Before the Hearing Panel
Appointed by the Waimakariri District Council

Under	the Resource Management Act 1991
In the matter of	a hearing on submissions on the proposed Waimakariri District Plan
	Hearing Stream 12: Rezoning
	Rachel Claire Hobson and Bernard Whimp
	Submission: 179 / Further submission: 90

Evidence of Stephany Pandrea

5 March 2024

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Introduction

1 My name is Stephany Pandrea.

2 I have completed a Bachelor of Civil Engineering from the University of Canterbury and I am a chartered member of Engineering New Zealand.

3 I am employed by Eliot Sinclair and Partners as a Three Waters Engineer and have held this position since 2018.

4 I have 5 years' experience in the water sector. My experience consists of design of water supply, wastewater and stormwater systems (including reticulation, treatment, detention and flood modelling), for small to large residential and commercial developments. My involvement ranges from concept to detailed design, project management, construction monitoring and erosion sediment control management.

5 I have prepared the Infrastructure Assessment (attached as **Appendix A**) and Flood Impact Assessment (attached as **Appendix B**) in respect of the submission of Rachel Claire Hobson and Bernard Whimp (**the Submitters**), relating to the following land (**the Site**):

(a) 518 Rangiora-Woodend Road, Rangiora;[1] and

(b) 4 Golf Links Road, Rangiora.[2]

6 The Submitters seek an extension of the North East Rangiora or South East Rangiora Development Area overlay to include the Site within a Future Development Area (**FDA**); and the rezoning of the Site from Rural to General Residential.

7 This evidence provides a summary of my:

(a) Infrastructure Assessment, attached as Appendix A

(b) Flood Impact Assessment, attached as Appendix B.

Code of Conduct for Expert Witnesses

8 While this is not a hearing before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023 and that I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person,

[1] Legal description Part Rural Section 1054

[2] Legal description Lot 2 DP 16884

this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Infrastructure Summary

Wastewater

9 The nearest connection point to the Waimakariri District Council (**WDC**) wastewater infrastructure is the wastewater gravity main located within Kippenberger Avenue approximately 350m from the Site, as shown in Figure 1 below. WDC have advised that there is currently no capacity within this existing network, and no plans to increase capacity to service developments east of Golf Links Road including this proposed development.

10 Upgrades to the WDC owned wastewater pressure main between Kippenberger Ave and the Rangiora WWTP are currently taking place, as part of the nearby Belgrove development. However, WDC have advised that the proposed Belgrove development wastewater system has not been sized with any spare capacity for residential development at this Site.

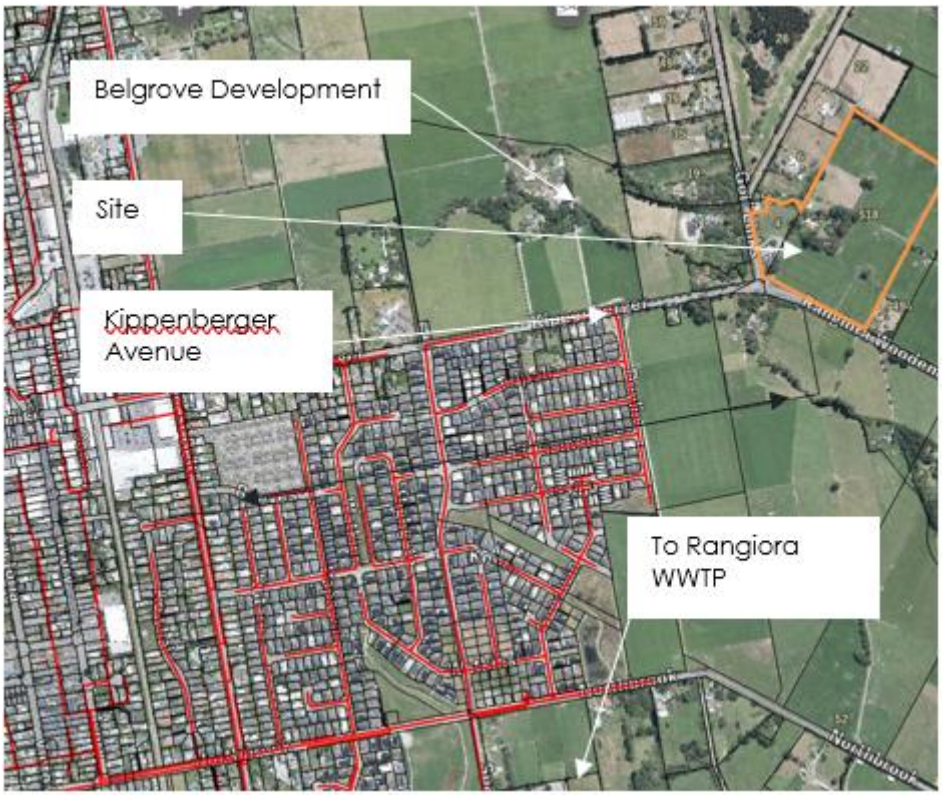

Figure 1 WDC Wastewater Assets

11 WDC have advised that there are two potential options to dispose of wastewater flows arising from the proposed residential development:

(a) Option 1 – Further upsizing of the existing pressure main between Kippenberger Ave and the Rangiora WWTP to discharge wastewater from the Site to the Rangiora WWTP.

(b) Option 2 – Construct an additional new pressure main between Kippenberger Ave and the Rangiora WWTP in parallel with the existing pressure main.

Water Supply

12 The closest existing water supply connection point is a WDC owned 200 mm diameter water main located at the Kippenberger Avenue and Devlin Avenue, located approximately 350m away from the south-west corner of the Site boundary. Refer to Figure 2.

13 To provide water supply for the development, a connection is proposed to the nearest existing WDC water supply network, which is the 200 mm diameter water main located at the Kippenberger Avenue and Devlin Avenue. A new water main would need to be extended approximately 350m along Kippenberger Avenue from the Site to this connection point.

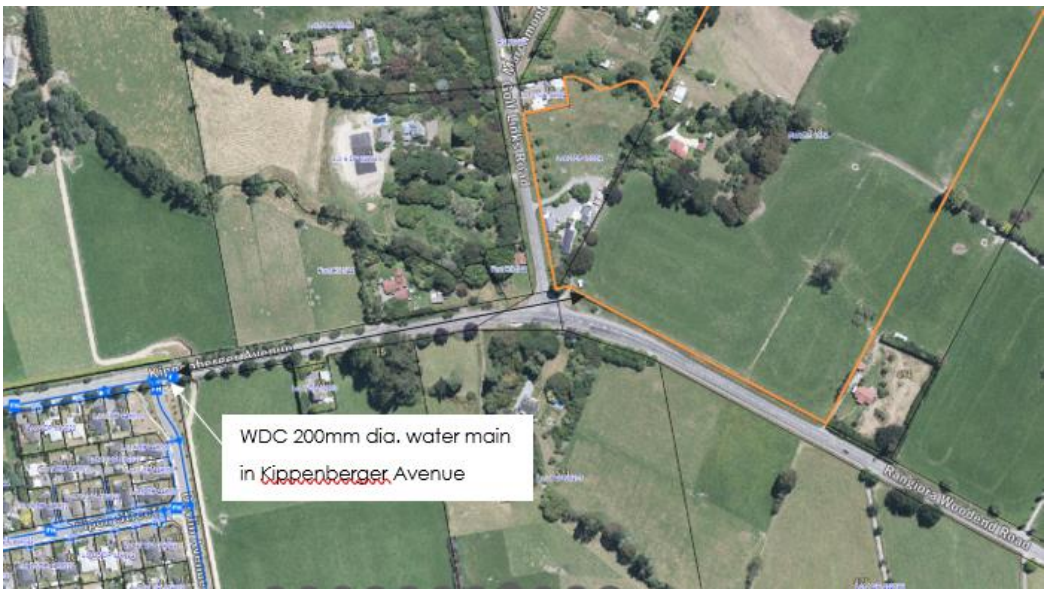

Figure 2 Water Supply Connection Points

14 WDC has confirmed that there is insufficient capacity within the existing WDC water supply network to service this Site. However, with some upgrades to the existing WDC water supply network (at the applicants cost), a water supply could be provided to the Site. WDC would need to carry out an investigation to confirm what upgrades are required to service the Site. This could be carried out at subdivision consent stage.

Stormwater

15 An existing WDC owned natural stormwater channel called Taranaki Stream (WDC Asset Number SW001221) runs through the centre of the Site as shown in Figure 3 below. Also, an ephemeral overland flow path runs through the north-west quadrant of the Site and joins with the Taranaki Stream.

Figure 3 Existing Waterways

16 Due to the Site topography, it is considered appropriate that stormwater from the north part of the Site discharges to the existing Taranaki Stream and the southern part of the Site discharges to the existing roadside drain along Rangiora Woodend Road. WDC has confirmed this is acceptable.

17 It is proposed that stormwater runoff from the Site will be conveyed via a network of roadside channels, sumps and pipes or swales to two Stormwater Management Areas (SMA). SMA 1 is proposed to be located on the north side of Taranaki Stream and SMA 2 located on the south side of Taranaki Stream in order to suit the Site topography as shown in Figure 4 below.

Figure 4 Proposed Indicative Stormwater Layout

18 WDC requires that stormwater treatment and attenuation is provided for the development down to pre-development discharge flow rates for all events up to the 50 year ARI critical duration storm event. We expect that WDC would also require stormwater pre-treatment. These requirements can be achieved within the proposed SMA, through a combination of first flush basins, detention basins and restricted outlets to the Taranaki Stream and Rangiora Woodend Road roadside drain.

19 During extreme rainfall above the SMA capacity, the North SMA will overflow into the Taranaki Stream and the south SMA will overflow into Rangiora Woodend Road roadside drain as a secondary flow path.

Utility Services

20 Utility service providers (Chorus, Enable and Mainpower) have provided high-level comments that the proposed development can be supplied by their networks.

Flood Impact Assessment Summary

21 Taranaki Stream and a tributary of Taranaki stream, combine into one overland flow path crossing the site from West to East. Additionally, some minor secondary overland flow paths cross the site from the North to the East boundary. The Waimakariri Flood Hazard maps indicate that the flood hazard for a 200 year event within the Taranaki Stream is Low to Medium.[3]

22 Flood modelling, using Hydrologic Engineering Center River Analysis (**HEC RAS**) software, has been carried out to determine the 200 year flood effects of the proposed residential development at the Site on the surrounding properties and roads.

23 Pre and post-development scenarios were modelled within the proposed development area and surrounding properties. The pre-development flood depths were calibrated against the Waimakariri flood model. The post-development model surface includes the new carriageways, new stormwater management areas and raised lot levels within the Site.

24 A comparison between pre and post-development 200 year flood depths, shown in Figure 1 below, indicate the following flood depth increases within the Rangiora Woodend Road and the neighbouring properties:

Table 1. Flood Depth Effects at Surrounding Properties

Property Address	Increase in Flood Depths (mm)	Comments
Lot 1 DP 75813	0-225	As shown in Figure 5, the increase in flood depth has not affected any dwellings and this depth increase is within the tributary of Taranaki Stream within pastured area of the property.
Lot 2 DP 75813	0-155	As shown in Figure 5, the increase in flood depth has not affected any dwellings and this depth increase is within the pastured area of property. A swale is provided along the North-West boundary of proposed site to divert the overland flow path towards the Taranaki Stream tributary.
Lot 3 DP 75813	0-410	As shown in Figure 5, the increase in flood depth is within the pastured area of the property. A swale is

[3] Refer Flood Impact Assessment, Figure 4.

Property Address	Increase in Flood Depths (mm)	Comments
		provided along the North-East boundary of the proposed site to divert the overland flow path around the development site.
Lot 1 DP 452196	0-90	As shown in Figure 5, the increase in flood depth has not affected any dwellings and this depth increase is within the pastured area of property.
RS 2332	0-100	As shown in Figure 5, the increase in flood depth has not affected any dwelling and this increase in flood depth is within the pastured area of property.
Rangiora Woodend Road	60 at road centreline, 100 at the road edge	As shown in Figure 5.

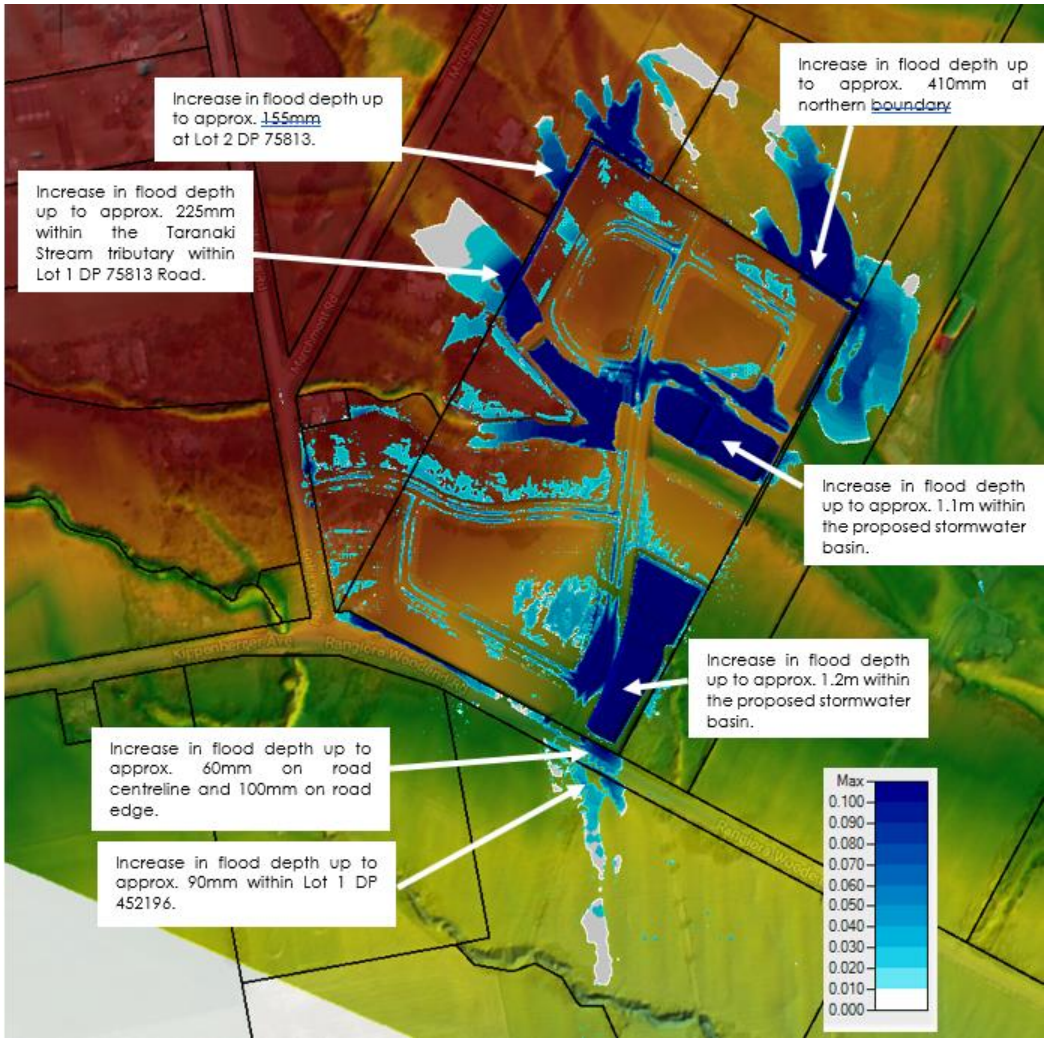

Figure 5 Post-development vs Pre-development Difference Map

25 The Flood Hazard (angular momentum) effects on pedestrians and vehicles within the development site has also been assessed. The Austroads Guide to Road

Design, Part 5: Drainage Design specifies that the maximum safety criteria within flood waters is an angular momentum of 0.4 m^2/s for pedestrians and 0.6 m^2/s for vehicles. Figure 6 shows a map of the Flood Hazard for the post-development scenario. As indicated the values within the proposed carriageways are less than 0.4 m^2/s which satisfies the pedestrian and vehicle safety criteria. Although the flood hazard values have increased along Rangiora Woodend Road, the highest value is 0.0165 m2/s which is less than 0.4m^2/s therefore the Austroads safety criteria for pedestrians and vehicles is still satisfied. Values higher than 0.4 m2/s are only indicated within the waterways.

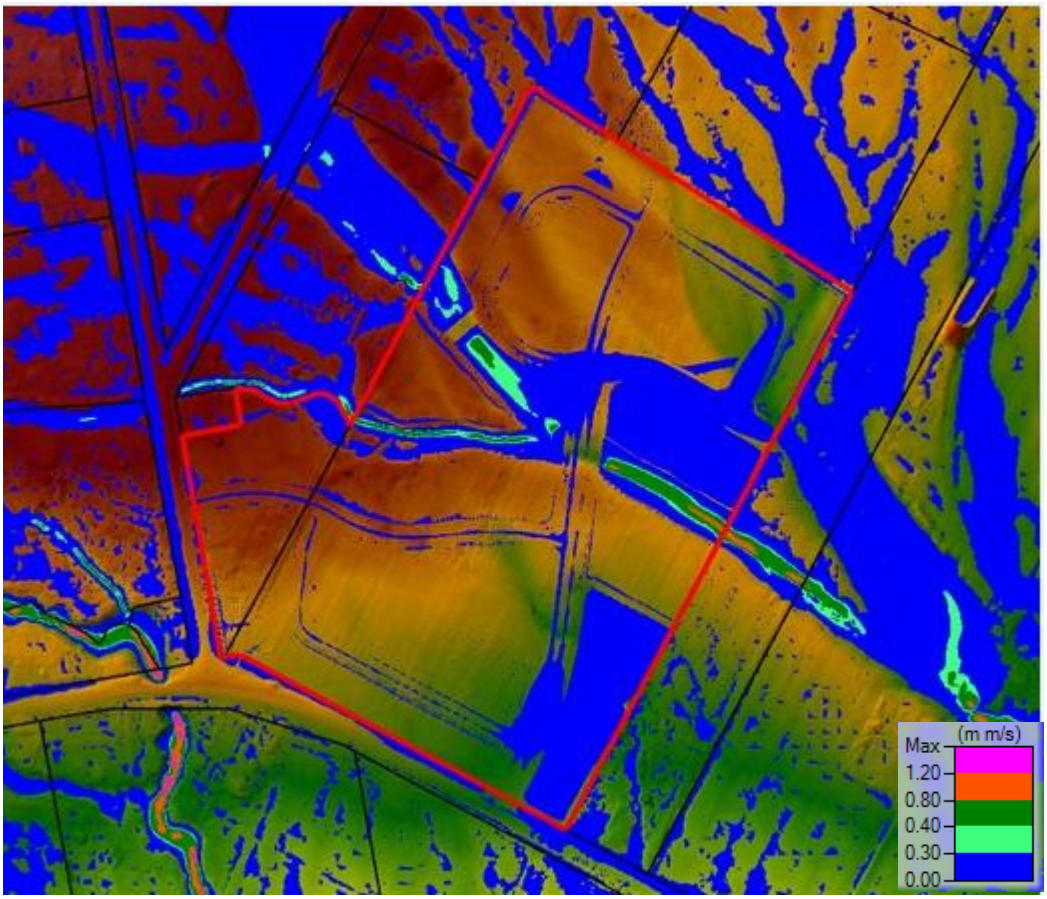

Figure 6 Post-development Map of Flood Hazard

26 The post-development flood model for the Site (as shown in section 6) has maximum flood depths of 0.3m along the carriageways and depths greater than 0.3m within the existing waterways, therefore it is considered that parts of the site are Low Hazard and parts Medium Hazard Flood areas. It is recommended that all the residential dwellings are set 500mm above the 200yr ARI flood level in accordance with Waimakariri District Council Medium Hazard Flood area requirement.

Conclusion

27 I support future residential development through an extension of the FDA to include the Site.

28 While there is currently no water supply or wastewater infrastructure on Rangiora Woodend or Golf Links Road, existing infrastructure is close to the Site and the Submitter is prepared to discuss potential upgrades to existing networks with WDC.

29 Provision is made within the ODP for appropriate treatment and discharge of stormwater.

30 In a 200 year event the flood hazard on the Site (within Taranaki Stream) is Low to Medium. In a 200 year flood event modelling predicts that the basin areas capture the majority of the flood flow. While there is flood depth increases within Rangiora Woodend Road and the neighbouring properties between 5mm and 410mm, the flooding occurs within pasture land and is unlikely to affect any dwellings.

31 I recommend that all the residential dwellings are set 500mm above the 200yr ARI flood level in accordance with Waimakariri District Council Medium Hazard Flood area requirement.

Dated 5 March 2024
Stephany Pandrea

Infrastructure Servicing Report

518 Rangiora Woodend Road and 4 Gold Links Road

Prepared for CVI Projects Limited

511185

eliot sinclair

Infrastructure Servicing Report

518 Rangiora Woodend Road and 4 Gold Links Road

Prepared for CVI Projects Limited

511185

Quality Control Certificate

Eliot Sinclair & Partners Limited

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Status:	A		
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Version History

Status	Description	Author	Release Date
A	First issue of document	SC	21 November 2023

Contents

1. Introduction

Eliot Sinclair has been engaged by CVI Projects Limited to carry out an infrastructure services assessment to assist with the rezoning application of "the Site" at 518 Rangiora Woodend Road and 4 Golf Links Road, Rangiora from rural to residential use.

This report addresses the serving requirements for earthworks, roading, stormwater, wastewater, water supply and utility services.

Refer to **Appendix A** for the proposed development concept masterplan layout.

2. Existing Site

2.1. Location and Surrounds

The Site address is 518 Rangiora Woodend Road and 4 Golf Links Road as shown in Figure 1 below. The area of the Site is approximately 11.3 Ha and consists of the following allotments:

- Lot 2 DP 16884
- Part RS 1054

Figure 1: Site Location Plan

There are two existing residential dwellings with various associated structures on the Site, the remainder of the Site is pasture. The north part of the Site falls from the north-west to the north-east and the south part of the Site falls from the north-west to the south-east.

2.2. Surface Waters

The Cam River / Ruataniwha crosses the Rangiora Woodend Road to the west of the Site. Taranaki Stream is an existing Waimakariri District Council (WDC) owned natural ephemeral stormwater channel (WDC Asset Number SW001221) that runs through the Site. There is also an ephemeral overland flow path runs through the north-west quadrant of the Site and joins with the Taranaki Stream. Refer to Figure 2 below for existing waterways within the Site and nearby.

Figure 2: Existing Waterways

2.3. Geology and Hydrogeology

The GNS Geological Map of New Zealand indicates that the geology in this area comprises Holocene river deposits (modern river floodplain/low-level degradation terrace, un-weathered, variably sorted gravel/sand/silt/clay).

Groundwater depth across the Site varies between 2m to 8m bgl based on available ECan well information.

2.4. Contamination

The 4 Golf Links Road Site is listed on the Environment Canterbury Listed Land Use Register (LLUR) and the Hazardous Activities and Industries List (HAIL) activity indicated on this Site is the "Persistent pesticide bulk storage and use". **Appendix B** provides the property statement from the LLUR. Further

advice from a suitably qualified and experienced practitioner will be required to confirm if further reporting and subsequent remediation works will be required to comply with the National Environmental Standard for assessing and Managing Contaminants in Soil to Protect Human Health (NESCS).

3. Potential for Development

At this stage, the proposed subdivision layout has not been confirmed, however it is assumed that a proposed residential development will comprise of approximately 140 residential lots, associated roading and two stormwater management areas.

Figure 3 shows the proposed development concept layout.

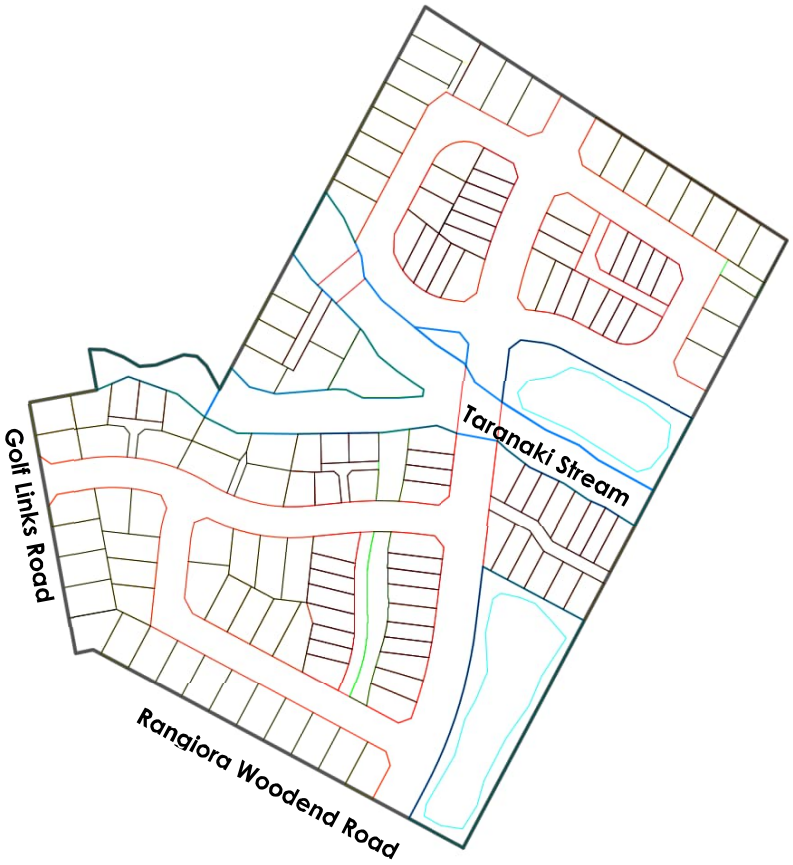


Figure 3 Proposed Indicative Development Layout

4. Earthworks

Earthworks will be required to construct road carriageways, form the stormwater basins, install services and fill the lots to achieve acceptable building Finished Floor Levels.

Where ground levels need to be raised to enable allotments to comply with the minimum flood levels, this shall be achieved, by placing controlled, compacted fill in accordance with to NZS 4431:2022.

Lots will be filled so that the minimum lot level at the center of the lot will be at least 175mm above the combined 0.5% Annual Exceedance Probability (AEP) flood event so that a 400mm freeboard to the dwelling Finished Flood Level (FFL) can be achieved (assuming that the top of foundation is 225mm above ground in accordance with Building Code E1/AS1 and E2).

The finished surface of each allotment will be filled (sloping down to the front boundary adjacent to the driveway at a grade of 1:300). The slope across the lots will ensure site drainage is towards the Roads and Right of Ways and associated stormwater conveyance infrastructure.

All bulk filling will be compacted in accordance with NZS 4431:2022 and all fill testing will be carried out by an independent laboratory.

A soils Californian Bearing Ratio (CBR) of 6% has been adopted for preliminary pavement design in the proposed Roads and Right of Ways. Further testing will be carried out during detailed design to confirm the design CBR and the exposed subgrade will be CBR tested during construction to define the required formation depth with more accuracy.

The earthworks cut and fill plan is included in **Appendix C**.

5. Roading

The proposed plan change area will connect to Rangiora Woodend Road and Golf Links Road via new local roads and new intersections, as shown in the proposed development concept masterplan layout in **Appendix A**.

Proposed road carriageway widths will facilitate two-way traffic. Standard kerb and channel will contain the carriageway formations and convey stormwater runoff to sump inlets. Roads will be sealed predominantly with a 2 Coat Chipseal or with Asphaltic Concrete. All roads will incorporate footpaths and landscaped berms. Typical road and Right of Way cross sections are included in **Appendix D**.

6. Water Supply

6.1. Existing Water Supply Network

There is no WDC water supply infrastructure within the vicinity of the development Site within Golf Links Road or Rangiora Woodend Road.

The closest existing water supply connection point is a WDC owned 200 mm diameter water main located at the Kippenberger Avenue and Devlin Avenue, located approximately 350m away from the south-west corner of the Site boundary as shown in Figure 4.

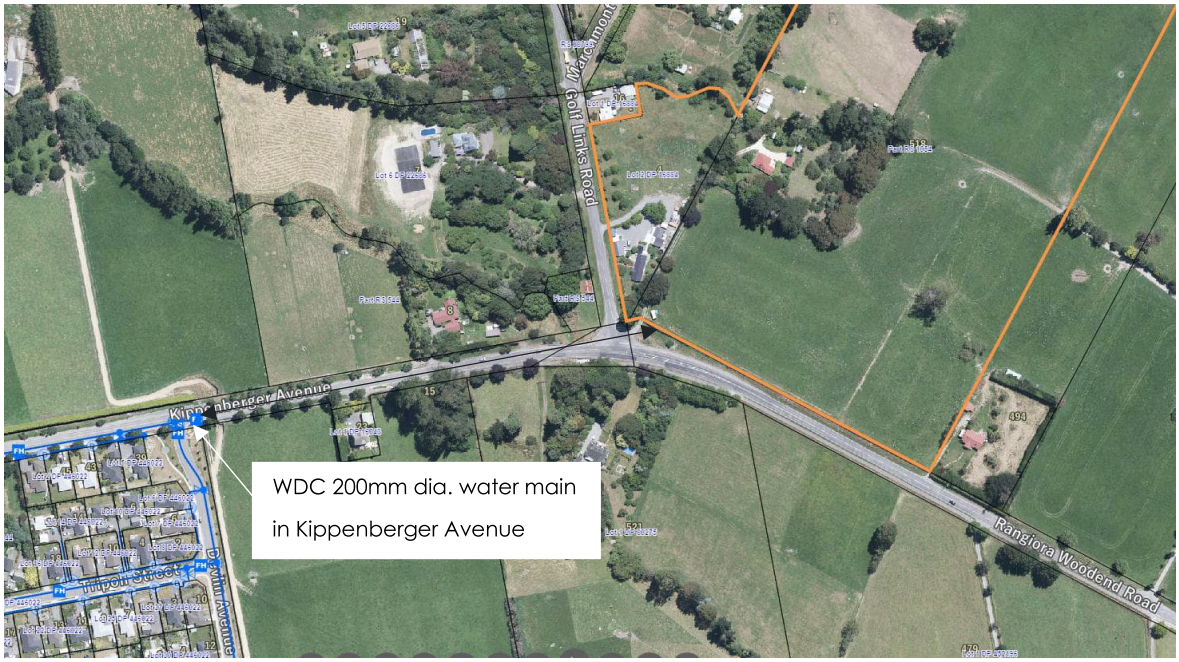


Figure 4: Water Supply Connection Points

6.2. Proposed Water Supply Connection

The Waimakariri District Council (WDC) Engineering Code of Practice (ECoP) indicates a peak potable water supply demand of 0.1 L/s/dwelling, therefore the peak demand to service the development is estimated to be 14 L/s based on an assumed 140 lot development.

It is anticipated for the residential subdivision an appropriate firefighting water category is FW2, requiring a supply demand of 25 L/s (in accordance with the SNZ PAS 4509:2008 New Zealand Fire Service Firefighting Water Supplies Code of Practice. The total demand for the Site could be conservatively calculated as 2/3 of peak potable demand + fire demand resulting in 33.4 L/s.

The water supply network within the development Site will need to be modelled at subdivision consent stage to demonstrate that it is sized to meet the minimum residual pressures under potable flows and fire-fighting flows.

To provide water supply for the development, a connection is proposed to the nearest existing WDC water supply network, which is the 200 mm diameter water main located at the Kippenberger Avenue and Devlin Avenue. A new water main would need to be extended approximately 350m along Kippenberger Avenue from the Site to this connection point.

WDC has confirmed that there is insufficient capacity within the existing WDC water supply network to service this Site. However, with some upgrades to the existing WDC water supply network (at the applicants cost), a water supply could be provided to the Site. WDC would need to carry out an investigation to confirm what upgrades are required to service the Site. This could be carried out at subdivision consent stage.

7. Wastewater

7.1. Existing Wastewater Network

There is no WDC wastewater infrastructure within the vicinity of the proposed development, within Golf Links Road or Rangiora Woodend Road, as shown in Figure 5 below.

