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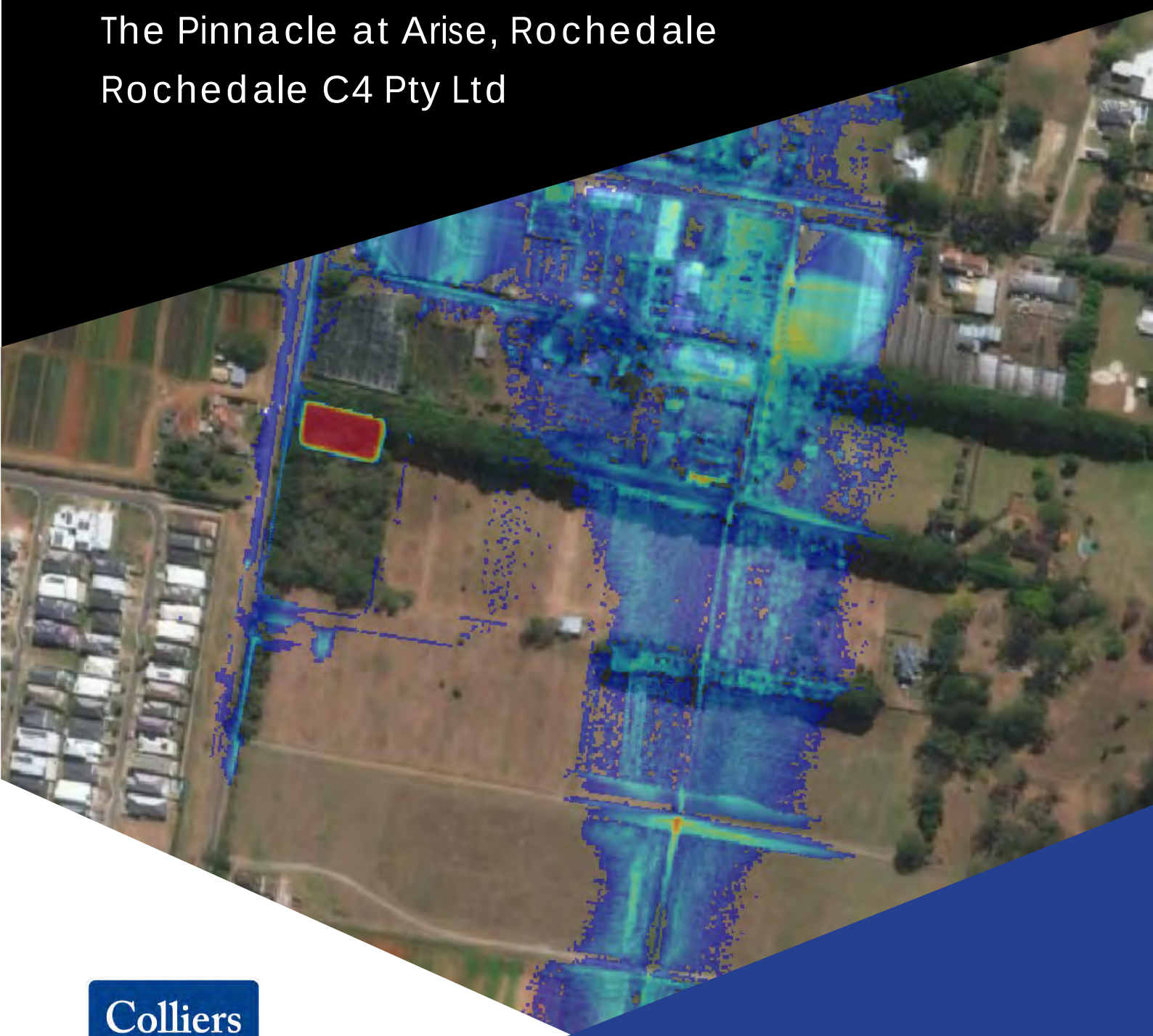
Flooding and Stormwater Management Plan

The Pinnacle at Arise, Rochedale

Rochedale C4 Pty Ltd



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20-0102FSMP-V3
18 November 2022

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EXECUTIVE SUMMARY

Colliers International Engineering & Design Pty Ltd have been engaged by Rochedale C4 Pty Ltd to provide a Flooding and Stormwater Management Plan in support of a development application to Brisbane City Council (BCC) for 'The Pinnacle' development. The proposed development is located at 520-560 Rochdale Road, Rochedale. It is currently described as Lot 1 on SP288673, Lot 2 & 3 on RP181371 and Lots 700 & 701 on SP309377. This development application seeks a development permit for a Reconfiguring of Lot application to create residential lots, roads, and greenspace.

The purpose of this document is to outline a proposed stormwater quantity management strategy for the operational phase of the development. This strategy will ensure compliance with the requirements of Brisbane City Council's *Brisbane City Plan* (2014) and the *Queensland Urban Drainage* Manual (2017). Water quality management for the operational phase of the development has been addressed in a separate document by Colliers International Engineering & Design Pty Ltd, titled 'Stormwater Quality Management Plan: *The Pinnacle at Arise, Rochedale'* and dated 14 November 2022 (Document Reference: *20-0102SQMP01-V3*).

The total site area across all land holdings by Rochedale C4 Pty Ltd for this application is approximately 23.02ha. It is predominantly zoned as an emerging community zone, however, is currently undeveloped and consistent with a rural residential land use. There is an area of high-density wooded vegetation on Lot 2 on RP181371, zoned as an environmental management zone. The total proposed development footprint for the site is approximately 12.73ha.

This report has been prepared to detail the technical assessments completed in respect to flooding and stormwater quantity management for the subject site. The report provides detailed and comprehensive information on the proposed stormwater management strategies to be implemented at the site to support the Ultimate Developed Scenario.

Final sizing of the network is to be confirmed as a part of Operational Works design and approval process.

The stormwater management strategies outlined in this report associated with both scenarios satisfactorily demonstrate compliant development outcomes with relevant industry guidelines and BCC codes and policies. We therefore request Council approval of the engineering components for the proposed development with reasonable and relevant conditions. Detailed design may result in changes to the proposed strategy; however, the design objectives will be maintained.

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1. INTRODUCTION

Colliers International Engineering & Design Pty Ltd have been engaged by Rochedale C4 Pty Ltd to provide a Flooding and Stormwater Management Plan in support of a development application to Brisbane City Council (BCC) for 'The Pinnacle' development. The proposed development is located at 520-560 Rochdale Road and, Rochedale. It is currently described as Lot 1 on SP288673, Lot 2 & 3 on RP181371 and Lots 700 & 701 on SP309377.

This development application seeks a development permit for a Reconfiguring of Lots (RoL) application to create residential lots, roads, and greenspace. The proposed development (referred to as 'The Pinnacle') includes the previously approved Stages 2-4 as per approval A005364788. The intent of the RoL has been demonstrated by a Plan of Reconfiguration showing the layout of the proposed development (refer to Appendix B). The Plan of Reconfiguration is indicative only and has been prepared for the purposes of demonstrating a functional and feasible development outcome consistent with the Brisbane City Plan.

The purpose of this document is to outline a proposed stormwater quantity management strategy for the operational phase of the development. This strategy will ensure compliance with the requirements of Brisbane City Council's *Brisbane City Plan* (2014) and the *Queensland Urban Drainage* Manual (2017). The intent of the codes associated with these documents will be achieved through the appropriate integration of stormwater management options within the proposed residential land-use.

The objectives of this Flooding and Stormwater Management Plan (FSMP) are to:

- Ensure the development achieves non-worsening principles from peak discharging stormwater flows to receiving waterways, properties, and infrastructure downstream of the site; and
- Demonstrate how the lawful point of discharge requirements for the site will be achieved.

Water quality management for the operational phase of the development has been addresses in a separate document by Colliers International Engineering & Design Pty Ltd, titled 'Stormwater Quality Management Plan: *The Pinnacle at Arise, Rochedale*' and dated 14 November 2022 (Document Reference: *20-0102SQMP01-V3*).

1.1. Assessment Status and Background

An approved Operational Works application (Application Reference: A005364788) exists over Stage 2-4 of The Pinnacle. This is pertinent to the detention basin located in the northwest corner of 520 Rochedale Road (2RP181371), which discharges towards Rochedale Road and the proposed trunk stormwater network. The application conditions for the approval have been satisfied, where the basin has been sized in accordance with the concept requirements and the BCC issued Concept Trunk Stormwater Strategy (dated 02/04/2020). For further information on the technical details regarding the detention basin, refer to "Detention Basin Outlet Analysis – 520 Rochedale Road, Rochedale" dated 31 July 2020 (document reference: 20 - 0102_TMSW1_V1.DOCX).

Advice received from the pre-lodgement meeting with BCC, indicated support for a standard road reserve (with no overland flow channels) to convey the major design flows. This support, however, rests on the proviso that it could be demonstrated that a minor storm pipe network sized to convey up to the 10% AEP storm could be safely utilised.

1.2. Site Location

The location of the proposed development site is shown in Figure 1-1, and has an approximate total lot area of 23.02ha. The site is predominantly zoned as an emerging community zone, is currently undeveloped and consistent with a rural residential land use. There is an area of high-density wooded vegetation on Lot 2 on RP181371, zoned as an environmental management zone. The total proposed development footprint for the site is approximately 12.73ha.

The site is accessed by Rochedale Road along the western boundary. The surrounding lots are consistent with rural residential land use with both upstream and downstream of the site zoned as emerging community. The downstream Lots 1 and 2 on RP71823 are currently under lawful control of the applicant and have been designated for future development under a separate RoL.

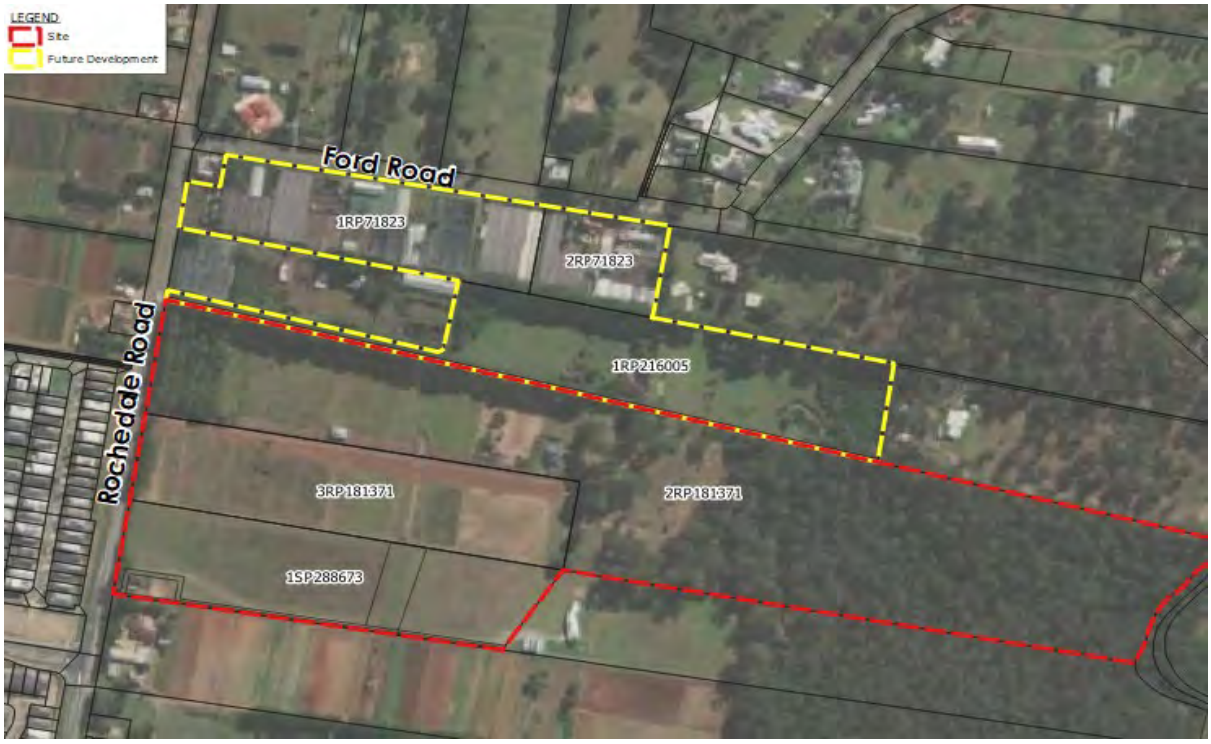


Figure 1-1: Site Location (*Source: ESRI Imagery, 2020*)

1.3. Existing Site Characteristics

1.3.1. Regional Flooding and Overland Flow

The site is located within the headwaters of a tributary to the Bulimba Creek catchment. A flood check development report was obtained from BCC's database for the proposed site. The report found the site is not affected by the Brisbane River Flood Planning overlay or the Creek/Waterway Flood Planning. The report did show the site is located in the Overland Flow Flood Planning area. Refer to Appendix C for BCC's "Floodwise Property Report". This was confirmed through a review of BCC's interactive mapping, where it was found the site is located over a central mapped overland flow path as shown in Figure 1-2.

1.3.2. Existing Site Topography

The site typically drains towards the central flow path which conveys channelised flow north before splitting at Ford Road. Partial flows overtop Ford Road and are conveyed through private property towards Rochedale Road. The remaining flow is conveyed down Ford Road and Rochedale Road before turning off towards a natural open channel located across the lot described as 4RP183802 (see Figure 1-2). Elevation across the site ranges between 70 mAHD to 82 mAHD.

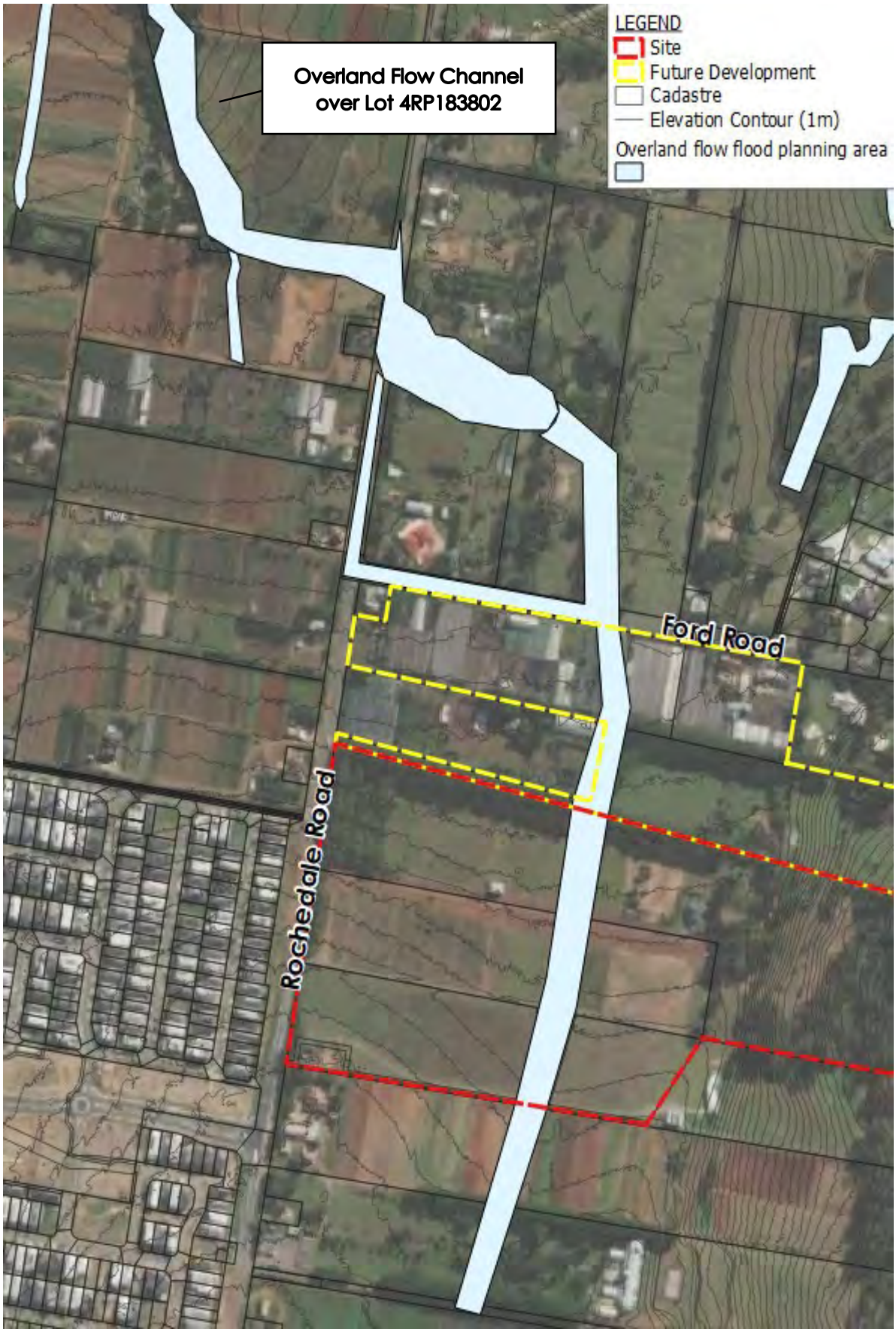


Figure 1-2: Overland Flow Paths and Flood Hazard Overlay Mapping

1.4. Development Scenarios

The intent of the FSMP is to investigate the impacts of development to ensure non-worsening principles both upstream and downstream are achievable. The following development scenarios have been assessed to consider construction sequencing and management options to ensure impacts are mitigated:

- Base Case Scenario – this scenario adopts the existing site conditions including the approved development application over Stage 2-4 of 'The Pinnacle'. It is assumed Stage 2-4 has been constructed and is operational. The base case scenario has been developed to compare subsequent development staging against and ensure no unacceptable impacts are generated.
- Ultimate Developed Scenario – this scenario assumes an entirely developed catchment reporting to the trunk infrastructure. This is to ensure:
    - the proposed stormwater management strategy fits in with BCC's future infrastructure planning; and,
    - the adopted measures proposed for the site operate as intended when impacted by future development.

2. STORMWATER QUANTITY

The objective of this component of the study is to investigate the potential impact that the proposed development will have on peak flows discharging downstream from the site. This will be achieved by conducting a hydrologic assessment to develop unique hydrographs for the catchment and applying them to a hydraulic assessment for spatial analysis.

2.1. Hydrologic Assessment

Hydrologic modelling of the catchments has been undertaken using the WBNM software developed by the University of Wollongong, Rienco Consulting and Balance R&D (Boyd et al., 2012). The 2012 version has been used for this investigation which utilizes ARR87 hydrology.

Modelling has been carried out for the 39%, 20%, 10%, 5%, 2% and 1% Annual Exceedance Probability (AEP) storm events for the three development scenarios discussed in Section 1.4:

1. Base Case Scenario
2. Ultimate Development Scenario

2.1.1. Base Case Hydrologic Modelling

The Base Case Scenario sub-catchments have been delineated using 1m contours derived from aerial laser survey flown in 2014. This has been sourced from the Geoscience Australia's Elevation Information System (ELVIS). The fraction impervious values have been calculated using aerial imagery sourced from ESRI. Figure 2-1 shows the base case sub-catchment delineation with a summary of parameters shown in Table 2-1.

