Bellgrove Development

Civil Infrastructure Report

Bellgrove Rangiora Ltd.

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Document control record

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1 Introduction

1.1 General

Bellgrove Rangiora Limited (BRL) are proposing to develop an area of land on the eastern outskirts of Rangiora township into a new residential subdivision (Bellgrove Development). The wider development is located between Northbrook Road to the south and Coldstream Road to the north and is approximately 100 hectares in area. The portions of the development north (~64Ha) and south (~36Ha) of Kippenberger Avenue will generally be referred to as Bellgrove North and South respectively.

Stage 1 consists of approximately 20.8ha and is the first step in development of BRL's landholding (refer Figure 1). Resource consent approval for Stage 1 is being sought under COVID-19 Recovery (Fast-track Consenting) Act 2020. Stage 1, is located immediately north of Kippenberger Ave and is herein referred to as 'the site'. Stage 1 will comprise general and medium density residential development yielding approximately 200 lots/dwellings, provision for a neighbourhood commercial area, retention of the heritage homestead for residential use, and associated roading, stormwater management and reserve networks.

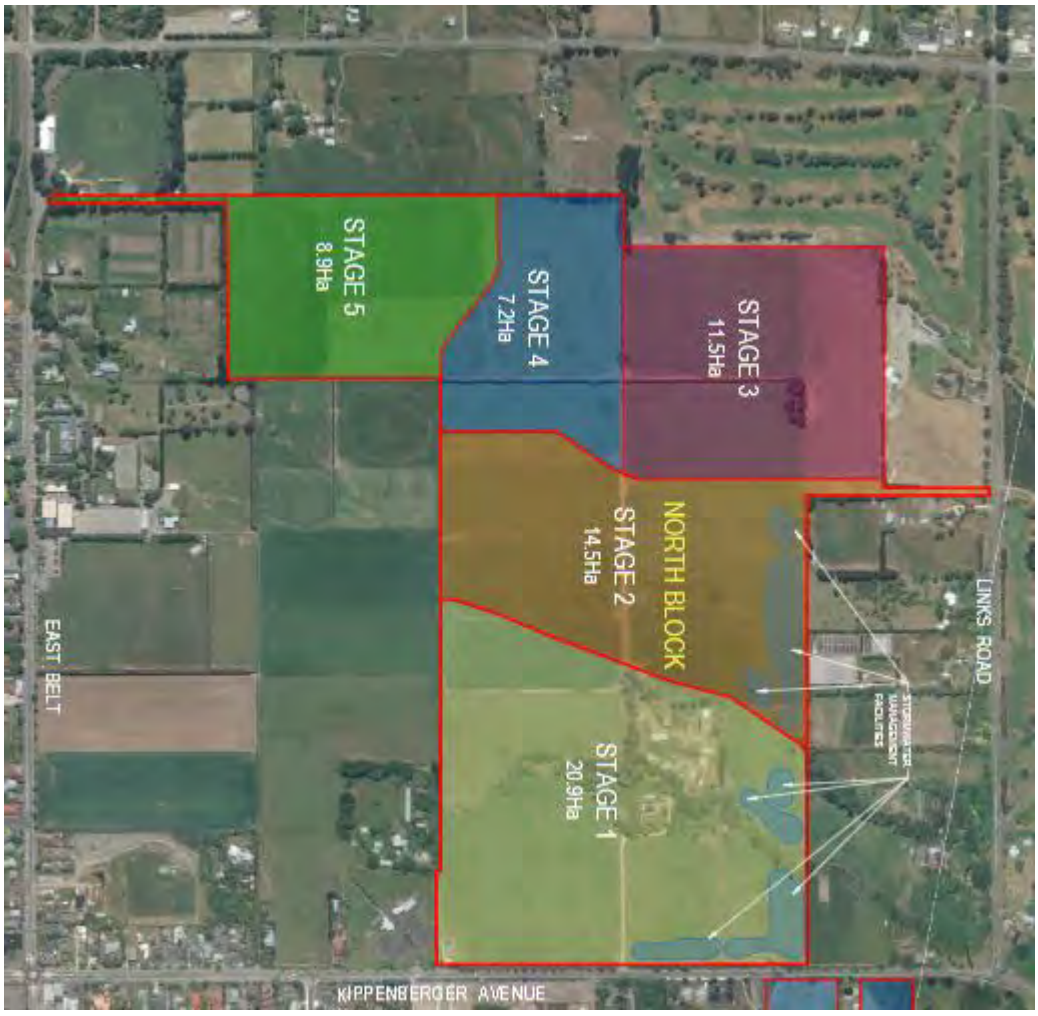


Figure 1, Bellgrove North Location and Indicative Staging

1.1.1 Scope

BRL has engaged Aurecon New Zealand Ltd (Aurecon) to provide engineering services for the development, part of which includes a Civil Infrastructure Assessment and Design Documentation to support the resource consent applications to be lodged with the Environmental Protection Authority (EPA).

The scope of works includes the following:

- Subdivision Layout
- Resource Consent application
- Infrastructure report
- Integrated Transport Assessment
- Engineering Design
- Sewer and Pump Station Design
- Construction Management and Certification
- General Consultancy

This Civil Infrastructure Report details the infrastructure upgrades proposed for sufficient servicing of the Proposal (Stage 1 of Bellgrove North including the associated housing development and future commercial lot) as required by the 'COVID-19 Recovery (Fast-track Consenting) Referred Projects Amendment Order (No 16) 2021 (Schedule 37)'.

1.1.2 Site Description

The currently rural site slopes gently to the southeast and is largely grassed and divided into paddocks. There are two existing houses located within Stage 1. The first is the Bellgrove Historic homestead situated south of the Cam/Ruataniwha River. Central to the site, it will be retained as existing as part of the development. Access is off Kippenberger Ave. The other existing house, at 76 Kippenberger Ave, is a residential dwelling located in the south west corner of the development. This house will be removed to enable a roundabout to be built on intersection of Kippenberger Ave and MacPhail Ave with a new Road leading to the north (Road 1) which will become the main Collector Road into the Bellgrove development. This roundabout and location is a WDC requirement.

Stage 1 of the site is naturally divided into two sections with Kippenberger Ave along the southern boundary then the Cam / Ruataniwha River separates sub-stages 1A-1B from sub-stages 1C-1D. The Northern Flow Channel that leads east to Golf Links Road is the northern boundary of stage 1. These waterbodies are generally speaking dry channels but are designed to be retained and will be enhanced with planting and naturalised to become main features of this stage.

Refer to Appendix A for an overview plan of the Bellgrove North site.

1.1.3 Subdivision Layout

The Northern block of the Bellgrove development is shown in Figure 1 above. Stage 1 of the development is situated between Kippenberger Ave the Northern Flow Channel.

1.1.4 Access

Access to the site will be north off Kippenberger Ave at two locations. A new roundabout will be constructed at the south-western edge of the site, linking Kippenberger Ave, McPhail Ave, and the new Collector road on the western boundary (Road 1) north into the Bellgrove Development. There will also be a second collector road into the site from Kippenberger Ave approximately mid-way between Devlin Ave and McPhail Ave (Road 2). Road 2 will be a T-intersection and will be controlled with a Give Way.

1.1.5 Development Staging

The development of Bellgrove North will be staged from south to north off Kippenberger Ave (see figure 1). Stage 1 includes all of the fast track area and has been split into four sub-stages. Stages 1A & 1B include the eastern and western portions (respectively) of the subdivision between Kippenberger Ave and the Cam River. Stages 1C & 1D includes the western and eastern lots (respectively) north of the Cam River and but south of the Northern Flow Channel that feeds towards Golf Links Road and the Taranaki flow channel. Refer to Figure 2 below for the construction staging plan (509177-0000-DRG-CC-0500) for Stage 1 of the development.

Kippenberger Ave, including the installation of the Round-a-bout, will be urbanised as a separate stage and is currently being design/discussed with WDC and the associate Community Board to ensure it will complement there future works.

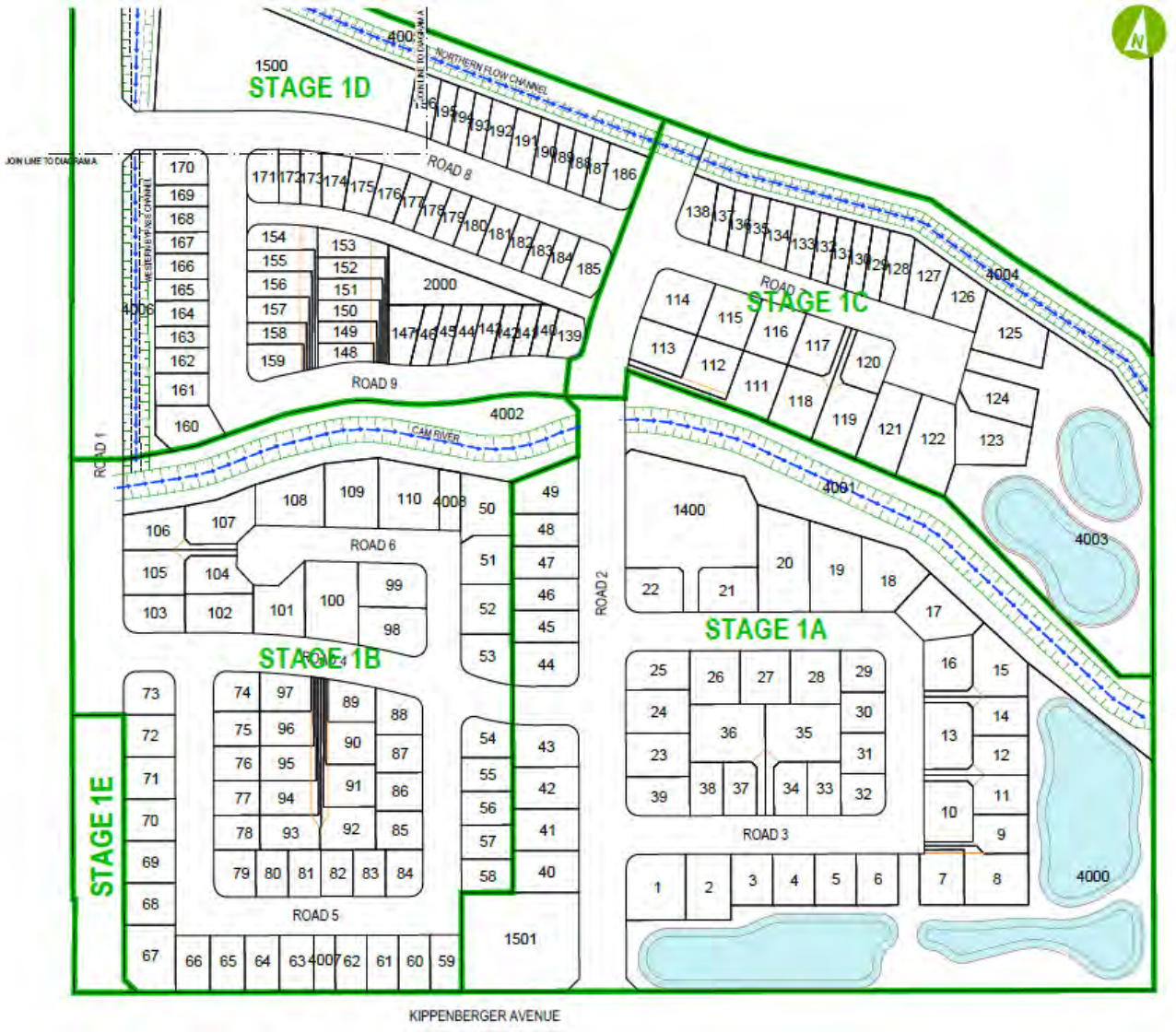


Figure 2, Bellgrove Stage 1, Construction staging plan

1.1.6 Development layout Development

Table 1 below shows the number of lots proposed for Stage 1, as well as an estimate of future lots for stages 2-5 based on a 'general residential density' as set out in the Waimakariri District Plan North East Rangiora Development Area. The general residential density has been calculated as 13.5 lots per hectare (gross area). Refer to Appendix B for the lot density calculations and areas.

Table 1 - Proposed Lots for the Development

Sub-Stage	General density Residential Lots*	Medium density Residential Lots**	*Cumulative Total*	Other
Stage 1 (fast-track)	*62*	*140*	***202***	Ex Homestead 1 x Super lot
Stage 2	178		***380***	Reserve
Stage 3	173		***553***	
Stage 4	115		***668***	
Stage 5	132		***800***	

**General density residential lots (stage 1) are generally 500m2 + in size.*
***Medium density residential lots (stage 1) are 200-499m2 in size.*

The following assumptions have been made around the proposed Lot 1400 and the commercial area in stage 1 for servicing demands to be estimated:

- Lot 1501 – This is proposed as a residential superlot with the potential to accommodate up to five future residential allotments. There is consideration that in the future it may also be developed as a pre-school (2384m2 land area), with the infrastructure designed to accommodate such additional demand (assumed maximum daily occupancy of 100 people (including staff))
- Lot 1500 (5354m2 land area) NW corner of Stage 1 to have land use type - Commercial
- Lot 1400 (2558m2 land area) is the Existing homestead which is to be retained

1.2 North East Rangiora Outline Development Plan

WDC have developed the East Rangiora Structure Plan (ERSP), now referred to as “North East Rangiora Outline Development Plan (NER ODP)” to guide future development of the land included and surrounding the plan change. The NER ODP identifies important road links, servicing requirements and reserve areas and links. The NER ODP has been through a consultation process with affected landowners and has been adopted as Council Policy. The Subdivision layout has been developed in general accordance with the NER ODP.

1.2.1 Roading

The NER ODP shows multiple road and shared path connections between Kippenberger Ave, Golf links Road, Coldstream Road and East Belt. Not all land is owned by Bellgrove but where possible this layout is generally being built into the subdivision layout in conjunction with discussions with the WDC Transport Engineer.

1.2.2 Stormwater

Early stormwater modelling and holistic design work was carried out by Aurecon in 2020 and reviewed by WDC along the way to confirm the most appropriate stormwater management strategy for the development. It was agreed that stormwater runoff from the Bellgrove North development would be managed at the south-east corner of the site. The 0.5% AEP Ashley River break out is being managed through the site and local stormwater discharge will be to ground. The proposed stormwater basin locations are general accordance with the NER ODP.

1.2.3 Wastewater

The NER ODP identifies a series of new pump stations and rising mains (as well as existing line upgrades) to service any new developments in Eastern Rangiora. This allows discharge of the wastewater to the Sewer Treatment Plant (STP) on Marsh Road in Southbrook. The wastewater discharge for the Bellgrove North development has been designed in accordance with the NER ODP objectives and has been coordinated with the WDC wastewater team via meetings and workshops.

1.2.4 Water Supply

The NER ODP identifies several new water mains and upgrades of existing mains to provide sufficient operating service to the new developments in Eastern Rangiora. The proposed water reticulation and connections for the Bellgrove North development have been designed in accordance with the NER ODP objectives and has been coordinated with WDC during development of the overall plan.

2 Earthworks

2.1 Existing Topography

The site is relatively flat with grade of approximately 1 in 200 (0.5%) in a South East direction. There is approximately 3.5m difference in elevation between the North West and South East corners of the site . There are two channels of significance which run through the site. The Northern Flow Channel is predominantly dry but is tied to the Ashley River breakout meaning retaining and improving it is an important part of the design. The other is the head of the Cam / Ruataniwha River. West of the homestead this is a dry channel but the full length of the channel through the property is to be retained and enhanced and will become a major feature of the layout of stage 1.

There is a total of 7.3m difference in elevation between the NW and SE corners of the wider Bellgrove North site.

2.2 Site Contamination

A full site investigation has been undertaken by Malloch Environmental dated July 2021, and this report can be found Appended to the “Assessment of Environmental Effects” report. It has confirmed the presence of contamination within the site – particularly around the homestead and farmyard (heavy metals), and within the Cam/Ruataniwha River (also heavy metals). These findings (including recommended land remediation) have been factored into the earthworks design for the site.

2.3 Geotechnical Investigations

A full site investigation has been undertaken by Aurecon NZ Ltd dated July 2021. Please refer to report 509177-0012-REP-GG-0001 that has been issued under separate cover. A summary of the findings that have informed the earthworks design is included below. The Ground has been identified as "good” with underlying gravels and a water table that increases in depth heading north from Kippenberger Ave.

2.3.1 Soil Composition

The soil profile of the site is described in the accompanying Geotechnical Report as:

Table 1 - Inferred Soil Composition

Unit	Depth to top of layer	Depth to bottom of layer	Material
1	0.0m	0.2m to 0.35m	Topsoil: SILT with some fine sand, trace rootlets; dark brown.
2	0.2m to 0.35m	0.5m to 2.2m	Silty SAND, sandy SILT, and SILT; yellowish brown. Sand - medium dense to dense, Silt – stiff to hard, moist.
3	0.5m to 2.2m	15m (i.e. depth investigated)	Sandy GRAVEL with minor cobbles; greyish brown. Very dense, moist. Minor silt layers present.

2.3.2 Groundwater

Groundwater levels across the development site have been monitored at regular monthly intervals since June 2020 and are discussed in further detail in the Geotechnical Report (509177-0012-REP-GG-0001). Table 2 below shows the average groundwater depths measured across the proposed development. The location map of each test site is shown in the Geotechnical Report.

Table 2 - Measured Groundwater Depths

Area	Test #	Min GWD (m bgl)	Max GWD (m bgl)
Stage 1A (Kippenberger Ave)	SP01	1.72	2.62
Stage 1A (Cam River)	BH08	1.1	2.45
Stage 1B (Cam River)	BH07	2.56	4
Stage 1C (Northern Flow Channel)	BH06	3.11	4.05
Future Stages (Bellgrove south)	SP05	2.96	3.75
Future Stages (2-5)	SP03	2.62	4.03

2.4 Proposed Earthworks

2.4.1 General

As the site is flat cut to fill will be required to ensure the surface drainage can be shaped back to the roads and the stormwater network. A balanced approach is desired to minimise the quantity of imported fil required. To maximise this the topsoil will be stripped and stockpiled while the land form is reshaped then will be respread to site in no more than 300mm layers.
Approximate areas and volumes for Stage 1 are shown below

The proposed earthworks quantities are approximately

Stripping area	210, 000m^2
Cut to fill	40,000m^3 solid
Import fill	1000m^3 solid
Respread topsoil	130,3000m^2
Cut to waste	TBC but could be expected to be 5% of the total material moved.

A separate document has been prepared for the erosion and sediment control. Further detail on the stockpile locations and the handling of the site during earthworks can be found here (see Appendix F).
The drawings detailing the proposed earthworks have been included in the Earthworks Cut and Fill Plan located in Appendix D. This plan shows the proposed cut and fill depths and ranges from adding 3.0m of fill where we are realigning the Cam / Ruataniwha River to 3.0m of cut where we are installing the new stormwater infiltration basins.

2.4.2 Earthworks Staging

Bellgrove Stage 1A-1B bulk earthworks is proposed to be completed as one (with an approx. duration of 3 month) with the exception of a 20.0m the proposed esplanade reserve adjacent to the realigned Cam / Ruataniwha River.The realignment of the Cam / Ruataniwha will be carried out at the same time as Stage 1A-1B but is to be carried out early but treated separately to ensure the new channel can be stabilised prior to any flow being introduced.

Bellgrove Stage 1C-1D bulk earthworks is proposed to be completed as one (with an approx. duration of 3 month) with the exception of a reserve strip adjacent to the Northern Flow Channel. The realignment of the Northern Flow Channel will be carried out at the same time as the aforementioned stage but is to be carried out separately to ensure the new channel can be stabilised prior to any flow being introduced.

2.4.3 Construction Traffic Movements

A dedicated stabilised access way will be constructed off Kippenberger Avenue during Stages 1A-1B with a secondary access coming off Golf Links Road enabling a separate entrance to be used during stage 1C-1D. The flow of the construction traffic will be managed and controlled to ensure limited disruption to the neighbourhood. The road public roads will also be regularly maintained and swept to ensure there is limited to no nuisance factors. It is currently expected that the subdivision of stages 1A to 1D may take 18 months to complete.

2.4.4 Boundary Interfaces

The surrounding properties are predominately rural properties. The exception to this is the Lamb and Hayward Crematorium on Kippenberger Ave and the Rangiora Golf Course on Golf Links Road.
The finished ground levels are proposed to match existing levels along all boundaries.
The infiltration basins in the south east corner of the site will require raised/bunded sides that will become smaller as they approach the Cam / Ruataniwha River. There will be no more than 0.3m of fill within 2.0m of the boundary lines (refer to plan 509177-0001-SKT-CC-0103-A in Appendix E). Road 1 runs south to north along the western boundary and is being designed to interface with the neighbouring ground levels. Three culverts cross under this road but it is planned to install headwalls within the Bellgrove property which will allow for the neighbouring properties flow paths to join to these directly.

Kippenberger Ave has been developed through an open dialogue process with the WDC Transport Engineer to ensure a common alignment is settled on. Earthworks are required along Kippenberger to fill the existing swale located on site. Following completion of the earthworks the road boundary between Bellgrove and the road reserve will be level.

2.4.5 Earthworks Near Streams

The areas bordering the Cam / Ruataniwha River and Northern Flow Channel will be treated separately and will include realignment and removal of any contaminated materials. It is likely that this will take place first but the contractor is to confirm in their programme the timing of this. This will then allow for them to both be realigned, reinstated and naturalised including a suitable working width to carry out the naturalisation works. The proposed earthworks design and proposed channel formation is based on the requirement to carry the Ashley River Breakout flood (0.5%AEP), local storm events and the ecology report prepared by Aquatic Ecology. This report can be found Appended to the “Assessment of Environmental Effects” report. This shows naturalisation of the upper reaches of the Cam / Ruataniwha within the Bellgrove property will enhance and promote good stream health in this area. A small wetland has been identified in the channel of the Cam River directly north of the Homestead which is to be protected and maintained in its original location.

2.4.6 Earthworks Near the Historic Bellgrove Homestead

The proposed earthworks have been designed to minimise the earthworks required within the vicinity of the Historic Bellgrove Homestead (Lot 1400). The proposed road and Cam / Ruataniwha River bank levels in vicinity of the homestead have been designed to match the existing levels of the lawn at the boundary of Lot

1400. The earthworks proposed within Lot 1400 follow a recommendation from the Detailed Site Investigation to remove the topsoil within this lot given the lead contamination found in the surrounding area (associated with lead-based paint being used on the historic homestead).

The proposed works within Lot 1400 will require the removal of 300mm of topsoil, disposal of the contaminated topsoil and replacement with new soil and re-grassing to the existing site levels.

Figure 3, Bellgrove Homestead, Contamination test locations

The topsoil stripping will be set back a minimum of 500mm from the Homestead itself. If required a hand dig closer to the building can be carried out if the soil is confirmed to contain contaiminants in this location.

Additional earthwork will include those associated with connecting the homestead to the new infrastructure (power, phone, wastewater, water, and stormwater). These will connect to the new network via the driveway to Lot 1400 from Road 3 or from the Road 2 frontage.

3 Erosion and Sediment Control (ESC)

3.1 Plan References

The preparation of a stand alone Erosion and Sediment Control (ESC) plan report has been undertaken in accordance with the Environment Canterbury Erosion and Sediment Control Toolbox 2017. A Draft version of the proposed ESC Plan report can be seen in Appendix F. This includes the documensts listed below;

-Erosion Sediment Control Plan Report
-509177-0001-DRG-CC-0013-A – ESC Plan
-509177-0001-DRG-CC-0014-A – ESC Plan Details 1
-509177-0001-DRG-CC-0015-A – ESC Plan Details 2

The final document is to be released once a Contractor has been appointed and the final details of the preferred compound and stockpile locations are confirmed.

3.2 Basis for Design

Site description

- Bellgrove North is approximately 63 hectares and slopes from the north-western corner to the south-eastern corner of the site. The current land use is pasture land for dairy farming. There is an existing residential dwelling located in the southern portion of the development with access off Kippenberger Ave.
- The site is predominantly flat grading at approximately 1 in 200 from the NW to SE and is broken into 5 stages of work. There is a topsoil layer that ranges between 0.2m and 0.35m deep. Below this there is a transition to silts and then free draining gravels.

Key principles for ESC management during construction are:

- Minimise Disturbance – design of ESC shall consider existing site features and minimise earthworks extents. A small wetland has been identified in the channel of the Cam River directly north of the Homestead which is to be protected and maintained in its original location.
- Stage Construction - staging of construction activities to limit exposed surfaces that may produce sediment
- Protect Slopes – avoid disturbance of existing slopes and provide diversions around or stabilisation of vulnerable slopes
- Protect Receiving environments – consideration of receiving environments including the existing Cam River and the Northern Flow Channel both which flow through stage 1 of the site.
- Rapidly Stabilise Exposed Areas – soils disturbed are to be progressively stabilised
- Install Perimeter Controls and Diversions - prevent clean water runoff mixing with dirty water runoff on the site. Divert upstream catchments around exposed areas through clean water diversion channels. Dirty water diversion channels which are located on steeper slopes may require velocity controls including rock lining and/or check dams.
- Erosion and sediment control methods such as stabilised entrance/exit, diversion bunds/channels, silt fence, sediment retention ponds, silt sock, rapid stabilisation and cut and cover methodology will all be used in some capacity to capture and treat runoff.
- Promotion of sediment removal through coagulation and flocculation process to improve the settlement of suspended sediments and efficiency of the retention devices, if required.
- Adjust the ESC plan as needed - ESC measures and the ESC plan should be reviewed and updated to reflect changes to construction sequencing, weather changes with input from the Contractor completing works on site.

- Storage of excavated materials or other materials may be required during the earthworks and civil works stage of the project. The exact location of stockpiles will be confirmed by the Contractor prior to construction and the ESC plan updated to include control measures. It is proposed that silt fences or other sediment control measures in accordance with ECAN requirements shall be applied around stockpiles if stored for long durations.
- Vegetation work at the site will consist of removing several trees and then planting a variety of bush, shrubs, and trees. This will be along the side of the roads and Cam River and Northern Flow Channel.
- Each phase of the project will ensure sufficient and progressive stabilisation to minimise the exposed soil at any one time.
- The ESC Plan and measures are to be regularly inspected and monitored during and after construction. This may lead to it needing to be adjusted or amended as construction progresses or weather conditions change.
- All staff are to be fully informed of all requirements and how the ESC plan is proposed to work.

4 Roading

4.1 Plan References

Please refer to the below drawings which are applicable to this section (Appendix G).

509177-0000-DRG-CC-0100-A – Plan
509177-0001-DRG-CC-0109-A – Cross sections
509177-0001-DRG-CC-0110-A – Cross sections

4.2 Existing Roading

The main entrance to the Bellgrove development will be off Kippenberger Ave. In line with the East Rangiora Structure Plan (NER ODP) WDC has requested that the intersection with Kippenberger and McPhail Ave be upgraded to a roundabout.

A second Collector road will be built east of this intersection to also feed north into the development. This is in line with the NER ODP although it has been moved to provide 125m separation to the intersection of Devlin Ave as requested by WDC.

Kippenberger Ave will be upgraded on the northern side of the road. WDC have requested that the existing on road cycle lanes maintained and the design is to include kerb and channel, a shared path and where possible bring in parallel parking.

We are currently also engaging with the WDC Traffic Engineer to see how we can incorporate and improve on the current line of Memorial trees along Kippenberger Ave. This layout will extend from the eastern end of the existing kerb and channel to approximately the threshold. All areas outside the Bellgrove property boundaries will remain the responsibility of WDC.

4.3 Proposed Roading

The proposed roading layouts have been presented to the WDC Transport Engineer for discussion before being developed into the proposed layout in aid of a no surprises approach being put forward. The road widths and path layouts have also been discussed and aligned with the Proposed District Plan and the overview of the NER ODP .

The proposed development will include the following hierarchy of roads;

- Collector Road (Primary) – Road 1 = 23.0m
- Collector Road (Secondary) – Road 2 = 22.0m
- Local Roads – Roads 3, 4, 5, 8 and 9 = 18.0m
- Local Roads (low volume) – Roads 6 and 7 = 16.0m

Excellent north/south and east/west roading connections have been promoted as well as a high focus of connectivity of the neighbourhood by foot and cycle shared paths positioned to provide efficient access through the development.

The proposed stormwater basins and reserve areas have also been incorporated into the shared path layout to ensure pleasant surroundings are achieved.

5 Stormwater

5.1 Existing Drainage

The site slopes gently to the southeast and is currently rural in nature, with the majority of the site grassed and divided into paddocks. There are two primary flow paths which run parallel to each other from west to east as indicatively shown in Figure 4. The northern being the Northern Flow Channel, which is a broad, shallow overland flow path that drains under Golf Links Road via a 900mm arch-top culvert. The southern being the Cam / Ruataniwha River, which is well-defined (~1m depth, 5-8m width) and drains to the south-eastern edge of the site and then south under Kippenberger Ave via a 2.85mx2.5m culvert.

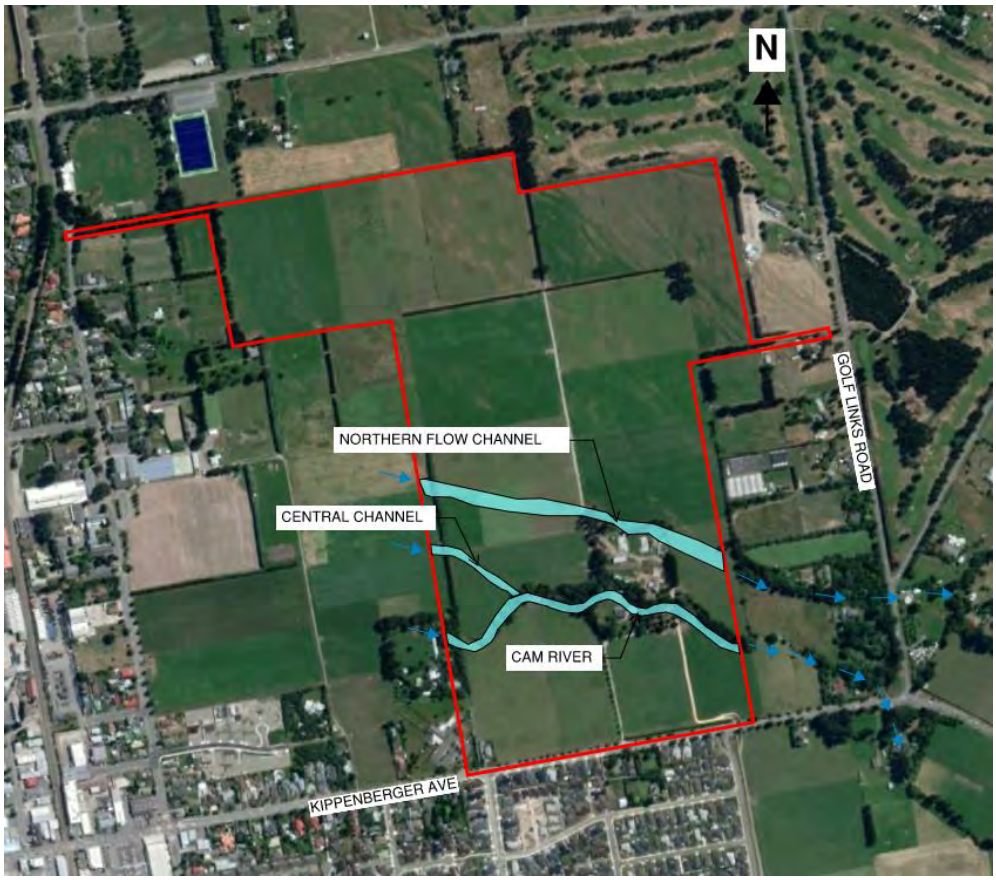


Figure 4 - Existing Flow Paths through the site

The Northern Flow Channel is predominantly grassed and during a walkover carried out in March 2020 was found to be completely dry. A site visit in May 2021 after a heavy rainfall event found there to be residual surface water through the channel and it was clear that this acts as an overland flow path during much larger events. It is understood that this channel is ephemeral as it only conveys water during rainfall events.

The Cam / Ruataniwha River is predominantly grassed, with vegetation in its lower reaches at the eastern extent of the site (Figure 4). Some ponding was observed in the eastern extent of the river during the March 2020 (dry weather) walkover, however it is understood that this section of channel has been lined by the owners to encourage water to pond there.

There is a small tributary channel to the Cam / Ruataniwha River that joins it approximately 250m east of the site's western boundary, this channel is also dry and believed to carry a relatively small amount of runoff during rainfall events.

5.1.1 Ground Infiltration

As described in the Geotechnical Report (509177-0012-REP-GG-0001), the ground conditions on the site are well suited to incorporating soakage disposal into the stormwater system for the development. Measured soakage rates in the SE stormwater management area of the site (measured in March 2020) ranged from 1,500mm/hr up to 10,000mm/hr. Measured soakage rates throughout the wider site were nearer the upper values of this range.

5.2 External Stormwater Management

Stormwater runoff entering the Bellgrove development from the wider north-west catchment will be conveyed across the site by a series of culverts and channels that closely mimic the existing drainage of the site. The following sections discuss the external stormwater management requirements and proposed systems.

