



ATTACHMENT 7

Stormwater Quality Management Plan
prepared by Biome

Conceptual Stormwater (Quality) Management Plan

Flinders Lakes Neighbourhood 3B & 3C

Pacific International Development Corporation
Pty Ltd as Trustee for The PIDC Trust

June 2026
BC-25066



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Author Angela Corey
BEng(Hons)

Reviewed by Brad Comley

Approved by Brad Comley
MSc, BAppSc, MEngPrac, NER, RPEQ (17706), CPEng

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Biome Consulting Pty Ltd
ABN: 86 166 087 476

PO Box 3469, Australia Fair SOUTHPORT QLD 4215

Office: 5532 7779

Mobile: 0415 935 222

Email: brad@BIOMEconsulting.com.au

Internet: www.BIOMEconsulting.com.au

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Executive Summary

This Conceptual Stormwater (Quality) Management Plan (SQMP) has been prepared so as to be considered as part of a Reconfiguration of a Lot (ROL) application over Lot 3 on S311896 at Lot 3 Mount Elliott Road, Flinders Lakes (the subject site).

This report has been prepared on behalf of Pacific International Development Corporation Pty Ltd as Trustee for The PIDC Trust and presents designs based on a comprehensive review of available Stormwater Quality Improvement Devices (SQIDs). The aim of this report is to ensure that the development adequately addresses the management of stormwater quality during the operational phase of the development.

Two (2) bioretention basins with a total filter area of 1,240 m² have been designed to provide the required pollutant removal efficiencies of 85%, 60%, 45% and 90% for total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN) and gross pollutants (GP), respectively.

MUSIC modelling has demonstrated that the inclusion of the above treatment option will achieve pollutant removal efficiencies of 80%, 60%, 45% and 90% for TSS, TP, TN and gross pollutants respectively for the development area.

The level of detail provided within this report is suitable for development assessment only and should not be relied upon for construction purposes. Detailed design documentation should be prepared in conjunction with civil operational works to finalise the stormwater concepts presented in this report.

This report has been reviewed by a Registered Professional Engineer of Queensland (RPEQ), and certification has been provided that if the design parameters set out in this report are included within the development:

- stormwater pollutant load reductions in accordance with best practice and as agreed by Council should be achieved.



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1 Introduction

This Conceptual Stormwater (Quality) Management Plan (SQMP) has been prepared so as to be considered as part of a Reconfiguration of a Lot (ROL) application for Neighbourhood 3C & 3D of the Flinders Lakes development, over part of Lot 3 on S311896 at Lot 3 Mount Elliott Road, Flinders Lakes (the subject site).

The report has been prepared on behalf of Pacific International Development Corporation Pty Ltd as Trustee for The PIDC Trust and presents the detailed designs for stormwater quality measures to be integrated into the development. The detailed designs have been based on a comprehensive review of available technical design guidelines. The aim of each design is to ensure that the development adequately addresses the management of stormwater quality during the operational phase of the development.

1.1 Objectives

The overarching objective of this report is to present practical conceptual stormwater designs which can be integrated into the development proposal so as to ensure that the development does not cause an unacceptable impact to receiving environments during the operational phase of development. In addition, the report is to be consistent with the approved Precinct 1 (Lake Concept) Infrastructure Master Plan: Stormwater by Mortons Urban Solutions (Revision A, 23 November 2017).

The following objective is to be achieved.

Operational Phase Objective (Quality)	Stormwater discharged from the site achieves the specified load based reduction targets in accordance Seqwater Development Guidelines: Water Quality Management in Drinking Water Catchments (2017). For the development site relevant targets are TSS 85%, TP 60%, and TN 45%.
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A Flood Impact Assessment has been produced by BMT in support of the current application to detail flooding and stormwater quantity management.



2 Site Location

Flinders Lakes is located approximately 50 kilometres south-west of the Brisbane CBD, within Logan City. The site is held under single ownership, with approximately one-third located within the Greater Flagstone Priority Development Area (PDA), as identified by Economic Development Queensland (EDQ)—referred to as Precinct 1.

Neighbourhoods 3B and 3C are located within the Flinders (Precinct 1) land holding, specifically over (part of) Lot 3 S311896 (the subject site). The subject site is located at Lot 3 Mount Elliott Road, Flinders Lakes. The site has a total area of approximately 678 ha, with access via Dairy Road at the southeast of the site.

The northern portion of the site is mountainous and vegetated, with the exception of unsealed roads. The southern portion consists of large cleared areas, dams, sparse buildings and unsealed access tracks. The site generally grades toward the south and vegetated waterways flow through the site and cross the southeastern boundary.

The current development is proposed over an area of approximately 16 ha in the southeastern corner of the site.

Figure 2.1 below, with imagery sourced from Google Maps, depicts the site's location and surrounding road network. Figure 2.2 shows the development location within the site.



Figure 2.1 Site Location

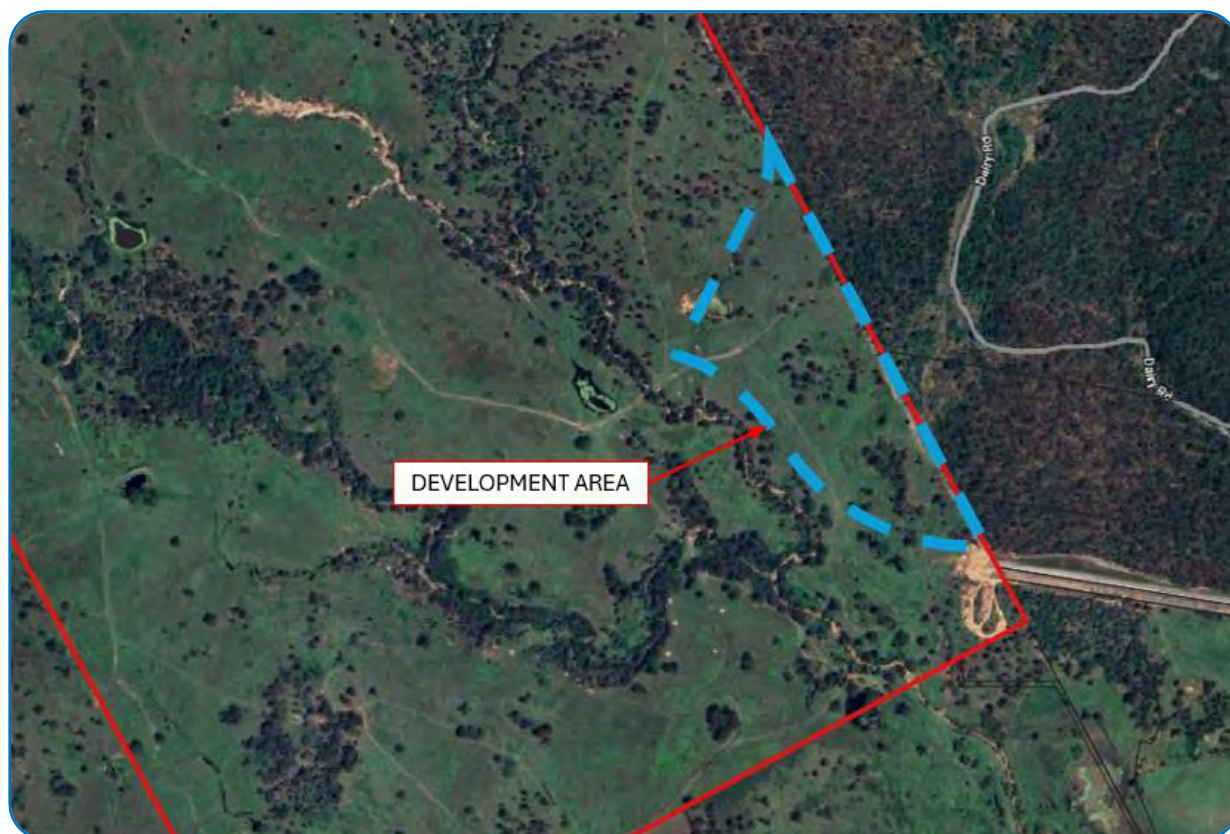


Figure 2.2 Development Location



3 Development Plan

The current proposal is for Neighbourhoods 3B and 3C, located within the Flinders (Precinct 1) land holding, which includes:

- 146 residential lots ranging in size from 335m² to 2,080m², including the provision of 6 lots able to accommodate duplex dwellings;
- A display village and associated car parking, signage and sales office;
- 1 local recreation park comprising 5,000m²;
- 2 local linear parks; and
- A coordinated road network including active transport (cycle) and pedestrian connections.

The stormwater devices required for the management of stormwater quality are to be public assets. The proposed plan of development is shown below in Figure 3.1.



Figure 3.1 Proposed Plan of Development (RPS)



4 Stormwater Strategy

In order to ensure that the operational phase objectives outlined within Section 1.1 of this report can be achieved, a network of stormwater management measures are proposed for inclusion within the development.

With consideration given to the existing site characteristics, the proposed development configuration and the range of available stormwater quality management measures, a set of conceptual stormwater management designs have been proposed and detailed within the drawing set contained within Appendix A.

The Flood Impact Assessment by BMT contains details regarding flooding and stormwater quantity management for the site.

4.1 External Drainage

High flows are to be conveyed through the development within drainage reserves, bypassing all stormwater quality treatment measures. These flows will be conveyed beneath the proposed roads via culverts before discharging from the site.

As the later stages of development are progressed, a lake will be constructed. The drainage reserves within the current stage of development will discharge to the lake prior to discharging from the site across the southeastern boundary within the waterway.

4.2 Internal Drainage

Runoff from the proposed lots, parks and road areas within Neighbourhood 3B & 3C are to be managed in two (2) bioretention basins. The residential allotments will be graded towards the internal road network. Within the road reserves, low flows will be piped toward the proposed basins within the proposed underground drainage, while high flows will be conveyed via the kerb and channel.

Upstream of the bioretention basins piped flows are to be split, with low flows ($\leq 0.4\text{EY}$) directed into the sediment forebay areas before being discharged to the bioretention filter cells to undergo quality treatment. High flows ($> 0.4\text{EY}$) will discharge to the drainage reserve at various locations and discharge from the site along with external catchment flows.



5 Quality Control – Pollutant Reduction

The State Planning Policy Interactive Mapping System, shows that the subject site is located within a mapped water resource catchment and water supply buffer area. As such, in accordance with the Seqwater Development Guidelines for Water Quality Management in Drinking Water Catchments, bioretention basins have been included to achieve the minimum mean annual load-based reductions of 85% for Total Suspended Solids (TSS); 60% for Total Phosphorus (TP), 45% for Total Nitrogen (TN), and 95% for Gross Pollutants (GP).

The Model for Urban Stormwater Improvement Conceptualisation (*MUSIC v6*) has been used to estimate the potential pollutant loads generated by the development and to size the proposed treatment measures. The following sections outline the parameters relied upon within the *MUSIC v6* modelling.

5.1 Rainfall and Evapotranspiration Data

Rainfall and evapotranspiration data has been obtained from the Bureau of Meteorology (BOM) and is summarised within Table 5.1 below. While the Beaudesert Cryna rainfall station is not the station located closest to the site, the mean annual rainfall within the data set is closer to the site's mean annual average and is more conservative compared to the data from the nearest rainfall station, which is located within the Logan City Council area (Greenbank Thompson Rd).

Table 5.1 Meteorological and Rainfall Runoff Data Reporting

Station	Beaudesert Cryna (40014)
Period	1/01/1968 to 31/12/1977 (10 years)
Time step	6 minute
Mean annual rainfall (mm)	829
Evapotranspiration	1,393

5.2 Catchment Parameters

All catchments have been modelled as having an urban residential land use. The lots have been split into roof, carpark and ground level source nodes. Table 5.2 summarises the sub-catchment areas and Drawing DWG-210 – Appendix A presents the sub-catchment delineation.

The adopted pollutant export and runoff parameters for each sub-catchment are based on data from the Water by Design *MUSIC v6* Modelling Guidelines (2010), as summarised in Table 5.3 and Table 5.4.

Table 5.2 MUSIC v6 Sub-Catchment Areas

Catchment ID	Land Use	Area (ha)	Total Impervious (%)
Catchment 1	Urban Residential – Roof	3.62	100
	Urban Residential – Road	2.61	65
	Urban Residential – Ground Level	2.96	30
	Urban Residential – Park	0.57	20
Catchment 2	Urban Residential – Roof	0.49	100
	Urban Residential – Road	0.32	65
	Urban Residential – Ground Level	0.40	30
Total (ha)	-	10.97	



Table 5.3 Rainfall Runoff Parameters

Parameter	All Nodes
Land use	Residential
Rainfall threshold (mm)	1
Soil storage capacity (mm)	500
Initial storage (% capacity)	10
Field capacity (mm)	200
Infiltration capacity coefficient a	211
Infiltration capacity exponent b	5.0
Initial depth (mm)	50
Daily recharge rate (%)	28
Daily baseflow rate (%)	27
Daily deep seepage rate (%)	0

Table 5.4 Pollutant Export Parameters

Flow Type	Surface Type	Total Suspended Solids (log ₁₀ mg/L)		Total Phosphorous (log ₁₀ mg/L)		Total Nitrogen (log ₁₀ mg/L)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Residential							
Base Flow	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Road	1.00	0.34	-0.97	0.31	0.20	0.20
	Ground	1.00	0.34	-0.97	0.31	0.20	0.20
Storm Flow	Roof	1.30	0.39	-0.89	0.31	0.26	0.23
	Road	2.43	0.39	-0.30	0.31	0.26	0.23
	Ground	2.18	0.39	-0.47	0.31	0.26	0.23

5.3 Treatment Measures

In order to determine the design requirements for the necessary stormwater treatment measures, key “Treatment Nodes” were added to the *MUSIC v6* model to represent the proposed SQIDs. The following sections outline the modelling parameters relied upon for the “Treatment Nodes”.

The following sections outline the modelling parameters relied upon.

5.3.1 Bioretention

Bioretention systems operate by capturing and retaining water in an extended ponding area, before filtering through a soil media. The devices remove pollutants via the following physical processes:

- Sedimentation in the extended detention storage;
- Filtration by filter media;
- Nutrient uptake by biofilms;
- Nutrient adsorption and pollutant decomposition by soil bacteria; and
- Adsorption of metals and nutrients by filter particles (Somes & Crosby, 2007).



In accordance with Water by Design Guidelines, Table 5.5 summarises the treatment node parameters used in the *MUSIC* v6 modelling whilst Figure 5.1 provides typical design parameters for the proposed bioretention devices. As the filter area of Bioretention 1 exceeds the upper limit as recommended by the Bioretention Technical Design Guidelines (Water by Design, 2014), the bioretention filter is to be split into three (3) cells of equal area. Flows are to be split evenly upstream of the cells and discharge at three (3) separate inlet points.

