

Infrastructure Services Report

**Submission to Proposed Waimakariri
District Plan**

Prepared for 199 Johns Road Limited
500189

**eliot
sinclair**

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Quality Control Certificate

Eliot Sinclair & Partners Limited

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Appendix A. Proposed West Rangiora and South West Rangiora Development Integration Plan

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1. Introduction

Eliot Sinclair has been engaged by 199 Johns Road Limited to address the servicing requirements for stormwater, wastewater and drinking water (three waters) for a residential rezoning submission for 163, 191, 199 and 203 Johns Road, Rangiora (the 'Site'), legally described as Lots 1-4 DP 333694. The Site has a total land area of 19.8305 ha and is currently zoned as Rural under the Waimakariri District Plan.

This Infrastructure Servicing Report has been prepared in support of a submission as part of the Waimakariri District Plan review process to confirm the site is not constrained in respect of future residential development, should the rezoning submission to General Residential Zone (GRZ) and Medium Residential Density Zone (MRZ) be successful.

Appendix A provides the Proposed West Rangiora and South West Rangiora Development Integration Plan.

2. Site Description

2.1. General

The Site currently consists of four smaller rural blocks with dwellings on each allotment that are serviced by individual private wells and septic tanks. Historically the Site was pastoral farmland. The Site is bounded by Johns Road to the north. The land to the west is zoned Rural, while the land to the south and east is zoned Residential 2 under the Operative District Plan and includes the new Te Matauru primary school (MOE D092).

The adjoining Residential 2 zone is currently known as the Townsend Fields subdivision. New roads Angus Place, Lusk Place, McCahon Drive and Goldie Drive will provide additional access to this Site once the Townsend Fields development is completed.

This site is within the urban limits of Rangiora and has been identified as a Greenfield Priority Area in the CRPS.

2.2. Existing Services

The Townsend Fields subdivision services were designed with capacity for an approximate 50 ha catchment which includes that of 163, 191, 199 and 203 Johns Road with sewer, water supply and stormwater infrastructure connections being made available.

The Townsend Fields Stormwater Management Area (SMA), located within the South of the subdivision, was designed/sized to provide both treatment and attenuation for a 50 ha upstream catchment which includes that of 163, 191, 199 and 203 Johns Road.

The existing infrastructure capacities are discussed in later sections of this report.

2.3. Topography

The Site has a gently sloping topography towards the south and southeast with a gradient of around 0.5%.

2.4. Geology

Previous geotechnical investigations completed by Eliot Sinclair as part of the Townsend Fields development described the overall area as being underlain by a surface geology comprising of

'unweathered brownish-grey, variable mix of gravels/sand/silt/clay in low river terraces with locally to a 2 m silt cap'.

Geotechnical pre purchase investigations and testing at 199 Johns Road indicated a top soil thickness of 250-350 mm, overlying silt/silty clay and silty sand to a depth of approximately 1.4 m below ground level (bgl) where gravels were encountered.

Geotechnical desktop investigations of 163 Johns Road indicate a top soil of 200-300 mm overlying clay bound gravels that extended to at least 12 m bgl.

Generally the soils across the entire area comprise of around 0.3 m depth of topsoil, with and underlying mix of sands, silts, clays and gravels.

2.5. Hydrogeology

Groundwater within the local vicinity is within the unconfined/semi-confined aquifer zone and groundwater flows in a southeast direction (Canterbury Maps, 2021).

For the period 2011-2015, groundwater levels were monitored frequently by Eliot Sinclair as part of the Townsend Fields development design, at the six locations shown in Figure 1.

