

BEFORE THE DUNEDIN CITY COUNCIL

IN THE MATTER of the Resource Management Act
1991

AND Application for subdivision
and earthworks consents for
15 lot residential development
at 94 Holyhead St, Outram.

**STATEMENT OF EVIDENCE OF JEAN-LUC PAYAN FOR OTAGO
REGIONAL COUNCIL**

Dated 10 NOVEMBER 2017

QUALIFICATIONS AND EXPERIENCE

1. My full name is Jean-Luc Payan.
2. I am employed by the Otago Regional Council (ORC) as the Manager of the Natural Hazards Team, and have been in the role for approximately 1 year and 5 months. Prior to this position, I was employed by the ORC as an Investigations Engineer from October 2008 to June 2016.
3. I hold the qualification of PhD in hydrology specialising in hydrological modelling from the French Institute of Forestry, Agricultural and Environmental Engineering (Paris), and of Master of Engineering in water sciences and environment from the French School of Water and Environment Engineering (Strasbourg).
4. My previous and current roles include investigations and assessments of the flood hazard in different parts of the Otago region including on the Taieri Plain. I was also involved in various investigations and analysis related to the performance and management of the Lower Taieri Flood Protection Scheme since 2008. Recently I was part of the team that responded to the July 2017 heavy rainfall event experienced in eastern Otago and in particular the Taieri Plain.
5. During the revision of the Dunedin City District Plan (2GP), I have provided flood hazard information for the Taieri Plain to the Dunedin City Council (DCC) to inform the planning provisions. The information included a detailed description of the flood hazard characteristics of different areas of the Taieri Plain and associated maps. I attended the 2GP hearing sessions on natural hazards in April 2017 and presented evidence in relation to Taieri Plain flood hazard.
6. I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed. This evidence is within my expertise.
7. I have visited the site of interest.

SCOPE OF EVIDENCE AND OVERVIEW

8. My evidence relates to the natural hazards of the site of interest. This evidence includes the following:
 - a. Taieri Plain flood hazard
 - b. Lower Taieri Flood Protection Scheme ("the Scheme") in the vicinity of the site of interest
 - c. Residual risk
 - d. Liquefaction

TAIERI PLAIN FLOOD HAZARD

9. The flood hazard on the Taieri Plain is described in the report titled "Flood hazard on the Taieri Plain" (ORC, 2015). This report has been prepared by the ORC to inform the hazard maps and land-use controls included in the revised Dunedin City District Plan (2GP).
10. In the report, the Taieri flood plain has been divided in different areas based on the flood hazard characteristics and sources of flooding.
11. The site of interest lies within area 1B (West Taieri Plain above high-tide level). Sources of flooding include the Taieri River to the east and internal runoff and overland flow.
12. Although more elevated than the rest of the West Taieri (area 1A), Outram and the site of interest are still on a natural flood plain. Figure 1 illustrates the topography of the Outram area. The figure shows that much of the urban area of Outram adjacent to the floodbank is elevated although equally some sections are relatively low-lying. The old courses of the Taieri River are clearly evident, in particular the course immediately north of Holyhead Street. Those lower lying areas are more susceptible to flooding from internal runoff and overland flow.
13. Figure 2 shows ponding on the site of interest during the July 2017 heavy rainfall event. This ponding is very likely to be the result of internal runoff and coincide with the lower sections of the site. Anecdotal observations made after the July 2017 heavy rainfall event indicates that some areas of the site of interest took few days to drain (Figure 3).

LOWER TAIERI FLOOD PROTECTION SCHEME

14. It is important to appreciate that this area is heavily reliant on the Scheme floodbanks to mitigate the Taieri River flood hazard (Figure 2 to Figure 6). The area also relies on a network of drains and swales to remove runoff resulting from heavy rainfall events.
15. The whole West Taieri area (including Outram) is protected from flooding from the Taieri River up to a flow of 2,500m³/s (measured at Outram).
16. The floodbanks in the vicinity of Outram are earth banks, typically 2.5m to 3m high and about 3.5m wide (Figure 5 and Figure 6) and could potentially have high water level on the riverside for extended periods of time (several hours).

RESIDUAL RISK

17. The ORC maintains and monitor the Scheme floodbanks to a high standard. The integrity of the Scheme floodbanks was extensively assessed in 2005 and is being re-assessed now. The results of the re-assessment are expected by the end of December.
18. Irrespective of the maintenance and monitoring regime, reliance on earth floodbanks for flood protection also means accepting some residual risk¹ exposure (failure before the design capacity is reached or events larger than the assumed design event).
19. This is of particular relevance to the site of interest given its close proximity to the Taieri River true right bank floodbank. Breaches in the Scheme floodbank network could significantly modify the characteristics of the flood hazard (duration and depth of inundation and water velocity) in the area of interest.
20. The effects of flooding could be catastrophic if the Scheme floodbanks were to fail, or were overtopped by a flood event larger than their intended design. In such a situation, the velocity and depth of flood flows could damage buildings and other assets, move vehicles and make walking difficult or unsafe, and therefore present a possible risk to life. The consequences of a floodbank breach near Outram in

¹ Residual risk is that part of the risk that is not mitigated, and includes risks due to events larger than the assumed design event or failure before the design capacity is reached

particular, would be significant, due to the potential impacts not only on this community but also on the rest of the West Taieri which includes critical infrastructures such as the Dunedin Airport.