Table 2-1: Summary of Base Case Catchment Parameters

Sub-catchment	Downstream Sub-	Area (ha)	Imperviousness (%)
A01	A03	4.822	2
A02	A03	2.751	3
A03	A05	3.020	0
A04	A06	3.260	0
A05	A06	3.577	8
A06	A07	3.117	1
A07	A08	4.015	1
A08	A16	4.319	39
A09	A10	3.281	70
A10	A14	2.387	70
A11	A12	2.371	35
A12	A16	2.023	70
A13	A14	2.109	42
A14	A16	0.841	58
A15	A19	3.200	0
A16	A19	3.219	22
A17	A19	2.044	0
A18	A27	3.252	5
A19	A27	0.327	16
A20	A21	0.927	38

Sub-catchment	Downstream Sub-	Area (ha)	Imperviousness (%)
A21	A27	0.264	58
A22	A25	2.503	5
A23	A25	2.907	5
A24	A25	3.824	5
A25	A29	5.650	5
A26	A27	2.290	11
A27	A29	5.430	3
A28	A29	0.762	0
A29	SINK	4.130	0

The WBNM has been run for events from 39% to 1% AEP and for durations of 10 minutes to 3 hours. A WBNM catchment lag factor of 1.6 was applied which is within the recommended range. An initial and continuing loss of 14mm/hr and 1.7mm/hr has been applied to the model. The resulting peak flows for the critical durations have been provided in Table 2-2 for the outlet of several key sub-catchments.

Table 2-2: Base Case Peak Flows at Key Sub-Catchments

Event AEP (%)	39	20	10	5	2	1
Catchment A05 (m^3/s)	1.56	2.24	2.65	3.21	3.85	4.45
Catchment A08 (m^3/s)	2.57	3.68	4.39	5.40	6.44	7.44
Catchment A10 (m^3/s)	1.34	1.78	2.04	2.40	2.62	2.96
Catchment A12 (m^3/s)	0.91	1.23	1.43	1.70	1.89	2.14
Catchment A29 (m^3/s)	7.75	11.03	13.03	15.8	18.85	21.73

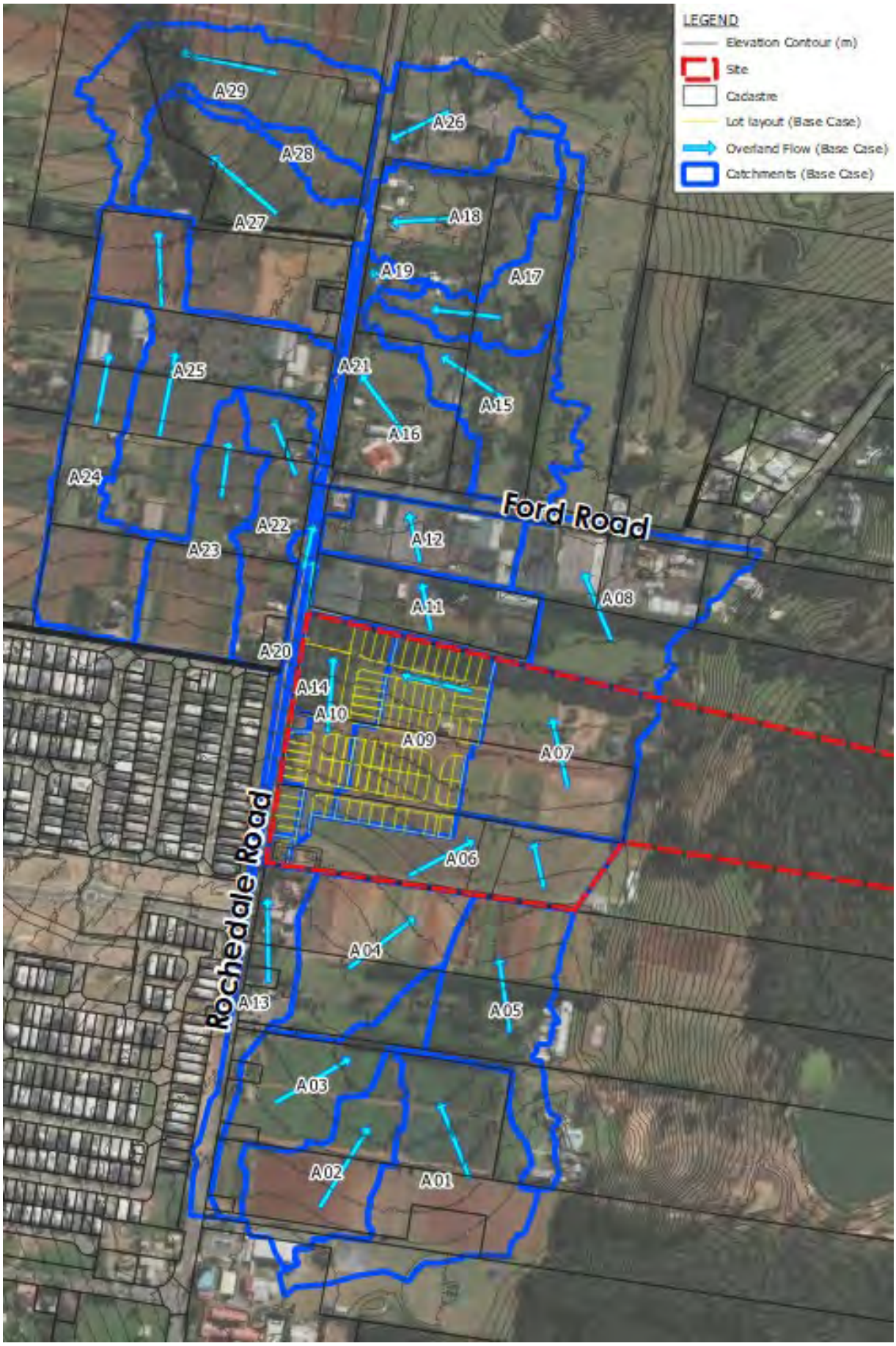


Figure 2-1: Base Case Catchment Delineation

2.1.1.1. *Rational Method Check*

Pre-development peak flows from the WBNM have been checked against peak flows determined using the Rational Method for sub-catchments A01 to A08. The differences between peak flows are less than ten percent across all assessed events, indicating that the WBNM is suitable for use and there are no gross errors. Refer to Appendix D for a summary of rational method parameters used.

Table 2-3: Comparison of WBNM and Rational Method Peak Flows (Catchment A08)

Event AEP (%)	39	20	10	5	2	1
WBNM (m^3/s)	2.57	3.68	4.39	5.4	6.44	7.44
Rational (m^3/s)	2.15	3.15	3.79	4.65	6.07	7.13
Difference (%)	20%	17%	16%	16%	6%	4%

2.1.2. Ultimate Developed Scenario

The Ultimate Developed Scenario assumes a completely developed and un-detained catchment reporting to the future drainage trunk infrastructure which outlets at the natural open channel located at Lot 4RP183802. This scenario has been modelled in the WBNM by adjusting the adopted fraction imperviousness values for the catchment based on the more conservative range of values given from QUDM (2017) for 'Urban Residential – low density (Including roads)' catchments. The catchment delineation remains mostly unchanged from the Base Case Scenario with some minor adjustments made to sub-catchments within the development site as shown in Figure 2-2. The changes to catchment parameters have been summarised in Table 2-4.

Table 2-4: Summary of Ultimate Scenario Sub-Catchment Parameter Changes

Sub-catchment	Developed Case Area (ha)	Change in Area (ha)	Ultimate Case Imperviousness (%)	Change in Imperviousness (%)
A01	4.822	0.000	70	68
A02	2.229	-0.522	70	67
A03	2.328	-0.692	70	70
A04	3.100	-0.160	70	70
A05	3.593	0.016	70	62
A06	2.614	-0.503	70	69
A07	4.537	0.522	70	69
A08	4.323	0.004	70	31
A09	3.281	0.000	70	0
A10	2.383	-0.004	70	0
A11	2.371	0.000	70	35
A12	2.023	0.000	70	0
A13	3.629	1.520	70	28
A14	0.945	0.104	70	12
A15	3.200	0.000	70	70
A16	3.219	0.000	68	46

Sub-catchment	Developed Case Area (ha)	Change in Area (ha)	Ultimate Case Imperviousness (%)	Change in Imperviousness (%)
A17	2.044	0.000	70	70
A18	3.252	0.000	70	65
A19	0.327	0.000	68	52
A20	0.747	-0.180	70	32
A21	0.254	-0.010	70	12
A22	1.545	-0.958	5	0
A23	1.234	-1.673	5	0
A24	2.149	-1.675	5	0
A25	5.650	0.000	5	0
A26	2.290	0.000	69	58
A27	5.430	0.000	3	0
A28	0.762	0.000	0	0
A29	4.130	0.000	0	0

The resulting peak flows for the critical durations have been summarised in Table 2-5 for several key sub-catchments. They have been compared against the peak flows from the Base Case Scenario with the change shown in Table 2-6. The hydrologic modelling shows that there is an increase in peak flows discharging from site.

Table 2-5: Developed Case Peak Flows at Key Sub-catchments

Event AEP (%)	39	20	10	5	2	1
Catchment A05 (m^3/s)	2.32	3.12	3.6	4.24	4.89	5.54
Catchment A08 (m^3/s)	3.67	4.99	5.79	6.88	8.12	9.25
Catchment A10 (m^3/s)	1.34	1.78	2.04	2.40	2.62	2.96
Catchment A12 (m^3/s)	1.09	1.45	1.66	1.96	2.13	2.41
Catchment A29 (m^3/s)	9.67	13.29	15.48	18.5	21.84	24.92

Table 2-6: Change in Peak Flows at Key Sub-Catchments (Developed Vs. Base Case)

Event AEP (%)	39	20	10	5	2	1
Catchment A05 (m^3/s)	0.76	0.88	0.95	1.03	1.04	1.09
Catchment A08 (m^3/s)	1.1	1.31	1.4	1.48	1.68	1.81
Catchment A10 (m^3/s)	0	0	0	0	0	0
Catchment A12 (m^3/s)	0.18	0.22	0.23	0.26	0.24	0.27
Catchment A29 (m^3/s)	1.92	2.26	2.45	2.7	2.99	3.19

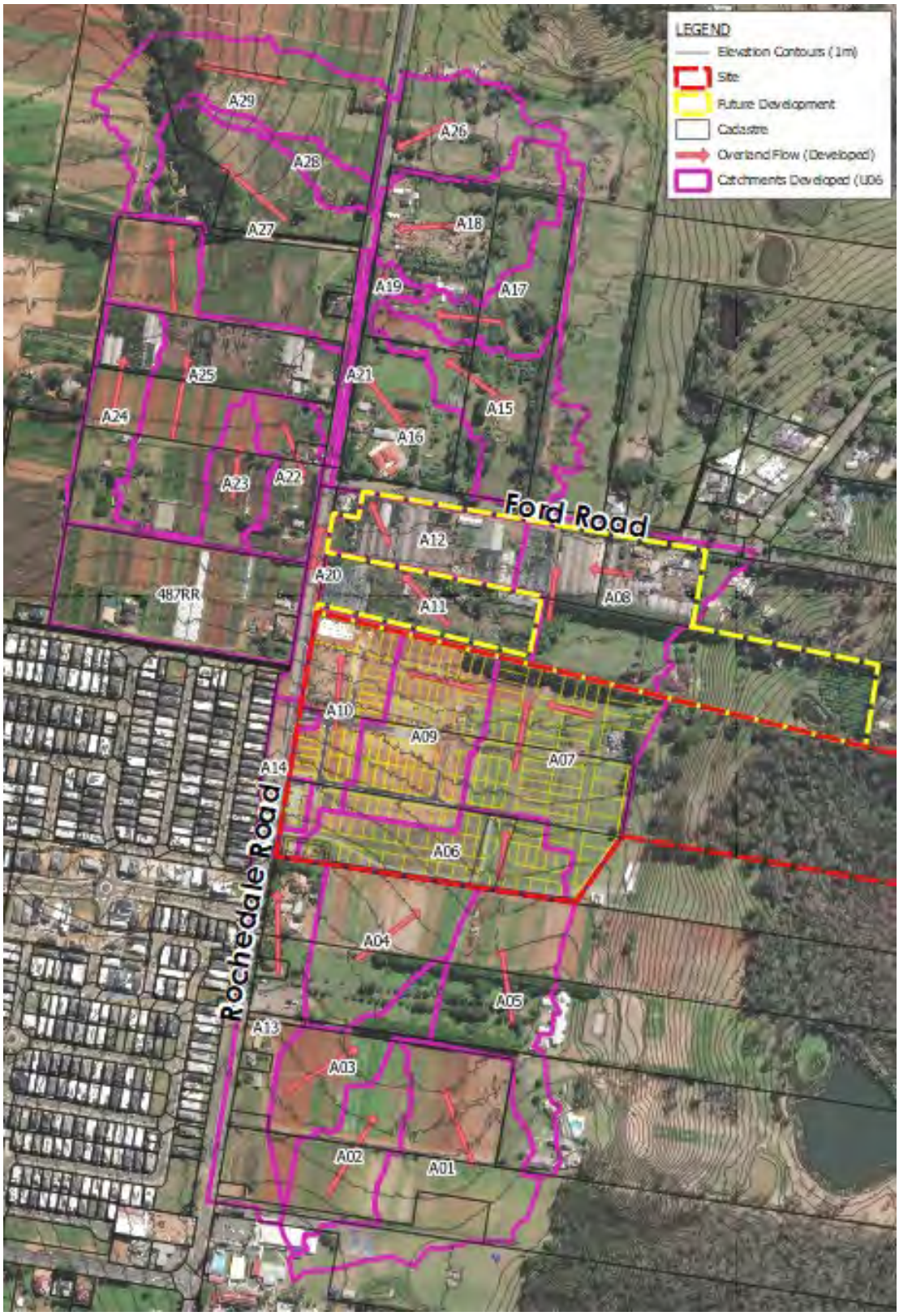


Figure 2-2: Developed Catchment Delineation

An assessment of the adverse impacts at the site is better informed using a hydraulic model whereby the impacts of the development and the stormwater management strategy can be assessed. The proposed management measures have been prescriptively included in a TUFLOW hydraulic model for which a spatial assessment of the flood impacts has been undertaken for a full range of design event magnitudes. This is discussed in detail in Section 2.2.

2.2. Hydraulic Model

A TUFLOW hydraulic model has been constructed for the hydraulic assessment of this study to inform the development outcomes relating to flooding and drainage. TUFLOW is a 1D-2D linked hydraulic model that solves depth average shallow water equations. All TUFLOW modelling was run at a 2m grid size utilising sub-grid sampling point at every 0.5m.

2.2.1. Base Case Model

The Base Case Model (E07) has been developed as the basis for change in which to assess the impacts of the development of the site. This modelling scenario applies the Base Case Scenario hydrologic modelling assumptions within the TUFLOW hydraulic model.

2.2.1.1. Model Layout

The TUFLOW hydraulic model is approximately 59.5ha in area. Inflows have been applied as 2d_sa polygons for the relevant catchments. All inflows were applied directly from the WBNM based on full hydrograph inclusion and run as unsteady state. Refer to Figure 2-3 for the Base Case model layout.

2.2.1.2. Model Topography

The topography used for the TUFLOW model was created based on 1m Lidar data, surveyed in 2014, as sourced from ELVIS. This scenario also included survey of Rochdale Road (8 June 2020) and the approved Stage 2-4 terrain model including the detention basin which discharges to the trunk main in Rochedale Road. A minor rectification to the digital elevation model around the basin embankment was made to ensure the correct embankment height was read into the TUFLOW model.

2.2.1.3. Hydraulic Structures

Details for the base case stormwater network included in the model was sourced from a combination of BCC's GIS database, survey, and detailed design drawings for the approved Stage 2-4 and "Stage 16 External Stormwater" for The Pinnacle (refer to drawing package 20-0102). Hydraulic structures have been connected to the 2d domain using 2d_bc and 1d_nwk pit connections. No allowance for blockage of the existing structures has been allowed for existing culvert structures as this has no bearing on the development impacts being assessed.

2.2.1.4. Downstream Model Boundary

The TUFLOW model boundary was extended approximately 250m downstream of the planned future stormwater outlet. This distance was deemed suitable as the flow path does not coincide with another tributary until considerably further downstream. As such, no consideration has been given to coincident flooding downstream. The downstream boundary was applied a steady state tailwater HQ boundary which was set at a slope of 1% to reflect the downstream waterway.

A second model boundary was adopted to the north of Ford Road to allow water to exit the model for larger events where cross catchment flow occurs. This downstream boundary was also applied as a steady state tailwater HQ boundary which was set at a slope of 1% to reflect the slope of sheet flow.

2.2.1.5. Roughness

Flood plain roughness was represented with Manning's 'n' roughness coefficients assigned to various land uses and spatial areas based on aerial imagery. Refer to Figure 2-4 demonstrating the existing case model roughness parameters used.