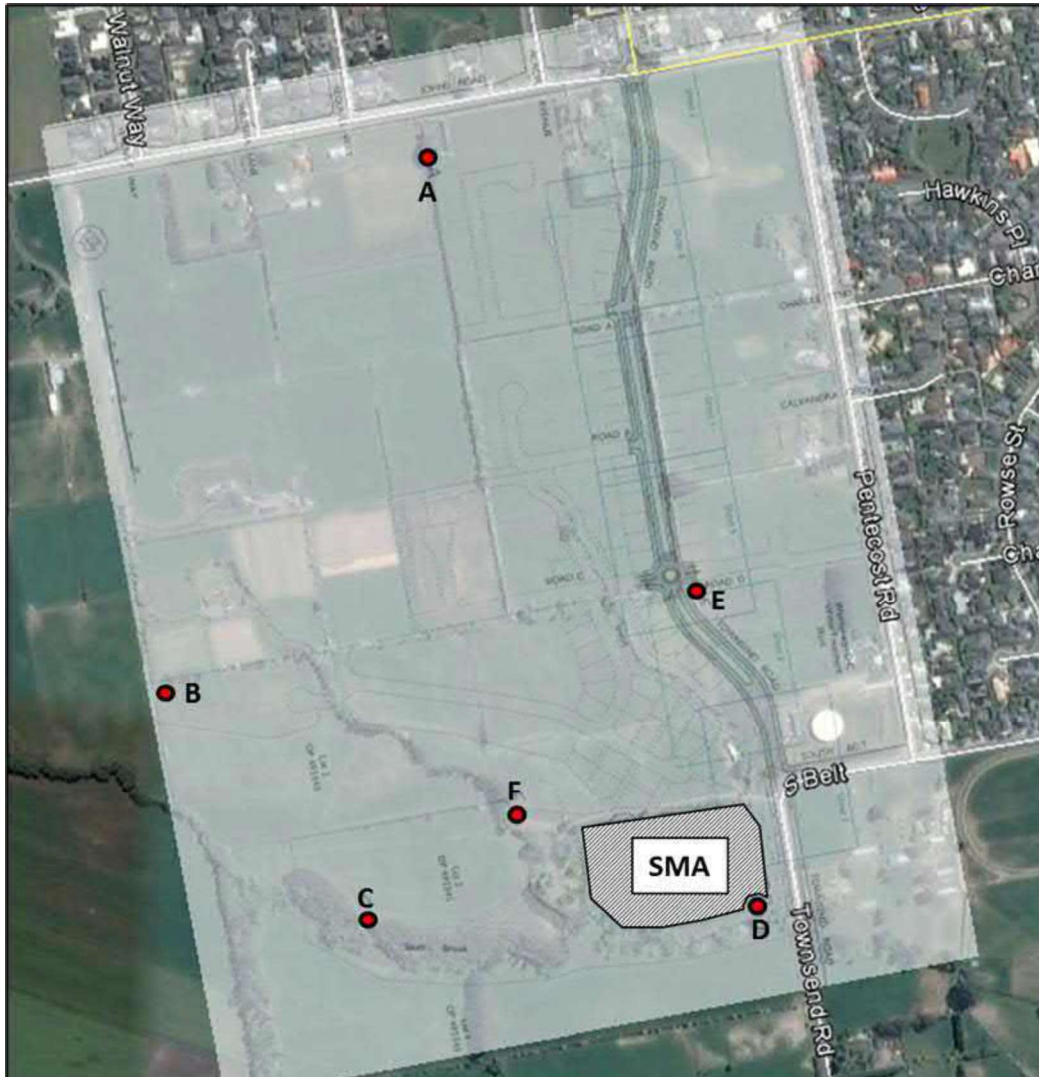


Figure 1. Groundwater Monitoring Locations (2011-2015)

Table 1 provides the recorded groundwater monitoring depths (2011-2015) and indicates a seasonal fluctuation across the monitoring area of 0.4 m – 0.5m.

Table 1. Groundwater Monitoring Depths (2011 – 2015)

| Bore | Lowest Groundwater (m bgl) | Mean Groundwater (m bgl) | Highest Groundwater (m bgl) |
|------|-------------------------------|-----------------------------|--------------------------------|
| A | 3.8 | 2.7 | 0.9 |
| B | 1.4 | 0.9 | 0.2 |
| C | 1.1 | 1.0 | 0.8 |
| D | 0.7 | 0.6 | 0.3 |
| E | 1.6 | 0.9 | 0.2 |
| F | 0.8 | 0.6 | 0.3 |

2.6. Surface Waters

There are three surface waters within the direct vicinity of the Site. South Brook flows in an easterly direction and is located to the south and two unnamed spring fed streams which form confluences with South Brook. The western unnamed stream is within the Site, as shown in Figure 2.



Figure 2. South Brook and Two Unnamed Spring Fed Streams (Canterbury Maps, 2021)

2.6.1. Eastern Unnamed Stream

The eastern unnamed stream is located within the Townsend Fields subdivision and was realigned as part of the Townsend Fields development works to free up available land for the siting of a SMA and discharges to South Brook. The stream generally has a permanent flow of water throughout the year however, site observations suggest this could potentially be due to groundwater interception as the spring itself has not be visually observed. The stream can become ephemeral during dry summer periods.

2.6.2. Western Unnamed Stream

The western unnamed stream originates within the 203 Johns Road property and flows in a southeast direction prior to forming a confluence with South Brook. The stream has similar characteristics to the eastern unnamed stream and is likely to have a similar flow regime.

2.6.3. South Brook

South Brook is spring feed and runs in an easterly direction to the south of the Site, prior to passing under Townsend Road via a 4 m wide and 1.8 m high box culvert. Little is known about the groundwater/South Brook interaction and connectivity, but it is reasonable to assume that the South Brook bed depth will intercept the underlying groundwater potentially year round.

2.6.4. Springs

Multiple springs are associated with South Brook and its various tributaries. Figure 3 shows 16 spring locations along an approximate 1,500 m reach of South Brook, sited between Lehmans Road and Townsend Road.



Figure 3. Spring Locations (Canterbury Maps, 2017)

It is assumed that the springs are related to weak zones in the upper semi-confining silty horizon and localised low spots in topography. However, no specific study has been carried out to define spring/soil horizon/groundwater interactions across the locality.

3. Stormwater

3.1. Stormwater Management

3.1.1. Overview

The existing SMA, located to the south of the Townsend Fields subdivision, is an extended detention wet pond facility designed to treat the water quality volume (also known as the 'first flush' of rainfall runoff) and to provide detention for the water quantity volume for rainfall events up to and including the 2% Annual Exceedance Probability (AEP, 1 in 50 year) storm of 12 hours in duration.

The existing SMA was sized with sufficient treatment and attenuation capacity to cater for an approximate 50 ha Residential 2 (R2) zoned upstream catchment, which has a minimum allotment size of 600 m². At the time of the original design WDC specified the percentage of impervious area within each allotment, which defined the basin capacity requirement.

It is our understanding that subsequent plan changes could potentially allow the building coverage and impervious areas within each allotment to be increased beyond the original SMA design assumptions; should this be the case then the downstream SMA may not have sufficient capacity to provide treatment and attenuation for the full 50 ha upstream catchment.

Figure 4 shows the SMA upstream catchment (note: the land area shown as Residential West covers 163, 191, 199 and 203 Johns Road,).