Table 5.5 Bioretention Parameters

Bioretention Parameter	3B3C-1	3B3C-2
Drainage Profile (Type 1 = Saturated Zone, Type 2 = Sealed, Type 3 = Conventional, Type 4 = Pipeless)	Type 1	Type 1
Surface area (m ²)	1,190	155
Extended detention depth (m)	0.3	0.3
Filter area (m ²)	1,110 (3 cells)	130
Unlined filter media perimeter (m)	0.01	0.01
Saturated hydraulic conductivity (mm/hr)	100	100
Filter depth (m)	0.5	0.5
TN content of filter media (mg/kg)	400	400
Proportion of organic material in filter (%)	< 5	< 5
Orthophosphate content of filter media (mg/kg)	30	30
Is the base lined?	Yes	Yes
Effectiveness of plant TN removal	Effective	Effective
Overflow weir width (m)	Surface Area/10	Surface Area/10
Exfiltration rate (mm/hr)	0.00	0.00
Underdrain present?	Yes	Yes
Submerged zone with carbon present?	Yes	Yes
Depth of submerged zone (m)	0.35	0.35
Confirmation that K and C* remain default?	Yes	Yes
Sediment Forebay Required (>2.0 ha contributing catchment)	Yes	No

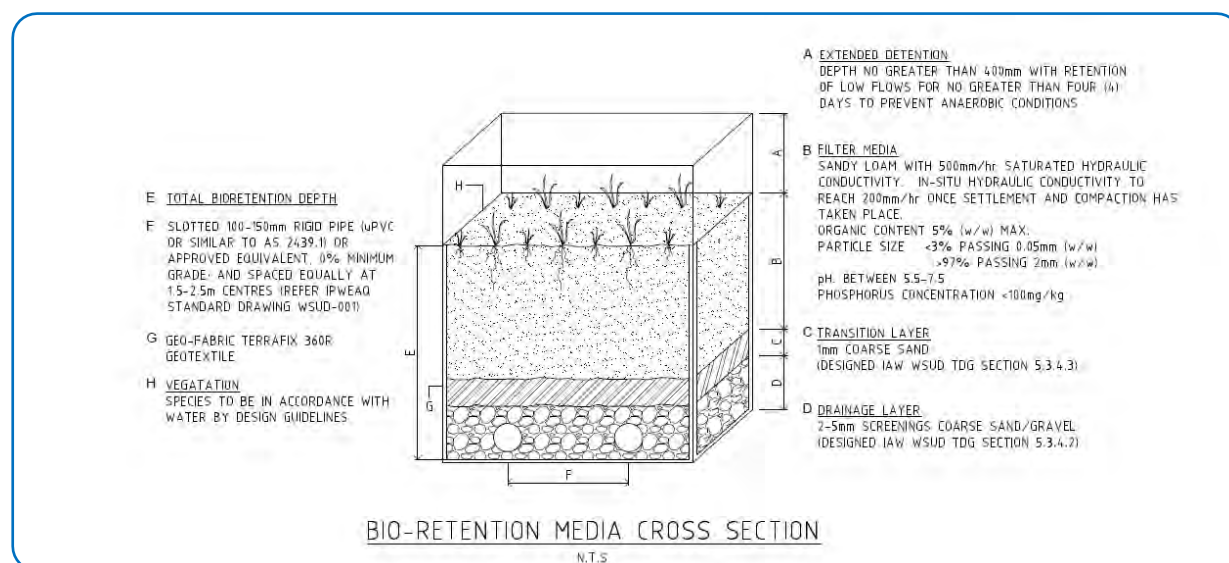


Figure 5.1 Bioretention Specifications



5.3.2 Coarse Sediment Forebay

Coarse sediment forebays have been designed at the inlets to each bioretention cell to facilitate maintenance and to limit sediment accumulation over the filter surface and reduce the potential for clogging. Although not required based on the contributing catchment, for ease of access and cleaning, a sediment forebay has been included in the design of Bioretention Basin 2. This will also help to reduce the frequency of maintenance required for the bioretention systems. Table 5.6 provides a summary of the sediment forebay calculations and requirements. The sediment forebays have been excluded from the *MUSIC* v6 modelling.

Table 5.6 Sediment Forebay Parameters

Basin ID	Cell ID	Contributing Catchment Area (ha)	Q _{3month} Inflow Rate (m ³ s)	Settling Velocity (m/s)	Area – min (m ²)	Area - provided (m ²)	Depth (m)	Capture Efficiency (%)
3B3C-1	1	3.25	0.23	0.10	28	40	0.3	83
	2	3.25	0.23	0.10	28	40	0.3	83
	3	3.25	0.23	0.10	28	40	0.3	83
3B3C-2		1.22	0.12	0.10	14	30	0.3	86

5.4 Modelling Results

Results of the *MUSIC* v6 modelling for the treatment train effectiveness are summarised in Table 5.7. The results indicate the 80%, 60%, 45% and 90% reduction target for TSS, TP, TN and GP respectively are achieved for the total flows captured and conveyed to the modelled treatment measures.

Screen captures of the *MUSIC* v6 modelling results are included as Figure 5.2.

Table 5.7 Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction (kg/yr)	Reduction (%)	Water Quality Objective (%)
TSS	9,700	1,400	8,300	85.6	85
TP	20.0	7.42	12.58	62.8	60
TN	121	54.7	66.3	54.6	45

NOTE: All simulations have been run with pollutant export estimation set to “stochastic generation”.

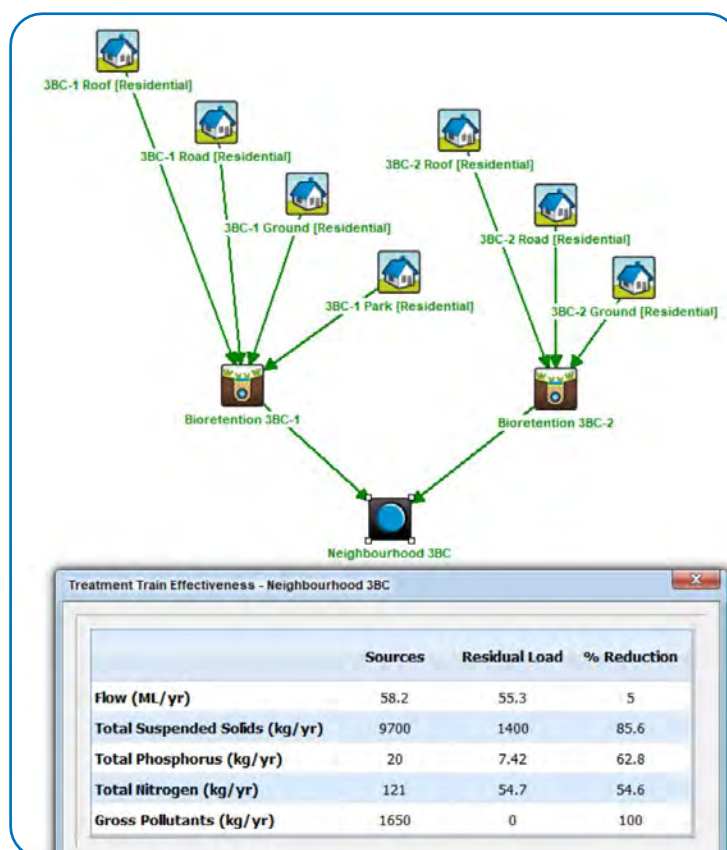


Figure 5.2 Screen Capture of *MUSIC* Modelling Results

5.5 Maintenance Access

The quality treatment measures (bioretention basins) will require regular maintenance, including weeding, replanting and cleanouts. In order to allow for the above maintenance measures to be undertaken, the access provisions detailed in Table 5.8 have been provided.

In order to limit access to the bioretention system, a lockable gate should be provided at the top of each access ramp.

Table 5.8 Maintenance Access Requirements

Access Type	Description	Dimension (m)	Batter	Design Requirements
BIORETENTION BASIN 3B3C-1				
Access Ramp	Access Ramp to extend to concrete forebays.	3.0	1:4 (Max)	Reinforced Concrete Capable of supporting a 22 tonne excavator (or as specified by Council).
Filter and Vegetation Maintenance Access	Access path provided for regular inspections and maintenance of bioretention filter media cells.	3.0 m path along min 40% of perimeter	-	Reinforced turf or gravel (for small utilities)
BIORETENTION BASIN 3B3C-2				
Access Ramp	Access Ramp to extend to concrete forebay.	3.0	1:4 (Max)	Reinforced Concrete Capable of supporting a 22 tonne excavator (or as specified by Council).
Filter and Vegetation Maintenance Access	Access track provided for regular inspections and maintenance of bioretention filter media cells	1.0 m trafficable path along min 40% of perimeter	-	Turf or Gravel (suitable for foot traffic)



6 Bioretention Basin Staged Construction and Establishment

In accordance with the Water by Design Construction and Establishment Guidelines: Swales Bioretention Systems and Wetlands (C & E Guidelines), inflow of sediment-laden runoff during the building stage is a major risk to the successful and long-term functioning of bioretention systems.

During the building phase of developments, sediment can seal the surface of the filter media, move into and clog the filter media and accumulate in the under-drainage. Within the C & E Guidelines, there are two (2) options recommended to overcome the challenges associated with delivering bioretention systems. These generally include the following options:

- Option 1: High Efficiency Sediment Basin; and
- Option 2: Temporary Surface Protection;

Any of the above options will ensure adequate protection of the bioretention during the building phase and are suitable for implementation.

It is proposed that Option 1 method for staged construction and establishment of the bioretention system is to be implemented for the proposed development. This method will be progressed in three (3) stages as follows:

- | | |
|---------|--|
| Stage 1 | Civil Works – earthworks and bulking out of basin followed by the installation of the hydraulic structures; |
| Stage 2 | Building Phase Protection – allowing the system to operate as a high efficiency sediment basin; and |
| Stage 3 | Civil Construction and Landscape Establishment <ul style="list-style-type: none">▪ when 90% of building in the catchment is complete, removal of the accumulated sediment.▪ finalisation of the civil works and installation of the under-drainage and bioretention media; and▪ planting and establishment of vegetation in the bioretention system. |

The details of the procedure and order of construction for the Option 1 method are contained within the C & E Guidelines Section 2.7 (Steps 1-25, 29, 30, 32-40). If an alternative option is found to be more suitable for the site, construction methods and steps should be referenced from the C & E Guidelines.



7 Water Quality Monitoring and Maintenance

In order to ensure that the stormwater management measures detailed within this management plan function correctly in the long term and to ensure that impacts to downstream receiving environments are mitigated, appropriate operational phase water maintenance and monitoring is to be undertaken. The following sections detail the minimum requirements for each specific control device.

7.1.1 Operational Phase Water Quality Monitoring

Monitoring during the operational phase will be undertaken to determine the impact of activities on the receiving waters. Surface water quality monitoring is to be undertaken at discharge points from the site. Samples should be collected for TSS, pH, dissolved oxygen (DO), TP, TN and hydrocarbons. Sampling is to be performed in accordance with procedures set out in the Environmental Protection Authority's Water Quality Sampling Manual. A NATA registered laboratory is to be used to analyse the collected samples.

Table 7.1 specifies the sampling parameters and frequencies required. Results of the monitoring program are to be compiled monthly into an ongoing Water Quality Monitoring Report. A copy of the report and monitoring data is to be maintained at all times.

Table 7.1 Operational Phase Water Quality Parameters and Sampling Frequencies

Sampling Parameter	Sampling Frequency
TSS	Water quality monitoring will be completed following a rainfall event of 25 mm or greater in any 24 hour period monthly for a minimum period of 12 months, or as specified by the Local Authority conditions of approval for the development.
pH	
Dissolved Oxygen (DO)	
TN	
TP	
Hydrocarbons	

Table 7.2 sets the water quality criteria for water discharged from the development site.

Table 7.2 Operational Phase Water Quality Discharge Criteria

Water Quality Parameter	Discharge Criteria
TSS	No net deterioration of the downstream receiving environment as a result of discharge from the development.
Turbidity (NTU)	
pH	
DO	
TN	
TP	
Hydrocarbons	

7.1.2 Operational Phase Device Maintenance

In order for each of the proposed stormwater treatment devices to achieve the necessary pollutant removal efficiencies regular maintenance is necessary. Poorly maintained devices will result in under performance and in some instances may cause leaching of pollutants to downstream receiving environments. Based on the proposed treatment train Table 7.3 details appropriate maintenance regimes for each treatment device.



Table 7.3 Operational Phase Device Maintenance Requirements

Treatment Device	Maintenance Action
Bioretention	Routine inspection to identify obvious increased sediment deposition. Remove sediment when flow within the bioretention is impeded or smothering of vegetation occurs.
	Routine inspection of inlet and outlet pit to identify any areas of scour, litter build up or blockages.
	Tilling of the bioretention surface if there is evidence of clogging.
	Regular watering of vegetation until plants are established.
	Removal and management of invasive weeds.
	Removal and replacement of dead and dying vegetation.
	Regular inspection and removal of litter and gross pollutants.
	Resetting (i.e. complete reconstruction) of the bioretention will be required if the flow within the bioretention system is reduced by 25% due to an accumulation of sediment.

All material removed during maintenance, whether solid or liquid, is to be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.



8 Conclusions

This Conceptual Stormwater (Quality) Management Plan (SQMP) has been prepared so as to be considered as part of a Reconfiguration of a Lot (ROL) application over Lot 3 on S311896 at Lot 3 Mount Elliott Road, Flinders Lakes (the subject site).

This report has been prepared on behalf of Pacific International Development Corporation Pty Ltd as Trustee for The PIDC Trust and presents designs based on a comprehensive review of available Stormwater Quality Improvement Devices (SQIDs). The aim of this report is to ensure that the development adequately addresses the management of stormwater quality during the operational phase of the development.

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MUSIC modelling has demonstrated that the inclusion of the above treatment option will achieve pollutant removal efficiencies of 80%, 60%, 45% and 90% for TSS, TP, TN and gross pollutants respectively for the development area.

The level of detail provided within this report is suitable for development assessment only and should not be relied upon for construction purposes. Detailed design documentation should be prepared in conjunction with civil operational works to finalise the stormwater concepts presented in this report.

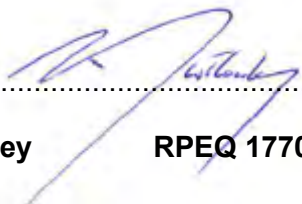


9 RPEQ Certification

I am aware that Council may rely upon the contents and findings of this assessment for the purposes of development assessment. In my opinion, the Council can rely upon the information contained within the report and there are no reservations or qualifications in respect to the information other than set out in the report.

I confirm that if the design parameters set out in this report are included within the development:

- stormwater pollutant load reductions in accordance with best practice should be achieved.