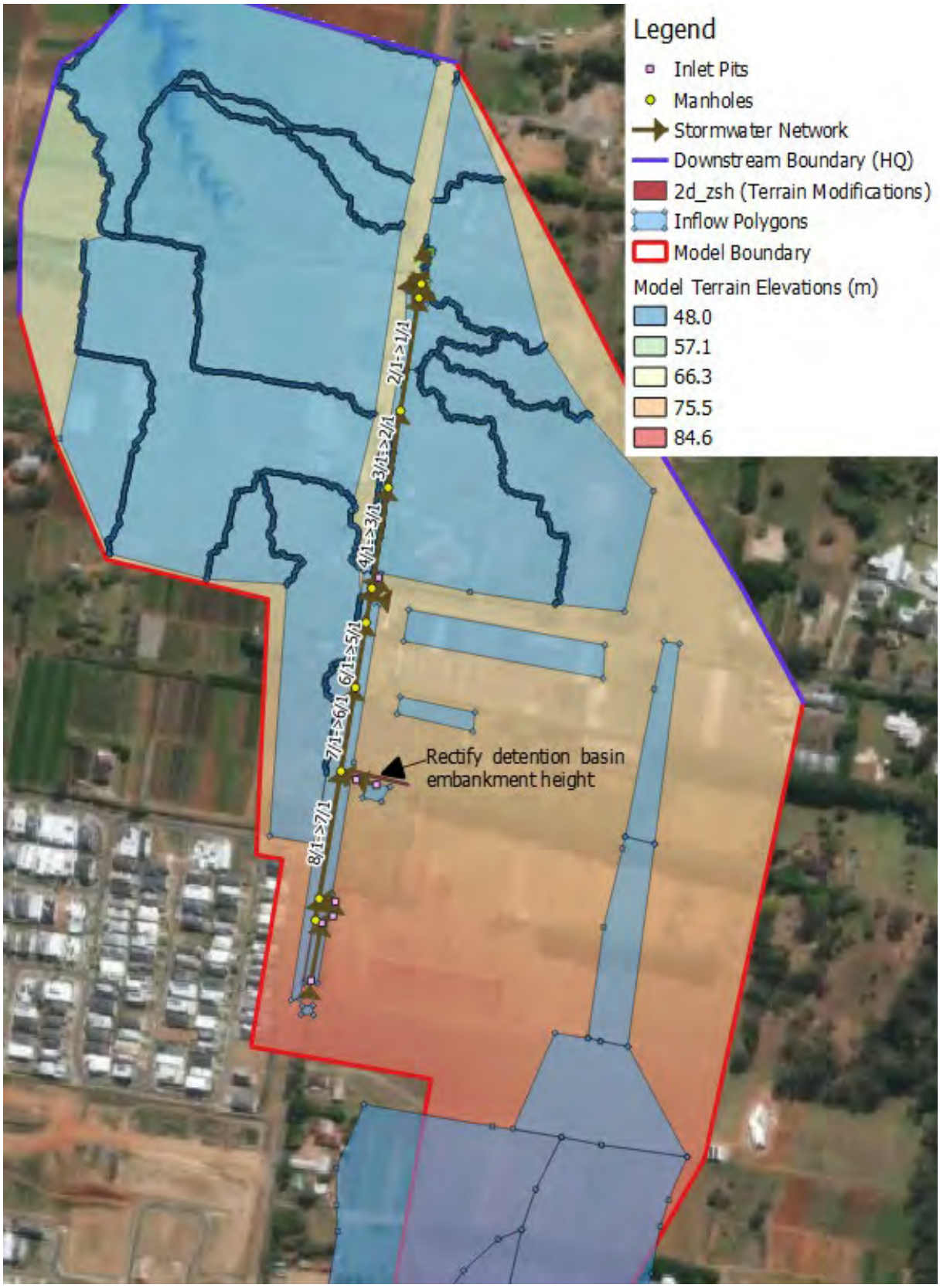


Figure 2-3: TUFLOW Hydraulic Model Layout - Existing Scenario

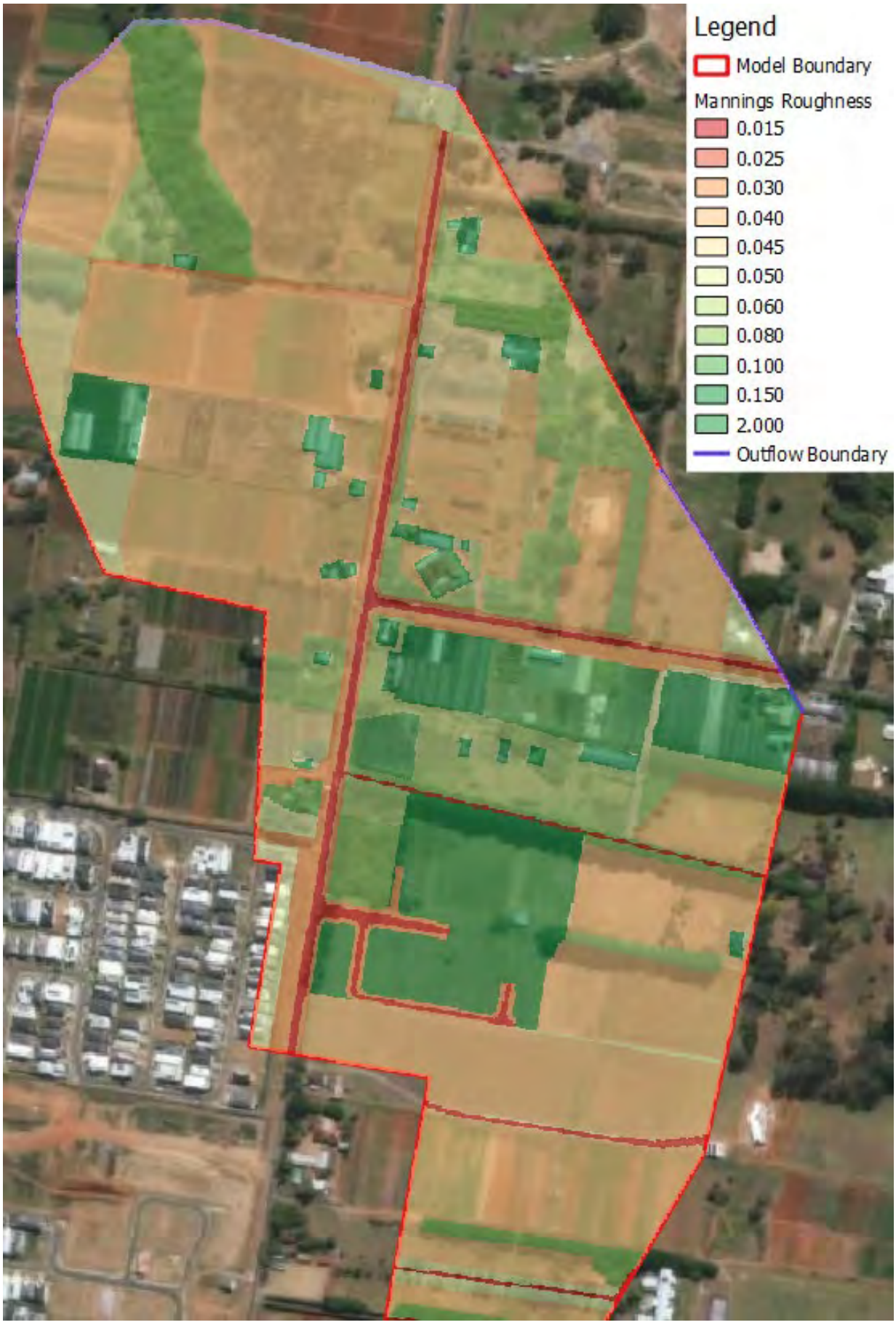


Figure 2-4: Base Case Model Manning's Roughness

2.2.2. Ultimate Developed Model

The Ultimate Developed Model (U09) has been built to assess whether the capacity of the proposed stormwater management measures meets the relevant design criteria assuming a completely developed catchment. This scenario adopts the Ultimate Developed Scenario hydrologic model for catchment discharge estimates.

The proposed stormwater quantity management measures for the development are summarised as follows:

- Utilise the proposed internal spine road as the 'major' design storm overland flow path to convey runoff the through the development.
- Utilise a stormwater trunk main to pipe the 10% AEP 'minor' design storm. This has been proposed to be beneath the spine road, Ford Road and Rochedale Road, and to outlet at the natural open channel on Lot 4RP183802.

The following assumptions have been made to this strategy:

- Stormwater runoff for up to the 10% AEP storm is expected be collected within the upstream stormwater network and piped in the trunk main within the spine road.
- External catchments are expected to be developed to direct overland flow to the spine road as concentrated flow.

2.2.2.1. Model Layout

The model has been constructed under the assumption that upstream catchments are developed as to direct overland flow to the spine road. Inflows for this scenario have been modified to reflect concentrated flows and have been applied directly to the trunk stormwater infrastructure at the outlet of each relevant catchment. Refer to Figure 2-5 for the proposed changes to the terrain model.

2.2.2.2. Model Topography

There were no known digital terrain models for any surrounding developments or upgrades to Ford and Rochedale Road available. The base case (E07) model topography has been manipulated using multiple 2d_zsh files to represent conceptual earthworks for the development. This includes formalising the roadside channels along Ford Road to improve immunity and formalising an outlet channel for the trunk main. The central spine road concept design has been included in the model as a digital elevation model (.dem).

2.2.2.3. Stormwater Drainage Network

The proposed stormwater network for the Ultimate Scenario (U09) has been summarised in Table 2-7 and shown in Figure 2-5. Inlet pits connecting to the trunk line have been designed to accommodate flows greater than the 10% AEP design, forcing the pipe size of the network to be the inlet control. No blockage has been applied to the pipe network. Blockage has been proposed to be managed with the pit inlet network at detailed design for operational works approvals.

It is noted that the final section of trunk infrastructure (Ult-1 ROC-PR-157) is proposed to be an open drain to be constructed within Lot 4RP183802 to achieve a lawful point of discharge. It is denoted an interim measure and may be decommissioned should BCC or others construct an ultimate trunk pipe connection with the same purpose at a later time. An ultimate trunk pipe connection need not be located within the extent of the drain as long as it serves the same purpose and provides sufficient capacity to replace the drain.

Table 2-7: Ultimate Proposed Stormwater Network

Culvert ID	No.	Size/Type	USIL (mAHD)	DSIL (mAHD)	Approx. Length (m)
C01	1	1.35m RCP	77.25	75.55	84
C02	1	1.50m RCP	75.45	71.2	195
C03	1	1.50m RCP	71.1	68.2	157
C04	1	1.80m RCP	68.18	67.65	45
C05	1	1.95m RCP	67.60	65.80	253
C06	1	2.10m RCP	65.70	65.25	40
C07	1	2.10m RCP	65.20	65.10	7
4/1->3/1	2	1.80m RCP	65.00	64.05	100
3/1->2/1	2	1.80m RCP	64.00	63.45	75
2/1->1/1	2	1.80m RCP	63.30	61.30	129
1/1->1/1A	2	1.80m RCP	61.20	61.02	7
Ult-1 (ROC-PR-157)*	*2*	*1.80m RCP*	*61.00*	*60.00*	*172*
A12	1	0.90m RCP	67.00	66.80	7
A16	1	0.75m RCP	64.50	64.45	20
A19	1	1.20m RCP	62.40	62.30	15
A26	1	0.75m RCP	63.50	63.00	78

**An interim channel is proposed to be constructed within Lot 4RP183802 (Ult-1 ROC-PR-157) to the waterway. Should an ultimate trunk pipe be constructed by BCC or others this drain may be decommissioned. The ultimate trunk pipe need not be located in the footprint of the drain as long as the trunk infrastructure has an intended function and sufficient capacity to replace the open drain. Details shown in these table provide an indicative sizing of an equivalent pipe.*

2.2.2.4. Roughness

Roughness values have been adjusted to reflect the development works within the flow path and development. The updated roughness values are shown in Figure 2-6.

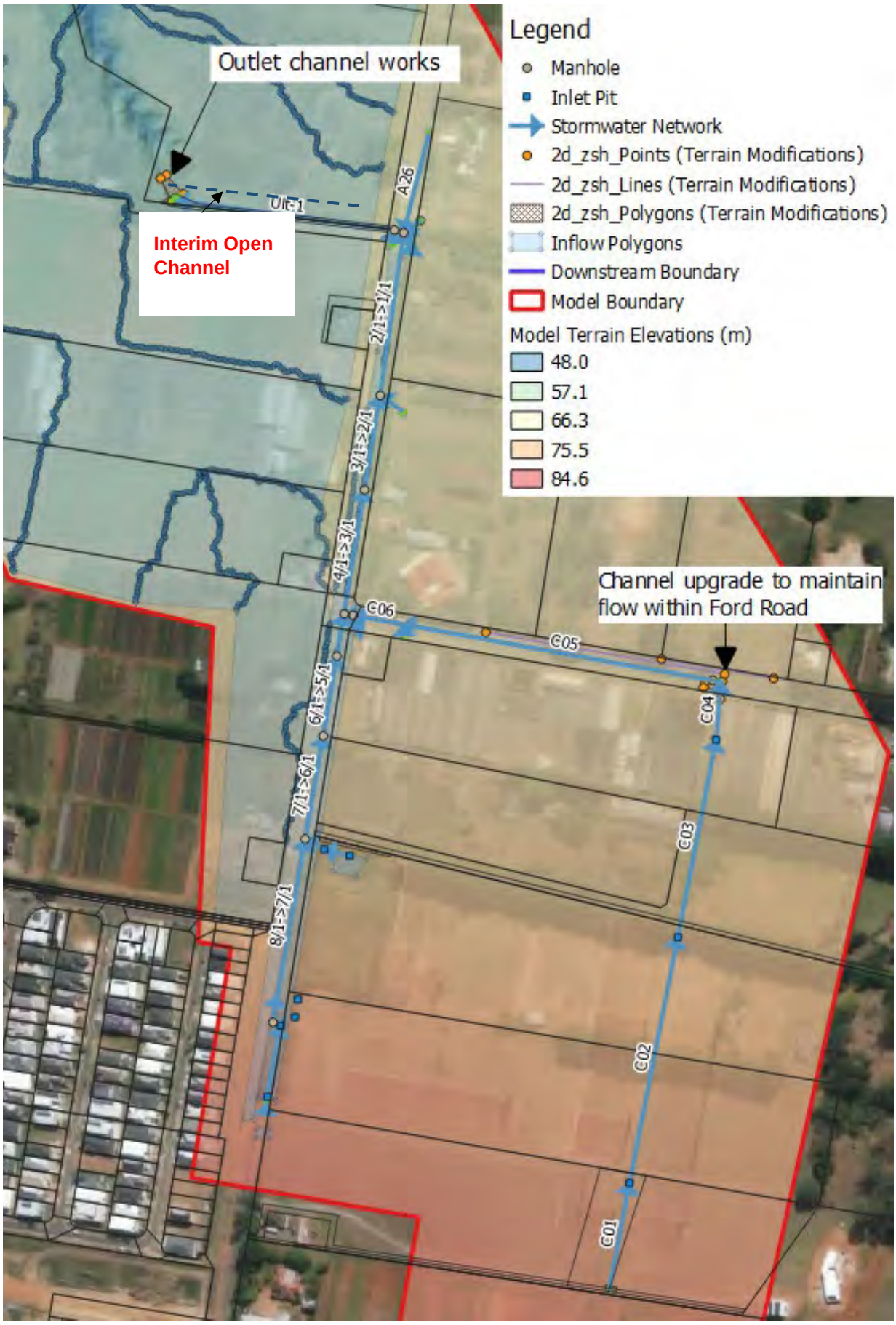


Figure 2-5: TUFLOW Hydraulic Model Layout - Ultimate Scenario

Figure 2-6: Ultimate Developed Model Manning's Roughness

2.3. Modelling Results

The TUFLOW hydraulic models, as discussed above, have been assessed for a range of flood events from the 39% to 1% AEP storm events. The assessment has considered a range of design storms to ensure that the critical storm is defined. The results of the hydraulic assessment are presented as a series of flood maps to illustrate the flooding characteristics of all the development scenarios and their resulting flood behaviours including flooded depth, velocities, hazard, and afflux. The flood maps are presented in Appendix E to Appendix F.

2.3.1. Base Case Model Results (E07)

The Base Case modelling results are shown in Appendix E and are summarised as follows:

- Widespread sheet flow across the development down to the model boundary was found in all design events resulting in a slow propagation of flooding across the catchment.
- A portion of flow opposite the central overland flow channel was found to break out into a different catchment to the northwest. This results from the poor level immunity of Ford Road which was found to overtop in frequent events.

2.3.2. Ultimate Case Model Results (U09)

The Ultimate Developed modelling results are shown in the series of flood maps in Appendix F. The flood maps have demonstrated that the proposed stormwater measures have no negative impacts on the surrounding properties. It is shown that there are reductions in flood extent and afflux across nearly all downstream properties, with no concerning velocity.

The pipe network provided for this design scenario effectively pipes the 'minor' storm (10% AEP event) from both the upstream catchments and the development. This is shown in Table 2-8, where there are no overland bypass flows.

Stormwater runoff generated from the site and upstream catchment for events greater than the 10% AEP design storm are conveyed down the spine road as overland flow. These flows are shown to be maintained within the proposed road reserve and meet QUDM's 'major' flow design requirements, being:

- Maximum depth of flow < 250mm as demonstrated by Figure 2-7; and
- Maximum flood hazard < 0.6m^2/s.

Overland and piped flow through the spine road for the 1% and 2% AEP have been summarised in Table 2-9 and Table 2-10.

The stormwater network adopted within this design scenario, as summarised in Table 2-7, provides suitable preliminary sizing for the ultimate trunk infrastructure to the open channel located at 4RP183802. This assumed the catchments reporting to the trunk main (see Section 2.1.2) are fully developed and un-detained. This is reflected in the 10% AEP flood maps showing nearly no flood extents to catchments with only minor breakouts from the road reserve. This is expected to be rectified by upgrades to Ford and Rochedale Road. Final sizing of the network is to be confirmed as a part of the Operational Works design and approval process.

Table 2-8: Summary of Flow Through Spine Road and Trunk Main (10% AEP)

Culvert ID	C01	C02	C03	C04
Pipe Flow (m3/s)	3.595	4.518	6.43	8.187
Bypass Flow (m3/s)	-	-	-	-

Table 2-9: Summary of Flow Through Spine Road and Trunk Main (2% AEP)

Culvert ID	C01	C02	C03	C04
Pipe Flow (m3/s)	4.039	5.255	6.996	8.682
Bypass Flow (m3/s)	0.848	0.6707	0.5821	0.7963

Table 2-10: Summary of Flow Through Spine Road and Trunk Main (1% AEP)

Culvert ID	C01	C02	C03	C04
Pipe Flow (m3/s)	4.039	5.289	7.233	8.791
Bypass Flow (m3/s)	1.4955	1.4321	1.4876	1.7327

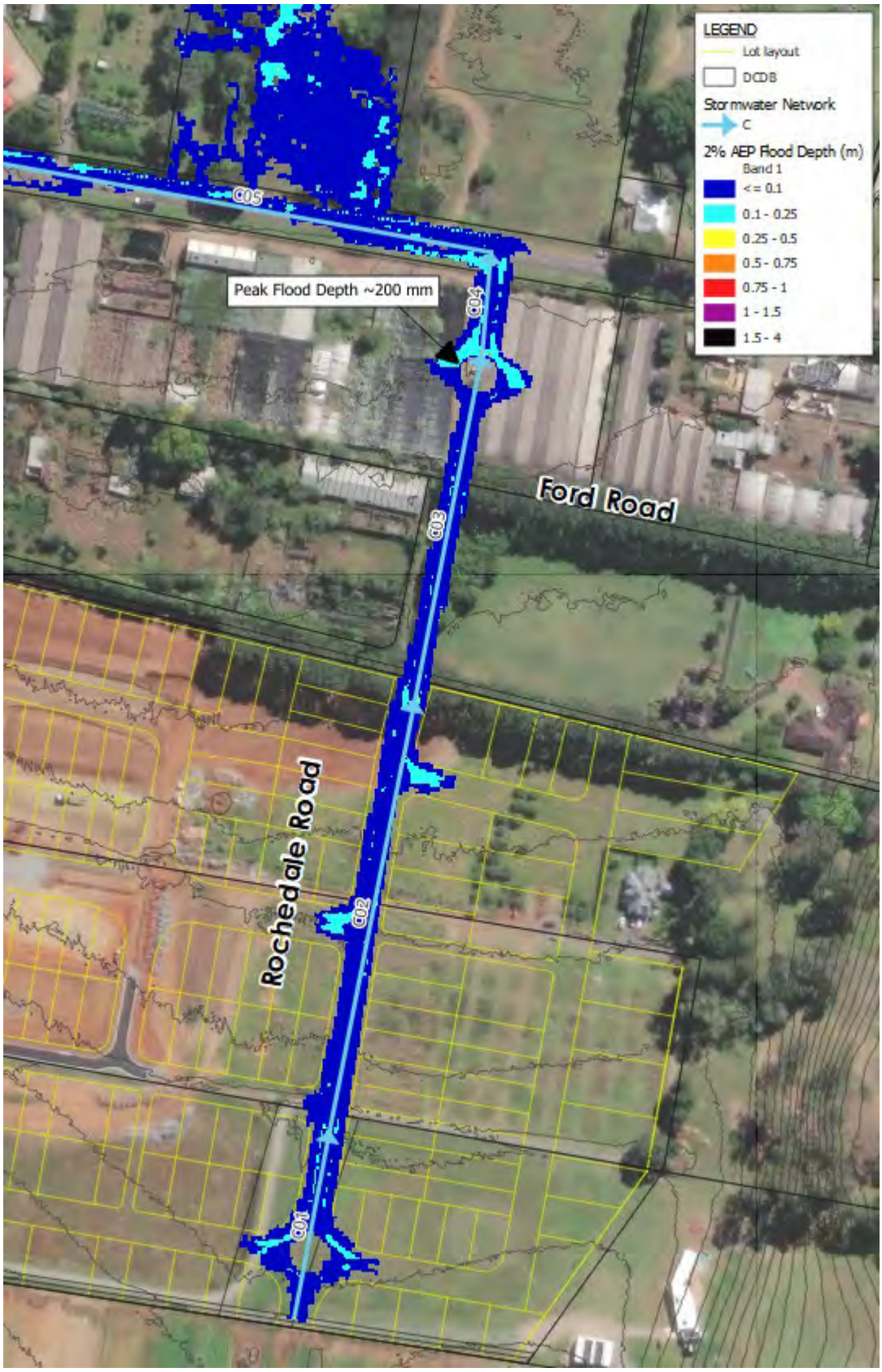


Figure 2-7: 2% AEP Peak Flood Depth at Spine Road

3. LAWFUL POINT OF DISCHARGE

As outlined by the *Queensland Urban Drainage Manual* (4th Edition – Institute of Public Works Engineering Australasia, Queensland Division) a test can be undertaken to determine whether a lawful point of discharge exists.

