



Infrastructure Report

ROLLESTON INDUSTRIAL DEVELOPMENTS LTD

MILL ROAD, OHOKA - PLAN CHANGE APPLICATION

PROJECT 14895

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INOVO
PROJECTS

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QUALITY ASSURANCE

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1. Introduction

1.1. Purpose

Inovo Projects Ltd has been engaged by Rolleston Industrial Developments Ltd to complete an Infrastructure Assessment and assess the suitability of rezoning the site for residential subdivision at 535 Mill Road, Ohoka. This Infrastructure Assessment has been prepared in support of a proposed Plan Change application for rezoning of the 156ha site for residential and commercial use, resulting in developing approximately 850 new residential allotments, two small commercial areas, and a special purpose zone which could be developed as either a school, retirement village, or additional housing.

The purpose of this report is to provide information on existing infrastructure around the site and to describe the proposed infrastructure works required to service the development in accordance with national standards, Waimakariri District Council's (WDC) policies and best practices relating to subdivision development. Reference is made to reports prepared by Pattle Delamore Partners Ltd (PDP) assessing Flood Effects, Stormwater Treatment, and Preliminary Community Water Supply Assessment (included as Appendices).

1.2. Proposed Development

The proposed development will consist of a mixture of residential and rural-residential allotments as shown on the Outline Development Plan (ODP) included as Appendix A.

The majority of the site is proposed to be zoned as "Residential 3", with varying densities within the development. The southern end of the development is proposed to be "Residential 4A" zoned land. The proposed development will yield approximately 700 Residential 3 zoned lots and approximately 150 Residential 4A zoned lots. Two commercial areas are also proposed to allow for small retail to service the local community.

A special purpose zone ("Residential 8") of approximately 4.16 ha is included and will provide for either a retirement village, school, or additional residential housing. For the purposes of accessing infrastructure requirements the following development options were considered:

- Retirement village with up to 305 units/villas
- High School site catering for 500 students
- Further residential dwellings at 12 lots/ha (approx. 45 to 50 additional lots)

A number of stormwater and recreation reserves will also be established throughout the development providing plenty of greenspaces to provide amenity and enjoyment.

1.3. Limitations

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Where information has been supplied to us for the purpose of the report by another party, this information is believed to be reliable but we can accept no responsibility if this should prove not to be so.

2. Existing Site Overview

2.1. Site Description

The Mill Road Ohoka Plan Change site is approximately 156 ha of farmland located immediately to the south of the Ohoka township and approximately 2 km to the northeast of Mandeville. The site is roughly trapezoidal in shape, bounded by Whites Road to the southeast, Bradleys Road to the northwest, Mill Road or existing residential properties fronting Mill Road to the north, and rural / rural-residential properties to the southwest.

The majority of the site is currently covered in variety of dry land and irrigated pasture and has predominantly been used for dairy farming for the last 30 years, and prior to that a mixture of dairy, livestock and arable farming. Currently the majority of the site comprises agricultural fields and pasture. There are 2 existing houses on the 152.5ha main block along with milking sheds and ancillary farm sheds. Vegetation and landcover across the site is predominantly open grass paddocks, with shelter belts and vegetation alongside fences and watercourses or surrounding existing buildings. It is understood there are 5 small properties each with a house and potentially ancillary sheds on the remaining lots within the proposed plan change area.

The Ohoka Stream crosses the northern end of the site, and the Ohoka South Branch (stream) crosses near the middle of the site. Two separate channels drain two springs located within the site and discharge to open drains on the west side of Whites Road. Another drain is formed along the southwestern boundary of the site taking private land drainage. The site is typically gently sloping (1:180) to flat, sloping from west to east towards Whites Road.

The current land use surrounding the site is primarily rural to the west of the site, with rural-residential to the south and east, and residential to the north (Ohoka village).

2.2. Ground Conditions

A geotechnical investigation and assessment of suitability for subdivision has been carried out by Coffey Services Ltd as described in their *Geotechnical Assessment Report* for 535 Mill Road, Ohoka (Ref. 773-CHCGE288040 dated June 2021).

The ground model for the site is described as river alluvium, with topsoil depths varying from 250-350mm thickness, on stiff to hard clayey silts varying in thickness from 0.5 to 1.2m all on dense to very dense sandy gravels where the layer thickness is >30m. Groundwater was encountered on site between 0.9 and 1.5m below ground level at the time of testing.

The soils on the site are described as Ayreburn moderately deep clay which are considered poorly drained according to the Manaaki Whenua – Landcare Research GIS layers on Canterbury Maps.

2.3. Groundwater & Hydrogeology

Groundwater on the Waimakariri-Ashley Plains is dominantly sourced from infiltration of rainwater falling on the plains, together with some seepage losses from the Ashley and Waimakariri River. Groundwater in the area generally flows to the southeast towards the coast. The occurrence of heavy soils, spring fed waterways and land drains indicates the site is located within a grounder discharge zone.

Groundwater levels across the site is typically shallow and subject to seasonal fluctuations. Well no. M35-0596 listed in **Table 1** below is an existing Environment Canterbury (ECan) groundwater monitoring well located to the north of the existing dwelling / sheds at 236 Bradleys Road (shown on **Figure 1** below) with groundwater monitoring records dating back 22 years. Further data dating back to 1977 is available, however there is a gap within the dataset between 1986 and 1999. Groundwater levels have been manually recorded each month since 2012. Groundwater levels fluctuate over the seasons but is typically greater than 0.4m below ground level. The highest recorded groundwater level at that location is 0.14m below ground level. See below **Figure 2** for a graph showing groundwater levels from 1999 to the present.

Investigations by Aquatic Ecology Ltd (AEL) identified two springs and a groundwater seep on the site. The ECan GIS database shows two springs located within the proposed site area (M35/7487 and M35/7485) being artesian

springs. These springs drain via a number of drainage channels across the site and discharge into the Ohoka South Branch to the east of the site at Whites Road.

Groundwater levels will influence the depth of stormwater management systems, particularly on the lower lying parts of the site where groundwater levels are influenced by the water level in the Ohoka Stream and Ohoka South Branch. Further monitoring of groundwater levels will be undertaken prior to detailed design of stormwater management areas to understand the seasonal variation in groundwater levels.

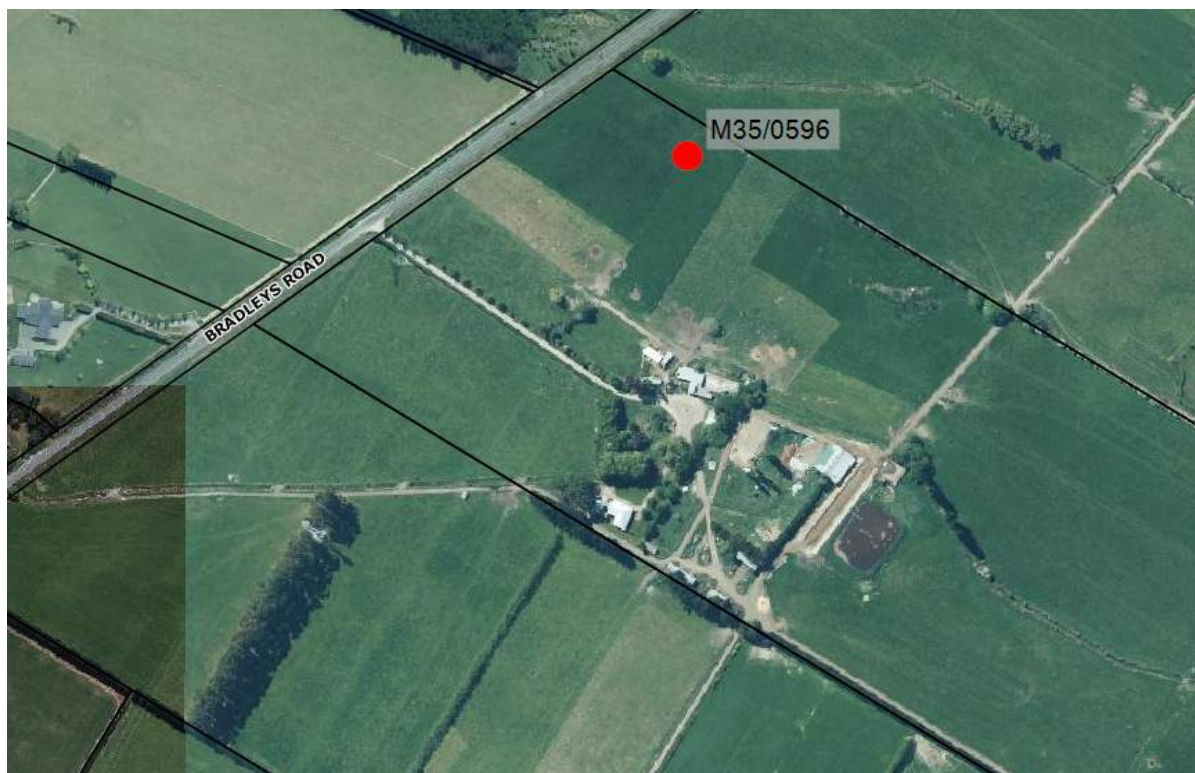


Figure 1 - Monitoring Well Location

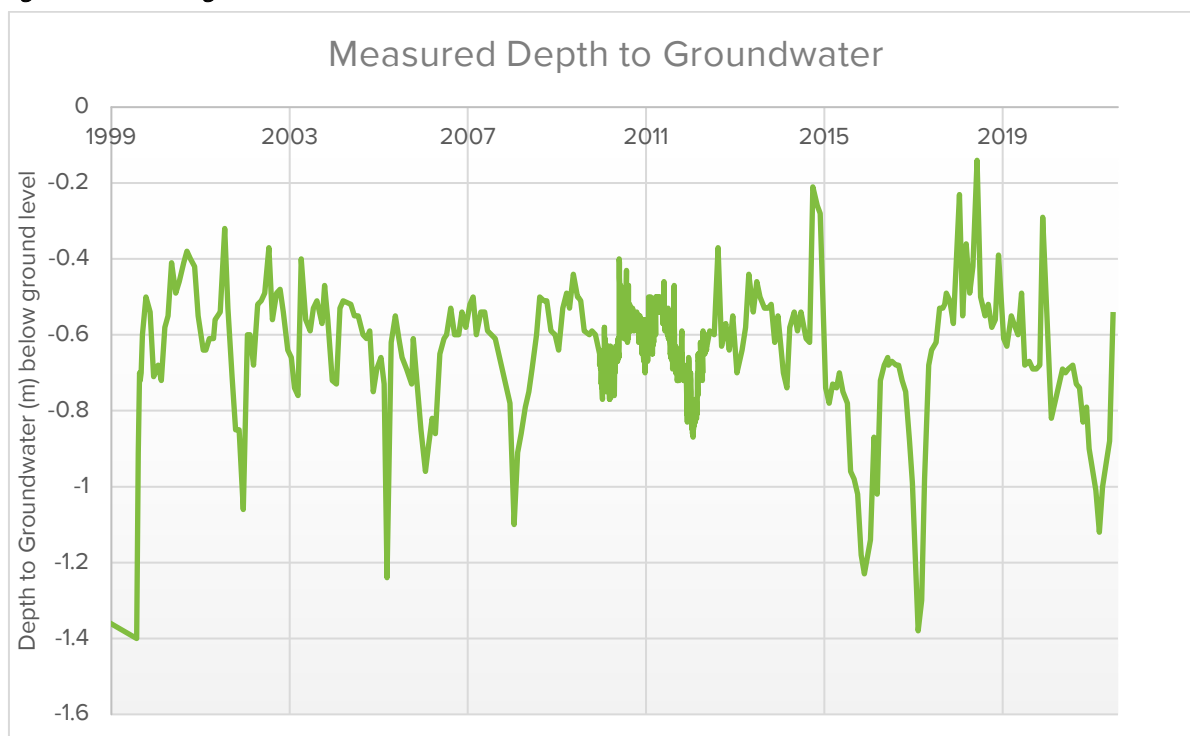


Figure 2 – Groundwater Data from M35/0596

Parts of the Ohoka/Mandeville area are reportedly sensitive to groundwater resurgence that can breach the ground surface and become surface flow when groundwater levels become high enough. Waimakariri District Council and ECan both have a network of groundwater monitoring wells that are used to monitor depth to

groundwater and predict if surface breakout of these undercurrents is likely. Any potential new development will need to consider the flowpaths of these undercurrents and consider the local groundwater conditions in the design and construction of the subdivision.

2.4. Existing Wells

The Environment Canterbury (ECan) GIS database shows 15 wells within the plan change site. A summary of the wells confirmed to be within the plan change area are provided in **Table 1** below.

All of the existing wells within the plan change site are less than 30m deep and draw water from Aquifer 1. The existing Council owned water supply bore at 335 Bradleys Road (Ohoka Well No. 1, Bore M35/5609) is only 19m deep and is known to have poor yield and water quality and is only used in emergency situations. Ohoka Well No. 2 (Bore BW24/0262) at 566 Mill Road is on the north side of Bradleys Road-Mill Road intersection and outside the proposed Plan Change area.

Table 1 – Well Data

Address	Well No.	Depth	Diameter	Recorded Use
236 Bradleys Road	M35/3064	12.5m	150mm	Irrigation
236 Bradleys Road	M35/3065	12.0m	150mm	Irrigation
236 Bradleys Road	M35/0326	13.7m	200mm	Irrigation, Domestic and Stockwater
236 Bradleys Road	M35/6688	18.0m	200mm	Irrigation, Domestic and Stockwater
236 Bradleys Road	M35/0366	6.7m	51mm	Dairy use and Domestic Supply
236 Bradleys Road	M35/8463	Unknown	Unknown	Not used
236 Bradleys Road	M35/0596	2.9m	50mm	Water Level Observation
290 Bradleys Road	M35/0305	5.8m	51mm	Domestic Supply
334 Bradleys Road	M35/5609	18.8m	200mm	Public Supply (Ohoka Well No. 1)
344 Bradleys Road	M35/4787	3.6m	38mm	Not used
347 Whites Road	M35/9423	30.0m	250mm	Irrigation
511 Mill Road	M35/7533	6.0m	150mm	Other
531 Mill Road	M35/0300	114m	38mm	Not Used
535 Mill Road	M35/0367	9.4m	600mm	Irrigation
535 Mill Road	M35/4747	5.4m	51mm	Dairy use and Domestic Supply

2.5. Existing Water Take Consents

Consent CRC991022 (expiry 12/09/2041) is an existing water permit to take and use water for irrigation of crops and pasture for grazing livestock (including milking dairy cows) from 3 bores on the site, and has the following limits;

- Bore M35/9423 – Maximum rate of 30 litres per second and volume not exceeding 2,484 m³/day
- Bore M35/3064 – Maximum rate of 30 litres per second and volume not exceeding 2,484 m³/day
- Bore M35/3065 – Maximum rate of 30 litres per second and volume not exceeding 2,484 m³/day

Overall, the maximum combined rate of extraction shall not exceed 60 litres per second with a combined volume of 4,968m³/day.

