Hawke's Bay Tsunami Inundation by Attenuation Rule

August, 2014

HBRC Report No. 14/03 Plan Number: 4616

Engineering Section

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1 Purpose and Study Area

This report was produced on behalf of the Hawke's Bay Civil Defence Emergency Management Group for the purposes of informing decisions on the risk reduction, community readiness and response to the tsunami hazard. Inundation extents for the coastline of Hawke's Bay were determined based on wave heights from offshore earthquakes which create tsunami waves (Power, 2013). The study area is shown in Figure 1. This study does not include the Napier segment (the coast from Te Awanga to Tangoio) or Wairoa to Mahia. Inundation in these areas was determined in other studies utilising 2-dimensional computer models.

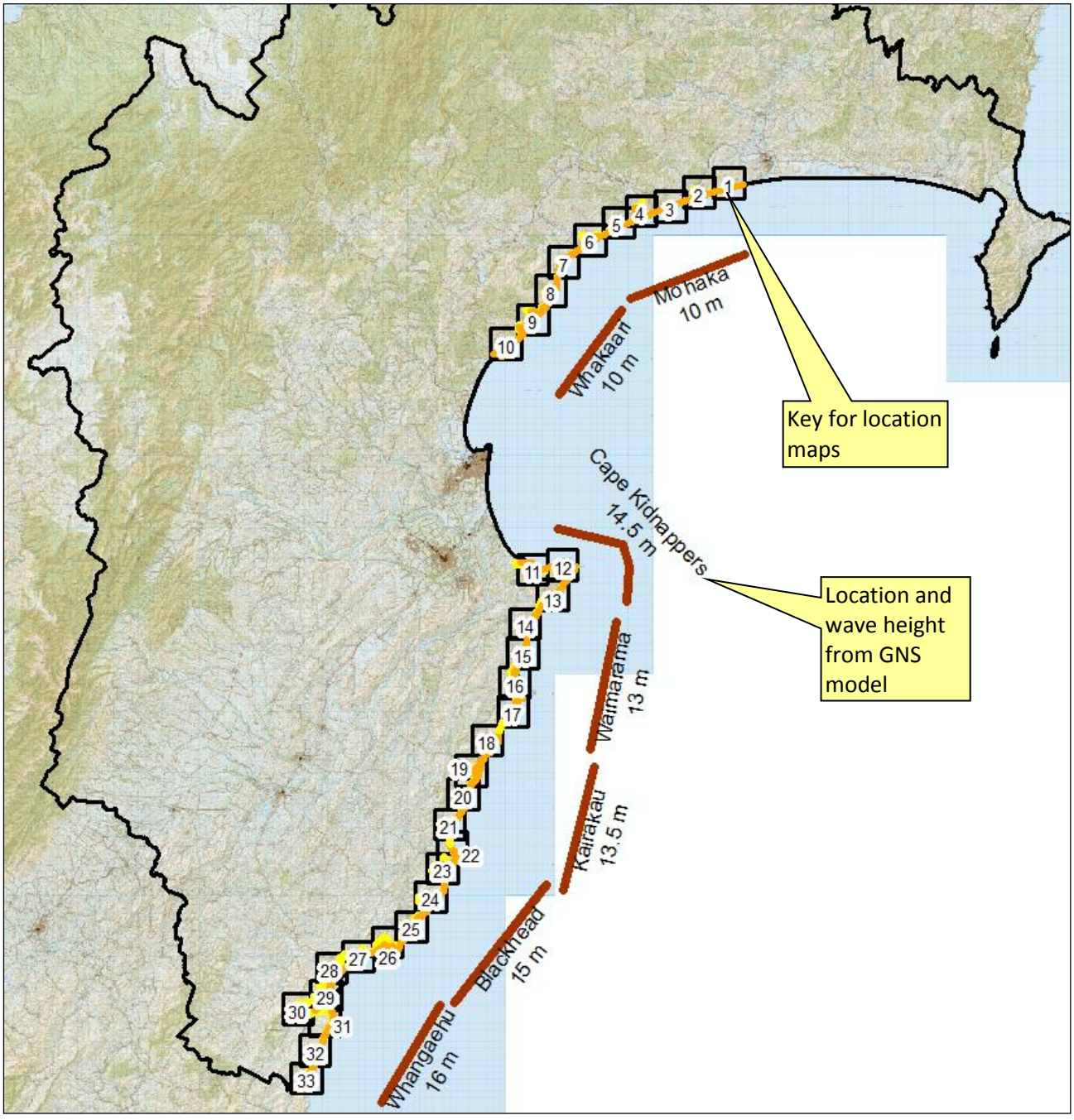

Figure 1: Study area

2 Method

The inundation extents were determined by applying the attenuation rule, developed by GNS (2009, Leonard et. al, and 2013, Fraser S., Power W.) to wave heights. Wave heights were determined from two categories: near source, and distant source earthquakes. The near source wave heights were taken from the GNS study *Tsunami hazard curves and deaggregation plots for 20 km coastal sections, derived from the 2013 National Tsunami Hazard Model* (Power, 2013). The wave height for the 2500 year return period, 84th percentile was used. A sample is shown in Figure 2.