The criteria for determining the lawful point of discharge are:

(i) Will the proposed development alter the site's stormwater discharge characteristics in a manner that may substantially damage a third-party property (see Section 3.6)?

- If not, then no further steps are required to obtain tenure for a lawful point of discharge (assuming any previous circumstances and changes were lawful).

(ii) Is the location of discharge from the development under lawful control of the local government or other statutory authority from whom permission to discharge has been received?

For the Ultimate Developed case (U09) it has been demonstrated that discharge of runoff from the proposed development is not altered in a manner that may substantially damage a third-party property. This is demonstrated by the reduced flood extent from the proposed ultimate stormwater mitigation measures. This scenario discharges to the proposed trunk drainage to a mapped waterway. This discharge location is considered a suitable lawful point of discharge. An interim open drain can be constructed within Lot 4RP183802 to achieve a lawful point of discharge. This drain can be removed upon completion of any future trunk pipe connection (ROC-PR-157) by BCC or others.

4. CONCLUSION

Colliers International Engineering & Design Pty Ltd have been engaged by Rochedale C4 Pty Ltd to provide a Flooding and Stormwater Management Plan in support of a development application to Brisbane City Council (BCC) for 'The Pinnacle', Rochedale. The site is predominantly zoned as an emerging community zone and is predominantly undeveloped as consistent with a rural residential land use.

There is an approved Operation Works application (Application Reference: A005364788) existing over Stage 2-4 of The Pinnacle. This approval pertains the detention basin located in the northwest corner of 520 Rochedale Road (2RP181371) which discharges towards Rochedale Road and the approved trunk stormwater network.

This report has been prepared to detail the technical assessments completed in respect to flooding and stormwater quantity management for the subject site. The report provides detailed and comprehensive information on the proposed stormwater management strategies to be implemented at the site to support the Ultimate Developed Scenario.

Final sizing of the network is to be confirmed as a part of Operational Works design and approval process.

Water quality management for the operational phase of the development has been addressed in a separate document by Colliers International Engineering & Design Pty Ltd, titled 'Stormwater Quality Management Plan: The Pinnacle at Arise, Rochedale' and dated 14 November 2022 (Document Reference: 20-0102SQMP01-V3).

The stormwater management strategies outlined in this report associated with both scenarios satisfactorily demonstrate compliant development outcomes with relevant industry guidelines and BCC codes and policies. We therefore request Council approval of the engineering components for the proposed development with reasonable and relevant conditions. Detailed design may result in changes to the proposed strategy; however, the design objectives will be maintained.

5. REFERENCES

- Brisbane City Council (BCC), *Brisbane City Plan*, 2014.
- Bureau of Meteorology, Online Rainfall IFD Data System, (access: http://www.bom.gov.au/water/designRainfalls/revised-ifd)
- Department of Infrastructure, Local Government and Planning 2017, *State Planning Policy*
- Institute of Engineers Australia 2019, *Australian Rainfall and Runoff.*
- Institute of Public Works Engineering Australasia, Queensland Division, 2017, *Queensland Urban Drainage Manual,* 4th Edition.
- Water by Design 2010, *MUSIC Modelling Guidelines*, Version 1.0.
- Water by Design 2012, *Maintaining Vegetated Stormwater Assets.*
- Water by Design 2012, *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands*

APPENDICES

Appendix A Code Response

Performance outcomes	Acceptable outcomes	Response
Section A—If for a material change of use, reconfiguring a lot, operational work or building work Note—Compliance with the performance outcomes and acceptable outcomes in this section should be demonstrated by the submission of a site-based stormwater management plan for high risk development only.		
PO1 Development provides a stormwater management system which achieves the integrated management of stormwater to: (a) minimise flooding; (b) protect environmental values of receiving waters; (c) maximise the use of water sensitive urban design; (d) minimise safety risk to all persons; (e) maximise the use of natural waterway corridors and natural channel design principles. Editor's note—The stormwater management system to be developed to address PO1 is not intended to require management of stormwater quality.	**AO1** Development provides a stormwater management system designed in compliance with the Infrastructure design planning scheme policy.	The stormwater management system for the development will comply with the design planning scheme policy unless otherwise approved by Council. Refer to the Flooding and Stormwater Management Plan prepared by PEAKURBN (Reference FSMP01-V3)
PO2 Development ensures that the stormwater management system and site work does not adversely impact flooding or drainage characteristics of premises which are up slope, down slope or adjacent to the site.	**AO2.1** Development does not result in an increase in flood level or flood hazard on up slope, down slope or adjacent premises.	The proposed development will achieve non-worsening of the upstream and downstream waterways through the implementation of a stormwater management plan. Stormwater discharge consent is currently being obtained for stormwater discharge through Lot 1 on RP216005 and will be provided under separate cover. An interim drain is proposed through 4RP183802 (if required). Refer to drawing 20-0218-P113.
	AO2.2 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	The stormwater management system for the development will comply with the design planning scheme policy unless otherwise approved by Council. The stormwater management plans will be co-ordinated with the bulk earthworks and stormwater drainage network at the detailed design stage to ensure an optimal design outcome is achieved.

Performance outcomes	Acceptable outcomes	Response
PO3 Development ensures that the stormwater management system does not direct stormwater run-off through existing or proposed lots and property where it is likely to adversely affect the safety of, or cause nuisance to properties.	**AO3.1** Development ensures that the location of the stormwater drainage system is contained within a road reserve, drainage reserve, public pathway, park or waterway corridor.	The proposed stormwater drainage has been shown within a road reserve, drainage reserve, future road or public pathway. Refer to Drawings 20-0218-P108 to P112 & P113.
	AO3.2 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	The stormwater management system for the development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council.
	AO3.3 Development obtains a lawful point of discharge in compliance with the standards in the Infrastructure design planning scheme policy.	A reticulated stormwater system has been provided throughout Stages 5-8 which ultimately connects into the existing stormwater system on Rochedale Road. Upgrades are proposed to occur to planned downstream trunk infrastructure (ROC-PR-154) along Rochedale Road to a legal point of discharge via an interim drain through 4RP183802 until such time the planned trunk infrastructure (ROC-PR-157) is completed.
	AO3.4 Where on private land, all underground stormwater infrastructure is secured by a drainage easement.	Any underground stormwater within private land will be secured by a drainage easement.
PO4 Development provides a stormwater management system which has sufficient capacity to safely convey run-off taking into account increased run-off from impervious surfaces and flooding in local catchments.	**AO4.1** Development provides a stormwater conveyance system which is designed to safely convey flows in compliance with the standards in the Infrastructure design planning scheme policy.	The stormwater conveyance system will comply with the infrastructure design planning scheme policy unless otherwise approved by Council.
	AO4.2 Development provides sufficient area to convey run-off which will comply with the standards in the Infrastructure design planning scheme policy.	Sufficient area will be provided to convey runoff as required.
PO5	**AO5**	

Performance outcomes	Acceptable outcomes	Response
Development designs stormwater channels, creek modification works, bridges, culverts and major drains to protect and enhance the value of the waterway corridor or drainage path for fauna movement.	Development ensures the design of stormwater channels, creek modifications or other infrastructure, permits terrestrial and aquatic fauna movement.	No works are proposed that would require stormwater design permits or terrestrial and aquatic fauna movement provisions. The discharge points of the development will be constructed to ensure minimal disturbance within the waterway corridor.
PO6 Development ensures that location and design of stormwater detention and water quality treatment: (a) minimises risk to people and property; (b) provides for safe access and maintenance; (c) minimises ecological impacts to creeks and waterways.	**AO6.1** Development locates stormwater detention and water quality treatment: (a) outside of a waterway corridor; (b) offline to any catchment not contained within the development.	Stormwater Quality objectives are met as required by the Brisbane City Council Planning Scheme Policy and State Planning Policy (SPP). Specifically, the water quality objectives for post development will be satisfied through the implementation of best practice end of line stormwater quality bio-filtration basins and inclusion of WSUD tree pits throughout the development. These have been adequately sized to effectively mitigate the pollutant loads generated from the site to the SPP pollutant load reduction targets.
	AO6.2 Development providing for stormwater detention and water quality treatment devices are designed in compliance with the standards in the Infrastructure design planning scheme policy.	Stormwater Quality objectives are met as required by the Brisbane City Council Planning Scheme Policy and State Planning Policy (SPP). Specifically, the water quality objectives for post development will be satisfied through the implementation of best practice end of line stormwater quality bio-filtration basins and inclusion of WSUD tree pits throughout the development. These have been adequately sized to effectively mitigate the pollutant loads generated from the site to the SPP pollutant load reduction targets.
PO7 Development is designed, including any car parking areas and channel works to: (a) reduce property damage; (b) provide safe access to the site during the defined flood event.	**AO7.1** Development (including any ancillary structures and car parking areas) is located above minimum flood immunity levels in Table 9.4.9.3.B, Table 9.4.9.3.C, Table 9.4.9.3.D, Table 9.4.9.3.E and Table 9.4.9.3.F. Note—Compliance with this acceptable outcome can be demonstrated by the submission of a hydraulic and hydrology report	The development will be designed in accordance with the infrastructure design planning scheme policy and will be located above minimum levels in the outlined tables.

Performance outcomes	Acceptable outcomes	Response
	identifying flood levels and development design levels (as part of a site-based stormwater management plan).	
	AO7.2 Development including the road network provides a stormwater management system that provides safe pedestrian and vehicle access in accordance with the standards in the Infrastructure design planning scheme policy.	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council. The stormwater management plans will be co-ordinated with the bulk earthworks and stormwater drainage network at the detailed design stage to ensure an optimal design outcome is achieved.
PO8 Development designs stormwater channels, creek modification works and the drainage network to protect and enhance the environmental values of the waterway corridor or drainage path.	**AO8.1** Development ensures natural waterway corridors and drainage paths are retained.	The proposed storm water strategy will achieve non-worsening of the upstream and downstream waterway through the implementation of the Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3).
	AO8.2 Development provides the required hydraulic conveyance of the drainage channel and floodway, while maximising its potential to maximise environmental benefits and minimise scour. Editor's note—Guidance on natural channel design principles can be found in the Council's publication Natural channel design guidelines.	The proposed Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3) demonstrates how hydraulic conveyance of existing overland flow paths have been considered.
	AO8.3 Development provides stormwater outlets into waterways, creeks, wetlands and overland flow paths with energy dissipation to minimise scour in compliance with the	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council.

Performance outcomes	Acceptable outcomes	Response
	standards in the Infrastructure design planning scheme policy.	Operational works applications will be submitted for approval by Council.
	AO8.4 Development ensures that the design of modifications to the existing design of new stormwater channels, creeks and major drains is in compliance with the standards in the Infrastructure design planning scheme policy.	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council. The proposed Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3) demonstrates how hydraulic conveyance of existing overland flow paths have been considered.
PO9 Development is designed to manage run-off and peak flows by minimising large areas of impervious material and maximising opportunities for capture and re-use.	**AO9** No acceptable outcome is prescribed.	Flows generated by the development will be managed in accordance with Council requirements and through the implementation of the Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3).
PO10 Development ensures that there is sufficient site area to accommodate an effective stormwater management system. Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.	**AO10** No acceptable outcome is prescribed.	Sufficient site area will be provided for stormwater management as approved by Council.
PO11 Development provides for the orderly development of stormwater infrastructure within a catchment, having regard to the: (a) existing capacity of stormwater infrastructure within and external to the site, and any planned stormwater infrastructure upgrades; (b) safe management of stormwater discharge from existing and future up-slope development;	**AO11.1** Development with up-slope external catchment areas provides a drainage connection sized for ultimate catchment conditions that is directed to a lawful point of discharge.	A drainage connection will be provided for up-slope external catchments if required.
	AO11.2 Development ensures that existing stormwater infrastructure that is undersized is upgraded in compliance with the Infrastructure design planning scheme policy.	Upgrades to occur to planned downstream trunk infrastructure (ROC-PR-154) along Rochedale Road to a legal point of discharge via an interim drain through 4RP183802 until such

Performance outcomes	Acceptable outcomes	Response
(c) implication for adjacent and down-slope development.	Development ensures that existing stormwater infrastructure that is undersized is upgraded in compliance with the Priority infrastructure plan and the standards in the Infrastructure design planning scheme policy.	time the planned trunk infrastructure (ROC-PR-157) is completed.
PO12 Development provides stormwater infrastructure which: (a) remains fit for purpose for the life of the development and maintains full functionality in the design flood event; (b) can be safely accessed and maintained cost effectively; (c) ensures no structural damage to existing stormwater infrastructure.	**AO12.1** The stormwater management system is designed in compliance with the Infrastructure design planning scheme policy.	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council. The stormwater management plans will be co-ordinated with the bulk earthworks and stormwater drainage network at the detailed design stage to ensure an optimal design outcome is achieved.
	AO12.2 Development provides a clear area with a minimum of 2m radius from the centre of an existing manhole cover and with a minimum height clearance of 2.5m.	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council.
PO13 Development ensures that all reasonable and practicable measures are taken to manage the impacts of erosion, turbidity and sedimentation, both within and external to the development site from construction activities, including vegetation clearing, earthworks, civil construction, installation of services, rehabilitation, revegetation and landscaping to protect: (a) the environmental values and water quality objectives of waters; (b) waterway hydrology; (c) the maintenance and serviceability of stormwater infrastructure. Note—The Infrastructure design planning scheme policy outlines the appropriate measures to be taken into account to achieve the performance outcome.	**AO13** No acceptable outcome is prescribed.	Development will adopt best practices to reasonably minimize impacts from erosion, turbidity and sedimentation.
PO14 Development ensures that:	**AO14** No acceptable outcome is prescribed.	Development will adopt best practices to reasonably minimize disturbance and erosion.

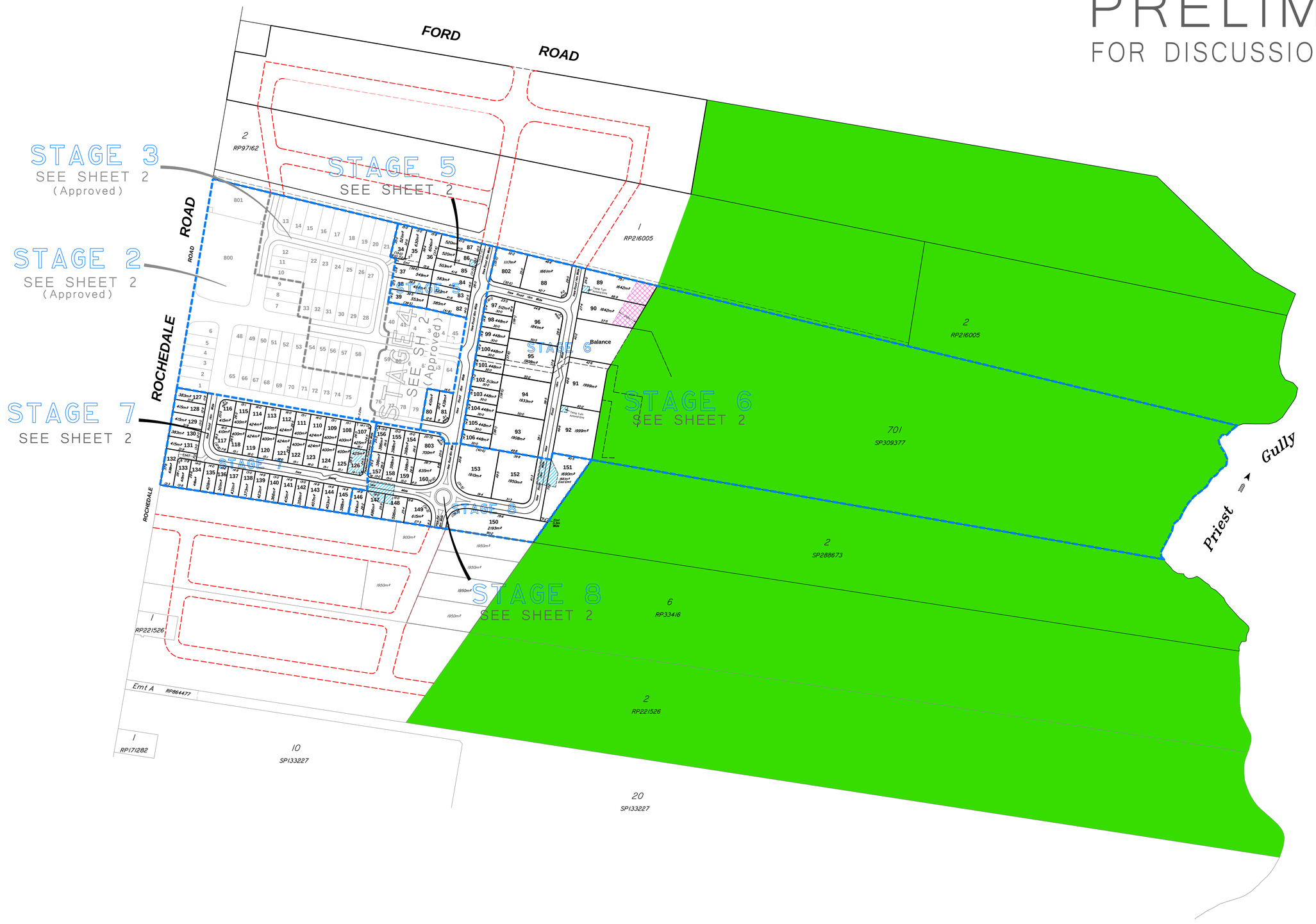
Performance outcomes	Acceptable outcomes	Response
(a) unnecessary disturbance to soil, waterways or drainage channels is avoided; (b) all soil surfaces remain effectively stabilised against erosion in the short and long term.		
PO15 Development does not increase: (a) the concentration of total suspended solids or other contaminants in stormwater flows during site construction; (b) run-off which causes erosion either on site or off site.	**AO15** No acceptable outcome is prescribed.	Erosion and sediment control will be implemented as a part of development. A certified ESC plan will be obtained, and necessary prestart meetings will be undertaken. Audits will be conducted by the Superintendent throughout construction to confirm controls are satisfactory.
Section B—Additional criteria which apply to high-risk development, being one or more of the following: (a) a material change of use for an urban purpose which involves greater than 2,500m^2 of land that: (i) will result in an impervious area greater than 25% of the net developable area; or (ii) will result in 6 or more dwellings. (b) reconfiguring a lot for an urban purpose that involves greater than 2,500m^2 of land and will result in 6 or more lots; (c) operational work for an urban purpose which involves disturbing greater than 2,500m^2 of land.		
PO16 Development ensures that the entry and transport of contaminants into stormwater is avoided or minimised to protect receiving water environmental values. Note—Prescribed water contaminants are defined in the *Environmental Protection Act 1994*. Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.	**AO16** Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	Erosion and sediment control will be implemented as a part of development. A certified ESC plan will be obtained, and necessary prestart meetings will be undertaken. Audits will be conducted by the Superintendent throughout construction to confirm controls are satisfactory. Water quality objectives for post development will be satisfied through the implementation of best practice end of line stormwater quality bio-filtration basins and inclusion of WSUD tree pits throughout the development.
PO17 Development ensures that: (a) the discharge of wastewater to a waterway or external to the site is avoided; or (b) if the discharge cannot practicably be avoided, the development minimises	**AO17** No acceptable outcome is prescribed.	N/A - wastewater will discharge to a sewer reticulation network in accordance with QUU requirements.