.....
Brad Comley **RPEQ 17706**

04/06/2026

DATE



10 References

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Appendix A

Stormwater Quality Management Design Drawings

CONCEPTUAL STORMWATER MANAGEMENT DESIGN DRAWINGS

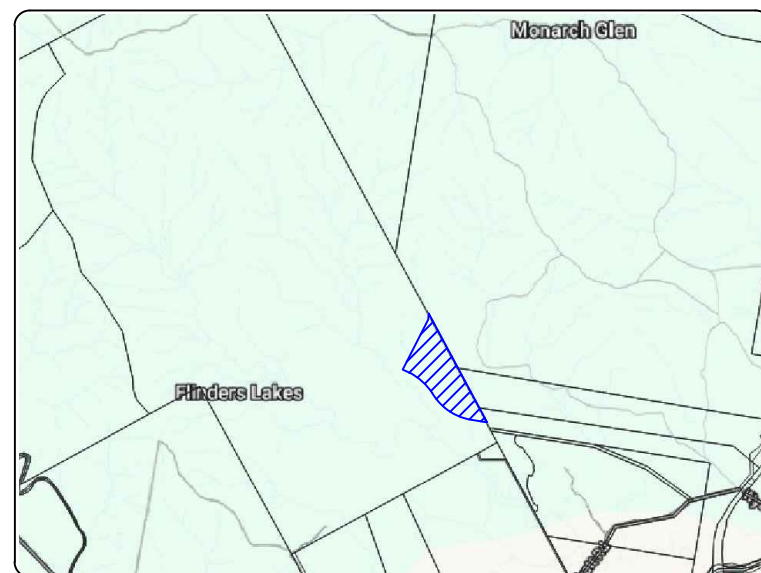
FLINDERS LAKES, NEIGHBOURHOOD 3B & 3C

for

PACIFIC INTERNATIONAL DEVELOPMENT CORPORATION PTY LTD
AS TRUSTEE FOR THE PIDC TRUST

Project No: BC-25066

June 2026



Site Location

BIOME Consulting Pty Ltd
Unit 30201, Southport Central Tower 3,
9 Lawson St, Southport QLD 4215
PO Box 3469, Australia Fair, Southport
O 07 5532 7779
M 0415 935 222
E brad@BIOMEconsulting.com.au
W www.BIOMEconsulting.com.au
ABN 86 166 087 476

SCHEDULE OF DRAWINGS

Drawing No.	Drawing Title
DWG-100	LOCALITY AND DRAWING INDEX PLAN
DWG-210	MUSIC CATCHMENT PLAN
DWG-300	OPERATIONAL CONTROL PLAN
DWG-310	BIORETENTION BASIN 3B3C-1 DETAILS (1 OF 2)
DWG-311	BIORETENTION BASIN 3B3C-1 DETAILS (2 OF 2)
DWG-312	BIORETENTION BASIN 3B3C-2 DETAILS
DWG-340	BIORETENTION FILTER MEDIUM AND UNDERDRAINAGE DETAILS
DWG-350	BIORETENTION STANDARD NOTES



LEGEND

MUSIC CATCHMENT

RESIDENTIAL LOT

MUSIC CATCHMENT AREAS

CATCHMENT ID	3B3C-1	3B3C-2
ROOF (ha)	3.62	0.49
ROAD (ha)	2.61	0.32
GROUND (ha)	2.96	0.40
PARK (ha)	0.57	-
TOTAL (ha)	9.76	1.21

BIORETENTION BASIN 3B3C-1

BIORETENTION BASIN 3B3C-2

ROOF AREA
55%

GROUND AREA
45%

TYPICAL RESIDENTIAL LOT CATCHMENT SPLIT

DATE

03.06.26

PROJECT No. :

BC-25066

DRAWING No. :

DWG-210

REVISION No. :

A

PROJECT

FLINDERS LAKES, NEIGHBOURHOOD 3B & 3C

DRAWING TITLE

MUSIC CATCHMENT PLAN

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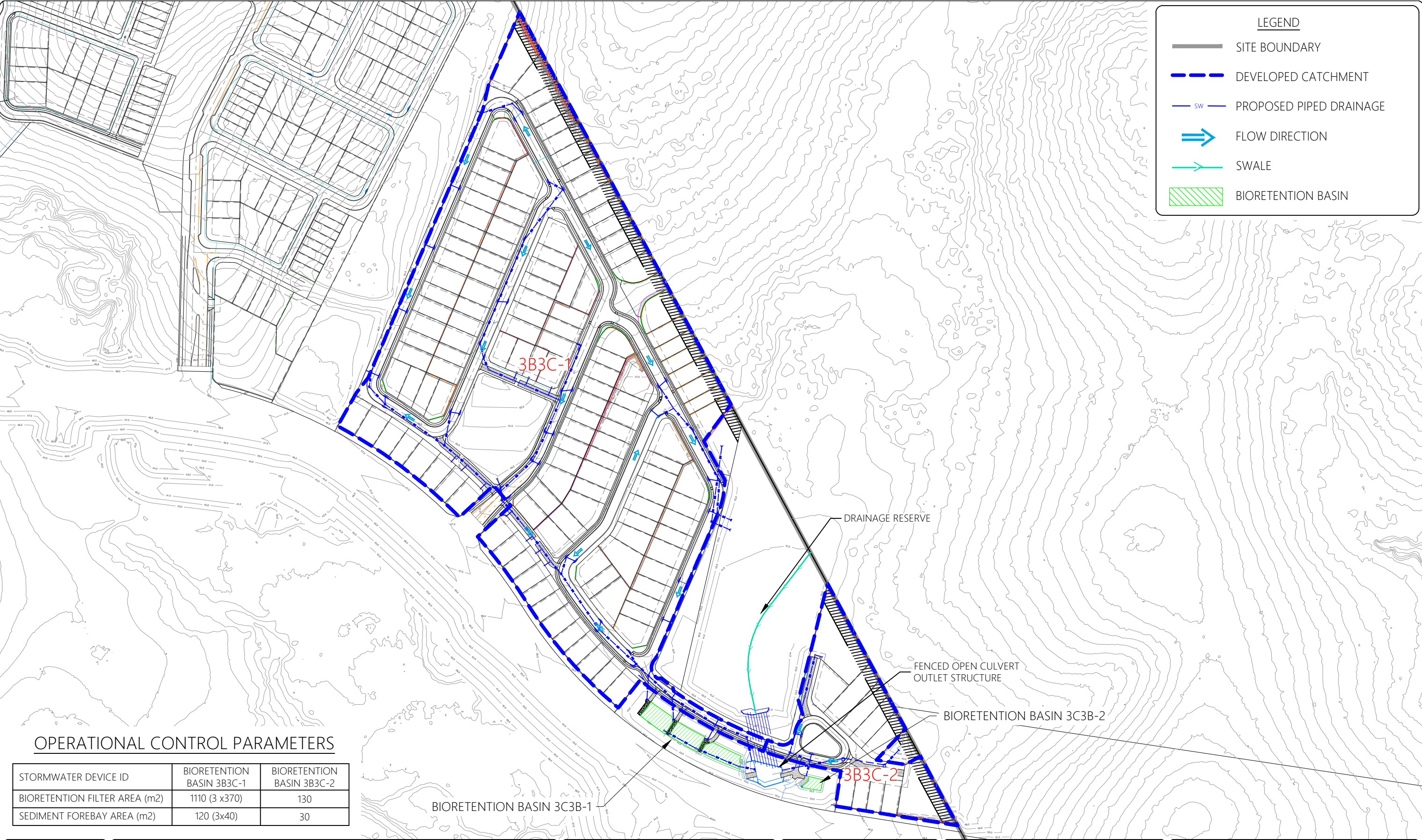
120

150

1 : 3000 (FULL SIZE) (metres)

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LEGEND

SITE BOUNDARY

DEVELOPED CATCHMENT

SW

PROPOSED PIPED DRAINAGE

FLOW DIRECTION

SWALE

BIORETENTION BASIN

OPERATIONAL CONTROL PARAMETERS

STORMWATER DEVICE ID	BIORETENTION BASIN 3B3C-1	BIORETENTION BASIN 3B3C-2
BIORETENTION FILTER AREA (m2)	1110 (3 x370)	130
SEDIMENT FOREBAY AREA (m2)	120 (3x40)	30

DATE
03.06.26

PROJECT No.:
BC-25066

DRAWING No.:
DWG-300

REVISION No.:
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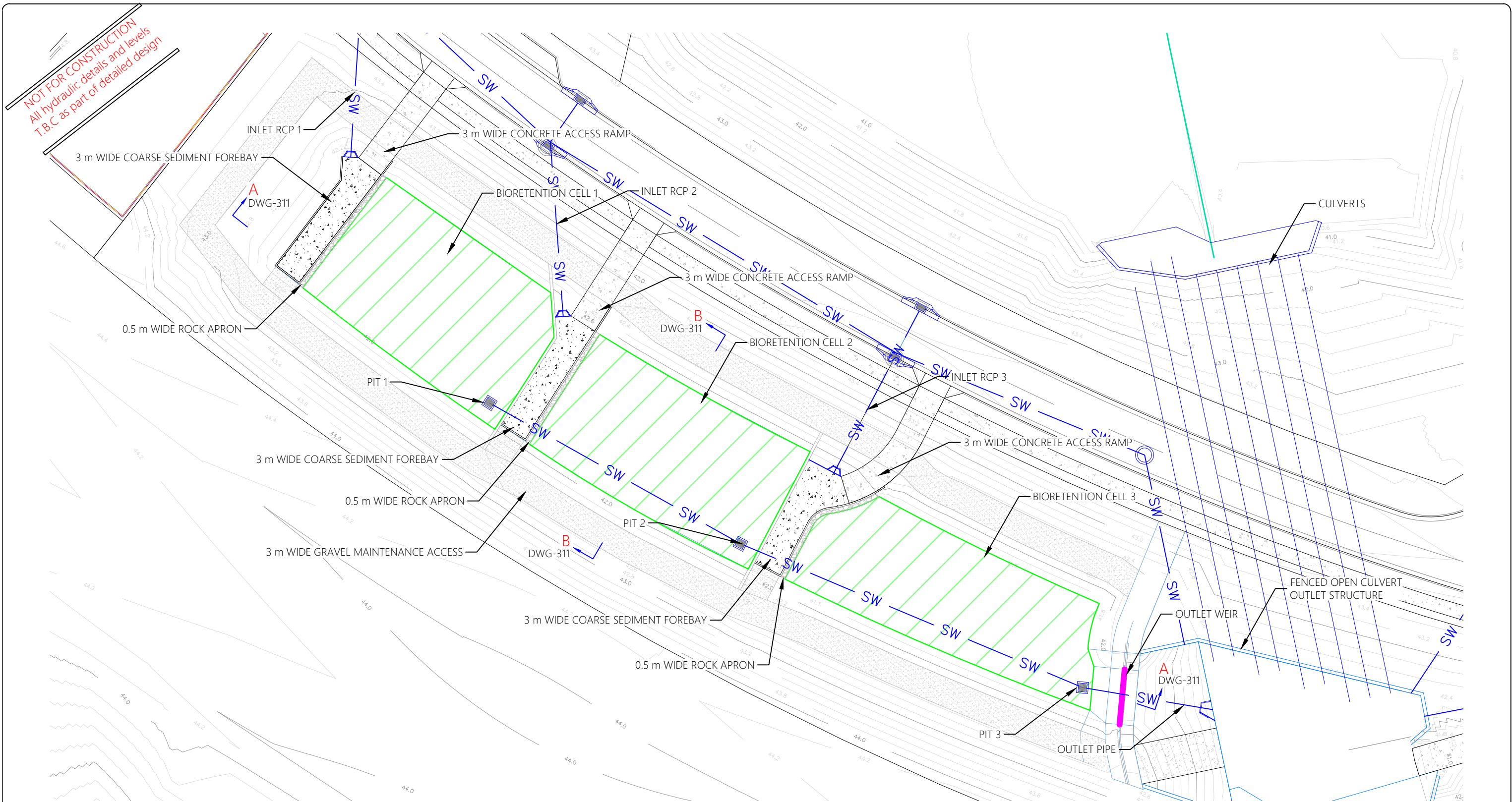
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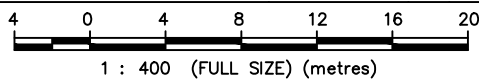
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BIORETENTION BASIN 3B3C-1 - PLAN



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DRAWING No.:
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PROJECT
FLINDERS LAKES, NEIGHBOURHOOD 3B & 3C

DRAWING TITLE
BIORETENTION BASIN 3B3C-1 DETAILS (1 OF 2)

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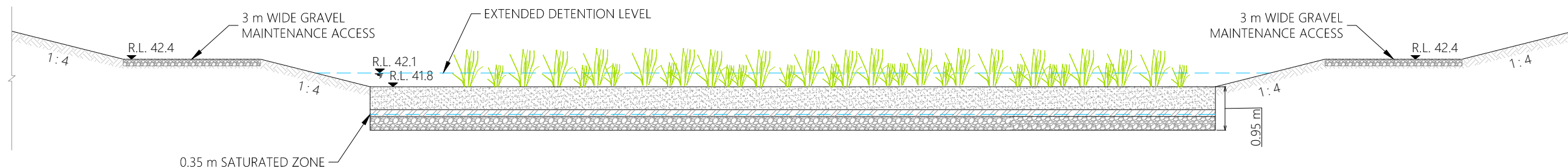
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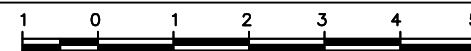
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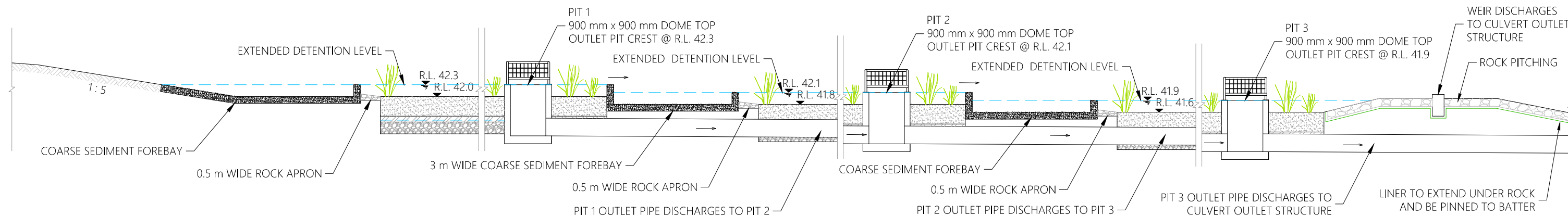
NOT FOR CONSTRUCTION
All hydraulic details and levels
T.B.C as part of detailed design



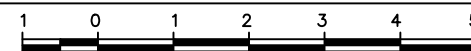
BIORETENTION BASIN 3B3C-1 - SECTION B-B



1 : 100 (FULL SIZE) (metres)



BIORETENTION BASIN 3B3C-1 - SECTION A-A



1 : 100 (FULL SIZE) (metres)

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FLINDERS LAKES, NEIGHBOURHOOD 3B & 3C

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BIORETENTION BASIN 3B3C-1 DETAILS (2 OF 2)