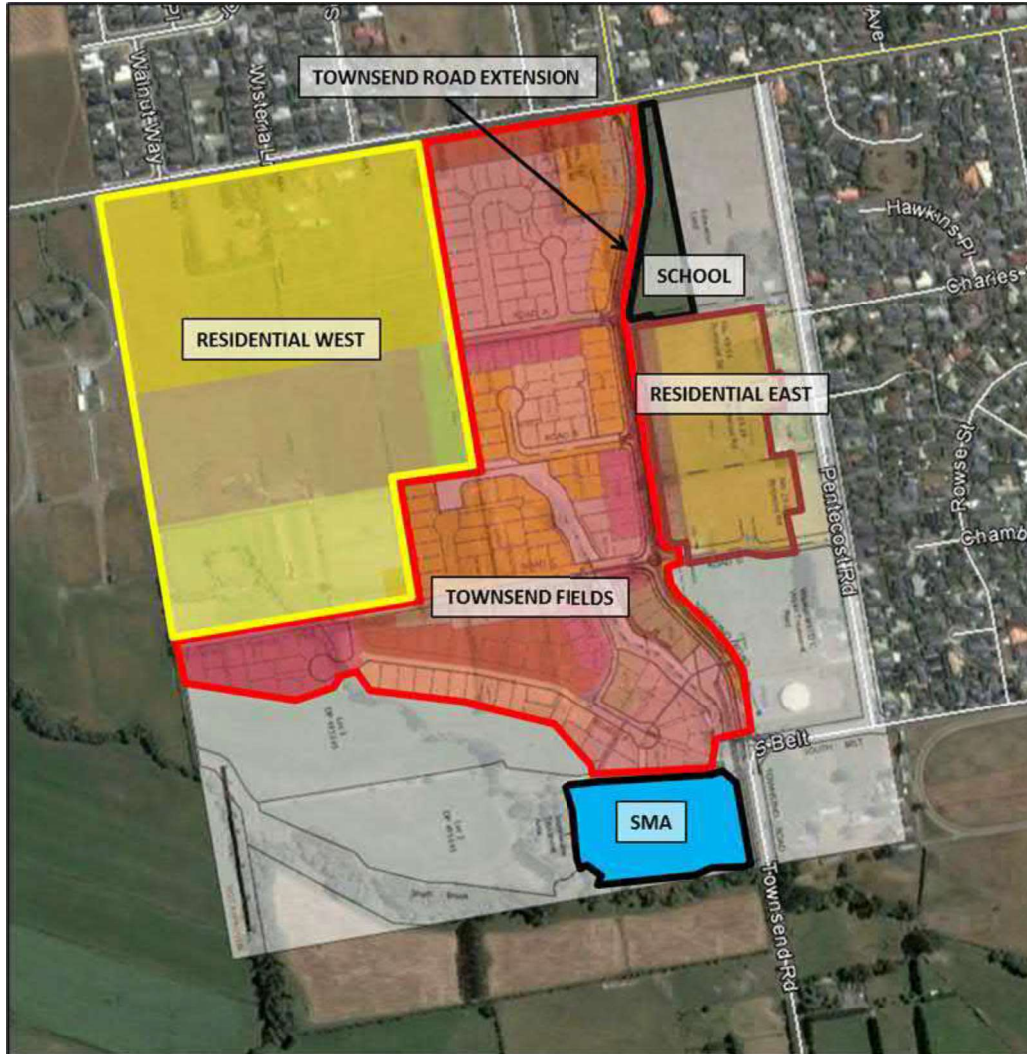


Figure 4. SMA Contributing Catchments

3.1.2. Treatment

The SMA is designed to provide treatment for stormwater runoff resulting from the first 25 mm rainfall depth and a runoff coefficient of 0.41 (based on the Christchurch City Council's (CCC) Waterways, Wetlands and Drainage Guide (WWDG)).

For subdivisions with a higher percentage of impervious area (up to 70%), as could potentially be the case for future development within 163, 191, 199 and 203 Johns Road, the WWDG recommends a runoff coefficient of 0.63 which would result in an increase in the volume of stormwater runoff requiring treatment.

Table 2 provides an approximate indication of the additional treatment capacity that would need to be provided by the SMA should the impervious areas within the Site increase beyond the original design assumptions.

Table 2. Potential Additional Volume of Stormwater Requiring Treatment

| | Land Area (ha) | Runoff Coefficient | Rainfall Depth (mm) | Runoff Volume Requiring Treatment (m ³) |
|--|-------------------|-----------------------|---------------------------|---|
| Original design parameters | 19.8305 | 0.41 | 25 | 2,033 |
| Updated design parameters | 19.8305 | 0.63 | 25 | 3,123 |
| Additional treatment capacity required to services the Site | | | | 1,091 |

3.1.3. Detention

The SMA detention storage capacity is designed to ensure that post development stormwater discharges from the upstream 50 ha catchment do not exceed that of the pre developed state (green field) for all rainfall events up to and including the 2% AEP of 12 hours in duration.

Hydrological and hydraulic modelling was originally carried out to define the SMA detention storage design parameters. As part of this rezoning submission, simplistic Manning's hand calculations have been completed to provide a rough gauge of the additional detention storage requirement that may result from a potential increase in impervious area.

Based on the WWDG recommendations a runoff coefficient of 0.53 was assumed for the original R2 design parameters and a runoff coefficient of 0.65 to account for the potential increase in impervious area. Rainfall data was taken from HIRDS RCP8.5 for the period 2081 – 2100; the results are presented in Table 3.

Table 3. Potential Additional Detention Storage Requirement

| 2% AEP Duration (hours) | Land Area (ha) | R2 Zoning Runoff Volume (m ³) | New Zoning Runoff Volume (m ³) | Additional Detention Storage Requirement |
|----------------------------|-------------------|---|--|--|
| 2 | 19.8305 | 5,476 | 6716 | 1,240 |
| 6 | 19.8305 | 8,965 | 10995 | 2,030 |
| 12 | 19.8305 | 11,982 | 14694 | 2,713 |

3.1.4. Proposed New Stormwater Detention Basin

To mitigate the increase in runoff from the Site (should the impervious area increase beyond the original SMA design parameters), it is proposed that a new stormwater basin be constructed within the Site. The basin would undergo hydrological and hydraulic modelling to confirm the required design parameters and would act as a detention storage basin to hold back the additional volume of stormwater generated. The stored water would be discharged via an outlet structure at a rate no greater than the original R2 design parameters, thereby ensuring the existing SMA capacity is not exceeded.