21. It is important to note that residing in close proximity to a high floodbank and a large river such as the Taieri River, particularly when in flood, can be an unsettling experience.
22. In addition to the flood hazard described above, the Outram Township could be isolated (road access inundated) during heavy rainfall events. This was the case in July 2017.

LIQUEFACTION

23. ORC has carried out investigations into the susceptibility of different soil types around Otago to liquefaction (Barrell et al., 2014²).
24. The site of interest falls within Domain C. Within this domain there is a moderate to high likelihood of liquefaction-susceptible materials being present (i.e. poorly consolidated marine and estuarine sediment such as silts and sands, with a shallow groundwater).

SUMMARY

25. The site of interest is subject to natural hazards.
26. The proposed development of the site of interest would create a risk that does not exist at present, a risk that is permanent and even with mitigation an element of residual risk would always remain.

DATED this 10th day of November 2017

Jean-Luc Payan



² Barrell, D. J. A.; Glassey, P. J.; Cox, S.C.; Smith Lytle, B. 2014. Assessment of liquefaction hazards in the Dunedin City district, GNS Science Consultancy Report 2014/068. 66 p.

Figure 1. Topography in the vicinity of Outram derived from LiDAR data (2016)



Figure 2. Vicinity of 94 Holyhead Street, Outram – 22/07/2017 morning. The Taieri River is on the bottom left corner with the Outram Township in the distance. The flow in the Taieri River is approximately $1600\text{m}^3/\text{s}$ and the river has just peaked and has started to recede - Photo extracted from an ORC video.



Figure 3. Taieri River in the vicinity of Outram – 25/07/2017 afternoon. The photo was taken three days after the Taieri River has peaked. Ponding is still visible on some sections of the site of interest (right bank) – Photo provided by the ODT



Figure 4. Outram Bridge during the June 1980 flood event. The Outram Township and the Lower Taieri Flood Protection Scheme right bank floodbank are visible at the top right corner of the photo

