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MARTINUS INLAND RAIL

FLOOD DESIGN REPORT

A2I| Albury to Illabo

Package: A2I – Cassidy Parade Footbridge

CONTRACT NUMBER: 0052

PROJECT DOCUMENT NUMBER:

5-0052-210-IHY-W4-RP-0001

Document Control

DOCUMENT TITLE:	Flood Design Report – Cassidy Parade Footbridge		
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Revision History

REVISION	REVISION DATE	AMENDMENT	DATE TO CLIENT
A	25/10/2023	SDR report	25/10/2023
B	13/05/2024	Initial PDR report	13/05/2024
C	08/01/2025	2nd PDR report (design updated for SDRP advice)	08/01/2025
D	04/04/2025	DDR report	04/04/2025
0	09/07/2025	Issued for Use (IFU Report)	09/07/2025

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GLOSSARY

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TABLE 1-1: DEFINITIONS

Term	Definition
A2I	Albury to Illabo
A2P	Albury to Parkes Enhancement Project
AEP	Annual Exceedance Probability
ADC	Assumptions, Dependencies and Constraints
AHD	Australian Height Datum
ALCAM	Australian Level Crossing Assessment Model
ARF	Areal Reduction Factor
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff
ARTC	Australian Railway Track Corporation
BoD	Basis of Design
BoM	Bureau of Meteorology
CIZ	Construction Impact Zone
CO	Construct Only
CRS	Coordination Reference System
CSSI	Critical State Significant Infrastructure
D&C	Design and Construct
DCN	Design Change Notice
DDR	Detailed Design Review
EMC	Electromagnetic compatibility
EDPM	Engineering, Design and Project Management
ECMP	Electromagnetic compatibility management plan
EIS	Environmental Impact Statement
FDR	Feasibility Design Review
FS	Finish-Start constraint type
FSL	Finished Surface Level
GDA	Geocentric Datum of Australia
GIR	Geotechnical Interpretative Report
HF	Human Factors
I2S	Illabo to Stockinbingal
IFC	Issued for Construction
IR	Inland Rail
ITC	Incentivised Target Cost
IV	Independent Verifier
Km	Kilometres
LPA	Licensed Project Area
LiDAR	Light Detection and Ranging
MGA	Map Grid of Australia
MIRDA	Master Inland Rail Development Agreement
NCR	Non-Conformance Report
NLPA	Non-Licensed Project Area

Term	Definition
NtP	Notice to Proceed
PDR	Preliminary Design Review
PMF	Probable Maximum Flood
PSR	Project Scope and Requirements
QDL	Quantitative Design Limits
RCP	Representative Concentration Pathway
REF	Review of Environmental Factors
RFI	Request for Information
S2P	Stockinbingal to Parkes
SAQP	Sampling, Analysis and Quality Plan
SDR	Systems Definition Review
SEMP	System Engineering Management Plan
TfNSW	Transport for New South Wales
TWL	Tail Water Level
V & V	Verification and Validation
WAD	Works Authorisation Deed
WAE	Work-as-Executed
WBNM	Watershed Bounded Network Model

1 A2P PROJECT INTRODUCTION

1.1 Albury to Parkes (A2P)

As part of the Inland Rail program of projects, the Australian Rail Track Corporation (ARTC) has appointed Martinus as the delivery contractor for the Albury to Parkes (A2P) project, which comprises the brownfield sections between Albury and Illabo (A2I) and Stockinbingal to Parkes (S2P). The greenfield portion between Illabo to Stockinbingal (I2S) is not a part of the A2P project scope.

1.2 Project Scope

The S2P section will be delivered under an REF and as such construction works associated with the two (2) Construct Only packages can commence at Contract Award. The Design and Construct for the other seven (7) projects sites will also commence at Contract Award.

The A2I section will be delivered under an EIS and requires a Notice to Proceed from ARTC before works can commence on site. Design for A2I will however commence at Contract Award. The project received State Planning approval on 8th Oct 2024, and Martinus received the Notice to Proceed from IRPL on 18 Oct 2024.

Within the A2I section there are twenty (20) locations with twenty-nine (29) Design and Construct (D&C) projects of varying degrees of design gate development:

- Murray River bridge (Structure modifications)
- Albury Station Yard (Track slews, track reconfigurations)
- Albury Station Yard Track Slews (retained 3-track alignment)
- Albury Station Yard Footbridge (footbridge replacement), both pre- and post- SDRP-response
- Riverina Highway bridge (Track lowering)
- Billy Hughes bridge (Track lowering)
- Tabletop Yard (Structure modification)
- Culcairn Station Yard (Track slews and bridge removal)
- Henty Yard (Track slews)
- Yerong Creek Yard (Track slews)
- The Rock Yard (Structure modification)
- Uranquinty Yard (Track slews)
- Pearson Street Bridge (Track lowering)
- Cassidy Parade Footbridge (Bridge replacement), both pre- and post- SDRP-response
- Edmondson Street Bridge (Stand-alone road bridge)
- Edmondson Street Footbridge (stand-alone road bridge)
- Edmondson Street bridge and footbridge (combined Bridge replacement), post- SDRP-response
- Wagga Wagga Station Yard (Track slews and Bridge replacement)
- Wagga Wagga Footbridge (footbridge replacement), both pre- and post- SDRP-response
- Bomen Yard (Track slews)
- Harefield Yard (Track slews)
- Kemp Street Bridge (stand-alone road bridge)
- Kemp Street Footbridge (stand-along footbridge)
- Kemp Street bridge and footbridge (combined Bridge replacement)
- Junee Station Yard (Track slews and bridge removal)
- Olympic Highway Underbridge (Track reconfiguration and Structure modification)
- Junee to I2S dual track section (Track slews)
- LX605 & LX1472 Activations
- LX605 relocation and LX1472 closure, both 16m and 4m slew options

Within the S2P section, there are two (2) Construct only projects:

- Daroobalgie New Loop
- Wyndham Avenue (Track lowering)

and seven (7) Design and Construct (D&C) projects:

- Milvale Yard (Structure modification)
- Bribbaree Yard (Track slews)
- Quandialla Yard (Structure modification)
- Caragabal Yard (Track slews)
- Wirrinya Yard (Track slews)
- Lachlan River bridge (Structure modifications)
- Forbes Station (Track slews and awning modifications)

The D&C scope typically includes works associated with route clearance to accommodate the new F2M clearance envelope, necessary to accommodate the double-stacked freight container trains and this includes.

- Structure modifications
- Track reconfigurations
- Bridge replacements
- Track lowering
- Track slews and level crossing upgrades
- Bridge removal

1.3 Sites Description

This study conducts a flood assessment for the Cassidy Parade footbridge site (refer to Figure 1:1 for site location). The background and previous studies for the site are listed below.

FIGURE 1:1: SITE LOCATION

1.3.1 Background

The Cassidy Parade footbridge forms part of the Albury to Illabo Section works at Chainage (CH) 521.700km. The Cassidy Parade footbridge site is located within the City of Wagga Wagga, between Cassidy Parade and Brookong Avenue, providing safe pedestrian crossing over the railway corridor. The proposed solution is to demolish the existing bridge, which has a vertical clearance of 4.7m, and construct a new footbridge with a vertical clearance of 7.1m over the main line and loop line to allow the passage of double-stack rail traffic underneath the bridge.

1.4 Objectives

This report has been prepared to support the delivery of the Cassidy Parade footbridge and comply with the CSSI Condition of Approval and updated mitigation measures for quantitative flood modelling demonstrating compliance with pre- and post-development criteria. This report provides a flood impact assessment for the Issued for Construction (IFC) stage. The flood assessment aims to estimate the flood behaviour within the study area and assess the potential flood impacts as a result of the design outside of the project boundary.

This report should be read in conjunction with the Detailed Design Report – Cassidy Parade Footbridge (5-0052-210-PEN-W4-RP-0001).

1.5 Scopes

The scope of this study includes:

- Assess the design difference between DDR and IFC stage.
- Carrying out the flood assessment for the design in the DDR stage for the design events of 10%, 5%, 2%, 1%, 0.05% AEPs, 1% AEP with Climate Change and PMF (Probable Maximum Flood).
- Checking flood assessment results against the design criteria, including flood impact and flood immunity.
- Proposing any mitigation measures if required.

1.6 Previous Studies

1.6.1 Flood Studies

Table 1-1 summarises all the flood studies associated with the Cassidy Parade footbridge site.

TABLE 1-1: SUMMARY OF THE PREVIOUS FLOOD STUDIES

Item No.	Flood Study	Description	Comments
1	Wagga Wagga Major Overland Flow Flood Study (WMAwater, 2011)	This flood study provided detailed local design flooding information for an area of 167 km^2 on a 5m grid resolution. The hydrologic and hydraulic (WBNM /TUFLOW) modelling system was utilised, calibrated and validated to historical events. ARR1987 was adopted.	-
2	Wagga Wagga Major Overland Flow Floodplain Risk Management Scoping Study – Final Report (WMAwater, 2012)	This study was conducted to contextualise findings from item 1 before a Floodplain Risk Management Study commenced and recommendations were made.	-
3	Wagga Wagga Major Overland Flow Model Update Report (WMAwater, 2015)	This flood study updated the flood models originally established in item 1 by adopting the recommendations from item 2.	-
4	Wagga Wagga Revised Murrumbidgee River Floodplain Risk Management Study and Plan (WMAwater, 2018)	This study and plan assessed and ultimately recommended a broad range of mitigation options to manage flood risk in Wagga Wagga due to Murrumbidgee River flooding.	-
5	Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (MOFFS) (WMAwater, 2021)	This study and plan updated the hydrology and hydraulic models used in Items 1 and 3. ARR2019 has been used. The ARR2019 flood level results have been compared against the ARR1987 levels and it showed that ARR2019 is 0.05 m - 0.3m higher than the ones from ARR1987. Therefore, ARR2019 is adopted as ARR1987 methodologies are likely to underestimate the flood risk throughout overland catchment areas. It is noted that ARR2019 flood extents remain largely unchanged compared with ARR1987 results.	TUFLOW and WBNM models in MOFFS were adopted and updated in this flood assessment. The TUFLOW model parameters can be found in Table 4-2.

1.6.2 Reference Design

Reference Design Report:

- Albury to Illabo (A2I) and Stockinbingal to Parkes (S2P) Projects Reference Design Report – Wagga Wagga (June 2022)

There is no detailed flood modelling within this report. The Reference Design report stated that the existing catchments and flow paths are unchanged, and the minor drainage diversion works have no impact on the existing rail immunity or local flooding. There are no watercourses within the project site. The nearest surface water receptors include the council stormwater network and the Murrumbidgee River. The construction layout will require consideration of local drainage.

1.6.3 Environmental Impact Statement

Environmental Impact Statement:

- Albury to Illabo Environmental Impact Statement (EIS) Technical Paper 11 – Hydrology, flooding and water quality (July 2022)

The Cassidy Parade footbridge enhancement works were investigated as part of the Reference Design. There is no detailed flood modelling within this report. A qualitative assessment was undertaken to assess the flood condition of the site based on two previous flood studies covering the City of Wagga Wagga: Wagga Wagga Revised Murrumbidgee River Floodplain Risk Management Study and Plan (2018) and MOFFS (WMAwater, 2021). It has been found that the site is not affected by flooding from the Murrumbidgee River up to the 1% AEP (Refer to Figure 1:2) and PMF, but is affected by local flooding during the 5% and 1% AEPs events (Refer to Figure 1:3).

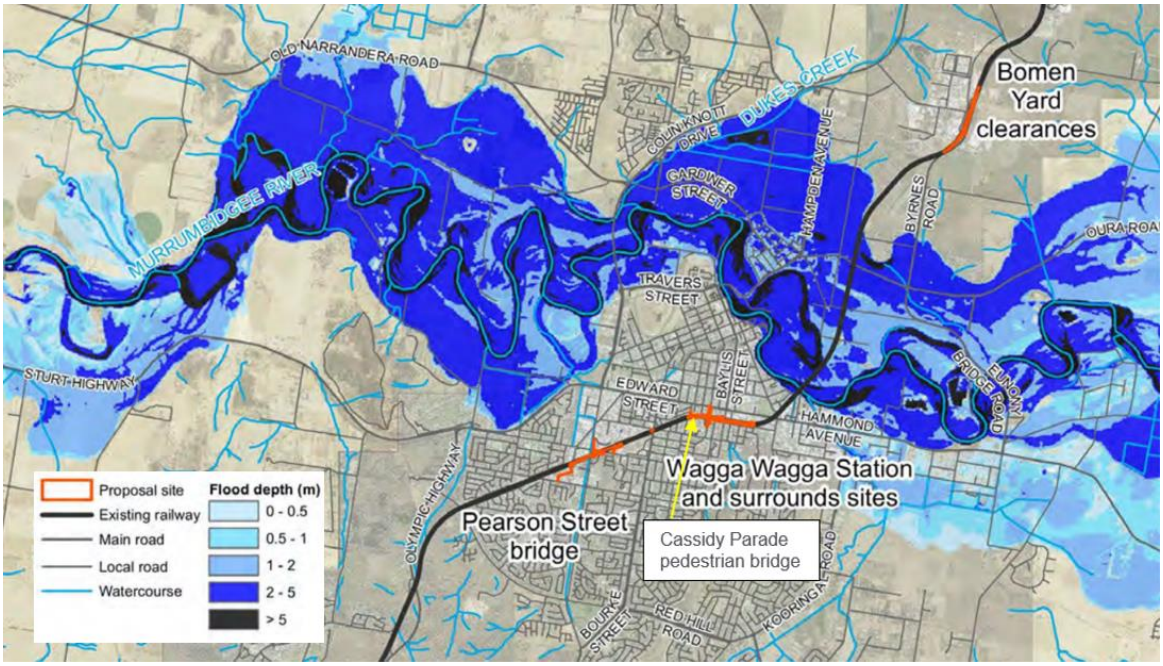


FIGURE 1:2: 1% AEP REGIONAL FLOODING (IMAGE SOURCE: ALBURY TO ILLABO EIS TECHNICAL PAPER 11 (JULY 2022))

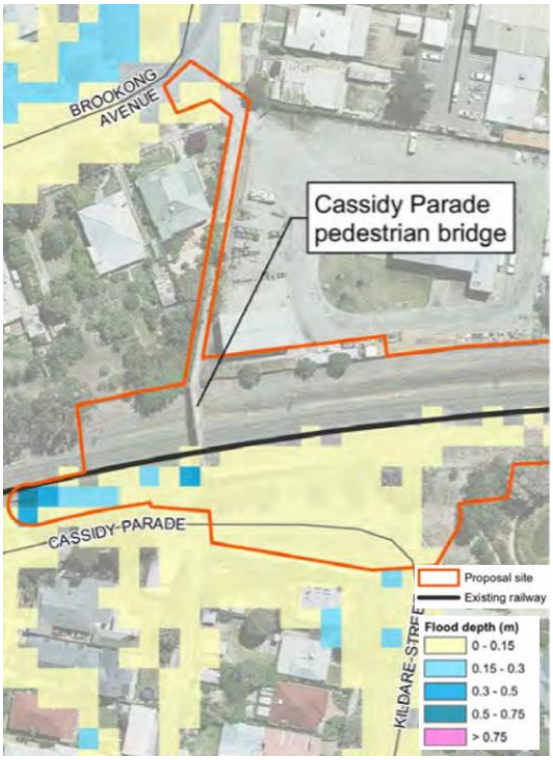


FIGURE 1:3: 1% AEP LOCAL FLOODING (IMAGE SOURCE: ALBURY TO ILLABO EIS TECHNICAL PAPER 11 (JULY 2022))

1.7 Purpose and Requirements

The primary purpose of this IFC flood assessment report is to describe how the design development and the associated review process was managed.

The secondary purpose of this report is to provide evidentiary documentation of consultation and review by external stakeholders, and the independent suitably qualified flood consultant, in demonstrating compliance with the CSSI conditions of approval. Refer to Appendix C for ARTC review, Appendix D for External Consultation Review, and Appendix E for the Independent Flood Consultant review.

1.8 Information Documents

The following documents have been provided 'For Information' and have been referenced/ reviewed as part of the design development:

- Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMA Water, 2021). This flood study supersedes the other flood study listed in Table 1-1 as it's the most recent flood study.
- Albury to Illabo (A2I) and Stockinbingal to Parkes (S2P) Projects Reference Design Report – Wagga Wagga (WSP, June 2022), 2-0008-210-PEN-03-RP-0002
- Albury to Illabo Environmental Impact Statement (EIS) Technical Paper 11 – Hydrology, flooding and water quality (WSP, July 2022), 2-0008-210-EAP-00-RP-0010

1.9 Inputs

The inputs to this flood assessment report include:

- Australian Standards and Guidelines: AS 7637 Railway Infrastructure – Hydrology and Hydraulics
- Australian Rainfall and Runoff: A Guide to Flood Estimation 2019 v4.1
- Austroads Guide to Bridge Technology – Part 8: Hydraulic Design of Waterway Structures
- Inland Rail Climate Change Risk Assessment Framework

1.9.1 Input Data

Table 1-2 outlines the available information relevant to the site and used for flood modelling.

TABLE 1-2: AVAILABLE INFORMATION

Item	Information	Type	Description / Comments
General			
1	Flood model used in Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMAwater, 2021)	TUFLOW model in GDA94 projection	Received from ARTC on 29/08/2023
2	Hydrology model used in Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMAwater, 2021)	WBN* PMF (Probable Maximum Flood) for GSDM* only, 0.2% AEP, 0.5% AEP, 1%AEP, 2% AEP, 5% AEP, 10% AEP, 20% AEP	Received on 29/08/2023 The WBN model files (refer to DJV RFI-007). WBN files received include single temporal pattern for durations 120 minutes, 360 minutes and 720 minutes for events 0.2% AEP, 0.5% AEP, 1% AEP, 2% AEP, 5% AEP, 10% AEP, 20% AEP and 90 minutes & 180 minutes for PMF
3	Additional GIS files with Indirectly Connected Area (ICA) and catchment data related to Hydrology.	GIS files	Received from Wagga Wagga City Council on 22/11/2023 as part of the response of RFI 020
4	LiDAR 2020 (The data used to create this DEM has an accuracy of 0.3m (95% Confidence Interval) vertical and 0.8m (95% Confidence Interval) horizontal)	TIF format in 1m resolution in GDA2020 projection	Downloaded from https://elevation.fsdf.org.au/ on 26/09/2023
5	LiDAR 2015 and High-Resolution Aerial Imagery. The data derived points have an accuracy of 0.15m (68% confidence interval) ARTC LiDAR	TIF format in 1m resolution in GDA94	The existing 1m LiDAR (provided by ARTC) was received from Martinus on 12/11/2024. However, the LiDAR2020 (item 4) is newer and in GDA2020. Therefore, only LiDAR 2020 (item 4) is used.
Site Specific			
6	5-0052-210-ISV-W0-MD-0001-WAGGA_FEATURE_SURVEY.dwg	DWG file	Site Survey in GDA94 projection Received from ARTC on 06/09/2023
7	241114 Cassidy Existing Drainage Model.12daz Cassidy Existing ILs.xlsx	12da file and Excel file	Existing Drainage Data in GDA 2020 projection. Received from DJV Drainage team on 06/09/2023
8	A2P CAS EXT GDA20Z55.12da A2P WGA EXT GDA20Z55.12da	12da file	Verified Point cloud data (topography data) – Site survey in GDA2020 projection Received from Martinus on 11/04/2024. Note this point cloud data is superseded by item 10.
9	A2P EDM EXT GDA20Z55 COMBINED_241021.12daz A2P CAS EXT GDA20Z55 COMBINED_241021.12daz A2P PSN EXT GDA20Z55 COMBINED_241021.12daz A2P WAG EXT GDA20Z55 COMBINED_241021.12daz	12da file	Detailed topography survey received from ARTC on 21/10/2024

Item	Information	Type	Description / Comments
10	6-0052-210-ISV-W4-SV-0001_A.12da 6-0052-210-ISV-W4-SV-0001_A.dwg	DWG and 12da file	Survey information on topography and drainage. Received from Martinus on 17/03/2025
11	20250319 W4 CASSIDY FLOOD TIN.dem	DEM file	DDR Civil design in GDA2020 projection. Received from DJV Civil team on 19/03/2025.
12	5-0052-210-SBD-W4-MD-2001-CASSIDY_PARADE_FOOTBRIDGE_3D_STRUCTURAL_DESIGN_BRIDGE_MODEL_DWG.dwg Structures - 20250314 - Cassidy Footbridge Checkprint.pdf	DWG file and PDF	DDR bridge design. Received from DJV Bridge team on 20/03/2025.
13	STD – Fence combined.pdf	PDF File	DDR fence design. Received from DJV Civil team on 20/03/2025
14	Civil design change sketch	JPG file	Sketch of civil design changes extent for IFC stage. Received from DJV Civil team on 25/06/2025

*: GSDM stands for Generalised Short-Duration Method.
* "WBN" is the extension of WBNM file.

1.10 IFC design

Minor design changes to the civil elements were made in the IFC stage. however, there have been no alterations to the bridge and drainage elements since the DDR stage (refer to Section 3.5)

The minor civil design update is done near the footpath sections of the playground area at Cassidy parade. As most of the changes are occurring outside the flood extent of 1% AEP, these changes are not anticipated to affect the overall flooding behaviour or results, nor to lead to any significant impacts. Given that the changes in the IFC are minimal compared to the DDR, the flood assessment will not result in any non-compliance. Therefore, the flood assessment results from the DDR stage will be utilised to inform the IFC flood assessment from Section 2 onwards.

1.11 Outputs

The list of flood maps and the flood maps are included in Appendix A.

1.12 Limitations and Assumptions

The following limitations and assumptions are applied to the current study.

- The site was not subjected to regional flooding as per the EIS (Technical Paper11, Hydrology, Flooding and Water Quality, Albury to Illabo Environmental Impact Statement).
- An assessment of temporary works and staging has not been undertaken as it is out of the flooding scope.
- Blockage assessment is carried out for the 1% AEP design scenario as per the guidance set out in ARR2019 for the culverts within the project boundary, while 20% blockage is adopted for all the other culverts, pits and pipes outside the project boundary.

2 COMPLIANCE WITH REQUIREMENTS

2.1 Project Scope and Requirements

Assessment of the detailed design to see if it meets the Project Scope and Requirements (PSRs) has been undertaken. This is demonstrated throughout the flood assessment with Table 2-1 below summarising the Cassidy Foot Bridge Design's Compliance with the PSRs.

TABLE 2-1: FLOODING CRITERIA WITHIN PSR ANNEXURE B TECHNICAL REQUIREMENTS

Requirement	Identifier	A2P Technical Requirements Description	Compliance Evidence Reference
Project Wide	5.4.10	Without limiting the environmental management requirements in Annexure F, section 6.1.1, all D&C Works in watercourses shall comply with the NSW Department of Primary Industries Standards: Policy and Guidelines for Fish Friendly Waterway Crossings; Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings; and Policy and Guidelines for Fish Habitat Conservation and Management Update.	N/A (structure modifications do not affect waterway flow)
Project Wide	5.4.2	Where existing flood immunity is lower than ARTC SMS minimum requirements, the functional requirements for flood immunity take precedence over the ARTC SMS.	The ARTC minimum requirement is 1% AEP. However, the track is not overtopped up to 0.05% AEP in the existing scenario. Thus 1% AEP will be adopted as Existing immunity. The existing immunity is maintained under design conditions. Refer to Section 6.3.
Project Wide	5.4.3	Where existing flood immunity is higher than ARTC SMS minimum requirements, the ARTC SMS requirements for flood immunity take precedence over the functional requirements.	The ARTC minimum requirement is 1% AEP. However, the track is not overtopped up to 0.05% AEP in the existing scenario. Thus 1% AEP will be adopted as Existing immunity. The existing immunity is maintained under design conditions. Refer to Section 6.3.
Project Wide	5.4.5	Bridge and culvert hydraulics shall comply with Austroads Guide to Bridge Technology Part 8: Hydraulic Design of Waterway Structures.	There are no other waterway structures within Cassidy Parade footbridge scope.
A2I Technical Requirements*	IR-SR-A2I-116	The System shall comply with 0-0000-900-ESS-00-ST-0001 Inland Rail Climate Change Risk Assessment Framework.	Climate change assessment was carried out by running the 1% AEP + 2090 RCP 8.5 and identifying that the bridge has low hazards. Refer to Section 6.5.2.
A2I Technical Requirements*	IR-SR-A2I-349	The Corridor System for Enhancement Corridors shall have a flood immunity of no worse than existing.	The existing immunity is maintained under design conditions. Refer to Section 6.3.
A2I Technical Requirements*	IR-SR-A2I-350	The Corridor System, where the existing track is lowered, shall maintain the existing flood immunity.	N/A (No track lowering included in Cassidy Parade footbridge scope).
A2I Technical Requirements*	IR-SR-A2I-352	The Corridor System shall prevent damage of the formation due to ponding of water.	There is no change in flood conditions and hence no additional damage to the formation will be incurred. Refer to Sections 6.2 & 0.

Requirement	Identifier	A2P Technical Requirements Description	Compliance Evidence Reference
A2I Technical Requirements*	IR-SR-A2I-458	The Corridor System shall prevent ponding in longitudinal open channels.	N/A (No open channel included in Cassidy Parade footbridge scope).
A2I Technical Requirements*	IR-SR-A2I-459	The Corridor System for Enhancement Corridors shall provide mitigation for flood impacts no worse than existing condition.	Existing condition is maintained. Refer to Section 6.3.
A2I Technical Requirements*	IR-SR-A2I-464	The Corridor System shall cause no adverse impacts either inside or outside the rail corridor when diverting water away from the track.	Existing condition is maintained. Refer to Section 6.4.
A2I Technical Requirements*	IR-SR-A2I-465	The Corridor System shall minimise changes to the existing or natural flow patterns.	Existing condition is maintained. Refer to Sections 6.2 & 0.
A2I Technical Requirements*	IR-SR-A2I-541	The Structures System new underbridges shall withstand the 0.05% annual exceedance probability design flood event.	The 0.05% AEP event simulation was carried out and identified that the flood velocity is generally less than 1m/s and the hazard is generally low. The flood level will not touch the bridge deck (refer to Sections 6.2). In addition, this is not a waterway bridge. So, it is low risk to the structure integrity. Refer to Section 4.6 Structure in 5-0052-210-PEN-W4-RP-0001 for details.
A2I Technical Requirements*	IR-SR-A2I-735	The Third-Party System private roads shall have flood immunity no worse than existing.	No third-party private roads are impacted.
A2I (Annexure F)	6.1.1	Without limiting clauses 8 and 14 of the Deed, the Contractor shall ensure that the Contractor's Activities and the Works comply with the following for A2I, the Conditions of Approval and the environmental assessment reports available on https://www.planningportal.nsw.gov.au/major-projects/projects/inland-rail-albury-illabo"	Refer to Table 2-2

*A2I Technical requirements are used in A2P as A2P is a part of A2I.

2.2 Conditions of Approval - Flooding

The Conditions of Approval (CoA) have been provided as part of the CSSI approval and Inland Rail Deed of Variation. The detailed design has been assessed to check if it meets the CoA and the compliance is presented in Table 2-2 below.

TABLE 2-2: CONDITIONS OF APPROVAL COMPLIANCE TABLE – FLOODING

Condition	Condition or Criteria	Compliance Evidence Reference
E38	All practicable measures must be implemented to ensure the design, construction and operation of the CSSI will not adversely affect flood behaviour, or adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.	Compliant. Refer to Section 6.
E39	The CSSI must be designed with the objective to meet or improve upon the flood performance identified in the documents listed in **Condition A1**. Variation consistent with the requirements of this approval at the rail corridor is permitted to effect minor changes to the design with the intent of improving the flood performance of the CSSI.	Compliant. Refer to Section 6.
E40	Updated flood modelling of the project's detailed design must be undertaken for the full range of flood events, including blockage of culverts and flowpaths, considered in the	Compliant. Refer to Sections 4 and 6.

Condition	Condition or Criteria	Compliance Evidence Reference
	documents listed in **Condition A1**. This modelling must include:	
E40	a) Hydrologic and hydraulic assessments consistent with *Australian Rainfall and Runoff – A Guide to Flood Estimation* (GeoScience Australia, 2019);	Compliant. Section 4.
E40	b) Use of modelling software appropriate to the relevant modelling task;	Compliant. Section 4 shows that the appropriate software (TUFLOW) was used
E40	c) Field survey of the existing rail formation and rail levels, should be included within the models; and	Compliant. The existing rail level was used to inform the flood immunity. Refer to Section 6.
E40	d) Confirmation of predicted afflux at industrial properties adjacent to Railway Street, Wagga Wagga based on field survey.	N/A. This report relates to the Cassidy Parade footbridge site. Refer to the Wagga Yard Flood design report (5-0052-210-IHY-W7-RP-0001) for Confirmation of predicted afflux at industrial properties.
E40	Updated flood modelling must be made publicly available in accordance with **Condition B18**.	Flood design report and independent review of the flood design report shall be provided to IR, through this submission, for IR to upload on the IR website, as per CoA B18 responsibility allocation.
E41	The Proponent's response to the requirements of **Conditions E38** and **E40** must be reviewed and endorsed by a suitably qualified flood consultant, who is independent of the project's design and construction and approved in accordance with **Condition A16,** in consultation with directly affected landowners, DCCEEW Water Group, TfNSW, DPI Fisheries, BCS, NSW State Emergency Service (SES) and relevant Councils.	Independent review of the flood modelling, model and Flood Design Report is undertaken by the Proof Engineer's specialist contractor, who satisfies and complies with the requirements of A16. Consultation with the council and other stakeholders is being undertaken through a formal review of this Flood Design Report.
E42	The CSSI must be designed and constructed to limit impacts on flooding characteristics in areas outside the project boundary during any flood event up to and including the 1% AEP flood event, to the following:	See items below
E42	(a) a maximum increase in inundation time of one hour, or 10%, whichever is greater;	Compliant. Refer to Section 6.4.4.
E42	(b) a maximum increase of 10 mm in above-floor inundation to habitable rooms where floor levels are currently exceeded;	Compliant. No flood level increase of 10 mm in above-floor inundation on any properties. Section 6.4.1.
E42	(c) no above-floor inundation of habitable rooms which are currently not inundated;	Compliant. No increase for above floor inundation of habitable rooms on any properties. Section 6.4.1.
E42	(d) a maximum increase of 50 mm in inundation of land zoned as residential, industrial or commercial;	Compliant. No flood level increase of more than 50mm in residential, industrial and commercial areas. Section 6.4.1.
E42	(e) a maximum increase of 100 mm in inundation of land zoned as environment zone or public recreation;	Compliant. No flood level increase of more than 100mm in the environment zone or public recreation (refer to Section 6.4.1.)
E42	(f) a maximum increase of 200 mm in inundation of land zoned as rural or primary production, environment zone or public recreation;	Compliant. No flood level increase of more than 200mm in rural or primary production, environment zone or public recreation (refer to Section 6.4.1.)

