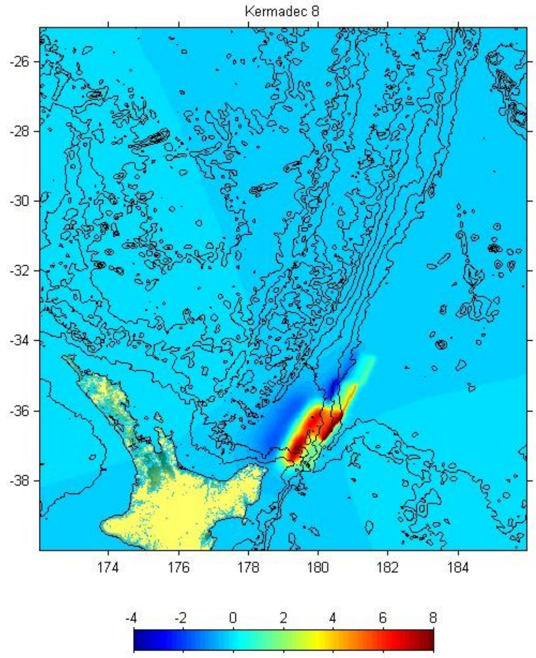

Figure 8: The 'maximum credible event' from the Tonga-Kermadec Trench. This event is a similar magnitude and nature to the 2011 Japan tsunami

How long does it take for regional source waves to arrive at Thames?

Assuming the magnitude (Mw) 8.9 earthquake described above, Figure 9 shows that:

- Water levels begin to fall about three hours following the earthquake, then rise and fall rapidly (5-6 times per hour) for at least five hours
- The third wave rises to the maximum size of ~0.5m around the three and a half-hour mark, and similar sized waves arrive between the six and seven-hour mark following the earthquake.

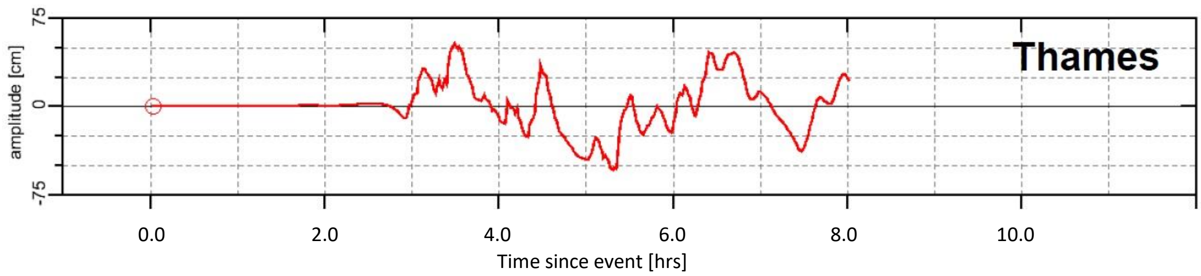

Figure 9: Wave arrival times and inundation levels from the Tonga-Kermadec Trench (at MHWS)

Inundation maps: impact of regional source tsunami waves on Thames

Figures 10, 11, 12, 13 and 14 (overleaf) show the potential inundation from a maximum credible earthquake on the Tonga-Kermadec Trench. It is important to note that the maps:

- Assume wave arrival at Mean High Water Springs (the highest level that spring tides reach on average over a period of time)
- Only show inundation of land areas that are normally above sea level.