5.2.1 Ashley River Flood Hazard

Environment Canterbury (ECan) have undertaken flood modelling and investigated the depth and extent of flooding across the Ashley River floodplain resulting from Ashley River breakout flood events of various Annual Exceedance Probability (AEP). The results of this study are documented in the Waimakariri District Flood Hazard Management Strategy – *Ashley River Floodplain Investigation (ECan, 2016)* report and show surface flooding across the Bellgrove North site. It has been agreed with WDC and ECan that the Bellgrove development needs to convey flooding from the Ashley Breakout event up to the 0.5% AEP (200yr event)we within channel banks and that finished floor levels are sufficiently protected from inundation during this event. There is also the requirement for the development to not induce negative flooding impacts to neighbouring areas during the 0.5% AEP flood event.

Modelling of the 0.5% AEP Ashley River breakout event (pre-development) shows overland flow crossing the Bellgrove site, with the majority of this through the Northern Flow Channel. Model results show flood water extending significantly beyond existing channel banks, and several areas of complete inundation. Flood water is shown to choke at the Golf Links Road culvert which results in backwater and significant inundation around the south-eastern boundary of the site.

The proposal to manage this 0.5% AEP event through the site is to re-shape and improve the conveyance capacity of the two existing channels and construct a new Western Bypass Channel to divert flood water from the currently 'choked' Northern Flow Channel down to the Cam / Ruataniwha River. Refer to Aurecon Memorandum *509177-Bellgrove_Dev_Flood_Assessment_Rev04 (Appendix H)*, for further details and discussion around the proposed mitigation of the Ashley River breakout event. The proposal results in a similar quantity and peak discharge east down the Taranaki Channel and south down the Cam / Ruataniwha River from pre-development conditions.

5.2.2 Culverts

Culverts will be installed at road crossing locations along the proposed channels and were included in the flood modelling assessment as discussed in section 5.2.1. The proposed culverts have been designed in accordance with WWDG Part B – chapter 22.9. The sizing of the proposed culverts is governed by the 0.5% AEP Ashley breakout flood impacts mitigation design and all locations have no base flow and will only carry water during large rainfall events.

Table 3 – Proposed Stormwater Culverts

Culvert Name	Road	Channel	Length (m)	Type	Size (mm)	No. Cells
CD-1	Road 2	Cam River	25.5	BOX	2000x1000	2
CD-2	Road 2	Northern Flow channel	24	BOX	4000x500	1
CD-3	Road 1	Cam River	24.5	BOX	1200x600	1

CD-4	Road 1	Western cut off channel	25.0	CIRCULAR	525dia	1
CD-5	Road 8	Western cut off channel	23.0	BOX	2000x1000	2
CD-6	Road 1	Northern Flow channel	37.0	BOX	2500x1000	2

5.3 Internal Stormwater Management

5.3.1 Stormwater Discharge Consent Requirements

The proposed stormwater management system has been designed to align with the WDC Rangiora Global Stormwater Discharge Consent (CRC184601) objectives and has been discussed with WDC to obtain feedback on their requirements and preferred outcomes. Key stormwater management objectives from Condition 14 of the global consent are outlined below in Table 4.

Table 4 – Stormwater Management Objectives – WDC Global Stormwater Discharge Consent (Condition 14)

Management Feature	Requirements
Condition 14 - Design & Construction Standards	All stormwater systems for sites that discharge stormwater under this consent, which are constructed after the date of this consent being issued, shall be designed and constructed using the best practicable option to meet the requirements detailed in this condition and the receiving environment objectives in condition (8). Requirements include, but are not limited to: Water quality and quantity mitigation facilities and devices shall be designed and constructed in accordance with the best practicable option and: The Christchurch City Council's Waterways, Wetlands and Drainage Guide, WDC's Engineering Code of Practice and the Stormwater Drainage and Watercourse Protection Bylaw 2018 or their respective successor document(s); or Other national and international best practice design criteria approved by the WDC over the duration of this resource consent
Condition 14 - Stormwater Quality Management	The consent holder shall ensure that the stormwater system for each site connected or connecting to the reticulated stormwater system meets the following requirements (as applicable) so that the receiving environment objectives set out in condition (8) can be achieved: ***Greenfield Sites*** Each greenfield site connecting into the system after the commencement of this resource consent shall provide one or more of: An onsite treatment system designed and constructed to treat the first flush from the development; or A contribution as required by the WDC towards the provision of a new treatment system which includes capacity to treat the first flush from that development; or A contribution as required by the WDC towards the cost of existing stormwater treatment infrastructure previously developed and which has capacity to treat the first flush from the additional development.

Condition14 - Stormwater Quantity Management	The consent holder shall ensure post-development discharge rates do not exceed pre-development discharge rates for a critical duration twenty percent and two percent Annual Exceedance Probability event within the receiving waterway when taking into account any greenfield or redeveloped site; and The Rangiora reticulated stormwater system shall be managed by the consent holder so that there is no increase in the peak network discharges for the two percent Annual Exceedance Probability event that is caused by additional urban hardstand area discharges resulting from either: Any District Plan zone change or resource consent; or Any urban infill or redevelopment within an existing zone that does not meet applicable plan rules or consent conditions.
Waterway Design	Accommodate the design freeboard including the required factor of safety. Provide access along at least one side of any waterway for maintenance.

5.3.2 Proposed Stormwater System

The proposed internal stormwater management system for the development is a piped network that discharges runoff from sumps within the kerb and channel and reticulates it to on-site stormwater basins for treatment and detention/infiltration. The stormwater treatment basin (Facility 1) has been sized to include approximately 3.0 hectares of land to the west of the development so as to ensure there will be no issues with discharge from this land should it be developed in the future. Reticulation to basins will be localised to the following catchments:

1) Stormwater Facility 1: Stages 1A and 1B (South of the Cam / Ruataniwha River)
2) Stormwater Facility 2: Stages 1C & 1D (Between the Cam / Ruataniwha River and Northern Flow Channel)
3) Stormwater Facility 3: Future Stages 2-5 (North of the Northern Flow Channel)

The stormwater basin facilities will comprise of a first flush infiltration basin, with a spillway through to a rapid soakage basin. Spillways will be constructed on both Facility 1 & 2 soakage basins to discharge into the Cam / Ruataniwha River during extreme events.

Roof runoff from each property will be reticulated within each property to a private soakpit and discharged to ground. These areas will be designed to capture storm events up to the 10% AEP 1-hour storm event as per the New Zealand Building Code: Clause E1 Surface Water. As required by WDC, private soakpits will have an overflow pipe that discharges to the public system should they become inundated. Geotechnical investigations have indicated that free drainage gravels sit anywhere from 500mm to 2m below natural ground level, and therefore private soakpits are considered a feasible drainage option.

Residual surface runoff from hardstand areas within the lots such as driveways etc. will drain to the public kerb and channel system which all lead to the stormwater treatment basins.

The following sections further detail the proposed internal stormwater system.

5.3.3 Surface Imperviousness

The development works will be increasing the sites surface imperviousness from predominantly pervious well-draining farmland to low-medium density residential coverage consisting of road pavement, driveways, roof coverage and other hardstand types. Table 5 summarises the post development surface coverage and imperviousness for Stage 1.

Table 5 - Stage 1 Surface Imperviousness Composition

Surface Type	Area (Ha)	Imperviousness (%)	Assumptions/notes
Public Road	5.40	85%	
Reserve	2.42	-	*basin areas
Lots (driveways, yard etc.)	10.30	30%	*excludes roof area
Roof	2.88	100%	*refer note 1
Total (Gross)	18.10	54% (average)	*excludes channels

**note 1 – Medium density lot roof area averaged to 150m2, high density lot roof area averaged to 100m2*

Coordination with WDC has indicated that the stage 1 stormwater facilities are also required to treat and attenuate runoff from the east-bound lane of Kippenberger Avenue, as well as a portion of the future RA05 block (west). Table 6 below summarises the additional catchment servicing requirements.

Table 6 - Additional Catchments to be serviced

Catchment	Surface Type	Area (Ha)	Imperviousness (%)
Kippenberger Ave (E-B Lane)	Asphalt (hardstand)	0.66	90%
RA05 (western block)	L1 Residential	3.0	55%

5.3.4 Piped Network Reticulation

The piped stormwater reticulation will consist of a network of inlet sumps along the public roads and private right of ways (ROWs). Due to the flat topography of the site there is insufficient fall to grade the stormwater pipes at their required minimum grade with continuous fall to the invert of the first flush basins. It is therefore proposed that the piped networks grade continuously to the last chamber before the basins, and then have an elevated invert as they grade down to the basin inlets. Elevating the last pipe in the network will create a semi-submerged stormwater network that will retain a permanent water level after a storm event. Sediment deposition is anticipated in the last chamber which will be known as the maintenance chamber and therefore periodic cleaning of the sump within the submerged chamber is recommended.

Minor Storm (20% AEP) Modelling

A hydraulic analysis has been carried out on the proposed piped network using 12d to produce the 20% AEP hydraulic grade line (HGL) and ensure that no stormwater sumps are surcharging during this event. The total rainfall depth for the critical peak flow duration event is approximately 1/3 of the first flush depth (25mm) and therefore tail water levels (TWL) for the hydraulic calculations have been based on the first flush basins being 1/3 full. Refer to the Stormwater Long Sections Drawings for the modelled 10% AEP HGL profiles.

5.3.5 Secondary Flow

The finished surface of the development has been designed to ensure that secondary (overland) flow up to the 2% AEP (50yr ARI) rainfall event with 100% blockage of the piped network is conveyed by the public roads down to the stormwater basin facilities without severe inundation to properties.

Critical secondary flow locations have been identified as Road 2 (south end) and Road 3, both of which are conveying the majority of the stage 1 runoff to stormwater Facility 1. The modelled 2% AEP secondary flow and flood resilience at the critical areas is summarised in Table 7 below.

Table 7 - Assessment of Critical Secondary Flow Locations

Location	2% AEP Secondary Flow (m3/s)	Longitudinal Road Grade (%)	Freeboard to Lot Boundary Elevation (mm)
Road 2 (south)	0.85 m^3/s	0.33%	75mm
Road 3 (SE)	1.0 m^3/s	0.40%	70mm

Lot levels in the above critical areas have been designed to allow for 500mm freeboard from finished floor level (FFL) to secondary flow (0.5% AEP) flood level.

Overland flow entry channels into both stormwater facilities have been designed to ensure 500mm freeboard to the adjacent Finished Floor Level's.

5.3.6 Stormwater Treatment

Primary stormwater treatment shall be provided by first flush infiltration basins to treat the initial 90% storm depth (25mm) in accordance with WWDG section 6. The first flush basins will treat and dispose of the first flush volume via infiltration to ground. Stormwater runoff greater than this 90% storm depth will bypass the first flush basin and enter the rapid soakage basins.

The first flush basins are both less than 1m depth as required and will have side batters of 4.5H:1V. The base of the first flush basins will comprise of the following:

- 150mm minimum surface layer of sandy topsoil (2-parts sand to 1-part topsoil),
- 250mm minimum layer of swale 2A sand (or equivalent),
- free drainage gravels (geofabric wrapped) embedded a minimum of 300mm into natural gravel media.

The basin inverts have been designed to be a minimum of 800mm above the highest measured (winter) ground water level.

The first flush basins have an allowance for up to 300mm live detention storage over the first flush storage as well as 250mm minimum freeboard above this to top of bank (TOB).

5.3.7 Stormwater Detention

A minimum stormwater detention volume will be provided equal to the 20% AEP 18 hour storm event and any additional flow up to the 2% AEP post-development scenario will be discharged entirely to ground via a rapid soakage area constructed within the detention basin. Stormwater runoff exceeding the first flush volume will discharge to the detention storage via a spillway constructed between the two basins.

The stormwater detention basins shall have a 1.5m maximum detention depth, 4.5H:1V side batters and an additional 250mm minimum freeboard.

The detention basins have been sized in accordance with the WWDG and with parameters adopted from the WDC Engineering Code of Practice for the proposed development zoning. Section 5.3.10 below summarises the size and shape of the proposed soakage basins for the site.

5.3.8 Rapid Soakage Pits

Rapid soakage is proposed within the detention basins to discharge stormwater runoff entering the basins. The soakage areas have been sized to soak to ground the stormwater volume (less any basin storage) from the 2% AEP storm event. In accordance with WWDG chapter 6.5, design soakage rates been determined from on-site permeability testing of the in-situ gravels with a reduction factor of 0.33 (6-24 section 9) to allow provision for potential reduced permeability or abnormal ground water levels. An adopted design infiltration rate of 675mm/hr and 1920mm/hr has been used for facility 1 and 2 respectively. Scale testing of the wider infiltration area will be carried out after excavation to validate the assumed soakage rates.

The soakage pits will consist of free draining river gravels wrapped in geofabric. The depth of the soakage media will extend a minimum of 500mm beneath the top level of native free draining gravels at the site. Geotechnical investigations have indicated that free drainage gravels sit anywhere from 500mm to 2m below natural ground level.

5.3.9 Floor Levels

Finished floor levels (FFL) of the development will be required to have a freeboard above the greater of the following flood levels:

- (0.5% AEP) 200-year ARI modelled Ashley Breakout flood level (refer section 5.2.1)
- (0.5% AEP) 200-year ARI modelled local storm event
- (1% AEP) 100-year ARI Storm Surge Event & (5% AEP) 20-year River Flow Event

From communication with WDC it is understood that freeboard requirements are:

- 400mm in 'low risk' areas such as lots facing minor roads with minimal catchment or overland flow,
- 500mm in 'medium to high risk' areas such as major roads with large catchments or lots adjacent channel banks and ponding areas.

Refer to Appendix H for which lots are considered low and high risk based on the above criteria.

Lots have typically been shaped to achieve a finished ground elevation no greater than 225mm below the finished floor level requirement.

6 Wastewater

6.1 Existing Infrastructure

There are two existing WDC gravity wastewater networks draining south from Kippenberger Ave, these are:

- DN225 sewer main on McPhail Ave which provided a connection point at the intersection between Kippenberger Ave and Spark Lane. This will be referred to as the 'western connection' in subsequent drawings.
- DN150 sewer main on Devlin Avenue with a connection point at the intersection of Kippenberger and Devlin Ave. This will be referred to as the 'eastern connection' in subsequent drawings.

WDC has indicated that the existing western and eastern connection points have additional capacity of 673 and 76 equivalent residential lots (respectively).

6.2 Proposed Wastewater Servicing

The wastewater system proposed for the site will consist of a uPVC gravity reticulation from the top North West corner of the site (stage 5), grading down to the South East (stage 1A) where it will discharge into a new on-site wastewater pump station (WWPS). The new WWPS will ultimately discharge to the Southbrook Wastewater Treatment Plant (WWTP).

Refer to the following drawing for the proposed wastewater reticulation (Appendix I) for the development:

- 509177-0000-DRG-CC-0300-WASTEWATER LAYOUT PLAN

6.2.1 Site Constraints

A pumped system has been adopted over discharging into the adjacent gravity networks due to the following:

- The site would require excessive fill to be imported to connect to the existing gravity network inverts and achieve the required pipe grades and cover requirements. The required site grading would also conflict with the overland flow requirements for stormwater management.
- The alternative of excess filling would be accepting reduced pipe grades to meet the existing gravity connection inverts. Accepting a system with reduced grade and hence reduced self-flushing capacity would require flushing tanks to meet WDC requirements. Flushing tanks would incur extra capital cost and operational/maintenance cost. Hence a reduced grade system is not preferred.
- It is also noted that the spare capacity in the Devlin Ave (eastern) existing network is reliant on installation of around ~500m of new pipe through the Bellgrove South block to connect into an existing DN225 with spare capacity. Installation of a new pipe through this block may restrict future development in this area and is therefore not preferred.
- The wider Bellgrove North development will ultimately require a new WWPS and therefore footprint and capital cost has already been allocated.

6.2.2 External Development Discharges

From consultation with WDC and as referenced in the NER ODP it is understood that external developments in the future will (or have potential to) also utilise the Bellgrove North gravity wastewater network and associated new pump station. These areas are:

- Western block (Partial RA05 servicing – 140 Lots). Partial servicing of the adjacent RA05 block to reduce future demand on the existing Northbrook Road Pump Station.
- Cold Stream Road (CSR) Parcel – 34 lots planned either side of Bellgrove North entry road.
- RA07(3) – small northern portion of future RA07 development block (30 lots)

- This system will also provide allowance for the High School block to utilise the spare capacity in the 225mm gravity network along MacPhail Ave

6.3 Design Standards

The design standards used to develop the proposed wastewater infrastructure for the development are:

- Waimakariri District Council Engineering Code of Practice (WDCCoP) -Chapter 6
- AS/NZS 1547 – On-site Domestic Wastewater Management
- GD06 On-site Wastewater Management Pg 47 - C3.0 Design Flow Allowance Per Person for Schools

Hydraulic performance of the proposed wastewater network has been assessed using a manning's assessment of discharge capacity and velocity under both peak dry (PDWF) and peak wet weather (PWWF) conditions. The PWWF demand was checked against the peak discharge capacity for each pipe length.

6.3.1 Self-cleansing velocity

Partial flow calculations were used based on PDWF conditions to determine if self-cleansing velocity within each pipe will be achieved. Self-cleansing velocities were generally <0.5m/s in the main trunk using stage 1 flows, however the ultimate development brings PDWF velocity to >0.7m/s. Velocities in the stage 1 tributary pipes are generally less than the required 0.65m/s, however these pipes have been designed at the required Class A gradients and fall at 1:160 for the first 25 lots.

6.3.2 Pipe Depth

A constant grade gravity line is proposed from the top to the bottom of the site, in order to avoid needing multiple lift stations. This results in approximately 50-100m of the main DN225 line (road 2) sitting at slightly over 4m of cover, which is the practical limit set in the WDC CoP regarding renewal (and requiring site specific design). It is believed that this is the most practical solution and hence is requested to be accepted as a minor non-conformance. Lifting this main trunk any higher to shallow the trench could potentially result in insufficient grades and/or cover in the later stages (4 & 5) at the northern end of the site.

6.4 Proposed Wastewater Pumping Station

A new wastewater pump station (WWPS#1) will be installed at the south-eastern corner of Stage 1 of the development. Wastewater will be discharged from the new gravity reticulation from the site into a wet well and then pumped through a rising main (RM#1) to the Southbrook Wastewater Treatment Plant (WWTP).

6.4.1 Design Standards

The design of the pump station will comply with WDC CoP Section 6.8-6.11.

6.4.2 Flow Staging

The expected PWWF demand on WWPS#1 at various stages of the development(s) are presented below in Table 8.

Table 8 – Proposed Water Water Flow, Stages 1-5

Stage	PWWF (cumulative)	Timing (approximate)
Stage 1	8.7	Aug-23
Stage 2	15.9	Dec-24
Stage 3	22.8	Aug-25
Stage 4	27.3	Feb-26
CSR	28.5	Dec-26
Stage 5	33.8	Dec-26
RA07(1-3)	45.0	2030
RA05 (partial)	50.5	2030-2040

6.4.3 Rising Mains

WWPS#1 will have a short-term rising main discharge (RM#1A&1B) west across the southern boundary of the development and into the existing DN225 gravity network at the top of MacPhail Avenue. This line discharges via the existing gravity network to the existing Northbrook WWPS. This rising main has been sized to service the entire Bellgrove North Development through to Stage 5.

The Bellgrove South development will have a new dedicated pumped wastewater system that will discharge directly to the Northbrook WWPS, however there is insufficient capacity in the Northbrook WWPS to receive flows from both new WWPS#1 & WWPS#2.

Once the Bellgrove South (WWPS#2) comes online WWPS#1 will be required to discharge directly to the Southbrook WWTP. During the construction of Bellgrove South a long term rising main (RM#1) will be incorporated in to the design and be laid from WWPS#1 all the way down to Southbrook prior to Bellgrove South being commissioned.

This currently being discussed with WDC engineering department to maximise the efficiencies of such a system incorporating timings.

6.4.4 Pump Station Configuration

Packaged pump systems suppliers are being consulted to find the best fit for this multi staged development. This is required to ensure the pumps and rising mains can both be selected to minimise any issues with the increasing volumes required to be moved during the growth of this development.

6.4.5 Emergency Storage

As required by the WDC CoP Emergency storage will be provided in the event of unexpected pump shut-down (power-cut / damage to facility etc.). Storage has been designed to accommodate 8 hours of average dry weather flow from the upstream network.

Additional emergency wet well storage required for the Bellgrove North development is 108m^3, with an additional 45m^3 of storage needed for external developments serviced by WWPS#1. This additional storage maybe achieved by installing tanks laterally from the side of the wet well system.

7 Water Supply

7.1 Existing Infrastructure

There is an existing public water infrastructure within the three roads bordering the development site, these are:

- DN200 watermain along Kippenberger Ave
- DN150 watermain along Coldstream Rd
- DN100 watermain along East Belt

The existing 200mm water main along Kippenberger Ave was installed to service the Elm Green Development to the south, and ready the area for future development. It has been confirmed by WDC that there is sufficient capacity in this existing 200mm main to add an additional 350 equivalent residential connections without requiring upgrades to the network. Stage 1 can therefore be services by the first connecting into the 200mm main on Kippenberger Avenue.

7.2 Planned Upgrades

The NER ODP has identified several new water mains and upgrades of existing mains to provide sufficient operating service to future planned developments in Eastern Rangiora.

The following works are to be carried out by WDC as required. Below is a summary of the planned water supply upgrades (via communication with WDC) within the vicinity of the development in anticipated chronological order:

- “East Belt Booster Main Stage 1” – new 150mm main (~230m) along East Belt connecting from Coldstream Rd. This upgrade is triggered by the commencement of the Bellgrove development,
- “East Rangiora Eastern & Northern Link Mains” – new 200mm mains through the Bellgrove North Development site.
- “North Northeast Rangiora Supply Main” – new 200mm and 300mm mains from the headworks through to East Belt. Upgrade triggered when development north of Kippenberger reaches approximately 75%
- “East Belt Booster Main Stage 2” – new 150mm and 200mm mains along East Belt connecting into the North-Northeast upgrades from the headworks (detailed above).
- “North East Rangiora Supply Main” – new 300mm and 375mm mains along Blackett Street from King Street through to the Rangiora East development area.

The proposed water supply system has been designed in accordance with the following standards and guidelines:

- Waimakariri District Council Engineering Code of Practice (WDC CoP) -Chapter 7
- SNZ PAS 4509:2008

7.3 Proposed Water Supply

In-line with the WDC NER ODP , a new DN200 uPVC PN12 watermain (East Rangiora Eastern & Northern Link Main) is proposed to be laid up the centre of the Bellgrove North Development, connecting into the existing 200mm main on Kippenberger Ave at Stage 1. It is understood that WDC require a 200mm watermain as this has some allowance for future growth beyond the Bellgrove North demand. There will be reduced resilience for the early stages of the development as only one connection will feed the supply for the site.

As future Bellgrove North stages progress to the north there will be other connections made to surrounding mains (and upgrades) on East Belt and Coldstream Road, forming a ring main with higher resilience. Future connections and proposed timings are as follows:

- Connection #1: Kippenberger Ave DN200 (existing main) – connection made at stage 1,
- Connection #2: Coldstream Road DN150 (existing main) – connection made at stage 4,
- Connection #3: East Belt (ex. DN100 upgraded to DN200) – connection made at stage 5,
- Connection #4: New DN300 main (NE Rangiora Supply Main) laid by WDC up to North-west corner of Stage 1 – timing of connection uncertain and reliant on development of the School Block to the west

7.3.1 Site Reticulation

Reticulation within Stage 1 of the development will typically consist of 100-150mm mains supplied from the central 200mm feed main running south-north up Road 02. 63OD PE Submains will be laid on both sides of the road to supply individual lot connections.

This area is within the Gazetted Rangiora Fire District and the proposed water supply system for the development has been designed to deliver firefighting protection to the standard required by SNZ PAS 4509:2008. Fire Hydrants have been allocated along water mains and hydraulic performance under fire demands assessed and catered for.

Refer to the following drawings for the proposed wastewater reticulation (Appendix J) for the development.

- 509177-0001-DRG-CC-0401-0405 – Water supply Layout Plans

8 Utilities

8.1 Basis of Design

Both Power and Telecommunications providers have been approached to provide services for an Urban Development based on the utilities appropriate standard and NZ specifications. These are also to align with the WDC requirements. All designs will be submitted for approval firstly by the developer then the Council once it has been shown the appropriate standards have been achieved.

8.2 Plan References

Plans will be provided from the chosen utility providers with when the development is applying to WDC for Engineering approvals.

8.3 Power

8.3.1 Existing Power

MainPower are the local power provider and are also the local installation company.

The site currently has overhead power lines running along the Kippenberger Ave frontage. It has been requested to MainPower that this line be changed to an underground service. They are currenting incorporating this into their design and will either be underground where it stands or relocated into the new roads berms within the development. There is no concerns about this not being able to be achieved.

There is also a major High Voltage overhead electricity distribution line that runs through the site from the south western corner of the site at Kippenberger Ave north where it crosses Coldstream Road then heads west to the Show Grounds. It has been confirmed that this line will be decommissioned (abandoned and removed) in entirety, at the very least through the Bellgrove property. MainPower have provided written confirmation of this, see Appendix K.

8.3.2 Proposed Power Supply

Sufficient supply is available from Kippenberger Ave to service the Bellgrove development. Additional ring main supplies will be considered within the future stages with connections to Golf Links Road and East Belt being options.

No issues are foreseen with the proposed works.

8.3.3 Proposed Street Lighting

All lighting will be designed to comply with the District Plan standards and the Waimakariri District Council Code of Practice. Windsor Urban have been engaged already to provide a design that meets all requirements.

8.4 Telecommunications

8.4.1 Existing Telecommunications

The existing Telecommunication network along Kippenberger Ave was installed to service the Elm Green Development to the south, and ready the area for future development.

8.4.2 Proposed Telecommunications

Both Enable and Chorus have showed interest in providing connections to the Bellgrove development. They have both confirmed sufficient supply is available from Kippenberger Ave.

No issues are foreseen with the proposed works.

9 Safety in Design

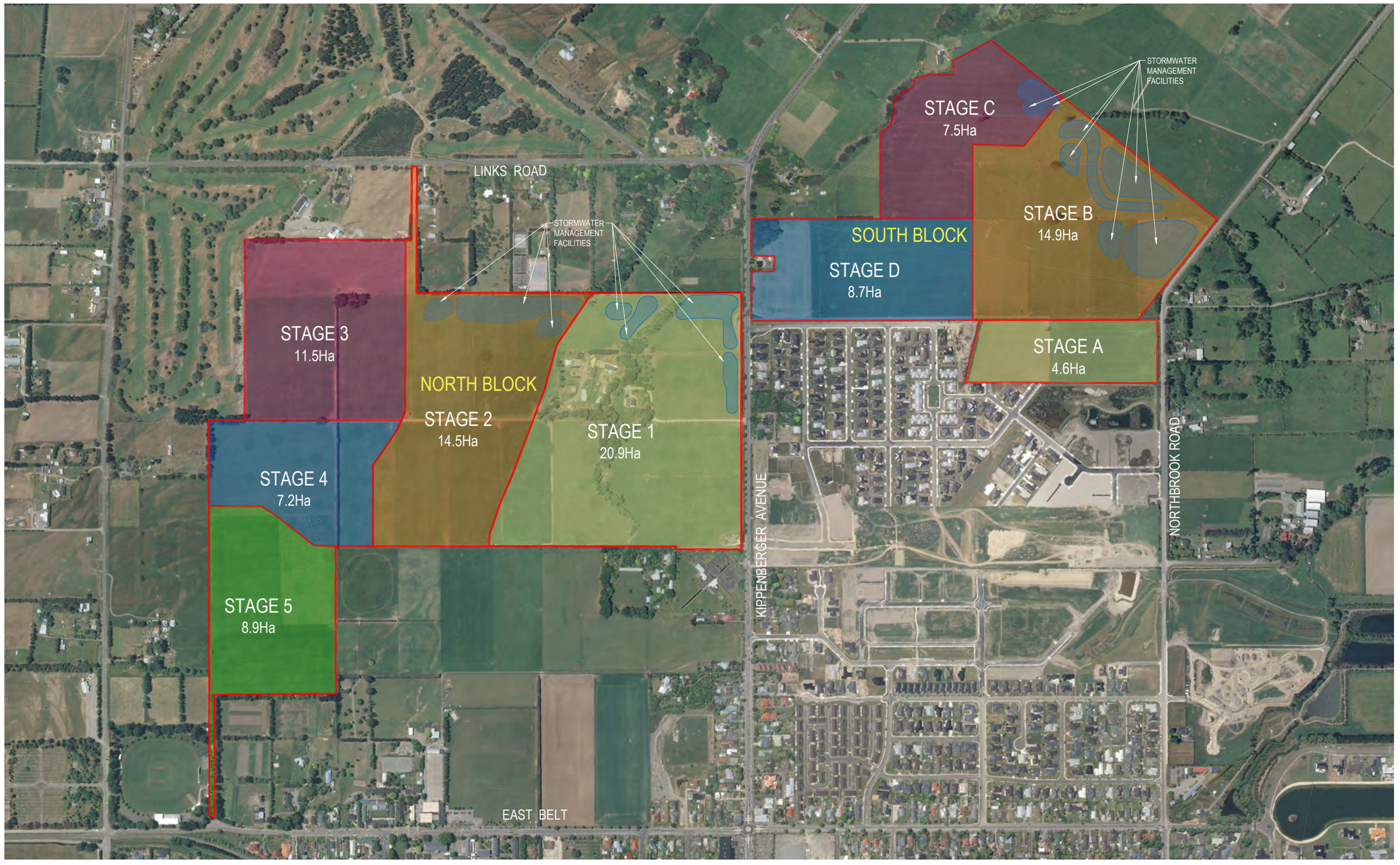
Safety in Design is implicit across all design aspect of the site, such as CPTED considerations incorporated into the layout and ensuring intervisibility between various transport modes. Formal Safety in Design workshops will be carried out as the project progresses to identify, address and mitigate any safety hazards that may present themselves. This assessment looks at the whole lifecycle of the project from design to construction, operation, maintenance and deconstruction/renewal for the proposed development.

Considerations include, but are not limited to the following aspects:

- Avoid the need to entre below ground structures for operational monitoring and maintenance activities
- Traffic and construction traffic movements
- Potential for contaminated material to be encountered during earthworks
- Minimising earthworks/trenching depths by using minimum grades for pipe networks.

A Safety in Design workshop will be scheduled in conjuntion with the Detailed design.

