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MARTINUS INLAND RAIL



FLOOD DESIGN REPORT

A2I | Albury to Illabo

Package: A2I – Junee to Illabo Clearances

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DOCUMENT OWNER:	Engineering Manager		
PREPARED BY:	Scott Mortimer	**TITLE:**	Senior Engineer, Water
	Yucen Lu	**TITLE:**	Senior Engineer, Water Resources
REVIEWED BY:	Jasmine Lee	**TITLE:**	Associate, Water Resources
VERIFIED BY:	Eric Lam	**TITLE:**	Technical Director, Water Resources

Approved by

NAME	TITLE	SIGNATURE	DATE
Zoe Cruice	Engineering Manager		15 Apr 2025

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GLOSSARY

Specific terms and acronyms used throughout this plan and sub-plans are listed and described in Table 0-1 below.

Table 0-1: 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
J2I-E	Junee to Illabo Eastern Model
J2I-W	Junee to Illabo Western Model
Km	Kilometers
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
NtP	Notice to Proceed
PDR	Preliminary Design Review
PSR	Project Scope and Requirements
QDL	Quantitative Design Limits
RCP	Representative Concentration Pathways
RFFE	Regional Flood Frequency Analysis
REF	Review of Environmental Factors
RFI	Request for Information
RORB	Runoff Routing
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
UMM	Updated Mitigation Measures
V & V	Verification and Validation
WAD	Works Authorisation Deed
WAE	Work-as-Executed

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 will require a Notice to Proceed from ARTC before works can commence on site. Design for A2I will however commence at Contract Award.

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)
- 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

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

- Daroobalgie New Loop
- Wyndham Avenue (track lowering)

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

- 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 Structure Outline D H F2 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 Site Description

1.3.1 Background

The Junee to Illabo Clearances design package forms part of the Albury to Illabo Section works. The Package includes track slews on the Main Lines (Down and Up Main) between Chainage 465+380km and 480+660km. Proposed slews within the design extents also require modification works to the level crossings LX603, LX604 and LX606. Details of the works at LX605 and LX1472 are discussed in a separate design package J10 (CH472+420km to 474+450km) as the design of this package is programmed to take place after the J2I package. Figure 1-1 shows the locality plan of the planned works.

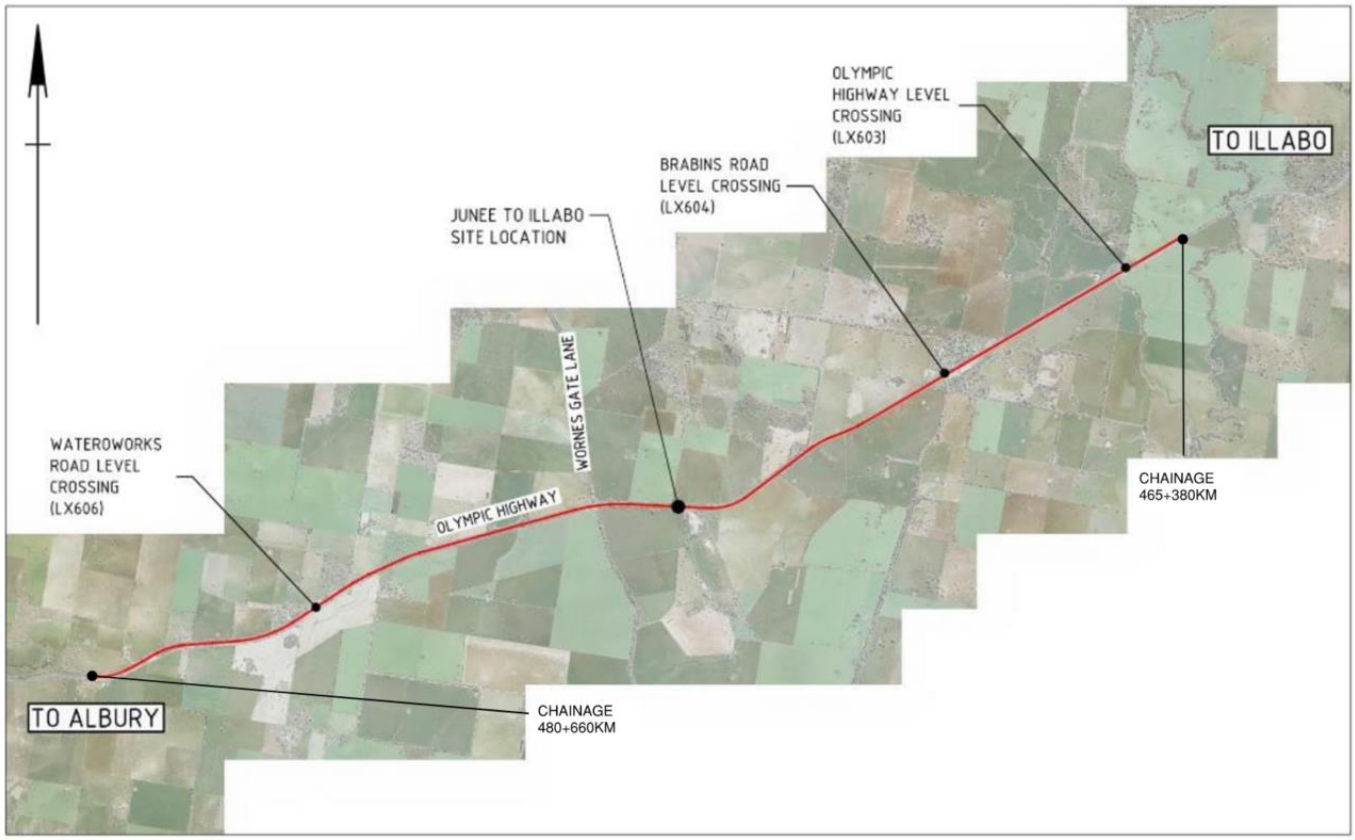

Figure 1-1: Junee to Illabo Clearances Extent

This package includes the track, civil (earthworks, formation, and level crossings), structural, geotechnical and drainage design for the proposed track slews.

1.3.2 Objectives

This report has been prepared to support the delivery of the Junee to Illabo Clearances between Chainage 465.380km and 480.660km by providing a flood impact assessment for the Issued For Construction (IFC) stage. The flood assessment aims to understand the flood behaviour within the study area and assess the potential flood impacts as a result of the rail design and associated drainage design.

This report should be read in conjunction with the Detailed Design Report – Junee to Illabo Clearances – (5-0052-210-PEN-J7-RP-0001).

1.3.3 Scope

The scope of this study for the flood assessment is the track slews on the Main Lines (Down and Up Main) between CH465+380km and CH480+660km. The assessment includes:

- Carrying out the flood assessment for the design in the IFC stage for the design events of 10%, 5%, 2%, 1% AEP, 1% AEP with climate change and Probable Maximum Flood (PMF),
- Checking flood assessment results against the flood impact and flood immunity criteria and
- Proposing mitigation measures (if required).

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 E for the ARTC review, Appendix F for the external consultation review, and Appendix G for the independent flood consultant review.

1.3.4 Previous Studies

1.3.4.1 Flood Studies

There is no flood study that has been previously undertaken that captures the project site.

1.3.4.2 Reference Design

Reference Design was performed by others prior to the commencement of the Contractor's detailed design engagement.

In the Reference Design, a high-level assessment was carried out using the DRAINS-RAFTS module for the hydrology assessment and the DRAINS model for a 1D hydraulics assessment for all the culverts along the extent of the Junee to Illabo Clearances. This was outlined in the following reports:

- Reference Design Report Junee Package (2-0008-210-PEN-04-RP-0002)

The Reference Design Report summarises the culverts that require replacement as based on structural assessments. 3 culverts and 1 underbridge were identified for replacement based on a structural assessment approach. The flood assessment across the package was limited to the existing drainage structures along the rail and did not assess the whole extent of proposed track slews on the Main Lines. All culverts that were identified to be replaced were proposed with like-for-like replacements to ensure the same flood area as existing.

The underbridge at CH476+988km was identified for replacement, as part of the reference design it was determined that there is a peak flow at the culvert of 46.7 m^3/s and 40.3 m^3/s in the 1% AEP and 2% AEP events, respectively. The Reference Design indicated that by replacing the culvert at CH476+988km with (4x) 3.0W x 2.1H (metres) RCBC, there will be a reduction in culvert discharge of 0.006 m^3/s (a 1% reduction) and a lowering of headwater levels by 0.32 m at the CH476+988 structure due to the increase in waterway area provided by the new culvert structure.

1.3.4.3 Environmental Impact Assessment

An EIS which has been approved, supports the application for approval of the Proposal under Division 5.2 of the Environmental Planning and Assessment Act 1979 (EP&A Act). It addresses the environmental assessment requirements set by the Secretary of the NSW Department of Planning, Industry and Environment, which is commonly referred to as the SEARs. The A2I CSSI Environmental Impact Statement contains the following relevant prior assessment documents:

- Albury to Illabo Environmental Impact Statement (EIS) Chapter 18 – Hydrology, flooding and water quality (July 2022) (currently under planning assessment)
- Albury to Illabo Environmental Impact Statement (EIS) Technical Paper 11 – Hydrology, flooding and water quality (July 2022) (currently under planning assessment)
- Response to Submissions – Appendix D – Hydrology and Flooding

13 hydraulic structures are along the existing rail alignment within the site. Assessments for 4 structures (Table 1-1) which were proposed to be changed as part of the design have been carried out to support and inform the EIS using the software package DRAINS in accordance with ARR2019, for both the hydrology and hydraulic assessment. The EIS identifies the enhancement site is not within a flood-prone area with only local overland flow mechanisms and no regional flooding. The

results from this assessment indicated that the overland flows do not overtop the rail in events up to and including the 1% AEP event at those four structure locations.

Table 1-1: Hydraulic Structures assessed in EIS (source: Table 4.11 from EIS Technical Paper 11, Hydrology, flooding and water quality, WSP, 2022)

ASSET ID	ASSET TYPE	ASSET CHAINAGE (m)	UPSTREAM AND DOWNSTREAM TRACK LEVEL (mAHD)	1% AEP FLOOD LEVEL (mAHD)	2% AEP FLOOD LEVEL (mAHD)	TOP OF RAIL IMMUNITY (%AEP)
S00100440 469.370SC	Culvert	469,370	271.58 271.78	270.95	270.89	1
S00100440 469.792SC	Culvert	469,792	277.01 277.17	276.00	275.95	1
S00100440 472.406SC	Culvert	472,406	296.13 296.39	295.53	295.51	1
S00100440 476.988UB	Bridge	476,988	313.41 313.50	312.48	312.30	1

Note: ^ Headwater levels are from the 1d model and represent peak head at peak flow.

The above findings from EIS are further discussed in Section 7.1.3.

1.4 Purpose and Requirements

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

A series of tasks and activities that the design development and design reporting process need to address and include is described in the requirements within the PSR Annexure F and Inland Rail's Design Management Specification.

1.5 Information Documents

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

- Albury to Illabo (A2I) and Stockinbingal to Parkes (S2P) Projects Reference Design Report – Junee Package (WSP, June 2022), 2-0008-210-PEN-04-RP-0002
- Albury to Illabo Environmental Impact Statement (EIS) Chapter 18 – Hydrology, flooding and water quality (July 2022) (currently under planning assessment)
- Albury to Illabo Environmental Impact Statement (EIS) Technical Paper 11 – Hydrology, flooding and water quality (July 2022) (currently under planning assessment)
- Illabo to Stockinbingal (I2S) Response to Submissions – Appendix D Revised Hydrology and Flooding Impact Assessment Report (2-0001-220-IHY-00-RP-002)

1.6 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
- Austroads Guide to Bridge Technology – Part 8: Hydraulic Design of Waterway Structures
- Inland Rail Climate Change Risk Assessment Framework
- The Jeralgambeth Creek at Illabo Flood Risk Management Study and Plan Report (Lyall & Associates, 2012)

1.7 Outputs

The IFC design gate flood maps and a list of the prepared flood maps are included in Appendices A and B.

1.8 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
1	1m 2015 LiDAR and High Resolution Aerial Imagery. (The data for the derived points have an accuracy of 0.15m (68% confidence level))	TIF format	Existing 1m LiDAR (carried out in 2015 by ARTC) received from Martinus 12/11/2024 for the rail corridor.
2	5m LiDAR 2015 (The data used to create this DEM has an accuracy of 0.9m (95% Confidence Interval) vertical and 1.25m (95% Confidence Interval) horizontal)	TIF format	Downloaded from https://elevation.fsdf.org.au/ on 21/11/2023. The information is in 5m resolution in the GDA2020 projection.
3	A2P EXT J2I GDA20Z55 TIN Detail Surface.12da A2P EXT J2I GDA20Z55 Detail.12da A2P EXT J2I GDA20Z55 RAIL.12da	12da	Received 26/04/2024 Existing Conditions Survey in the GDA 2020 Projection from Martinus.
4	5-0052-210-CAL-J7-MD-0003-JUNEE_TO_ILLABO_EXISTING_TRACK_3D	DWG	03/06/2024 Existing Rail Strings and Elevations
5	20250124 - DRAINAGE 21 J7 MD21J7001 20250124 - CAPPING 21 J7 20250124 - BALLAST 21 J7 MR21J7001 20250124 - BALLAST 21 J7 MR21J7002	DEM	Received 24/01/2025 IFC Design Rail Surface in the GDA 2020 Projection from DJV Rail Team
6	5-0052-210-CCW-J7-MD-0002-JUNEE_TO_ILLABO_3D_CIVIL_DESIGN_STRINGS	DWG	Received 24/01/2025 IFC Design Rail Strings and Elevations
7	Track & CSR - 20250205 -Junee-to-Illabo	PDF	Received 05/02/2025 IFC Design Drawings of Culverts
8	A2P J2I EXT GDA20Z55 DRAINAGE 250114	DWG	Received 14/01/2025 Survey of Culverts along the Olympic Highway

The track and civil design that is incorporated into this flood assessment is detailed in the Junee to Illabo Clearances Report (5-0052-210-PEN-J7-RP-0001). The track alignment within this track and civil design packages shows that the underbridge at Ch476+988 is at a critical low point for flows from the south, where the rail and culvert act as the critical hydraulic control, setting flood levels on the upstream (south) side and controlling the outflow to the Olympic Highway directly downstream. Refer to the track alignment plan and profile drawing 5-0052-210-CAL-J7-DR-1136. The current culvert structure at Ch476+988 is shown below in Figure 1-2. It is planned for replacement as part of the J2I works, as the current structure cannot accommodate the widening necessary to support the Inland Rail track centres.



Figure 1-2: Existing Structure at Ch476+988 to be replaced

1.9 Limitations and Exclusions

The following limitations and assumptions apply to the flood assessment for the IFC stage.

- As stated in the EIS, the site is not affected by any mainstream creeks or rivers nearby, and is not affected by regional flooding. This has been assumed for the site, and has been checked with no nearby watercourses except for Billabong Creek which was excluded from the assessment.
- The influence of Billabong Creek catchments (north of the Olympic Highway) is excluded from the J2I modelling as the creek crosses the Illabo to Stockinbingal (I2S) section instead of A2I. In addition, the construction of A2I is in advance of I2S. So, the accumulative impact assessment should be undertaken by the I2S contractor. The approach to exclude the Billabong Creek catchments from this assessment has been discussed and agreed upon with the Proof Engineer on 13/12/2024.
- The TUFLOW Rainfall-on-Grid (RoG) hydraulic model has not been calibrated or validated against historical data. As there are no water level gauges or rainfall gauges within the local catchment, this would only be possible to be undertaken using anecdotal evidence which would not provide a quantitative assessment.
- An assessment of temporary works and staging has not been undertaken.
- 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.
- According to Clause 5.4.2 and Clause 5.4.3 in Annexure B of PSR (Table 2-1), the highest flood event shall be the one stipulated by the ARTC Safety Management System (SMS). As per Section 10.1.3 of Track and Civil Code of Practise Section 10 Flooding, the 1% AEP shall be used. The flood impact would be assessed up to the 1% AEP for the project.

2 COMPLIANCE WITH REQUIREMENTS

2.1 Project Scope and Requirements

The preliminary design has been assessed to check if it meets the Project Scope and Requirements (PSRs). This is demonstrated throughout the flood assessment with Table 2-1 below, summarising the Junee to Illabo Clearances - Design 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 any watercourses)
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 the 1% AEP. However, the floodwaters overtop sections of the rail in the 10% AEP. Thus the existing immunity for this section of the rail is the 10% AEP. The existing immunity is maintained or improved under the design conditions. See Section 7.3 for further details.
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.	See Section 7.3
Project Wide	5.4.5	Bridge and culvert hydraulics shall comply with Austroads Guide to Bridge Technology Part 8: Hydraulic Design of Waterway Structures.	Hydraulic results in Section 7.1.3 were provided to assess the structure impact of the floodwaters on the proposed culverts. This information was used in the Section 4.5 of the Detailed Design Report A2I – Junee to Illabo Clearance (5-0052-210-PEN-J7-RP-0001_C) to ensure culvert hydraulics complies with Austroads Part 8: Hydraulic Design of Waterway Structures.
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 using RCP 8.5 Year 2090, see Section 6.4 for more details.
A2I Technical Requirements	IR-SR-A2I-349	The Corridor System for Enhancement Corridors shall have a flood immunity of no worse than existing.	Refer to Section 7.3 the overtopping extent of flooding has not been increased on the rail line in the design conditions.

Requirement	Identifier	A2P Technical Requirements Description	Compliance Evidence Reference
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 has taken place across the J2I Clearances site.)
A2I Technical Requirements	IR-SR-A2I-352	The Corridor System shall prevent damage of the formation due to ponding of water.	No damage to the formation due to ponding of water. Existing condition is maintained. Refer to Section 7.4.4
A2I Technical Requirements	IR-SR-A2I-458	The Corridor System shall prevent ponding in longitudinal open channels.	There is no ponding in longitudinal channels in the design conditions, and existing flooding behaviour is maintained. Refer to Section 7.4
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 7.4.
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.	There are no adverse impacts outside the rail corridor or inside the rail corridor. Impacts only occur in the rail corridor within the project boundary. See Section 7.4, Appendix A and Appendix B.
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 Section 7.4.
A2I Technical Requirements	IR-SR-A2I-541	The Structures System new underbridges shall withstand the 0.05% annual exceedance probability design flood event.	N/A. There is no new underbridge structure within the J2I Clearances site.
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.

2.2 Conditions of Approval – Flooding

The Conditions of Approval (CoA) have been provided under cover of IR2140-TRANSMIT-002001. 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 river banks or watercourses.	Compliant, see rows below.
E39	The CSSI must be designed with the objective to meet or improve upon the flood performance identified in the	Compliant (refer to Section 7)

Condition #	Condition or Criteria	Compliance Evidence Reference
	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.	
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 documents listed in Condition A1. This modelling must include:	Compliant (refer to Sections 6 and 7)
E40	a) Hydrologic and hydraulic assessments consistent with Australian Rainfall and Runoff – A Guide to Flood Estimation (GeoScience Australia, 2019);	Compliant. Section 5 methodology shows that ARR2019 guidelines were used for this assessment.
E40	b) Use of modelling software appropriate to the relevant modelling task;	Compliant. Section 6 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. Section 1.8 and Section 6 show that existing field survey and rail levels were used in the models.
E40	d) Confirmation of predicted afflux at industrial properties adjacent to Railway Street, Wagga Wagga based on field survey.	N/A – Railway Street in Wagga Wagga is not relevant to this site.
E40	Updated flood modelling must be made publicly available in accordance with Condition B18.	Flood design report and independent review of 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 E42 and E44 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 satisfy and comply with the requirements of A16. Consultation with Council will be undertaken through formal review of this Flood Design Report. Consultation with other stakeholders will occur prior to the commencement of permanent works that have the potential to impact flooding.
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 E42 items below
E42	(a) a maximum increase in inundation time of one hour, or 10%, whichever is greater;	Compliant, refer to Section 7.4.4

Condition #	Condition or Criteria	Compliance Evidence Reference
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 on any properties. Section 7.4.1
E42	(c) no above-floor inundation of habitable rooms which are currently not inundated;	Compliant. No flood level increase on any properties. See Section 7.4.1
E42	(d) a maximum increase of 50 mm in inundation of land zoned as residential, industrial or commercial;	Compliant. No flood level increase in residential, industrial and commercial areas. Refer to Section 7.4.1
E42	(e) a maximum increase of 100 mm in inundation of land zoned as environment zone or public recreation;	Compliant. No increases of more than 100mm on land zoned as environment or public recreation. See Section 7.4.1
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 increases of more than 200mm on land zoned as rural or primary production. See Section 7.4.1
E42	(g) no increase in the flood hazard category or risk to life; and	Compliant, no reasonable flood hazard increase or increase in Velocity x Depth to cause risk to life. See Section 7.4.3
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, no increase in velocity of more than 0.5m/s. See Section 7.4.2.
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.	N/A – 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 7)
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	Flood information will be provided to the relevant Council, BCS and the SES in order to assist in preparing relevant

Condition #	Condition or Criteria	Compliance Evidence Reference
	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.	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 E43.**	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 Junee Shire 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-J7-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
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 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	This report relates to the Junee to Illabo site, and so is not relevant to Wagga Wagga Yard. Compliant. Quantitative assessment has been undertaken. Refer to Section 7.

Condition	Condition or Criteria	Compliance Evidence Reference
	areas that are impacted by drainage and/or flooding. The outcomes of the assessment are to be provided to DCCEW– BCS	
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 Junee to Illabo 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 the table below.

Table 3-1: Design Differences between Concept Design and SDR

Item	Difference	Reason for Difference
1	DJV created a new TUFLOW hydraulic model to assess the area of interest	No TUFLOW hydraulic model was available for the Concept Design stage.

3.1 SDR to PDR

Key design changes between the SDR Design and PDR design are listed in the table below.

Table 3-2: Design Differences between SDR and PDR

Item	Difference	Reason for Difference
1	Incorporation of the latest existing conditions survey into the TUFLOW model.	A new existing conditions survey was undertaken and received.
2	Incorporation of updated rail design (ballast, capping and top of rail)	New rail design.
3	Incorporation of design drainage (culvert)	New flood relief culvert at CH496+988

3.2 PDR to DDR

The key difference between the PDR and DDR designs is the addition of the yellow and pink areas into the flood assessment of the J2I package, which was previously just assessing the red-outline area. Other changes are also summarised in the Table 3-3 below.

The PDR approach had been that the rail culverts located in the pink and yellow areas were low risk and were to be assessed by Culvert Master / Flow Master only. With the finalisation of the Conditions of Approval, and the requirement to demonstrate – quantitatively – compliance with the performance and immunity limits, the full extent needed to be included in the flood assessment.

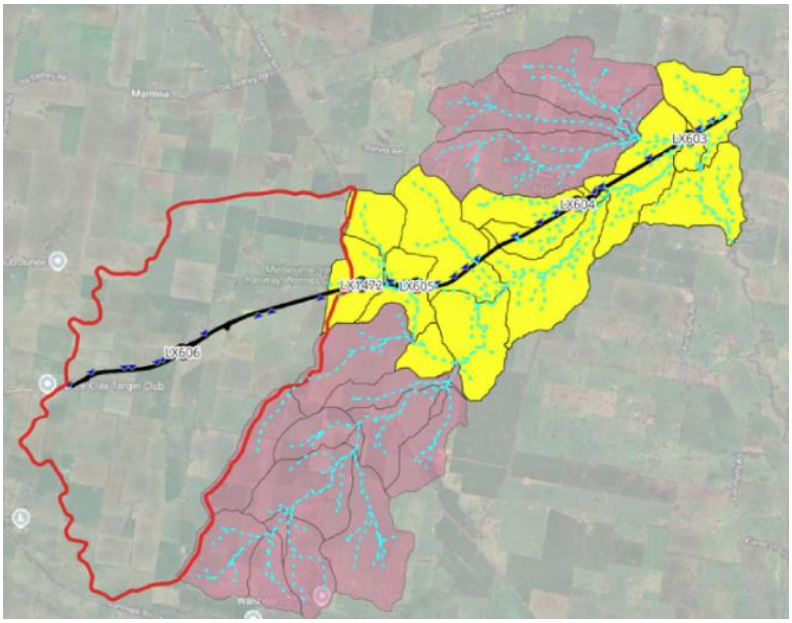

Figure 3-1 Extent of Flood Modelling Catchment in PDR (Red Polygon) and at DDR (Red+Yellow+Pink Polygons)

Table 3-3: Design Differences between PDR and DDR

Item	Difference	Reason for Difference
1	Model created for the eastern extent of Junee to Illabo works between CH474+800 and CH465+250.	Assessment of the whole Junee to Illabo Clearances project area, as opposed to the western portion only in the PDR assessment, as indicated in Figure 3-1 and Section 4.1 above.
2	Inclusion of 1m LiDAR of the greater rail corridor provided by Martinus	1m LiDAR within the model domain was provided and more accurate than 5m data previously used.
3	Inclusion of culverts along Olympic Highway sized from the survey, high-resolution aerial imagery and 1m LiDAR.	Survey of culverts along Olmypic Highway, high resolution aerial imagery and 1m LiDAR was received to model culverts along the highway.
4	Incorporation of updated rail design (ballast, capping and top of rail)	New DDR stage rail design.
5	Incorporation of design drainage (culvert)	New culvert size at CH496+988.

3.3 DDR to IFC

Minor changes to slew values adjacent to LX603, changes to the slew extents at the I2S tie-in, and positioning of 0.9 RCP at CH476+988km have occurred in the design between the DDR and IFC gates for the track and civil design. These changes have been captured in this IFC stage of the flood modelling assessment.

3.4 IFC Rev 0 to IFC Rev 1

Comments were received from TfNSW which noted that one of the map figures in the appendices was duplicated. The Rev 1 IFC report has been updated to correct this, as well as include the closed-out comments register from TfNSW review.

Attempts were made to obtain review comments from Junee Shire Council, but efforts were unsuccessful. The record of consultation is provided at Appendix F1.

The proof engineer was contacted to advise of the IFC update, and they have confirmed, via email attached Appendix G2 that the certification provided on the Rev 0 design still applies. The Rev 0 certification is provided at Appendix G1, and correspondence confirming it's retained applicability at Appendix G2.

4 MODELLING METHODOLOGY

The Junee to Illabo Clearances consists of works over 15.4km of track. Two separate models for catchments of 34.5km^2 and 61.6km^2 were created for manageable run times. These models are referred to as Junee to Illabo West (J2I-W) between CH480+650km and CH474+200km and Junee to Illabo East (J2I-E) between CH474+800km and CH464+300km. There is a 600m overlap between J2I-W and J2I-E for modelling purposes which is discussed in Section 6.

4.1 Catchment Description

The total catchment area for the Junee to Illabo Clearances works is 96.1km^2. The catchment is split both north and south of the rail line. The catchment was split into two distinguishable sub-catchments to supply the hydrologic inputs for J2I-E and J2I-W. The catchment and the splits between J2I-E and J2I-W are seen in Figure 4-1.

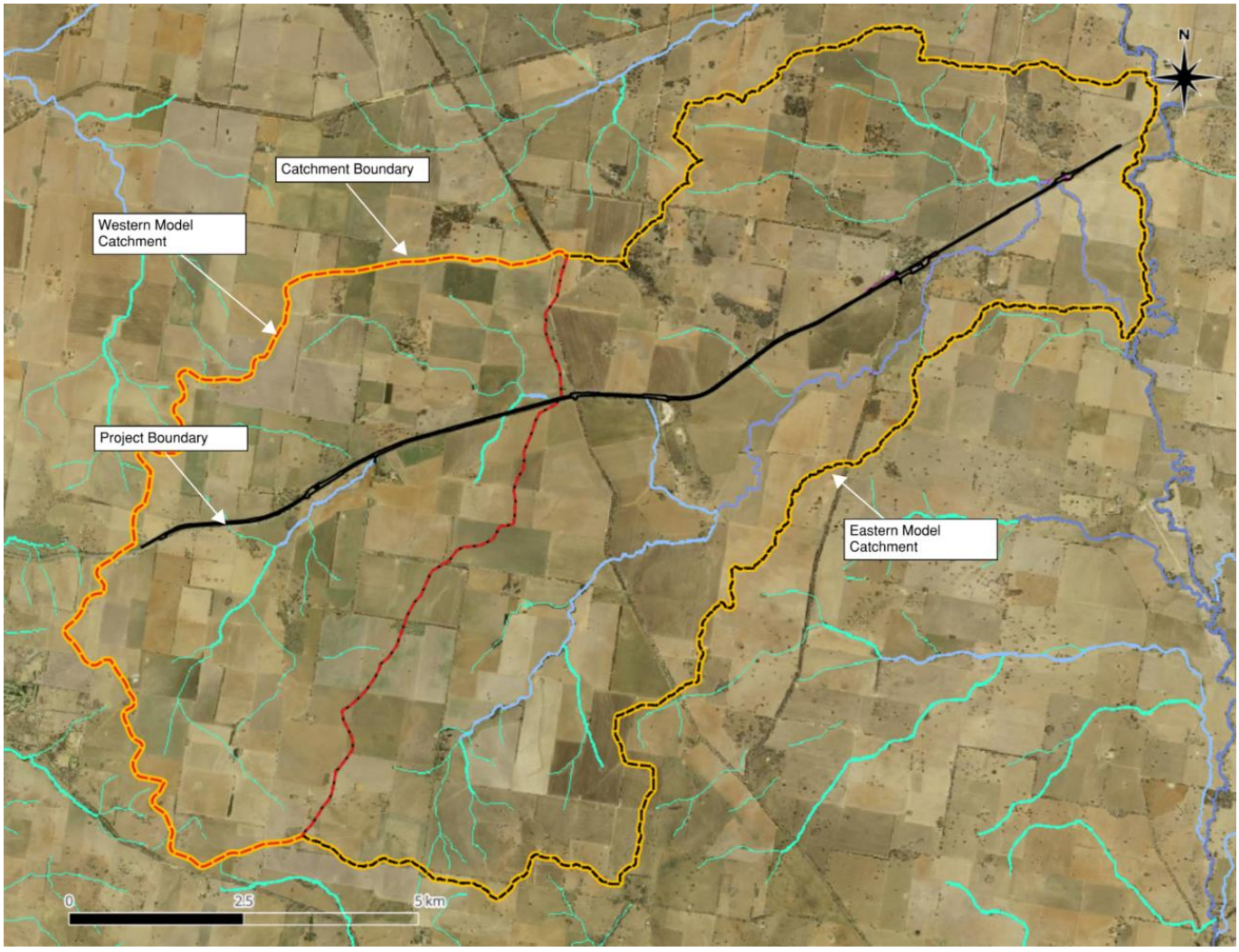

Figure 4-1: Junee to Illabo Clearances Catchment

4.1.1 Junee to Illabo Western Catchment

The western model extent compromises of the local catchment to CH474+100km. There are local tributaries to the north and south of the rail line with the largest flow path travelling from the south of the rail line crossing the rail line at CH476+988km. The catchment area flowing to the rail underbridge at CH476+988km chainage is 19.8km^2. Refer to Figure 4-2.

The catchment is predominantly farmland with areas used for pastureland or crops. Approximately 260m upstream of the rail underbridge at CH476+988km there are existing residential and industrial buildings. The terrain falls away to the east, and the crossing at CH476+988km is a localised low point before grading down along the rail line to the east towards the Olympic Railway culverts.

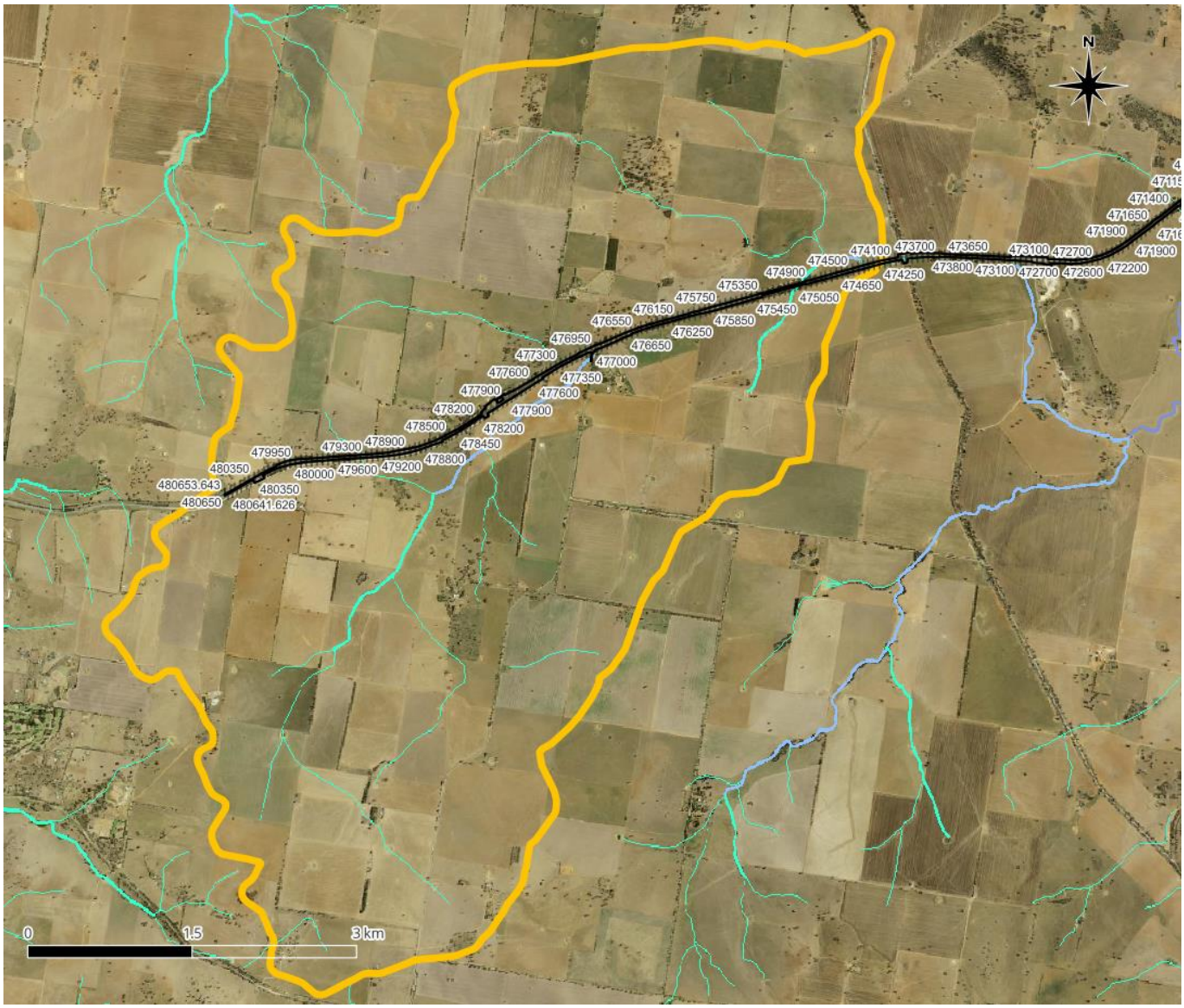

Figure 4-2: J2I-W Catchment

4.1.2 Junee to Illabo Eastern Catchment

The eastern model extent is 61.6km^2, the catchment compromises of Jeralgambeth Creek which follows the railway with tributaries joining the creek from the northern side of the rail before joining Billabong Creek as illustrated in Figure 4-3. Within the catchment is the township of Illabo, however the catchment is predominantly farmland with areas used for pastureland or crops. There are major watercourse crossings of the railway at CH473+850km and CH466+500km.

A section of rail across both A2P and I2S is affected in the 1% AEP and PMF event. In the PMF event, the floodwaters from Billabong Creek affect the rail from CH465+223km to CH465+900km from the I2S Appendix D *'Revised Hydrology and Flooding Impact Assessment Report'* (2-0001-220-IHY-00-RP-002) (IRDJV, 2022). From this report the estimated afflux from the I2S and A2P works at this area in the 1% AEP event is between 0.01-0.05m. This occurs in land used for grazing and cropping with an afflux allowance of 200mm based on the CoA. The track changes within J2I in this area are less than 50mm. As such, the Billabong Creek Catchment would not cause non-compliance with J2I. The track design and construction of J2I is in advance of I2S, therefore a cumulative assessment cannot be done by the A2P contractor and should be done by the I2S contractor. This is discussed and stated in Section 1 'Limitations and Exclusions'.

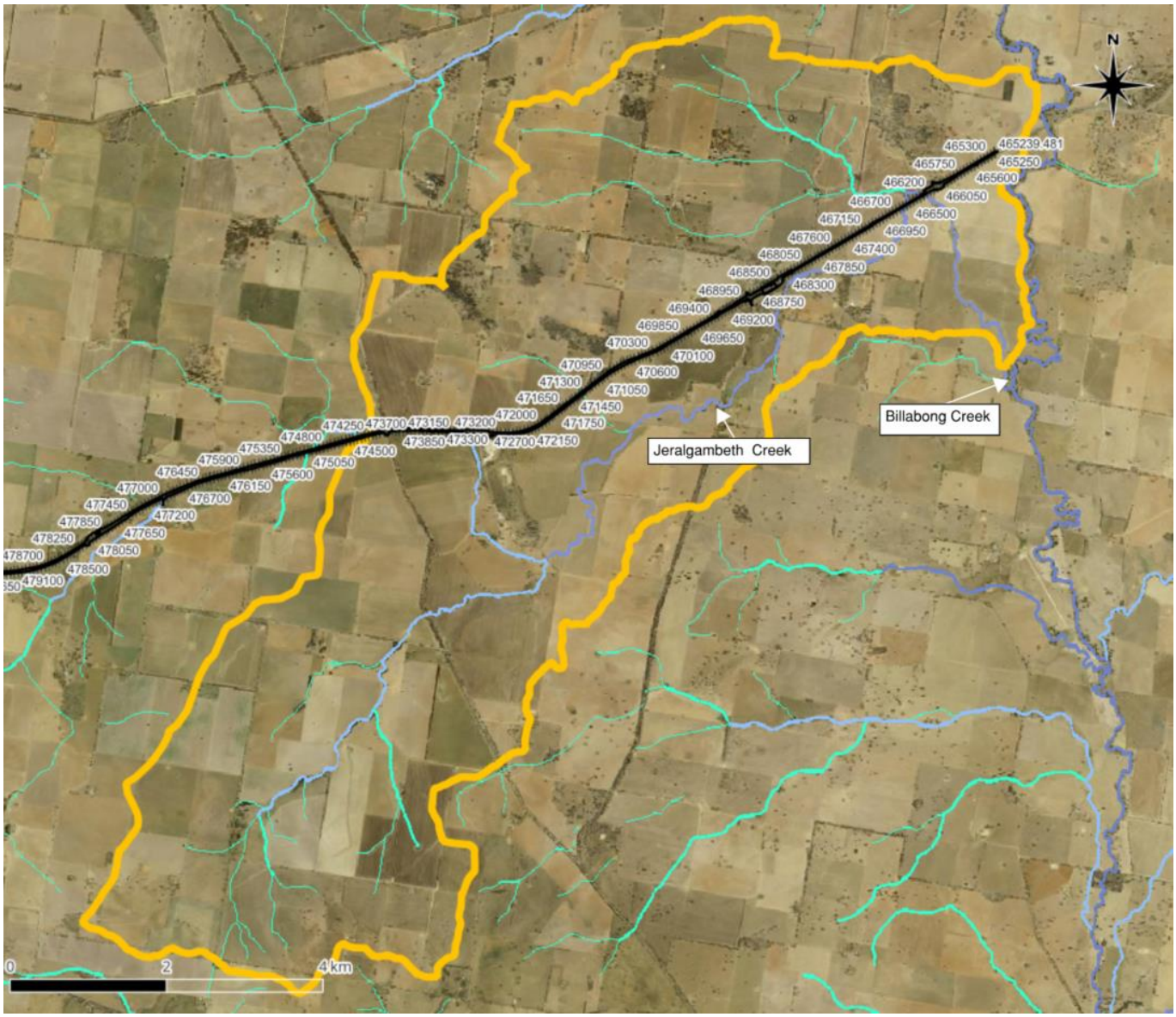

Figure 4-3: J2I-E Catchment

5 HYDROLOGIC MODELLING

5.1 Hydrologic Parameters

For consistency in the modelling across the two catchments the same hydrologic parameters were adopted between the two models, due to the similar topography, land use and vicinity of the catchments to each other. These are listed below in Table 5-1. The ARR data hub output and the BOM IFD data used in the modelling is supplied in Appendix C. J2I-W and J2I-E adopted different hydrologic modelling approaches due to the size and location of the catchments. This is detailed in Section 5.2.