Condition	Condition or Criteria	Compliance Evidence Reference
E42	(g) no increase in the flood hazard category or risk to life; and	Compliant (refer to Section 6.4.3)
E42	(h) maximum relative increase in velocity of 10%, or to 0.5m/s, whichever is greater, unless adequate scour protection measures are implemented and/or the velocity increases do not exacerbate erosion as demonstrated through site-specific risk of scour or geomorphological assessments	Compliant (refer to Section 6.4.2).
E42	Where the requirements set out in clauses (d) to (f) inclusive cannot be met alternative flood levels or mitigation measures must be agreed to with the affected landowner.	Clause (d) to (f) are compliant
E43	A Flood Design Report confirming the:	
E43	a) final design of the CSSI meets the requirements of **Condition E42;** and	Compliant (refer to Section 6)
E43	b) the results of consultation with the relevant council in accordance with **Condition E46**	Refer to E46
E43	must be submitted to and approved by the Planning Secretary prior to the commencement of permanent works that would impact on flooding.	This report will be submitted to the Planning Secretary for approval prior to the commencement of permanent works that would impact on flooding.
E44	The **Flood Design Report** required by **Condition E43** must be approved by the Planning Secretary prior to works that may impact on flooding or the relevant council's stormwater network.	This report will be submitted to the Planning Secretary for approval prior to the commencement of permanent works that would impact on flooding.
E45	Flood information including flood reports, models and geographic information system outputs, and work as executed information from a registered surveyor certifying finished ground levels and the dimensions and finished levels of all structures within the flood prone land, must be provided to the relevant Council, BCS and the SES in order to assist in preparing relevant documents and to reflect changes in flood behaviour as a result of the CSSI. The Council, BCS and the SES must be notified in writing that the information is available no later than one (1) month following the completion of construction. Information requested by the relevant Council, BCS or the SES must be provided no later than six (6) months following the completion of construction or within another timeframe agreed with the relevant Council, BCS or the SES.	Flood information will be provided to the relevant Council, BCS and the SES in order to assist in preparing relevant documents and to reflect changes in flood behaviour as a result of the CSSI in accordance with the requirements of CoA E45
E46	The design, operation and maintenance of pumping stations and storage tanks and discharges to council's stormwater network must be developed in consultation with the relevant council. The results of the consultation are to be included in the report required in **Condition E47.**	Local drainage flow regime, catchment area and imperviousness remain the same as per existing condition, there is no additional flow towards the existing Council's stormwater network. The design has not worsened the existing condition. Discharges to the council's stormwater networks have been consulted with Wagga Wagga City Council during the briefing workshops, various stages of design submissions with the Council's comments closed out, details are documented in 5-0052-210-PEN-W4-RP-0001.

2.3 Updated Mitigation Measures - Flooding

The Updated Mitigation Measures (UMM) have been provided and the detailed design has been assessed to meet the UMM and the compliance is presented in Table 2-3 below.

TABLE 2-3 UPDATED MITIGATION MEASURES COMPLIANCE TABLE - FLOODING

Condition	Condition or Criteria	Compliance Evidence Reference	Comment if non-compliant
HFWQ3	Further consultation will be undertaken with local councils and other relevant authorities to identify opportunities to coordinate the proposal with flood mitigation works committed to as part of the council's flood management plans, or other strategies.	Consultation with Council and other relevant authorities will be undertaken through a formal review of this Flood Design Report.	-
HFWQ4	At Wagga Wagga Yard enhancement site, flood modelling would be carried out during detailed design to confirm predicted afflux at industrial properties located at Railway Street and compliance with the Quantitative Design Limits for Inland Rail. This would be informed by topographic and building floor surveys and a review of localised drainage structures (as required). Quantitative assessment of the sites of low and moderate hydraulic complexity will be carried out during detailed design and will consider the impact of the Possible Maximum Flood event at built-up areas (where information is available) and the tenure of the upstream areas that are impacted by drainage and/or flooding. The outcomes of the assessment are to be provided to DCCEW– BCS	This report relates to the Cassidy Parade footbridge site, and so is not relevant to the Wagga Wagga Yard enhancement site, Refer to Wagga Yard Flood design report (5-0052-210-IHY-W7-RP-0001) for predicted afflux at industrial properties. Compliant. Quantitative assessment has been undertaken. Refer to Section 6.	-
HFWQ5	At Riverina Highway bridge enhancement site, flood and drainage network modelling (including capacity and operation of the stormwater storage and pump system) will be carried out during detailed design to confirm predicted compliance with the Quantitative Design Limits (QDLs)* for Inland Rail. The modelling would be undertaken in consultation with Albury City Council.	This report relates to the Cassidy Parade footbridge site, and so is not relevant to the Riverina Highway track lowering site.	-

* QDL is superseded by CoA E42.

3 CHANGE MANAGEMENT

This section summarises the changes made to this design package due to changes in the project scope and/or evolution of the design.

3.1 Concept Design to SDR

Key design changes between the Concept Design and the SDR Design are listed in Table 3-1.

TABLE 3-1: DESIGN DIFFERENCES BETWEEN PROPOSAL AND SDR

Item	Difference	Reason for Difference
1	Incorporation of the latest existing conditions survey	A new existing conditions survey was undertaken
2	Incorporation of drainage design	New drainage design

3.2 SDR to Initial PDR

Key design changes between the SDR and PDR Design stages are listed in Table 3-2.

TABLE 3-2: DESIGN DIFFERENCES BETWEEN SDR AND PDR

Item	Difference	Reason for Difference
1	Updated hydrology, which resulted in changes in critical durations for each AEP event.	Additional information was provided with regards to provided hydrology,
2	Incorporation of the latest existing conditions survey	A new existing conditions survey was undertaken
3	Incorporation of bridge design	New bridge design
4	Incorporation of drainage design	New drainage design
5	Incorporation of civil design	New civil design

3.3 Initial PDR to 2nd (Revised) PDR

There is a need for design revision due to the State Design Review Panel (SDRP) advice on the Cassidy Parade footbridge package. The required changes to the design are documented in a re-submission of PDR (70%). A re-submission of PDR was deemed warranted to enable stakeholder consultation (Wagga Wagga Council, Kildare College, Telstra and ARTC) to be undertaken based on the updated design.

Key design changes between the initial PDR and 2nd PDR Design stages are listed in Table 3-3.

TABLE 3-3: DESIGN DIFFERENCES BETWEEN INITIAL PDR AND 2ND PDR

Item	Difference	Reason for Difference
1	Incorporation of the latest existing conditions survey	A new existing conditions survey was undertaken
2	Incorporation of bridge design	New bridge design
3	Incorporation of civil design	New civil design

3.4 2nd (Revised) PDR to DDR

The table below outlines the changes occurring between 2nd (Revised) PDR and DDR submissions.

TABLE 3-4: DESIGN DIFFERENCES BETWEEN 2ND PDR AND DDR

Item	Difference	Reason for Difference
1	Incorporation of the latest existing conditions survey	A new existing conditions survey was undertaken
2	Incorporation of updated bridge design	Updated bridge design, due to design development to DDR design stage.
3	Incorporation of updated civil design	Updated civil design, due to design development to DDR design stage.

3.5 DDR to IFC

The table below outlines the changes occurring between DDR and IFC submissions.

TABLE 3-5: DESIGN DIFFERENCES BETWEEN DDR AND IFC

Item	Difference	Reason for Difference
1	Updating report sections and text throughout the report	To address external stakeholder (e.g.TfNSW) review comments
2	Minor earthworks adjustments at the playground area on Cassidy Parade, which is not impacting DDR flooding results (see Table 1-2 Item 14 in Section 1.9.1)	Updated design, due to design development to IFC design stage.

4 MODELLING METHODOLOGY

The overall approaches for flood modelling are listed below:

- Utilise the hydrological model and generate flow hydrographs for input to the hydraulic model for all events to perform critical duration analysis.
- Update the received TUFLOW model by incorporating the latest LiDAR (Section 4.2.1) and survey. Use the updated TUFLOW model to predict hydraulic behaviour and this will be formed as the existing model for this study.
- Compare the updated existing condition TUFLOW model results against the received model results (Refer to Section 5).
- Incorporate the Edmondson Street Bridge and Footbridge design (5-0052-210-IHY-W5-RP-0001) and Wagga Wagga Yard design (5-0052-210-IHY-W7-RP-0001) into the Master Design condition to understand the cumulative impact on the site.
- Update the TUFLOW model from the existing condition to the master design condition model by incorporating the rail and drainage design into the existing model.
- Conduct a climate change risk sensitivity assessment for the 1% AEP to inform the potential impact on the railway track flood immunity.
- Conduct a blockage assessment as per ARR 2019 procedures
- The flood impact was assessed up to the 1% AEP + Climate Change (Refer to Section 4.2.3.1 for details) and the flood results were shown up to including the PMF event to allow understanding of flood risk.

4.1 Hydrologic modelling

The WBNM (City Catchment) was utilised to generate flow hydrographs for input to the hydraulic model. The hydrology model covers Glenfield Drain as well as the Wagga Wagga CBD and outer areas lying on the southern Murrumbidgee River floodplain. Refer to Figure 4:1 for the sub-catchment extents of the hydrology model.

As stated in Item 2 in Table 1-2, only WBNM running files generated by the Storm Injector were received, and those files could not be run directly through the WBNM software due to the lack of ICA and geometry data. To produce the inflow hydrographs for critical duration analysis, Storm Injector HL (V 1.3.9.0) was used alongside the provided ICA and geometry data (Item 3, Table 1-2). However, generating identical hydrograph inflow values proved challenging. As a conservative approach, slightly higher inflow values (generally 0.0035 m^3/s) than the received ones were created, which were then utilised in the hydraulic assessment. Table 4-1 presents a comparison between the received and adopted WBN files.

Flow hydrographs were generated for input to the hydraulic model for the 10% AEP, 5% AEP, 2% AEP, 1% AEP, 1% AEP + Climate Change and 0.05%AEP events to perform critical storm duration analysis (Refer to Table 4-3 in the Hydraulic modelling).

The PMF Hydrology model was based on the ARR1987 guidelines. This was then updated as per ARR2019 guidelines incorporating an ensemble of 11 temporal patterns for GSDM PMF from 15 minutes to 180 minutes.

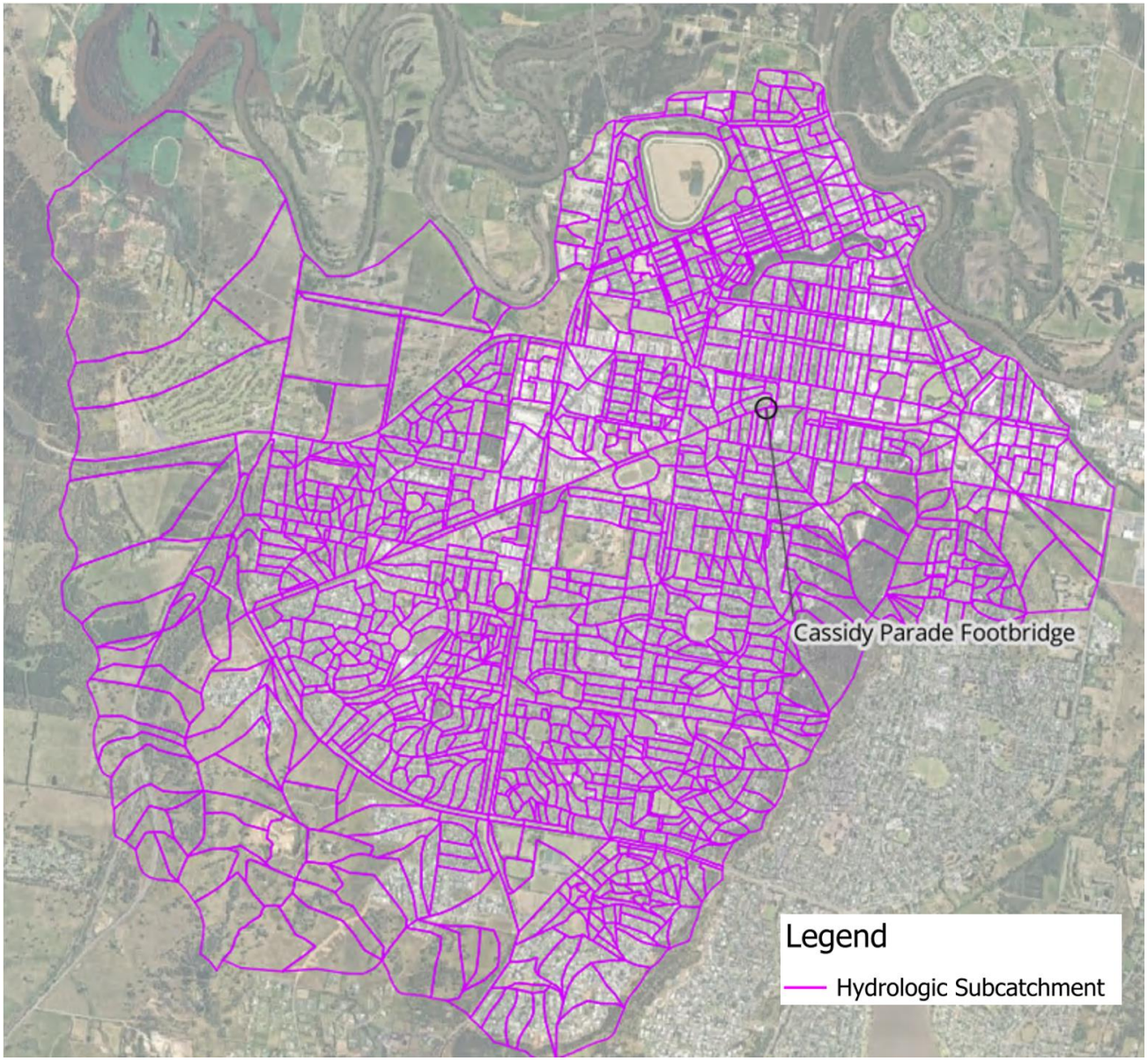


FIGURE 4:1: HYDROLOGIC SUB-CATCHMENT

TABLE 4-1: MODEL PARAMETERS OF HYDROLOGY MODEL

Parameters	Received Hydrology Model	Adopted Hydrology Model
Hydrology model and version	WBNM model (v2017) with WBN files	WBNM model (v2017) using Storm injector HL (v 1.3.9.0).
Total catchment area	3835 ha (38.35 km^2).	3835 ha (38.35 km^2).
Events	PMF (1987), 0.2% AEP, 0.5% AEP, 1% AEP, 2% AEP, 5% AEP, 10% AEP, 20% AEP	1% AEP + Climate Change, 1% AEP, 2% AEP, 5% AEP, 10% AEP. PMF
Duration Temporal pattern received/generated	Single temporal pattern for durations 120 minutes, 360 minutes and 720 minutes 90 minutes and 180 minutes for PMF	Ensemble temporal pattern for duration ranging from 10 minutes to 720 minutes
Indirectly Connected Area (ICA)	Utilised received inflow hydrographs for events 1% AEP, 2% AEP, 5% AEP and 10% AEP which had ICA included. No 1% AEP + Climate Change event inflow hydrographs were received.	The hydrology model was updated with relevant ICA values from the data received from the Wagga Wagga City Council (Item 3 in Table 1-2) and generated relevant inflow hydrographs for the hydraulic models. These inflow hydrographs were then used in the model for the flood assessment.

4.2 Hydraulic Modelling

4.2.1 Existing Model Update

The existing model was updated based on the received TUFLOW from MOFFS (WMAwater, 2021) mentioned in Section 1.6.1. A summary of the received model and updated model parameters can be found in Table 4-2. The model extent encompasses Wagga Wagga's central business district (CBD) and surrounding regions situated along the southern floodplain of the Murrumbidgee River, spanning an area of approximately 42 km^2 (refer to Figure 4:2).

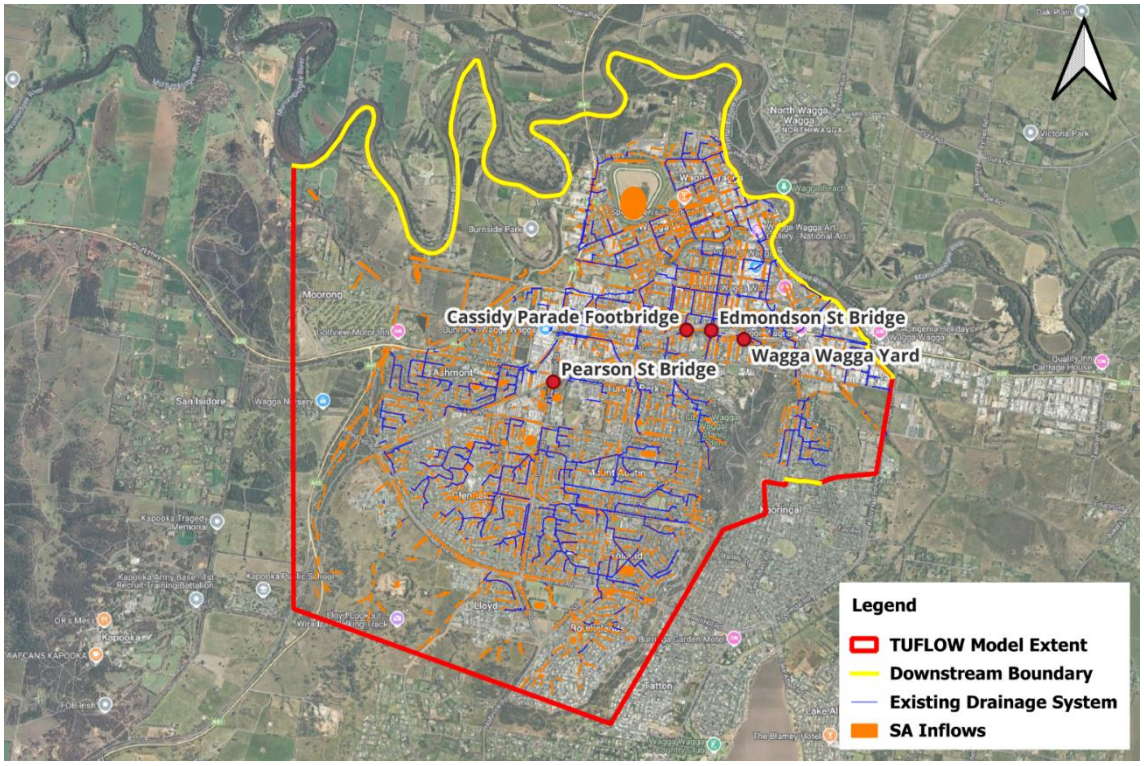


FIGURE 4:2: TUFLOW MODEL EXTENT

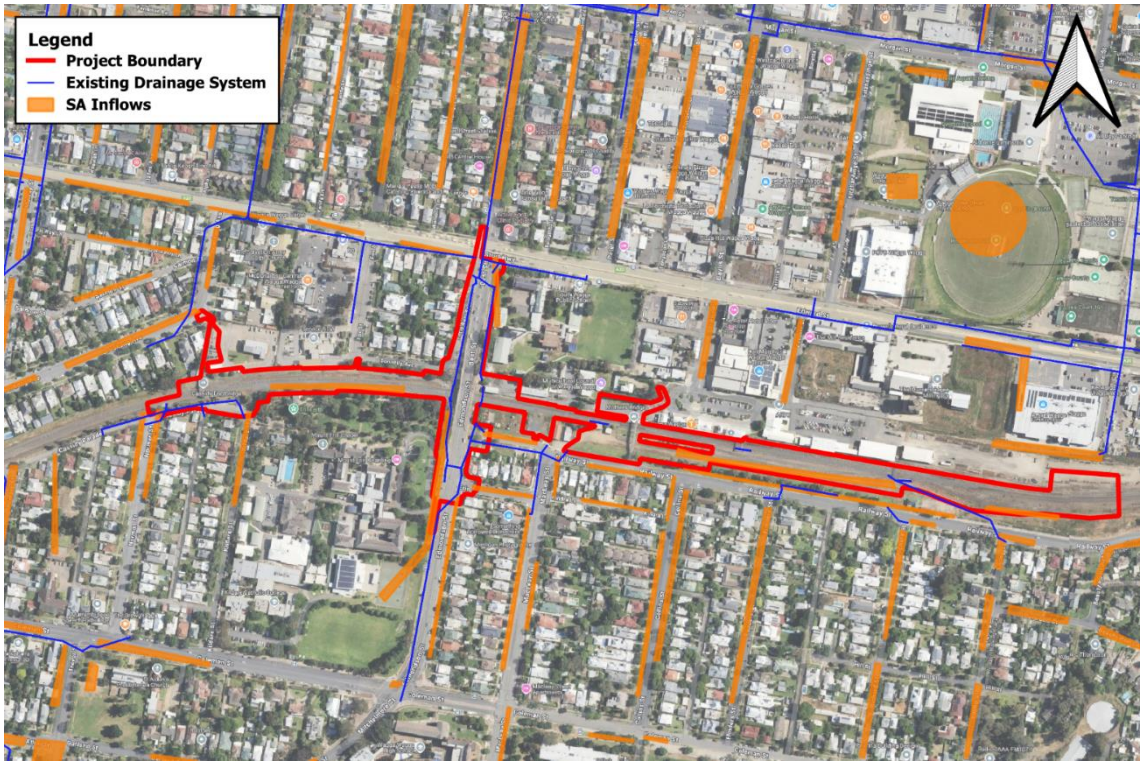


FIGURE 4:3: CASSIDY PARADE (ZOOMED IN)

TABLE 4-2: MODEL PARAMETERS IN THE UPDATED EXISTING MODEL AND MOFFS 2021 TUFLOW MODEL

Parameters	MOFFS 2021 Model	Updated TUFLOW Model
Build	TUFLOW 2018-03-AC HPC	TUFLOW.2020-10-AF HPC (Refer to Section 4.2.1.2- "TUFLOW model version and grid size" for more details)
Coordination Reference System (CRS)	GDA94 MGA 55	GDA2020 MGA 55
Grid Size	5m	1.25m within the quadtree area (Site area) and 5m outside of the quadtree area (Refer to Figure 4:5). (Refer to the following Section of "TUFLOW model version and grid size" for more details)
Hydrology	WBNM ARR2019	WBNM ARR2019
Inflow type	SA Polygon	SA Polygon (Refer to Figure 4:2)
Key Structures	No bridge was included	The existing Edmondson Street Bridge and Wagga Wagga footbridge abutment was represented in the model.
Extent	Wagga Wagga's central business district (CBD) and surrounding regions are situated along the southern floodplain of the Murrumbidgee River.	Wagga Wagga's central business district (CBD) and surrounding regions are situated along the southern floodplain of the Murrumbidgee River.
Downstream Boundary	Dynamic downstream water boundary and slope boundary	Dynamic downstream water boundary and slope boundary
Timestep	Dynamic	Dynamic
Building Representation	Null polygon	Null polygon
Topography	▪ 1 m resolution LiDAR collected in 2008 ▪ 5 m x 5 m resolution photogrammetry was obtained from Geoscience Australia – Elevation Information System (ELVIS) ▪ 2014 LiDAR was used for two basins upstream of Jubilee Park on Bourkelands Drive	▪ 1 m resolution LiDAR collected in 2008 ▪ 5 m x 5 m resolution photogrammetry was obtained from Geoscience Australia – Elevation Information System (ELVIS) ▪ 2014 LiDAR was used for two basins upstream of Jubilee Park on Bourkelands Drive ▪ 2020 LiDAR for the project site ▪ Site survey and verified cloud point data (Refer to Item 5, 7 and 8 in Table 1-2)
Roughness	▪ Pasture: 0.045 ▪ 1D cross-section elements: 0.040 ▪ Lots: 0.060 ▪ Ponds and other water bodies: 0.030 ▪ Newly built/resurfaced road: 0.018 ▪ Industrial: 0.070 ▪ Roads: 0.022 ▪ Creek permanent water: 0.040 ▪ Vegetation: 0.100 ▪ Vegetated creek: 0.080 ▪ Railway: 0.060 ▪ select 1D cross section (crooked creek): 0.060	▪ Pasture: 0.045 ▪ 1D cross-section elements: 0.040 ▪ Lots: 0.060 ▪ Ponds and other water bodies: 0.030 ▪ Newly built/resurfaced road: 0.018 ▪ Industrial: 0.070 ▪ Roads: 0.022 ▪ Creek permanent water: 0.040 ▪ Vegetation: 0.100 ▪ Vegetated creek: 0.080 ▪ Railway: 0.060 ▪ select 1D cross section (crooked creek): 0.060 ▪ Design Channel: 0.035 ▪ Note: Some roughness areas in the site (the rail line) were refined
Design Events	PMF, 0.2% AEP, 0.5% AEP, 1% AEP, 2% AEP, 5% AEP, 10% AEP, 0.2 EY	PMF, 1% AEP + Climate Change, 1% AEP, 2% AEP, 5% AEP, 10% AEP, 0.05% AEP

4.2.1.1 GDA 2020 conversion

The conversion to the Geocentric Datum of Australia 2020 (GDA2020) represents a crucial update to modernise and align the model with the latest geodetic standards and reference systems and to meet project requirements on the CRS. The model layers and the rasters were converted into GDA2020 Map Grid of Australia (MGA) 55 from GDA94 MGA 55.

4.2.1.2 TUFLOW model version and grid size

The initial 5-meter grid size and TUFLOW 2018-03-AC HPC were adopted in the MOFFS 2021 TUFLOW model. However, the 5m grid was found to be insufficient to model the detailed specific requirements of the study area. Consequently, a more refined grid size is required. The application of a finer grid to the whole model extent is not cost-effective in terms of the computation time, as the site areas are limited compared with the model extent. As such, the approach of applying quadtree (only available in versions from 2020 onwards) with 1.25m to the site area is favoured.

2023-03-AC is the most up to date TUFLOW version at the time when the modelling was carried out. However, when running the model using the 2023-03-AC HPC, inconsistencies were noted near the site area, particularly at area 1 and area 2 (refer to

Figure 4:4), in comparison to the results obtained from the 2018-03-AC HPC. Area 1, which is located near Pearson Street Bridge, experienced an increase of around 0.1 m in flood level, while area 2 (upstream of Wagga Yard) experienced an increase of around 0.5 m in flood level.

Following a series of tests, it was found that version 2020-10-AF HPC (the latest release prior to 2023) yielded results most similar to the results produced by the MOFFS 2021 model (2018-03-AC HPC), which Wagga Wagga City Council accepts (refer to Section 5 for more details). In areas 1 and 2, the flood levels were increased by around 0.02m and 0.15m.

Therefore, TUFLOW 2020-10-AF HPC with a quadtree of 1.25m was adopted for this study (refer to Figure 4:5) for the adopted quadtree extent.

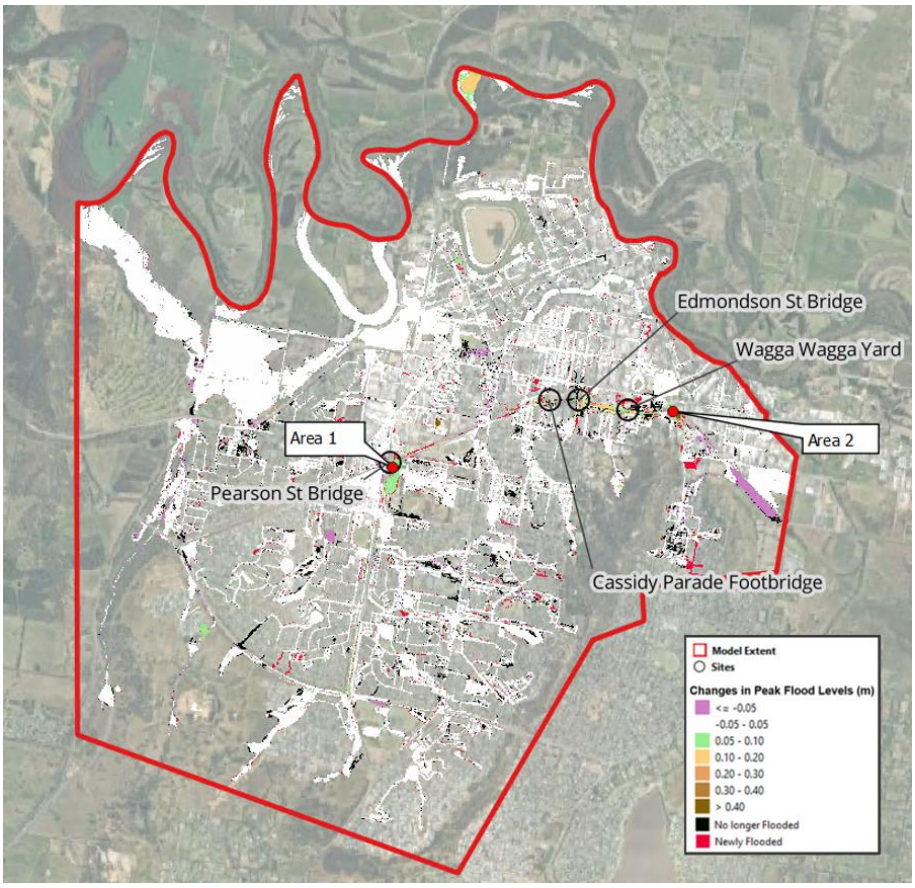


FIGURE 4:4: DISCREPANCIES BETWEEN 2023-03-AC AND 2018-03-AC TUFLOW VERSION FLOOD LEVELS RESULTS

FIGURE 4:5: QUADTREE EXTENT

4.2.1.3 Topography

The model topography was updated by incorporating the 2020 LiDAR and the site survey for both the existing case and the proposed design surfaces. The channel along CH521 760 was updated using the latest existing survey (refer to no.10 of Table 1-2). This update was performed to enhance the accuracy of the model, ensuring a proper representation of the most recent topography within the study area. Figure 4:6 shows the 2020 LiDAR extent.

FIGURE 4:6: 2020 LIDAR EXTENT

4.2.1.4 Key Structures

The MOFFS TUFLOW Model (2021) did not model any bridges within the study area including the Cassidy Parade footbridge. As the key structure within the site, ignoring the bridge will result in an inaccurate outcome. As such, the existing Cassidy Parade footbridge was included in the updated existing model. The bridge piers and the access ramp were represented in the model based on the survey. These elements were chosen as they are most pertinent to flood risk assessment and safety considerations within this particular area.

4.2.1.5 Drainage Network

Drainage networks (shown in Figure 4:7) were updated around the Cassidy Parade footbridge study area. The existing layout and pipe sizes and inverts of the drainage system were adopted from Item 6 in Table 1-2.

FIGURE 4:7: DRAINAGE NETWORK

4.2.2 Design Model Update

To establish the model for design condition, further updates were undertaken to incorporate the Inland Rail Project Works as part of the DDR stage, including:

- Design bridge representation - The piers, stairs and ramps of the design bridge were represented in the model. The abutment ramps and stairs were modelled as a solid obstruction, while the piers were modelled as Layered Flow Constrictions (Item 9 in Table 1-2).
- Proposed civil design with new parking spaces along the southern bridge access ramp (Item 10 in Table 1-2).
- The proposed chainlink fence is also added to the model.

Figure 4:8 shows the changes in site topography around Cassidy Parade Footbridge. The inclusion of the design data did not result in any alterations to the sub-catchment (Figure 12 of Wagga Wagga Major Overland Flow Flood Study, WMAwater, 2011). Thus, the inflow locations remain consistent with the existing model.