3.2. Primary Conveyance

The land areas of 163, 191, 199 & 203 Johns Road were included within the original Townsend Fields Stage 1 subdivision stormwater modelling and capacity was included within the pipe reticulation to convey stormwater discharges from the western land areas to the SMA.

A DN900 stormwater pipe has been terminated at the end of Goldie Drive and a DN750 terminated at the end of Angus Place, both these pipes have been sized to convey stormwater runoff from the future development of 163, 191, 199 & 203 Johns Road.

Figure 5 shows the western land areas which were included within the Townsend Fields Stage 1 stormwater modelling.

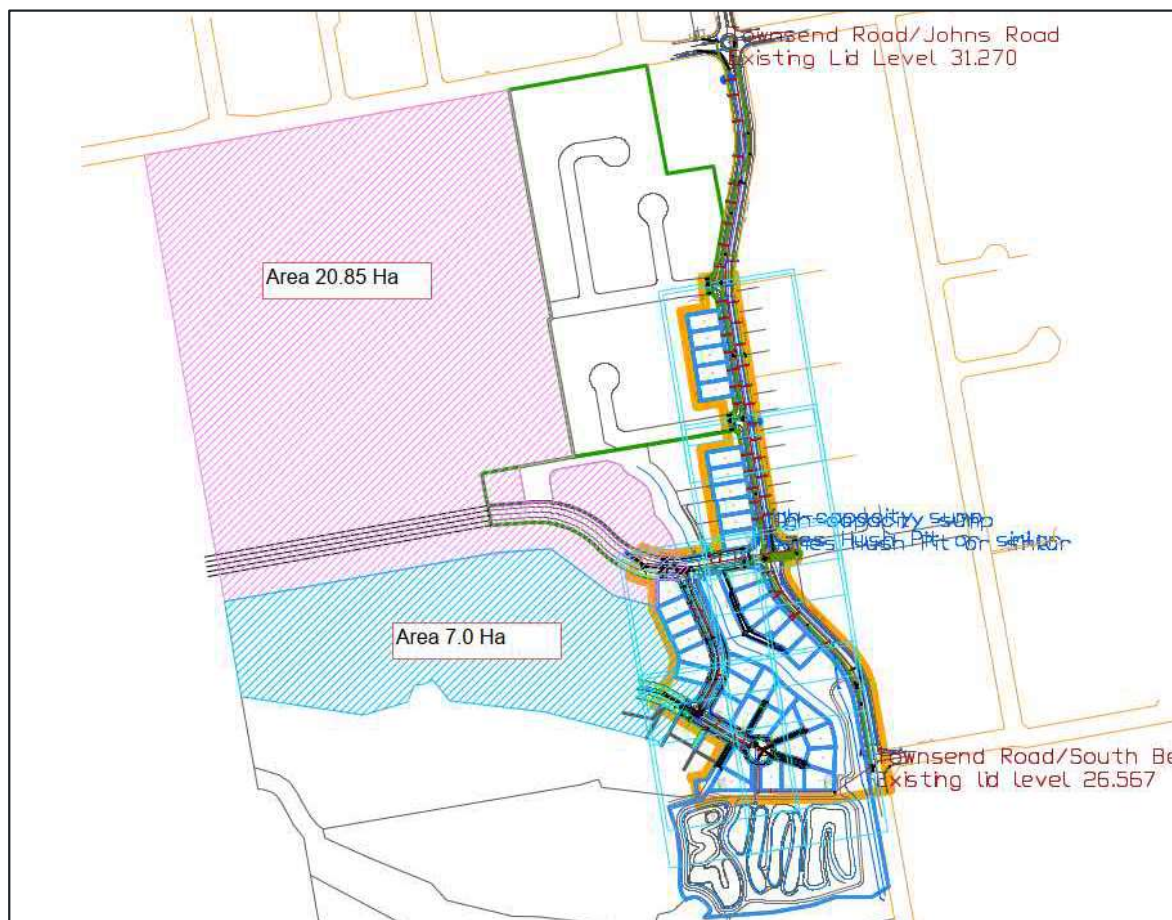


Figure 5. Original Townsend Fields Subdivision Stormwater Modelling Catchments

Stormwater runoff from future residential allotments and roading can be conveyed by swales, kerb and channel, sumps and pipe reticulation to a new stormwater detention basin (if one is required), from where it would be released to the downstream SMA at a rate not exceeding that of the original R2 design parameters. The basin would discharge to either the Goldie Drive and/or Angus Place existing reticulation (this is a detailed design component).

The future stormwater network would be required to have capacity to convey the 10% AEP (1 in 10 year) critical duration rainfall runoff and will need to adhere with the WDC Engineering Code of Practise.

Each future allotment would be provided with a connection of sufficient capacity to take the 10% AEP runoff, as required by the New Zealand Building Code.

The minimum stormwater pipe diameter would be DN225 and all double sumps would have DN300 connections, as required by the WDC Engineering Code. All double sumps would be fitted with submerged outlets, as per CCC SD 329.

Hydrological and hydraulic modelling would be carried out to ensure the pipe network capacity is sized adequately.

3.3. Secondary Conveyance

Stormwater runoff flow rates beyond the pipe or sump capacities will discharge into the road network and will be conveyed via the roads to the new detention basin previously mentioned (if one is required), prior to discharging to the downstream existing SMA. Depending on the outcome of future stormwater modelling potentially some secondary flow may discharge directly to the existing SMA with the remainder being held back within the new detention basin.

Angus Drive (and applicable upstream Townsend Fields Roding) was designed with sufficient capacity to cater for secondary discharges from the upstream 50 ha catchment, prior to discharging into the SMA.