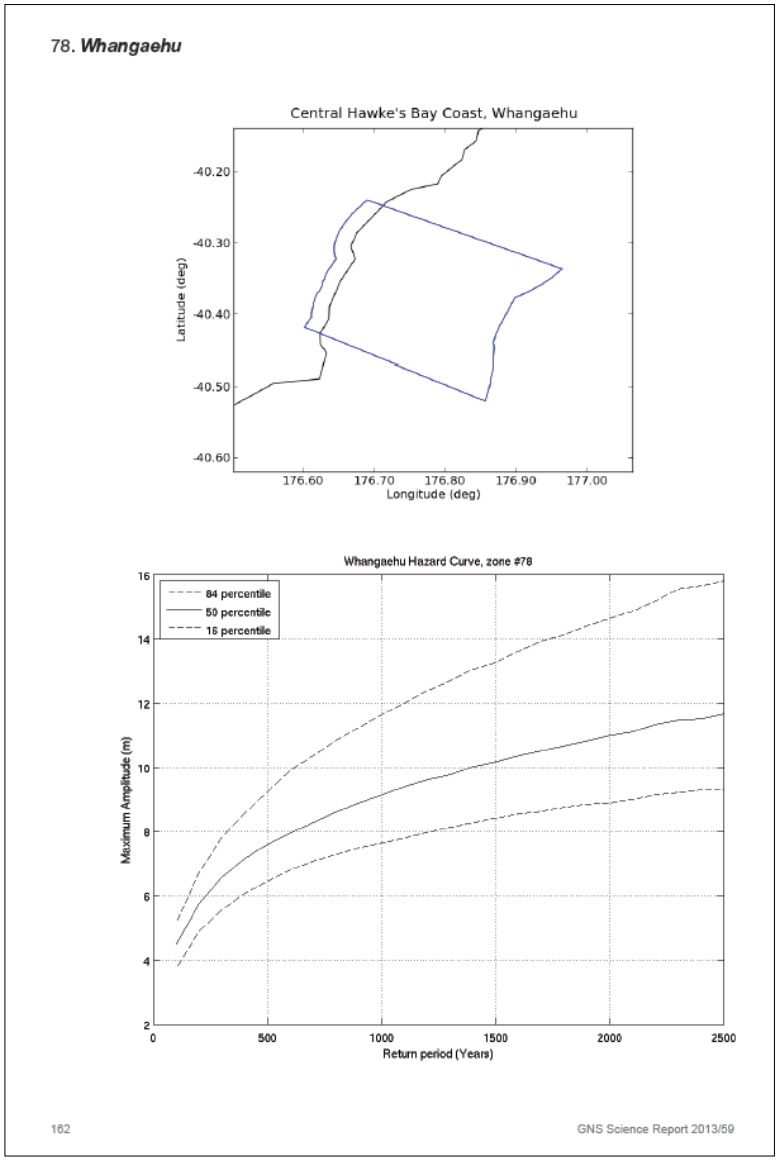

Figure 2: Sample wave height for Whangaehu (Power, 2013)

The distant source wave height used was 5 m, determined from the GNS estimate of likely maximum wave height from distant source earthquakes.

The wave height at the coast was doubled to account for the increase in wave height as the tsunami wave hits the shoreline, then the wave height was added to a high tide value (in this case 1 m high tide). Next, the attenuation rules were applied, which are:

- The potential runup height attenuates at a rate of 1 m for every 200 m horizontal inland for flow direct from the coast.
- The potential runup height attenuates at a rate of 1 m for every 400 m horizontal inland for flow up a significant river.
- The potential runup height attenuates at a rate of 1 m for every 50 m horizontal inland for flow over land away from a significant river.

The application of these rules was by a manual method using contours along with a 100 m grid to estimate the distance inland and amount of attenuation to apply, while estimating where the attenuation line would intersect the appropriate ground contour. A typical screen showing the contours, grid and inundation lines is shown in Figure 3, implemented using Arcmap.