Appendix A – Development Overview Plans



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CLIENT
Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
D	2021-08-17	STORMWATER MANAGEMENT FACILITIES SHOWN	J TRIST
C	2021-08-17	SOUTH BLOCK STAGING AMENDED	J TRIST
B	2021-08-16	SOUTH BLOCK ADDED	J TRIST
A	2021-07-13	PRELIMINARY ISSUE	J TRIST

SCALE	SIZE
1:4000	A1

DRAWN: R DAWSON
DESIGNED:
REVIEWED:

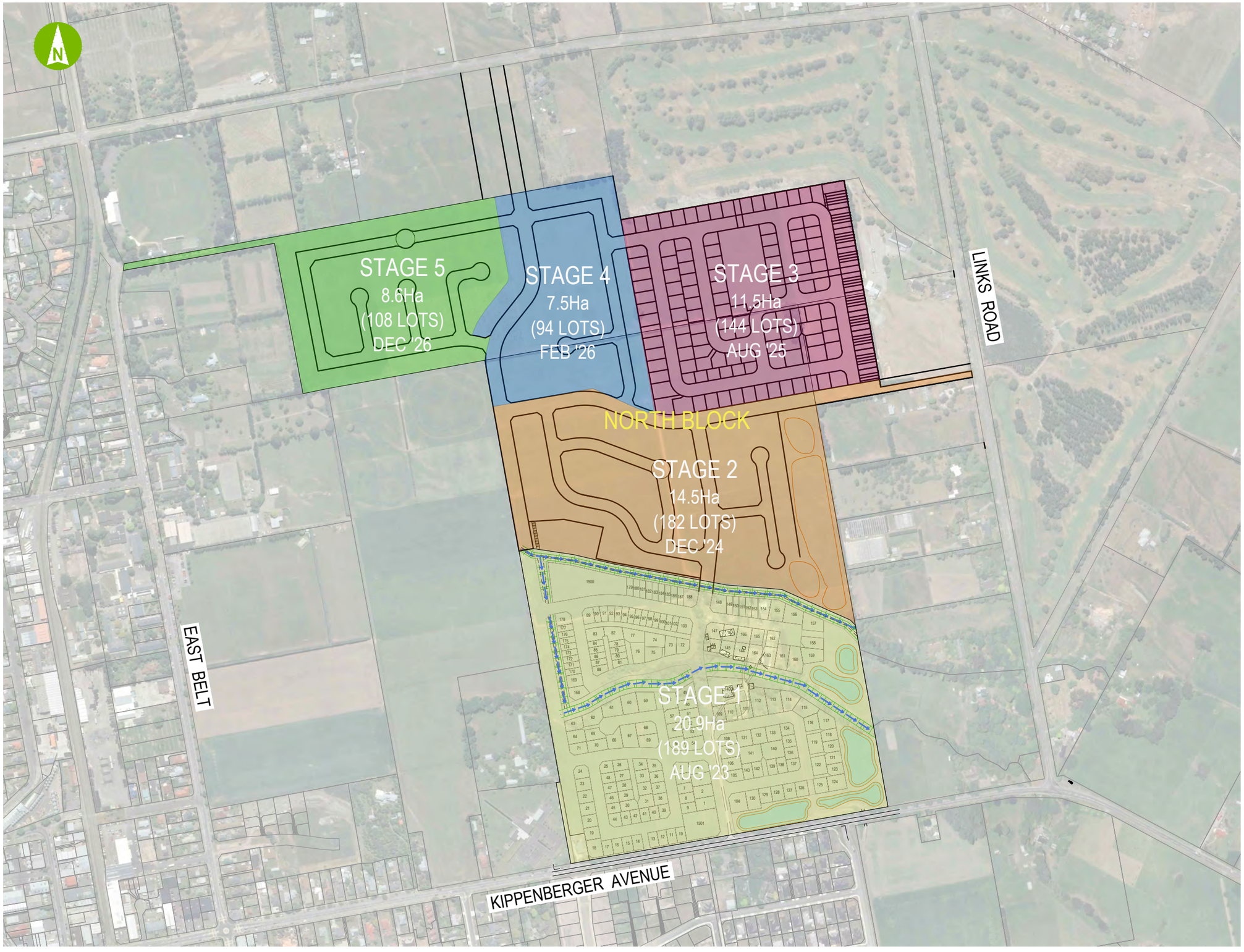
FOR INFORMATION

APPROVED
DATE
J TRIST

PROJECT: BELLGROVE, RANGIORA

TITLE: PROPOSED DEVELOPMENT STAGING (NORTH AND SOUTH BLOCKS)

DRAWING No. | PROJECT No. 509177 | AREA 0000 | TYPE DRG | DISC UU | NUMBER 0014 | REV D



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CLIENT
Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
A		PRELIMINARY ISSUE	J TRIST

SCALE	SIZE
1:3000	A1

DRAWN: T STOCKER
DESIGNED:
REVIEWED:

FOR INFORMATION

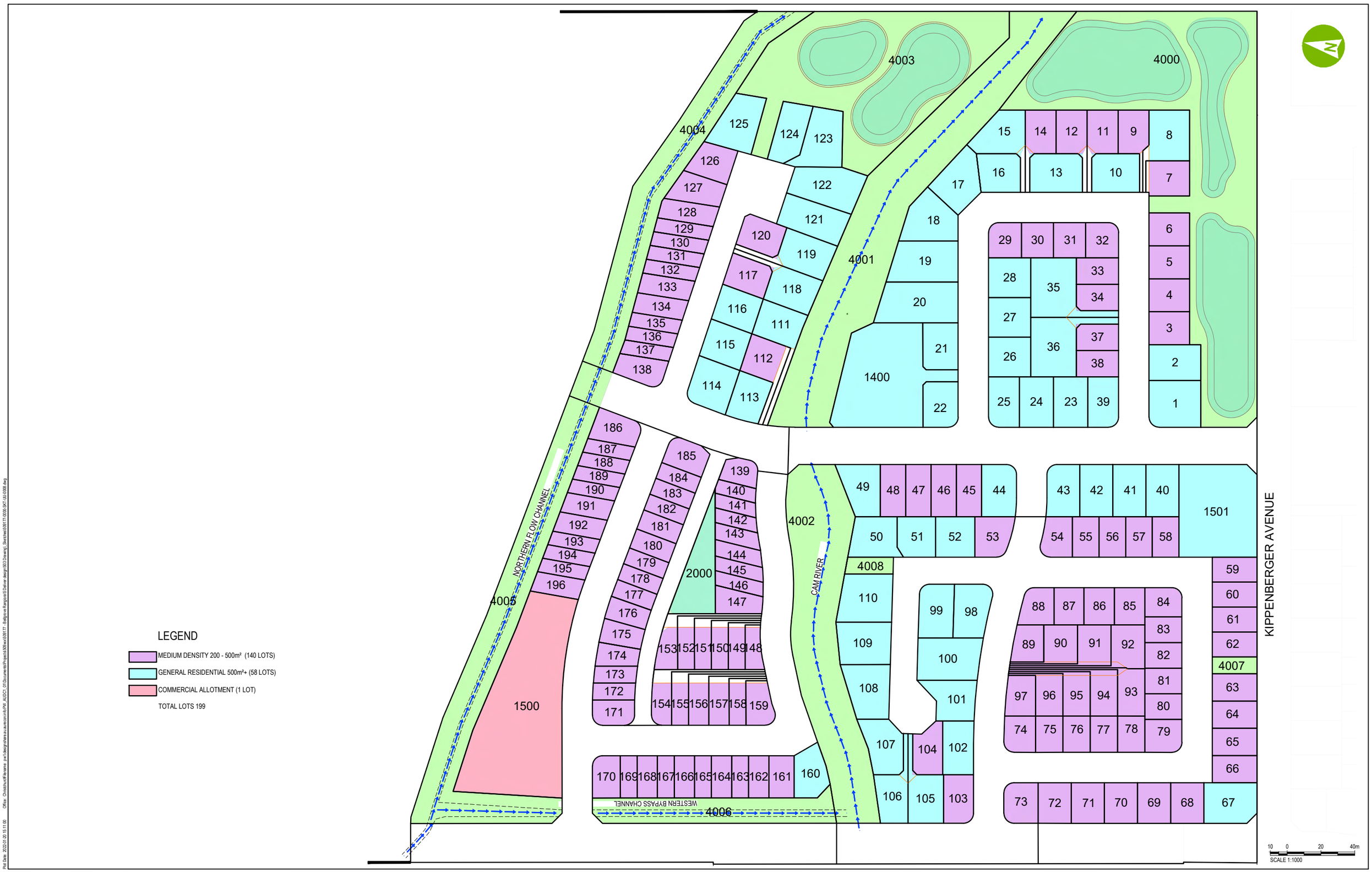
APPROVED
DATE
J TRIST

PROJECT: BELLGROVE, RANGIORA

TITLE: CONCEPT PROPOSED SUBDIVISION
BALANCE LAND
OVER ALL STAGING PLAN

DRAWING No.: PROJECT No. 509177 – AREA 0000 – TYPE SKT – DISC UU – NUMBER 0009 – REV A

Appendix B- Residential lot density



LEGEND

- MEDIUM DENSITY 200 - 500m² (140 LOTS)
- GENERAL RESIDENTIAL 500m²+ (58 LOTS)
- COMMERCIAL ALLOTMENT (1 LOT)

TOTAL LOTS 199

Plot Date: 2022-01-20 15:11:00 Office: Christchurch\Filename: p:\x\designshare.au.aurecon.com\fs\PW_AUDC1_01\Documents\Projects\509xxx\509177 - Bellgrove Rangiora\3 Deliver design\03 Drawing\ Sketches\509177-0000-SKT-UU-0008.dwg

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CLIENT: Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
H	2022-01-20	REVISED LOT LATOUT	J TRIST
G	2021-12-13	CORNER ROUNDING AMENDED	J TRIST
F	2021-11-30	REVISED LOTS AT LOTS 1400 & RENUMBERED	J TRIST
E	2021-11-04	REVISED LAYOUT	J TRIST
D	2021-10-20	REVISED AREAS	J TRIST
C	2021-10-07	TABLE ADDED & REVISED LEGEND	J TRIST
B		UPDATED LEGEND 250-350	J TRIST
A		FOR INFORMATION	J TRIST

SCALE	SIZE
1:1000	A1

DRAWN: T STOCKER
DESIGNED:
REVIEWED:

FOR INFORMATION

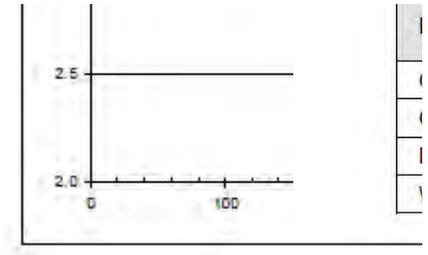
APPROVED
DATE
J TRIST

PROJECT: BELLGROVE, RANGIORA

TITLE: ALLOTMENT DENSITY STAGE 1

DRAWING No.: PROJECT No. 509177 – AREA 0000 – TYPE SKT – DISC UU – NUMBER 0008 – REV H

			WASTEWATER FLOW PARAMETERS			
TYPE	ADWF (L/p/d)	Occupancy no.	PDWF_fac -	PWWF_fac -	PDWF/lot L/s/lot	PWWF/lot L/s/lot
Medium Res Density	250	2.7	2.5	2.05	0.0195	0.0400
High Res Density	250	2.7	2.5	2.05	0.0195	0.0400
School	30	100	2.5	2.05	0.0868	0.1780
	Land use	DWF (l/s/ha)	PDWF(L/s/ha)	WWF (L/s/ha)		
Commercial Superlot	Commercial	0.2	0.5	1.0		
Future dev.						
General Res Density	250	2.7	2.5	2.05	0.0195	0.0400



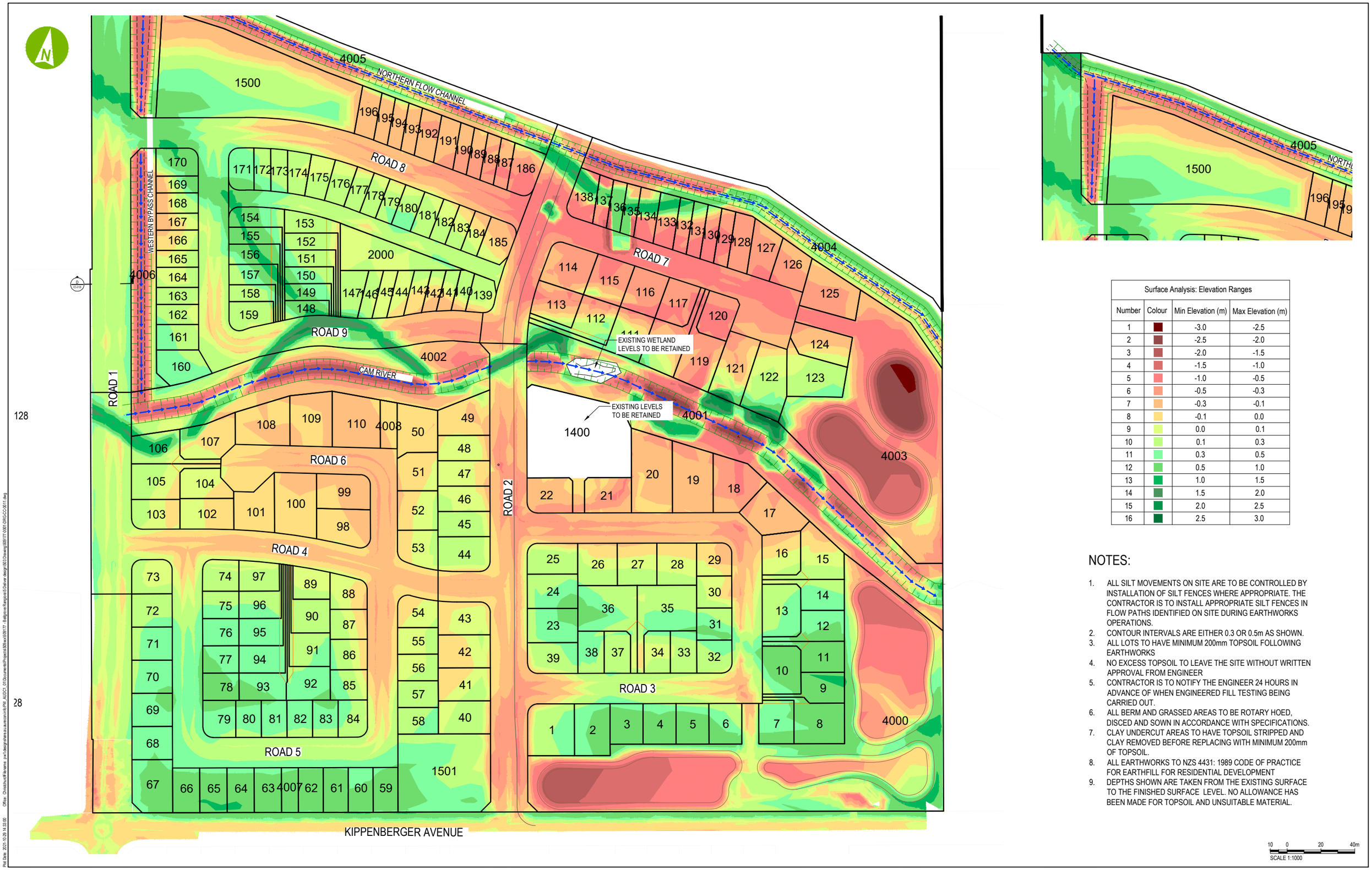
		AREA BREAKDOWN				General Res Density		Pre-School (Stage 1B)		Medium Res Density		uture BG Developmerld Stream Rd Developme				RA07		TOTALS	
Stage	Timing	Total Area (m2)	% Road	% Reserve	NET Area (m2)	Residential Lots	Residential (PWWF) (L/s)	Equiv Residential-high Lots	Res-high (PWWF) (L/s)	Residential-high Lots	Res-high (PWWF) (L/s)	No. Lots	Urban (PWWF)	No. Lots	Urban (PWWF)	No. Lots	Urban (PWWF)	ADWF Sub-total (L/s)	PWWF Sub-total (L/s)
Stage 1A &1B	Dec-22					45	1.802	4	0.178	67	2.683							0.91	4.66
Stage 1C & 1D	Aug-23					13	0.521			73	2.923							0.79	4.02
		180996										202						1.70	8.68
Stage 2	Dec-24	145820	25%	20.0%	80201							178	7.127					1.39	7.13
Stage 3	Aug-25	114998	25%	10.0%	74749							173	6.927					1.35	6.93
Stage 4	Feb-26	74755	25%	7.5%	50460							115	4.604					0.90	4.60
Stage 5	Dec-26	86131	25%	7.5%	58138							132	5.285					1.03	5.29
External Development	2030 +											RA05 (partial) 138	5.525	34.0	1.361	30.0	1.201	0.27 0.23	1.36 6.73
	Future Dev Area	**421704**			**263548**	**58**	**2.32**	**4.00**	**0.18**	**140**	**5.61**	**598**	**23.94**	**0.0**		**30.0**		**6.9**	**40.7**

TOTAL LOTS 800

Appendix C – Geotech report

Please refer to report 509177-0012-REP-GG-0001

Appendix D – Earthworks



Surface Analysis: Elevation Ranges			
Number	Colour	Min Elevation (m)	Max Elevation (m)
1		-3.0	-2.5
2		-2.5	-2.0
3		-2.0	-1.5
4		-1.5	-1.0
5		-1.0	-0.5
6		-0.5	-0.3
7		-0.3	-0.1
8		-0.1	0.0
9		0.0	0.1
10		0.1	0.3
11		0.3	0.5
12		0.5	1.0
13		1.0	1.5
14		1.5	2.0
15		2.0	2.5
16		2.5	3.0

NOTES:

1. ALL SILT MOVEMENTS ON SITE ARE TO BE CONTROLLED BY INSTALLATION OF SILT FENCES WHERE APPROPRIATE. THE CONTRACTOR IS TO INSTALL APPROPRIATE SILT FENCES IN FLOW PATHS IDENTIFIED ON SITE DURING EARTHWORKS OPERATIONS.
2. CONTOUR INTERVALS ARE EITHER 0.3 OR 0.5m AS SHOWN.
3. ALL LOTS TO HAVE MINIMUM 200mm TOPSOIL FOLLOWING EARTHWORKS
4. NO EXCESS TOPSOIL TO LEAVE THE SITE WITHOUT WRITTEN APPROVAL FROM ENGINEER
5. CONTRACTOR IS TO NOTIFY THE ENGINEER 24 HOURS IN ADVANCE OF WHEN ENGINEERED FILL TESTING BEING CARRIED OUT.
6. ALL BERM AND GRASSED AREAS TO BE ROTARY HOED, DISCED AND SOWN IN ACCORDANCE WITH SPECIFICATIONS.
7. CLAY UNDERCUT AREAS TO HAVE TOPSOIL STRIPPED AND CLAY REMOVED BEFORE REPLACING WITH MINIMUM 200mm OF TOPSOIL.
8. ALL EARTHWORKS TO NZS 4431: 1989 CODE OF PRACTICE FOR EARTHFILL FOR RESIDENTIAL DEVELOPMENT
9. DEPTHS SHOWN ARE TAKEN FROM THE EXISTING SURFACE TO THE FINISHED SURFACE LEVEL. NO ALLOWANCE HAS BEEN MADE FOR TOPSOIL AND UNSUITABLE MATERIAL.

10 0 20 40m
SCALE 1:1000

Plot Date: 2021-10-29 14:33:00 Office: Christchurch\Filename: p:\vc\designshare.au.aurecon.info\PW_AUSC1_01\Documents\Projects\509xxx\509177 - Bellgrove Rangiora\5 Online design\503 Drawing\509177-0001-DRG-CC-0011.dwg

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CLIENT: Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
A	2021-10-29	FOR CONSENT	J TRIST

SCALE	SIZE
1:1000	A1

DRAWN: I DUNCAN
DESIGNED: A GRAY
REVIEWED: D WATSON

FOR CONSENT
NOT FOR CONSTRUCTION

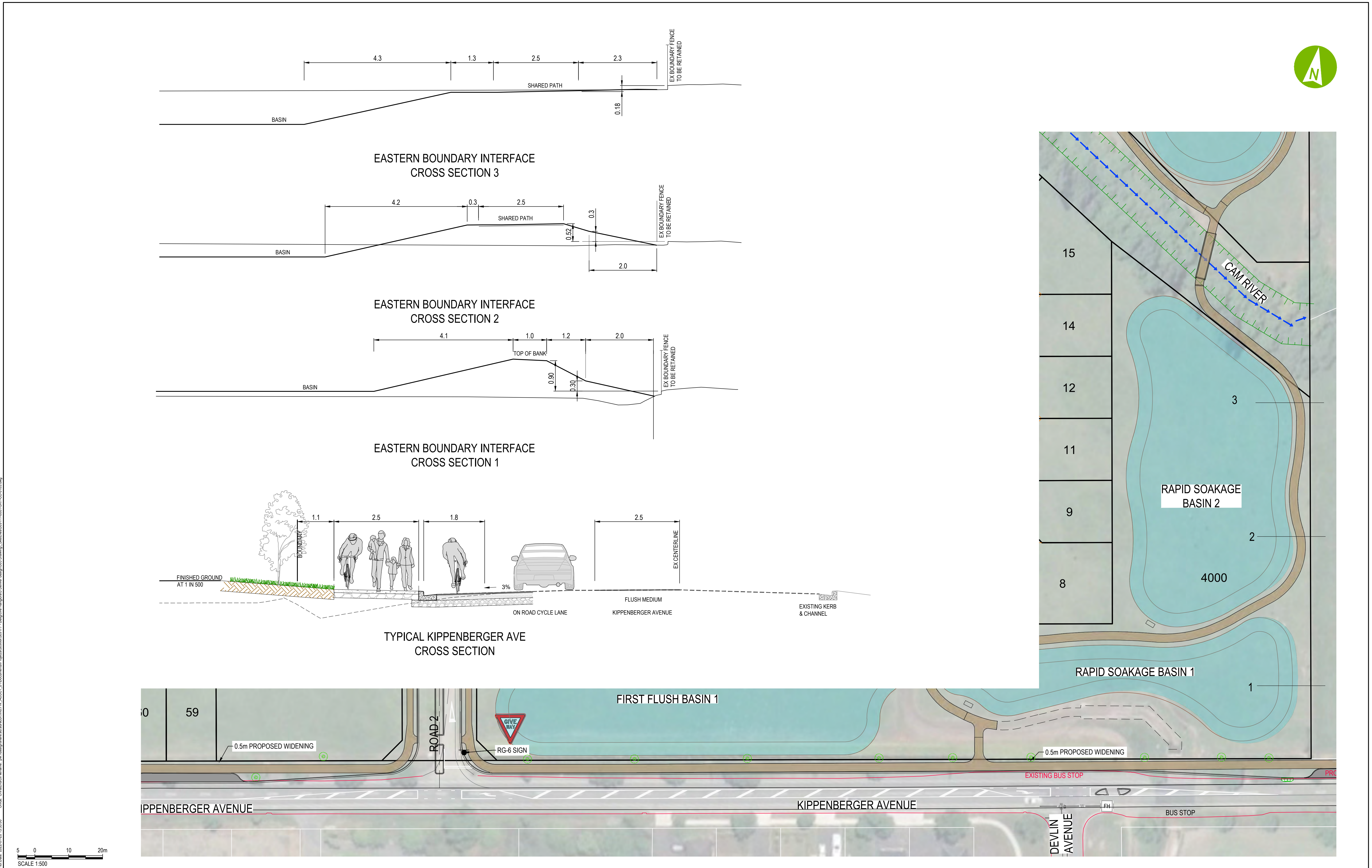
APPROVED
DATE
J TRIST

PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1
EARTHWORKS CUT & FILL PLAN

DRAWING No.: PROJECT No. 509177 – AREA 0001 – TYPE DRG – DISC CC – NUMBER 0011 – REV A

Appendix E – Boundary interface cross sections



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CLIENT

Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
B	2022-01-20	REVISED LOT LATOUT	J TRIST
A		ISSUED FOR DISCUSSION PURPOSES ONLY	

SCALE	SIZE
1:500	A1

DRAWN: T STOCKER
DESIGNED: M CROWE
REVIEWED: D WATSON

FOR DISCUSSION
NOT FOR CONSTRUCTION

APPROVED
DATE
J TRIST

PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1
PROPOSED KIPPENBERGER AVENUE
BOUNDARY INTERFACE CROSS SECTION

DRAWING No.	PROJECT No.	AREA	TYPE	DISC	NUMBER	REV
	509177	0001	SKT	CC	0103	B

Appendix F - Erosion and Sediment Control Plan

Bellgrove, Rangiora

Erosion Sediment Control Plan

Bellgrove Rangiora Limited

Reference: 509177

Revision: 1

2022-02-09

aurecon

Bringing ideas to life

Document control record

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Document control						aurecon
Report title		Erosion Sediment Control Plan				
Document code			**Project number**		509177	
File path		https://aurecongroup.sharepoint.com/:w:/r/sites/509177/_layouts/15/Doc.aspx?sourcedoc=%7BE86F80F8-BD86-4845-BEDD-6CD61A44F6B4%7D&file=Erosion%20Sediment%20Control%20Plan%20Report.docx&action=default&mobileredirect=true				
Client		Bellgrove Rangiora Limited				
Client contact			**Client reference**			
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
0	2021-11-02		A Hoskins	D Watson		J Trist
1	2022-02-09	Issued for consent	A. Hoskins	D Watson		J Trist
Current revision		**1**				

Approval			
Author signature		Approver signature	
Name	Alice Hoskins	Name	Jason Trist
Title	Civil Engineer	Title	Associate

Contents

1 Background

Bellgrove Rangiora Limited (BRL) is proposing to develop an area of land on the eastern outskirts of Rangiora township into a new residential subdivision (Bellgrove Development). The wider development is located between Northbrook Road to the south and Coldstream Road to the north and is approximately 100 hectares in area. The portions of the development north (~64ha) and south (~36ha) of Kippenberger Avenue will generally be referred to as Bellgrove North and South respectively.

Under new government legislation, a portion of the Bellgrove North Development is currently seeking fast-track Resource consent approval for Stage 1 is being sought under the COVID-19 Recovery (Fast-track Consenting) Act 2020.The land proposed for fast tracked development in stage 1 is located immediately north of Kippenberger Ave and is approximately 20 hectares in area. The fast-tracked area is herein referred to as 'the site'.

2 Plan references

This report details the Erosion and Sediment Control Plan (ESCP) to manage potential sediment laden run-off, with the aim of minimising the effects of construction on the surrounding environment.

The preparation of this ESC plan has been undertaken in accordance with the Environment Canterbury Erosion and Sediment Control Toolbox 2017. This ESC plan will be a live document and will be updated as required to run in line with the construction staging and the varying weather or site conditions as required at the time of construction.

Refer to the following documents for visual details of the ESC plan:

- 509177-0001-DRG-CC-0013-A – ESC Plan
- 509177-0001-DRG-CC-0014-A – ESC Plan Details 1
- 509177-0001-DRG-CC-0015-A – ESC Plan Details 2

3 Basis for design

3.1 Site description

The site is predominantly flat grading at approximately 1 in 200 from the north west to south east. The topsoil consists of fine sand and traces of rootlets with dark brown soil. From 0.25 m-2.2 m the soil consists of silty sand, sandy silt, and silt. Beyond 2 m and up to 15 m, the soil transitions to a sandier gravel with minor cobbles in a greyish brown colour. Here the soil is very dense and moist with the presence of minor silt layers.

The currently rural site slopes gently to the southeast and is largely grassed and divided into paddocks. Stage 1 of the site is naturally divided into two sections with Kippenberger Ave along the southern boundary then the Cam / Ruataniwha River separates sub-stages 1A-1B from sub-stages 1C-1D. The Northern Flow Channel that leads east to Golf Links Road is the northern boundary of stage 1. These waterbodies are generally speaking dry channels but are designed to be retained and will be enhanced with planting and naturalised to become main features of this stage. The Cam / Ruataniwha river is the most sensitive receiving environment and it is important that people using this ESCP are aware of this and protect this channel appropriately.

3.2 Proposed development

Bellgrove North is currently proposed to be developed in five stages of work. Stage 1 consists of four sub-stages, 1A, 1B, 1C and 1D. Kippenberger Ave upgrade will also be carried out as a separate stage which is going through a consultation period with WDC and the associated community groups.

3.3 Key principles for ESC management during construction

The key principles for ESC management during construction are as follows:

- Minimise Disturbance – the design of ESC plan shall consider existing site features and minimise earthworks extents
- Stage Construction - staging of construction activities to limit exposed surfaces that may produce sediment. With the maximum staging area of Stage1A is 75582m2 (including the Cam works to Road 1)
- A small wetland has been identified in the channel of the Cam River directly north of the Homestead which is to be protected and maintained in its original location
- Protect Slopes – avoid disturbance of existing slopes and provide diversions around or stabilisation of vulnerable slopes such as channel banks. Although unlikely, to be a concern on site, there may be minor slopes at the banks of the Cam and Northern Flow Channel.
- Protect Receiving Environments – consideration of receiving environments including the existing Cam / Ruataniwha River and Northern Flow Channel which flow through the site. Bunds and separate staging will be used to protect the Cam River and Northern Flow Channels.
- Rapidly Stabilise Exposed Areas – soils disturbed are to be progressively stabilised
- Install Perimeter Controls and Diversions - prevent mixing of clean water runoff with dirty water runoff in the site. Divert upstream catchments around exposed areas through clean water diversion channels. Dirty water diversion channels which are located on steeper slopes, such as riverbanks, may require velocity controls including rock lining and/or check dams. Within the steeper sections of the site, drop out pits located within the dirty water diversion channels could potentially be used to reduce the load on the downstream treatment devices
- Employ Sediment Retention Devices - capture and treat runoff with structural devices. By preference sediment laden water will be retained within the site and discharged into land. Where flows are to be directed to surface waterbodies (i.e. the Cam / Ruataniwha River) and more natural controls cannot reach the required standard (50 mg/L) promotion of sediment removal through coagulation and flocculation processes to improve the settlement of suspended sediments and efficiency of the retention devices
- Adjust the ESC plan as needed - ESC measures and the ESC plan should be reviewed and updated to reflect changes to construction sequencing, weather changes with input from the Contractor completing works on site
- Storage of excavated materials or other materials may be required during the earthworks and civil works stage of the project. The exact location of stockpiles will be confirmed by the Contractor prior to construction. After the pre-construction meeting the ESC plan will be updated if required to include additional control measures or new stockpile locations. It is proposed that silt fences or other sediment control measures in accordance with Environment Canterbury (ECan) requirements shall be applied around stockpiles especially if stored for long durations
- Vegetation work at the site will consist of some tree removal and planting of a variety of bush, shrubs, and trees. This will include planting along the side of the roads, the Cam / Ruataniwha River and the Northern Flow Channel. This work will be tied in with the Landscaping plan being developed by Rough and Milne.
- Care shall be taken during each phase of the project to ensure sufficient and progressive stabilisation and minimisation of exposed soil. Measure such as the following should be used;
    - Grass seed, if conditions are appropriate

- Hydroseed with a stabilising agent
- Straw mulch with a stabilising agent
- Ready lawn
- Covering with filter fabric if a quick fix temporary measure is required.

3.4 Programme of works

Stage 1 consists of approximately 20ha and has been shown as four sub-stages 1A, 1B, 1C and 1D. It is proposed that the site will be very close to a balanced cut and fill leaving very little excess. Currently the cut and fill volumes for the four sub-stages total 40,000m³ of cut and 38,000m³ of fill. Some material may be required to leave site. The intention is that any removal will be undertaken as back filling loads to reduce traffic movements and double handling.

Stages 1A and 1B are between the Cam / Ruataniwha River and Kippenberger Ave. This will lend itself to be earth worked together and will utilise a single stabilised entranceway and stockpile location.

The methodology for the initial stages of construction is given below:

- It is recommended to construct the sediment retention ponds first
- Build earth bunds around the banks of the Cam / Ruataniwha River and the Northern Flow Channel to ensure dirty sediment laden water/run off does not enter the waterbodies. The small wetland opposite the Homestead is also to be protected in a similar manager to ensure this is not disturbed.
- Divert any runoff water in the direction of the basins to ensure the dirty water has an area to drain to
- All staff will be required to understand the theory behind the ESC plan so they can ensure it works efficiently and do not unintentionally short cut the system
- All staff need to know in advance the emergency procedures that will be implemented for any accident, including spills and accidental untreated sediment discharge reaching surface water

As per standard earthworks practise the topsoil strip will occur over areas where cut to fill can be done together so material can be placed immediately after being cut allowing it to be handled once. As soon as practical after placing topsoil will be re-spread and seeded to re-establish a stabilised surface.

The roadways will be treated separately from the bulk earthworks as the services being installed in the roadways will mean a delay in getting them completely re-covered. As the roadways will be sitting lower than the surrounding ground any water entering these areas will be able to be controlled by damming. Service installation will be very close to the under lying gravels and the natural drainage will be sufficient to ensure any runoff can be handle on site.

The final stormwater treatment basins are to be dry basins therefore by installing the basins early there will be storage available to hold any runoff. The underlying gravels enable any gathered stormwater runoff to be captured and discharged back to ground with little, if any, overland run off having to be discharged to the nearby waterbodies. If discharge to the waterbodies is required, it will be after several treatment types and only be required if the sediment retention basins become inundated. The final stormwater soak pit locations will be in different locations to that utilised by the sediment basins however when the sediment basin are no longer in use it will be a requirement to remove all gathered sediment from site before completing the dry basins.

Upon the works being completed in stage 1A and 1B the focus will move to stage 1C and 1D which is the land between the Northern Flow Channel and the Cam / Ruataniwha River. Two stockpile locations and sediment ponds are shown in this area as the shape of the site has a low point that may not be able to grade to the eastern-most boundary. Again, it is hoped to work both these stages together so as to ensure a balanced approach on the earthworks can occur.

3.5 Inspection and monitoring programme

Key principles for ESC inspection and monitoring during and after construction are:

- Adjust the ESC plan as needed - ESC measures and the ESC plan should be reviewed and updated to reflect changes to construction sequencing, weather changes with input from the contractor completing works on site
- It is essential that the ESC plan has an inspection and monitoring system is good enough to pick up any potential issues, and to communicate these to the relevant people who can act on them quickly

The contractor's ESC plan will state the frequency and methodology of checking ESC measures, including who is responsible for doing this, and how the findings are recorded, reported and assessed. This includes checks that will be needed during rainfall events, and to accommodate any times that the site will be unattended, including weekends.

3.6 Other considerations

The proposed ESC measures will consider dam and pump or dam and divert measures where the new stream alignment intersects the existing stream alignment, such as prioritising works to be undertaken in dry season and provide for pump/divert if needed. Silt fences and super silt fences will be used where the new alignment can be completed independently from the existing watercourses prior to the final stream diversion. Temporary waterbody crossings (such as farm tuff temporary culverts) could potentially be required for short-term use by construction vehicles.

It is proposed that the in-stream works will be completed once bulk earthworks in the upstream catchments have been completed and that disturbed areas adjacent to streams are stabilised immediately during and following construction. The proposed works within waterbodies will be completed during dry periods when there is no baseflow in the channel. A small wetland has been identified in the channel of the Cam River directly north of the Homestead which is to be protected and maintained in its original location.

Larger volumes of dewatering water will be pumped to adequately sized sediment retention ponds, or directly injected into the underlying gravels. Smaller volumes may exceed the limitations of the ponds and will be captured via silt fences, bunds or to flat, grassed land and will not be discharged into the neighbouring properties.