The secondary conveyance network would be sized/designed in accordance with the WDC Engineering Code of Practise to convey the 2% AEP.

4. 200 Year Ashley River Breakout and ARI Flooding

As part of the Townsend Fields development, 200 year Ashley River breakout and ARI flood modelling was completed to define the required dwelling finished floor levels and to ensure the subdivision did not exacerbate flooding within neighbouring properties. A bund was constructed down the western boundary of the Townsend Fields subdivision (eastern boundary the 163, 191, 199 & 203 Johns Road land areas). The purpose of the bund was to divert flood waters to the south away from the Townsend Fields subdivision, with the goal of reducing the potential flood impact on the area.

It is proposed that the existing Townsend Fields bund be decommissioned and moved to the western boundary of the 163, 191, 199 & 203 Johns Road land areas, to reduce the flood impacts in the same manner as was achieved for the Townsend Fields subdivision.

Fluent Solutions has completed flood modelling of the bund if it were to be located along the western boundary of the 163, 191, 199 & 203 Johns Road land areas. The model indicated that flooding was exacerbated (flood depth increase) around neighbouring dwellings to the west. Therefore, it is proposed that a channel be constructed down the western boundary to convey flood waters to the south. It is also proposed that a bund be positioned down the eastern bank of the channel to prevent flood waters overtopping the channel and spilling into the future residential area to the east (within 163, 191, 199 & 203 Johns Road).

Fluent Solutions has completed a second round of flood modelling which included the proposed channel and bund configuration. The modelling indicated that the channel and bund combination conveyed flood waters to the south successfully and did not result in adverse effects on surrounding dwellings (flood depths did not increase). The modelled channel was 20 m wide (top width), 1 m in depth, with bank batters of 1 in 4. The proposed bund width is 10m.

The modelling did indicate that flood waters could over top the southern-most reach of the channel resulting in an approximate 50-200 mm flood depth increase within the southern-most areas of the 205 Johns Road and 117 Townsend Road properties. However, there are no dwellings within this area (land is pasture) and both properties at this location are already subject to a modelled food depth ranging from 0.45 m to 1 m.

Appendix B provides the Fluent Solutions flood modelling maps.

During the design of the 163, 191, 199 & 203 Johns Road subdivision further modelling will be carried out which will include the potential new stormwater detention basin (if required), road layouts and will optimise the channel and bund dimensions. The design will also be adjusted to mitigate any adverse effects within the southern land areas of 205 Johns Road and 117 Townsend Road (should WDC consider this necessary given that these areas are already subject to a significant flood depth).

Overall, and based on preliminary modelling carried out to date, it is not considered that the 200 year Ashley River Breakout and ARI flood event presents a constraint to the proposed submission for General Residential and Medium Residential Density Zone.

5. Wastewater

As part of the Townsend Fields development the gravity sewer network was designed with sufficient capacity to cater for the of the future subdivision of the 163, 191, 199 & 203 Johns Road land areas. The wastewater pipe sizes were provided by WDC to serve the Townsend Fields Subdivision and the surrounding land area to the west. Wastewater discharges from the area gravitate to an existing DN450 pipe in South Belt.

As part of the Townsend Field subdivision the following future connections are available:

- DN375 sewer main has been terminated at the end of Goldie Drive allowing for a future connection.
- DN150 sewer main has been terminated at the end of McCahon Drive allowing for a future connection.
- DN150 sewer main has been terminated at the end of Lusk Crescent allowing for a future connection.
- DN150 sewer main has been terminated at the end of Angus Place allowing for a future connection.

The Proposed Waimakariri District Plan makes an allowance for the wastewater servicing of the West Rangiora Development Area, and states:

“Gravity wastewater infrastructure will service the West Rangiora Development Area and only the key trunk infrastructure is shown. Trunk mains run through the centre of the catchments to eventually connect to the Townsend Fields trunk main (and the Rangiora Central Sewer Upgrades). Ideally, the network would be constructed from south to north, so that there is infrastructure for subsequent catchments to connect into. Temporary solutions would need to be discussed if development was to occur in the north first.”

In accordance with the District Plan, the 163, 191, 199 & 203 Johns Road area would ideally be developed prior to any other land areas to the west or north, as the infrastructure servicing future areas would be brought up through the Site.

Figure 5, shows the West Rangiora Development Area Proposed Wastewater and Water Supply servicing.



Figure 6. West Rangiora Development Area Water & Wastewater Proposed Servicing (WDC, 2021)

6. Drinking Water

The existing points of water supply for the Townsend Fields subdivision are the DN300 main in South Belt near Pentecost Road and the DN300 main at the Johns Road and West Belt intersection. The initial water supply modelling was completed by WDC who provided the Townsend Fields water main sizes, during this initial Townsend Fields water supply modelling it is our understanding the 163, 191, 199 & 203 Johns Road land areas were accounted for.

As part of the Townsend Field subdivision the following future connections are available:

- DN300 water main has been terminated at the end of Goldie Drive allowing for a future connection.
- DN150 water main has been terminated at the end of McCahon Drive allowing for a future connection.
- DN100 water main has been terminated at the end of Lusk Crescent allowing for a future connection.
- DN150 water main has been terminate at the end of Angus Place allowing for a future connection.

The Proposed Waimakariri District Plan makes an allowance for the water supply servicing of the West Rangiora Development Area, and states:

“The provision of reticulated water supply assumes a skeleton network where only water pipes of 100 mm in diameter and greater are specified. The exact location of the reticulation may change when road layouts are confirmed.....

"Reticulation upgrades for proposed for Rangiora are both within Development Areas (East, North East and West) and within the existing network. Due to their location, all of the existing network upgrades can be attributed to the Development Areas. Source and headworks upgrades are not Development Area specific, rather they apply to the whole scheme.