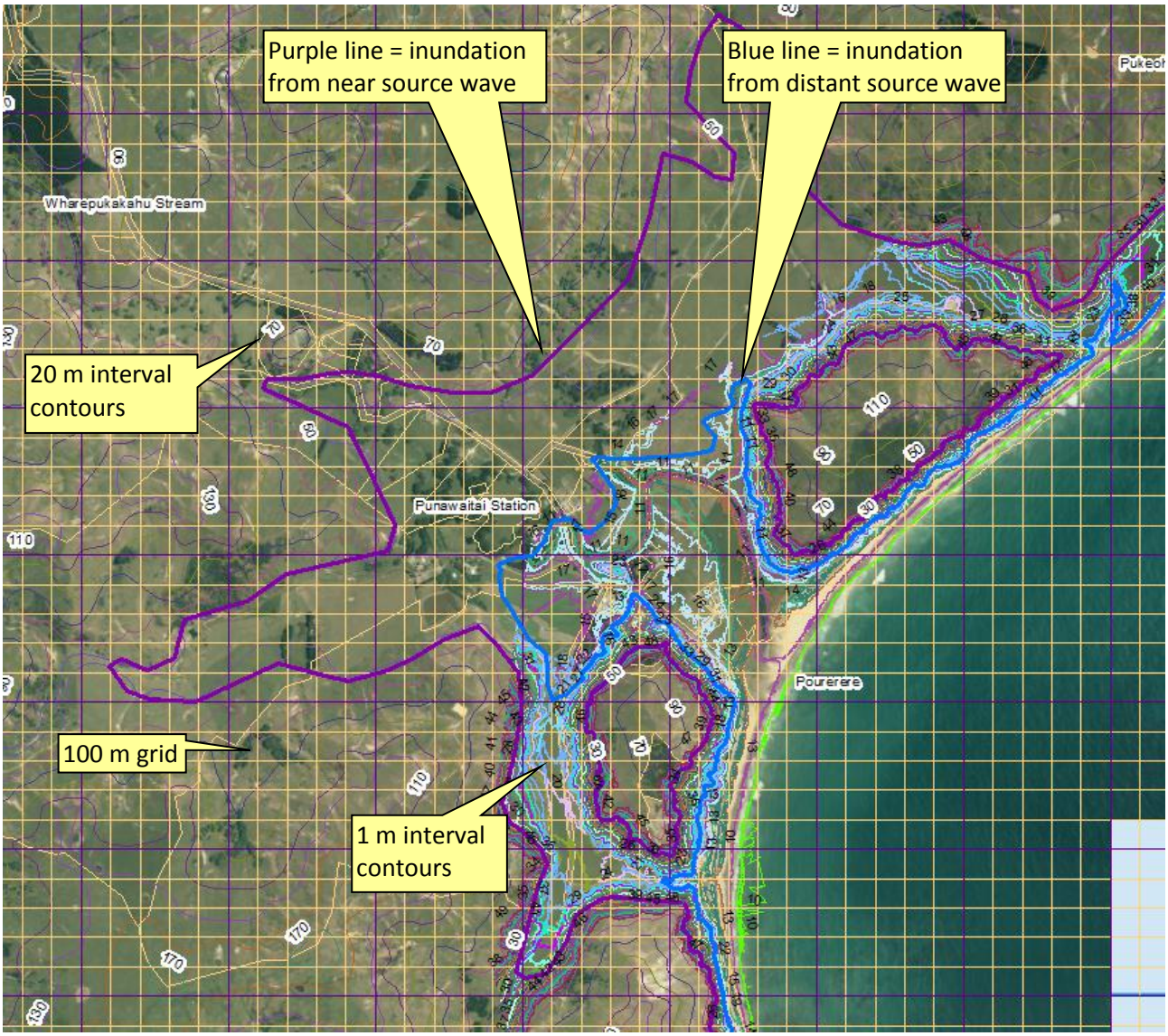

Figure 3: Arcmap setup for implementing inundation rules

In areas where 1 m contours were not available, the inundation line was estimated using a combination of air photos and the 20 m contours available from the NZ topo map series. Accuracy in these areas is less

than the areas with 1 m contours, however, the inundation extents were generally mapped to include a larger margin of error. Mapping was done at a variety of scales ranging from 1:1000 to 1:20,000 depending on the complexity of the terrain and the proximity of the inundation extents to buildings and houses.

3 Results

Results from the inundation mapping are presented in a series of maps included as an appendix. A sample is shown in Figure 4. Arcmap shape files of the inundation extents are also available from HBRC.