ESC measures for the dewatering of deep excavations will be managed in compliance with ECan requirements, such as TSS limits. It is anticipated that dewatering will be required for the installation of the wastewater pump station and potentially the downstream end of gravity networks. A "cut and cover" methodology is suggested which will ensure exposed areas are covered at the end of the day's works and before any potential rainfall event.

4 Material storage and construction support area

Storage of both imported and excavated materials may be required during the earthworks and civil works of the project. The locations of stockpiles have been indicated on the ESC plan however the exact locations are to be confirmed by the Contractor prior to construction starting. If required, the ESC plan is to be updated to reflect any changes and include additional control measures to reflect the Contractor's construction methodology and staging. It is proposed that silt fences or other sediment control measures in accordance with ECan's ESCT be applied around stockpiles if stored for long durations (exceeding two weeks).

The location of the Construction Support Area (CSA) is also to be confirmed by the Contractor prior to construction works starting.

5 ESC device selection

Stormwater management and sediment pollution mitigation strategies described in the following sections are based on ECan Sediment Control Toolbox.

The ESC plan described in the following sections and on drawings 509177-0001-DRG-CC-0013-A, 0014-A, and 0015-A are indicative only and are to be further developed at the detailed design stage for the project, in conjunction with the preferred earthworks contractor.

Table 1 Erosion and sediment control devices

Control	Application
Stabilised entrance/exit	Entrance/ exit to site must be stabilised prevent sediment being uplifted and transported by vehicle movement. This will consist of 50-150mm washed aggregate however temporary sealed access may also be used depending on expected traffic volumes. Shaker ramps could be integrated into the stabilised entrance/exit.
Diversion bunds/channels	To prevent upstream flows entering or exiting the disturbed areas, for discharge to stormwater network, treatment device or land. These can include a combination of clean water and dirty water diversion bunds/channels. Dirty water bunds/channels would be used to divert sediment-laden water to an appropriate sediment retention device. Clean water diversion bunds/channels would be used to divert clean water from upstream catchment around the site and to convey clean water from basins through to discharge points. Diversion gradients greater than 2% may need to be lined to minimise erosion.
Silt fence	Acts as a perimeter boundary to prevent sediment escaping the site area.. To be applied in accordance to ECan Sediment Control Toolbox.
Sediment retention ponds	Acts as a perimeter boundary to prevent sediment escaping the site area. To be applied in accordance to ECan Sediment Control Toolbox. Coagulation and flocculation maybe required within the basins to increase sediment removal efficiencies. If flocculants or coagulants are to be used to reduce sediment loading a site-specific water treatment plan will need to be prepared. Flocculants or coagulants must be used in accordance with the ESCT or other recognised guideline.
Silt sock	Can be used for two purposes, to treat sediment-laden water prior to discharge or as a perimeter control to prevent sediment escaping the site area. The use of these would be limited to smaller catchment areas. Silt socks require regular maintenance, and are easily damaged by vehicles.
Rapid stabilisation	Mulch/topsoiling and grass seeding, or other measures discussed in ECan Sediment Control Toolbox can be applied to cover exposed areas, preventing erosion and dust generation.
Cut and cover methodology	Stabilisation of earthworks using cut to fill methodologies and staged construction approaches where possible. This could be typically used for the installation of trenched services.

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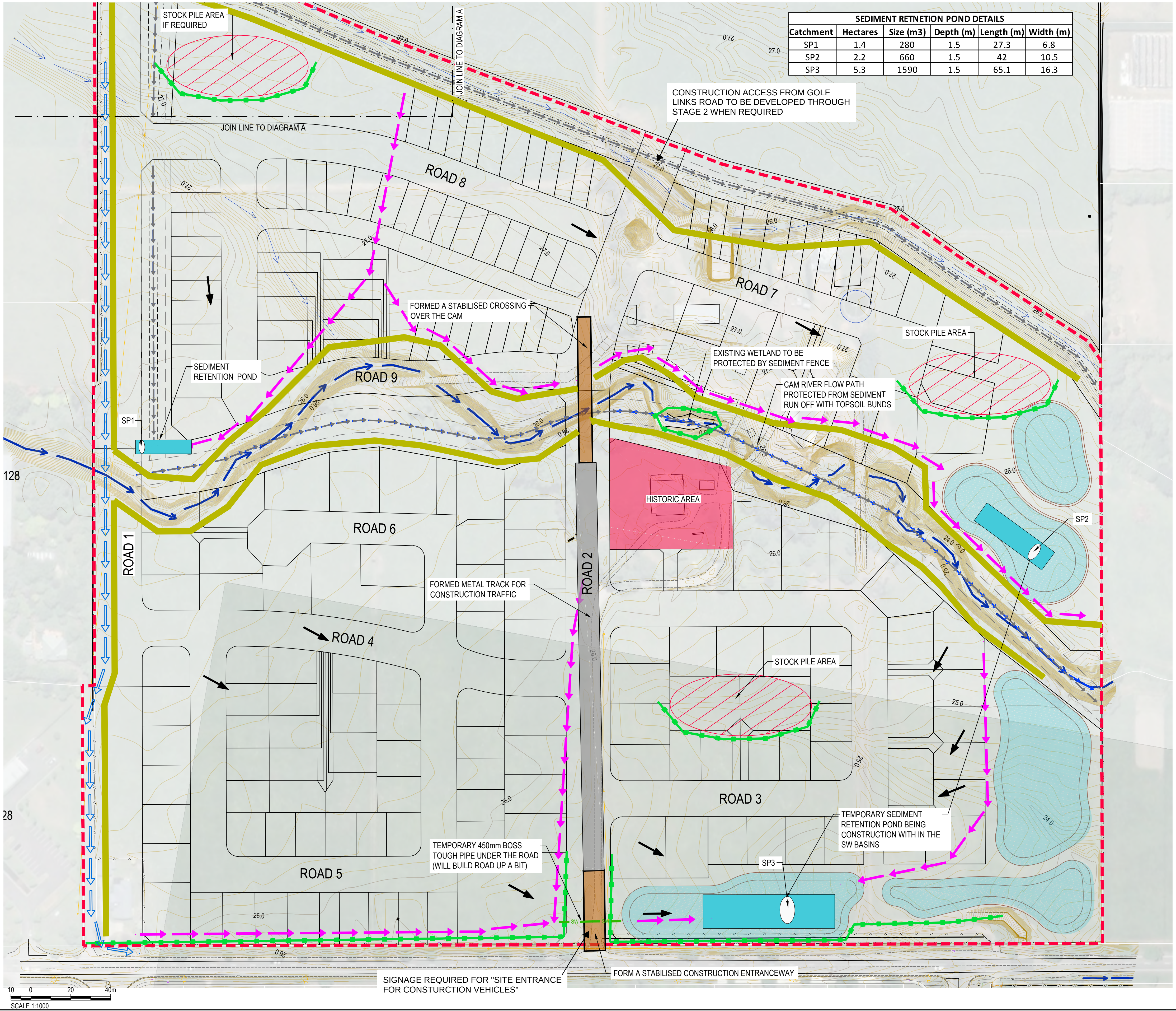
SEDIMENT RETENTION POND DETAILS

Catchment	Hectares	Size (m3)	Depth (m)	Length (m)	Width (m)
SP1	1.4	280	1.5	27.3	6.8
SP2	2.2	660	1.5	42	10.5
SP3	5.3	1590	1.5	65.1	16.3



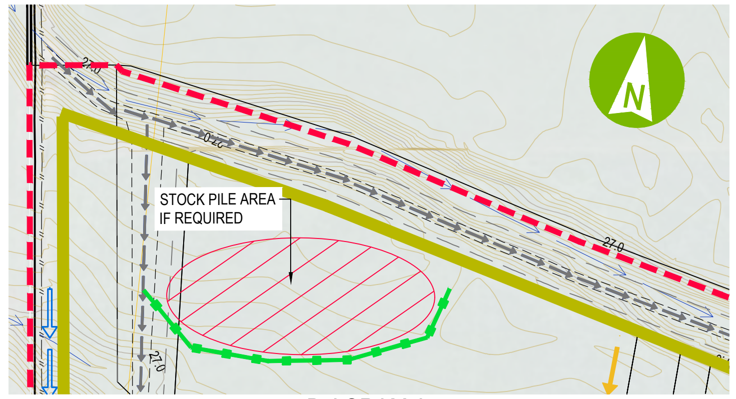


DIAGRAM A

1:1000

LEGEND

- STAGE 1 BOUNDARY
- EXISTING OPEN DRAIN
- DIRTY WATER DIVERSION
- CLEAN WATER DIVERSION
- SLOPE DIRECTION OF EXISTING GROUND
- TOPSOIL BUND
- SEDIMENT FENCE
- STABILISED CONSTRUCTION ENTRANCEWAY WITH SHAKER RAMP
- STORMWATER RETENTION POND
- OUTLET STRUCTURE
- SEDIMENT RETENTION POND WITH SOAK HOLE

NOTES

1. THE CONSTRUCTION SUPPORT AREA (CSA) AND EXACT LOCATION OF STOCKPILES WILL BE CONFIRMED BY THE CONTRACTOR PRIOR TO CONSTRUCTION AND THE EROSION AND SEDIMENT CONTROL PLAN BE UPDATED ACCORDINGLY.
2. EROSION AND SEDIMENT CONTROL IS TO BE UNDERTAKEN IN ACCORDANCE WITH ENVIRONMENT CANTERBURY - EROSION AND SEDIMENT CONTROL GUIDE FOR LAND DISTURBING ACTIVITIES IN THE CANTERBURY REGION.
3. THIS PLAN IS AN INDICATIVE PLAN, FOR RESOURCE CONSENT PURPOSES, BASED ON AN ASSUMED CONSTRUCTION METHODOLOGY WHEREBY ALL PROPOSED EARTHWORK AREAS WILL BE OPENED UP CONCURRENTLY AND DIRECT ALL RUNOFF TO A TEMPORARY DOWNSTREAM SEDIMENT RETENTION POND. IT IS THE CONTRACTOR'S RESPONSIBILITY TO UPDATE AND PREPARE A SITE SPECIFIC EROSION AND SEDIMENT CONTROL PLAN THAT FITS WITH THEIR CONSTRUCTION METHODOLOGY AND PROPOSED STAGING. THE EROSION AND SEDIMENT CONTROL METHODOLOGY TO BE USED IS AS FOLLOWS:
   A. CONSTRUCT STABILISED SITE ENTRANCE;
   B. CONSTRUCT SILT FENCES AROUND STOCKPILE AREA(S), CONTRACTOR'S LAY DOWN AREA(S) AND AROUND EXTENT OF CIVIL WORKS PRIOR TO STRIPPING ANY TOPSOIL;
   C. CONSTRUCT CONTRACTOR'S LAY DOWN AREA(S) AND STABILISE WITH METAL;
   D. CONSTRUCT DIVERSION BUNDS;
   E. CONSTRUCT SEDIMENT PONDS WITH DISCHARGE TO GROUND
4. ALL SEDIMENT DECANTS SHALL DISCHARGE TREATED WATER TO SOAK PITS WITHIN THE SEDIMENT POND LOCATION.
5. SEDIMENT DECANT SIZING IS BASED ON 2 OR 3% OF THE CONTRIBUTING CATCHMENT AREA.
6. ALL EXISTING STORMWATER INLETS ALONG KIPPENBERGER AVE SHALL BE PROTECTED USING SILT SOCKS OR SUITABLE ALTERNATIVE IN ACCORDANCE WITH ECAN REQUIREMENTS.
7. SITE ACCESS ONTO PUBLIC ROADS SHALL BE ESTABLISHED TO THE REQUIREMENTS OF WAIMAKARIRI DISTRICT COUNCIL AND ACCESS TO AND FROM THE SITE SHALL ONLY BE VIA THE APPROVED ACCESS POINTS.
8. ANY DISTURBED AREA OUTSIDE OF THE WORKS AREA TO BE STABILISED IMMEDIATELY BY CONTRACTOR USING STRAW MULCH OR AN APPROVED ALTERNATIVE.
9. HORIZONTAL COORDINATES IN TERMS OF NZGD 2000, MOUNT PLEASANT 2000 CIRCUIT. HEIGHTS IN TERMS OF LYTTELTON VERTICAL DATUM 1937.ORIGIN OF LEVELS : EJ89 (SS 809 SO 809 NO 2).
10. ANY CONTAMINATED SOIL WILL BE DEALT WITH SEPARATELY TO THE BULK EARTHWORKS BUT WILL FIT WITHIN THE REQUIREMENTS OF THIS ESCP.
11. WHERE EARTHWORKS ARE REQUIRED WITHIN EXISTING CHANNELS ALL WORKS ARE TO BE COMPLETED IN DRY CONDICTIONS AND OFF LINE TO THE CHANNEL WHEN POSSIBLE. SAND BAGS, BUNDS, AND TEMPORARY PUMPING TO SEDIMENT RETENTION PONDS (IF REQUIRED) ARE TO BE USED TO ENSURE NO SEDIMENT OR DIRTY WATER MAKE IT TO THE MAIN CHANNELS.

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CLIENT: Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
A		FOR CONSENT	

SCALE: 1:1000 | SIZE: A1

DRAWN: R DAWSON
DESIGNED: A HOSKIN
REVIEWED: D WATSON

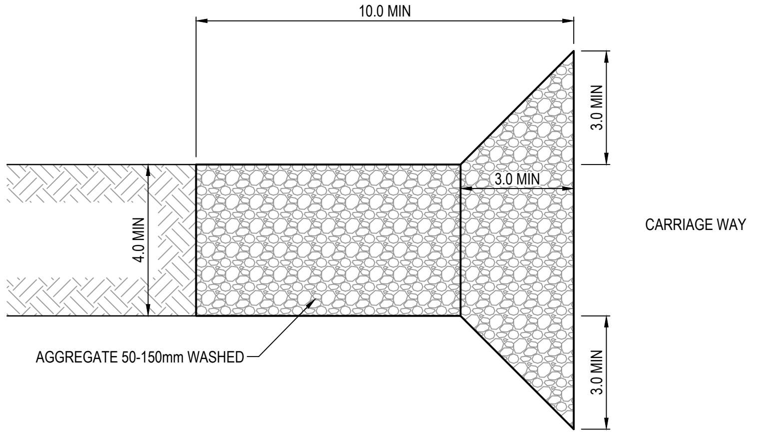
FOR CONSENT
NOT FOR CONSTRUCTION

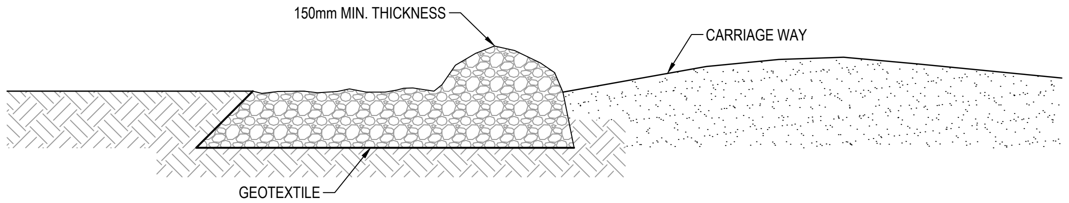
APPROVED: J TRIST | DATE

PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1 EROSION & SEDIMENT CONTROL

DRAWING No.: PROJECT No. 509177 – AREA 0001 – TYPE DRG – DISC CC – NUMBER 0013 – REV A

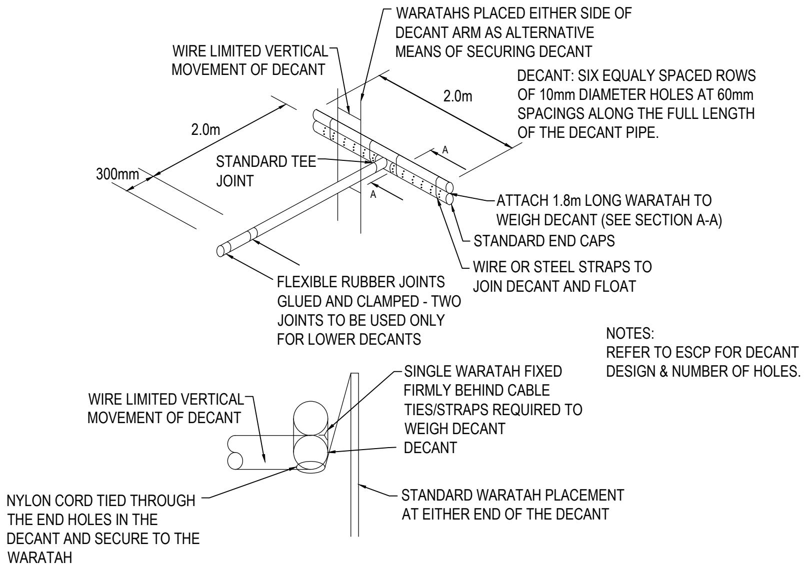




STABILISED CONSTRUCTION ENTRANCE
(REFER TO GD05 SECTION E2.6)
1:100

DESIGN PARAMETER	SPECIFICATION
AGGREGATE SIZE	50 - 150 mm WASHED AGGREGATE
MINIMUM THICKNESS	150mm
MINIMUM LENGTH	10m
MINIMUM WIDTH	4m

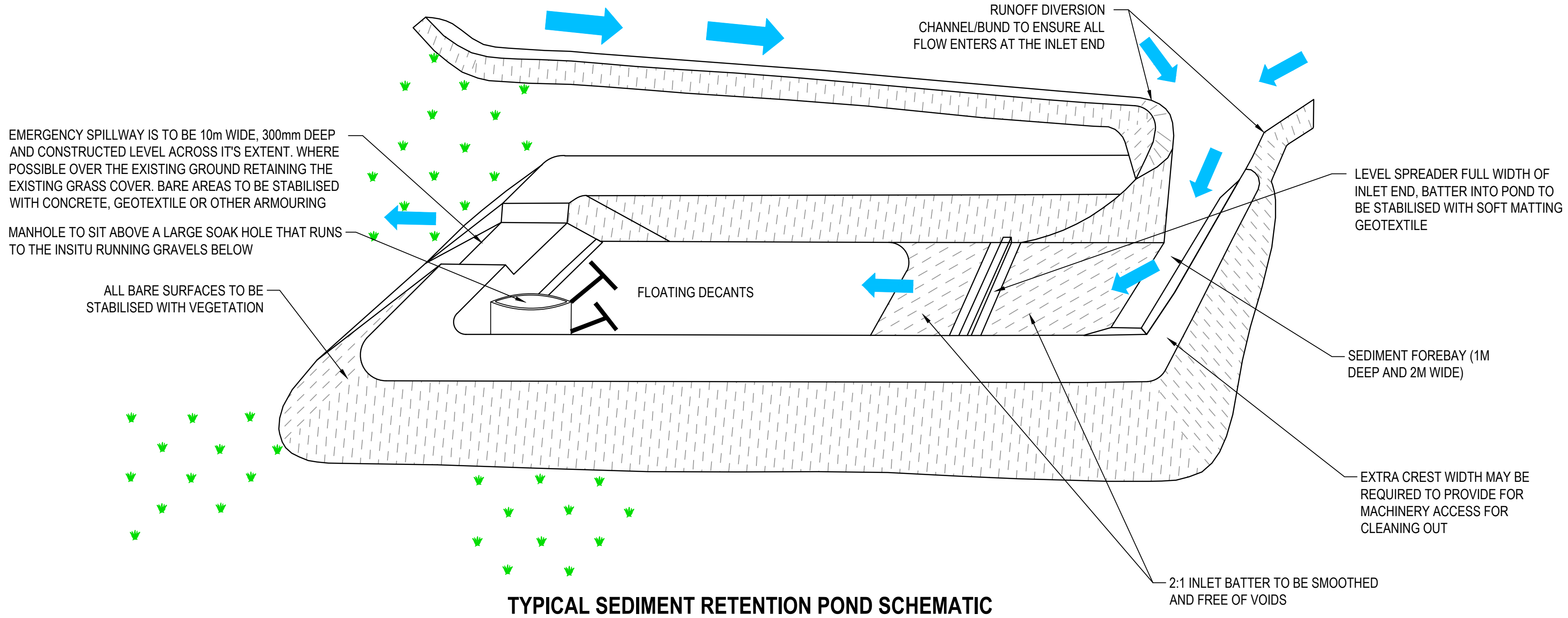
STABILISED ENTRANCEWAY SPECIFICATIONS



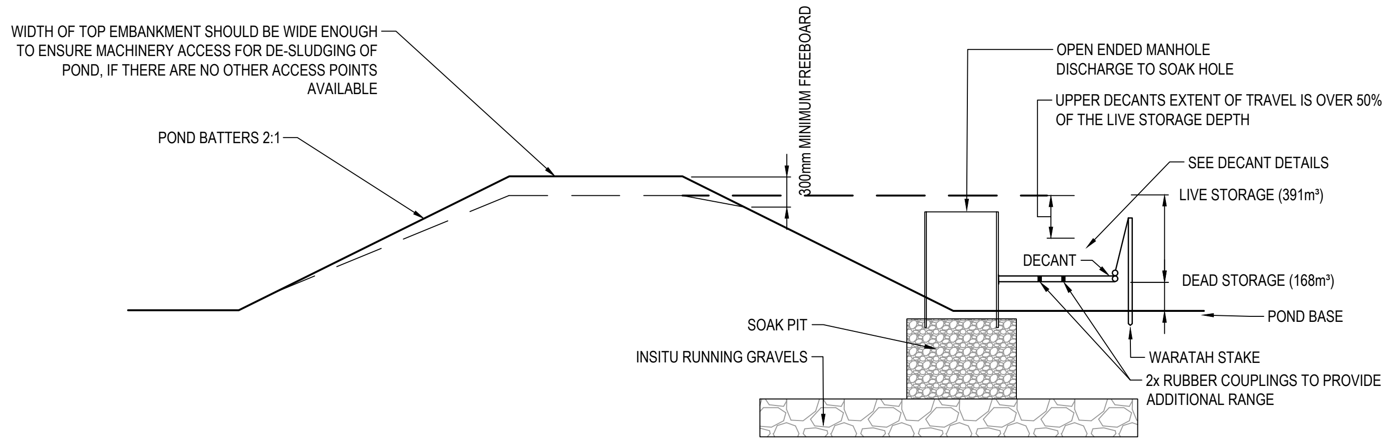
NOTES:
REFER TO ESCP FOR DECANT DESIGN & NUMBER OF HOLES.

DECANT DETAIL
1:50

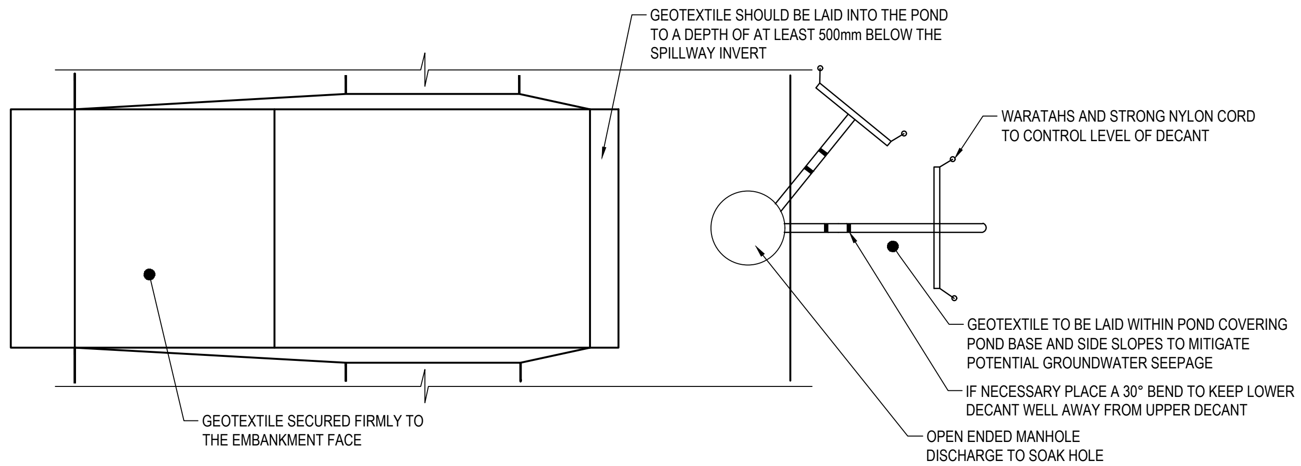
SCALE 1:50 (0.5, 0, 1, 2m)
SCALE 1:100 (1, 0, 2, 4m)



TYPICAL SEDIMENT RETENTION POND SCHEMATIC
(REFER TO GD05 SECTION F1.1)
NTS.



INDICATIVE CROSS SECTION
SEDIMENT RETENTION POND(REFER TO GD05 SECTION F1.1)
NTS.



INDICATIVE PLAN DETAIL
SEDIMENT RETENTION POND FOR 1.5 TO 3 ha CATCHMENT (REFER TO GD05 SECTION F1.1)
NTS.

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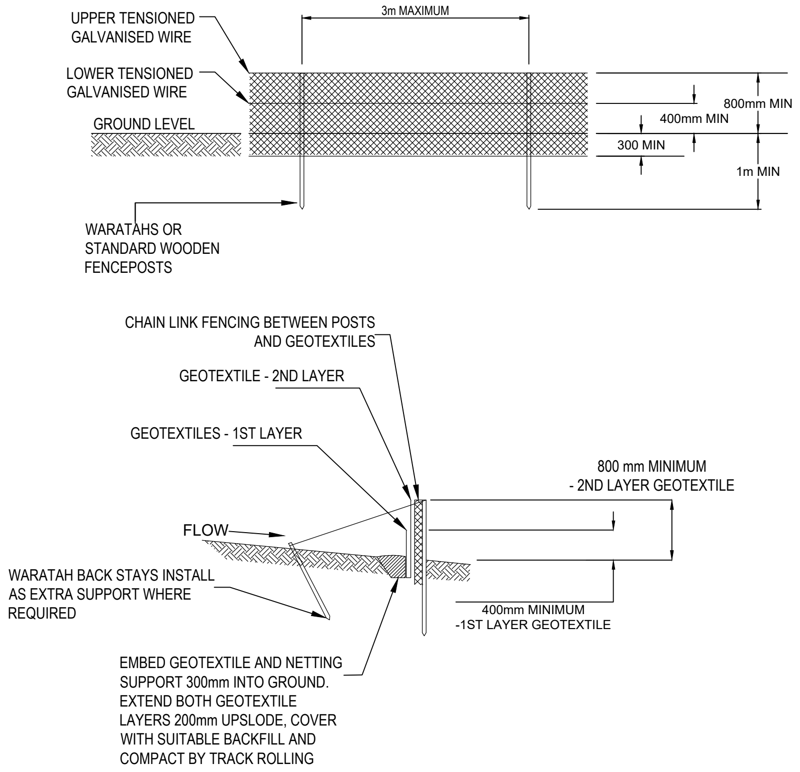
CLIENT: Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
A		FOR CONSENT	

SCALE: AS SHOWN | SIZE: A1
DRAWN: R DAWSON
DESIGNED: M CROWE
REVIEWED: D WATSON
FOR CONSENT
NOT FOR CONSTRUCTION
APPROVED: J TRIST | DATE

PROJECT: BELLGROVE, RANGIORA
TITLE: STAGE 1 EROSION & SEDIMENT CONTROL PLAN DETAILS SHEET 1 OF 2
DRAWING No.: PROJECT No. 509177 - AREA 0001 - TYPE DRG - DISC CC - NUMBER 0014 - REV A



SUPER SILT FENCE DEATIL
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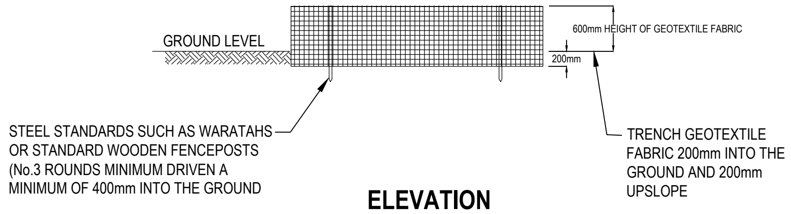

ELEVATION
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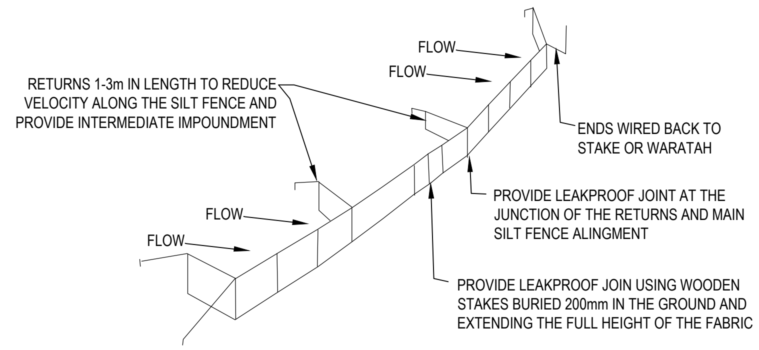

SILT FENCE RETURNS AND WIRE
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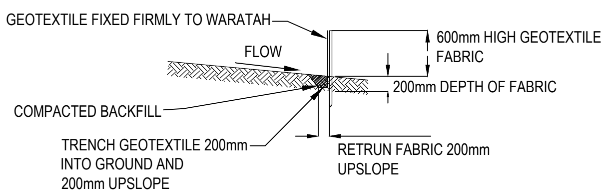

SILT FENCE CROSS SECTION
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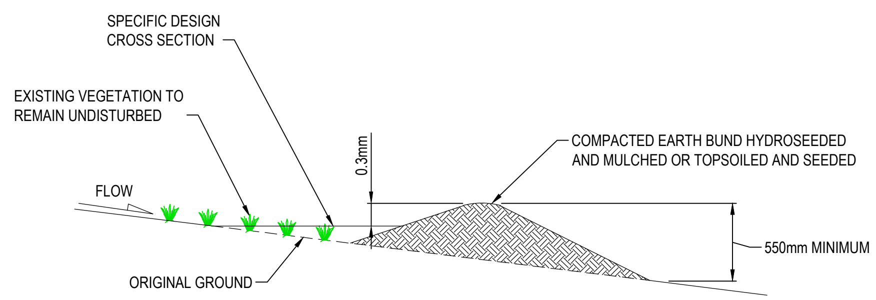
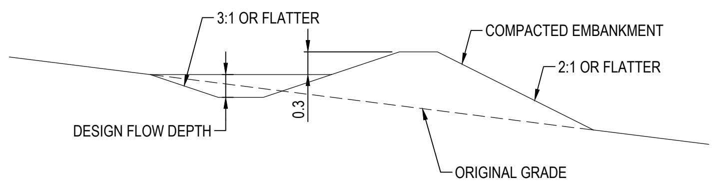


CLEAN WATER DIVERSION BUND DETAIL
1:50



DIRTY WATER DIVERSION CHANNEL DETAIL
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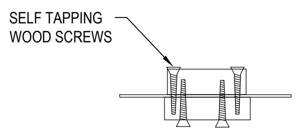