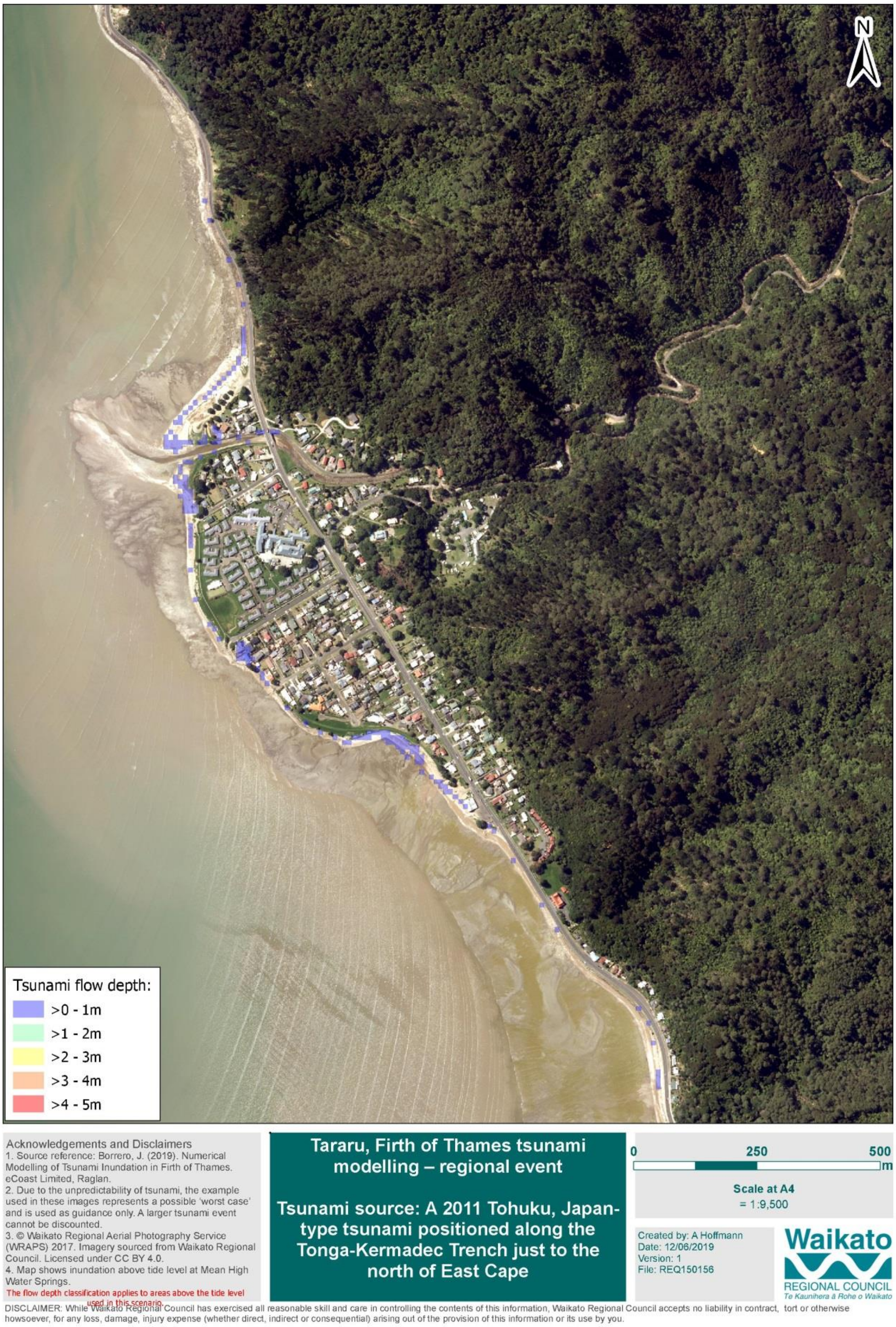

Figure 10: Tararu
Potential inundation from a maximum credible earthquake on the Tonga-Kermadec Trench

Figure 11: Thames North

Potential inundation from a maximum credible earthquake on the Tonga-Kermadec Trench