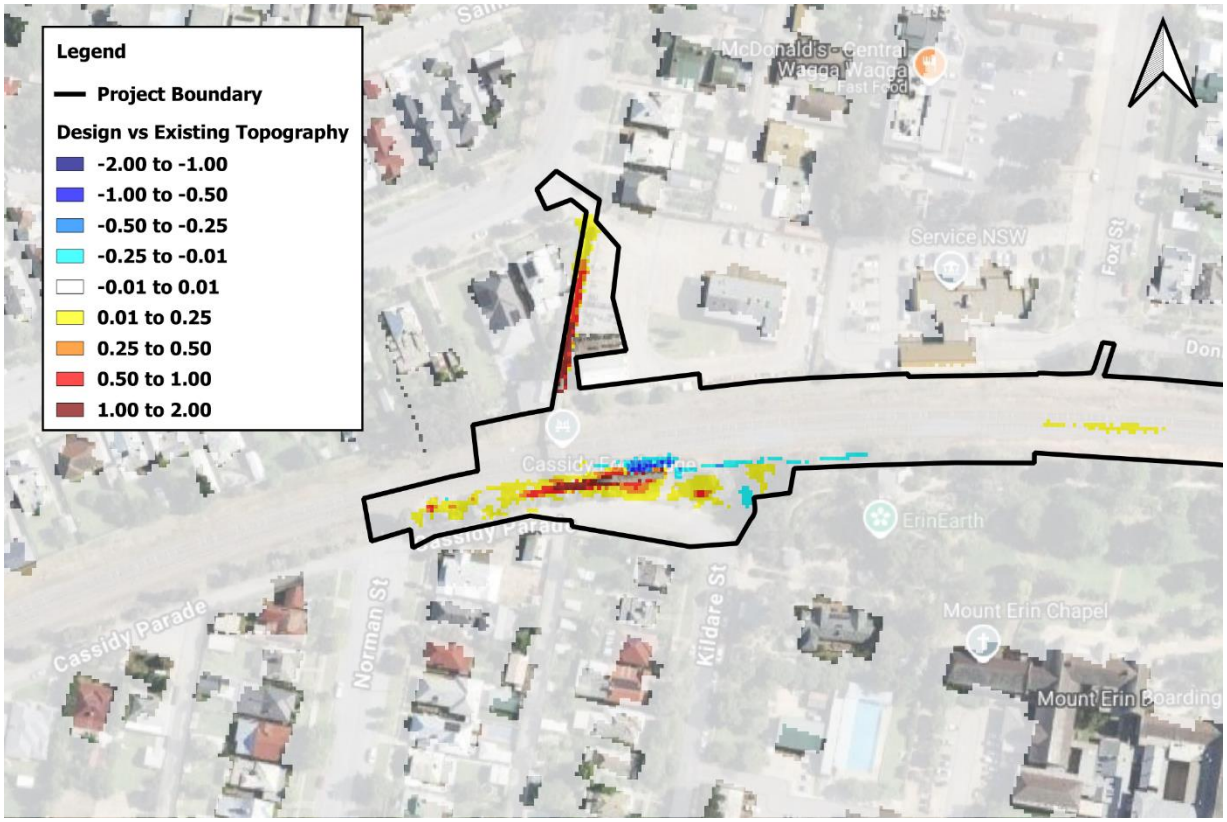


FIGURE 4:8: CHANGES IN SITE TOPOGRAPHY – DESIGN VS EXISTING

4.2.3 Design Events

The storm durations of 10min, 15min, 20min, 25min, 30min, 45min, 60min, 90min, 120min, 180min, 270min, 360min, 540min and 720min were modelled. An ensemble of 10 temporal patterns was run for each duration as recommended in ARR2019. The critical durations were determined based on the maximum envelope method across the selected durations.

The model was run for the design events of 10%, 5%, 2%, 1%, 1% AEP with climate change 0.05% AEP and PMF. The critical duration and temporal patterns determined and elaborated below in Table 4-3 summarise the information on the design events.

TABLE 4-3: SUMMARY OF EVENTS AND CRITICAL DURATIONS RUN IN TUFLOW – WAGGA WAGGA YARD

Design Events	Master Design Critical Duration	Temporal Pattern
10% AEP	30 minutes, 60 minutes, 120 minutes	All 10 temporal patterns for each duration
5% AEP	30 minutes, 90 minutes, 120 minutes	
2% AEP	30 minutes, 45 minutes, 60 minutes, 90 minutes	
1% AEP & 1% AEP + Climate Change	30 minutes, 45 minutes, 60 minutes	
0.05% AEP	20 minutes, 30 minutes, 45 minutes, 60 minutes	
PMF	30 minutes, 45 minutes, 60 minutes	

4.2.3.1 Climate Change

There are no design criteria for flood impact on climate change. Therefore, a sensitivity assessment was conducted to evaluate the influence of climate change on flooding to anticipate future climate change flood risk. The existing WBNM model was employed to generate hydrographs for the TUFLOW model for the 1% AEP with climate change.

As per the EIS report (Section 3.3.5 of Albury to Illabo Environmental Impact Statement Technical Paper 11) and the agreement between the Contractor and ARTC for the continued use of the prior version of ARR2019 climate change method (refer to IR2140-RTRFI-000773), the Year 2090 RCP8.5 interim climate change factor sourced from the ARR Data Hub (https://data-legacy.arr-software.org/) and the associated 20.2% increase in rainfall was adopted.

5 HYDRAULIC MODEL COMPARISON

The comparison in this section involves the results from the updated DDR model existing condition against the results from the MOFFS TUFLOW model for the 1% AEP design event storm duration of 120 minutes and TP3935.

Generally, this comparison revealed a high degree of consistency in flood levels between the two sets of results, with variations typically falling within the range of +/- 50 mm (refer to Figure 5:1). In some localised areas, larger differences were found, ranging from 0.05 to 0.3 metres. The possible reasons are listed below:

- It was initially expected that transitioning to a newer version of TUFLOW, which incorporates the quadtree method, might lead to minor changes in flood levels. The quadtree method could alter the model running timestep compared to the original model, potentially contributing to an increase in flood levels of up to 0.2m at the northern downstream boundary. However, since this area is distant from the sites, any such changes in flood levels would not impact the site.
- The changes in flood levels around the sites primarily stem from the integration of the 2020 LiDAR data and the comprehensive site survey.
- The existing drainage networks were updated based on the data provided by the DJV Drainage team, which involved modifications in terms of pipe location, pipe size, inverts, etc.
- Modifications were done based on the Proof Engineer's (Hatch) comments regarding the SA inflow polygons which additional flows were directed to the open channel at Colemans Street, creating more flows to the site.

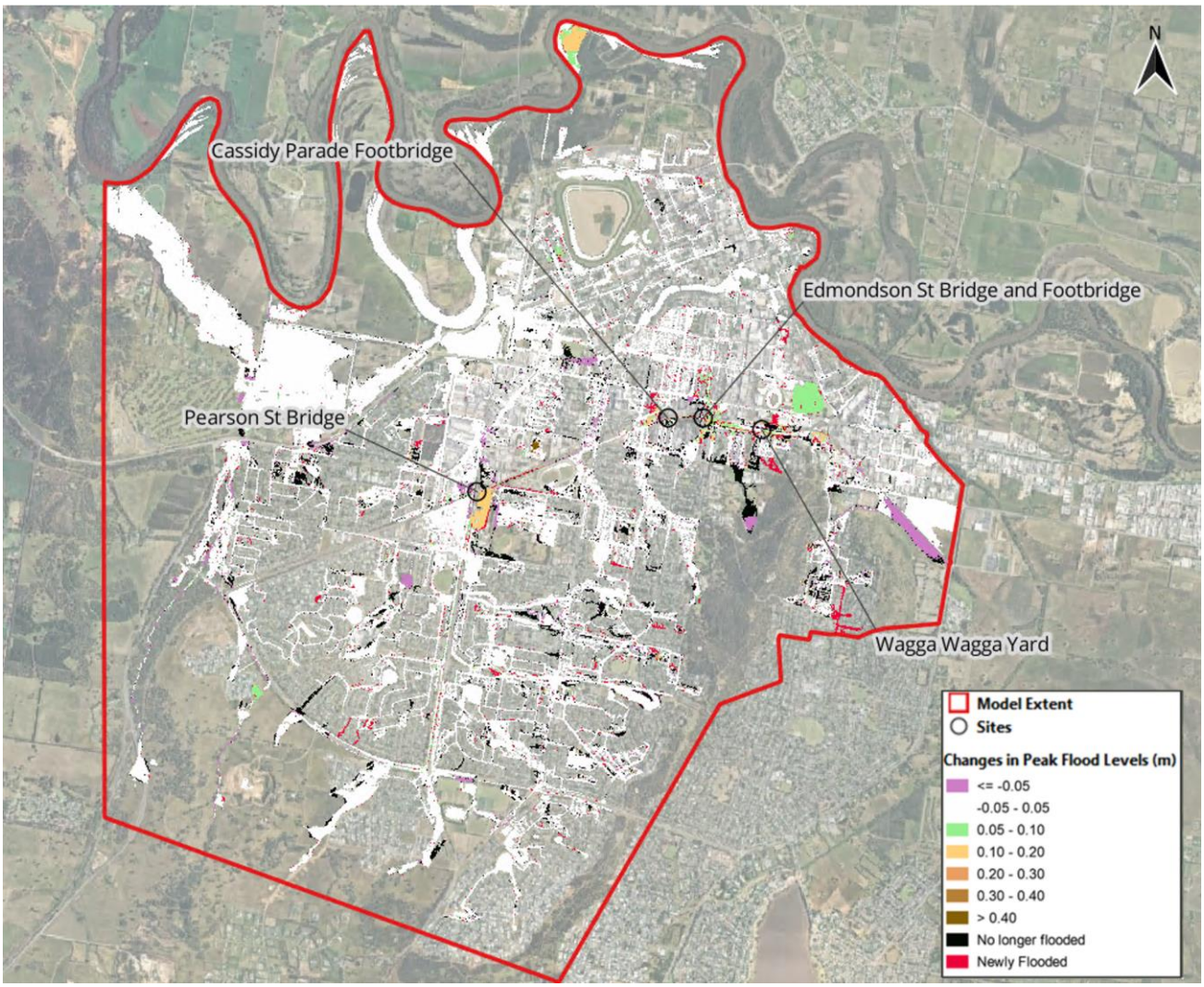


FIGURE 5:1: COMPARISON - CHANGES IN PEAK FLOOD LEVELS (UPDATED TUFLOW MODEL VS MOFFS 2021 TUFLOW MODEL)

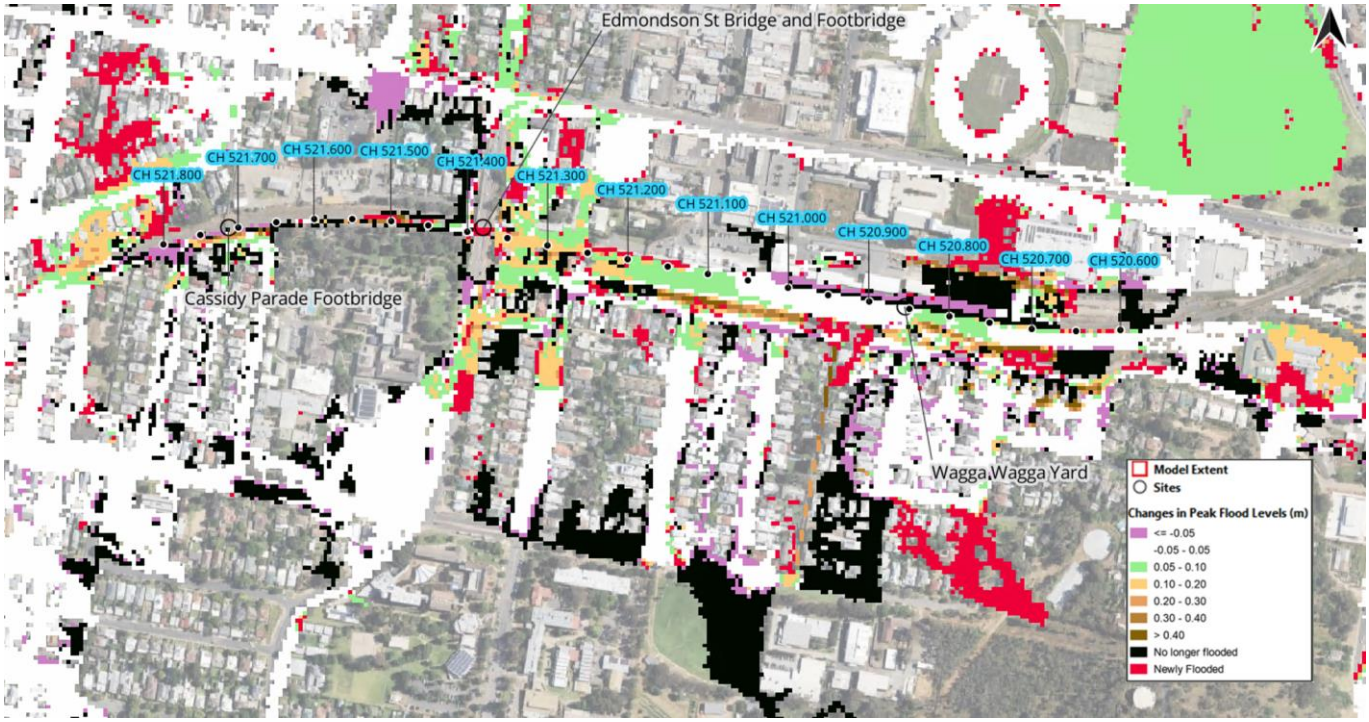


FIGURE 5:2: COMPARISON - CHANGES IN PEAK FLOOD LEVELS ZOOMED IN (UPDATED TUFLOW MODEL VS MOFFS 2021 TUFLOW MODEL)

6 FLOOD ASSESSMENT

6.1 Existing Condition

Existing flood maps, including peak flood depth and levels, peak flood velocity, and peak flood hazard for the events modelled are provided in Appendix A.

The Cassidy Parade footbridge primarily encounters flooding along its southern side, while the northern section remains unaffected. The southern side is mainly impacted due to overland flow channelled along Kildare Street, which ultimately diverges at the footbridge. Upon reaching this point, the floodwater divides, flowing eastward and westward along the railway corridor open channel. The flood depths are generally shallow along the Cassidy Parade and Kildare Street. The flood water leading towards the west flows into an existing culvert, conveying flood water across the railway track, located roughly 50 meters west of the existing bridge ramp (Refer to Figure 6:1). This culvert is a critical component in managing and redirecting the excess water, helping mitigate the impact of the flooding event.

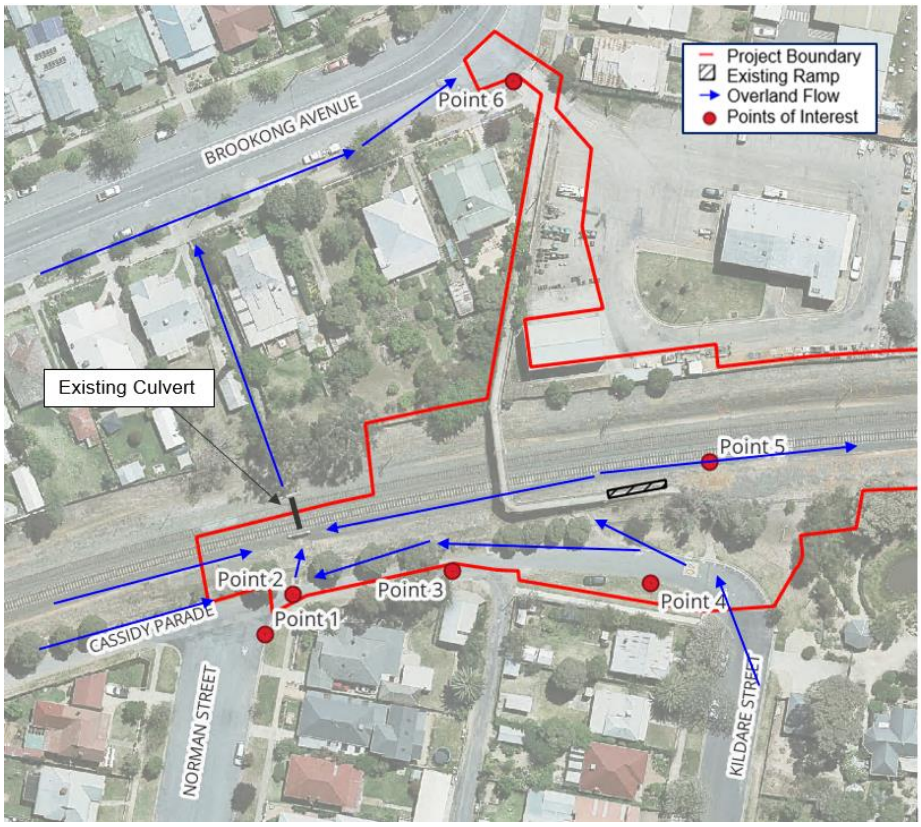


FIGURE 6:1: SITE FLOW PATHS AND POINTS OF INTEREST - EXISTING CONDITION

Table 6-1 summarises the peak flood level results for existing conditions at Cassidy Parade footbridge.

TABLE 6-1: PEAK FLOOD LEVELS – EXISTING CONDITION

Design Events	Flood Levels
10% AEP	▪ The flood waters do not overtop the existing railway tracks at the site. ▪ Refer to Table 6-2 for flood level comparison based on points of interest.
5% AEP	
2% AEP	
1% AEP	
1% AEP + Climate Change	
0.05% AEP	
PMF	▪ The flood waters overtop the existing railway tracks at the site. ▪ Refer to Table 6-2 for flood level comparison based on points of interest.

Table 6-2 shows the peak flood levels for all simulated events at the points of interest for the existing condition (Figure 6:1).

TABLE 6-2: POINTS OF INTEREST DATA – PEAK FLOOD LEVELS (MAHD) – EXISTING CONDITION

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	0.05% AEP	PMF
Point 1	185.75	185.77	185.78	185.79	185.80	185.82	186.33
Point 2	185.76	185.77	185.78	185.79	185.80	185.81	186.31
Point 3	186.06	186.06	186.08	186.09	186.10	186.12	186.29
Point 4	186.93	186.94	186.94	186.95	186.96	186.97	187.04
Point 5	184.97	184.98	185.00	185.03	185.07	185.13	185.91
Point 6	182.53	182.53	182.53	182.53	182.54	182.55	183.10

The flow velocity is generally low along the railway corridor's open channel, compared to the flow velocity along Kildare Street and Cassidy Parade. Table 6-3 summarises the peak flood velocity results for existing conditions at Cassidy Parade footbridge.

TABLE 6-3: PEAK FLOOD VELOCITY – EXISTING CONDITION

Design Events	Flood Velocity
10% AEP	▪ Refer to Table 6-4 for flood velocity comparison based on points of interest. ▪ The peak velocity along the rail corridor open channel is generally less than 1 m/s
5% AEP	
2% AEP	
1% AEP	
1% AEP + Climate Change	
0.05% AEP	
PMF	▪ Refer to Table 6-4 for flood velocity comparison based on points of interest. ▪ The peak velocity along the rail corridor open channel is generally less than 1.3 m/s

Table 6-4 shows the peak flood velocity for all simulated events at the points of interest for the existing condition (Figure 6:1).

TABLE 6-4: POINTS OF INTEREST DATA – PEAK FLOOD VELOCITY (M/S) – EXISTING CONDITION

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	0.05% AEP	PMF
Point 1	0.2	0.2	0.3	0.3	0.4	0.5	1.5
Point 2	0.1	0.2	0.3	0.3	0.4	0.4	1.3
Point 3	0.3	0.3	0.4	0.4	0.4	0.5	0.8
Point 4	0.5	0.5	0.6	0.6	0.7	0.8	1.4
Point 5	0.2	0.2	0.2	0.2	0.2	0.2	0.8
Point 6	0.7	0.7	0.7	0.7	0.7	0.8	1.4

The flood hazard assessment is based on the general flood hazard classification set by the Australian Institute for Disaster Resilience in the Australian Disaster Resilience Handbook Collection-Flood Hazard, 2017. The Figure 6:2 and the tables below describe the hazards.

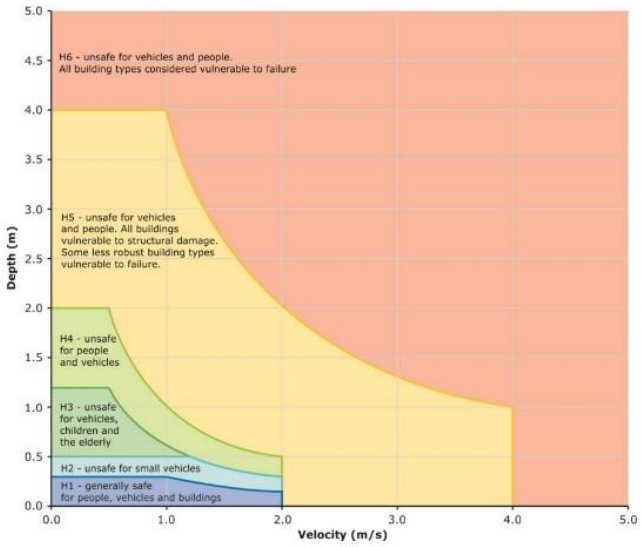


FIGURE 6:2: HAZARD CATEGORY CLASSIFICATION

The flood hazard is generally low (H2 or less) around the site area. The flood hazards for the existing case at the Cassidy Parade footbridge study area are presented in Table 6-5 and the maps are shown in Appendix A.

TABLE 6-5: FLOOD HAZARD – EXISTING CONDITION

Design Events	Flood Hazard
10% AEP	▪ Refer to Table 6-6 for flood hazard comparison based on points of interest. ▪ The peak hazard near the access ramps and piers is generally H2 or less (low hazard).
5% AEP	
2% AEP	
1% AEP	
1% AEP + Climate Change	
0.05% AEP	
PMF	▪ Refer to Table 6-6 for flood hazard comparison based on points of interest. ▪ The peak hazard near the access ramps and piers generally H4 or less.

Table 6-6 shows the peak flood hazard for all simulated events at the points of interest for the existing condition (Figure 6:1).

TABLE 6-6: POINTS OF INTEREST DATA – PEAK FLOOD HAZARD – EXISTING CONDITION

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	0.05% AEP	PMF
Point 1	H1	H1	H1	H1	H1	H1	H4
Point 2	H1	H1	H1	H1	H1	H1	H4
Point 3	H1	H1	H1	H1	H1	H1	H1
Point 4	H1	H1	H1	H1	H1	H1	H2
Point 5	H1	H1	H1	H1	H2	H2	H4
Point 6	H1	H1	H1	H1	H1	H1	H4

6.2 Design Condition

Design condition flood maps, including peak flood depth and levels, peak flood velocity, and peak flood hazard for the events modelled are provided in Appendix A.

During design conditions, flooding is mainly impacted by the southern bridge access ramp. As the southern access ramp blocks the flow path which converges flood water into the existing rail corridor open channel, additional flood water is directed along the Cassidy Parade towards the west which then flows into the existing culvert at the railway corridor (refer to Figure 6:3). This improved the flood levels within the railway corridor open channel near the site.

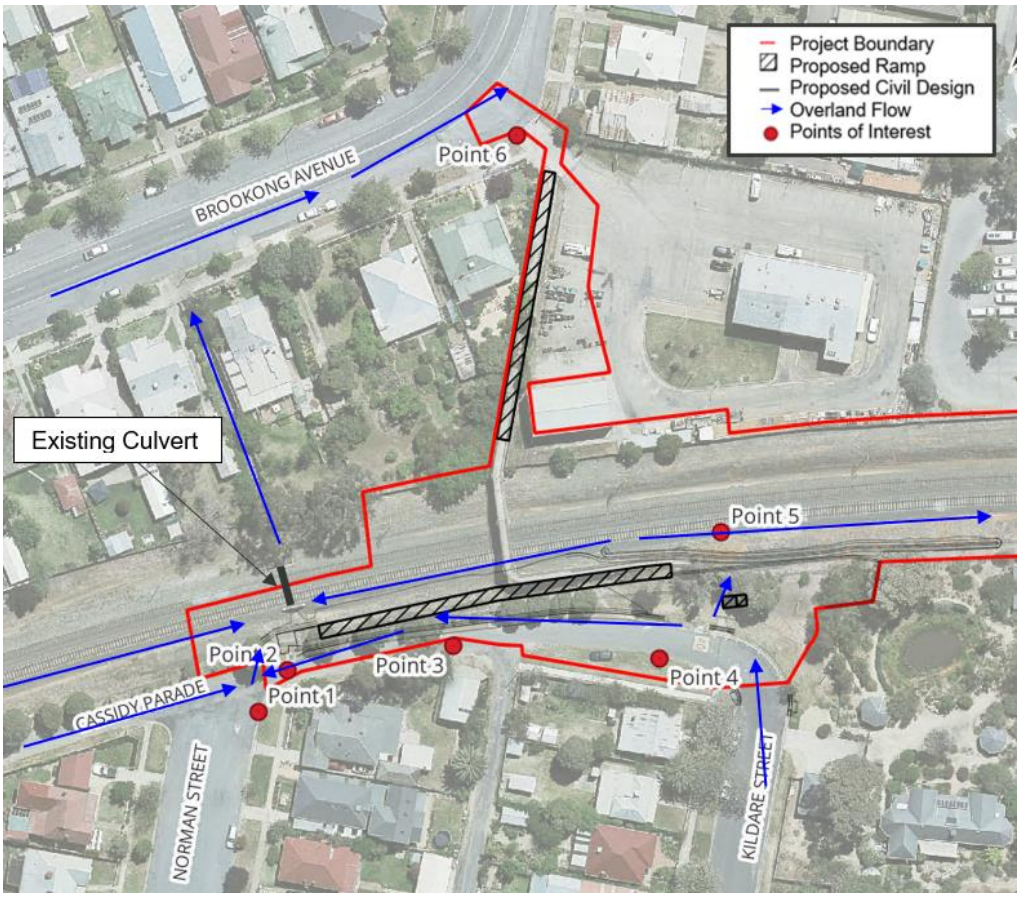


FIGURE 6:3: SITE FLOW PATHS AND POINTS OF INTEREST – DESIGN CONDITION

Table 6-7 summarises the peak flood level results for design conditions at Cassidy Parade footbridge.

TABLE 6-7: PEAK FLOOD LEVELS – DESIGN CONDITION

Design Events	Flood Levels
10% AEP	▪ The flood waters do not overtop the existing railway tracks. ▪ Refer to Table 6-8 for flood level comparison based on points of interest.
5% AEP	
2% AEP	
1% AEP	
1% AEP + Climate Change	
0.05% AEP	
PMF	▪ The flood waters overtop the existing railway tracks. ▪ Refer to Table 6-8 for flood level comparison based on points of interest.

Table 6-8 shows the peak flood levels for all simulated events at the points of interest for the design condition (Figure 6:3).

TABLE 6-8: POINTS OF INTEREST DATA – PEAK FLOOD LEVELS (MAHD) – DESIGN CONDITION

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	0.05% AEP	PMF
Point 1	185.75	185.77	185.78	185.79	185.80	185.82	186.39
Point 2	185.76	185.77	185.78	185.79	185.80	185.81	186.38
Point 3	186.07	186.08	186.09	186.10	186.12	186.14	186.38
Point 4	186.93	186.94	186.94	186.95	186.96	186.97	187.04
Point 5	184.94	184.96	184.98	185.00	185.05	185.09	185.90
Point 6	182.53	182.53	182.53	182.53	182.54	182.55	183.11

In the design condition, the flow velocity is generally low along the railway corridor open channel compared to the flow velocity along Kildare Street and Cassidy Parade. Table 6-9 summarises the peak flood velocity results for design conditions at Cassidy Parade footbridge.

TABLE 6-9: PEAK FLOOD VELOCITY – DESIGN CONDITION

Design Events	Flood Velocity
10% AEP 5% AEP 2% AEP 1% AEP 1% AEP + Climate Change 0.05% AEP	▪ The peak velocity along the rail corridor open channel is generally less than 1m/s. ▪ Refer to: ○ Table 6-10 shows the peak flood velocity for all simulated events at the points of interest for the design condition (Figure 6:3). ○ Table 6-10 for flood velocity comparison based on points of interest.
0.05% AEP	▪ The peak velocity along the rail corridor open channel is generally less than 1.2 m/s. ▪ Refer to: ○ Table 6-10 shows the peak flood velocity for all simulated events at the points of interest for the design condition (Figure 6:3). ○ Table 6-10 for flood velocity comparison based on points of interest.

Table 6-10 shows the peak flood velocity for all simulated events at the points of interest for the design condition (Figure 6:3).

TABLE 6-10: POINTS OF INTEREST DATA – PEAK FLOOD VELOCITY (M/S) – DESIGN CONDITION

Location	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	0.05% AEP	PMF
Point 1	0.2	0.2	0.3	0.3	0.4	0.5	1.4
Point 2	0.1	0.2	0.3	0.3	0.4	0.5	1.2
Point 3	0.4	0.4	0.4	0.4	0.4	0.5	1.1
Point 4	0.5	0.5	0.6	0.6	0.7	0.8	1.4
Point 5	0.2	0.2	0.2	0.2	0.2	0.2	0.9
Point 6	0.7	0.7	0.7	0.7	0.7	0.8	1.5

The flood hazard is generally low (H2 or less) at the site area in design condition. The flood hazard for the design condition at the Cassidy Parade footbridge study area is presented in Table 6-11 and the maps are presented in Appendix A.

TABLE 6-11: FLOOD HAZARD – DESIGN CONDITION

Design Events	Flood Hazard
10% AEP	▪ The peak hazard near the access ramps and piers is generally H2 or less (low hazard). ▪ Refer to Table 6-12 for a comparison of flood hazard based on points of interest.
5% AEP	
2% AEP	
1% AEP	
1% AEP + Climate Change	
0.05% AEP	
PMF	▪ The peak hazard near the access ramps and piers is generally H4 or less (low hazard). ▪ Refer to Table 6-12 for a comparison of flood hazard based on points of interest

Table 6-12 shows the peak flood hazard for all simulated events at the points of interest for the design condition (Figure 6:3).

TABLE 6-12: POINTS OF INTEREST DATA – PEAK FLOOD HAZARD – DESIGN CONDITION

Location	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	0.05% AEP	PMF
Point 1	H1	H1	H1	H1	H1	H1	H4
Point 2	H1	H1	H1	H1	H1	H1	H4
Point 3	H1	H1	H1	H1	H1	H1	H1
Point 4	H1	H1	H1	H1	H1	H1	H2
Point 5	H1	H1	H1	H1	H2	H2	H4
Point 6	H1	H1	H1	H1	H1	H1	H4

6.3 Flood Immunity and Scour Protection

The railway corridor retains the same flood immunity up to 0.05% AEP in design and existing condition, which complies with the criteria in PSRs and CoA. Furthermore, in the design condition, the flood velocity along both the design bridge's access ramp and the piers generally remains below 1m/s for events up to 0.05% AEP. This signifies that the water in these critical areas is not excessively fast. Such controlled water velocities indicate a lower potential for scouring. However, it is recommended to maintain a basic ground cover around piers and ramps without exposing bare soil to reduce any scouring risk.