STANDARD DETAIL FOR FABRIC JOIN
1:25

250 0 500 1000mm
SCALE 1:25

500 0 1000 2000mm
SCALE 1:50

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CLIENT: Bellgrove RANGIORA

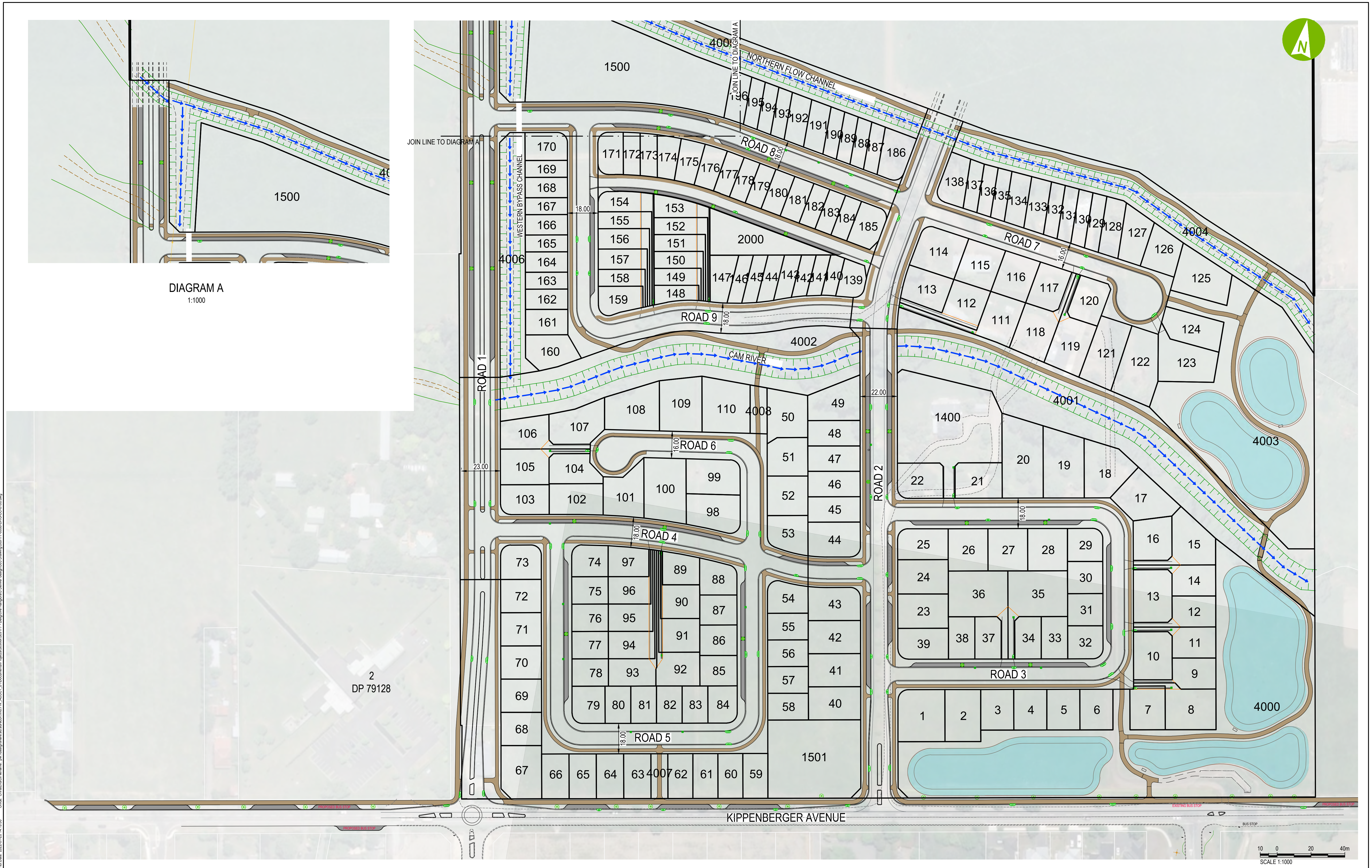
REV	DATE	REVISION DETAILS	APPROVED
A		FOR CONSENT	

SCALE	AS SHOWN
SIZE	A1
DRAWN	R DAWSON
DESIGNED	M CROWE
REVIEWED	D WATSON
APPROVED	J TRIST
DATE	

FOR CONSENT
NOT FOR CONSTRUCTION

PROJECT	BELLGROVE, RANGIORA
TITLE	STAGE 1 EROSION & SEDIMENT CONTROL PLAN DETAILS SHEET 2 OF 2
DRAWING No.	PROJECT No. 509177 – AREA 0001 – TYPE DRG – DISC CC – NUMBER 0015 – REV A

Appendix G – Roading



CLIENT	REV	DATE	REVISION DETAILS	APPROVED
Bellgrove Rangiora	C	2022-01-20	REVISED LOT LAYOUT	J TRIST
	B	2021-12-17	CORNER ROUNDING	J TRIST
	A	2021-10-22	FOR CONSENT	J TRIST

SCALE	SIZE
1:1000	A1

DRAWN: R DAWSON
DESIGNED: M CROWE
REVIEWED: D WATSON

FOR CONSENT
NOT FOR CONSTRUCTION

APPROVED — DATE
J TRIST

PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1 PRELIMINARY ROADING LAYOUT

DRAWING No.	PROJECT No.	AREA	TYPE	DISC	NUMBER	REV
	509177	0000	DRG	CC	0100	C

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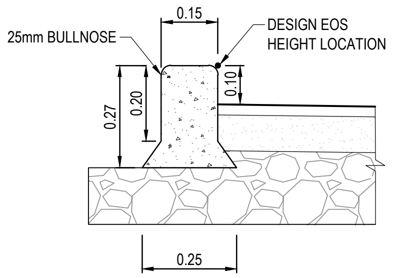
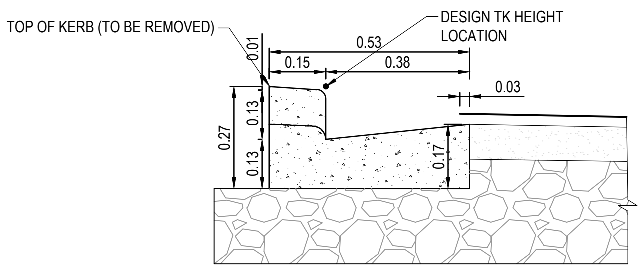
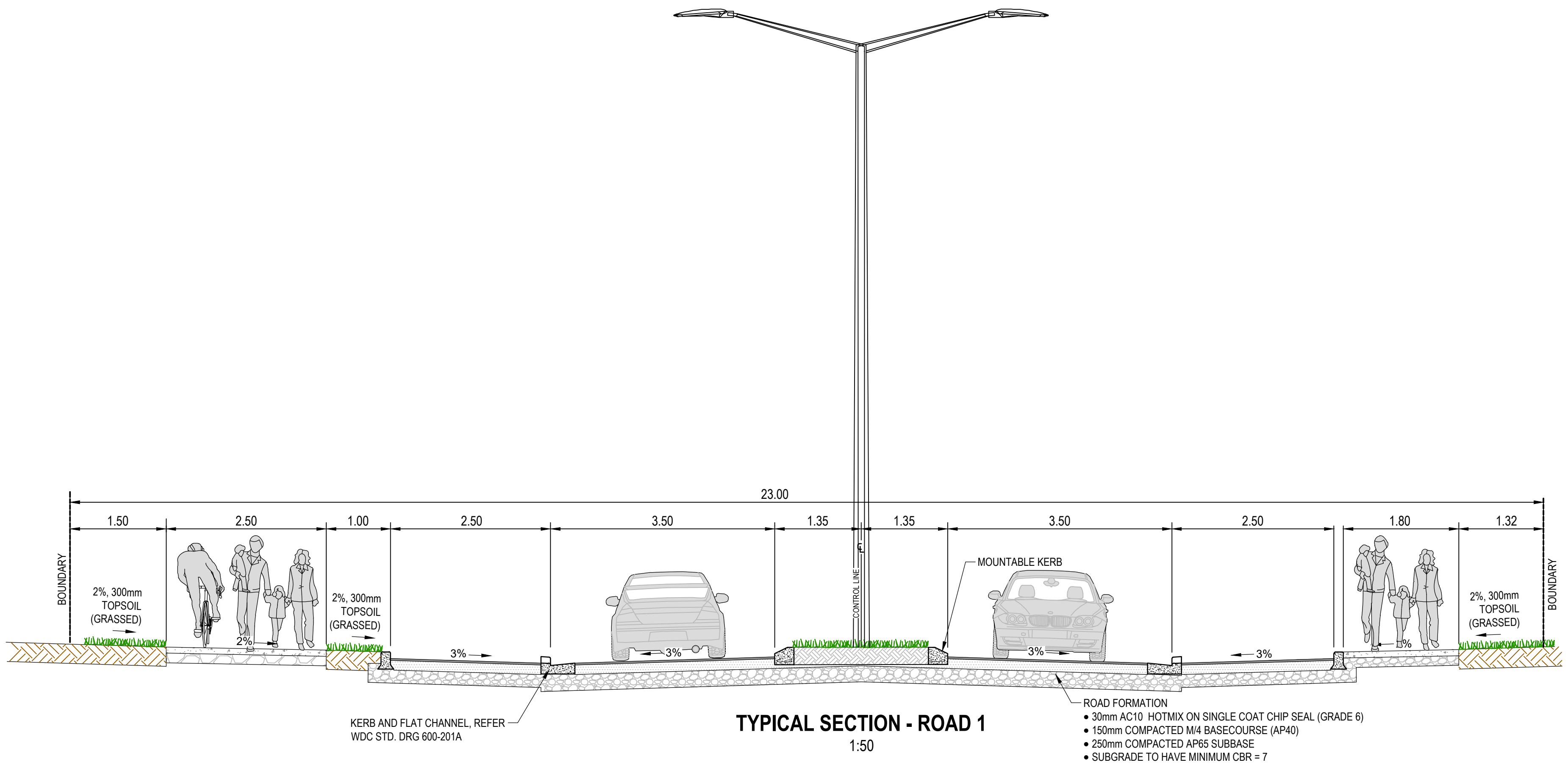


KERB ONLY (SD602)
SCALE 1:10



KERB & FLAT CHANNEL (SD601)
SCALE 1:10



TYPICAL SECTION - ROAD 1
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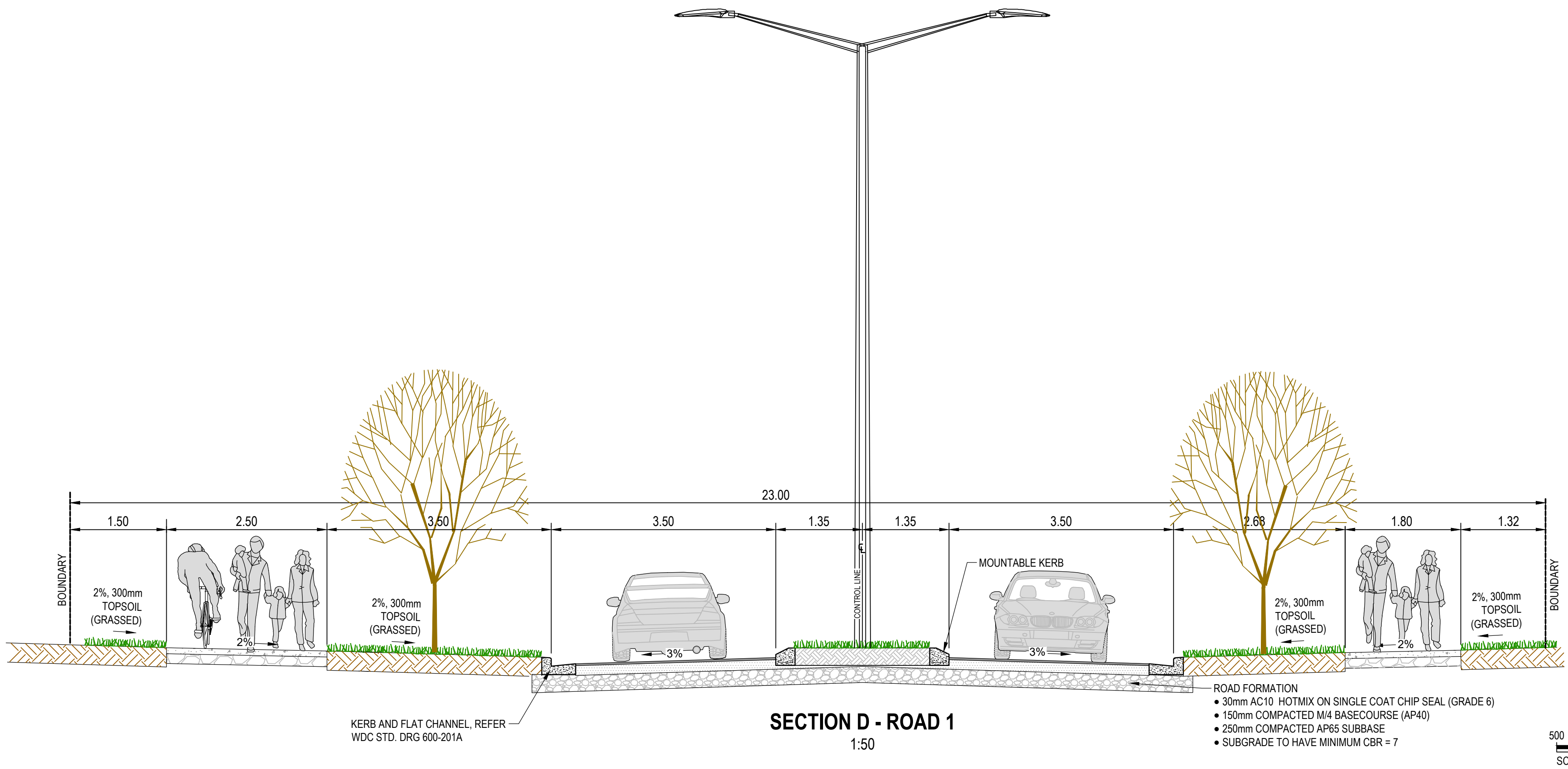

SECTION D - ROAD 1
1:50

500 0 1000 2000mm
SCALE 1:50

PAVEMENT NOTES:

1. PAVEMENT FOUNDATION DESIGN IS BASED ON DESIGN 6M ESA TRAFFIC LOADING FROM THE AUSTROADS GUIDE TO PAVEMENT TECHNOLOGY (PART 2).
2. CONTRACTOR TO CONTACT ENGINEER IF CBR IS LESS THAN 7 FOR ALTERNATIVE PAVEMENT DESIGN.

KERB NOTES:

1. CONCRETE STRENGTH TO BE 20MPa AT 28 DAYS.
2. CONCRETE FINISH TO CONFORM WITH CLASS U3 OF NZS 3114

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CLIENT: Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
C	2022-01-20	ADDITIONAL SECTIONS ADDED	J TRIST
B	2021-12-14	PARKING REVISED	J TRIST
A		FOR CONSENT	

SCALE	AS SHOWN
SIZE	A1
DRAWN	R DAWSON
DESIGNED	M CROWE
REVIEWED	D WATSON
APPROVED	J TRIST
DATE	

FOR CONSENT
NOT FOR CONSTRUCTION

PROJECT	BELLGROVE, RANGIORA
TITLE	STAGE 1 ROADING TYPICAL CROSS SECTIONS & DETAILS SHEET 1 OF 2

DRAWING No.	PROJECT No.	AREA	TYPE	DISC	NUMBER	REV
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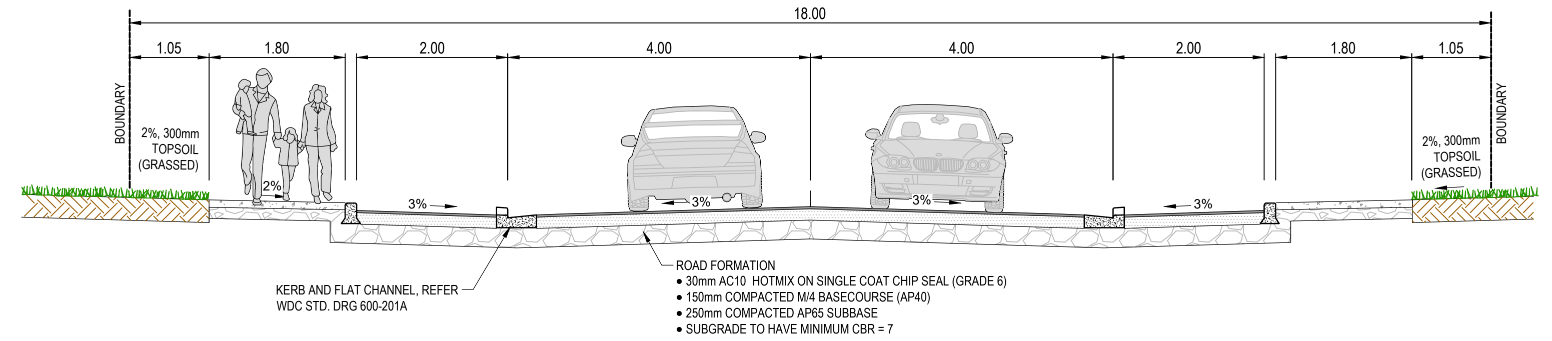

TYPICAL SECTION - ROAD 8
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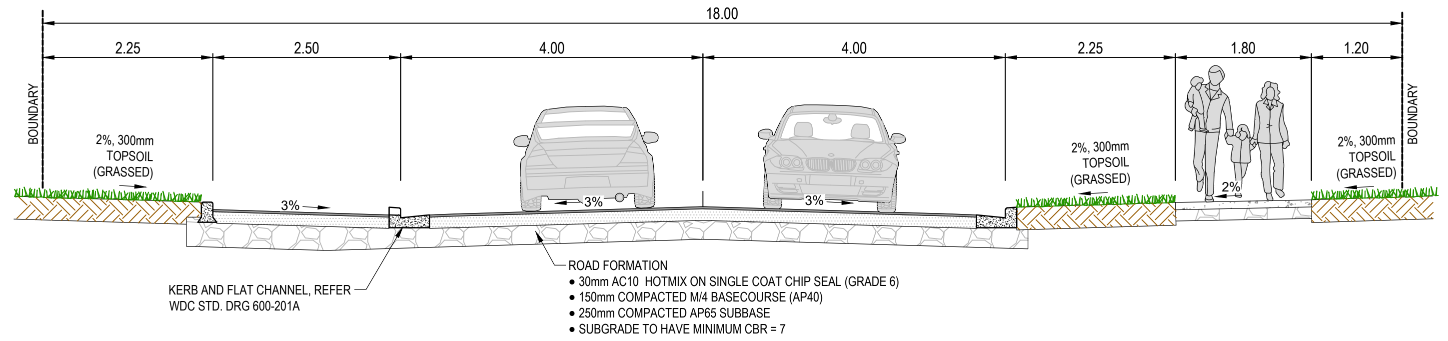
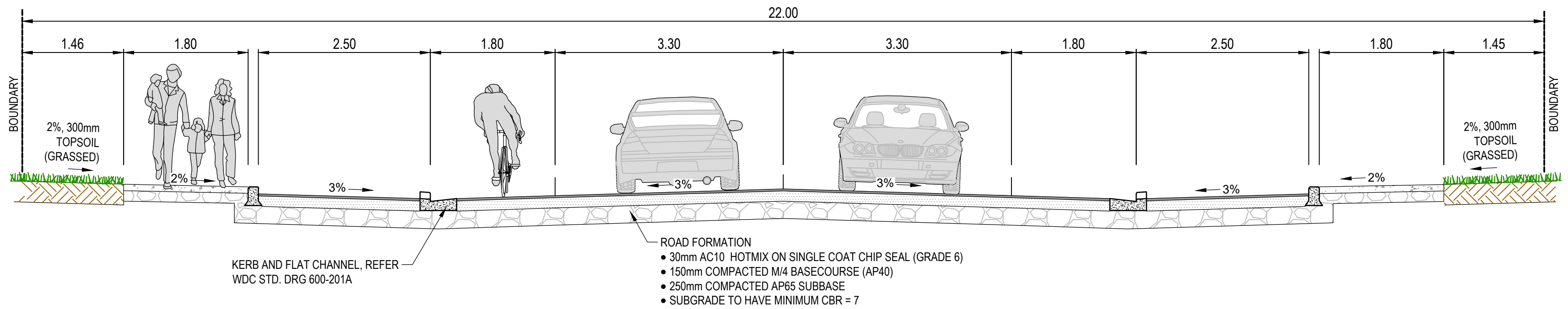
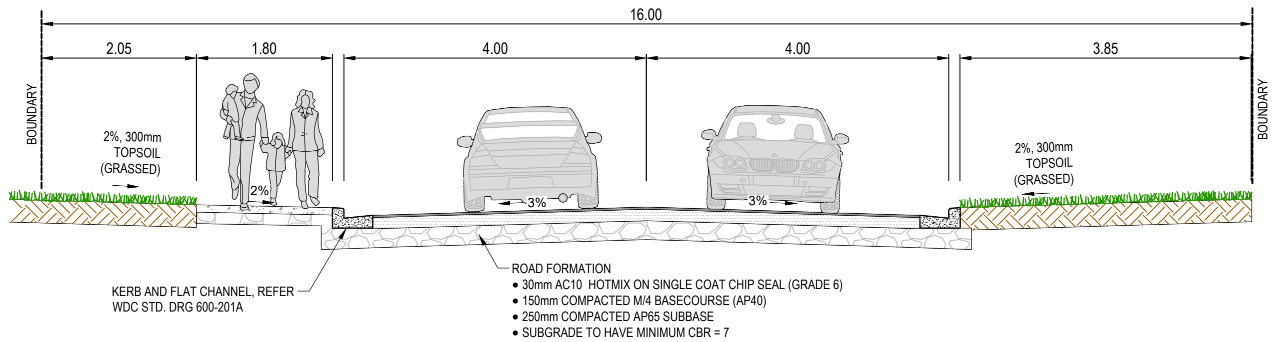


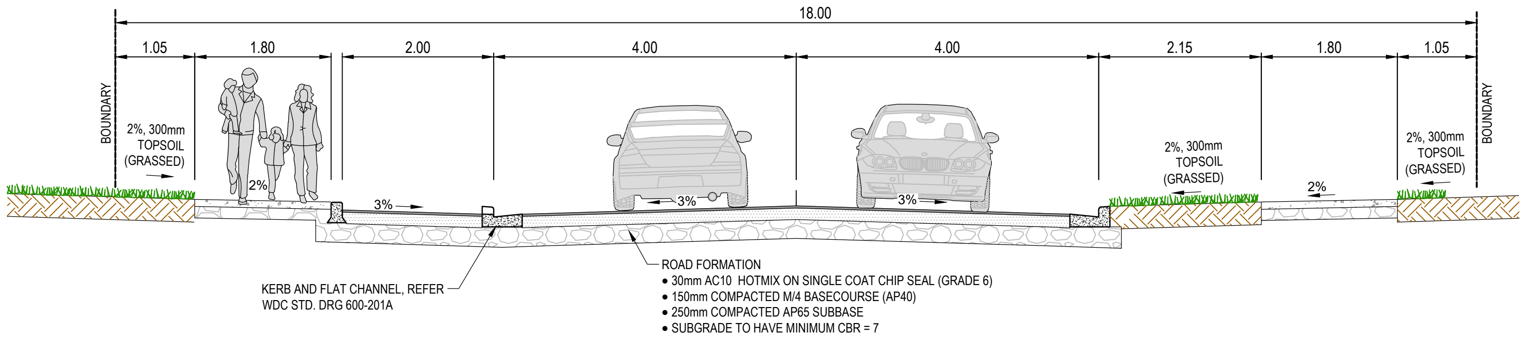
TYPICAL SECTION - ROADS 3,5 & 9
1:50



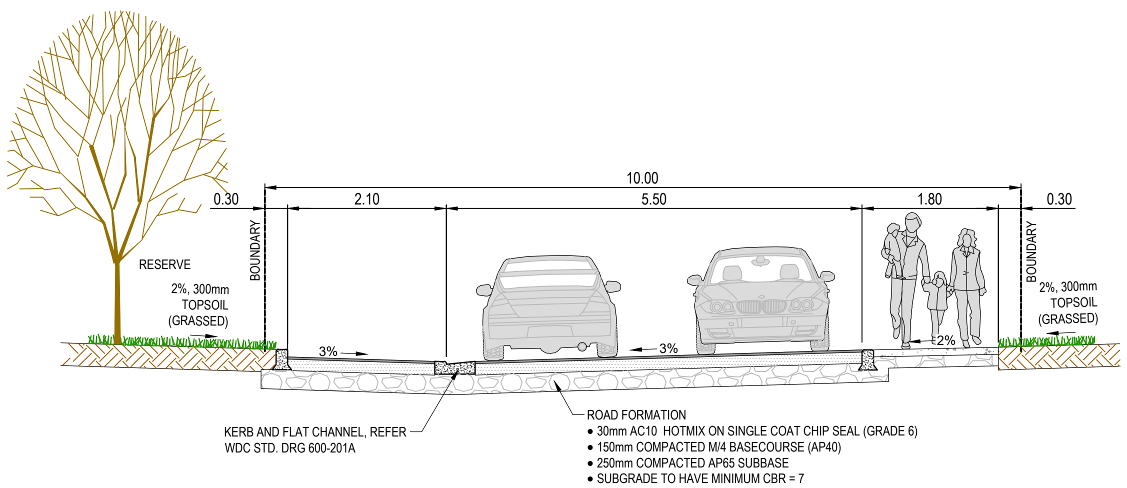
TYPICAL SECTION - ROAD 2
1:50



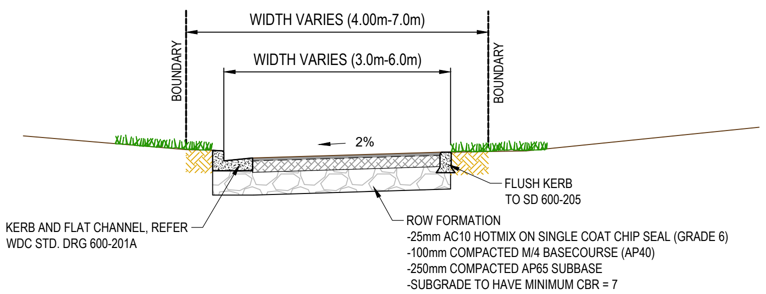
TYPICAL SECTION - ROADS 6 & 7
1:50



TYPICAL SECTION - ROAD 4
1:50



TYPICAL SECTION - ROAD 10
1:50



TYPICAL SECTION - ROW's
1:50

500 0 1000 2000mm
SCALE 1:50

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Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
C	2022-01-20	ADDITIONAL SECTIONS ADDED	J TRIST
B	2021-12-14	ROAD 10 ADDED	J TRIST
A		FOR CONSENT	

SCALE	SIZE
AS SHOWN	A1

DRAWN: R DAWSON
DESIGNED: M CROWE
REVIEWED: D WATSON

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NOT FOR CONSTRUCTION
APPROVED
DATE
J TRIST

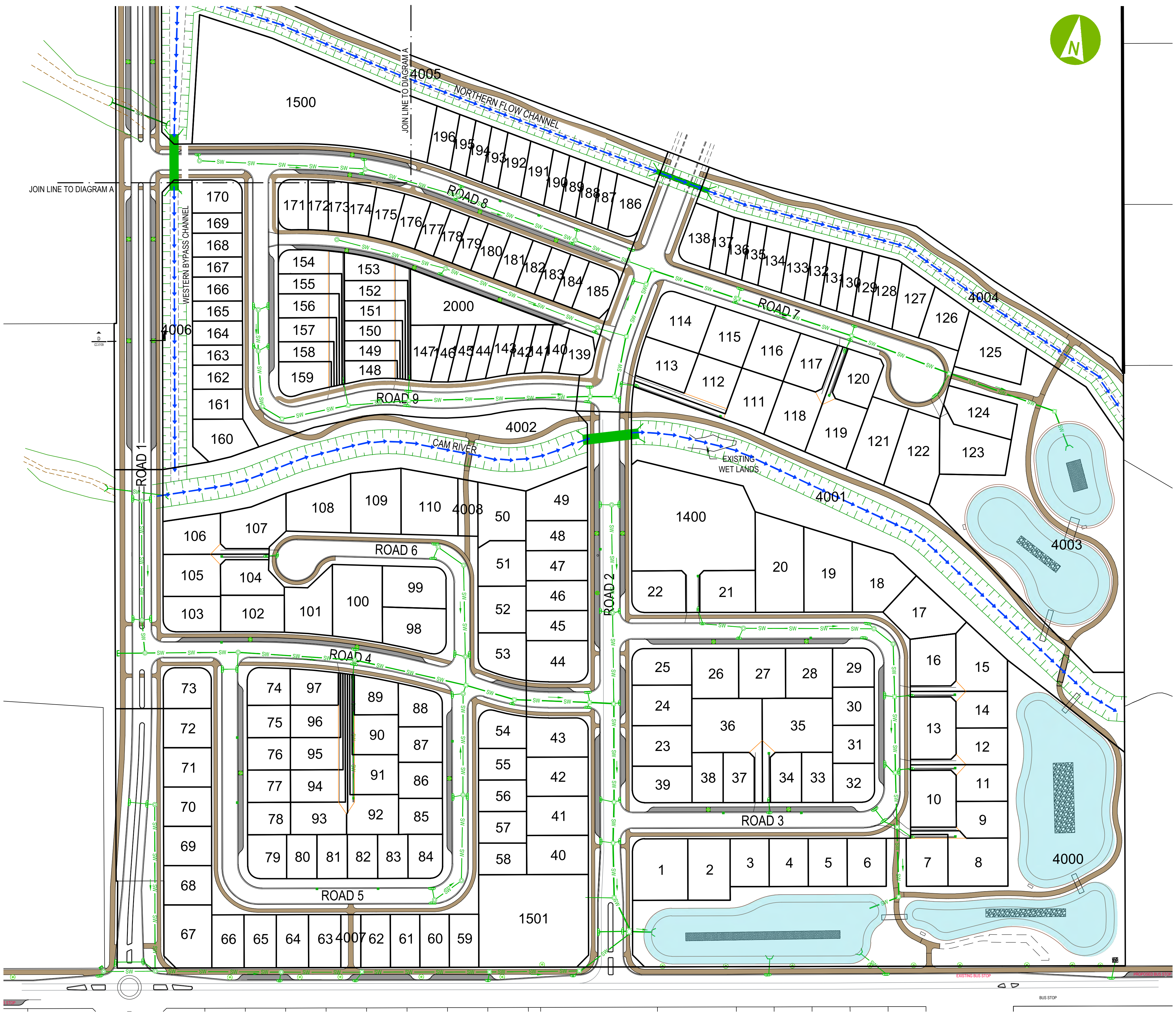
PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1
ROADING TYPICAL CROSS SECTIONS & DETAILS
SHEET 2 OF 2

DRAWING No.	PROJECT No.	AREA	TYPE	DISC	NUMBER	REV
	509177	0001	DRG	CC	0110	C

Appendix H – Stormwater

- Infrastructure plan
- 1 in 200 break out Stormwater Memo (Bellgrove Dev Flood Assessment 210624)



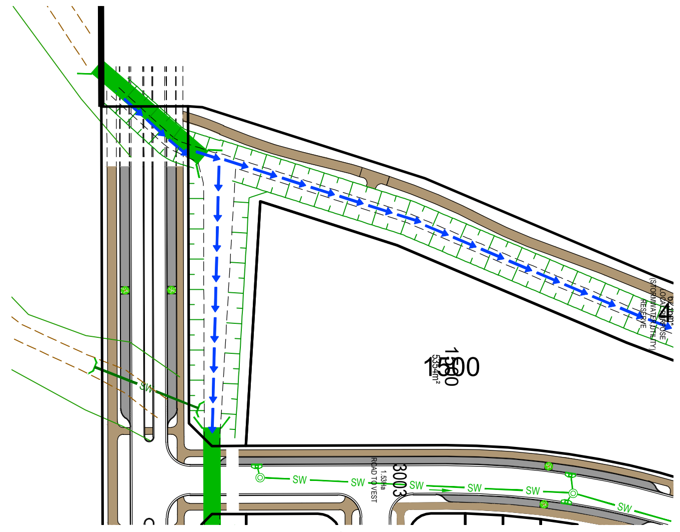


DIAGRAM A

1:1000

LEGEND

- STORMWATER PIPE
- STORMWATER MANHOLE
- STORMWATER SUMP
- PIPE FLOW DIRECTION
- CIRCULAR CULVERT
- BOX CULVERT
- WING WALL
- SPILL WAY

NOTES:

1. MANHOLE AND SUMP SYMBOLS ENLARGED FOR CLARITY.
2. ALL PIPE TO BE MIN 1m CLEAR FROM THE KERB LINE.

SCALE 1:1000

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CLIENT: Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
C	2022-01-20	REVISED LOT LATOUT	J TRIST
B	2021-12-17	CORNER ROUNDING	J TRIST
A	2021-10-22	FOR CONSENT	J TRIST

SCALE	SIZE
1:1000	A1

DRAWN: R DAWSON
DESIGNED: I DUNCAN
REVIEWED: D WATSON

FOR CONSENT
NOT FOR CONSTRUCTION

APPROVED — DATE
J TRIST

PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1 PRELIMINARY STORMWATER LAYOUT

DRAWING No.	PROJECT No.	AREA	TYPE	DISC	NUMBER	REV
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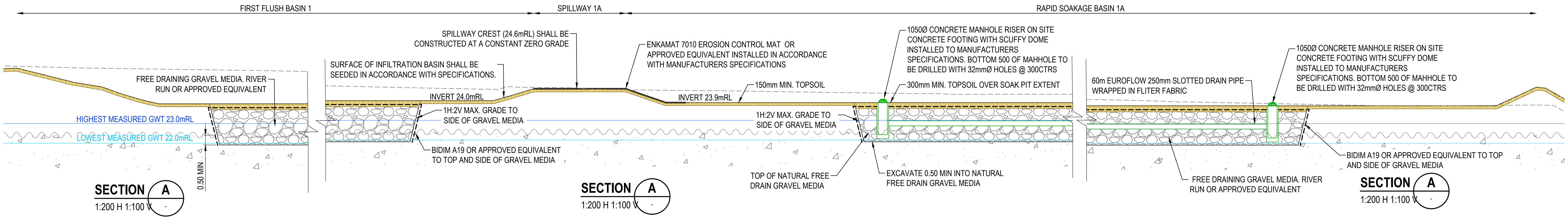

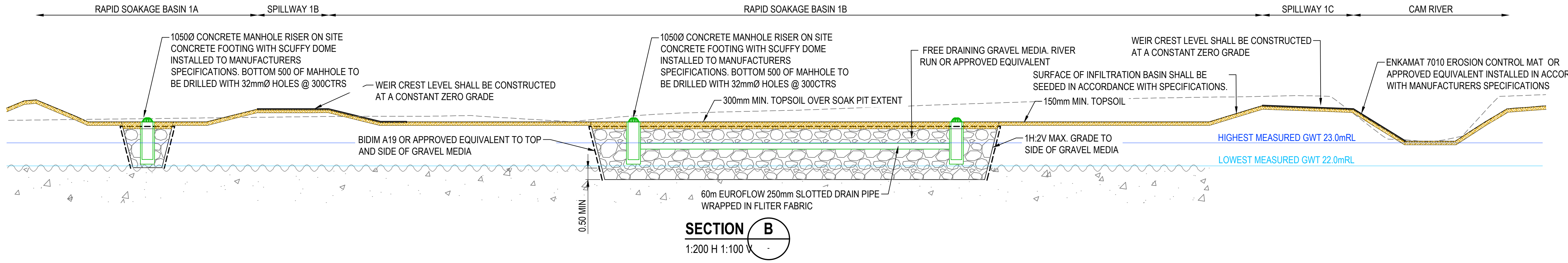

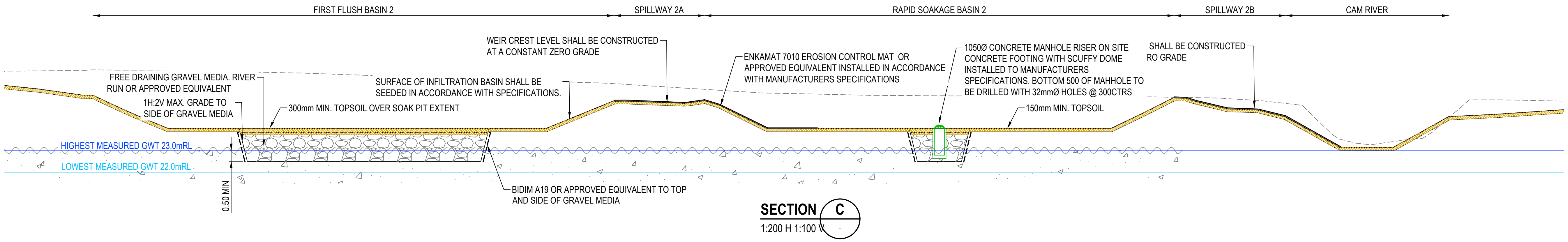

SCALE 1:100

SCALE 1:200

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REV	DATE	REVISION DETAILS	APPROVED
A	2021-10-22	FOR CONSENT	J. TRIST

SCALE	SIZE
AS SHOWN	A1

DRAWN: R DAWSON
DESIGNED: I DUNCAN
REVIEWED: D WATSON

FOR CONSENT
NOT FOR CONSTRUCTION

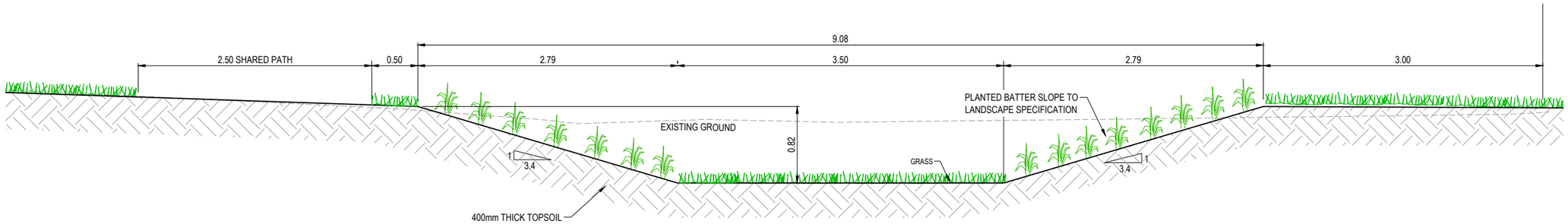
APPROVED: J TRIST
DATE

PROJECT: BELLGROVE, RANGIORA

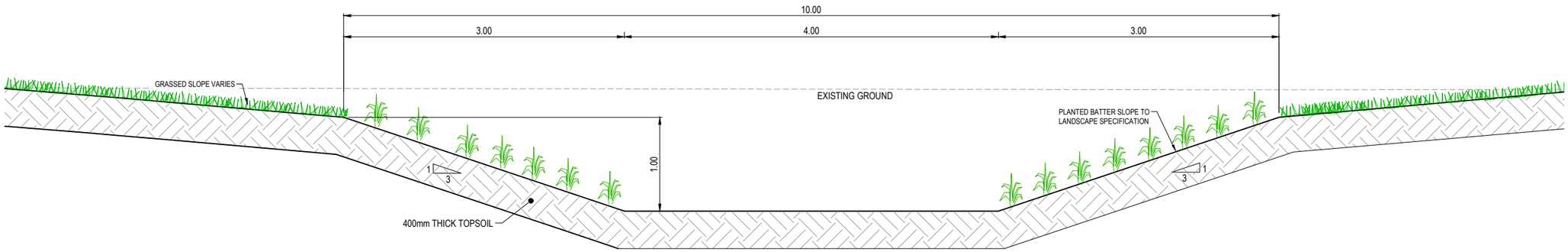
TITLE: STAGE 1 STORMWATER TYPICAL SECTIONS AND DETAILS SHEET 1 OF 3

DRAWING No.

