Appendix 8 – Memo from Nick Griffiths on the Flood Assessment Overlay

Response to information request

Date	28 February 2025
To	Timaru District Council. Attn: Consultant Andrew Willis (Director – Planning Matters)
CC	Deidre Francis (Principal Planner – Environment Canterbury)
From	Nick Griffiths (Science Team Leader, Natural Hazards – Environment Canterbury)

Flood assessment area overlay

Key Messages

To effectively reduce the impact of future flood events, it is important that the overlay used to trigger flood hazard provisions in the Proposed Timaru District Plan identifies areas that are potentially susceptible to flooding. This memo presents mapping that could be used as part of a revised 'flood assessment area' overlay in the proposed district plan, and describes the method used to produce it.

Introduction and Purpose

Timaru District Council (**TDC**) notified a proposed district plan on 22 September 2022. The proposed plan includes a 'flood assessment area' overlay and associated provisions to manage development in this area. Environment Canterbury made a submission on the proposed plan, which (among other things) noted that the areas identified as potentially subject to flooding by the overlay are too narrow.

Data and analysis

The mapping presented in this memorandum is intended to broadly identify areas where the potential for flooding **may** exist. The fundamental assumption behind the mapping is that if the land is relatively flat, then there is generally some potential for flooding, and if the land is relatively steep, flooding is generally unlikely. The main exception is alluvial or debris flow fans which can be steep but still pose a significant flood hazard. The mapping does not distinguish between sources of flooding, and areas may be subject to river flooding, surface flooding, coastal flooding or any combination of the three.

Due to the nature of flooding (particularly surface flooding) and the topography of the Timaru district, there are often no obvious physical boundaries between areas that are susceptible to flooding and those that are not. Instead, the degree of flooding can gradually transition from minor to severe in an irregular fashion across widespread areas, and it is therefore challenging to accurately separate areas that may be subject to flooding from those that may not.

As a starting point, we used ArcGIS software to produce a slope raster from several LiDAR based digital elevation models (DEMs). The slope raster was converted to a binary raster, where the slope values were split into two classes; slopes greater than 5 degrees (steep) and slopes less than 5 degrees (flat).

Using topographic maps, aerial imagery, and Google Maps 3D and Street View imagery as a reference, the raster painter tool was used in ArcGIS to manually modify the binary raster based on the following approach:

- where there were steep areas amongst generally flat areas, and the steep areas were related to the following features, they were added to the flat class
    - waterways (e.g., river channels, river banks, river terraces, stopbanks, steep slopes adjacent to incised channels)
    - escarpments and poorly defined low hills
    - roads (e.g., road embankments, bridge approaches, cuttings)
    - other artificial features (e.g., gravel pits, golf courses, fill, stockpiled material)
    - minor natural features (e.g., small hills, ridges, and depressions)
    - DEM seam lines
- where there were flat areas amongst generally steep areas, and the flat areas were related to the following features, they were removed from the flat class
    - ridges
    - plateaus
    - well defined river and stream channels
    - remote high country river valleys
- the flat class was extended to include obvious alluvial and debris flow fans that were too steep to have been included by default
- the boundary between flat and steep areas was cleaned up to remove ‘noise’ along the boundary (i.e., removing individual pixels or small clusters of steep pixels from the flat class and vice versa) and to refine the position of the boundary as needed.

The modified flat areas were then converted to vector polygons using a raster to polygon conversion tool, with a ‘simplify’ setting applied to smooth the boundaries. In some areas – especially where LiDAR data was not available (e.g., the Upper Rangitata River valley) – vector polygons were added or extended manually to capture other areas based on aerial imagery. Where necessary, the mapping was adjusted to ensure it incorporated all areas shown to be impacted by coastal inundation in a 100 year average recurrence interval (**ARI**) event, with 1.2 m of sea level rise. This inundation area was based on hydrodynamic modelling (Jacobs, 2020). While inundation from a 200 year ARI event was not modelled, a similar extent of inundation would likely result from a 200 year ARI event with 0.9 m of sea level rise.

The approach used to produce the mapping for TDC was very similar to that used to produce mapping for Kaikoura, Waimakariri, Selwyn, Mackenzie, and Waitaki district councils.

The mapping did not address parts of Timaru and Geraldine townships that may be subject to flooding, as TDC have produced separate mapping for these areas based on flood model results. We worked alongside staff at TDC to ensure both sets of mapping would join logically, and only minor adjustments were necessary to create a cohesive set of mapping that could be used as an overlay in the district plan. The combined mapping is shown in Figure 1.

