Land River Sea Consulting Limited
5/245 St Asaph Street, Christchurch
PO Box 27121, Shirley
Christchurch 8640
http://www.landriversea.com

Memorandum

Recipient Name:	Tim van Woerden
Recipient Organisation:	Otago Regional Council
Issue Date:	5 June 2024
Author:	Rose Beagley

SUBJECT: GLENORCHY FLOOD MODELLING – FLOOD HAZARD SCENARIOS

1. INTRODUCTION

Scope

Land River Sea Consulting (LRS) has been contracted by Otago Regional Council (ORC) to run a series of scenarios in the LRS Dart-Rees hydraulic model as part of the Head of Lake Wakatipu projects.

The peak depth, speed, hazard, and water surface extent results of each scenario are to then be provided to ORC in raster format for use by their risk assessment consultant.

2. MODEL

Full details of the Dart-Rees model set up can be found in "*Rees / Dart Rivers: Flood Hazard Modelling*" (Gardner, 2022), whilst a brief summary has been provided here.

- The model extent and the Dart and Rees River flow inputs are as shown in Figure 2-1.
- The Digital Elevation Model is from the 2019 LiDAR flown by LandPro.
- Roughness has been represented using a variable Manning's 'n' coefficient, and is as detailed in Gardner, 2022.
- The model has been validated against the February 2020 flood event.

Changes from the LRS 2022 Dart-Rees model include:

- Converting the existing MIKE 21 2D model into a HEC RAS (version 6.3.1) 2D model.
- Representing the Glenorchy stopbank by modifying the DEM to the surveyed crest level.
- Four additional flow inputs at the request of ORC (Figure 2-1). These represent the Buckler Burn, Bible Stream, Glenorchy, and Glenorchy landfill catchments (Figure 2-2).

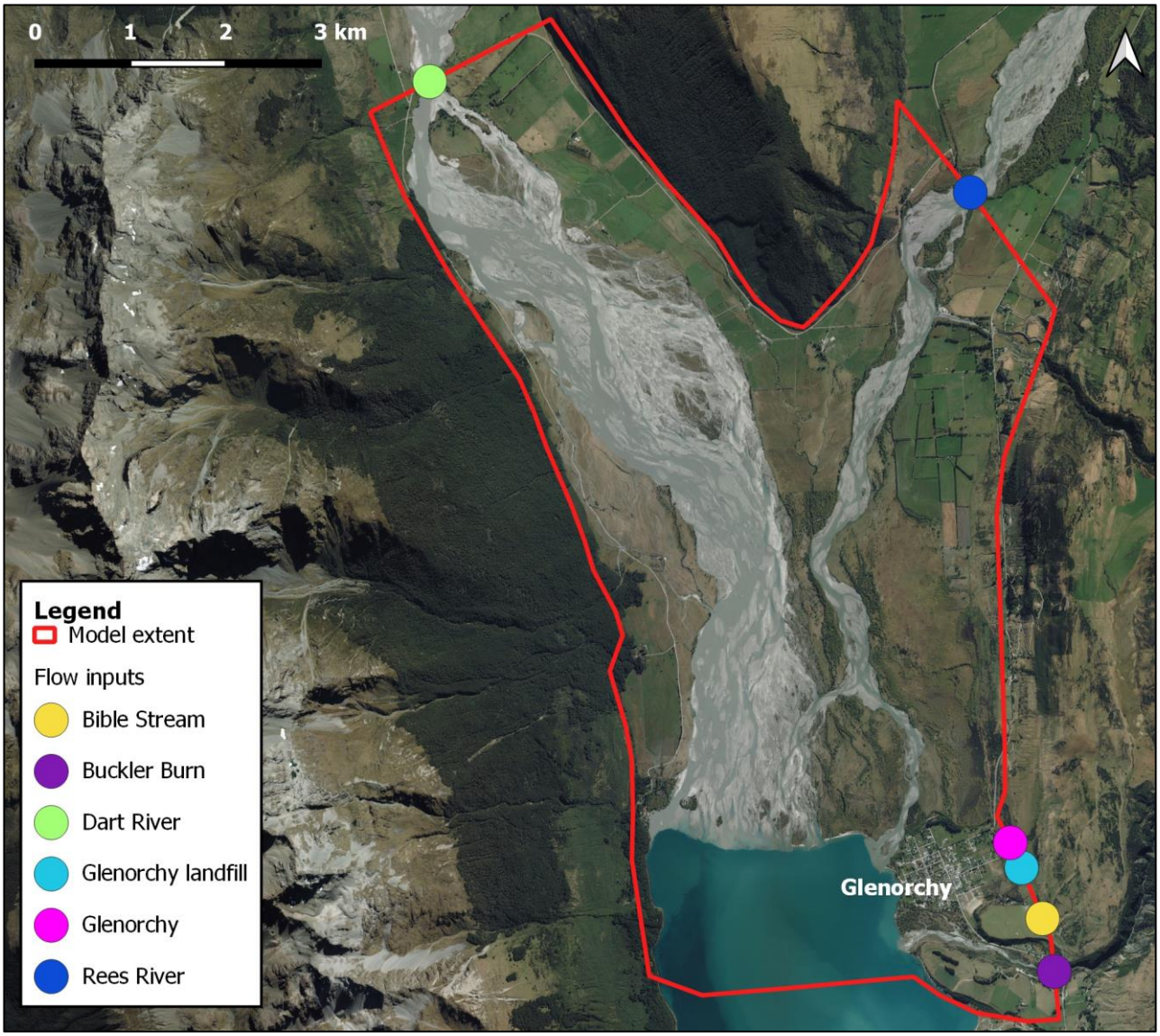


Figure 2-1: Model extent with all hydrological input points shown.