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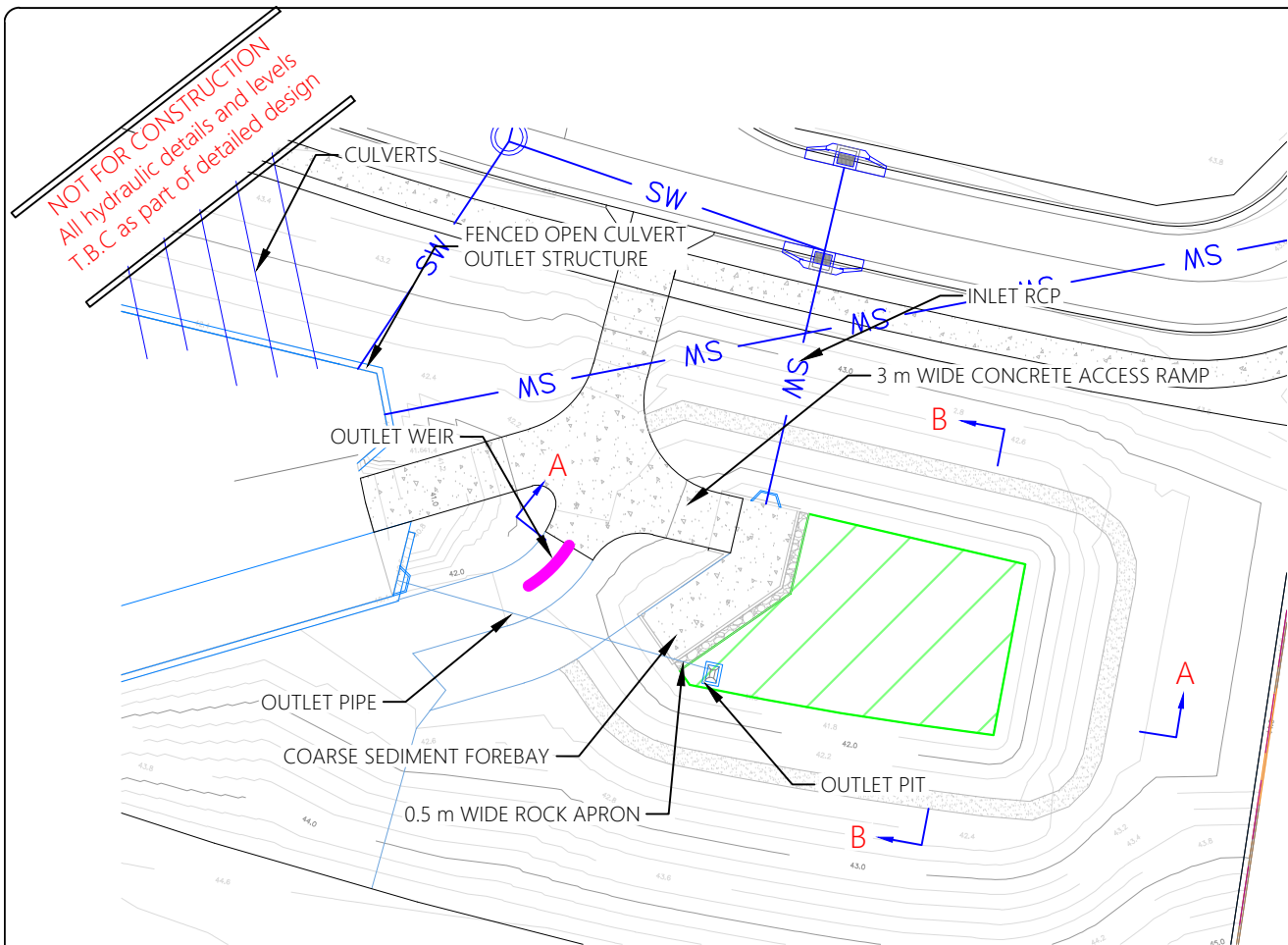


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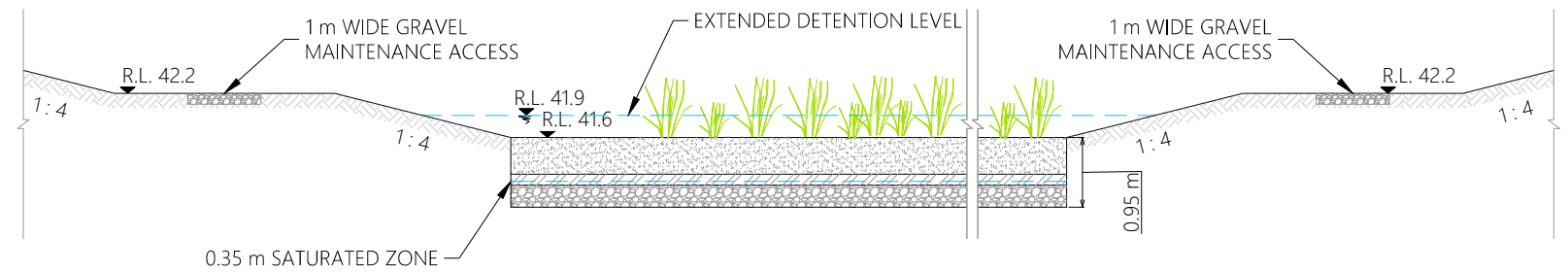
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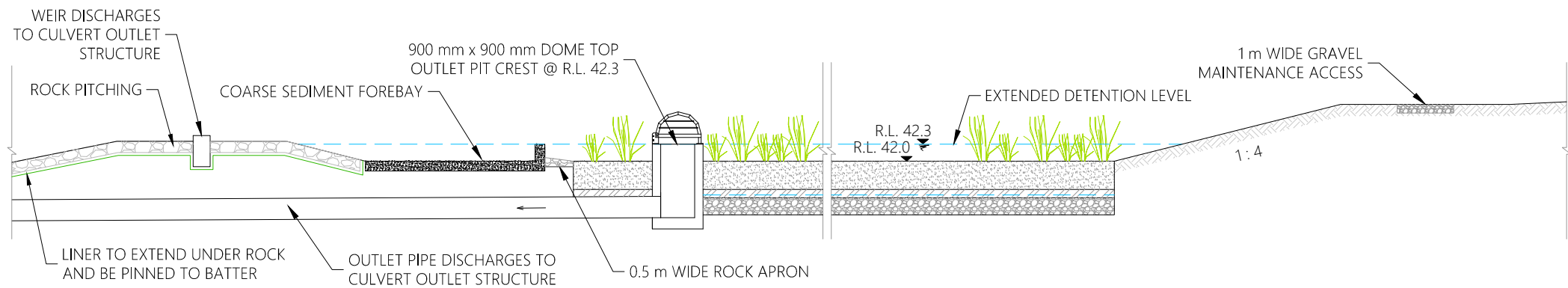
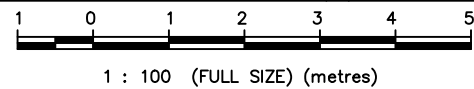




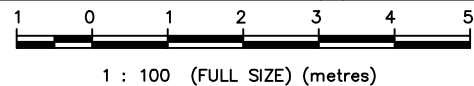
BIORETENTION BASIN 3B3C-2 - PLAN



BIORETENTION BASIN 3B3C-2 - SECTION B-B



BIORETENTION BASIN 3B3C-2 - SECTION A-A



DATE

03.06.26

PROJECT No.:

BC-25066

DRAWING No.:

DWG-312

REVISION No.:

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PROJECT

FLINDERS LAKES, NEIGHBOURHOOD 3B & 3C

DRAWING TITLE

BIORETENTION BASIN 3B3C-2 DETAILS

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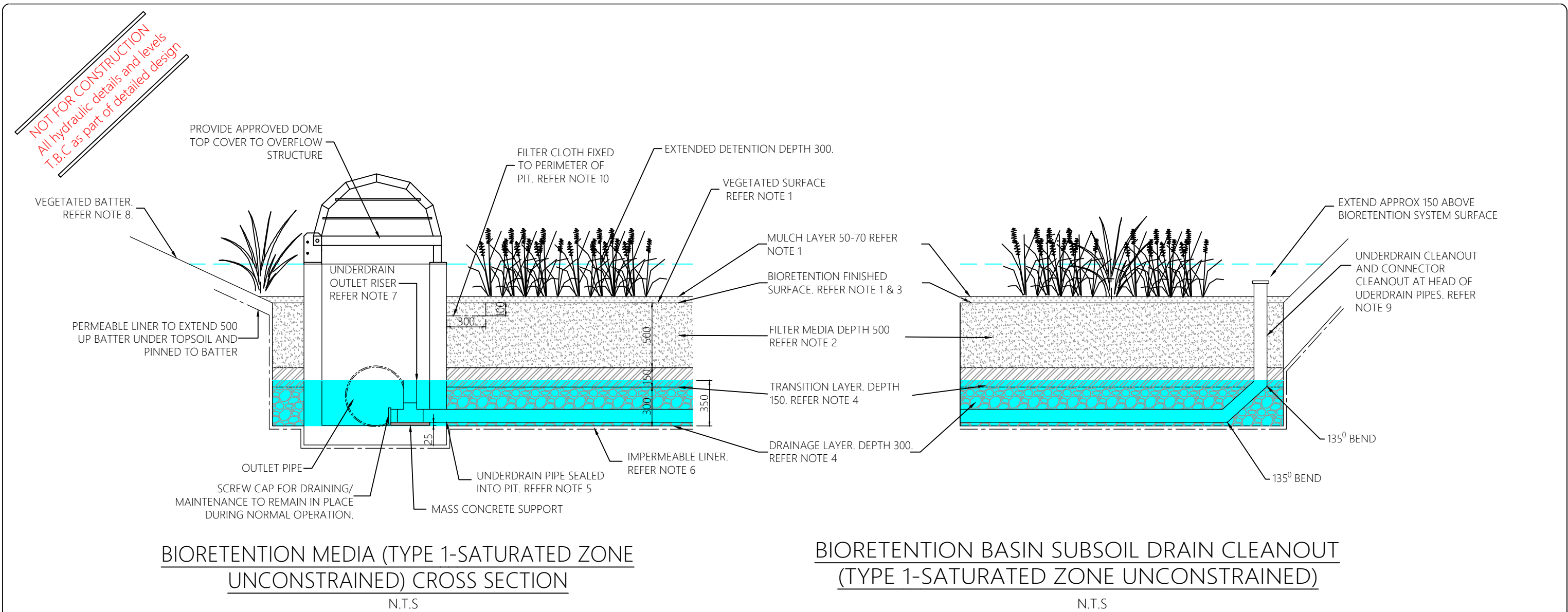


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NOTES (IN ACCORDANCE WITH IPWEAQ STANDARD DRAWING DSD-501):

1. BIORETENTION SYSTEM SURFACE. SURFACE LEVEL IS TOP OF FILTER MEDIA. SURFACE TO BE MULCHED AND PLANTED AS PER THE 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN).

2. FILTER MEDIA SPECIFICATION SHALL BE IN ACCORDANCE WITH THE 'ADOPTION GUIDELINES FOR STORMWATER BIOFILTRATION SYSTEMS (CRC FOR WATER SENSITIVE CITIES) AND THE 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN). BIORETENTION HYDRAULIC CONDUCTIVITY SHALL BE IN ACCORDANCE WITH PRACTICE NOTE 1: IN SITU MEASUREMENT OF HYDRAULIC CONDUCTIVITY' (FAWB). THE NUMBER OF SAMPLES TO BE TESTED SHALL BE IN ACCORDANCE WITH THE 'CONSTRUCTION AND ESTABLISHMENT GUIDELINES - SWALES, BIORETENTION SYSTEMS AND WETLANDS' (WATER BY DESIGN).

3. CONSTRUCTION TOLERANCES SHALL BE IN ACCORDANCE WITH THE 'CONSTRUCTION AND ESTABLISHMENT GUIDELINES -SWALES, BIORETENTION SYSTEMS AND WETLANDS' (WATER BY DESIGN)

4. TRANSITION LAYER AND DRAINAGE LAYER. DEPTHS AND SPECIFICATION TO BE IN ACCORDANCE WITH THE 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN)

5. UNDERDRAIN. SLOTTED RIGID PIPE TO LAID FLAT. PIPE SHOULD NOT BE INSTALLED WITH A FILTER SOCK SURROUNDING PIPE. UNDERDRAIN PIPES SHALL BE SEALED INTO PITS USING GROUT OR OTHER APPROVED WATERTIGHT SEAL.
6. IMPERMEABLE LINER. COMPACTED CLAY OR SYNTHETIC LINER WITH PERMEABILITY OF NO GREATER THAN 1 x 10-9 m/s. IMPERMEABLE LINER AS PER 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN).

7. UNDERDRAIN OUTLET RISER ESTABLISHES MAX SATURATED ZONE WATER LEVEL. UNDERDRAIN OUTLET RISER AS PER 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN).

8. VEGETATED BATTER. SLOPE AND PLANTING TO BE IN ACCORDANCE WITH 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN).

9. INSPECTION/CLEANOUT POINT. VERTICAL SOLID PIPE SECTION ATTACHED TO THE END OF EACH UNDERDRAIN IN ACCORDANCE WITH THE 'BIORETENTION TECHNICAL DESIGN GUIDELINES'(WATER BY DESIGN)

10. FILTER CLOTH TO BE FIXED TO PERIMETER OF PIT TO AVOID RUNNELLING OF WATER BETWEEN PIT AND SOIL INTERFACE. BEGIN FILTER CLOTH 100 ABOVE SURFACE. EXTEND TO 100 BELOW SURFACE. CONTINUE 300 HORIZONTALLY INTO FILTER MEDIA.

11. FOR GENERAL DESIGN AND CONSTRUCTION NOTES REFER TO DWG-350.

12. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE
01.06.26

PROJECT No. :
BC-25066

DRAWING No. :
DWG-340

REVISION No. :
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PROJECT
FLINDERS LAKES, NEIGHBOURHOOD 3B & 3C

DRAWING TITLE
BIORETENTION – FILTER MEDIUM & UNDERDRAINAGE DETAILS

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BIORETENTION SYSTEM SPECIFICATION

1. Referenced documents.
- The following documents are incorporated into this specification by reference:
- 1.1. Standards
- 1.1.1. AS 1289- Methods of Testing Soils for Engineering Purposes
- 1.1.2. AS 1289.5.4.1-2007- Soil Compaction and Density Tests-Compaction Control Test-Dry Density Ratio, Moisture Variation and Moisture Ratio
- 1.1.3. AS 1289.5.7.1-2006 - Soil Compaction and Density Tests - Compaction control Test-Hilf Density Ratio and Hilf Moisture Variation (rapid method)
- 1.1.4. AS 2758 - Aggregates and Rock for Engineering Purposes
- 1.1.5. AS 4419 - Soils for Landscaping and Garden Use
- 1.1.6. AS 4454 - Composts, Soil Conditioners and Mulches
- 1.2. Other publications
- 1.2.1. Guidelines for Soil Filter Media in Bioretention Systems (FAWB) - the current version of the guideline can be found at <http://www.Monash.edu.au/FAWB/>
- 1.2.2. Construction and Establishment Guidelines - Swales, Bioretention systems and Wetlands (Water by Design) <http://waterbydesign.com.au/ceguide/>
- 1.2.3. Transferring Ownership of Vegetated Stormwater Assets (Water by Design) <http://waterbydesign.com.au/transferguide/>
- 1.2.4. Transferring Ownership of Vegetated Stormwater Assets (Water by Design) <http://waterbydesign.com.au/transferguide/>
- 1.2.5. Bioretention Technical Design Guidelines (Water by Design) <http://waterbydesign.com.au/techguide/>
- 1.2.6. Water Sensitive Urban Design Field Guide (Water by Design)

2. Abbreviations and definitions
- 2.1. The bioretention system specification consists of the following abbreviations and definitions:
- 2.2. Filter soil layer which acts as a pollutant filter and supports plant growth.
- 2.3. Impermeable liners: the liner that prevents water movement between the filter and the surrounding soils and defines the edge of the system.
- 2.4. Transition layer: layer to separate filter layer from the drainage layer to avoid migration of soils from the filter to the drainage layer
- 2.5. Drainage layer relatively free d raining layer to convey infiltrated water to the underdrainage.
- 2.6. Under-drains: slotted drains collect treated stormwater from the drainage layer at the base of the bioretention system.

3. Test methods and standards
- 3.1. The following test methods and standards are to be used as specified in the above guidelines when conducting tests associated with this specification:
- 3.2. The hydraulic conductivity of potential filter media shall be measured using the ASTM F1815 -11 method
- 3.3. Particle size distribution: AS1289.3.6.1 - 1995
- 3.4. Soils for landscaping and garden use: AS4419 - 2003.