Table 5-1: Model Hydrologic Parameters

Parameters	Value	Notes
Initial Loss	Probability Neutral Losses	ARR2019 Data Hub.
Continuing Loss	1.8mm/hr	ARR2019 Data Hub using NSW hierarchy of losses.
Impervious Losses	Initial Loss: 1 mm Continuing Loss: 0mm/hr	-
Event	1% + Climate Change, 1%, 2%, 5% and 10% AEP.	-
Rainfall	Accessed from BOM IFD from the catchment centroid.	Attached in Appendix C.
Climate Change Factors	20.2%	A Climate change factor of 20.2% was applied from the representative concentration pathway (RCP) 8.5, the Year 2090.
Duration	10min to 1440min	-
Temporal Pattern	10 Temporal Patterns from the Murray Basin region were used for each duration	As per ARR2019 guidelines.

Table 5-2 lists the hydrologic parameters used in the Probable Maximum Precipitation (PMP) across J2I-E and J2I-W.

Table 5-2: Model Hydrologic Parameters for PMP

Parameters	Value	Notes
Method	Generalised Short Duration Method (GSDM)	Applicable for size catchment and location.
Initial Loss	1 mm	-
Continuing Loss	0 mm/hr	-
Duration	30min to 360min	-
Temporal Pattern	11 Temporal Patterns for each duration	As per ARR2019 guidelines (Jordan et al and BOM TP's).

5.2 Hydrologic Model Setup

The hydrologic modelling for J2I-W and J2I-E varied between the catchments, due to the individual size of each. The flows for J2I-W were created using a rainfall-on-grid approach detailed in Section 5.2.1, the internal flows for the area within the J2I-E catchment were created using a RORB model

5.2.1 Junee to Illabo Western Model - Rainfall-on-Grid

A rainfall-on-grid (RoG) approach was chosen for this catchment as the site is not impacted by regional flooding, and the major catchment within the model is reasonable to model in a rainfall-on-grid approach (19.8km^2). RoG modelling also known as direct rainfall, is a technique for simulating rainfall-runoff by applying rainfall directly to each cell within a model

extent. A RoG modelling approach is applicable for this area of the works as the catchment is a discrete geographic area only impacted by rainfall patterns directly in the area feeding to and across the site. RoG was also applicable as it allows the modelling of hydraulic structures. The rail embankment and underbridge at CH476+988km is a significant hydraulic control to the catchment, decreasing the amount of flow travelling downstream. The flow at the downstream boundary of the RoG model was extracted and input as an inflow to the J2I-E hydraulic model.

Using the TUFLOW hydraulic model, an ensemble of duration and temporal patterns was run for each modelled AEP event, and a critical duration analysis was undertaken to determine the critical durations for the site area. These durations were then used for the flood assessment.

Flows derived at CH476+988km in the J2I-W are listed below in Table 5-3. The flows are compared against Regional Flood Frequency Analysis (RFFE) flows for the catchment, as seen below, the flows fall within the confidence limits of the catchment.

Table 5-3: Flow Comparison at CH476+988km

Design Event (AEP)	Flow approaching CH476+988km (RoG)	RFFE (Expected Value) (m^3/s)	RFFE (Lower Confidence Limit) (m^3/s)	RFFE (Upper Confidence Limit) (m^3/s)
10% AEP	56.5	21.32	4.39	93.61
5% AEP	75.6	33.7	6.65	146.24
2% AEP	96.3	53.3	9.28	249.63
1% AEP	117.8	70.1	10.85	364.28

5.2.2 Junee to Illabo Eastern Model - RORB

A RORB model was developed for J2I-E. RORB is a general runoff and streamflow routing program used to calculated flood hydrographs from rainfall and other channel inputs. The RORB model layout for J2I-E is shown in Figure 5-1. The flow path within the J2I-E catchment is generally from southwest to northeast towards the Billabong Creek on the east. The RORB parameters are summarised in Table 5-4.

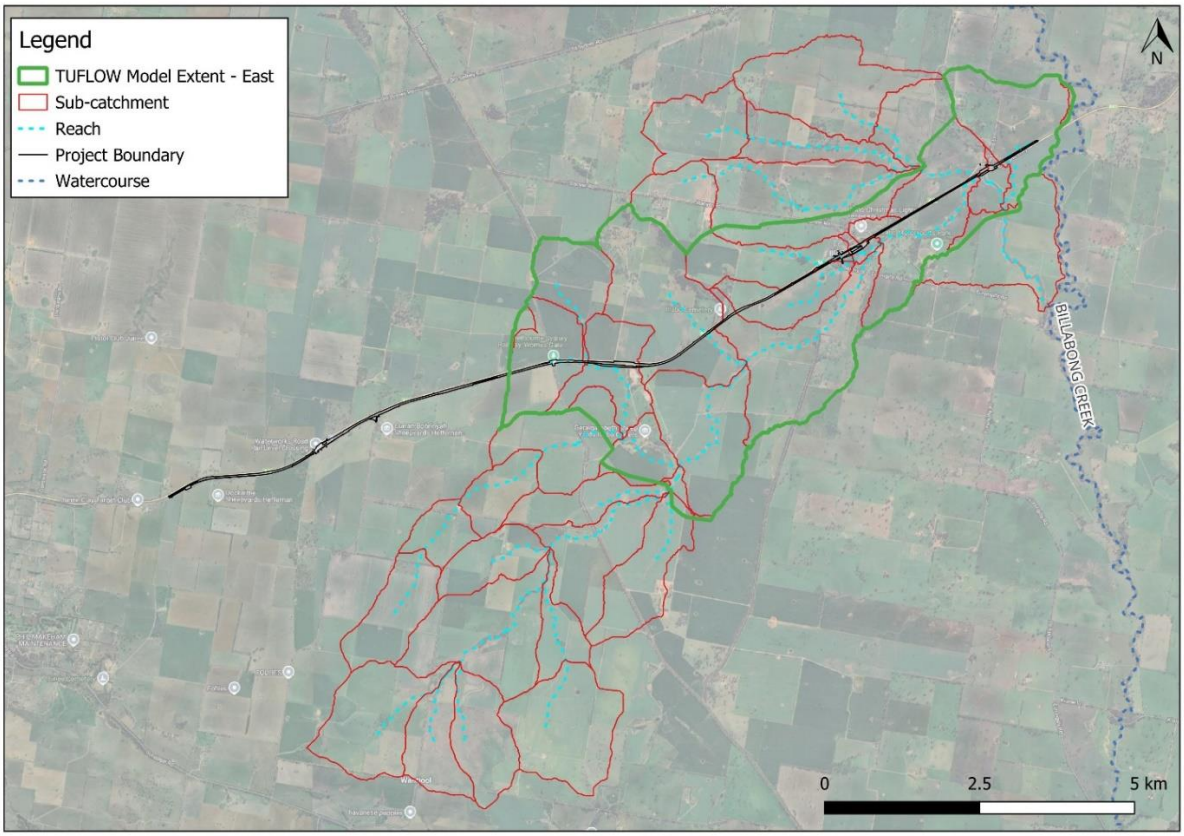

Figure 5-1: Junee to Illabo East RORB Model Layout

Table 5-4: J2I-E RORB Model Parameters

Parameters	Value
Hydrology model and version	RORBwin model (Version 6.52) using Storm injector HL(v1.4.0).
Kc Routing Parameter	10.89
m Value	0.8
Total Catchment Area	61.6 km^2
Impervious Area	Based off Aerial imagery
Sub-catchments	Derived from 5m LiDAR (item 2 in Table 1-2)
Reaches	Derived from 5m LiDAR (item 2 in Table 1-2)

A comparison was undertaken to assess the impact and sensitivity of the results to the Kc routing factor, by using the values from the 4 different equations used to derive this parameter from the 4 different methods (shown in Table 5-5). Each of these Kc values was run through RORB and Storm Injector to derive the peak flows for the 10%, 5%, 2% and 1% AEP events at the model outlet.

Table 5-5: Kc Parameters

Kc Value	Method, Equation
7.92	ARR2019, Equation 7.6.13
17.43	RORB manual, equation 2.5
12.93	Dyer (1994, Pearse et. al. 2002)
10.89	Yu (1989, Pearse et. al. 2002)

These values were then compared against the flows from the Regional Flood Frequency Analysis (RFFE) for the site (Table 5-6 and Figure 5-2). The flows derived from the Yu show good agreement with RFFE for 1% AEP and 2% AEP (Table 5-66), while a bit higher value than RFFE in 5% AEP and 10% AEP. However, in terms of the overall comparison, the Yu method shows the best agreement compared with other methods.

The external flows to the J2I-E catchment from the west were captured in the J2I-W TUFLOW RoG approach and were not needed to be included in the RORB modelling.

Table 5-6: Flow (m^3/s) Comparison at RORB Model Outlet

Events	Aus wide Yu (1989, Pearse et. al. 2002) *	Aus wide Dyer (1994, Pearse et. al. 2002)	ARR2019 Equation 7.6.13	RORB manual, equation 2.5	RFFE (Expected Value)
10% AEP	60.7	50.6	77.6	35.4	39.6
5% AEP	77.3	66.3	100.4	46.8	63.7
2% AEP	107.1	91.8	142.2	67.7	102.8
1% AEP	134.0	117.2	179.2	89.7	136.9

*Adopted Kc Parameter

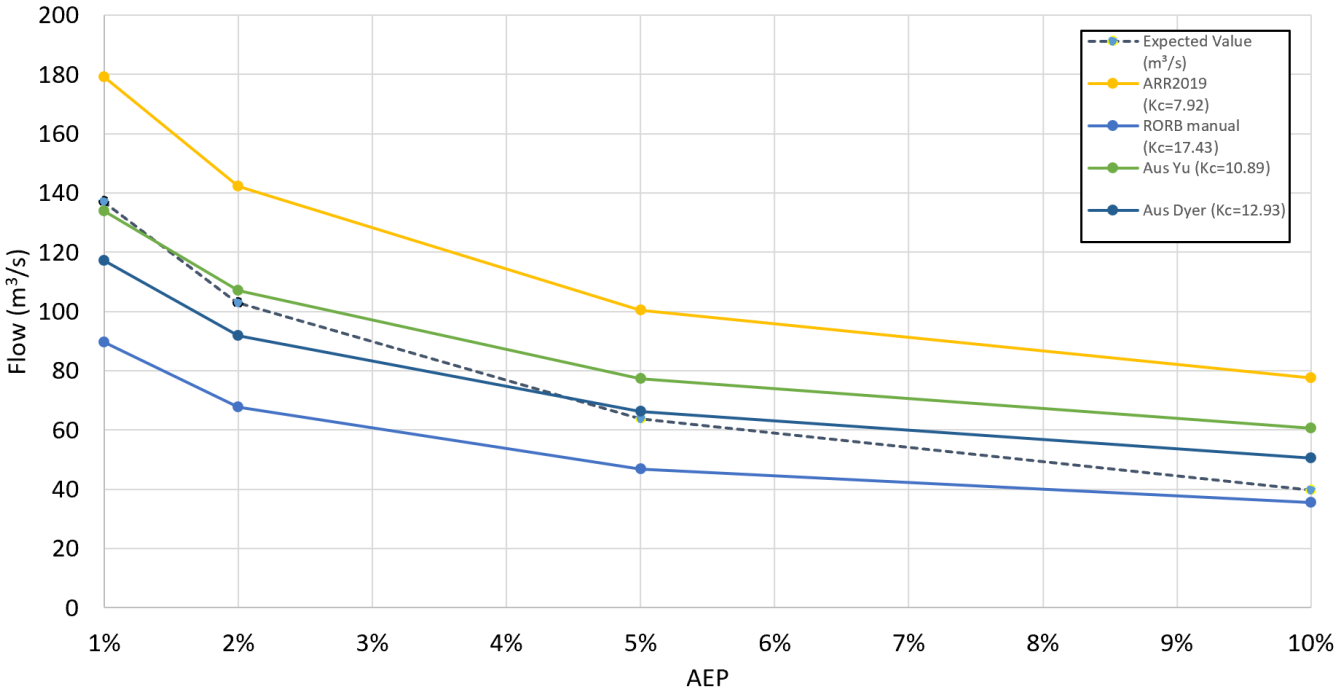

Figure 5-2: Peak Flow Comparison

6 HYDRAULIC MODELLING

The Junee to Illabo Dual Track Clearance consists of works over 15.4km of track. Two separate hydraulic models for the catchment of 34.5km^2 and 61.6km^2 were created for manageable run times. These models are referred to as Junee to Illabo West (J2I-W) and Junee to Illabo East (J2I-E).

TUFLOW, a hydrodynamic 1D/2D computer simulation software for flooding, urban drainage and coastal hydraulics was used for the hydraulic assessment across both J2I-W and J2I-E. TUFLOW is internationally recognised as the industry leader for hydraulic modelling accuracy, speed and efficiency. Details on the model setup of both J2I-W and J2I-E are detailed in Section 6.1. The extents of the two hydraulic models are shown in Figure 6-1. The model extents have been designed to overlap to allow for a transition area between the flows being extracted from the J2I-W and applied in the J2I-E while ensuring the complete catchment is covered in the model extent. The flow from the J2I-W model was extracted at a location where the flow was in a condensed flow path, to where the flow could be reapplied within the J2I-E simulating the same flood behaviour.

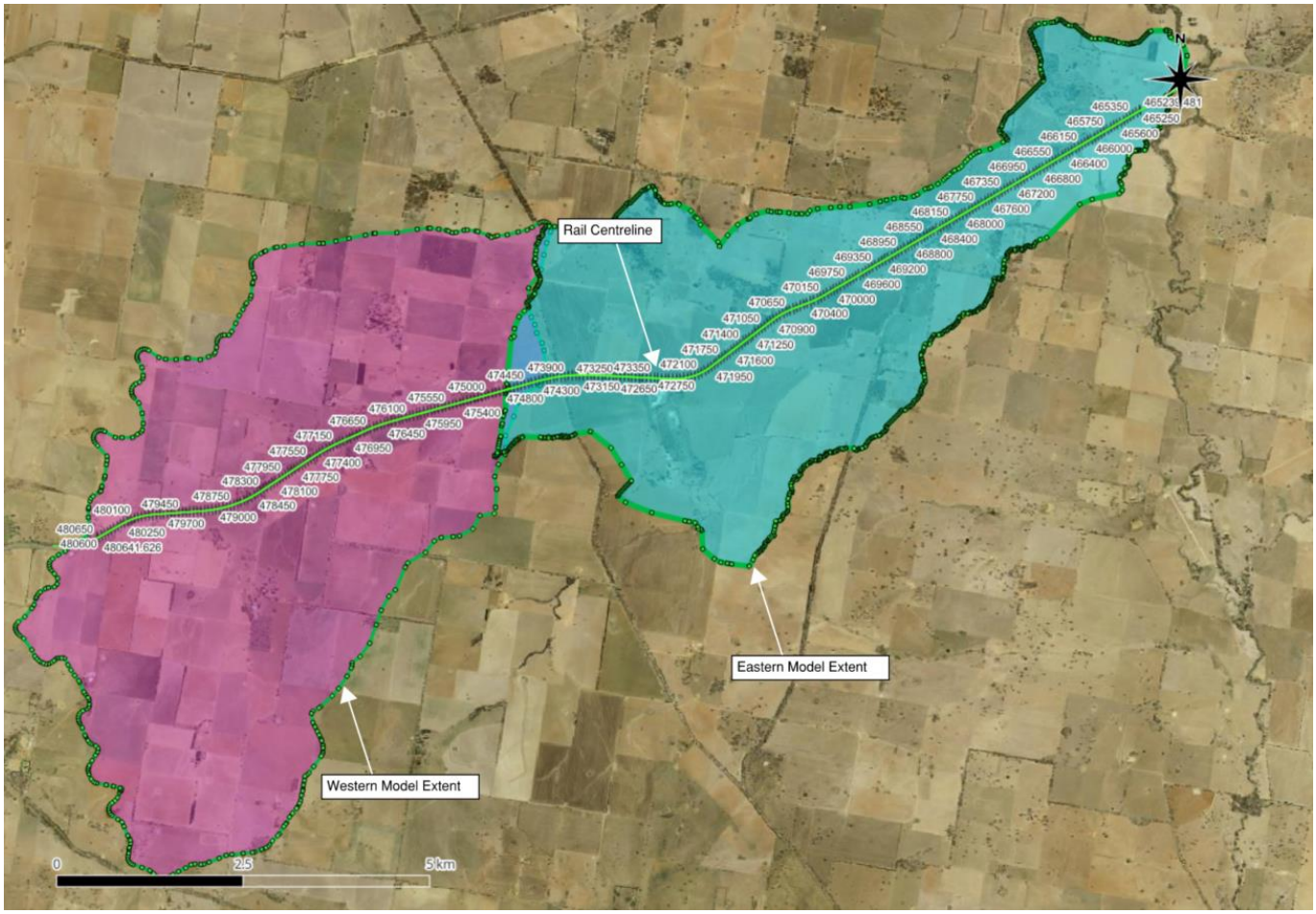

Figure 6-1: TUFLOW Model Extents

6.1 Hydraulic Model Setup

6.1.1 Junee to Illabo Western TUFLOW Model Setup

The TUFLOW hydraulic model for J2I-W was developed to assess the site for local catchment flooding. Table 6-1 describes the modelling setup for J2I-W. The input data that was used within the model is listed in Section 1.6.

Table 6-1: TUFLOW Model Setup of J2I-W

Parameter	Comment
TUFLOW Version	TUFLOW 2023-03-AC
Model Extent	CH480+650km to CH474+200km

Parameter	Comment
Adopted Grid Cell Size	2.5m for a buffered extent of the rail corridor using Quadtree, 10m for the greater catchment, applying sub-grid-sampling (SGS) of 5m.
Model Topography	Based on the 1m LiDAR supplied by Martinus, 5 m LiDAR from ELVIS was used in areas outside of the 1m LiDAR extent. Survey DEMs were provided for the rail corridor, including the rail embankment, in both the design and existing scenarios. The mosaic of the various topography DEMs used in the modelling can be seen in Figure 6-2.
Inflows	Rainfall-on-Grid applied with a 2d_rf layer across the entire model extent
Dams Initial Water Levels	All farm dams were assumed to be full as a conservative approach.
Drainage and Culverts	Culverts were modelled as 1d network elements with connections to the 2d domain via 2d_bc lines. A list of culverts in the model can be seen in Table 6-2.
Downstream Boundary Conditions	Set as HQ (head vs flow) boundary with a slope of 0.004 based on the slope of the local area.
Terrain Modifiers	Z-shapes were used to reinforce the top of rail and road along the rail line and Olympic highway.
Manning's Roughness	Manning's Roughness was set up based on aerial imagery to the categories below following ARR2019 guidance: Farms (pastureland/crops) – 0.045 Rail Embankment – 0.060 Streets/Roads – 0.022
Rainfall Losses	Rainfall losses were applied via the rainfall excess method (materials file). The losses for pervious and impervious areas are listed below. Pervious Losses – initial loss 27mm, continuing loss 1.8mm/hr Impervious Losses – initial loss 1mm, continuing loss 0mm/hr

The model DEMs used within the J2I-W model extent are shown in Figure 6-2.

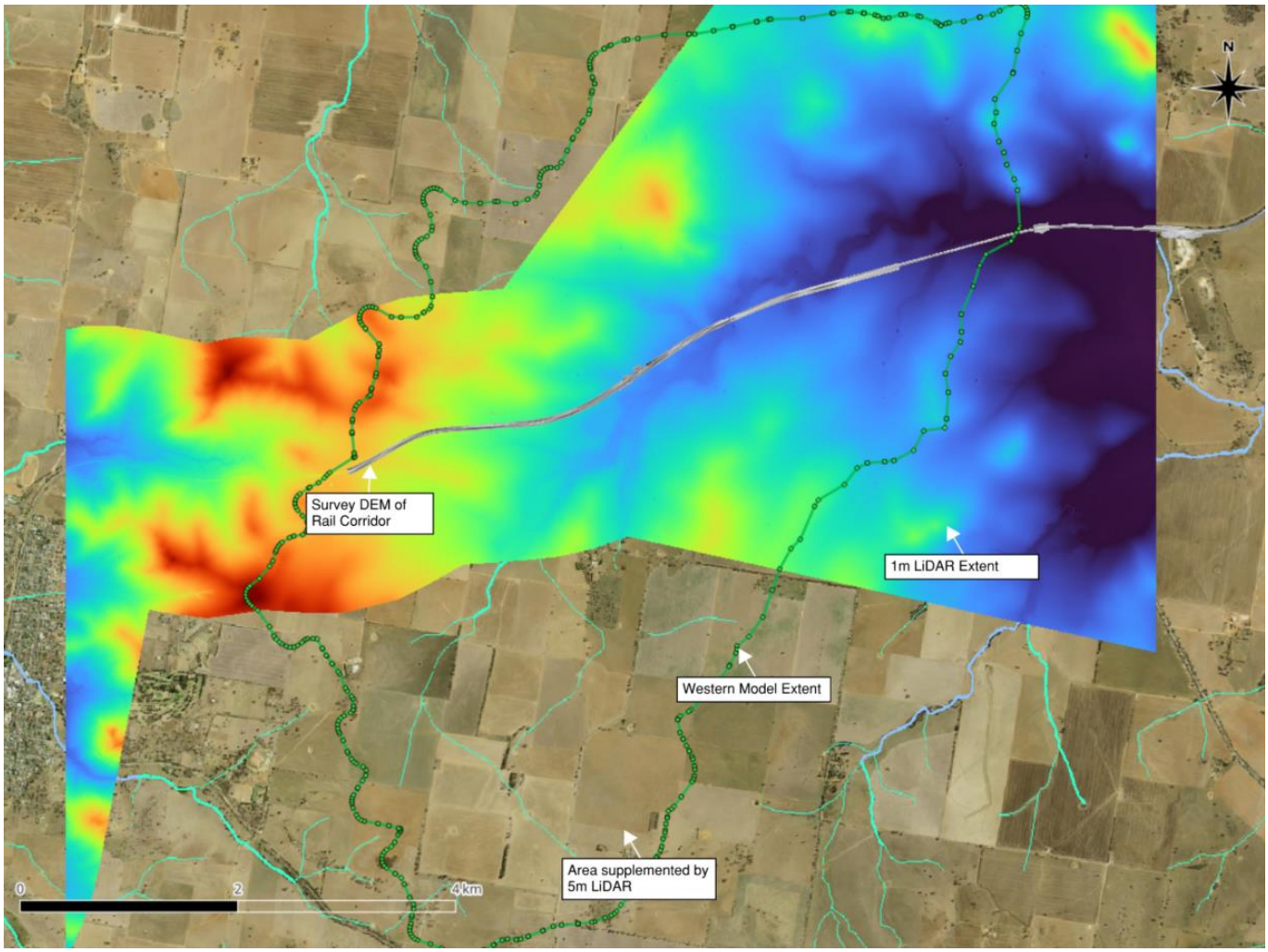

Figure 6-2: J2I-W Model Topography

6.1.1.1 Drainage Network

Survey of the rail length of the Junee to Illabo Dual Track Clearance was undertaken and the dimensions and inverts of the drainage features were recorded. The drainage elements were modelled as per the received survey. The existing drainage design is comprised of drains and channels as well as cross culverts through the rail and the Olympic Highway. Olympic Highway culverts within the J2I-W model were either surveyed or their dimensions were estimated from the available 1m LiDAR and aerial imagery. Detailed site survey of culverts in some discrete areas along the Olympic Highway was unavailable due to the steep embankment slopes posing health and safety risks. Survey of culverts in major flowpaths was undertaken. Table 6-2 lists the culverts included in the model. The location along the rail line is shown in Figure 6-3. If not stated otherwise, the culvert information within the model was received from the rail and feature survey.

Table 6-2: Modelled Culverts in the J2I-W TUFLOW model

Chainage (km)	Existing Culvert Dimensions	Design Culvert Dimensions
Rail Culverts		
CH476+023km	1/0.6m wide x 0.6m high RCBC	No change
CH476+325km	1/1.2m wide x 0.65m high RCBC	No change
CH476+988km	Based on the Reference Design drawings, the existing rail underbridge at CH476+988 has been modelled as a culvert with two openings. 1/6m wide x 2.1m high opening and 1/3.6m wide x 2.1m high opening.	3/2.8m wide x 2.1m high RCBC + 1/0.9m RCP

Chainage (km)	Existing Culvert Dimensions	Design Culvert Dimensions
Rail Culverts		
CH477+529km	1/1.2m wide x 0.6m high RCBC	No change
CH478+103km	1/3m wide x 0.8m high RCBC	No change
CH478+120km	1/0.9m wide RCP and 1/0.9m wide x 0.9m high RCBC	No change
CH478+607km	1/0.9m wide x 0.6m high RCBC	No change
CH478+757km	1/0.9m wide x 0.6m high RCBC	No change
CH479+301km	1/0.9m wide x 0.6m high RCBC	No change
CH479+465km	1/0.9m wide x 0.6m high RCBC	No change
CH480+169km	1/0.9m wide x 0.6m high RCBC	No change
Olympic Highway Culverts		
North of CH476+988km	5/1.25m wide x 0.9m high RCBC – received from survey	No change
North of CH477+300km	2/1.5m wide x 0.6m high RCBC (assumed from 1m LiDAR and aerial imagery)	No change
North of CH477+529km	2/0.375m RCP (assumed from 1m LiDAR and aerial imagery)	No change
North of CH478+607km	1/1.5m wide x 0.6m high RCBC (assumed from 1m LiDAR and aerial imagery)	No change
North of CH479+301km	1/1.5m wide x 0.6m high RCBC (assumed from 1m LiDAR and aerial imagery)	No change
North of CH479+465km	2/1.5m wide x 0.6m high RCBC (assumed from 1m LiDAR and aerial imagery)	No change
North of CH480+169km	3/0.45m RCP (assumed from 1m LiDAR and aerial imagery)	No change



Figure 6-3: J2I-W Rail Culvert Locations

6.1.2 Junee to Illabo Eastern TUFLOW Model

The TUFLOW model for J2I-E was created to assess the site for flooding in Jeralgambeth Creek and its surrounding tributaries. It includes an external inflow from the boundary of the J2I-E model into the western edge of the model. Table 6-3 lists the TUFLOW parameters used in the J2I-E model.

Table 6-3: J2I-E TUFLOW Parameters

Parameter	Comment
TUFLOW Version	TUFLOW 2023-03-AC
Model Extent	CH474+200km to CH465+250km
Adopted Grid Cell Size	2.5m for a buffered extent of the rail corridor using Quadtree, 10m for the greater catchment applying sub-grid-sampling (SGS) of 5m.
Model Topography	Based on 1m LiDAR supplied by Martinus. Survey DEMs were provided for the rail corridor, including the rail embankment, in both the design and existing scenarios. The mosaic of the various topography DEMs used in the J2I-E modelling can be seen in Figure 6-4.
External Inflows	2d_bc on the boundary of the model extent was used to apply external inflows to the TUFLOW model. This included the recorded inflows from J2I-W and the external inflows from the RORB model.
Internal Inflows	Point flows from the RORB model were applied across the entire applicable catchment via the Read GIS SA All command using 2d_sa layers.
Dams Initial Water Levels	All farm dams were assumed to be full as a conservative approach.

Parameter	Comment
Drainage and Culverts	Culverts were modelled as 1d network elements with connections to the 2d domain via 2d_bc lines. A list of culverts in the J2I-E model can be seen in Table 6-4.
Downstream Boundary Conditions	Set as HQ (head vs flow) boundary with a slope read from the terrain of the local area.
Terrain Modifiers	Z-shapes were used to reinforce the top of rail and road levels along the rail line and Olympic highway.
Manning's Roughness	Manning's Roughness were setup based off aerial imagery to the categories below following ARR2019 guidance: Farms (pastureland/crops) – 0.045 Rail Embankment – 0.060 Streets/Roads – 0.022 Watercourses – 0.050
Rainfall Losses	Rainfall losses were applied to the rainfall in the RORB modelling and were not applied in the TUFLOW model.

The model DEMs used within the J2I-E model extent is shown in Figure 6-4.

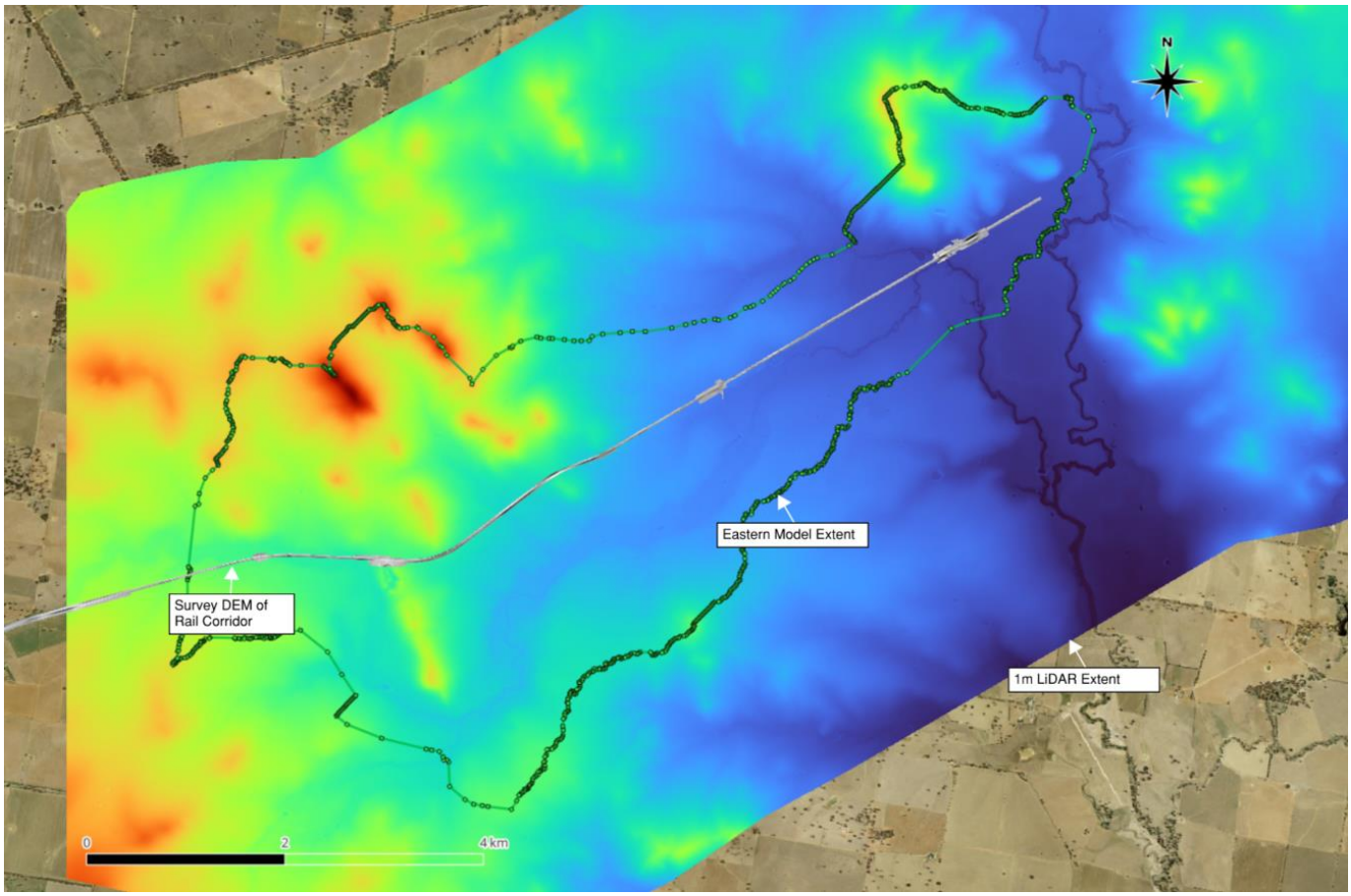

Figure 6-4: J2I-E Model Topography

6.1.2.1 Drainage Network

Survey of the rail length of the Junee to Illabo Clearances was undertaken, and the dimensions and inverts of the drainage features were recorded. The drainage elements were modelled as per the received survey. The existing drainage design is comprised of drains and channels as well as longitudinal culverts through the rail and the Olympic Highway. Olympic

Highway culverts within the J2I-E model were either surveyed or their dimensions were estimated from the available 1m LiDAR and aerial imagery. The list of culverts used within the model and their locations can be seen in Table 6-4 and Figure 6-5. If not listed, the drainage infrastructure within the model was received via survey.

Table 6-4: Culverts within the J2I East Model

Chainage (km)	Existing Culvert Dimensions	Design Culvert Dimensions
Rail Culverts		
CH465.523	2/1.27m wide x 0.6m high RCBC	No change
CH465.841	1/2.52m wide x 0.6m high RCBC	No change
CH466.32	3/1.8m wide x 1.8m high RCBC	No change
CH467.073	1/0.6m wide x 0.45m high RCBC	No change
CH468.404	1/0.45m wide RCP	No change
CH468.261	1/0.6m wide x 0.45m high RCBC	No change
CH468.908	1/4.28m wide x 0.9m high RCBC	No change
CH469.090	1/1.85m wide x 0.95m high RCBC	No change
CH469.370	1/1.2m wide x 0.6m high RCBC	No change
CH469.792	1/1.2m wide x 0.6m high RCBC	No change
CH470.396	1/1.8m wide x 1.8m high RCBC	No change
CH471.354	1/1.2m wide RCP	No change
CH471.649	1/0.6m wide x 0.6m high RCBC	No change
CH471.950	1/0.6m wide x 0.6m high RCBC	No change
CH472.406	1/0.6m wide x 0.6m high RCBC	No change
CH473.033	1/1.54m wide x 1.54m high RCBC	No change
CH473.413	1/0.825m wide RCP	No change
CH473.710	9/3.8m wide x 1.2m high RCBC	No change
CH474.256	2/1.2m wide x 1.2m high RCBC	No change
Level Crossing Culverts		
LX603 Pipe 1 (south side of rail)	1/0.375m wide RCP	Upgraded to 1/0.45m wide RCP
LX603 Pipe 2 (north side of rail)	No pipe in the existing case.	1/0.45m wide RCP
Olympic Highway Culverts		
North of CH471.354	3/0.6m wide RCP	No change
North of CH470.396	1/0.6m wide RCP	No change

Chainage (km)	Existing Culvert Dimensions	Design Culvert Dimensions
North of CH469.370	2/0.45m wide RCP	No change
North of CH469.250	1/1m wide x 0.3m high RCBC	No change
North of CH469.090	1/1.6m wide x 0.3m high RCBC	No change
North of CH469.000	1/0.3m wide x 0m high RCBC	No change
North of CH468.900	1/1.4m wide x 0.45m high RCBC	No change
North of CH472.406	3/0.6m wide x 0.6m high RCBC (the dimensions of this culvert was estimated from 1m Aerial and LiDAR)	No change
North of CH473.710	9/3m wide x 0.6m high RCBC	No change
North of CH468.260	3/0.45m wide RCP	No change
North of CH473.500	1/0.375m wide RCP	No change
North of CH473.100	1/0.45m wide RCP	No change
North of CH474.000	1/0.3m wide RCP	No change
North of CH466.350	1/4m wide x 2.4m high RCBC	No change
North of CH466.100	1/0.45m wide RCP	No change

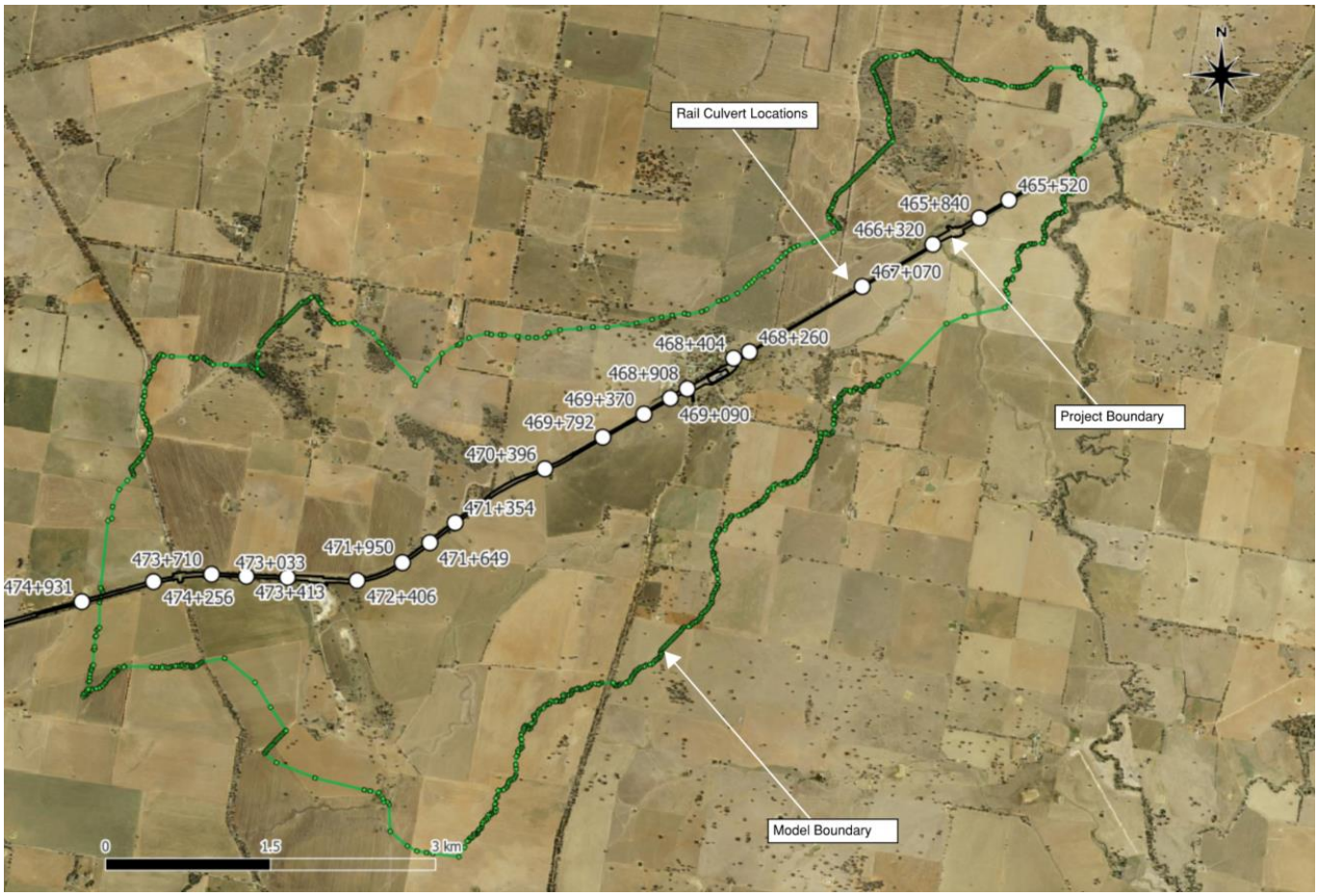

Figure 6-5: Location of Culverts within J2I-E

6.2 Design Events

The TUFLOW hydraulic model was run for the 10%, 5%, 2%, and 1% AEP design events, 1% AEP + climate change and PMF. Both J2I-E and J2I-W were run in an ensemble approach, with all 10 temporal patterns simulated for the durations of 30 minutes to 24 hours as per ARR2019 guidelines. From this ensemble approach, the median of each duration was identified, and the maximum of these medians was taken to identify the critical duration and storm. As the rail line is a linear piece of infrastructure that crosses different sized tributaries and flowpaths throughout the catchment, there are multiple critical durations for the Junee to Illabo Dual Track Clearance Package. This is particularly the case for the J2I-E model extent due to the major flowpath Jeralgambeth Creek travelling parallel to the rail. Whereas within J2I-W the majority of the flow from the catchment travels perpendicular to the rail and ponds behind the rail embankment. The list of critical durations for both J2I-E and J2I-W are listed below in Table 6-5.