Consent CRC991827 (expiry 12/09/2041) is an existing water permit to take and use water for irrigation of crops and pasture for grazing livestock (including milking dairy cows) from the following bores:

- Bore M35/0326 – Maximum rate of 22.8 litres per second and volume not exceeding 1,806m³/day
- Bore M35/0367 - Maximum rate of 22.8 litres per second and volume not exceeding 1,806m³/day

The limit of abstraction from these bores is reliant on the flow in the Ohoka Stream taken from measurements at the confluence with the Kaiapoi River. A lower abstraction limit is set if the flows in the Kaiapoi river are below

300 litres per second, and the combined water take for both M35/0326 and M35/0367 shall not exceed 16 litres per second or 1267 m³/day with the combined volume not exceeding 5,069 m³ in any period of seven consecutive days.

Discussions between WDC and the developer have indicated that these consents could be transferred to Council for public supply to support the development in the establishment of a new source or upgrading of the existing source, refer to section 5 for further discussion.

The proposed plan change site sits within the Eyre groundwater allocation zone which is currently over-subscribed for irrigation use. Mill Road is the dividing line between the Eyre groundwater allocation zone and the Cust groundwater allocation zone.

2.6. Groundwater Water Protection Zones

Groundwater water protection zones are in place around existing wells M35/5609 (Ohoka Well No. 1) and BW24/0262 (Ohoka Well No. 2) which form part of the Ohoka water supply scheme. **Figure 3** below shows the extent of the groundwater protection zone.

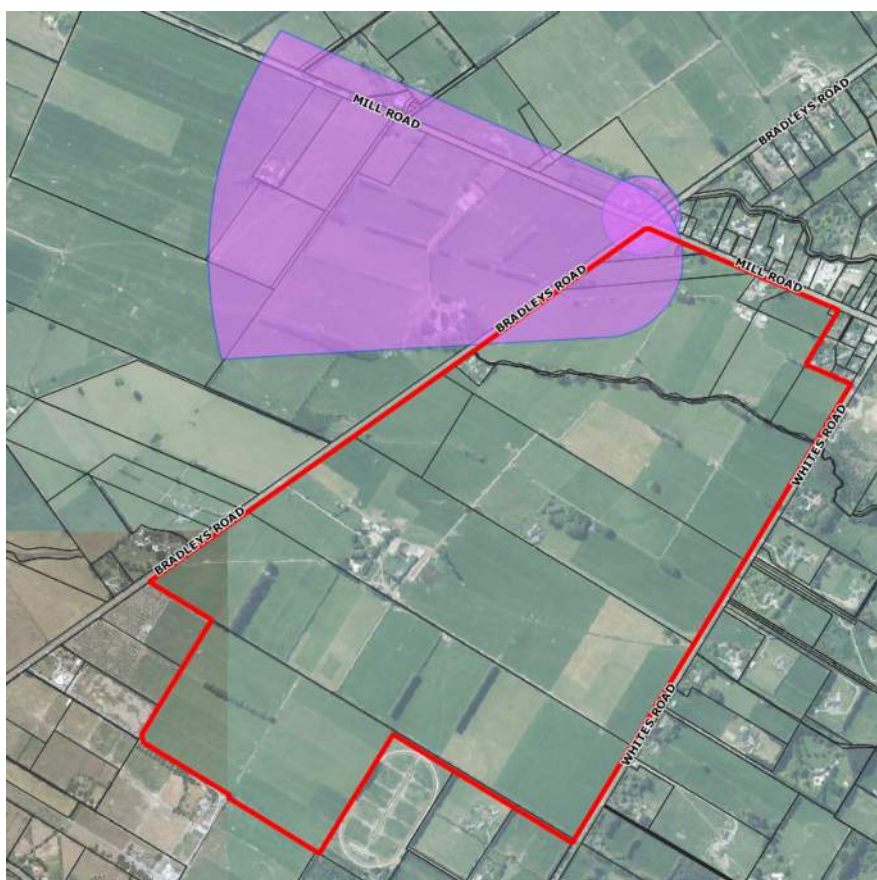


Figure 3 - Groundwater Protection Zones

2.7. Drainage Features

Drainage features on the site include public and private open land drains which form part of the Ohoka Rural Drainage Area as shown on the WDC Ohoka Rural Drainage Map included as Appendix C.

The main drainage features include the Ohoka Stream which crosses the northern end of the site, and the Ohoka South Branch (stream) crossing near the middle of the site. Both streams pass through box culverts under Bradleys and Whites Roads. Within the site are a number of land drains crossing the site (generally following fence lines) that discharge directly into the Ohoka Stream or Ohoka South Branch, or into the roadside drain alongside Whites Road draining ultimately to the Ohoka Stream or Ohoka South Branch. Another drain is formed along the southwestern boundary of the site taking private land drainage.

The WDC network of stockwater races does not extend into the subject area.

2.8. Existing Infrastructure

The majority of the existing dwellings located within the plan change site have on-site domestic water supply wells and wastewater treatment and disposal systems, with individual connections for power and telecommunications. Some properties surrounding the site being included with the plan change application are serviced with restricted water supply connections and low-pressure sewer connections.

An existing Ø200mm wastewater rising main runs along the western side of Bradleys Road. Known as the Mandeville-Ohoka rising main, this rising main originates from Bradleys Road Pump Station at the corner of Bradleys Road / Tram Road Intersection, conveying pumped wastewater along Bradleys Road and Mill Road and eventually to the Rangiora Wastewater Treatment Plant (WWTP). Further discussion of sewer infrastructure is included in Section 3.

Land drainage throughout the site discharges to open stormwater drains along Whites Road, which ultimately discharge to the culverts under Whites Road at the Ohoka Stream or Ohoka South Branch. Further discussion of stormwater and flood risk is found in Section 4.

Existing water supply infrastructure is located at Mill Road, adjacent to the proposed development site. There is an existing community drinking water supply in Ohoka, with the source and headworks being located adjacent to the site to the north. Further discussion of water supply is found in Section 5.

3. Wastewater

3.1. Existing Wastewater Network

The Ohoka township is serviced by the Mandeville Area Wastewater Scheme which is included as part of the wider Eastern Districts Wastewater Scheme (EDWS). The Mandeville Area Wastewater Scheme principally consists of Bradleys Road Pump Station and rising main (known as the Mandeville-Ohoka rising main) that conveys wastewater some 11.2km to the Rangiora Wastewater Treatment Plant (WWTP).

The existing Mandeville-Ohoka rising main conveys wastewater along Bradleys Road, Mill Road, Threlkelds Road, Flaxton Road and Lineside Road, and is constructed of a combination of DN225mm PE100 PN10 (nominal bore 200mm) and DN200mm PN12 uPVC pipeline. Two Mono positive displacement pumps at Bradleys Road pump station operate in a duty/standby arrangement. The design pump duty point is 21.7 L/s at a total head between 7 and 77m. Above ground storage at Bradleys Road pump station consists of 6 × 30m³ tanks (180m³ total storage volume).

Dwellings within the Mandeville area to the south of the plan change site are serviced by Septic Tank Effluent Pumping (STEP) systems which pump wastewater to Bradleys Road Pump Station where effluent is accumulated in storage tanks before being conveyed via the Mandeville-Ohoka rising main to the Rangiora WWTP in Marsh Road. Existing dwellings within the Ohoka township are typically serviced by individual low-pressure sewer pump stations which discharge directly into the Mandeville-Ohoka rising main in Mill Road or via a sub-main connection in Bradleys Road. Neighbouring lifestyle properties (generally >4ha), older dwellings and surrounding farms have on-site wastewater treatment and disposal systems.

The Mandeville-Ohoka rising main was originally designed to service up to a total of 875 properties split between 625 in Mandeville and 250 in Ohoka (ref: *Mandeville & Ohoka Wastewater Scheme Design Report*, CPG (2012)). A second pump station for the Ohoka area was proposed as part of the scheme but has not eventuated, and properties in the Ohoka area are instead serviced by local pressure sewer systems which discharge directly into the Mandeville-Ohoka rising main. The current number of properties in Mandeville and Ohoka being serviced by the Mandeville-Ohoka rising main is approximately 536 (as at 2019).

Design flows for Bradleys Road pump station from the CPG report are summarised in **Table 2** below.

Table 2 – Bradleys Road Pump Station Design Flows (CPG 2012)

	Bradleys Pump Station	Ohoka Pump Station	Total to WWTP
Properties Connected	625	250	875
Average daily flow (m ³ /day)	312.5	125	437.5
Peak Daily Flow (m ³ /day)	437.5	175	612.5
Peak Daily Flow (L/s)	18.1	7.2	25.3
Contingency (20%)	3.6	1.4	5.0
Design Flow (L/s)	21.7	8.6	30.3

The Mandeville-Ohoka rising main was originally designed for a maximum flow rate of 30.3 L/s as reported in the *Mandeville and Ohoka Wastewater Scheme Design Report* prepared by CPG (2012). For a rising main of nominal Ø200mm, this design flow rate equates to a design velocity of 0.96 m/s. The rising main is constructed from PN10 pipe (maximum design head 100m), and the pumps at Bradleys Road pump station have a maximum design head of 77m. The rising main is 11,195m long and features 7× air release valves along its length.

Wastewater flows from the Bradleys Road pump station to the Rangiora WWTP under gravity conditions at times of low inflow into the storage tanks at Bradleys Road. Once per day, or at times of high inflow to the storage tanks at Bradleys Road pump station, a level set-point triggers the pumps to start and pump wastewater through the rising main at a velocity suitable for solids re-suspension. An actuated control valve at the Rangiora WWTP end of the pipeline maintains the pipeline full and minimises the potential for air entrapment within the rising main. This control valve is linked to the levels in the effluent storage tanks at Bradleys Road.

3.2. Rangiora Wastewater Treatment Plant

The Rangiora Wastewater Treatment Plant (WWTP) currently services Rangiora (7,400 connections) plus the Mandeville Area wastewater scheme (536 connections) which is an equivalent population of approximately 20,000 people. The Rangiora WWTP includes solids and grit removal followed by an aeration basin, then two facultative ponds with mechanical aeration and two smaller maturation ponds. Effluent from the final maturation pond is transferred to the wetlands at the Kaiapoi Wastewater Treatment Plant via a gravity pumping main for further treatment before discharging via ocean outfall.

Currently the Mandeville Area Wastewater Scheme (including Ohoka township) accounts for approximately 3.5% of the treatment capacity of the Rangiora WWTP and 2.5% of the capacity of the Rangiora to Kaiapoi WWTP discharge pipe capacity (ref: *Mandeville & Ohoka Wastewater Activity Management Plan, WDC (2021)*). Discussions with the Asset Engineers at WDC have confirmed that the treatment plant has capacity to accept additional flows from the proposed plan change area (approximately 7% of Rangiora WWTP treatment capacity).

3.3. Wastewater Collection within Plan Change Area

Wastewater collection and conveyance within the plan change area could be provided by conventional gravity network, low pressure sewer systems, or combination of both. Waimakariri District Council have indicated that gravity sewer systems are preferred for higher density residential development, but that low-pressure sewer is considered suitable for lower housing density areas or where ground conditions such as high groundwater or liquefaction risks make conventional gravity systems unfavourable.

Servicing of the plan change area has been assessed for two options:

1. Conventional gravity sewer for Res3, Res8 and commercial areas, with low pressure sewer for the Res4A area.
2. Low pressure sewer network for entire plan change area

3.3.1. Gravity System + LPS (Option 1)

Due to the relatively flat site topography and high groundwater levels across the site, conventional gravity sewer drainage would require multiple pump stations or lift stations to convey wastewater to a centralised pump station before pumping to the Rangiora WWTP. The general ground slope in the Plan Change area is towards Whites Road, and the proposed ODP layout leans towards multiple lift stations along a common gravity main running more or less parallel with Whites Road towards a main pump station located near the Mill Road end of the development. A concept gravity sewer network has been developed based on limiting the depth to invert entering lift stations to 2.5m in general and 3m maximum (maximum depth considered practical for dewatering during construction), and is presented in Appendix D.

Storage at pump station(s) in a gravity system is required to provide storage for emergency purposes such as power outage or pump breakdown/blockage. Pump stations constructed as part of a conventional gravity network are typically sized to provide 8 hours storage of Average Dry Weather flow (Ref: Cl. 6.8.1 WDC ECoP). The estimated storage volume required at 8 hrs \times ADWF = 240 m³ (cf. storage at Bradleys Road pump station = 180m³). The economics of underground storage versus an extra lift station to pump-up into above-ground storage tanks will be evaluated at the detailed design stage.

For conventional gravity sewer network the main pump station and rising main is sized for Peak Wet Weather Flow (PWWF) to convey the anticipated peak flows. Preliminary sizing of the rising main required for a conventional gravity + LPS network servicing the plan change area is described in Section 3.5 below.

3.3.2. Local Pressure Sewer System (Option 2)

A local pressure sewer system with an individual pump station at each dwelling connected to common local pressure rising mains in each street is a feasible option for part or all of the proposed development. The potential for infiltration and inundation of local pressure sewer networks due to high rainfall events or high groundwater levels is significantly less than compared to conventional gravity networks, effectively reducing the peak wet weather discharge from the system. Local pressure sewer systems can also allow for the network operator to have a far greater control over the peak discharge from the network when smart controls such as the IOTA Onebox or Aquatec Omnibox smart controllers are implemented.