Performance outcomes	Acceptable outcomes	Response
wastewater discharge through re-use, recycling, recovery and treatment. Note—The preparation of a wastewater management plan can assist in demonstrating achievement of this performance outcome. Editor's note—This code does not deal with sewerage which is the subject of the Wastewater code.		
Section C—Additional performance outcomes and acceptable outcomes for assessable development for a material change of use or reconfiguring a lot.		
PO18 Development protects stormwater infrastructure to ensure the following are not compromised: a. the long term infrastructure for the stormwater network in the Long term infrastructure plans; b. the existing and planned infrastructure for the stormwater network in the Local government infrastructure plan; c. the provision of long term, existing and planned infrastructure for the stormwater network which: i. is required to service the development or an existing and future urban development in the planning scheme area; or ii. is in the interests of rational development or the efficient and orderly planning of the general area in which the site is situated. Editor's note—A condition which requires a proposed development to keep permanent improvements and structures associated with the approved development clear of the area of long term infrastructure, may be imposed.	**AO18** Development protects stormwater infrastructure in compliance with the following: a. for long term infrastructure for the stormwater network, the Long term infrastructure plans; b. for existing and planned infrastructure for the stormwater network, the Local government infrastructure plan; c. the standards for stormwater drainage in the Infrastructure design planning scheme policy.	Works will comply with the infrastructure design planning scheme policy and development guidelines unless otherwise approved by Council.
PO19 Development provides for the payment of extra trunk infrastructure costs for the following: a. for development completely or partly outside the priority infrastructure area in the Local government infrastructure plan; b. for development completely inside the priority infrastructure area in the Local government infrastructure plan involving: i. trunk infrastructure that is to be provided earlier than planned in the Local government infrastructure plan;	**AO19** No acceptable outcome is prescribed.	The development is located within the Local Government Infrastructure Plan and will be delivered in accordance with the accepted conditions of approval.

Performance outcomes	Acceptable outcomes	Response
ii. long term infrastructure for the stormwater network which is made necessary by development that is not assumed future urban development; iii. other infrastructure for the stormwater network associated with development that is not assumed future urban development which is made necessary by the development. Editor's note—The payment of extra trunk infrastructure costs for development completely inside the priority infrastructure area in the Local government infrastructure plan is to be worked out in accordance with the Charges Resolution. Editor's note—See section 130 Imposing Development conditions (Conditions for extra trunk infrastructure costs) of the Planning Act		

Appendix B Reconfiguration of Lot Plan

PRELIMINARY
FOR DISCUSSION PURPOSES



Legend

- Regional Landscape and Rural Production Area/Environmental Management Zone
- Dwelling Exclusion Zone - 20m wide
- Temporary Turnaround Easement
- Proposed Stage Boundary
- Proposed Road

Notes

1. Any licence, express or implied, to use this document for any purpose whatsoever is restricted to the terms of the agreement or implied agreement between Wolter Consulting Group and the instructing party.

2. Design subject to local authority approval & detailed engineering requirements , areas and dimensions are approximate only and are subject to survey. Therefore this drawing is not to be used for engineering design.

3. This note is an integral part of this plan. This plan may not be reproduced without this notation being included.

Table of Development

Gross area of subject land	27.19 ha
Area of proposed park and open space (Including drainage reserve)	1.093ha
Area of new road	3.716 ha
Length of new road	2815m
Net area of subject land (Excluding new road, park & open space)	22.38ha
Number of proposed residential lots	102
Number of existing lots	6

Final intended use of new lots:

Proposed Lots 1-45,48-255 are for residential use.
Proposed Lot 800 is for park and open space.
Proposed Lots 801-806 is for Drainage.

WOLTER consulting group
Planning Urban Design Landscape Environment Surveying
Brisbane: Level 2, 1 Breakfast Ck Road, Newstead, QLD 4006 Phone: (07) 3666 5200

Scale 1:2000 @ A1 - Lengths are in Metres.
20 0 20 40 60 80 100 120 140 160 180 200

Plan of Reconfiguration

Rochedale Road, Rochedale

Local Authority — Brisbane City

Description
Lot 1 on SP288673, Lot 3 on RP181371 & Lots 700 & 701 on SP309377

DRAWING NO.	VERSION
SB1039-14-01	AE
DATE DRAWN	SHEET NO.
16-09-2022	1 of 2

Appendix C Floodwise Property Report

Brisbane City Council

FloodWise Property Report

Dedicated to a better Brisbane

Report Reference
1610662202262

15/01/2021 08:10:02

THIS REPORT IS FOR BUILDING AND DEVELOPMENT PURPOSES ONLY

The FloodWise Property Report provides property or lot-based flood information for building and development requirements. This report provides information on estimated flood levels, habitable floor level requirements and more technical information on the four sources of flooding: river, creek / waterway, storm tide and overland flow. Refer to the Useful Definitions section for a glossary of terms.

To find out more about how the contents of this report may affect building or development on this property, please visit www.brisbane.qld.gov.au/planning-building.For more general information about understanding your flood risk and how to prepare your property, family or business for potential flooding visit www.brisbane.qld.gov.au/beprepared

THIS IS A REPORT FOR:

Rateable Address: 520 ROCHEDALE RD, ROCHEDALE QLD 4123

Lot Details: L.701 SP.309377

This property has flags for building or development purposes only

Brisbane City Council has not assigned flood level information for this property for building or development purposes. However, mapping indicates that it is affected by one or more flood or property development flags. Please refer below for details.

For professional advice or detailed assessment of a property contact a Registered Professional Engineer of Queensland.

For general information on your flood risk and how to prepare your home or business for potential flooding visit www.brisbane.qld.gov.au/beprepared.

FLOOD AND PLANNING DEVELOPMENT FLAGS

DEVELOPMENT FLAG(S)

This property may also be affected by one or more flood or property development overlays or flags. These include: OVERLAND FLOW PATH,LARGE ALLOTMENT,WATERWAY CORRIDOR

Please review the technical summary over page and refer to Council's planning scheme for further information.

Brisbane City Council

FloodWise Property Report

Dedicated to a better Brisbane

Report Reference
1610662202262

15/01/2021 08:10:02

TECHNICAL SUMMARY

This section of the FloodWise Property Report contains more detailed flood information for this property so surveyors, builders, certifiers, architects and engineers can plan and build in accordance with Council's planning scheme. For more information about building and development in Brisbane please visit www.brisbane.qld.gov.au/planning-building or talk to a Development Assessment Planning Information Officer via Council's Contact Centre on (07) 3403 8888.

THIS IS A REPORT FOR:

Rateable Address: 520 ROCHEDALE RD, ROCHEDALE QLD 4123

Lot Details: L.701 SP.309377

FLOOD PLANNING DEVELOPMENT INFORMATION

This section of the FloodWise Property Report contains information about Council's planning scheme overlays. Overlays identify areas within the planning scheme that reflect distinct themes that may include constrained land and/or areas sensitive to the effects of development.

FLOOD OVERLAY CODE

The Flood overlay code of Council's planning scheme uses the following information to provide guidelines when developing properties. The table below summarises the Flood Planning Areas (FPAs) that apply to this property. Development guidelines for the FPAs are explained in Council's planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

FLOOD PLANNING AREAS (FPA)		
RIVER	CREEK/WATERWAY	OVERLAND FLOW
		Applicable

COASTAL HAZARD OVERLAY CODE

There are currently no Coastal Hazard Overlays that apply to this property.

PROPERTY DEVELOPMENT FLAGS

Overland Flow Path - Mapping indicates this property may be located within an overland flow path. Overland flow flooding usually occurs when the capacity of the underground piped drainage system is exceeded and/or when the overland flow path is blocked. It is recommended you consult a Registered Professional Engineer of Queensland to determine this property's habitable floor level and flooding depth. Please refer to Council's planning scheme for further information.

Waterway Corridor - This property may also be located within a mapped waterway corridor as identified in the waterway corridors overlay map of Council's planning scheme. Please consider this in conjunction with Council's planning scheme requirements.

Large Allotment - This property is either a Large Allotment of over 1000 square metres or is located within a Large Allotment. Flood levels may vary significantly across allotments of this size. Further investigations may be warranted in determining the variation in flood levels and the minimum habitable floor level across the site. For more information or advice, it is recommended you engage a Registered Professional Engineer of Queensland.

Brisbane City Council

FloodWise Property Report

Dedicated to a better Brisbane

Report Reference
1610662202262

15/01/2021 08:10:02

Useful Definitions

Australian Height Datum (AHD) - The reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.

Annual Exceedance Probability (AEP) – The probability of a flood event of a given size occurring in any one year, usually expressed as a percentage annual chance.

Defined Flood Level (DFL) - The DFL for Brisbane River flooding is a level of 3.7m AHD at the Brisbane City Gauge based on a flow of 6,800 m^3/s.

Maximum and Minimum Ground Level – Highest and lowest ground levels on the property based on available ground level information. A Registered Surveyor can confirm exact ground levels.

Minimum Habitable Floor Level – The minimum level in metres AHD at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family and rumpus rooms) must be constructed.

Council's Planning Scheme - The City Plan (planning scheme) has been prepared in accordance with the Sustainable Planning Act as a framework for managing development in a way that advances the purpose of the Act. In seeking to achieve this purpose, the planning scheme sets out the Council's intention for future development in the planning scheme area, over the next 20 years.

Residential Flood Level (RFL) – Residential flood level (RFL) for Brisbane River flooding equates to the flood level applicable to the extent of January 2011 floods as depicted by mapping on the Queensland Reconstruction Authority website or the Council's defined flood level (DFL) for the Brisbane River, whichever is higher.

Rateable Address - A Lot or Property may have more than one street address. The address shown on this report is the address used by Council for the Lot or property selected.

Property - A property will contain 1 or more lots. The *Multiple Lot Warning* is shown if you have selected a property that contains multiple lots.

Brisbane City Council's Online Flood Tools

Council provides a number of online flood tools:

- to guide planning and development
- to help residents and businesses understand their flood risk and prepare for flooding.

Planning and Development Online Flood Tools

Council's online flood tools for planning and development purposes include:

- FloodWise Property Report
- Flood Overlay Code

For more information on Council's planning scheme and online flood tools for planning and development:

- phone 07 3403 8888 to talk to a Development Assessment Customer Liaison Officer
- visit www.brisbane.qld.gov.au/planning-building
- visit a Regional Business Centre.

Helping residents and businesses be prepared for flooding

Council has a range of free tools and information to help residents and businesses understand potential flood risks and how to be prepared. This includes:

- Flood Awareness Map
- Flooding in Brisbane – A Guide for Residents
- Flooding in Brisbane – A Guide for Businesses
- Early Warning Alert Service. Visit www.brisbane.qld.gov.au/earlywarning to register for email, home phone or SMS severe weather alert updates.

Note: The Flood Awareness Map shows four levels of flood likelihood from high likelihood (flooding is very likely to occur) through to very low likelihood (very rare and extreme flood events).

For more information on Council's online flood tools for residents and business:

- Visit www.brisbane.qld.gov.au/beprepared
- Phone (07) 3403 8888.

Appendix D Summary of Rational Method

RATIONAL METHOD SUMMARY & RAINFALL DATA

Project The Pinnacle at Arise, Rochedale
Project # 20-0102

Rainfall IFD Input Data (Australian Rainfall and Runoff)

$^{2}I_{1}$	$^{2}I_{12}$	$^{2}I_{72}$	$^{50}I_{1}$	$^{50}I_{12}$	$^{50}I_{72}$	F2	F50	G
47.85	8.21	2.63	96.64	17.48	5.39	4.4	17.24	0.11

Rainfall Intensity (mm/hr)

DURATION		AVERAGE RECURRENCE INTERVAL (years)						
(hours)	(minutes)	1 yr	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr
0.083	5	118	151	192	215	248	290	323
0.1	6	111	142	180	203	233	273	304
0.167	10	91	117	149	168	193	227	254
0.25	15	76	98	125	142	164	193	216
0.333	20	66	85	110	124	144	170	190
0.417	25	59	76	98	112	130	153	172
0.5	30	54	69	90	102	119	141	158
0.75	45	43.0	56	73	83	97	115	129
1	60	36.5	47.5	62	71	83	99	111
1.5	90	27.6	35.9	47.2	54	63	75	85
2	120	22.5	29.3	38.6	44.3	52	62	70
3	180	16.8	21.9	29.0	33.4	39.1	46.8	53
4.5	270	12.6	16.4	21.8	25.1	29.4	35.3	39.9
6	360	10.2	13.3	17.8	20.5	24.1	28.9	32.7
9	540	7.63	9.99	13.3	15.4	18.2	21.9	24.8
12	720	6.21	8.15	10.9	12.6	14.9	17.9	20.3
18	1080	4.88	6.39	8.53	9.86	11.6	13.9	15.8
24	1440	4.11	5.38	7.16	8.26	9.70	11.7	13.2
30	1800	3.58	4.69	6.22	7.18	8.42	10.1	11.4
36	2160	3.20	4.18	5.54	6.38	7.48	8.98	10.2
48	2880	2.66	3.47	4.58	5.27	6.18	7.40	8.36
72	4320	2.00	2.61	3.44	3.95	4.62	5.52	6.23

Catchment Data

Details: Existing

Variable	Value	Units
Area:	28.91	ha
C_{10}	0.70	fraction

Rational Method Summary

Adopted Time of Concentration (tc) 65 Minutes (or 1.08 hours)

Variable	AVERAGE RECURRENCE INTERVAL (years)						
	1 yr	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr
Freq Factor	0.80	0.85	0.95	1.00	1.05	1.15	1.20
Intensity (mm/hr)	35	45	59	67	79	94	106
Discharge (m^3/s)	1.56	2.15	3.15	3.79	4.65	6.07	7.13

Appendix E Base Case Model Flood Maps

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_100yr_d_crit

- 0.004
- 0.25
- 0.5
- 0.75
- 1
- 1.5

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	100Y ARI - FLOOD DEPTH MAP - BASE CASE (E07)	FIGURE NO: 01A	

© Colliers

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_050yr_d_crit

- 0.004
- 0.25
- 0.5
- 0.75
- 1
- 1.5

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	50Y ARI - FLOOD DEPTH MAP - BASE CASE (E07)	FIGURE NO: 02A	

© Colliers

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_020yr_d_crit

- 0.004
- 0.25
- 0.5
- 0.75
- 1
- 1.5

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	20Y ARI - FLOOD DEPTH MAP - BASE CASE (E07)	FIGURE NO: 03A	

© Colliers

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_010yr_d_crit

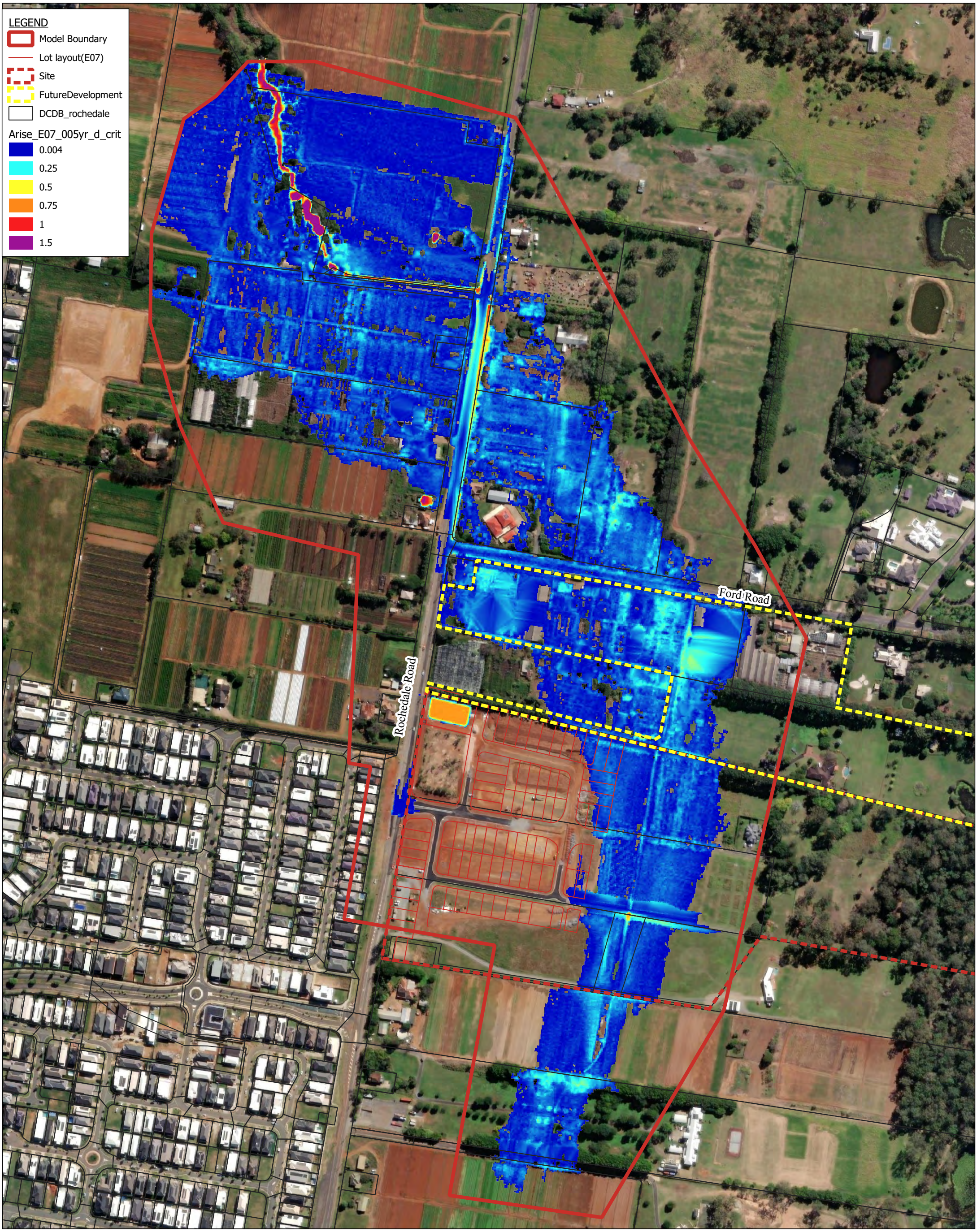
- 0.004
- 0.25
- 0.5
- 0.75
- 1
- 1.5

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	10Y ARI - FLOOD DEPTH MAP - BASE CASE (E07)	FIGURE NO: 04A	