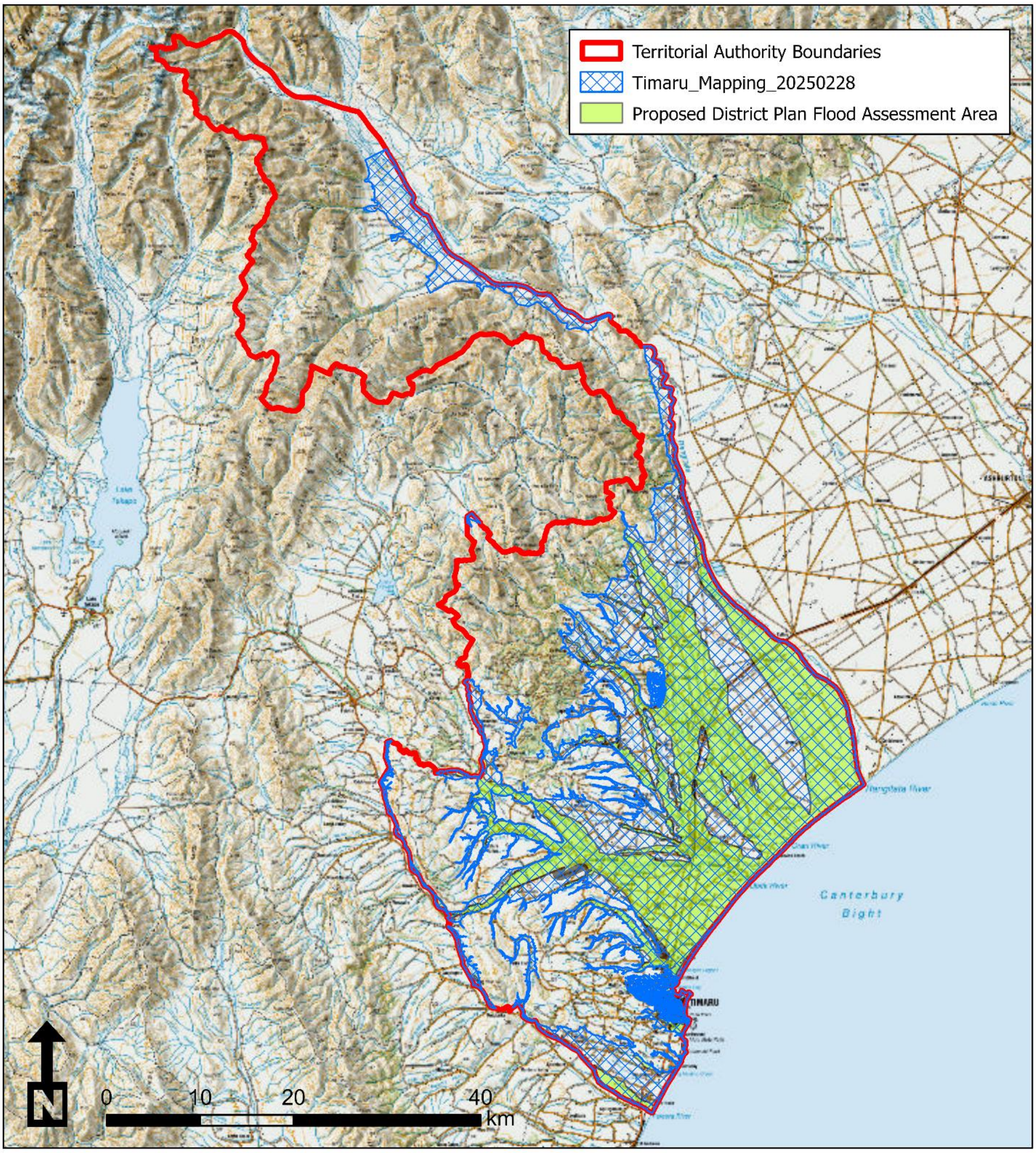

Figure 1: Mapping of areas where the potential for flooding may exist, and the notified district plan 'flood assessment area' overlay.

Interpretation

The mapping presented in this memorandum is more comprehensive and extensive than the notified overlay. The notified overlay does a reasonable job of identifying parts of the district that could be susceptible to flooding from major rivers and streams, but does not adequately account for potential flooding from smaller streams or drains, or surface flooding from rainfall runoff.

While the mapping presented here is less likely to 'miss' areas that may be susceptible to flooding than the notified overlay, it is inevitable that there will be some areas outside of the mapping that are susceptible to flooding. For example, a site could be subject to flooding from a small high country stream or localised depression that has not been included in the mapping as the surrounding area is broadly classified as steep hill country. While these will generally be areas where new development is unlikely, and where the potential for flooding is reasonably obvious, it is still important that the absence of mapping is not construed to mean an absence of flood hazard in all cases. The only practical way to avoid this would be to adopt a more conservative trigger for site-specific assessments (e.g., require an assessment in all locations).

References

MacDonald, K. 2020. *Timaru Coastal Erosion Assessment,* Jacobs New Zealand Ltd.