Flow data analysis carried out by the Western Bay of Plenty District Council on low pressure sewer schemes within their rating area reported ADWF to PWWF peaking factors of up to 1.5 for two LPS schemes of 128 and 523 connections. Therefore, the following parameters have been used to estimate wastewater flows for a low pressure sewer network servicing all or part of the plan change area;

- ADWF = 2.7 People/lot × 250L/person/day for residential connections
- $PF_{DWF} = 1.0$ (system design is based on dry weather flow peaking factor of 1)
- $PF_{WWF} = 1.5$ (wet weather peaking factor)

It is anticipated that a central pump station with above-ground holding tanks similar to Bradleys Road pump station would be located near the Mill Road end of the plan change area. From this central pump station wastewater would be pumped to the Rangiora WWTP via a dedicated rising main or make use of spare capacity within the existing Mandeville-Ohoka rising main. A limited number of Res4A properties with frontage to Bradleys Road and Mill Road could potentially connect direct into the existing Mandeville-Ohoka rising main.

The volume of storage required at a central pump station would depend on whether smart system controls are implemented to control when individual pump stations start/stop (as compared to the existing Mandeville system which has STEP tanks with high-level float control only). Although WDC currently doesn't implement any form of smart controllers on their low-pressure sewer schemes for centralised control, this is an option that could be incorporated into system operation in the future to allow greater control over the network and reduce peak loads on the system.

Individual pump stations installed on each property as part of local pressure sewer reticulation systems typically provide on-site storage capacity for 24 hours of average dry weather flow ($250 \text{ L/p/day} \times 2.7 \text{ p/dwelling} = 675 \text{ Litres}$) in case of service or power outage. Connections from the house to the individual pump station are typically conventional gravity drainage.

Preliminary sizing of the rising main required for a low pressure sewer network servicing the plan change area is described in Section 3.5 below.

3.4. Estimated Wastewater Flows from Plan Change Area

Estimated wastewater flows from the Plan Change area are based on an equivalent number of proposed connections with the highest demand scenario as follows ;

- 700 Residential3 zoned lots (avg. 2.7 persons per unit)
- 150 Residential4A zoned lots (avg. 2.7 persons per unit)
- 305 retirement units/villas in special purpose Residential 8 zone (avg. 1.5 persons per unit)
- 1.7 Ha commercial area (approximate)

The 305 retirement units/villas within the special purposes zone is equivalent to $305 \times (1.5 \div 2.7) = 170$ residential connections (rounded). Therefore, the total equivalent residential connections is $700 + 150 + 170 = 1020$.

The following parameters from the WDC Engineering Code of Practice have been used to estimate residential wastewater flows for the proposed development for a gravity network:

- ADWF = 2.7 People/lot × 250L/person/day for residential connections
- $PF_{DWF} = 2.5$ (dry weather flow peaking factor)
- $PF_{WWF} = 2.1$ (wet weather peaking factor for >550 dwellings using equation 6.1)

The following parameters have been used to estimate residential wastewater flows for local pressure sewer networks (as above):

- ADWF = 2.7 People/lot × 250L/person/day for residential connections
- $PF_{DWF} = 1.0$ (dry weather flow peaking factor = 1)
- $PF_{WWF} = 1.5$ (wet weather peaking factor)

Wastewater flows generated by the proposed commercial areas have been calculated using the following parameters from the WDC ECoP. These numbers have been used for both analysis of a gravity system and a local pressure sewer system based on a 0.5ha floor area:

- ADWF = 0.2 L/s/ha
- PDWF = 0.5 L/s/ha
- PWWF = 1.0 L/s/ha

Figures for the estimated wastewater flow from the proposed Plan Change area (including allowance for the commercial area) plus full build-out of the existing Mandeville-Ohoka service area are presented in **Table 3** below.

Table 3 – Estimated Wastewater Flows for Existing Service Area + Plan Change Area

	Mandeville	Ohoka	PC Area (Gravity + LPS)	PC Area (LPS only)	Total to WWTP (Gravity + LPS)	Total to WWTP (LPS only)
Properties Connected	625	250	1020*	1020*	1895*	1895*
PF _{dwf}	2.5	2.5	2.5(1.0)	1.0	2.5	2.5(1.0)
PF _{wwf}	2.1	2.1	2.1(1.5)	1.5	2.1	2.1(1.5)
ADWF [L/s]	4.9	2.0	8.1	8.1	15.0	15.0
ADWF [m ³ /day]	422	169	697	697	1288	1288
PDWF [L/s]	12.2	4.9	18.4	8.2	35.5	25.3
PWWF [L/s]	25.6	10.3	37.9	12.4	73.8	48.3

* equivalent # of residential properties

The estimated wastewater flows to be conveyed to the Rangiora WWTP includes full build-out of the Mandeville area serviced by Bradleys Road pump station (625 dwellings) and the Ohoka township area (250 dwellings) as per the assumptions in the *Mandeville & Ohoka Wastewater Scheme Design Report prepared by CPG (2012)*. The figure of 250 dwellings for Ohoka township presumably includes an allowance for future development of part of the Plan Change area, so the total estimated flows presented above will be conservative.

3.5. Conveyance to Rangiora WWTP

Options for conveyance of wastewater from the plan change site to the Rangiora WWTP include construction of a new dedicated rising main (for conventional gravity network + LPS) or utilising spare capacity within the existing Mandeville-Ohoka Rising Main (LPS network only).

3.5.1. New Rising Main

Servicing of the proposed plan change area with conventional gravity sewer will require construction of a new rising main from Ohoka to the Rangiora WWTP to convey the peak wet weather flows. A new rising main would likely follow the same route as the existing Mandeville-Ohoka rising main (i.e., via Mill, Threlkelds, Flaxton and Lineside Roads). Assuming that a centralised pump station for the plan change site would be located at the Mill Road end of the site, the resulting length of rising main would be approximately 7.5km. Obstacles along the route include crossing of the Cust Main Drain, Lineside Road and the Main North Railway Line.

For a gravity + LPS collection system, a Ø225mm PE100 PN10 rising main will convey the PWWF of 37.9 L/s at a flow velocity of 1.27 m/s and a total dynamic head of 59m head. Calculations were based on an aged pipeline with an increased roughness using the Darcy-Weisbach equation ($k_s=0.1$).

For a local pressure sewer system only, a rising main of Ø140mm PE100 PN10 would convey the PWWF of 12.4 ($k_s=0.1$).

Sizing assessment is based on polyethylene PE100 grade pipe as construction using flexible pipeline reduces the requirement for thrust blocks at changes in direction. Further modelling will be required at subdivision design stage to finalise rising main and pump selection.

3.5.2. Existing Mandeville-Ohoka Rising Main

Table 4 below summaries the estimated flows in Mandeville Area scheme as described in WDC's *2021 Mandeville Wastewater Activity Management Plan* (AMP). The AMP states that there are a total of 536 connections to the scheme as of the July 2019. WDC growth projections predict that over the next 30-50 years the Mandeville wastewater scheme will grow to a total of 862 connections (approximately 1.5% annualised growth over 30 years).

Table 4 - Wastewater Flows (WDC Mandeville Wastewater AMP 2021)

	As at July 2019	Projected after 30-50 years
No. of Connections	536	862
Average Dry Weather Flow ADWF [m ³ /day]	248	468
Peak Wet Weather Flow PWWF [m ³ /day]	1,208 (4.9×ADWF)	2,307 (4.9×ADWF)

The WDC AMP provides some historic wastewater statistics from the Mandeville Area scheme for the period July 2013 to June 2020 as shown in **Table 5** below:

Table 5 - Mandeville Area Wastewater Scheme Statistics

	July '13 - June '14	July '14 - June '15	July '15 - June '16	July '16 - June '17	July '17 - June '18	July '18 - June '19	July '19 - June '20	5 yr average	10 yr average
Average Daily Flow m ³ /day	237	130	201	212	232	248	270	233	153
Average Dry Weather Flow m ³ /day	145	125	108	206	231	245	268	212	133
Peak Daily Flow m ³ /day	2304	402	604	338	507	422	425	459	500
Peak Weekly Flow m ³ /day	1911	222	250	246	307	299	294	279	353
Peak Monthly Flow m ³ /day	867	185	236	232	265	275	287	259	235

Rating Connections	267	305	427	454	478	518	538		
Average Daily Flow per Connection L/con/day	889	425	472	468	484	479	503	481	372
Peak Daily Flow per Connection L/con/day	8629	1318	1415	744	1061	815	790	965	1477

The Peak Wet Weather Flow in the system provided in the AMP is over-stated as the figure is calculated using a peaking factor of 4.9 which is derived from historical flows which includes 2013-2014 data before upgrades to the Mandeville Area scheme were completed. In June 2014 the Mandeville area experienced a significant rainfall event which resulted in surface flooding throughout the area inundating private septic tanks and causing a very high peak PWWF (16 × ADWF) being recorded in the Mandeville-Ohoka scheme due to high infiltration. After the 2014 event, major upgrade works were carried out to private septic tanks in the Mandeville area that has reduced infiltration into the scheme, and therefore the 2013-14 figures for peak wet weather flows should be ignored when assessing system capacity. The ratio of average dry weather flow to peak daily flow for the 2014 to 2020 period (2013-14 data removed) is 2.7 average which is close to the average wet weather peaking factor stated in the WDC Engineering Code of Practice of 2.5.

SCADA Telemetry data of Bradleys Road pump station pump operation times (start-stop) and discharge flow rates from the rising main for the period 1/7/2020 to 30/06/2021 was made available for analysis by WDC. **Figure 4** below shows a plot of incoming flows (daily average) into the Rangiora WWTP from the Mandeville-Ohoka rising main and **Figure 5** below shows a plot of pump runtime at Bradleys Road pump station.

Flow under gravity conditions from Bradleys Road pump station varies from 3 to 7 L/s and occurs 83% of the time. Flow under pumped conditions varies, peaking at 25-26 L/s and occurs only 2% of the time as the majority of discharge from Bradleys Road occurs as gravity flow, despite the rising main being designed as a pumped system. The remaining 15% of time there is no flow as the valve at Rangiora WWTP is closed to maintain pipe full conditions. There is currently significant spare capacity in the existing rising main if the pumps are operating only 2% of the time, which is the current case.