4. Materials
- 4.1. Materials shall meet the required specifications detailed in Section 8 Filter media, Section 9 Transition layer, Section 10 Drainage layer, Section 11 Under drainage. Section 12 Permeable liner. Section 13 Impermeable liner end section 14 landscaping of this document.
- 4.2. All materials must be certified by the supplier with certification and delivery supply dockets shall be provided on request to certify the material delivered is the material tested.

5. Timing and erosion and sediment control
- 5.1. The timing of civil and landscape works for bioretention systems must be carefully planned to ensure that both the bioretention system and the downstream waterways, are not impacted by stormwater and sediment (e.g. through best practice erosion and sediment control). In particular, the drainage layer, transition layer and filter media must not be placed until the risk of high sediment loading from upstream construction activities has been mitigated. The construction sequence must be approved by the superintendent
- 5.2. Erosion and sediment control during construction must be delivered in accordance with all legislative requirements including, where required, the preparation of site-specific ESC plan/s in accordance with current Best Practice Erosion and Sediment Control (e.g. IECA 2008, or later version).

6. Earthworks and hydraulic structures
- 6.1. The construction of hydraulic structures must ensure the design levels are achieved. Bunds/ embankments surrounding the system shall be at correct levels. The below table summarises the construction tolerances for each element of a typical bioretention system.
- 6.2. Bioretention systems tolerances

Bioretention element	Tolerance (unless specified otherwise)
Hydraulic structures	+/-25 mm (+/-15 mm for streetscape systems)
Earthworks	+ / - 50 mm
Underdrainage	+/- 25 mm
Drainageand transition layers	+ 25 mm
Surface level	+/- 25mm +/- 40mm for filter media >300m² provided the average extended detention requirement is within 25mm of the design requirement.
Embankments and bunds	- 25 mm, + 50 mm

7. Maintenance access.
- Maintenance access is provided in accordance with the design drawings.

8. Filter media
- 8.1. Materials
- A fundamental part of bioretention systems is the filter media. The main role of the filter media is to support vegetation and remove pollutants. Filter media should be loamy sand that has high permeability when compacted. It should not contain any rubbish or deleterious material. The loamy sand should contain some organic matter to improve water-holding capacity and plant health, but it should be low in nutrient content. The filter media must be compliant with AS 4419 - Soils for Landscaping and Garden Use, and meet the following requirements:

Parameter	Test method in accordance with	Requirement
Saturated hydraulic conductivity	ASTM f1815 -11	50 - 500 mm/hr (200 preferred)
pH	AS 4419	5.5 - 7.5
Electrical conductivity	AS 4419	<1,2 dS/m
Nitrogen content	AS 4419	<800 mg/kg
Phosphorus content	AS 4419	<40 mg/kg
Organic content	AS 4419	3%-10%. Where organic content is below this threshold, the filter media may be ameliorated by adding 50mm of compost and tining it into the top 150mm of filter media.
Particle size distribution	AS 1289.3.6.1 - 1995	Clay & silt 3-6% (<0.05mm) Very fine sand 5-30% (0.05-0.15mm) Fine sand 10-30% (0.15-0.25mm) Medium to coarse sand 40-60% (0.25 -1.0mm) Coarse sand 7-10% (1.0-2.0mm) Fine gravel <3% (2.0-3.4%)

Source: Guidelines for Soil Filter Media in Bioretention Systems (FAWB) and Bioretention Technical DEsign Guidelines (Water by Design)

Filter media must be free of weeds and propagates. Other characteristics of the filter media required for plant growth should be confirmed with a soil analysis or confirmed with a horticulturist/landscape architect.

- 8.2. Testing frequency
- Suitable filter media can be delivered to site or imported sand can be ameliorated to meet the above specification. In either case, the media shall be tested against the above parameters at one sample per 500m³ of filter media. For soil supplied to site, testing must be undertaken on the actual material to be delivered to the bioretention system. The supplier and contractor will be responsible for ensuring the filter media meets the specification and the correct material is delivered to site prior to installation.
- 8.3. Installation and compaction
- When installing, the following specifications shall be applied:
- 8.3.1. Filter media shall be installed and compacted in two lifts for depths of over 500mm. Compaction shall be light and even across the surface.
- 8.3.2. The top surface of the drainage layer, transition layer and the filter media layer shall be level and free from localised depressions to ensure even distribution of stormwater flows across the surface and prevent localised ponding.
- 8.3.3. Filter fabric must not be used between drainage layer, transition layer and the filter media layers or wrapped around the under-drainage

9. Transition layer
- 9.1. Transition layers prevent filter media migrating into the drainage layer.
- 9.1.1. Materials

- 9.1.1.1. Transition layer shall be minimum thickness of 100 mm coarse sand unless otherwise specified (typically 1mm particle size diameter) with <2% fines.
- 9.1.1.2. A particle size distribution for the sand shall be obtained to ensure that it meets the following criteria (VicRoads).
- 9.1.1.3. D15 (transition layer) = < 5x D85 (filter media)
- 9.2. Testing
- A sample of the proposed transition layer is to be provided to the superintendent for approval prior to installation. The superintendent may require the transition layer to be tested to ensure its particle size.

10. Drainage layer
- Drainage layers convey infiltrated water into the slotted under-drainage pipes.
- 10.1. Materials
- 10.1.1. Drainage layer shall be comprised of fine gravel (nominal 2-5mm) with <2% fines and a minimum saturated hydraulic conductivity of 400mm/hr. The depth of the drainage layer shall ensure at least 50mm of aggregate cover over all perforated under-drainage pipes.
- 10.1.2. A particle size distribution for the gravel shall be obtained to ensure that it meets the following bridging criteria (VicRoads): D15 (drainage layer) = < 5xD85 (transition layer)
- 10.2. Testing
- A sample of the proposed drainage layer is to be provided to the superintendent for approval prior to installation. The superintendent may require the drainage layer to be tested to ensure its particle size.

11. Under-drainage
- 11.1. Materials
- Either slotted rigid pipe (HDPE or similar) or ag-pipe can be used for under-drainage as specified in the construction drawings. When installing, the following specifications shall be considered:
- 11.1.1. Typically 100mm-slotted hdpe pipe is the preferred type of rigid pipe.
- 11.1.2. The slots in the pipe shall not allow the drainage layer aggregate to freely enter the pipe (under-drainage with slot width of 2mm or smaller is preferred).
- 11.1.3. Under-drainage pipes must not be surrounded by any geofabric or sock.
- 11.2. Installation
- 11.2.1. The maximum spacing of under-drains for blo-retentlon systems <100m² is 1.5m from centre to centre. For bioretention systems >100 m² the maximum spacing can be increased to 2.0-2.5m if specified in the construction drawings.
- 11.2.2. The under-drains shall be sloped towards the outlet pit (min. 0.5% longitudinal grade) and the base of filtration trench shall be free from localised depressions. For bioretention systems with a saturated zone a 0% pipe grade is acceptable.
- 11.2.3. All junctions and connections shall be appropriately sealed.
- 11.2.4. Under-drainage pipes shall be sealed into the overflow pit
- 11.2.5. All under drainage pipes to have raised dean out points constructed from non-slotted pipes which extend to 150mm above filter media surface

12. Permeable liner (where specified)
- 12.1. A permeable geotextile liner fabric must be used to line the outside of the bioretention system.
- 12.2. The liner must extend at least 500mm beyond the top of the sides and must be keyed into batter and covered by at least 200mm of topsoil.
- 12.3. The liner must be resistant to all soil acids and alkalis, resistant to microorganisms and comply with the requirements of AS 3706.12 and AS 3706.13.

13. Impermeable liner (where specified)
- 13.1. Materials
- Liner options include day, geosynthetic bentonite day liners or high-density poly ethylene (HDPE) liners. Refer to the project drawings for liner details.
- 13.2. Installation
- Installation must be in accordance with manufacturers specifications and design drawings and achieve the following:
- 13.2.1. The liners shall be keyed into the batters and to the embankments.
- 13.2.2. Liners must be sealed around protrusions such as outlet pipes.
- 13.2.3. Must achieve a maximum permeability of 1 x10⁻⁹m/s

14. Landscaping
- 14.0. Refer to landscape design drawings.
- 14.1. Batter slopes must have min 200mm topsoil which must be tested by a NATA-accredited laboratory in accordance with AS 4419.
- 14.2. Subsoils to be cultivated to 150mm prior to placing topsoil on batter slopes.
- 14.3. Planting densities and species must be consistent with the landscape design drawings. No substitutions should be made unless approved by the superintendent.
- 14.4. Plants supplied to site must:

- 14.4.1. Be grown in clean, weed-and pest-free conditions;
- 14.4.2. Be well developed, sun-hardened and contain a fully established root ball that does not crumble when removed from its container.
- 14.4.3. Be at least 200mm high.
- 14.4.4. Show no sign of pest and disease
- 14.4.5. Show no signs of nutrient deficiency
- 14.4.6. Be free from weeds
- 14.4.7. Be clearly labelled
- 14.4.8. Be supplied in a container that is at least 90mm high x 50mm wide
- 14.5. Preparing filter media: unless specified otherwise, each plant must receive at least 10 g of slow-release native fertilizer in granular or tablet form. Pre-hydrated water crystals may be applied at 1-2% by weight
- 14.6. Mulch must be applied in accordance with the design drawings, be applied prior to planting, provide coverage of the soil and not exceed 75mm thickness, and be kept 50 mm dear of plant stems. Unless otherwise specified, mulch should be fine sugar cane mulch secured in place by a loose weave jute net pinned at 500mm centres.
- 14.7. Filter media surface and plant stock are to be watered immediately prior to planting. Unless otherwise specified, plants should be planted in clumps of the same species, and large monocultures avoided.
- 14.8. Plant method must minimise soil compaction and ensure that all roots are covered by at least 10-20mm of soil, avoid covering plant crowns.
- 14.9. Unless specified otherwise, the following irrigation schedule applies during plant establishment (at 2.5 - 5L per plant per week)
- Week 1 -5 five waterings per week
- Week 6-10 three waterings per week
- Week 11-15 two waterings per week
- Thereafter as required to sustain plants until successful establishment
- 14.10. Replanting must occur during the establishment period if less than 90% of plants survive.
- 14.11. Successful plant establishment in bioretention systems is considered when the plants are robust and self-sustaining, and meet the following criteria.
- Vegetation must cover at least 90% of the bioretention surface with mulch covering the remainder (< 10% mulch visible from above)
- Average groundcover plant height must be greater than 500mm.
- Plants must be healthy and free from disease.
- No weeds or litter to be present.

15. Certification and chain of custody
- 15.1. The following certification and the chain of custody applies to bioretention media:
- 15.1.1. The supplier and contractor are responsible for ensuring the bioretention media meets the specifications outlined in these guidelines and that the correct material is delivered to site. The supplier must arrange for testing of the filter media by a soil laboratory certified for the methods in accordance with the requirements listed above. On the basis of the testing, the soil laboratory and supplier must certify the material meets these specifications. The supplier must provide the certification and laboratory test results to the contractor with the supply docket.
- 15.1.2. The contractor provides a copy of the supplier's certification, test results and supply docket to the site superintendent or bioretention designer for review.
- 15.1.3. Following review of the certification, test results and the supply docket, the site superintendent or bioretention designer approves installation of the bioretention media.
- 15.1.4. The relevant sections of the bioretention media sign-off form as per the construction and establishment guidelines (Water by Design) should be completed and signed. This sign-off form is provided as part of the construction certification by the site superintendent or bioretention designer.

16. Hold points
- 16.1. The following hold points must be observed in accordance with the most recent Water by Design construction checklists and superintendent approval is required for works to proceed:
- 16.1.1. Prestart meeting
- 16.1.2. Completion of hydraulic structures and under-drainage
- 16.1.3. Prior to placing filter media
- 16.1.4. After placement of filter media (prior to applying mulch and planing).

17. Compliance testing (for on-maintenance or off-maintenance)
- 17.1. Compliance testing must be in accordance with chapter 5 of Transferring Ownership of Vegetated Stormwater Assets (Water by Design). Checklists must be completed and signed by the superintendent.

Disclaimer:It is the responsibility of the certifying registered professional engineer to ensure these standard notes are adapted to the specific needs of the project. It is expected that additional drawing notes would be required to cover other important project issues (e.g. Workplace Health and Safety, Environmental Protection, Erosion and Sediment Control, etc). Healthy waterways, IPWEA and all contributors to this document accept no liability for the use, misuse or any omission or inaccuracy in this document.

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BIOME Consulting Pty Ltd PO Box 3469, Australia Fair, Southport M 0415 935 222 E brad@BIOMEconsulting.com.au ABN 86 166 087 476

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ATTACHMENT 8

Flood Impact Assessment prepared by BMD

Flinders Master Planned Community - Neighbourhood 3B and 3C Flood Impact Assessment

Flood impact assessment of the proposed residential development

Customer
Project
Deliverable
Version

Pacifiq Communities
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Synopsis	This report provides a flood impact assessment to support the development application of Neighbourhoods 3B and 3C within the Flinders Master Planned Community
Author	Nigel Hardie
Reviewed By	Damion Cavanagh
Project Manager	Nigel Hardie

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1 Introduction

1.1 Background

Flinders Lakes (hereafter referred to as 'Flinders Lakes') is located approximately 50 kilometres south-west of the Brisbane CBD, within Logan City. The site is held under single ownership, with approximately one-third located within the Greater Flagstone Priority Development Area (PDA), as identified by Economic Development Queensland (EDQ)—referred to as Precinct 1. The master plan for Flinders Lakes Precinct 1 proposes the development of a sustainable township designed to accommodate approximately 7,282 dwellings and a future population of 18,205 residents. The development comprises a network of walkable neighbourhoods, a central mixed-use town centre, and a substantial employment and enterprise precinct, strategically planned to generate local job opportunities.

The vision and structure for Flinders Lakes has been developed through a collaborative process involving a multi-disciplinary project team. This process has resulted in a comprehensive master plan that establishes a strong foundation for a thriving and connected community.

Neighbourhoods 3B and 3C are located within the Flinders (Precinct 1) land holding, specifically over (part of) Lot 3 S311896. These neighbourhoods constitute a development area of ~16ha, which includes:

- 146 residential lots consisting of 4 lot typologies ranging in size from 335m² to 2,080m², including the provision of 6 lots able to accommodate duplex dwellings;
- A Display village and associated car parking, signage and sales office;
- 1 local recreation park comprising 5,000m²;
- 2 Local linear parks;
- A coordinated road network including active transport (cycle) and pedestrian connections; and
- Necessary infrastructure to service the proposed development.

Although this Flood Impact Assessment (FIA) has been prepared to support the development application with Economic Development Queensland (EDQ) for NH3B3C, the assessment has also considered the following development areas external to NH3B3C:

- Neighbourhood 3A – a ~22ha residential area adjoining Neighbourhood 3B to the north. The two neighbourhoods are divided by a linear park which also acts as a drainage pathway through the development. The preliminary earthworks plan for Neighbourhood 3A has been used in this assessment. This plan is not expected to change significantly from the ultimate design which will be subject to a separate development application.
- Flinders Lakes Drive – the proposed road along the southern border of Neighbourhood 3A, 3B and 3C. The road includes cross drainage infrastructure that is integral to the residential developments.
- Logan Water Pump Station – a pump station located on the southern side of Flinders Lakes Drive adjacent to the downstream waterway.