The flooding levels at the railway corridor are around 185.8mAHD in the PMF event and well below the bridge deck level (193.8mAHD) in all events up to the PMF. At around footbridge access ramps and piles, flood hazard is generally lower (H1 and H2) in 0.05% AEP, and the flooding is not expected to cause any surface damage to the bridge due to abrasing/erosion.

6.4 Flood Impact Assessment

As mentioned in Section 4, the flood impact assessment up to the 1% AEP event was conducted and the results are summarised below. The designed bridge access ramp is situated along the existing flow path, which directs water from Cassidy Parade to the open channels of the existing rail corridor. Due to the presence of the new access ramp, the flow path is obstructed, causing floodwater to divert westward along the ramp before eventually entering the open channel. This

redirection results in a water level increase along Cassidy Parade. The discussion about the peak level, velocity and hazard impact due to the design is illustrated in the following sections.

6.4.1 Changes in Peak Flood Level

Table 6-13 provides details regarding the peak flood level changes during the Design scenario.

TABLE 6-13: FLOOD LEVEL IMPACT ASSESSMENT

Design Events	Changes in Peak Flood Levels
10% AEP	▪ The changes in flood level happening inside the project boundary are due to the changes in the design terrain. For the areas outside of the project boundary, the changes in flood level are generally less than 0.01 m (surrounds of residential building and Cassidy Parade - refer to Figure A43 to A46 in Appendix A). ▪ Newly wet areas are created due to the ramp with a depth of generally less than 0.05m.
5% AEP	
2% AEP	
1% AEP	

For the areas outside of the project boundary, the changes in flood level are generally less than 0.01 m, which complies with PSR and CoA project requirements.

6.4.2 Changes in Peak Flood Velocity

Table 6-14 provides details regarding changes in peak flood velocity during the Design scenario.

TABLE 6-14: FLOOD VELOCITY IMPACT ASSESSMENT

Design Events	Changes in Peak Flood Velocity
10% AEP	▪ The Changes in velocity outside the site are less than 0.5m/s. (Refer to Figure A48 to A51 in Appendix A). ▪ The velocity at new wet areas is less than 0.5m/s.
5% AEP	
2% AEP	
1% AEP	

The points of interest 1 to 6 experiences less than 0.5m/s of changes in velocity for the 10% AEP, 5% AEP, 2% AEP and 1% AEP events. The existing condition velocity outside the project boundary is less than 0.5m/s. Thus, the design complies with PSR and CoA.

6.4.3 Changes in Flood Hazard

Table 6-15 details the peak flood velocity changes during the design scenario.

TABLE 6-15: FLOOD HAZARD IMPACT ASSESSMENT

Design Events	Changes in Peak Flood Hazard
10% AEP	▪ There is no increase in flood hazard outside the project boundary. (Refer to Figure A53 to A56 in Appendix A). ▪ The hazard at new wet areas is generally H1.
5% AEP	
2% AEP	
1% AEP	

There is no increase in hazard from Points 1 to 6 and the areas outside of the project boundary for 10% AEP, 5% AEP, 2% AEP and 1% AEP events. Thus, the design complies with PSR and CoA.

6.4.4 Changes in Duration of Inundation

The analysis around the changes in the duration of inundation was undertaken by comparing the existing and flood level vs time in the selected locations. Figure 6:4 presents the three selected locations used for comparing flood level vs time. Figure 6:5, Figure 6:6 and Figure 6:7 illustrate detailed comparisons of the flood level vs time curves at Reporting Locations 1, 2, and 3, respectively. Both the existing and design flood level vs time are mostly similar. These demonstrate that the design will not create an extra duration of inundation upstream and downstream outside the project boundary. Consequently, the changes in the duration of inundation comply with the CoA E42(a).

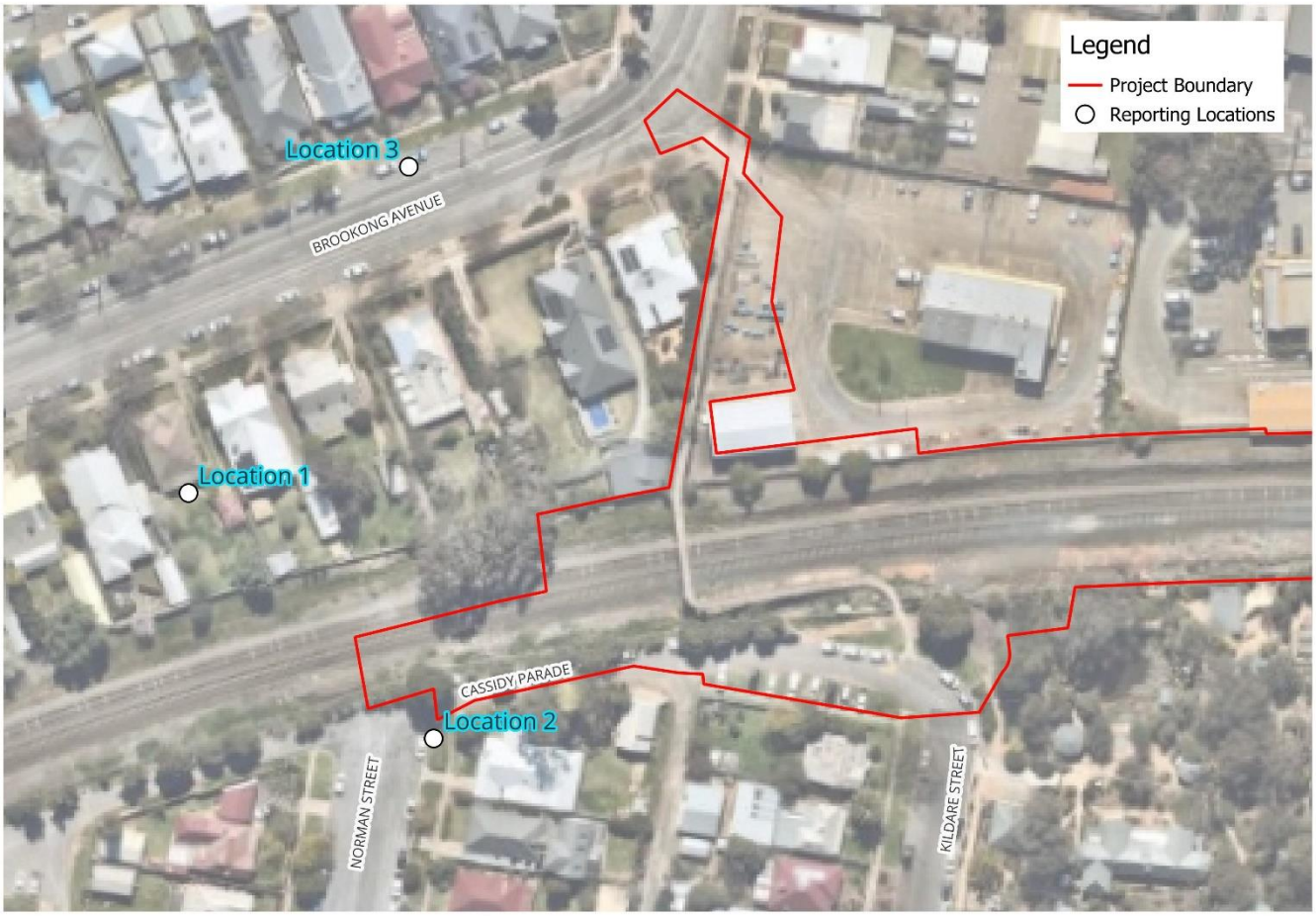


FIGURE 6:4: REPORTING LOCATIONS FOR THE CHANGES IN DURATION OF INUNDATION

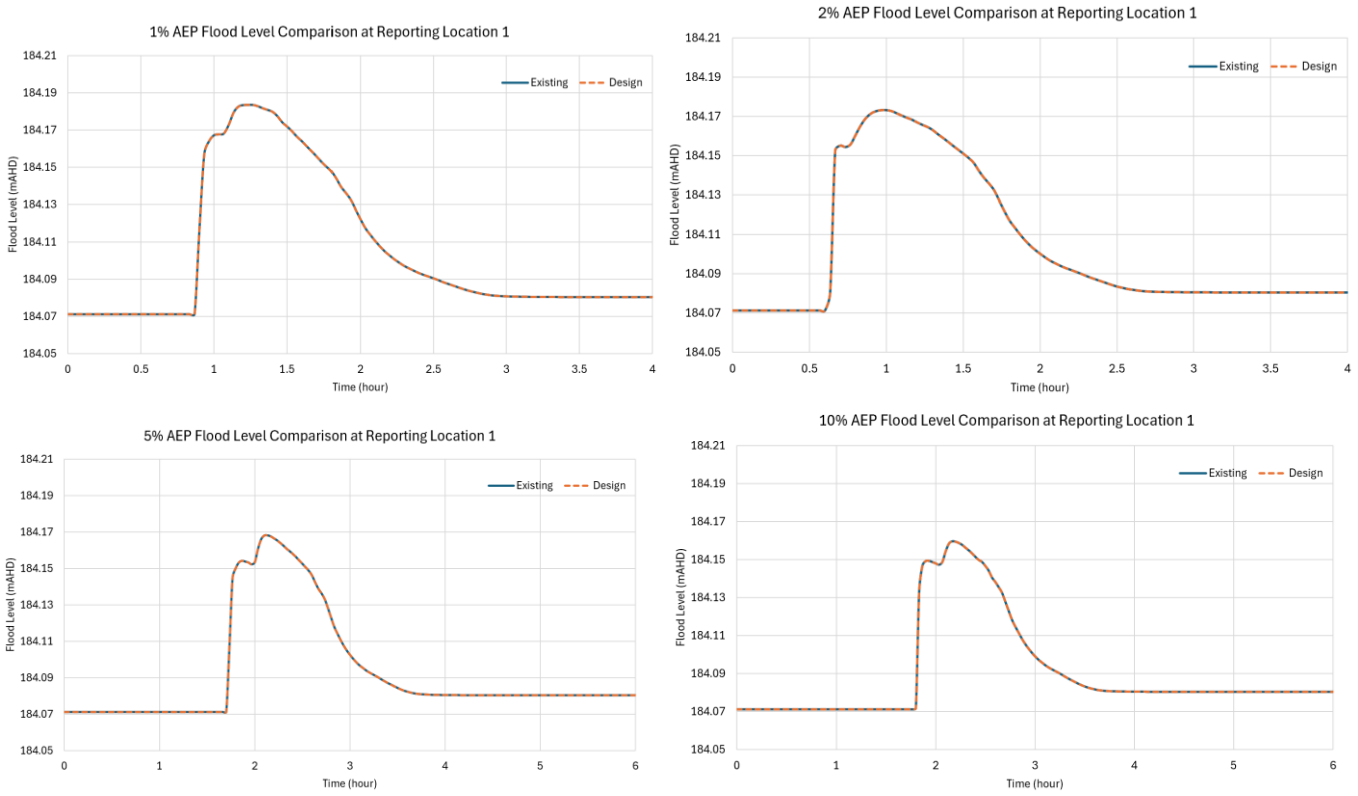


FIGURE 6:5: COMPARISON OF FLOOD LEVEL VS. TIME AT REPORTING LOCATION 1

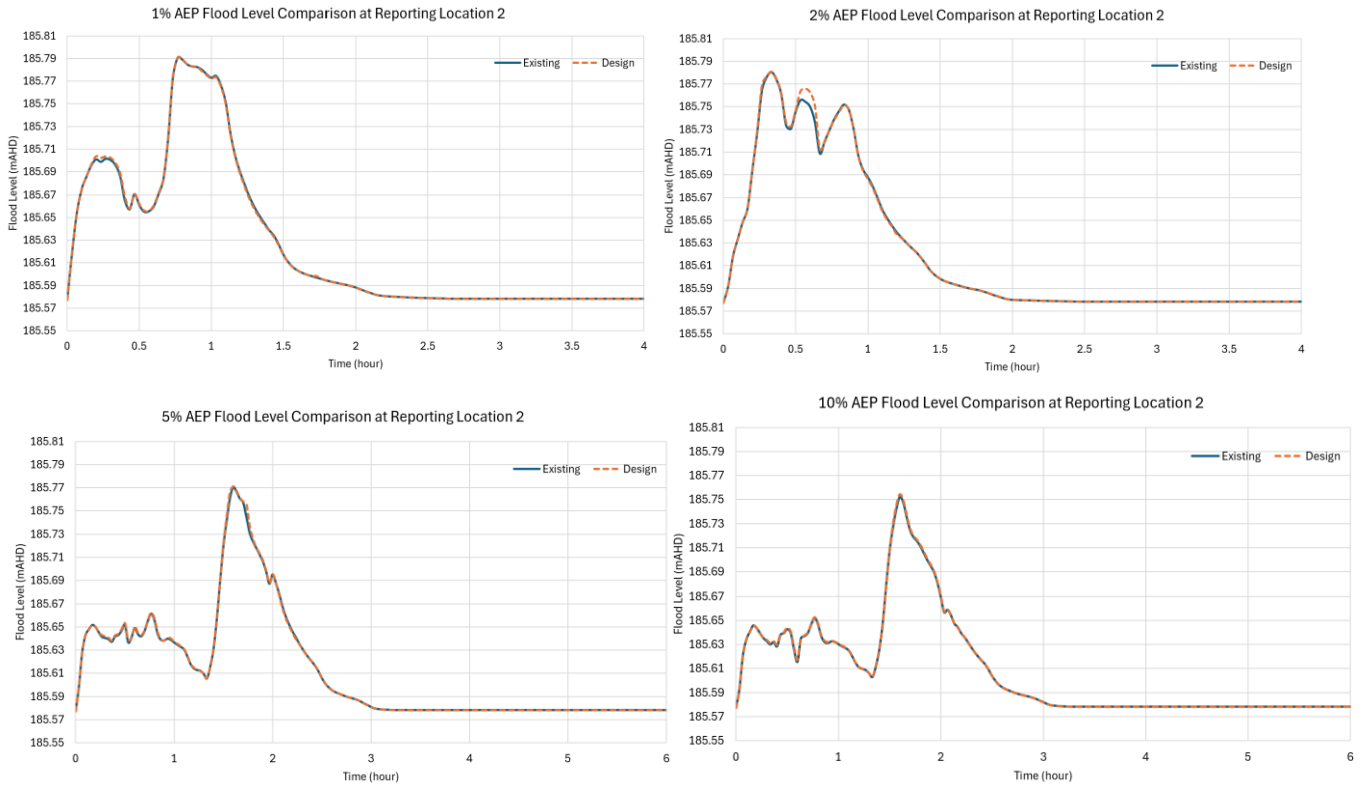


FIGURE 6:6: COMPARISON OF FLOOD LEVEL VS. TIME AT REPORTING LOCATION 2

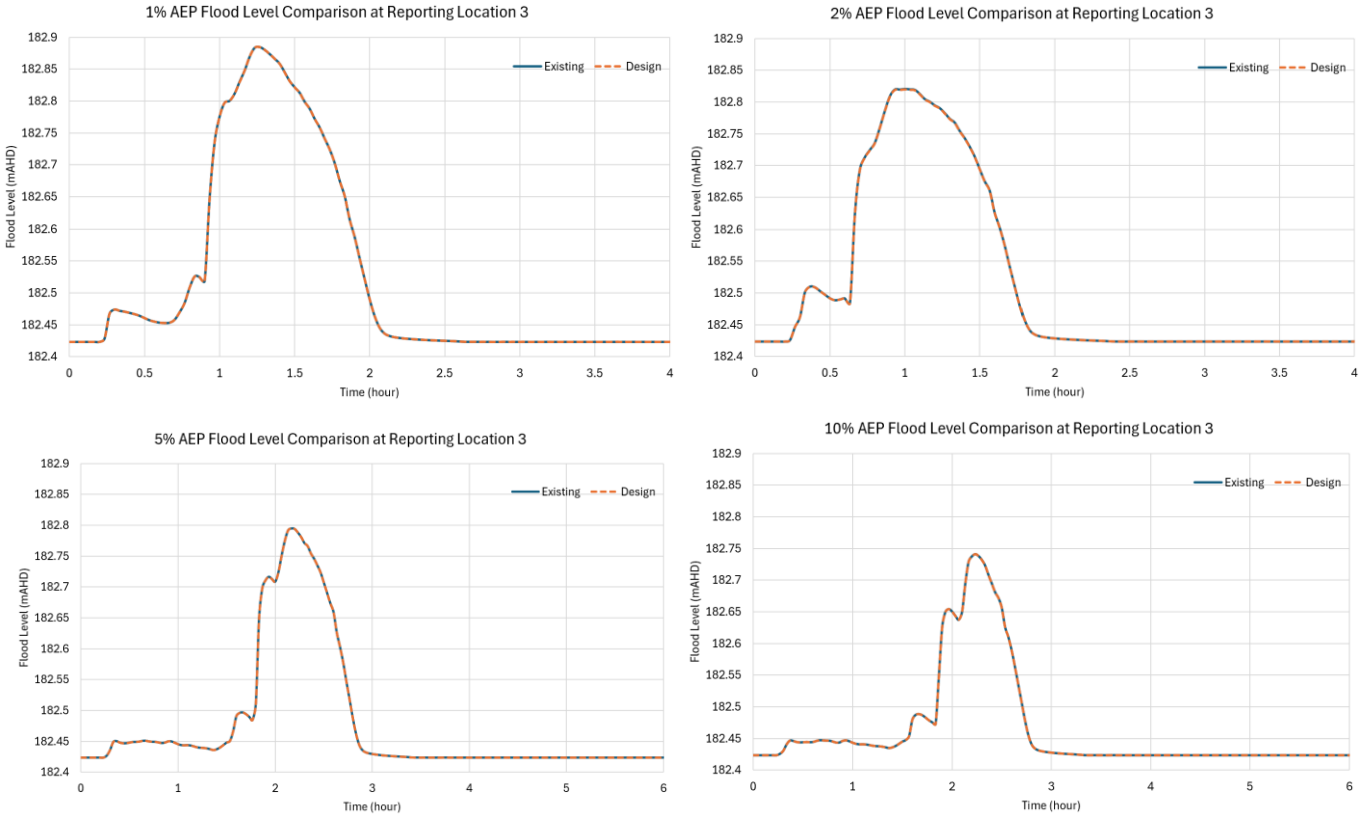


FIGURE 6:7: COMPARISON OF FLOOD LEVEL VS. TIME AT REPORTING LOCATION 3

6.4.5 Cumulative impact

The Cassidy Parade footbridge is located approximately 250m upstream of the Edmondson Street Bridge. Based on the flood assessment done for the Edmondson Street Bridge and Footbridge submitted for the PDR2 stage (Refer to 5-0052-210-IHY-W5-RP-0001) and Wagga Wagga Yard submitted for the DDR stage (Refer to 5-0052-210-IHY-W7-RP-0001) the

flood impacts from the Edmondson Street bridge and Wagga Wagga Yard do not affect the Cassidy footbridge site flooding characteristics up to the 1% AEP. Thus, there will be no cumulative impacts on the Cassidy Parade footbridge.

6.5 Sensitivity Test

6.5.1 Blockage Assessment

A hydraulic blockage assessment was carried out for the 1% AEP design scenario as per the guidance set out in ARR2019. The assessment involved assessing the site area for debris availability, mobility and transportability and this, in conjunction with culvert size was used to determine the relevant blockage factors shown. There are no proposed culverts for Cassidy Parade, however 25% of blockage was adopted for the stormwater pipes within the site (refer to Table 6-16 and Table 6-17). 20% blockage was adopted for all the other culverts, pits and pipes outside the project boundary (refer to Table 6-16 and Figure 6:8).

A flood level comparison between the blockage scenario and design is shown in Figure 6:9. A general water level increase of up to 0.013 m is mainly found within the site. As a consequence of implementing the 20% blockage in the drainage networks located outside the site, Brookong Avenue experiences a rise in water levels of up to 0.030m. Furthermore, the open channel records an afflux of less than 0.06m as a result of the blockage applied to its downstream culverts.

TABLE 6-16: CULVERT BLOCKAGE PERCENTAGE

Pipe	Blockage Percentage (1% AEP)	Comments
W4_E01_01t02 (1 cell 0.525m in diameter)	25%	Inside the project boundary
W4_E01_02t03 (1 cell 0.525m in diameter)	25%	Inside the project boundary
W4_E01_03t04 (1 cell 0.525m in diameter)	25%	Inside the project boundary
W4_E01_4t1.1 (1 cell 0.525m in diameter)	25%	Inside the project boundary
Brookong 04 (2 cell 1.4m in Width X 0.8m in Height)	25%	Inside the project boundary
EX1p1to1 (1 cell 0.6m in diameter)	25%	Inside the project boundary
All others (culvert, pit and pipe)	20%	Outside of the project boundary

TABLE 6-17: PIPE BLOCKAGE PARAMETERS

Pipe	Debris Availability	Debris Mobility	Debris Transportability	AEP Adjusted Debris Potential
W4_E01_01t02	Low	Medium	Low	Low
W4_E01_02t03	Low	Medium	Low	Low
W4_E01_03t04	Low	Medium	Low	Low
W4_E01_4t1.1	Low	Medium	Low	Low
EX1p1to1	Low	Medium	Low	Low
Brookong04	Low	Medium	Low	Low

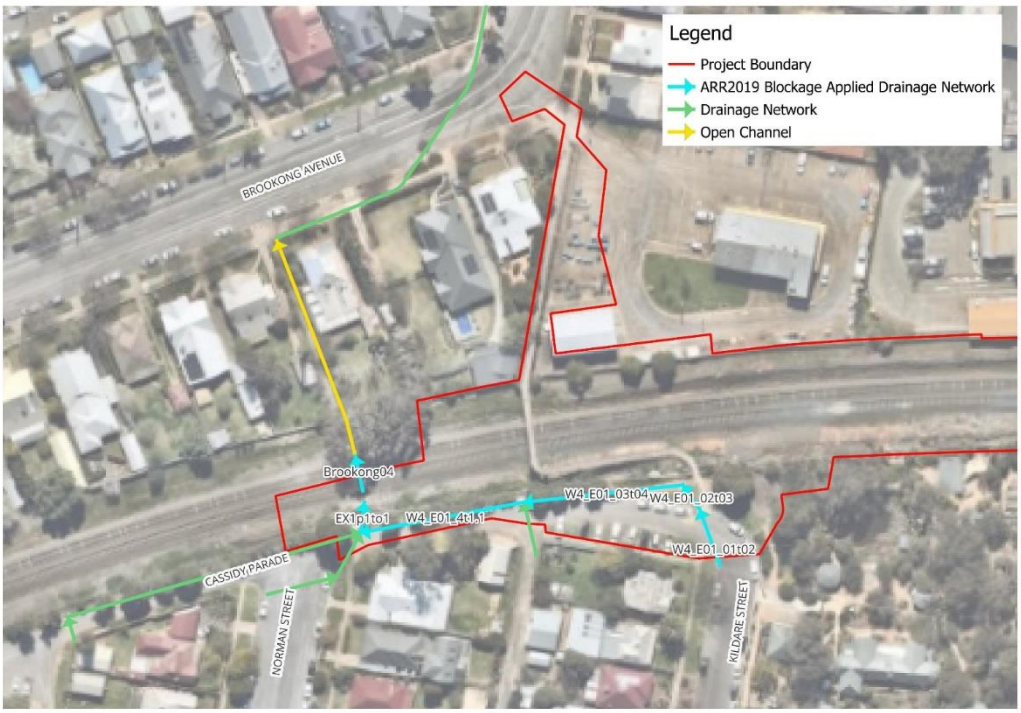


FIGURE 6:8: CULVERTS AT CASSIDY PARADE FOOTBRIDGE SITE

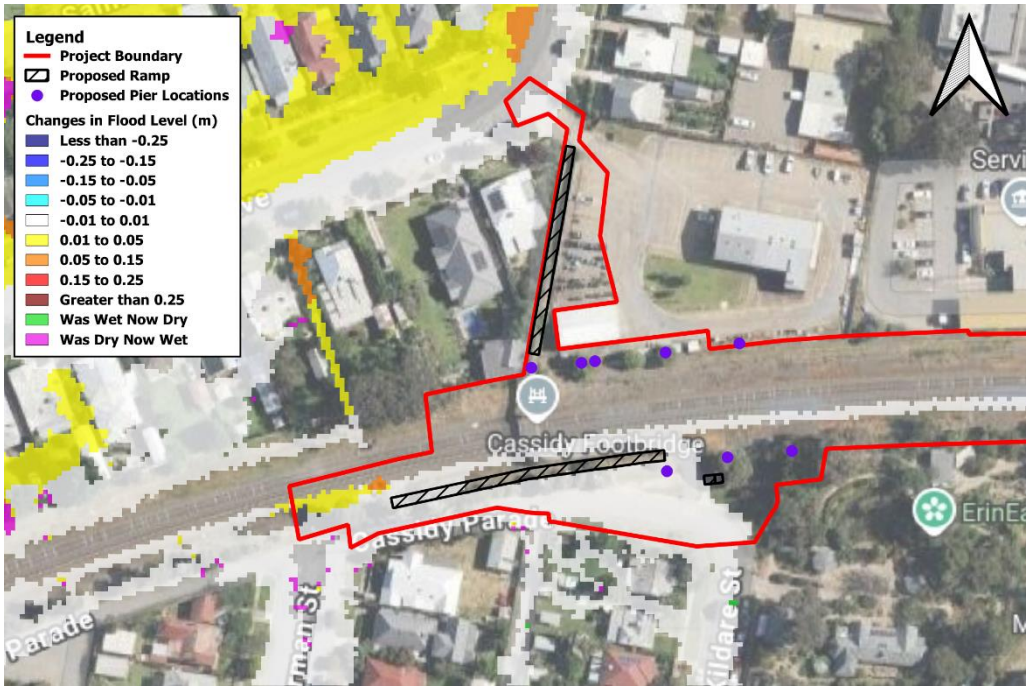


FIGURE 6:9: FLOOD LEVEL COMPARISON FOR 1% AEP DESIGN CONDITION – BLOCKAGE VS DESIGN

6.5.2 Climate Change Risk Assessment

A Climate Change risk assessment was carried out by running the 1% AEP with 2090 RCP8.5 interim climate change factor (refer to Section 4.2.3.1 for details of the approach) and the results of flood depth, flood velocity and flood hazard can be found in Section 6.1 and Section 6.2. The corresponding flood maps can be found in Appendix A. The assessment is summarised below:

- Within the study area, the railway track achieves flood immunity of the 1% AEP with Climate Change.
- The changes in flood level are less than 0.1m with values generally ranging less than 0.05m outside the project boundary (Refer to Figure A41 in Appendix A).
- Within the study area, the flood hazard was classified as low (H1) in the 1% AEP with Climate Change.

7 MITIGATION MEASURES

No instances of non-compliance in terms of flood impact were documented. Therefore, no additional mitigation measures are necessary at this IFC stage.

8 RECOMMENDATIONS AND NEXT STAGE

This is the final IFC stage of the report, and the following are finalised:

- No instances of non-compliance have been identified through the assessment.
- All comments raised by relevant parties have been resolved (refer to Appendices C, D and E)

Consequently, there are no further recommendations.