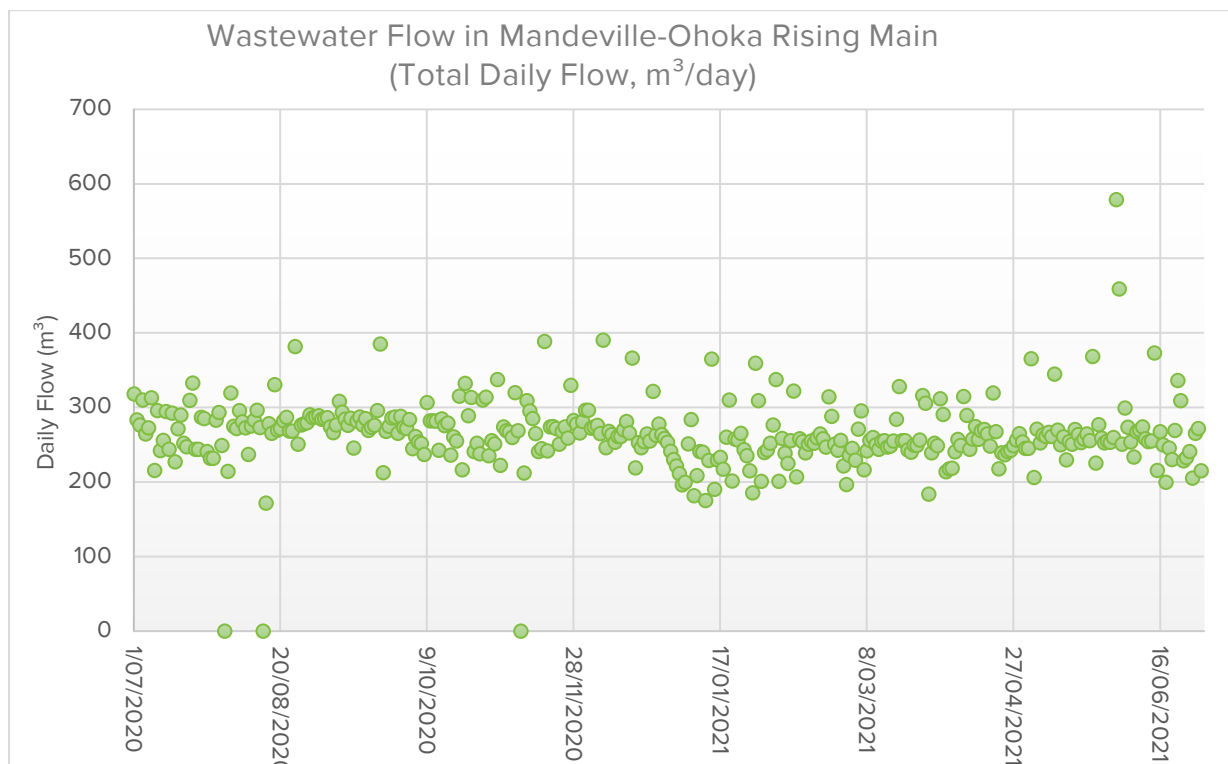


Figure 4 - Mandeville-Ohoka Daily Wastewater Flows

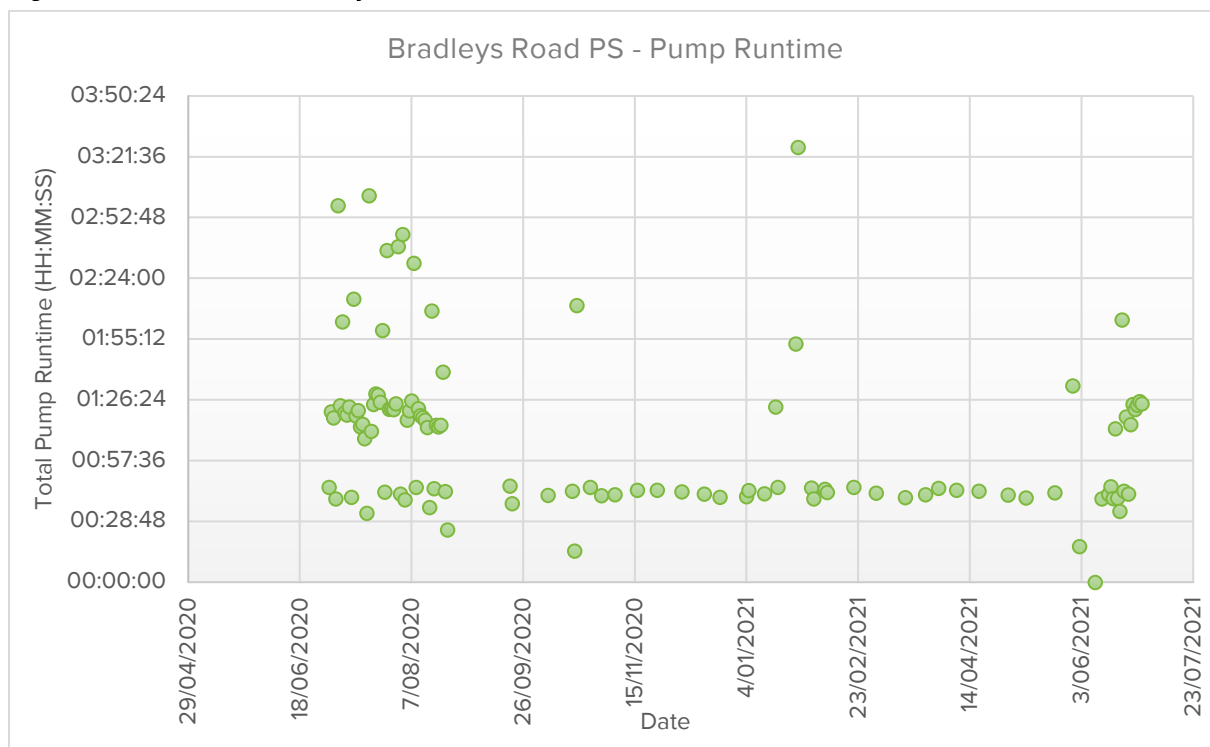


Figure 5 - Bradleys Road Pump Station Pump Runtime

Analysis of the flow data following significant rainfall events (e.g. 30-31 May 2021 rainfall event) shows that the peak flows from Bradleys Road pump station (approximately 25-26 L/s) only occurs for a limited period of time due to the buffering effect of the in-built storage in the STEP systems in the Mandeville Scheme and the storage provided at Bradleys Road pump station (refer to **Figure 6** below). In this example, the duration of the peak wet weather flow (PWWF) in the rising main was approximately 1 hr 33 mins in the 48 hours following a 1-in-15 to 1-in-20 year rainfall event.

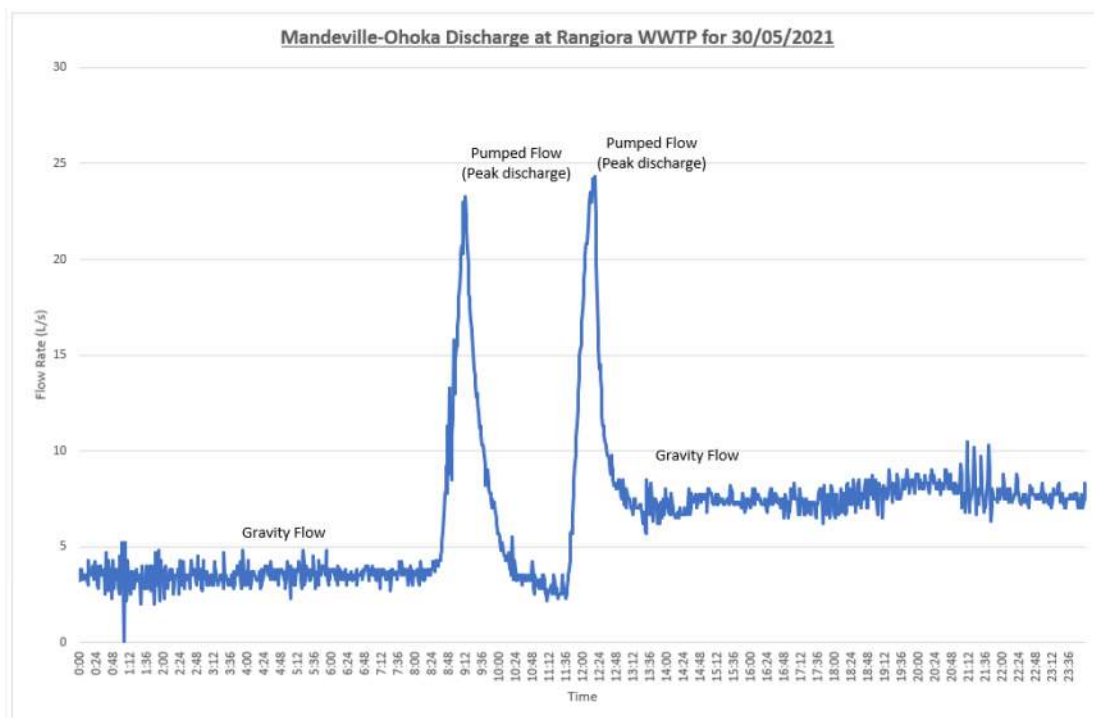


Figure 6 –Mandeville-Ohoka Discharge at Rangiora WWTP for single event on 30/05/2021

This analysis shows that the existing Mandeville-Ohoka rising main has spare capacity to take daily flows from the proposed change area at times when the existing Bradleys Road pump station and other private LPS connections in the Ohoka area are not pumping (up to 98% of the time). **Table 6** below summarises the estimated ADWF storage and pumping times for each area scheme based on a conservative long-term discharge capacity of 26 L/s (existing Bradleys Road pump discharge rate) and each scheme operating in sequence (not concurrently).

Table 6 – Pumping Times & Storage Volumes for Existing Service Area + Plan Change Area

	Mandeville	Ohoka	Plan Change Site	Total
ADWF [m ³ /day]	422	169	697	1288
Pumping time @ 26 L/s [hrs]	4.5	1.8	7.4	13.7
8 hrs storage @ ADWF [m ³]	141	56	232	429
Time to empty @ 26 L/s [hrs]	1.5	0.6	2.5	4.6

The estimated storage required in each scheme is based 8 hours storage of Average Dry Weather Flow (ADWF) as per Cl. 6.8.1 WDC ECoP which is approximately the same as 1.5 hours storage of the Peak Wet Weather Flow (PWWF).

Development of a pump station or pressure sewer connection at Ohoka means Bradleys Road pump station will discharge under pressure more frequently (as per the original design intent). However, there is still sufficient capacity within the rising main as the pumping time for the Average Dry Weather Flow discharging at 26 L/s is only 13.7 hours.

In-built storage provided in STEP tanks, individual pump stations and main pump stations has the effect of attenuating peak wet weather flows. The figures in **Table 6** may overestimate the storage in the existing Ohoka low pressure systems which connect directly to the rising main, therefore additional storage to buffer flows from the Plan Change area may be required. Dynamic modelling to optimise storage volumes and residence time within the system would be carried out at detailed design stage.

3.6. Summary

Waimakariri District Council have indicated that gravity sewer systems are preferred for higher density residential development. Low-pressure sewer is considered suitable in lower density areas or where ground

conditions such as high groundwater, liquefaction risks etc make gravity systems unfavourable. Gravity or local pressure sewer system are both feasible options for wastewater collection and discharge from the plan change area, although storage requirements for a gravity network with pumped discharge to the Rangiora WWTP will be greater.

There is potential to utilise spare capacity in the existing Mandeville-Ohoka rising main if peak wet weather flows within the existing Mandeville or Ohoka area can be attenuated within the system. Construction of a new rising main and pump station would ensure discharge capacity from the plan change area to the Rangiora WWTP is available at all times.

Detailed design of a gravity or local pressure sewer network (or combination of both) will be developed in consultation with the WDC Engineer's at time of subdivision design. Dynamic analysis would be required at subdivision design stage to assess the proposed development and ensure that appropriately sized infrastructure is installed.

From a wastewater perspective, the plan change can be supported with new infrastructure servicing the plan change area and convey wastewater to discharge at the Rangiora WWTP as outlined above.

4. Stormwater & Flood Risk

4.1. Flooding Assessment

The Waimakariri District Council have published flood hazard maps (available on-line) for the district for the 200-year and 500-year flood events. Refer to **Figure 7** and **Figure 8** below for the WDC flood hazard maps covering the proposed plan change site.

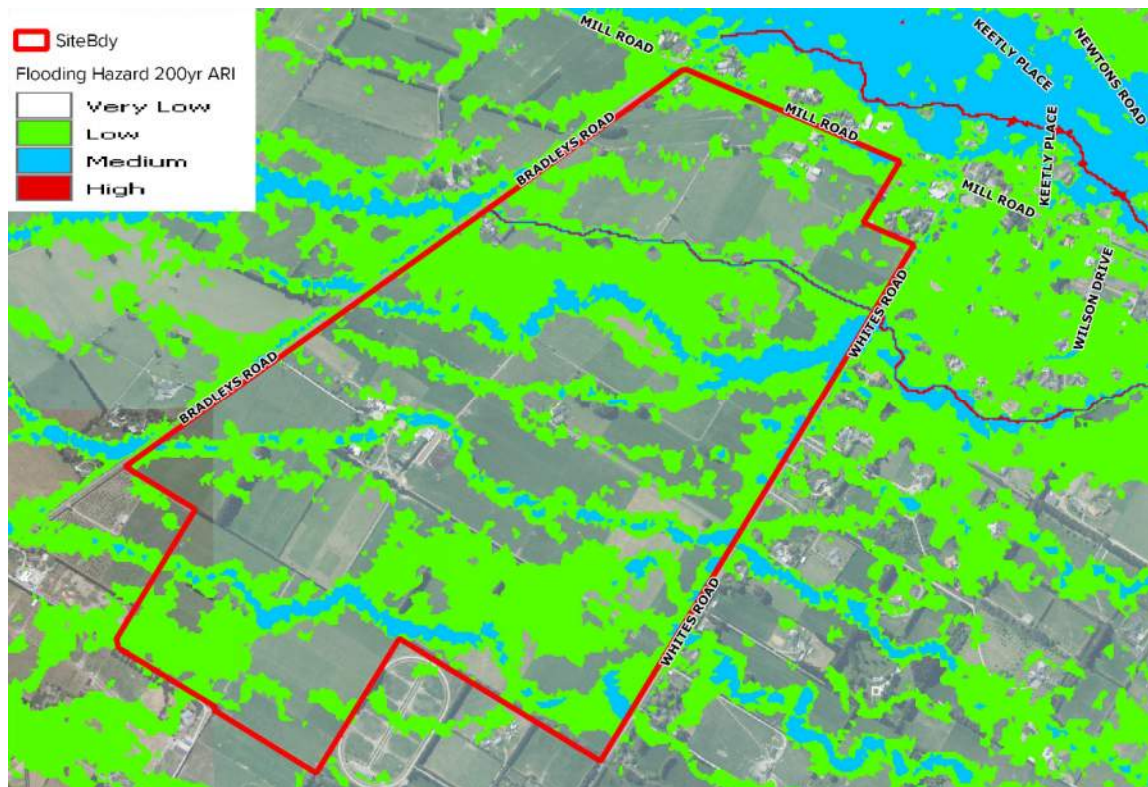


Figure 7 – WDC Regional Flood Modelling Results 200 Year Hazard

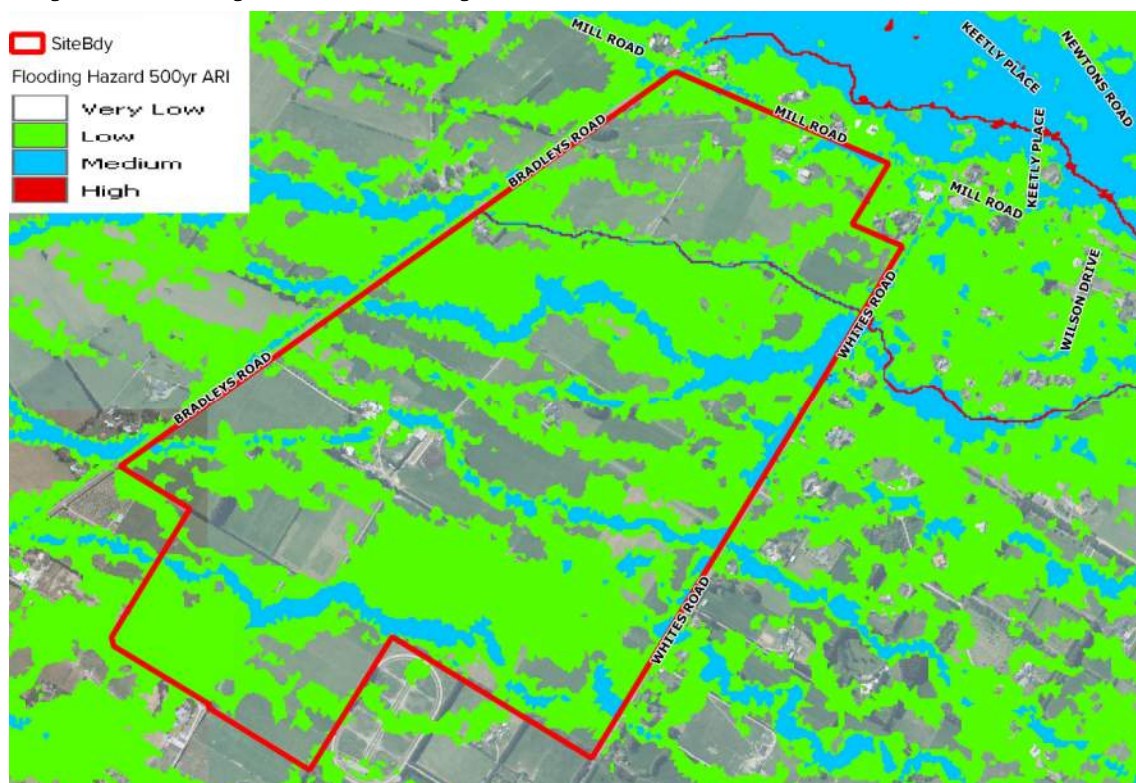


Figure 8 – WDC Regional Flood Modelling Results 500 Year Hazard

Predicted flooding on the pre-development site for 200-year and 500-year events results from significant rainfall events generating overland runoff from the upstream catchment. As shown on **Figure 7** and **Figure 8** above, the flood risk for the pre-development site is assessed as very low to low, with some smaller pockets of medium hazard along overland flowpaths coinciding with existing streams and channels. The site is not at risk of overland flows resulting in breakout of Cust Main Drain, the Eyre River or any other large watercourses in the vicinity such as Ashley River. Any groundwater resurgence breakout is expected to be delayed and will not compound surface flooding during storm events.