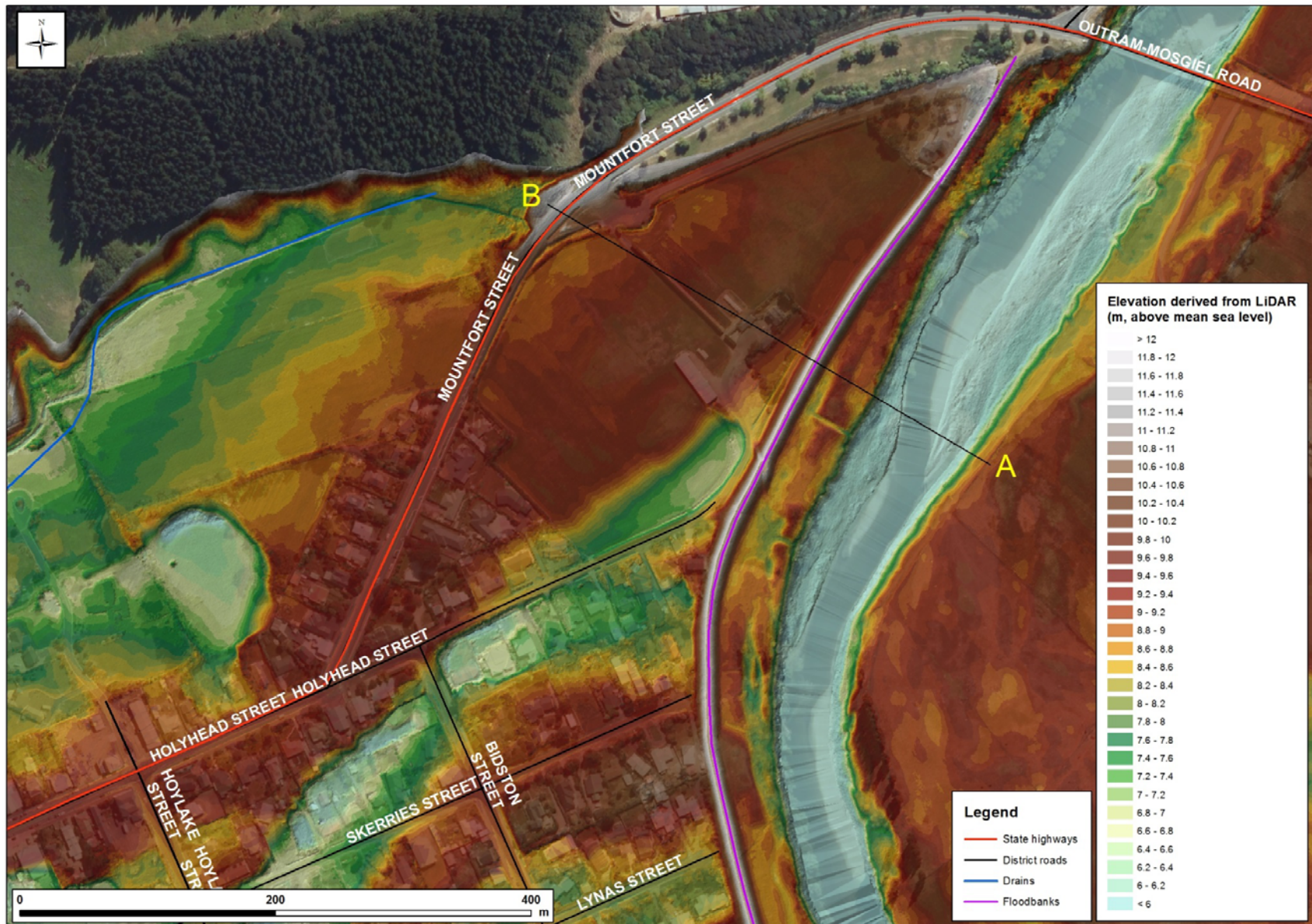


Figure 5. Cross section AB location

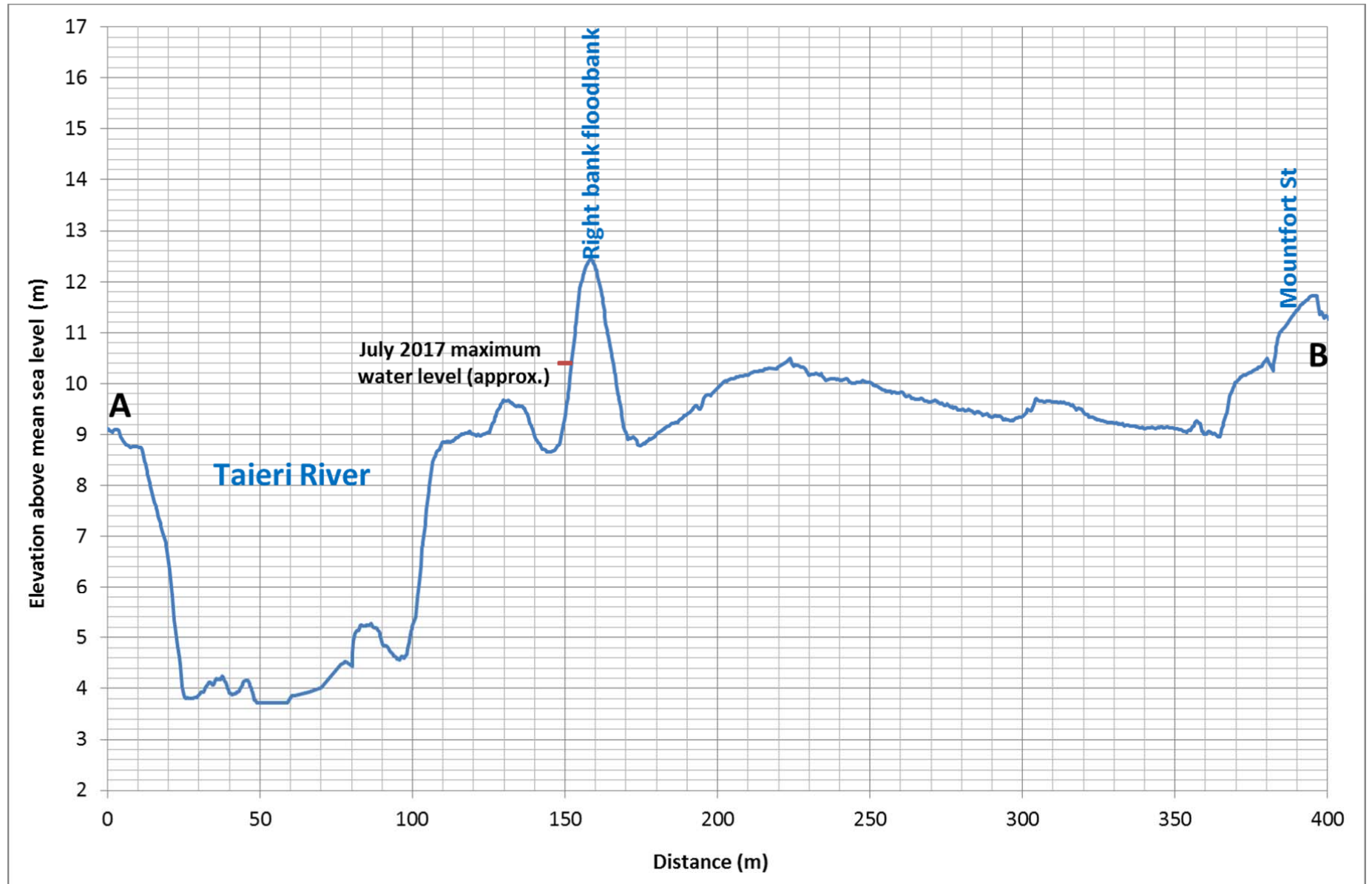


Figure 6. Cross section AB (derived from LiDAR data 2016)