APPENDIX A

FLOOD MAPS

TABLE A- 1: LIST OF MAPS IN APPENDIX A

Map ID	Map description
Figure A01	10% AEP Peak Flood Depth and Levels - Existing Condition
Figure A02	5% AEP Peak Flood Depth and Levels - Existing Condition
Figure A03	2% AEP Peak Flood Depth and Levels - Existing Condition
Figure A04	1% AEP Peak Flood Depth and Levels - Existing Condition
Figure A05	1% AEP Climate Changes Peak Flood Depth and Levels - Existing Condition
Figure A06	0.05% AEP Peak Flood Depth and Levels - Existing Condition
Figure A07	PMF Peak Flood Depth and Levels - Existing Condition
Figure A08	10% AEP Peak Flood Velocity - Existing Condition
Figure A09	5% AEP Peak Flood Velocity - Existing Condition
Figure A10	2% AEP Peak Flood Velocity - Existing Condition
Figure A11	1% AEP Peak Flood Velocity - Existing Condition
Figure A12	1% AEP Climate Changes Peak Flood Velocity - Existing Condition
Figure A13	0.05% AEP Peak Flood Velocity - Existing Condition
Figure A14	PMF AEP Peak Flood Velocity - Existing Condition
Figure A15	10% AEP Peak Flood Hazard - Existing Condition
Figure A16	5% AEP Peak Flood Hazard - Existing Condition
Figure A17	2% AEP Peak Flood Hazard - Existing Condition
Figure A18	1% AEP Peak Flood Hazard - Existing Condition
Figure A19	1% AEP Climate Changes Peak Flood Hazard - Existing Condition
Figure A20	0.05% AEP Peak Flood Hazard - Existing Condition
Figure A21	PMF AEP Peak Flood Hazard - Existing Condition
Figure A22	10% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A23	5% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A24	2% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A25	1% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A26	1% AEP Climate Changes Peak Flood Depth and Levels - Master Design Condition
Figure A27	0.05% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A28	PMF Peak Flood Depth and Levels - Master Design Condition
Figure A29	10% AEP Peak Flood Velocity - Master Design Condition
Figure A30	5% AEP Peak Flood Velocity - Master Design Condition
Figure A31	2% AEP Peak Flood Velocity - Master Design Condition
Figure A32	1% AEP Peak Flood Velocity - Master Design Condition
Figure A33	1% AEP Climate Changes Peak Flood Velocity - Master Design Condition
Figure A34	0.05% AEP Peak Flood Velocity - Master Design Condition
Figure A35	PMF Peak Flood Velocity - Master Design Condition
Figure A36	10% AEP Peak Flood Hazard - Master Design Condition
Figure A37	5% AEP Peak Flood Hazard - Master Design Condition
Figure A38	2% AEP Peak Flood Hazard - Master Design Condition
Figure A39	1% AEP Peak Flood Hazard - Master Design Condition

Map ID	Map description
Figure A40	1% AEP Climate Changes Peak Flood Hazard - Master Design Condition
Figure A41	0.05% AEP Peak Flood Hazard - Master Design Condition
Figure A42	PMF Peak Flood Hazard - Master Design Condition
Figure A43	Changes in Peak Flood Levels for 10% AEP - Master Design Condition vs Existing Condition
Figure A44	Changes in Peak Flood Levels for 5% AEP - Master Design Condition vs Existing Condition
Figure A45	Changes in Peak Flood Levels for 2% AEP - Master Design Condition vs Existing Condition
Figure A46	Changes in Peak Flood Levels for 1% AEP - Master Design Condition vs Existing Condition
Figure A47	Changes in Peak Flood Levels for 1% AEP Climate Changes - Master Design Condition vs Existing Condition
Figure A48	Changes in Peak Flood Velocity for 10% AEP - Master Design Condition vs Existing Condition
Figure A49	Changes in Peak Flood Velocity for 5% AEP - Master Design Condition vs Existing Condition
Figure A50	Changes in Peak Flood Velocity for 2% AEP - Master Design Condition vs Existing Condition
Figure A51	Changes in Peak Flood Velocity for 1% AEP - Master Design Condition vs Existing Condition
Figure A52	Changes in Peak Flood Velocity for 1% AEP Climate Changes - Master Design Condition vs Existing Condition
Figure A53	Changes in Peak Flood Hazard for 10% AEP - Master Design Condition vs Existing Condition
Figure A54	Changes in Peak Flood Hazard for 5% AEP - Master Design Condition vs Existing Condition
Figure A55	Changes in Peak Flood Hazard for 2% AEP - Master Design Condition vs Existing Condition
Figure A56	Changes in Peak Flood Hazard for 1% AEP - Master Design Condition vs Existing Condition
Figure A57	Changes in Peak Flood Hazard for 1% AEP Climate Changes - Master Design Condition vs Existing Condition
Figure A58	1% AEP Peak Flood Depth and Levels - Master Design Blockage Condition
Figure A59	1% AEP Peak Flood Velocity - Master Design Blockage Condition
Figure A60	1% AEP Peak Flood Hazard - Master Design Blockage Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

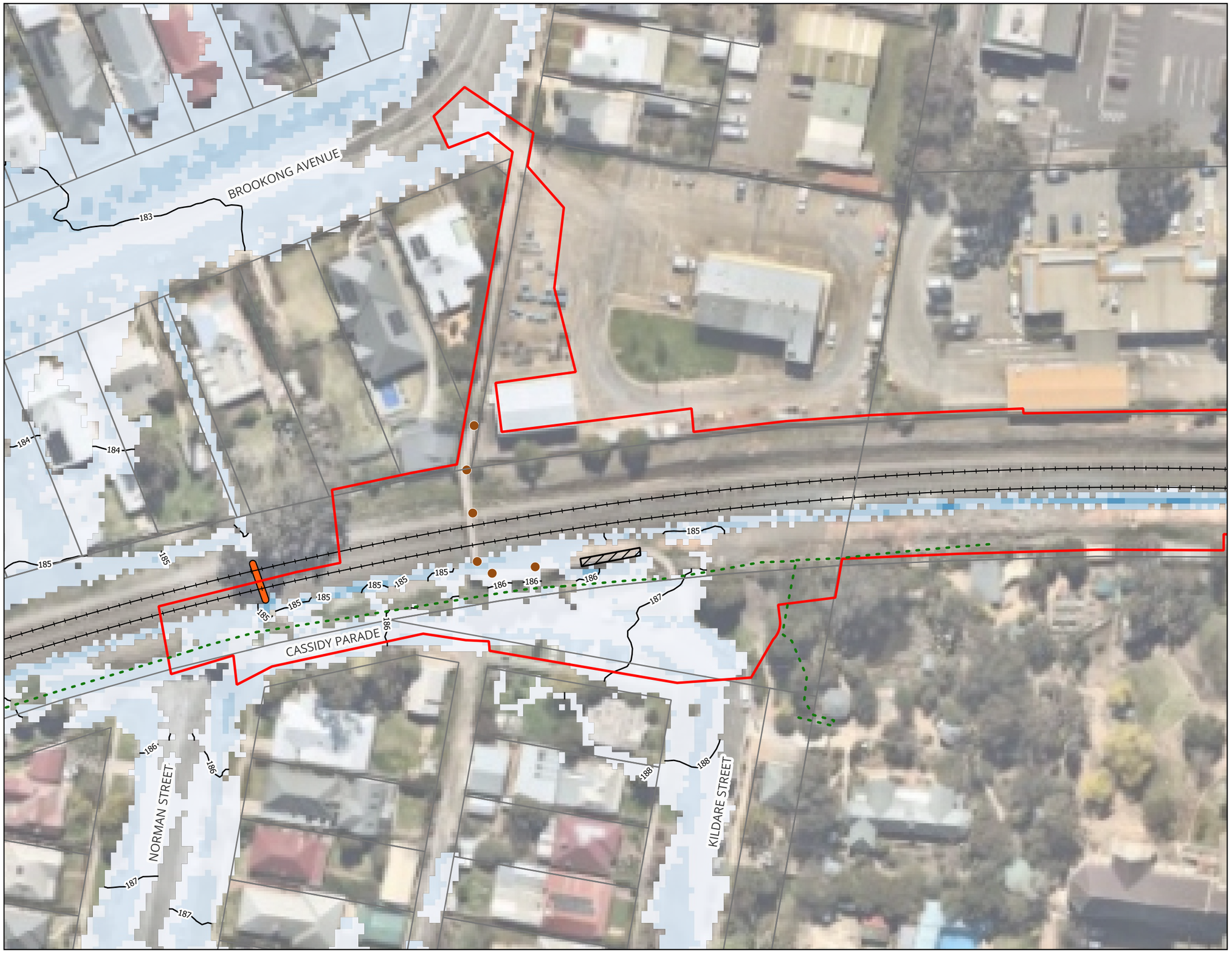
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A01 : 10% AEP Peak Flood Depth and Levels - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

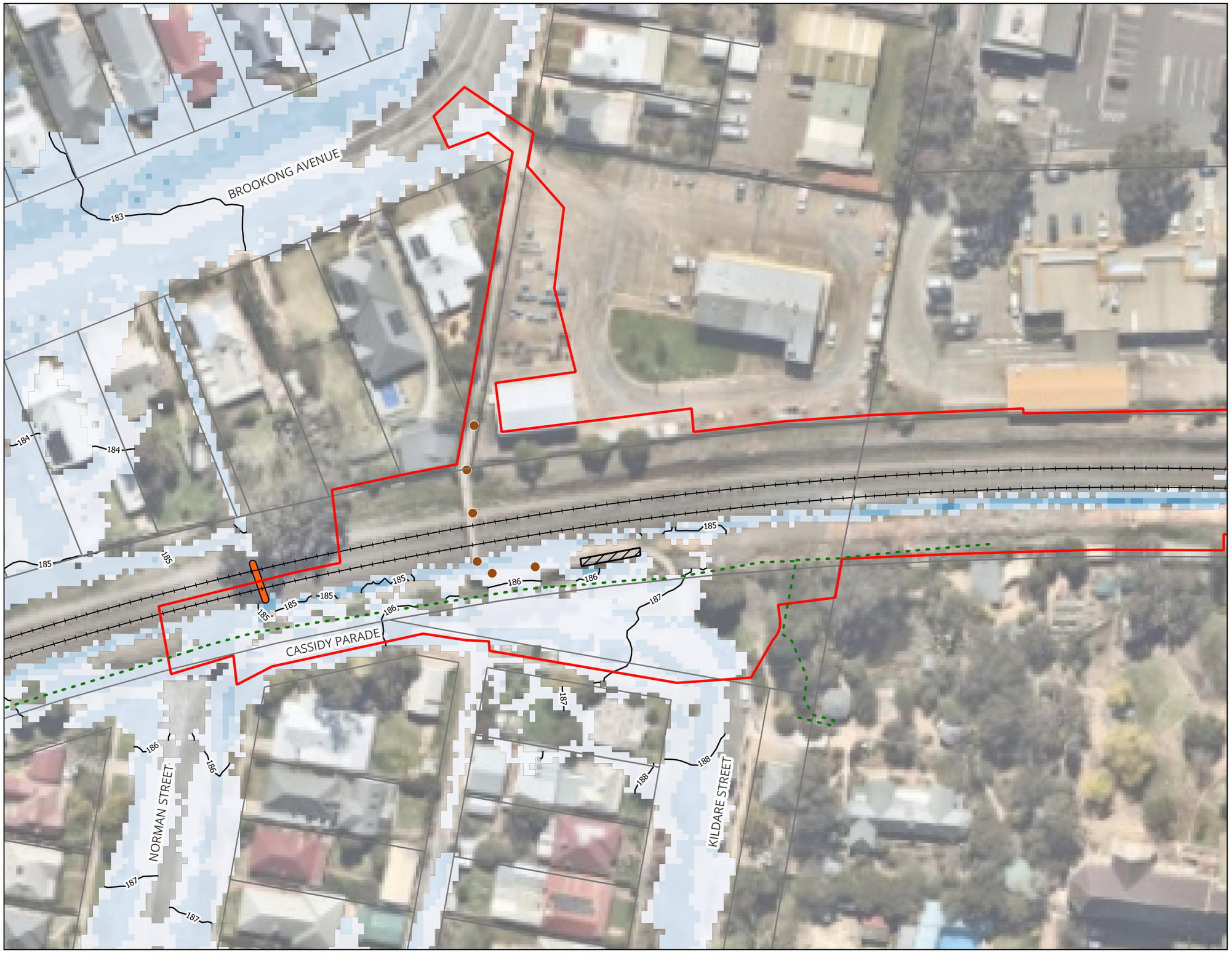
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A02 : 5% AEP Peak Flood Depth and Levels - Existing Condition



MARTINUS

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Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

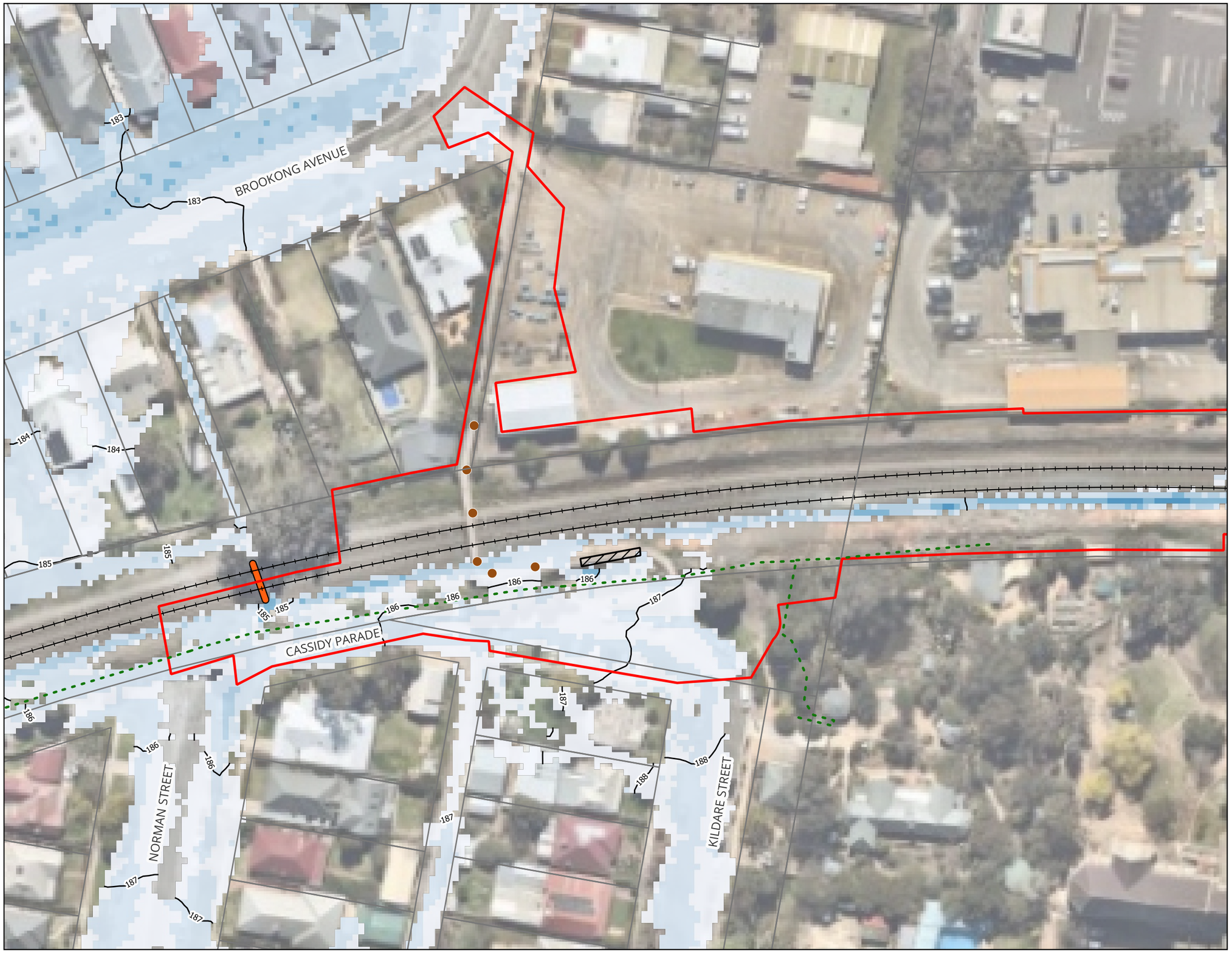
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A03 : 2% AEP Peak Flood Depth and Levels - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A04 : 1% AEP Peak Flood Depth and Levels - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

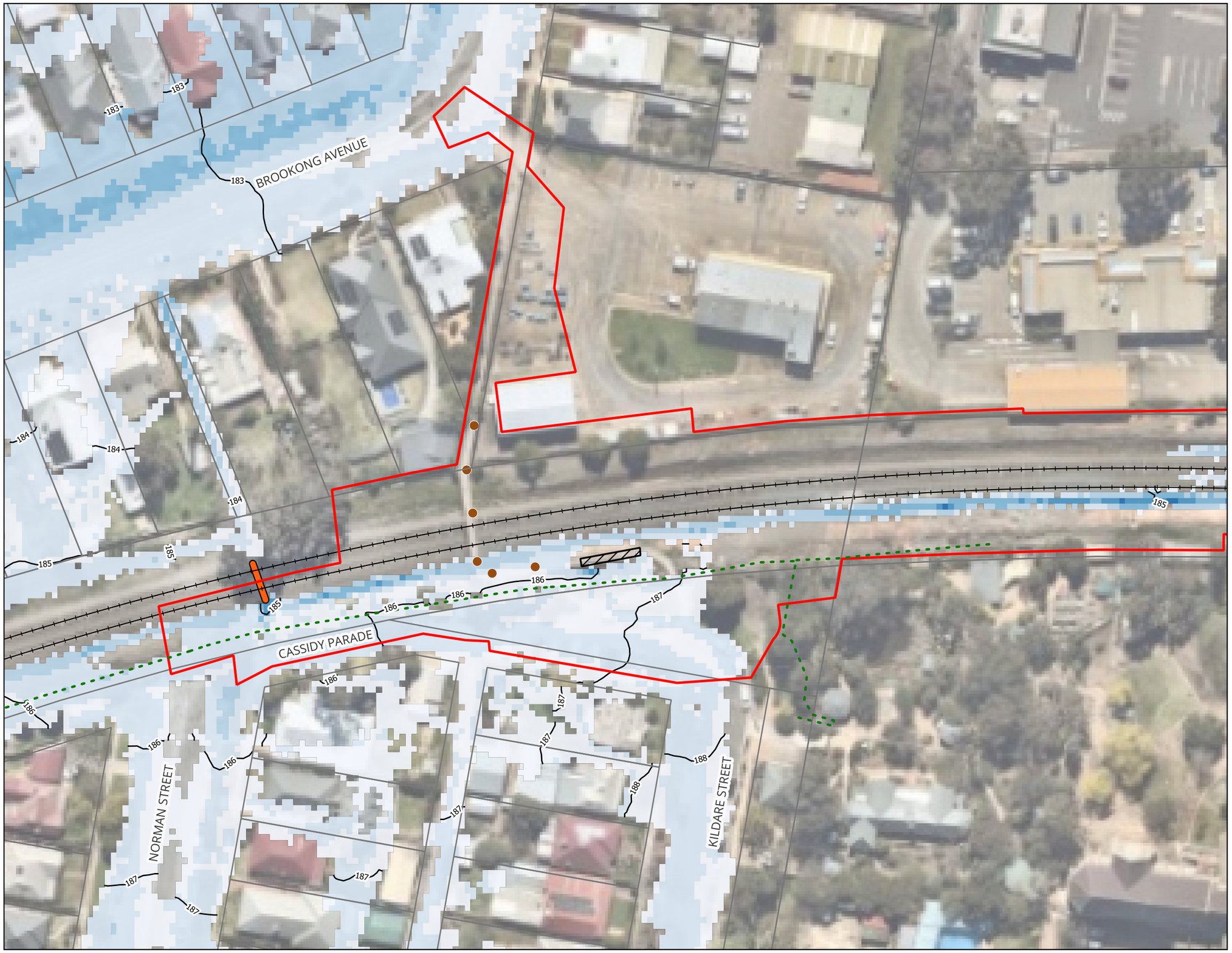
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A05 : 1% AEP Climate Changes Peak Flood Depth and Levels - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

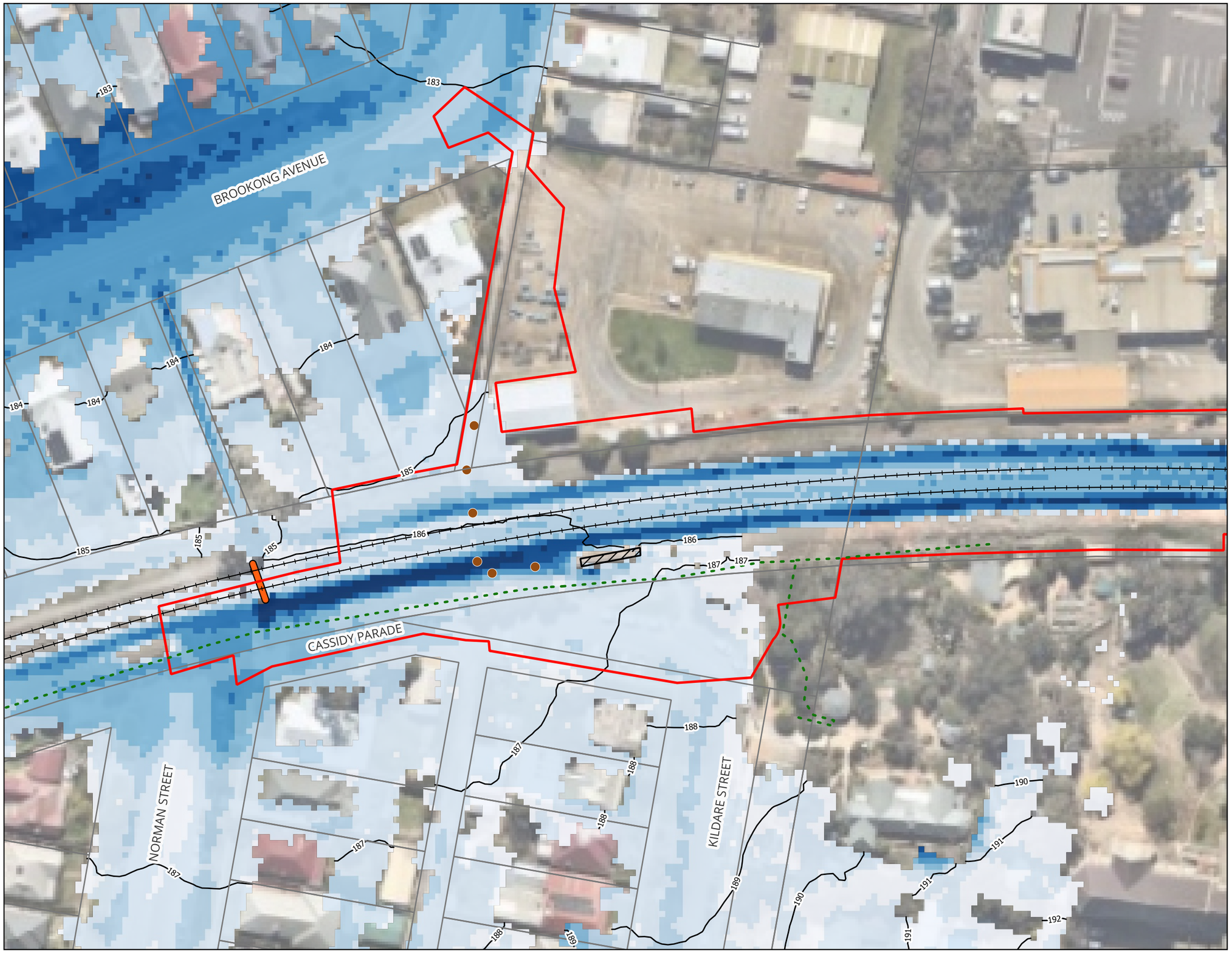
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A06 : 0.05% AEP Peak Flood Depth and Levels - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A07 : PMF Peak Flood Depth and Levels - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

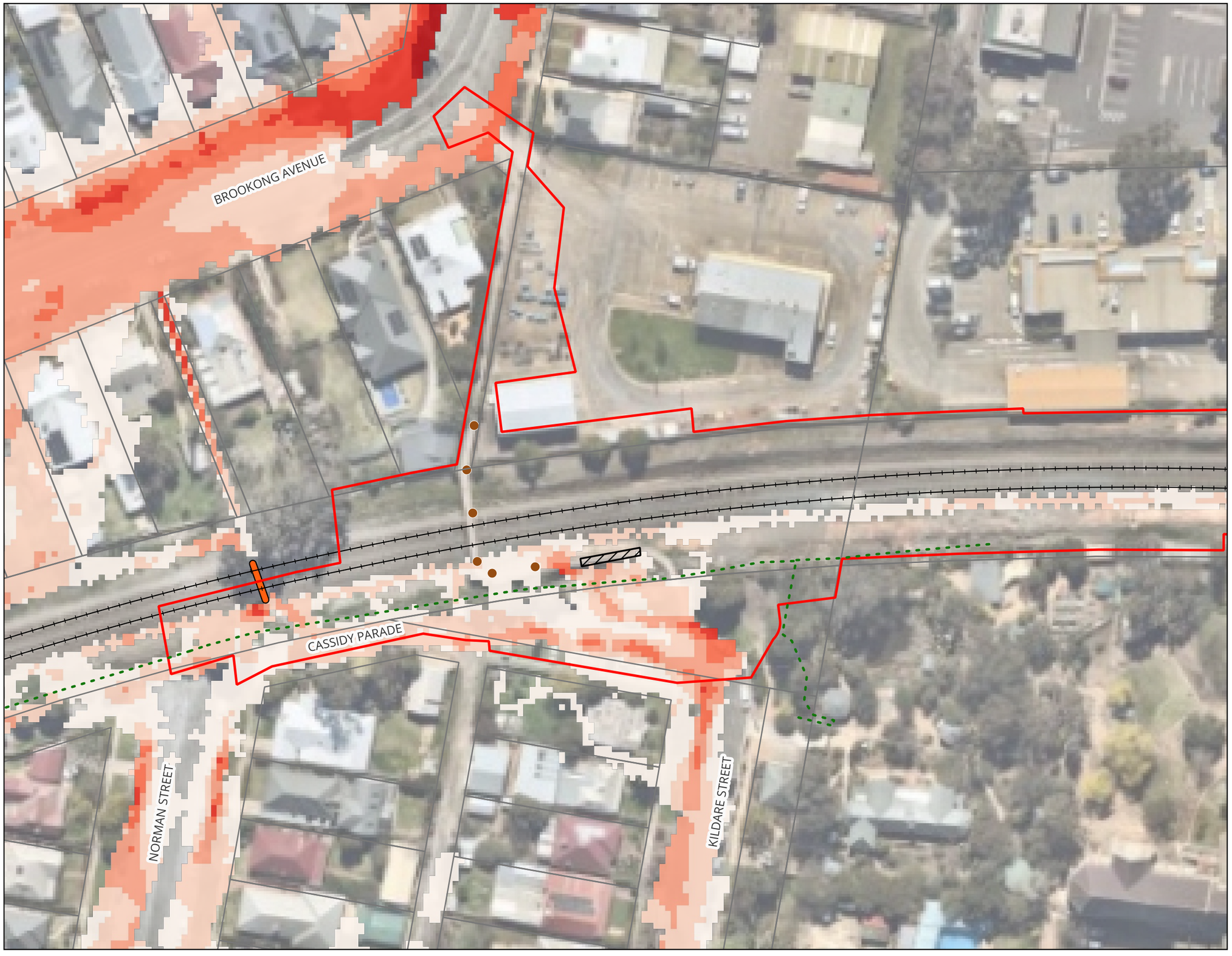
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A08 : 10% AEP Peak Flood Velocity - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A09 : 5% AEP Peak Flood Velocity - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A10 : 2% AEP Peak Flood Velocity - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A11 : 1% AEP Peak Flood Velocity - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A12 : 1% AEP Climate Changes Peak Flood Velocity - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A13 : 0.05% AEP Peak Flood Velocity - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A14 : PMF AEP Peak Flood Velocity - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A15 : 10% AEP Peak Flood Hazard - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A16 : 5% AEP Peak Flood Hazard - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A17 : 2% AEP Peak Flood Hazard - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A18 : 1% AEP Peak Flood Hazard - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A19 : 1% AEP Climate Changes Peak Flood Hazard - Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

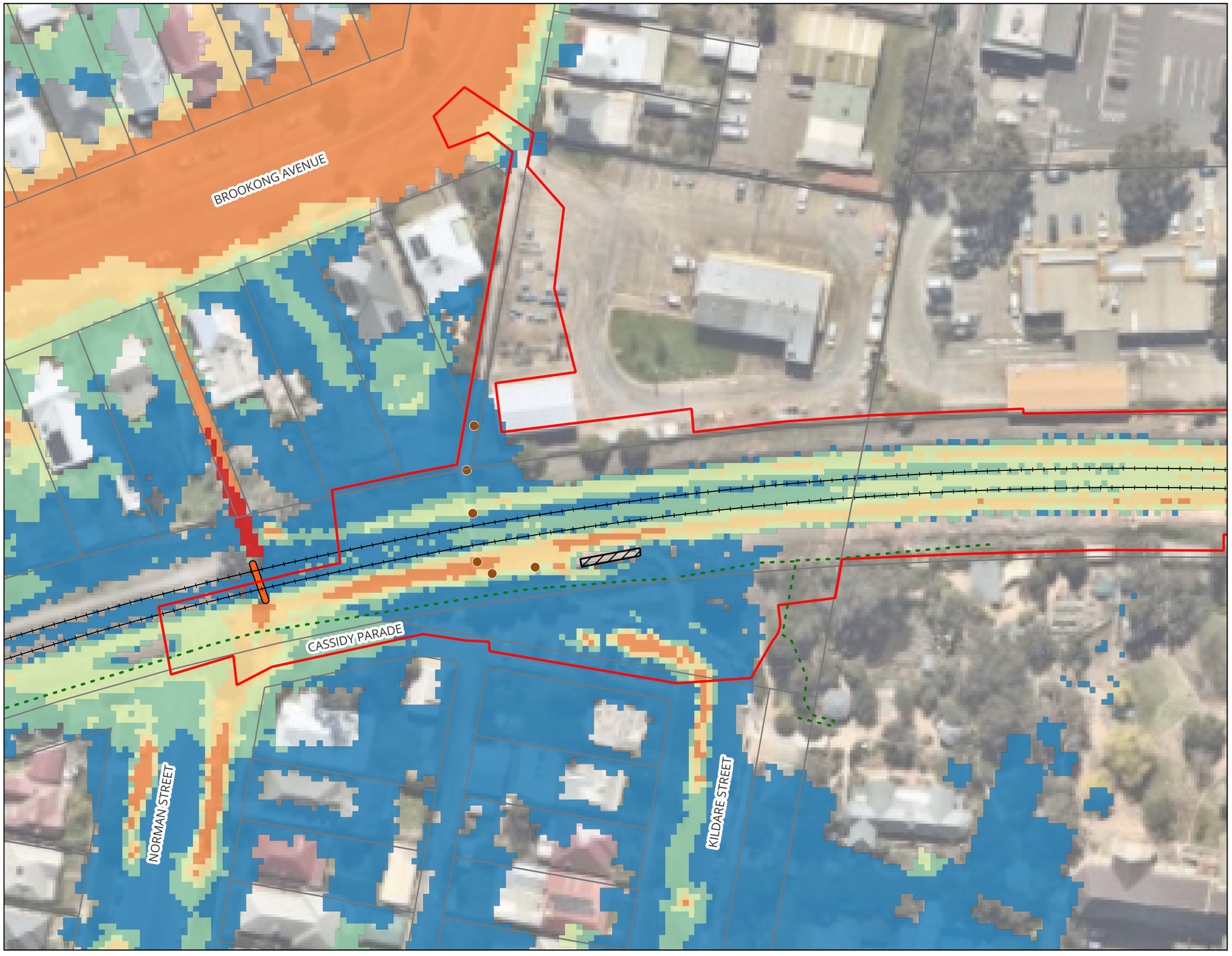
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A20 : 0.05% AEP Peak Flood Hazard - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Modelled Existing Bridge Pier
- Existing Fence
- Modelled Existing Culvert
- Modelled Existing Bridge Access Ramp
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

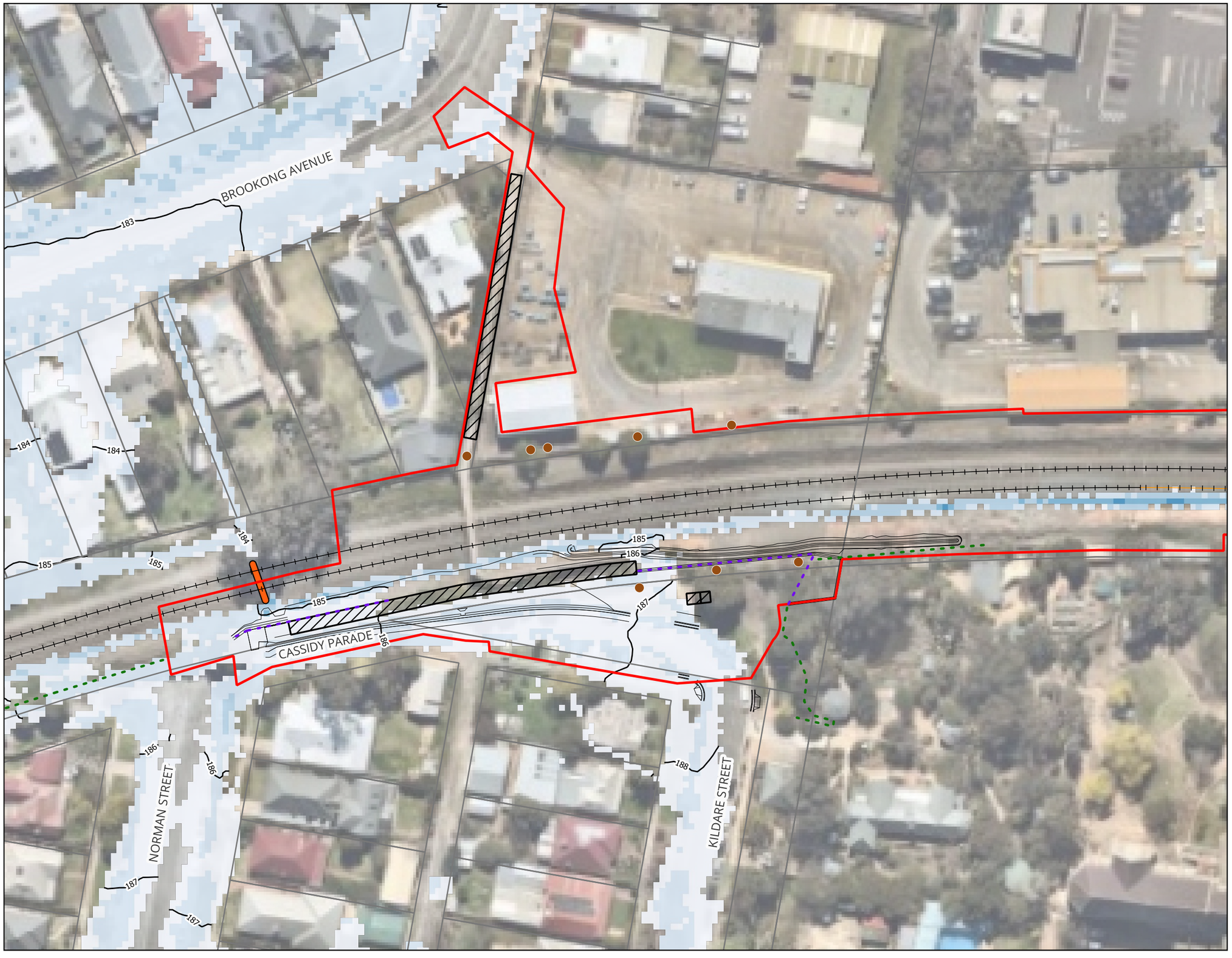
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A21 : PMF AEP Peak Flood Hazard - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