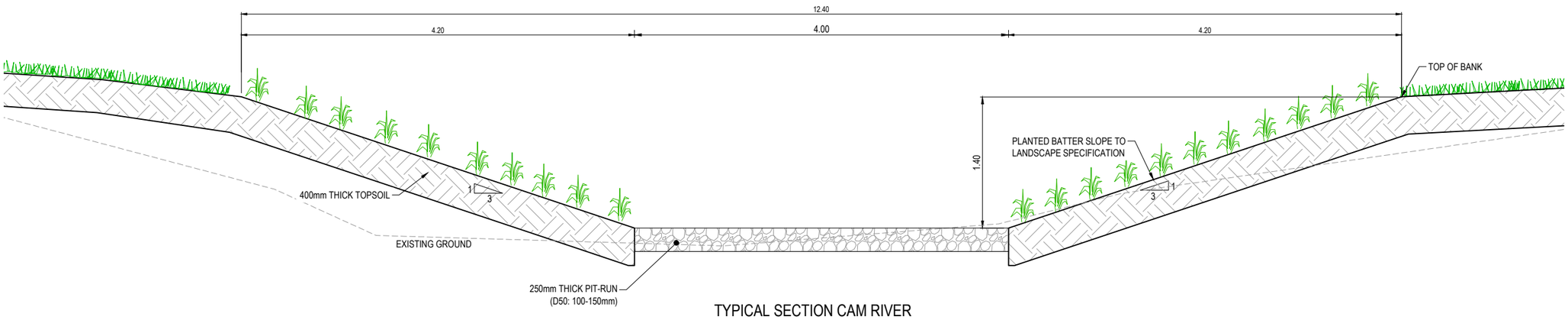
PROJECT No.	AREA	TYPE	DISC	NUMBER	REV
509177	0001	DRG	CC	0213	A



TYPICAL SECTION NORTHERN FLOW CHANNEL



TYPICAL SECTION WESTERN BYPASS CHANNEL



TYPICAL SECTION CAM RIVER

0.25 0 0.5 1m
SCALE 1:25

Plot Date: 2021-10-22 07:59:00 Office: ChristchurchFilename: p:\designs\aurecon\rfs\PW_AUDC1_01\Documents\Projects\509xx\509177 - Bellgrove Rangiora\5 Deliver design\03 Drawings\509177-0001-DRG-CC-0214.dwg

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A	2021-10-22	FOR CONSENT	J. TRIST

SCALE	SIZE
AS SHOWN	A1

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DESIGNED: I DUNCAN
REVIEWED: D WATSON

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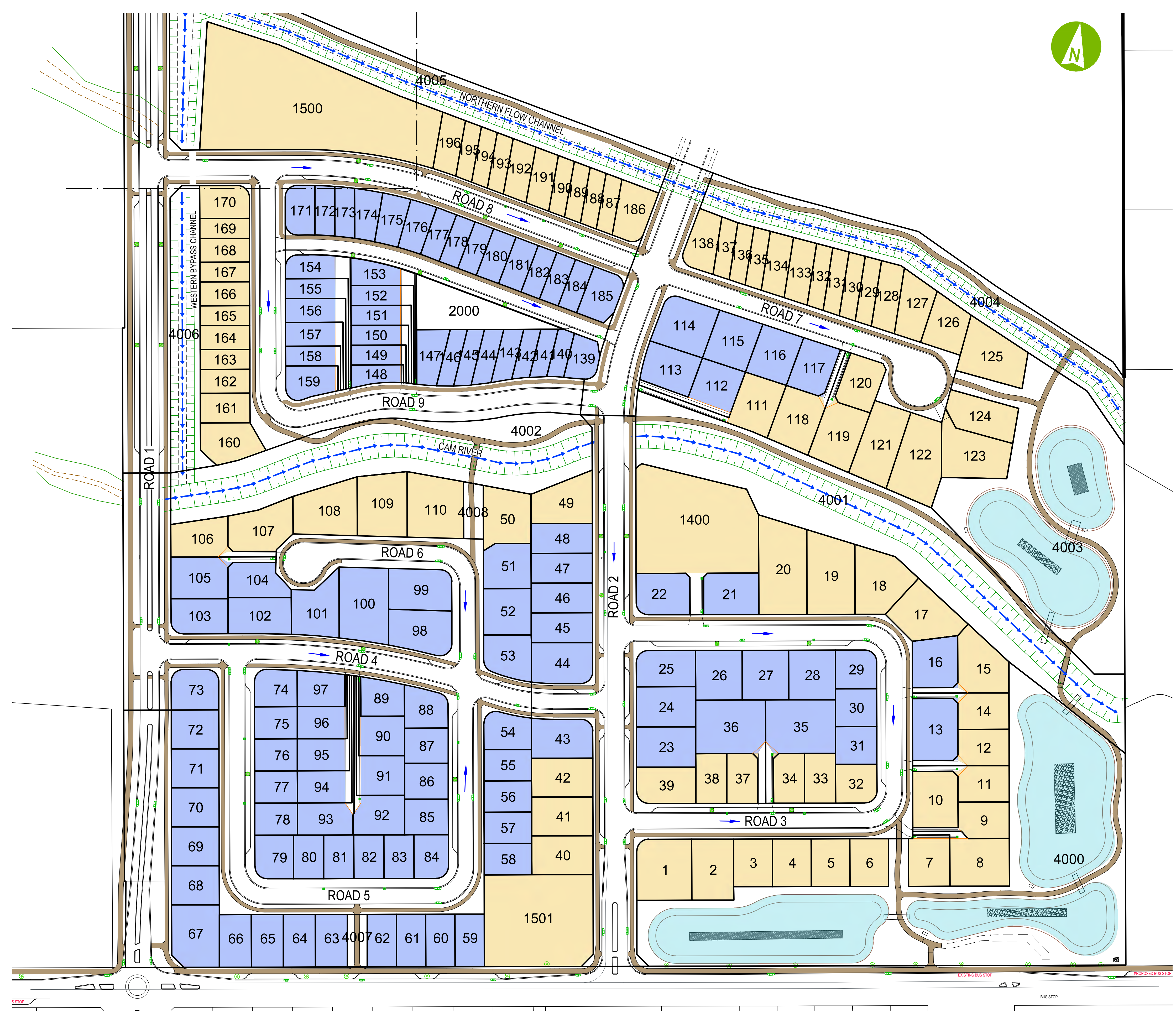
APPROVED
DATE
J TRIST

PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1
STORMWATER TYPICAL SECTIONS AND DETAILS
SHEET 2 OF 3

DRAWING No.: PROJECT No. 509177 – AREA 0001 – TYPE DRG – DISC CC – NUMBER 0214 – REV A



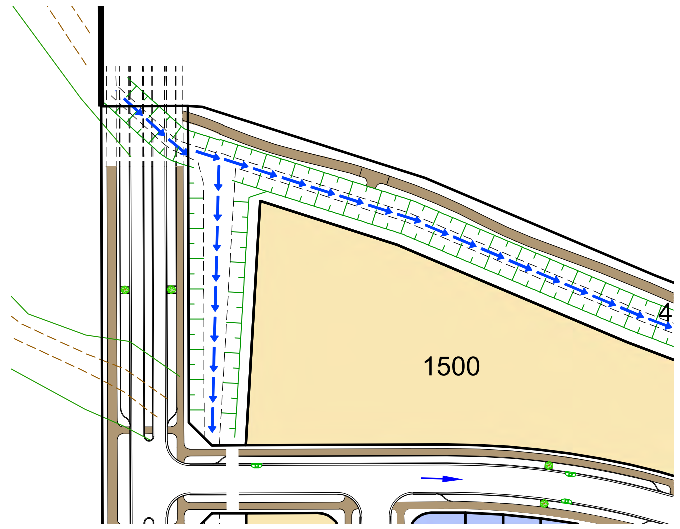


DIAGRAM A

1:1000

LEGEND

MEDIUM TO HIGH FLOOD RISK - REQUIRING 500mm FREEBOARD TO THE 200yr FLOOD LEVEL. (LOTS FRONTING OPEN CHANNELS AND AREAS WHERE PONDING COULD HAPPEN WITH BLOCKED SUMP INLETS)

LOW FLOOD RISK - REQUIRING 400mm FREEBOARD TO THE 200yr FLOOD LEVEL.

DIRECTION OF ROAD FLOW

NOTE 1 - "200yr FLOOD" REFERS TO THE GREATER OF THE FLOOD WATER LEVEL FROM THE 200yr ARI ASHLEY BREAKOUT EVENT OR THE 200yr ARI LOCAL STORM EVENT.

SCALE 1:1000

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REV	DATE	REVISION DETAILS	APPROVED
C	2022-01-20	REVISED LOT LATOUT	J TRIST
B	2021-12-17	CORNER ROUNDING	J TRIST
A	2021-10-22	FOR CONSENT	J TRIST

SCALE	SIZE
1:1000	A1

DRAWN: R DAWSON
DESIGNED: I DUNCAN
REVIEWED: D WATSON

FOR CONSENT
NOT FOR CONSTRUCTION

APPROVED: J TRIST
DATE

PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1
FLOOR LEVEL FREEBOARD REQUIREMENTS

DRAWING No.: PROJECT No. 509177 – AREA 0000 – TYPE DRG – DISC CC – NUMBER 0201 – REV C

Aurecon New Zealand Limited
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F +64 3 379 6955
E christchurch@aurecongroup.com
W aurecongroup.com

To	**Chris Bacon & Kelly La Valley**	From	**Derek Watson / Innes Duncan**
Copy	**David Delagarza / Jason Trist**	Reference	**509177 – Rev04**
Date	**2021-12-16**	Pages (including this page)	**11**
Subject	**Bellgrove Concept Stormwater Modelling – MIKE Flood**		

1 Introduction

The purpose of this memorandum is to outline the impacts of flooding from the Ashley River breakout within the concept design of the proposed Bellgrove subdivision. This memo primarily focuses on the northern portion of the site, comprised of approximately 63 ha located east of Rangiora, north of Kippenberger Ave as shown in Figure 1.

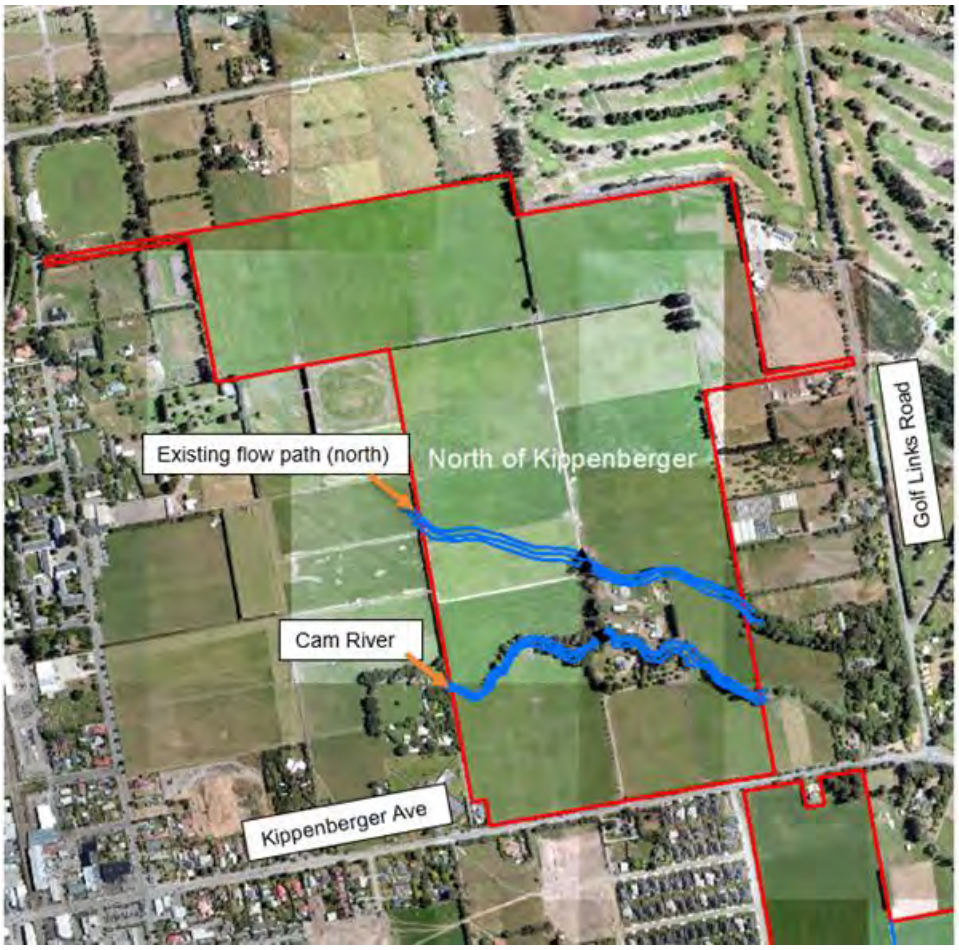


Figure 1 - Bellgrove Northern Site Plan

As documented in previous Aurecon stormwater memoranda, flow from the Ashley River breakout flooding scenario (0.5% Annual Exceedance Probability [AEP]) will generally follow three channels through the northern part of the Bellgrove site. The southernmost of these three is known as the Cam River. The Cam River is a well-defined channel with no observed base flow between the western border of the site and the existing homestead that sits near the centre of the site. The central channel

is a tributary to the Cam River, intersecting approximately 250 m east of the site's western boundary. This is a dry channel and will carry the smallest flow of the three channels during rainfall events.

The Northern Flow Channel (that leads to the Taranaki) is a broad, shallow channel that sits north of the Cam River. This will carry the largest portion of the flow to the western boundary. Previous models have also indicated that there are several locations where flood flow breaks out of the northern channel and travels overland to the Cam River. Figure 2 shows the results of this modelling.

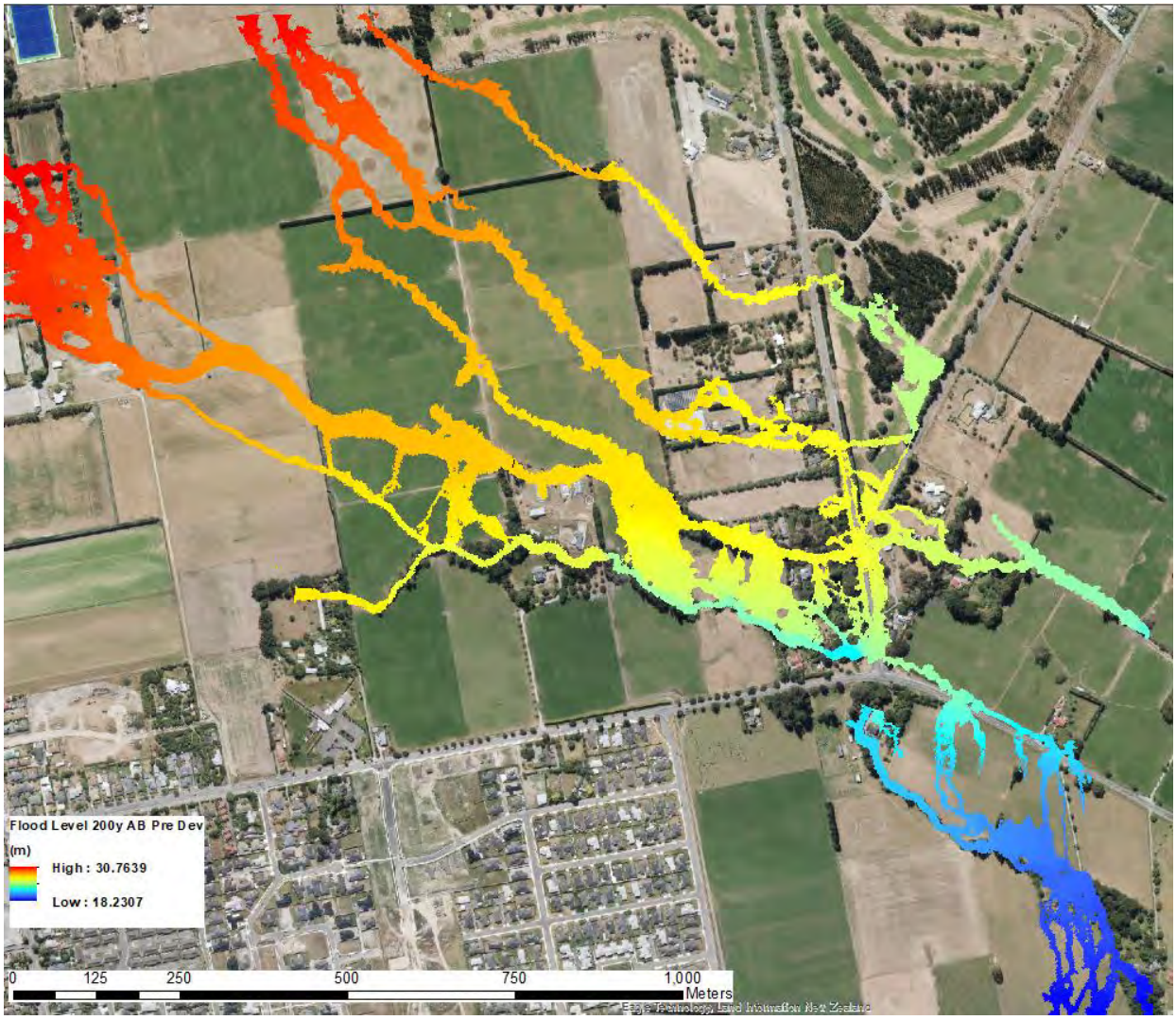


Figure 2 - Pre-Development Flood Surface Elevation

2 Scope of Works

As part of the preparation of this memo, the following tasks have been carried out:

- Modelling of a concept scheme layout in 12D, including 3d geometry of drains
- Modelling of Ashley River 1 in 200 (0.5% AEP) breakout scenario in MIKE Flood using the above information
- Hydraulic design of diversion structures at the junction of the proposed Northern Flow Channel and Western Bypass Channels
- Refining of the grid across the site to remove and minimise errors/noise from the original mesh
- Creation of memo summarising findings

3 Analysis

3.1 Proposed Management Strategy

Boundary conditions were extracted from the latest WDC Flood Model (2019) and are:

- 10.8m3/s at the North-west edge of the Bellgrove stage 1 site (existing northern flow path)
- 1.3m3/s at the western boundary (ex. Cam River flow)

The proposed Bypass channel along the western site boundary ("Western Bypass Channel") is designed to carry 7.4 m^3/s of this flow south to the Cam River. To maintain the existing flow rates, the remainder of the flow (3.4 m^3/s) is proposed to travel along the Northern Flow Channel. The proposed Western Bypass Channel would also intercept flows from the centre channel, conveying this to the Cam River.

This strategy will take advantage of the existing lower bed level of the Cam River to convey the majority of the flow. This reduces the width of the required land designation relative to what would be required to convey the flow through the Northern Flow Channel. This strategy closely maintains the relative flow split at Golf Links Road and Kippenberger Road by formalising the split flows across the site. Refer to section 5 for further discussion around resultant flow splits.

There are two existing box culverts downstream of the Bellgrove site. One sits in the Northern Flow Channel alignment under Golf Links Road and is 0.90m x 0.90m. The second sits in the Cam River beneath Kippenberger Road and is 2.85m x 2.5m. These culverts are the confining factors and will limit the flow that can be conveyed through the channel drains without spilling overland.

Note that as part of the concept design, the Northern Flow Channel and the Cam River are to be reshaped in order to slightly straighten the drains and create a uniform grade through the site.

3.2 Western Bypass Channel

The proposed western Bypass Channel has been designed for a flow rate of 7.4 m^3/s. Bentley FlowMaster software was originally used to establish the proposed cross section depicted in Figure 3. This cross section was modelled in 12D to establish the proposed geometry as part of the scheme layout.

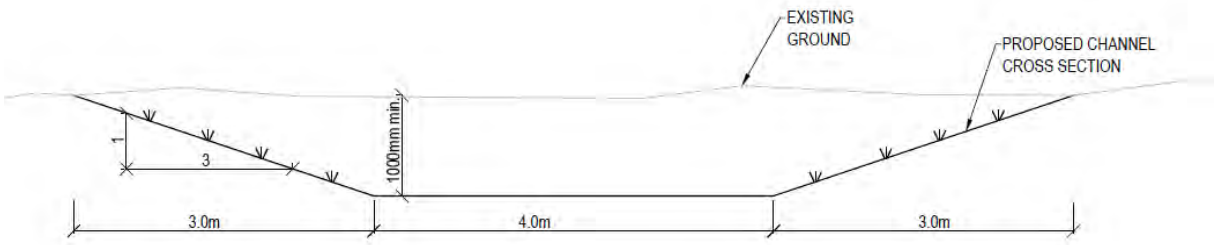


Figure 3 - Typical Western Bypass Channel

3.3 Cam River

As part of the development of the Bellgrove site, the Cam River is proposed to be realigned which will also be aligned with the removal of a small amount of contaminated soil in the area. The Cam River will be conveying a flow rate of 8.8 m^3/s. The typical section for the Cam has been modelled as per Figure 4. Bentley FlowMaster software was originally used to show that this section is capable of conveying this flow at the 1 in 170 grade of the proposed alignment. This has also been confirmed using Mike Flood software.

Figure 4 - Typical Cam River Section

3.4 Northern Flow Channel

The Northern Flow Channel north of the Cam River is to convey 3.4 m^3/s in the Ashley River breakout flood event. Using tie in points with the existing ground at the western and eastern sides of the Bellgrove site, it was found that the grade would be approximately 1 in 500. Using this grade, it was found that the cross section shown in Figure 5 would be sufficient to convey this flow, while maintaining sufficient free board from housing floor levels. This channel cross section would be standard along the entirety of the northern channel and would require a top width of 9.1m at the proposed depth of 0.82m.

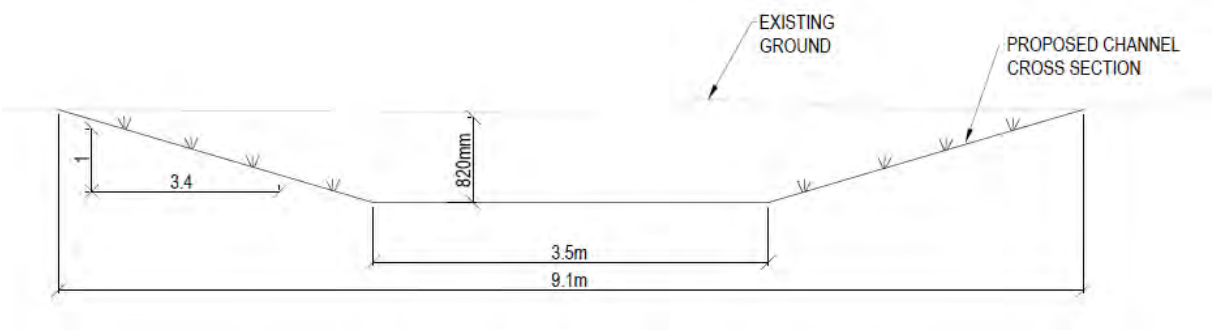


Figure 5 - Typical Northern Flow Channel Section

4 Updated 0.5% AEP Flood Modelling

The proposed concept for the Bellgrove site including the above channels has been modelled in 12D in order to create a design surface which can be used in updated flood modelling in MIKE Flood.

The MIKE Flood one/two-dimensional coupled model has been updated to incorporate the design surface and the proposed management structure to allocate the Ashley River breakout flow to the Northern Flow Channel and the Western Bypass Channel.

The Northern Flow Channel, the Western Bypass Channel, and the Cam River are modelled as one-dimensional channels using the design channel geometry. The two-dimensional model topography is built using the design surface within the extent of Stage 1 of the subdivision. The Northern Flow Channel, the Western Bypass Channel and the Cam River are blocked out from the two-dimensional topography to avoid double counting on flood volume. Mesh size has been refined within the design extent; and further refined within the proposed spillways between the detention ponds to better capture the design surface level changes.

The proposed flow management structure is modelled in the 1D network model. The structure consists of two components: a sluice on the Northern Flow Channel with gate level of 26.95 mRL, and a broad crested weir on the Western Bypass Channel with crest level of 26.8 mRL. The sluice is designed to allow 3.4 m^3/s in the Ashley River breakout flood event to be conveyed by the Northern Flow Channel. The weir is designed to convey the rest of flow (7.4m^3/s) by the Western Bypass Channel when the water level reaches the weir crest level of 26.8 mRL.

A 525 mm diameter culvert connecting the existing central channel and the proposed Western Bypass channel has been modelled to convey the central channel flood into the Bypass channel beneath future Road 1 between the western boundary and the Western Bypass Channel. The flow from this culvert is limited by the tailwater level.

A 1.2m x 0.6m box culvert has also been included in the model to convey the flood flow from the upstream reach of the Cam River under proposed Road 1.

Figure 6 shows the flood level results of this modelling.

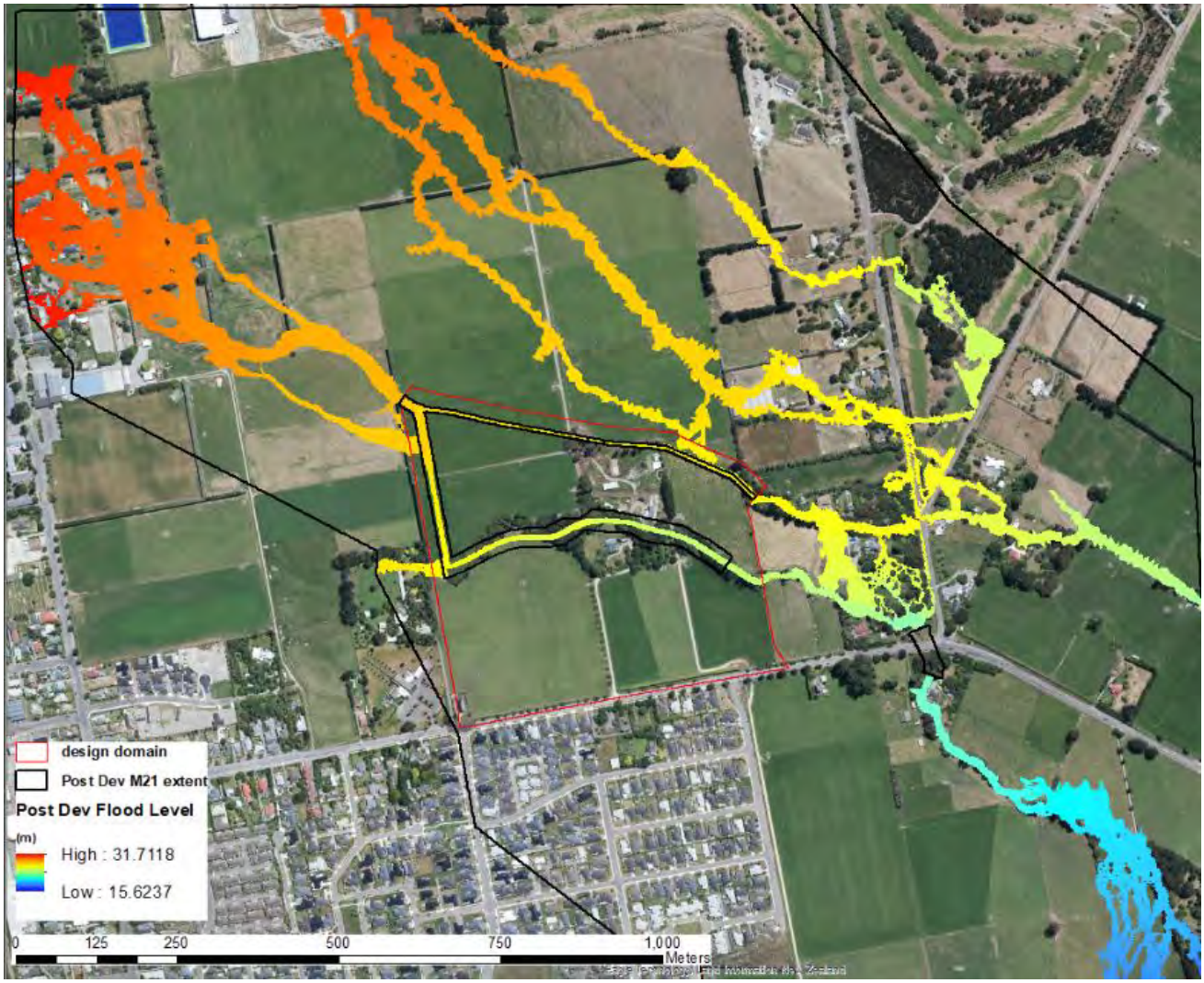


Figure 6 - Post-Development Flood Surface Elevation

The model shows significant improvements with the flood extent within the development being reduced to the channel extents only. The neighbouring property to the east of the Bellgrove development still experiences overland flow from the northern channel but significantly less than pre-development. Flooding along both Golf Links and Rangiora-Woodend Road are also significantly reduced as a result of the stormwater diversion proposed.