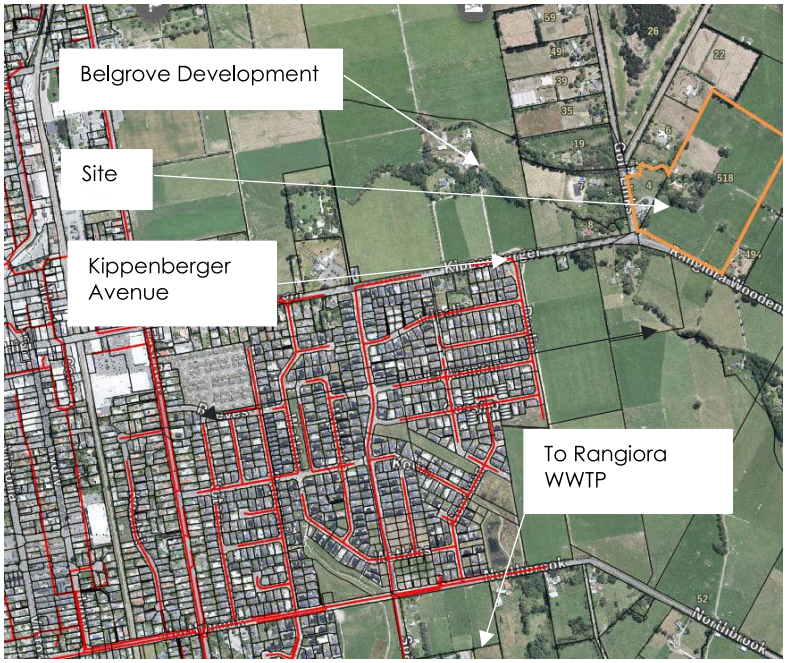


Figure 5: WDC Wastewater Assets

The nearest connection point would be to the DN150 wastewater gravity main within Kippenberger Avenue. The Rangiora Wastewater Treatment Plant (WWTP) is located on Marsh Road.

WDC have advised that there is no capacity within their existing network, or any plans, to service developments east of Golf Links Road including this proposed development. Refer to **Appendix E** for correspondence.

Currently some Council owned infrastructure upgrades are taking place to the wastewater pressure main between Kippenberger Ave and the Rangiora WWTP, as part of the nearby Belgrove development. However, WDC have advised that the proposed Belgrove development wastewater system has not been sized with any spare capacity for residential development at this Site. The wastewater infrastructure that the Belgrove development will be installing has not yet been constructed, however, realistically the planned upgrades are likely to have already been undertaken before any proposed development proceeds.

Retrospective upsizing of the Belgrove development wastewater infrastructure upgrades between Kippenberger Avenue and the Rangiora WWTP could be considered.

There will be some time dependant capacity in the short to medium once all Belgrove development wastewater upgrades are undertaken, however further work would be required to determine how much short-term capacity is available, when additional upgrades would be needed and what additional financial contributions would be needed to pay for these future upgrades.

7.2. Proposed Wastewater Network

The proposed development with an estimate of 140 residential lots, would generate a wastewater design flowrate of 1.09 L/s or 94.5 m^3/day for the average dry weather flow (ADWF), 2.73 L/s for the peak dry weather flow (PDWF) and 8.2 L/s for the peak wet weather flow (PWWF) when calculated in accordance with WDC ECoP Section 6.5.6 wastewater design criteria.

7.2.1. Connection to WDC Wastewater Network

WDC have advised that there are two potential options to dispose of wastewater flows arising from the proposed residential development:

- Option 1 – Further upsizing of the existing pressure main between Kippenberger Ave and the Rangiora WWTP to discharge wastewater from the Site to the Rangiora WWTP.
- Option 2 – Construct an additional new pressure main between Kippenberger Ave and the Rangiora WWTP in parallel with the existing pressure main.

For either of the above options the pressure main within Kippenberger Ave will need to be extended to the Site frontage.

7.2.2. Internal Wastewater Network

It is proposed that the development will discharge wastewater to the pressure main within Kippenberger Ave which will need to be extended to the Site frontage. At least one pump or lift station will be required on the Site to convey wastewater to this wastewater pressure main.

There are two options for providing wastewater within the development Site:

- Option 1 – This option would require a gravity sewer system within the Site to convey wastewater flows from individual dwellings to a new centralised wastewater pump station which would pump to the pressure main within Kippenberger Ave.
- Option 2 – A Low Pressure Sewer network is an alternative option for servicing the Site for wastewater. Individual low-pressure sewer pumping stations would be located on each of the future allotments and would be owned and operated by each property owner. These would pump into a common rising main vested in WDC which would be located in the new roads and will connect to the pressure main within Kippenberger Ave. With this system the LPS pumps can be controlled remotely to buffer peak flows by using the storage volume on each lot to defer pumping.

Discussions with WDC will be required at detailed design to confirm emergency storage requirements for either system as well as the upgrades required to service the development for wastewater.

8. Stormwater

8.1. Existing Waterways and Stormwater Discharge Points

An existing WDC owned natural stormwater channel called Taranaki Stream (WDC Asset Number SW001221) runs through the centre of the Site as shown in Figure 6 below. Also, an ephemeral overland flow path runs through the north-west quadrant of the Site and joins with the Taranaki Stream.

Figure 6: Existing Waterways

Due to the Site topography, it is considered appropriate that stormwater from the north part of the Site discharges to the existing Taranaki Stream and the southern part of the Site discharges to the existing roadside drain along Rangiora Woodend Road.

WDC has confirmed that development stormwater can discharge to the existing Taranaki Stream ephemeral drain crossing the Site and the roadside drain along Rangiora Woodend Road, refer to **Appendix E** for WDC correspondence.

Stormwater discharge to ground has not been investigated for this development at this stage. This could be investigated at detailed design stage to confirm if it is a feasible option as an alternative to discharging to the existing waterways.

8.2. Proposed Primary Stormwater System

It is proposed that stormwater runoff from the Site will be conveyed via a network of roadside channels, sumps and pipes or swales to two Stormwater Management Areas (SMA). SMA 1 is proposed to be located on the north side and SMA 2 located on the south side of Taranaki Stream in order to suit the Site topography as shown in Figure 7 below.

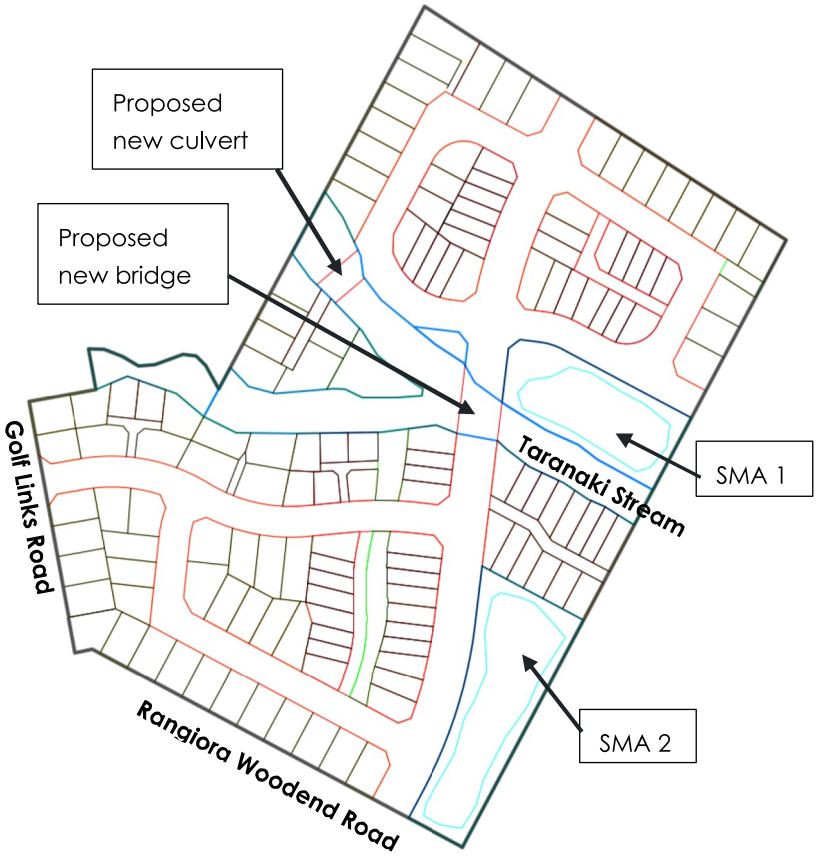


Figure 7 Proposed Indicative Development Layout

The primary stormwater conveyance system will be designed to accommodate the 20% AEP storm event in accordance with the Waimakariri Engineering Code of Practice.

Stormwater discharges from lots will be to the kerb via a PVC kerb entry adaptor. However, should it not be possible to discharge via a kerb entry adaptor, stormwater will be discharged to roadside pipe reticulation either via direct entry lateral or a bubble up sump within the roadside channel.

A new culvert for a road crossing is proposed within the tributary of Taranaki Stream and another culvert within Taranaki Stream.

8.3. Proposed Stormwater Management Area

WDC requires that stormwater treatment and attenuation is required for the development down to pre-development discharge flow rates for all events up to the 50 year ARI critical duration storm event, refer to correspondence in **Appendix E**.

We expect that WDC would also require stormwater pre-treatment. It is proposed that this is provided via forebays.

The following options are proposed for stormwater treatment:

i) First flush basins

ii) Wetlands

Wetlands are considered suitable in areas with high groundwater table and first flush basins require a 1m separation from the groundwater table. Since the groundwater levels are expected to be low, first flush dry basins are considered more suitable than wetlands for stormwater treatment on this Site. However, the groundwater level should be confirmed at detailed design stage to confirm the most appropriate stormwater treatment solution.

Therefore, it is proposed that each SMA will consist of a forebay, first flush basin and a detention basin. The first flush basins will be sized to treat the first 25mm rainfall depth. Overall, the SMAs will be sized to detain stormwater runoff from the Site for all events up to and including the 2% AEP storm event for the 24 hour duration. It is proposed that the first flush basins will discharge to the detention basins over a 4 day period, via a controlled outlet and swales are provided within the detention basins to provide an extra level of treatment of the first flush flows. Figure 8 shows the indicative proposed stormwater treatment and attenuation system.

The detention basins will also have a restricted outlet which will discharge attenuated flows to the Taranaki Stream and the Rangiora Woodend Road roadside drain. The practical depth of the SMAs is limited by the invert of these discharge points.

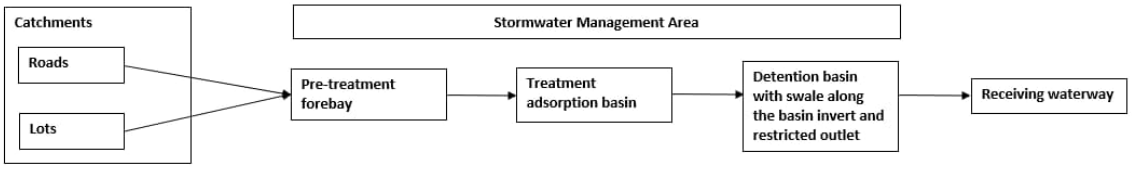


Figure 8: Stormwater Treatment and Attenuation System

The sizing calculations assume the basins will have a 3 m wide access track around the perimeter. The basin calculations have been based on HIRDS RCP 8.5 rainfall data and a runoff coefficient of 0.65.

Preliminary calculations indicate that the required volume for the SMAs is as shown in Table 1 below.

Table 1 – Preliminary SMA Volumes and Areas

Characteristic	North Basin	South Basin
Residential Catchment Area (ha)	4.67	6.39
Detention Required Volume 2% AEP 24 hour (m3)	1790	2380
First Flush Required Volume (m3)	760	1038
First Flush Basin Area (m2)	3014	1351
Detention Basin Area (m2)	2462	2211
Total Area including access tracks (m2)	6417	4748

8.4. Proposed Secondary Flow Path

Stormwater runoff flow rates beyond the pipe or sump capacities will discharge into the internal road network and will be conveyed within the road reserve into the SMAs which have sufficient capacity to ensure post development discharges will not be greater than the pre development for all rainfall events up to 2% AEP 24 hours. During extreme rainfall above the 2% SMA capacity, the North SMA will overflow into the Taranaki Stream and the south SMA will overflow into Rangiora Woodend Road roadside drain.

9. Flood Hazard Investigation

The WDC flood modelling results indicate areas within the Site that could be susceptible to flooding in a 200-year ARI flood resulting from heavy rainfall. Refer to Figure 9 below for the predicted SDC 200-year ARI flooding model results. These model results predict flood depths up to 1.0m within the Taranaki Stream crossing the Site.

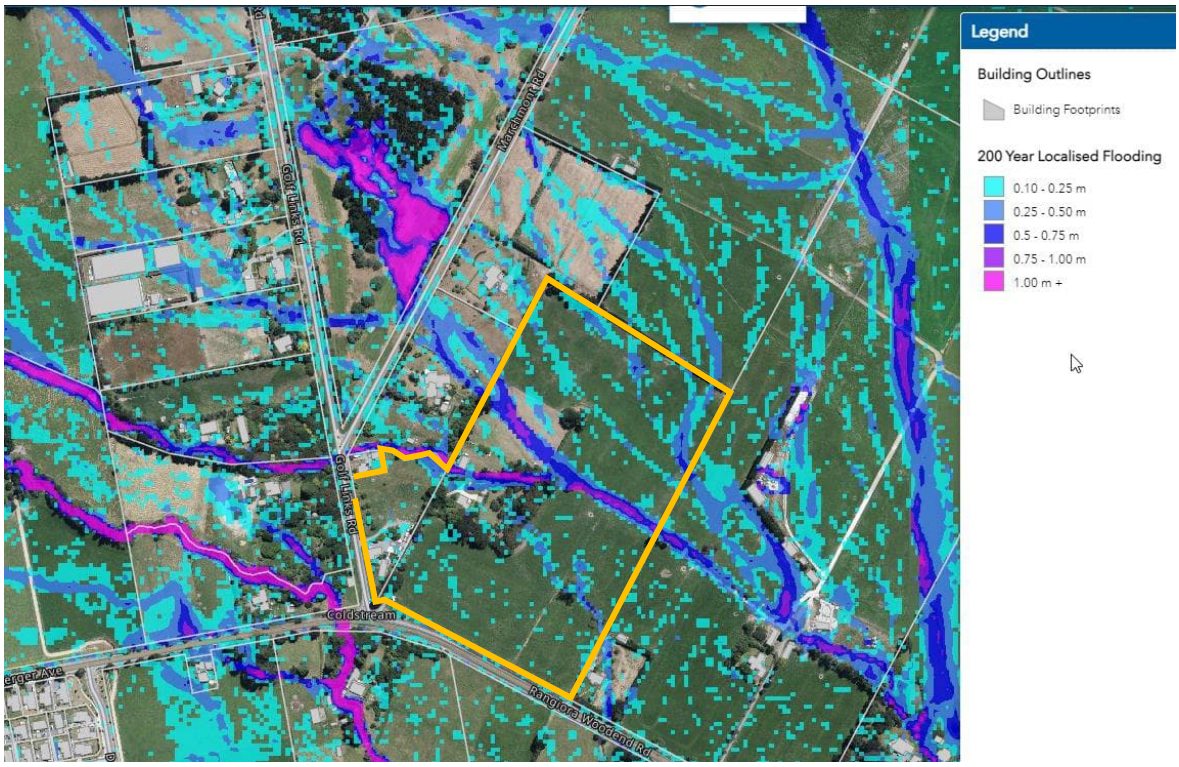


Figure 9 Waimakariri Hazard Flood Map 200 year Event

WDC have confirmed that a flood risk assessment will be required to determine the effects and impacts the proposed development will have on overland flow paths and the surrounding area.

Please refer to the Flood Impact Assessment attached in **Appendix F**.

10. Common Services (Power / Telecommunications)

Chorus have provided a high-level comment that the proposed development can be supplied by their network.

Enable have provided a high-level comment that the proposed development can be supplied by their network.

Mainpower have provided a high-level comment that the proposed development can be supplied by their network.

Appendix G provides the correspondence with the relative utility providers.

11. Conclusion

WDC has confirmed that there is insufficient capacity within the existing WDC water supply network to service this Site. However, with some upgrades to the existing WDC water supply network (at the applicants cost), a water supply could be provided to the Site.

WDC have advised that there is no capacity within their existing wastewater network, to service this development. Upgrades of the WDC wastewater pressure main between Kippenberger Ave and the Rangiora WWTP would be required to service this development. The wastewater pressure main within Kippenberger Ave will need to be extended to the Site frontage. The wastewater network within the development Site can be either a gravity network with a centralised pump station or a Low Pressure sewer network.

WDC requires that stormwater treatment and attenuation is provided for the development. To suit the Site topography, it is proposed that two stormwater management areas are provided, one to service the north part of the Site and one to service the south part. To provide treatment and attenuation, each stormwater management area will comprise of a forebay, first flush basin and detention basin. The SMA should be designed to detain all events up to the 2% AEP 24 hours duration and discharge via restricted outlets to Taranaki Stream or the roadside drain along Rangiora Woodend Road. During extreme rainfall above the 2% SMA capacity, the North SMA will overflow into the Taranaki Stream and the south SMA will overflow into Rangiora Woodend Road roadside drain.

Utility providers have provided high-level comments that the proposed development can be serviced by their network.

The ability for the development to be serviced is subject to advice from the WDC on the upgrades required to service the development for water supply and wastewater.

Also, it is recommended that consultation with the WDC and ECan is carried out to determine if the options noted above are considered acceptable.

12. Disclaimer

This report has been prepared by Eliot Sinclair & Partners Limited ("Eliot Sinclair") only for the intended purpose as a preliminary servicing report. The report is based on:

- Canterbury Maps (2022)
- WDC Services Maps
- Correspondence with WDC and relevant authorities
- Waimakariri Flood Hazard Maps

Where data supplied by CVI Projects Limited or other external sources, including previous reports have been relied upon, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Eliot Sinclair for incomplete or inaccurate data supplied by other parties.

Whilst every care has been taken during our investigation and interpretation of available data to ensure that the conclusions drawn, and the opinions and recommendations expressed are correct at the time of reporting, Eliot Sinclair has not performed an assessment of all possible conditions or circumstances that may exist at the Site. Eliot Sinclair does not provide any warranty, either express or implied, that all conditions will conform exactly to the assessments contained in this report.

The exposure of conditions or materials that vary from those described in this report, may require a review of our recommendations. Eliot Sinclair should be contacted to confirm the validity of this report should any of these occur.

This report has been prepared for the benefit of CVI Projects Limited for the purposes as stated above. No liability is accepted by Eliot Sinclair or any of their employees with respect to the use of this report, in whole or in part, for any other purpose or by any other party.

Appendix A. Proposed Development Concept Masterplan Layout

G:\Jobs\51\511185\Acad\Urban Design\x511185_Masterplan

NOTES
1. Contractors to verify all dimensions and the location of all underground services on site prior to commencing work.
2. Unless noted otherwise, all work shall be undertaken in accordance with the NZBC and any relevant Territorial Authority Engineering Standards and Specifications as a minimum standard.

REV.	DRAWN	DATE	NOTE
D	JM	05.10.23	Amend SMA location
C	JM	21.07.23	Amend density
B	JM	11.06.23	Amend allotments
A	JM	22.05.23	Preliminary

CLIENT

CVI Projects Ltd

DESIGNED	JM
DRAWN	JM
REVIEWED	SB
APPROVED	05.10.23 CM
STATUS	PRELIMINARY
SCALE	1:2000 [A3]

West Rangiora
Proposed Rezoning
Golf Links Rd

MASTERPLAN CONCEPT

PROJECT	SET	SHEET	REV.
511185	L1	L101	D

eliot sinclair

Appendix B. Contamination Property Statement from the LLUR

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Dear Sir/Madam

Thank you for submitting your property enquiry from our Listed Land Use Register (LLUR). The LLUR holds information about sites that have been used or are currently used for activities which have the potential to cause contamination.

The LLUR statement shows the land parcel(s) you enquired about and provides information regarding any potential LLUR sites within a specified radius.

Please note that if a property is not currently registered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR database is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; additional relevant information may be held in other files (for example consent and enforcement files).

Please contact Environment Canterbury if you wish to discuss the contents of this property statement.

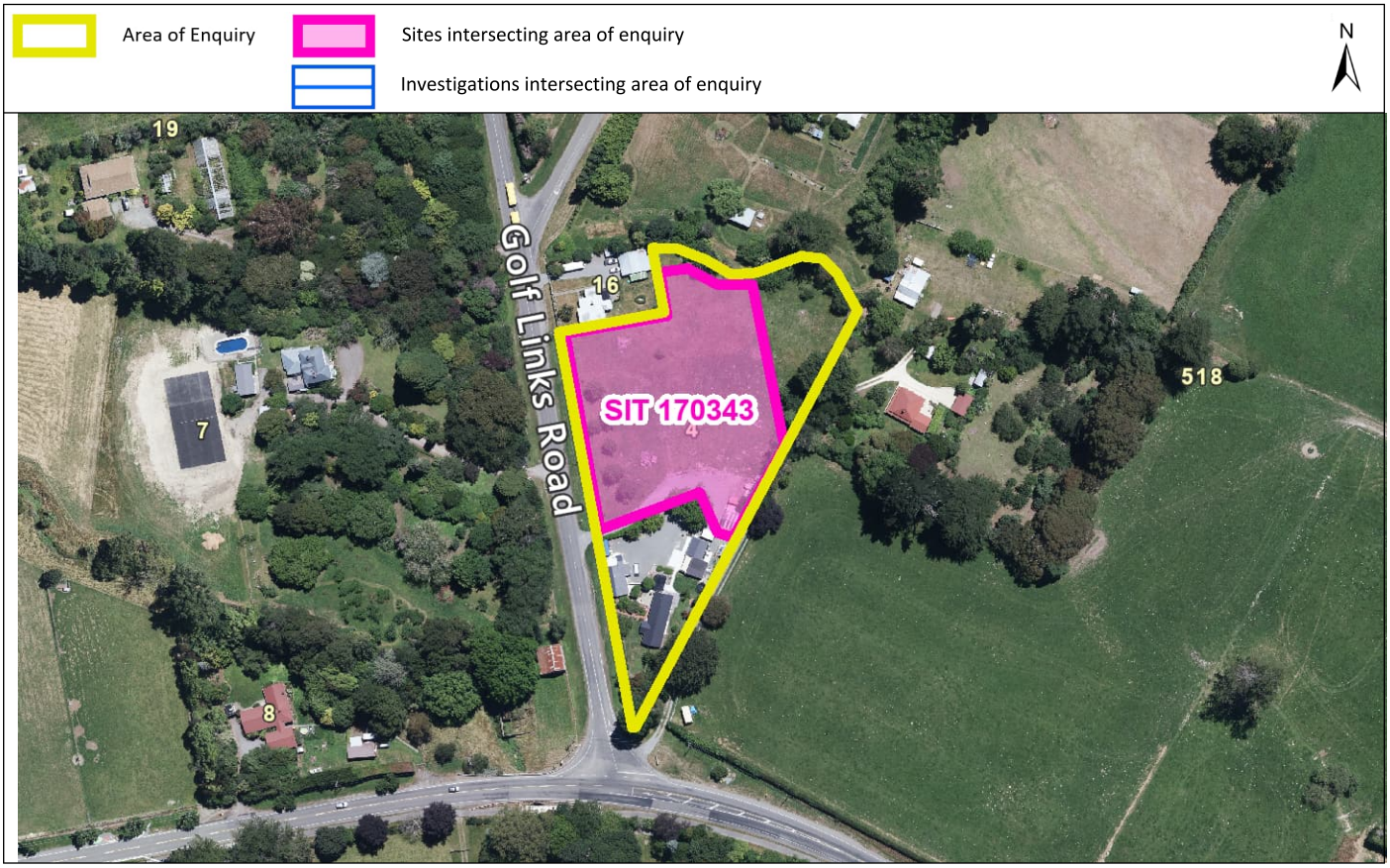
Yours sincerely

Contaminated Sites Team

Property Statement
from the Listed Land Use Register

Visit ecan.govt.nz/HAIL for more information or
contact Customer Services at ecan.govt.nz/contact/ and quote ENQ352599

Date generated: 23 August 2023
Land parcels: Lot 2 DP 16884



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Sites at a glance

Sites within enquiry area

Site number	Name	Location	HAIL activity(s)	Category
170343	4 Golf Links Road, Rangiora	4 Golf Links Road, Rangiora	A10 - Persistent pesticide bulk storage or use;	Not Investigated

More detail about the sites

Site 170343: 4 Golf Links Road, Rangiora (Intersects enquiry area.)

Category: Not Investigated
Definition: Verified HAIL has not been investigated.

Location: 4 Golf Links Road, Rangiora
Legal description(s): Lot 2 DP 16884

HAIL activity(s):

Period from	Period to	HAIL activity
1963	1984	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

6 Feb 2017	This record was created as part of the Waimakariri District Council 2016 HAIL identification project.
7 Jul 2017	Area defined from 1963 to 1984 aerial photographs. A10 - Horticultural activities, a poultry farm or sports turf were noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Disclaimer

The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987.

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

[1] The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

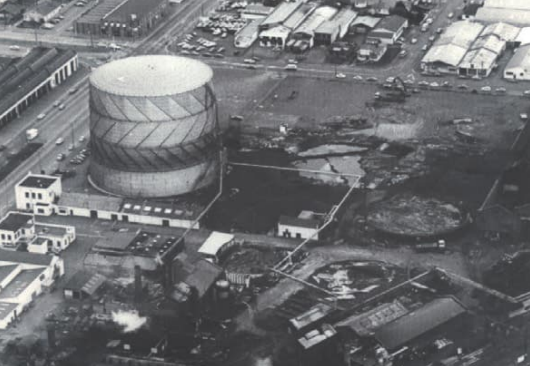
Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

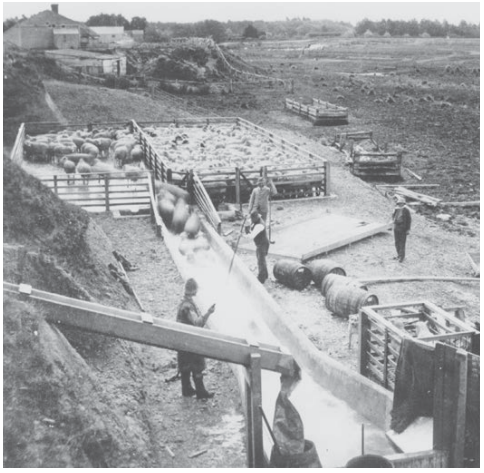
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.



IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.

If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.

I think my site category is incorrect – how can I change it?

If you have an environmental investigation undertaken at your site, you must send us the report and we will review the LLUR category based on the information you provide. Similarly, if you have information that clearly shows your site has not been associated with HAIL activities (eg. a preliminary site investigation), or if other HAIL activities have occurred which we have not listed, we need to know about it so that our records are accurate.

If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

Appendix C. Earthworks Cut Fill Plan

G:\Jobs\51\511185\Acad\Civil\511185-C1-01-Cut Fill Layout

LEGEND

Cut Depth			Fill Depth			
>	-1.50	m	0.00 to	0.10	m	
-1.50 to	-1.40	m	0.10 to	0.20	m	
-1.40 to	-1.30	m	0.20 to	0.30	m	
-1.30 to	-1.20	m	0.30 to	0.40	m	
-1.20 to	-1.10	m	0.40 to	0.50	m	
-1.10 to	-1.00	m	0.50 to	0.60	m	
-1.00 to	-0.90	m	0.60 to	0.70	m	
-0.90 to	-0.80	m	0.70 to	0.80	m	
-0.80 to	-0.70	m	0.80 to	0.90	m	
-0.70 to	-0.60	m	0.90 to	1.00	m	
-0.60 to	-0.50	m	1.00 to	1.10	m	
-0.50 to	-0.40	m	1.10 to	1.20	m	
-0.40 to	-0.30	m	1.20 to	1.30	m	
-0.30 to	-0.20	m	1.30 to	1.40	m	
-0.20 to	-0.10	m	1.40 to	1.50	m	
-0.10 to	0.00	m	1.50	<		

NOTES

1. Depths shown are from existing top of silt to design subgrade level.
2. Existing top of silt is based on LINZ LiDAR 2020 (NZVD2016) with an assumed stripped topsoil depth of 300mm.
3. All design levels are preliminary only and subject to detailed design.
4. The following allowances have been made:
   - Road pavement = 450mm
   - Road berms = 150mm
   - Topsoil fill depths on Lots and SW reserves = 300mm
5. Pavement thickness is preliminary only and subject to geotechnical analysis of the site.
6. Volumes are solid volume. No allowance for reject material, consolidation, compaction or bulking.
7. No allowance for excavation and remediation of any historic watercourses within the site.
8. No allowance for earthworks relating to works within Rangiora Woodend Road and Golf Links Road.
9. No allowance for ROW construction.

Volumes:

Topsoil Strip	= 31,200 m³
Topsoil Fill	= 23,200 m³
Subsoil Cut	= 8,300 m³
Subsoil Fill	= 39,500 m³
Total Earthworks	= 102,200 m³

10. Lot Layout shown are preliminary only.

REV.	DRAWN	DATE	NOTE
A	JM	07.09.23	Preliminary

CLIENT

CVI PROJECTS LIMITED

DESIGNED	PIH
DRAWN	JM
REVIEWED	JDF
APPROVED	16.10.2023 JDF
STATUS	PRELIMINARY
SCALE	1:1000 [A1]

FEASIBILITY STUDY FOR PRIVATE PLAN CHANGE

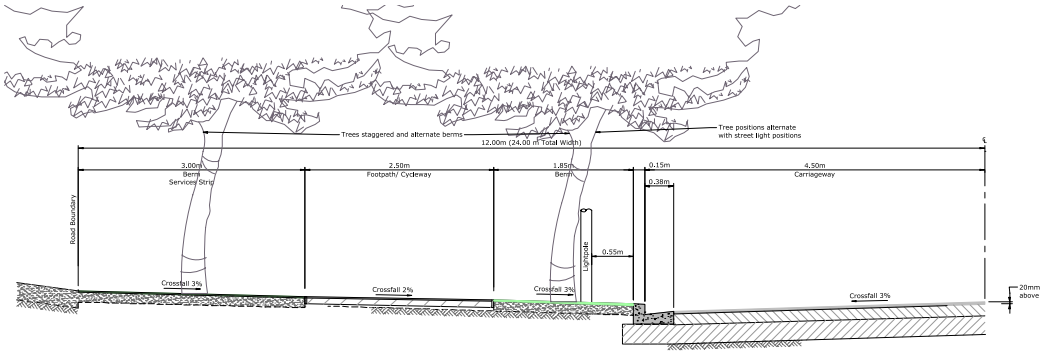
4 Golf Links Road, Rangiora
Canterbury

PRELIMINARY EARTHWORKS SUBGRADE CUT/FILL DEPTHS

PROJECT	SET	SHEET	REV.
511185	C1	C01	A

eliot sinclair

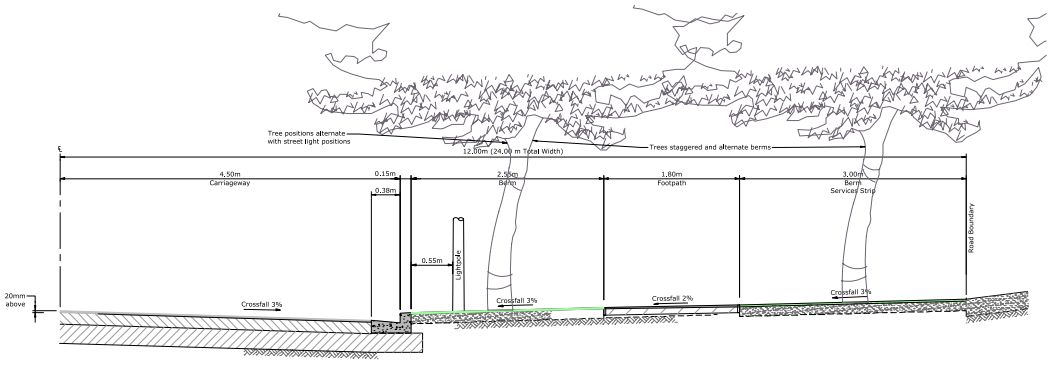
Appendix D. Typical Road Cross Sections



Typical Cross Section - Road 01 LHS

Scale 1:25

Metalcourse depths to be confirmed by testing subgrade prior to placing sub-base material. Minimum 2.0 CBR is required on the subgrade.



Metalcourse depths to be confirmed by testing subgrade prior to placing sub-base material. Minimum 2.0 CBR is required on the subgrade.

Typical Cross Section - Road 01 RHS

Scale 1:25

NOTES
1. Contractors to verify all dimensions and the location of all underground services on site prior to commencing work.
2. Unless noted otherwise, all work shall be undertaken in accordance with the NZBC and any relevant Territorial Authority Engineering Standards and Specifications as a minimum standard.