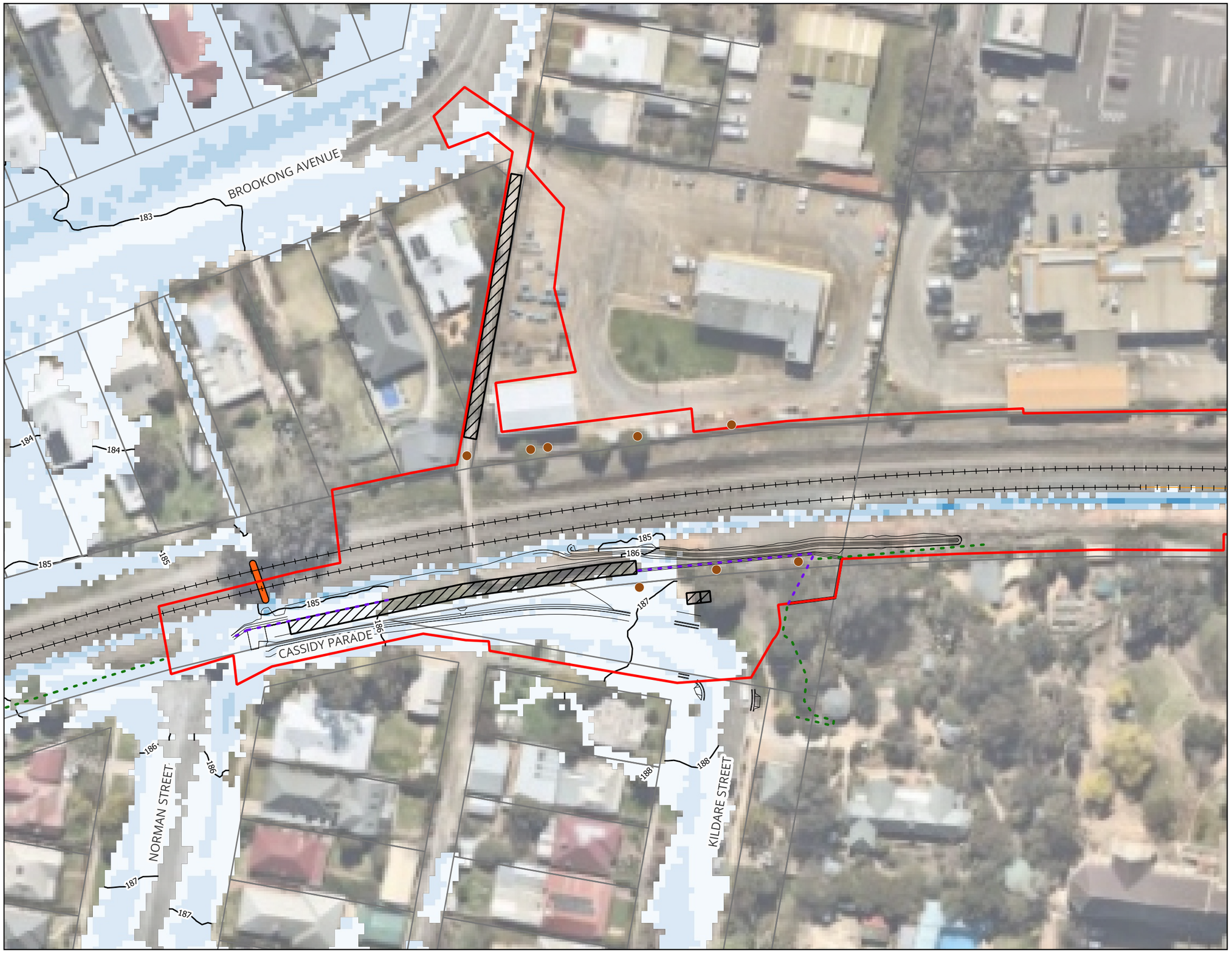
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A22 : 10% AEP Peak Flood Depth and Levels - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

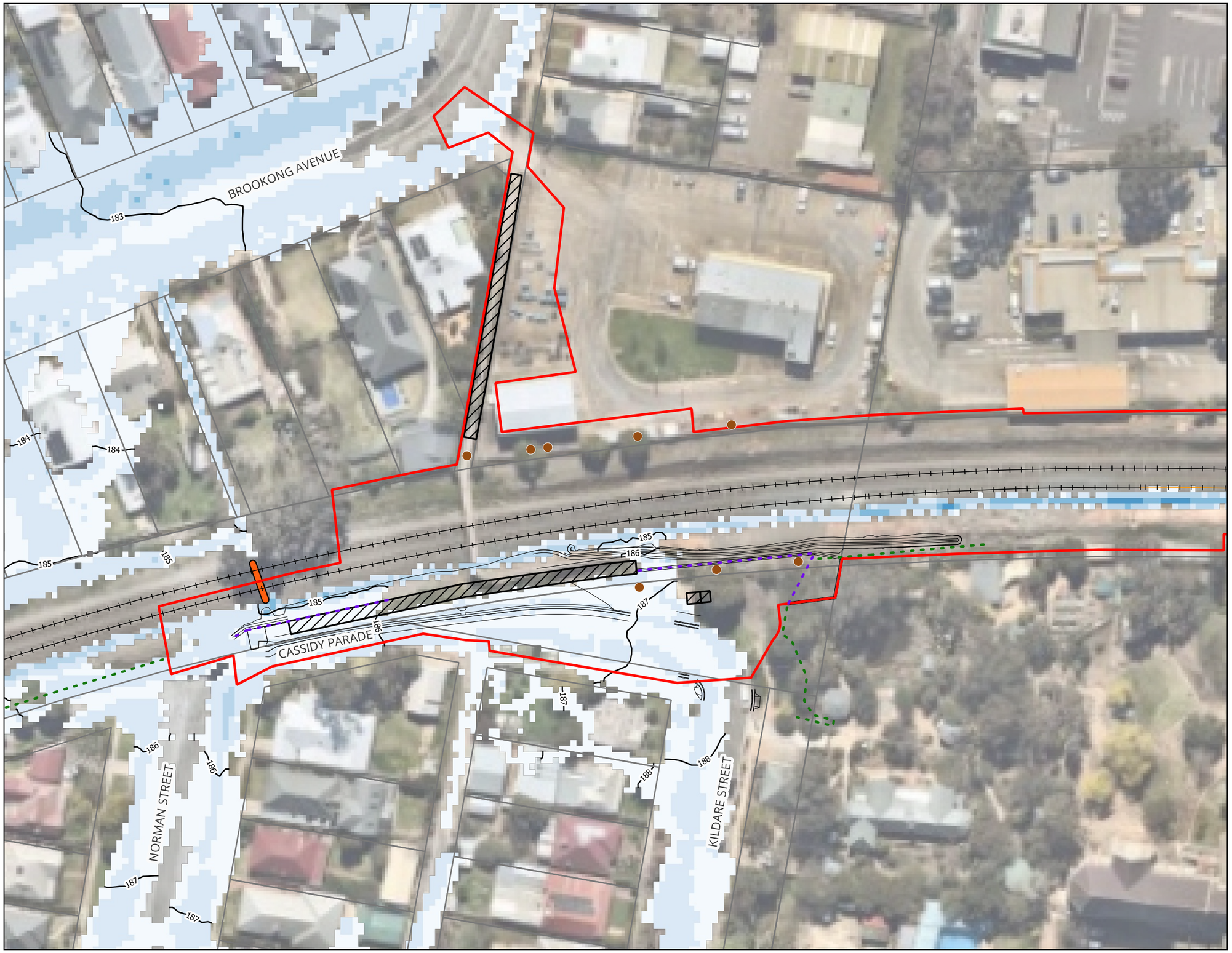
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A23 : 5% AEP Peak Flood Depth and Levels - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

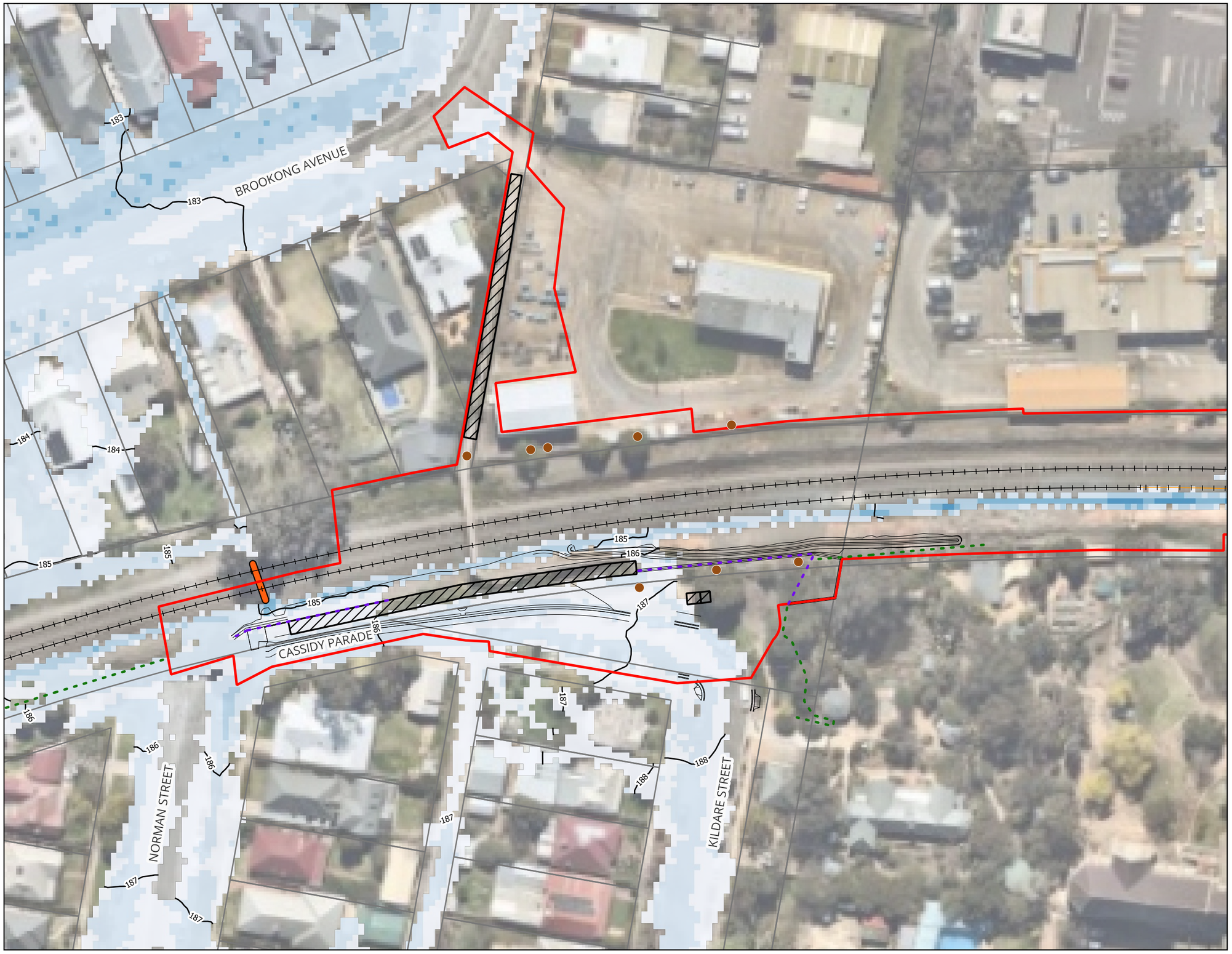
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A24 : 2% AEP Peak Flood Depth and Levels - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A25 : 1% AEP Peak Flood Depth and Levels - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

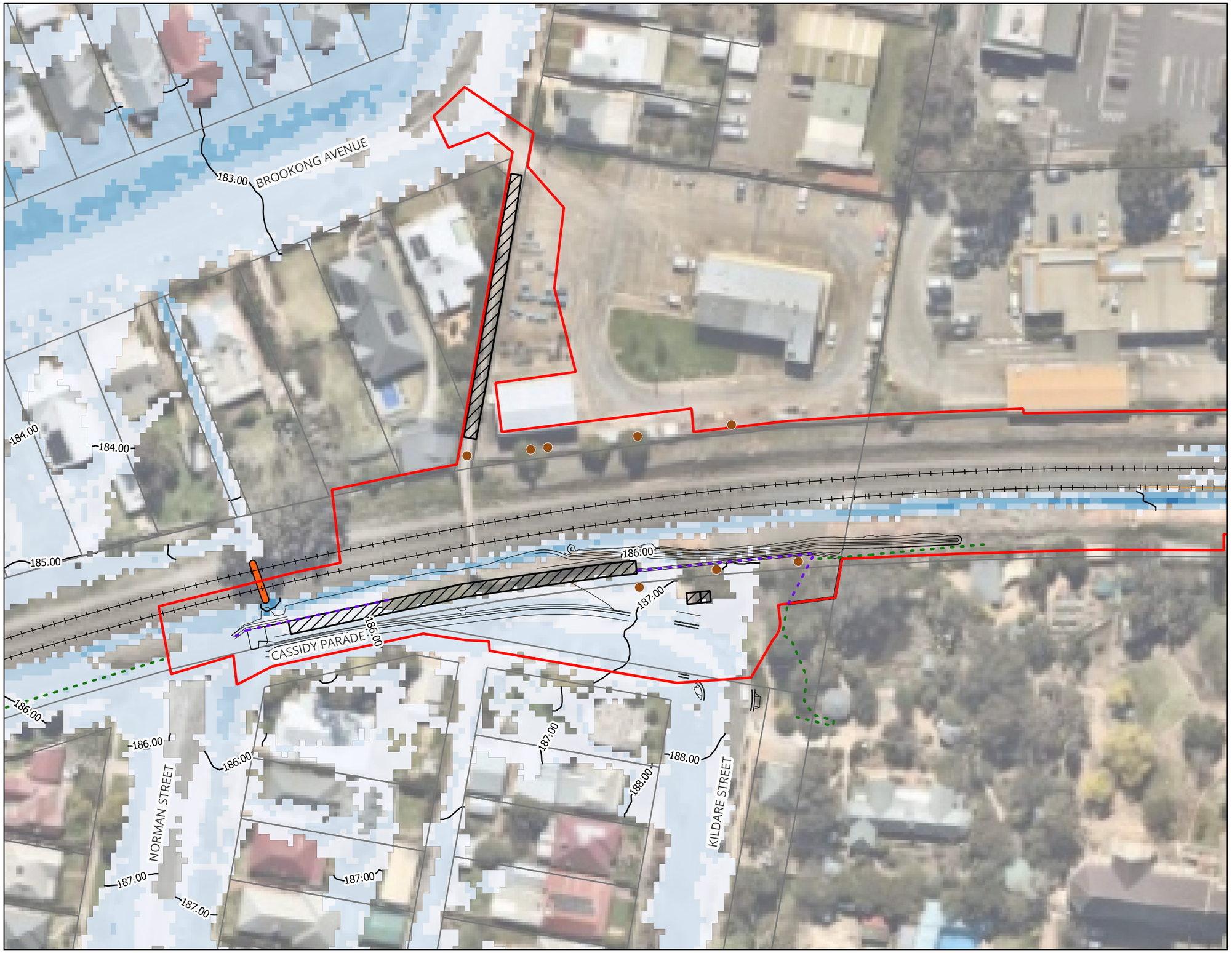
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A26 : 1% AEP Climate Changes Peak Flood Depth and Levels - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

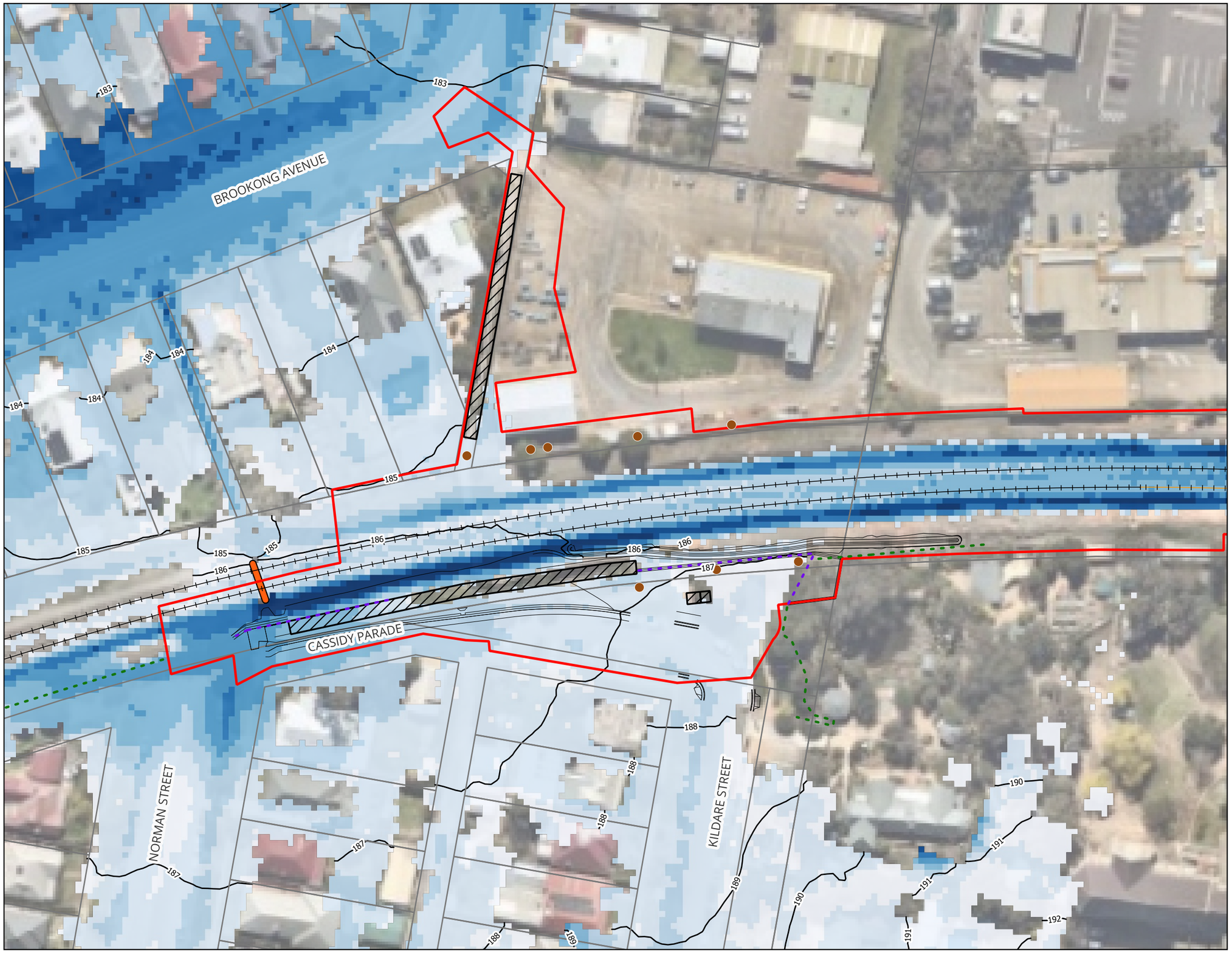
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A27 : 0.05% AEP Peak Flood Depth and Levels - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A28 : PMF Peak Flood Depth and Levels - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A29 : 10% AEP Peak Flood Velocity - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A30 : 5% AEP Peak Flood Velocity - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A31 : 2% AEP Peak Flood Velocity - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A32 : 1% AEP Peak Flood Velocity - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A33 : 1% AEP Climate Changes Peak Flood Velocity - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A34 : 0.05% AEP Peak Flood Velocity - Master Design Condition

MARTINUS
aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A35 : PMF Peak Flood Velocity - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A36 : 10% AEP Peak Flood Hazard - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A37 : 5% AEP Peak Flood Hazard - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A38 : 2% AEP Peak Flood Hazard - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A39 : 1% AEP Peak Flood Hazard - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A40 : 1% AEP Climate Changes Peak Flood Hazard - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

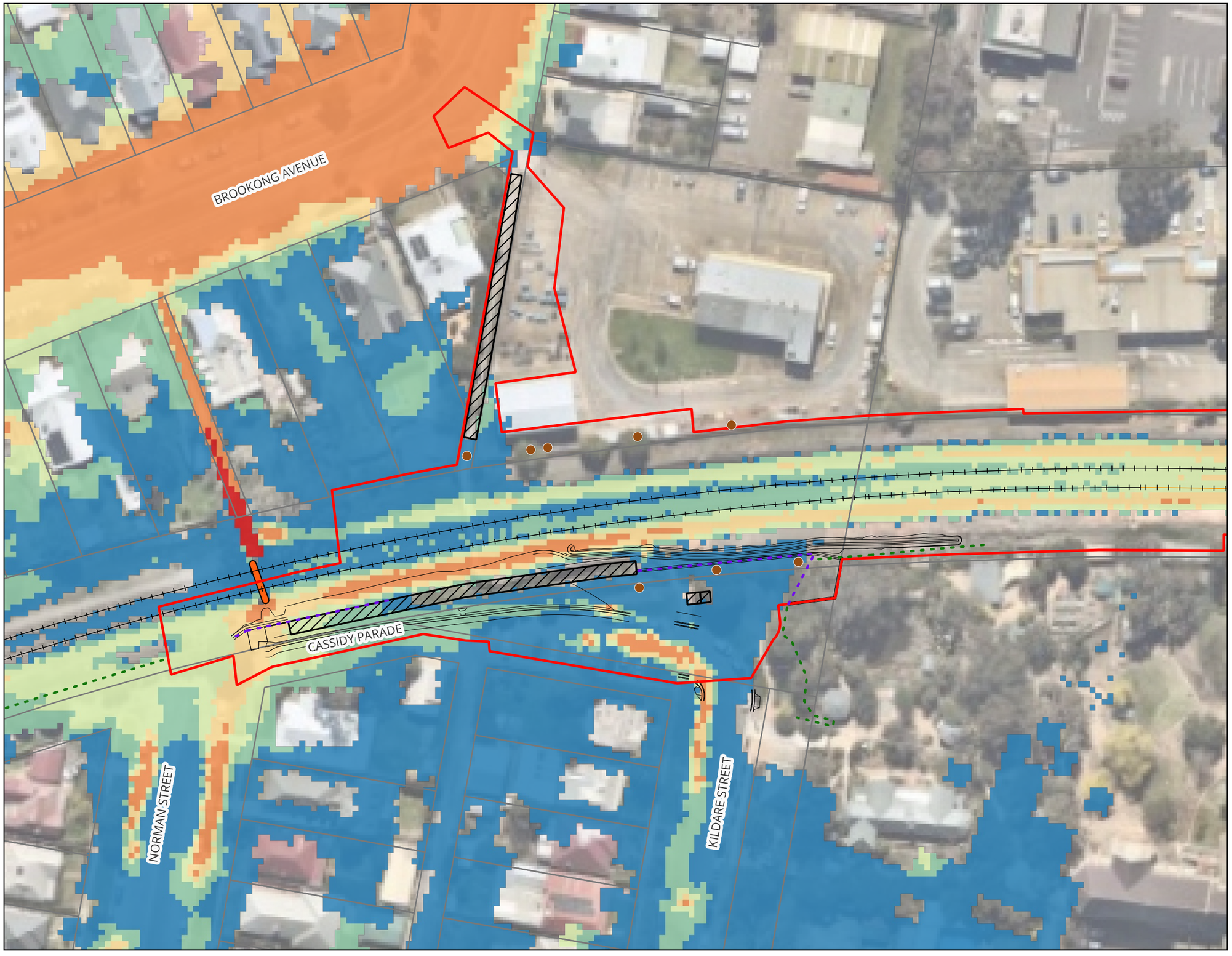
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A41 : 0.05% AEP Peak Flood Hazard - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A42 : PMF Peak Flood Hazard - Master Design Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A43 : Changes in Peak Flood Levels for 10% AEP - Master Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A44 : Changes in Peak Flood Levels for 5% AEP - Master Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A45 : Changes in Peak Flood Levels for 2% AEP - Master Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A46 : Changes in Peak Flood Levels for 1% AEP - Master Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Flood Level (m)

Band 1 (Gray)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

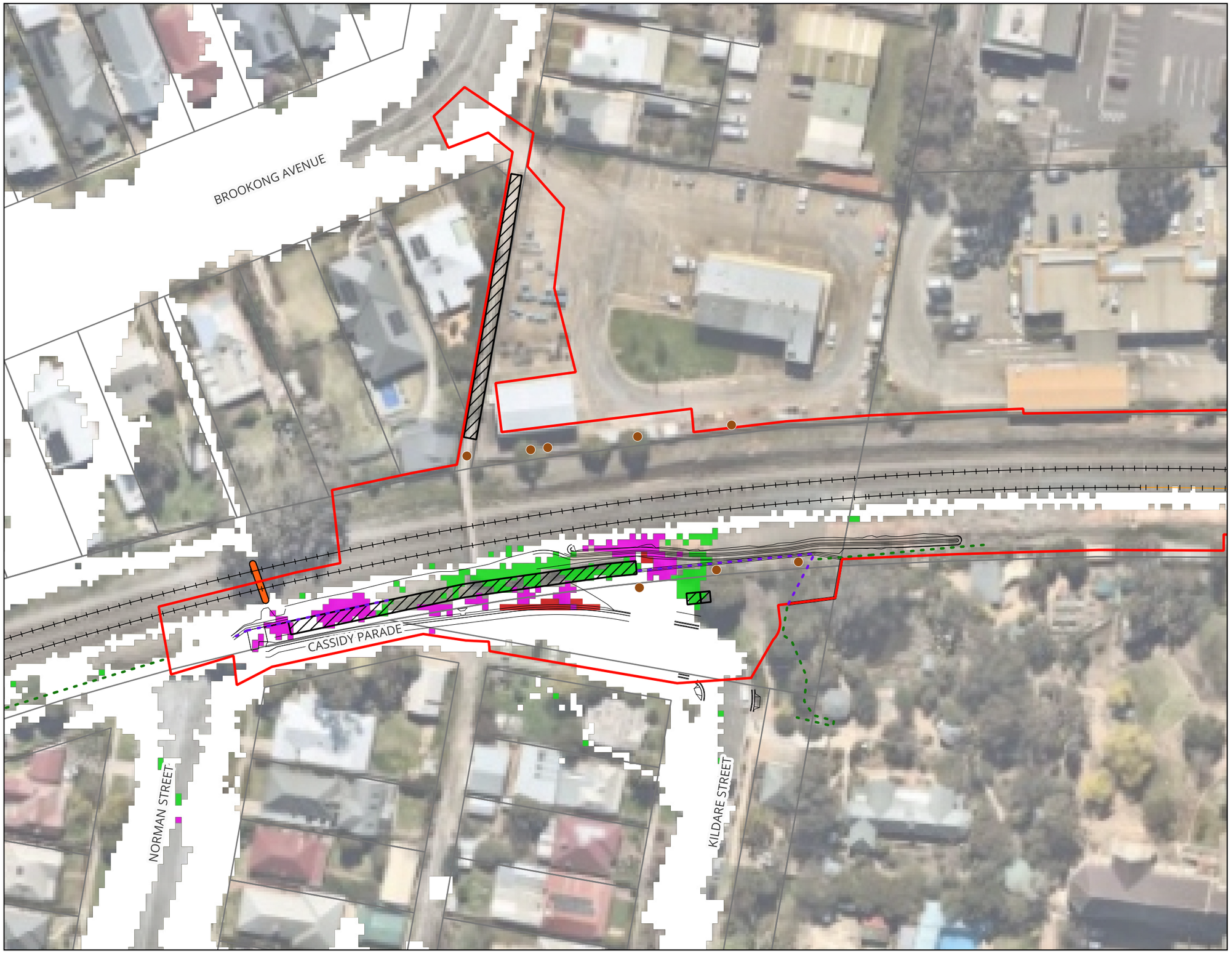
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A47 : Changes in Peak Flood Levels for 1% AEP Climate Changes - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Velocity (m/s)

- <= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

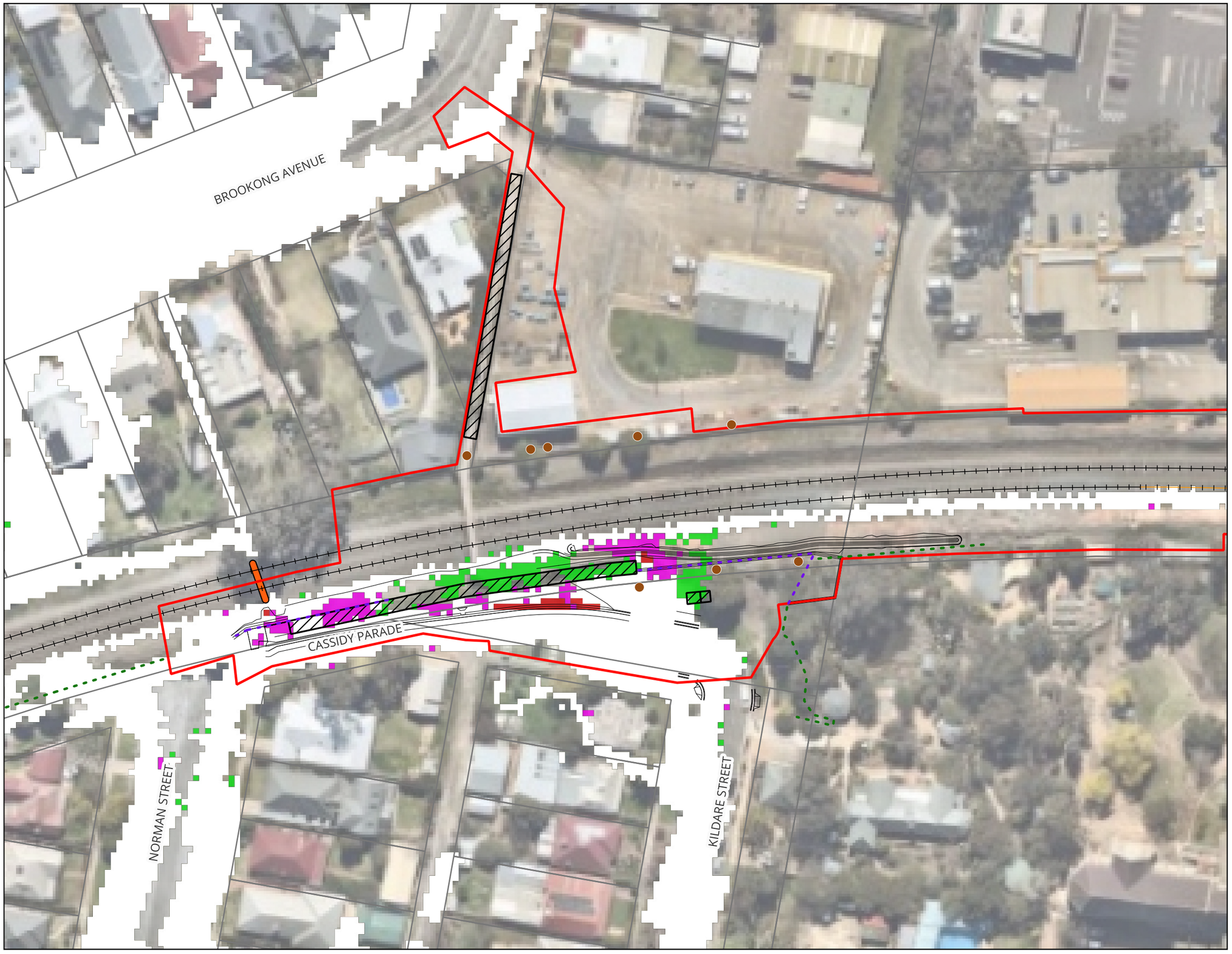
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A48 : Changes in Peak Flood Velocity for 10% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Velocity (m/s)

