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18 January 2019

Highlander Trusts Ltd
c/o Don MacLachlan

By Email: don@lindix.co.nz

Attention: Don MacLachlan

Dear Don

**Coneburn Special Housing Area Proposal
Flood and Stormwater Management**

1.0 Introduction

Further to recent discussions on the proposed Coneburn Special Housing Area (SHA) development we have outlined below preliminary concept layouts for flood mitigation and stormwater management works for the SHA proposal.

2.0 Background

2.1 Locality

The proposed Coneburn SHA site is located 3 kilometres (km) south of Frankton and 7.5km east of Queenstown. The locality of the SHA is shown in Figure 2.1 below.

2.2 Flood Conditions

Flood flows enter the Coneburn site from the western face of the Remarkables immediately upgradient of the Coneburn site, from catchments on Peninsula Hill and via Woolshed Creek. Woolshed Creek collects runoff from the western face of Remarkables catchments to the south, Peninsula Hill and from the valley floor including pastoral and urban land use areas. Woolshed Creek flows north from the Coneburn site down the valley to the Kawarau River.

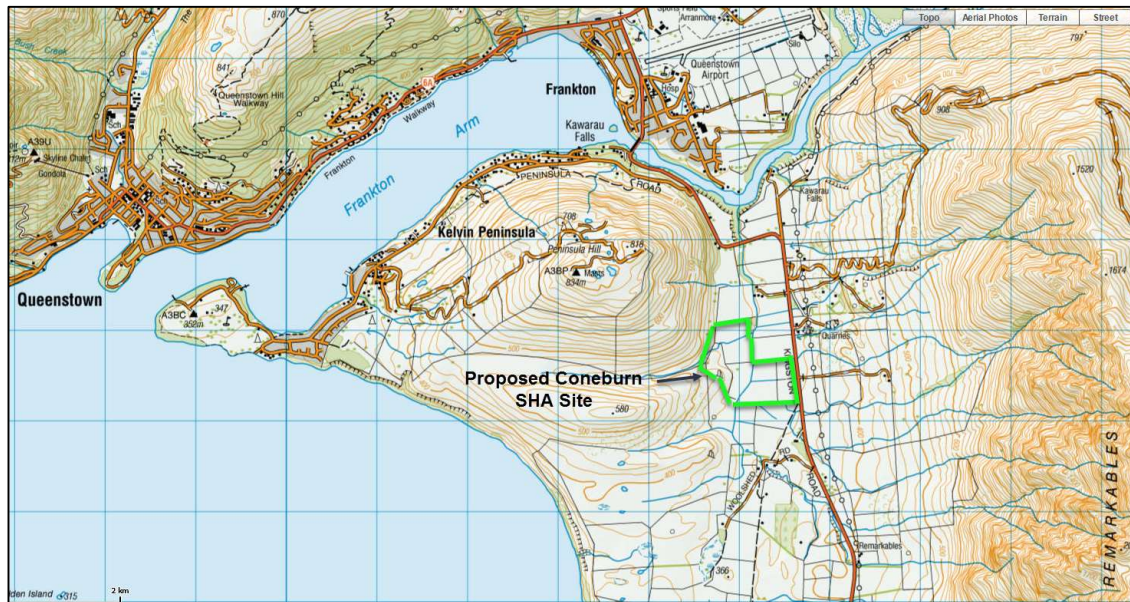
Woolshed Creek is a modified natural flow path. The modification is in the form of farm drains that convey dry weather and minor flood flows. The floor of the valley is relatively flat and Woolshed Creek has sections with little or no gradient and therefore during periods of high rainfall ponding would occur due to the limited capacity of the farm drains. Woolshed Creek discharges to the Kawarau River 1,500m downstream of the SHA site. The flow in the Kawarau River stormwater receiving waters is very large compared to the stormwater runoff

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rate from the proposed SHA site, but to the contrary, the water quality in the Kawarau River is very high.

Figure 2.1: Locality Plan Coneburn SHA Area



2.3 Natural Hazards

The Coneburn site straddles the floor of the valley between the Remarkables range and Peninsula Hill above the Kelvin Peninsula. The floor of the Woolshed Creek valley is below alluvial fans that have been created by runoff from the Remarkables Range and to a lesser extent runoff from Peninsula Hill. The Otago Regional Council Hazards Register identifies the general nature and extent of the alluvial fan activity. The nature of the alluvial fan activity within the site is defined as “recently active”, “less recently active” and “flood dominated”. A significant area of the site is identified as “recently active” alluvial fan.

The alluvial fan condition means that the flow conditions in the flow paths down an alluvial fan can vary during a flood event, and over time, such the flow paths may change course and so the flow rate may vary from place to place along the lower bounds of the fan. Flows on alluvial fans are also characterised by their sediment transport capability. At the “apex”, or upper limit of a fan, debris flows are common. Debris flows are flows with major concentrations of sand, gravels and rock plus vegetation. In the mid elevation range of a fan there is typically a mix of finer sediments and therefore flood waters are less destructive. In the lower bounds of the fan the flow conditions are flood water dominated. The “recently active” and “flood dominated” alluvial fan hazard assessment means that flows within the site may vary, but critically, are unlikely to contain debris and therefore diverting potential flows to a flood channel is a means of mitigating the hazard.