A number of water network upgrades are required to service West Rangiora Development Area's four catchments. Reticulation requirements include upgrades to the existing network and extra over upgrades to development reticulation. These upgrades are required to maintain the existing levels of service to current and future customers. New mains along key roads are required to upgrade the Southwest Rangiora Supply Main, Johns Road West Supply Main, Lehmans Road Ring Main and Ayers Street Supply Main.

Development in the West Rangiora, North East and East Development Areas also contribute to the requirement to upgrade a number of wider Rangiora sources and headworks, such as additional wells and associated pipework at Rangiora Source, new Surface Pumps and Generator at Ayers Street Headworks, new reservoirs at Ayers Street and South Belt, and a new Surface Pump at South Belt Headworks.

Existing water reticulation extends to the edge of the West Rangiora Development Area, making it straight-forward to connect to the scheme. High groundwater levels in the very southern portions of the Development Area may lead to some elevated costs."

The district plan requirements are not prohibitive towards supplying potable and firefighting water to the Site and sufficient infrastructure has been brought through the Townsend Fields subdivision area. Water supply modelling carried out during the design of Townsend Fields Stages 2 and 3 easily achieved the pressure and water supply flow requirement, indicating there is additional capacity available to service 163, 191, 199 & 203 Johns Road. At the time of design water supply modelling will be carried out for confirmation and to determine if any upgrades to the existing infrastructure are required.

7. Conclusion

It is concluded that the sites at 163, 191, 199 & 203 Johns Road are suitable, from a servicing perspective, for residential rezoning. The sites can be provided with necessary stormwater, wastewater and drinking water services and there are no constraints to the proposed submission for General Residential Zone.

The Site is located within the 200 year Ashley River Breakout and ARI flood path and preliminary flood modelling has been carried out to determine the effects on surrounding land areas. It is concluded that management and conveyance of the flood waters can be via a channel and bund located down the western boundary (with further conveyance via the internal road network) and that the effects on surrounding land areas will be less than minor (negligible).

Disclaimer

This report has been prepared by Eliot Sinclair & Partners Limited ("Eliot Sinclair") only for the intended purpose as technical supporting documentation for a district plan review submission.

The report is based on:

- Review of Canterbury Maps (2021).
- Review of WDC Services Maps.
- Review of Townsend Fields subdivision engineering drawings.
- Correspondence with WDC (2021).

Where data supplied by 199 Johns Road Limited or other external sources, including previous site investigation reports, have been relied upon, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Eliot Sinclair for incomplete or inaccurate data supplied by other parties.

Whilst every care and reasonable effort has been taken during our investigation and interpretation of the site characteristics and services to ensure that the conclusions drawn, and the opinions and recommendations expressed are correct at the time of reporting, Eliot Sinclair has not performed an assessment of all possible conditions or circumstances that may exist at the site. Variations in conditions may occur between investigatory locations and there may be conditions such as the ability of the site to discharge stormwater etc. that were not detected by the scope of the investigation that was carried out or have been covered over or obscured over time. Eliot Sinclair does not provide any warranty, either express or implied, that all conditions will conform exactly to the assessments contained in this report.

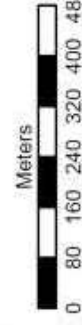
The exposure of conditions or materials that vary from those described in this report may require a review of our recommendations. Eliot Sinclair should be contacted to confirm the validity of this report should any of these occur.

This report has been prepared for the benefit of 199 Johns Road Limited for the purposes as stated above. No liability is accepted by Eliot Sinclair or any of their employees with respect to the use of this report, in whole or in part, for any other purpose or by any other party.

Appendix A. Proposed West Rangiora and South West Rangiora Development Integration Plan