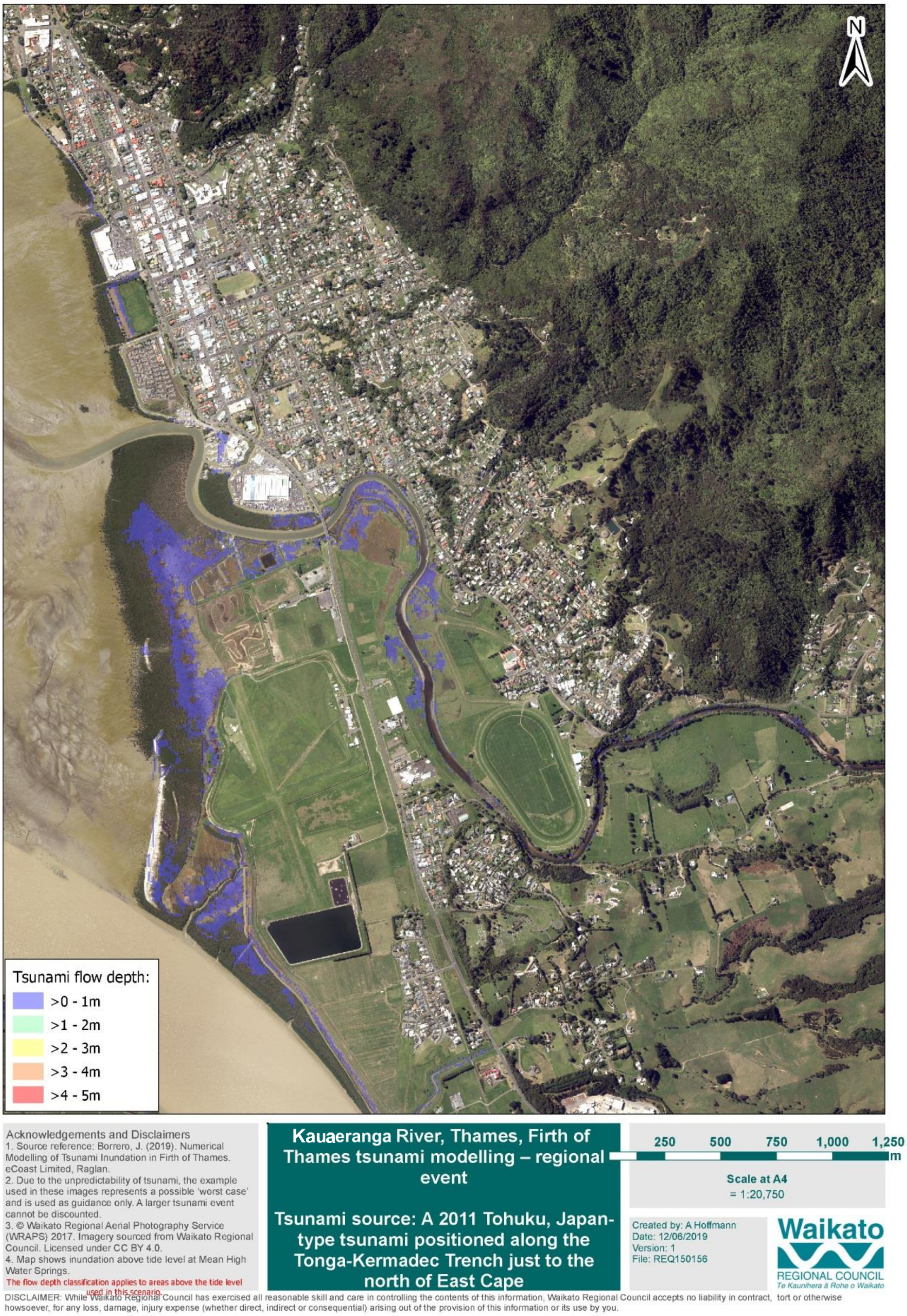

Figure 12: Kauaeranga River

Potential inundation from a maximum credible earthquake on the Tonga-Kermadec Trench

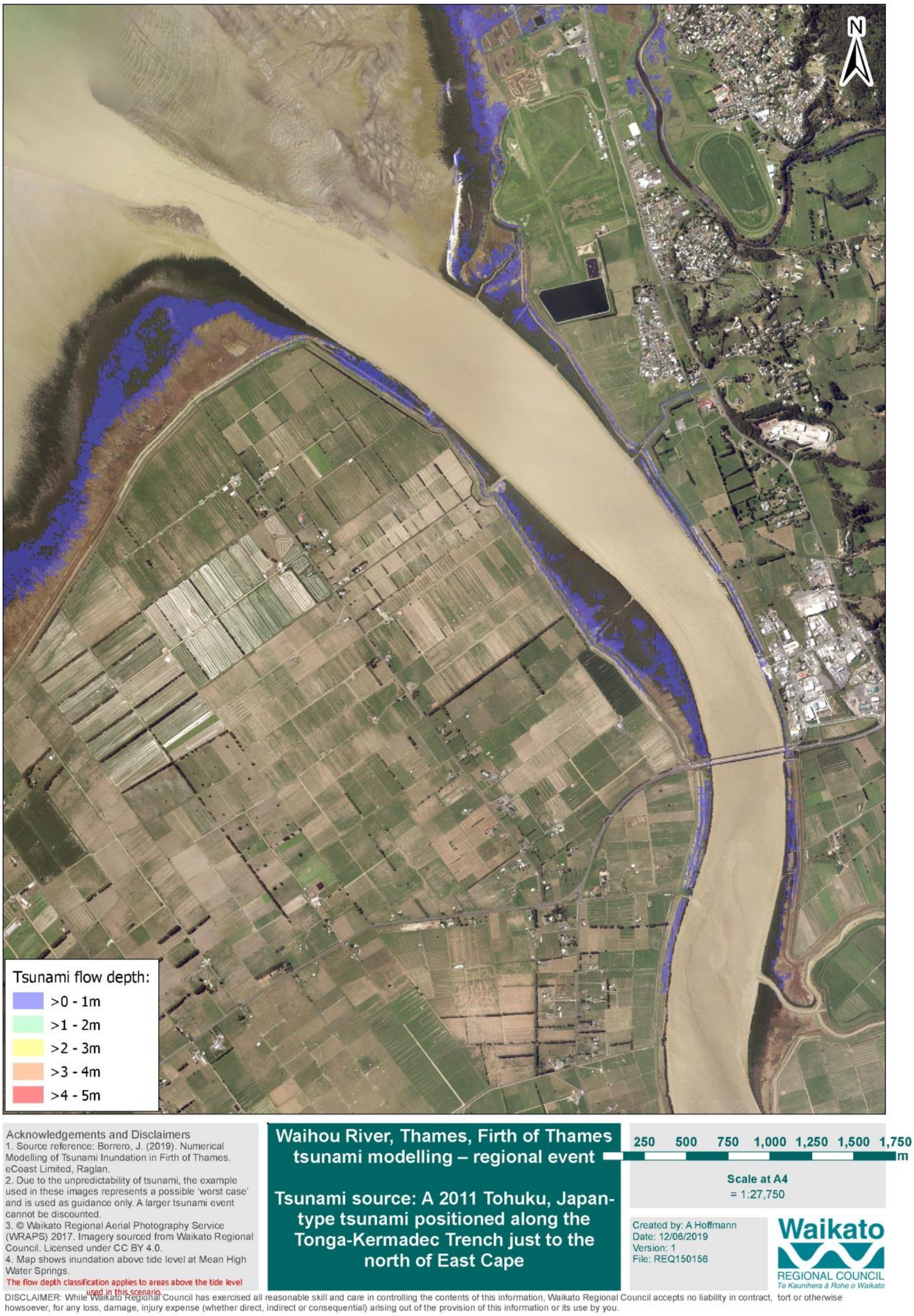

Figure 13: Waihou River

Potential inundation from a maximum credible earthquake on the Tonga-Kermadec Trench