Table 6-5: J2I Rail Critical Durations

Design Events	J2I-W Critical Duration	J2I-E Critical Duration
10% AEP	120min	120min, 180mim, 540min, 720min
5% AEP	120min	120min, 180mim, 540min, 720min
2% AEP	360min	30min, 60min, 180min, 360min
1% AEP	90min	45min, 60min, 180min, 360min
1% AEP + Climate Change	60min	45min, 60min, 180min, 270min, 360min
PMF	90min	15min, 45min, 60min, 90min, 240min, 300min

An example of the different durations within the J2I-E model extent is seen in Figure 6-6.

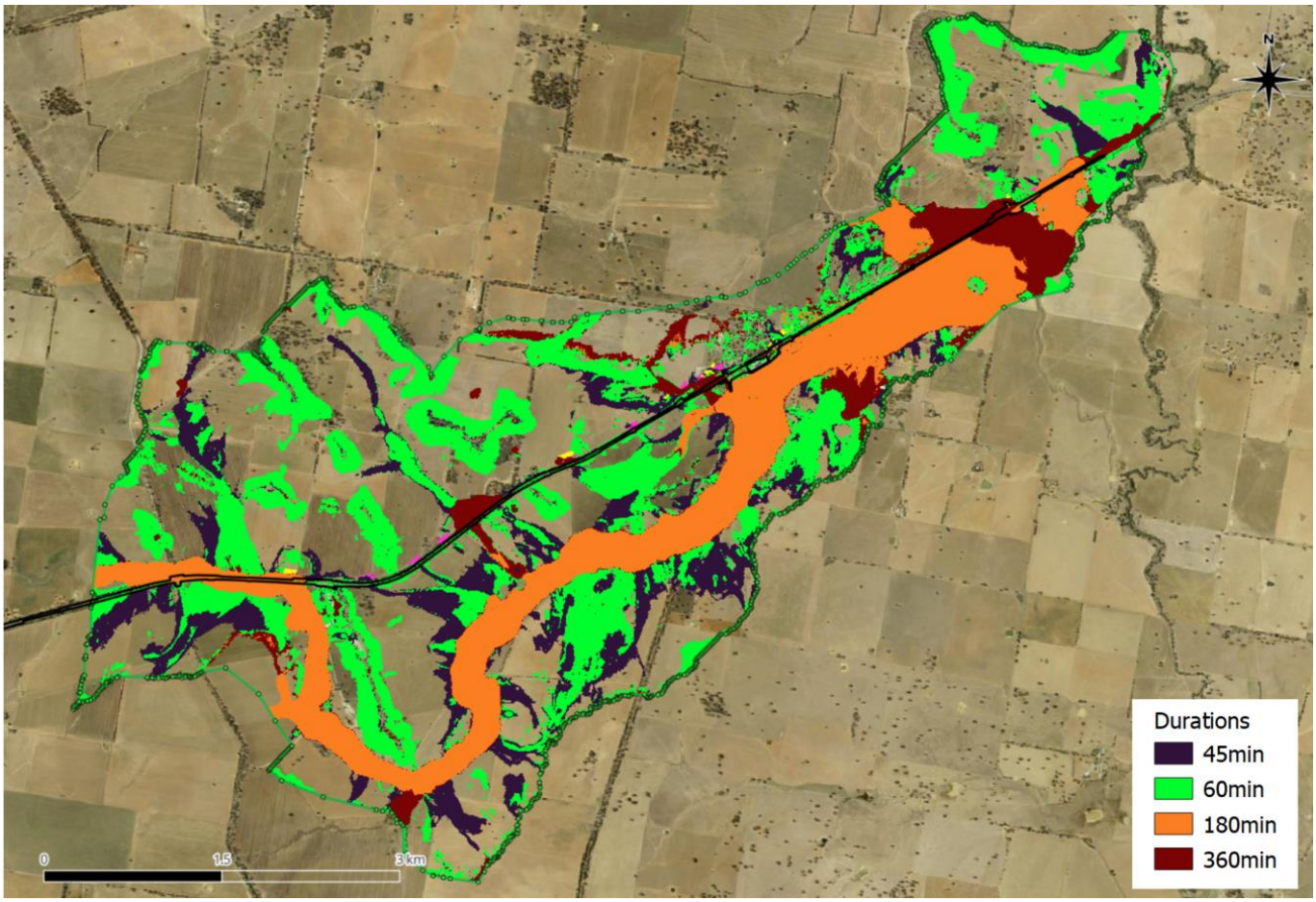

Figure 6-6: 1% AEP Critical Durations for J2I-E

6.3 Design Model Update

For the J2I-W and J2I-E the TUFLOW models were updated for the proposed IFC design of the rail conditions. This consisted of the rail design, which was represented as break lines to reinforce the overtopping level of the rail, and DEMs for the rail formation and capping layer. The typical rail lift across the J2I package was 50 to 60mm as a results of the track slews, the slews were less than 300mm across the package so DEMs for the rail ballast and formation for the length of works were not provided, as the changes in these locations from the existing design are minimal. Ballast and formation DEMs were only provided at level crossings and locations of culvert works within the model extents. The data used for the design model is listed in Section 1.8 above.

For J2I-E, no track changes were made between CH472+420km and CH474+450km as this falls within the scope of works for the level crossing LX 605 / LX 1472 package (Package J10), which has yet to finalise the design process. As part of the J10 design process, the design works will be assessed in the model.

In some areas, extra drainage or culverts were added or modified, the entire list of modelled culverts can be seen in Table 6-2 and Table 6-4. A summary of the culverts that have been modified in the design is listed in Table 6-6.

Table 6-6: Changes in Rail Culverts

Chainage (km)	Existing Culvert Dimensions	Design Culvert Dimensions
CH476+988km	Based on the onsite inspection of the structure as part of the design, and recent survey of the underbridge, the existing rail underbridge at CH476+988 has been modelled as a culvert with two openings. 1/6m wide x 2.1m high opening and 1/3.6m wide x 2.1m high opening.	3/2.8m wide x 2.1m high RCBC + 1/0.9m RCP
LX603 Pipe 1 (south side of rail)	1/0.375m wide RCP	Upgraded to 1/0.45m wide RCP

Chainage (km)	Existing Culvert Dimensions	Design Culvert Dimensions
LX603 Pipe 2 (north side of rail)	No pipe in existing case.	1/0.45m wide RCP

6.4 Climate Change

There are no design criteria to assess flood impacts in a climate change scenario. Therefore, a sensitivity assessment was conducted to anticipate future climate change flood risk. As per the EIS report (Section 3.3.5 of Albury to Illabo Environmental Impact Statement Technical Paper 11), the 2090 RCP8.5 interim climate change factor sourced from the ARR Data Hub (https://data.arr-software.org/) was adopted. The use of the 2090 RCP8.5 interim climate change factor is associated with a 20.2% increase in design rainfall.

6.5 Blockage Assessment

A hydraulic blockage assessment was carried out for the 1% AEP design scenario as per ARR2019 blockage guidelines. The assessment involved assessing the site area for debris availability, mobility, and transportability. In conjunction with this, the size of each individual culvert was used to determine the blockage factors applicable. For all culverts outside of the project area a consistent blockage of 20% was applied. The culvert blockage parameters adopted are seen below in Table 6-7.

Table 6-7: Blockage Parameters Adopted for the 1% AEP Event

Debris Availability	Debris Mobility	Debris Transportability	Blockage Width Less than 1.8m	Blockage Width Greater than 1.8m
Low	Low	Medium	25%	0%

7 FLOOD IMPACT AND IMMUNITY ASSESSMENT

7.1 Existing Conditions

7.1.1 Junee to Illabo Western Model Existing Conditions

In existing conditions, the rail line acts like an embankment blocking flows from the catchment to the south and creating ponding upstream of the rail line. With the existing rail levels the rail embankment is overtopped in the smallest modelled event, the 10% AEP. In the 1% AEP event the flood levels reach up to 313.79mAHD behind the rail line with depths of up to 2.5m. Floodwater velocities are high in this region and reach up to 2.9m/s on the Olympic Highway downstream of the culvert at CH476+988, flood hazard is high, reaching up to H5 (Unsafe for vehicles and people, All building types vulnerable to structural damage, Some less robust building types vulnerable to failure), on the Olympic Highway downstream side of the culverts in the 1% AEP event.

Figure 7-1 shows the 1% AEP event flood depths in the existing conditions and the reporting locations used within this report. Flood mapping of the existing conditions for J2I-W can be seen in Appendix A.

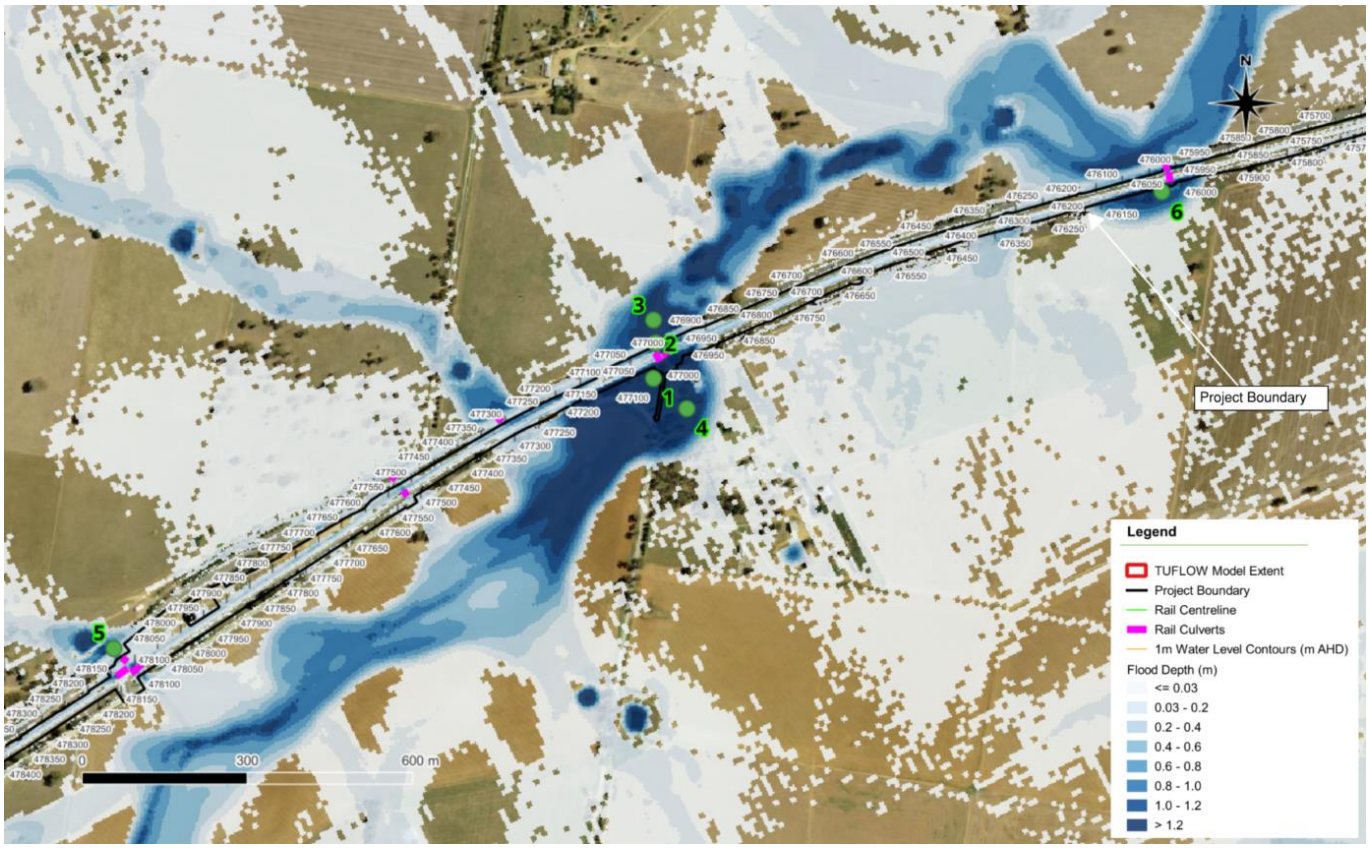

Figure 7-1: Reporting Locations - 1% AEP Existing Conditions Flood Depths

The reporting locations are described in Table 7-1.

Table 7-1: Reporting Location Description

Reporting Location	Description
1	Upstream of the underbridge structure at CH496+988km where the land use is grazing native vegetation
2	On the Olympic Highway downstream of the underbridge structure CH496+988km
3	Downstream of the Olympic Highway where the land use is cropping
4	Upstream of the underbridge structure at CH496+988km where the land use is Residential and farm
5	On the Olympic Highway Upstream of the Level Crossing 606 at CH478+145km
6	Upstream of the rail culvert at CH476+023km

The majority of the flow approaching the crossing at CH476+988km comes from the catchment to the south of the rail line. There are portions of the catchment that contribute to flow at CH476+988km that come from the north of the rail alignment. These cross the rail line, travelling north to south at CH477+300km and CH478+100km, and join the major flow path, which travels from the south to CH476+988km. The flow approaching the culvert at CH476+988km is listed in Table 7-2 for the modelled events. CH476+988km is a natural low point and the rail alignment grades up towards the east.

When the rail line is overtopped in the 10% AEP event, floodwaters travel along the rail formation between the two rail centrelines. There is a buildup of floodwaters behind the culvert at CH476+023km from this flow, which also has its own local catchment. A portion of floodwaters continue onward to the east trapped in the rail formation.

Table 7-2: Flow towards Culvert at CH476+988

Design Event	Flow (m^3/s)
1% AEP	117.8
2% AEP	96.3
5% AEP	75.6

The existing condition flood behaviour is discussed in Table 7-3 to Table 7-6.

Table 7-3: Overtopping Locations – Existing Conditions in the J2I-W Model

Design Events	Flood Levels
10% AEP	▪ The floodwaters overtop the rail at CH477+300km and at LX606
5% AEP, 2% AEP, 1% AEP, 1% AEP plus Climate Change	▪ The floodwaters overtop the rail at CH496+988km, CH477+300km and at LX606

The rail is overtopped in the smallest modelled AEP event (10% AEP). The major flowpath location is at the underbridge structure at CH496+988km. This overtops in the 5% AEP event. Overtopping occurs further to the west of the rail line at CH477+300km and at LX606 which is located at CH478+145km in the 10% AEP event. The flood depths at the reporting locations are listed in Table 7-4. Locations 1 and 4 have the highest depths indicative of the ponding behind the rail embankment at CH496+988km. The overtopping depths at the Olympic Highway LX606 remain shallow, less than 0.3m in events up to the PMF as the size of the catchment is much smaller than that approaching the main crossing at CH496+988.

Table 7-4: Reporting Locations - Peak Flood Depths (m)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	2.2	2.5	2.7	2.8	2.9	4.4
Location 2	0.3	0.3	0.4	0.4	0.5	2.7
Location 3	1.1	1.2	1.3	1.5	1.6	4.1
Location 4	1.6	1.9	2.1	2.2	2.3	3.8
Location 5	0.2	0.2	0.2	0.3	0.3	0.6
Location 6	0.6	0.8	0.9	1.2	1.4	3.0

Flood velocities upstream and downstream of the rail are shown in Table 7-5. Generally, there are lower velocities upstream of the rail as the floodwaters are slowed by the hydraulic control of the rail embankment. Once floodwaters have crossed the rail line, the velocities increase in the rail corridor between the rail line and Olympic Highway. The peak flood velocity occurs downstream of the CH476+988km underbridge as the flow path is condensed through this crossing, the flood velocity on the Olympic Highway downstream of this location is high with velocities of 2.9 m/s in the 1% AEP event.

Table 7-5: Reporting Locations - Flood Velocities (m/s)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	0.4	0.4	0.4	0.4	0.5	2.0
Location 2	2.2	2.6	2.8	2.9	3.1	3.7

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 3	0.6	0.6	0.7	0.8	0.9	2.0
Location 4	0.4	0.4	0.4	0.4	0.5	1.3
Location 5	0.3	0.4	0.4	0.5	0.6	1.5
Location 6	0.1	0.1	0.1	0.1	0.2	0.2

The flood hazard indicates the level of danger from flooding. This 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 and table below describe the flood hazard at the site.

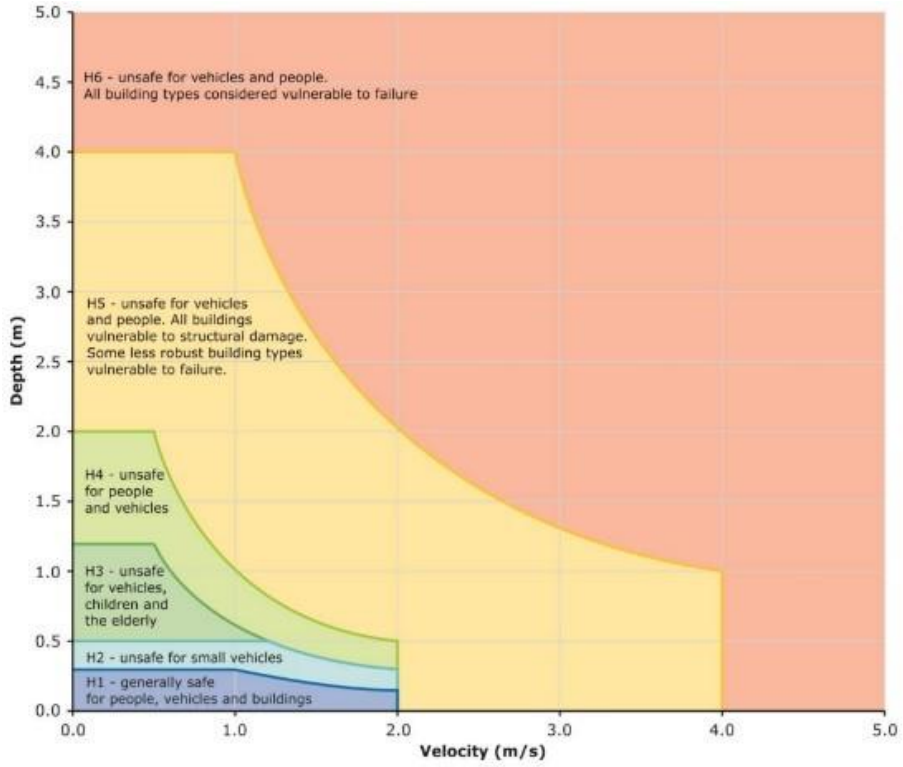

Figure 7-2: ARR Flood Hazard

The flood hazard upstream and downstream of the rail at CH496+988km is high varying between H4 and H5 due to the high flood depths and velocities. The flood hazard at Location 5 and Location 6 are lower as there are less flows coming to these locations. The flood hazard at Location 5 at LX606 remains at H1 due to relatively smaller depths until the PMF event.

Table 7-6: Reporting Locations - Flood Hazard (ARR2019)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	H5	H5	H5	H5	H5	H6
Location 2	H5	H5	H5	H5	H5	H6
Location 3	H4	H4	H4	H5	H5	H6
Location 4	H4	H4	H4	H5	H5	H6
Location 5	H1	H1	H1	H1	H1	H4
Location 6	H3	H3	H3	H3	H4	H5

7.1.2 Junee to Illabo Eastern Model Existing Conditions

In the existing conditions, the major flow path in Jeralgambeth Creek through the J2I-E model travels parallel to the rail line. The tributaries that feed into Jeralgambeth Creek from the northern side of the catchment cross the rail line which acts like an embankment holding back flows and overtopping at sections. The major flow paths to the rail occur at CH473+450km, CH471+150km, and CH466+250. There is also a minor flow path that travels along the border of Illabo and crosses the rail at CH469+300km. The flood immunity of the rail, flood depths, velocities and hazard are discussed further in this section. Reporting locations are used within this report to highlight key areas within the model extent. Figure 7-3 shows the 1% AEP event flood depths in the existing conditions and the reporting locations used within this report for this model.

Flood mapping of the existing conditions for J2I-E can be seen in Appendix B.

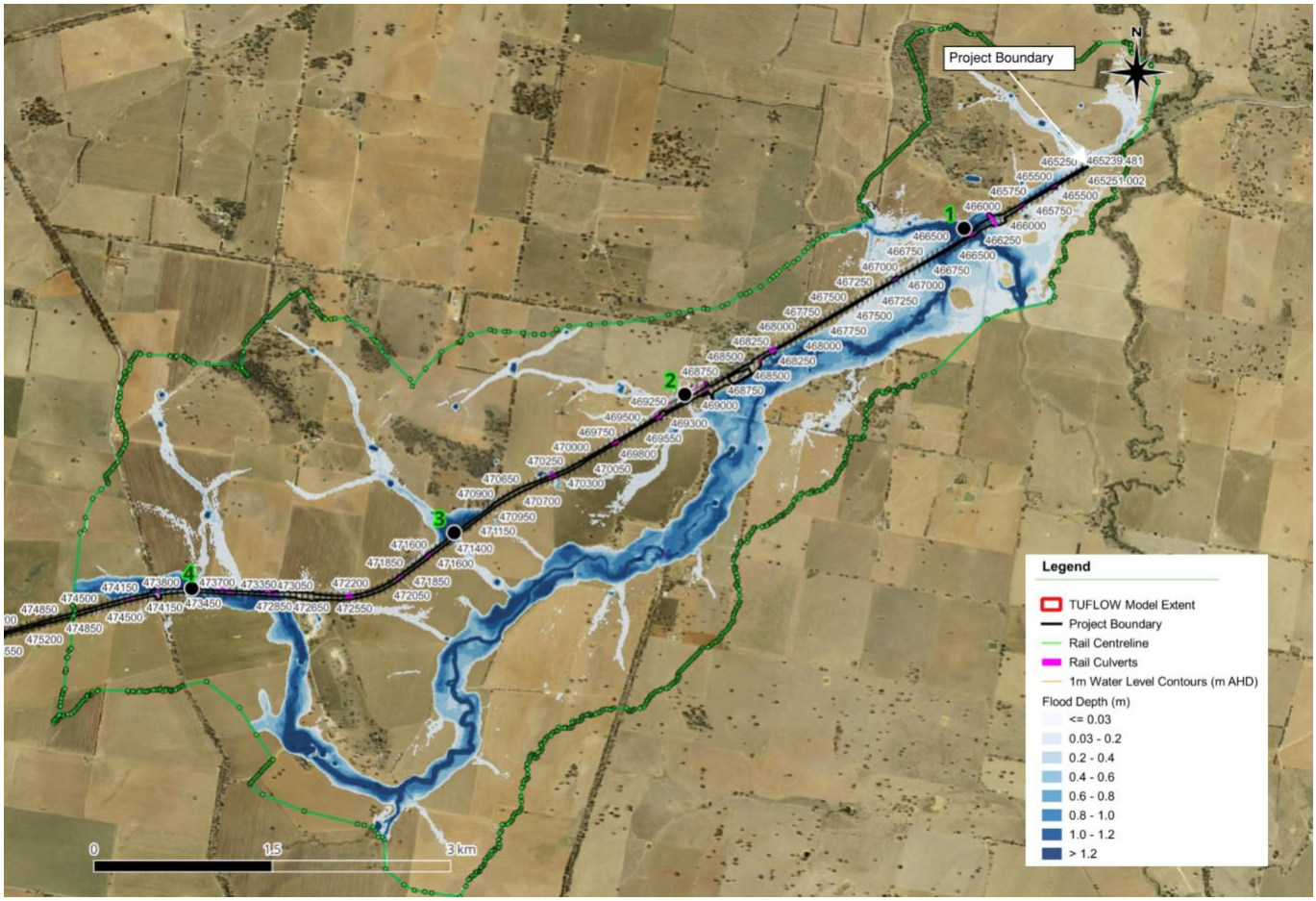

Figure 7-3: J2I-E Reporting Locations - 1% AEP Existing Conditions

An explanation of the reporting locations is provided in Table 7-7.

Table 7-7: Reporting Locations within J2I-E

Reporting Location	Description
1	On the Olympic Highway upstream of the major rail crossing at CH466+320km. 250m west of LX603
2	On the Olympic Highway in the flowpath that approaches Illabo, north of the rail culvert at CH469+090km, 200m west of LX604.
3	On the Olympic Highway at a location where a tributary approaches the rail, upstream of the culvert crossing at CH471+354km.
4	On the Olympic Highway upstream of the bank of rail culverts at CH473+710km, 1km west of LX603.

The existing condition flood behaviour is discussed in Table 7-8 to Table 7-11.

Table 7-8: Overtopping Locations - Existing Conditions in the J2I-E Model

Design Events	Flood Levels
10% AEP and 5% AEP events	▪ The floodwaters overtop the rail at CH473+413km (Reporting Location 4)
2% AEP and 1% AEP events	▪ The floodwaters overtop the rail at CH473+413km culvert (Reporting Location 4). ▪ The floodwaters overtop the rail at the CH466+320km culvert (Reporting Location 1).

The rail extent in the J2I-E model is overtopped in the smallest modelled AEP event (10% AEP). The major overtopping location is near reporting location 4, where the major flow path crosses the rail. Overtopping also occurs in the 2% and 1% AEP events near reporting location 1, where the major flow path crosses the rail. LX603 near reporting location 1 is not flooded until the 1% AEP + climate change, however the highway leading to it is inundated in the 2% AEP. LX604 and the Olympic Highway near Illabo at location 2 will not be flood affected until the PMF event. The flood depths at the reporting locations are listed in Table 7-9. Locations 1 and 3 have the highest depths on the Olympic Highway.

Table 7-9: Reporting Locations – Existing Conditions Peak Flood Depths (m)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	0.2	0.5	0.9	1.2	1.3	3.2
Location 2	Not flood affected	Not flood affected	Not flood affected	Not flood affected	Not flood affected	0.4
Location 3	0.9	1.1	1.4	1.7	2.1	3.0
Location 4	0.3	0.4	0.7	0.9	1.1	3.7

Flood velocities upstream and downstream of the rail are shown in Table 7-10. Generally, the velocity ranges between 0 and 2m/s when the Olympic Highway is flooded. The velocities remain low in these areas due to the Highway being on the upstream side of the rail embankment, where floodwaters have ponded behind the rail.

Table 7-10: Reporting Locations - Existing Conditions Flood Velocities (m/s)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	0.7	1.0	1.2	1.2	1.3	2.2
Location 2	Not flood affected	Not flood affected	Not flood affected	Not flood affected	Not flood affected	1.2
Location 3	0.4	0.4	0.4	0.4	0.4	0.7
Location 4	1.5	1.6	1.6	1.6	1.6	3.0

The flood hazard along the rail line and Olympic Highway is shown in Table 7-11. In smaller events like the 10% and 5% AEP, the flood hazard ranges between H3 and H1. For larger events, such as the 2% AEP and the 1% AEP, the flood hazard increases and ranges between H3 and H5. Location 4 is the most high-risk location in terms of flood risk, with it reaching H5 in the 2% AEP event.

Table 7-11: Reporting Locations - Flood Hazard (ARR2019)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	H1	H2	H3	H4	H4	H6
Location 2	Not flood affected	Not flood affected	Not flood affected	Not flood affected	Not flood affected	H2
Location 3	H3	H3	H4	H4	H5	H5

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 4	H2	H2	H5	H5	H5	H6

7.1.3 Comparison With EIS Existing Condition

Based on the results above, it was found that culverts at CH469+370km, CH469+792km, CH472+406km had the immunity similar to that listed in the EIS assessment and were not overtopped in the 1% AEP + Climate Change. The underbridge at CH476+988km was found to overtop in events greater than the 10% AEP. The immunity of these culverts in the EIS is listed in Table 1-1.

7.2 Design Conditions

7.2.1 Junee to Illabo Western Model Design Conditions

The design condition hydraulic modelling incorporated raising the rail tracks in addition to the new design culvert (3/2.8m wide x 2.1m high RCBC and 1/0.9m RCP) at CH476+988km. No changes were made to the track ballast and capping layers along the rail at CH476+988km, and as the track slew is less than 300 mm in this area, no rail formation design DEM was created.

The design conditions for flood depths are similar to the existing conditions, with increases up to 40mm due to the raised rail levels in the 1% AEP event. The rail line is overtopped from the smallest modelled event (10% AEP). In the 1% AEP event, the floodwaters reach up to 313.83mAHD with depths up to 2.9m. Similar to existing conditions at the culvert at CH476+988km in the 1% AEP event, flood hazard (velocity x depth) is high, reaching up to H5 (Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure) downstream and upstream of the culvert in the 1% AEP event. These findings for design conditions flood behaviour are similar to the simulated existing conditions.

As the rail line is nominally raised to enable construction of the lateral slew, there is an increase in the transfer of flows along the rail alignment to the culvert at CH476+023km (Reporting Location 6). Floodwaters are transferred along the rail alignment towards the east. The flood depths in the 1% AEP event for the design conditions are presented in Figure 7-4. The tables below discuss in detail the differences in flooding between design conditions and existing conditions. Flood mapping of the depths, hazard, and velocity for the design conditions is provided in Appendix A.

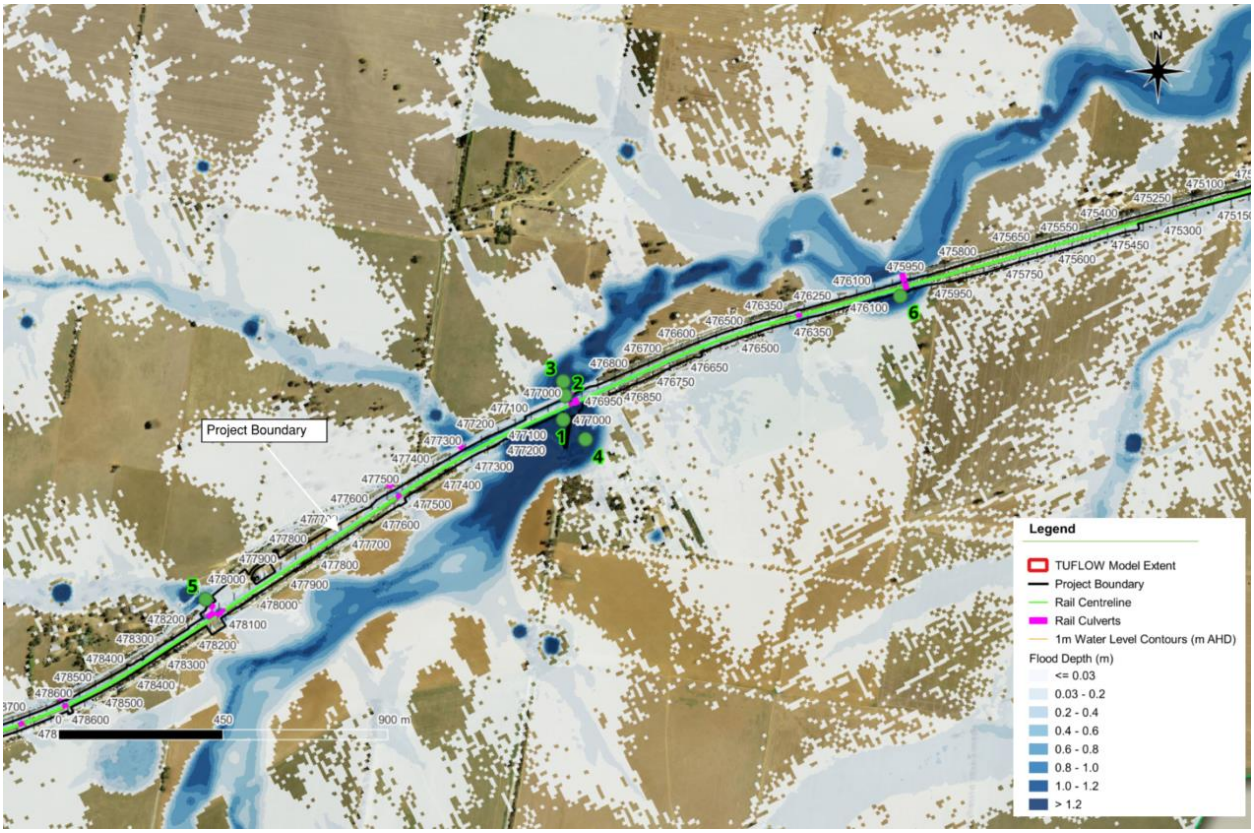

Figure 7-4: Design Conditions Flood Depths – 1% AEP Event

The rail is overtopped in all modelled events at CH477+300km-between CH477+300km and CH476+988km is the main area of overtopping due to the catchment size at this area and it being a low point relatively in the rail. With the raise in rail levels as LX606 the rail crossing is not overtopped until the PMF event. Table 7-12 refers to the overtopping locations in the model extent.

Table 7-12: Peak Flood Levels – Design Conditions in the J2I-W Model

Design Events	Flood Levels
10% AEP	▪ The floodwaters overtop the rail CH477+300km
5% AEP, 2% AEP, 1% AEP, 1% AEP plus Climate Change	▪ The floodwaters overtop the rail at CH496+988km, CH477+300km

Table 7-13 lists the flood depths at the reporting locations. The peak flood depths occur at Location 1 and Location 4, where the ponding behind the rail embankment occurs. The depths over the Olympic Highway near LX606 at Location 5 is shallow with depths less than 0.3m in events up to the PMF event.

Table 7-13: Reporting Locations - Peak Flood Depths (m)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	2.2	2.5	2.7	2.8	3.0	4.2
Location 2	0.3	0.3	0.4	0.4	0.5	2.4
Location 3	1.1	1.2	1.3	1.4	1.6	3.8
Location 4	1.6	1.9	2.1	2.2	2.4	3.7
Location 5	0.2	0.2	0.2	0.3	0.3	0.5
Location 6	0.6	0.8	1.0	1.2	1.4	2.9

The design flood velocities are similar to the existing conditions. Before the rail line there are slow velocities due to hydraulic control of the rail line acting as an embankment at CH476+988km. The highest velocity from the reporting locations occurs at Location 2 on the Olympic Highway downstream of the culvert at CH476+988km due to the headwater buildup behind the rail, creating pressurised flow through the culvert and overtopping of the rail. The values of the velocities upstream and downstream of the rail are presented in Table 7-14.

Table 7-14: Reporting Locations – Design Conditions Peak Flood Velocities (m/s)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	0.4	0.4	0.4	0.4	0.5	1.8
Location 2	2.2	2.5	2.8	2.9	3.1	3.6
Location 3	0.6	0.6	0.7	0.8	0.9	1.9
Location 4	0.4	0.4	0.4	0.4	0.5	1.1
Location 5	0.3	0.4	0.4	0.5	0.6	1.4
Location 6	0.1	0.1	0.1	0.1	0.2	0.2

Flood Hazard is similar to existing, there is high hazard (H4 to H5) upstream and downstream of the rail surrounding the underbridge at CH476+988km due to the high depths and velocities. The only reporting location with low hazard H1 up to the PMF event is at Location 5 (Olympic Highway near LX606). Table 7-15 lists the flood hazard at the reporting locations.

Table 7-15: Reporting Locations - Design Conditions Flood Hazard (ARR2019)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	H5	H5	H5	H5	H5	H6
Location 2	H5	H5	H5	H5	H5	H6
Location 3	H4	H4	H4	H5	H5	H6

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 4	H4	H4	H5	H5	H5	H6
Location 5	H1	H1	H1	H1	H1	H4
Location 6	H3	H3	H3	H3	H4	H5

7.2.2 Junee to Illabo Eastern Model Design Conditions

The design conditions involved modelling the design rail levels and the proposed design culverts along the J2I-E model extent. No changes were made to the ballast and formation layers except where level crossing and culvert works were occurring. As the slews for the J2I Dual Track Clearances are less than 300mm, no formation or ballast design for the entire rail length was created.