For the purposes of this report, NH3B3C and each of the above external areas will be referred to as the 'Site'.

BMT has previously provided flooding and stormwater quality related advice in the area in support of the Whole of Site Material Change of Use (MCU) application, including the following relevant reports:

- Flinders Precinct 1: Flood Impact Assessment (BMT, 2017).
- Flinders Precinct 1: Stormwater Quality Management Plan (BMT, 2017).
- Flinders Precinct 1: Lake Infrastructure Master Plan (BMT, 2019).
- Flinders Precinct 1: Neighbourhoods 3A & 3B, Flood Impact Assessment and Stormwater Quality Management Plan (BMT, 2019).

1.2 Scope

This FIA updates previous modelling that was undertaken prior to the revision to the Australian Rainfall and Runoff Guidelines (ARR), and updates to the Logan-Albert flood model.

The investigation included the following elements:

- *Hydrologic Assessment:* A WBNM hydrologic model of the local catchment was created to provide inflow hydrographs to the hydraulic model. As per the LCC Planning Scheme, the hydrologic model utilised the 2019 revision to ARR and included consideration of the 1%+Climate change design storm event (Year 2090, RCP 4.5).
- *Hydraulic Assessment:* A two-dimensional model of the local catchment was established to demonstrate that the proposed development does not lead to any unacceptable adverse off-site impacts with respect to flooding. The model incorporated the revised 1%+Climate Change (2090 RCP 4.5) tailwater conditions derived from the LCC 2021 Logan-Albert flood study.
- *Extreme Blockage and Severe Storm Assessment:* The hydraulic model was used to assess the impact of extreme culvert blockages on minor storms, and partial blockage on severe storms (as per QUDM Table 10.4.1).

2 Site Description

2.1 Location

Precinct 1 is 1024-hectare, agricultural and forested site located within the LCC local government area on Lot 3 on S311896 and Lot 200 on SP133189. The Site is a 38-hectare portion of this precinct located on the eastern boundary within Lot 3 on S311896.

The location of the Precinct 1 and the Site is presented in Figure 2.1 with a recent aerial photograph of the area.

2.2 Topography and Drainage

Flinders Lakes is located within the Logan River drainage basin, with two major creeks abutting the western boundary including Undullah Creek which flows from north to south along the western boundary and Woollaman Creek, which joins Undullah Creek along the southern boundary.

The study area features steep, densely wooded terrain to the north including peaks of the Teviot Range (also referred to as the Flinders Peak Group) up to 320 metres Australian High Datum (AHD). Precinct 1 drains towards the south where topography becomes flatter towards its lowest point of approximately 33 metres AHD.

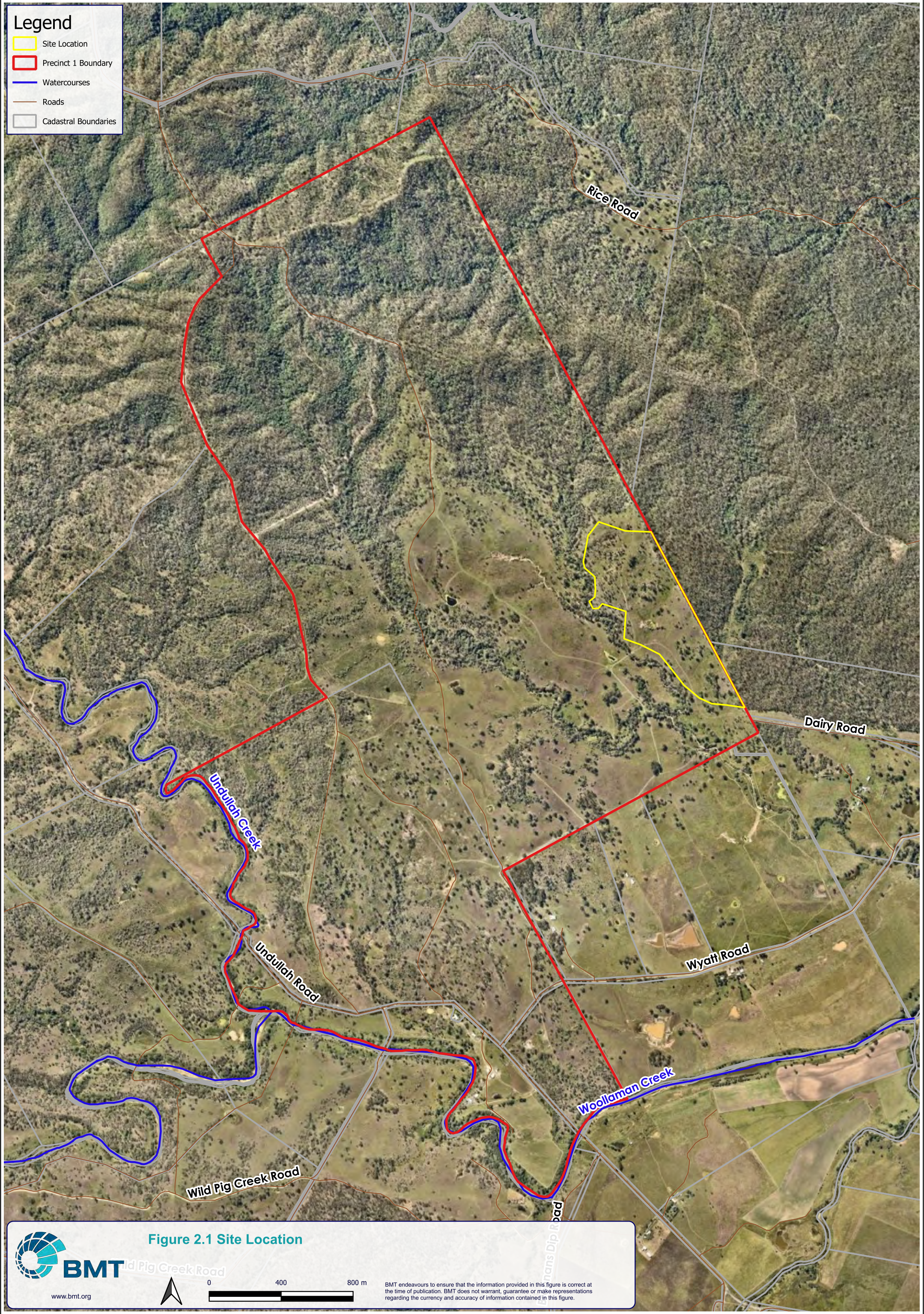
The topography of the site and surrounding areas is presented in Figure 2.2.

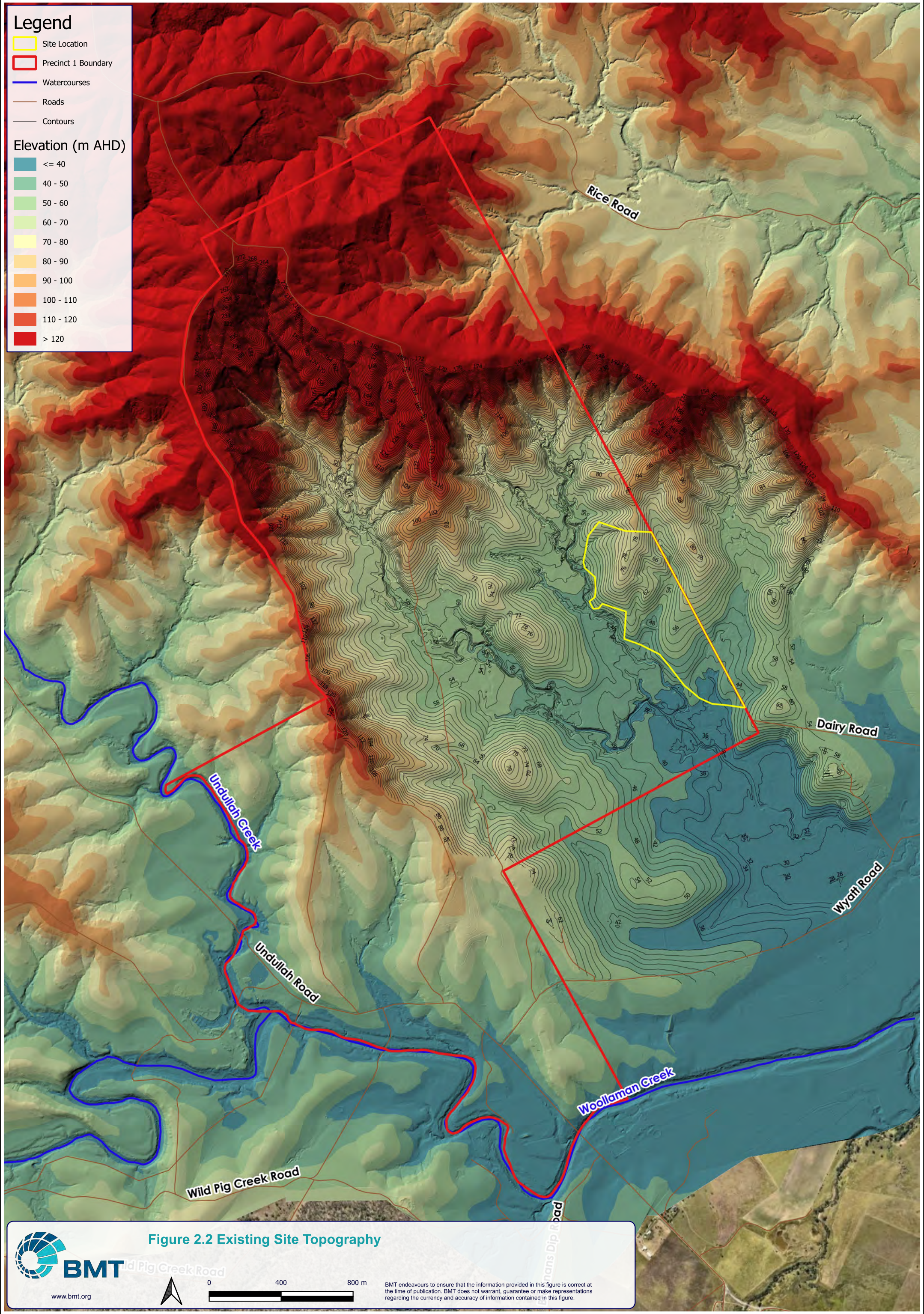
Within the Site, ground elevations vary between 79.8m AHD on the northern boundary, to 37.1m AHD on the southern boundary. Two overland flow paths exist within the Site with a 14-hectare catchment draining in a south westerly direction through the centre of the proposed development, and an 86-hectare catchment draining through the southern portion. The two flow paths join outside the Site boundary before draining across the Precinct 1 boundary to Teviot Brook.

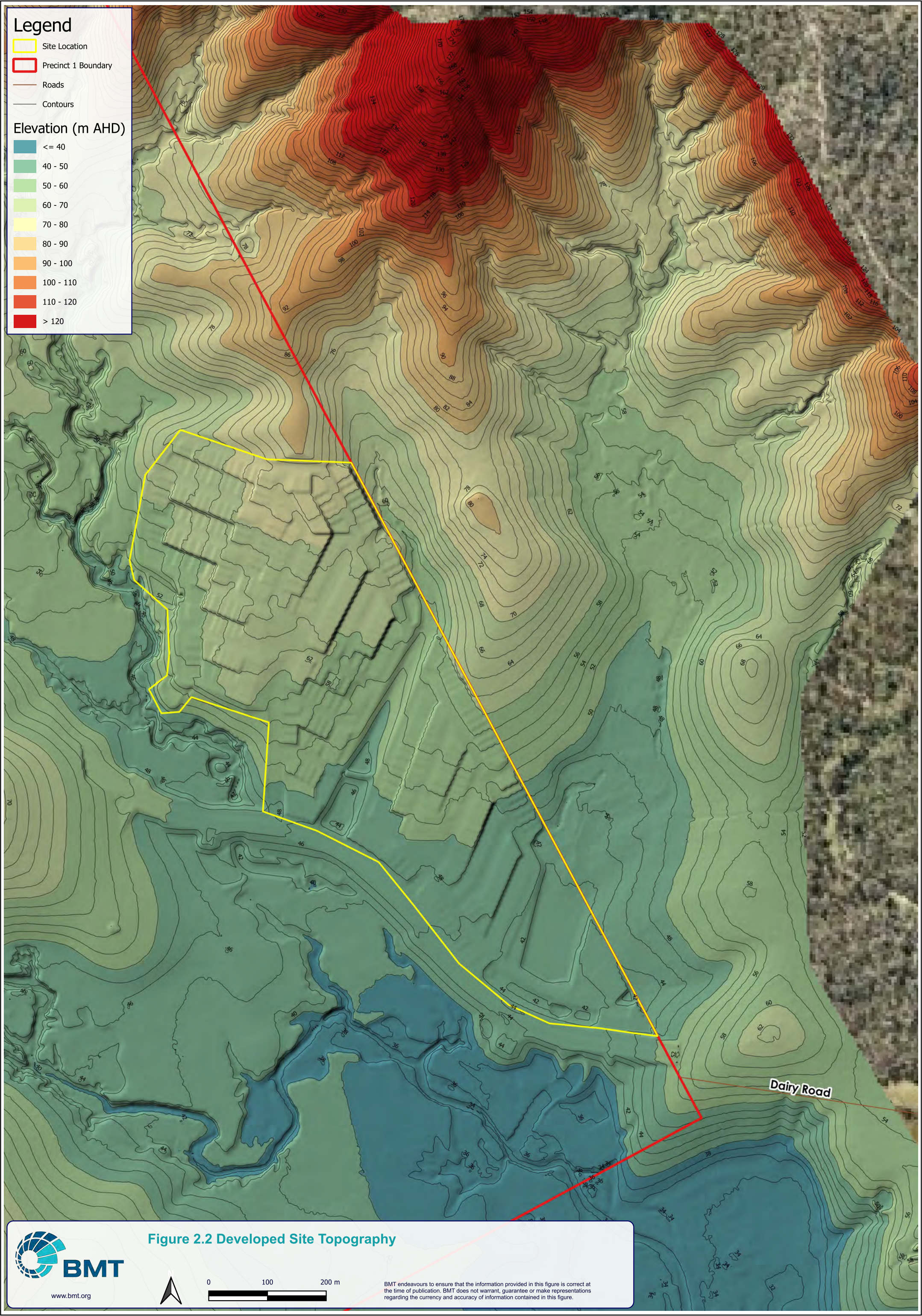
Teviot Brook flows from Wyaralong Dam in a north-easterly direction past the south-east corner of Precinct 1. Woollaman Creek flows into Teviot Brook approximately 1.4 kilometres downstream of Precinct 1 and then flows into the Logan River a further 3.2 kilometres downstream of the confluence of these two waterways. The ultimate receiving environment for Precinct 1 is the southern Moreton Bay.

2.3 Proposed Development

A layout plans of the proposed development are provided in Annex A. The topography of the proposed development has been supplied by Mortons Urban Solutions. This topography is presented in Figure 2.3.







3 Hydrologic Model

3.1 Overview

Hydrologic models were constructed for both the existing and developed site using the WBNM (2007 v1.04) non-linear runoff routing software. Runoff hydrographs calculated by the models were used as inflows to the hydraulic models.