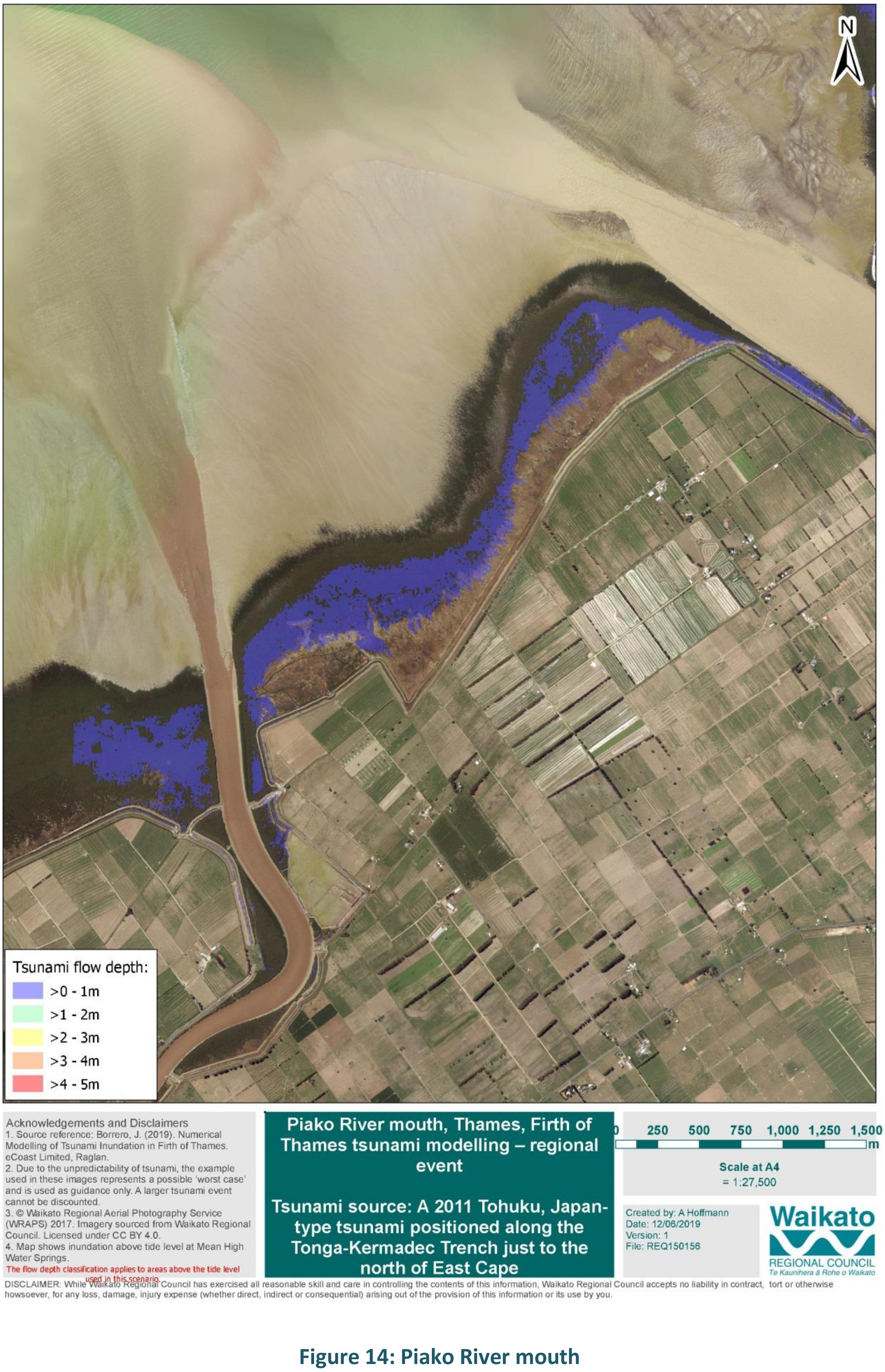

Figure 14: Piako River mouth

Potential inundation from a maximum credible earthquake on the Tonga-Kermadec Trench

Distant source tsunami from South America

South American sources

Previous studies have indicated that tsunamis produced by large earthquakes along the South American Subduction Zone have the greatest impact of all the distant tsunami sources on New Zealand.

