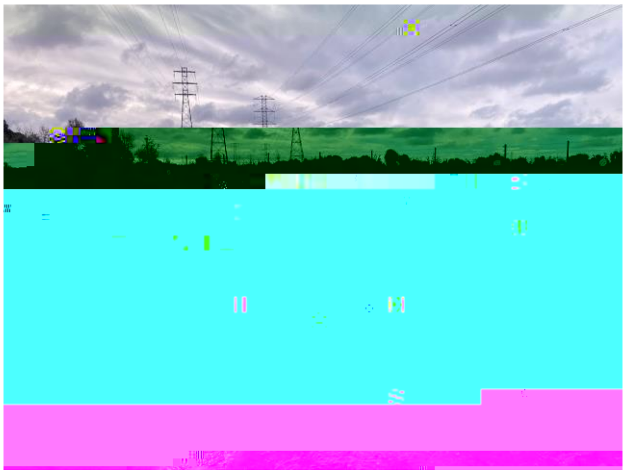
Planning for Flooding at Trees For Canterbury



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Executive Summary

This research examines the flooding in the Outback areas of Trees For Canterbury. To identify effective mitigation options, it is important to understand the key causes of the flooding.

The research question addressed within the study is finding the main contributing factors to the flooding in the Outback area of Trees For Canterbury and identifying potential strategies to manage the flooding.

The methods carried out include a combination of qualitative and quantitative data collection. Specifically, fieldwork for collecting high-resolution imagery of this location, and interviewing Steve Bush, the community partner to obtain background information about the site.

Open-source data was retrieved for Sea level data from NZ Sea Rise, groundwater measurements from ECAN, and precipitation data from StatsNZ and NIWA.

The study identified three primary causes of flooding in the Outback area: an impermeable clay layer that blocks drainage, uneven topography that leads to water accumulation, and continuous irrigation and rainfall.

1.0 Introduction

Across New Zealand, native forest cover has faced significant reduction since settlement, contributing to biodiversity loss, habitat fragmentation, and ecosystem degradation (

Figure 1 Map of Christchurch City with Trees For Canterbury Nursery located in Ferrymead, indicated by the yellow square

Figure 2 LiDAR models illustrating different measures of vertical land movement through the Canterbury Earthquake

sheets and glaciers melt, and ocean waters expand, as illustrated by historical tide station records in figure 5.

Figure 5 This graph shows a positive linear line of sea level rise from 1920 to 2020 illustrating the constant increase of sea level in New Zealand (Christchurch City Council, 2021).

2.4 Soil structure

A previous TFC Study by Macdonald et al. (2016) details the soil structure, composition, and

Figure 6

3.0 Methods

season, summer experiences the most precipitation. Winter is the wettest season, according to this research, but it sees the least amount of precipitation.

Figure 9 Excess evaporation table and graph using Hargraves formula with data supplied from NIWA

4.2 Groundwater

Figure 10 9 Depth to groundwater at Environment Canterbury's monitoring well 170 metres north of the site, red line indicates the surface level.

4.3 Sea level rise

Within 400 metres of TFC, sea level rise

Figure 11 12 Visual projection of sea level rise expected for the year 2050, with a 0.2-meter increase under the SSP2-4.5 scenario (National Institute of Water and Atmospheric Research, n.d.).

4.4 Elevation

Elevation profiles taken across different parts of the Outback (figure 13), all intersect with the most commonly flooded area. There is significant variation in elevation and a clear difference in height between the Northern and Southern ends of the Outback. In the main catchment, the lowest point is approximately 1.5m above sea level. Sharp spikes on either side of the plot indicate the location of the bund surrounding the perimeter.

Figure 13 12

Figure 14 13 Flood model of the "Outback" area at Trees For Canterbury Nursery. The model was produced from photogrammetry data collected as part of the project. The darkest blue indicates the lowest area (<2cm) and the lightest blue indicates the highest (>300cm).

The flood model of the Outback area (figure 14) highlights the catchment area based on depth. The lowest part of the Outback (2 cm depth) is the darkest shade of blue and the highest is the lightest (300cm depth). There is a second, small catchment in the southern end of the Outback, but doesn't tend to flood in such a significant manner.

groundwater being high in the TFC area it is unlikely groundwater is directly contributing to the flooding (Bouwer, 1987). However, it could be indirectly contributing as high groundwater levels reduce infiltration capacity and the soil becomes saturated more quickly (Cox et al., 2012).

5.2 Implications

As climate change intensifies it can be assumed that flooding rates will increase, although the severity in which it will, is difficult to predict (Parliamentary Commissioner for the Environment, 2015). Accuracy is improved using RCP scenarios and 1/100-year floods of which >6 have been experienced in the last 60 years (Federal Emergency Management Agency [FEMA], 2021). Assuming current emission trends these events can be expected to increase (Riahi et al., 2011). Over the coming years, TFC can expect to experience more frequent and intense flooding across the site. The site's water may also become contaminated through saline intrusion due to rising sea levels (Webb & Howard, 2010), impacting water quality at the site. A rise in sea level and increased salinity of groundwater could also lead to the degradation of soil structure (Tang et al., 2020). The impacts of flooding may be minimised in the short term with an engineered solution. The longevity and effectiveness

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