REV.	DRAWN	DATE	NOTE
A	JM	07.09.23	Preliminary

CLIENT

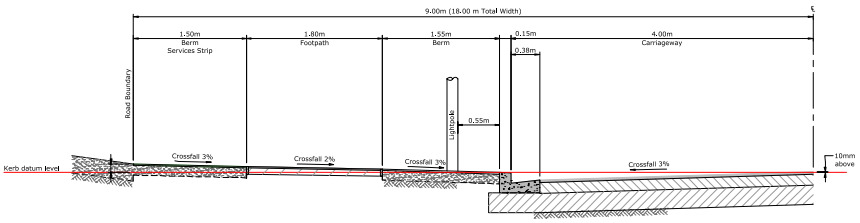
DESIGNED	JIM
DRAWN	JM
REVIEWED	JDF
APPROVED	16.10.2023 JDF
STATUS	PRELIMINARY
SCALE	1:25 [A1]

FEASIBILITY STUDY FOR PRIVATE PLAN CHANGE
4 Golf Links Road, Rangiora
Canterbury

ROADING SECTION AND DETAILS
SHEET 1 of 2

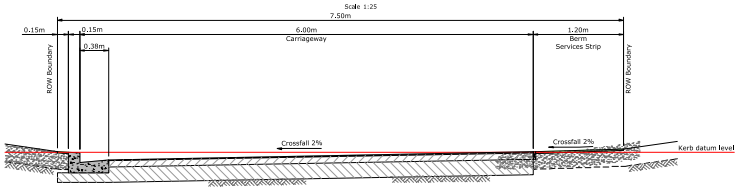
PROJECT	SET	SHEET	REV.
511185	C1	C02	A

eliot sinclair



Typical Cross Section - Roads 02-06

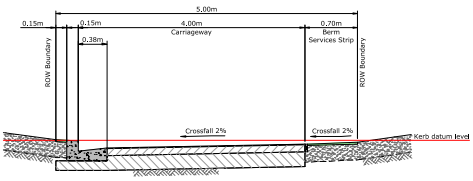
Scale 1:25



Metalcourse depths to be confirmed by testing subgrade prior to placing sub-base material. Minimum 6.0 CBR is required on the subgrade.

Typical Cross Section - 7.5m ROW

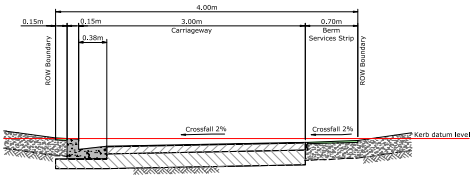
Scale 1:25



Metalcourse depths to be confirmed by testing subgrade prior to placing sub-base material. Minimum 6.0 CBR is required on the subgrade.

Typical Cross Section - 5.0m ROW

Scale 1:25



Metalcourse depths to be confirmed by testing subgrade prior to placing sub-base material. Minimum 6.0 CBR is required on the subgrade.

Typical Cross Section - 5.0m ROW

Scale 1:25

NOTES
1. Contractors to verify all dimensions and the location of all underground services on site prior to commencing work.
2. Unless noted otherwise, all work shall be undertaken in accordance with the NZBC and any relevant Territorial Authority Engineering Standards and Specifications as a minimum standard.

REV.	DRAWN	DATE	NOTE
A	JM	07.09.23	Preliminary

CLIENT

DESIGNED	JIM
DRAWN	JM
REVIEWED	JDF
APPROVED	16.10.2023 JDF
STATUS	PRELIMINARY
SCALE	1:25 [A1]

FEASIBILITY STUDY FOR PRIVATE PLAN CHANGE

4 Golf Links Road, Rangiora
Canterbury

ROADING SECTION AND DETAILS SHEET 2 of 2

PROJECT	SET	SHEET	REV.
511185	C1	C03	A

eliot sinclair

Appendix E. WDC Correspondence

Stephany Pandrea

From: Jennifer McSloy <jennifer.mcsloy@wmk.govt.nz>
Sent: Wednesday, 31 May 2023 11:32 am
To: Simon Crundwell
Cc: Stephany Pandrea; Jason Recker
Subject: RE: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

[EXTERNAL EMAIL: Always check the FROM address of an email and treat links and attachments with caution. Check with Helpdesk if unsure.]

Hi Simon,

Yes a flood hazard assessment looking at the impacts of the development on the 200 year event would be required for the plan change. The hazards applicable to the site, and whether they can be managed, need to be understood at the time of a plan change application to assess whether the proposed plan change complies with the Regional Policy Statement and district plan requirements.

If you are proposing to divert an overland flowpath, I would expect the flood hazard assessment to consider the issues with that diversion and how they will be managed. As a baseline approach, generally we do not permit construction in overland flowpaths, or diversions of them due to upstream/downstream effects. This flowpath is near the head of the Cam River as well, and any proposed diversion would need to be thoroughly assessed.

I'm not a planner by training, so these comments are from a development engineering perspective. I think Claire McKeever has looked over this site, and she will be able to help with the level of detail required to support the plan change.

Cheers,
Jen

Jennifer McSloy | Development Manager
Project Delivery Unit

Phone: 0800 965 468 (0800 WMK GOV)
Mobile: +64272479815
DDI: +6433118947

WAIMAKARIRI DISTRICT COUNCIL

waimakariri.govt.nz

From: Simon Crundwell <sc@eliotsinclair.co.nz>
Sent: Monday, 29 May 2023 2:35 PM
To: Jennifer McSloy <jennifer.mcsloy@wmk.govt.nz>
Cc: Stephany Pandrea <sp@eliotsinclair.co.nz>
Subject: RE: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

Hi Jennifer,

Just following up on my email below. Also, will flood modelling be required for the plan change application or could it be carried out at the subdivision consent stage?

Cheers

Simon Crundwell
CIVIL ENGINEER
BE(Hons) Civil
+64 3 379 4014 ext. 192
eliotsinclair.co.nz
Christchurch | Rangiora | Wānaka
Queenstown | Hokitika | Nelson

From: Simon Crundwell
Sent: Tuesday, 16 May 2023 10:27 am
To: 'jennifer.mcsloy@wmk.govt.nz' <jennifer.mcsloy@wmk.govt.nz>
Cc: Stephany Pandrea <sp@eliotsinclair.co.nz>
Subject: FW: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

Hi Jennifer,

We are progressing an infrastructure servicing report for a proposed plan change application for this property. I have queried Jason whether we would need to complete a flood modelling report to support this plan change application if we were to propose modifications to the existing secondary overland flow path. Jason responded stating that a flood modelling report would be required, but he wasn't clear whether this report would be required for the plan change application, or if it could be provided at a later date (i.e. subdivision consent etc).

For the plan change application, we have two options:

1. Propose a modification to the existing secondary overland flow path (as indicated in my email below)
2. Propose no changes to the existing secondary overland flow path

Could you please let me know which of the above options would require a flood modelling report for the plan change application?

Cheers

From: Jason Recker <jason.recker@wmk.govt.nz>
Sent: Friday, 12 May 2023 3:38 pm
To: Simon Crundwell <sc@eliotsinclair.co.nz>
Subject: RE: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

[EXTERNAL EMAIL: Always check the FROM address of an email and treat links and attachments with caution. Check with Helpdesk if unsure.]

Hi Simon,

I was forwarded your email by Caroline Fahey. Please see my answers to your questions below (in red):

Could you please let me know what WDC's requirements are regarding the following:

- *Would council accept the stormwater discharge to the ephemeral drain crossing the site or what would be a suitable stormwater point of discharge?*
  Potentially you could if you were able to show post-development peak flows up to the 50-yr storm event were less than or equal to pre-development flows. You would also need to show that there were no adverse impacts downstream of your site up to the 200-yr storm event.
- *Attenuation requirements*
  You would be required to provide attenuation for any runoff beyond the pre-development flows up to the 50-yr storm event.
- *First flush treatment requirements*
  You would be required to treat the first 25mm of runoff.
- *Alterations to existing secondary overland flow paths*
  The secondary flow path modification you have proposed below raises concerns. Based on our flood mapping that looks to be a significant overland flow path you are redirecting. The multiple bends to redirect the flow path also add to this concern. We would need to have a more detailed discussion about your proposed modifications and would require a flood modelling report.
- *Minimum freeboard requirements for proposed dwellings and accessway?*

  Freeboard Requirements:

  Generally, it is based on the flood hazard mapping:
  - 200-yr Medium Hazard – Requires finished floor 500mm above the 200-yr water surface elevation.
  - 200-yr Low Hazard – Requires finished floor 400mm above the 200-yr water surface elevation.
  - No hazard – 400mm above undisturbed ground level.

  Accessways:
  No more that 300 mm of flooding in a 50-yr event.
  No flooding in a 20-yr event.

- *Will a flooding assessment be required for this site?*
  A flood modelling report would likely be required for your submittal. For further questions what would be required please contact the Development Manager, Jen McSloy (jennifer.mcsloy@wmk.govt.nz).

These are generally the guidelines, but I would reach out to the subdivision team for your specific site.

For further questions about the development requirements contact the Development Manager, Jen McSloy jennifer.mcsloy@wmk.govt.nz.

Thanks,

Jason Recker | Stormwater and Waterways Manager
3 Waters

Phone: 0800 965 468 (0800 WMK GOV)
Mobile: 0273394316
DDI: +6432603516

WAIMAKARIRI DISTRICT COUNCIL

waimakariri.govt.nz

From: Caroline Fahey <Caroline.Fahey@wmk.govt.nz>
Sent: Monday, 8 May 2023 11:57 AM
To: Jason Recker <jason.recker@wmk.govt.nz>

Cc: Simon Crundwell <sc@eliotsinclair.co.nz>; Greg Bennett <greg.bennett@wmk.govt.nz>
Subject: FW: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

Hi Jason

Fyi, email from Simon below.

Cheers
Caroline.

Caroline Fahey | Water Operations Team Leader
3 Waters

Phone: 0800 965 468 (0800 WMK GOV)
Mobile: +64274065138
DDI: +6432669256

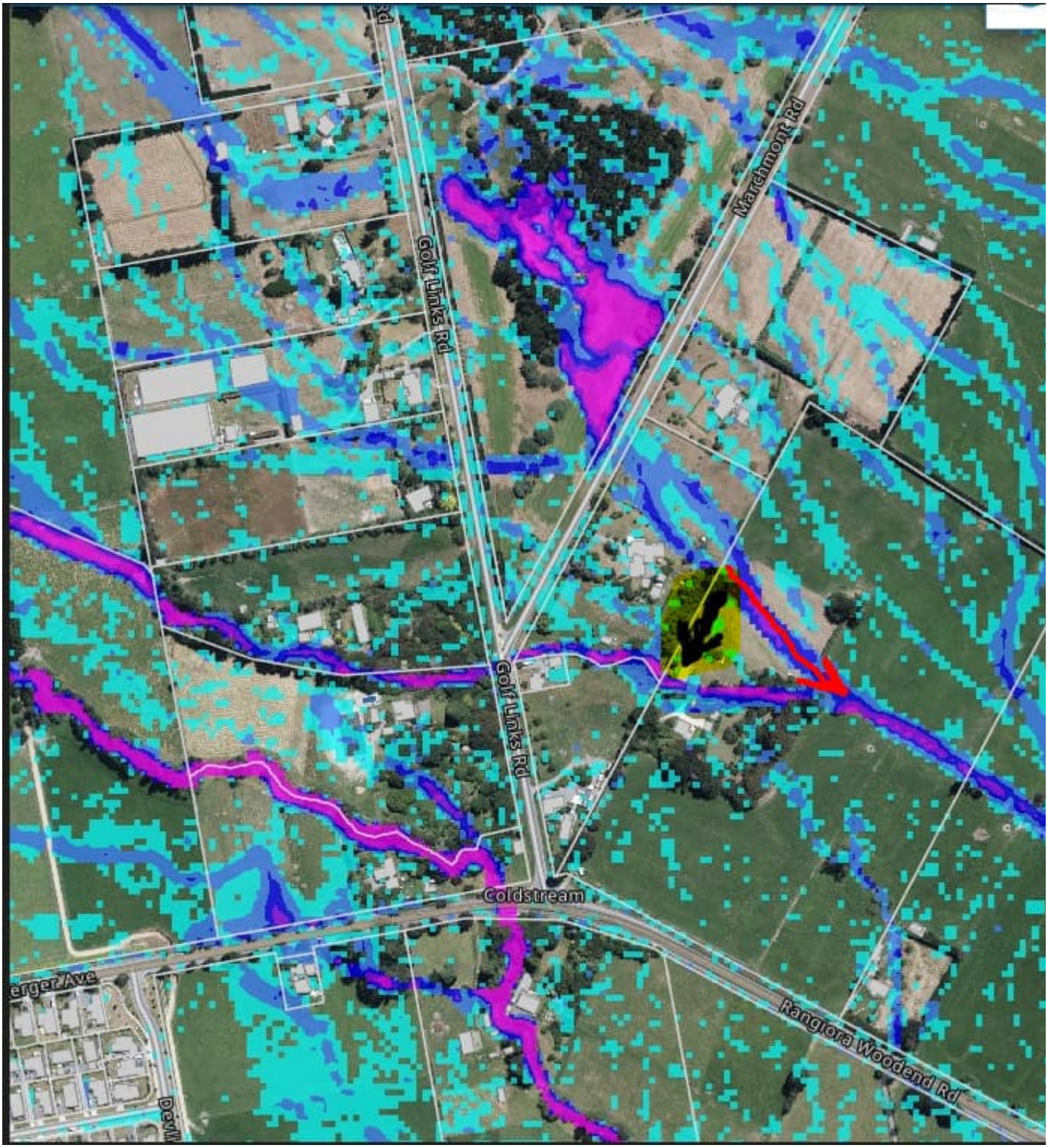
WAIMAKARIRI DISTRICT COUNCIL

waimakariri.govt.nz

From: Simon Crundwell <sc@eliotsinclair.co.nz>
Sent: Monday, 8 May 2023 11:50 AM
To: Owen.Davies@wmk.govt.nz
Cc: Caroline Fahey <Caroline.Fahey@wmk.govt.nz>; Stephany Pandrea <sp@eliotsinclair.co.nz>
Subject: FW: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

Hi Owen,

I have a specific stormwater question relating to my email below. Would WDC accept the existing secondary overland flow channel indicated by the red arrow in the image below to be redirected to the existing WDC open channel along the western boundary as indicated by the black arrow (and yellow highlight)?



Cheers,

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Christchurch | Rangiora | Wānaka
Queenstown | Hokitika | Nelson

Stephany Pandrea

From: Simon Crundwell
Sent: Thursday, 18 May 2023 4:37 pm
To: Stephany Pandrea; Justin Finlay
Subject: FW: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

FYI

Simon Crundwell
CIVIL ENGINEER

Shape tomorrow

From: Tasha Tan <tasha.tan@wmk.govt.nz>
Sent: Thursday, 18 May 2023 4:35 pm
To: Simon Crundwell <sc@eliotsinclair.co.nz>
Cc: Subdivision Eng <subdivisioneng@wmk.govt.nz>
Subject: RE: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

Hi Simon,

In short, yes. The pipelines currently haven't been constructed yet so theoretically there is still the possibility they could be upsized. However, realistically, the upgrades for Belgrove would be undertaken before this proposed development would occur.

I hope this helps, let me know if you have any other queries.

Cheers,

Tasha Tan | Land Development Engineer
Project Delivery Unit

Phone: 0800 965 468 (0800 WMK GOV)
Mobile: +64273640493
DDI: +6432669262

WAIMAKARIRI DISTRICT COUNCIL

waimakariri.govt.nz

From: Simon Crundwell <sc@eliotsinclair.co.nz>
Sent: Thursday, 18 May 2023 3:58 PM
To: Tasha Tan <tasha.tan@wmk.govt.nz>
Cc: Subdivision Eng <subdivisioneng@wmk.govt.nz>
Subject: RE: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

Hi Tasha,

Thanks for your email.

Based on your wastewater commentary about there being some short to medium term capacity in the Belgrove development wastewater upgrades, does this mean that the proposed Belgrove development wastewater upgrade works are likely to be carried out before we have the opportunity to have these upsized/future proofed to cater for this proposed development?

Cheers

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Queenstown | Hokitika | Nelson

From: Tasha Tan <tasha.tan@wmk.govt.nz>
Sent: Thursday, 18 May 2023 2:50 pm
To: Simon Crundwell <sc@eliotsinclair.co.nz>
Cc: Subdivision Eng <subdivisioneng@wmk.govt.nz>
Subject: RE: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

Hi Simon,

My apologies for the delay getting you this information. Please see the information below.

Wastewater

In short, the Belgrove wastewater system is not sized for this and any potential solution to upsize or make extra capacity for this site is going to be very expensive and challenging. Currently there is no capacity available (or being planned) for the land east of Golf Links Road. The wastewater infrastructure that Belgrove will be installing will only have long term capacity for their development and a small additional allowance for the undeveloped sections in the block bordered by Golf Links/Coldstream/Kippenberger. In order to service any land east of Golf Links Road consideration would need to be given for either

1. Further upsizing the proposed wastewater pressure main upgrades being installed by Belgrove between Kippenberger Avenue and the Rangiora WWTP, or
2. Duplicating the proposed Belgrove upgrades in the future with additional infrastructure down to the WWTP.

There will be some time dependant capacity in the short to medium term once all the Belgrove upgrades are undertaken, however further work would be required to determine how much short term capacity is

available, when additional upgrades would be needed and what additional financial contributions would be needed to pay for those future upgrades.

Water Supply
For water supply we haven't considered it before and there would not be existing capacity. However, with some upgrades (at applicant's cost), we would probably be able to accommodate it from East Rangiora. We haven't done the work to see what that would be yet as it would probably have to be a reasonable sized study. Once a plan for this has been developed, we can look into this in more detail.

Stormwater
For stormwater as it is unplanned Greenfield area, attenuation and treatment is required for the additional discharge down to pre-development levels. Given that Belgrove has been able to find soakage this would probably be worth exploring here. The Taranaki Stream that runs through the site would be the most logical discharge point for stormwater.

We would also require a flooding assessment. Previously these sites are in the middle of an Ashley Breakout flow path but this is the path that comes from where a secondary stopbank has been built so it will mostly just be localised flooding that twill need to be looked at.

I hope the above helps, but please let me know if you need anything else.

Cheers,
Tasha Tan | Land Development Engineer
Project Delivery Unit

Phone: 0800 965 468 (0800 WMK GOV)
Mobile: +64273640493
DDI: +6432669262

WAIMAKARIRI DISTRICT COUNCIL
waimakariri.govt.nz

From: Simon Crundwell <sc@eliotsinclair.co.nz>
Sent: Wednesday, 3 May 2023 1:11 PM
To: Caroline Fahey <Caroline.Fahey@wmk.govt.nz>
Cc: Owen.Davies@wmk.govt.nz; Greg Bennett <greg.bennett@wmk.govt.nz>; Colin Roxburgh <colin.roxburgh@wmk.govt.nz>; Kalley Simpson <kalley.simpson@wmk.govt.nz>; Chris Bacon <chris.bacon@wmk.govt.nz>; Stephany Pandrea <sp@eliotsinclair.co.nz>
Subject: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Preliminary three waters capacity

Hi Caroline,

Could you please make sure this email is sent to the right person at council for each of the three waters disciplines stated below?

I am carrying out a preliminary engineering servicing capacity checks for a proposed 11.35 Ha residential development at 518 Rangiora Woodend Road and 4 Golf Link Road, Rangiora ("site"). We anticipate that the client will propose rezoning the site to medium density residential and we estimate that the site will consist of approximately 200 new residential lots.

Please refer to my preliminary desktop review of the site below with corresponding questions.

Figure 1: Site location

Wastewater

There is no existing WDC wastewater reticulation within the vicinity of this site. However, we understand that the nearby Belgrove development is proceeding and we are interested to know if there is any possibility that this development is proposing new wastewater infrastructure that will eventually be vested with WDC that we potentially could connect into? Alternatively, the remaining wastewater options are:

- On site treatment and disposal
- New wastewater pump station with rising main to nearest WDC discharge location (potentially the Northbrook Road Sewer Pump station?)

Based on an estimated 200 Lots, I have calculated the following wastewater flow rates for the proposed development based on WDC ECoP Section 6.5.6:

- ADWF: 2.77 L/s, PDWF: 3.9 L/s and PWWF: 10.8 L/s

Could you please comment on the capacity of the future or the existing WDC wastewater network to receive wastewater discharge from this proposed development and if there are any constraints that need to be overcome at the time of subdivision?

Water supply

Similar to the wastewater, there is no existing WDC water supply reticulation within the vicinity of this site. However, we understand that the nearby Belgrove development is proceeding and we are interested to know if there is any possibility that this development is proposing new water supply infrastructure that will eventually be vested with WDC that we potentially could connect into? Alternatively on site water supply bores with suitable treatment is the only other option to supply the proposed development.

Based on an estimated 200 Lots, the peak residential water supply hourly demand from WDC ECoP Table 7.2 is 20 L/s. The waster supply system must meet the criteria set out in WDC ECoP Section 7.5.3, including but not limited to the following:

- 35 L/s (i.e. half peak residential demand plus 25 L/s fire hydrant demand) with minimum residual pressure of 100 kPa at hydrants and lateral lot connections
- 20 L/s with minimum residual pressure of 300 kPa

Could you please comment on the capacity of the future or the existing WDC water supply network to supply this proposed development and if there are any constraints that need to be overcome at the time of subdivision?

Stormwater

An existing WDC natural stormwater channel (WDC Asset Number SW001221) runs adjacent to the northern 4 Golf Link Road boundary and through the centre of 518 Rangiora Woodend Road. The 200 year ARI flooding map below (and attached) indicates that there is a second notable natural water course which drains into WDC natural stormwater channel from the north, although this watercourse is not an official WDC asset.

Could you please let me know what WDC's requirements are regarding the following:

- Would council accept the stormwater discharge to the ephemeral drain crossing the site or what would be a suitable stormwater point of discharge?
- Attenuation requirements
- First flush treatment requirements
- Alterations to existing secondary overland flow paths
- Minimum freeboard requirements for proposed dwellings and accessways
- Will a flooding assessment be required for this site?

Are there any other stormwater requirements not covered above?

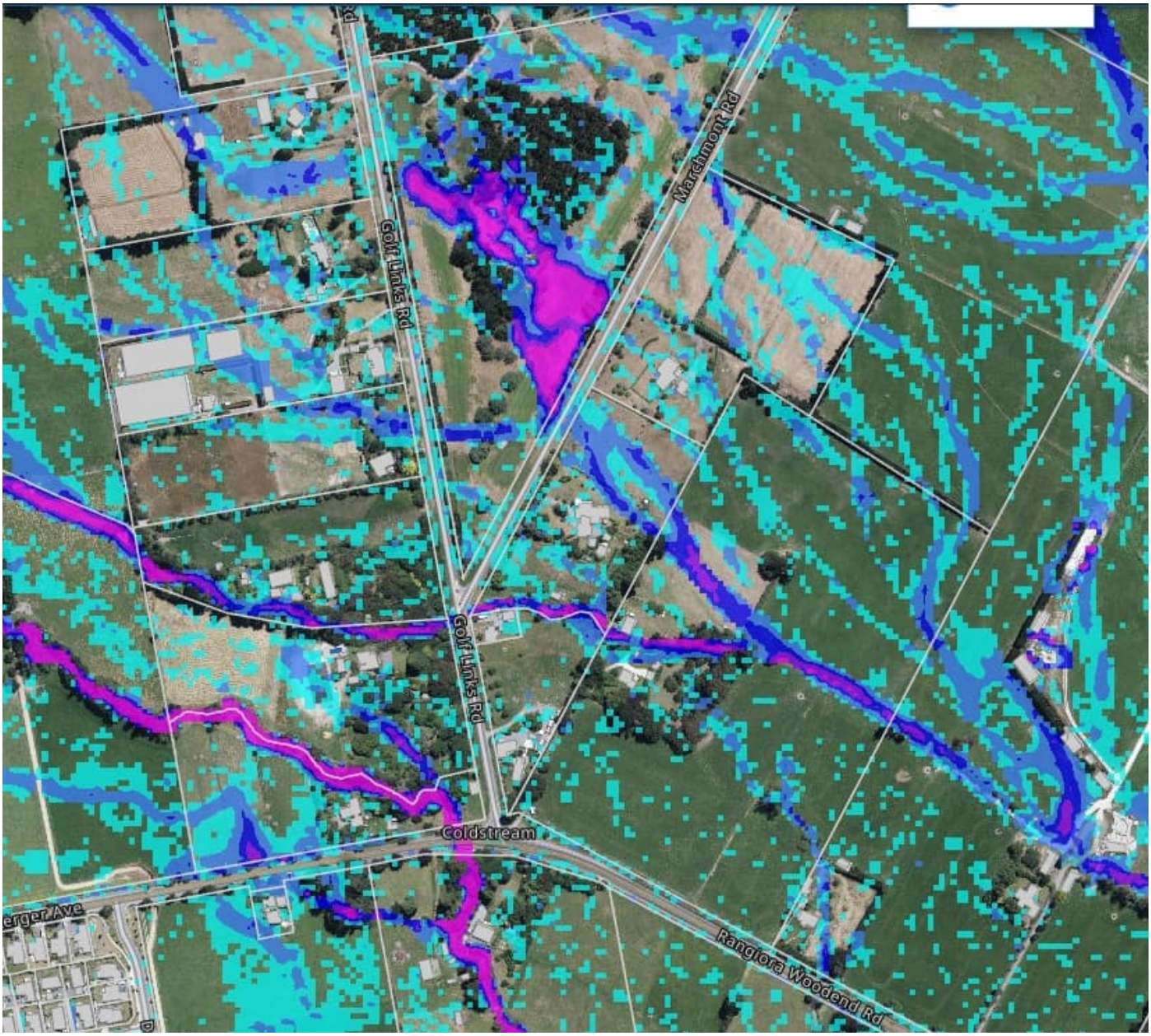

Figure 2: 200 year flood extent

Cheers

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Queenstown | Hokitika | Nelson

Stephany Pandrea

From: Simon Crundwell
Sent: Tuesday, 15 August 2023 10:32 am
To: Stephany Pandrea
Cc: Justin Finlay
Subject: Fwd: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Stormwater discharge location

FYI

Get Outlook for Android

Simon Crundwell
CIVIL ENGINEER

Shape tomorrow

From: Tasha Tan <tasha.tan@wmk.govt.nz>
Sent: Tuesday, August 15, 2023 10:26:18 AM
To: Simon Crundwell <sc@eliotsinclair.co.nz>
Cc: Jason Recker <jason.recker@wmk.govt.nz>; Jennifer McSloy <jennifer.mcsloy@wmk.govt.nz>; Caroline Fahey <Caroline.Fahey@wmk.govt.nz>
Subject: RE: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Stormwater discharge location

Hi Simon,

In principle, discharge should be maintained to the existing discharge points so if that southern portion of the site already drains out to Rangiora Woodend Road in this manner currently then we don't see issues with that at this stage. I would note the following:

- Treatment and attenuation down to pre-development levels is required.
- Consideration of the existing capacity of the downstream drainage channel will be needed. This drainage channel, according to our records goes down the driveway of No 475 Rangiora Woodend Road before discharging into the Cam River, so we will need to see that flooding off-effects from the proposed discharge is not created.
- I note that the new location of the proposed Southern SMA is close to the existing dwelling and shed of 494 Rangiora Woodend Road which may cause lateral stretch issues for these two buildings. I would advise seeking geotechnical advice on this due to the proximity of this to the existing house.

I hope this helps, please let me know if you need anything else.

Cheers,

Tasha Tan | Land Development Engineer
Project Delivery Unit

Phone: 0800 965 468 (0800 WMK GOV)
Mobile: +64273640493
DDI: +6432669262

waimakariri.govt.nz

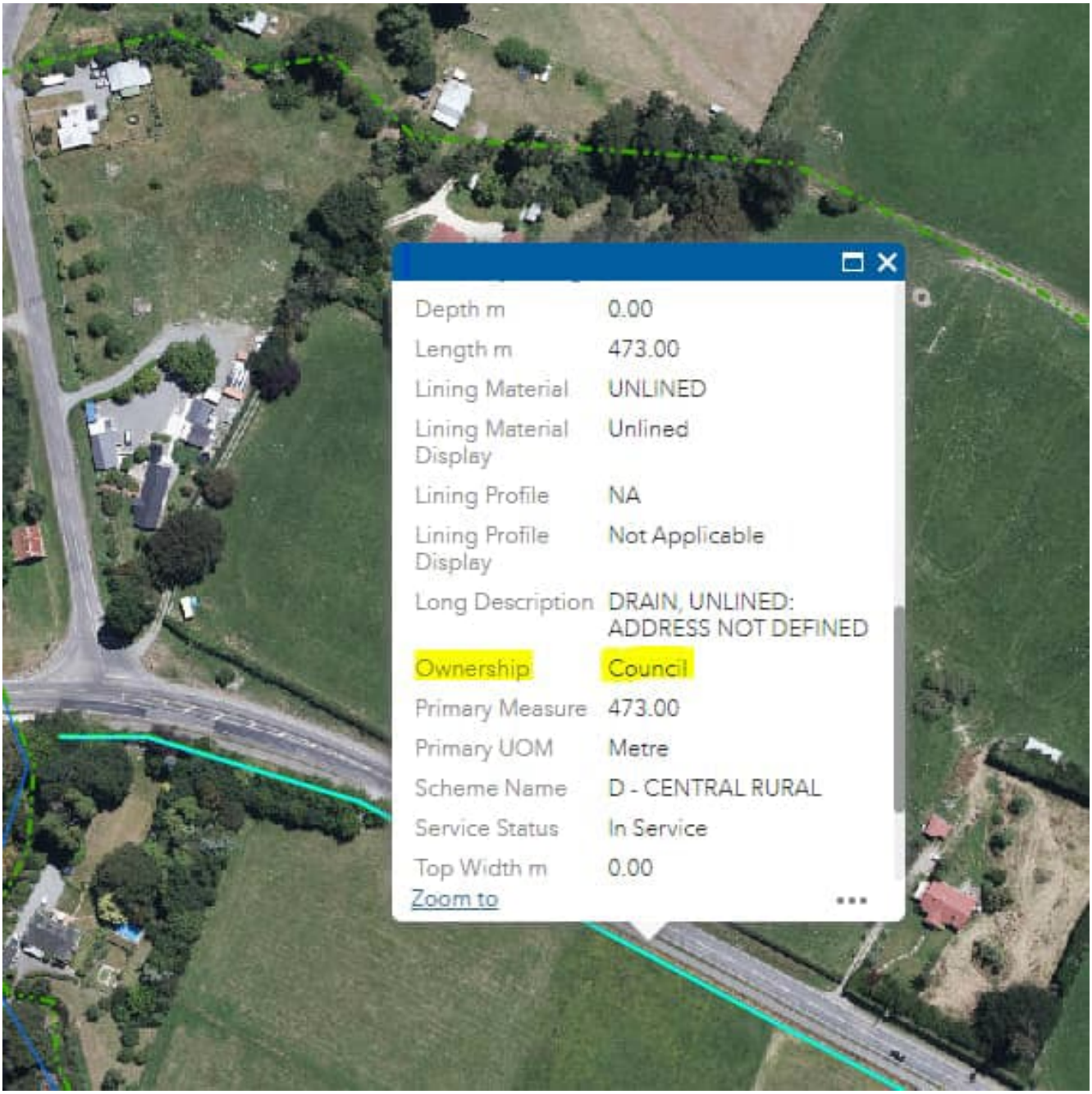
From: Simon Crundwell <sc@eliotsinclair.co.nz>
Sent: Thursday, August 10, 2023 9:34 AM
To: Tasha Tan <tasha.tan@wmk.govt.nz>
Cc: Jason Recker <jason.recker@wmk.govt.nz>; Jennifer McSloy <jennifer.mcsloy@wmk.govt.nz>; Caroline Fahey <Caroline.Fahey@wmk.govt.nz>
Subject: [#511185] 518 Rangiora Woodend Road and 4 Golf Links Road - Stormwater discharge location

Hi Tasha,

I am not sure exactly who to direct this query to as Jason Recker has also answered prior stormwater queries (see attached email).

We have progressed a concept design for this site, see attached marked up plan. Initially we proposed two stormwater management areas either side of the Taranaki Stream, with stormwater discharging into this stream. However, we have realised that stormwater runoff from the existing low point within the site (located at the south-east corner, with an elevation of 22m RL) cannot be directed into the southern SMA (which has an elevation of 24m RL and approx. 1m depth).