The technical report considers three scenarios from South America (see Figure 15):

1. The 1960 Valdivia, Chile earthquake (magnitude ~9.2)
2. The 1868 Arica, Chile and Southern Peru earthquake (magnitude ~9.4)
3. 'FF7', a theoretical variant of the 1960 Valdivia earthquake placed in Central Peru (magnitude ~9.2).

Of the three scenarios considered, the FF7 earthquake has the most impact on Thames at Mean High Water Springs, although this *impact is far lower* than the local and regional sources.

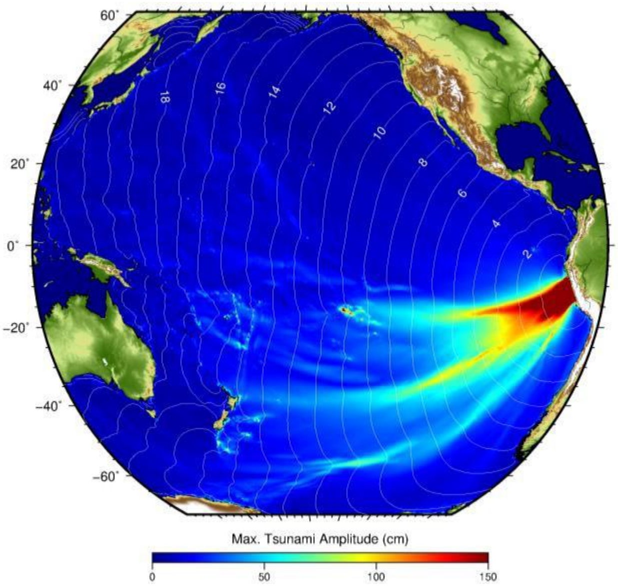

Figure 15: Map of the 'FF 7' variant of the 1960 Chilean earthquake, placed in Central Peru

How long does it take for distant source waves to arrive at Thames?

Assuming the 'FF7' scenario, Figure 16 shows that:

- Water levels begin to rise about 17 hours following the earthquake, then rise and fall rapidly (4-6 times per hour) for at least 13 hours following first wave arrival at Thames
- The initial waves are small (~0.25m), and the waves rise slowly to the maximum inundation level of 0.35m above the existing water level after a further 5-6 hours.

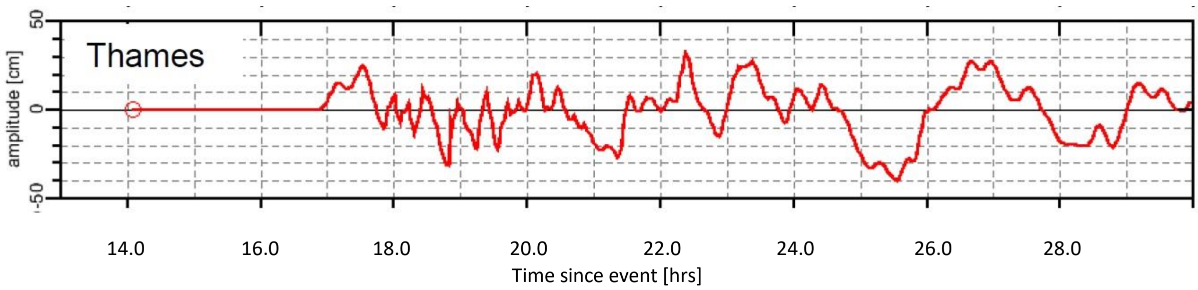

Figure 16: Wave arrival times and inundation levels from the 'FF7' distant source scenario

Inundation maps: impact of distant source tsunami waves on Thames

Figures 17, 18, 19, 20 and 21 (overleaf) show the potential inundation from a maximum credible earthquake from the Central Peru region of South America. It is important to note that the maps:

- Assume wave arrival at Mean High Water Springs (the highest level that spring tides reach on average over a period of time)
- Only show inundation of land areas that are normally above sea level.