For both the existing and developed case hydrology models, it was assumed that the area to the east of the Precinct 1 boundary is undeveloped and that appropriate measures will be put in place in accordance with Common Law requirements to ensure that development of the area does not result in an increase in discharge into the Flinders development area.

3.2 Existing Case Hydrologic Model Setup

3.2.1 Catchment

To represent the hydrologic behaviour of the catchment, 38 sub-catchments were created using GIS software for use in the hydrologic models. The sub-catchment layout is presented in Figure 3.1.

3.2.2 Land Use Percentage Imperviousness

Catchment landuse was determined for the existing site based on aerial photography and site inspection. Appropriate fraction impervious areas were then defined for each use based on Table 4.5.1 of the Queensland Urban Drainage Manual (QUDM, 2016). The impervious percentage values adopted for each landuse are listed in Table 3.1.

Table 3.1 Landuse Impervious Percentage

Landuse	Impervious %
Urban Residential	75%
Commercial and Community Centres	90%
Dense Vegetation	0%
Light Vegetation	0%
Open Space / Grass	0%
Standing Waterbodies	100%
Roads – Pavement	90%
Exposed Creek Channel Bed	0%
Rock for Scour Protection	100%

3.2.3 Rainfall Depths

The rainfall parameters used in the WBNM model were extracted from ARR 2019 for the Undullah area. The adopted parameters are presented in Table 3.2.

Table 3.2 AR&R 2019 Design Rainfall Depths (mm)

Duration	Annual Exceedance Probability (AEP)						
	63.20%	50%	20%	10%	5%	2%	1%
10 min	13.5	15.4	21.4	25.3	29.2	34.2	37.9
15 min	17.2	19.6	27.2	32.3	37.1	43.5	48.3
20 min	19.9	22.7	31.4	37.3	43	50.4	56
25 min	21.9	25	34.7	41.2	47.5	55.9	62.2
30 min	23.6	26.9	37.3	44.4	51.2	60.3	67.2
45 min	27.2	30.9	42.9	51.1	59.2	70	78.3
1 hour	29.6	33.7	46.7	55.7	64.7	76.8	86.2
1.5 hour	33.1	37.6	52	62.2	72.5	86.5	97.5
2 hour	35.7	40.5	56	67	78.3	93.7	106
3 hour	39.8	45	62.3	74.7	87.4	105	119
4.5 hour	44.6	50.5	69.9	84	98.5	119	135
6 hour	48.8	55.2	76.5	92.1	108	131	149

3.2.4 Rainfall Losses

The rainfall losses adopted for use in the WBNM model are presented in Table 3.3 and Table 3.4. These losses were extracted from ARR 2019.

Table 3.3 Global Rainfall Losses

Parameter	Values
Initial loss (impervious areas)	1.0
Continuing loss (impervious areas)	0.0 mm/hr
Continuing loss (pervious areas)	1.6 mm/hr

Table 3.4 Storm Dependant Initial Loss (pervious area)

Duration	63.2% and 50% AEP	20% AEP	10% AEP	5% AEP	2% AEP	1% and 1%+CC AEP
25 min	23.4	21	19.4	17.8	16.9	16.3
30 min	23.4	21	19.4	17.8	16.9	16.3
60 min	23.4	21	19.4	17.8	16.9	16.3
90 min	23.9	22.9	22.1	21.4	12.7	6.1
120 min	24	21.5	19.9	18.4	11.3	6.1

3.2.5 Global Lag Parameter

A Global Lag parameter of 1.6 was adopted which is within the recommended range of 1.3 to 1.8 as per the WBNM instruction manual.

3.2.6 Critical Design Storm Events

The WBNM model was used to simulate a range of design storm events, durations, temporal patterns:

- Present Climate Annual Exceedance Probability (AEP) Events:
 - 63.2%, 50%, 20%, 10%, 5%, 2% 1%
- The 1% AEP Year 2090 RCP 4.5 was adopted for the climate change event. This is in accordance with the LCC Planning Scheme. A new revision (2024, Version 4.2) of ARR has been released, but at this stage not adopted by LCC.
- Durations for each event:
 - 60, 90, 120 minutes.
- The ARR 2019 ten (10) ensemble temporal patterns for each combination of event and duration.

The simulation results were assessed to determine the single temporal pattern to be adopted for each storm AEP and duration. The adopted temporal pattern was chosen based on that which produced the first peak flow exceeding the median of the ten temporal patterns for each AEP and duration. The adopted temporal patterns for design storm are provided in Table 3.5.

Table 3.5 Adopted Temporal Patterns

AEP	60 min	90 min	120 min
63.20%	5	9	8
50%	6	9	8
20%	4	1	9
10%	5	8	2
5%	7	1	2
2%	6	4	4
1%	6	4	4
1%+CC	10	5	6

3.2.7 Rational Method Verification

Due to the absence of a stream gauge on the watercourse that drains through the site, it was not possible to calibrate the hydrologic models to historic flood events.

In lieu of stream gauge data, recourse was made to the Rational Method to confirm that the peak flows calculated by the hydrologic model were reasonable. For the Rational Method assessment, which was completed in accordance with the procedures nominated in Section 4 of the *Queensland Urban*

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Drainage Manual, the parameters presented in Table 3.6 were adopted for the local catchment draining through the site.

Table 3.7 presents a comparison between the peak flows calculated by WBNM and those calculated using the Rational Method. Based on the WBNM model, the critical duration at the outlet of sub-catchment 35 was identified to be 90 minutes.

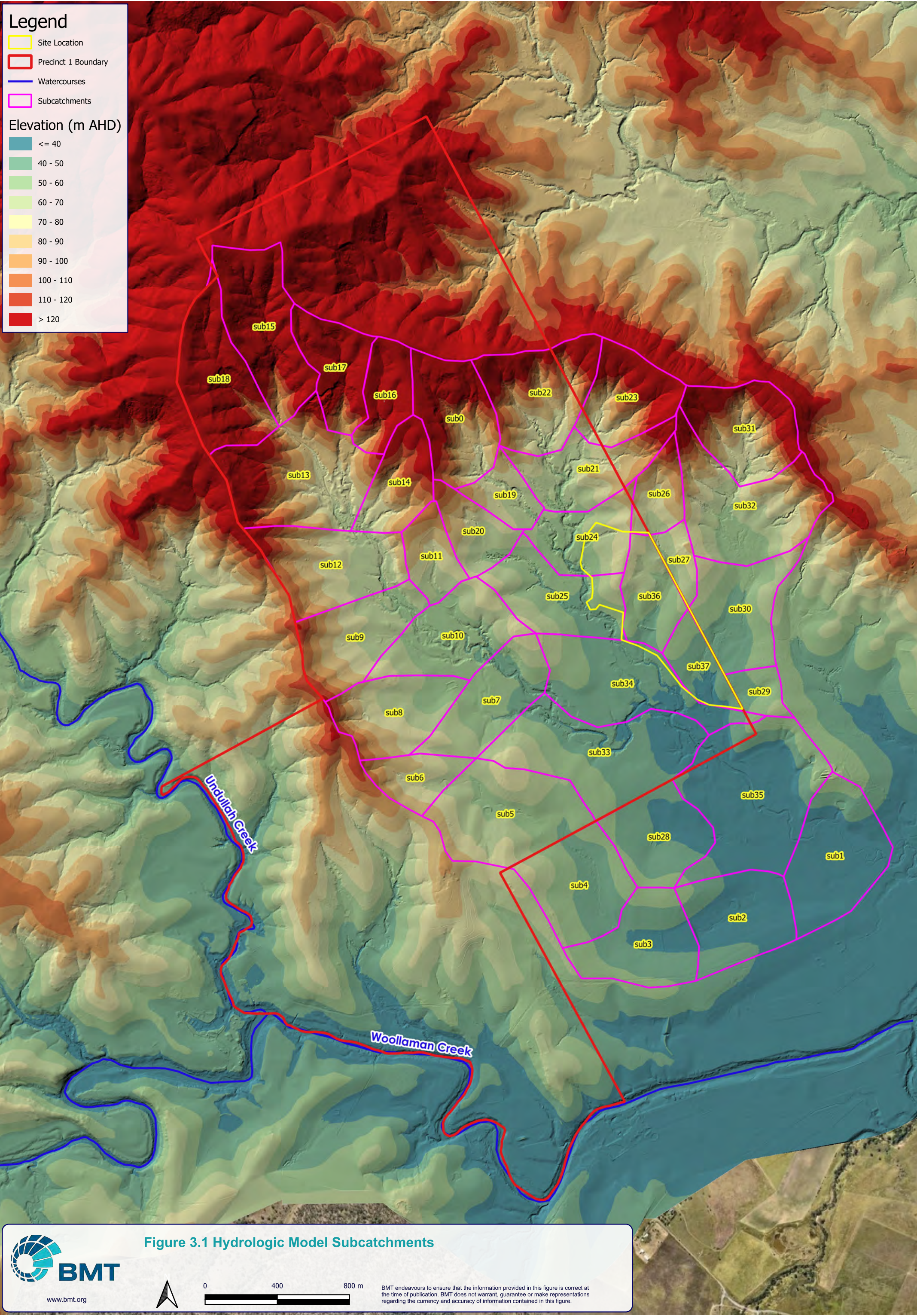
Table 3.6 Rational Method Parameters

Parameter	Value	Notes
Catchment Area	776 ha	Subcatchment 35 and Upstream
Fraction Impervious	10%	
Length of Flow Path	4.8 km	
Time of Concentration	114 min	QUDM Table 4.6.6 – 0% to 1.5% Average Slope
Runoff Coefficient (C10)	0.70	

Table 3.7 Rational Method Comparison

AEP	Rational Method	WBNM	% Difference
63.20%	17.4	12.1	-30%
50%	20.9	14.4	-31%
20%	32.1	22.9	-29%
10%	40.5	38.0	-6%
5%	49.7	46.8	-6%
2%	65.3	59.8	-8%
1%	77.4	74.1	-4%

Based on the results presented in Table 3.7 above, it is considered that a good correlation exists between the WBNM model and the Rational Method and that therefore the model can be used with confidence to define runoff hydrographs for use in the hydraulic model. In any event, the majority of routing is completed by the hydraulic model and the losses adopted for the model ensure that runoff volume is conservatively estimated.



4 Hydraulic Model

4.1 Overview

To confirm that the development will not cause an unacceptable impact on adjacent properties, detailed flood modelling of the local catchment was undertaken.

For the analysis, a TUFLOW two-dimensional model of the local catchment was established. The model included a detailed representation of the surface drainage network via a two-dimensional grid, linked with one-dimensional elements representing the underground (pipe) drainage network.

This section provides a description of the assessment undertaken and the results obtained from the simulation.

4.2 Existing Case Model Setup

4.2.1 Model Extent and Topography

The TUFLOW model created for this assessment covers the area from the top of the local catchment to 1km downstream of the Precinct 1 boundary. The downstream extent of the model was chosen to ensure that conditions at the downstream end of the model do not affect results at the site.

Ground level data for the model was obtained from 2013 LIDAR survey data provided by DNRM. This is the most recent LIDAR survey of the area.

To provide a high level of detail, a hydraulic model with a 5-metre grid cell size was used in the 2D domain.

4.3 Roughness

A roughness map representing the Manning 'n' roughness coefficients was adopted based on previous flood studies for the site (G&S 2012a report) which in turn had been derived from a review of aerial photography and site inspections. As part of the current investigation, the adopted roughness values were reviewed and found to be consistent with ARR Project 15, Two-Dimensional Modelling of Urban and Rural Floodplains (AR&R, 2012). Given this, the adopted roughness values presented in Table 4.1 were considered appropriate for use.

Table 4.1 Roughness Values

Landuse	Manning's Roughness
Urban Residential	0.20
Commercial and Community Centres	0.20
Dense Vegetation	0.08
Light Vegetation	0.06
Open Space / Grass	0.05
Standing Waterbodies	0.02
Roads – Pavement	0.02
Exposed Creek Channel Bed	0.035
Rock for Scour Protection	0.022

4.3.2 Boundary Conditions

Inflow boundary conditions were extracted from the WBNM model described in Section 3.

The tailwater level adopted for the hydraulic model was revised from that used in the previous flood studies. The previous tailwater condition of 33.02m AHD represented the combined influence of regional flooding from the Teviot Brook and the Logan River catchments for the 1% AEP regional flood event. This value was derived from the 2014 Logan-Albert Flood Study.

The Logan-Albert flood model was revised in 2021 to include updated topographic and climatic detail including a climate change allowance. From this study, a new tailwater level of 35.15m AHD (1%+Climate Change Year 2090 RCP 4.5) was derived for the Flinders hydraulic model.

4.4 Developed Case Model Setup

4.4.1 Model Extent and Topography

To assess the proposed redevelopment of the site, the existing case model 2D domain, as described above, was updated to reflect the proposed terrain and land usage changes associated with the development.

4.4.2 Roughness

The roughness values adopted for the existing case were adjusted to reflect the development layout as outlined in Annex A .

4.4.3 Culvert Network

A 1D domain was used to represent the primary culvert network within the proposed development. The culvert network was based on the preliminary landuse layout and is limited to only the waterway crossings within the development. The proposed culvert sizes used in the hydraulic model are presented in Table 4.2. The culvert locations are presented in Figure 4.1

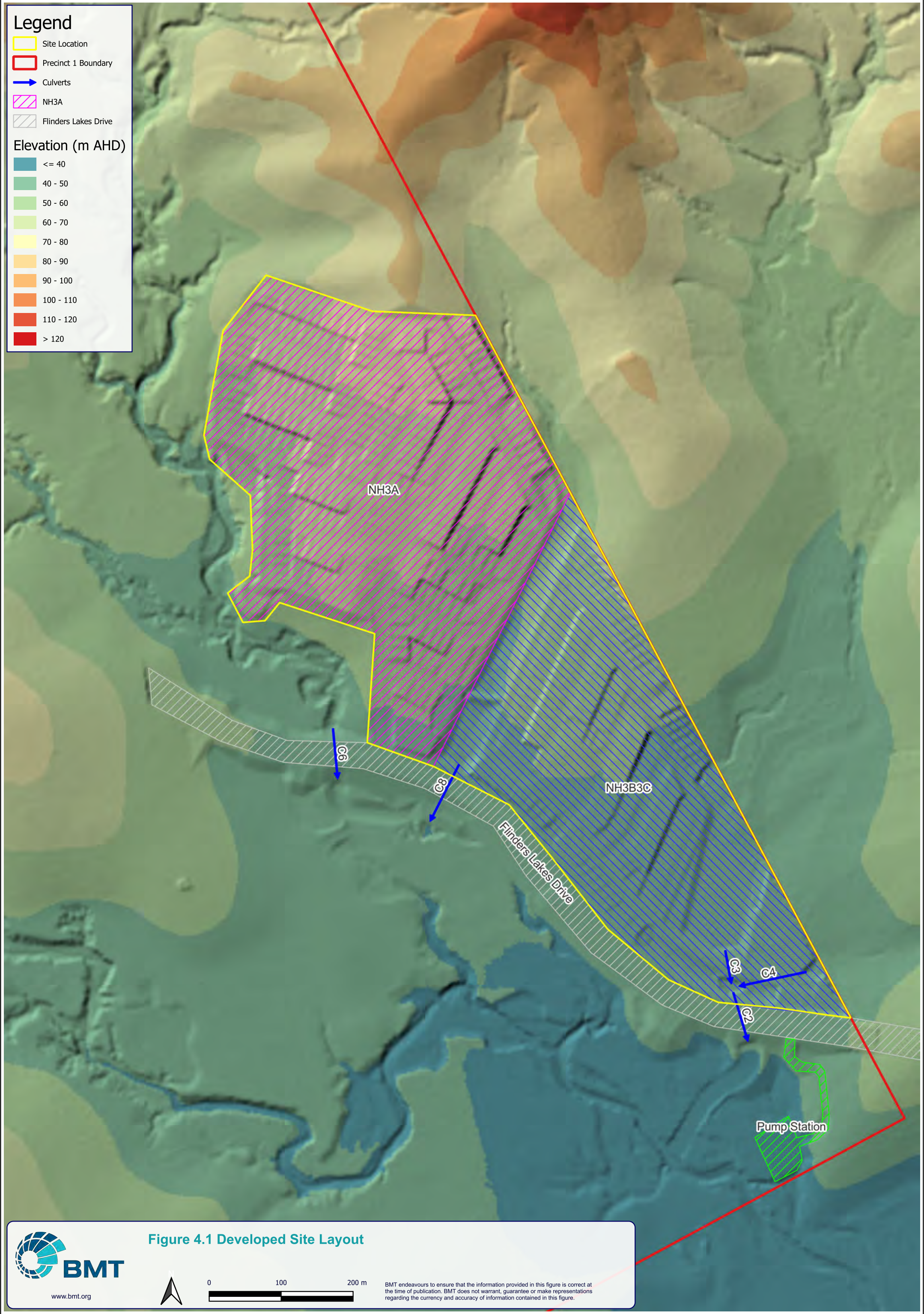
Table 4.2 Proposed Culverts

Culvert ID	Quantity	Size (mm x mm)	Type	Design Blockage (QUDM Table 10.4.1)
C2	9	2100 x 900	RCBC	20%
C3	9	2100 x 900	RCBC	20%
C4	1	1800 x 600	RCBC	20%
C6	3	1800 x 900	RCBC	20%
C8	3	1800 x 900	RCBC	20%