- <= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

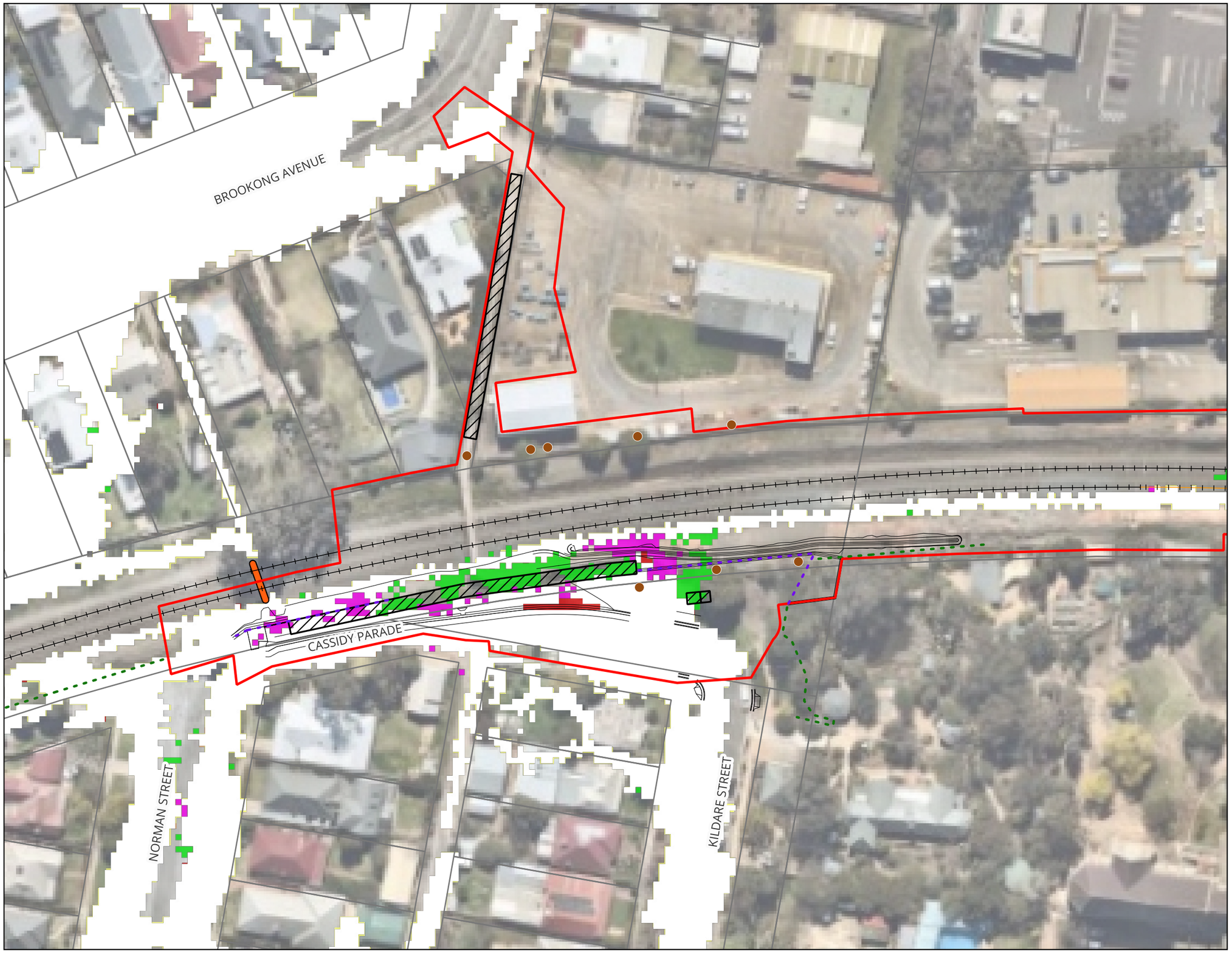
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A49 : Changes in Peak Flood Velocity for 5% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Velocity (m/s)

- <= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

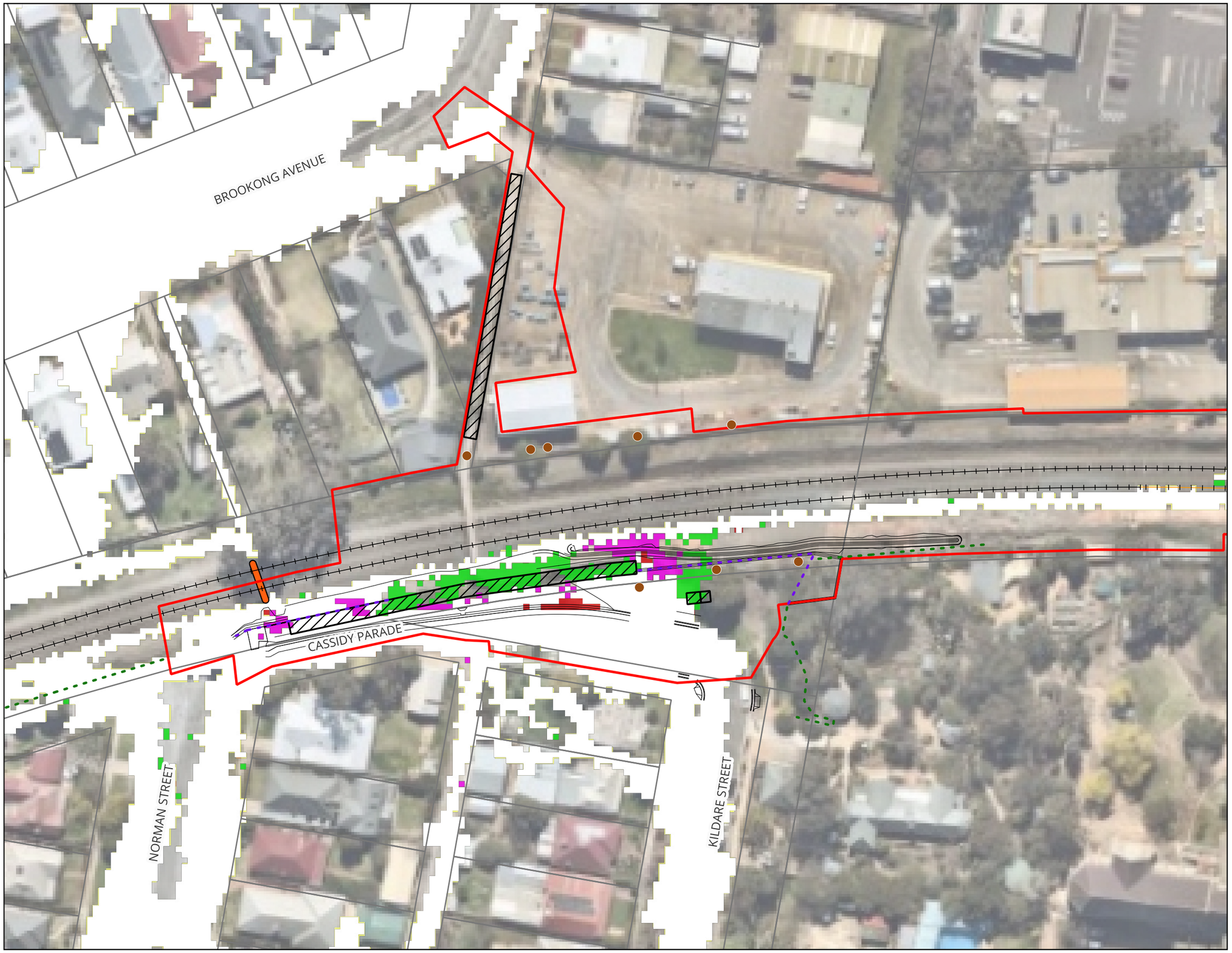
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A50 : Changes in Peak Flood Velocity for 2% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Velocity (m/s)

- <= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

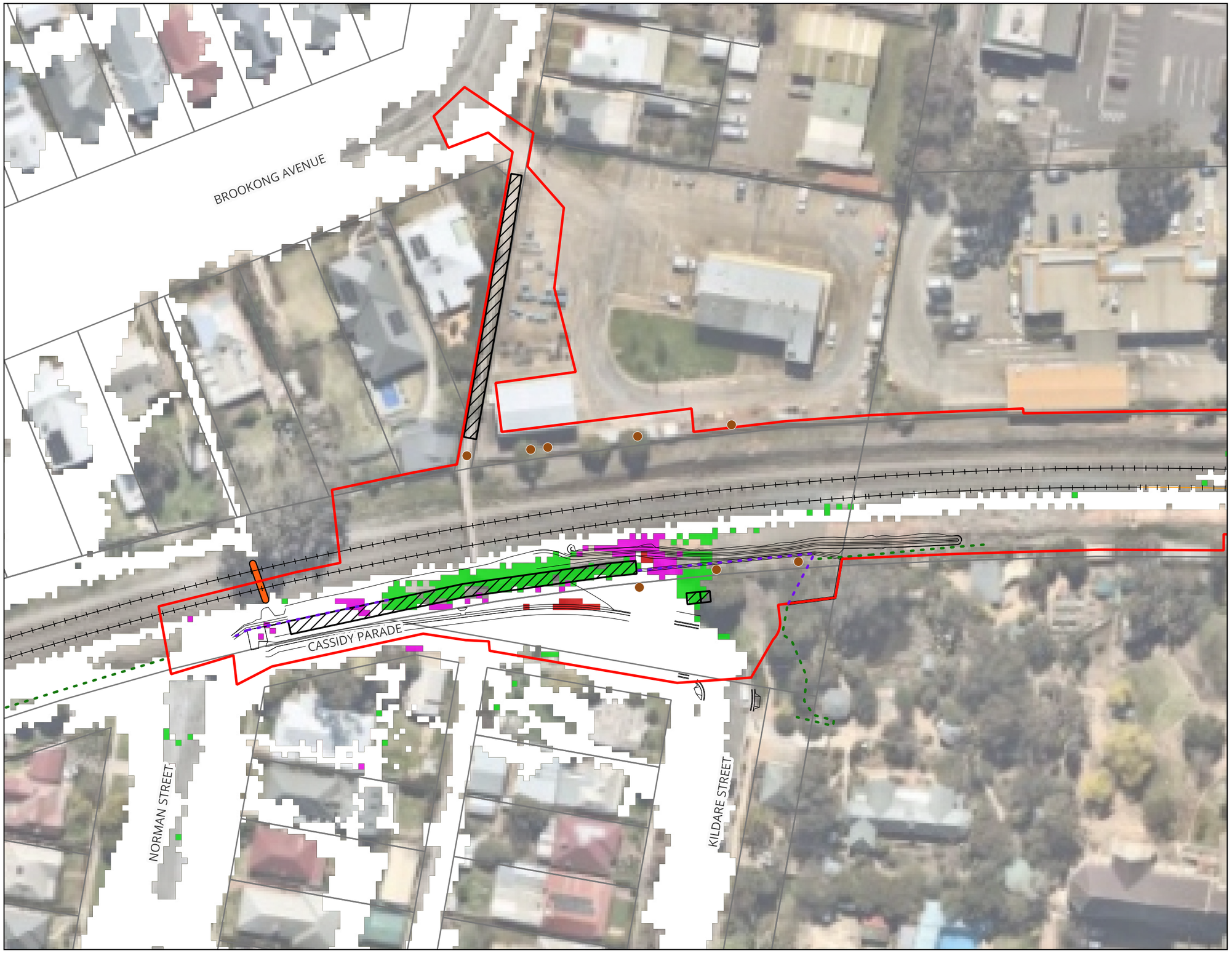
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A51 : Changes in Peak Flood Velocity for 1% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Velocity (m/s)

- <= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A52 : Changes in Peak Flood Velocity for 1% AEP Climate Changes - Master Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

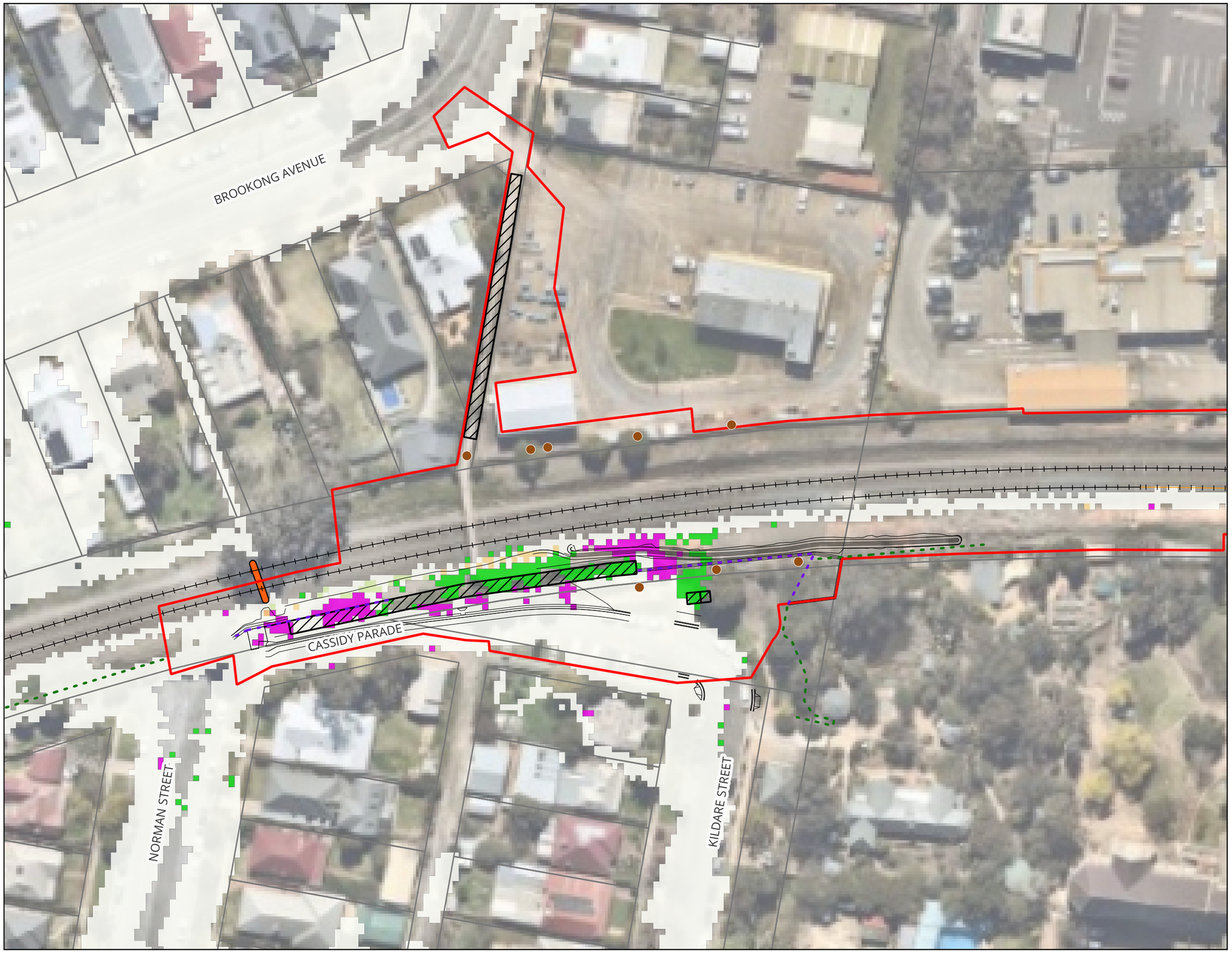
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A53 : Changes in Peak Flood Hazard for 10% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

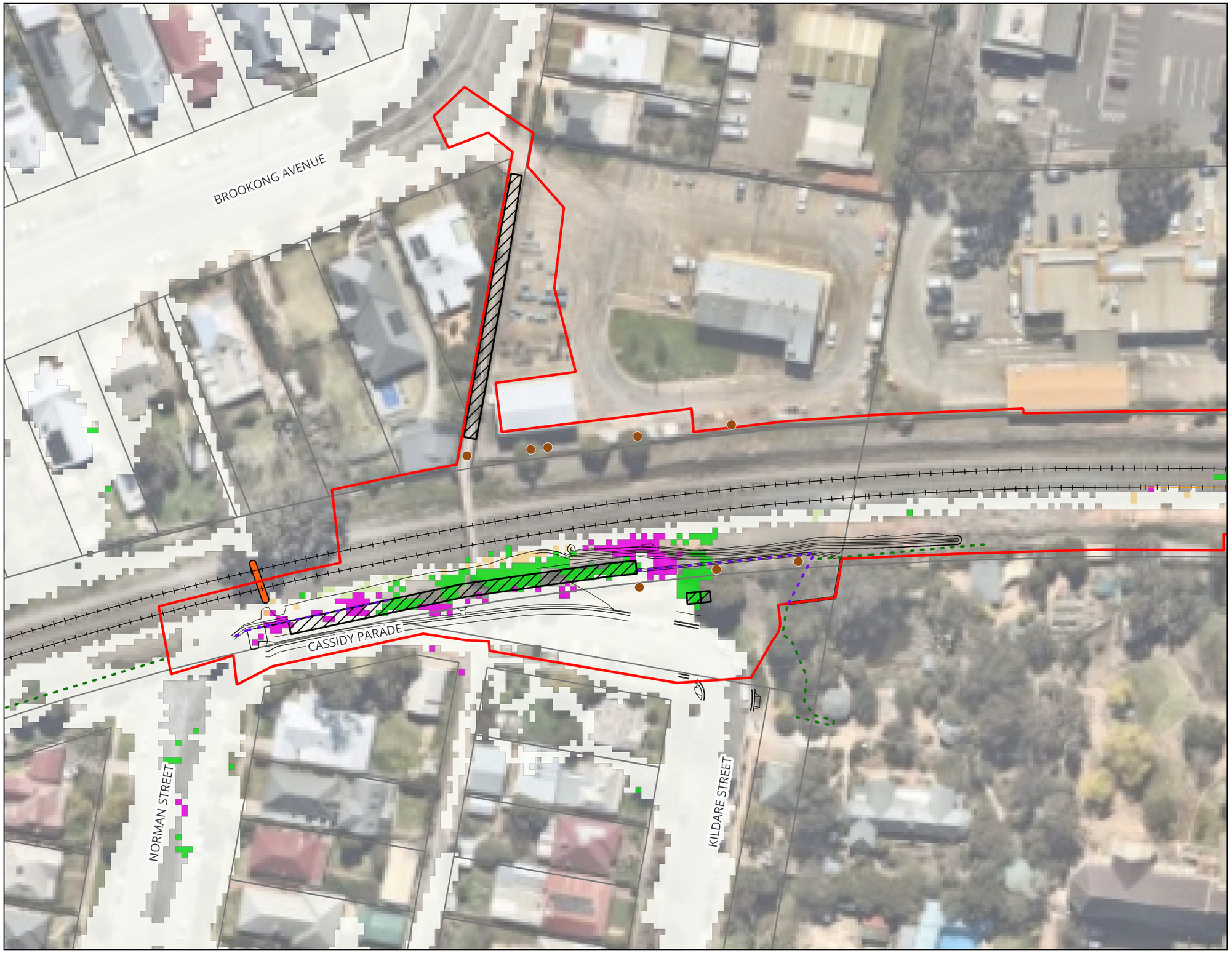
0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A54 : Changes in Peak Flood Hazard for 5% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A55 : Changes in Peak Flood Hazard for 2% AEP - Master Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A56 : Changes in Peak Flood Hazard for 1% AEP - Master Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A57 : Changes in Peak Flood Hazard for 1% AEP Climate Changes - Master Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A58 : 1% AEP Peak Flood Depth and Levels - Master Design Blockage Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A59 : 1% AEP Peak Flood Velocity - Master Design Blockage Condition

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Existing Railway Track
- Proposed Railway Track
- Road Design Extent
- Modelled Design Bridge Pier
- Modelled Design Bridge Access Ramp
- Design Fence
- Existing Fence
- Modelled Existing Culvert
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT, YL, JE

0 60 120 m

A3 Scale: 1:800

26/6/2025 GDA2020 / MGA zone 55

Cassidy Parade Footbridge - Inland Rail (A2P) - IFC Stage

Figure A60 : 1% AEP Peak Flood Hazard - Master Design Blockage Condition

APPENDIX B

ARR DATA HUB DATA

Results - ARR Data Hub

[STARTTXT]

Input Data Information

[INPUTDATA]

Latitude,-35.122268

Longitude,147.367080

[END_INPUTDATA]

River Region

[RIVREG]

Division,Murray-Darling Basin

River Number,12

River Name,Murrumbidgee River

[RIVREG_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v1

[END_RIVREG]

ARF Parameters

[LONGARF]

Zone,Southern Temperate

a,0.158

b,0.276

c,0.372

d,0.315

e,0.000141

f,0.41

g,0.15

h,0.01

i,-0.0027

[LONGARF_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v1

[END_LONGARF]

Storm Losses

[LOSSES]

ID,30818.0

Storm Initial Losses (mm),26.0

Storm Continuing Losses (mm/h),4.7

[LOSSES_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v1

[END_LOSSES]

Temporal Patterns

[TP]

code,MB

Label,Murray Basin

[TP_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v2

[END_TP]

Areal Temporal Patterns

[ATP]

code,MB

arealabel,Murray Basin

[ATP_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v2

[END_ATP]

Median Preburst Depths and Ratios

[PREBURST]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),1.8 (0.089),1.6 (0.057),1.5 (0.044),1.4 (0.034),0.9 (0.019),0.5 (0.010)

90 (1.5),2.8 (0.123),1.9 (0.059),1.3 (0.033),0.7 (0.016),0.6 (0.011),0.5 (0.009)

120 (2.0),4.4 (0.178),3.2 (0.093),2.5 (0.059),1.7 (0.035),0.8 (0.013),0.1 (0.001)

180 (3.0),3.0 (0.108),2.9 (0.075),2.8 (0.062),2.8 (0.052),1.6 (0.025),0.7 (0.010)

360 (6.0),2.2 (0.065),1.3 (0.027),0.7 (0.012),0.1 (0.001),1.2 (0.016),2.1 (0.025)

720 (12.0),0.1 (0.002),1.0 (0.018),1.5 (0.024),2.1 (0.028),4.0 (0.045),5.4 (0.055)

1080 (18.0),0.0 (0.000),0.3 (0.005),0.5 (0.006),0.6 (0.008),2.5 (0.025),3.8 (0.035)

1440 (24.0),0.0 (0.000),0.2 (0.002),0.3 (0.003),0.4 (0.004),0.6 (0.006),0.8 (0.007)

2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

[PREBURST_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST]From preburst class

10% Preburst Depths

[PREBURST10]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

90 (1.5),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

120 (2.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

180 (3.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

360 (6.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

720 (12.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

1080 (18.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

1440 (24.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

[PREBURST10_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST10]From preburst class

25% Preburst Depths

[PREBURST25]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),0.1 (0.005),0.1 (0.002),0.0 (0.001),0.0 (0.000),0.0 (0.000),0.0 (0.000)

90 (1.5),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

120 (2.0),0.1 (0.004),0.1 (0.001),0.0 (0.001),0.0 (0.000),0.0 (0.000),0.0 (0.000)

180 (3.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

360 (6.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

720 (12.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

1080 (18.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

1440 (24.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

[PREBURST25_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST25]From preburst class

75% Preburst Depths

[PREBURST75]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),15.3 (0.750),13.8 (0.480),12.7 (0.369),11.7 (0.291),11.8 (0.246),11.9 (0.220)

90 (1.5),15.3 (0.666),13.0 (0.404),11.5 (0.297),10.0 (0.222),10.5 (0.196),10.9 (0.180)

120 (2.0),16.6 (0.664),16.4 (0.471),16.3 (0.391),16.2 (0.334),12.4 (0.215),9.6 (0.147)

180 (3.0),11.8 (0.423),15.8 (0.410),18.5 (0.401),21.0 (0.393),20.3 (0.320),19.8 (0.278)

360 (6.0),12.7 (0.380),12.2 (0.265),11.8 (0.216),11.4 (0.181),17.4 (0.233),21.9 (0.261)

720 (12.0),5.5 (0.136),9.1 (0.167),11.5 (0.178),13.8 (0.185),18.3 (0.207),21.6 (0.219)

1080 (18.0),2.9 (0.064),6.1 (0.102),8.3 (0.117),10.4 (0.126),13.2 (0.136),15.4 (0.141)

1440 (24.0),0.2 (0.004),3.5 (0.054),5.7 (0.074),7.8 (0.088),9.1 (0.088),10.1 (0.087)

2160 (36.0),0.0 (0.000),0.9 (0.012),1.4 (0.017),2.0 (0.020),3.1 (0.027),4.0 (0.031)

2880 (48.0),0.0 (0.000),0.4 (0.006),0.7 (0.008),1.0 (0.010),1.1 (0.009),1.2 (0.009)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.1 (0.001),0.1 (0.001),0.0 (0.000),0.0 (0.000)

[PREBURST75_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST75]From preburst class

90% Preburst Depths

[PREBURST90]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),36.2 (1.772),29.9 (1.042),25.7 (0.746),21.7 (0.539),29.0 (0.603),34.4 (0.636)

90 (1.5),38.3 (1.665),34.2 (1.061),31.4 (0.814),28.8 (0.640),30.3 (0.566),31.5 (0.522)

120 (2.0),39.0 (1.565),36.1 (1.038),34.1 (0.821),32.3 (0.667),32.3 (0.561),32.3 (0.499)

180 (3.0),26.5 (0.953),31.5 (0.816),34.7 (0.755),37.9 (0.709),41.0 (0.647),43.4 (0.609)

360 (6.0),26.9 (0.804),28.0 (0.611),28.8 (0.528),29.5 (0.467),41.5 (0.555),50.5 (0.601)

720 (12.0),16.1 (0.400),24.9 (0.457),30.8 (0.477),36.4 (0.488),39.8 (0.451),42.3 (0.428)

1080 (18.0),16.2 (0.362),19.2 (0.318),21.1 (0.297),23.0 (0.280),30.3 (0.312),35.7 (0.328)

1440 (24.0),6.7 (0.138),13.4 (0.207),17.9 (0.234),22.2 (0.252),23.2 (0.223),23.9 (0.206)

2160 (36.0),1.1 (0.021),9.3 (0.131),14.8 (0.176),20.0 (0.208),17.3 (0.152),15.2 (0.119)

2880 (48.0),0.4 (0.007),6.8 (0.089),11.0 (0.123),15.1 (0.147),17.3 (0.143),18.9 (0.140)

4320 (72.0),0.0 (0.000),3.1 (0.037),5.1 (0.052),7.0 (0.063),13.9 (0.106),19.0 (0.130)

[PREBURST90_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST90]From preburst class

Interim Climate Change Factors

[CCF]

,RCP 4.5,RCP6,RCP 8.5

2030,0.816 (4.1%),0.726 (3.6%),0.934 (4.7%)

2040,1.046 (5.2%),1.015 (5.1%),1.305 (6.6%)

2050,1.260 (6.3%),1.277 (6.4%),1.737 (8.8%)

2060,1.450 (7.3%),1.520 (7.7%),2.214 (11.4%)

2070,1.609 (8.2%),1.753 (8.9%),2.722 (14.2%)

2080,1.728 (8.8%),1.985 (10.2%),3.246 (17.2%)

2090,1.798 (9.2%),2.226 (11.5%),3.772 (20.2%)

[CCF_META]

Time Accessed,18 June 2024 01:04PM

Version,2019_v1

Note,ARR recommends the use of RCP4.5 and RCP 8.5 values. These have been updated to the values that can be found on the climate change in Australia website.

[END_CCF]

Probability Neutral Burst Initial Loss

[BURSTIL]

min (h)\AEP(%),50.0,20.0,10.0,5.0,2.0,1.0

60 (1.0),17.6,10.7,10.6,11.3,10.9,9.0

90 (1.5),17.1,11.2,10.9,11.8,11.9,9.3

120 (2.0),16.3,10.8,10.5,11.4,11.1,9.4

180 (3.0),17.7,12.1,10.9,11.3,9.7,7.3

360 (6.0),18.1,13.6,13.3,14.1,12.4,8.1

720 (12.0),21.1,15.8,14.6,14.6,12.5,8.5

1080 (18.0),22.0,17.3,16.6,17.1,14.3,9.0

1440 (24.0),24.3,19.2,18.7,19.1,17.1,11.5

2160 (36.0),25.6,21.0,20.4,21.2,19.3,15.9

2880 (48.0),26.2,21.5,21.4,22.4,20.6,15.4

4320 (72.0),26.6,22.1,23.3,24.0,21.9,15.7

[BURSTIL_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. Probability neutral burst initial loss values for NSW are to be used in place of the standard initial loss and pre-burst as per the losses hierarchy.

[END_BURSTIL]

Transformational Pre-burst Rainfall

[PREBURST_TRANS]

min (h)\AEP(%),50.0,20.0,10.0,5.0,2.0,1.0

60 (1.0),8.4,15.3,15.4,14.7,15.1,17.0

90 (1.5),8.9,14.8,15.1,14.2,14.1,16.7

120 (2.0),9.7,15.2,15.5,14.6,14.9,16.6

180 (3.0),8.3,13.9,15.1,14.7,16.3,18.7

360 (6.0),7.9,12.4,12.7,11.9,13.6,17.9

720 (12.0),4.9,10.2,11.4,11.4,13.5,17.5

1080 (18.0),4.0,8.7,9.4,8.9,11.7,17.0

1440 (24.0),1.7,6.8,7.3,6.9,8.9,14.5

2160 (36.0),0.4,5.0,5.6,4.8,6.7,10.1

2880 (48.0),0.0,4.5,4.6,3.6,5.4,10.6

4320 (72.0),0.0,3.9,2.7,2.0,4.1,10.3

[PREBURST_TRANS_META]

The tranformational pre-burst is intended for software suppliers in the NSW area and is simply the Initial Loss - Burst Initial Loss. It is not appropriate to use these values if considering a calibrated initial loss.