Therefore, we proposed to retain the northern SMA location and shift the southern SMA to the south-east corner of the site. The areas north of the Taranaki Stream will be directed to the northern SMA before discharge into the Taranaki Stream. The areas south of Taranaki Stream will be directed to the new southern SMA location before discharge into the existing roadside drain on the south side of Rangiora-Woodend Road. Note that this change will result in more like for like pre- vs post development catchments.



Cheers

Simon Crundwell
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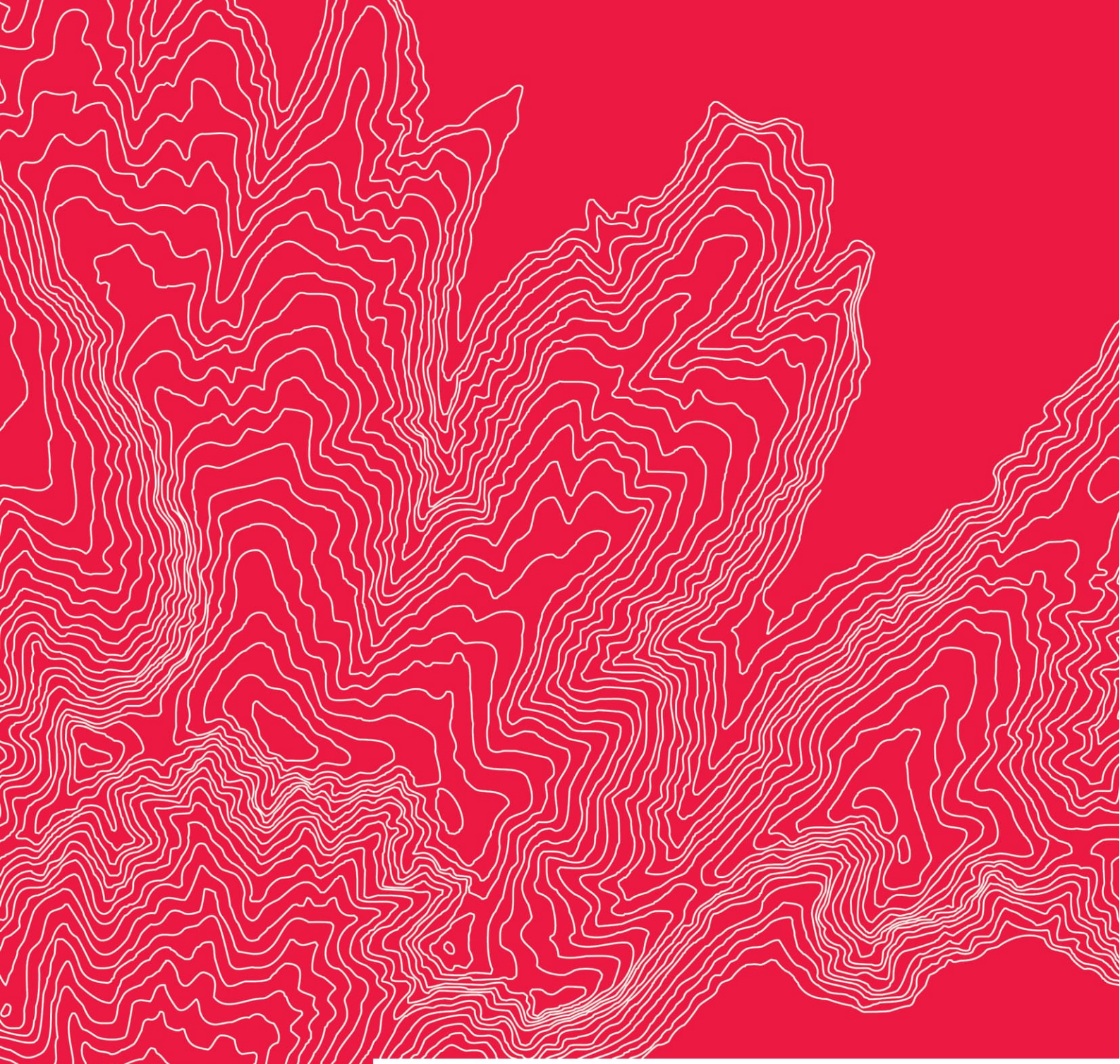
Christchurch | Rangiora | Wānaka
Queenstown | Hokitika | Nelson

From: Tasha Tan <tasha.tan@wmk.govt.nz>
Sent: Thursday, 18 May 2023 2:50 pm
To: Simon Crundwell <sc@eliotsinclair.co.nz>

Appendix F. Flood Impact Assessment



Flood Impact Assessment

Version A

4 Golf Links Road and 518 Rangiora Woodend Road, Rangiora

Prepared for CVI Projects Limited

511185

eliot sinclair

Flood Impact Assessment

4 Golf Links Road and 518 Rangiora Woodend Road, Rangiora

Prepared for CVI Projects Limited

511185

Quality Control Certificate

Eliot Sinclair & Partners Limited

eliotsinclair.co.nz

Action	Name	Signature	Date
Prepared by:	Jenish Manandhar Civil Engineer DipEng Civil jenish.manandhar@eliotsinclair.co.nz		10 October 2023
Reviewed by:	Stephany Pandrea 3 Waters Engineer BE(Hons) Civil MEngNZ stephany.pandrea@eliotsinclair.co.nz		10 October 2023
Directed and approved for release by:	Stephany Pandrea 3 Waters Engineer BE(Hons) Civil MEngNZ stephany.pandrea@eliotsinclair.co.nz		10 October 2023
Status:	Version A		
Release date:	10 October 2023		
Distributed to:	CVI Projects Limited Waimakariri District Council		

Version History

Status	Description	Author	Release Date
A	Plan Change Issue	J. Manandhar	10 October 2023

Contents

1. Introduction

Eliot Sinclair have been engaged by CVI Projects Limited, to compile a Flood Impact Assessment to support a plan change application from rural to residential land use for the site located at 518 Rangiora Woodend Road and 4 Golf Links Road, Rangiora. The proposed residential development comprises of new residential allotments, new carriageways, and two new stormwater management areas.

2. Scope of works

Eliot Sinclair has prepared this Flood Impact Assessment for the proposed subdivision to support the application for land use plan change. The report has been prepared to provide an assessment of the flooding effects of the proposed development on:

- Existing overland flow paths
- Flooding at surrounding properties
- Accessibility within proposed new carriageways
- Accessibility within existing council vested carriageways

3. Site description

The site is located at 518 Rangiora Woodend Road and 4 Golf Links Road as shown in Figure 1. Refer to Appendix A for proposed site development plan. The site area is approximately 11.3 ha and consists of the following legal allotments:

- Lot 2 DP16884
- Part RS 1054

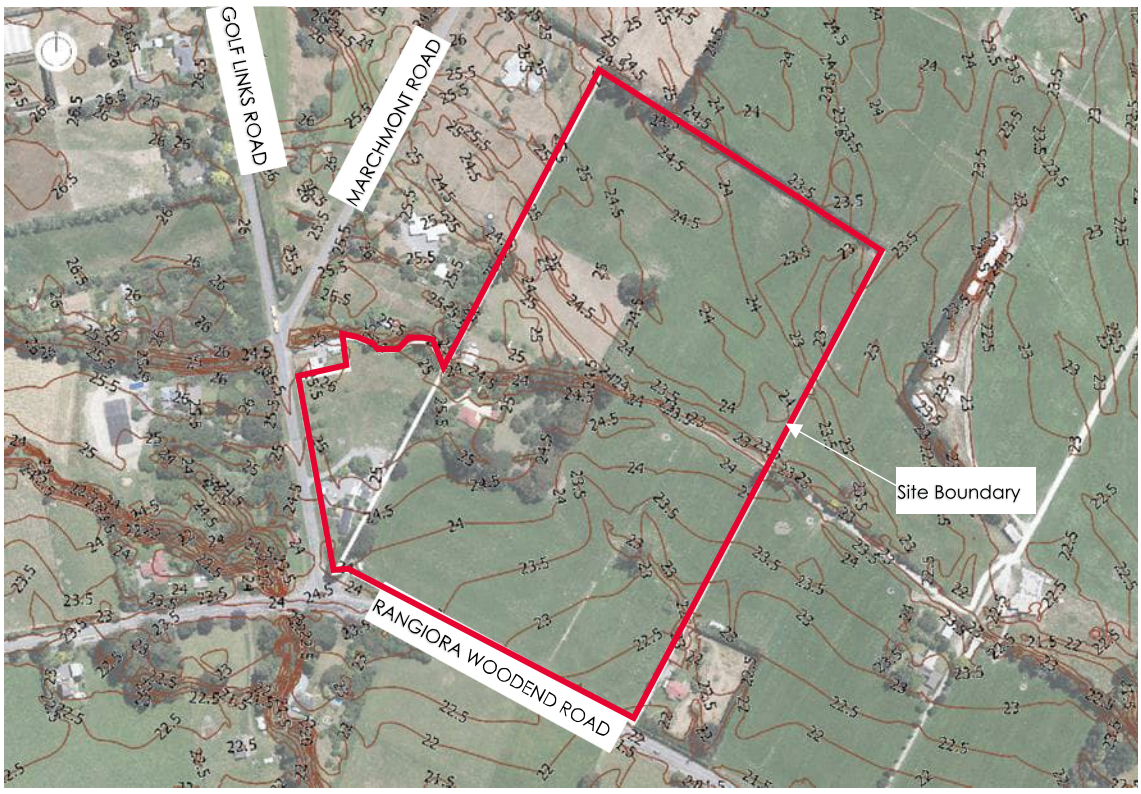


Figure 1. Site Location Plan

There are two existing residential dwellings with various associated structures on-site and the remainder of the site is pasture. The North part of the site falls from the North-west to the North-east and the South part of the site falls from the North-west to the South-east.

The Cam River/ Ruataniwha crosses the Rangiora Woodend Road to the West of the site. An existing Waimakariri District Council (WDC) owned natural stormwater channel (Taranaki Stream) runs adjacent to the northern boundary of 4 Golf Link Road and through the centre of 518 Rangiora Woodend Road. An existing ephemeral tributary of Taranaki stream crosses the site from North-west and converges to Taranaki stream at approximately central location of 518 Rangiora Woodend Road. Refer to Figure 2 for existing waterways within and nearby the site.

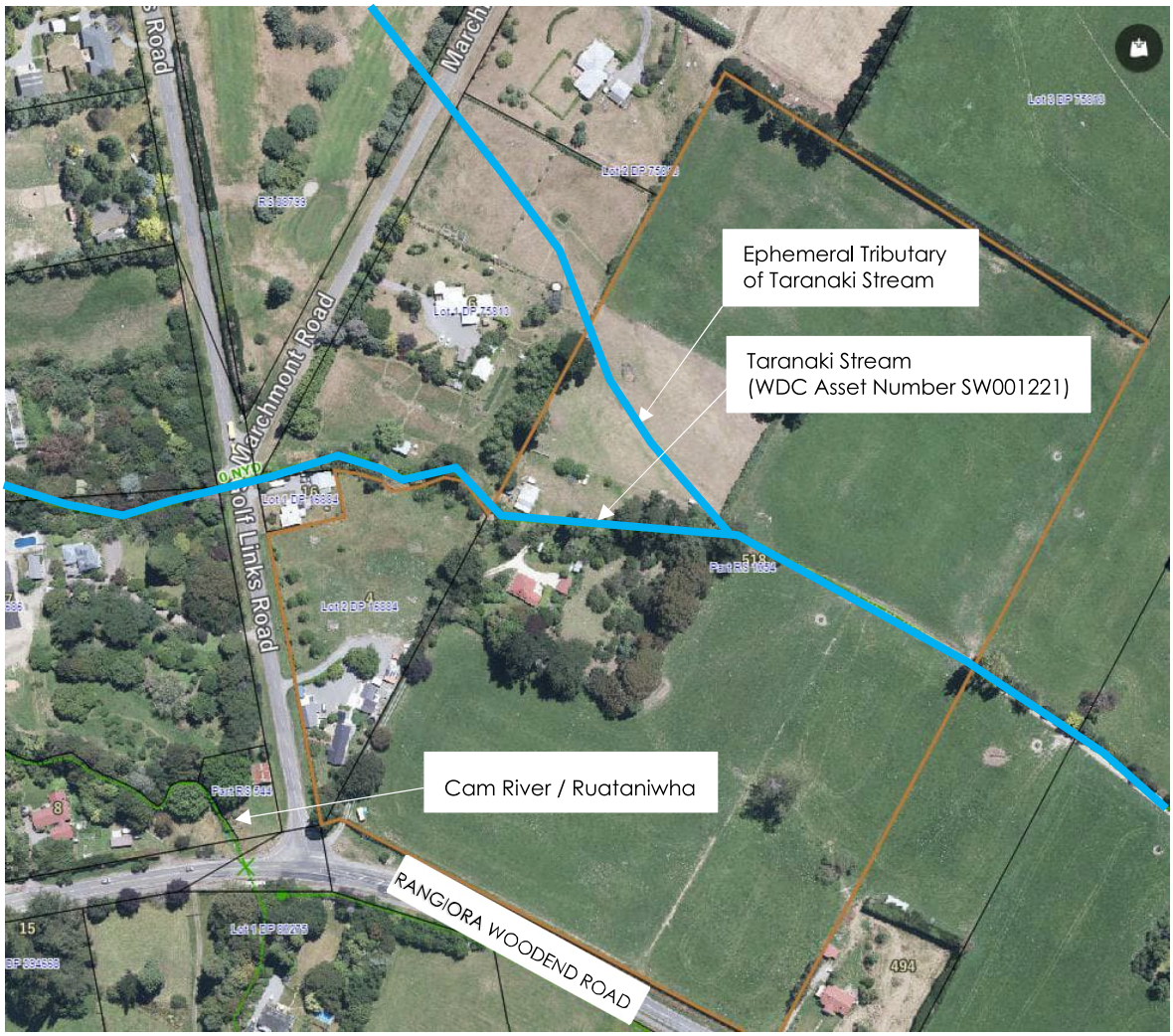


Figure 2. Existing Waterways

4. Waimakariri Flood Hazard Maps

The Waimakariri Flood Hazard Map also gives the predicted flood depths at the site from the 200yr ARI rainfall event as shown in Figure 3. As indicated, Taranaki Stream and a tributary of Taranaki stream, combine into one overland flow path crossing the site from West to East. Additionally, some minor secondary overland flow paths cross the site from the North to the East boundary.

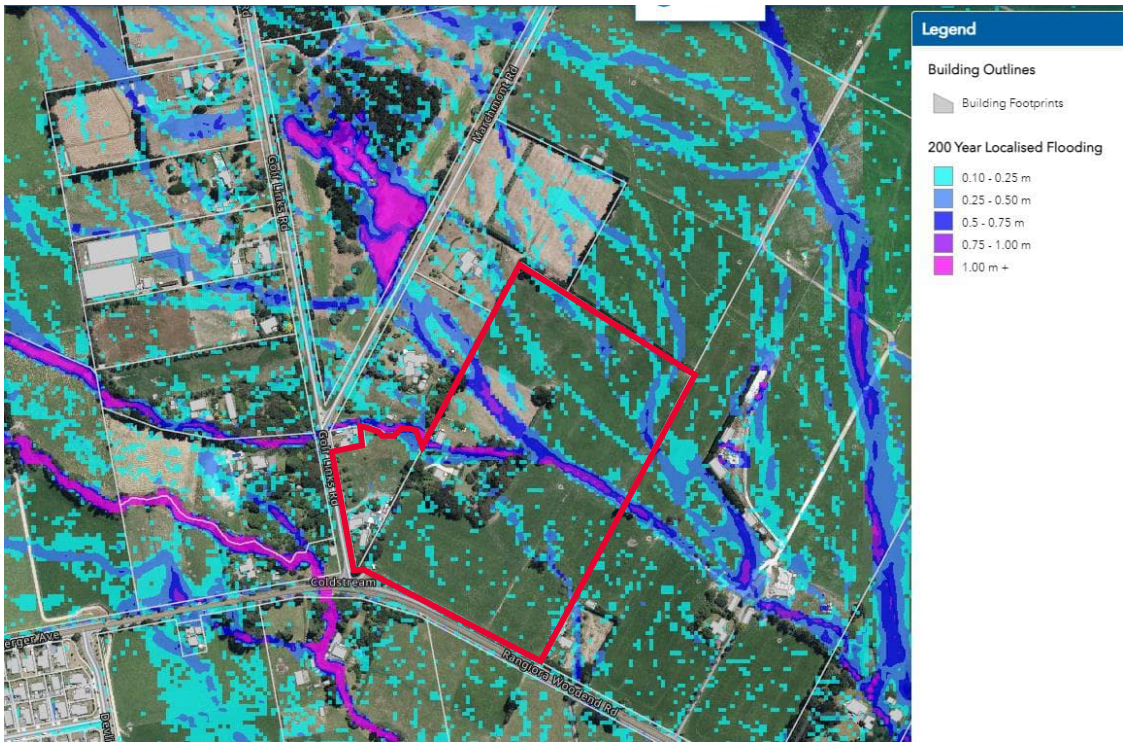


Figure 3. Predicted 200 Year ARI Flood Depths (Source: Waimakariri Flood Model)

Figure 4 indicates that within the Taranaki Stream the flood hazard is Low to Medium.

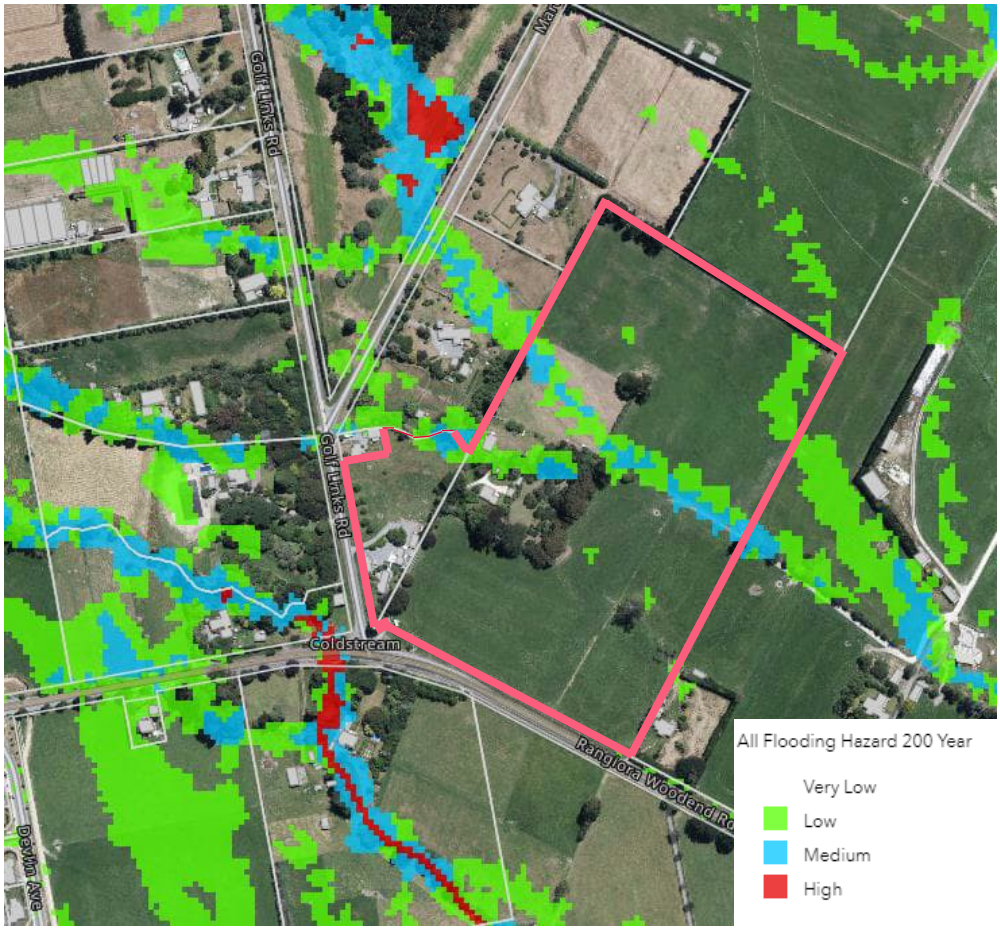


Figure 4. Current Level of Flood Hazard at the Site (Source: Waimakariri Flood Hazard Map)

5. HEC RAS Flood Modelling

200yr ARI Flood modelling has been carried out using the U.S Army Corps of Engineers' Hydrologic Engineering Center (HEC) River Analysis System (RAS) software to determine the effects of the proposed development at 4 Golf Links Road and 518 Rangiora Woodend Road, Rangiora.

HEC RAS has been used to model the pre and post-development flood flow patterns within the proposed development area and surrounding properties. Figure 5 shows the extent of the model layout.

Figure 5. Flood Model Extents

5.1. Modelling Parameters and Data

5.1.1. Boundary Conditions

The HEC RAS pre-development model was calibrated visually against Waimakariri 200-year Flood Map. The flood waters flow towards the South-east and therefore the flow in the HEC RAS model was applied in the same direction.

The 200 year flow hydrograph provided by Waimakariri District Council, shown in Figure 7, was applied to the catchment along the upstream boundary condition. A precipitation hyetograph for the 200 year ARI 24-hour duration was generated from Chicago Nested Rainfall Distribution as shown in Figure 6, and applied as rain on grid across the modelled catchment.

The pre-development flood depths were calibrated with the Waimakariri Flood Map depths. The same flow and rainfall depths were applied in the post-development model.

The downstream boundary condition was set to normal depth with the slope of the downstream LiDAR surface.

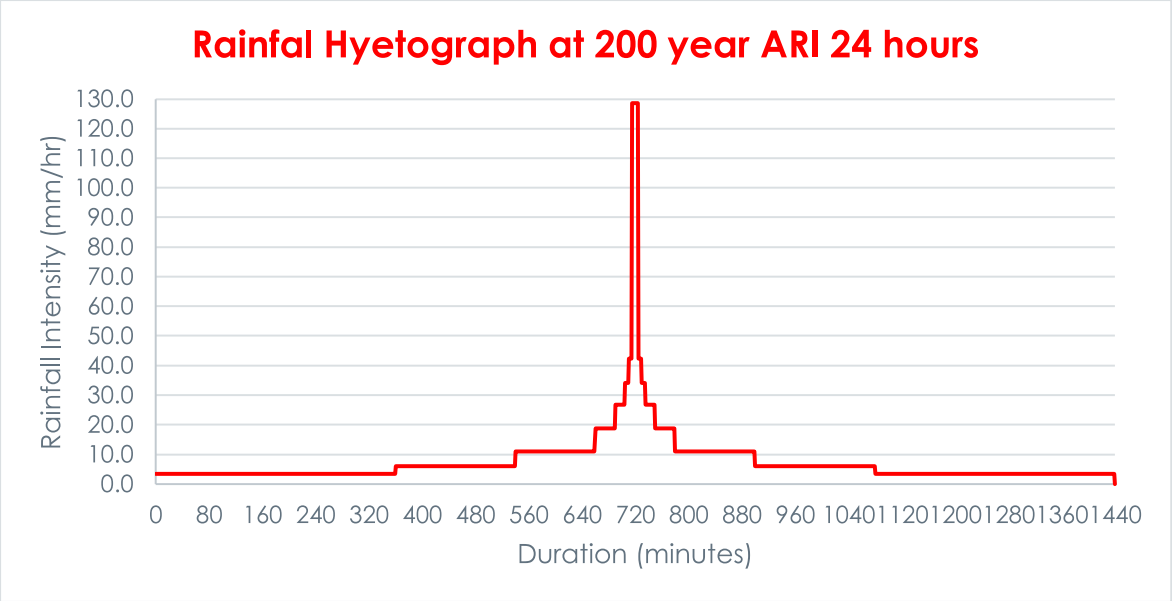


Figure 6. Rainfall Hyetograph for 200 year ARI 24 hrs Duration

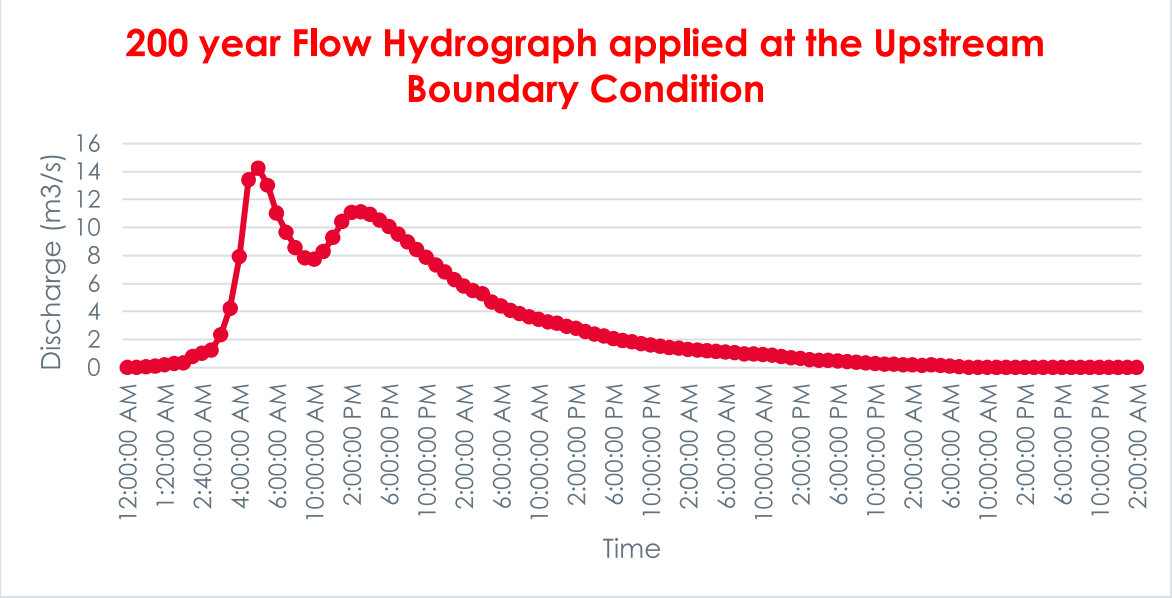


Figure 7. 200 year ARI flow Hydrograph Provided by Waimakariri District Council

5.1.2. Pre-development model surface

The pre-development model surface was based on the most recent LINZ LiDAR data (2020-2022) as shown in Figure 8. The existing bridge across Rangiora Woodend Road and existing culvert across Golf Links Road were included in the model as shown in Figure 8. The Golf Links Road culvert diameter was assumed to be 1.050m, and the Rangiora Woodend Road bridge was assumed to be 2.5m high and 1.5m wide. These assumptions were made by visually calibrating the obtained flood depths against the WDC Flood Map.

A default roughness coefficient of 0.06 for short grass was applied for the pre-development scenario.

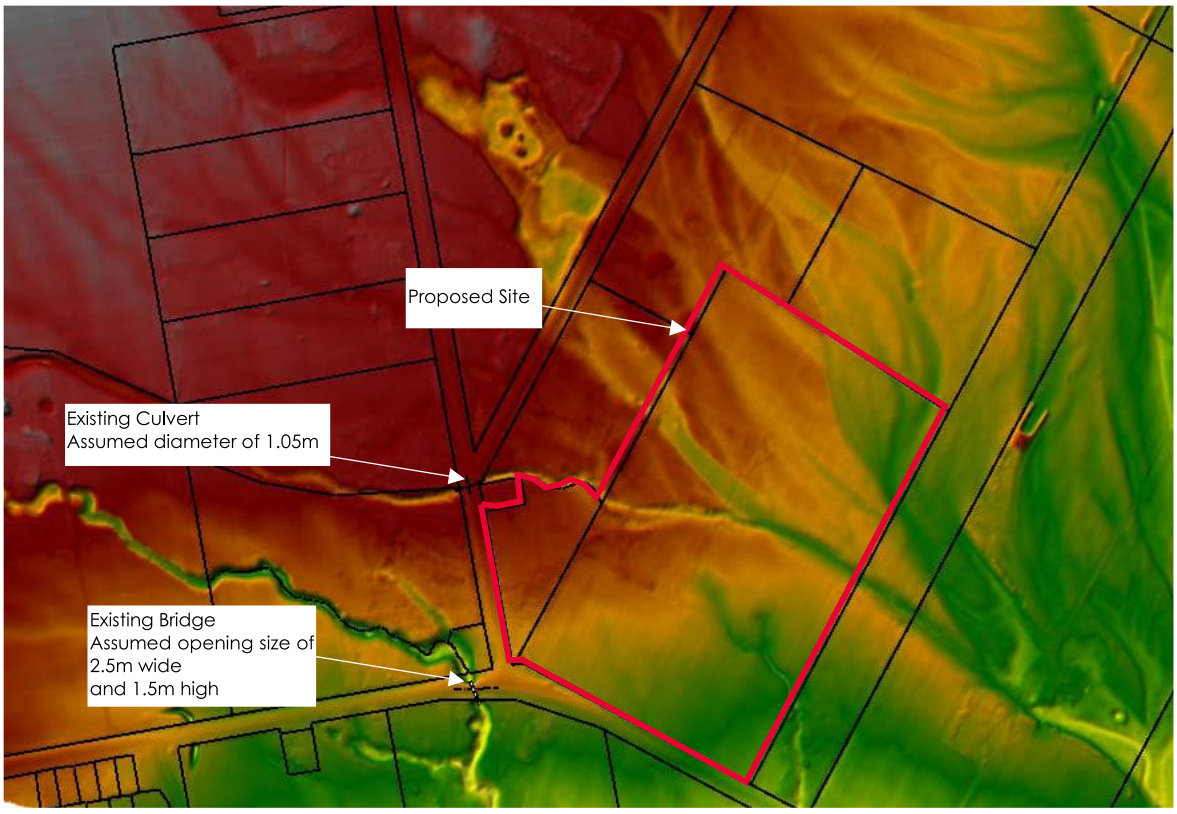


Figure 8. Pre-development 3D Topographical Surface

5.1.3. Post-development model surface

The post-development model surface was based on combination of most recent LINZ LiDAR (2020-2022) and the conceptual phase design surface, including new carriageways, new stormwater management areas and raised lot levels, as shown in Figure 9. The proposed model surface also includes the following:

- A new box culvert 8m wide and 0.5m high crossing the tributary of Taranaki stream.
- A new box culvert 8.5m wide and 0.5m high crossing Taranaki stream.
- A new 450mm diameter culvert at vehicular crossing to Rangiora Woodend Road, located at South-east part of site.
- A swale at the North-west boundary to divert existing overland flow paths.
- A swale at North-east and North boundary to divert existing overland flow paths.

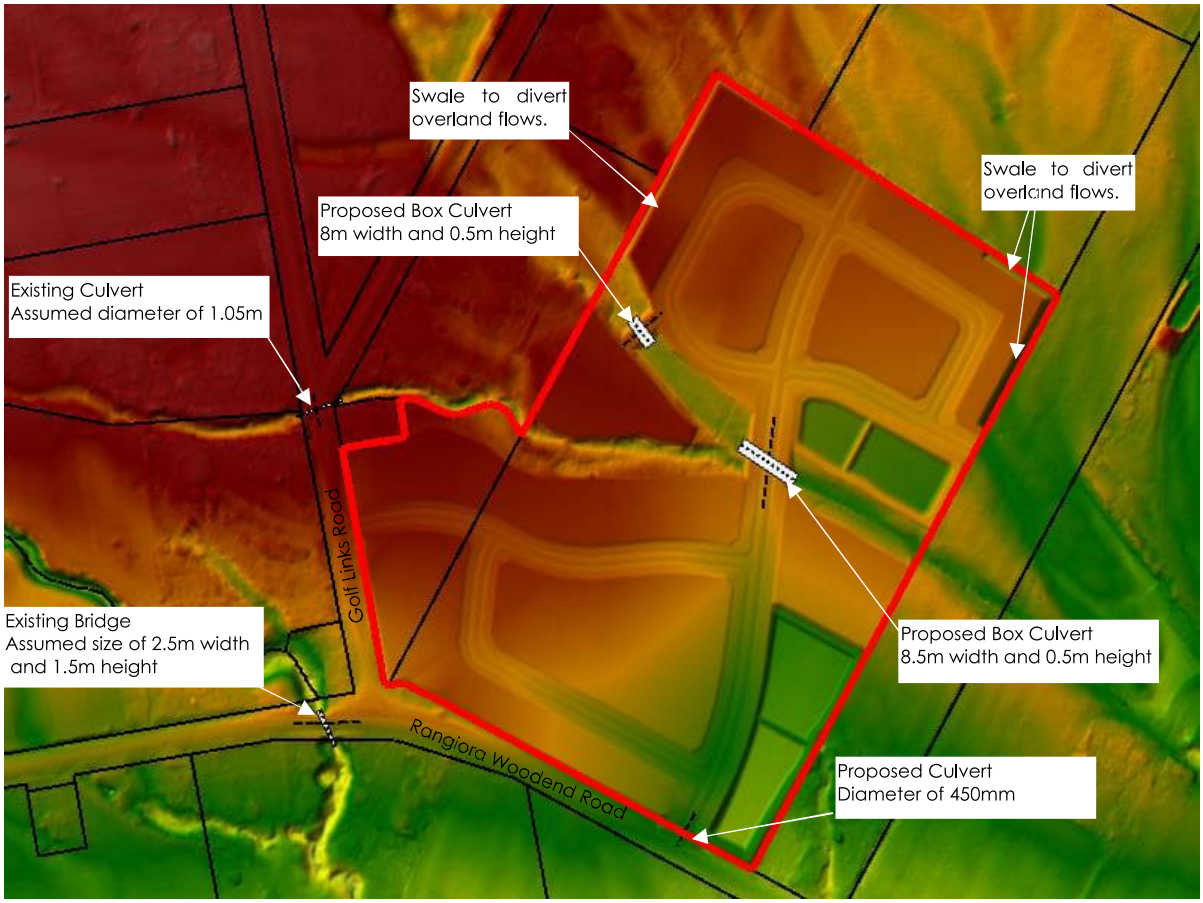


Figure 9. Post-development 3D Topographical Surface

A roughness coefficient of 0.01 was applied for the carriageways in the post-development scenario.