© Colliers



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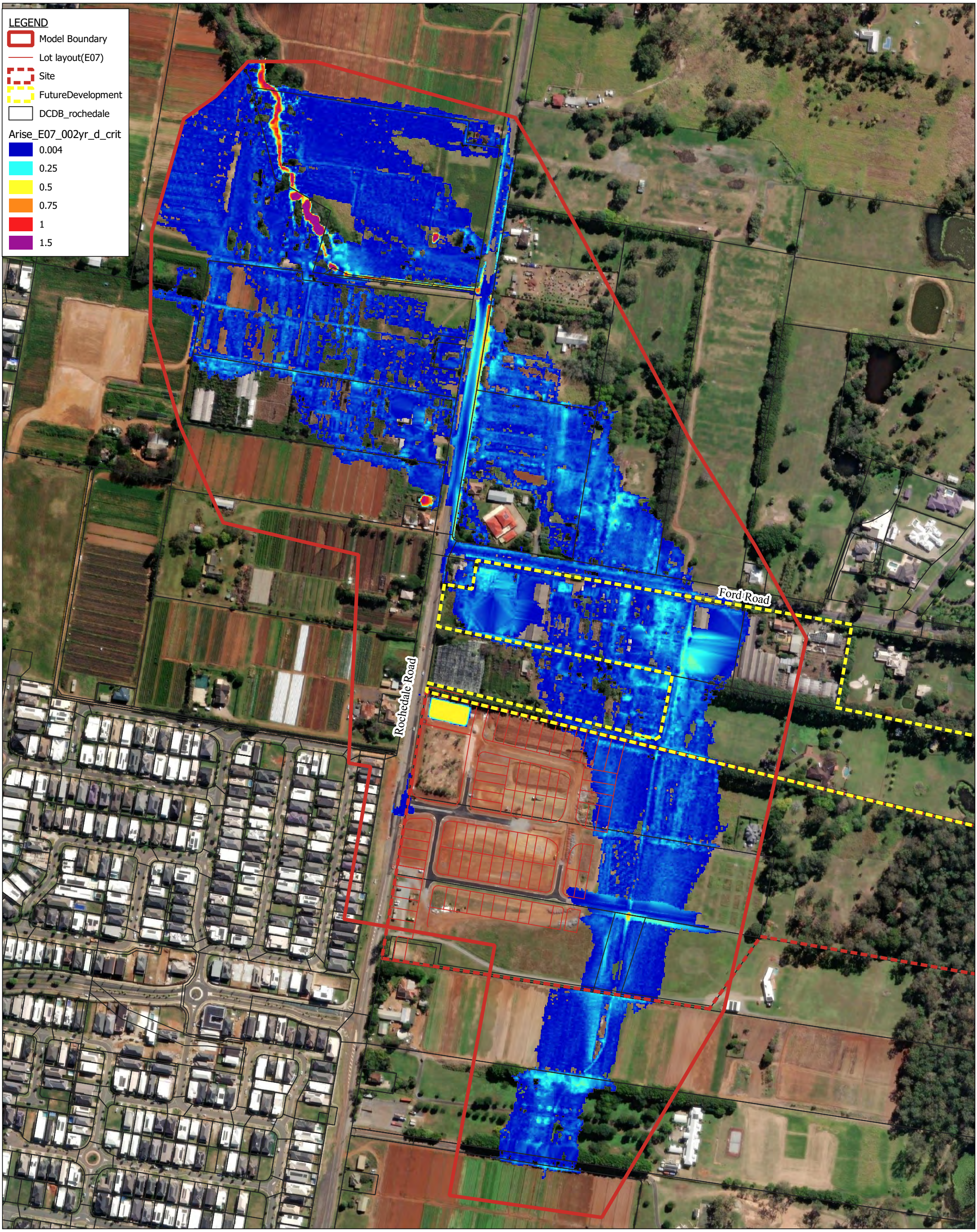
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
REVISION:	A	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	5Y ARI - FLOOD DEPTH MAP - BASE CASE (E07)	FIGURE NO: 05A	

© Colliers



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STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	2Y ARI - FLOOD DEPTH MAP - BASE CASE (E07)	FIGURE NO: 06A	

© Colliers

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_100yr_V_crit

- <= 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
REVISION:	A	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	100Y ARI - FLOOD VELOCITY MAP - BASE CASE (E07)	FIGURE NO: 07A	

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LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_050yr_V_crit

- <= 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	50Y ARI - FLOOD VELOCITY MAP - BASE CASE (E07)	FIGURE NO: 08A	

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LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_020yr_V_crit

- <= 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
REVISION:	A	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	20Y ARI - FLOOD VELOCITY MAP - BASE CASE (E07)	FIGURE NO: 09A	

© Colliers

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_010yr_V_crit

- <= 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
REVISION:	A	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	10Y ARI - FLOOD VELOCITY MAP - BASE CASE (E07)	FIGURE NO: 10A	

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LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_005yr_V_crit

- <= 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
REVISION:	A	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	5Y ARI - FLOOD VELOCITY MAP - BASE CASE (E07)	FIGURE NO: 11A	

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LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_002yr_V_crit

- <= 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
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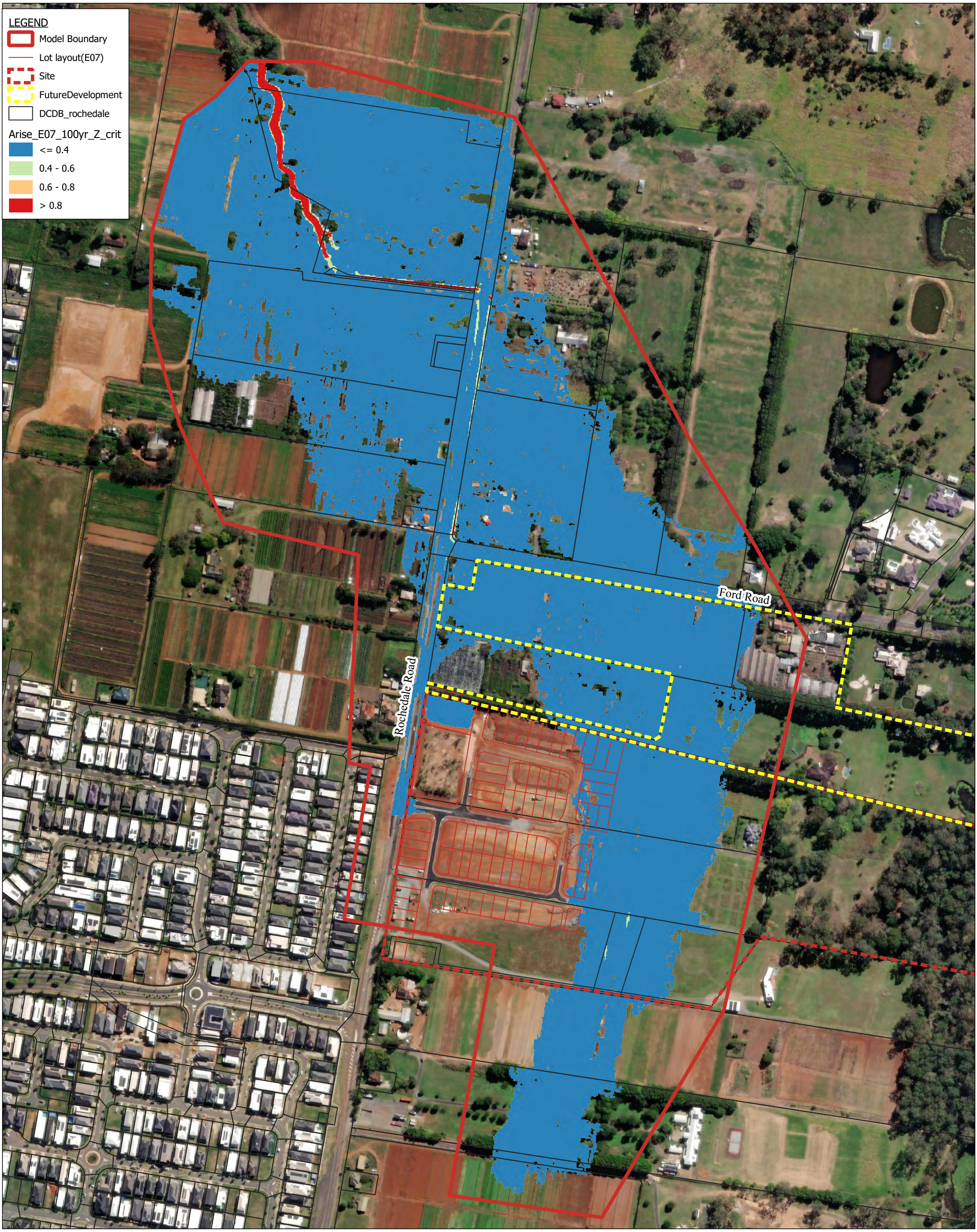
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	2Y ARI - FLOOD VELOCITY MAP - BASE CASE (E07)	FIGURE NO: 12A	

© Colliers



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STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	100Y ARI - FLOOD HAZARD MAP - BASE CASE (E07)	FIGURE NO: 13A	

© Colliers

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_050yr_Z_crit

- <= 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- > 0.8

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
REVISION:	A	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	50Y ARI - FLOOD HAZARD MAP - BASE CASE (E07)	FIGURE NO: 14A	

© Colliers

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_020yr_Z_crit

- <= 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- > 0.8

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
REVISION:	A	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	20Y ARI - FLOOD HAZARD MAP - BASE CASE (E07)	FIGURE NO: 15A	

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LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_010yr_Z_crit

- <= 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- > 0.8

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	10Y ARI - FLOOD HAZARD MAP - BASE CASE (E07)	FIGURE NO: 16A	

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LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_005yr_Z_crit

- <= 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- > 0.8

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
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PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	5Y ARI - FLOOD HAZARD MAP - BASE CASE (E07)	FIGURE NO: 17A	

© Colliers

LEGEND

- Model Boundary
- Lot layout(E07)
- Site
- FutureDevelopment
- DCDB_rochedale

Arise_E07_002yr_Z_crit

- <= 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- > 0.8

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY	PAGE SIZE: A3 SCALE: 1:4,000	
REVISION:	A	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
STATUS:	Issue		
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	2Y ARI - FLOOD HAZARD MAP - BASE CASE (E07)	FIGURE NO: 18A	

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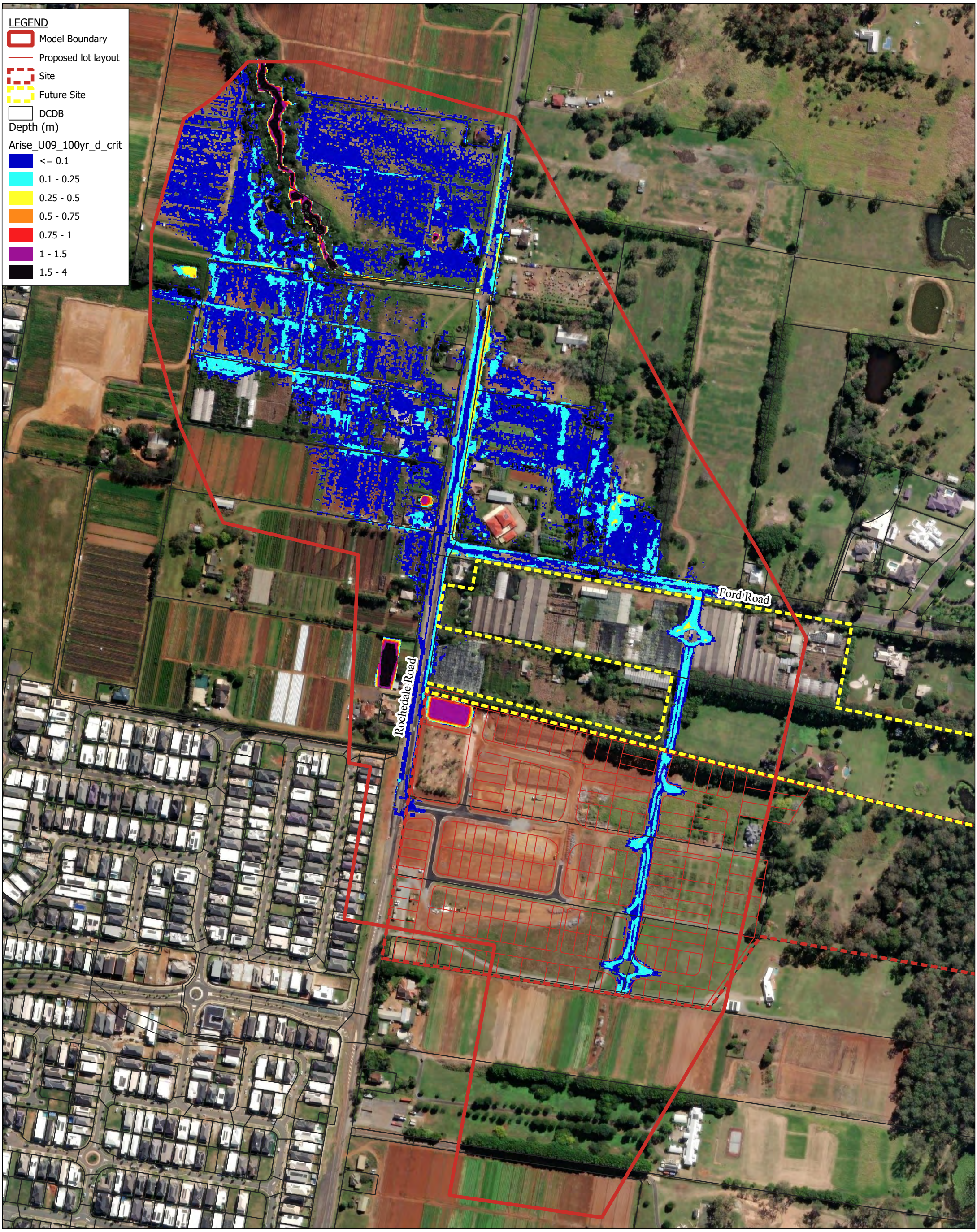
Appendix F Ultimate Developed Model Flood Maps



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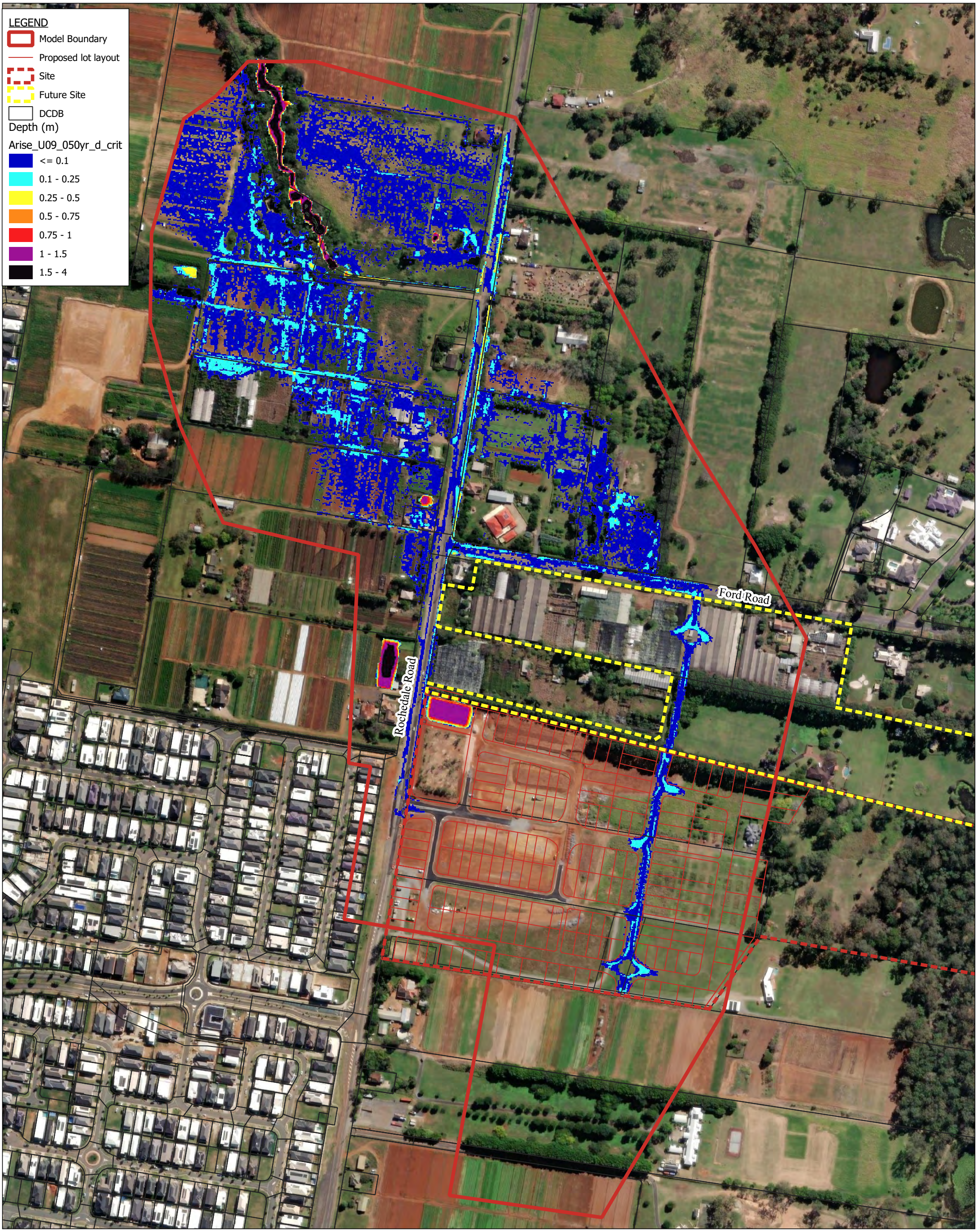
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	100Y ARI - FLOOD DEPTH MAP - ULTIMATE (U09)	FIGURE NO: 19A	