The flooding conditions for the design conditions are similar to those of the existing. Where there are increases in the rail levels, there are increases in water levels behind the rail, as the rail embankment is the controlling hydraulic feature. Details about the flooding depths, levels and hazard for the design conditions are explained in Table 7-16 to Table 7-19.

Flood mapping of the design conditions for J2I-E can be seen in Appendix B.

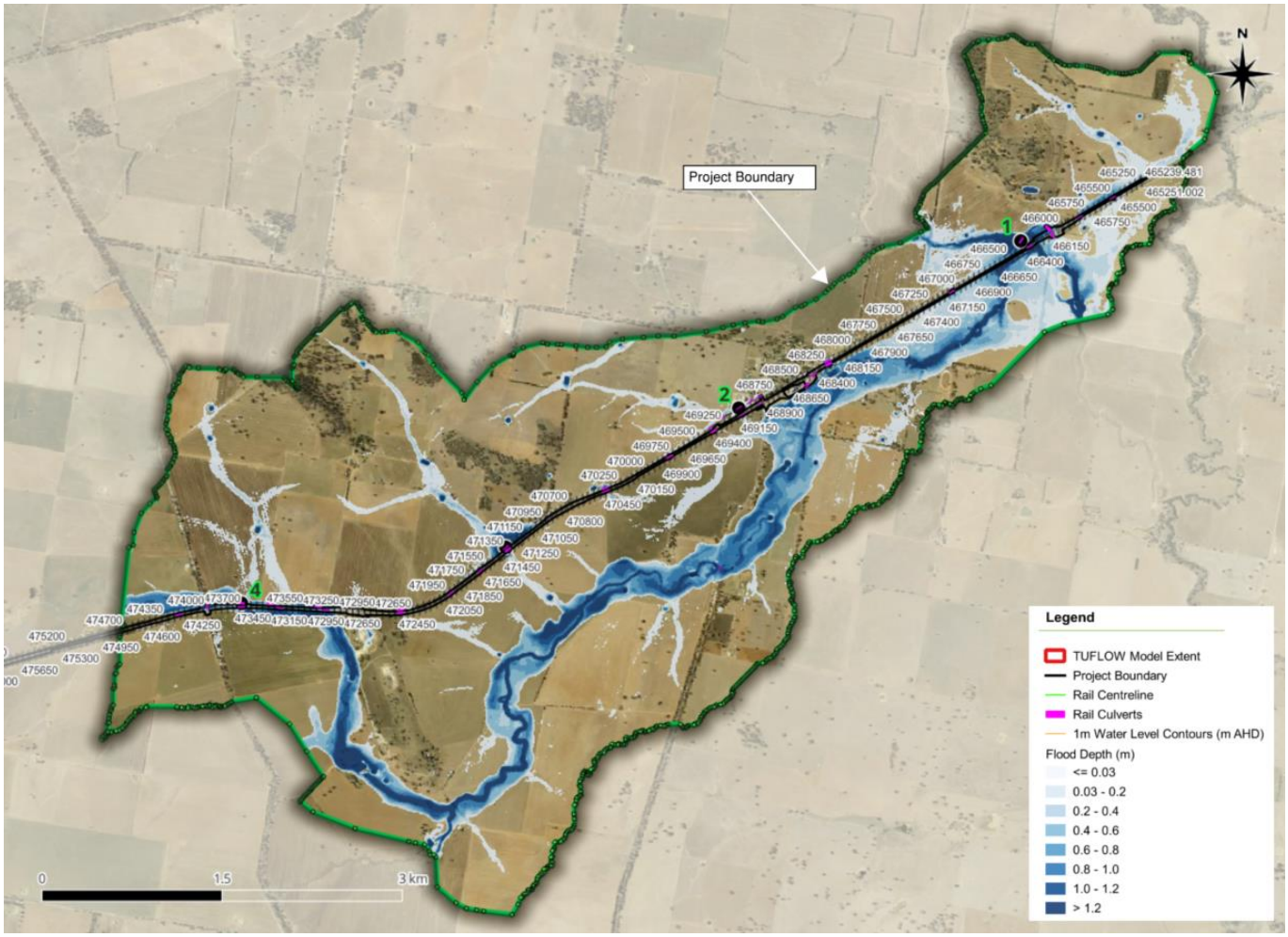

Figure 7-5: J2I-W Reporting Locations - 1% AEP Design Conditions

The rail overtopping locations are similar to the existing conditions, with reporting location 4 at CH473+413km being overtopped in the smallest modelled AEP event. This is a major overtopping location as the major flow path crosses the rail. At location 1, the flood immunity has increased in the design conditions, with the rail being overtopped in the 1% AEP event. This is due to the increase of the rail level at this location. LX603 nearby is not overtopped until the 1% AEP + climate change similar to the existing conditions. At LX603 there is an increase of approximately 60mm in the rail levels, making these tracks co-planar which does not significantly affect the flood behaviour. Reporting location 2 on the Olympic Highway near Illabo and LX604 is not inundated until the PMF event. Table 7-16 shows the overtopping locations along the rail line in the design conditions.

Table 7-16: Overtopping Locations - Design Conditions in the J2I-W Model

Design Events	Flood Levels
10% AEP, 5% AEP and 2% AEP events	▪ The floodwaters overtop the rail at CH473+413km (Reporting Location 4)
1% AEP event	▪ The floodwaters overtop the rail at CH473+413km culvert (Reporting Location 4). ▪ The floodwaters overtop the rail at the CH466+320km culvert (Reporting Location 1).

The flood depths at the reporting locations are listed in Table 7-17, similar to the existing conditions, locations 1 and 3 have the highest depths on the Olympic Highway and location 2 is not affected until the PMF event.

Table 7-17: Reporting Locations - Design Conditions Peak Flood Depths (m)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	0.2	0.5	0.9	1.2	1.3	3.3
Location 2	Not flood affected	Not flood affected	Not flood affected	Not flood affected	Not flood affected	0.4
Location 3	0.9	1.1	1.4	1.7	2.1	3.0
Location 4	0.3	0.4	0.7	0.9	1.1	3.7

Flood velocities upstream and downstream of the rail are shown in Table 7-18. The flood velocities are similar to the existing conditions, with the highest velocities on location 4, where the Olympic Highway and rail line are most severely overtopped. Velocities generally increase with each AEP event as the flow over the roads becomes more greater.

Table 7-18: Reporting Locations - Design Conditions Flood Velocities (m/s)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	0.7	1.0	1.1	1.2	1.3	2.1
Location 2	Not flood affected	Not flood affected	Not flood affected	Not flood affected	Not flood affected	1.2
Location 3	0.4	0.4	0.4	0.4	0.4	0.7
Location 4	1.5	1.6	1.6	1.6	1.6	3.0

The flood hazard along the rail line and Olympic Highway in the design condition is shown in Table 7-19. Similar to the existing conditions, location 4 is the most high-risk location in terms of flood risk with it reaching H5 in the 2% AEP event. Overall, in smaller events like the 10% and 5% AEP events, the flood hazard ranges between H3 and H1. For larger events such as the 2% AEP and the 1% AEP events the flood hazard increases and ranges between H3 and H5.

Table 7-19: Reporting Locations - Design Conditions Flood Hazard (ARR2019)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Location 1	H1	H2	H3	H4	H4	H6
Location 2	Not flood affected	Not flood affected	Not flood affected	Not flood affected	Not flood affected	H2
Location 3	H3	H3	H4	H4	H5	H5
Location 4	H2	H2	H5	H5	H5	H6

7.3 Flood Immunity and Scour Protection

7.3.1 Junee to Illabo Western Model Flood Immunity and Scour Protection

As referred to in Section 7.1 and Section 7.1.3, the rail is overtopped in both the existing and design conditions in the smallest modelled event (10% AEP). This overtopping occurs at CH477+300km, there is no change to flood immunity in these areas. There is an increase in immunity at LX606 with the raise in rail levels leading to the top of rail at the level crossing not being overtopped in flood events until the PMF event, in the existing case this area is overtopped in the 10% AEP event.

A comparison of the freeboard for each flood event for the design and existing conditions at CH476+988km is presented in Table 7-20. There is an increase in freeboard in the 10% AEP event due to the increase in rail levels as part of the design works. In flood events greater than the 10% AEP event, the overtopping depth is similar in the design conditions as compared to existing conditions. Negative values in Table 7-20 describe the depth of overtopping over the rail.

Table 7-20: Comparison of Freeboard at CH476+988km

AEP Event	Existing Conditions – Freeboard to Rail Level (m)	Design Conditions – Freeboard to Rail Level (m)	Change in Freeboard (m)
10% AEP	0.02	0.05	+0.03
5% AEP	-0.27	-0.25	+0.02
2% AEP	-0.45	-0.43	+0.02
1% AEP	-0.54	-0.53	+0.01
1% AEP + Climate Change	-0.69	-0.68	+0.01

Due to the rail alignment being nominally raised approximately 50mm at CH476+988km to facilitate the lateral slews and the bridge replacement works, there is an increase in flows travelling down the rail line to the east, increasing the floodwater levels within the rail corridor. There is an increase in the extent of floodwaters on the rail corridor up to 450m, depending on the design event. The depths in these areas are up to 250mm in the 1% AEP event as the floodwaters are trapped between the dual track section and modelled rail centrelines. In reality, these floodwaters will disperse through the permeable ballast formation. The extent of the rail that is overtopped from the catchment leading to CH476+988km is similar to that of the existing conditions satisfying PSR condition IR-SR-A2I-349.

The floodwater velocity in the 1% AEP going over the rail is relatively low with velocities up to 1.0m/s across all flood events. Upstream of the rail, there are velocities less than 1.0 m/s, downstream of the rail, there are higher velocities of up to 2.9m/s in the 1% AEP event. The high velocities are downstream of the culvert crossing at CH476+988km in the corridor between the rail and the Olympic Highway. These pose a high risk of scour and damage to the rail formation in both the existing and design scenarios, which warrants investigation into scour protection in this area. The maintenance record at CH496+988 and downstream Olympic Highway culvert should be inspected if scouring at either of these culverts is observed. The scouring risk is not increased as a result of the proposed design.

7.3.2 Junee to Illabo Eastern Model Flood Immunity and Scour Protection

As explained in the previous Sections 7.1 and 7.1.3, the rail line within the J2I-E model extent is overtopped at multiple locations. In the proposed design, the rail line is being lifted as the tracks are slewed, resulting in a slight increase in the flood immunity of the rail line. This is shown in Table 7-21.

Table 7-21: Comparison of Flood Immunity at Overtopping Locations

Overtopping Location	Existing Condition Overtopping AEP	Design Condition Overtopping AEP
CH473+413km	10% AEP event (smallest modelled design event)	10% AEP event (smallest modelled design event)
CH466+ 320km	2% AEP event	1% AEP event

An assessment of the flood immunity at the noted locations of overtopping along the rail is seen in

Table 7-22 and Table 7-23 for CH473+413km and CH466+320km where overtopping of the rail occurs.

Table 7-22: Overtopping Details at CH473+413km

Chainage	Top of the Rail Level (mAHD)	Top of the Formation Level (mAHD)	10% AEP Flood Level (mAHD)		2% AEP Flood Level (mAHD)		1% AEP Flood Level (mAHD)	
	Existing & Design	Existing & Design	Existing	Design	Existing	Design	Existing	Design
CH473+413km **	293.88	293.22*	294.02	294.02	294.17	294.17	294.17	294.20

*Note that the existing top of formation level has been assumed to be 667mm below the existing top of rail level, assuming a 167mm depth 53kg/m rail, 10mm rail pad, 250mm sleeper depth and 250mm ballast depth below the sleeper.

**Note that design rail levels between 472+420km and 474+450km are currently modelled as existing conditions within the Junee to Illabo Clearances package, as this area is part of Package J10 and is subject to change.

Table 7-23: Overtopping Details at CH466+320km

Chainage	Top of the Rail Level (mAHD)		Top of the Formation Level (mAHD)		10% AEP Flood Level (mAHD)		2% AEP Flood Level (mAHD)		1% AEP Flood Level (mAHD)	
	Existing	Design	Existing	Design	Existing	Design	Existing	Design	Existing	Design
CH466+320km*	259.41	259.46	258.74**	258.79	258.48	258.49	259.42	259.41	259.69	259.71

*Note the overtopping location behind the culvert CH466+320km does not occur directly at this chainage along the rail line but is associated with the constriction of the flow path from this structure.

**Note that the existing top of formation level has been assumed to be 667mm below the existing top of rail level, assuming a 167mm depth 53kg/m rail, 10mm rail pad, 250mm sleeper depth and 250mm ballast depth below the sleeper.

As demonstrated in the tables above, the extent of the rail overtopped from the northern catchments within the J2I-E model is reduced to that of the existing conditions satisfying PSR condition IR-SR-A2I-349.

The floodwater velocity in the 1%AEP going over the rail is relatively low in the existing and design conditions with velocities generally remaining around 1m/s. There is a minimal change in flood velocities between the existing and design conditions, as seen in the velocity afflux maps in Appendix B. The maximum velocities across the model occur on the downstream ends of the major culverts crossing the rails, such as the rail culvert at CH466+320km and CH473+710km. The flood velocities in these areas are 3.2m/s and 2.3m/s, respectively. These velocities occurring on grazing and cropping land downstream of the rail line show no major change in the design and existing conditions. So, the proposed condition does not increase the potential scour risk.

7.4 Flood Impact Assessment

A flood impact assessment was conducted, comparing the flood assessment results between the design and existing conditions in the following sections for events up to and including the 1% AEP event. The following report sections present the outcomes for comparing the existing and design conditions. Full mapping of the flood impacts can be seen in Appendix A and B for each respective model.

7.4.1 Changes in Peak Flood Levels

7.4.1.1 Junee to Illabo West Changes in Flood Levels

The impacts across the reporting locations are presented below, including the introduction of the rail design and the culvert replacement at CH476+988km. Table 7-24 shows the changes in flood levels across the reporting locations. The maximum increase occurs in the larger events behind the rail embankment at locations 1, 4 and 6. In locations downstream of the rail embankment such as locations 2 and 3, there are either decreases or no change (+/- 0.01 m). Where increases occur, they are within the afflux limits of the applicable land use.

Table 7-24: Reporting Locations – J2I-W Changes in Flood Level (m)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP
Location 1	0.01	0.02	0.03	0.03
Location 2	-0.01	-0.01	-0.02	-0.01
Location 3	No change	-0.01	-0.02	-0.01

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP
Location 4	No change	0.02	0.03	0.03
Location 5	No change	No change	No change	No change
Location 6	0.01	0.01	0.04	0.03

Based on the above, the changes in flood level between the existing and design cases are within the CoA and comply with the CoA E42. Appendix A provides a full mapping of the changes in flood levels.

7.4.1.2 Junee to Illabo East Changes in Flood Levels

The impacts across the Reporting Locations from the introduction of the rail line design strings and design culverts are presented below. Table 7-25 shows the change in flood levels across the reporting locations. The maximum increase occurs at location 1. This is when the rail has a higher overtopping level due to the rail lift, leading to an afflux of 0.02m on the upstream location. Other increases occur within the model extent however, these are within the project boundary and do not affect neighbouring lots. Full mapping of the change in afflux is available in Appendix B for J2I-E.

Table 7-25: Reporting Locations – J2I-E Changes in Flood Level (m)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP
Location 1	No change	0.01	No change	0.02
Location 2	No change	No change	No change	No change
Location 3	No change	No change	No change	No change
Location 4	No change	No change	No change	No change

Based on the above, the changes in flood level between the existing and design cases are within the CoA and comply with the CoA E42.

7.4.2 Changes in Peak Flood Velocity

7.4.2.1 Junee to Illabo West Changes in Peak Flood Velocity

When comparing the existing and design velocities across J2I-W, there is minimal change due to the changes in the design conditions. At Location 2 downstream of the rail, there is a decrease in flood velocity up to 0.09m/s due to increased rail embankment height, reducing the amount of flood waters overtopping onto the Olympic Highway. The results for the reporting locations are shown in Table 7-26.

Table 7-26: Reporting Locations – J2I-W Changes in Flood Velocity (m/s)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP
Location 1	No change	No change	No change	-0.01
Location 2	-0.08	-0.09	-0.05	-0.02
Location 3	No change	-0.01	-0.01	-0.01
Location 4	No change	No change	No change	No change
Location 5	No change	No change	No change	No change
Location 6	No change	No change	No change	No change

Based on the above, the changes in flood velocity between the existing and design cases are within the CoA and comply with the CoA E42(h). Appendix A provides a full mapping of the change in flood velocities.

7.4.2.2 Junee to Illabo East Changes in Peak Flood Velocity

No changes in flood velocity at the reporting locations are shown in Table 7-27 and the maps are in Appendix B for J2I-E.

Table 7-27: Reporting Locations - J2I-E Changes in Flood Velocity (m/s)

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP
Location 1	0.0	0.0	0.0	0.0

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP
Location 2	0.0	0.0	0.0	0.0
Location 3	0.0	0.0	0.0	0.0
Location 4	0.0	0.0	0.0	0.0

Based on the above, the changes in flood velocity between the existing and design cases are within the CoA and comply with the CoA E42(h).

7.4.3 Changes in Peak Flood Hazard

7.4.3.1 Junee to Illabo West Changes in Peak Flood Hazard

Across the reporting locations, there is minimal change in flood hazard as seen in Table 7-28 due to the minimal change in flood depths and flood velocity, as reported in previous sections.

Table 7-28: Reporting Locations - J2I-W Changes in Flood Hazard

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP
Location 1	No change	No change	No change	No change
Location 2	No change	No change	No change	No change
Location 3	No change	No change	No change	No change
Location 4	No change	No change	1	No change
Location 5	No change	No change	No change	No change
Location 6	No change	No change	No change	No change

There are pixels that show changes in flood hazard maps, as shown in Appendix A. This is due to a difference in depths and velocities leading to a triggering of the next flood hazard category as per the ARR classification shown in Figure 7-2. In these areas, a check against the velocity depth product (VxD) was undertaken to assess the potential increase in hazard. Velocity depth product is used to derive ARR Flood Hazard as seen in Figure 7-2. A VxD of greater than 0.4m^2/s is classified as significant hazard for children and an extreme hazard for adults is classified as a VxD greater than 1.2m^2/s (Cox et al., 2010). An example of this for the 1% AEP is seen in Figure 7-6.

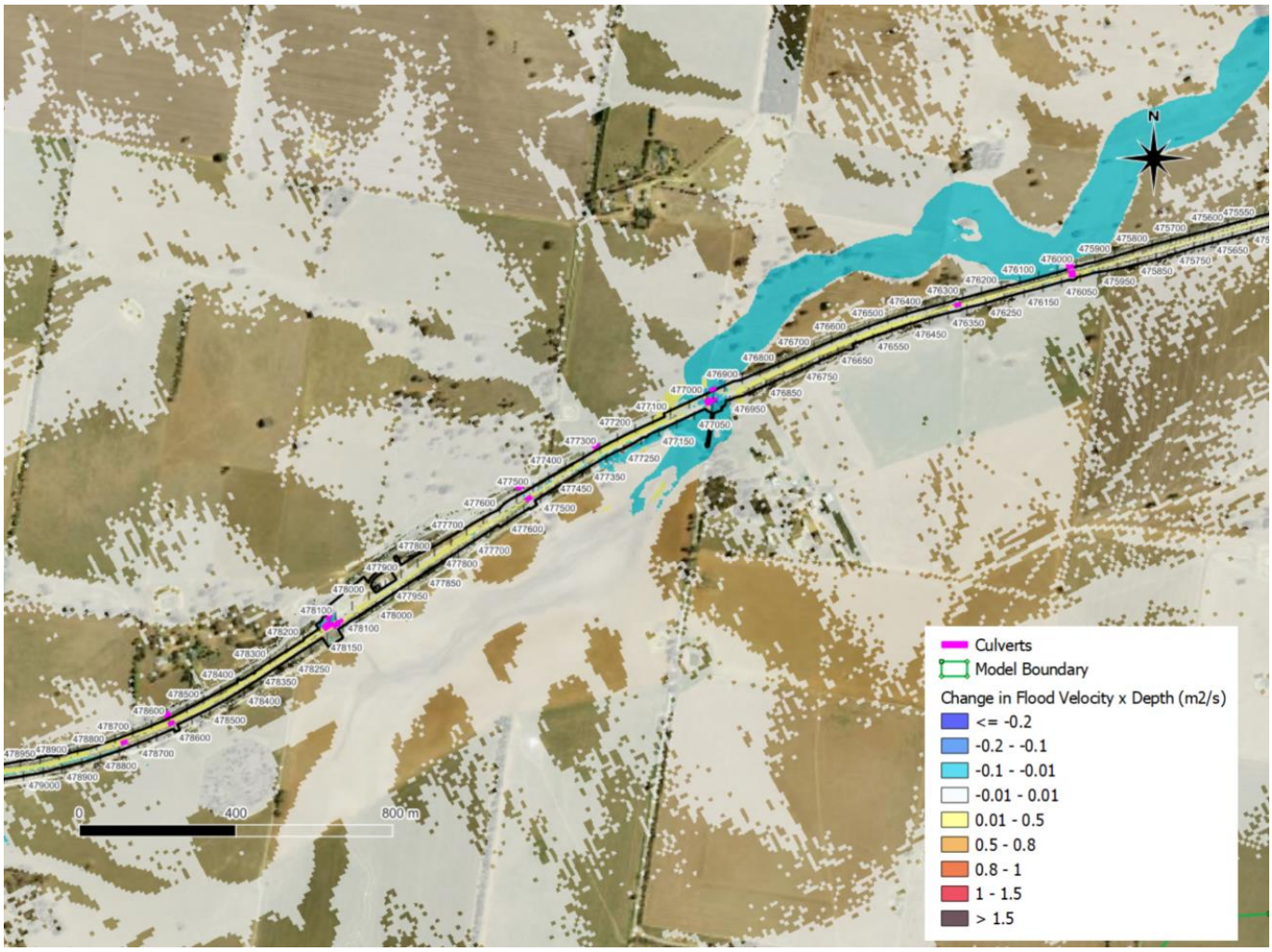

Figure 7-6: 1% AEP Changes in Velocity x Depth (VxD) J2I-W

Across all events, it was found that the increase in VxD fluctuated between +0.06 and -0.04m^2/s, in some areas of the Olympic Highway, there are individual cells with a change of 2 categories in the ARR2019 flood hazard and the change in VxD 0.03m^2/s, this is a small change in flood hazard at this location less than 10% of the classification of significant hazard for children (Cox et al., 2010). The change in VxD in this case, is so small that it should not be interpreted as an increase in risk to life. Based on the above, the changes in flood hazard between the existing and design cases comply with CoA E42(g) in the western model.

7.4.3.2 Junee to Illabo East Changes in Peak Flood Hazard

Across the reporting locations, there is minimal change in the flood hazard as seen in Table 7-27 as there is minimal change in flood depths and flood velocity.

Table 7-29: Reporting Locations - J2I-E Changes in Flood Hazard

AEP Event	10% AEP	5% AEP	2% AEP	1% AEP
Location 1	No change	No change	No change	No change
Location 2	No change	No change	No change	No change
Location 3	No change	No change	No change	No change
Location 4	No change	No change	No change	No change

In the flood hazard afflux maps within Appendix B, similar to J2I-W, there are pixels that show a change in flood hazard. This is due to a difference in depths and velocities leading to a triggering of the next flood hazard category as per the ARR classification shown in Figure 7-2. A check against change in VxD was undertaken to assess the potential increase in hazard. As seen in Figure 7-7 for the 1% AEP, there is minimal change in VxD for the 1% AEP event. The maximum increase is 0.05m^2/s. The change in VxD occurs on cropping and grazing land and is not considered a risk to life.

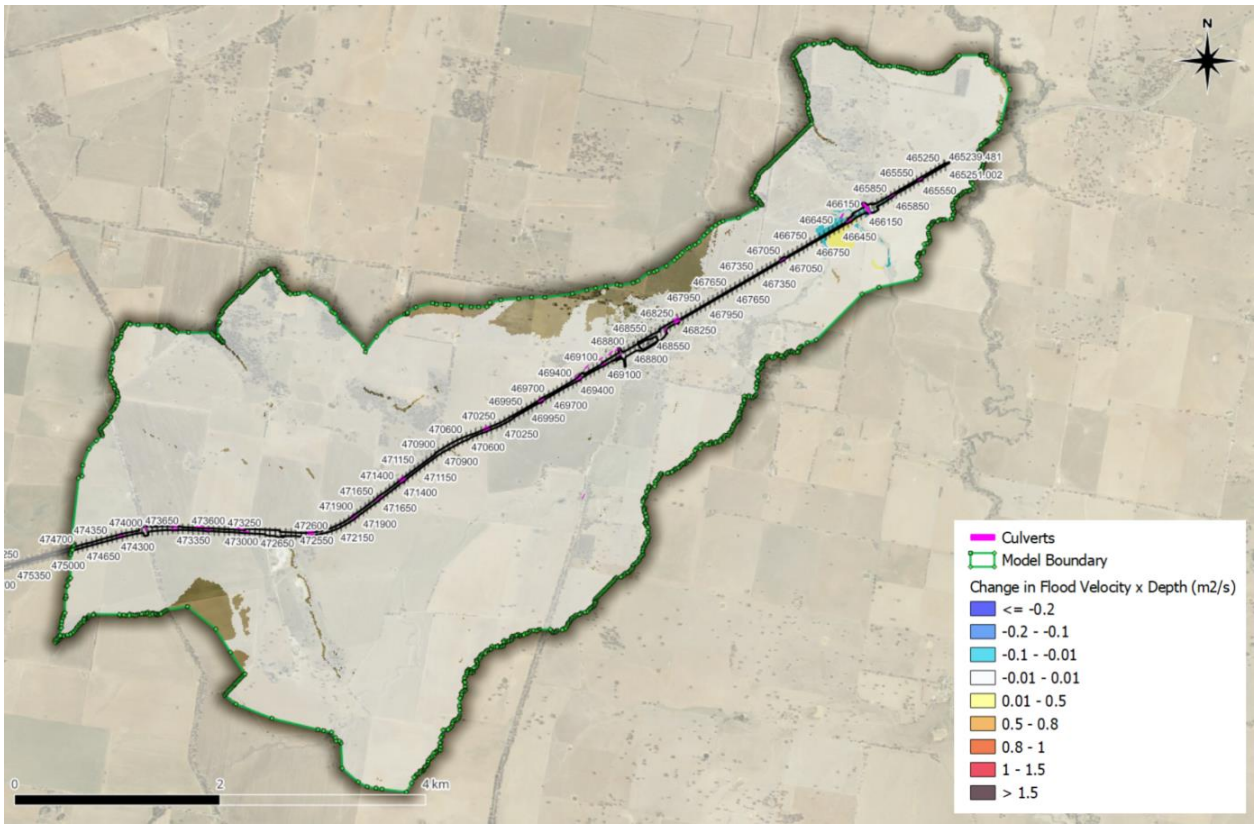

Figure 7-7: 1% AEP Changes in Velocity x Depth (VxD) J2I-E

Based on the above, the changes in flood hazard between the existing and design cases comply with CoA E42(g) in the Eastern Model.

7.4.4 Changes in Duration of Inundation

7.4.4.1 Junee to Illabo West - Changes in Duration of Inundation

The change in duration of inundation was assessed at reporting location 1, the area of ponding behind CH476+988, comparing the water level vs time (2d_po) at this specific point. There is a slight decrease between the design and existing once each condition has reached the peak water level as the peak water level is slightly higher than the existing due to the raise in the design rail levels, however the rate of rise and decrease is very similar between existing and design conditions. The graphs comparing the rate of rise at reporting location 1 can be seen in Appendix D.

From this assessment, it was determined that there was no significant change to the time of inundation across the model extent, and the change of inundation complies with the CoA.

7.4.4.2 Junee to Illabo East - Changes in Duration of Inundation

The changes in duration of inundation were assessed at various locations north of the rail line within the J2I-E and J2I-W model extent. This assessment was undertaken by comparing the water level vs time (2d_po) at this specific point. The location of the extraction points and graphs comparing the time series across the locations for each AEP event are seen in Appendix D. From this assessment, it was determined there was no significant change to the time of inundation across the model extent, and the changes of duration of inundation complies with the CoA.

7.5 Sensitivity Tests

7.5.1 Blockage Assessment

A comparison of the water levels between the design conditions and design conditions with blockage applied can be seen in Figure 7-8 for J2I-W and Figure 7-9 for J2I-E. As expected, where additional blockage is applied, there is an increase in flood levels on the upstream side of the culvert as the flow path through the rail embankment and Olympic Highway is decreased. There are decreases on the downstream side of the rail as floodwaters pass through the culverts at a slower rate.

Within J2I-W, the major increases occur behind the culvert at CH476+023km with increases up to 250mm. There are no major increases behind the culvert at CH476+988km as due to the width of the culvert no blockage was applied. These increases can be seen in Figure 7-8.

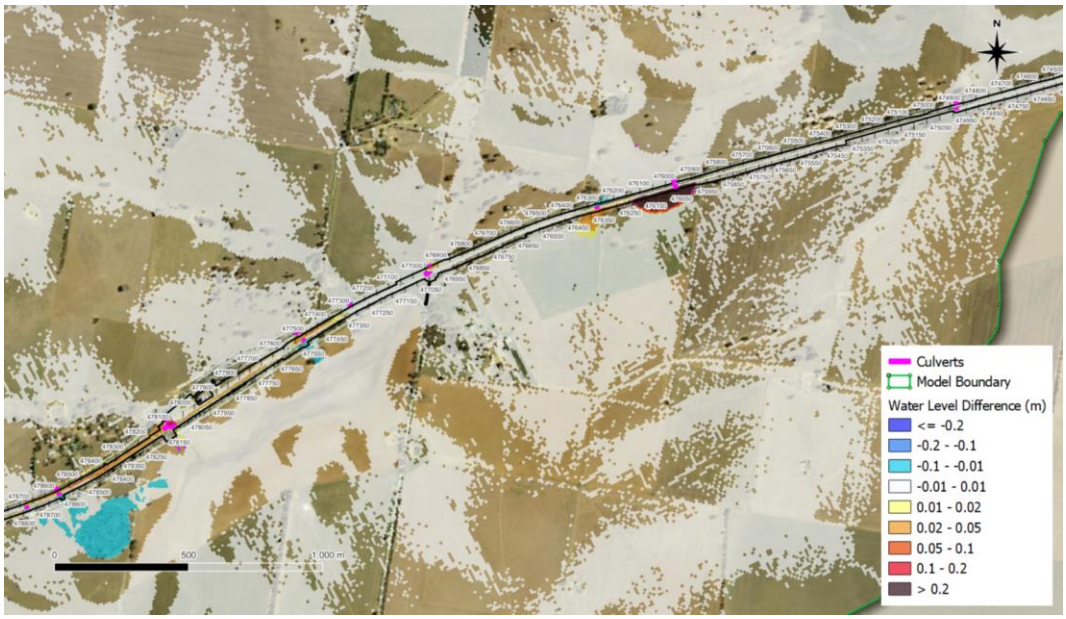

Figure 7-8: J2I-W Blockage Sensitivity for the 1% AEP Event

In J2I-E, there is an increase of up to 210mm upstream of the culvert at CH471+354km and up to 30mm upstream of the rail culvert at CH465+520km, as seen in Figure 7-9. These increases are not assessed as part of the CoA E42, and undertaking the blockage assessment ensures the flood design report is compliant with the CoA E40.

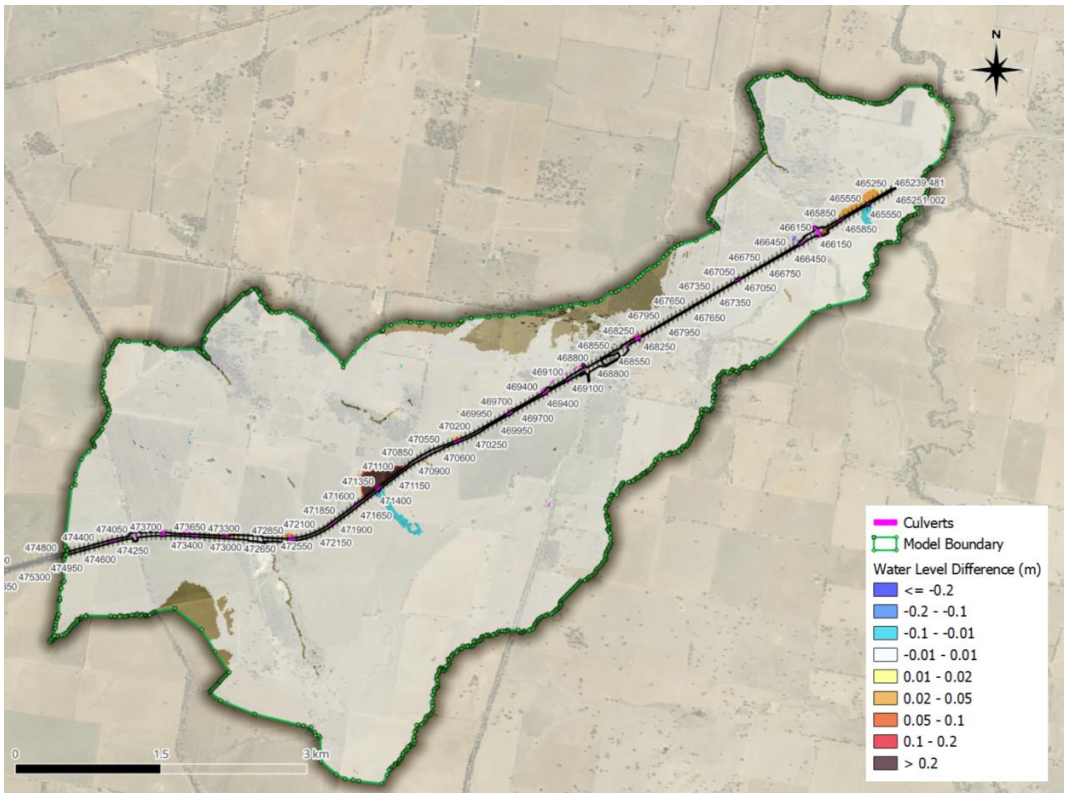

Figure 7-9: J2I-E Blockage Sensitivity for the 1% AEP Event

7.5.2 Climate Change Risk Assessment

The climate change risk assessment was carried out by running the 1% AEP with the Year 2090 RCP8.5 interim climate change factor (refer to Section 6.4 for details of the approach) and the results of flood depth, flood velocity and flood hazard for both J2I-W and J2I-E can be found in Section 7.1 and Section 7.1.3. The corresponding flood maps can be found in Appendix A and B for each flood model. The assessment has shown that within the study area for J2I-W and J2I-E, in the 1% AEP event plus climate change, the railway track is overtopped, similar to the 1% AEP event.

8 MITIGATION MEASURES

No mitigation measures are required for Junee to Illabo Clearances due to no non-compliance with the CoA at this stage.

9 RECOMMENDATIONS AND NEXT STAGE

This is the final IFC stage of the report, and the followings 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 E, F, and G)

The J10 package, which falls within the extent of the Junee to Illabo Clearances package, will need to be assessed for the flooding CoA as part of its design process.