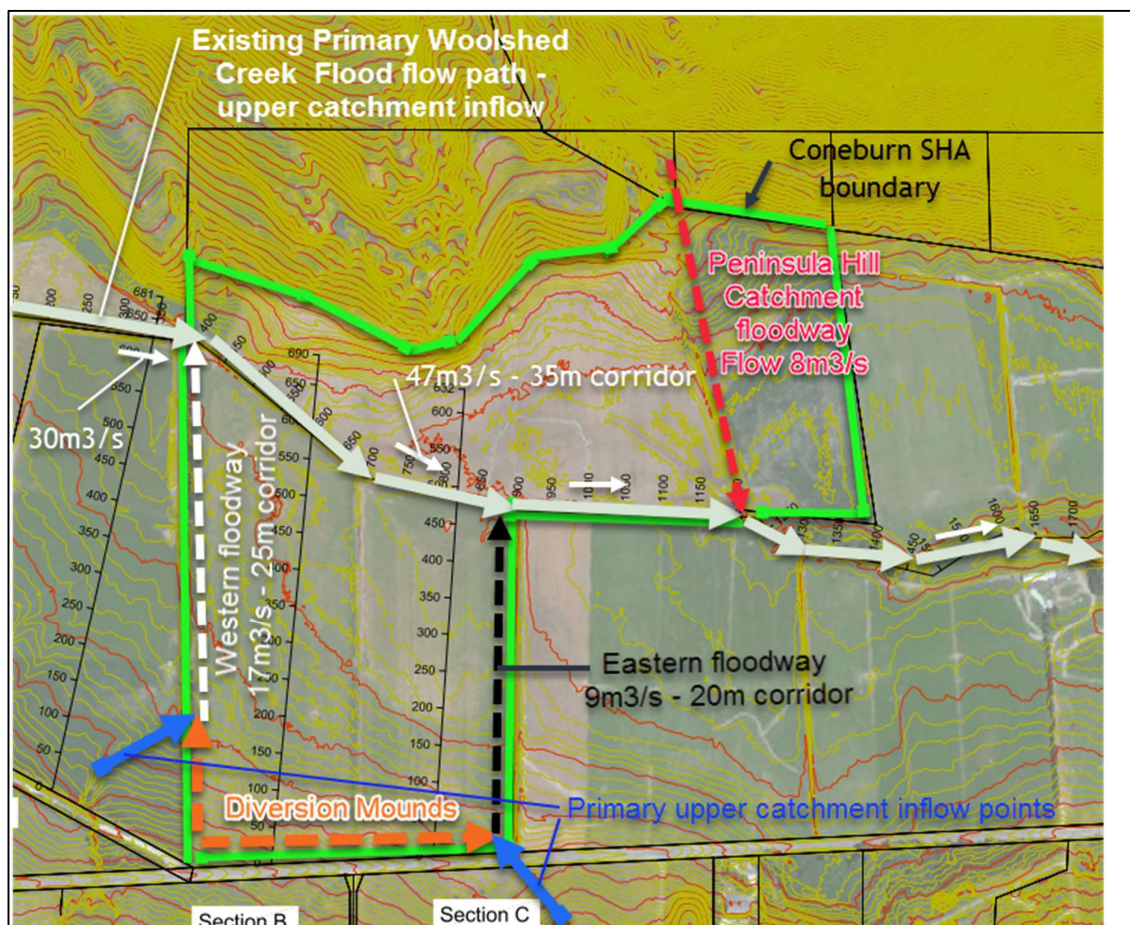
We note that the site is subject to liquefaction hazard but is addressed in detail by others and therefore is not addressed further in this letter.

3.0 Flood and Alluvial Fan Risk Management

As noted above the site is subject to flood flows down Woolshed Creek and from local streams down the alluvial fan above the SHA site. The flood and alluvial fan management works that are envisaged to mitigate flood risks to the development are illustrated in Figure 3.1 below. The flood mitigation works include the following:

- a. A flood corridor for Woolshed Creek that would manage flood levels to land within the SHA site adjacent to the Creek. The indicative flow capacity required and the indicative width of the Woolshed Creek floodway corridor is shown in Figure 3.1.
- b. Three floodway corridors within the SHA site would manage flood flows. The flood corridors would convey flood water sources from outside the site to Woolshed Creek, receive flood flows from the Diversion Mounds (see Figure 3.1) and collect sub-soil drainage system for the lower areas of the site. The subsoil drainage system, if required, would facilitate road corridor construction.
- c. Diversion mounds are proposed to provide protection from alluvial fan flows outside the recognised flow paths above the site. The diversion mounds would be constructed to divert distributed alluvial fan flows from the proposed site and therefore mitigate the alluvial fan risk.