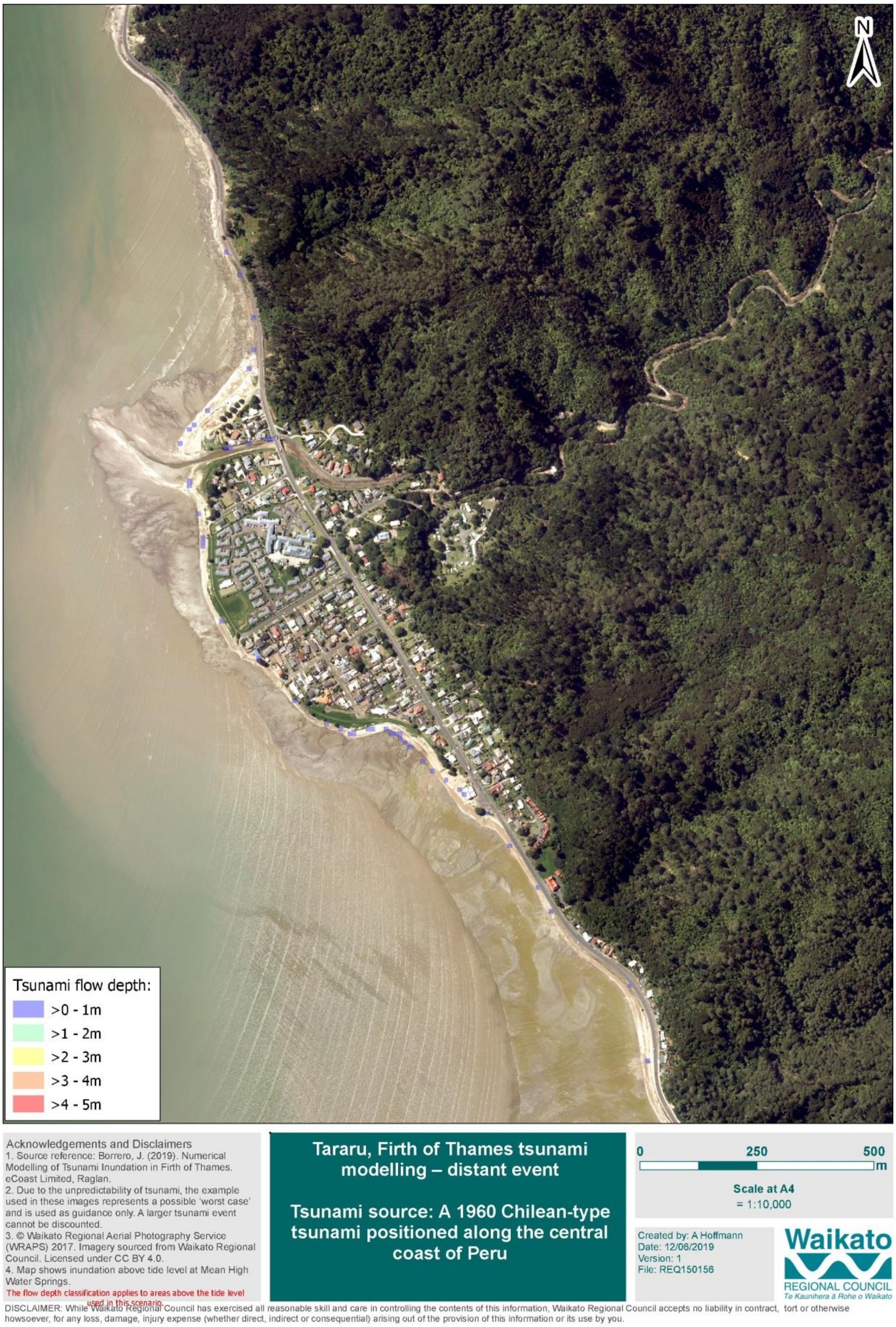

Figure 17: Tararu

Potential inundation from a maximum credible earthquake from Central Peru in South America

Figure 18: Thames North

Potential inundation from a maximum credible earthquake from Central Peru in South America