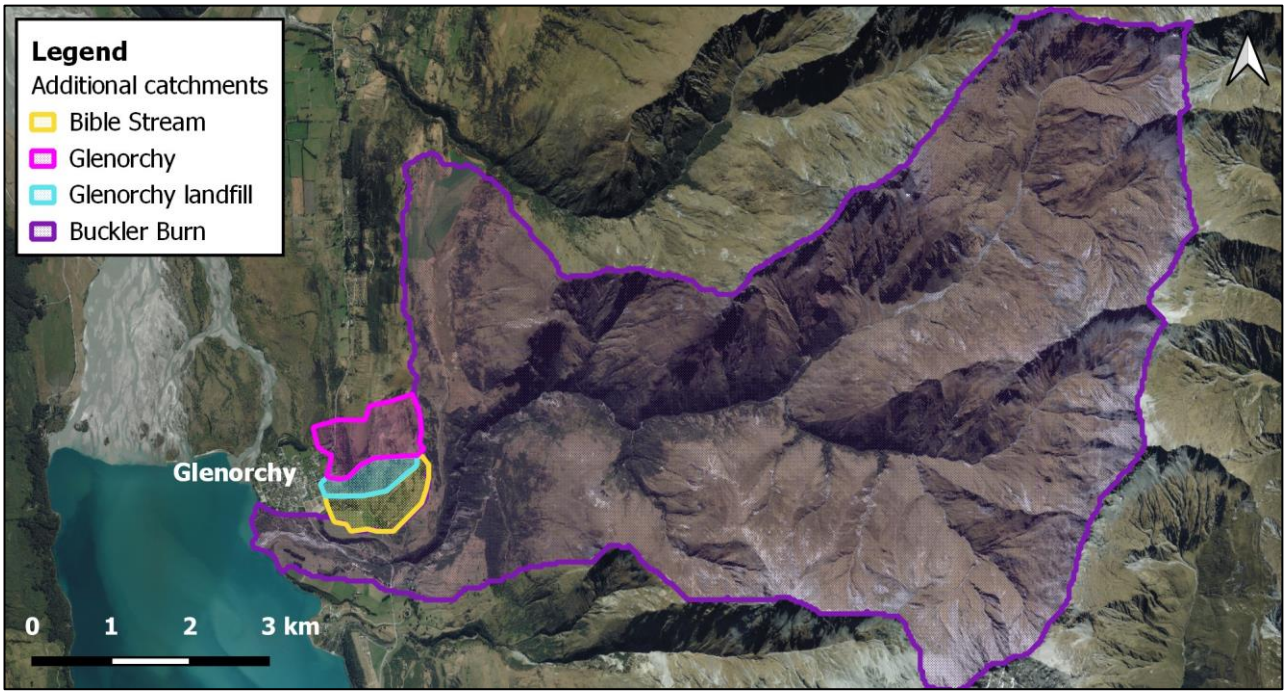


Figure 2-2: Additional catchments.

3. SCENARIOS

We have simulated three sets of scenarios as defined by ORC, resulting in a total of nine runs. Each set of scenarios has different hydrological inputs, and these have then been run with a range of annual recurrence interval (ARI) flows.

All three sets use the same 2019 LiDAR; however the Buckler Burn set includes a 1 m aggradation layer (from the previous modelling; Gardner and Beagley, 2023) on top of this.

The scenarios are outlined in Table 3-1 and the hydrological input flows and water levels defined in Table 3-2 and Table 3-3.

Table 3-1: The three sets of scenarios run in the Land River Sea – Glenorchy Flood Model.

Scenario	DEM	Hydrological inputs	Flow input ARI	Lake level ARI
Buckler Burn	2019 with 1 m aggradation scenario	Buckler Burn input and the Lake level only. No other hydrological inputs	50-year	10-year
			100-year	20-year
			500-year	100-year
Dart-Rees	2019	Dart River and Rees River inputs and the Lake level only. No other hydrological inputs	50-year	10-year
			100-year	20-year
			500-year	100-year
Joint scenario	2019 with 1 m aggradation scenario in the Buckler Burn	All hydrological inputs (Buckler Burn, Bible Stream, both Glenorchy catchments, Dart River, Rees River) and Lake level.	50-year	10-year
			100-year	20-year
			500-year	100-year

Table 3-2: Lake Wakatipu water levels (m) for the different annual recurrence interval events.

Likelihood (ARI)	Lake Wakatipu – water level (m)
10-year	311.3875
20-year	311.6921
100-year	312.5966

Table 3-3: 50, 100 and 500-year ARI flows (m^3/s) for each of the hydrological inputs in the Glenorchy flood model.

Likelihood (ARI)	Buckler Burn	Bible Stream	Glenorchy Landfill	Glenorchy	Rees River	Dart River
50-year	146	2	1	2	855	1,849
100-year	166	2	2	2	962	1,952
500-year	217	3	2	2	1,223	2,153

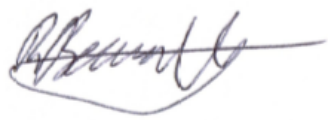
4. RESULTS

The results have been supplied electronically to ORC as raster files (TIF.), and include:

- Peak depth
- Peak speed
- Hazard
- Water surface extent

Please contact me if you need further clarification.

Kind regards,



Rose Beagley (BSc, MSc)
Geomorphologist / Water Resources Scientist
Land River Sea Consulting Ltd.