Figure 3.1: Preliminary Flood Conveyance Concept – Indicative 100yr ARI Flow Rates



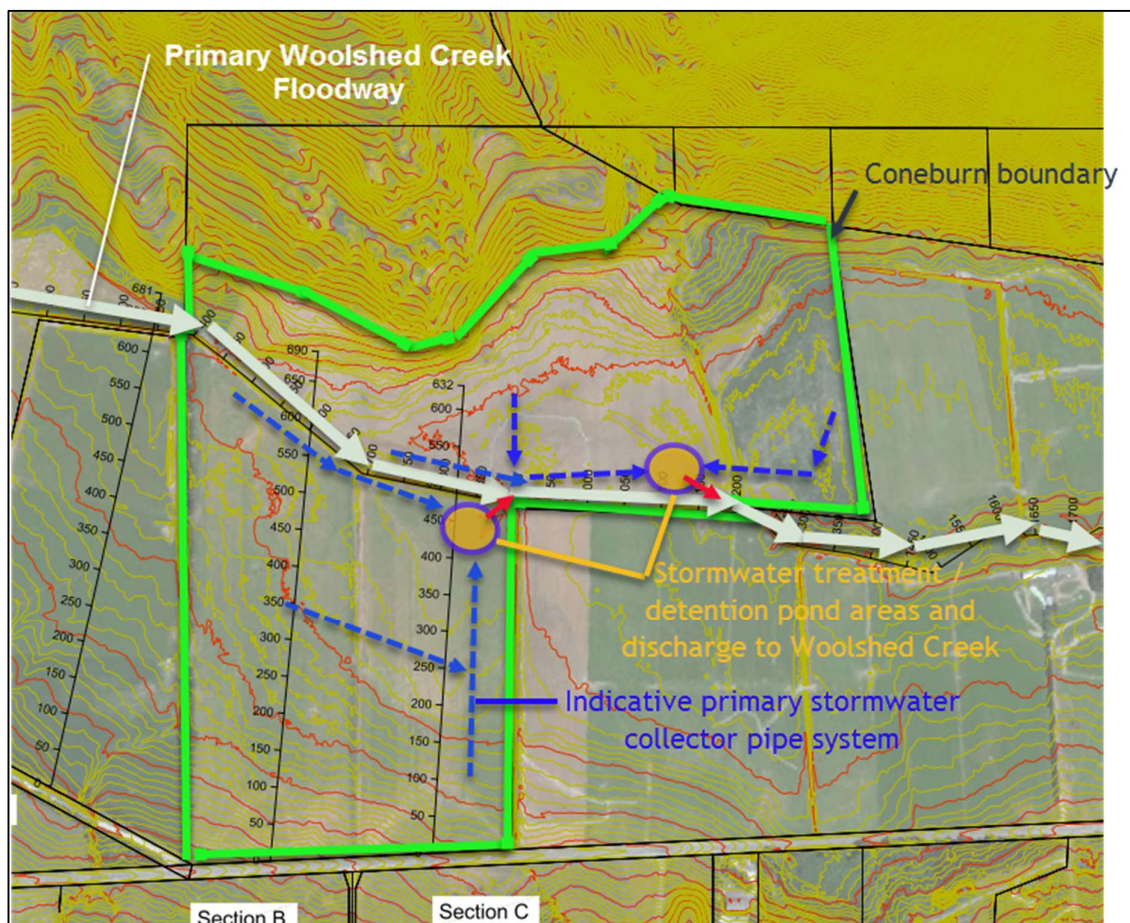
4.0 Stormwater Network Concept

A preliminary stormwater network concept is illustrated in Figure 4.1 below. The network would have the following components:

- A conventional piped stormwater collector network collecting urban stormwater runoff from lots would convey runoff under roads to a stormwater treatment pond.
- Two stormwater treatment ponds that would provide treatment for urban runoff before discharge to Woolshed Creek. The treatment ponds would be sized to remove contaminants but not provide detention for the 20year and 100year Average Recurrence Interval (ARI) flows.
- A controlled stormwater discharge structure at each stormwater treatment pond would be provided for the discharge to Woolshed Creek.

The runoff for major rainfall events from the proposed SHA development and discharge to Woolshed Creek would occur before the flood flow would arrive from the upper Remarkables catchments and therefore it is anticipated that detention storage in addition to the stormwater treatment volume would not be required.

Figure 4.1: Preliminary Stormwater Network Concept



For further clarification on the proposal for flood management and stormwater works described above please contact Gary Dent from our Dunedin office (Mobile: 027 476 3155).

Yours faithfully

FLUENT INFRASTRUCTURE SOLUTIONS LTD

Per:

Gary Dent
Senior Environmental Engineer / Director