APPENDICES



APPENDIX A

Flood Maps – Junee to Illabo West



List of Flood Maps:

Figure ID	Figure
A1	10% AEP Peak Flood Depth and Levels - Existing Conditions
A2	5% AEP Peak Flood Depth and Levels - Existing Conditions
A3	2% AEP Peak Flood Depth and Levels - Existing Conditions
A4	1% AEP Peak Flood Depth and Levels - Existing Conditions
A5	1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions
A6	PMF Peak Flood Depth and Levels - Existing Conditions
A7	10% AEP Peak Flood Velocity - Existing Conditions
A8	5% AEP Peak Flood Velocity - Existing Conditions
A9	2% AEP Peak Flood Velocity - Existing Conditions
A10	1% AEP Peak Flood Velocity - Existing Conditions
A11	1% AEP Climate Change Peak Flood Velocity - Existing Conditions
A12	PMF Peak Flood Velocity - Existing Conditions
A13	10% AEP Peak Flood Hazard - Existing Conditions
A14	5% AEP Peak Flood Hazard - Existing Conditions
A15	2% AEP Peak Flood Hazard - Existing Conditions
A16	1% AEP Peak Flood Hazard - Existing Conditions
A17	1% AEP Climate Change Peak Flood Hazard - Existing Conditions
A18	PMF Peak Flood Hazard - Existing Conditions
A19	10% AEP Peak Flood Depth and Levels - Design Conditions
A20	5% AEP Peak Flood Depth and Levels - Design Conditions
A21	2% AEP Peak Flood Depth and Levels - Design Conditions
A22	1% AEP Peak Flood Depth and Levels - Design Conditions
A23	1% AEP Climate Change Peak Flood Depth and Levels - Design Conditions
A24	PMF Peak Flood Depth and Levels - Design Conditions
A25	10% AEP Peak Flood Velocity - Design Conditions
A26	5% AEP Peak Flood Velocity - Design Conditions
A27	2% AEP Peak Flood Velocity - Design Conditions
A28	1% AEP Peak Flood Velocity - Design Conditions
A29	1% AEP Climate Change Peak Flood Velocity - Design Conditions
A30	PMF Peak Flood Velocity - Design Conditions
A31	10% AEP Peak Flood Hazard - Design Conditions

Figure ID	Figure
A32	5% AEP Peak Flood Hazard - Design Conditions
A33	2% AEP Peak Flood Hazard - Design Conditions
A34	1% AEP Peak Flood Hazard - Design Conditions
A35	1% AEP Climate Change Peak Flood Hazard - Design Conditions
A36	PMF Peak Flood Hazard - Design Conditions
A37	10% AEP Changes in Peak Flood Level - Design Condition vs Existing Condition
A38	5% AEP Changes in Peak Flood Level - Design Condition vs Existing Condition
A39	2% AEP Changes in Peak Flood Level - Design Condition vs Existing Condition
A40	1% AEP Changes in Peak Flood Level - Design Condition vs Existing Condition
A41	1% AEP Climate Change Changes in Peak Flood Level - Design Condition vs Existing Condition
A42	10% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
A43	5% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
A44	2% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
A45	1% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
A46	1% AEP Climate Change Changes in Peak Flood Velocity - Design Condition vs Existing Condition
A47	10% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
A48	5% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
A49	2% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
A50	1% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
A51	1% AEP Climate Change Changes in Peak Flood Hazard - Design Condition vs Existing Condition
A52	1% AEP Peak Flood Depth and Levels - Blockage Sensitivity
A53	1% AEP Peak Flood Velocity - Blockage Sensitivity
A54	1% AEP Peak Flood Hazard - Blockage Sensitivity

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A1 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A2 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A3 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A4 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

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Figure A5 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

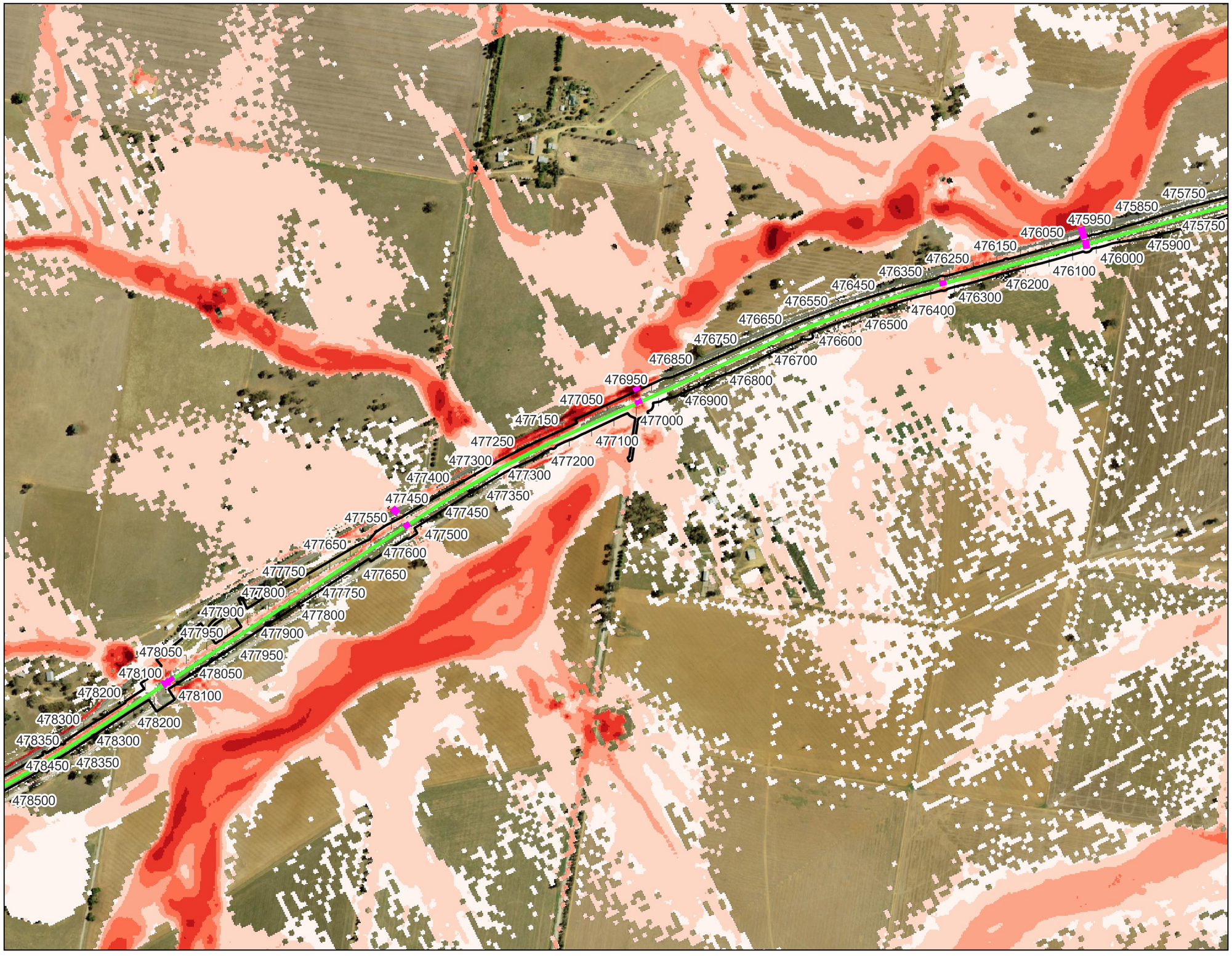
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A6 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

PMF Peak Flood Depth and Levels - Existing Conditions



Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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:

Figure A7 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

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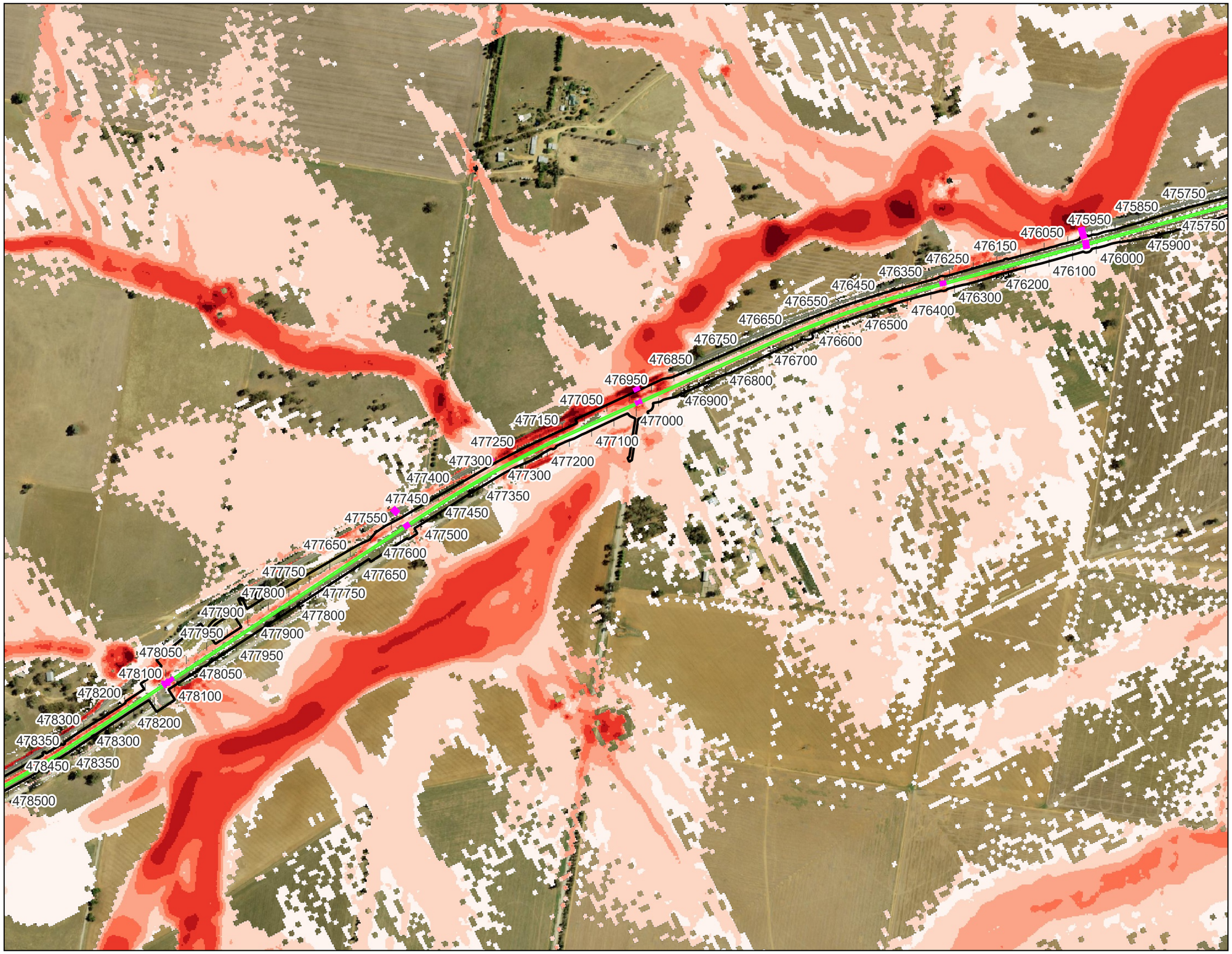
Figure A8 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Peak Flood Velocity - Existing Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

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Figure A9 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A10 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

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Figure A11 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

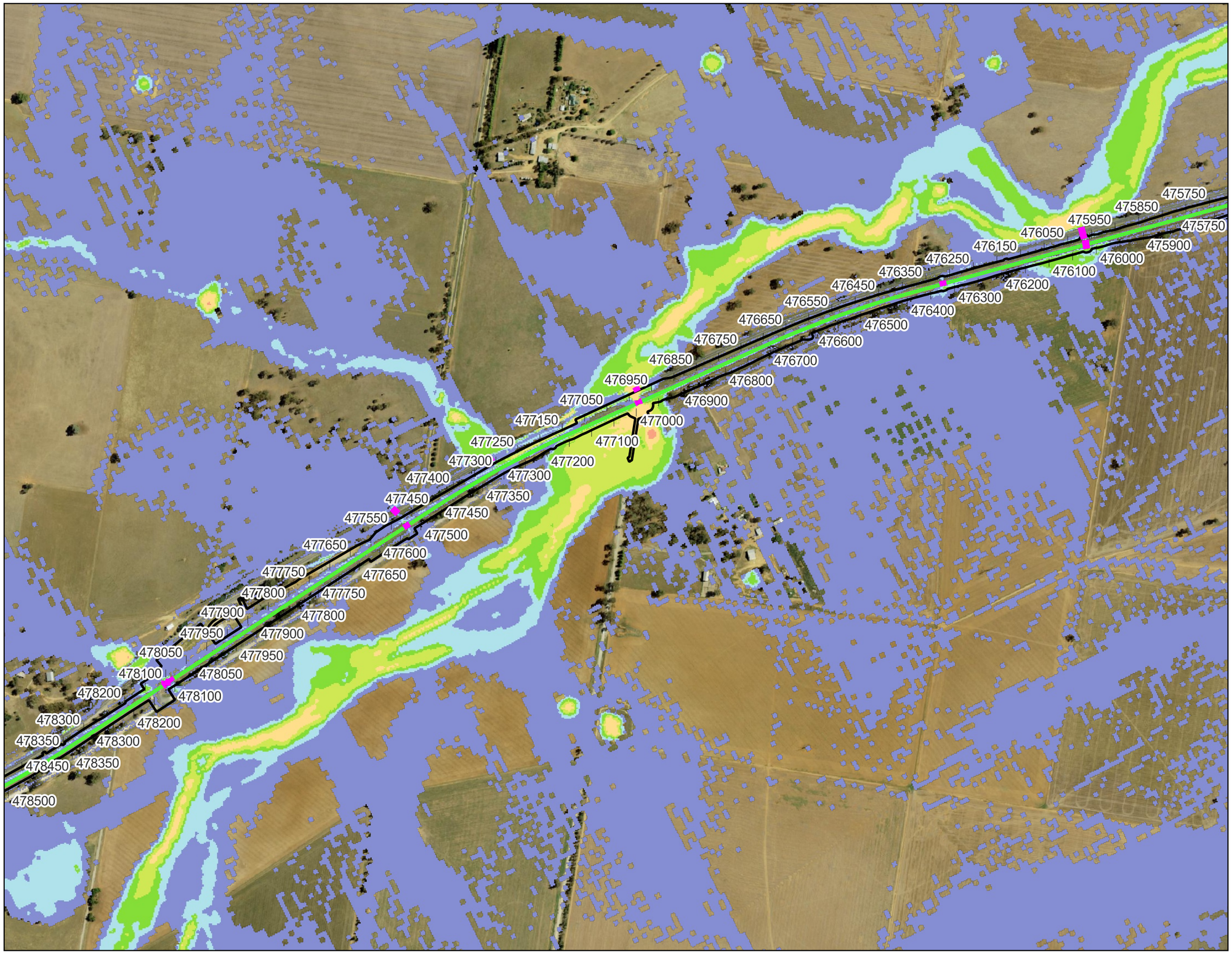
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A12 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

PMF Peak Flood Velocity - Existing Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

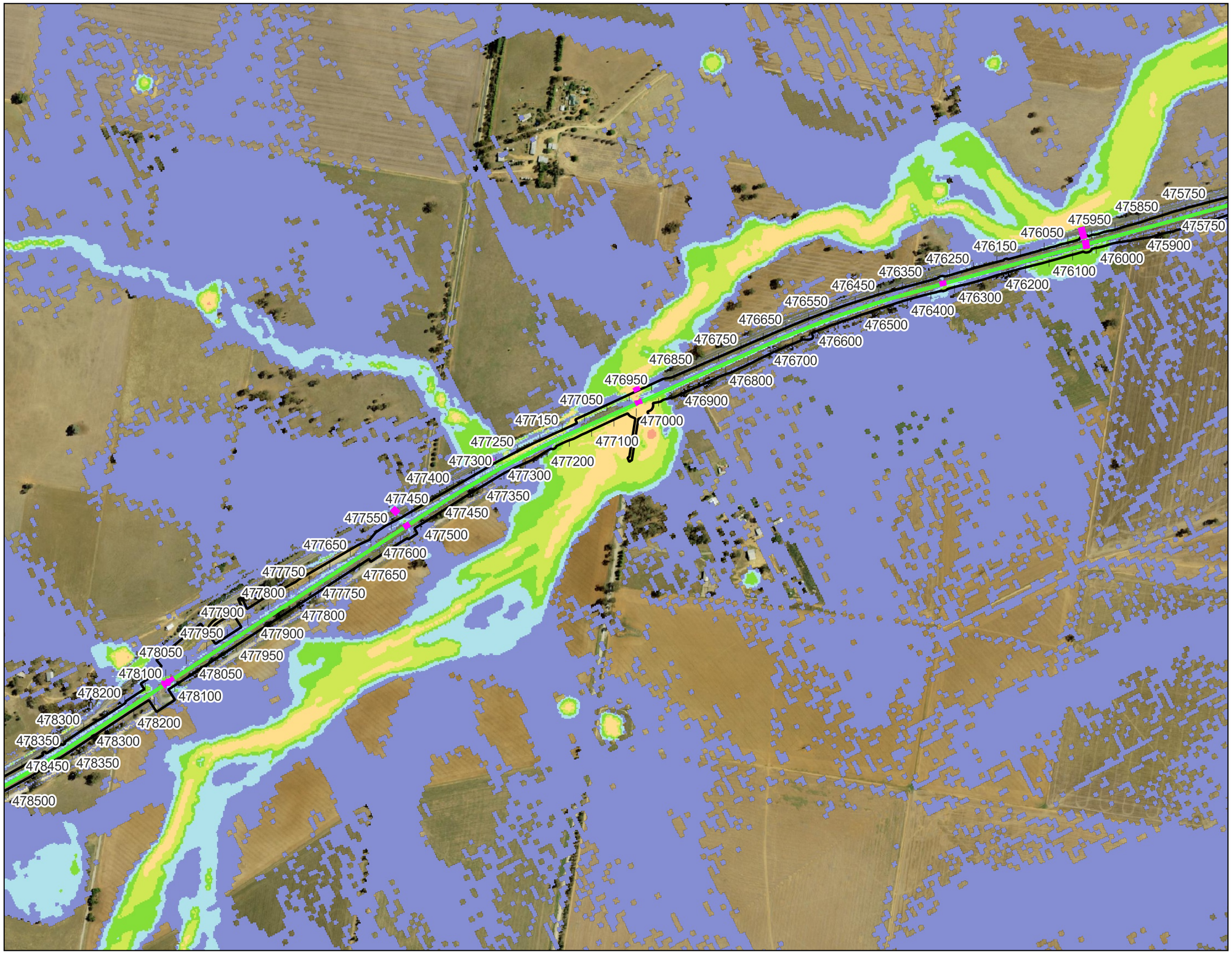
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A13 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Peak Flood Hazard - Existing Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A14 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A15 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A16 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A17 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A18 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

PMF Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A19 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Peak Flood Depth and Levels - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A20 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Peak Flood Depth and Levels - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A21 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Peak Flood Depth and Levels - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A22 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Depth and Levels - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A23 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Peak Flood Depth and Levels - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

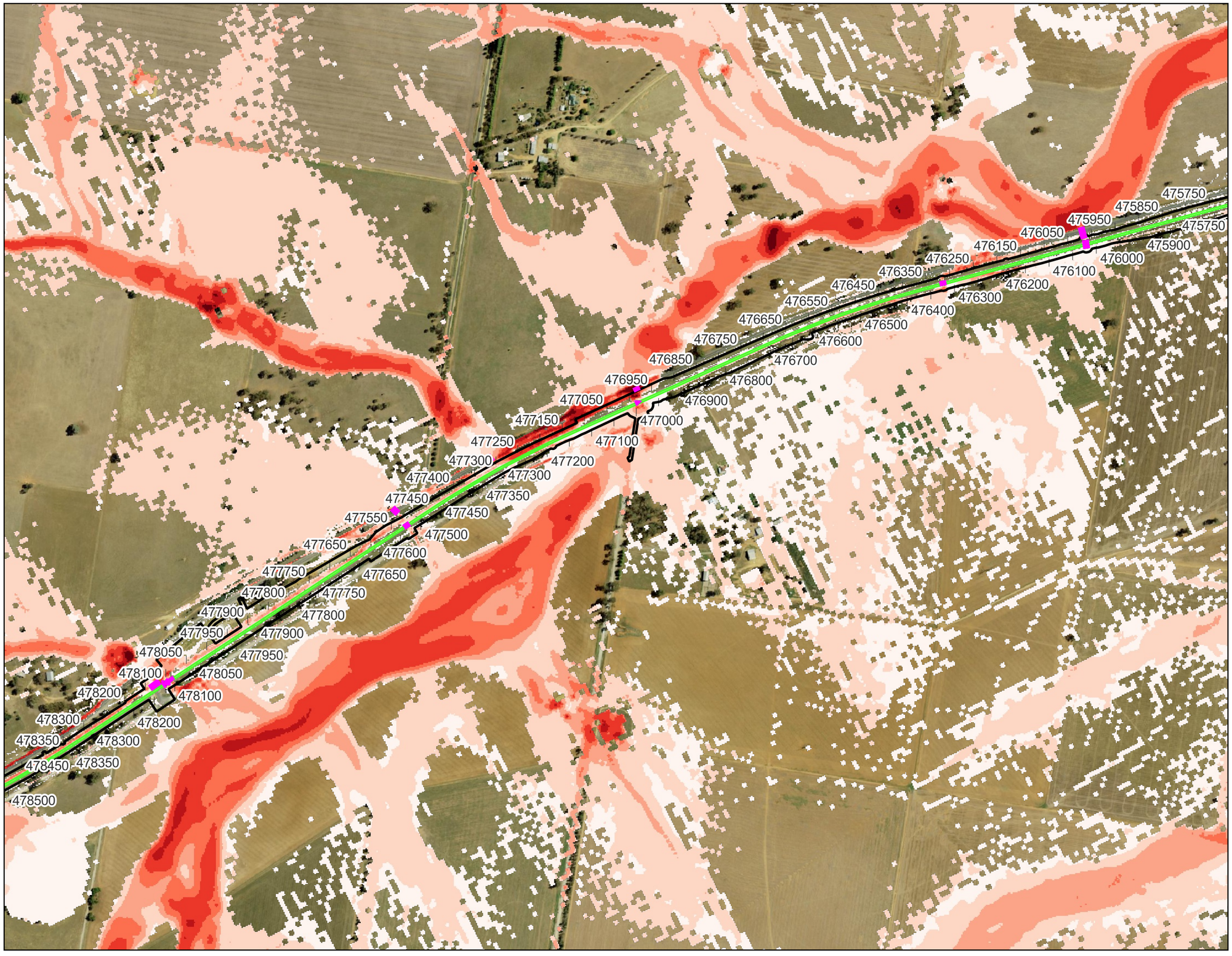
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A24 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

PMF Peak Flood Depth and Levels - Design Conditions



Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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:

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A25 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Peak Flood Velocity - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A26 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Peak Flood Velocity - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A27 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Peak Flood Velocity - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A28 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Velocity - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A29 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Peak Flood Velocity - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

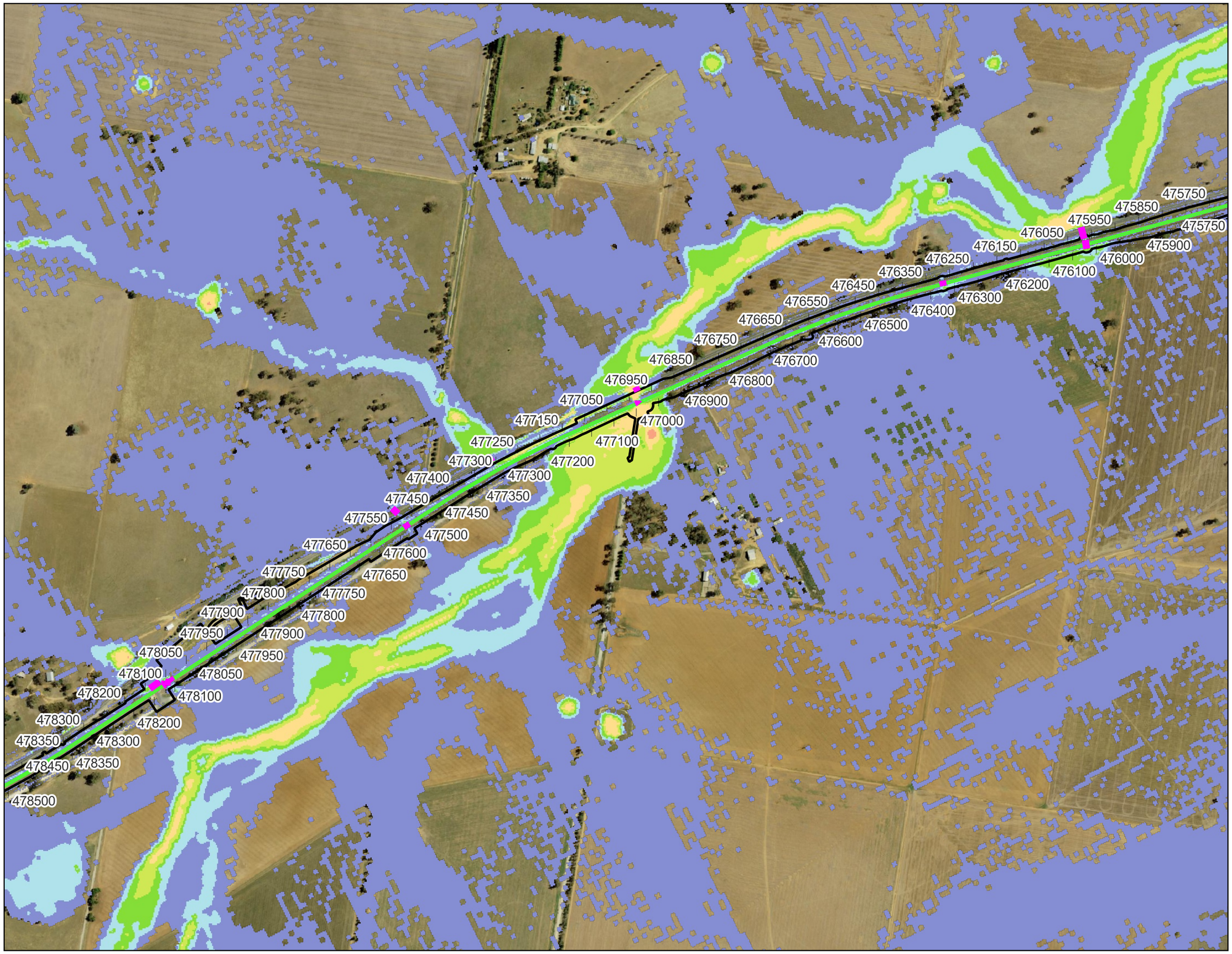
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A30 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

PMF Peak Flood Velocity - Design Conditions



Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

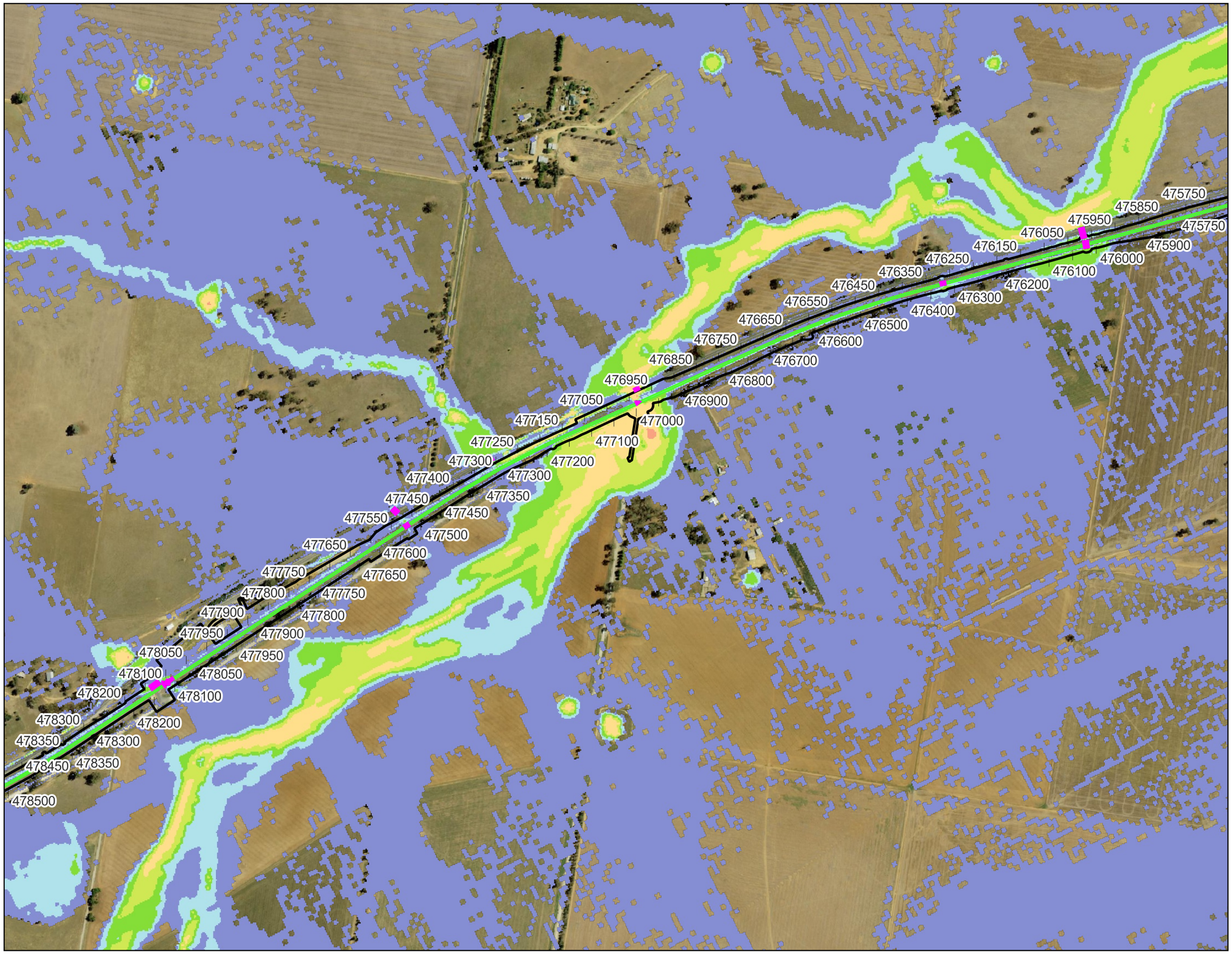
ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Figure A31 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Peak Flood Hazard - Design Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

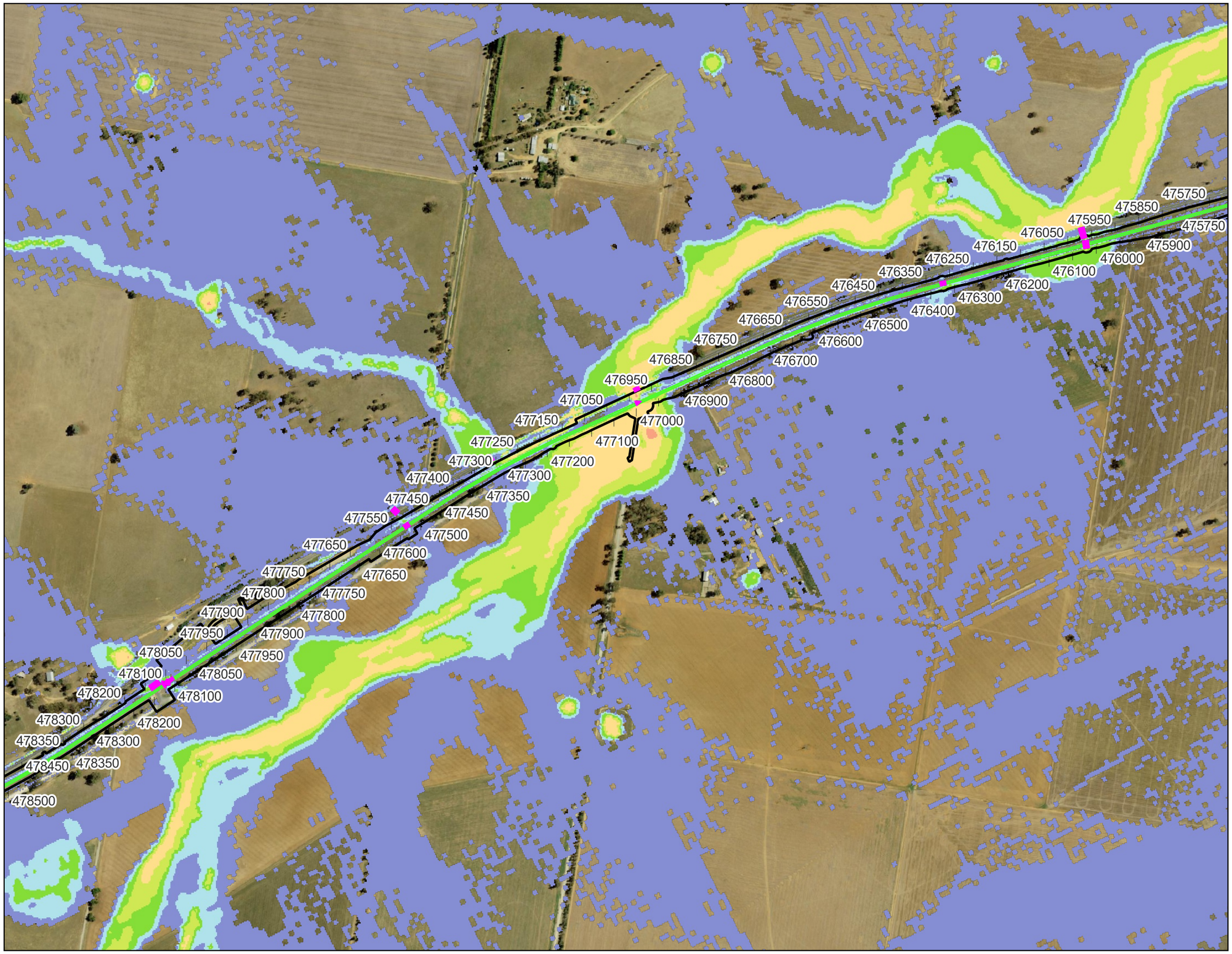
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A32 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Peak Flood Hazard - Design Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

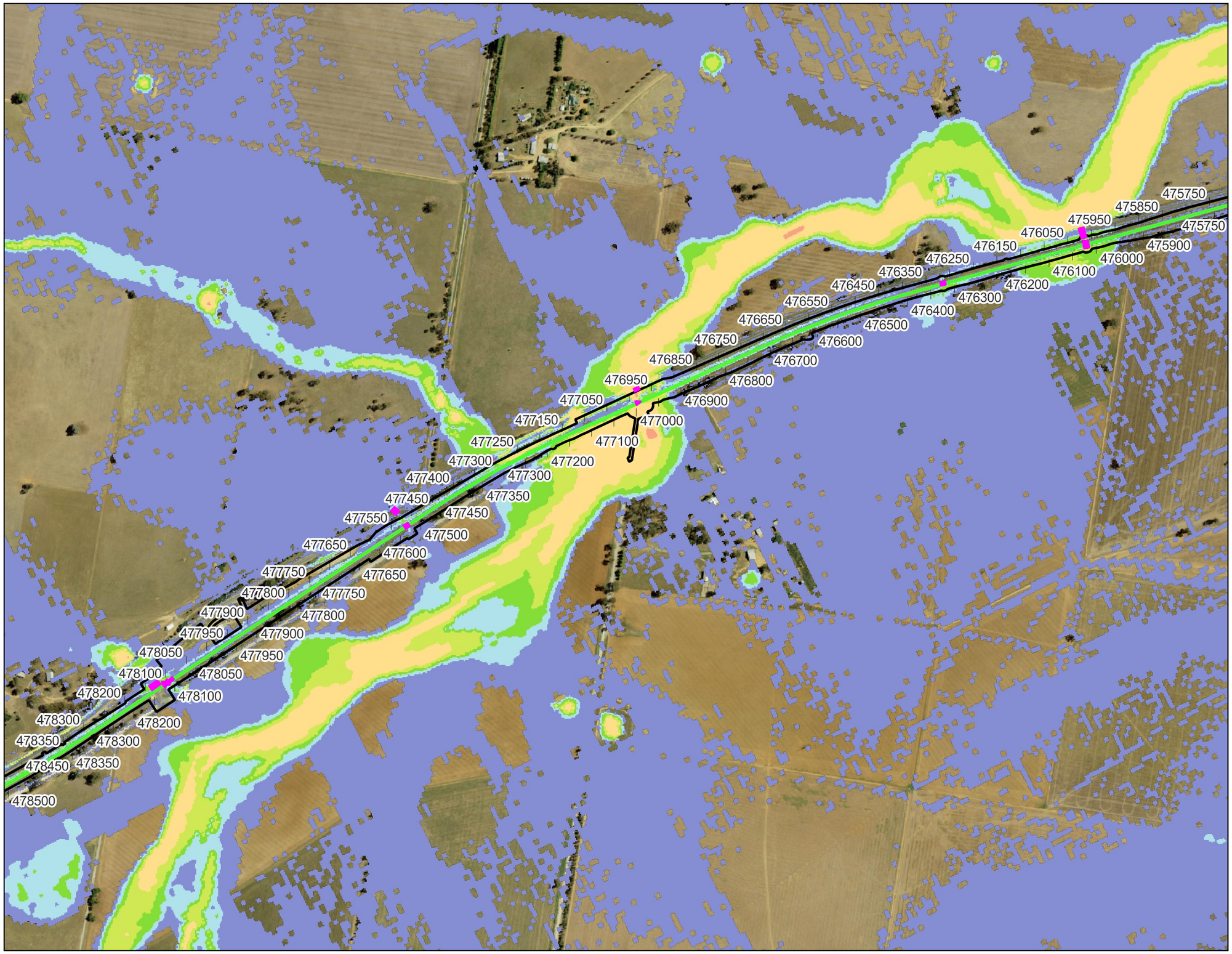
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A33 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Peak Flood Hazard - Design Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A34 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Hazard - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

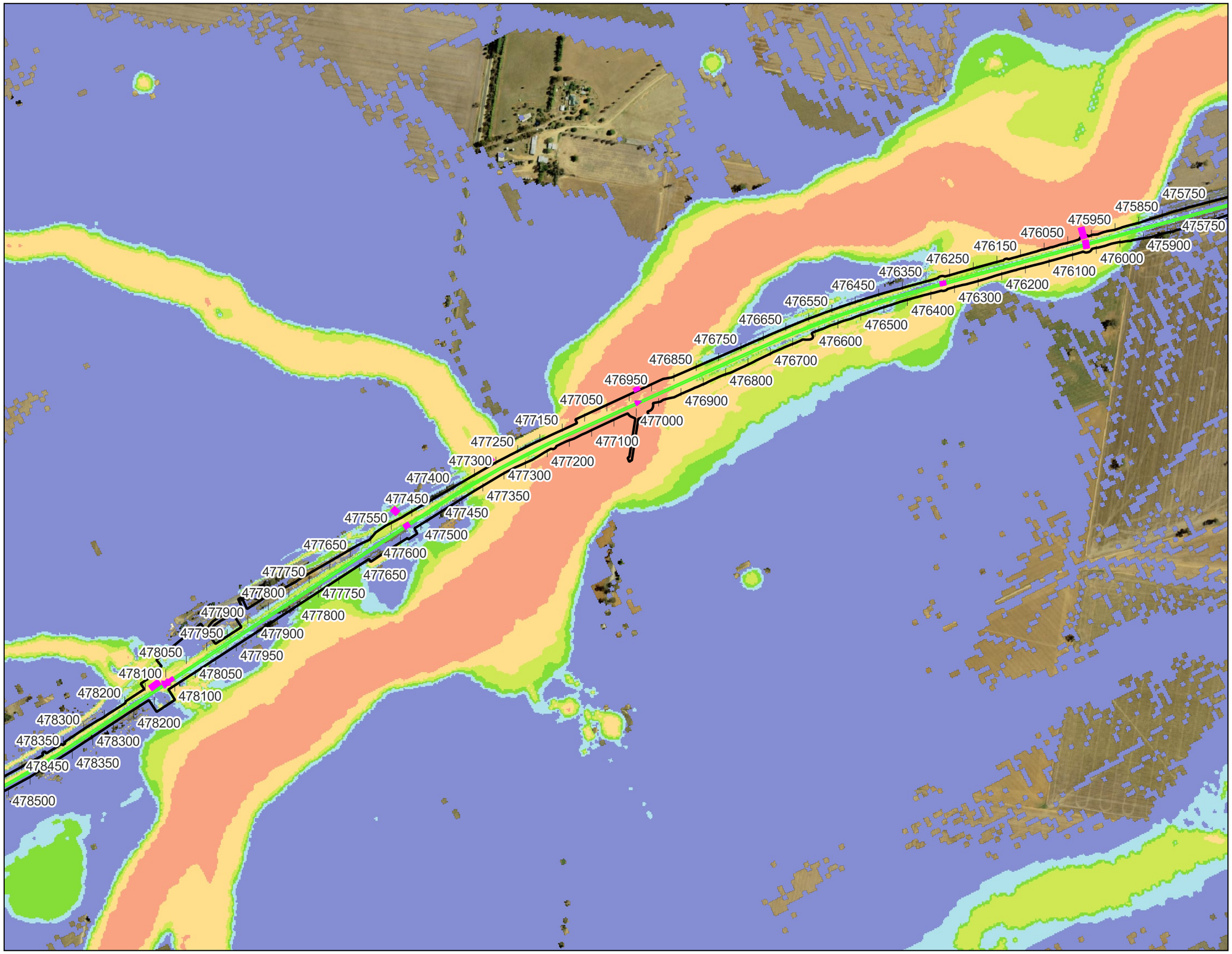
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A35 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Peak Flood Hazard - Design Conditions



Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

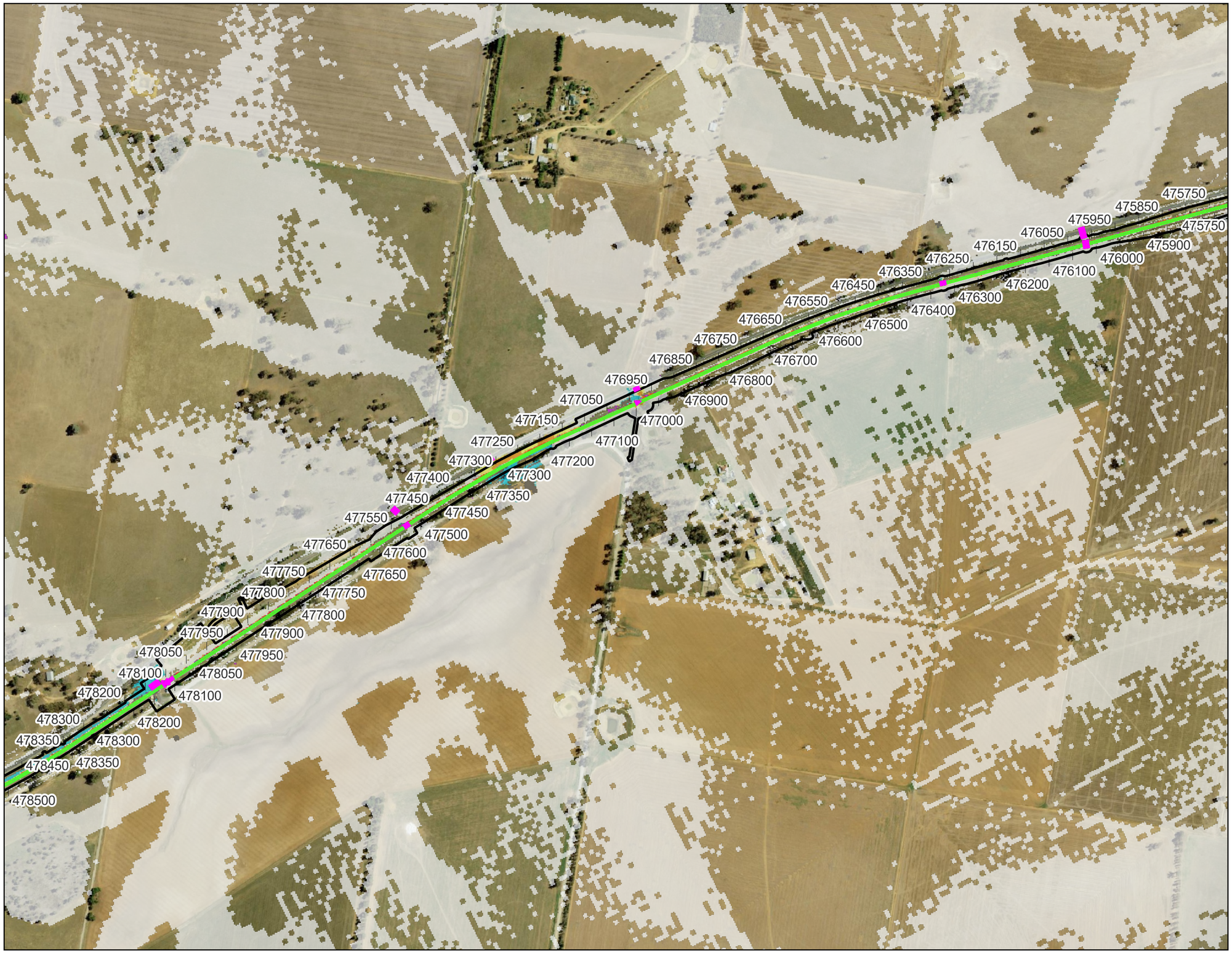
ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Figure A36 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

PMF Peak Flood Hazard - Design Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Water Level Difference (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

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Map by: SM

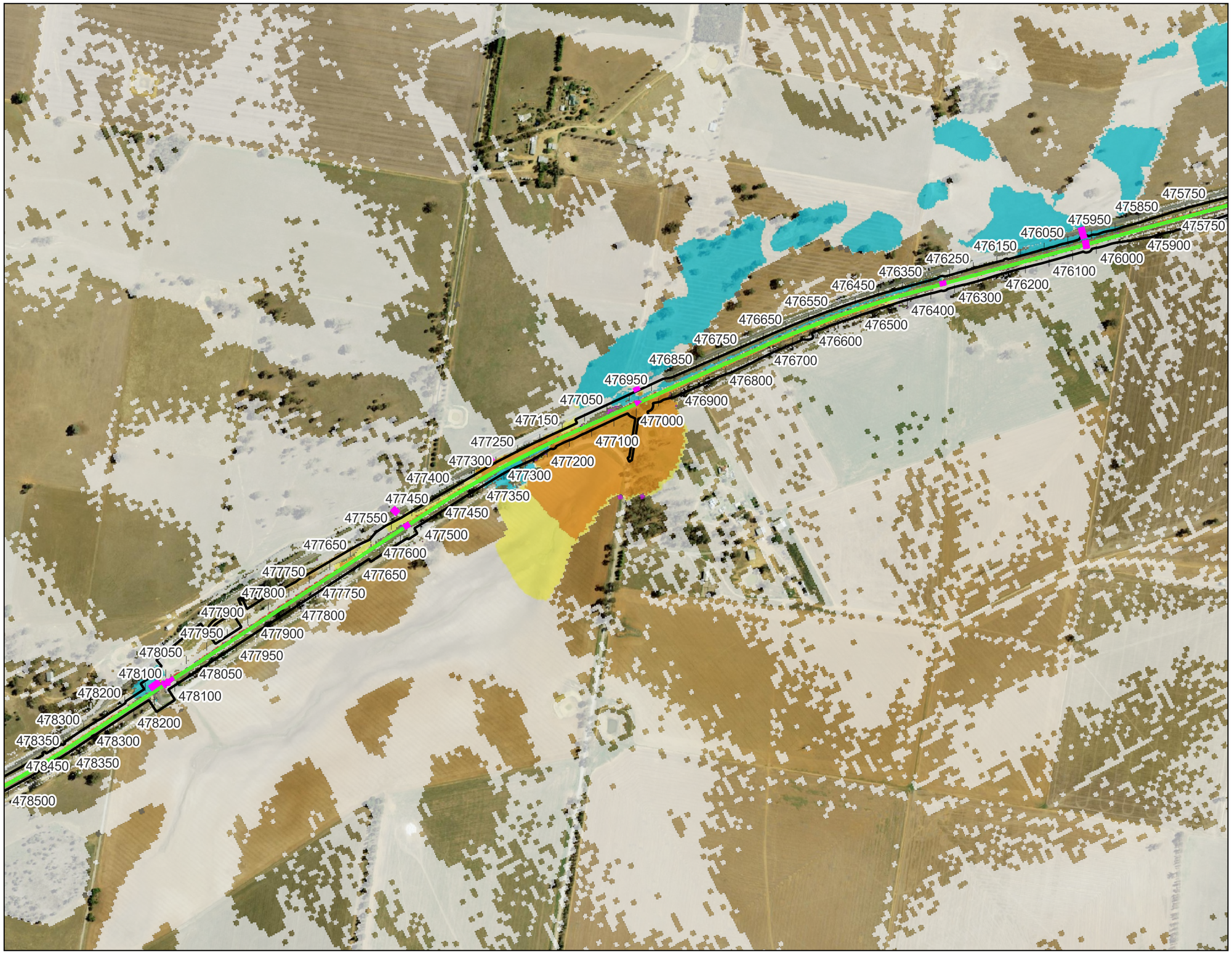
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A37 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Changes in Peak Flood Level - Design Condition vs Existing Condition



Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Water Level Difference (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

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

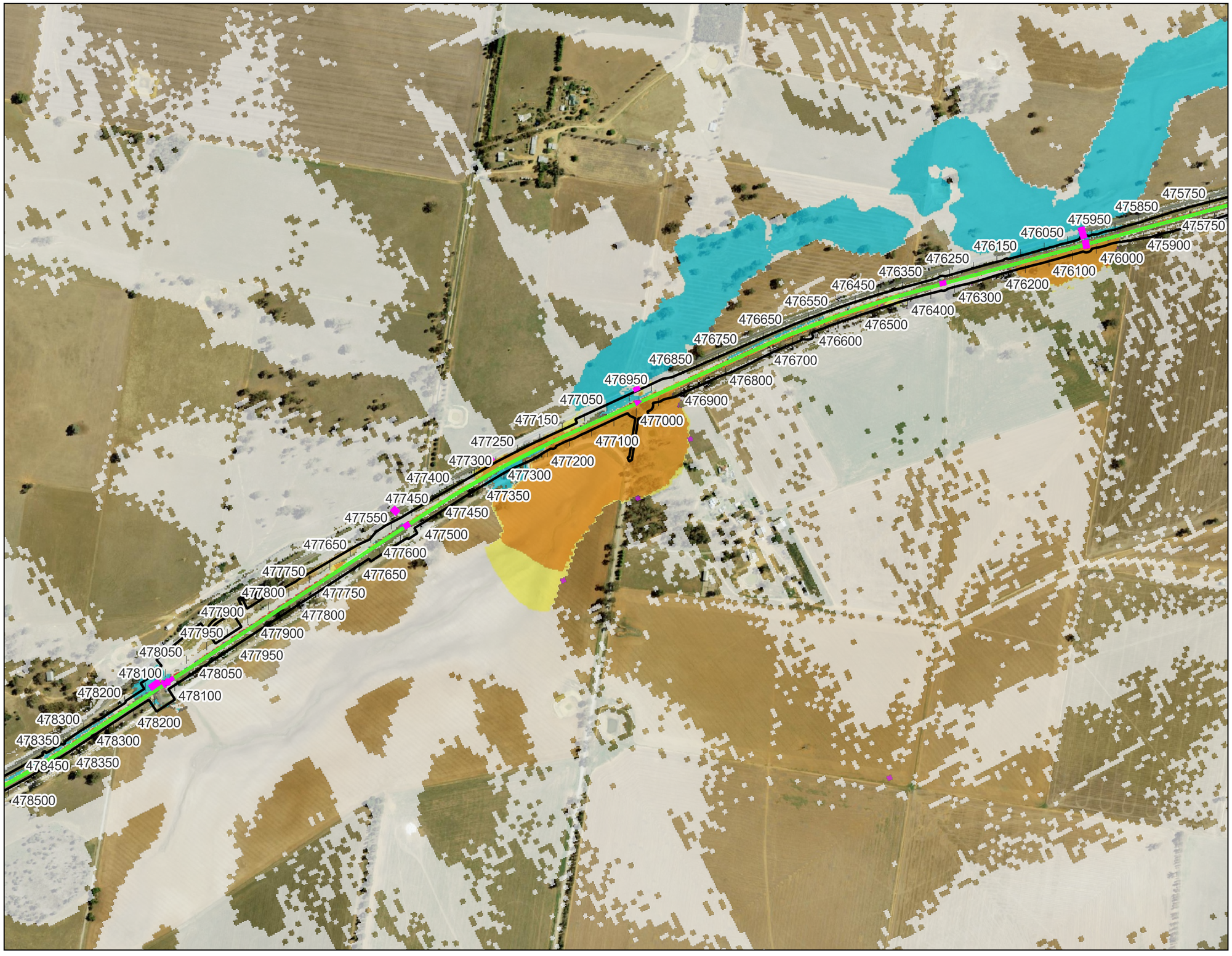
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A38 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Changes in Peak Flood Level - Design Condition vs Existing Condition



Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Water Level Difference (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

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Figure A39 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Changes in Peak Flood Level - Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Water Level Difference (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

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Map by: SM

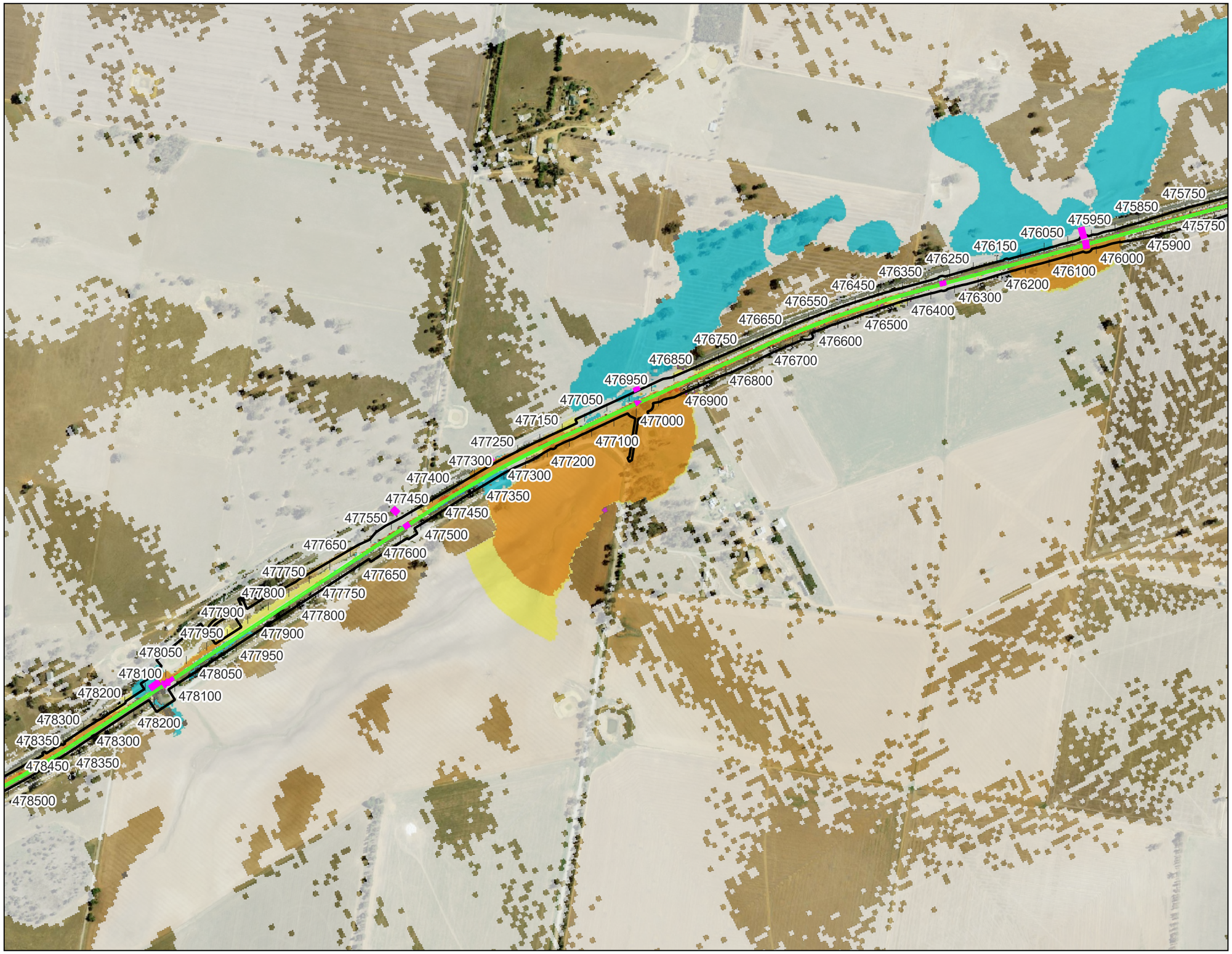
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A40 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Changes in Peak Flood Level - Design Condition vs Existing Condition



Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Water Level Difference (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

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

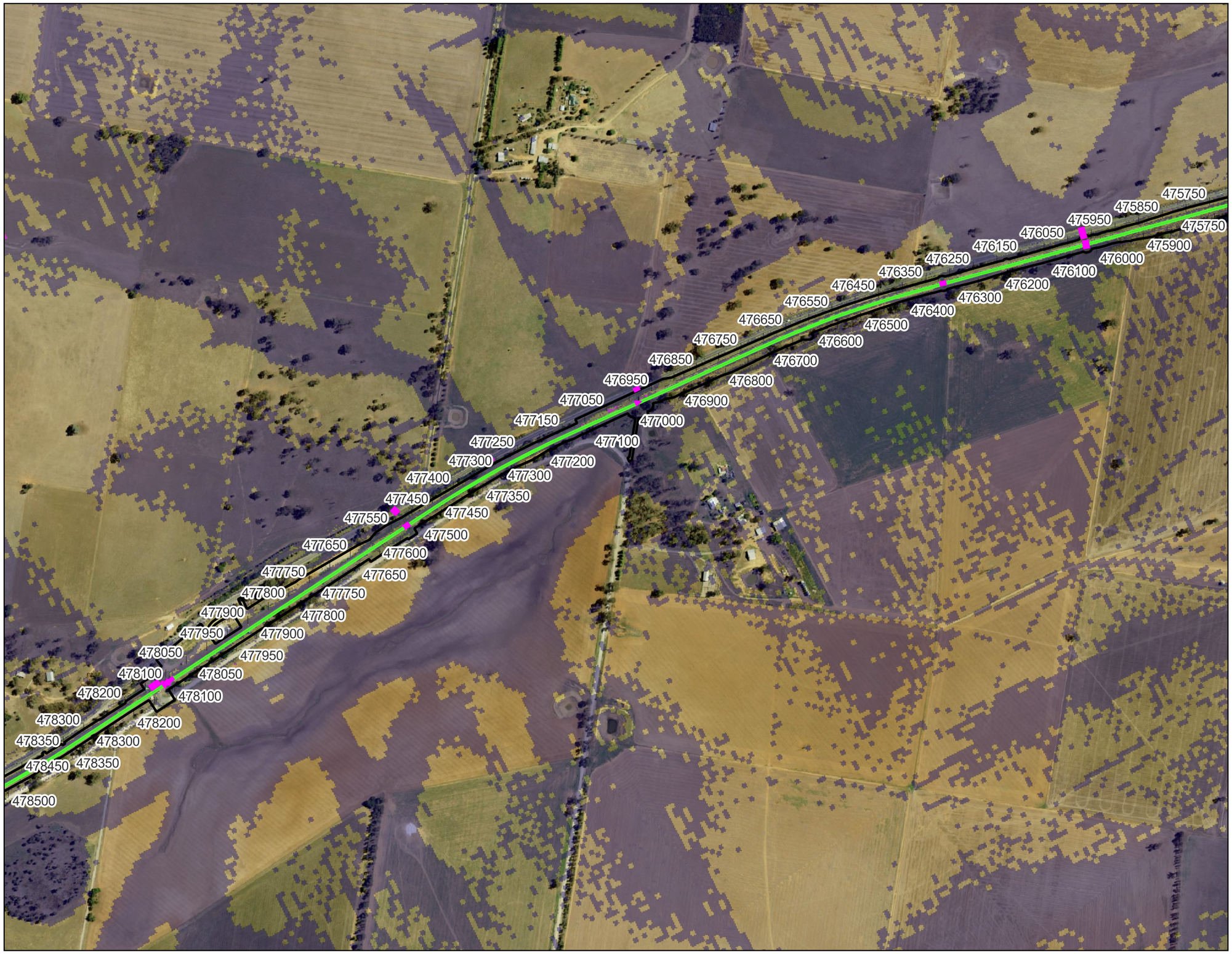
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A41 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Changes in Peak Flood Level - Design Condition vs Existing Condition



Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Change in Velocity (m/s)

- <= 0.5
- 0.5 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 2.0

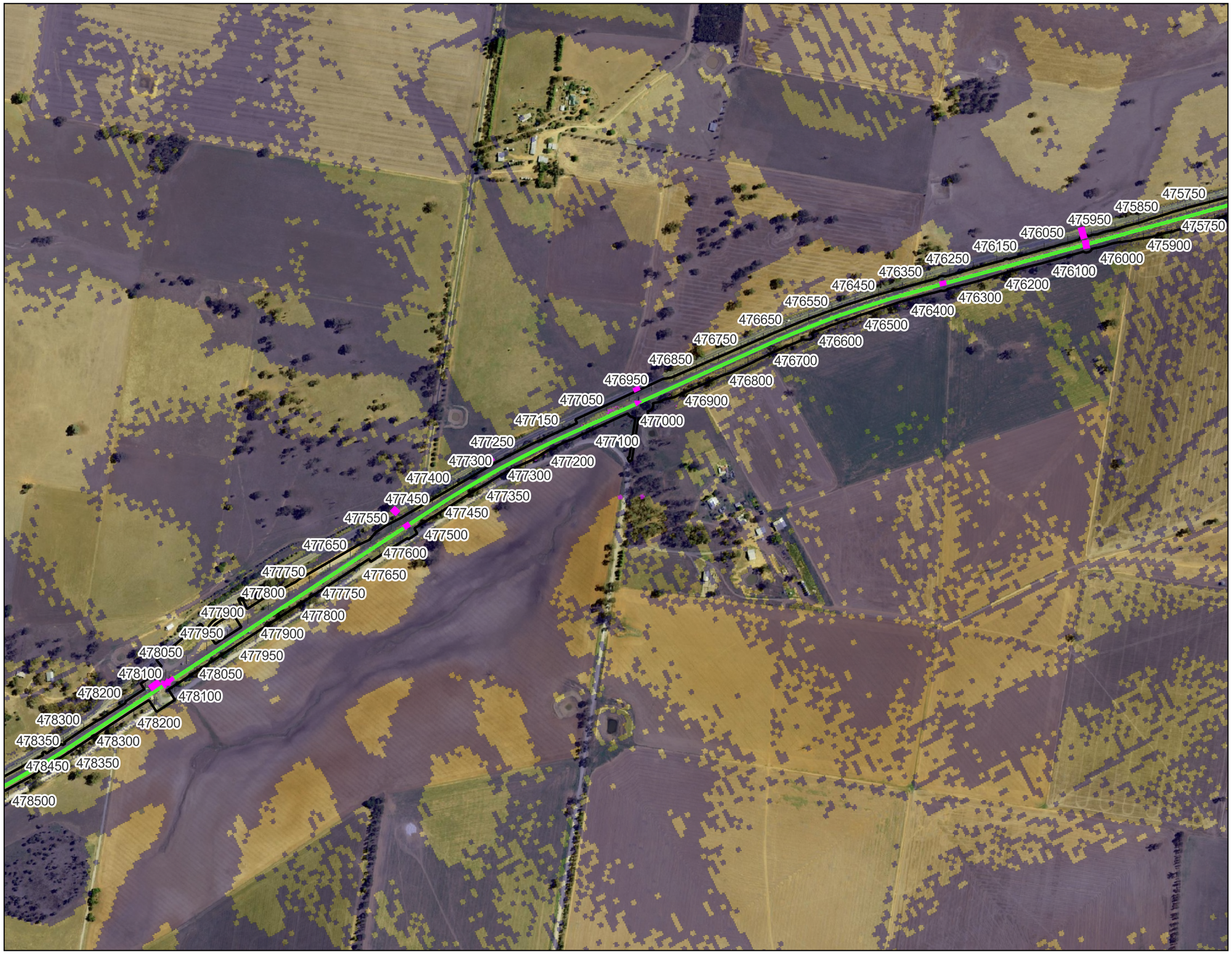
Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Figure A42 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Change in Velocity (m/s)

- <= 0.5
- 0.5 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 2.0

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A43 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition



Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Change in Velocity (m/s)

- <= 0.5
- 0.5 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 2.0

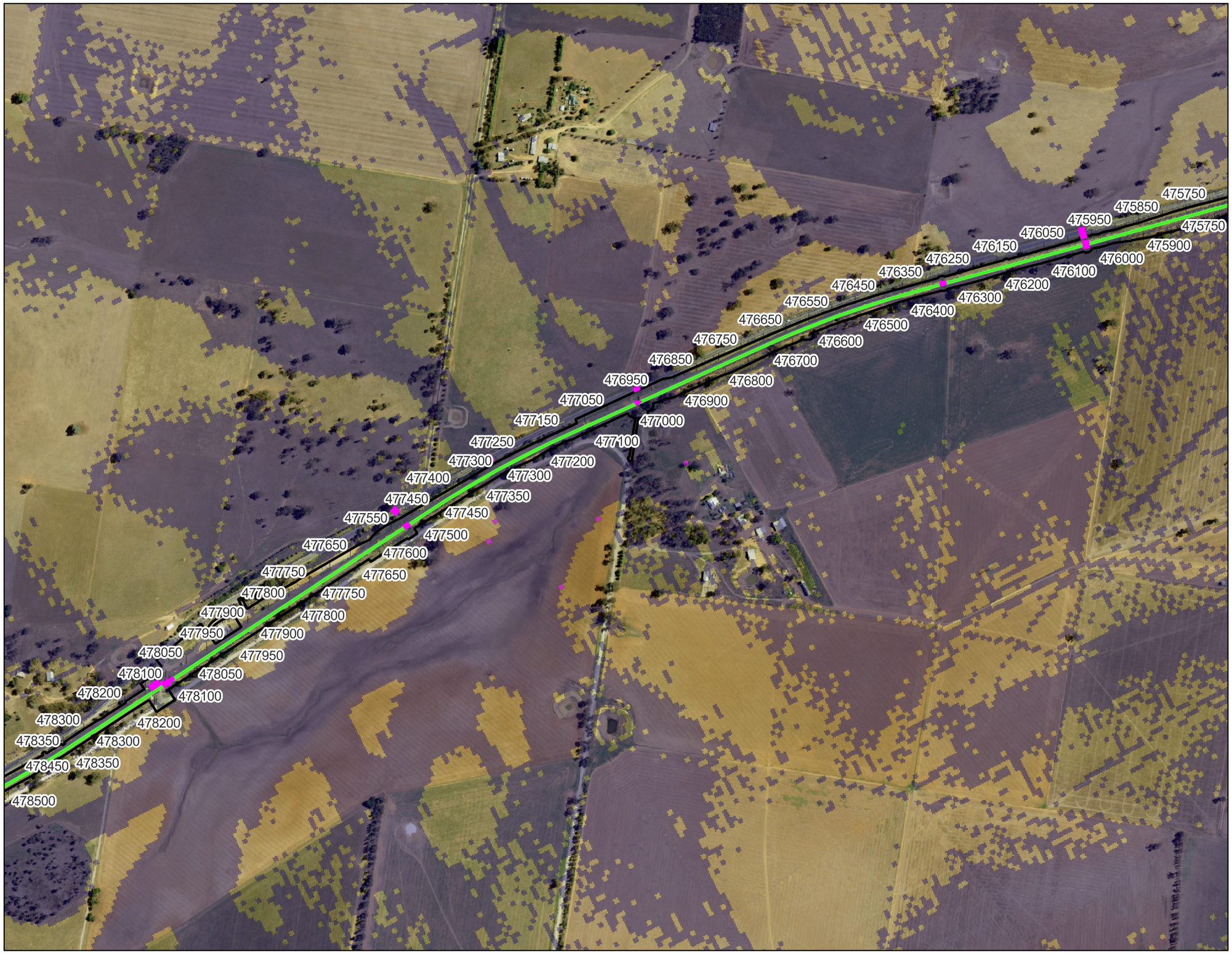
Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Figure A44 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition



Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Change in Velocity (m/s)

- <= 0.5
- 0.5 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 2.0

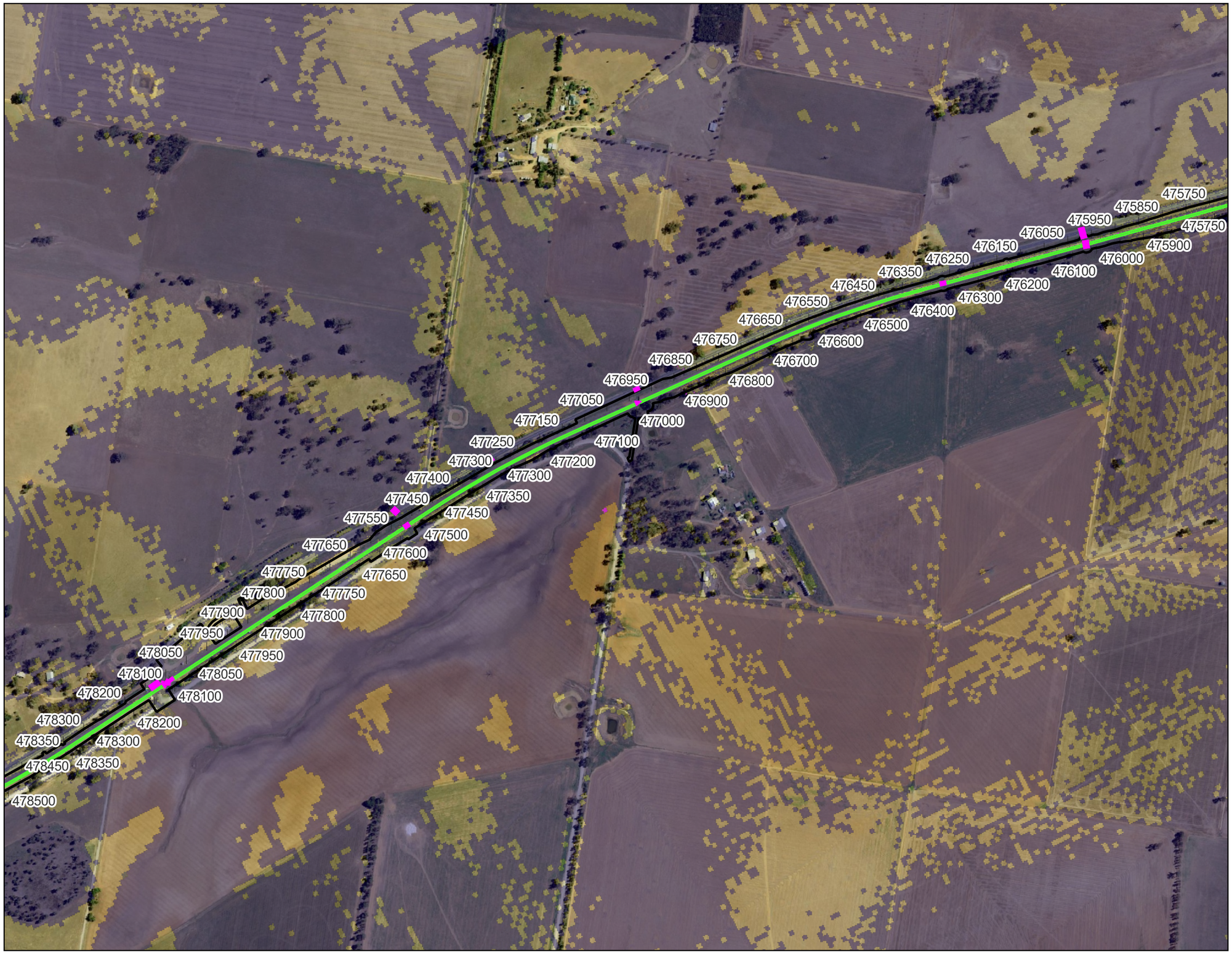
Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Figure A45 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Change in Velocity (m/s)

- <= 0.5
- 0.5 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 2.0

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A46 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Changes in Peak Flood Velocity - Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Difference in Flood Hazard (ARR)

- <= -2.00
- -2.00 - -1.00
- -1.00 - 0.00
- 0.00 - 1.00
- 1.00 - 2.00
- > 2.00

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Map by: SM

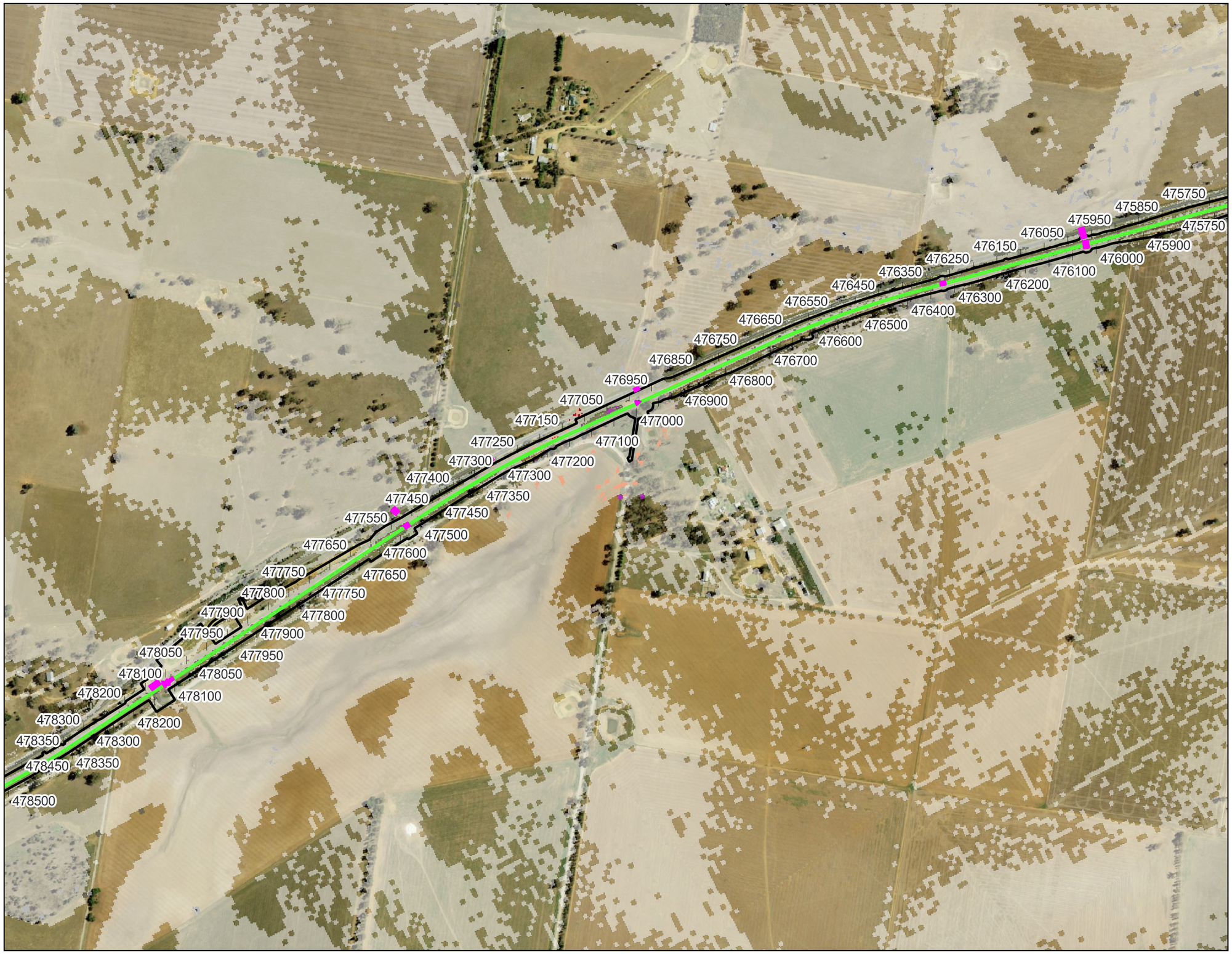
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A47 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

10% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition



Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Difference in Flood Hazard (ARR)

- <= -2.00
- -2.00 - -1.00
- -1.00 - 0.00
- 0.00 - 1.00
- 1.00 - 2.00
- > 2.00

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A48 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

5% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition



Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Difference in Flood Hazard (ARR)

- <= -2.00
- -2.00 - -1.00
- -1.00 - 0.00
- 0.00 - 1.00
- 1.00 - 2.00
- > 2.00

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

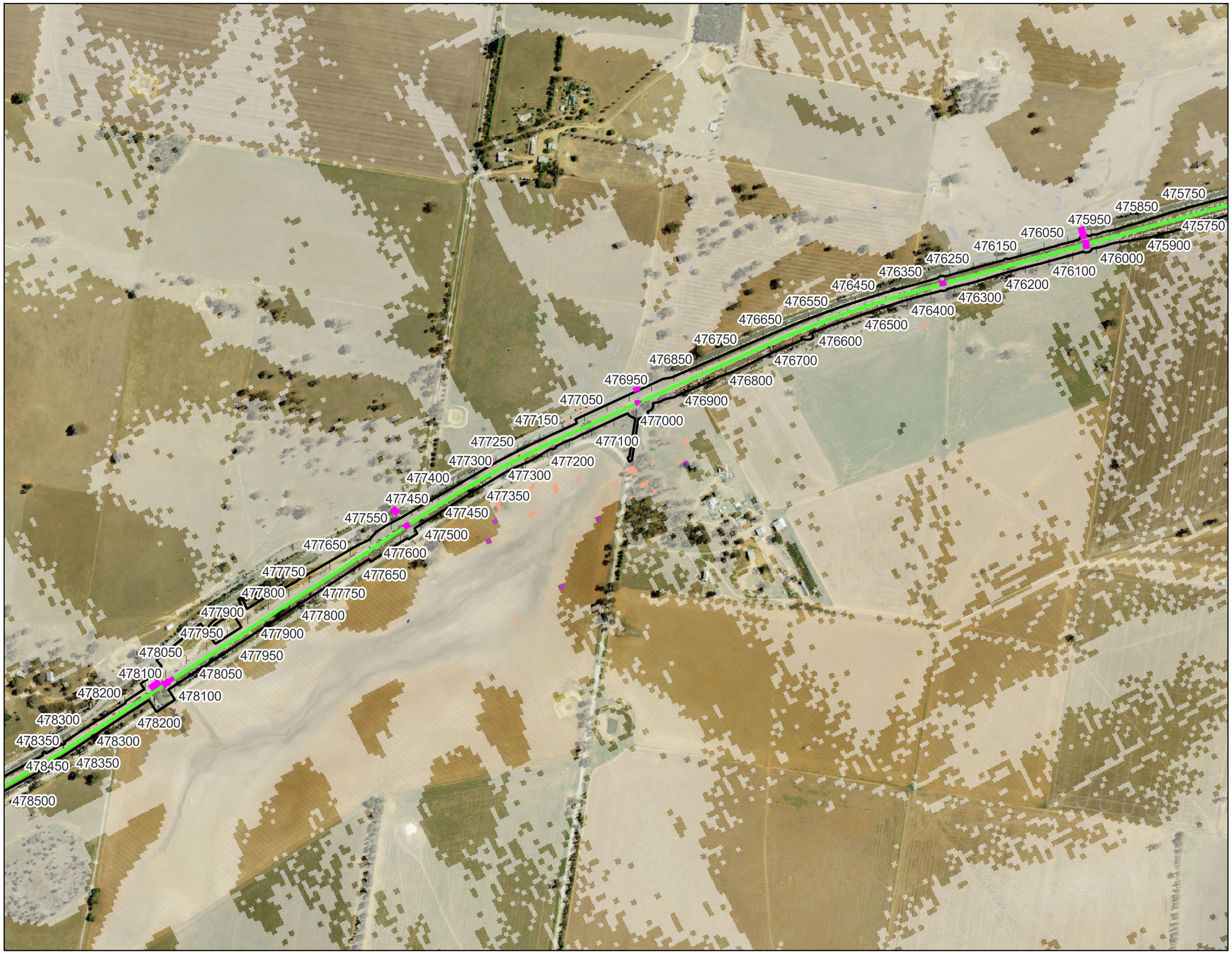
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A49 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

2% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition



Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Difference in Flood Hazard (ARR)

- <= -2.00
- -2.00 - -1.00
- -1.00 - 0.00
- 0.00 - 1.00
- 1.00 - 2.00
- > 2.00

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A50 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition



Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

Difference in Flood Hazard (ARR)

- <= -2.00
- -2.00 - -1.00
- -1.00 - 0.00
- 0.00 - 1.00
- 1.00 - 2.00
- > 2.00

Wet/Dry

- Was Wet - Now Dry
- Was Dry - Now Wet

Notes:

Figure A51 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Climate Change Changes in Peak Flood Hazard - Design Condition vs Existing Condition

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts
- 1m Water Level Contours (m AHD)

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: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A52 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Depth and Levels - Blockage Sensitivity

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

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: SM

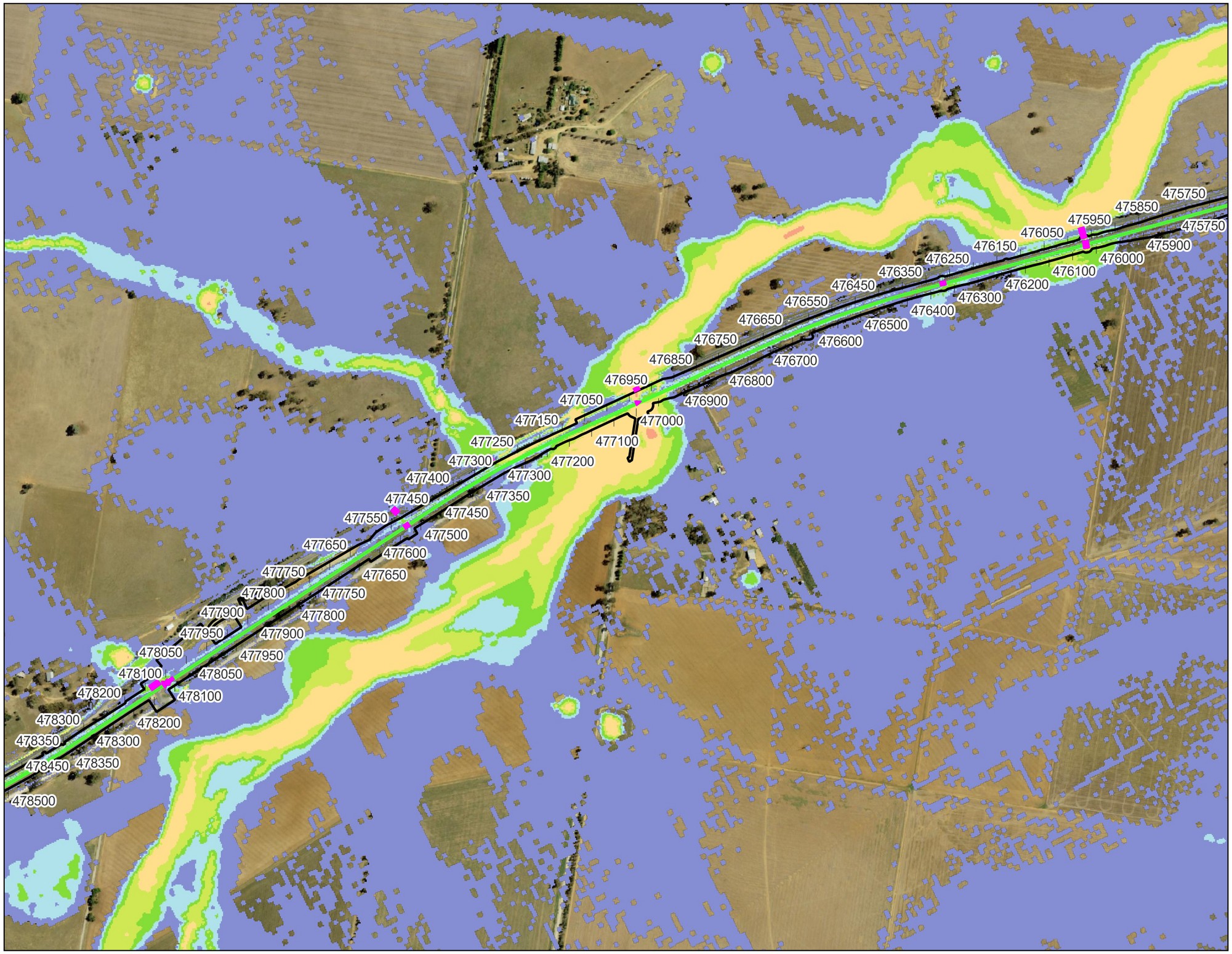
0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A53 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Velocity - Blockage Sensitivity



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Rail Culverts

ARR Flood Hazard

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

Map by: SM

0 300 600 m

A3 Scale: 1:7,703.338383

5/2/2025 GDA2020 MGA Zone55

Figure A54 Junee to Illabo Dual Track Clearance - Western Model - IFC Stage

1% AEP Peak Flood Hazard - Blockage Sensitivity

APPENDIX B

Flood Maps – Junee to Illabo East



List of Flood Maps:

Figure ID	Figure
B0	Figures Set Up
B1	10% AEP Peak Flood Depth and Levels - Existing Conditions
B1a	10% AEP Peak Flood Depth and Levels - Existing Conditions
B1b	10% AEP Peak Flood Depth and Levels - Existing Conditions
B1c	10% AEP Peak Flood Depth and Levels - Existing Conditions
B2	5% AEP Peak Flood Depth and Levels - Existing Conditions
B2a	5% AEP Peak Flood Depth and Levels - Existing Conditions
B2b	5% AEP Peak Flood Depth and Levels - Existing Conditions
B2c	5% AEP Peak Flood Depth and Levels - Existing Conditions
B3	2% AEP Peak Flood Depth and Levels - Existing Conditions
B3a	2% AEP Peak Flood Depth and Levels - Existing Conditions
B3b	2% AEP Peak Flood Depth and Levels - Existing Conditions
B3c	2% AEP Peak Flood Depth and Levels - Existing Conditions
B4	1% AEP Peak Flood Depth and Levels - Existing Conditions
B4a	1% AEP Peak Flood Depth and Levels - Existing Conditions
B4b	1% AEP Peak Flood Depth and Levels - Existing Conditions
B4c	1% AEP Peak Flood Depth and Levels - Existing Conditions
B5	1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions
B5a	1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions
B5b	1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions
B5c	1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions
B6	PMF Peak Flood Depth and Levels - Existing Conditions
B6a	PMF Peak Flood Depth and Levels - Existing Conditions
B6b	PMF Peak Flood Depth and Levels - Existing Conditions
B6c	PMF Peak Flood Depth and Levels - Existing Conditions
B7	10% AEP Peak Flood Velocity - Existing Conditions
B7a	10% AEP Peak Flood Velocity - Existing Conditions
B7b	10% AEP Peak Flood Velocity - Existing Conditions
B7c	10% AEP Peak Flood Velocity - Existing Conditions
B8	5% AEP Peak Flood Velocity - Existing Conditions
B8a	5% AEP Peak Flood Velocity - Existing Conditions
B8b	5% AEP Peak Flood Velocity - Existing Conditions
B8c	5% AEP Peak Flood Velocity - Existing Conditions
B9	2% AEP Peak Flood Velocity - Existing Conditions
B9a	2% AEP Peak Flood Velocity - Existing Conditions
B9b	2% AEP Peak Flood Velocity - Existing Conditions
B9c	2% AEP Peak Flood Velocity - Existing Conditions

Figure ID	Figure
B10	1% AEP Peak Flood Velocity - Existing Conditions
B10a	1% AEP Peak Flood Velocity - Existing Conditions
B10b	1% AEP Peak Flood Velocity - Existing Conditions
B10c	1% AEP Peak Flood Velocity - Existing Conditions
B11	1% AEP Climate Change Peak Flood Velocity - Existing Conditions
B11a	1% AEP Climate Change Peak Flood Velocity - Existing Conditions
B11b	1% AEP Climate Change Peak Flood Velocity - Existing Conditions
B11c	1% AEP Climate Change Peak Flood Velocity - Existing Conditions
B12	PMF Peak Flood Velocity - Existing Conditions
B12a	PMF Peak Flood Velocity - Existing Conditions
B12b	PMF Peak Flood Velocity - Existing Conditions
B12c	PMF Peak Flood Velocity - Existing Conditions
B13	10% AEP Peak Flood Hazard - Existing Conditions
B13a	10% AEP Peak Flood Hazard - Existing Conditions
B13b	10% AEP Peak Flood Hazard - Existing Conditions
B13c	10% AEP Peak Flood Hazard - Existing Conditions
B14	5% AEP Peak Flood Hazard - Existing Conditions
B14a	5% AEP Peak Flood Hazard - Existing Conditions
B14b	5% AEP Peak Flood Hazard - Existing Conditions
B14c	5% AEP Peak Flood Hazard - Existing Conditions
B15	2% AEP Peak Flood Hazard - Existing Conditions
B15a	2% AEP Peak Flood Hazard - Existing Conditions
B15b	2% AEP Peak Flood Hazard - Existing Conditions
B15c	2% AEP Peak Flood Hazard - Existing Conditions
B16	1% AEP Peak Flood Hazard - Existing Conditions
B16a	1% AEP Peak Flood Hazard - Existing Conditions
B16b	1% AEP Peak Flood Hazard - Existing Conditions
B16c	1% AEP Peak Flood Hazard - Existing Conditions
B17	1% AEP Climate Change Peak Flood Hazard - Existing Conditions
B17a	1% AEP Climate Change Peak Flood Hazard - Existing Conditions
B17b	1% AEP Climate Change Peak Flood Hazard - Existing Conditions
B17c	1% AEP Climate Change Peak Flood Hazard - Existing Conditions
B18	PMF Peak Flood Hazard - Existing Conditions
B18a	PMF Peak Flood Hazard - Existing Conditions
B18b	PMF Peak Flood Hazard - Existing Conditions
B18c	PMF Peak Flood Hazard - Existing Conditions
B19	10% AEP Peak Flood Depth and Levels - Design Conditions
B19a	10% AEP Peak Flood Depth and Levels - Design Conditions

Figure ID	Figure
B19b	10% AEP Peak Flood Depth and Levels - Design Conditions
B19c	10% AEP Peak Flood Depth and Levels - Design Conditions
B20	5% AEP Peak Flood Depth and Levels - Design Conditions
B20a	5% AEP Peak Flood Depth and Levels - Design Conditions
B20b	5% AEP Peak Flood Depth and Levels - Design Conditions
B20c	5% AEP Peak Flood Depth and Levels - Design Conditions
B21	2% AEP Peak Flood Depth and Levels - Design Conditions
B21a	2% AEP Peak Flood Depth and Levels - Design Conditions
B21b	2% AEP Peak Flood Depth and Levels - Design Conditions
B21c	2% AEP Peak Flood Depth and Levels - Design Conditions
B22	1% AEP Peak Flood Depth and Levels - Design Conditions
B22a	1% AEP Peak Flood Depth and Levels - Design Conditions
B22b	1% AEP Peak Flood Depth and Levels - Design Conditions
B22c	1% AEP Peak Flood Depth and Levels - Design Conditions
B23	1% AEP Climate Change Peak Flood Depth and Levels - Design Conditions
B23a	1% AEP Climate Change Peak Flood Depth and Levels - Design Conditions
B23b	1% AEP Climate Change Peak Flood Depth and Levels - Design Conditions
B23c	1% AEP Climate Change Peak Flood Depth and Levels - Design Conditions
B24	PMF Peak Flood Depth and Levels - Design Conditions
B24a	PMF Peak Flood Depth and Levels - Design Conditions
B24b	PMF Peak Flood Depth and Levels - Design Conditions
B24c	PMF Peak Flood Depth and Levels - Design Conditions
B25	10% AEP Peak Flood Velocity - Design Conditions
B25a	10% AEP Peak Flood Velocity - Design Conditions
B25b	10% AEP Peak Flood Velocity - Design Conditions
B25c	10% AEP Peak Flood Velocity - Design Conditions
B26	5% AEP Peak Flood Velocity - Design Conditions
B26a	5% AEP Peak Flood Velocity - Design Conditions
B26b	5% AEP Peak Flood Velocity - Design Conditions
B26c	5% AEP Peak Flood Velocity - Design Conditions
B27	2% AEP Peak Flood Velocity - Design Conditions
B27a	2% AEP Peak Flood Velocity - Design Conditions
B27b	2% AEP Peak Flood Velocity - Design Conditions
B27c	2% AEP Peak Flood Velocity - Design Conditions
B28	1% AEP Peak Flood Velocity - Design Conditions
B28a	1% AEP Peak Flood Velocity - Design Conditions
B28b	1% AEP Peak Flood Velocity - Design Conditions
B28c	1% AEP Peak Flood Velocity - Design Conditions

Figure ID	Figure
B29	1% AEP Climate Change Peak Flood Velocity - Design Conditions
B29a	1% AEP Climate Change Peak Flood Velocity - Design Conditions
B29b	1% AEP Climate Change Peak Flood Velocity - Design Conditions
B29c	1% AEP Climate Change Peak Flood Velocity - Design Conditions
B30	PMF Peak Flood Velocity - Design Conditions
B30a	PMF Peak Flood Velocity - Design Conditions
B30b	PMF Peak Flood Velocity - Design Conditions
B30c	PMF Peak Flood Velocity - Design Conditions
B31	10% AEP Peak Flood Hazard - Design Conditions
B31a	10% AEP Peak Flood Hazard - Design Conditions
B31b	10% AEP Peak Flood Hazard - Design Conditions
B31c	10% AEP Peak Flood Hazard - Design Conditions
B32	5% AEP Peak Flood Hazard - Design Conditions
B32a	5% AEP Peak Flood Hazard - Design Conditions
B32b	5% AEP Peak Flood Hazard - Design Conditions
B32c	5% AEP Peak Flood Hazard - Design Conditions
B33	2% AEP Peak Flood Hazard - Design Conditions
B33a	2% AEP Peak Flood Hazard - Design Conditions
B33b	2% AEP Peak Flood Hazard - Design Conditions
B33c	2% AEP Peak Flood Hazard - Design Conditions
B34	1% AEP Peak Flood Hazard - Design Conditions
B34a	1% AEP Peak Flood Hazard - Design Conditions
B34b	1% AEP Peak Flood Hazard - Design Conditions
B34c	1% AEP Peak Flood Hazard - Design Conditions
B35	1% AEP Climate Change Peak Flood Hazard - Design Conditions
B35a	1% AEP Climate Change Peak Flood Hazard - Design Conditions
B35b	1% AEP Climate Change Peak Flood Hazard - Design Conditions
B35c	1% AEP Climate Change Peak Flood Hazard - Design Conditions
B36	PMF Peak Flood Hazard - Design Conditions
B36a	PMF Peak Flood Hazard - Design Conditions
B36b	PMF Peak Flood Hazard - Design Conditions
B36c	PMF Peak Flood Hazard - Design Conditions
B37	10% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B37a	10% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B37b	10% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B37c	10% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B38	5% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B38a	5% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition

Figure ID	Figure
B38b	5% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B38c	5% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B39	2% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B39a	2% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B39b	2% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B39c	2% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B40	1% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B40a	1% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B40b	1% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B40c	1% AEP Changes in Peak Flood Levels - Design Condition vs Existing Condition
B41	1% AEP Climate Change Changes in Peak Flood Levels - Design Condition vs Existing Condition
B41a	1% AEP Climate Change Changes in Peak Flood Levels - Design Condition vs Existing Condition
B41b	1% AEP Climate Change Changes in Peak Flood Levels - Design Condition vs Existing Condition
B41c	1% AEP Climate Change Changes in Peak Flood Levels - Design Condition vs Existing Condition
B42	10% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B42a	10% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B42b	10% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B42c	10% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B43	5% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B43a	5% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B43b	5% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B43c	5% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B44	2% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B44a	2% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B44b	2% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B44c	2% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B45	1% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B45a	1% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B45b	1% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B45c	1% AEP Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B46	1% AEP Climate Change Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B46a	1% AEP Climate Change Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B46b	1% AEP Climate Change Changes in Peak Flood Velocity - Design Condition vs Existing Condition

Figure ID	Figure
B46c	1% AEP Climate Change Changes in Peak Flood Velocity - Design Condition vs Existing Condition
B47	10% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B47a	10% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B47b	10% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B47c	10% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B48	5% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B48a	5% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B48b	5% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B48c	5% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B49	2% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B49a	2% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B49b	2% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B49c	2% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B50	1% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B50a	1% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B50b	1% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B50c	1% AEP Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B51	1% AEP Climate Change Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B51a	1% AEP Climate Change Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B51b	1% AEP Climate Change Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B51c	1% AEP Climate Change Changes in Peak Flood Hazard - Design Condition vs Existing Condition
B52	1% AEP Peak Flood Depth and Levels - Blockage Sensitivity
B52a	1% AEP Peak Flood Depth and Levels - Blockage Sensitivity
B52b	1% AEP Peak Flood Depth and Levels - Blockage Sensitivity
B52c	1% AEP Peak Flood Depth and Levels - Blockage Sensitivity
B53	1% AEP Peak Flood Velocity - Blockage Sensitivity
B53a	1% AEP Peak Flood Velocity - Blockage Sensitivity
B53b	1% AEP Peak Flood Velocity - Blockage Sensitivity
B53c	1% AEP Peak Flood Velocity - Blockage Sensitivity
B54	1% AEP Peak Flood Hazard - Blockage Sensitivity
B54a	1% AEP Peak Flood Hazard - Blockage Sensitivity
B54b	1% AEP Peak Flood Hazard - Blockage Sensitivity
B54c	1% AEP Peak Flood Hazard - Blockage Sensitivity

MARTINUS

aurecon BG&E

Legend

Notes:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B0 - Junee to Illabo Eastern Model - IFC Stage

Figures Set Up

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B1 - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B1a - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B1b - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B1c - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B2 - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B2a - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B2b - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B2c - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B3 - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B3a - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B3b - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B3c - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B4 - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B4a - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B4b - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B4c - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B5 - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B5a - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B5b - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B5c - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B6 - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B6a - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B6b - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Depth and Levels - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

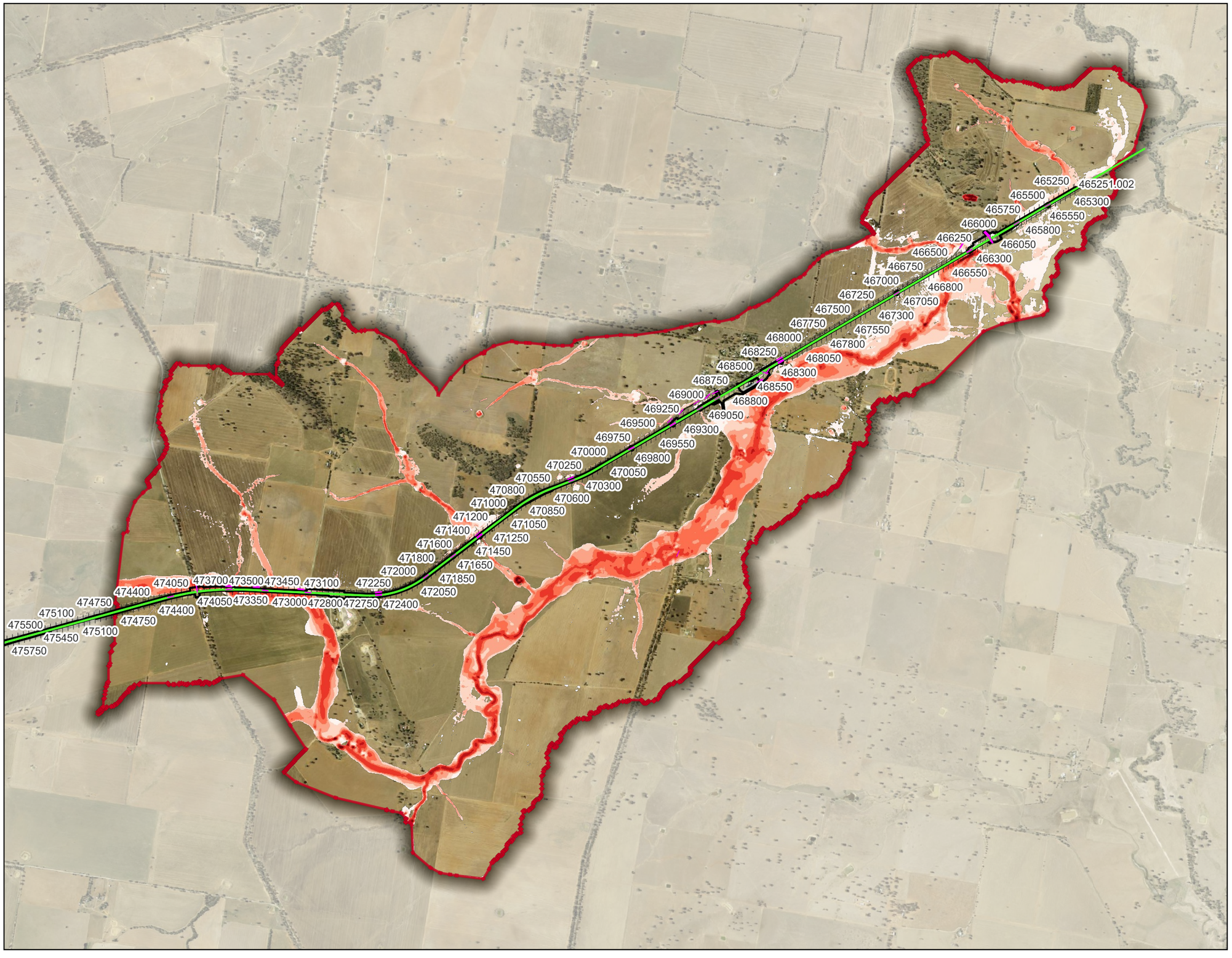
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B6c - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Depth and Levels - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B7 - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Map by: SM

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Figure B7a - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B7b - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Velocity - Existing Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B7c - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B8 - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Velocity - Existing Conditions

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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B8a - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B8b - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B8c - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B9 - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Velocity - Existing Conditions

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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B9a - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B9b - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

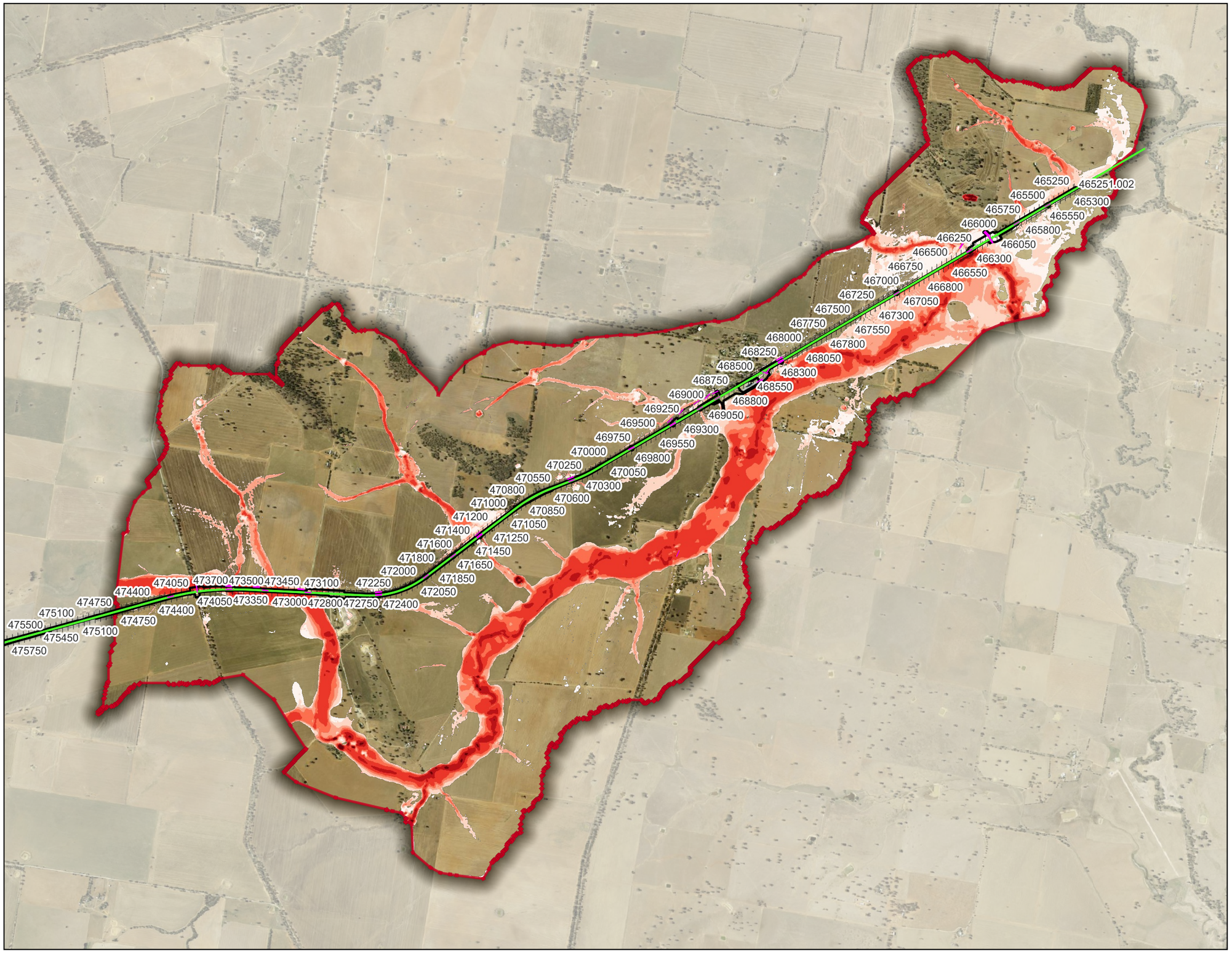
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B9c - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Velocity - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B10 - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B10a - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Velocity - Existing Conditions

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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B10b - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

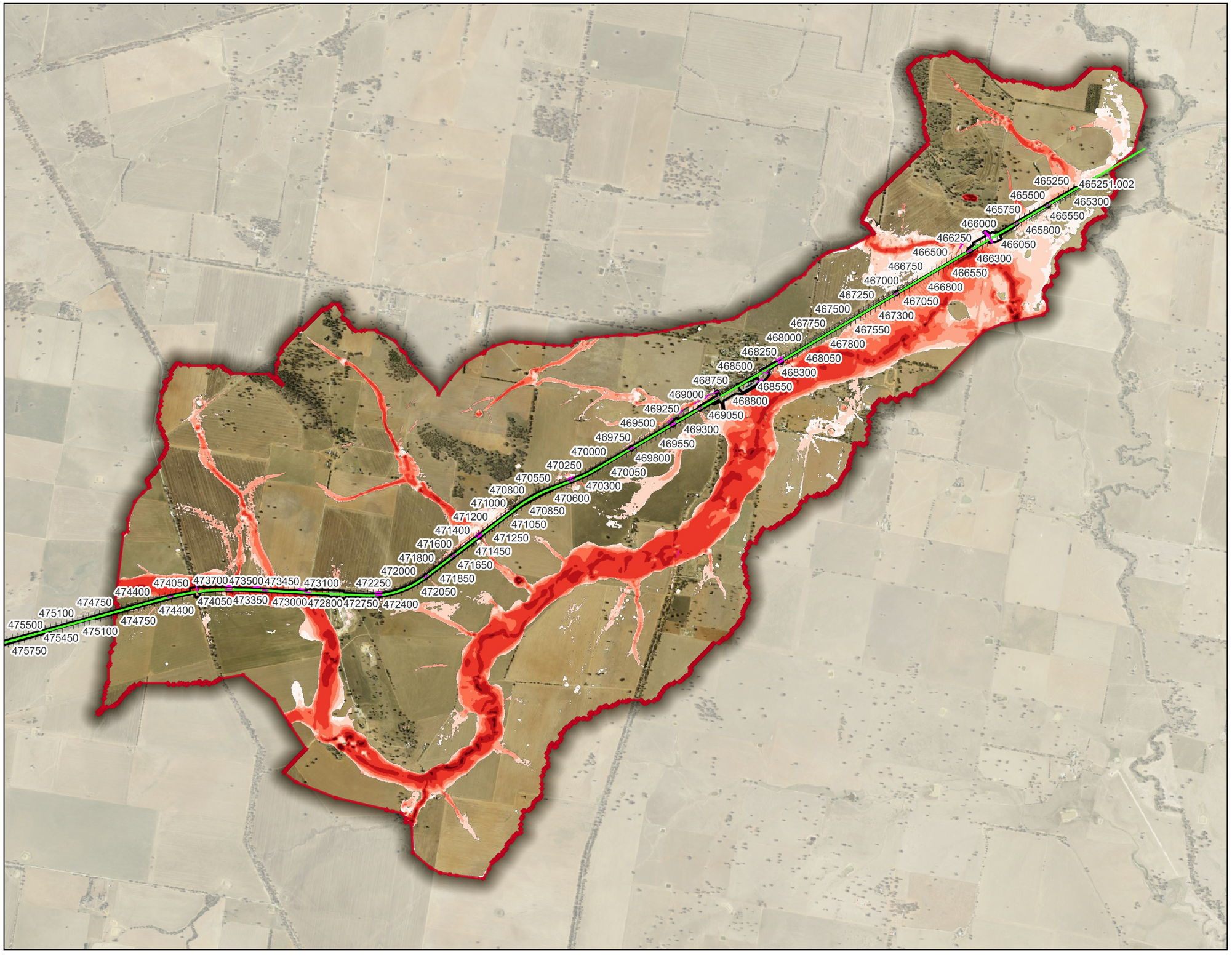
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B10c - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Velocity - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B11 - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B11a - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B11b - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B11c - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B12 - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Velocity - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B12a - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Velocity - Existing Conditions

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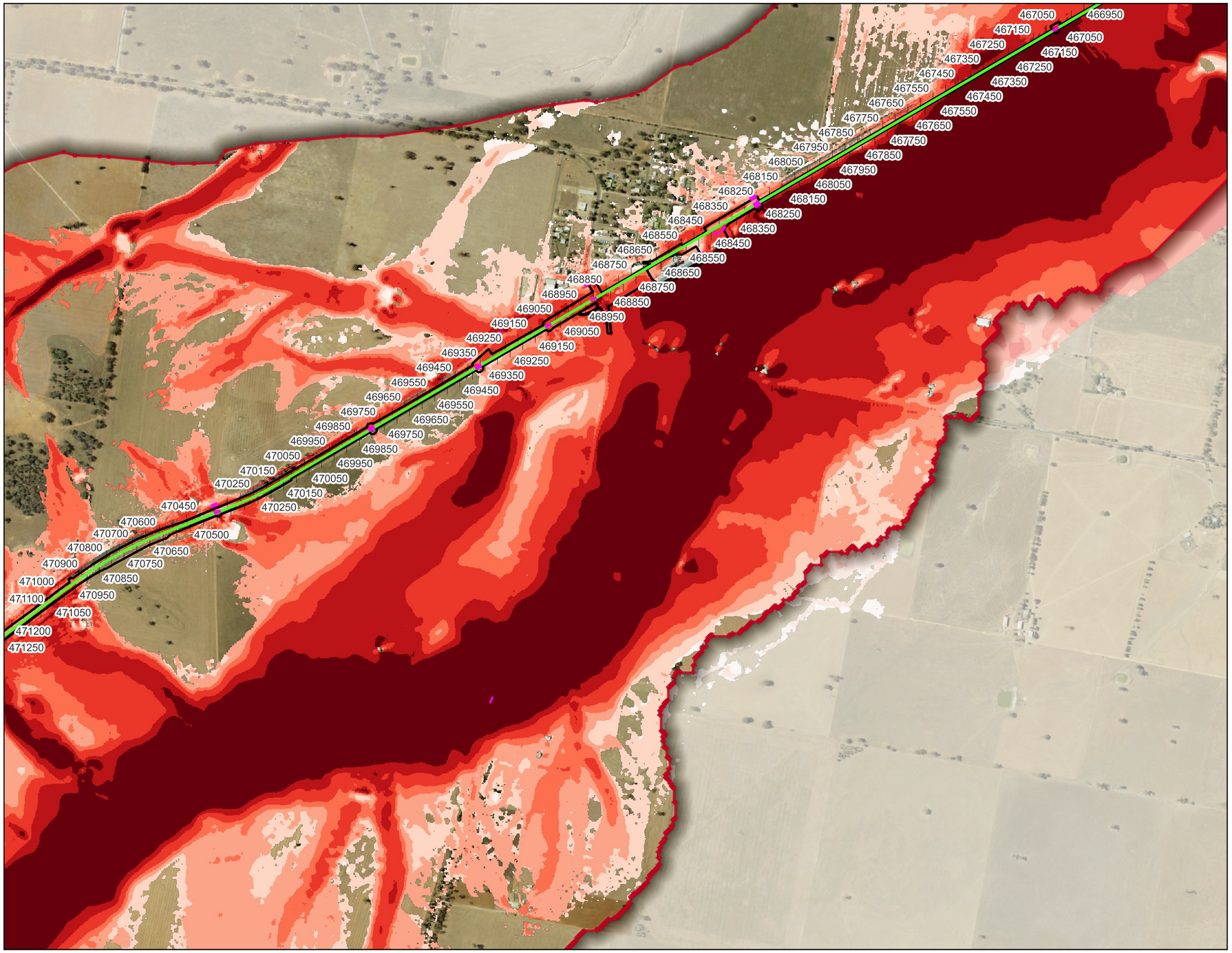
Map by: SM



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

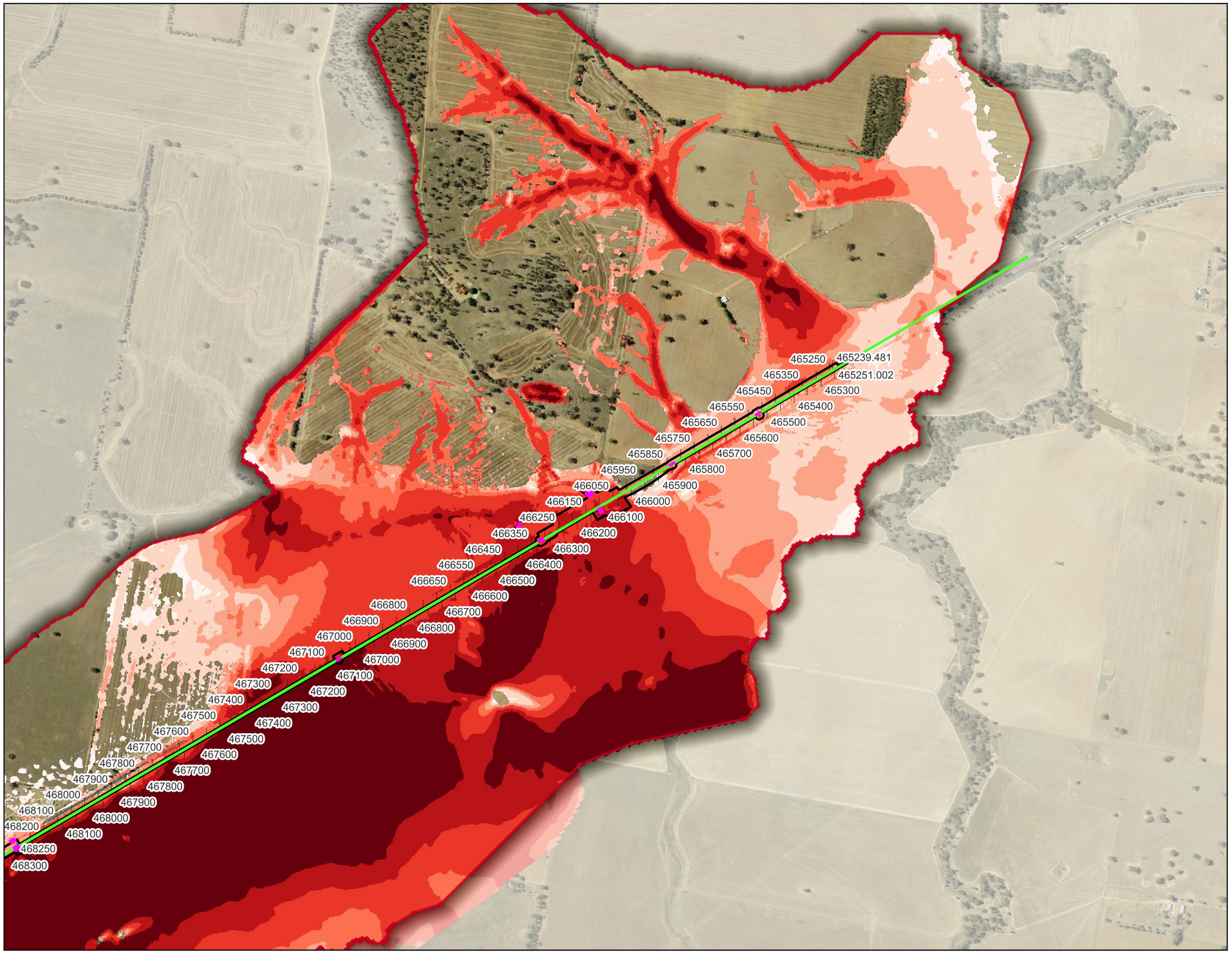
0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B12b - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Velocity - Existing Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Velocity (m/s)

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

Notes:

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Map by: SM

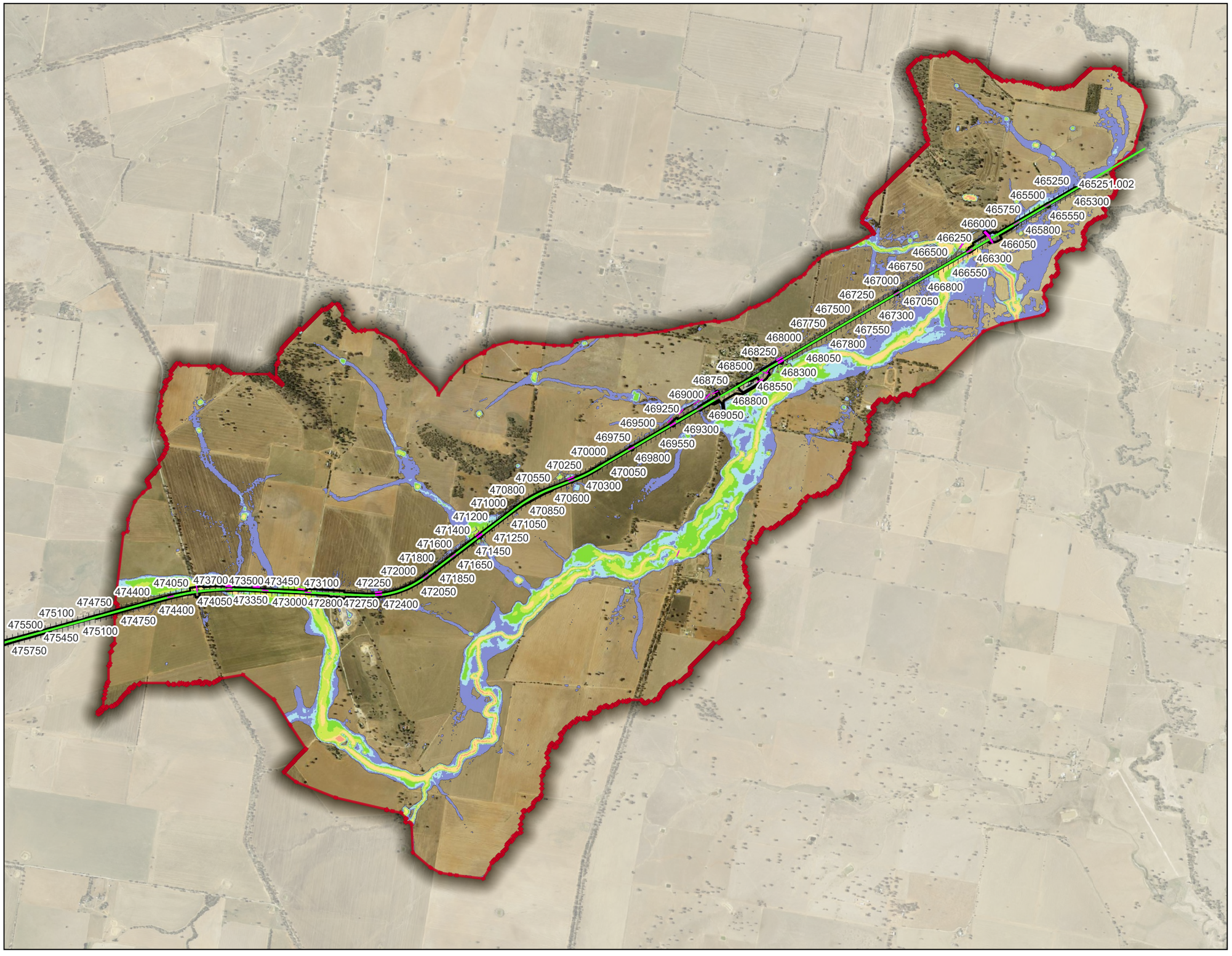
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B12c - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Velocity - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B13 - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B13a - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B13b - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

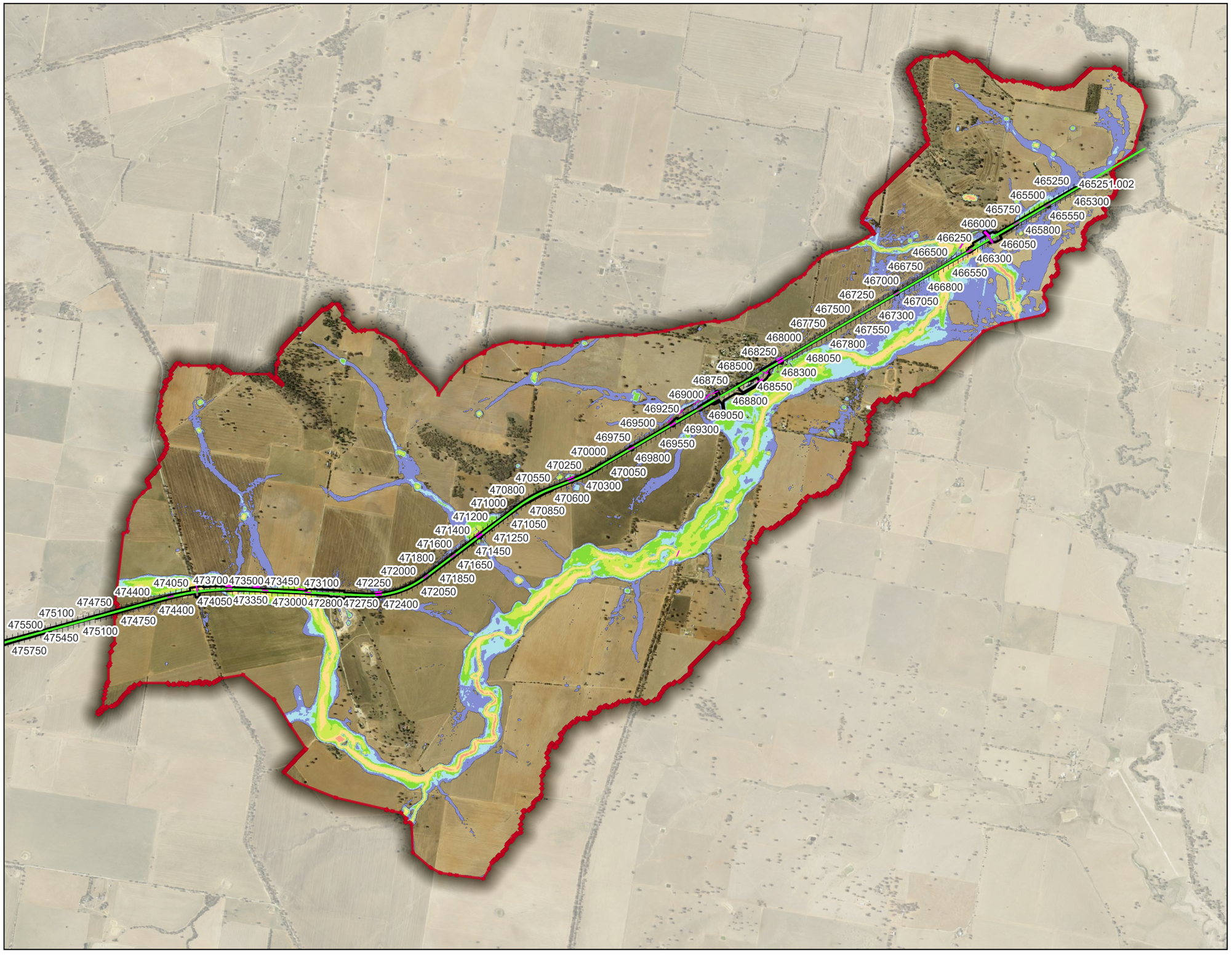
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B13c - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Hazard - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B14 - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B14a - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

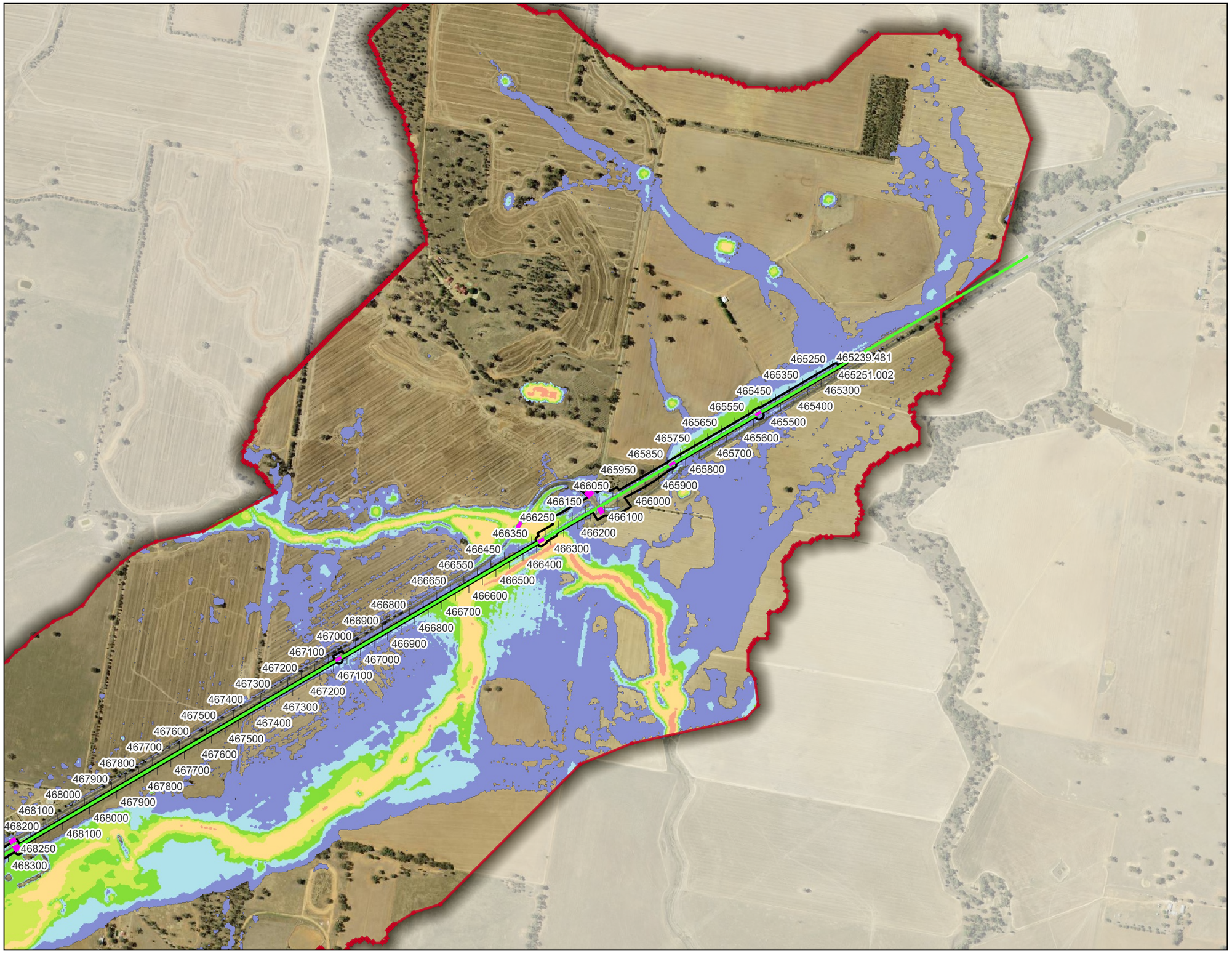
0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B14b - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Hazard - Existing Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

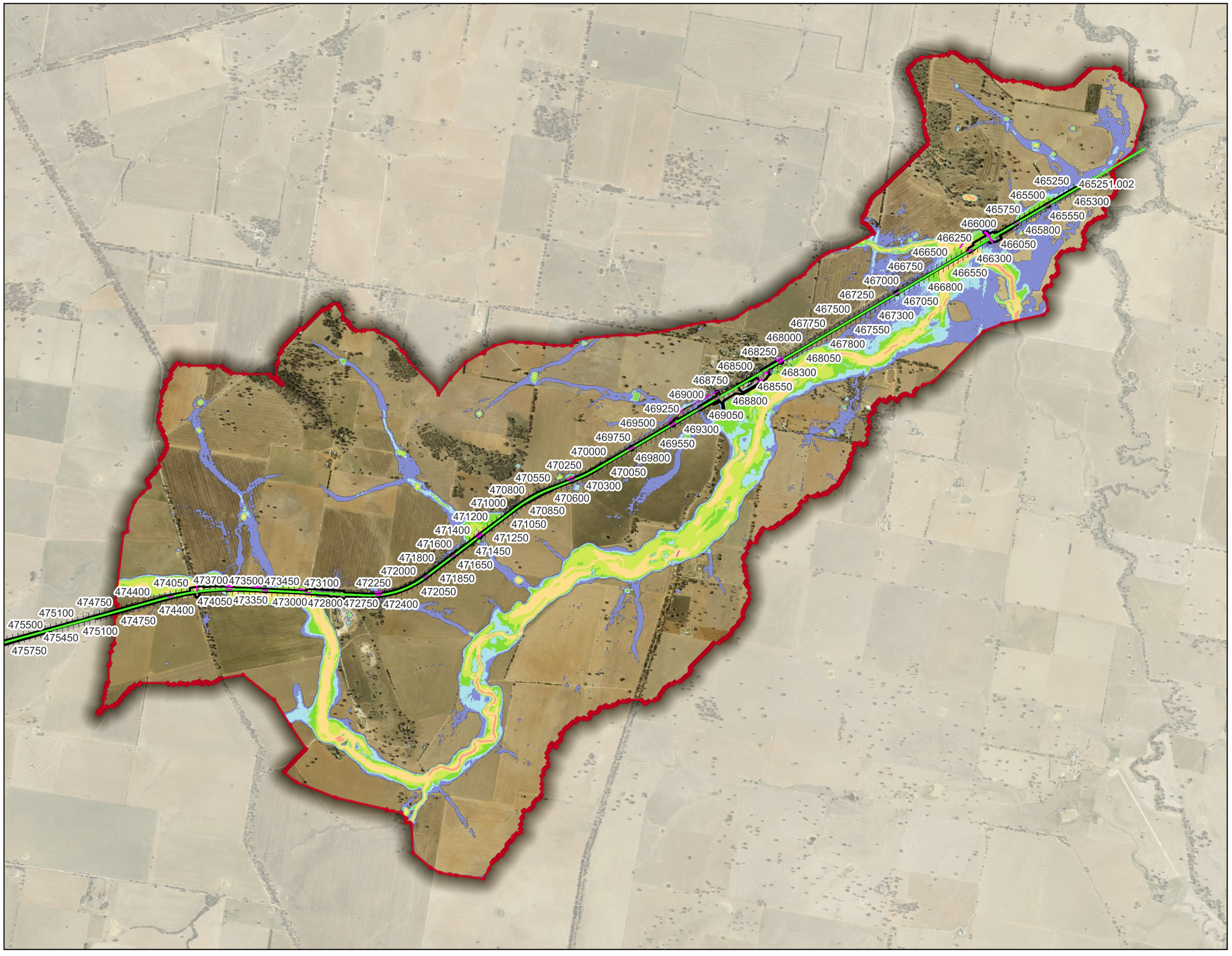
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B14c - Junee to Illabo Eastern Model - IFC Stage

5% AEP Peak Flood Hazard - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B15 - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B15a - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B15b - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

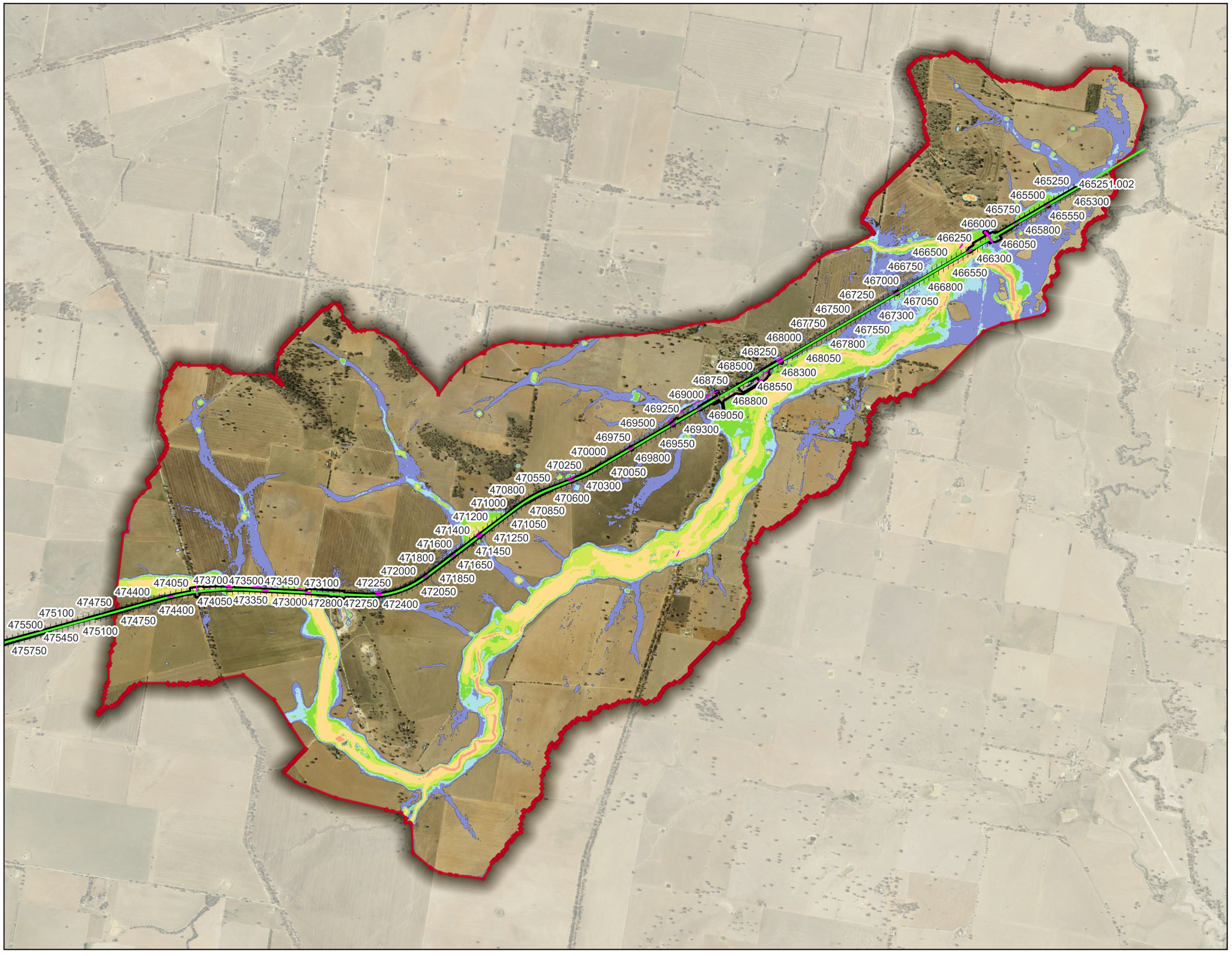
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B15c - Junee to Illabo Eastern Model - IFC Stage

2% AEP Peak Flood Hazard - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

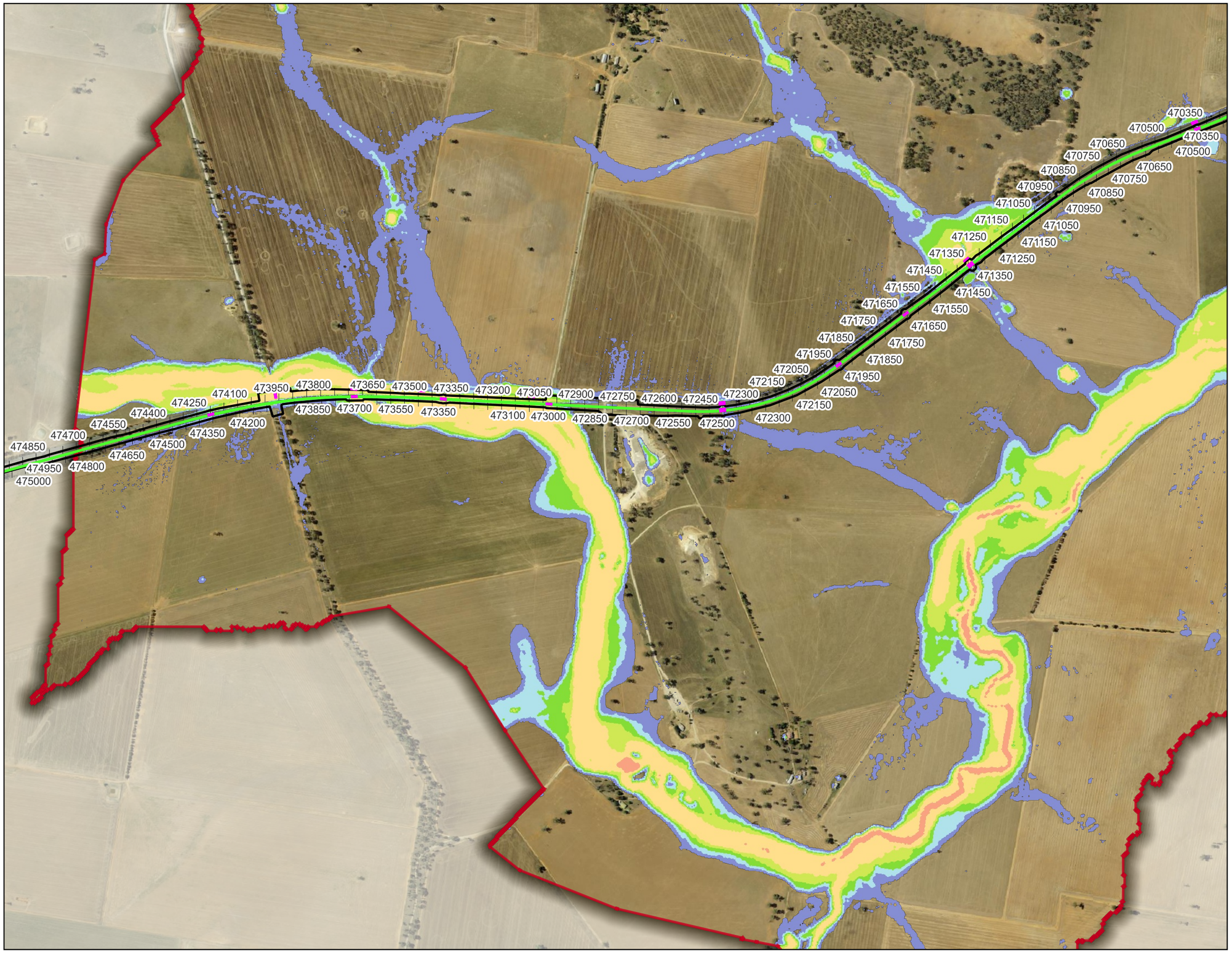
0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B16 - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Hazard - Existing Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B16a - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B16b - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

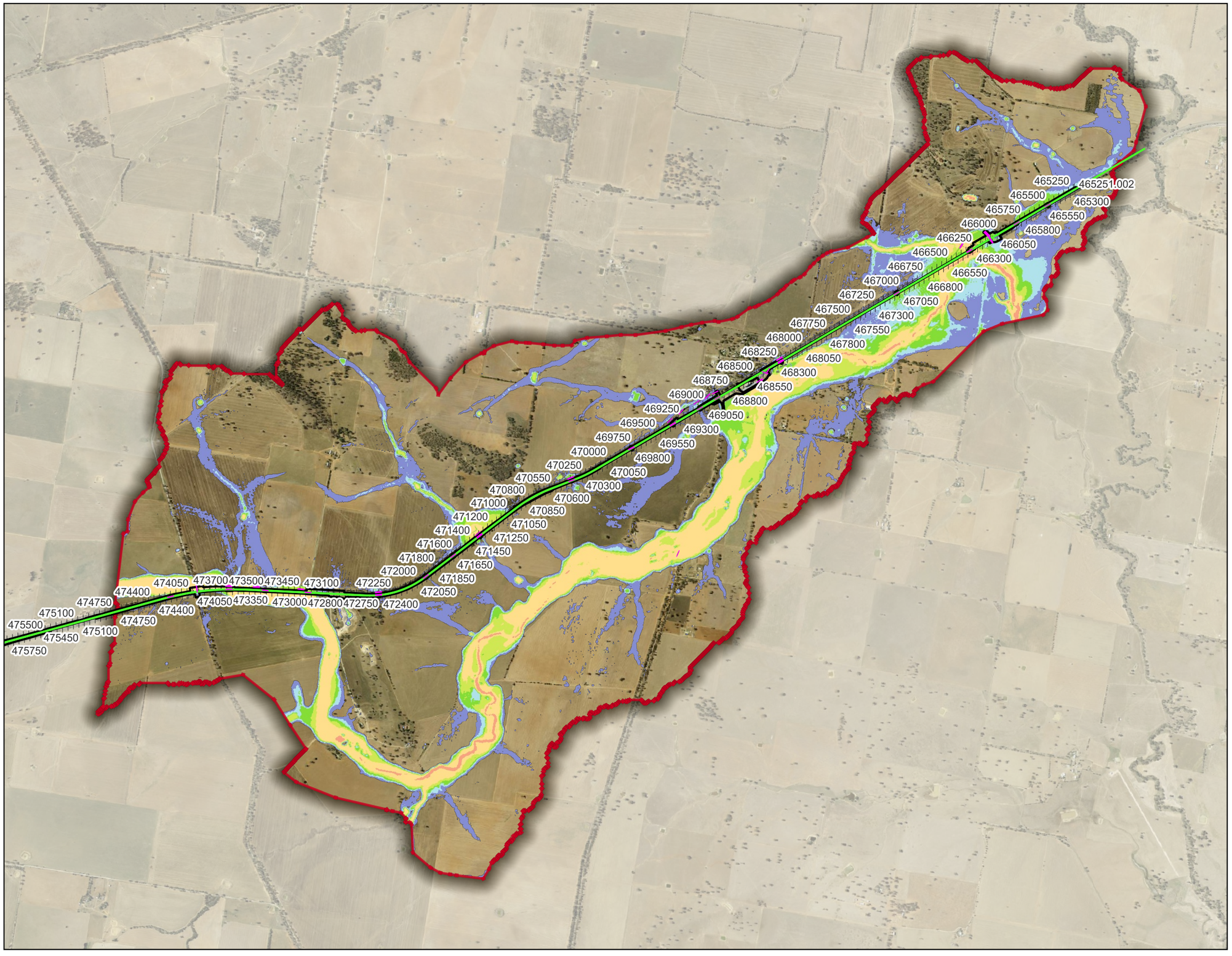
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B16c - Junee to Illabo Eastern Model - IFC Stage

1% AEP Peak Flood Hazard - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

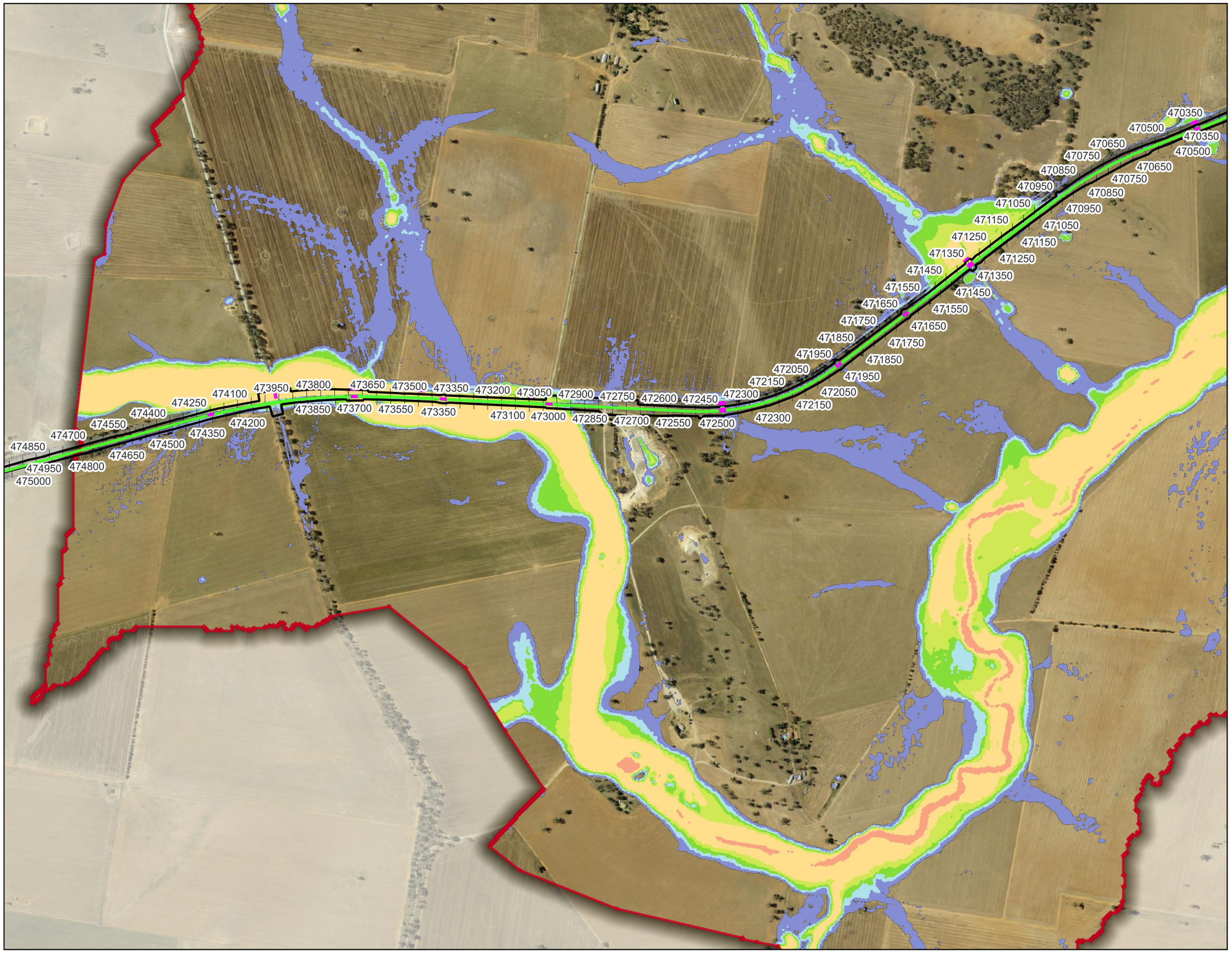
0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B17 - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Hazard - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B17a - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

R:\BGE\BNE\BE22012.01 A2P ENHANCEMENT D&C\100 DRAW\100.8 Flooding\Workspace

Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B17b - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

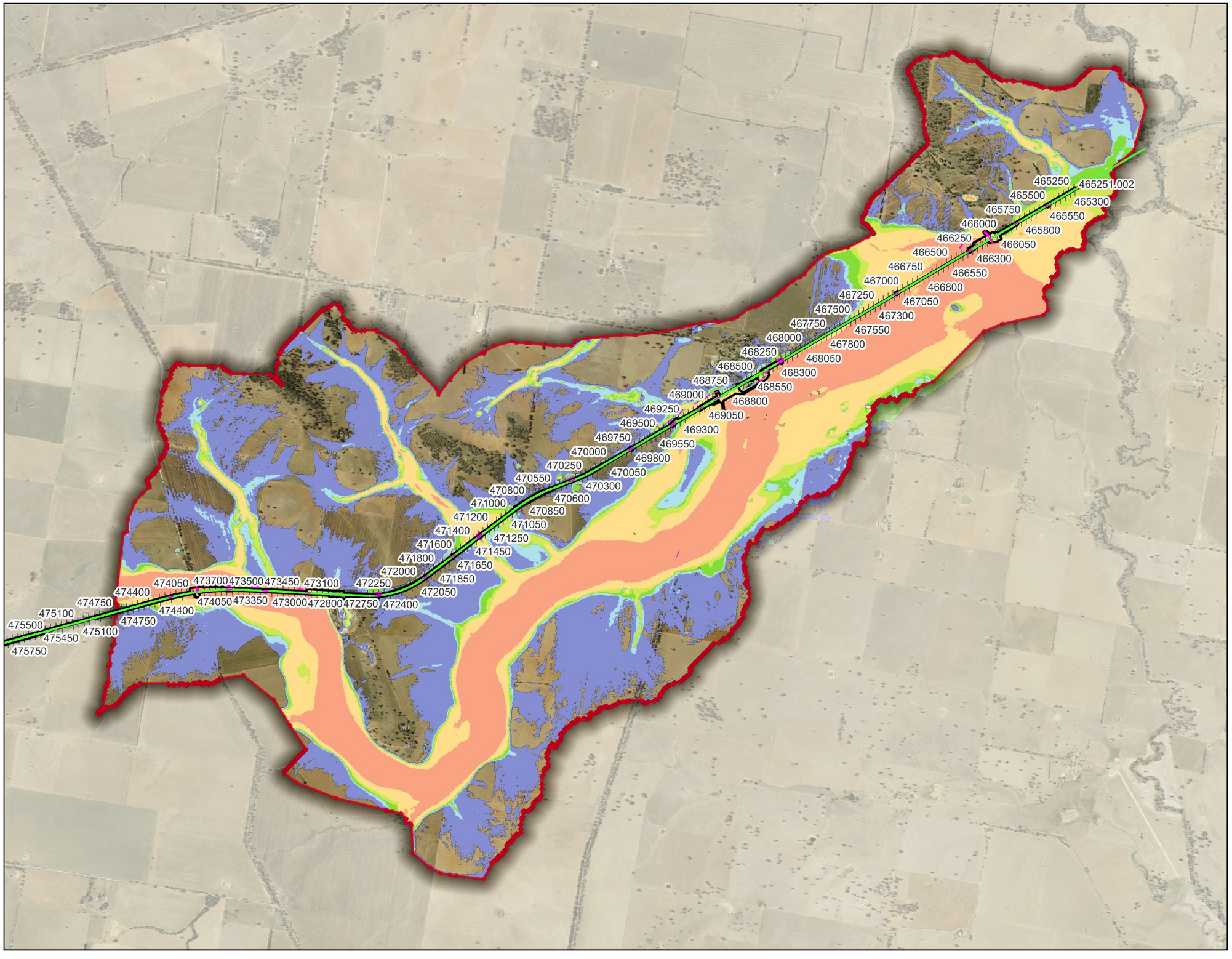
0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B17c - Junee to Illabo Eastern Model - IFC Stage

1% AEP Climate Change Peak Flood Hazard - Existing Conditions



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Map by: SM

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

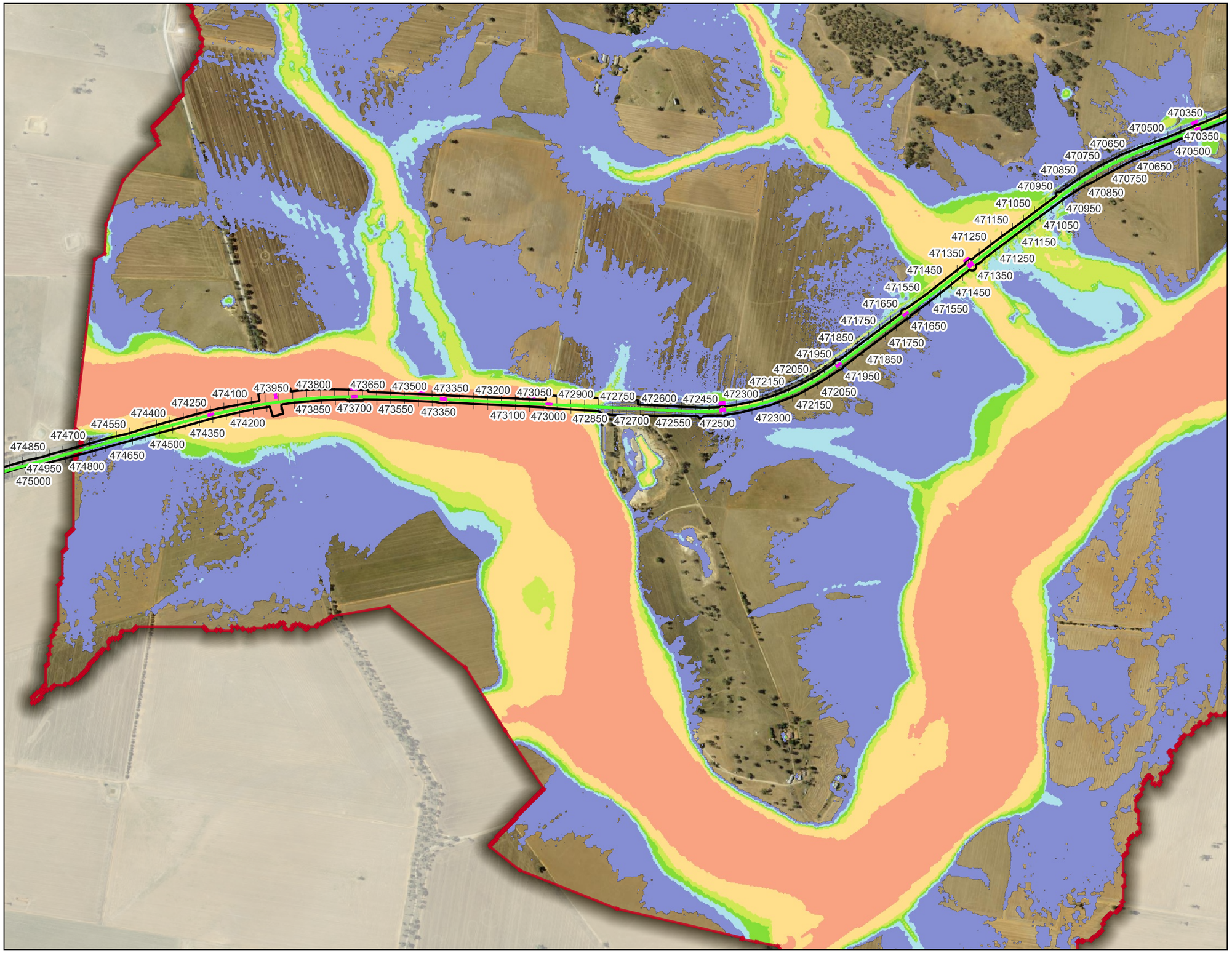
0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B18 - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Hazard - Existing Conditions



MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B18a - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:12,957.77933

7/2/2025 GDA2020 MGA Zone55

Figure B18b - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts

Flood Hazard Category

- 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 building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6: Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

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Map by: SM

0 400 800 m

A3 Scale: 1:12,028.820886

7/2/2025 GDA2020 MGA Zone55

Figure B18c - Junee to Illabo Eastern Model - IFC Stage

PMF Peak Flood Hazard - Existing Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 1,000 2,000 m

A3 Scale: 1:33,430.136314

7/2/2025 GDA2020 MGA Zone55

Figure B19 - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Depth and Levels - Design Conditions

MARTINUS

aurecon BG&E

Legend

- TUFLOW Model Extent
- Project Boundary
- Rail Centreline
- Culverts
- 1m Water Level Contours (m AHD)

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:

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Map by: SM

0 500 1,000 m

A3 Scale: 1:13,592.138399

7/2/2025 GDA2020 MGA Zone55

Figure B19a - Junee to Illabo Eastern Model - IFC Stage

10% AEP Peak Flood Depth and Levels - Design Conditions