Pattle Delamore Partners Ltd (PDP) have carried out a more detailed flood assessment for the site including running pre- and post-development hydraulic flood models to determine the effects of the proposed redevelopment on flood depth, flows and hazard for the plan change site and neighbouring properties. Refer to Appendix E for PDP report titled *Effects on flooding – 535 Mill Road Ohoka – Stormwater Management* (Final issued 2022 ref. C04518300).

The results of the flood modelling by PDP show that for the post-development event, flood depths within the plan change site are displaced by the developed areas but constrained to the proposed drainage and road corridors within the plan change site. Flood depths greater than 1m are constrained to the existing natural waterways as shown in **Figure 10** below.

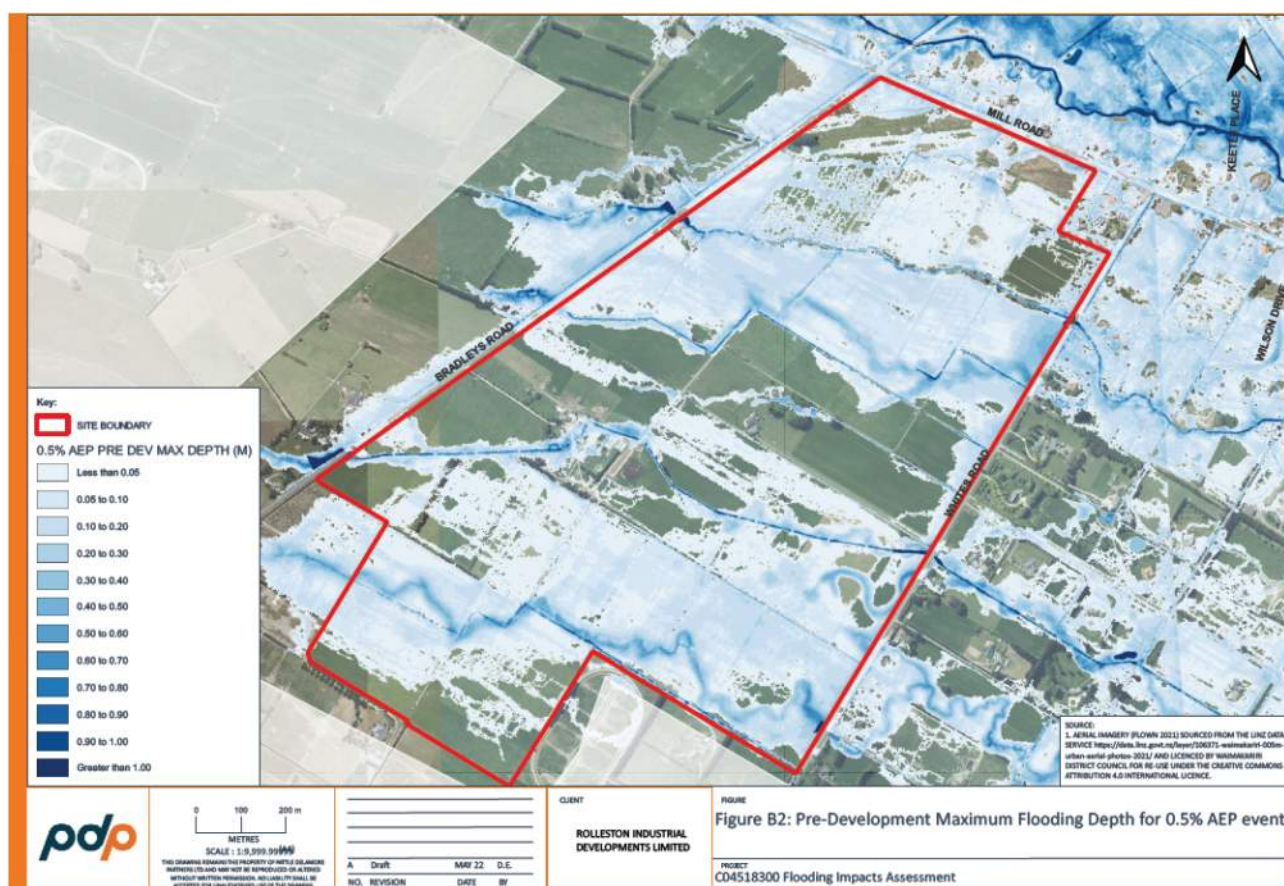


Figure 9 – PDP Pre-Development Maximum Flood Depth 1:200 year event

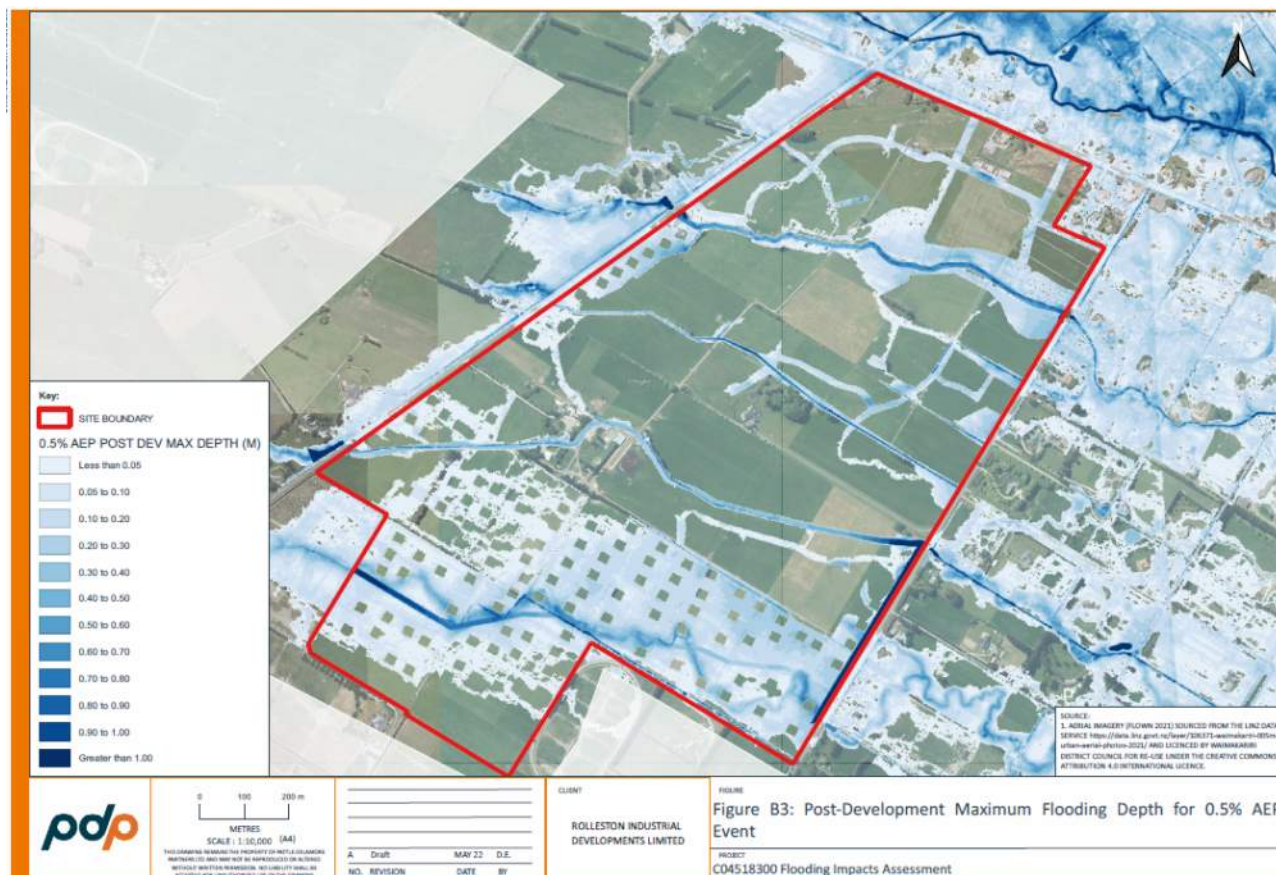


Figure 10 – PDP Post-Development Maximum Flood Depth 1:200 year event

Key conclusions of the assessment completed by PDP are that:

- the proposed development is consistent with the Canterbury Regional Policy Statement (CRPS) for the development of new subdivisions. Floor levels for new dwellings can be set above the 0.5% AEP event, and no development will take place in areas designated as “high hazard” (depth greater than 1m or where flow depth × velocity is greater than 1)
- modelling predicts that flood flows over the south-eastern boundary of the subdivision (Whites Road) increases slightly (from 36.1m³/s to 36.4m³/s), and the flow over the north-eastern boundary (Mill Road) decreases marginally
- the predicted increase in flood level for existing habitable dwellings outside the plan change area (i.e., downstream) is no greater than 45mm in flood depth

Further work during the detailed design stage including more detailed flood modelling of the proposed terrain, stormwater storage and conveyance channels is expected to eliminate predicted increases in flood levels at Bradleys Road / Mill Road intersection and to the south-east of Whites Road.

A site-specific flood risk assessment will be carried out in more detail at subdivision consent application stage as required by Section 106 of the Resource Management Act and minimum floor level rules will be set. In general, ground levels for residential lots will be above internal road levels so the roads act as secondary flow paths to safely convey any potential floodwaters.

4.2. Diversion of Land Drains

There are a number of existing land drains located across the site that will be incorporated into the development at the subdivision design stage. Existing drains running along fence lines may be diverted to suit the proposed development layout, improve amenity value by naturalisation, and to achieve stormwater quality objectives.

Existing natural waterways such as Ohoka Stream and Ohoka South Branch (stream) are to be retained as natural features within the development. Land drainage upslope and downslope of the site will not be affected.

4.3. Stormwater Management

By developing the site for residential land-use there will be an increase in impervious areas such as roofs, driveways and roads and therefore increased stormwater runoff from the site. Management of this runoff in terms of quality and quantity will be required to minimise the effect on the receiving environment.

Poorly drained soils and high groundwater levels across the site mean that stormwater generated from impervious areas within individual residential lots will not be able to be infiltrated on site and therefore will need to be managed as part of the proposed development. For the purpose of this assessment, it is assumed that all additional stormwater resulting from the development will be managed using on-site stormwater treatment and attenuation located within the development.

PDP have completed a stormwater management assessment for the proposed plan change. Refer to Appendix F for PDP report titled *Stormwater Treatment – 535 Mill Road Ohoka – Stormwater Management* (issued 10 June 2022 ref. C04518300).

Stormwater attenuation can be provided across the plan change area for management of stormwater to limit post-development runoff so not to exceed pre-development flows. Formalised attenuation can be provided for up to the 2% AEP event by means of;

- attenuation basins located at the downstream end of sub-catchments with controlled outlets discharging into drainage corridors,
- attenuation tanks to capture and attenuate roof runoff from rural-residential areas (Res4A)
- designated flow path corridors crossing the site will provide additional storage for events exceeding the 2% AEP event runoff.

The percentage of area required to provide attenuation has been estimated by PDP to be between 7% and 9% based on a maximum basin depth of 0.5m. This allowance includes areas required for maintenance access.

Stormwater treatment wetlands which would typically be used for such a large development have been ruled out for this site due to the potential groundwater take resulting from evapotranspiration losses exceeding permitted groundwater take limits. Water quality treatment for runoff from residential areas, rural-residential and retirement village/school areas will be treated by means of swales, raingardens, and bioscapes before discharge to the existing natural streams and drainage channels. The treatment train proposed by PDP includes;

- swales to collect runoff from lots and roads and provide pre-treatment,
- swales to direct runoff towards high-infiltration raingardens and/or bioscapes where further treatment of will be provided by filtration through proprietary filter media. First flush volume storage can be provided in rain gardens and within the bioscape garden, and
- flows exceeding the water quality flow can be either captured by sumps & discharge into conventional gravity stormwater network, or directed as overland flow towards flow path corridors and/or attenuation basins.

Business areas with carparking is to be treated by means of proprietary filtration devices due to higher contaminant load associated with carparks.

4.4. Summary

Flood assessment carried out by PDP has demonstrated that flood waters displaced by the proposed land development can be constrained to drainage and road corridors within the plan change site. Further work during the detailed design stage, including more detailed flood modelling of the proposed terrain, stormwater storage and conveyance channels, is expected to eliminate predicted increases in flood levels at Bradleys Road / Mill Road intersection and to the south-east of Whites Road.

Formalised stormwater attenuation basins can be provided across the plan change area for management of stormwater to limit post-development runoff to pre-development flows for up to the 2% AEP event. The

percentage of area required has been estimated by PDP to be between 7% and 9% of plan change site based on a maximum basin depth of 0.5m.

Stormwater treatment from the development can be provided using pre-treatment swales and high-infiltration raingardens and/or bioscapes for filtration treatment through filter media before discharge to the existing natural streams and drainage channels. Flows in excess of the water quality flow can be either captured by sumps & discharge into conventional gravity stormwater network or directed as overland flow towards flow path corridors towards attenuation basins.

From a stormwater and flood management perspective, the plan change can be supported with areas set-aside for stormwater treatment and attenuation as outlined above.

5. Potable Water

5.1. Existing Network

The Ohoka supply scheme is owned and operated by WDC and so falls under the definition of a reticulated supply. The Ohoka scheme is currently a semi-restricted supply (mixture of properties with supply restricted to 2m³/day and 19m³/day). The nearby Mandeville-Fernside water supply scheme is also a restricted supply scheme with each serviced lot receiving 2m³ per day as a trickle feed. This results in each property requiring an on-site tank and booster pump to provide adequate pressure.

The existing Ohoka Water supply scheme's principal source is the Ohoka Well No.2 located at 566 Bradleys Road (corner of Bradleys Road-Mill Road intersection), to the north western side of the intersection within the Cust groundwater allocation zone. The well is 77m deep with interim secure status. A second shallow well (Ohoka Well No.1) located at 336 Bradleys Road adjacent to the site (approx. 140m south of Bradleys Road-Mill Road intersection), and within the Eyre groundwater allocation zone is only used for emergency supply due to water quality issues. The resource consent for the primary source and backup well allows for an abstraction of 248,000 m³/year at a maximum rate of 18 L/s.