© Colliers



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STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	50Y AR - FLOOD DEPTH MAP - ULTIMATE (U09)	FIGURE NO: 20A	

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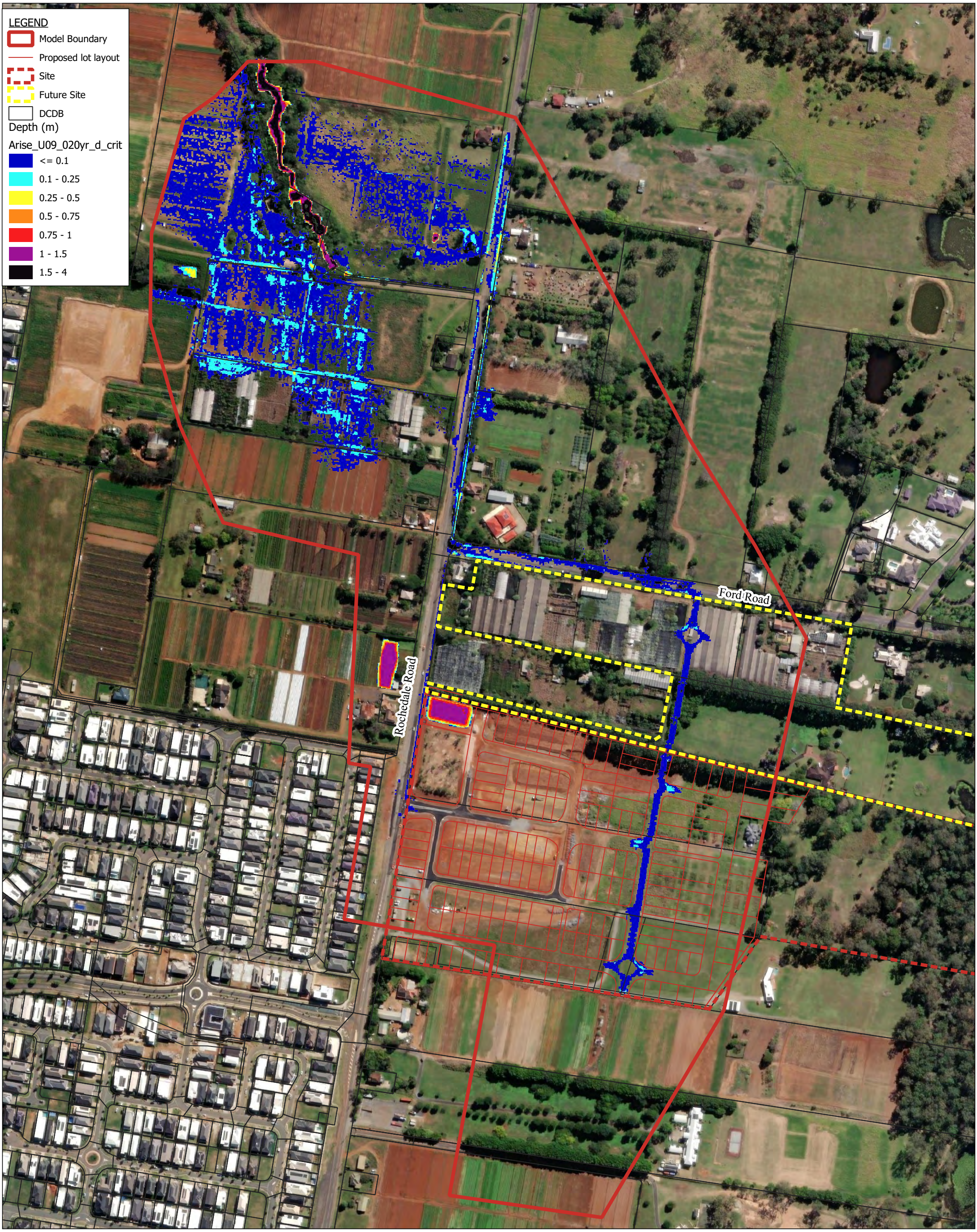

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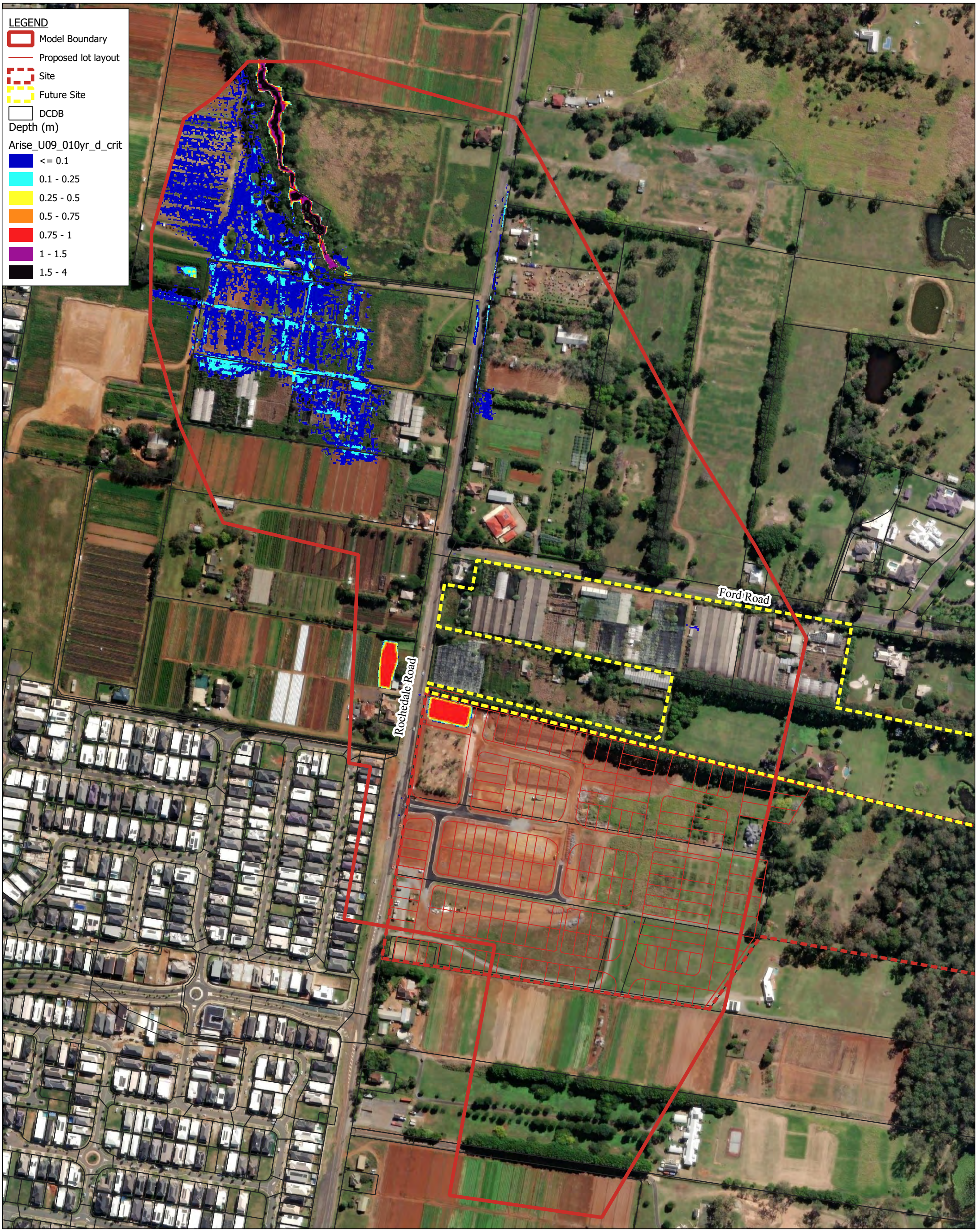
PROJECT TITLE: ARISE, ROCHEDALE		PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE: 20Y AR - FLOOD DEPTH MAP - ULTIMATE (U09)		FIGURE NO: 21A	

© Colliers



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REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
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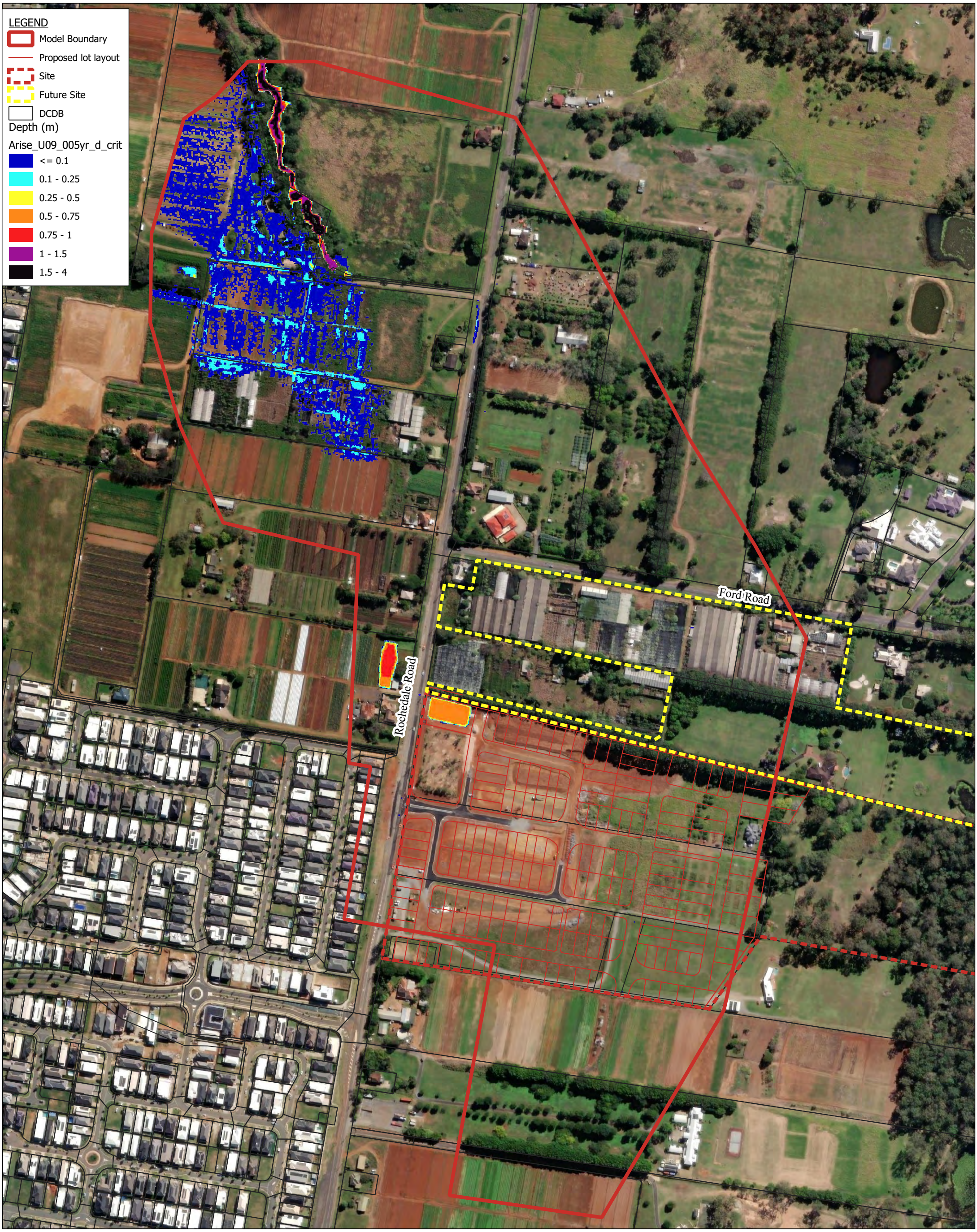
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	10Y AR - FLOOD DEPTH MAP - ULTIMATE (U09)	FIGURE NO: 22A	

© Colliers



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CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
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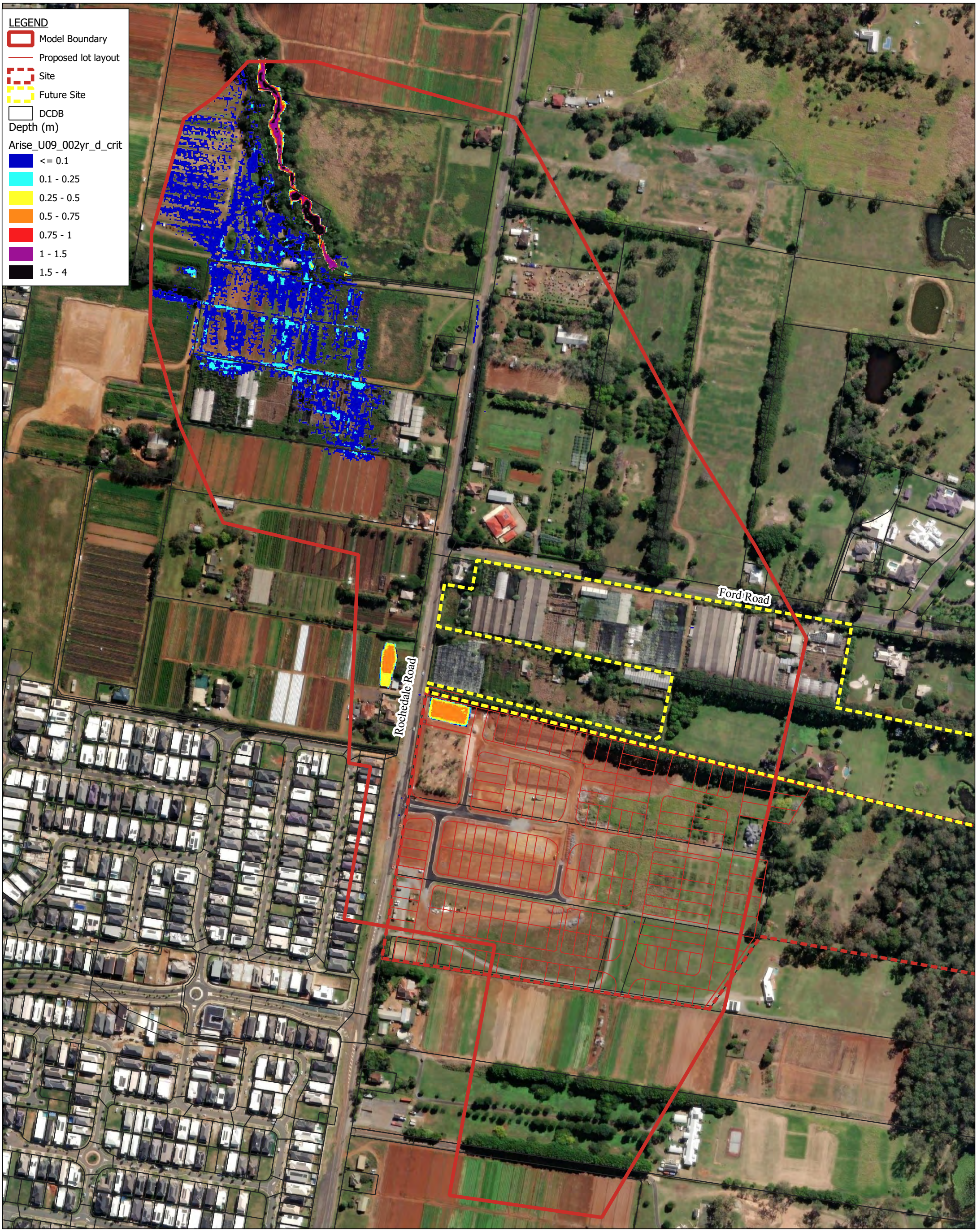
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	5Y AR - FLOOD DEPTH MAP - ULTIMATE (U09)	FIGURE NO: 23A	

© Colliers



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STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	2Y AR - FLOOD DEPTH MAP - ULTIMATE (U09)	FIGURE NO: 24A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Velocity (m/s)

Arise_U09_100yr_V_crit

<= 0.5

0.5 - 1

1 - 1.5

1.5 - 2

2 - 2.5

2.5 - 3

3 - 3.5

> 3.5

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	100Y ARI - FLOOD VELOCITY MAP - ULTIMATE (U09)	FIGURE NO: 25A	

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LEGEND

- Model Boundary
- Proposed lot layout
- Site
- Future Site
- DCDB

Velocity (m/s)

Arise_U09_050yr_V_crit

- <= 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	50Y ARI - FLOOD VELOCITY MAP - ULTIMATE (U09)	FIGURE NO: 26A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Velocity (m/s)

Arise_U09_020yr_V_crit

<= 0.5

0.5 - 1

1 - 1.5

1.5 - 2

2 - 2.5

2.5 - 3

3 - 3.5

> 3.5

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m			CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY				
REVISION:	A	PAGE SIZE: A3	SCALE: 1:4,000	N	
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56			
PROJECT TITLE:	ARISE, ROCHEDALE		PROJECT NO:	20-0102	CLIENT:
FIGURE TITLE:	20Y ARI - FLOOD VELOCITY MAP - ULTIMATE (U09)		FIGURE NO:	27A	

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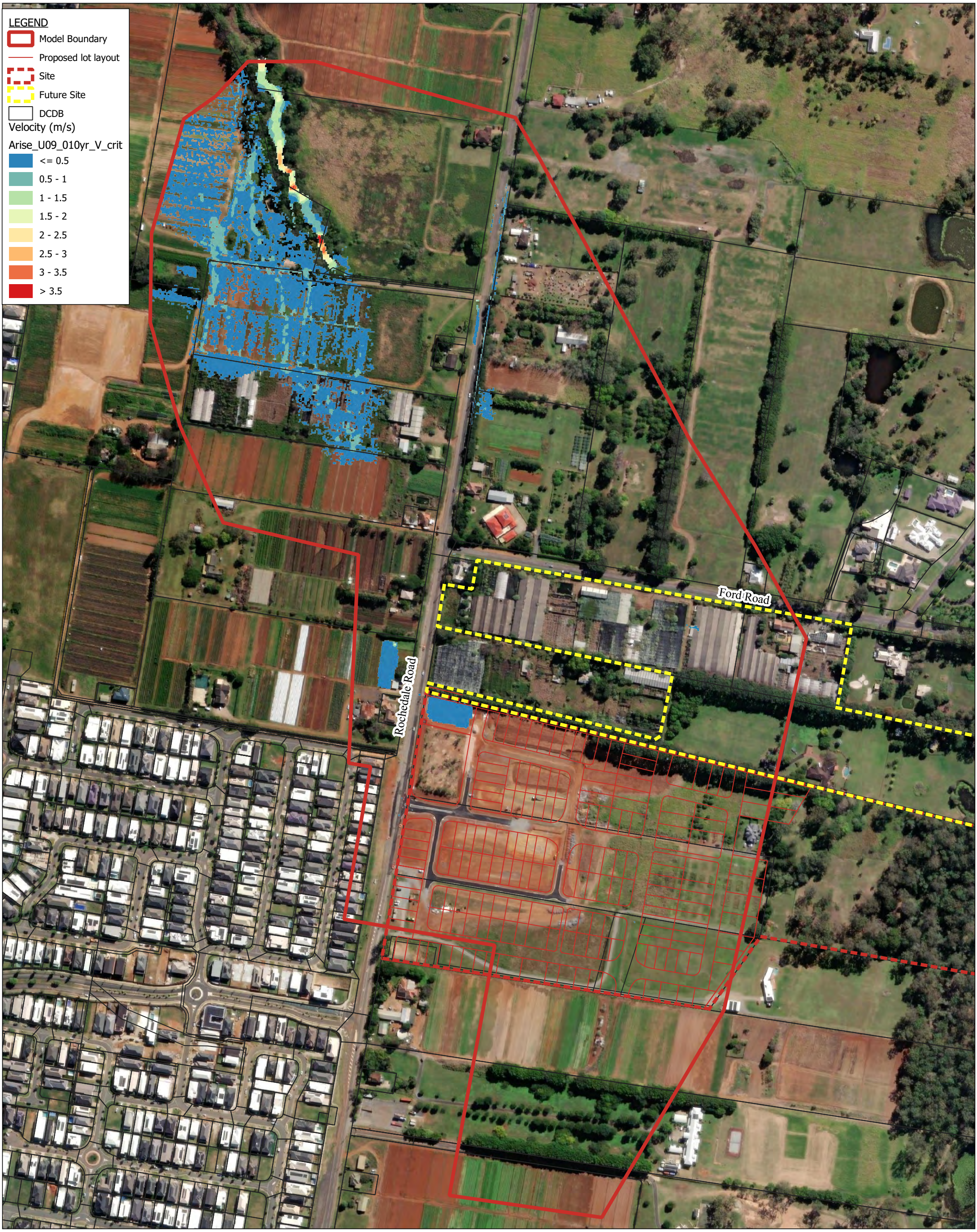