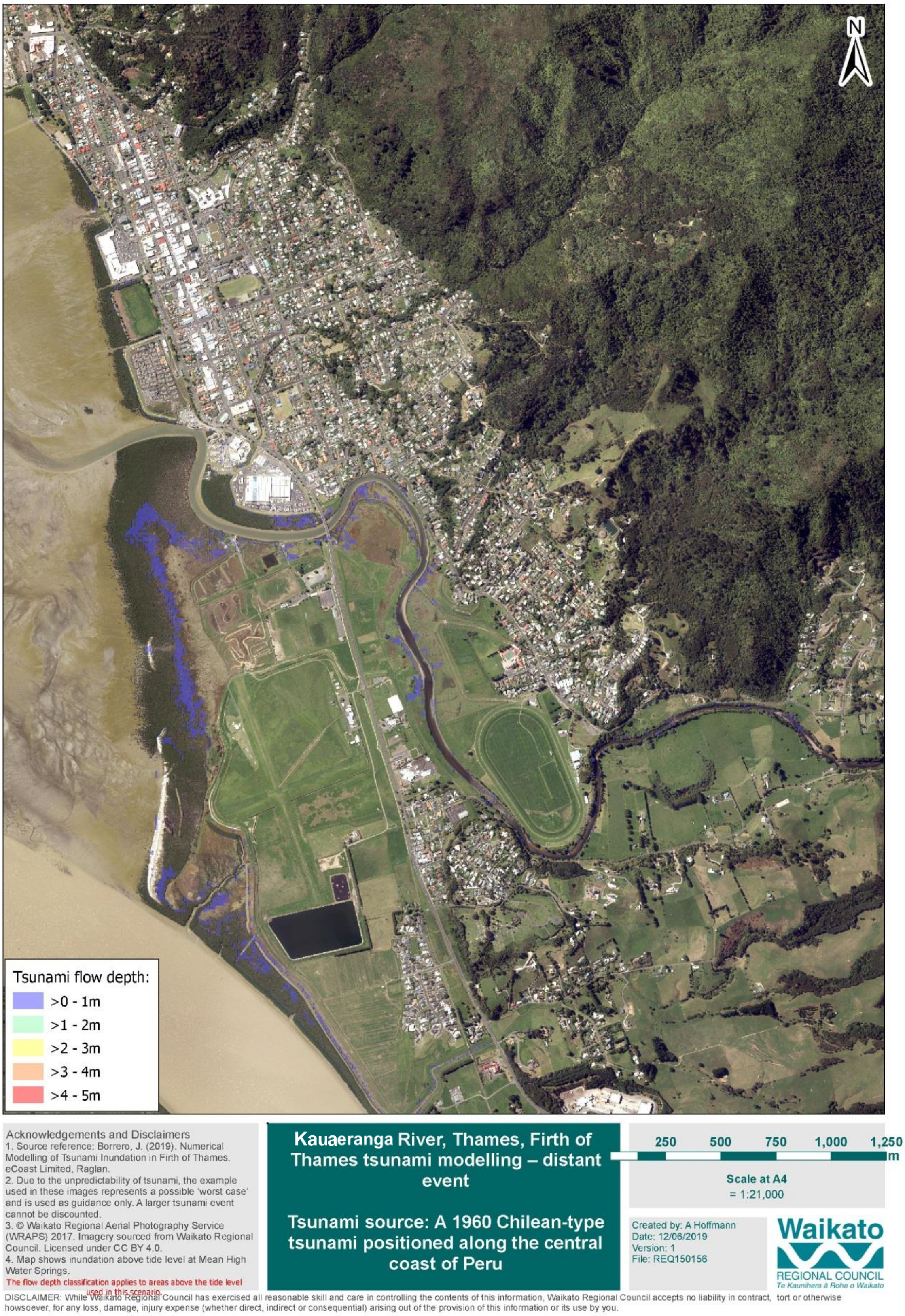

Figure 19: Kauaeranga River

Potential inundation from a maximum credible earthquake from Central Peru in South America