The Ohoka water supply headworks at 336 Bradleys Road site has 3× 23m³ reservoirs feeding through 2× pumps with variable speed drives into the reticulation network. The pumps operate as duty-assist and have an estimated combined capacity of 14.2 L/s/. The primary bore has a duty point set of 12.8 L/s and the back-up bore set to 18 L/s. The existing treatment system comprises chlorine disinfection and pH correction using soda ash. The pH correction is only required in the event that the old source is required to be brought back online. There is limited storage available at the headworks site, with 69m³ of capacity available split between 3 tanks.

Currently the Ohoka water supply scheme has 118 connections (ref: 2021 WDC Ohoka Activity Management Plans), with an average daily flow of 143m³/day (5-year average). Peak daily flow is 503m³/day (5-year average), with a resource consent abstraction limit of 1,555 m³/day with the consents expiring in 2041 & 2051.

5.2. WDC Planned Network Upgrades

The Ohoka scheme is expected to grow over the next 30-50 years with the total number of connections expected to grow to 225 (91% increase). These growth projections however do not consider the Plan Change area or other surrounding areas where plan changes could be possible.

WDC's Long Term Plan (2021-2031) notes that a second primary well is to be established due to the current back-up well (Ohoka No. 1) being non-compliant with current standards. The Activity Management Plans for the Mandeville-Fernside water supply scheme also notes that a Bradleys Road water main extension project is planned for 2037. The Ohoka water scheme activity management plan outlines that there are a number of projects such as a water storage upgrade planned for 2022, further reservoir upgrades in 2032 and a new backup source planned for 2035.

5.3. Demand Estimate for Plan Change Area

It is assumed that the proposed development will be serviced by an on-demand scheme, with the residential 4A zone having a restricted supply of 2m³/day. The following demands are presented in **Table 7** below:

Table 7 – Potable Water Demand for Plan Change Area

Zone	No. Connections	Average Demand (L/con/day)	Average demand (m ³ /day)	Peaking Factor	Peak Demand (L/con/day)	Peak Demand (m ³ /day)
Res3	700	1,000	700	2.5	2,500	1,750
Res4A	150	1,000	150	2.3 ⁽¹⁾	2,300	345
Res8	305	375	114	2.5 ⁽³⁾	937.5	285
Business			16	2.0		32
TOTALS:			980			2,412

The water demand estimate for Residential 4A of 2,300 L/connection/day is based on 2,000L/connection/day (max allowance for restricted supply) + 15% for losses / growth. The Residential 8 demand is based on 375 L/unit/day for 250 L/person/day with 1.5 persons/unit (unit occupancy based on industry feedback). The Residential 8 zone demand has assumed irrigation use is included, however a separate bore may be installed for irrigation purposes reducing the potable water demand. Business zone demand estimates have been based on the Watercare Water and Wastewater Code of Practice for Land Development and Subdivision chapter 6 table 6.1.c.

Based on the above demand calculations, the required peak source flow would be 33.5 L/s based on 20 hours maximum pumping time (WDC ECoP Cl. 7.8.1). The predicted annual water take for the development has been estimated as:

$$\rightarrow 980 \text{ m}^3/\text{day (average)} \times 365 \text{ days/year} + 15\% \text{ (deviation from average + leakage)} = 412,000 \text{ m}^3/\text{year}$$

The plan change site has a number of wells that are currently consented for irrigation use. Existing consent CRC991022 permits a total take of 4,968m³/day or 1.81 million m³/yr (no annual limit) for irrigation use and could be transferred to WDC for reallocation for use as community drinking water supply. Change of consent conditions to reallocate the water use and source (new deep bore) will be required, along with a new bore permit to install a new deep bore.

5.4. Water Supply Feasibility Assessment

PDP have prepared a preliminary feasibility assessment for establishing a community drinking water supply at the site considering water demand requirements, aquifer performance, assessment of environmental effects and planning considerations. Details of their assessment including parameters used for draw-down calculations are detailed in their report titled *Plan Change Request - 535 Mill Road, Ohoka - Preliminary Community Water Supply Assessment* (dated 9 June 2022 Ref. C04518500) included as Appendix G.

PDP concluded that it is viable to establish a community drinking water supply with the plan change area with an estimated total of four (4) new bores to provide adequate redundancy (N+1). **Figure 11** below illustrates four new bores situated within the plan change area at a spacing of 500m (PDP estimated a spacing of 300-500m). New bores would be developed to draw water from the deeper aquifer at a similar depth to the existing Ohoka Well No. 2 community supply bore (70-80m). On the basis that proposed new bores established within the plan change site would be similar in capacity to Ohoka Well No. 2, the drawdown effects on neighbouring shallow bores and stream depletion effects in the area were estimated to be minor.

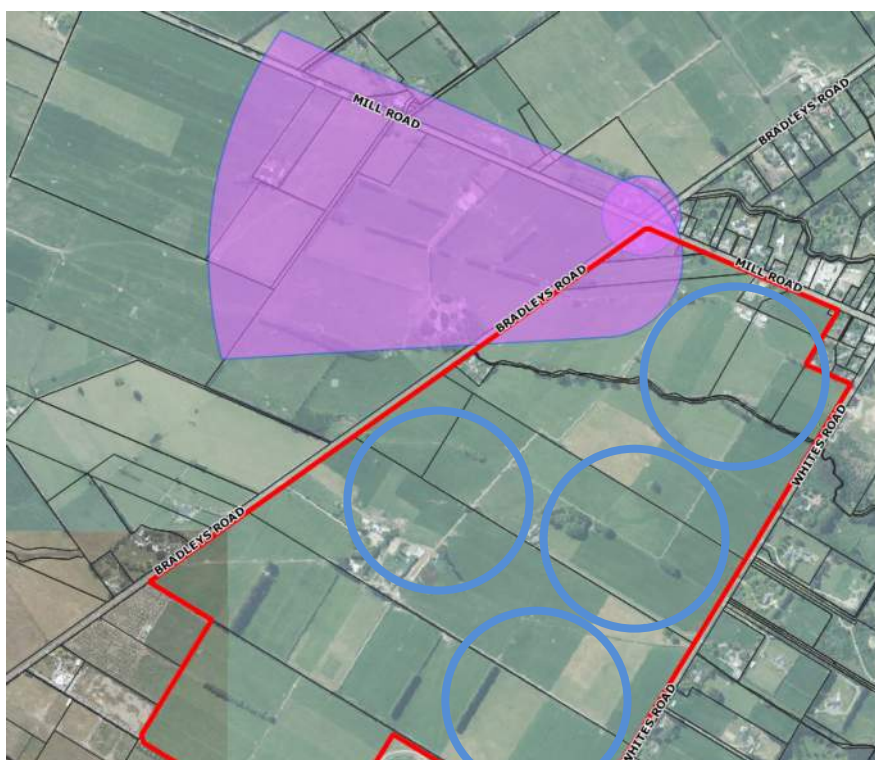


Figure 11 –Indicative Well Spacing (500m)

The consenting strategy for establishing a new community water supply is outlined in the PDP report in Appendix G. If pumping test results from newly established bores within the plan change area are similar to the existing established bore at Ohoka Well No. 2 site, then transfer of the existing irrigation consents is a viable consenting pathway. Site specific pumping tests for newly developed wells would be required to prepare an assessment of environmental effects in support of a resource consent application to establish a community drinking water supply.

5.5. Fire Fighting Flows

Currently the Ohoka & Mandeville water supply schemes are not considered fire districts, although fire hydrants are provided throughout Ohoka and Mandeville. The existing reticulation and well capacity cannot supply sufficient flow (25 L/s) from 2 hydrants to comply with FW2 zoning as per SNZ PAS 4509:2008.

The proposed development can be provided with reticulation designed to allow compliance with SNZ/PAS 4509:2008 for all Residential 3, Residential 8 and Business Zoned areas. Hydrants for fire-fighting supply within the Residential 4A zoned areas is expected to be provided to similar standard to the surrounding Mandeville and Ohoka areas. The internal pipework within the development can be designed to accommodate peak demand including provision for fire-fighting demand in accordance with WDC's *Engineering Code of Practice* and SNZ/PAS 4509:2008 *Fire Service Code of Practice*.

5.6. Summary

It is anticipated that new supply bores would be established within the plan change area to provide for community water supply as the existing Mandeville-Fernside water supply scheme (including Ohoka) does not have sufficient capacity to service the proposed plan change area. Assessment carried out by PDP concluded that it is viable to establish a community drinking water supply within the plan change area with an estimated total of four (4) new bores to provide N+1 redundancy. PDP identified possible consenting pathways including transfer of existing irrigation consents.

From a water supply perspective the plan change can be supported on the basis that new water supply bores can be developed within the plan change area.

6. Electricity / Telecommunications

6.1. Electrical Power

The existing 11kV and 33kV electricity network bordering the site can be extended to provide sufficient power to the development. Full appraisal of the network extension requirements will be carried out once the Plan Change has been obtained.

Electrical power can be provided to all allotments to utility company and industry standards. All network and reticulation cabling is expected to be installed underground, with 11kV transformer kiosk sites located on separate lots at locations approved by MainPower and Council.

6.2. Transpower Transmission Lines

66kV overhead transmission lines cross the site in the south west corner as shown on the site plan included in Appendix B. These transmission lines form part of the national grid operated by Transpower and are known as the Islington to Southbrook A (ISL-SBK-A) distribution line.

The National Grid Yard is the area beneath and immediately next to National Grid lines (including their support structures). Incompatible activities and land uses need to be set back from National Grid lines as they can compromise the ongoing operation, maintenance, upgrading and development of the National Grid or the safety of those living or working around it. For 66 kV transmission lines, the National Grid Yard is 10m setback either side of the centreline of the transmission cables and 10m in any direction from the outer edge of support structures (i.e., transmission towers).

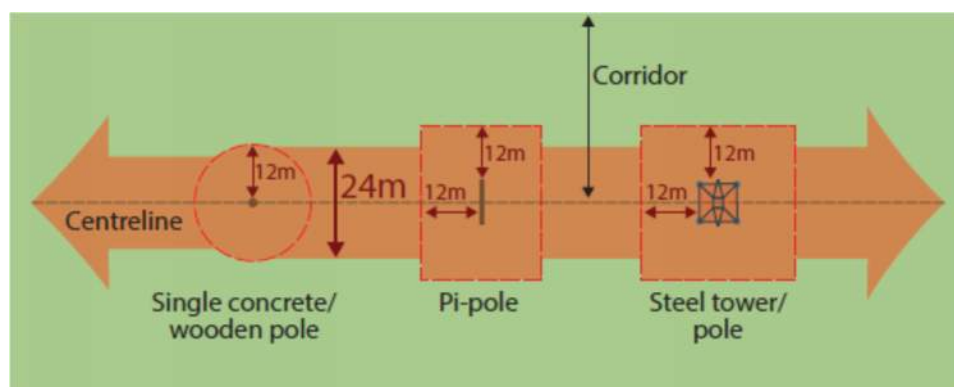


Figure 12 - National Grid Yard Diagram

Buildings and structures must also comply with the minimum safe clearance requirements in the New Zealand Electrical Code of Practice for Electrical Safe Distances 2001 (NZECP 34). NZECP 34 specifies minimum safe separation distances for people, buildings/structures, mobile plant and earthworks from National Grid lines (including their support structures).

6.3. Streetlighting

Streetlighting is expected to be provided to roading and reserves in accordance WDC engineering standards where required. The applicant will provide a streetlight style consistent with styles used elsewhere in Ohoka and the surrounding Mandeville Area.

6.4. Telecommunications

Telecommunications can be provided to all sites in the form of fibre optic network installed to utility company and industry standards. The existing fibre network in Mill Road can be extended to the site and distributed to individual allotments. All network and reticulation cabling is expected to be installed underground.

7. Roding

7.1. Road Layout

The proposed roading layout is shown on the ODP plans attached as Appendix A indicating the road layout and possible local road connections to Mill Road, Bradleys Road and Whites Road. Intersections with external roads will be priority-controlled with priority given to the external road network. Direct vehicular access to private properties can be provided to Mill Road and Whites Road where road frontage upgrades are indicated on the ODP. Otherwise, direct vehicular access to Bradleys Road and Whites Road from Residential 4A zoned properties shall be limited as much as practical. Where direct property access is proposed to the Whites Road frontage, this road would also include a footpath connecting to the proposed shared path on Mill Road.

The road hierarchy will deliver an accessible and coherent neighbourhood that provides safe and efficient access to the new development. The movement network for the area shall integrate into the existing and proposed pedestrian and cycle network beyond the ODP area. Cycling and walking can be provided for within the road reserve and incorporated into the road design of the overall road network where applicable. Adequate space must be provided to accommodate cyclists and to facilitate safe and convenient pedestrian movements.

7.2. Road Cross Section

Proposed carriageway widths range depending on the street type and function. Roadside swales will be utilised in areas where appropriate in fitting with the surrounding environment. All roads will have berms on either side of the road for common services installation. Carriageways will differ for shared space zones, standard roads and larger roads.

Grass shoulders and drainage swales incorporated into the road corridor are proposed for stormwater conveyance in lieu of a hard shoulder defined by kerb and channel, with either single one-way cross-fall for the carriageway or two-way cross-fall (camber) to swales on both sides. Street trees are proposed on both sides of the carriageway. Larger roads will feature footpaths on both sides of the road, single footpath on smaller to standard roads and no footpaths in shared space zones. Standard footpaths will be wider where paths accommodate both pedestrians and cyclists. Where roads run alongside waterways and green space shared pathways can be integrated into the green margins. Sufficient berm width will be provided for common services installation.

7.3. Road Stormwater Drainage

Stormwater runoff within road corridors will be via roadside swales and culverts. All sumps will have trapped and/or inverted outlets and connected to the piped stormwater network. The road corridor will be used as overland flow paths to direct stormwater runoff when the drainage network is at full capacity.

8. Earthworks

8.1. Bulk Earthworks

The topography of the existing site is generally sloping west to east towards Whites Road at an average gradient of 1:180 and with height difference of approximately 7 metres total elevation change from RL 28 to RL 21m NZVD 2016 (New Zealand Vertical Datum).

Bulk earthworks design will be determined by providing overland flow paths along roads and achieving 1:500 (absolute minimum) grade from the top of kerb to the rear of the sections fronting the road. The design philosophy for the setting of earthwork levels will be determined by the following criteria:

1. Road gradients not to exceed 1 in 20, not to be less than 1:450 where possible
2. Cut/fill balance where applicable
3. Overland flow paths for the subdivision are to follow the road layout, with the overall site overland flows not being different to the current situation.