DATE: 22/11/2022 CREATED BY: K. MCKENDRY REVISION: A STATUS: Issue	0 53 106 159 212 m PAGE SIZE: A3 SCALE: 1:4,000 COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N	CONSULTANT: Colliers
PROJECT TITLE: ARISE, ROCHEDALE		PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE: 10Y ARI - FLOOD VELOCITY MAP - ULTIMATE (U09)		FIGURE NO: 28A	

© Colliers

LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Velocity (m/s)

Arise_U09_005yr_V_crit

<= 0.5

0.5 - 1

1 - 1.5

1.5 - 2

2 - 2.5

2.5 - 3

3 - 3.5

> 3.5

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	5Y ARI - FLOOD VELOCITY MAP - ULTIMATE (U09)	FIGURE NO: 29A	

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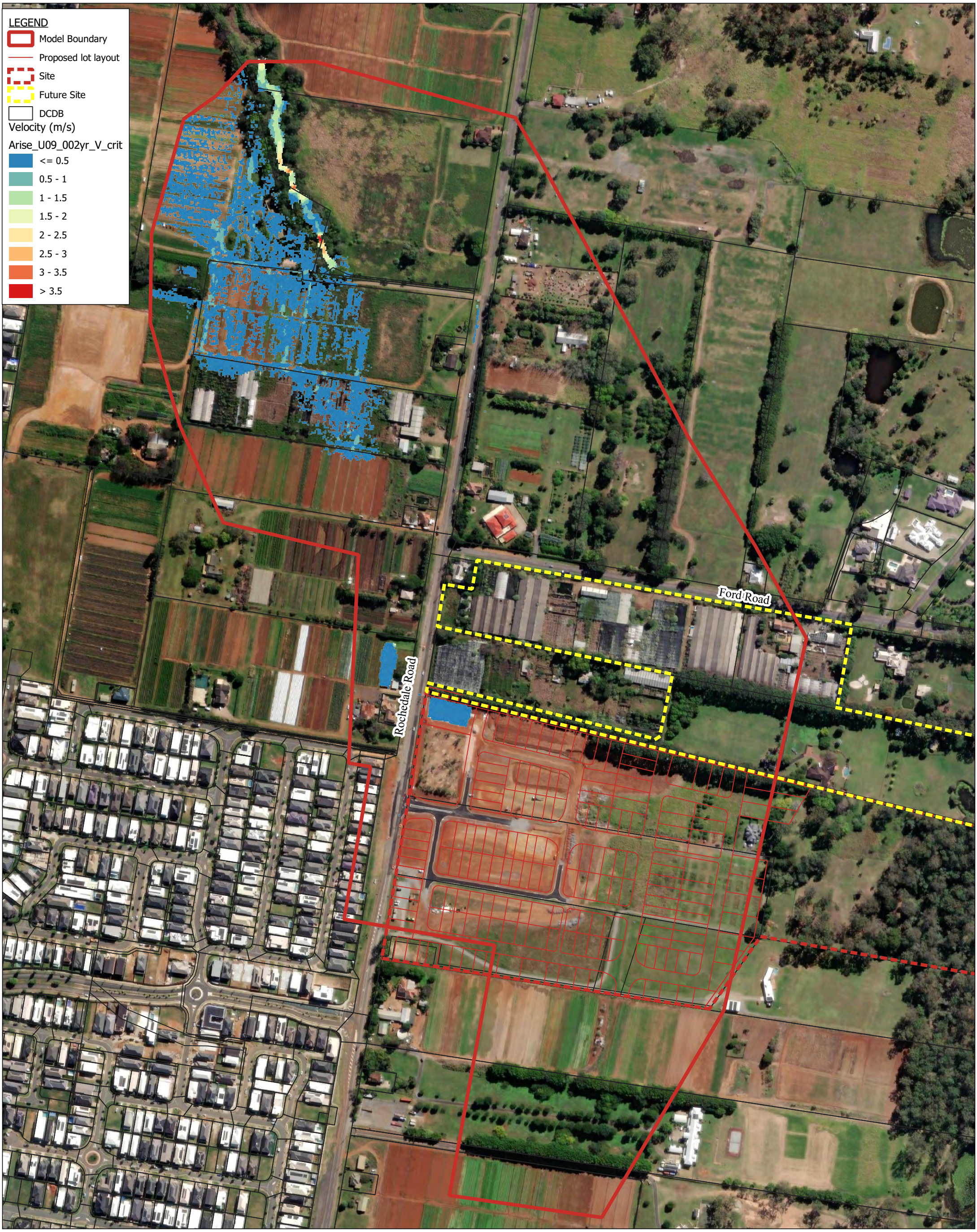

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	2Y ARI - FLOOD VELOCITY MAP - ULTIMATE (U09)	FIGURE NO: 30A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Hazard

Arise_U09_100yr_Z_crit

<= 0.4

0.4 - 0.6

0.6 - 0.8

> 0.8

Ford Road

Rochedale Road

DATE:	22/11/2022	CONSULTANT: Colliers	
CREATED BY:	K. MCKENDRY	0 53 106 159 212 m	N
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	100Y ARI - FLOOD HAZARD MAP - ULTIMATE (U09)	FIGURE NO: 31A	

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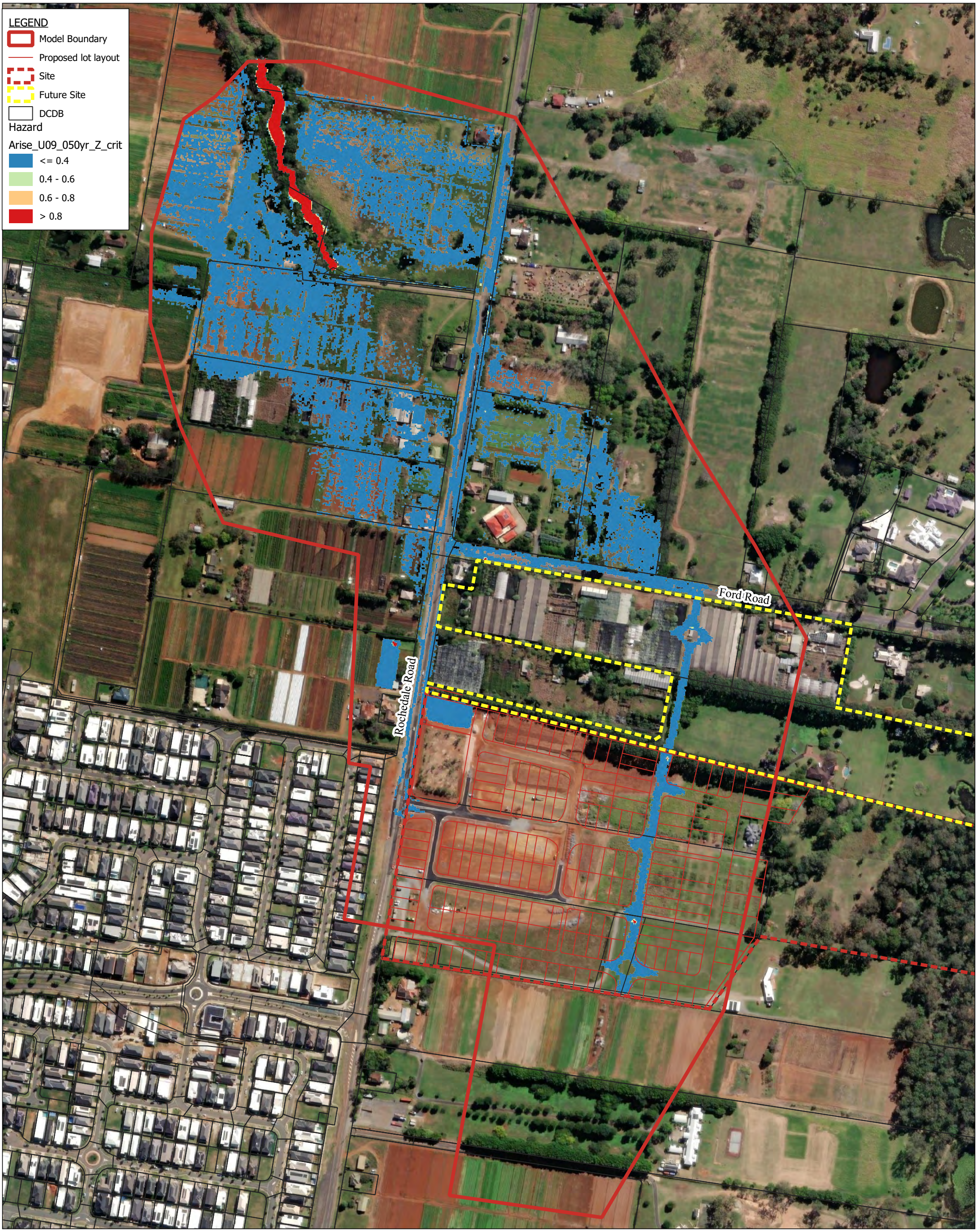

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	50Y ARI - FLOOD HAZARD MAP - ULTIMATE (U09)	FIGURE NO: 32A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Hazard

Arise_U09_020yr_Z_crit

<= 0.4

0.4 - 0.6

0.6 - 0.8

> 0.8

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	20Y ARI - FLOOD HAZARD MAP - ULTIMATE (U09)	FIGURE NO: 33A	

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LEGEND

- Model Boundary
- Proposed lot layout
- Site
- Future Site
- DCDB

Hazard

Arise_U09_010yr_Z_crit

- <= 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- > 0.8

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	10Y ARI - FLOOD HAZARD MAP - ULTIMATE (U09)	FIGURE NO: 34A	

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LEGEND

- Model Boundary
- Proposed lot layout
- Site
- Future Site
- DCDB

Hazard

Arise_U09_005yr_Z_crit

- <= 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- > 0.8

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	5Y ARI - FLOOD HAZARD MAP - ULTIMATE (U09)	FIGURE NO: 35A	

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LEGEND

- Model Boundary
- Proposed lot layout
- Site
- Future Site
- DCDB

Hazard

Arise_U09_002yr_Z_crit

- <= 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- > 0.8

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	2Y ARI - FLOOD HAZARD MAP - ULTIMATE (U09)	FIGURE NO: 36A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Afflux_100yr_U09-E07

<-0.1

-0.08 to -0.1

-0.06 to -0.08

-0.04 to -0.06

-0.02 to -0.04

-0.02 to 0.02

0.02 to 0.04

0.04 to 0.06

0.06 to 0.08

0.08 to 0.1

>0.1

Afflux_100yr_U09-E07_wd

Was Wet now Dry

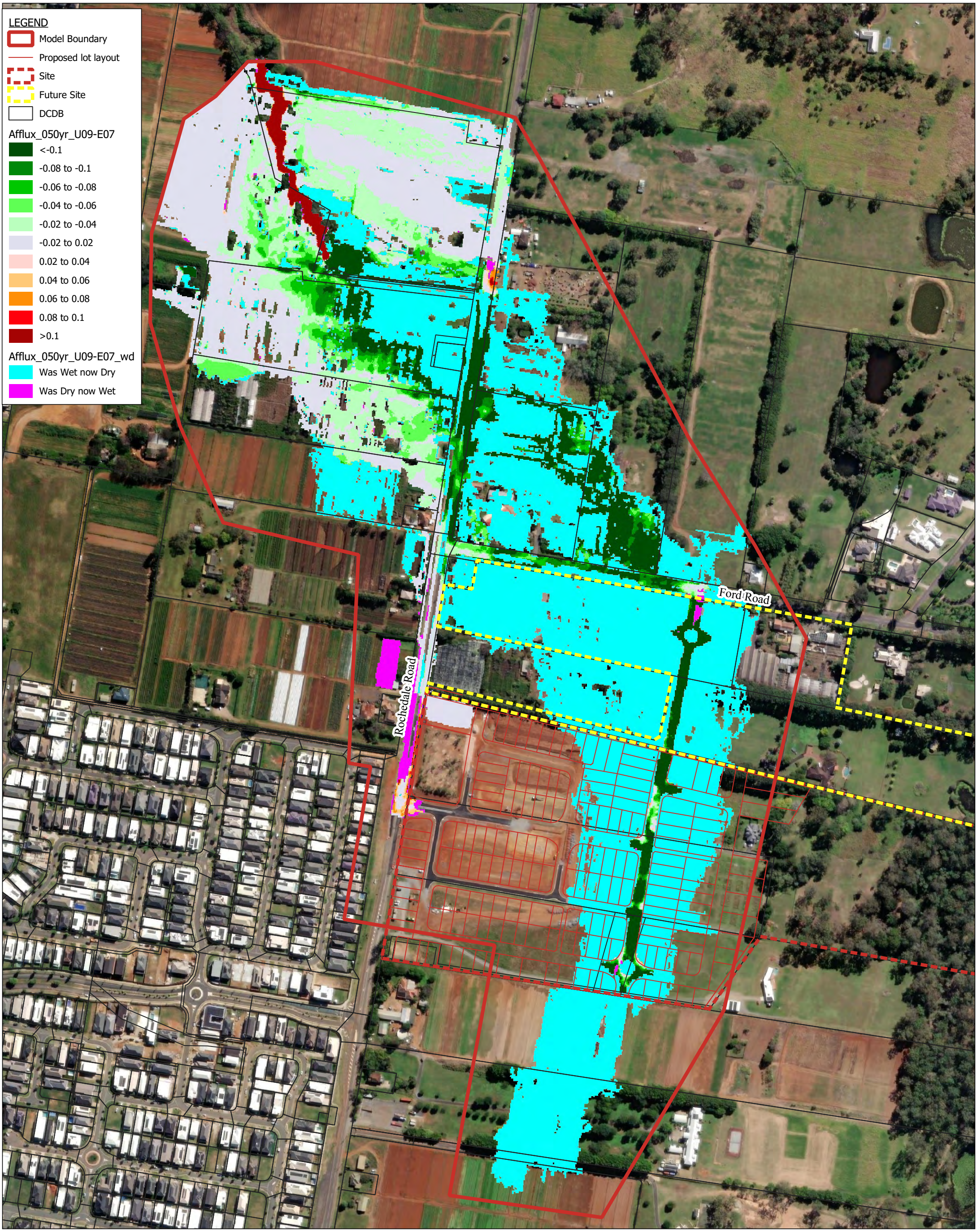
Was Dry now Wet

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	100Y ARI - FLOOD AFFLUX MAP - ULTIMATE (U09) Vs BASE CASE (E07)	FIGURE NO: 37A	

© Colliers



DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	50Y ARI - FLOOD AFFLUX MAP - ULTIMATE (U09) Vs BASE CASE (E07)	FIGURE NO: 38A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Afflux_020yr_U09-E07

<-0.1

-0.08 to -0.1

-0.06 to -0.08

-0.04 to -0.06

-0.02 to -0.04

-0.02 to 0.02

0.02 to 0.04

0.04 to 0.06

0.06 to 0.08

0.08 to 0.1

>0.1

Afflux_020yr_U09-E07_wd

Was Wet now Dry

Was Dry now Wet

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	20Y ARI - FLOOD AFFLUX MAP - ULTIMATE (U09) Vs BASE CASE (E07)	FIGURE NO: 39A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Afflux_010yr_U09-E07

<-0.1

-0.08 to -0.1

-0.06 to -0.08

-0.04 to -0.06

-0.02 to -0.04

-0.02 to 0.02

0.02 to 0.04

0.04 to 0.06

0.06 to 0.08

0.08 to 0.1

>0.1

Afflux_010yr_U09-E07_wd

Was Wet now Dry

Was Dry now Wet

Rochedale Road

Ford Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	10Y ARI - FLOOD AFFLUX MAP - ULTIMATE (U09) Vs BASE CASE (E07)	FIGURE NO: 40A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Afflux_005yr_U09-E07

<-0.1

-0.08 to -0.1

-0.06 to -0.08

-0.04 to -0.06

-0.02 to -0.04

-0.02 to 0.02

0.02 to 0.04

0.04 to 0.06

0.06 to 0.08

0.08 to 0.1

>0.1

Afflux_005yr_U09-E07_wd

Was Wet now Dry

Was Dry now Wet

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	N
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	5Y ARI - FLOOD AFFLUX MAP - ULTIMATE (U09) Vs BASE CASE (E07)	FIGURE NO: 41A	

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LEGEND

Model Boundary

Proposed lot layout

Site

Future Site

DCDB

Afflux_002yr_U09-E07

<-0.1

-0.08 to -0.1

-0.06 to -0.08

-0.04 to -0.06

-0.02 to -0.04

-0.02 to 0.02

0.02 to 0.04

0.04 to 0.06

0.06 to 0.08

0.08 to 0.1

>0.1

Afflux_002yr_U09-E07_wd

Was Wet now Dry

Was Dry now Wet

Ford Road

Rochedale Road

DATE:	22/11/2022	0 53 106 159 212 m	CONSULTANT: Colliers
CREATED BY:	K. MCKENDRY		
REVISION:	A	PAGE SIZE: A3 SCALE: 1:4,000	
STATUS:	Issue	COORDINATE SYSTEM: GDA 94 / MGA ZONE 56	N
PROJECT TITLE:	ARISE, ROCHEDALE	PROJECT NO: 20-0102	CLIENT:
FIGURE TITLE:	2Y ARI - FLOOD AFFLUX MAP - ULTIMATE (U09) Vs BASE CASE (E07)	FIGURE NO: 42A	

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