Table 1 below summarises the pre and post channel flows from the Mike Flood model.

Channel	Pre-development Flow (m3/s)	Post-development Flow (m3/s)
Northern Flow Path / Flow Channel	10.8	3.4
Western Bypass Channel	-	*7.4*
Cam River	1.3	8.8
Flow from Cold Stream Road	0.5	0.5
Total	***12.6***	***12.7***

Table 1 - Pre and post modelled channel flows throughout the development

Figure 7 shows the flood level difference between post-development and pre-development.

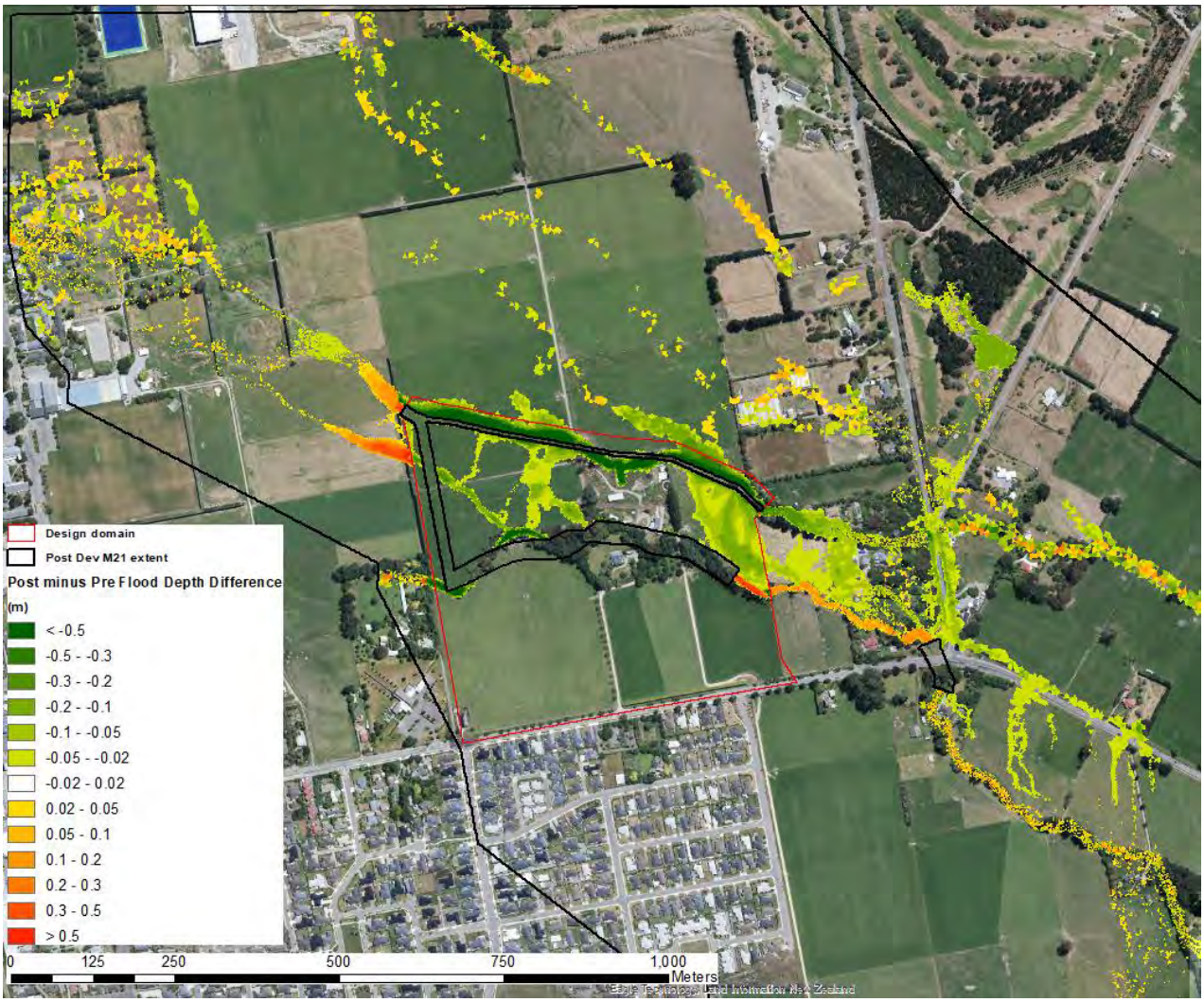


Figure 7 – Flood Depth Difference Map: Post-development minus Pre-development

There is a small area at the far south-east corner of the map showing both plus and minus 20-50mm impact, however this is considered modelling 'noise' as the generated surface mesh varies slightly between the pre and post models.

There are also several isolated areas to the north of the Bellgrove development that show 'plus and minus' impacts on the difference map. Again, this is understood to be a result of the pre and post model mesh generation discrepancies, as there is no logical reason that the proposed stormwater management system would have an isolated impact in these areas as shown.

There are extents immediately downstream from the Kippenberger Ave culvert that show 50-100mm impacts within the channel. It should be noted that the pre-development, a portion of this flow was spilling uncontrolled down Golf Links Road and into Rangiora Woodend Road then making its way into the Cam river across the southern block. The proposed works capture this water early and control it through the Kippenberger Ave culvert and hence the minor increase in controlled channel flow here is expected and seen as an improvement. Further down the channel (past the pre-development ingress point) the impact reduces to negligible as expected. As depth increases are within the channel extent this is not considered to be an increase in flooding risk to the neighbouring properties.

There are also two isolated areas showing impacts within the headwaters of the north-west culvert(s) under Road 1 (western most road) proposed for Stage 1 of the development. This impact is believed to be acceptable as it is a rural zone and contained within the banks of the existing channel which have been demonstrated in the pre-development modelling to already be wet. Figures 8 and 9 below show a comparison between the pre and post development flooding extents during this 200yr ARI breakout event.

Figure 8 - Pre-development 200yr Flooding

Figure 9 - Post Development 200yr Flooding

The peak flows upstream and downstream of this culvert, as demonstrated in Table 1 above, are matched (10.8m3/s) and therefore no attenuation is believed to be occurring here. There is a small depth of flow shown to spill from the top headwater south, however this is considered negligible as it is 20-30mm and in an area that will be filled to meet the levels of Road 1, should the school block be developed in the future.

5 Downstream Effects

As a result of diverting flood water directly into the Cam River at the top end of the site, the modelling has shown a reduction in the net conveyance from the site east via the Northern Flow channel and Taranaki, and an increase in the conveyance south via the Cam River. WDC have requested that the resultant flow split (downstream from Bellgrove North) between the Taranaki Channel and Cam River be kept as close to pre-development as possible, to prevent adverse impacts further downstream at flood plains and flood management areas.

Flow and volume extractions at the downstream extents of the two channels have been plotted and are shown below in Figures 10 and 11. There is a reduction in the peak flow and total volume conveyed in the d/s Taranaki channel, and conversely, an increase in peak flow and volume conveyed in the d/s Cam River. The results suggest a reduction of around 40,000m3 of flood water being conveyed east via the Taranaki. The peak channel flow reduced from 1.98m3/s (pre-development) to 1.66m3/s (post-development). The modelled peak channel flow in the downstream Cam River increases from 10.41m3/s to 10.65m3/s (2%). The modelled increase in volume down the Cam River is around 60,000m3.

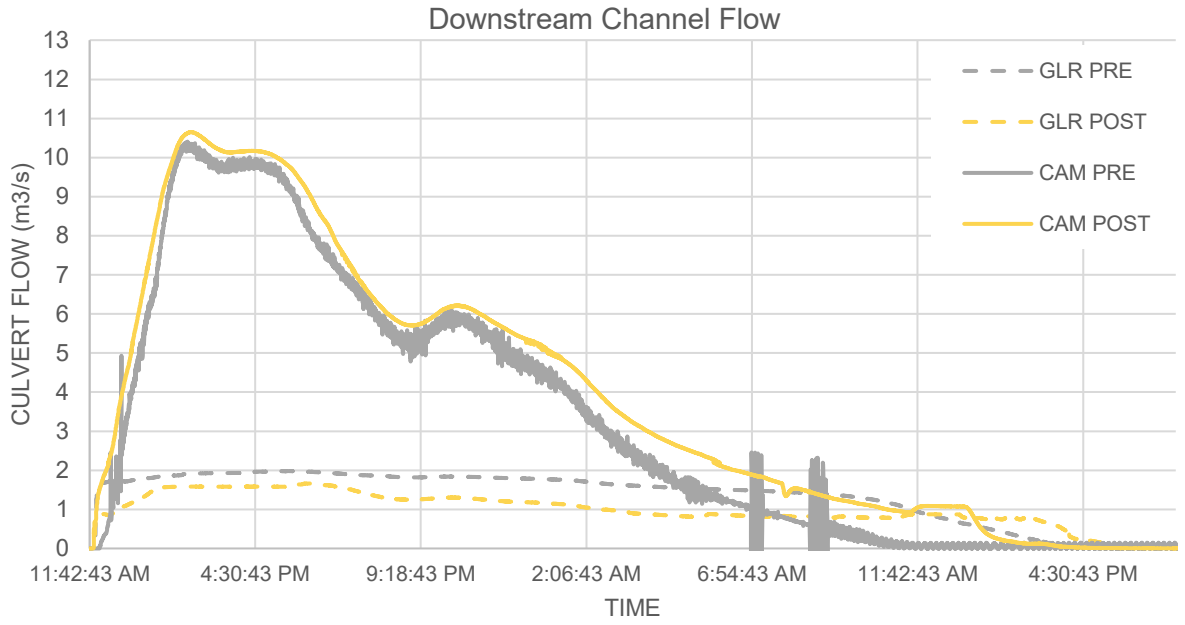


Figure 10 - Flow in downstream channels

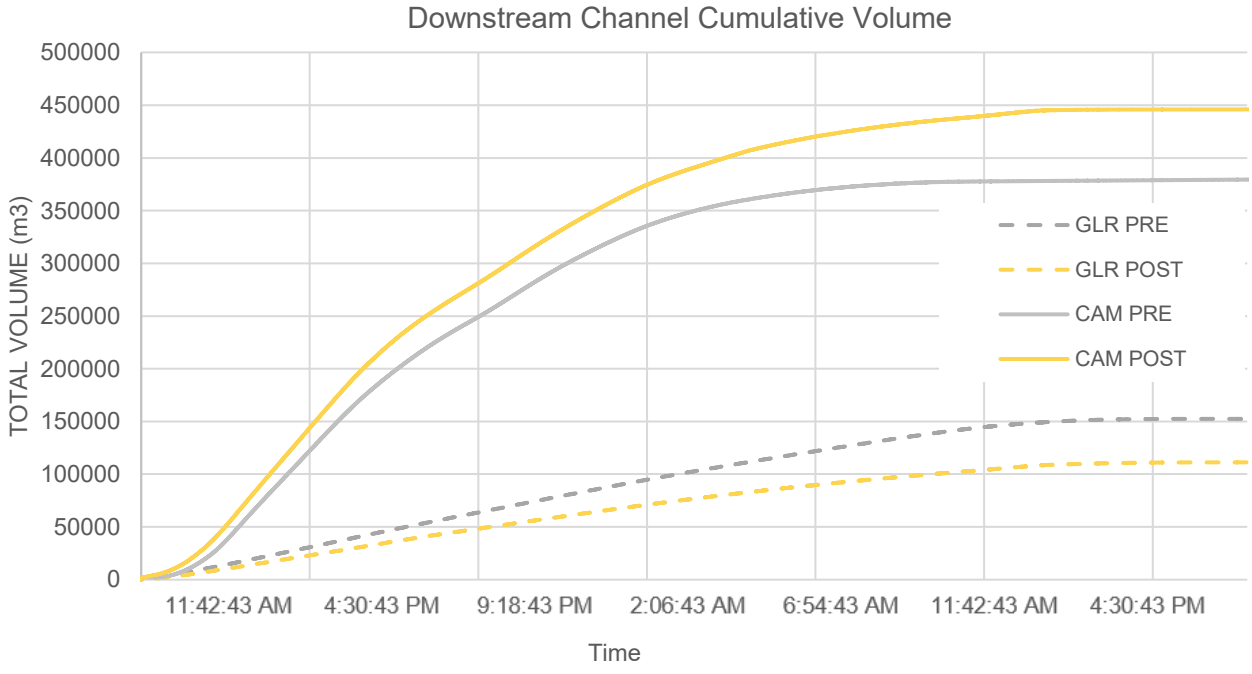


Figure 11 - Total volume conveyed through downstream channels

5.1 On-site Attenuation

The above modelling shows several flood improvements across the site, neighbouring properties and roads; however, it does show a minor (2%) increase in peak flow and volume (15%) down the Cam River, which WDC have expressed is still a concern.

There are several benefits (not accounted for the in the flood model) from the multiple stormwater soakage basins (and private soakpits) within the Bellgrove North site. The basins within the site will provide storage and ground infiltration that will attenuate both post-development peak flows and runoff volumes to **below** pre-development levels – and therefore offset the above modelled increase in net flow and volume in the Cam River.

The following analytical calculations were based on a similar 200-year ARI – 24-hour storm event as per the above numerical modelling and have been used to compare on-site attenuation benefits against modelled increases outside of the site.

5.1.1 Peak Flow Attenuation

The peak flow from the pre-development (existing) site over a 24-hour storm event is expected to be approximately 0.53m^3/s. The post-development peak flow is expected to increase to 0.72m^3/s. The ground infiltration across the numerous stormwater basins within the development is expected to be 0.44m3/s. Conservatively assuming all basins are full at the peak stage of the storm, the resultant excess peak flow spilling into the Cam River (flow that is not soaked to ground) would be approximately 0.28m^3/s. The development is therefore expected to reduce the excess peak flow into the Cam River (for this given storm event) by around 0.25 m^3/s compared with pre-development conditions. As the above modelled peak flow increase in the Cam River is 0.24m^3/s, the calculated on-site attenuation from the basins within the development is expected to offset this and mitigate any increase in the downstream reaches of the Cam River.

5.1.2 Volume Attenuation

The runoff volume from the pre-development (existing) site, which is largely farmland, over a 24-hour storm event is expected to be approximately 45,000m3. The post-development runoff volumes is expected to increase to 63,000m3 once the new subdivision is built. The calculated combined soakage to ground and storage across the numerous stormwater basins within the development (over a 24-hour period) is 58,000m3. This suggests that, post development, the resultant excess runoff volume spilling into the Cam River would be approximately 5,000m3. The development is therefore expected to reduce the net runoff volume into the Cam River (for this given storm event) by around 40,000m3 compared with pre-development conditions. This would therefore offset the above modelled cumulative volume increase of 60,000m3 back to around 20,000m3.

The area downstream from the site deemed “high flooding hazard” north-west of Kaiapoi, shown on the latest WDC 200 year flood map, is estimated to be >870 hectares. Therefore an additional 20,000m3 of water being conveyed to this area is expected to induce less than 3mm increase in depth. WDC have indicated that any impact less than 15mm within this flood zone is considered negligible. Refer to Figure 12 below for the flood zone extent NW of Kaiapoi.

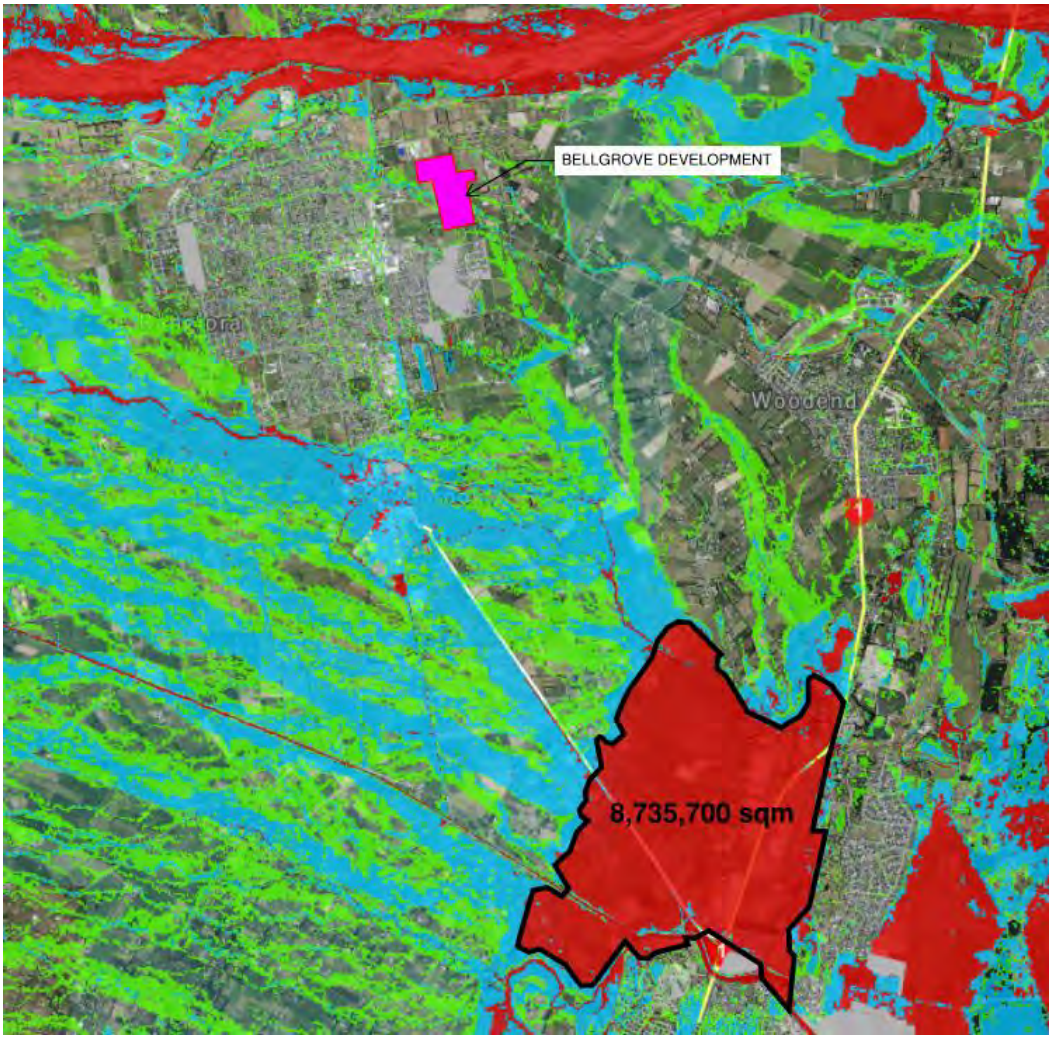


Figure 12 - High Hazard 'Flood Zone' downstream from the development

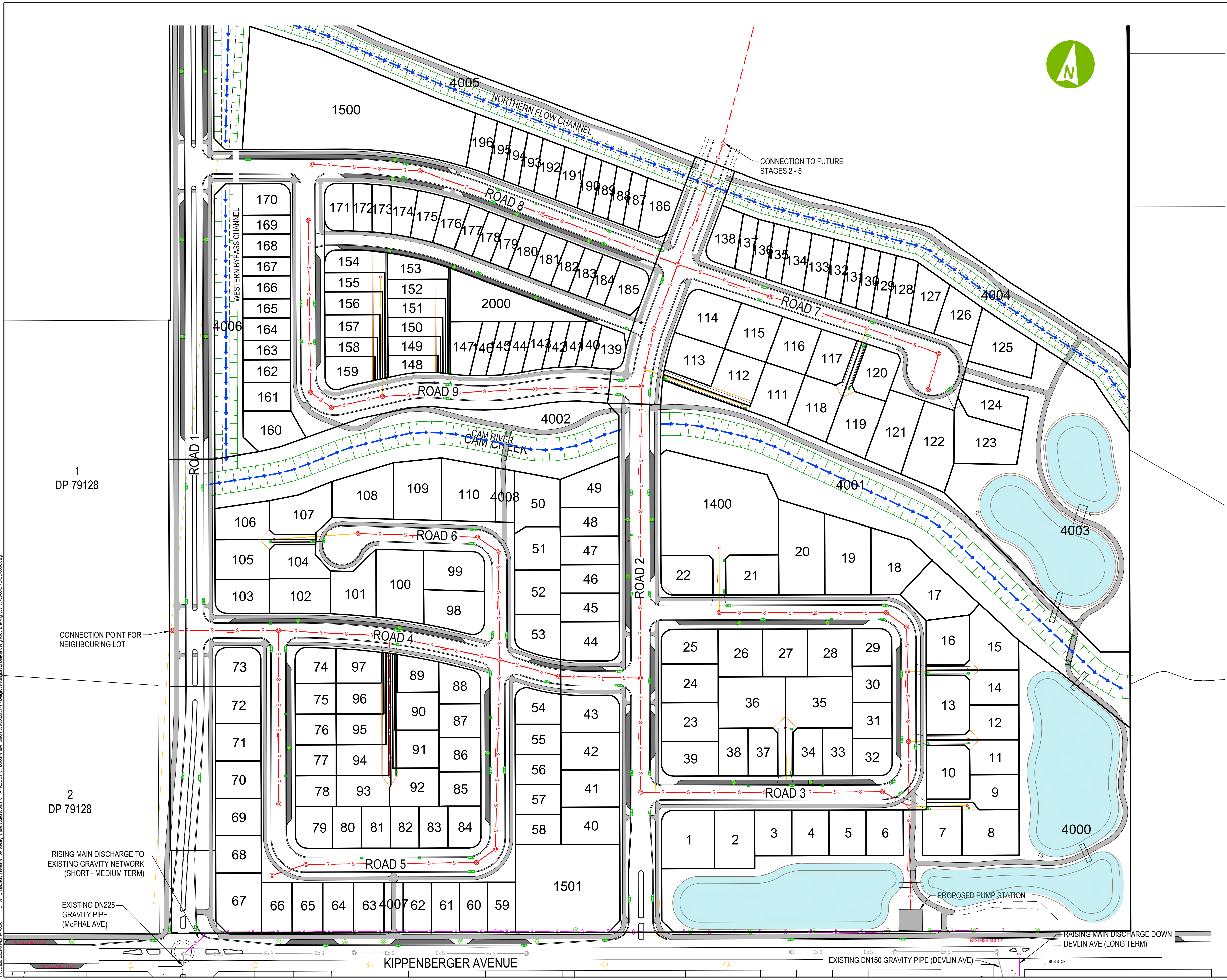
6 Summary

The above modelling has shown that the proposed realignment and development around the Cam River and the Northern Flow Channel, along with the addition of culverts as required at road crossings, manages to maintain or improve the flows through the site during the 0.5% AEP (1 in 200 year) Ashley River break out event without significant impacts locally or within the Kaiapoi Flood Plain further downstream. The proposed stormwater diversion is shown to significantly reduce flooding across the property east of the Bellgrove development as well as reduce flooding along both Golf Links and Rangiora-Woodend Road.

Isolated areas showing as minor impacts on the difference map are interpreted as modelling noise due to mesh generation discrepancies, and all other impact areas are within defined channel banks and expected as a result of the proposed drainage realignment.

The minor peak flow and volume increase modelled in the downstream section of the Cam River has been shown to be offset by the on-site basin attenuation and additional opportunities to infiltrate stormwater runoff to ground (private soakpits). Any downstream flood depth impacts in the Kaiapoi Flood Zone have been demonstrated to be less than 3mm which is believed to be acceptable.

Appendix I – Wastewater



LEGEND

- EXISTING SEWER
- PROPOSED WASTEWATER MAIN
- PROPOSED WASTEWATER LATERAL
- PROPOSED COMMON LATERAL CONNECTION
- PROPOSED RISING MAIN
- PROPOSED CIRCULAR PRECAST MANHOLE TO SD303/1
- PROPOSED Ø600 INSPECTION CHAMBER

NOTES:

1. FOR CLARITY INDIVIDUAL LATERALS FROM PROPERTIES HAVE NOT BEEN SHOWN.

aurecon
www.aurecongroup.com

CLIENT: Bellgrove RANGIORA

REV	DATE	REVISION DETAILS	APPROVED
C	2022-01-20	REVISED LOT LATOUT	J TRIST
B	2021-12-17	CORNER ROUNDING	J TRIST
A	2021-10-22	FOR CONSENT	J TRIST

SCALE	SIZE
1:1000	A1

DRAWN: R DAWSON
DESIGNED: I DUNCAN
REVIEWED: D WATSON

FOR INFORMATION
NOT FOR CONSTRUCTION

APPROVED: J TRIST
DATE

PROJECT: BELLGROVE, RANGIORA

TITLE: STAGE 1 PRELIMINARY WASTEWATER LAYOUT

DRAWING No.	PROJECT No.	AREA	TYPE	DISC	NUMBER	REV
	509177	0000	DRG	CC	0300	C

Appendix J – Water Supply

CLIENT	REV	DATE	REVISION DETAILS	APPROVED
Bellgrove RANGIORA	C	2022-01-20	REVISED LOT LAYOUT	J TRIST
	B	2021-12-17	CORNER ROUNDING	J TRIST
	A	2021-10-22	FOR CONSENT	J TRIST

aurecon
www.aurecongroup.com

SCALE	1:1000
SIZE	A1
DRAWN	R DAWSON
DESIGNED	I DUNCAN
REVIEWED	D WATSON
APPROVED	J TRIST
DATE	

FOR CONSENT
NOT FOR CONSTRUCTION

PROJECT	BELLGROVE, RANGIORA
TITLE	STAGE 1 PRELIMINARY WATER LAYOUT
DRAWING No.	PROJECT No. 509177 – AREA 0000 – TYPE DRG – DISC CC – NUMBER 0400 – REV C

Appendix K – Utilities

MainPower New Zealand Limited
172 Fernside Road, RD 1, Kaiapoi 7691
PO Box 346, Rangiora 7440
T. +64 3 311 8300 F. +64 3 311 8301

24th November 2021

BELLGROVE
Rangiora Ltd

ATTN: Jason Trist

Dear Jason,

Re: Bellgrove subdivision

MainPower confirms that the electrical reticulation required for the Bellgrove development can be supplied as per concept plans provided.

The existing 33,000 high voltage line that currently runs through the development will be decommissioned and removed as part of this project.

Please do not hesitate to contact me if you have any questions.

Yours faithfully

Mark Appleman
Network General Manager

Approved S. Wilson
16/09/21

Joint new 11kV onto existing 11KV on pole 1J3Y. Pole 1J3Z to be stay pole recover 1MKV OH West

Link cct from Site 7134 add as much load as volt drop will allow.

LB1

LB1

LB1

LB1

LB1

LB2

750Kva

Commercial 200A

Bar Restaurant 200A

300AL cable

150mm Duct

Joint new 11kV onto existing 11kV at pole 22FA. Pole 1J3N to be stay pole.

Link cct from Site 174M:8 add as much load as volt drop will allow

New cct from Site 174M add as much load as volt drop will allow

KIPPENBERGER AVENUE

39

41

43

45

47

51

53

55

76

DOCUMENT TRANSMITTAL NOTICE

connetics
ALL WAYS CONNECTING
DESIGN + ENGINEERING

Project Bellgrove Rangiora - Stage 1 - 52 Kippenberger Ave

Project No 4007410

Discipline Lighting Design

Page 1 of 1

		Date of Issue									
Year		21	21								
Month		10	11								
Day		12	3								

Doc. No.	Document Title	Rev	Issue								
400157	Bellgrove Rangiora Sub-Division - Stage 1A-B-C-D - Sheet 1	B	A	B							
400157	Bellgrove Rangiora Sub-Division - Stage 1A-B-C-D - Sheet 2	B	A	B							
400157	Bellgrove Rangiora Sub-Division - Stage 1A-B-C-D - Sheet 3	B	A	B							
400157	Bellgrove Rangiora Sub-Division - Stage 1A-B-C-D - Sheet 4	B	A	B							
400157	Bellgrove Rangiora Sub-Division - Stage 1A-B-C-D - Sheet 5	B	A	B							
400157	Bellgrove Rangiora Sub-Division - Stage 1A-B-C-D - Sheet 6	B	A	B							
	Pole Offset drawing										
400157	Autocad DWG Format										
	Producer Statement										
	Design Report										
	Street Lighting Specification										
	15.0m Road - Road 1 (V4) - Dual-Central										
	22.0m Road - Road 2 - Single Sided										
	22.0m Road - Road 2 - Staggered										
	18.0m Road - Road 3-4-5-8 - Single Sided										
	18.0m Road - Road 3-4-5-8 - Staggere										
	18.0m Road - Road 9 - 5.1m Offset Single Sided										
	18.0m Road - Road 9 - 5.1m Offset Staggered										
	18.0m Road - Road 9 - 5.5m Offset Single Sided										
	18.0m Road - Road 9 - 5.5m Offset Staggered										
	16.0m Road - Road 6-7 - Single Sided										
	16.0m Road - Road 6-7 - Single Sided										
	AGI Compliance Plot										
	Windsor Urban Column Drawing - Column L1-L2										
	Column Producer Statement - Windsor Urban										
	Column Structural Compliance Certificate - Windsor Urban										
	Spunlite Poles Drawing - Column L3										
	Spunlite Poles Drawing - Column L4										
	Column Producer Statement - Spunlite Poles										
	Column Structural Compliance Certificate - Spunlite Poles										
224	Lighting Completion Form (Spunlite Poles)										
	Lighting Completion Form (Installer)										
	Orion Test Certificate										
	Certificate of Compliance										
	As-Built Drawings										

DELIVERY - Company Name	Attention	COPIES									
Aurecon Group	Jason Trist	#	#								
Spunlite Poles Ltd	Marcus Brandrick	#	#								
Reason For Issue		P	P								

***P** - Preliminary / **A** - Approval / **T** - Tender / **C** - Construction / **X** - 224 / **RQ** -Requested*

Document Type Symbol

PDF	#
A4 Copy	*
A3 Copy	**
A1 Copy	***

Connetics Ltd
11 Islington Avenue *P: (03) 353 7200*
Islington *F: (03) 353 7201*
Christchurch 8042 *E: www.connetics.co.nz*

LIGHTING SCHEDULE

L1 Install new luminaire on new column. (See Luminaire & Column Notes 1 to 8)
Luminaire: OrangeTek Terraled Mini 18 MX1 XPG3 4000K 350mA - 20W luminaire, Color: Black
Column: 7.5m MH Standard Decorative Stepped C Column complete with single 1.0m XXX outreach arm. Color: Black.
Connection: Connect to U/G SLN

L2 Install new luminaire on new column. (See Luminaire & Column Notes 1 to 8)
Luminaire: LED Roadway NXT-S 52W 36LED 450mA 4000k Type 4AH luminaire, Color: Black.
Column: 7.5m MH Standard Decorative Stepped C Column complete with single 2.0m XXX outreach arm. Color: Black.
Connection: Connect to U/G SLN

L3 Install new luminaire on new column. (See Luminaire & Column Notes 1 to 8)
Luminaire: LED Roadway NXT-S 60W 36LED 525mA 4000k Type 2ES luminaire, Color: Grey (RAL 7035)
Column: 10.3m MH Standard Octagonal Lighting Column complete with Double 3.0m curved outreach arm. Color: Galvanized.
Connection: Connect to U/G SLN

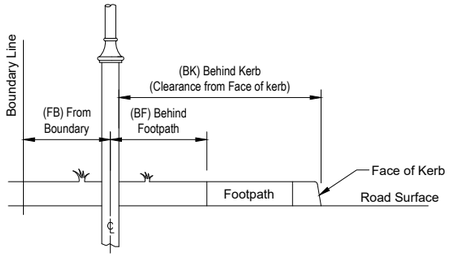
L4 Install new luminaire on new column. (See Luminaire & Column Notes 1 to 8)
Luminaire: LED Roadway NXT-S 60W 36LED 525mA 4000k Type 2ES luminaire, Color: Grey (RAL 7035)
Column: 10.3m MH Standard Octagonal Lighting Column complete with Single 3.0m curved outreach arm. Color: Galvanized.
Connection: Connect to U/G SLN

MAXIMUM DESIGN SPACING

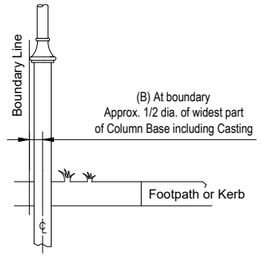
Street Name	Width	Arrangement Type*	Max Spacing
Road 1 - (V4)	15.0m	Dual-Central	60.0m
Road 2	22.0m	Single Sided	50.6m
Road 2	22.0m	Staggered	59.8m
Road 3-4-5-8	18.0m	Single Sided	57.9m
Road 3-4-5-8	18.0m	Staggered	60.4m
Road 9 - 5.1m Offset	18.0m	Single Sided	59.9m
Road 9 - 5.1m Offset	18.0m	Staggered	60.4m
Road 9 - 5.5m Offset	18.0m	Single Sided	59.8m
Road 9 - 5.5m Offset	18.0m	Staggered	60.5m
Road 6-7	16.0m	Single Sided	59.7m
Road 6-7	16.0m	Staggered	60.2m

* = Arrangement type as per AS/NZS 1158.2:2020 Fig. 5.1

TYPICAL COLUMN POSITION:



Column to be installed from Boundary Line, Behind Footpath or from Face of Kerb



Column to be installed at Boundary Line

ISSUED FOR INFORMATION
Wednesday, November 3, 2021 10:26:20 AM
NOT FOR CONSTRUCTION

SYMBOLS:

E	Existing column / pole, outreach arm and luminaire to remain.
R	Remove column / pole, outreach arm and luminaire.
R	Remove outreach arm and luminaire, existing Pole to remain.
Lx	New luminaire on new or existing outreach arm.
Lx	New column / pole, Single outreach arm and luminaire.