To avoid carting material off-site earthworks will be designed to achieve a cut/fill balance across the site. Any filling operations exceeding 300mm depth will be carried out in accordance with NZS4431:2022 *Engineered Fill Construction for Lightweight Structures*. It is envisaged that material won from site, will be sufficient to use as engineered fill.

All earthworks on residential lots and roads will be carried out in accordance with principles outlined on the Environment Canterbury's Erosion Sediment Control Toolbox to minimising the adverse effects of erosion and sedimentation during construction. Dust and noise generation during earthworks construction is expected to be no worse than if the land was under cultivation or during harvest if farming operations continue on the site.

8.2. Diversion of Drains

Existing drains may be diverted to suit the proposed development layout, improve the amenity value by naturalisation of formal land drains, and to achieve stormwater quality objectives. Further detailing will be carried out prior to engineering approval along with other consultants such as urban designers, ecology and groundwater consultants.

9. Summary & Conclusion

New infrastructure is required to be developed to service the proposed plan change area, including wastewater, stormwater and water infrastructure.

Conventional gravity or local pressure sewer systems are both feasible options for wastewater collection and discharge from the proposed higher density areas (Res3 & Res8). Lower density rural-residential areas (Res4A) favour local pressure sewer collection and reticulation. Due to the relatively flat terrain and high groundwater levels a conventional gravity network would require multiple pump or lift stations to convey wastewater to a centralised pump station near Mill Road before pumping to the Rangiora WWTP. Construction of a new rising main to the Rangiora WWTP would be required for a conventional gravity system. There is potential to utilise current spare capacity in the existing Mandeville-Ohoka rising main to the Rangiora WWTP in the short term if a local pressure sewer system with smart control systems at individual pump stations were to be adopted to reduce peak wet weather flow.

Flood assessment carried out by PDP has demonstrated that flood waters displaced by the proposed land development can be constrained to drainage and road corridors within the plan change site. No development will take place

in areas designated 'high hazard' and there will be no increased risk to life as a result of the development.

Formalised stormwater attenuation basins can be provided across the plan change area for management of stormwater to limit post-development runoff to pre-development flows for up to the 2% AEP event. Stormwater treatment from the development can be provided using pre-treatment swales and high-infiltration raingardens and/or bioscapes for filtration treatment through filter media before discharge to the existing natural streams and drainage channels.

It is considered viable to establish a community drinking water supply within the plan change area, with an estimated total of four (4) new bores required to provide N+1 redundancy. PDP identified possible consenting pathways for development of a community supply including transfer of existing irrigation consents. Water reticulation can be provided to supply on-demand potable water demand to Residential 3 and Residential 8 areas, and restricted supply to Residential 4A areas. Provision can be made in higher density areas for hydrants for firefighting.

Existing electricity and fibre broadband networks in the neighbouring developments can be extended to service the proposed plan change areas. Electricity and telecommunications will be provided to all sites to utility company and industry standards. All cables within the development sites are expected to be installed below ground and kiosks will be constructed on separate individual lots.

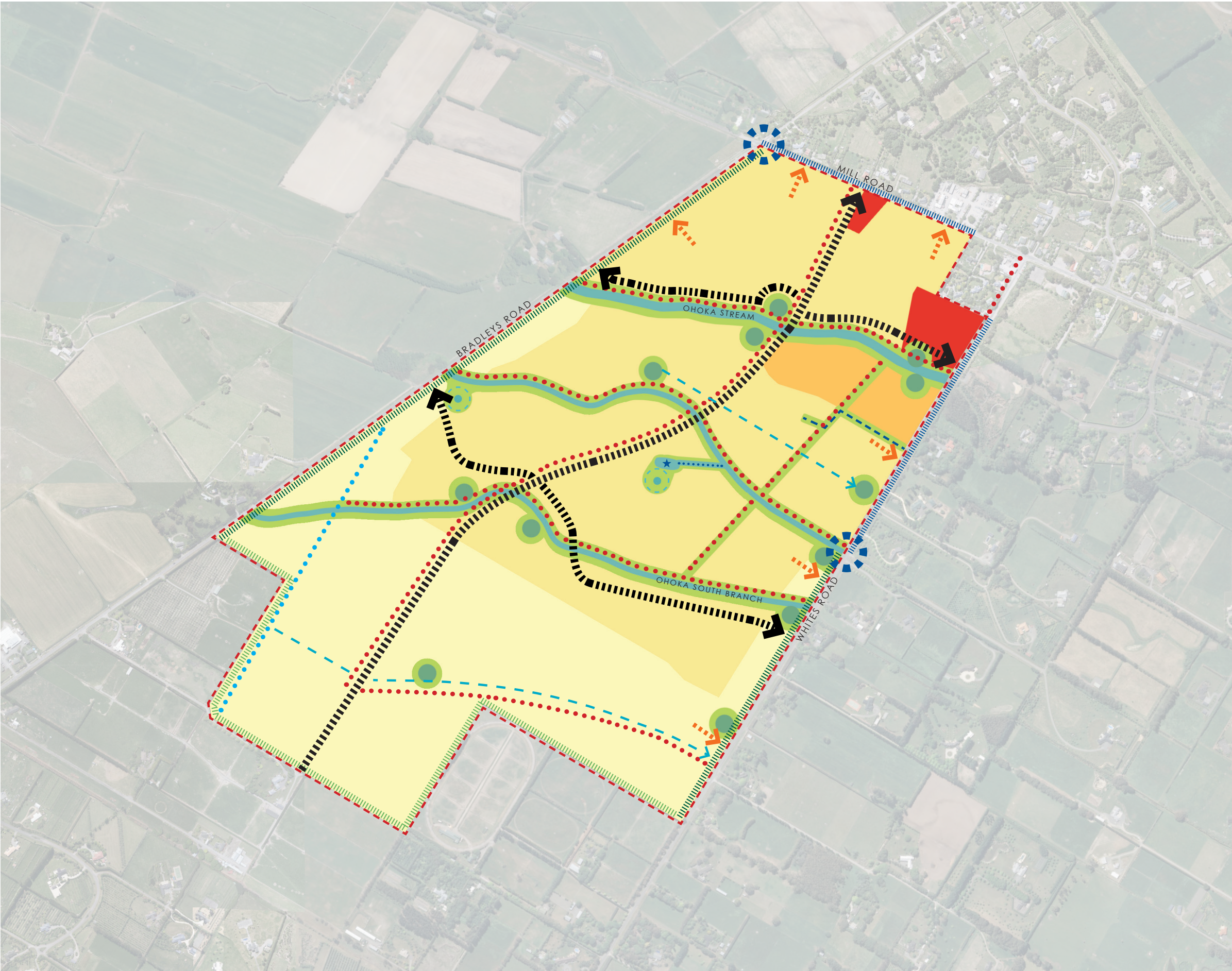
From an overall infrastructure perspective, the proposed plan change can be supported by a combination of extending existing infrastructure from neighbouring subdivisions (electricity and fibre) and the provision of new water supply, wastewater infrastructure, and stormwater treatment options to service the development areas.

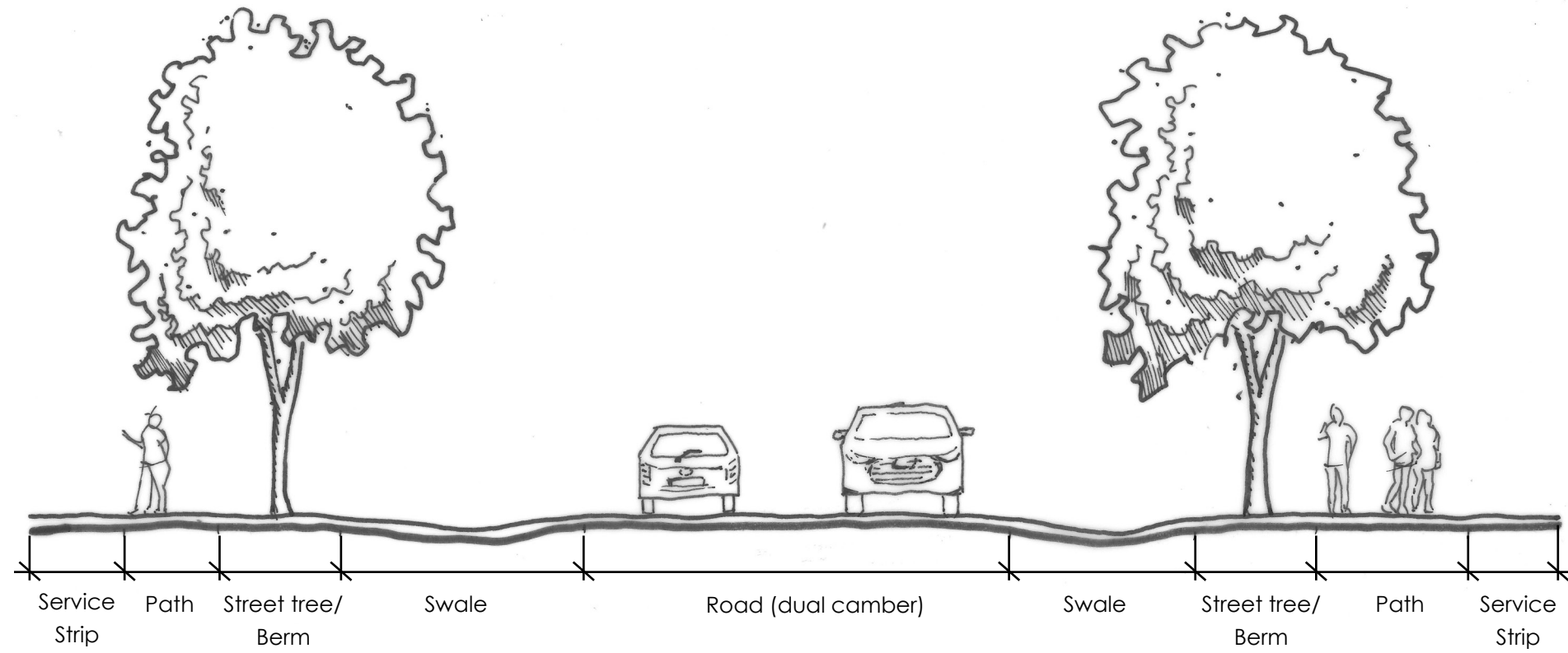
APPENDIX A | Outline Development Plan

OUTLINE DEVELOPMENT PLAN - MILL ROAD

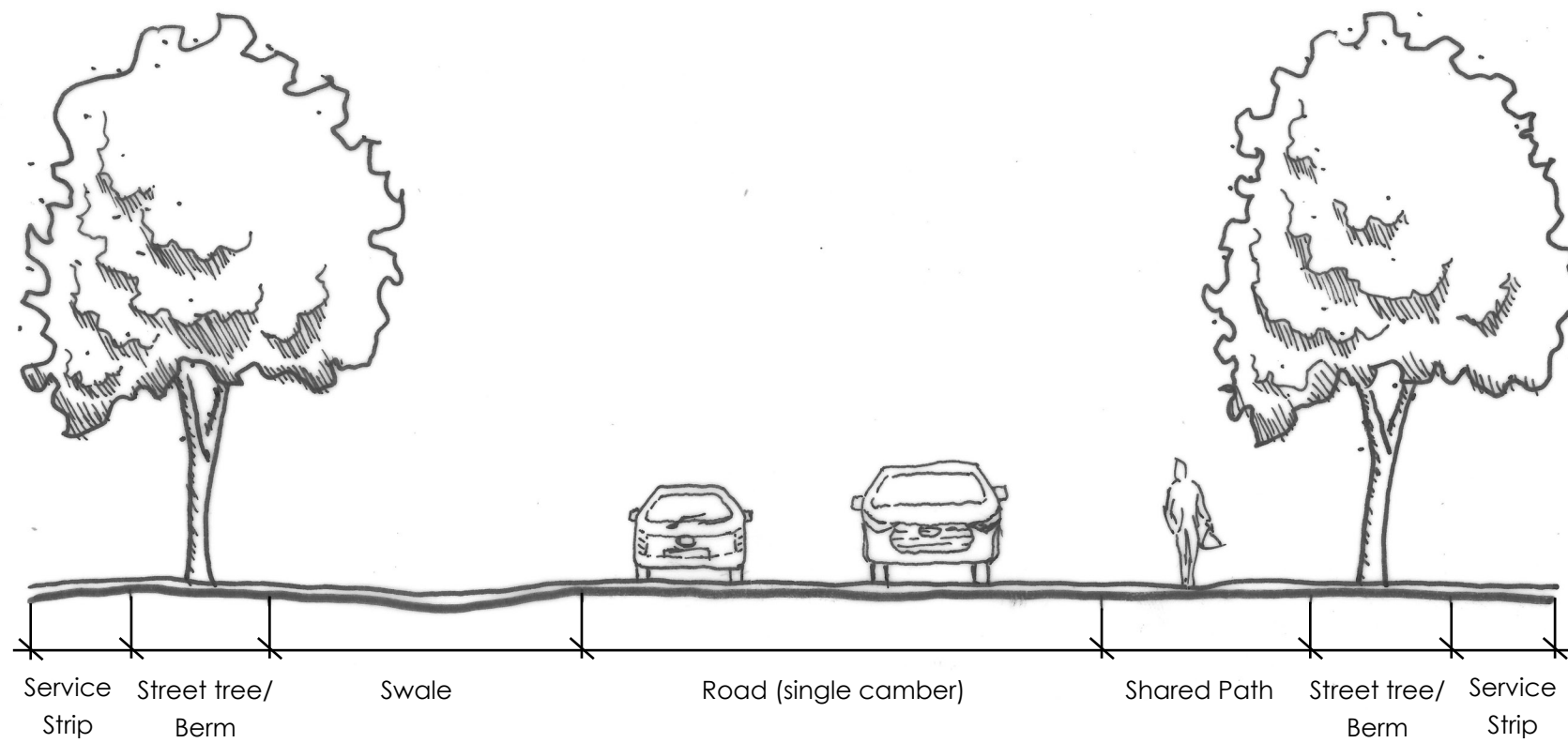
LEGEND

- Outline Development Plan Area
- Residential 3
- Residential 4a
- Residential 8
- Business 4 Zone
- Indicative Road
- Indicative Local Road Connection
- Threshold / Gateway
- Indicative Pedestrian Network
- Indicative Stormwater Management Areas (size and location to be confirmed)
- Existing / Naturalised Waterways
- Existing Springs and Associated Setback
- Stormwater Conveyance Flow Path
- Groundwater Seep
- Existing Pond (size and location to be confirmed)
- Southern Spring Channel
- Green Network
- Landscape Treatment A
- Landscape Treatment B
- Extent of Road Frontage Upgrade
- Overhead 66kV Power Lines