5.1.4. Modelling Computation

Both pre-development and post-development models were computed with time step of 4 seconds. A grid size of 10m x 10m was used for areas outside the development site and a refined region were used within the development site with a grid size of 3m x 3m grid.

5.1.5. Soil Infiltration

Soil infiltration was not included within the modelling therefore, it is assumed that the ground is fully saturated throughout the simulation.

5.1.6. Margin of Error

The pre and post-development flood modelling will have an unknown margin of error resulting from the following:

- The flow hydrograph provided by Waimakariri District Council was applied at the upstream boundary condition and was used to produce flood depths that match the Waimakariri Flood map depths. The flood depths were calibrated visually against Waimakariri Flood Maps.
- Exclusion of fence lines, trees and other potential obstruction to the flood passage.
- Accuracy of the LINZ LiDAR Surface
- The size of the grid used throughout the catchment and timesteps will incorporate a level of sensitivity error.
- Soils infiltration has not been included

- The size of existing culvert and bridge is an assumed size, and the inverts are adopted from existing LiDAR surface.

5.2. HEC RAS Flood Modelling Results

5.2.1. Effects on Overland Flow Path

Figure 10 shows the existing overland flow paths conveyed through the site. As indicated, a tributary of Taranaki stream merges into Taranaki stream within the site, and a number of small overland flows from North and North-west of site converge into Taranaki stream and flow in a South-east direction.

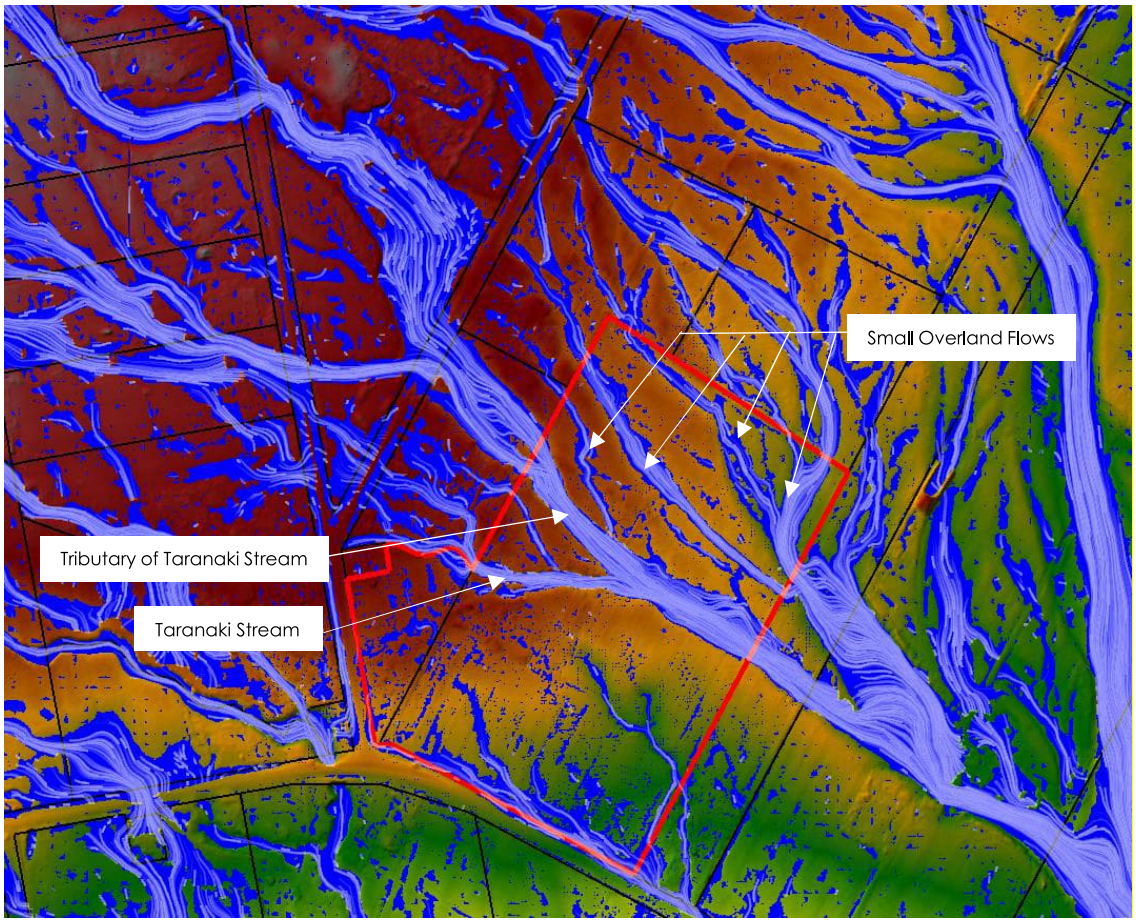


Figure 10. Pre-development Overland Flow Paths

Figure 11 shows the post-development overland flow paths.

As shown in Figure 11, the existing flow paths from Taranaki stream and a tributary of Taranaki stream are maintained and flows are conveyed within the development site with culverts and some overflow across the proposed new road. Accessibility is discussed further in Section 5.2.4.

The smaller overland flow paths from North-west and North, are diverted and conveyed by swales along the boundary of site to the tributary of Taranaki stream.

All overland flow paths, South of Taranaki Stream are diverted to the new basin located at South-east corner of site. The basin overflow discharges to the road side channel along Rangiora-Woodend Road. The capacity of this channel is exceeded in the 200 year flood event and the flows cross the road towards Lot 1 DP 452196.

The proposed culvert across Taranaki Stream, located centrally within the site will be designed for 50 year ARI flows, and during the 200 year flood event, the road will be designed with a spillway to allow 200 year flows to spill over the road into new basin located North of Taranaki stream.

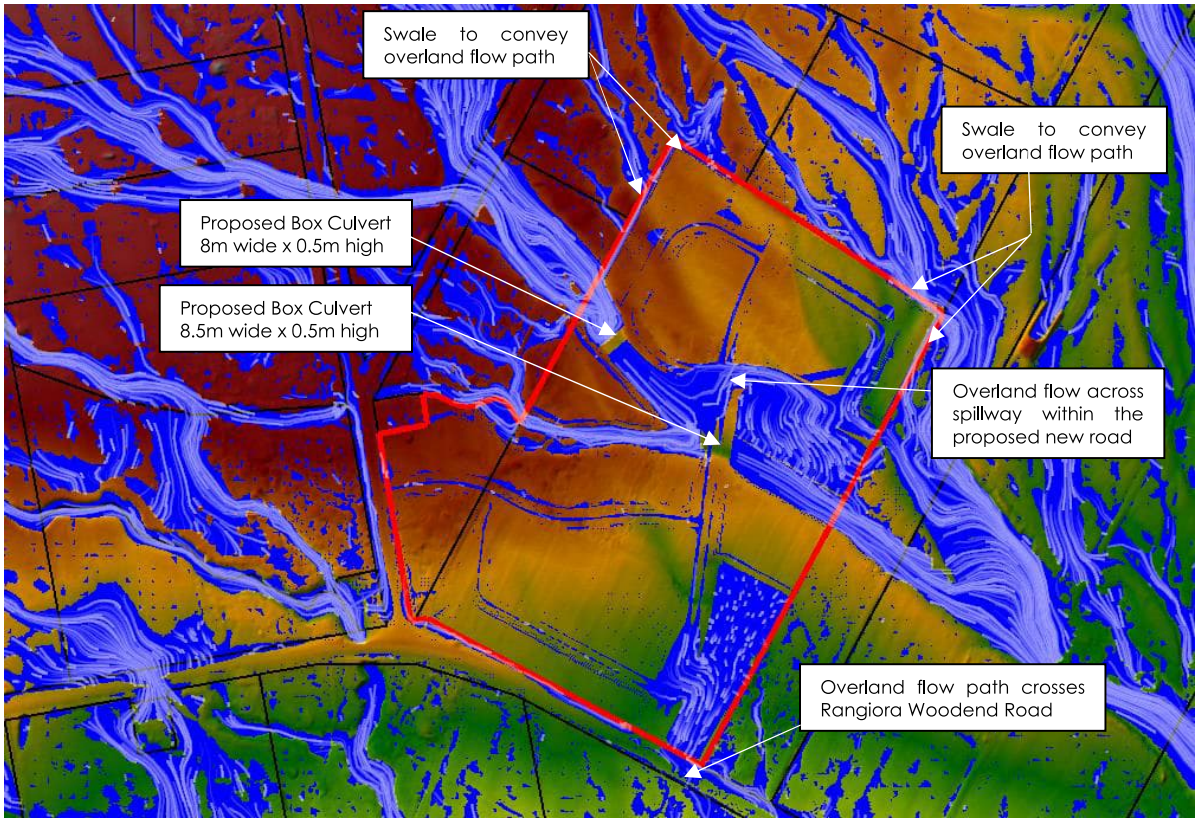


Figure 11. Post-development Overland Flow Paths

5.2.2. 200 Year Flood Depths

Figure 12 provides the HEC RAS pre-development flood depth results map. As shown the pre-development flood depths generally match the Waimakariri 200yr Flood Map depths shown in Figure 3.

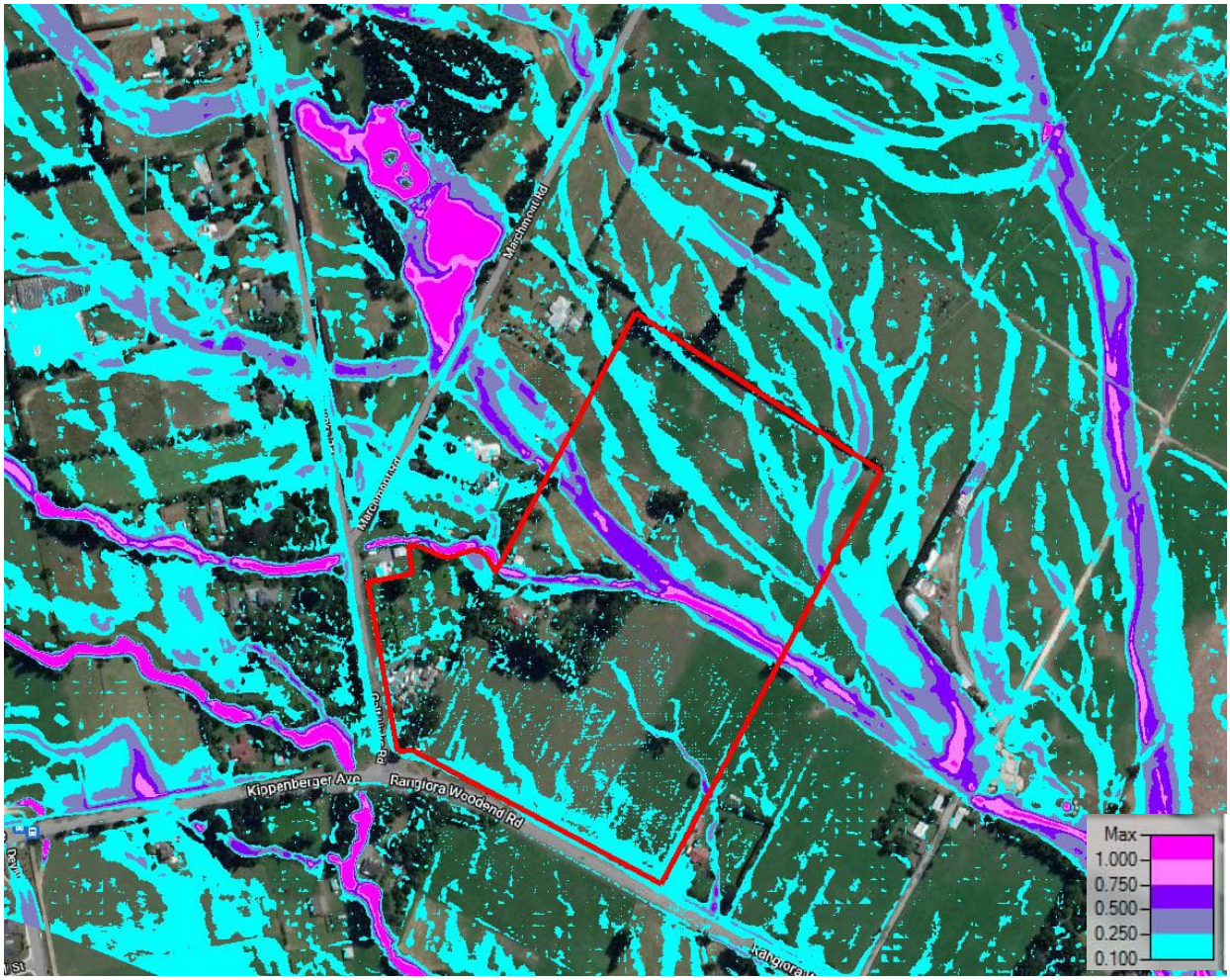


Figure 12. Pre-development 200 Year Flood Depths (m)

It should be noted that the WDC flood hazard map (Figure 3) does not include flood depths less than 100mm, whereas the HEC RAS pre-development model flood depths include flooding less than 100mm.

The post-development flood depths result map is shown in Figure 13.

Note: The post-development flood depths less than 10mm are not shown.

The proposed lots within the development site are above the 200 year flood level as required. There is up to 300mm flood depth within the proposed roads.

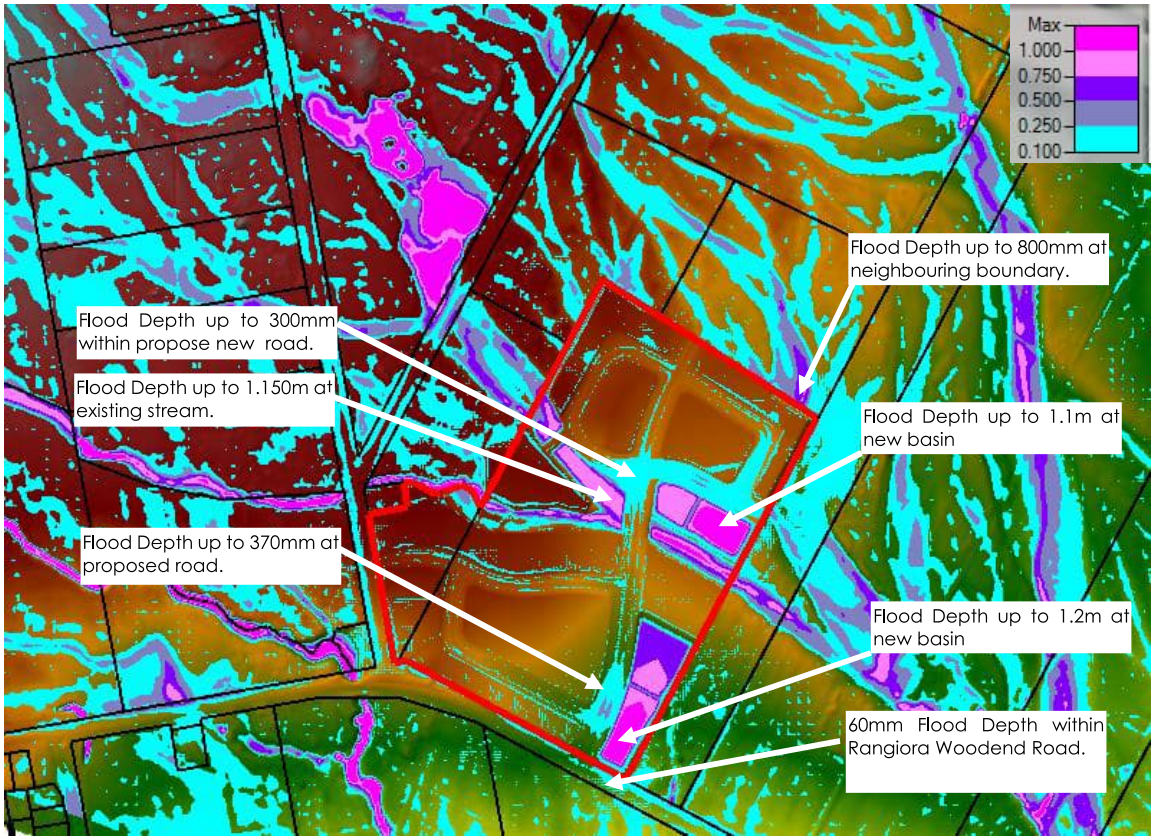


Figure 13. Post-development 200 Year Flood Depths (m)

Figure 14 shows the difference between the pre-development and post-development flood depths and the flood effects associated with the proposed development.

Note: The differences less than 5mm are not shown on the results map.

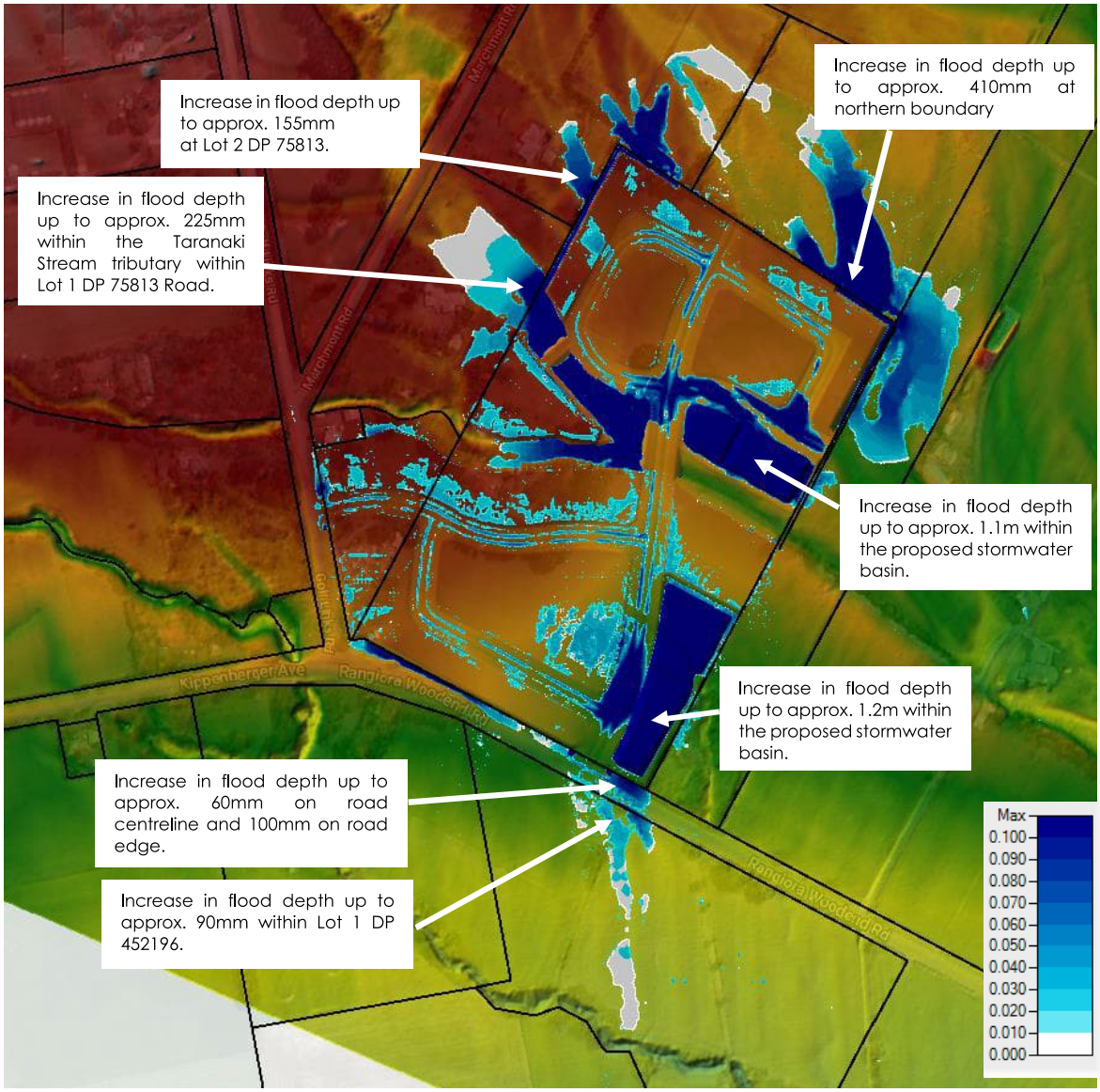


Figure 14. Post-development vs Pre-development Difference Map

As shown in Figure 14, generally the flood effects due to the proposed subdivision are as follows:

- The basin areas capture the majority of the flood flow
- There is an increase of flood depths to the north of the development site where some existing secondary flow paths have now been diverted via new swales along the development boundary to Taranaki Stream. The increase in flood depth does not occur at existing dwellings. However, the flood depth within pasture land has increased as shown.
- There is an increase in the flood depth within Taranaki Stream and its tributary due to the proposed new road crossings however this increase is mainly contained within the development site. There is up to 225mm increase within Lot 1 DP 75813 however this does not affect the existing dwelling.
- Within Rangiora Woodend Road, the water depth increase is approximately 60mm at the road centreline and up to 100mm at the road edge. This is due to the overland flow path to the south of the development exceeding the capacity of the Rangiora Woodend Road roadside channel and crossing the road.

5.2.3. Effects on Surrounding Properties

Figure 15 shows the surrounding properties (highlighted in light blue) that are affected by the post-development flood effects.

Figure 15. Surrounding Properties considered for flood effect (highlighted in blue)

Table 1 provides the flood depths increase at surrounding properties.

Table 1. Flood Depth Effects at Surrounding Properties

Property Address	Increase in Flood Depths (mm)	Comments
Lot 1 DP 75813	0-225	As shown in Figure 14, the increase in flood depth has not affected any dwellings and this depth increase is within the tributary of Taranaki Stream within pastured area of the property.
Lot 2 DP 75813	0-155	As shown in Figure 14, the increase in flood depth has not affected any dwellings and this depth increase is within the pastured area of property. A swale is provided along the North-West boundary of proposed site to divert the overland flow path towards the Taranaki Stream tributary.
Lot 3 DP 75813	0-410	As shown in Figure 14, the increase in flood depth is within the pastured area of the property. A swale is provided along the North-East boundary of the proposed site to divert the overland flow path around the development site.
Lot 1 DP 452196	0-90	As shown in Figure 14, the increase in flood depth has not affected any dwellings and this depth increase is within the pastured area of property.
RS 2332	0-100	As shown in Figure 14, the increase in flood depth has not affected any dwelling and this increase in flood depth is within the pastured area of property.

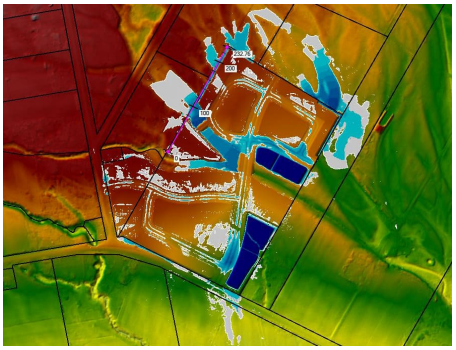


Figure 16. Long-section location at North-west Boundary of site

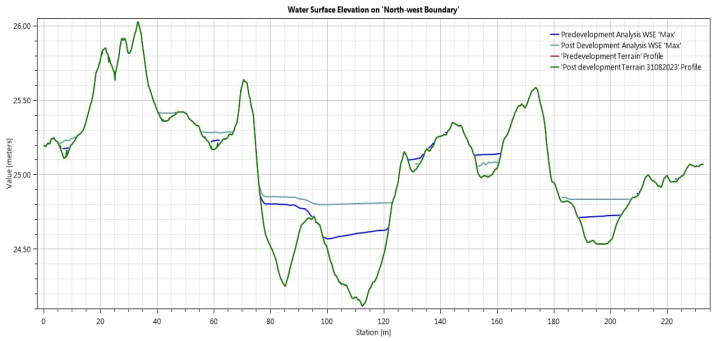


Figure 17. Long-section at North-west Boundary of site

As shown in Figure 17, the flood depth along North-west boundary has a depth increase of approximately 70mm along chainage 50-70m. As indicated, the water depth in the existing tributary of Taranaki stream has a flood depth increase of 225mm between chainage 70-120m. There is a flood depth increase of approximately 50-155mm from chainage 100-120m and 190-215m.

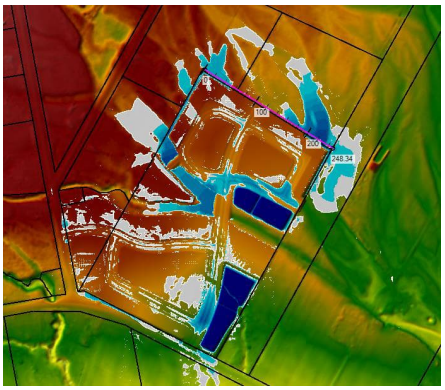


Figure 18. Long-section Location at North Boundary of site.

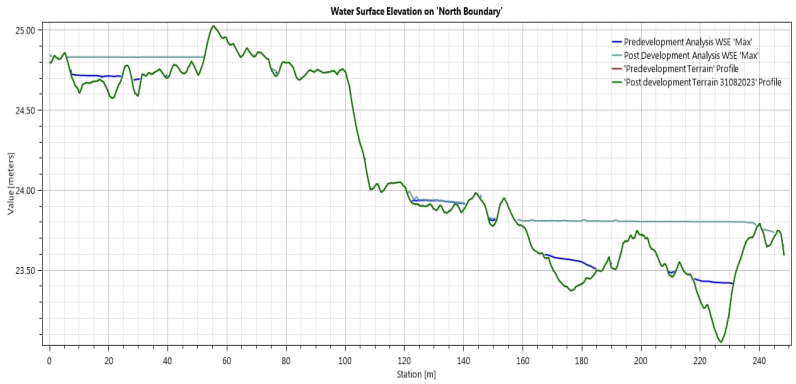


Figure 19. Long-section at North Boundary of site.

As shown in Figure 19, the increase in flood depth is approximately 150mm between chainage 0 to 55m. There is increase in flood depth of approximately 100 to 410mm along chainage 150-240m.

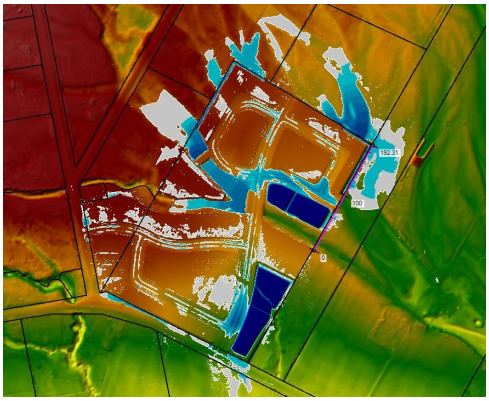


Figure 20. Long-section Location at North-east Boundary of site

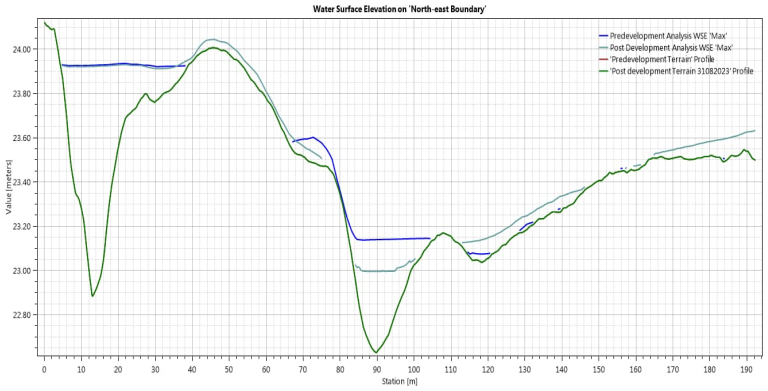


Figure 21. Long-section at North-east Boundary of site

As shown in Figure 21, there is a decrease in flood depth of approximately 100-150mm along chainage 80-105m. There is an increase in flood depth of approximately 50-100mm along chainage 110-190m.

5.2.4. Egress Hazard Assessment

Austroads Guide to Road Design, Part 5: Drainage Design specifies that the maximum pedestrian safety criteria within flood waters is 0.4 m^2/s (also known as angular momentum). Where pedestrian safety is not of concern, the maximum value for vehicle safety is 0.6 m^2/s.

Figure 22 shows a map of depth x velocity for the post-development scenario. As indicated the values within the proposed carriageways and Rangiora Woodend Road are less than 0.4 m^2/s. Values higher than 0.4 m^2/s are only indicated within the waterways.

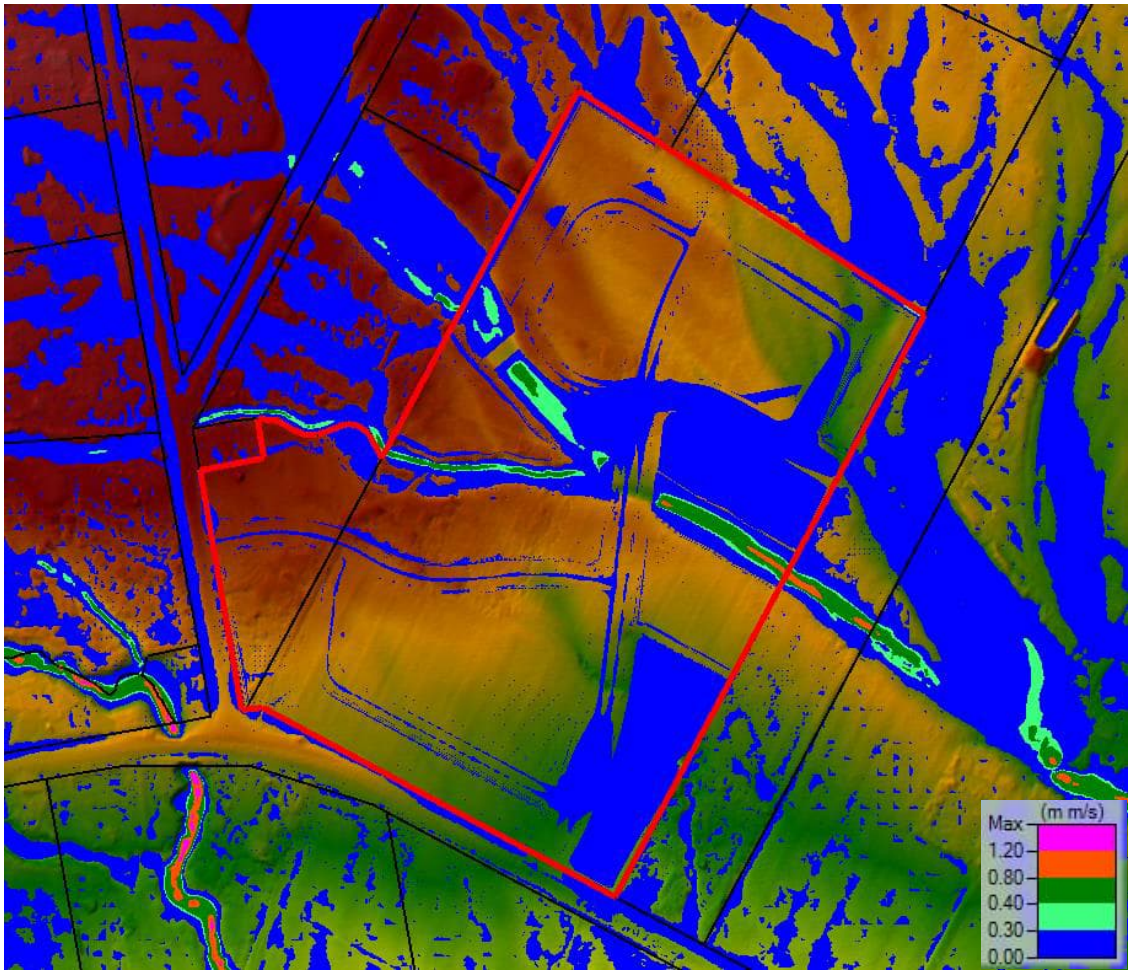


Figure 22. Post-development Map of Depth x Velocity

As shown in Figure 23, the depth x velocity values along the centreline of Rangiora Woodend Road have increased from pre-development to post-development scenario with a maximum value of 0.017m^2/s, which is less than the maximum pedestrian safety criteria and vehicle safety criteria.