SYMBOLS LEGEND:

LX — Lighting Schedule Reference
XXW — Luminaire Wattage
P1 — Column Identification
0.0m-XX — Column offset
X° — Luminaire Tilt from the horizontal (See Adjustment Table)

Offset Descriptions

B	At Boundary
BEOS	Behind Edge of Seal
BEL	Behind Edge Line
BF	Behind Footpath
BK	Behind Kerb
FB	From Boundary
FEOS	From Edge of Seal
M	Center of Median

For Decorative Tubular and Octagonal Column

With Decorative Arms and 0° Spigot*

Value Shown on Plan	Adjustment on Luminaire
10°	10°
5°	5°
0°	0°
-5°	-5°

* As per CCC and SDC Standard Column Requirements

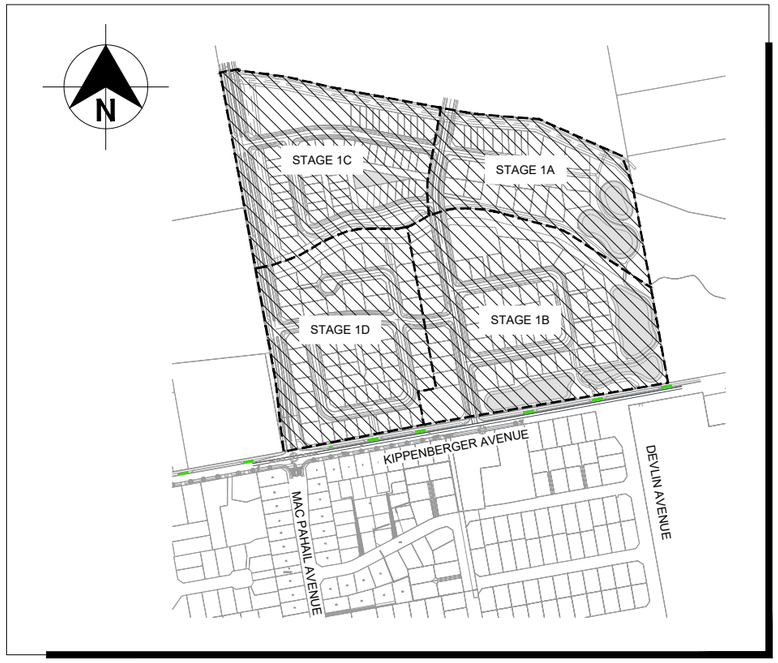
For Sectional Octagonal Column

With Mitred Arms and 5° Spigot*
With Elliptical Arms and 5° Spigot*
With Curved Arms and 5° Spigot*
Subdivisional with 5° Spigot*

Value Shown on Plan	Adjustment on Luminaire
10°	5°
5°	0°
0°	-5°
-5°	-10°

* As per CCC and SDC Standard Column Requirements

KEY PLAN



LUMINAIRE & COLUMN NOTES:

1. Luminaire to be fitted with mounting bracket to fit 42mm spigot.
2. Luminaire to be supplied with an integral TMS compatible dimmable DALI driver suitable for operating at the specified load and a prewired 7 pin NEMA Socket and complete with shorting cap.
3. Luminaire to have an IP rating of IP66 unless stated otherwise.
4. Luminaire colour temperature to be 4000K
5. Luminaire to have Identification label applied at time of installation.

NOTES:

1. Road illumination is designed to comply with AS/NZS 1158; subcategory PR4, V4 and WDC "Code of Practice Part 11" and NZTA M30. Refer to lighting specification for lighting installation requirements.
2. Consult the designer for any lighting installation works that conflict on site. eg. recorded or unrecorded services.
3. On completion documentation, record GPS location of all new Lighting columns.
4. New column location to be marked by the main contractor surveyor.
5. Existing Services Identified in this design are indicative only and it is the contractor responsibility to locate any existing services by contacting BeforeUdig at https://www.beforeudig.co.nz before the start of any underground work.

SPUNLITE NOTE:

The use of this **FREE** Lighting design, is authorised by Windsor Urban Ltd and Spunlite Poles Ltd, and is conditional upon the specified lighting items(columns and luminaires), being purchased directly from Windsor Urban Ltd and Spunlite Poles Ltd, or our nominated agents. All nominated installing agents are to contact Windsor Urban Ltd and Spunlite Poles Ltd, to obtain product prices related to this project.

Any use of alternative manufacturer's products, differing from those listed in this design, and installed by any contractor, will automatically forfeit the right to use this intellectual property (lighting design).

Windsor Urban Ltd and Spunlite Poles Ltd hold all copyrights to any of our designs and manufactured products in accordance with the Berne Convention.

The lighting designer reserves the right to request that any alternative products, sourced from a non-listed manufacturer, be removed and replaced with the specified products, prior to any audit being conducted.

1 : 1500

1 : 1000

Rev	Description	Date	Des	Dn	Chk	Apd	Or Acp	Contractor
A	Issued to Client for Comments	09/08/21	RSD	RSD	·	·	·	·
B	Issued to Client for Comments	03/11/21	RSD	RSD	·	·	·	·

Designed	R. St-Denis / Conn	Sept 21
Drawn	R. St-Denis / Conn	Sept 21
Checked	L. Timan / Conn	-
Approved	B. Cathro / WDC	-
Connetics	-	-

Scale: 1:1000
Revision: B

STREETLIGHTING LAYOUT

Bellgrove Ragiora Stage 1A-B-C-D
52 Kippenberger Ave
Rangiora

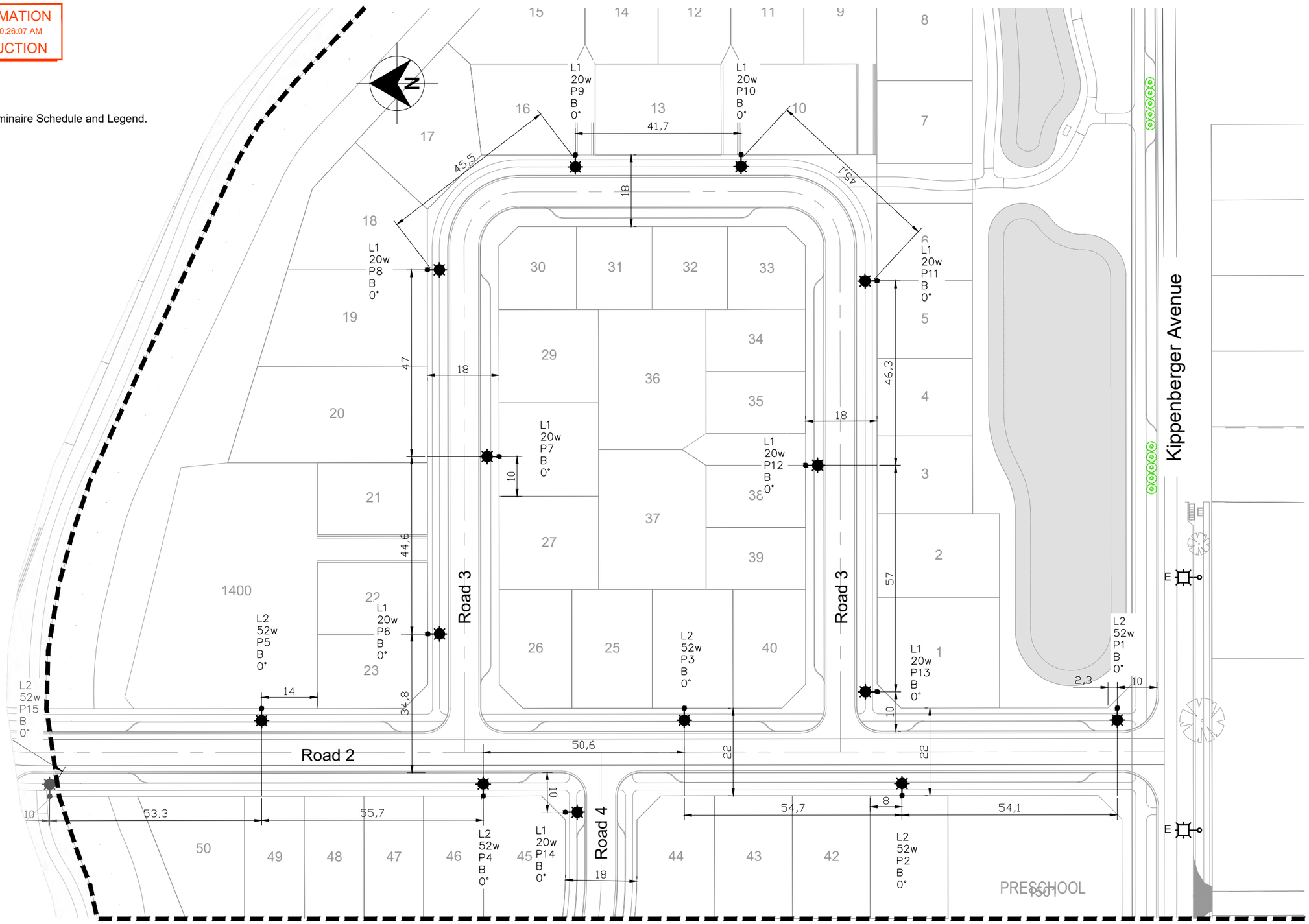
windsorurban LIGHTING FURNITURE
611 Halswell junction Rd, Hornby, Christchurch, NZ
Phone: (03) 349-7853 Fax: (03) 349-6529 Freepk: (0800) 845-845
Inet: www.windsorurban.co.nz

Size	Drawing Number	Sheet
A3	400157	1/6

ISSUED FOR INFORMATION
Wednesday, November 3, 2021 10:26:07 AM
NOT FOR CONSTRUCTION

NOTES:

1. Refer to Sheet 1 for Luminaire Schedule and Legend.



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Rev	Description	Date	Des	Dn	Chk	Apd	Or Acp	Contractor
A	Issued to Client for Comments	09/08/21	RSD	RSD	·	·	·	·
B	Issued to Client for Comments	03/11/21	RSD	RSD	·	·	·	·

Designed	R. St-Denis / Conn	Oct 21
Drawn	R. St-Denis / Conn	Oct 21
Checked	L. Timan / Conn	-
Approved	B. Cathro / WDC	-
Connetics	-	-

Scale: 1:1000
Revision: B

STREETLIGHTING LAYOUT

Bellgrove Ragiora - Stage 1A
52 Kippenberger Ave
Rangiora

windsorurban LIGHTING FURNITURE
611 Halswell junction Rd, Hornby, Christchurch, NZ
Phone: (03) 349-7853 Fax: (03) 349-6529 Freepk: (0800) 845-845
Inet: www.windsorurban.co.nz

Size	Drawing Number	Sheet
A3	400157	2/6

STAGE 1A - SEE SHEET 2 FOR CONTINUATION

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Wednesday, November 3, 2021 10:25:47 AM
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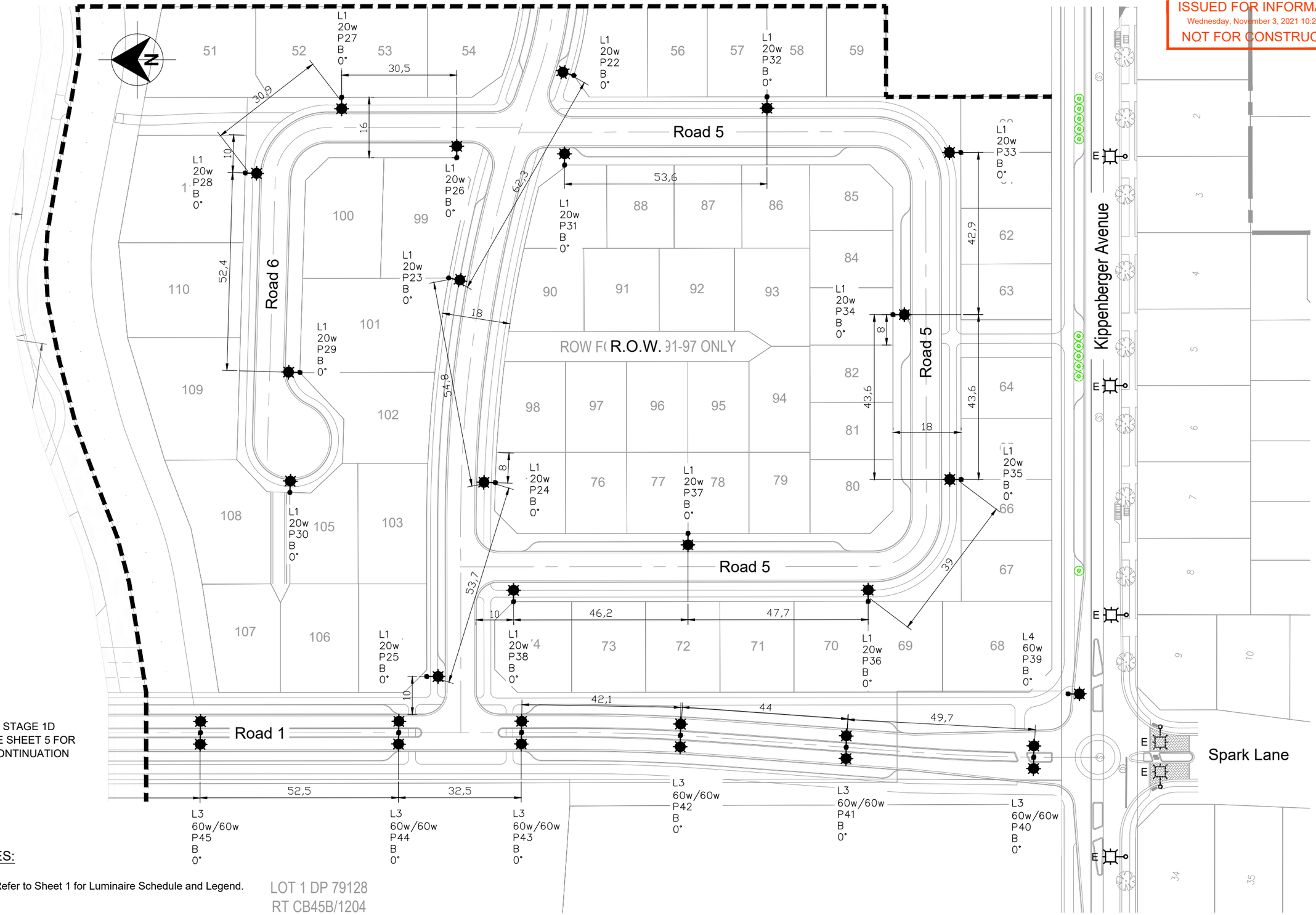

STAGE 1D
SEE SHEET 5 FOR
CONTINUATION

NOTES:

1. Refer to Sheet 1 for Luminaire Schedule and Legend.

LOT 1 DP 79128
RT CB45B/1204

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1 : 1000

Rev	Description	Date	Des	Dn	Chk	Apd	Or Acp	Contractor
A	Issued to Client for Comments	12/10/21	RSD	RSD	·	·	·	·
B	Issued to Client for Comments	03/11/21	RSD	RSD	·	·	·	·

Designed	R. St-Denis / Conn	Oct 21
Drawn	R. St-Denis / Conn	Oct 21
Checked	L. Timan / Conn	-
Approved	B. Cathro / WDC	-
Connetics	-	-

Scale: 1:1000

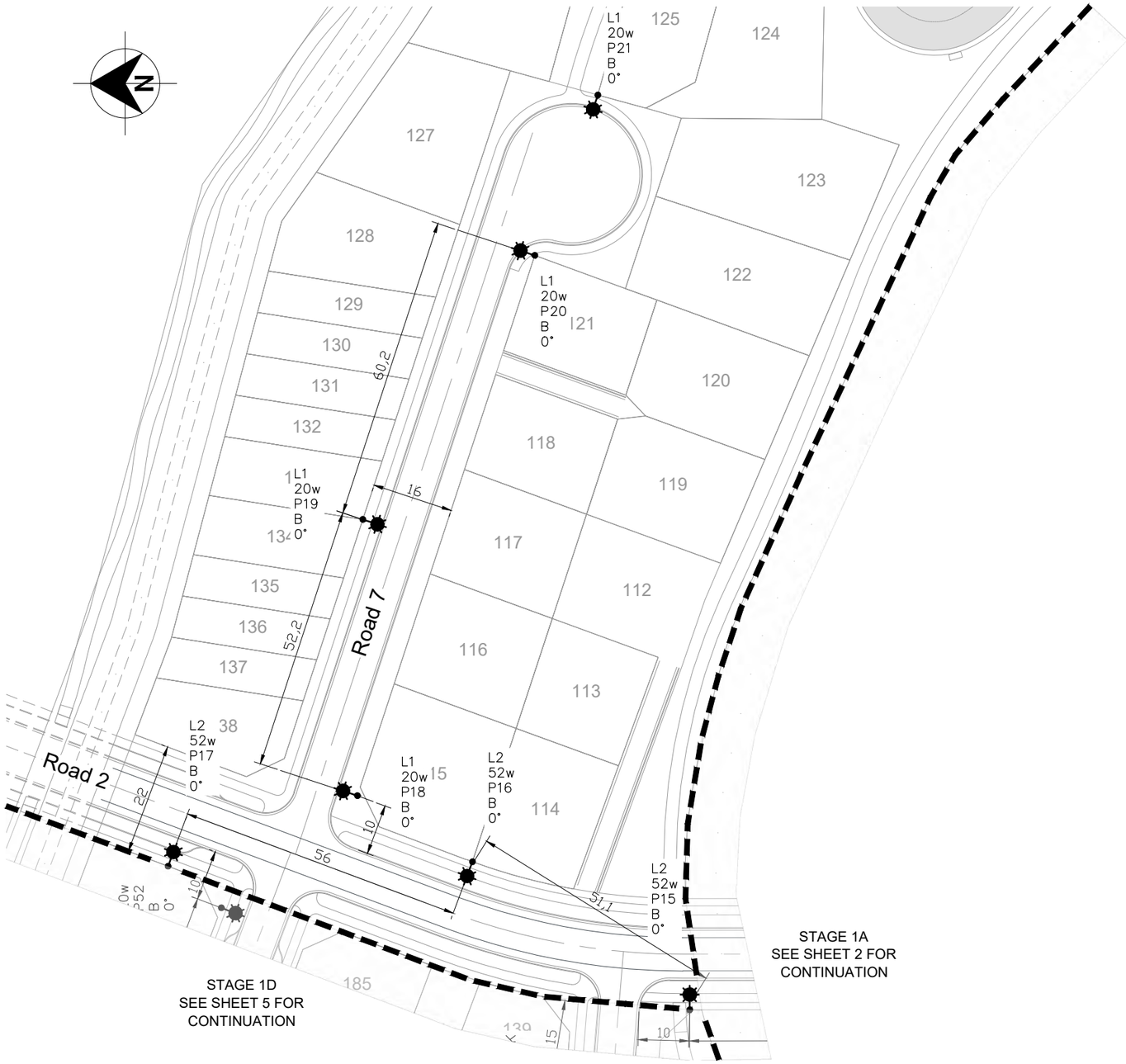
Revision: B

STREETLIGHTING LAYOUT

Bellgrove Ragiora - Stage 1B
52 Kippenberger Ave
Rangiora

windsorurban LIGHTING FURNITURE
611 Halswell junction Rd, Hornby, Christchurch, NZ
Phone: (03) 349-7853 Fax: (03) 349-6529 Freeph: (0800) 845-845
Inet: www.windsorurban.co.nz

Size	Drawing Number	Sheet
A3	400157	3/6



ISSUED FOR INFORMATION
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NOT FOR CONSTRUCTION

NOTES:

1. Refer to Sheet 1 for Luminaire Schedule and Legend.

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B	Issued to Client for Comments	03/11/21	RSD	RSD	·	·	·	·

Designed	R. St-Denis / Conn	Oct 21
Drawn	R. St-Denis / Conn	Oct 21
Checked	L. Timan / Conn	-
Approved	B. Cathro / WDC	-
Connetics	-	-

Scale: 1:1000
Revision: B

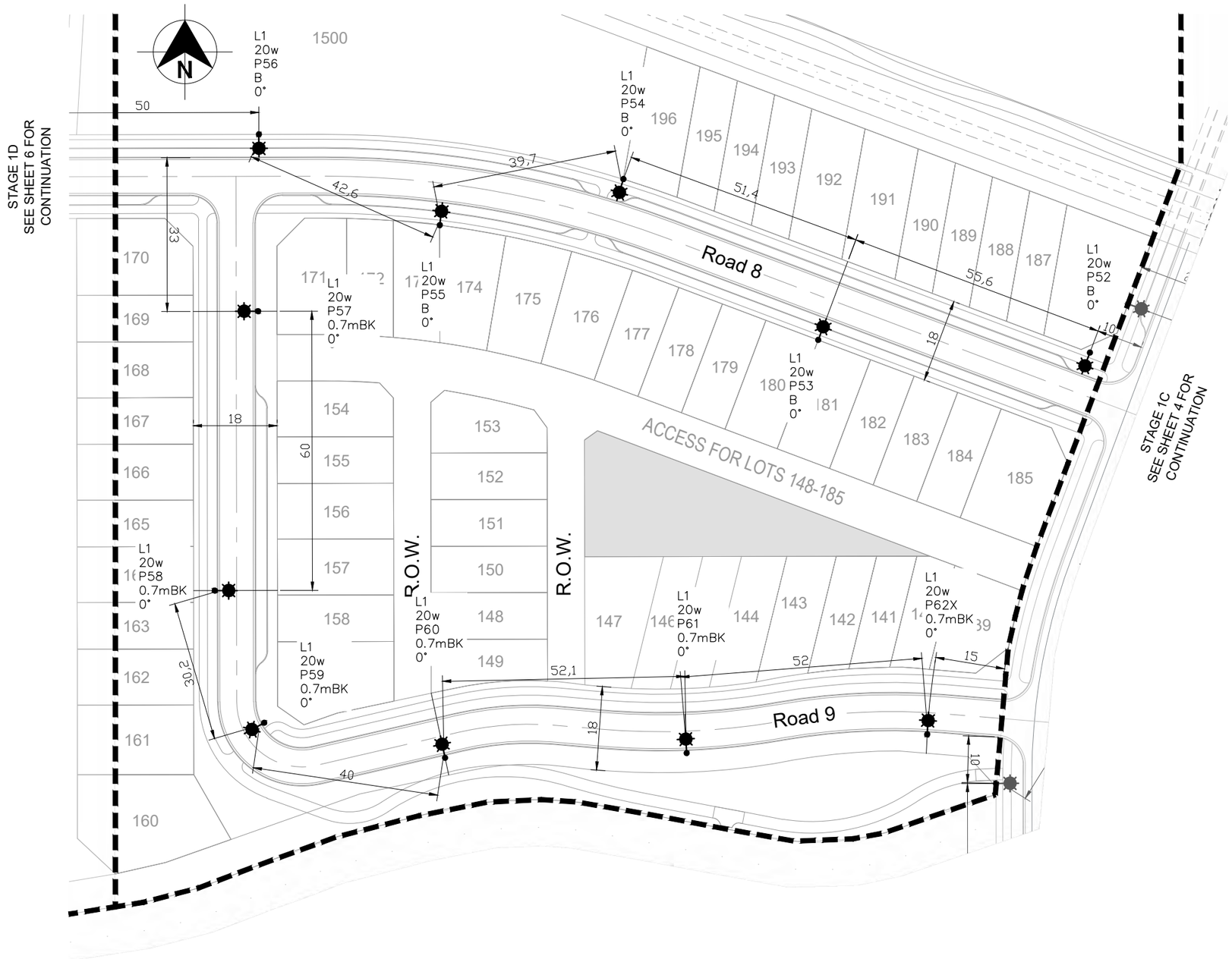
STREETLIGHTING LAYOUT

Bellgrove Ragiora - Stage 1C
52 Kippenberger Ave
Rangiora

windsorurban LIGHTING FURNITURE
611 Halswell junction Rd, Hornby, Christchurch, NZ
Phone: (03) 349-7853 Fax: (03) 349-6529 Freeph: (0800) 845-845
Inet: www.windsorurban.co.nz

Size	Drawing Number	Sheet
A3	400157	4/6

1 : 1500
1 : 1000



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ISSUED FOR INFORMATION
Wednesday, November 3, 2021 10:25:05 AM
NOT FOR CONSTRUCTION

NOTES:

1. Refer to Sheet 1 for Luminaire Schedule and Legend.

Rev	Description	Date	Des	Dn	Chk	Apd	Or Acp	Contractor
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B	Issued to Client for Comments	03/11/21	RSD	RSD	·	·	·	·

Designed	R. St-Denis / Conn	Oct 21
Drawn	R. St-Denis / Conn	Oct 21
Checked	L. Timan / Conn	-
Approved	B. Cathro / WDC	-
Connetics	-	-

Scale: 1:1000

Revision: B

STREETLIGHTING LAYOUT

Bellgrove Ragiora - Stage 1D
52 Kippenberger Ave
Rangiora

windsorurban LIGHTING FURNITURE
611 Halswell junction Rd, Hornby, Christchurch, NZ
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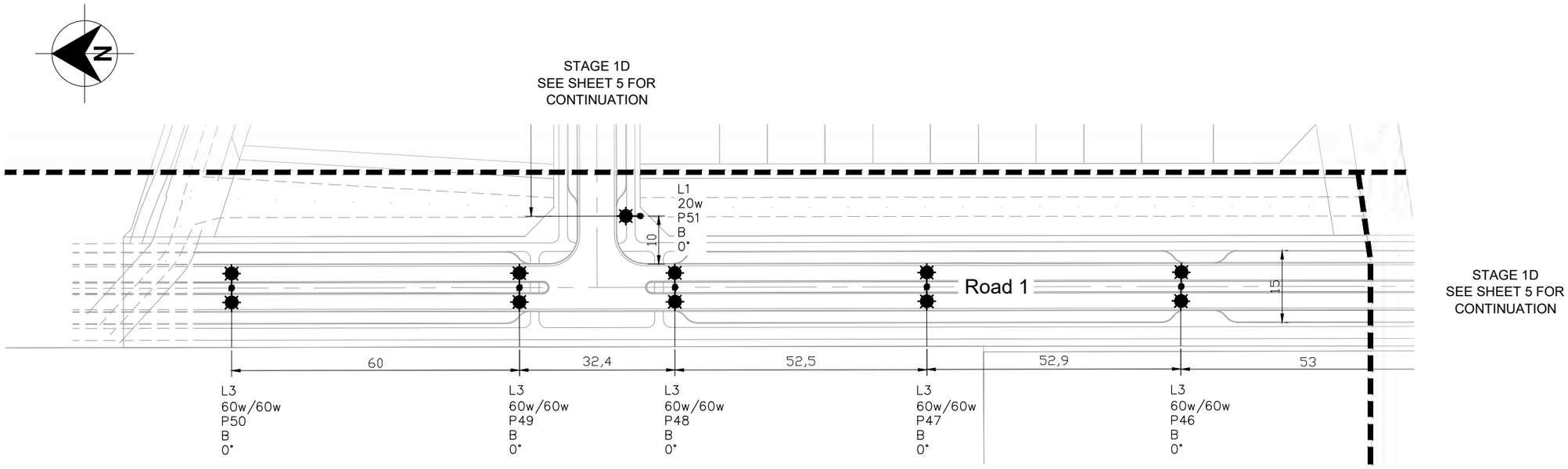
Size	Drawing Number	Sheet
A3	400157	5/6



ISSUED FOR INFORMATION
Wednesday, November 3, 2021 10:24:42 AM
NOT FOR CONSTRUCTION

NOTES:

1. Refer to Sheet 1 for Luminaire Schedule and Legend.

Rev	Description	Date	Des	Dn	Chk	Apd	Or Acp	Contractor
A	Issued to Client for Comments	12/10/21	RSD	RSD	·	·	·	·
B	Issued to Client for Comments	03/11/21	RSD	RSD	·	·	·	·

Designed	R. St-Denis / Conn	Oct 21
Drawn	R. St-Denis / Conn	Oct 21
Checked	L. Timan / Conn	-
Approved	B. Cathro / WDC	-
Connetics	-	-

Scale: 1:1000

Revision: B

STREETLIGHTING LAYOUT

Bellgrove Ragiora - Stage 1D
52 Kippenberger Ave
Rangiora

windsorurban LIGHTING FURNITURE
611 Halswell junction Rd, Hornby, Christchurch, NZ
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Size	Drawing Number	Sheet
A3	400157	6/6

1 : 1500

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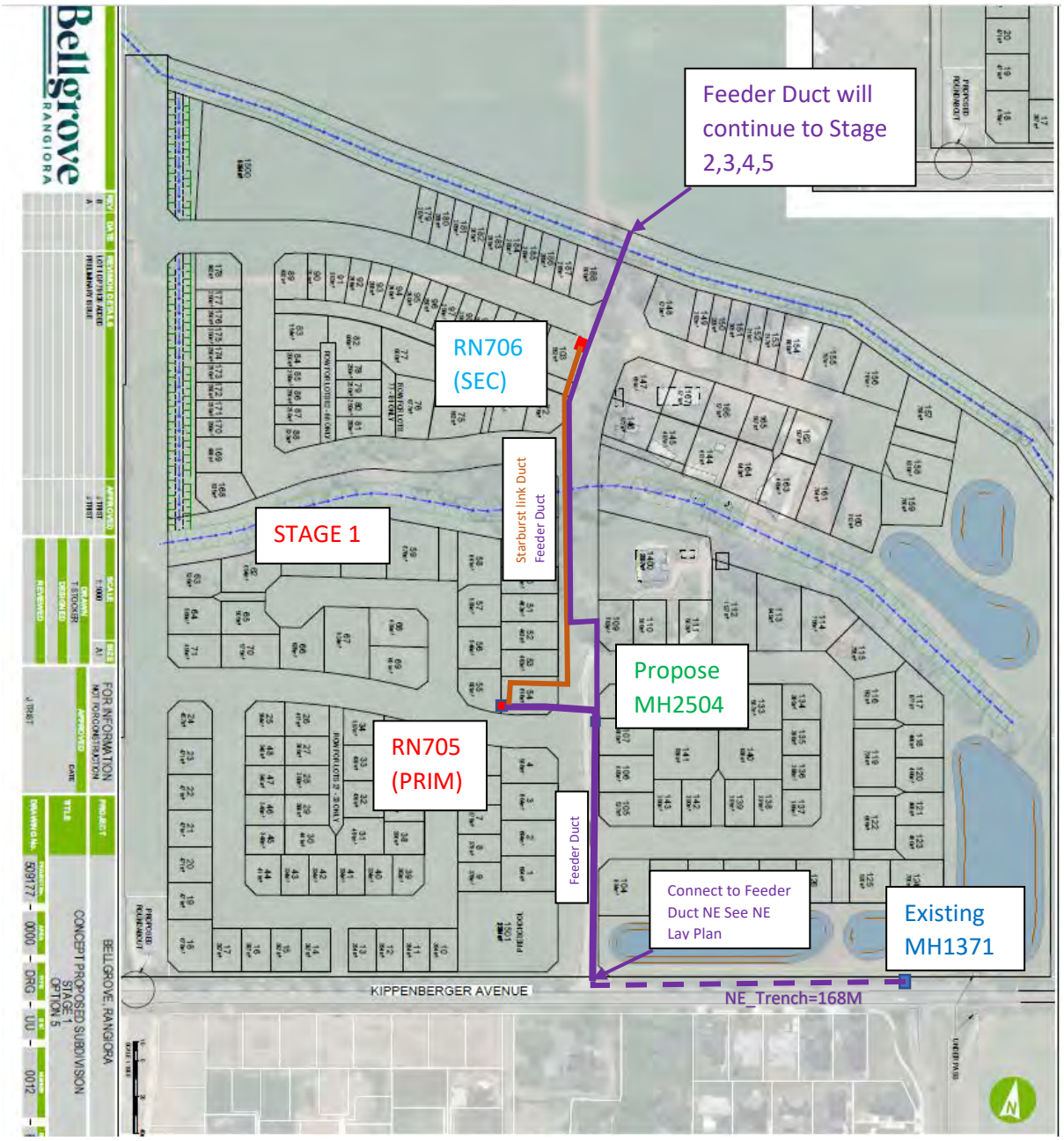
FN990_CIM706387_52 Kippenberger Ave_Bellgrove North S1
Requires Network Extension



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