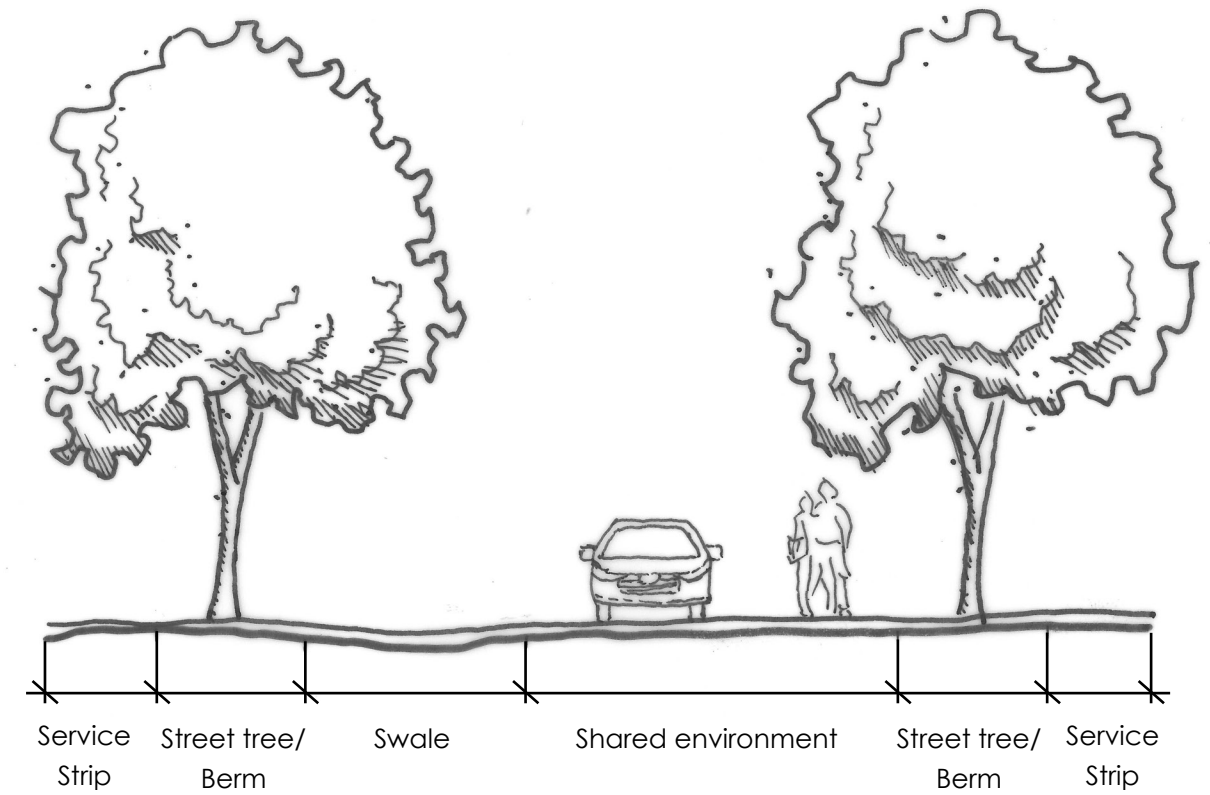




INDICATIVE ROAD TYPE A



INDICATIVE ROAD TYPE B



INDICATIVE ROAD TYPE C

APPENDIX B | Existing Site Plans

MILL ROAD DEVELOPMENT

MILL ROAD, OHOKA



LOCATION PLAN



REV	DESCRIPTION	DATE
A	FOR COMMENT	04/10/21
B	SITE BOUNDARY UPDATES	16/11/21

SCALE: NOT TO SCALE
DRAWING NO: 000 REV. B
PROJECT NO: 14895

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MILL ROAD, OHOKA

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122 Montreal St,
Sydenham,
Christchurch 8023
PO Box 7069
Sydenham 8240





NOTES

1. LiDAR data from LINZ Data Service - 1m DEM
2. LiDAR Major contours 5.0m interval, minor 1.0m.
3. Boundary Information from LINZ Data Service
4. Areas and dimensions are subject to final survey.

LEGEND

Site Boundary

HV

High Voltage Power Cable

25.0

Major contour (5m intervals)

24.0

Minor contour (1.0m interval)

Territorial Authority:

Waimakariri District Council

Application Address:

Mill Road, Ohoka

Comprised In:

72971 - 3, CB19B/21, CB26B/467, CB33F/217 And 218, CB35A/112, CB36C/1075, CB742/18

Zone:

Rural - Residential

Total Area:

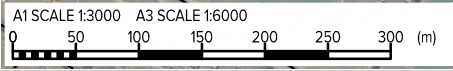
155.70 ha

Legal Description:

Lot 1&2 DP 55404, Lot 1-3 DP 318615, Part Lot 1 DP 2267 DP 8301, Lot 1 DP 55849, Lot 2 and Part Lot 1 DP 8301, Lot 2 DP 61732, Part RS 2220

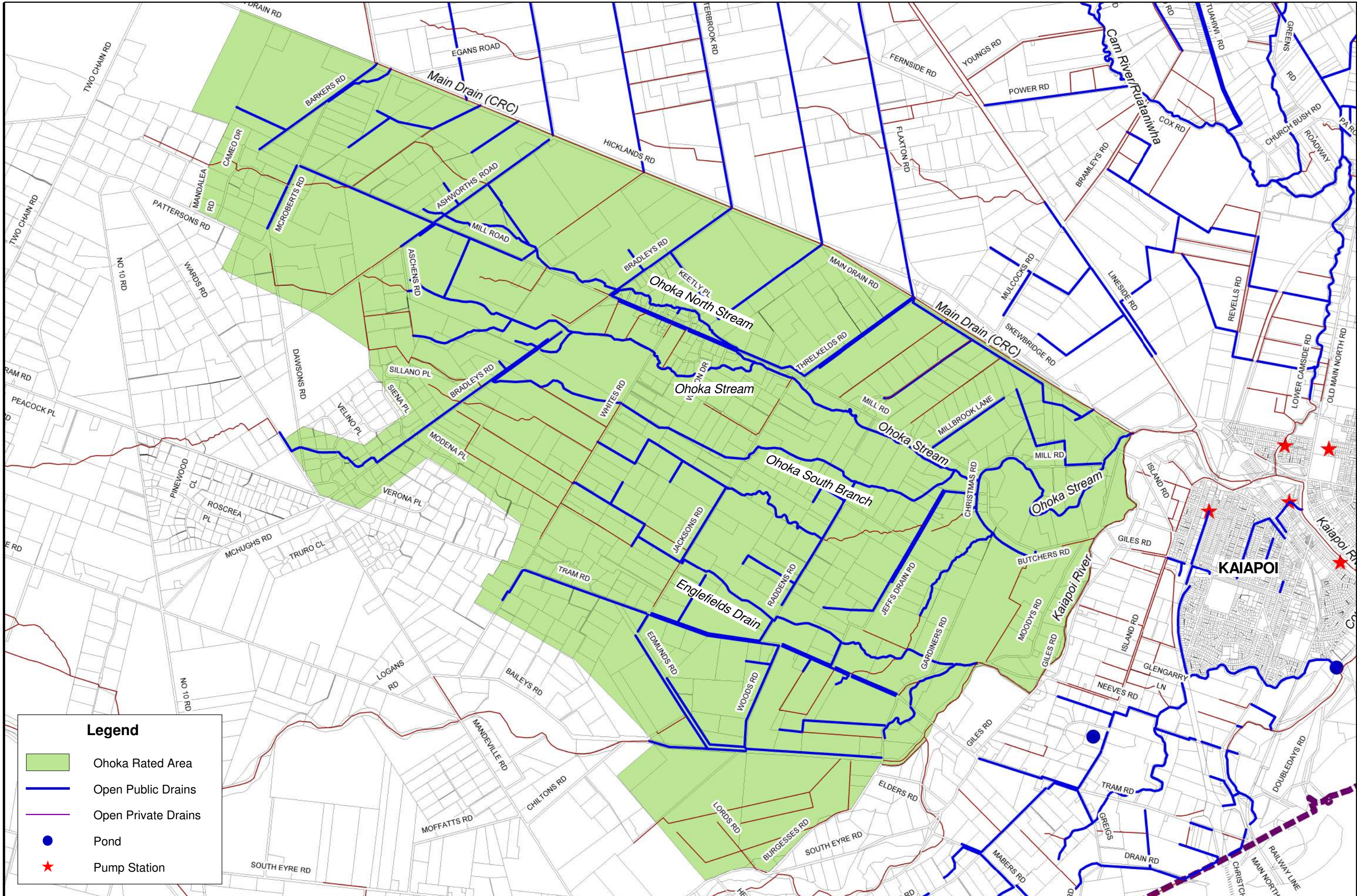
NOTES

1. Areas and dimensions are subject to final survey.



Rev#1	Description	Drawn	Date		122 Montreal St, Sydenham, Christchurch 8022 Ph. 03 377 3290 11 Clayton St, Newmarket, Auckland 1149 Ph. 09 600 1099 www.inovo.nz	Scale A1 1:3000 Scale A3 1:6000 DO NOT SCALE FROM DRAWING	Designed ABM Approved TDM Date 04.10.2021	Client ROLLESTON INDUSTRIAL DEVELOPMENTS LTD	Project MILL ROAD OHOKA	Drawing Title EXISTING SITE OVERVIEW PLAN	Status FOR INFORMATION NOT FOR CONSTRUCTION	Drawing No. 14895-E-100	Rev B
B	UPDATING SITE BOUNDARY	EM	04.11.21										
A	PRELIMINARY ISSUE	ABM	04.10.21										

APPENDIX C | Ohoka Drainage Map



Ohoka Rated Area

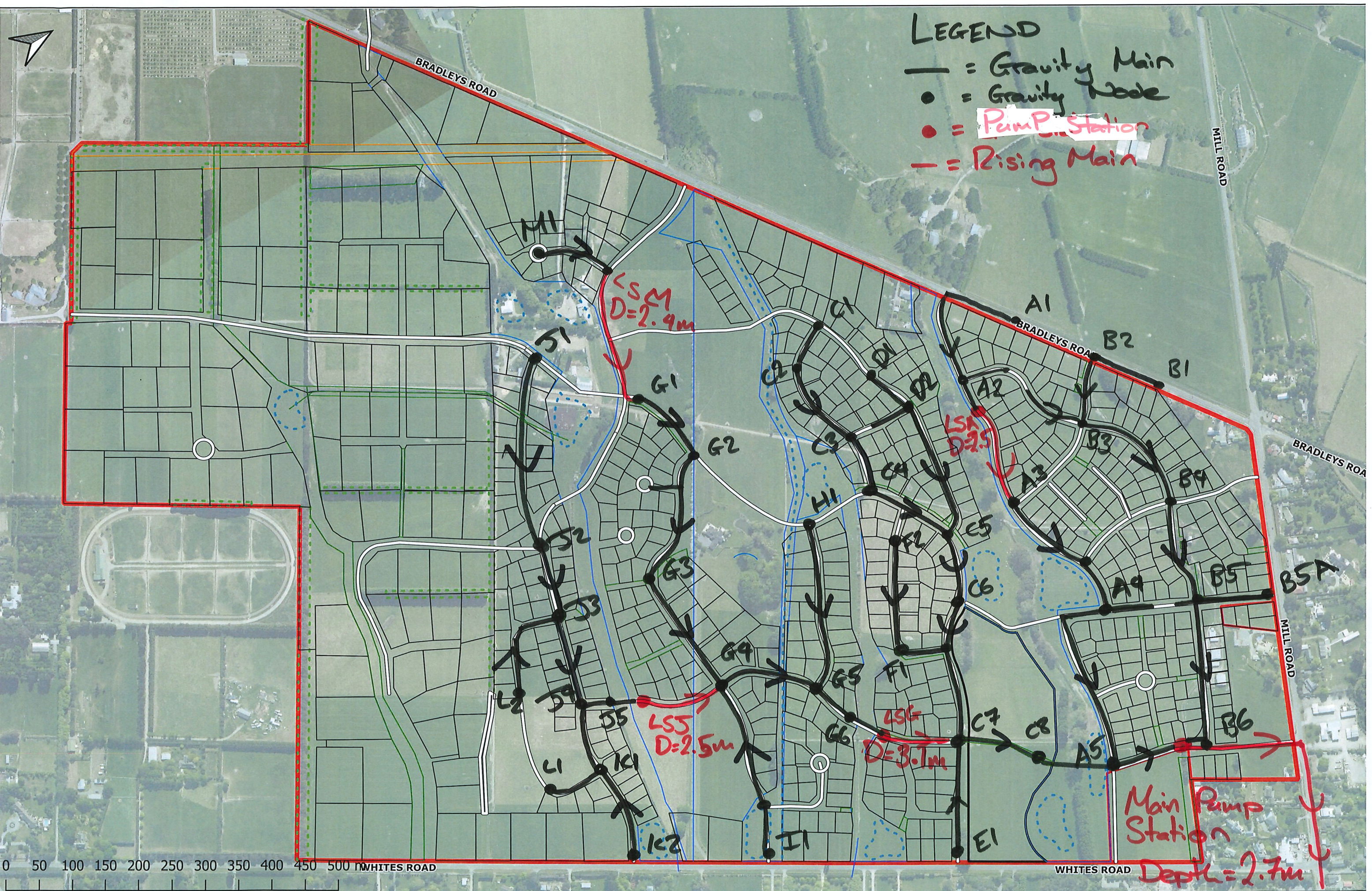
Open Public Drains

Open Private Drains

Pond

Pump Station

APPENDIX D | Gravity Sewer Concept Layout



LEGEND
— = Gravity Main
● = Gravity Node
● = Pump Station
- - = Rising Main