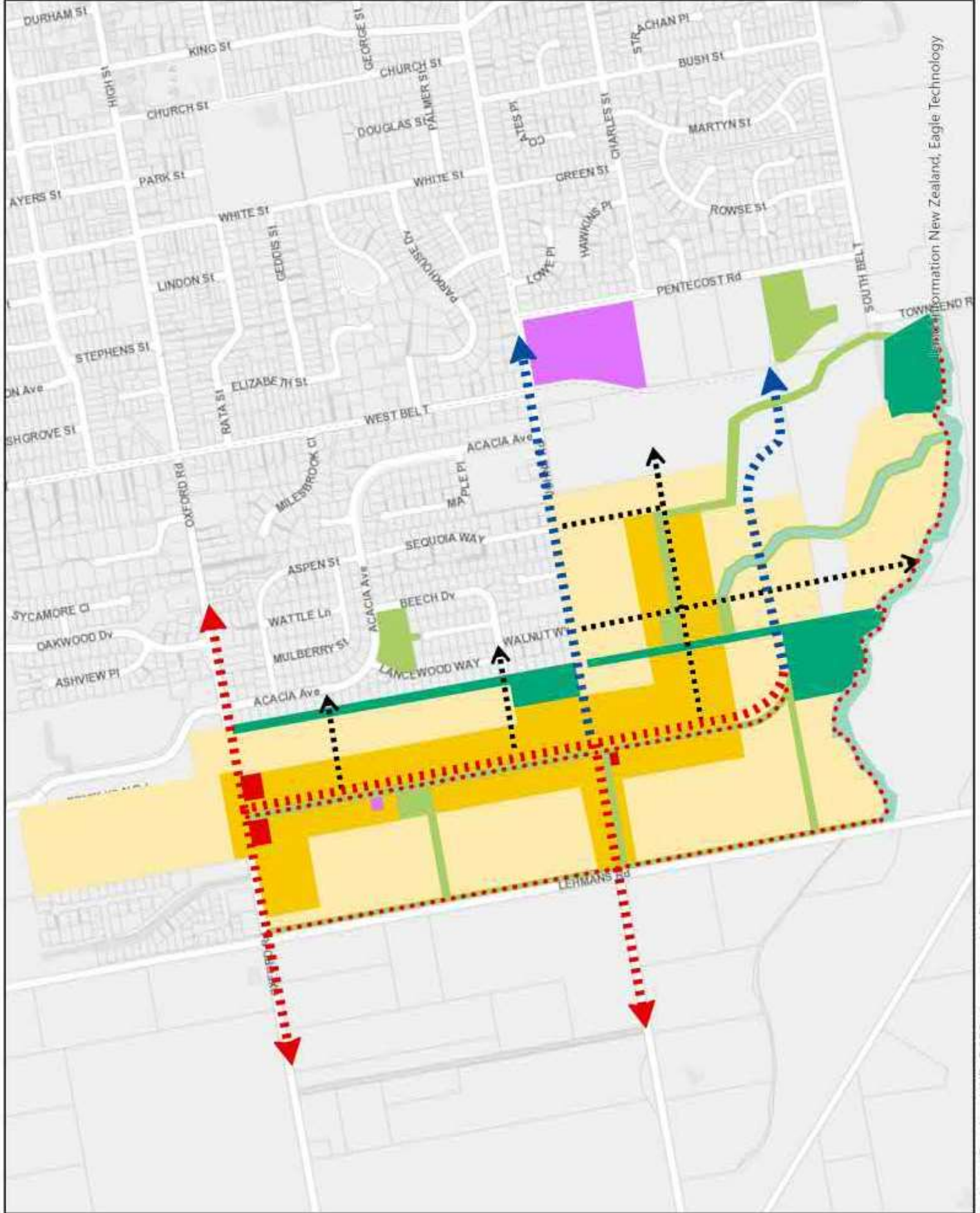


- Primary Road + Cycleway
- Primary Road + Shared Pathway
- Secondary Road
- Green Link + Cycleway
- Cycleway (Outside Study Area)
- Open Space Reserve
- Stormwater Reserve
- Flow Path
- Commercial / Business
- Education / Community
- General Residential Density
- Medium Residential Density



Scale 1:12,000 (A4)

West Rangiora & South West Rangiora Development Integration Plan

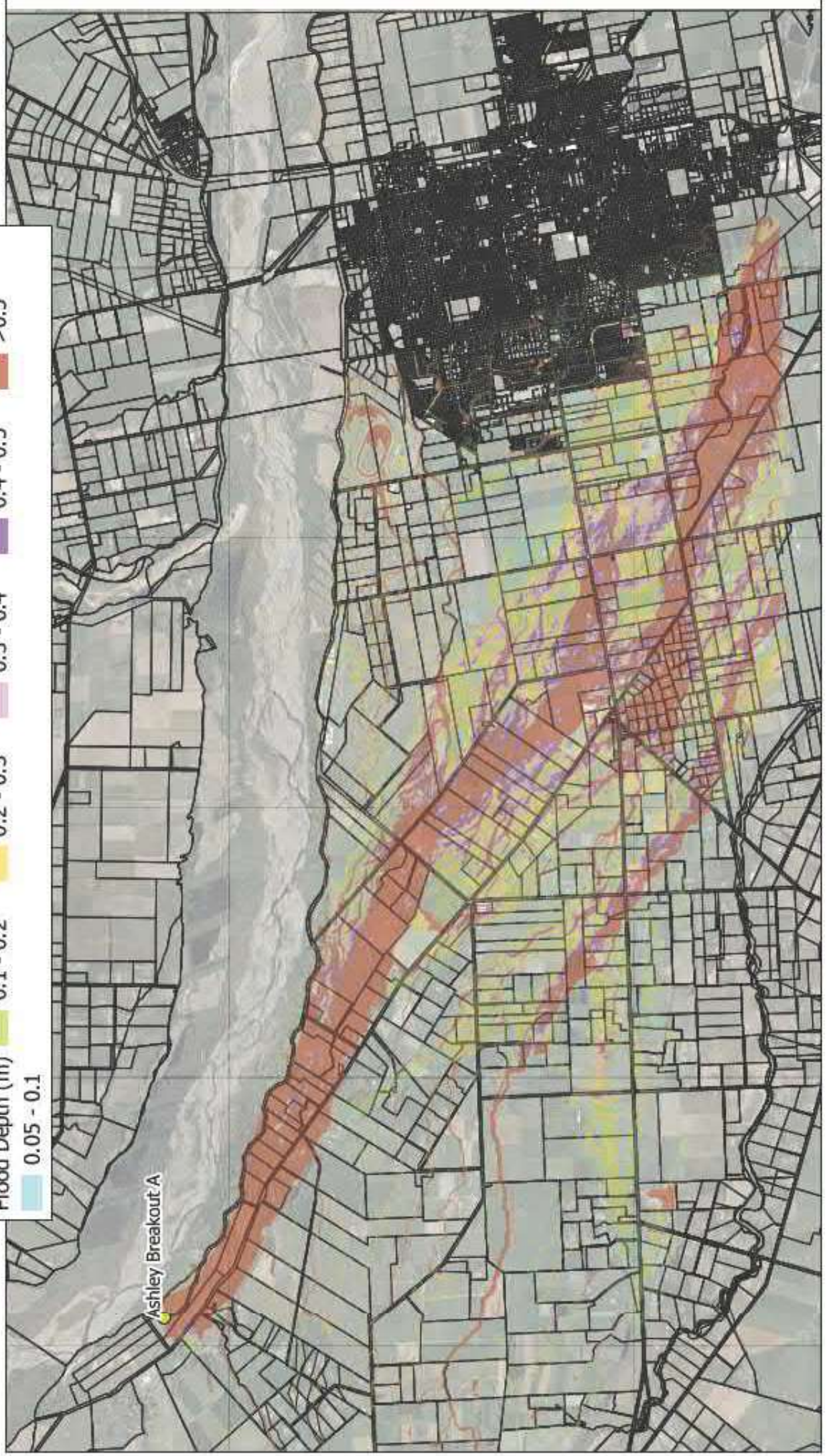
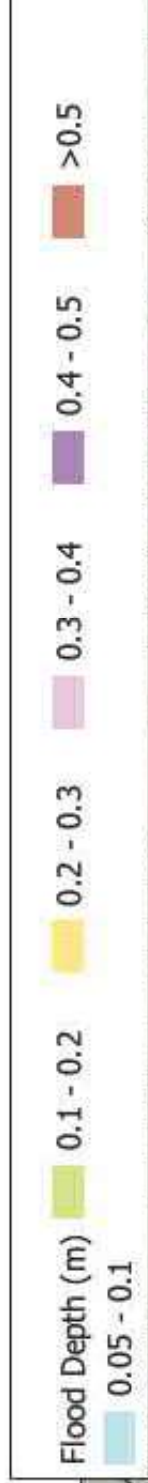