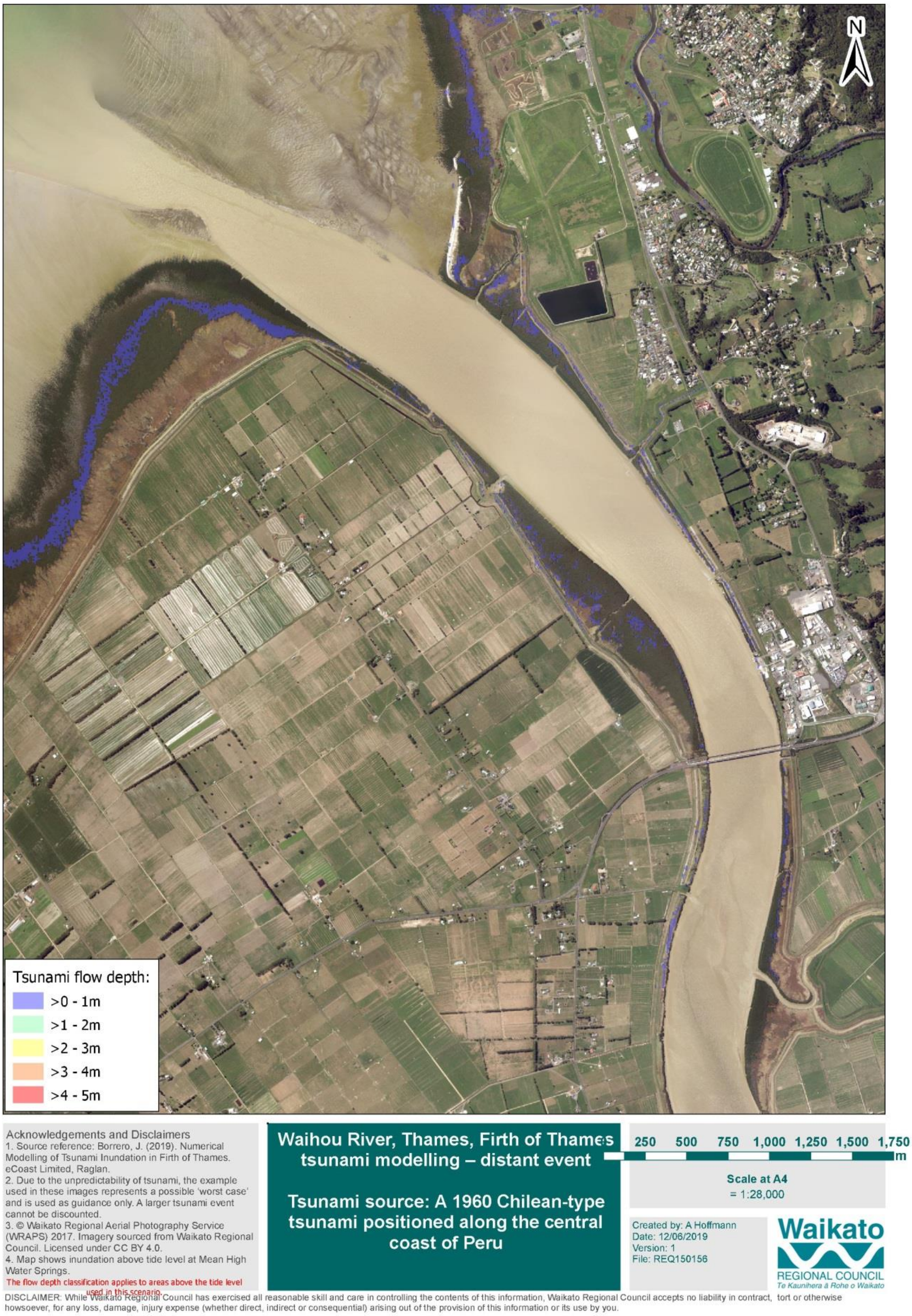

Figure 20: Waihou River

Potential inundation from a maximum credible earthquake from Central Peru in South America

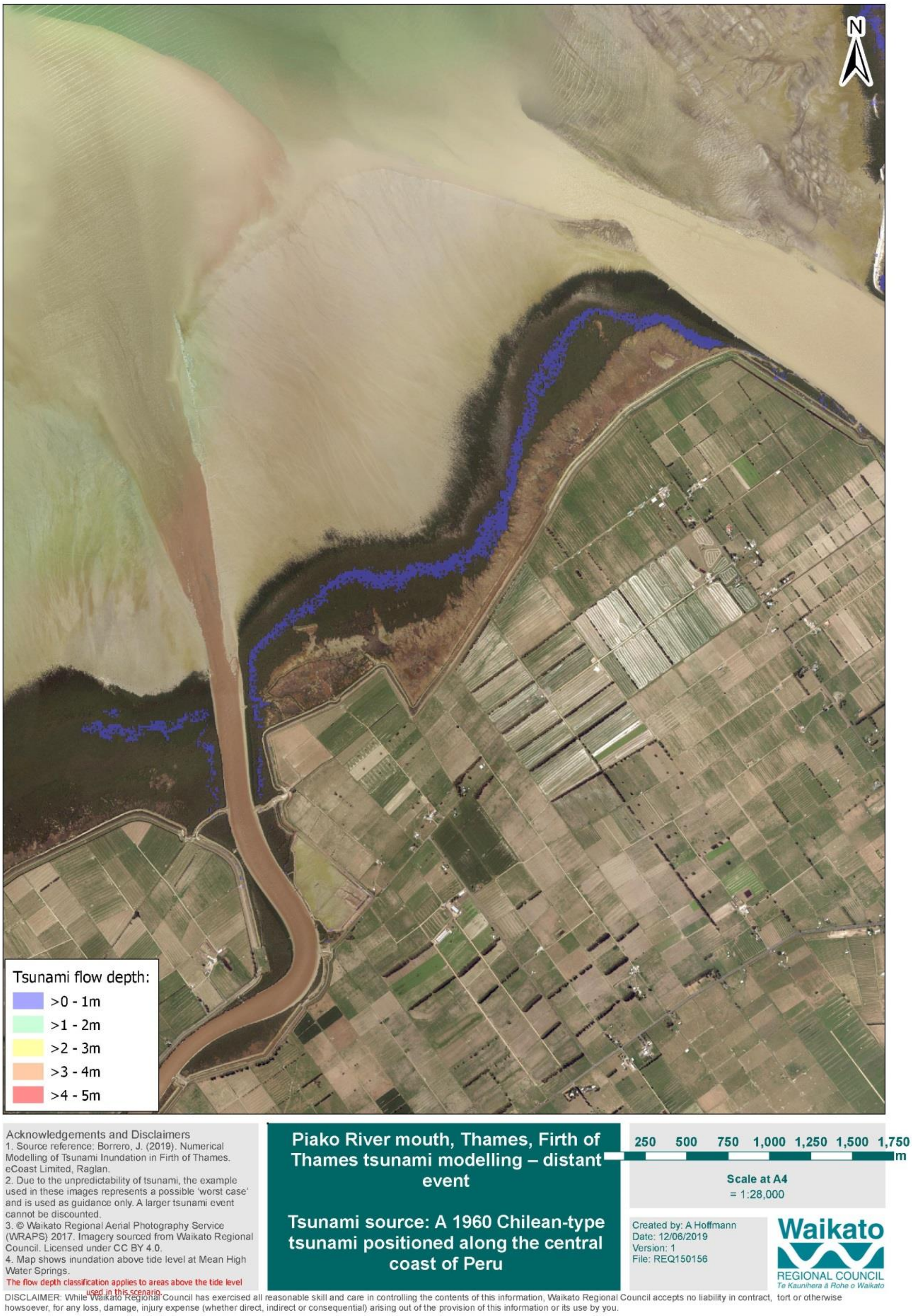

Figure 21: Piako River mouth

Potential inundation from a maximum credible earthquake from Central Peru in South America