[END_PREBURST_TRANS]

[ENDTXT]

APPENDIX C

ARTC REVIEW

Document Control Information			
	Contractor DC to update for re-submission	**Submitted Document No. or Transmittal No.:**	Martinus-PTRAN-001157
Project:	2100 - A2I	**Date Submission Received:**	4/04/2025
Comment Sheet Number_Revision:	5-0052-210-IHY-W4-CS-0001_E	**Comment Sheet Title:**	***External Comment Sheet - A2I | Flood Design Report - Cassidy Parade Footbridge***
Revision Date:	10/04/2025	**Documents related in Aconex** (by IR DC)	*Yes* — *All of the comments from 1 to 14 transferred from 5-0052-210-PEN-W4-CS-0001_H.*

Review Comments (Reviewer)									Responses (Document Owner)					Close-Out			
#	PSR ID No. **or** Compliance Reference Document *(State the fully qualified reference the deliverable is non-compliant with)*	Document / drawing number - Revision Number	Section # / page #	Engineering Assurance Stage	Comment *(for example must be specific on non compliance. Reference mark-ups, if required)*	Comment Type	Full Name	Date	Full Name	Company	Date	Response *(must be specific on how the comment has been addressed. Agreed approach for re-submission)*	Documentation Section # / Figure #	Full Name	Date	Comment Status	Close-Out Comment
Example	*IR-SR-A2I-517* **or** *01-3500-PD-P00-DE-0008-A*	*0-0000-900-PEN-00-TE-0020_A*		*CRR*	*Is there sufficient space for a 10m maintenance vehicle to turn around at the end of the RMAR?*	*Non-Compliant*	*Joe Bloggs*	*15/02/2023*	*Fred Bloggs*	*Designer*	*15/03/2023*	*The area has been increased - now possible to turn 12.5m vehicle. The drawings are updated.*	*01-3500-PD-P00-DE-0008-A 01-3500-PD-P00-DE-0015-C*	*Jane Doe*	*27/09/2023*	CLOSED	
1	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 1, General comments	Draft	can you include a section to cover and address the planning mitigation measures and future conditions of approval. At the minute there's HFWQ3 to HFWQ6 in the EIS specific to flooding. Even if the mitigation is not relevant to the package, I would include a note saying why that's the case.	Minor	Chris Fay	16/11/2023	Yucen Lu	DJV Flood modeller	13/05/2024	HFWQ6 is related to water quality in the construction phase, which is out of DJV flooding scope. A section will be added to the PDR flood assessment report to address HFWQ3. (Section 2.3)	PDR submission design deliverables	Stephen Brierley	9/07/2024	CLOSED	
2	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 5, Glossary Table 0-1 Definitions Pg 4	Draft	Please update this table to include all acronyms used in this report. It is noted that RCP8.5 is used but not defined. There may be others as well.	Minor	Andrew Aitken	15/11/2023	Yucen Lu	DJV Flood modeller	13/05/2024	It will be included in the report in the PDR stage.	PDR submission design deliverables	Andrew Aitken	9/01/2025	CLOSED	Comment not addressed RCP not in Glossary. It is also noted that within the PDR report RCP is used for Representative Concentration Pathway as well as Reinforced Concrete Pipe. 16/12/2024 - comment not addressed in PDR No. 2 report. 9/01/2025 - CLOSED - Glossary uodated
3	1.1.2 Works on ARTC tracks other than those identified for double-stacked freight trains (refer Annexure A, Tables 1 & 2) do not need to comply with ARTC F2 and H outline clearance requirements.	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 8, Section 1.3.1, 5-0052-210-IHY-W4-RP-0001_A	Draft	Please add 'vertical' before both words 'clearance' in this sentence and confirm vertical clearance requirements over the platform loop	Minor	Stephen Brierley	13/12/2023	Michal Plesko	Design Coordination	13/05/2024	Noted, sentence updated.	PDR submission design deliverables	Stephen Brierley	12/06/2023	CLOSED	Notes updated
4	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 9, Section 1.3.2.3, 5-0052-210-IHY-W4-RP-0001_A	Draft	Any inundation map due to local flooding will help understanding the flooding pattern. Any overland flow path map will also be helpful.	Major	Ayub Ali	4/12/2023	Yucen Lu	DJV Flood modeller	13/05/2024	It will be included in the report in the PDR stage.	PDR submission design deliverables	Ayub Ali	10/07/2024	CLOSED	
5	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 11, Section 1.8, 5-0052-210-IHY-W4-RP-0001_A	Draft	What assumptions were made and what was its basis?	Minor	Ayub Ali	4/12/2023	Yucen Lu	DJV Flood modeller	13/05/2024	The pipe invert levels were assumed by checking the terrain and the upstream available pipe. Then, the engineering judgement was used to work out the unknown invert levels.	PDR submission design deliverables	Ayub Ali	10/07/2024	CLOSED	
6	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 11, Section 1.8, 5-0052-210-IHY-W4-RP-0001_A	Draft	What additional drainage information were needed? How important are they? what are the risks of this information being unavailable? What assumptions you will be making in absence of this information?	Major	Ayub Ali	4/12/2023	Yucen Lu	DJV Flood modeller	13/05/2024	The drainage system, including pits and pipes, is needed. Without it, the modelled flood behaviour may not reflect the actual situation. The assumption of excluding the drainage system in the SDR model was made due to lack of data. The available drainage design will be included in the PDR stage.	PDR submission design deliverables	Ayub Ali	10/07/2024	CLOSED	
7	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 11, Section 1.8, 5-0052-210-IHY-W4-RP-0001_A	Draft	What assumptions were made and what was its basis?	Minor	Ayub Ali	4/12/2023	Yucen Lu	DJV Flood modeller	13/05/2024	The Ramp levels utilised in the model are provided as per Section 4.1.2 of the report. The Ramp heights were calculated based on the provided bridge design PDF from the drawing scale provided in the document "5-0052-210-SBD-W4-DR-COMBINED (005).pdf". The calculated height was then added to the existing surface level to determine the Ramp level.	PDR submission design deliverables	Ayub Ali	10/07/2024	CLOSED	
8	Annexure A Scope	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 11, Section 1.8, 5-0052-210-IHY-W4-RP-0001_A	Draft	I'm not aware ARTC approval is required for the stairs access at Cassidy, please proceed with your design for the Cassidy Footbridge.	Minor	Stephen Brierley	13/12/2023	Michal Plesko	Design Coordination	13/05/2024	Noted. Cassidy FB design to proceed accordingly.	No action.	Stephen Brierley	12/06/2023	CLOSED	
9	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 11, Section 1.8, 5-0052-210-IHY-W4-RP-0001_A	Draft	Limitations and assumptions. Penultimate paragraph states Martinus are waiting for the original hydrology model before they can update - has a RFI be raised, if so, what is the RFI number?	Minor	Stephen Brierley	13/12/2023	Yucen Lu	DJV Flood modeller	13/05/2024	DJV RFI -020 has been raised. The information will be used and updated in the PDR stage.	PDR submission design deliverables	Stephen Brierley	12/06/2023	CLOSED	
10	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 20, Section 4.1.1.1, 5-0052-210-IHY-W4-RP-0001_A	Draft	What is the reason for the latest version 2023-03-AC producing significantly different result? Generally, the latest version would produce more accurate result. Hence, it is expected that the latest version is used for simulation unless there is a valid reason.	Major	Ayub Ali	4/12/2023	Yucen Lu	DJV Flood modeller	13/05/2024	A sensitivity test between 2023-03-AC results and 2018-03-AC results will be provided in the PDR stage report. The updates (including any available topographic survey and structure survey) made to the TUFLOW model are constrained within the project boundary. However, when using the 2023-03-AC to run the model, some significant differences (between 2023-03-AC and the original 2018-03-AC) were identified far away from the project boundary, which purely resulted from TUFLOW software version changes. Fine-tuning the parameter across the whole TUFLOW model extent irrelevant to this project is not deemed necessary. Given that the 2020-10-AF version could produce closer results as per 2018-03-AC, it is appropriate to use 2020-10-AF.	PDR submission design deliverables	Ayub Ali	10/07/2024	CLOSED	
11	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 22, 4.1.1.5 Drainage Network	Draft	could these assumptions be elaborated on a bit please.	Minor	Hartley Bulcock	21/11/2023	Yucen Lu	DJV Flood modeller	13/05/2024	In the SDR stage, the pipe invert levels were assumed by checking the terrain and the upstream available pipe. Then, the engineering judgement is made to work out the unknown invert levels. Without survey data, this method is considered suitable at this stage, and it will be updated in the next stage when the survey data is available.	PDR submission design deliverables	Stephen Brierley	8/08/2024	CLOSED	
12	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 23, Section 4.1.3.2 Climate Change Pg 22	Draft	Please expand on the description of how climate change was included in the model in the PDR report. This should align with the requirements in the Climate Change credits of the IS rating. Please consult the DJV Sustainability resource for details.	Minor	Andrew Aitken	15/11/2023	Yucen Lu	DJV Flood modeller	13/05/2024	In the PDR stage, the 1%AEP climate change sensitivity flood assessment will be carried out by adopting the 2090 RCP 8.5 climate change factor to increase the rainfall of 1% AEP (20.2% increase). The flood impact results will be provided and the flood map of the 1% AEP with climate change will be produced.	PDR submission design deliverables	Andrew Aitken	10/07/2024	CLOSED	
13	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 25, 6 Flood Assessment	Draft	Introduction refers to Figure 6-1 with south/west drainage directions, please add a North sign to understand the explanations.	Minor	Stephen Brierley	13/12/2023	Yucen Lu	DJV Flood modeller	13/05/2024	North Arrow will be added to Figure 6-1 in the PDR flood assessment report.	PDR submission design deliverables	Stephen Brierley	12/06/2023	CLOSED	
14	Annexure F, Appendix F1, Design Development Deliverables - clarification	5-0052-210-IHY-W4-RP-0001_A.pdf	Page 28, Section 6.2, 5-0052-210-IHY-W4-RP-0001_A	Draft	Is this impacted area limited within the IR corridor or extended beyond it? In case the impact extended beyond the IR corridor, does it comply with the QDL. Please include details.	Major	Ayub Ali	4/12/2023	Yucen Lu	DJV Flood modeller	13/05/2024	The flood impact complies with QDL and there is no non-compliance.	PDR submission design deliverables	Ayub Ali	10/07/2024	CLOSED	

Comment Sheet Number_Revision:	5-0052-210-IHY-W4-CS-0001_E	**Comment Sheet Title:**	***External Comment Sheet - A2I | Flood Design Report - Cassidy Parade Footbridge***
Revision Date:	10/04/2025	**Documents related in Aconex** (by IR DC)	*Yes* — *All of the comments from 1 to 14 transferred from 5-0052-210-PEN-W4-CS-0001_H.*

Review Comments (Reviewer)									**Responses (Document Owner)**					**Close-Out**			
#	PSR ID No. **or** Compliance Reference Document *(State the fully qualified reference the deliverable is non-compliant with)*	Document / drawing number - Revision Number	Section # / page #	Engineering Assurance Stage	Comment *(for example must be specific on non compliance. Reference mark-ups, if required)*	Comment Type	Full Name	Date	Full Name	Company	Date	Response *(must be specific on how the comment has been addressed. Agreed approach for re-submission)*	Documentation Section # / Figure #	Full Name	Date	Comment Status	Close-Out Comment
15	Opportunity	5-0052-210-IHY-W4-RP-0001_C.pdf	Page 19, 5-0052-210-IHY-W4-RP-0001_C, Section 4.1	PDR	Appears to be typo. Please check and correct it.	Opportunity	Ayub Ali	13/01/2025	Thinesh Thirumurugan	DJV	10/03/2025	Typo will be corrected in DDR stage 4/4/25 ZC: Spelling and grammar check has been run. Spelling amended to WBNM.	DDR submission design deliverables 5-0052-210-IHY-W4-RP-0001_D, Section 4.1	Ayub Ali	7/04/2025	CLOSED	
16	Opportunity	5-0052-210-IHY-W4-RP-0001_C.pdf	Page 19, 5-0052-210-IHY-W4-RP-0001_C, Section 4.1	PDR	Space missing between Table 1-2, and only. Correction is recommended.	Opportunity	Ayub Ali	13/01/2025	Thinesh Thirumurugan	DJV	10/03/2025	The space will be corrected in DDR stage 4/4/25 ZC: comma and psace provided after 'Table1-2'	DDR submission design deliverables 5-0052-210-IHY-W4-RP-0001_D, Section 4.1	Ayub Ali	7/04/2025	CLOSED	
17	Opportunity	5-0052-210-IHY-W4-RP-0001_C.pdf	Page 33, 5-0052-210-IHY-W4-RP-0001_C, Section 6.4	PDR	Referred Section number does not exist. Therefore, correction is recommended.	Opportunity	Ayub Ali	13/01/2025	Thinesh Thirumurugan	DJV	10/03/2025	Section number will be corrected in DDR stage 4/4/25: Updated to read Section 4	DDR submission design deliverables 5-0052-210-IHY-W4-RP-0001_D, Section 6.4	Ayub Ali	7/04/2025	CLOSED	
18	CoA E42	5-0052-210-IHY-W4-RP-0001_C.pdf	Page 34, 5-0052-210-IHY-W4-RP-0001_C, Section 6.4.2	PDR	It's stated here that changes of velocity is less than 0.5 m/s, hence complies with the CoA. CoA E42 requires the changes of velocity to be less than 10% or to 0.5 m/s whichever is greater. To my understanding, 0.5 m/s is the acceptable post development velocity instead of the changes of velocity. Therefore, rewriting is required demonstrating compliance of CoA E42.	Non-Compliant	Ayub Ali	22/01/2025	Thinesh Thirumurugan	DJV	10/03/2025	As stated in CoA E42 (h), "maximum relative increase in velocity of 10%, or to 0.5m/s, whichever is greater". DJV believes "0.5m/s" refers to the relative increase in velocity instead of absolute value of velocity in the post development scenario. 4/4/25 ZC: The CoA is to be read "*maximum relative increase ... to 0.5m/s* " meaning it's a relative, or incremental change, of (or up to) 0.5m/s. This is our environmental team reading of the condtion also.		Ayub Ali	7/04/2025	CLOSED	
19	Opportunity	5-0052-210-IHY-W4-RP-0001_C.pdf	Page 34, 5-0052-210-IHY-W4-RP-0001_C, Section 6.4.4	PDR	Flow rate vs time hydrograph should not be used for estimating time of inundation. Flood level vs time hydrograph is appropriate and sufficient. Hence, it is recommended to remove all flow rate vs time hydrograph figures from this section and to utilise flood level vs time hydrographs for all locations. I believe, the term "flow level vs time" would be "flood level vs time". Therefore, correction is recommended.	Opportunity	Ayub Ali	13/01/2025	Thinesh Thirumurugan	DJV	10/03/2025	Flow rate vs time hydrograph will be removed. The Flood level vs. time will be used. 4/4/25 ZC: refer Section 6.4.4 for level vs time	DDR submission design deliverables 5-0052-210-IHY-W4-RP-0001_D, Section 6.4	Ayub Ali	7/04/2025	CLOSED	
20	Opportunity	5-0052-210-IHY-W4-RP-0001_C.pdf	Page 35, 5-0052-210-IHY-W4-RP-0001_C	PDR	I believe, vertical axis label should be flow rate instead of flood rate in Figures 6-5 and 6-7. Therefore, checking and correction is recommended.	Opportunity	Ayub Ali	13/01/2025	Thinesh Thirumurugan	DJV	10/03/2025	Flow rate vs time hydrograph will be removed in the DDR stage as per comment #19 4/4/25 ZC: refer Section 6.4.4 for level vs time	DDR submission design deliverables 5-0052-210-IHY-W4-RP-0001_D, Section 6.4	Ayub Ali	7/04/2025	CLOSED	
21	Opportunity	5-0052-210-IHY-W4-RP-0001_C.pdf	Page 36, 5-0052-210-IHY-W4-RP-0001_C	PDR	I believe, it will be flood level instead of flow level. Please check and correct it.	Opportunity	Ayub Ali	13/01/2025	Thinesh Thirumurugan	DJV	10/03/2025	The wording will be corrected in DDR stage 4/4/25 ZC: refer Section 6.4.4 for level vs time	DDR submission design deliverables 5-0052-210-IHY-W4-RP-0001_D, Section 6.4	Ayub Ali	7/04/2025	CLOSED	

Non-Compliant:	Non-compliance which requires correction before further design development occurs.
Opportunity:	Comment which identifies an opportunity to save capex, achieve increased quality or operational outcome. Not a non-compliance.

OPEN:	Comment has not been addressed.
CLOSED:	Comment is closed. No further action.
NEXT PHASE:	Comment response has been accepted. Resulting actions have been deferred to the next Phase of the Project (for Doc Control purposes the comment is considered OPEN)
TRANSFERRED:	Response is not acceptable or review has been split and the comment has been transferred to another comment sheet. (for Doc Control purposes comment is considered CLOSED)

APPENDIX D

APPENDIX D EXTERNAL CONSULTATION REVIEW

D1 – TFNSW REVIEW COMMENTS

D2 – WWCC REVIEW COMMENTS

APPENDIX D1

TFNSW REVIEW COMMENTS

A2I Flood Design Report CONSULTATION - COMMENTS REGISTER

Title: A2I | Transport for NSW - Flood Design Report - Cassidy Parade Footbridge - Comment Register
Doc No.: 5-0001-210-IHY-W4-RG-0001 **Revision:** 2 **Revision Date:** 18/06/2025

Stakeholder Category	Stakeholder Name	Flood Design Report name	Document reference	Date raised	Topic that comment relates to	Comments	Full Name	Company	Date	Response *(must be specific on how the comment has been addressed. Agreed approach for re-submission)*	Stakeholder Name	Date	Comment Status	Close-Out Comment
State Government	TfNSW	5-0052-210-IHY-W4-RP-0001_C - Cassidy Pde FB - Flood Design Report - combined	Whole document	21/02/2025	Climate Change Assumptions	The climate change assumptions are not aligned with the latest guidance in ARR2019 (Version 4.2). Therefore, the reports do not fully comply with the Draft Conditions of Approval – Flooding. Specifically: *E40* *Hydrologic and hydraulic assessments consistent with Australian Rainfall and Runoff – A Guide to Flood Estimation (Geoscience Australia, 2019);* Any instances of non-compliance must be justified.	Yucen Lu	DJV Flood Modeller	18/03/2025	The Contractor queried the post-contract-award change to the ARR2019 Climate Change approach (changed in Sep 2024), and IR confirmed (post CSSI approval on 8 Oct) the continued use of the prior version of ARR2019 climate change method (refer to IR2140-RTRFI-000773). It was determined that the prior version should be used to ensure consistency (and thus parity) with the methods used through the EIS Technical assessments.	TfNSW	18/06/2025	Closed	Noted.
State Government	TfNSW	5-0052-210-IHY-W4-RP-0001_C - Cassidy Pde FB - Flood Design Report - combined	Table 6.3 Tuflow Parameters	21/02/2025	Roughness assumptions	The rail embankment roughness of 0.06 is high given the material type. A value of 0.3-0.5 may be more appropriate. However a reduced embankment roughness is unlikely to materially change the modelled flood behaviour or the impact assessment outcomes.	Yucen Lu	DJV Flood Modeller	18/03/2025	Noted. The rail embankment roughness was retained same as the TUFLOW model of Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMAwater, 2021) received from Wagga Wagga City Council.	TfNSW	18/06/2025	Closed	Noted.
State Government	TfNSW	5-0052-210-IHY-W4-RP-0001_C - Cassidy Pde FB - Flood Design Report - combined	Whole document	21/02/2025	In text referencing	Broken section references throughout. References to Section 0. Check all reports	Yucen Lu	DJV Flood Modeller	18/03/2025	The formating of report will be fixed in the next design phase.	TfNSW	18/06/2025	Closed	Noted.
State Government	TfNSW			18/06/2025		In Table 2-2 for Condition of Approval E41 this should read "The Proponent's response to the requirements of Conditions E38 and E40..." - please correct.	Thinesh Thirumurugan	DJV Flood Modeller	26/06/2025	The COA reference for E41 has been corrected Refer to 5-0052-210-IHY-W4-RP-0001_E Table 2-2 E41 | The Proponent's response to the requirements of Conditions E38 and E40 must be reviewed and endorsed by a suitably qualified flood consultant, who is independent of the project's design and construction and approved in writing by the Planning Secretary, in consultation with directly affected landowners, ALC, Local Water Group, TfNSW, DPI Fisheries, BCS, NSW State Emergency Service (SES) and relevant Councils. | Independent review of the flood modelling, model and Flood Design Report is undertaken by the Proof Engineer's specialist contractor, who satisfies and complies with the requirements of AAS. Consultation with Council and other stakeholders is being undertaken through a formal review of this Flood Design Report.				

APPENDIX D2

WAGGA WAGGA CITY COUNCIL REVIEW COMMENTS

A2I Flood Design Report CONSULTATION - COMMENTS REGISTER

Title: A2I | Wagga Wagga City Council - Flood Design Report - Cassidy Parade Footbridge - Comment Register

Doc No.: 5-0001-210-IHY-W4-RG-0002 **Revision:** 0.2 **Revision Date:** 20/06/2025

Stakeholder Category	Stakeholder Name	Flood Design Report name	Document reference (e.g. section, figure	Date raised	Topic that comment relates to	Comments	Full Name	Company	Date	Response *(must be specific on how the comment has been addressed. Agreed approach for re-submission)*	Documentation Section # / Figure #	Full Name	Date	Comment Status	Close-Out Comment
Local Government	WWCC	Flood Design Report – Cassidy Parade Footbridge Rev C	Hydraulic Model	05.02.2025	TUFLOW Model	Please provide a copy of the TUFLOW model files for review.	Yucen Lu	DJV Flood Modeller	19/03/2025	Once all mitigations and independant review are finalised the TUFLOW model will be provided.		Geordi Paxton	10.06.2025	Closed	
Local Government	WWCC	Flood Design Report – Cassidy Parade Footbridge Rev C	Hydraulic Model	05.02.2025	TUFLOW Model	The WWCC MOFFS model does not incorparate the subsuface 1d network. Can you please confirm the extent of the 1d network included in the updated model.	Yucen Lu	DJV Flood Modeller	19/03/2025	The 1d pit and pipe network is included in the TUFLOW model of Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMAwater, 2021) recevied from Wagga Wagga City Council, which was shown in Figure 4-2 in Section 4.2.1. The 1d network around the Cassidy Parade footbridge were updated based on the available survey data. A zoomed-in figure around the site area including the 1d network will be added in Section 4.2.1 in the next design stage.	5-0052-210-IHY-W4-RP-0001 Section 4.2.1	Geordi Paxton	10.06.2025	Closed	
Local Government	WWCC	Flood Design Report – Cassidy Parade Footbridge Rev C	Hydraulic Model	05.02.2025	TUFLOW Model	No information given on SA inflow locations.	Yucen Lu	DJV Flood Modeller	19/03/2025	The SA inflow locations will be included in Figure 4-2 in the next design stage.	5-0052-210-IHY-W4-RP-0001 Section 4.2.1 Figure 4-2	Geordi Paxton	10.06.2025	Closed	
Local Government	WWCC	Flood Design Report – Cassidy Parade Footbridge Rev C	Hydraulic Model	05.02.2025	TUFLOW Model	Confirm topographic modifications to represent the civil works closest to the rail culvert. No change in DEMZ map provided.	Yucen Lu	DJV Flood Modeller	19/03/2025	The changes in DEMz map will be provided in the next design stage.	5-0052-210-IHY-W4-RP-0001 Section 4.2.2	Geordi Paxton	10.06.2025	Closed	
Local Government	WWCC	Flood Design Report – Cassidy Parade Footbridge Rev C	Hydraulic Model	05.02.2025	TUFLOW Model	The downstream open channel is represented as a 1d channel. Confirm the 1d channel setup (x-sections, roughness, service crossing blockages) are appropriate for current site conditions.	Yucen Lu	DJV Flood Modeller	19/03/2025	It will be checked and updated in the next design stage against available data if required. Please note the the design did not interact with the open channel.		Geordi Paxton	10.06.2025	Closed	
Local Government	WWCC	Flood Design Report – Cassidy Parade Footbridge Rev C	Hydraulic Model	05.02.2025	TUFLOW Model	Actionable flooding afflux (>10mm) is apparent on the private property adjacent the downstream open channel in the 1%AEP + CC event. Potential for more impact pending review of 1d channel setup.	Yucen Lu	DJV Flood Modeller	19/03/2025	The afflux more than 10mm is within the channel area and does not touch the property. In addition, as per CoA E42, the flood impact should be only considered for the events up to the 1% AEP.		Geordi Paxton	10.06.2025	Closed	
Local Government	WWCC	Flood Design Report – Cassidy Parade Footbridge Rev D	Hydraulic Model	10.06.2025	TUFLOW Model	Independent Peer Reviewer comments in App E are for structural elements? Can you add the flooding ones?	Zoe Cruice	Engineering Manager	20/06/2025	Apologies - you're correct. I have appended the wrong one. Correct (IHY) Proof Engineer comment sheet will be re-submitted with the final report, but I have also emailed it acorss. 18/7 - MR issue the updated correct report on 20/6. MR have not recievd a response from WWCC so the comment is deemed closed.	Appendix E (and emailed 20/6/25)				

APPENDIX E

INDEPENDANT FLOOD CONSULTANT REVIEW

Project: 2100 **Deliverable:** Cassidy Parade

Comment Sheet Reference: 5-0052-210-IHY-W4-CS-0001-PE_G

Review Comments (Reviewer)										Responses (Document Owner)					Close-Out				
#	Document number / drawing number - Revision Number	Section # / page #	Company	Full Name	Functional Area	Date	Design Gate	Comment (for example must be specific on non compliance. Reference mark-ups, if required)	Comment Type	Full Name	Role	Date	Response (must be specific on how the comment has been addressed)	Where addressed (Section # / Figure #)	Full Name	Company	Date	Comment Outcome	Close-Out Comment
1	5-0052-210-IHY-W4-RP-0001_B	TUFLOW files	Hatch	Sam Drysdale	Flood Assessment	16/10/2024	PDR	Inconsistency in representation of baseline conditions between work packages W4, W5 and W7.	Minor	Thinesh Thirumurugan	DJV Flood Modeller	31/01/2025	The flood design report 5-0052-210-IHY-W4-RP-0001_B (PDR No. 1) has been superseded by 5-0052-210-IHY-W4-RP-0001_C (PDR No. 2). 5-0052-210-IHY-W5-RP-0001_C is based on the master TULFLOW model, which includes W4, W5, and W7. Both the baseline scenario and design scenario are consistent across these sites. The updated model has been submitted to PE in December 2024.	PDR No.2 flood model	Darren Lyons	Hatch	29/01/2025	CLOSED	Comment relates to the initial PDR submission and has been resolved in the updated PDR submission of Dec 2024
2	5-0052-210-IHY-W4-RP-0001_B	TUFLOW files	Hatch	Sam Drysdale	Flood Assessment	16/10/2024	PDR	The representation of the pedestrian bridge is not standard practice for modelling bridge structures, nor does the representation appear to be achieving its intent. It is recommended to replace the localised polygon representation with a full structure length layered flow constriction polyline. This is unlikely to have enough influence to change outcomes of the assessment but should be revised for the DDR stage.	Minor	Yucen Lu	DJV Flood Modeller	31/01/2025	It is recognized that layered flow constriction (LFC) is commonly used to model bridges. However, it is not the universal standard. In particular, LFC is typically more suited to waterway bridges. In this assessment, the structure is a pedestrian bridge with the majority of flow passing along the southern side (see the 1% AEP Existing Flood Depth screenshot, where the yellow circles indicate the bridge piers). If a continuous LFC is applied across the full span, the resulting bridge losses would be distributed uniformly, including areas that experience no flow—most notably the piers over the railway and on the northern side. This would underestimate the actual hydraulic losses. Therefore, DJV believes that representing each pier individually (flood level will not reach the deck, so assessing the pier is appropriate), is an accurate reflection of the flow conditions and a conservative modelling approach. 	PDR No.2 flood model	Darren Lyons	Hatch	29/01/2025	CLOSED	An alternate representation was made in the Proof Engineering modelling and determined that the oucome of the assessment is not affected by this representation
3	5-0052-210-IHY-W4-RP-0001_B	TUFLOW files	Hatch	Sam Drysdale	Flood Assessment	16/10/2024	PDR	No detail has been provided of the concrete pad at the end of the ramp on Cassidy Parade. Depending on the design this may restrict flow into the cross drainage under the railway. This is unlikely to have enough influence to change outcomes of the assessment, but detail should be included for the DDR stage.	Minor	Thinesh Thirumurugan	DJV Flood Modeller	31/01/2025	Noted. The current design has been superseded by the PDR No. 2 design. However, if the concrete pad is included in the DDR design, the relevant details will be incorporated.	DDR flood model	Darren Lyons	Hatch	29/01/2025	CLOSED	Comment relates to the initial PDR submission and has been resolved in the updated PDR submission of Dec 2024
4	5-0052-210-IHY-W4-RP-0001_B	TUFLOW files	Hatch	Sam Drysdale	Flood Assessment	16/10/2024	PDR	The cross drainage under the railway was represented as being a three-cell box culvert. Google Street View indicates that this is only two cells. This will reduce flow away from the area of interest. This is unlikely to have enough influence to change outcomes of the assessment but should be revised for PDD stage.	Minor	Thinesh Thirumurugan	DJV Flood Modeller	31/01/2025	Noted. The Railway cross culvert details were based on the original Council TUFLOW model. The culvert details will be checked against the latest survey data and included in the DDR stage.	DDR flood model	Darren Lyons	Hatch	29/01/2025	CLOSED	An alternate representation was made in the Proof Engineering modelling and determined that the oucome of the assessment is not affected by this representation
5	5-0052-210-IHY-W4-RP-0001_B	TUFLOW files	Hatch	Sam Drysdale	Flood Assessment	16/10/2024	PDR	While the recommended changes for W4 are minor and not expected to individually be significant enough to change the outcomes of the assessment, all the changes together may result in greater pooling on the upstream side of the works which could result in impacts being exacerbated.	Major	Thinesh Thirumurugan	DJV Flood Modeller	31/01/2025	Noted. The comments above will be addressed during the DDR stage and the flood impact will be checked against CoA to make sure there is no non-compliance.	DDR flood model	Darren Lyons	Hatch	29/01/2025	CLOSED	Comment relates to the initial PDR submission and has been resolved in the updated PDR submission of Dec 2024
6	5-0052-210-IHY-W4-RP-0001_C		Hatch	Daniel Williams	Flood Assessment	31/01/2025	rePDR	No further comments.		Zoe Cruice	Eng Manager	1/04/2025	Noted. No action required		Darren Lyons	Hatch		CLOSED	
7	5-0052-210-IHY-W4-RP-0001_D		Hatch	Daniel Williams	Flood Assessment	23/05/2025	DDR	No further comments.		Zoe Cruice	Eng manager	23/05/2025	Noted. No action required		Darren Lyons	Hatch	23/05/2025	CLOSED	
8	5-0052-210-IHY-W4-RP-0001_0		Hatch	Daniel Williams	Flood Assessment	7/08/2025	IFC	No further comments.											

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