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Appendix B. 200 Year Ashley River Breakout and ARI Flood Modelling

TOWNSEND FIELDS - FULL CATCHMENT - POST-DEVELOPMENT
ASHLEY RIVER BREAKOUT + RAINFALL - 200YR ARI

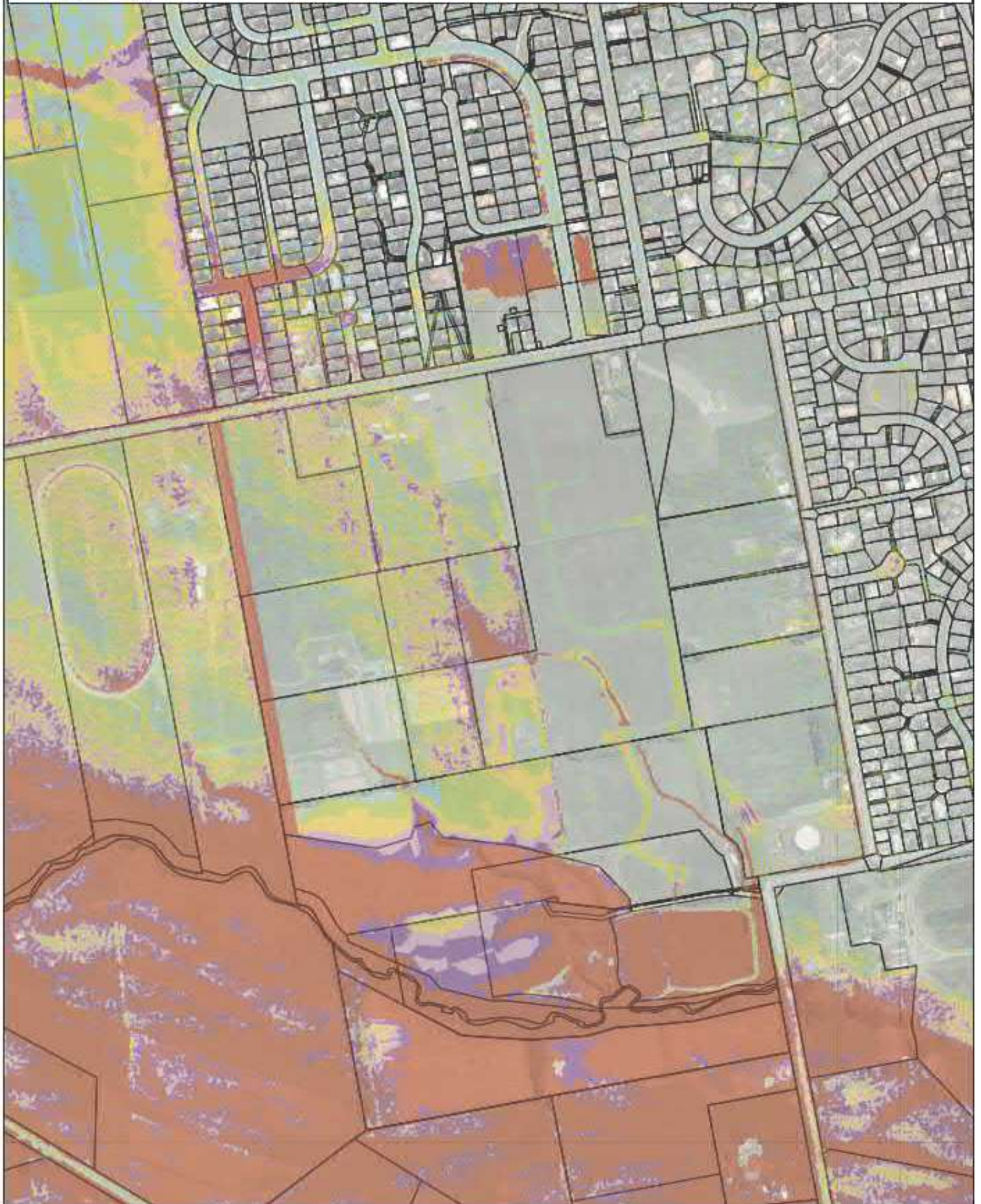
Preliminary Move Bund West
Presented 1 October 2021



TOWNSEND FIELDS - LOCAL SITE - POST-DEVELOPMENT
ASHLEY RIVER BREAKOUT + RAINFALL - 200YR ARI

Preliminary Move Bund West
Presented 1 October 2021

Flood Depth (m) 0.1 - 0.2 0.2 - 0.3 0.3 - 0.4 0.4 - 0.5 >0.5
0.05 - 0.1



TOWNSEND FIELDS - FLOOD DEPTH DIFFERENCE
ASHLEY RIVER BREAKOUT + RAINFALL - 200YR ARI

Preliminary Move Bund West
Presented 1 October 2021