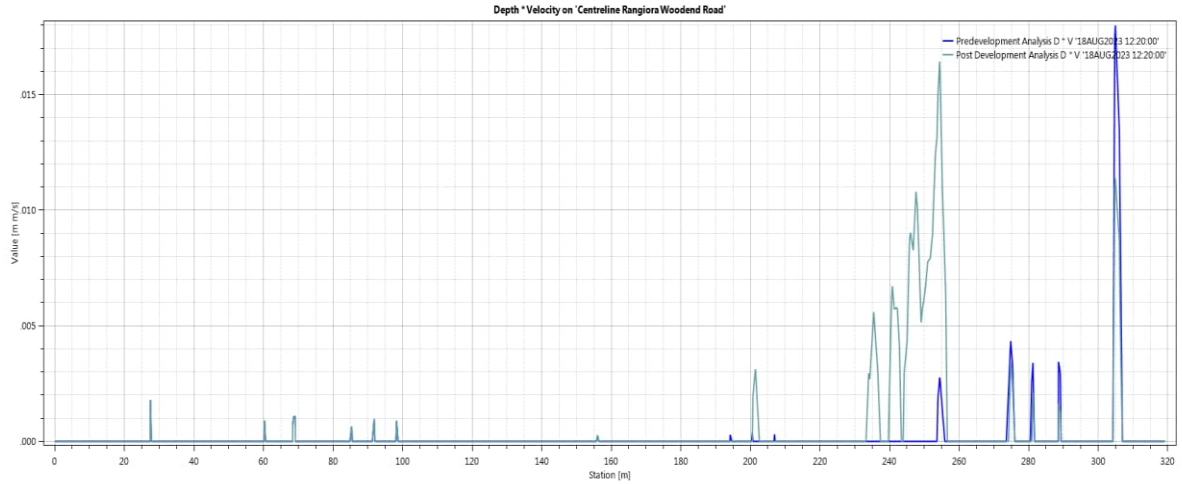


Figure 23. Depth x Velocity along Rangiora Woodend Road

As shown in Figure 25, the depth x velocity value along the centreline of proposed carriageway is a maximum value of 0.066m^2/s, which is less than the maximum pedestrian safety criteria and vehicle safety criteria. The location of the long section for Angular momentum (depth x velocity) check is shown in Figure 24.

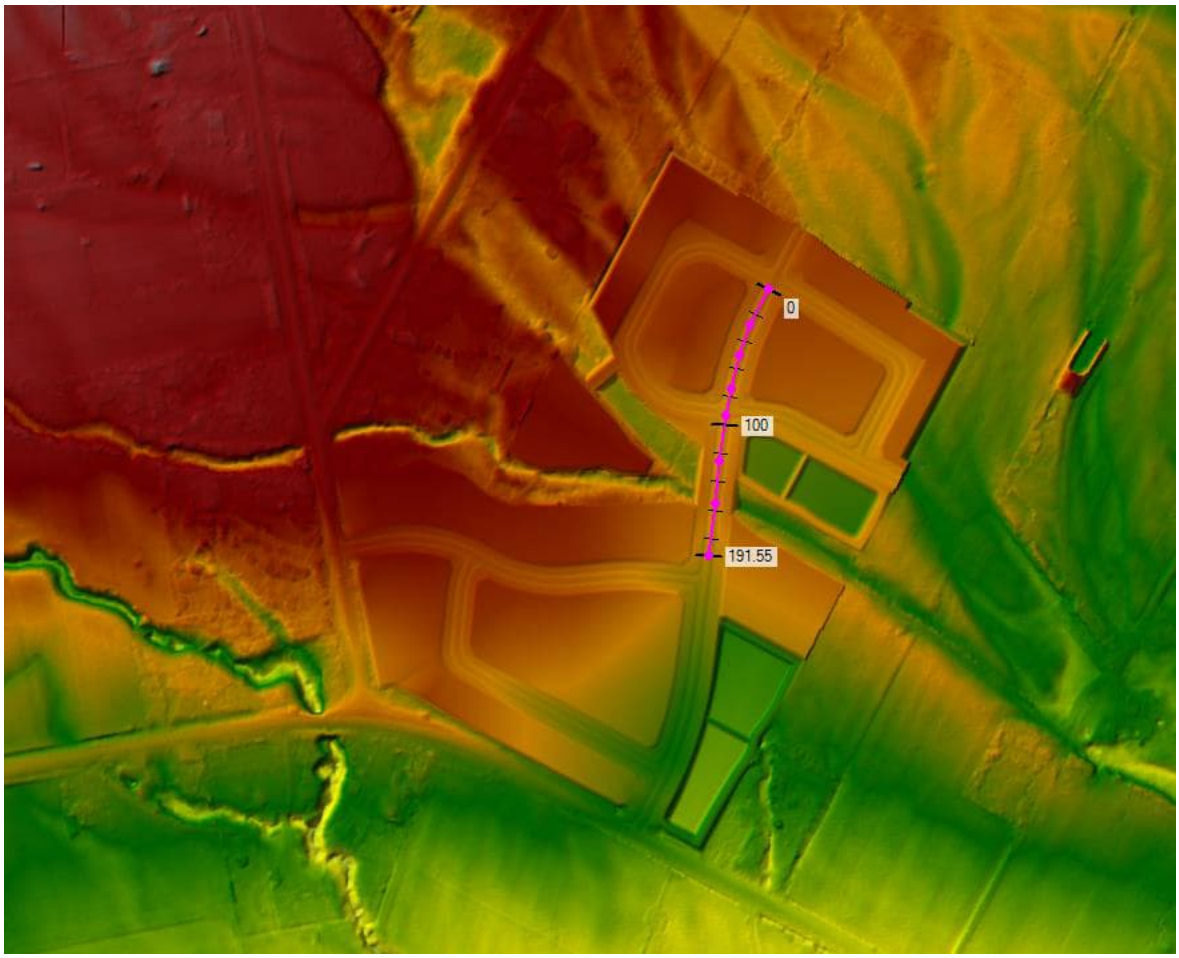


Figure 24. Longsection along the proposed new road for Angular Momentum Check

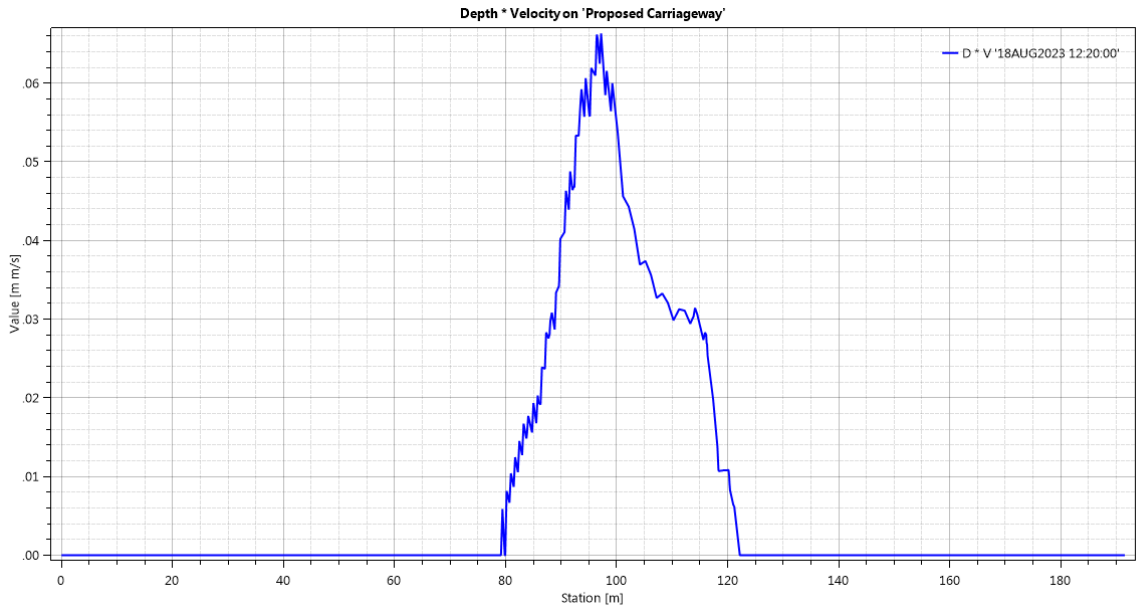


Figure 25. Depth x Velocity along Proposed Carriageway

Therefore the angular momentum within the development roadways, footpaths paths and Rangiora Woodend Road adhere with the Austroads safety criteria for pedestrians and vehicles.

6. Proposed Building Finished Floor Level

The Waimakariri District Council (WDC) requires that the proposed building finished floor level be 500mm above the 200yr ARI flood level in a Medium Hazard Flood area and 400mm above the 200yr ARI flood level in a Low Hazard Flood area.

In accordance with the Waimakariri District Flood classification, areas with flood depths less than 0.3m are considered Low Hazard Flood areas and with flood depths between 0.3-1m are considered Medium Hazard.

The post-development flood model for the proposed site (as shown in section 6) has maximum flood depths of 0.3m along the carriageways and depths greater than 0.3m within the existing waterways, therefore it is considered that parts of the site are Low Hazard and parts Medium Hazard Flood areas. Therefore, it is proposed that all the residential dwellings should be 500mm above the 200yr ARI flood level.

7. Conclusion

HEC RAS flood modelling has been carried out to determine the 200 year flood effects of the proposed development at 4 Golf Links Road and 518 Rangiora Woodend Road on the surrounding properties and roads.

Pre and post-development scenarios were modelled within the proposed development area and surrounding properties. The pre-development flood depths were calibrated against the Waimakariri flood model. The post-development model surface includes the new carriageways, new stormwater management areas and raised lot levels within the development site.

A comparison between pre and post-development 200 year flood depths, indicate the following flood increases within the Rangiora Woodend Road and the neighbouring properties:

- Within properties to the North-west, there is a flood depth increase varying between 5mm and 230mm.
- Within properties to the North and North-east, there is a flood depth increase varying between 5mm and 410mm.
- Within Rangiora Woodend Road, there is a flood depth increase of approximately 60mm at the road centreline and up to 100mm at the road edge.
- Within properties to the South of Rangiora Woodend Road, there is a flood depth increase varying between 5mm and 90mm.

Accessibility has been considered and although the angular momentum values have increased along Rangiora Woodend Road, the highest value is 0.0165 m2/s which is less than the Austroads safety criteria for pedestrians and vehicles..

8. Disclaimer

This report has been prepared by Eliot Sinclair & Partners Limited ("Eliot Sinclair") only for the intended purpose as a Flood Impact Assessment Report.

The report is based on:

- Lidar data (2020-2022) obtained from LINZ
- Waimakariri Flood Hazard maps
- Flow hydrograph obtained from Waimakariri District Council

Where data supplied by CVI Projects Limited or other external sources, including previous site investigation reports, have been relied upon, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Eliot Sinclair for incomplete or inaccurate data supplied by other parties.

Whilst every care has been taken during our investigation and interpretation of Lidar data and the District flood maps to ensure that the conclusions drawn, and the opinions and recommendations expressed are correct at the time of reporting, the accuracy of the flood model and results is based on the accuracy of the Lidar data and a calibration of that data against the Waimakariri Flood Hazard maps. As such, the post-development flood modelling may include a margin of error, the extent of which is unknown at the time of writing this report.

Eliot Sinclair does not provide any warranty, either express or implied, that all conditions will conform exactly to the assessments contained in this report. The exposure of conditions that vary from those described in this report, or any update to Lidar data or Waimakariri flood maps may require a review of our recommendations. Eliot Sinclair should be contacted to confirm the validity of this report should any of these occur.

This report has been prepared for the benefit of CVI Projects Limited and Waimakariri District Council for the purposes as stated above. No liability is accepted by Eliot Sinclair or any of their employees with respect to the use of this report, in whole or in part, for any other purpose or by any other party.

Appendix G. Utility Provider Correspondence

10/05/2023- via email

Network Reference: 00049358

MainPower New Zealand Limited
172 Fernside Road, RD 1 Kaiapoi 7691
PO Box 346, Rangiora 7440
T. 0800 30 90 80

Simon Crundwell
Eliot Sinclair

Dear Simon,

Re: Power Connection for Proposed Subdivision. CB388/195 and Lot 2 DP 16884, 518 Rangiora Woodend Road and 4 Golf Links Road Rangiora

MainPower confirms that the High voltage Network in the vicinity of 518 Rangiora Woodend Road and 4 Golf links Road Rangiora has the capacity to supply the proposed subdivision.

This letter is to advise you that MainPower's network has the capacity for the proposed subdivision. This does not mean that there is an electrical supply to the boundary of the proposed lots.

Please do not hesitate to contact the MainPower NZ Ltd NSR Team on 03 311 8311 or NSR@mainPower.co.nz if you have any questions.

Yours sincerely,

Matthew Bate
Network Services Representative

CHORUS

Hi Team,

Thank you for providing an indication of your development plans in this area. I can confirm that we have UFB fibre infrastructure in the area that you are proposing to develop. Chorus will be able to extend our network to provide connection availability. However, please note that this undertaking would of course be subject to Chorus understanding the final total property connections that we would be providing, roll-out of property releases/dates and what investment may or may not be required from yourselves and Chorus to deliver the infrastructure to and throughout the site in as seamless and practical way as possible.

The costs involved can only be finalised at the time that you are ready to proceed.

Chorus is happy to work with you on this project as the network infrastructure provider of choice. What this ultimately means is that the end customers (business and home owners) will have their choice of any retail service providers to take their end use services from once we work with you to provide the physical infrastructure.

Please reapply with a detailed site plan when you are ready to proceed.

Thanks

Grant

Flood Impact Assessment

Version A

4 Golf Links Road and 518 Rangiora Woodend Road, Rangiora

Prepared for CVI Projects Limited

511185

eliot sinclair

Flood Impact Assessment

4 Golf Links Road and 518 Rangiora Woodend Road, Rangiora

Prepared for CVI Projects Limited

511185

Quality Control Certificate

Eliot Sinclair & Partners Limited

eliotsinclair.co.nz

Action	Name	Signature	Date
Prepared by:	Jenish Manandhar Civil Engineer DipEng Civil jenish.manandhar@eliotsinclair.co.nz		10 October 2023
Reviewed by:	Stephany Pandrea 3 Waters Engineer BE(Hons) Civil MEngNZ stephany.pandrea@eliotsinclair.co.nz		10 October 2023
Directed and approved for release by:	Stephany Pandrea 3 Waters Engineer BE(Hons) Civil MEngNZ stephany.pandrea@eliotsinclair.co.nz		10 October 2023
Status:	Version A		
Release date:	10 October 2023		
Distributed to:	CVI Projects Limited Waimakariri District Council		

Version History

Status	Description	Author	Release Date
A	Plan Change Issue	J. Manandhar	10 October 2023

Contents

1. Introduction

Eliot Sinclair have been engaged by CVI Projects Limited, to compile a Flood Impact Assessment to support a plan change application from rural to residential land use for the site located at 518 Rangiora Woodend Road and 4 Golf Links Road, Rangiora. The proposed residential development comprises of new residential allotments, new carriageways, and two new stormwater management areas.

2. Scope of works

Eliot Sinclair has prepared this Flood Impact Assessment for the proposed subdivision to support the application for land use plan change. The report has been prepared to provide an assessment of the flooding effects of the proposed development on:

- Existing overland flow paths
- Flooding at surrounding properties
- Accessibility within proposed new carriageways
- Accessibility within existing council vested carriageways

3. Site description

The site is located at 518 Rangiora Woodend Road and 4 Golf Links Road as shown in Figure 1. Refer to Appendix A for proposed site development plan. The site area is approximately 11.3 ha and consists of the following legal allotments:

- Lot 2 DP16884
- Part RS 1054

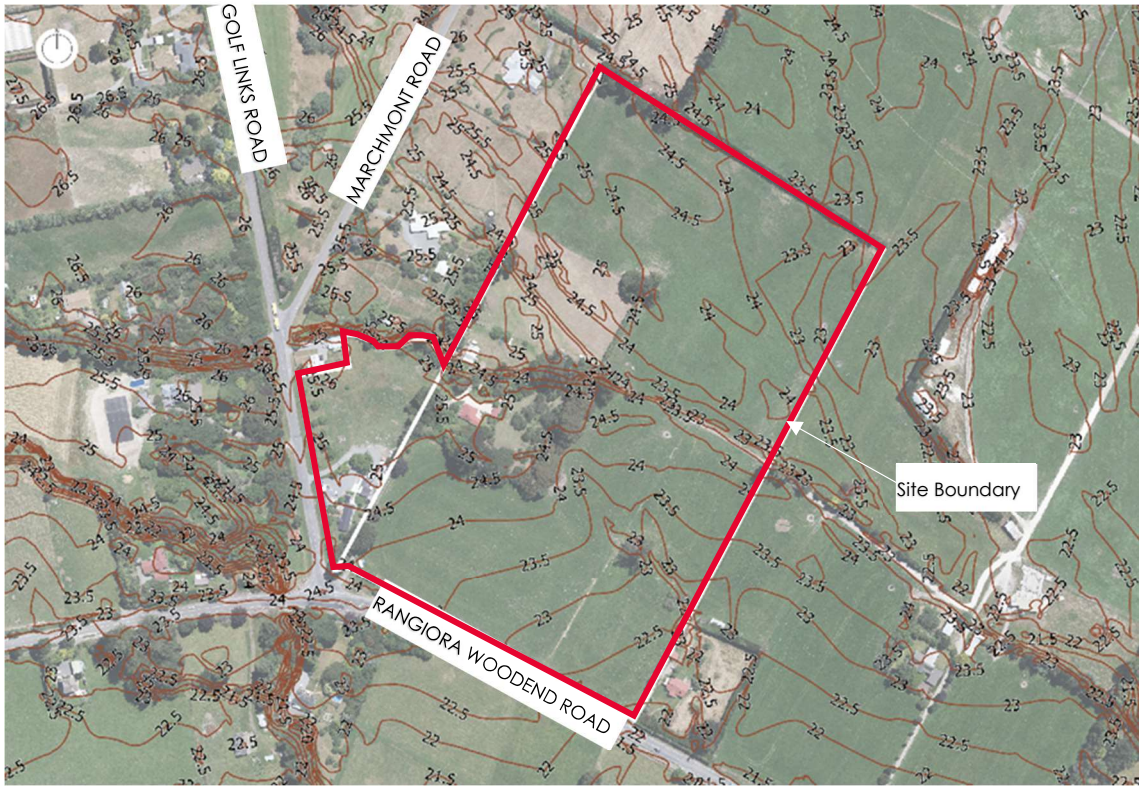


Figure 1. Site Location Plan

There are two existing residential dwellings with various associated structures on-site and the remainder of the site is pasture. The North part of the site falls from the North-west to the North-east and the South part of the site falls from the North-west to the South-east.

The Cam River/ Ruataniwha crosses the Rangiora Woodend Road to the West of the site. An existing Waimakariri District Council (WDC) owned natural stormwater channel (Taranaki Stream) runs adjacent to the northern boundary of 4 Golf Link Road and through the centre of 518 Rangiora Woodend Road. An existing ephemeral tributary of Taranaki stream crosses the site from North-west and converges to Taranaki stream at approximately central location of 518 Rangiora Woodend Road. Refer to Figure 2 for existing waterways within and nearby the site.

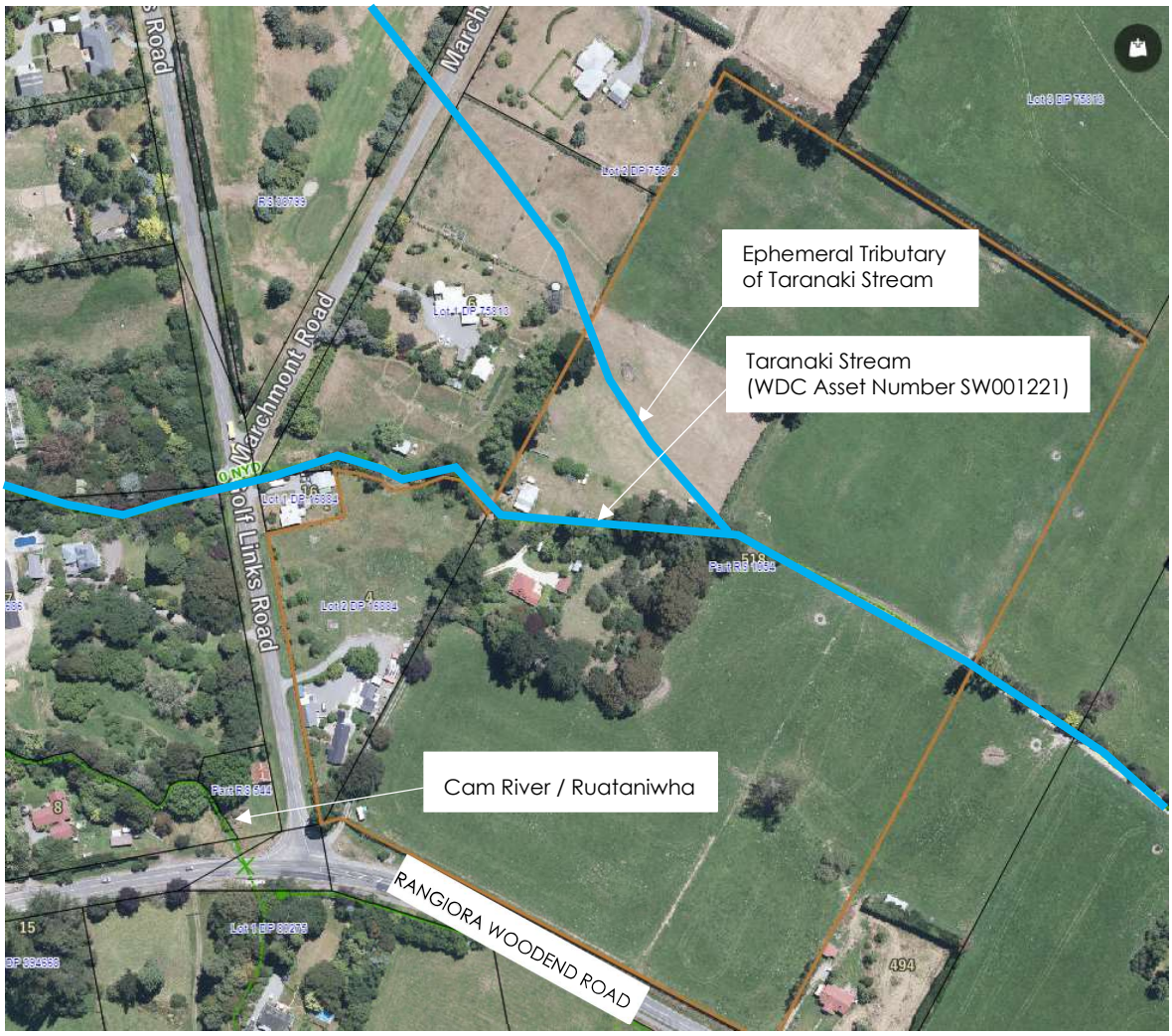


Figure 2. Existing Waterways

4. Waimakariri Flood Hazard Maps

The Waimakariri Flood Hazard Map also gives the predicted flood depths at the site from the 200yr ARI rainfall event as shown in Figure 3. As indicated, Taranaki Stream and a tributary of Taranaki stream, combine into one overland flow path crossing the site from West to East. Additionally, some minor secondary overland flow paths cross the site from the North to the East boundary.

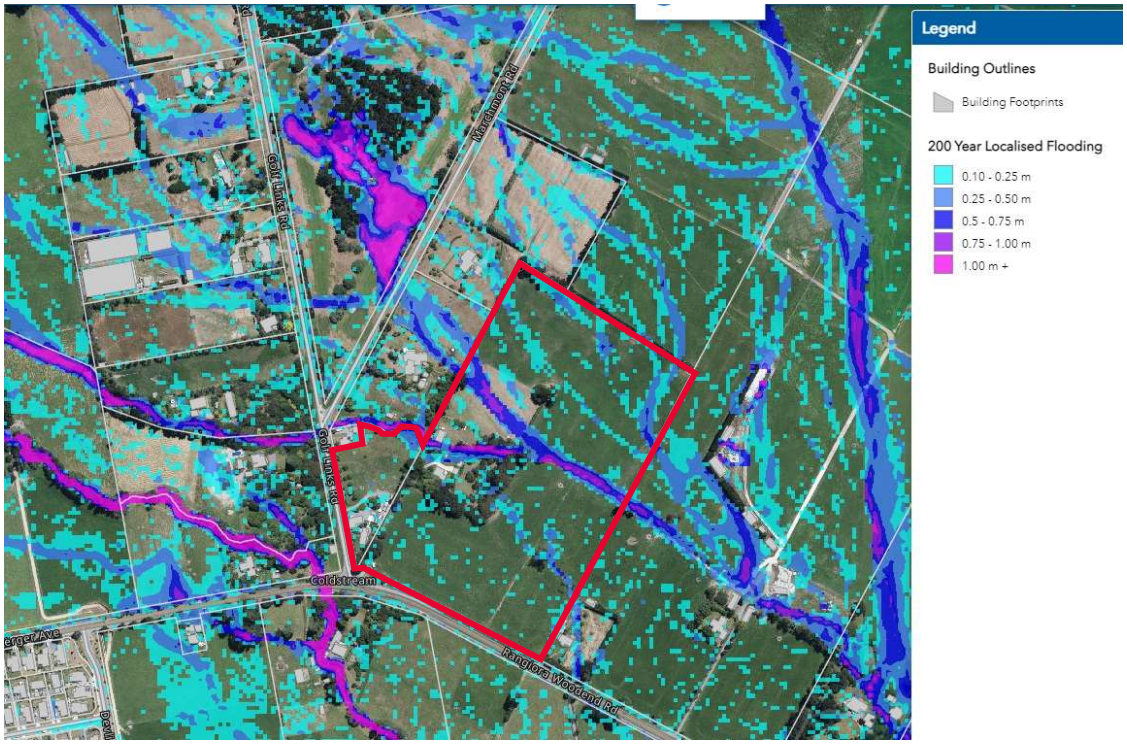


Figure 3. Predicted 200 Year ARI Flood Depths (Source: Waimakariri Flood Model)

Figure 4 indicates that within the Taranaki Stream the flood hazard is Low to Medium.

Figure 4. Current Level of Flood Hazard at the Site (Source: Waimakariri Flood Hazard Map)

5. HEC RAS Flood Modelling

200yr ARI Flood modelling has been carried out using the U.S Army Corps of Engineers' Hydrologic Engineering Center (HEC) River Analysis System (RAS) software to determine the effects of the proposed development at 4 Golf Links Road and 518 Rangiora Woodend Road, Rangiora.

HEC RAS has been used to model the pre and post-development flood flow patterns within the proposed development area and surrounding properties. Figure 5 shows the extent of the model layout.

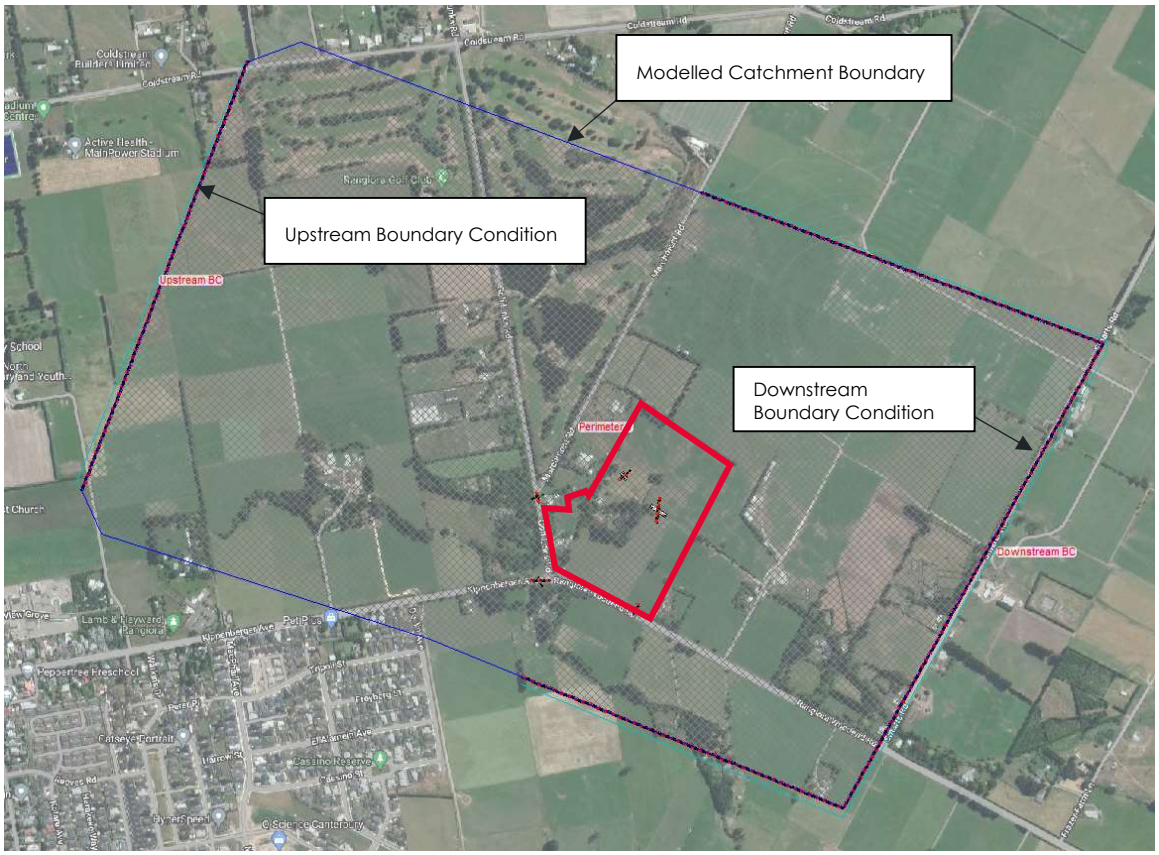


Figure 5. Extent of the model being analysed

5.1. Modelling Parameters and Data

5.1.1. Boundary Conditions

The HEC RAS pre-development model was calibrated visually against Waimakariri 200-year Flood Map. The flood waters flow towards the South-east and therefore the flow in the HEC RAS model was applied in the same direction.

The 200 year flow hydrograph provided by Waimakariri District Council was applied to the catchment along the upstream boundary condition. A precipitation hyetograph for the 0.5% AEP 24-hour duration was generated from Chicago Nested Rainfall Distribution as shown in Figure 6, and applied as rain on grid across the modelled catchment.

The pre-development flood depths were calibrated with the Waimakariri Flood Map depths. The same flow and rainfall depths were applied in the post-development model.

The downstream boundary condition was set to normal depth with the slope of the downstream LiDAR surface.