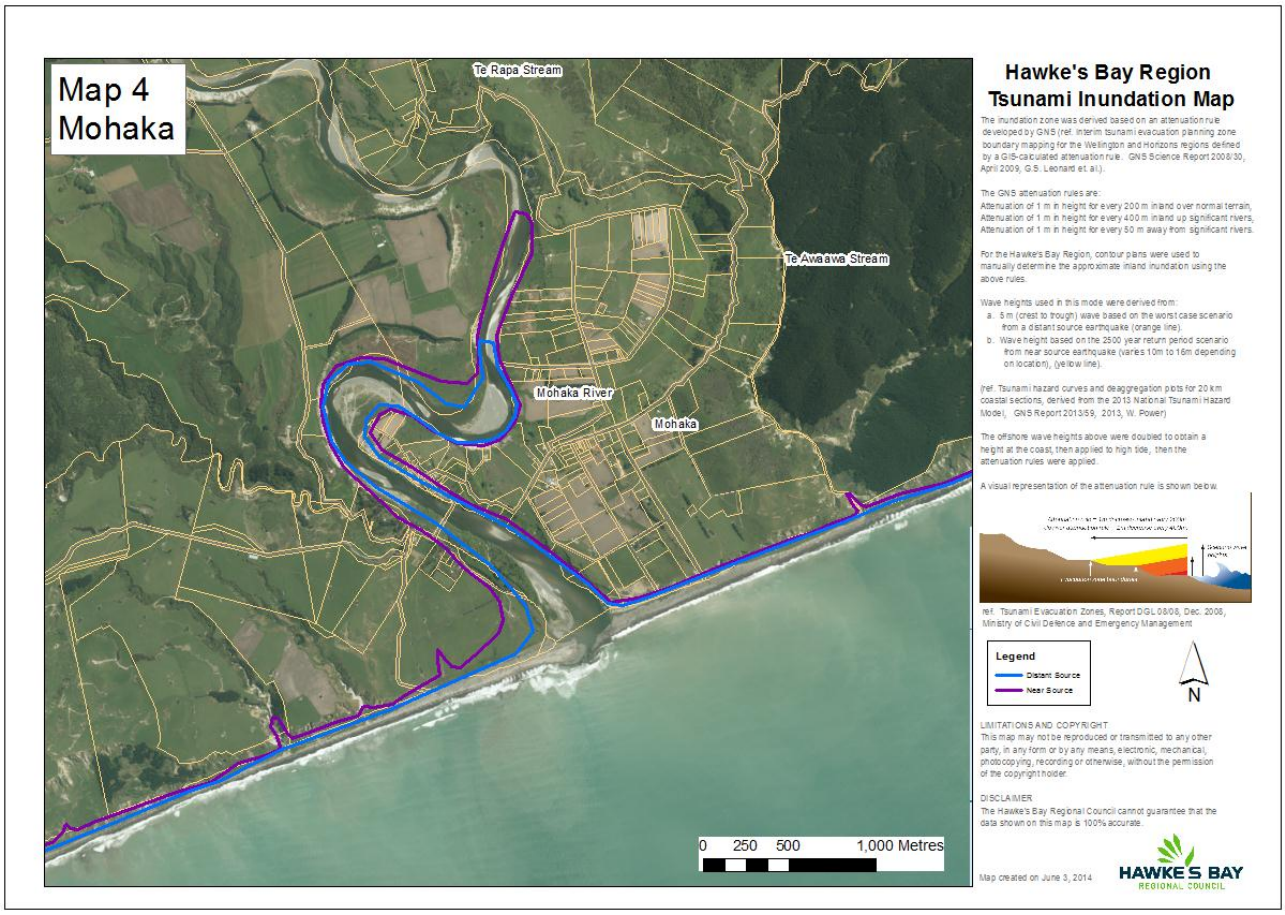

Figure 4: Sample map showing inundation extents

4 References

Fraser, S., Power, W., (2013), *Validation of a Gis-based attenuation rule for indicative tsunami evacuation zone mapping (report 2013/02),* Institute of Geological and Nuclear Sciences Ltd., (GNS), Wellington, New Zealand.

Leonard, G., et. al., (2008), *Tsunami evacuation zones for Wellington and Horizons regions defined by a GIS-Calculated attenuation rule (report 2008/30),* Institute of Geological and Nuclear Sciences Ltd., (GNS), Wellington, New Zealand.

Power, W., (2013), *Tsunami hazard curves and deaggregation plots for 20 km coastal sections, derived from the 2013 National Tsunami Hazard Model (report 2013/59),* Institute of Geological and Nuclear Sciences Ltd., (GNS), Wellington, New Zealand.

Appendix A Inundation Maps