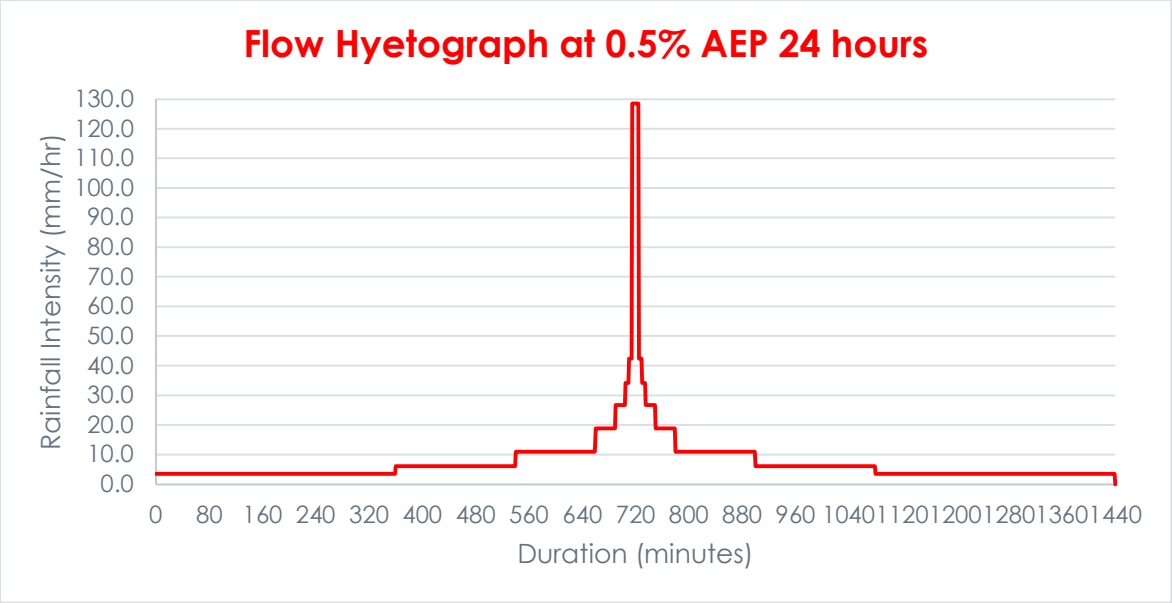


Figure 6. Flow Hyetograph at 0.5% AEP 24 hrs

5.1.2. Pre-development model surface

The pre-development model surface was based on the most recent LINZ LiDAR data (2020-2022) as shown in Figure 7. The existing bridge across Rangiora Woodend Road and existing culvert across Golf Links Road were included in the model as shown in Figure 7. The Golf Links Road culvert diameter was assumed to be 1.050m, and the Rangiora Woodend Road bridge was assumed to be 2.5m high and 1.5m wide. These assumptions were made by visually calibrating the obtained flood depths against the WDC Flood Map.

A default roughness coefficient of 0.06 for short grass was applied for the pre-development scenario.

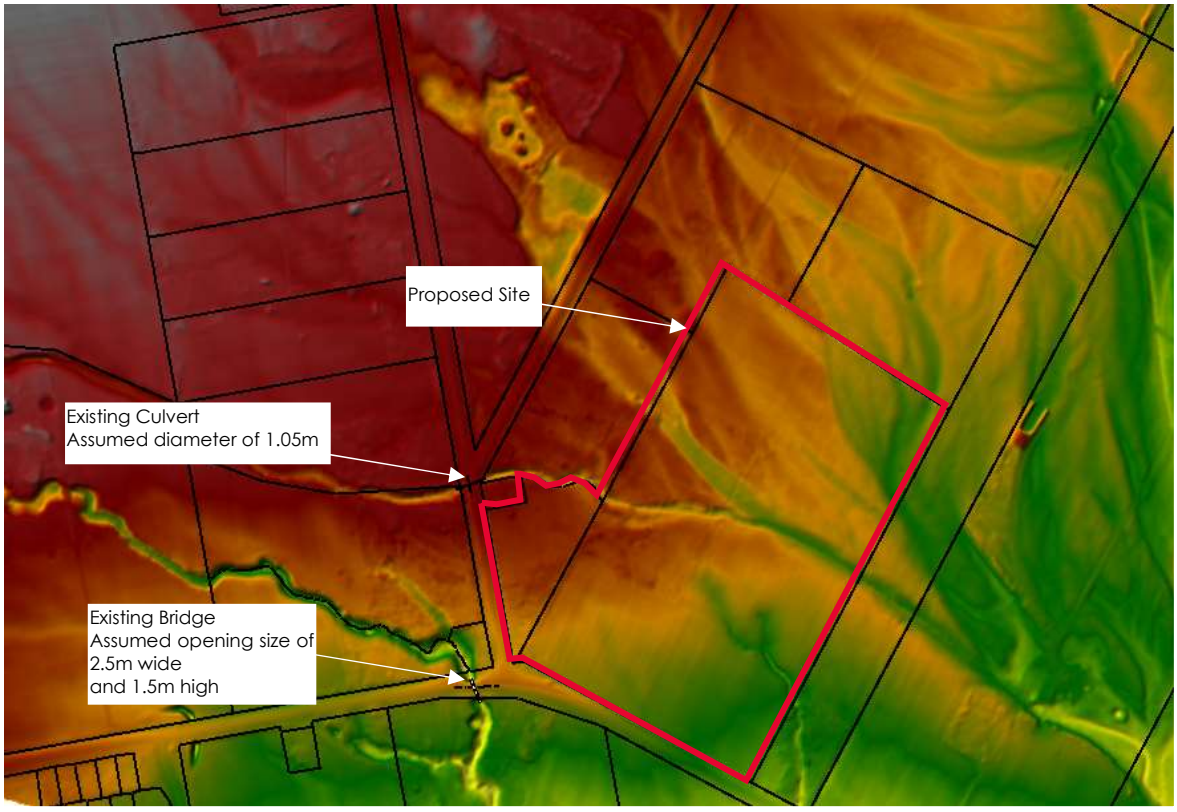


Figure 7. Pre-development 3D Topographical Surface

5.1.3. Post-development model surface

The post-development model surface was based on combination of most recent LINZ LiDAR (2020-2022) and the conceptual phase design surface, including new carriageways, new stormwater management areas and raised lot levels, as shown in Figure 8. The proposed model surface also includes the following:

- A new box culvert 8m wide and 0.5m high crossing the tributary of Taranaki stream.
- A new box culvert 8.5m wide and 0.5m high crossing Taranaki stream.
- A new 450mm diameter culvert at vehicular crossing to Rangiora Woodend Road, located at South-east part of site.
- A swale at the North-west boundary to divert existing overland flow paths.
- A swale at North-east and North boundary to divert existing overland flow paths.

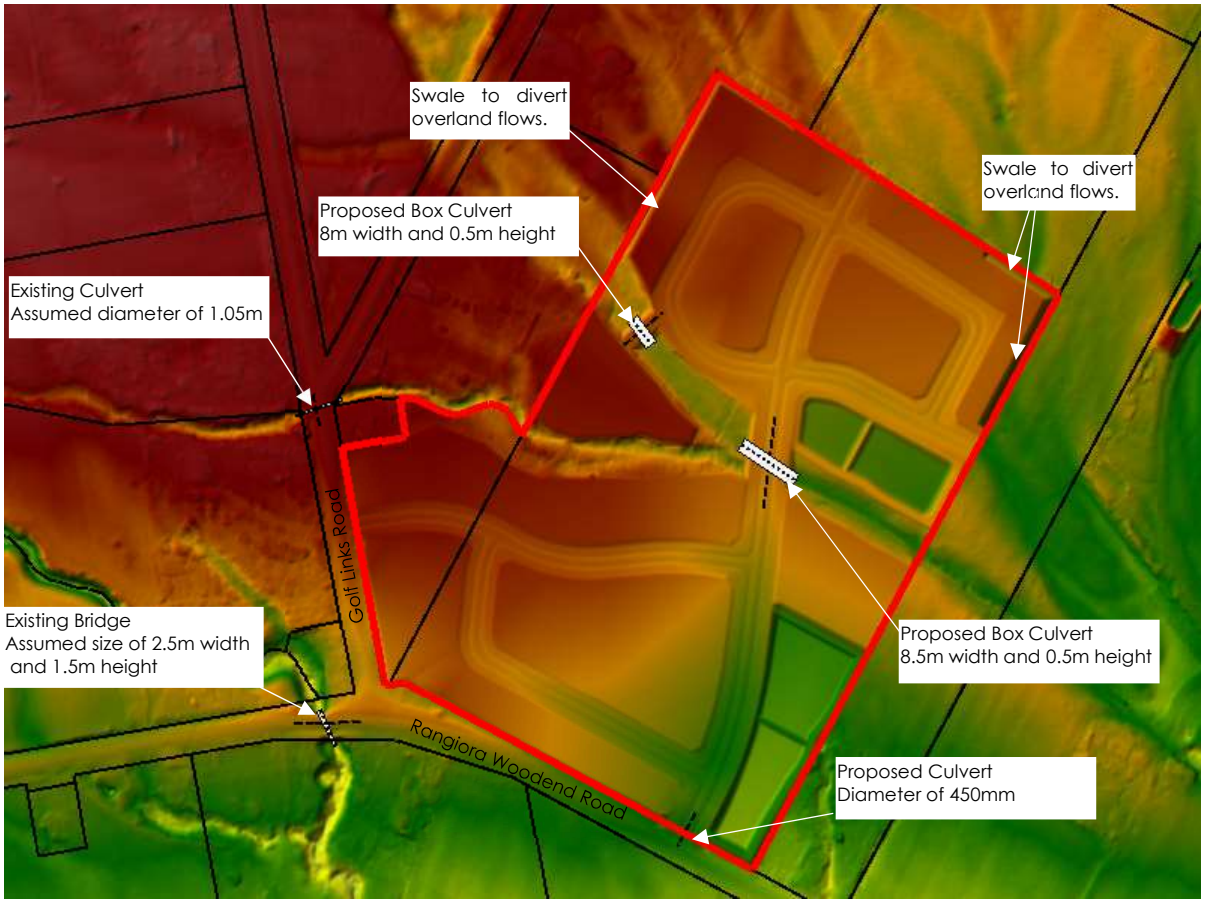


Figure 8. Post-development 3D Topographical Surface

A roughness coefficient of 0.01 was applied for the carriageways in the post-development scenario.

5.1.4. Modelling Computation

Both pre-development and post-development models were computed with time step of 4 seconds. A grid size of 10m x 10m was used for areas outside the development site and a refined region were used within the development site with a grid size of 3m x 3m grid.

5.1.5. Soil Infiltration

Soil infiltration was not included within the modelling therefore, it is assumed that the ground is fully saturated throughout the simulation.

5.1.6. Margin of Error

The pre and post-development flood modelling will have an unknown margin of error resulting from the following:

- The flow hydrograph provided by Waimakariri District Council was applied at the upstream boundary condition and was used to produce flood depths that match the Waimakariri Flood map depths. The flood depths were calibrated visually against Waimakariri Flood Maps.
- Exclusion of fence lines, trees and other potential obstruction to the flood passage.
- Accuracy of the LINZ LiDAR Surface
- The size of the grid used throughout the catchment and timesteps will incorporate a level of sensitivity error.
- Soils infiltration has not been included

- The size of existing culvert and bridge is an assumed size, and the inverts are adopted from existing LiDAR surface.

5.2. HEC RAS Flood Modelling Results

5.2.1. Effects on Overland Flow Path

Figure 9 shows the existing overland flow paths conveyed through the site. As indicated, a tributary of Taranaki stream merges into Taranaki stream within the site, and a number of small overland flows from North and North-west of site converge into Taranaki stream and flow in a South-east direction.

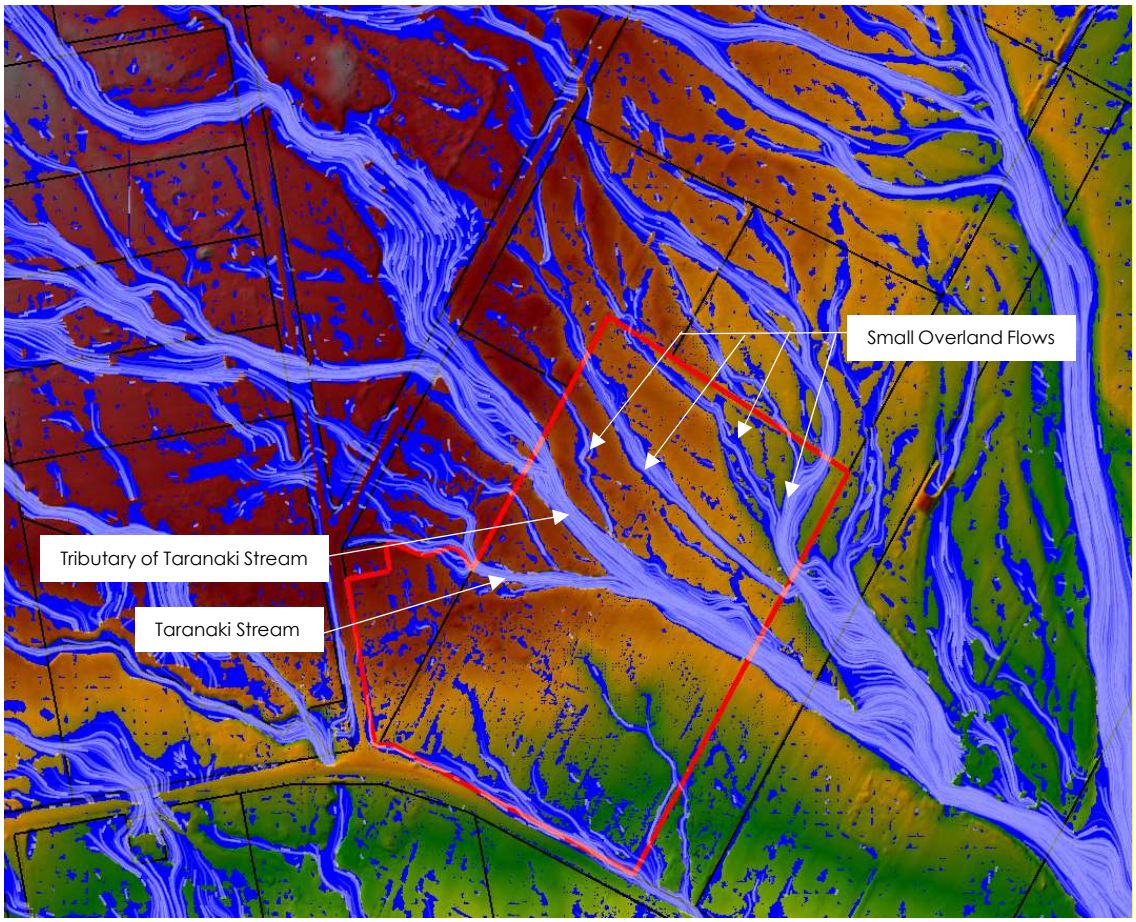


Figure 9. Pre-development Overland Flow Paths

Figure 10 shows the post-development overland flow paths.

As shown in Figure 10, the existing flow paths from Taranaki stream and a tributary of Taranaki stream are maintained and flows are conveyed within the development site with culverts and some overflow across the proposed new road. Accessibility is discussed further in Section 5.2.4.

The smaller overland flow paths from North-west and North, are diverted and conveyed by swales along the boundary of site to the tributary of Taranaki stream.

All overland flow paths, South of Taranaki Stream are diverted to the new basin located at South-east corner of site. The basin overflow discharges to the road side channel along Rangiora-Woodend Road. The capacity of this channel is exceeded in the 200 year flood event and the flows cross the road towards Lot 1 DP 452196.

The proposed culvert across Taranaki Stream, located centrally within the site will be designed for 50 year ARI flows, and during the 200 year flood event, the road will be designed with a spillway to allow 200 year flows to spill over the road into new basin located North of Taranaki stream.

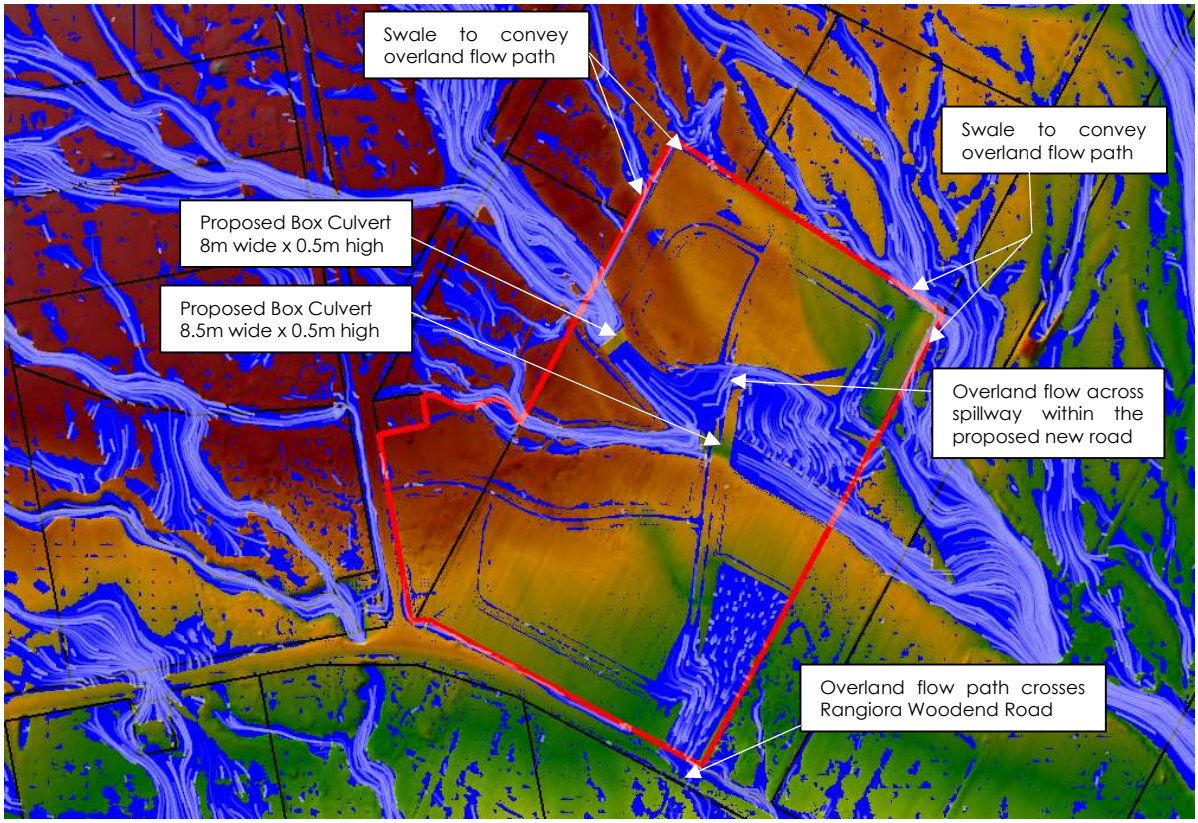


Figure 10. Post-development Overland Flow Paths

5.2.2. 200 Year Flood Depths

Figure 11 provides the HEC RAS pre-development flood depth results map. As shown the pre-development flood depths generally match the Waimakariri 200yr Flood Map depths shown in Figure 3.

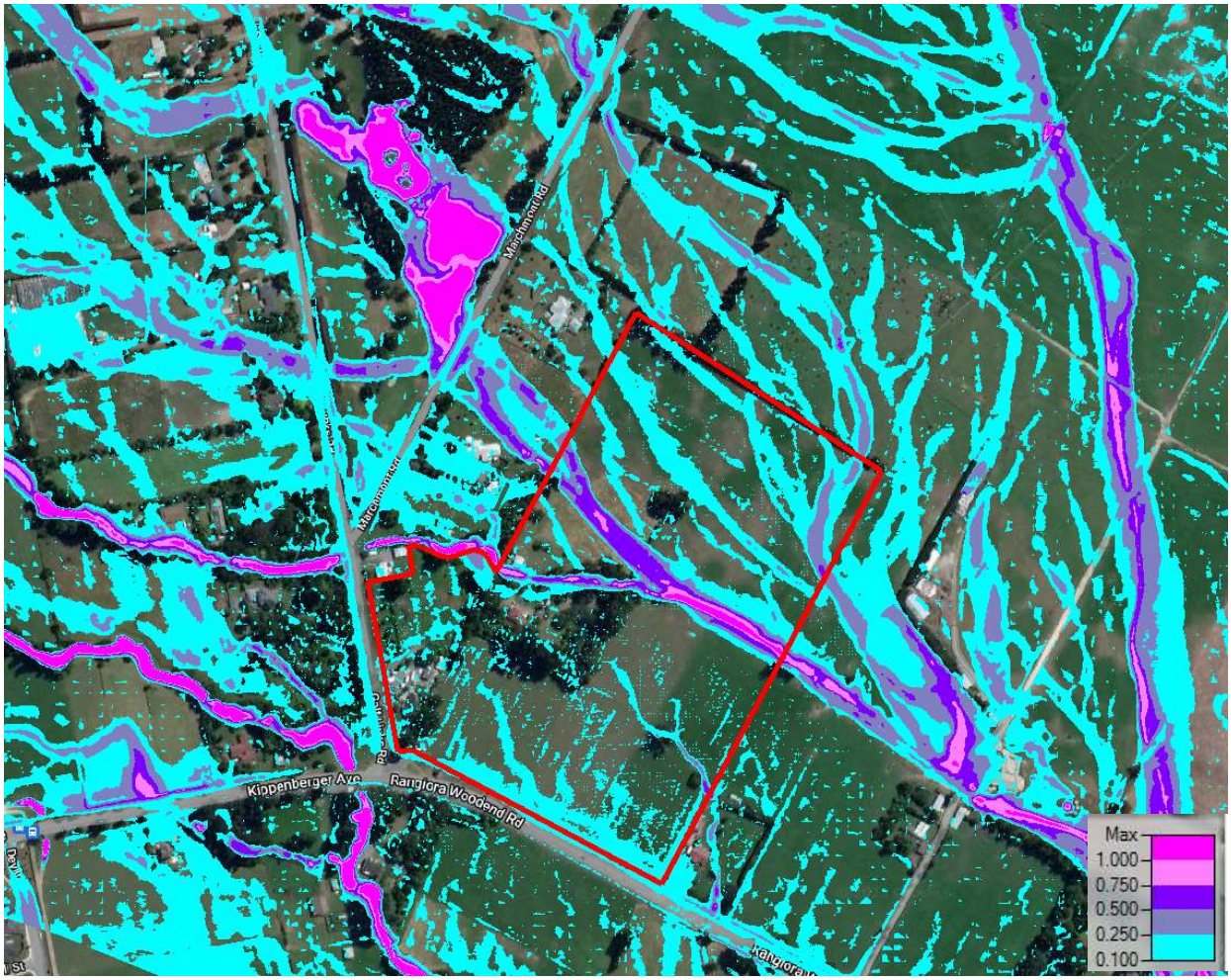


Figure 11. Pre-development 200 Year Flood Depths (m)

It should be noted that the WDC flood hazard map (Figure 3) does not include flood depths less than 100mm, whereas the HEC RAS pre-development model flood depths include flooding less than 100mm.

The post-development flood depths result map is shown in Figure 12.

Note: The post-development flood depths less than 10mm are not shown.

The proposed lots within the development site are above the 200 year flood level as required. There is up to 300mm flood depth within the proposed roads.

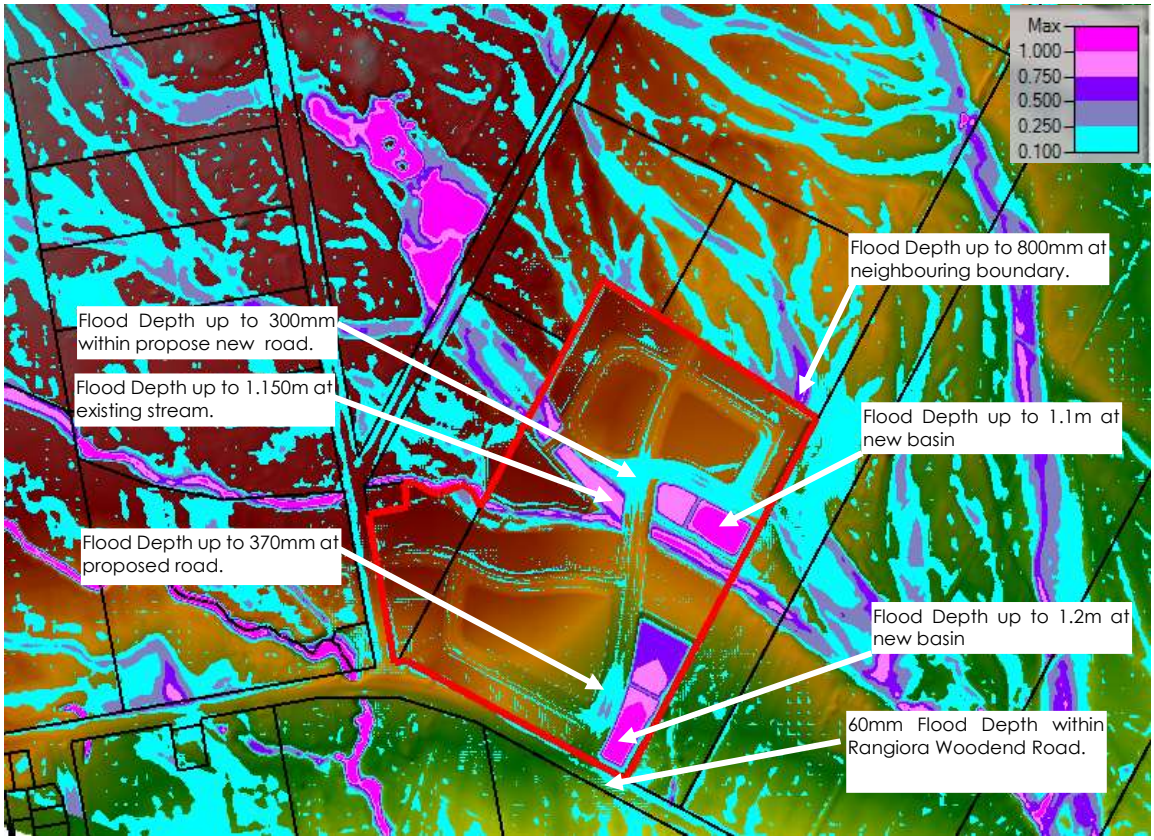


Figure 12. Post-development 200 Year Flood Depths (m)

Figure 13 shows the difference between the pre-development and post-development flood depths and the flood effects associated with the proposed development.

Note: The differences less than 5mm are not shown on the results map.

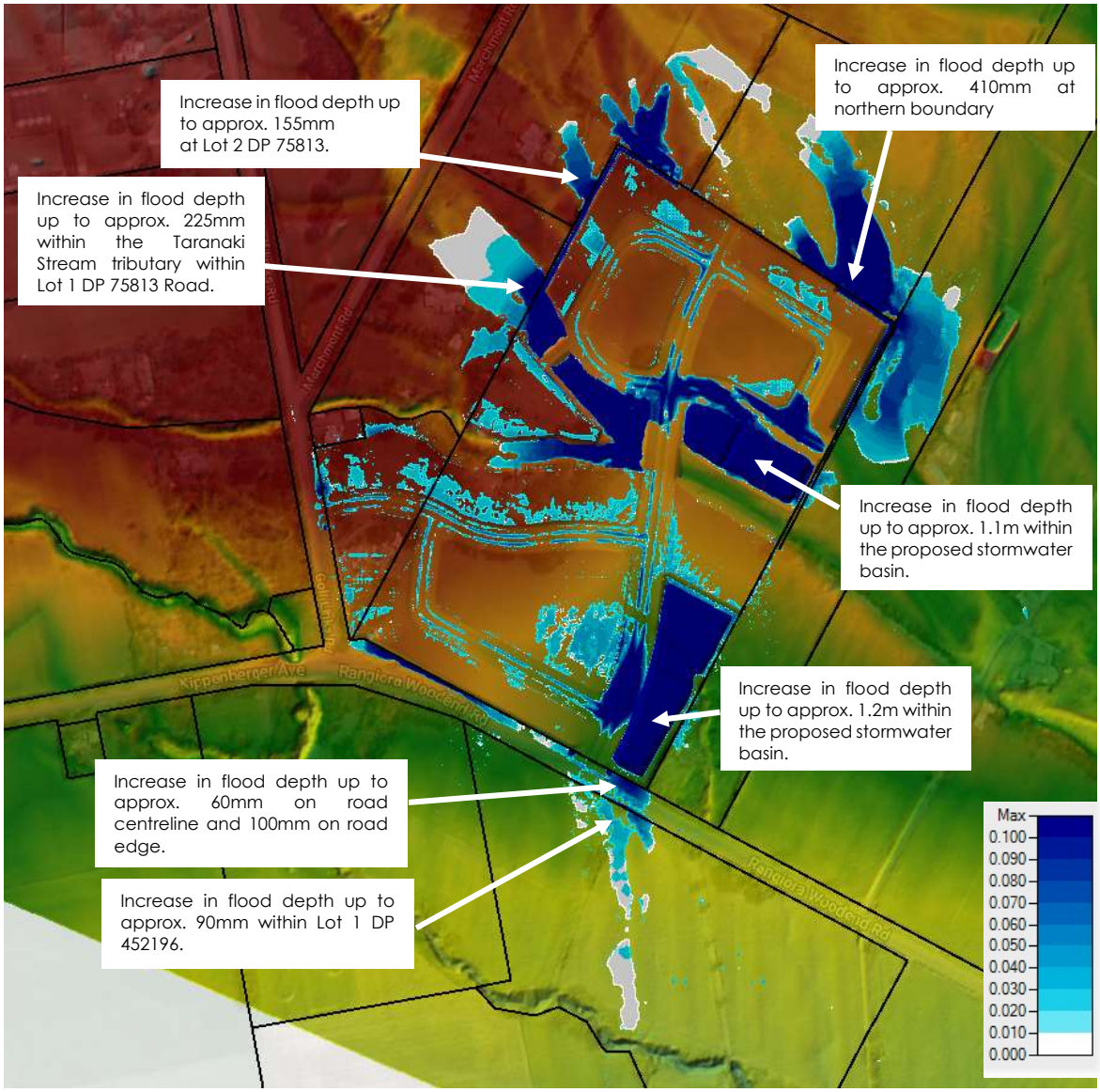


Figure 13. Post-development vs Pre-development Difference Map

As shown in Figure 13, generally the flood effects due to the proposed subdivision are as follows:

- The basin areas capture the majority of the flood flow
- There is an increase of flood depths to the north of the development site where some existing secondary flow paths have now been diverted via new swales along the development boundary to Taranaki Stream. The increase in flood depth does not occur at existing dwellings. However, the flood depth within pasture land has increased as shown.
- There is an increase in the flood depth within Taranaki Stream and its tributary due to the proposed new road crossings however this increase is mainly contained within the development site. There is up to 225mm increase within Lot 1 DP 75813 however this does not affect the existing dwelling.
- Within Rangiora Woodend Road, the water depth increase is approximately 60mm at the road centreline and up to 100mm at the road edge. This is due to the overland flow path to the south of the development exceeding the capacity of the Rangiora Woodend Road roadside channel and crossing the road.

5.2.3. Effects on Surrounding Properties

Figure 14 shows the surrounding properties (highlighted in light blue) that are affected by the post-development flood effects.

Figure 14. Surrounding Properties considered for flood effect (highlighted in blue)

Table 1 provides the flood depths increase at surrounding properties.

Table 1. Flood Depth Effects at Surrounding Properties

Property Address	Increase/ Decrease in Flood Depths (mm)	Comments
Lot 1 DP 75813	0-225	As shown in Figure 13, the increase in flood depth has not affected any dwellings and this depth increase is within the tributary of Taranaki Stream within pastured area of the property.
Lot 2 DP 75813	0-155	As shown in Figure 13, the increase in flood depth has not affected any dwellings and this depth increase is within the pastured area of property. A swale is provided along the North-West boundary of proposed site to divert the overland flow path towards the Taranaki Stream tributary.
Lot 3 DP 75813	0-410	As shown in Figure 13, the increase in flood depth is within the pastured area of the property. A swale is provided along the North-East boundary of the proposed site to divert the overland flow path around the development site.
Lot 1 DP 452196	0-90	As shown in Figure 13, the increase in flood depth has not affected any dwellings and this depth increase is within the pastured area of property.
RS 2332	0-100	As shown in Figure 13, the increase in flood depth has not affected any dwelling and this increase in flood depth is within the pastured area of property.

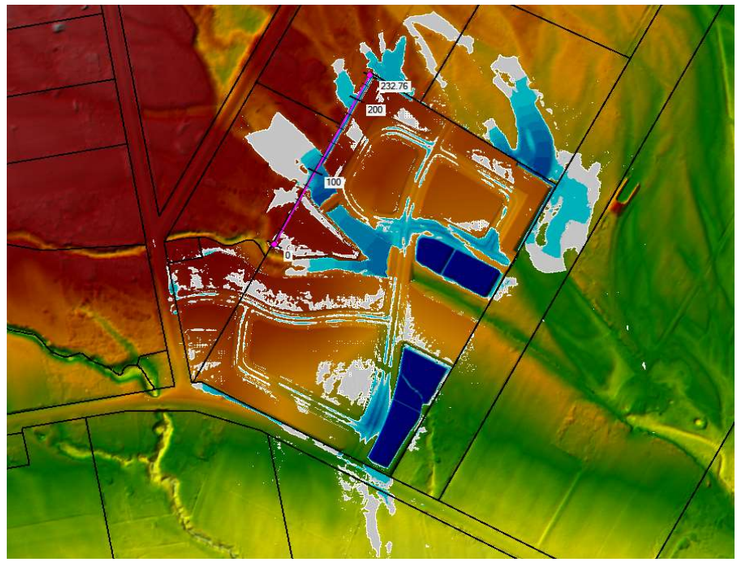


Figure 15. Long-section location at North-west Boundary of site

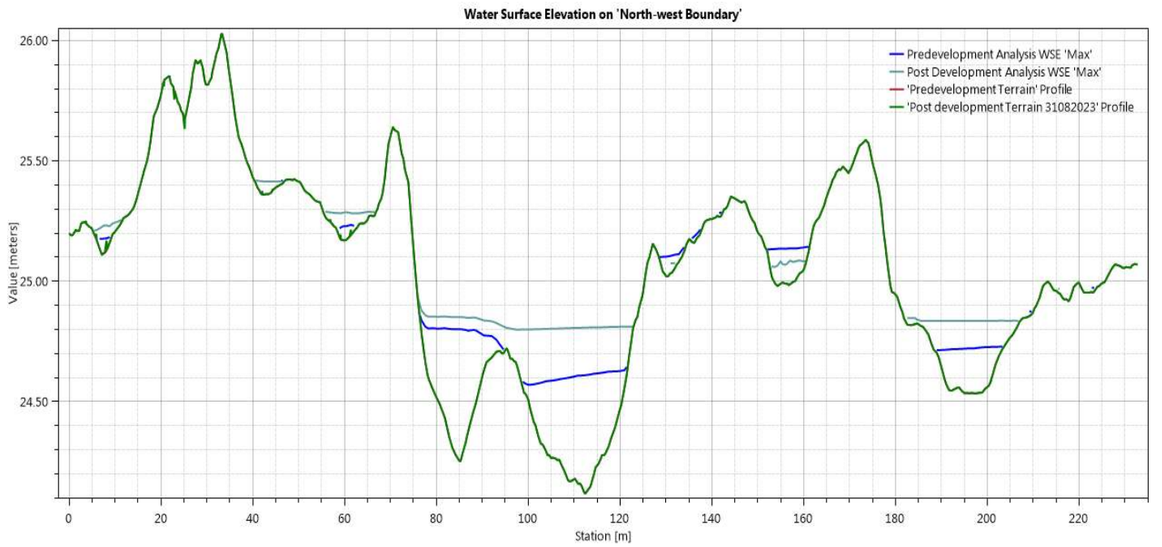


Figure 16. Long-section at North-west Boundary of site

As shown in Figure 16, the flood depth along North-west boundary has a depth increase of approximately 70mm along chainage 50-70m. As indicated, the water depth in the existing tributary of Taranaki stream has a flood depth increase of 225mm between chainage 70-120m. There is a flood depth increase of approximately 50-155mm from chainage 100-120m and 190-215m.

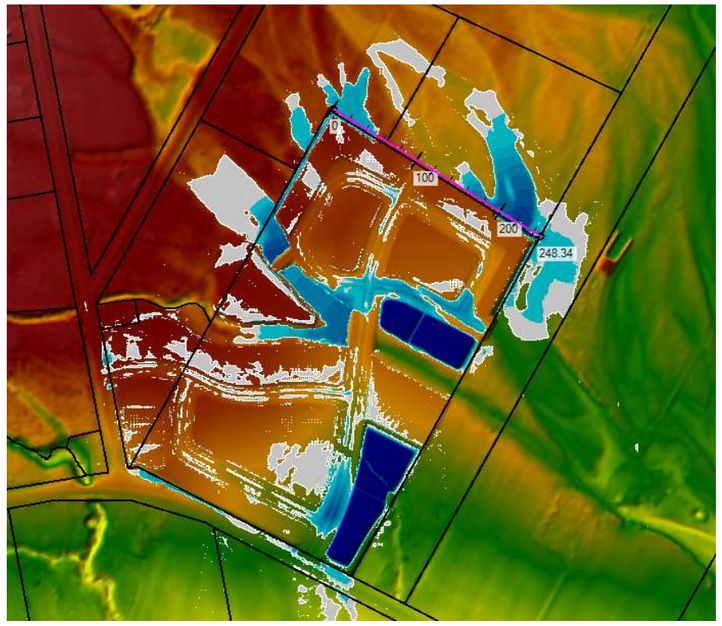


Figure 17. Long-section Location at North Boundary of site.

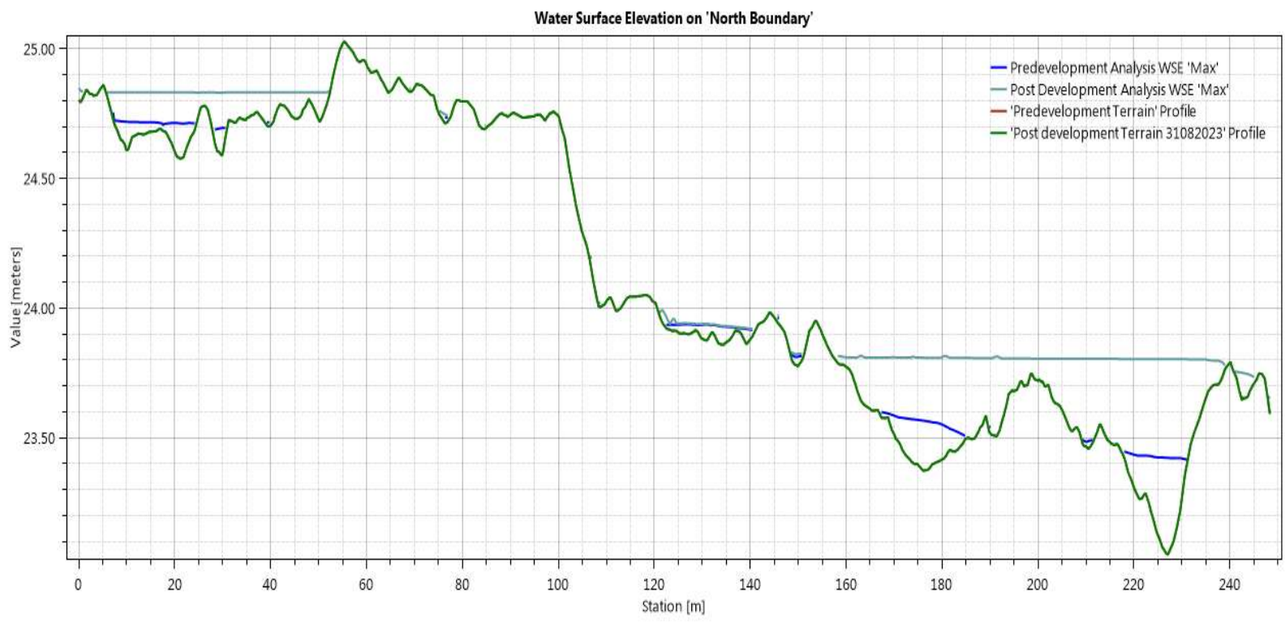


Figure 18. Long-section at North Boundary of site.

As shown in Figure 18, the increase in flood depth is approximately 150mm between chainage 0 to 55m. There is increase in flood depth of approximately 100 to 410mm along chainage 150-240m.

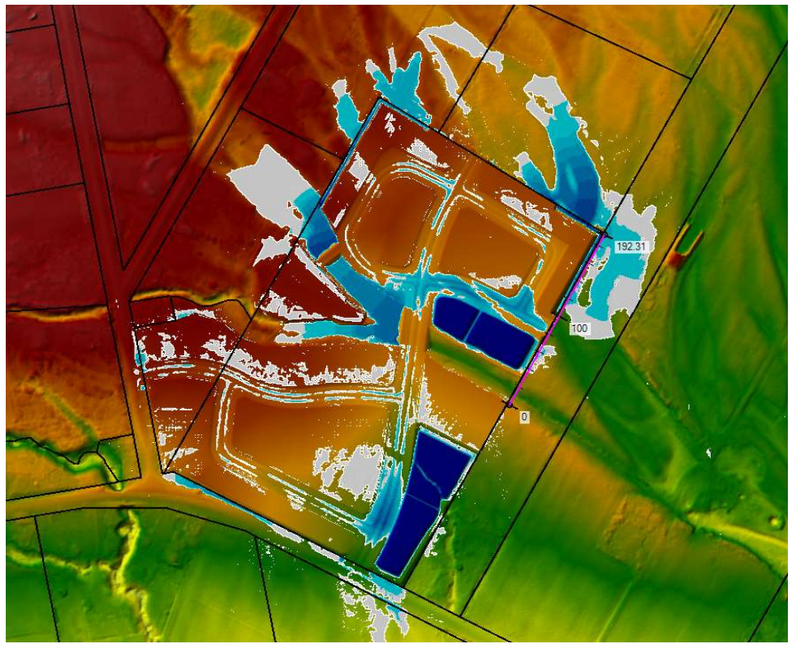


Figure 19. Long-section Location at North-east Boundary of site

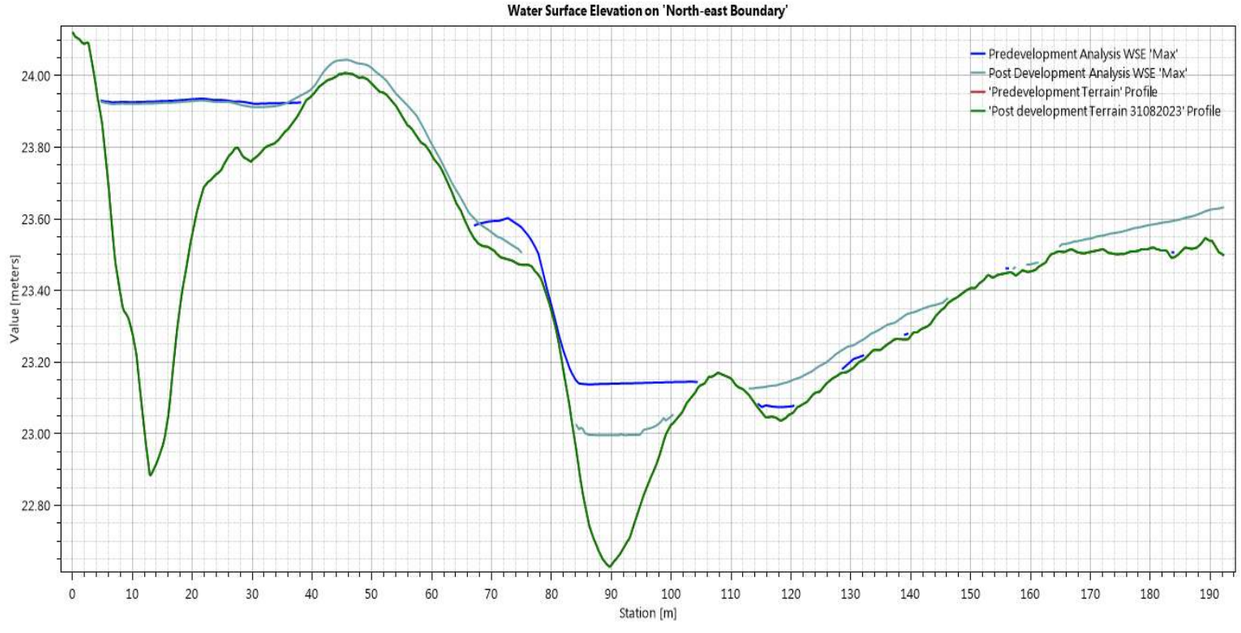


Figure 20. Long-section at North-east Boundary of site

As shown in Figure 20, there is a decrease in flood depth of approximately 100-150mm along chainage 80-105m. There is an increase in flood depth of approximately 50-100mm along chainage 110-190m.

5.2.4. Egress Hazard Assessment

Austroads Guide to Road Design, Part 5: Drainage Design specifies that the maximum pedestrian safety criteria within flood waters is 0.4 m^2/s (also known as angular momentum). Where pedestrian safety is not of concern, the maximum value for vehicle safety is 0.6 m^2/s.

Figure 21 shows a map of depth x velocity for the post-development scenario. As indicated the values within the proposed carriageways and Rangiora Woodend Road are less than 0.4 m^2/s. Values higher than 0.4 m^2/s are only indicated within the waterways.

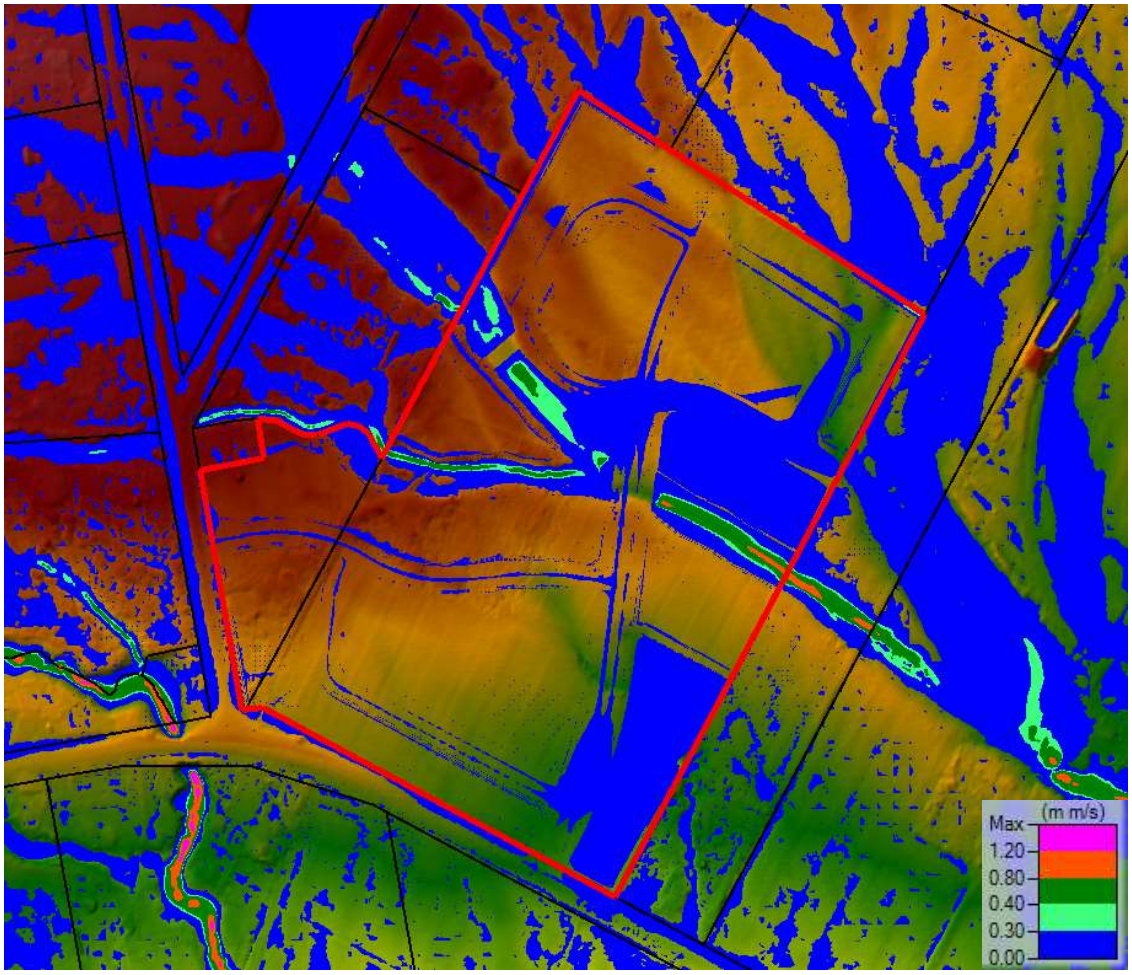


Figure 21. Post-development Map of Depth x Velocity

As shown in Figure 22, the depth x velocity values along the centreline of Rangiora Woodend Road have increased from pre-development to post-development scenario with a maximum value of 0.017m^2/s, which is less than the maximum pedestrian safety criteria and vehicle safety criteria.

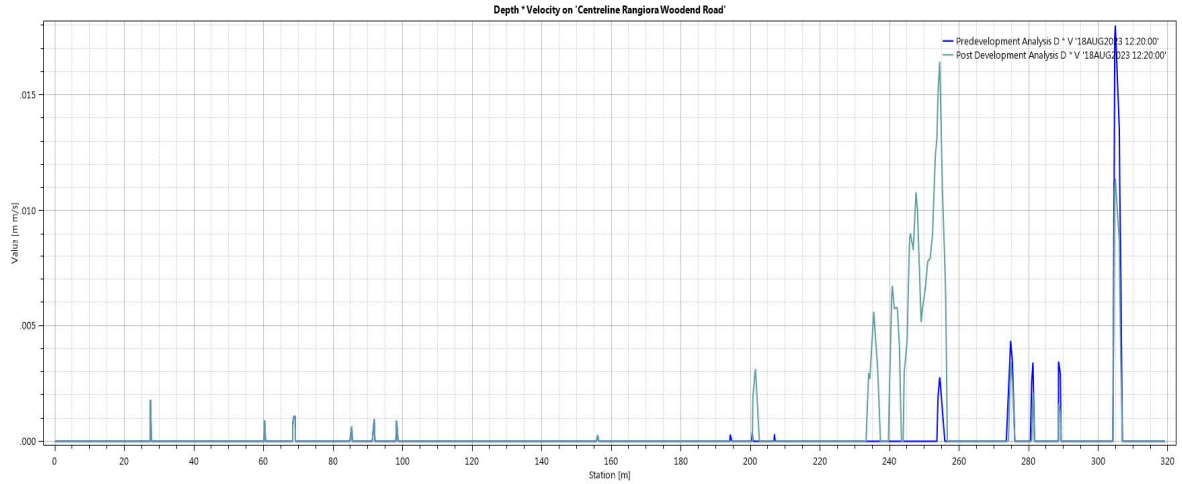


Figure 22. Depth x Velocity along Rangiora Woodend Road

As shown in Figure 24, the depth x velocity value along the centreline of proposed carriageway is a maximum value of 0.066m^2/s, which is less than the maximum pedestrian safety criteria and vehicle safety criteria. The location of the long section for Angular momentum (depth x velocity) check is shown in Figure 23.

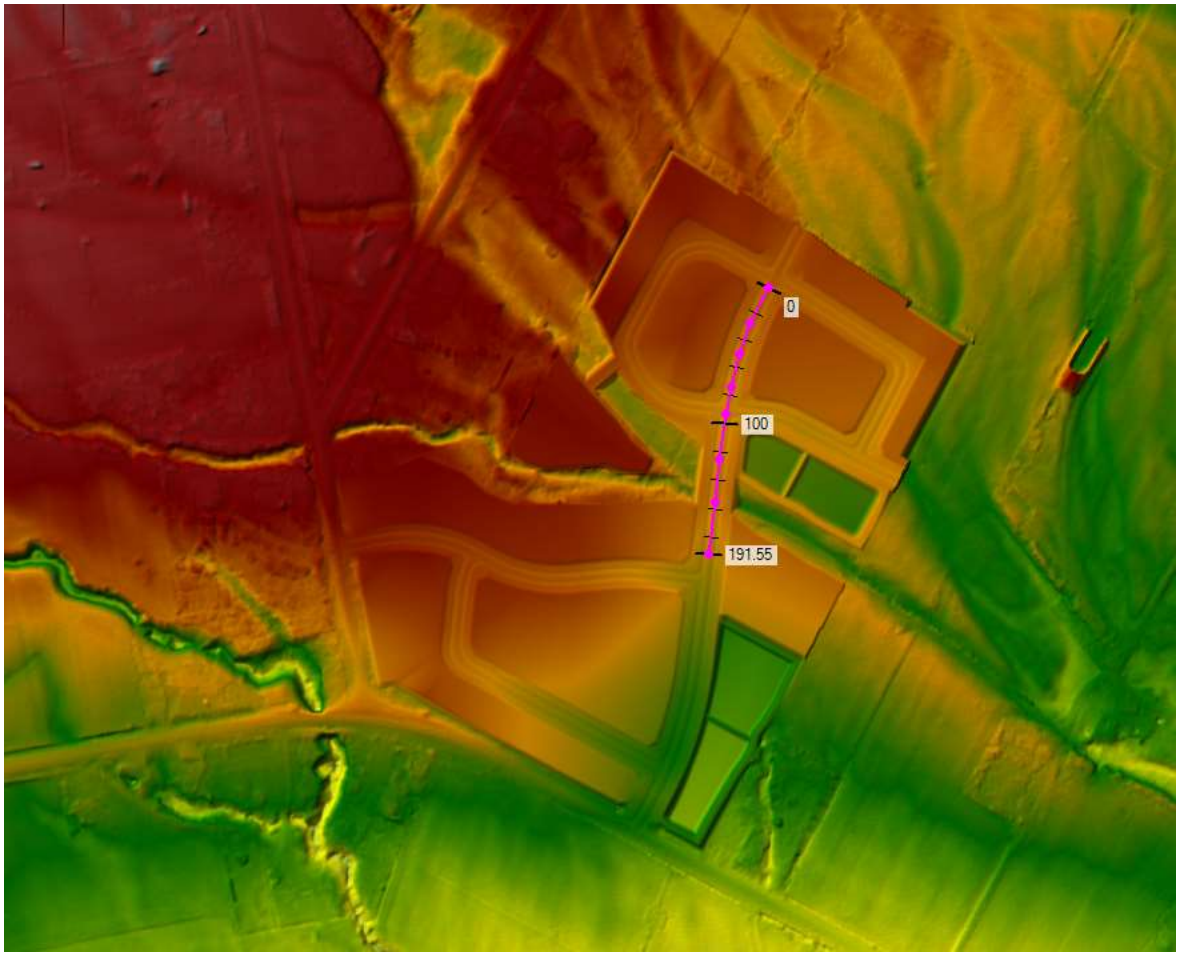


Figure 23. Longsection along the proposed new road for Angular Momentum Check

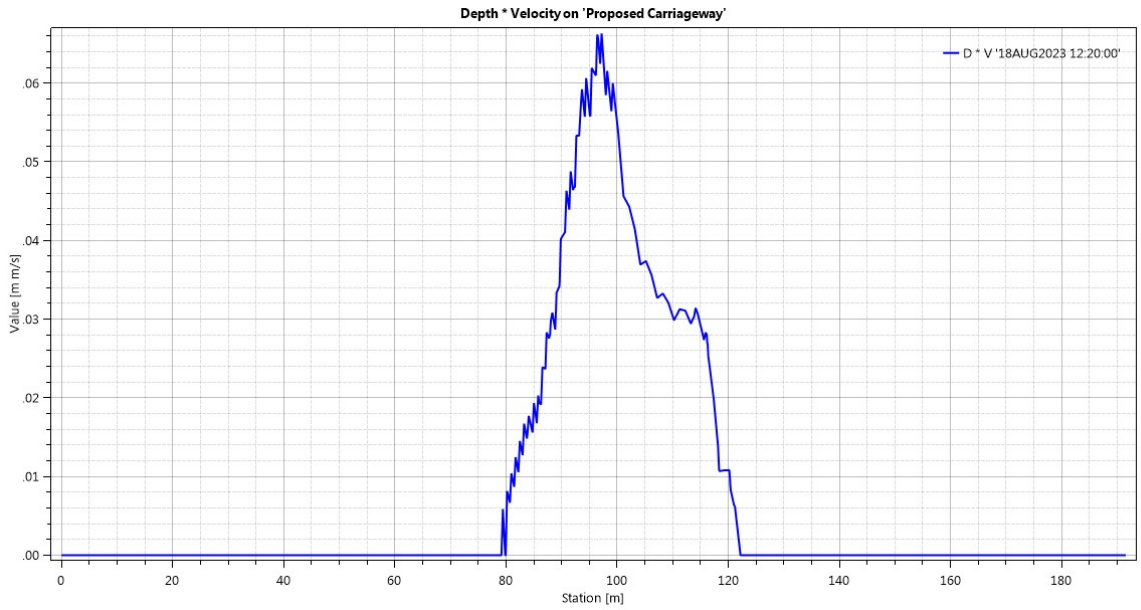


Figure 24. Depth x Velocity along Proposed Carriageway

Therefore the angular momentum within the development roadways, footpaths paths and Rangiora Woodend Road adhere with the Austroads safety criteria for pedestrians and vehicles.

6. Proposed Building Finished Floor Level

The Waimakariri District Council (WDC) requires that the proposed building finished floor level be 500mm above the 200yr ARI flood level in a Medium Hazard Flood area and 400mm above the 200yr ARI flood level in a Low Hazard Flood area.

In accordance with the Waimakariri District Flood classification, areas with flood depths less than 0.3m are considered Low Hazard Flood areas and with flood depths between 0.3-1m are considered Medium Hazard.

The post-development flood model for the proposed site (as shown in section 6) has maximum flood depths of 0.3m along the carriageways and depths greater than 0.3m within the existing waterways, therefore it is considered that parts of the site are Low Hazard and parts Medium Hazard Flood areas. Therefore, it is proposed that all the residential dwellings should be 500mm above the 200yr ARI flood level.

7. Conclusion

HEC RAS flood modelling has been carried out to determine the 200 year flood effects of the proposed development at 4 Golf Links Road and 518 Rangiora Woodend Road on the surrounding properties and roads.

Pre and post-development scenarios were modelled within the proposed development area and surrounding properties. The pre-development flood depths were calibrated against the Waimakariri flood model. The post-development model surface includes the new carriageways, new stormwater management areas and raised lot levels within the development site.

A comparison between pre and post-development 200 year flood depths, indicate the following flood increases within the Rangiora Woodend Road and the neighbouring properties:

- Within properties to the North-west, there is a flood depth increase varying between 5mm and 230mm.
- Within properties to the North and North-east, there is a flood depth increase varying between 5mm and 410mm.
- Within Rangiora Woodend Road, there is a flood depth increase of approximately 60mm at the road centreline and up to 100mm at the road edge.
- Within properties to the South of Rangiora Woodend Road, there is a flood depth increase varying between 5mm and 90mm.

Accessibility has been considered and although the angular momentum values have increased along Rangiora Woodend Road, the highest value is 0.0165 m2/s which is less than the Austroads safety criteria for pedestrians and vehicles..

8. Disclaimer

This report has been prepared by Eliot Sinclair & Partners Limited ("Eliot Sinclair") only for the intended purpose as a Flood Impact Assessment Report.

The report is based on:

- Lidar data (2020-2022) obtained from LINZ
- Waimakariri Flood Hazard maps
- Flow hydrograph obtained from Waimakariri District Council

Where data supplied by CVI Projects Limited or other external sources, including previous site investigation reports, have been relied upon, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Eliot Sinclair for incomplete or inaccurate data supplied by other parties.

Whilst every care has been taken during our investigation and interpretation of Lidar data and the District flood maps to ensure that the conclusions drawn, and the opinions and recommendations expressed are correct at the time of reporting, the accuracy of the flood model and results is based on the accuracy of the Lidar data and a calibration of that data against the Waimakariri Flood Hazard maps. As such, the post-development flood modelling may include a margin of error, the extent of which is unknown at the time of writing this report.

Eliot Sinclair does not provide any warranty, either express or implied, that all conditions will conform exactly to the assessments contained in this report. The exposure of conditions that vary from those described in this report, or any update to Lidar data or Waimakariri flood maps may require a review of our recommendations. Eliot Sinclair should be contacted to confirm the validity of this report should any of these occur.

This report has been prepared for the benefit of CVI Projects Limited and Waimakariri District Council for the purposes as stated above. No liability is accepted by Eliot Sinclair or any of their employees with respect to the use of this report, in whole or in part, for any other purpose or by any other party.

Appendix A. Proposed Subdivision Plan

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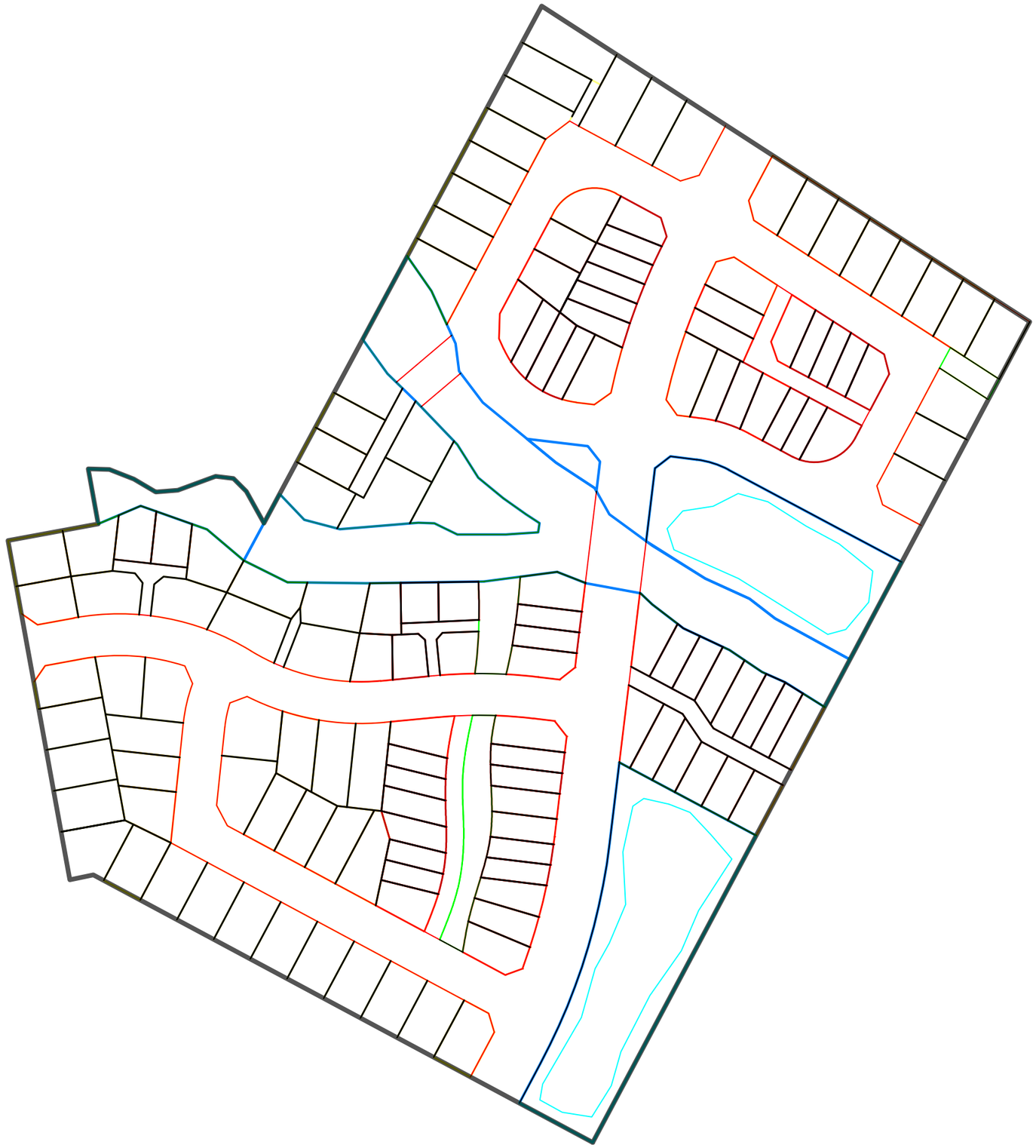

NOTES
1. Contractors to verify all dimensions and the location of all underground services on site prior to commencing work.
2. Unless noted otherwise, all work shall be undertaken in accordance with the NZBC and any relevant Territorial Authority Engineering Standards and Specifications as a minimum standard.

REV.	DRAWN	DATE	NOTE
D	**JM**	**05.10.23**	**Amend SMA location**
C	**JM**	**21.07.23**	**Amend density**
B	**JM**	**11.06.23**	**Amend allotments**
A	**JM**	**22.05.23**	**Preliminary**

CLIENT

CVI Projects Ltd

DESIGNED		**JM**
DRAWN		**JM**
REVIEWED		**SB**
APPROVED	**05.10.23**	**CM**
STATUS		**PRELIMINARY**
SCALE		**1:2000 [A3]**

West Rangiora
Proposed Rezoning
Golf Links Rd

MASTERPLAN CONCEPT

PROJECT	SET	SHEET	REV.
511185	**L1**	**L101**	**D**

eliot sinclair

Appendix B. Waimakariri District Council Flow Hydrograph