4.4.4 Severe Storm and Extreme Culvert Blockage Assessment

As per QUDM Table 10.4.1, a severe storm and extreme blockage investigation was conducted as follows:

- Extreme Blockage: minor storms 63% to 10% AEP - 100% blockage of all culverts.
- Severe Storm 0.5% AEP and 0.5% AEP + Climate Change (Year 2090, RCP 4.5) - all culverts with a partial blockage (50%) applied.



5 Hydraulic Model Results

The hydraulic model was used to calculate flood levels, depths, velocities, and flood hazard (depth x velocity) for both the existing and developed cases for a range of storm events and durations.

Design floods with an AEP ranging from 63% AEP to 1% AEP with Climate Change were simulated using the hydraulic model. For each event a range of storm durations was considered, with the envelope of peak levels and flows used for the preparation of flood mapping.

The mapped resultant existing case peak flood level, depth, velocity, and hazard for all storm events are presented in Annex B. Developed case mapped results, including impact maps, are presented in Annex C. the peak water levels at the reporting points shown in the post-development maps are tabulated in Table 5.1.

Table 5.1 Post-Development Peak Water Levels (m AHD) at Reporting Points

AEP	RP1	RP2	RP3	RP4	RP5
63.2%	44.39	40.58	35.17	35.15	35.16
50%	44.41	40.62	35.18	35.15	35.16
20%	44.46	40.76	35.41	35.15	35.18
10%	44.54	40.84	35.58	35.41	35.20
5%	44.61	40.95	35.72	35.57	35.22
2%	44.67	41.03	35.79	35.65	35.24
1%	44.75	41.15	35.91	35.72	35.26
1%CC	44.84	41.28	35.98	35.80	35.28

5.2 Flood Impacts

For each of the design storm events considered, flood impact mapping is provided in Annex C (Figures C.33 to C.40). The change in flood levels at the downstream reporting points are tabulated in Table 5.2.

Table 5.2 Flood Level Impacts (mm) at the Downstream Reporting Points

AEP	RP3	RP4	RP5
63.2%	-38	-215	-2
50%	-24	-285	-2
20%	+39	-455	-18
10%	+34	-267	-25
5%	+24	-182	-21
2%	+15	-150	-17
1%	-11	-145	-17
1%CC	-27	-152	-26

From the flood impact mapping and tabulated values, the following observations can be made:

- For all design storm events considered, there are no adverse upstream flood impacts present on the neighbouring property.
- Downstream of the Precinct 1 boundary, a redistribution of flows is present causing both *increases* and *decreases* in peak flood levels:
 - For the 63.2% and 50% AEP storm events *decreases* are present in the main channel (RP3), minor channel (RP4), and the downstream confluence of main and minor channel (RP5)
 - For the 20%, 10%, 5%, and 2% AEP storm events:
 - At RP3 *increases* are present between 15mm to 39mm
 - At RP4 *decreases* are present between 150mm to 455mm
 - At RP5 *decreases* are present between 17mm to 25mm
 - For the 1% AEP and 1% AEP + Climate Change storm events, *decreases* are present at RP3, RP4, and RP5.

From the above observations it can be concluded that although increases in water level greater than 10mm are present downstream of the boundary, these increases are offset by the significant decreases in the minor channel, and once the minor and main channels merge overall decreases in water level are present.

5.3 Severe Storm and Extreme Culvert Blockage Results

The post-development model was simulated for the events and blockage scenarios outlined in Section 5.3. The mapped resultant peak flood levels, depths, velocities and flood hazard for the post-development case are provided in Annex D on the following figures:

5.3.1 Extreme Blockage: minor storms 63% to 10% AEP - 100% blockage of all culverts.

The results mapping for this analysis are provided in the following figures:

- Level - Figures D.1 to D.4
- Depth – Figures D.7 to D.10
- Velocity – Figures D.13 to D.16
- Flood Hazard – Figures D.19 to D.22

The results indicate that only the 10% AEP design storm results in transverse flow of flood waters on Flinders Lakes Drive. From the 10% AEP figures the following observations can be made:

- Figure D.10 - 10% AEP Peak Flood Depth: The crest of the road has a flood depth of 124mm (Reporting Point RP1b), and the road kerb (RP1a) has a depth of 344mm.
- Figure D.22 – 10% AEP Peak Flood Hazard: The flood hazard varies from 0.07 m²/s on the crest to 0.10 m²/s in the road kerb.

PRIVATE

From QUDM Section 7.4 '*Roadway flow limits and capacity*', the minor storm transverse flow limits for vehicle safety (no risk to life) provided in Table 7.4.3, indicate that a maximum depth of less than or equal to 300mm or a flood hazard of less than or equal to 0.3 m.m/s is required.

The above results indicate that the road will remain trafficable during this storm event given the flood depth and hazard on the crest of the road are below the required limits.

5.3.2 Severe storm 0.5% AEP and 0.5% AEP + Year 2090 Climate Change (RCP 4.5) - all structures with a partial blockage (50%) applied.

The results mapping for this analysis are provided in the following figures:

- Level – D.6 and D.7
- Depth – D.12 and D.13
- Velocity - D.17 and D.18
- Flood Hazard – D.23 and D.24

From above figures, Flinders Lakes Drive does not experience transverse flow during these storms with a partial blockage of the culverts.

6 Conclusion

A detailed flood investigation has been undertaken with respect to Neighbourhoods 3A and 3BC within Precinct 1 of the proposed Flinders Master Planned Community. The investigation updates previous modelling that was undertaken prior to the revision to the Australian Rainfall and Runoff guidelines (2019), and updates to the Logan-Albert flood model.

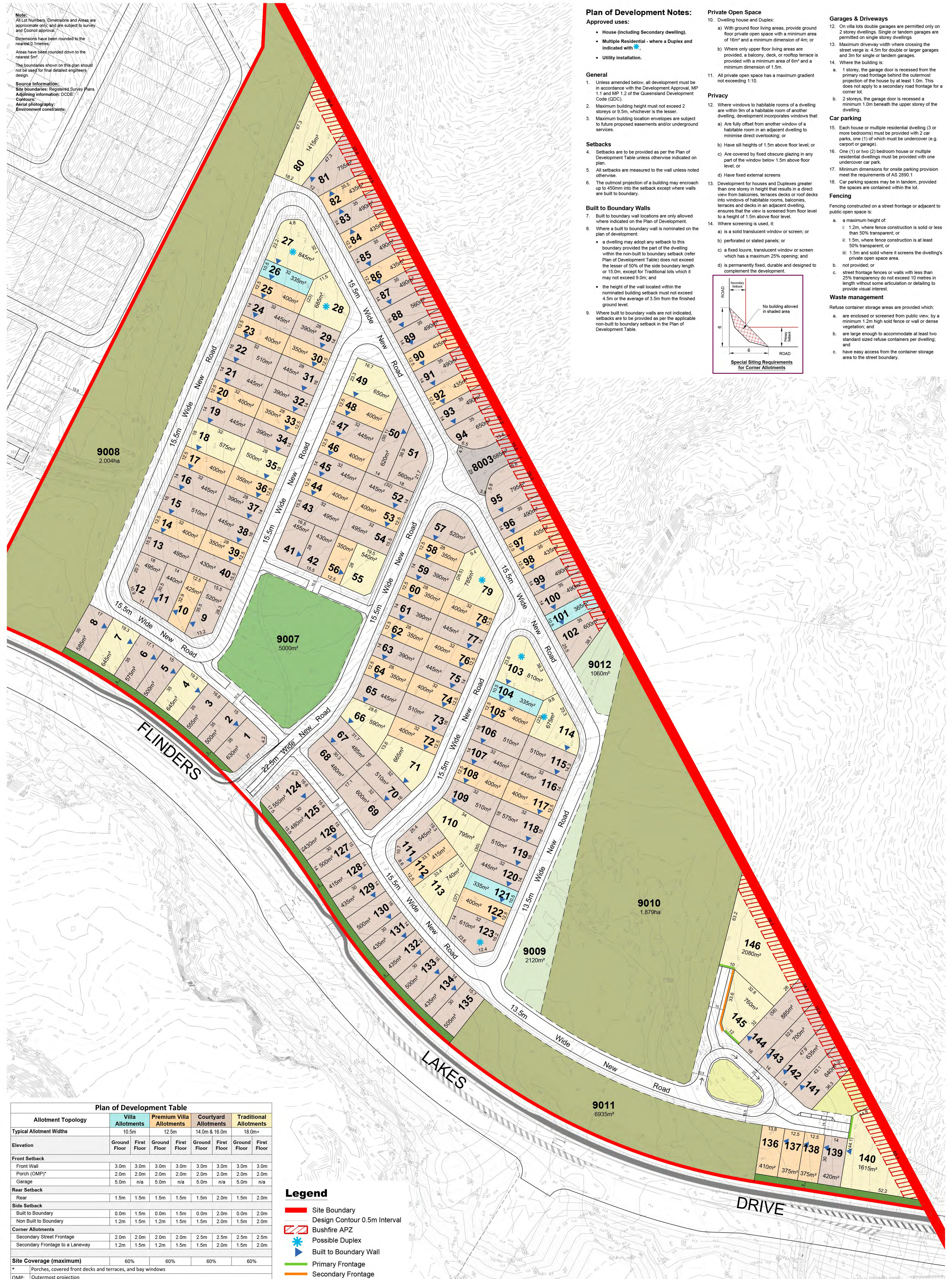
The investigation included the following elements:

- *Hydrologic Assessment:* Pre- and post-development hydrologic models of the local catchment were established to provide inflow hydrographs to the hydraulic model. The models utilised the 2019 revision to ARR and included consideration of the 1%+Climate change design storm event (Year 2090, RCP 4.5).
- *Hydraulic Assessment:* Pre- and post-development hydraulic models were established for the local catchment. Flood impact mapping indicated that the proposed development of the Site would not lead to any adverse off-site impacts with respect to flooding.
- *Extreme Blockage and Severe Storm Assessment:* The extreme culvert blockage (100%) of the post-development minor storms indicated that Flinders Lakes Drive will remain trafficable during the design storm events assessed. The severe storm assessment indicated that when a 50% culvert blockage is applied to the 0.5% AEP and 0.5% AEP with Climate Change events Flinders Lakes Drive remains trafficable.

Based on the results of the investigations outlined in this report it is considered that, subject to suitable detailed design, the site can be developed without causing a material increase in flood level upstream or downstream of the Precinct 1 boundary.

Annex A Site Development Plans

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.
Dimensions have been rounded to the nearest 0.1 metres.
Areas have been rounded down to the nearest 5m².
The boundaries shown on this plan should not be used for final detailed engineers design.
Source Information:
Site boundaries: Registered Survey Plans
Adjoining information: DCDB
Contours: Aerial photography
Environment constraints:



Plan of Development Notes:

Approved uses:

- House (including Secondary dwelling).
- Multiple Residential - where a Duplex and indicated with *
- Utility installation.

General

1. Unless amended below, all development must be in accordance with the Development Approval, MP 1.1 and MP 1.2 of the Queensland Development Code (QDC).
2. Maximum building height must not exceed 2 storeys or 9.5m, whichever is the lesser.
3. Maximum building location envelopes are subject to future proposed easements and/or underground services.

Setbacks

4. Setbacks are to be provided as per the Plan of Development Table unless otherwise indicated on plan.
5. All setbacks are measured to the wall unless noted otherwise.
6. The outmost projection of a building may encroach up to 450mm into the setback except where walls are built to boundary.

Built to Boundary Walls

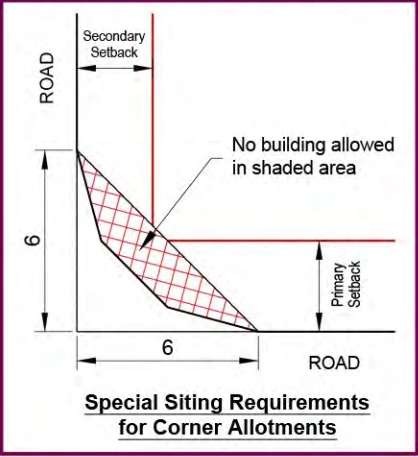
7. Built to boundary wall locations are only allowed where indicated on the Plan of Development.
8. Where a built to boundary wall is nominated on the plan of development:
 - a dwelling may adopt any setback to this boundary provided the part of the dwelling within the non-built to boundary setback (refer Plan of Development Table) does not exceed the lesser of 50% of the side boundary length or 15.0m, except for Traditional lots which it may not exceed 9.0m; and
 - the height of the wall located within the nominated building setback must not exceed 4.5m or the average of 3.5m from the finished ground level.
9. Where built to boundary walls are not indicated, setbacks are to be provided as per the applicable non-built to boundary setback in the Plan of Development Table.

Private Open Space

10. Dwelling house and Duplex:
 - a) With ground floor living areas, provide ground floor private open space with a minimum area of 16m² and a minimum dimension of 4m; or
 - b) Where only upper floor living areas are provided, a balcony, deck, or rooftop terrace is provided with a minimum area of 6m² and a minimum dimension of 1.5m.
11. All private open space has a maximum gradient not exceeding 1:10.

Privacy

12. Where windows to habitable rooms of a dwelling are within 9m of a habitable room of another dwelling, development incorporates windows that:
 - a) Are fully offset from another window of a habitable room in an adjacent dwelling to minimise direct overlooking; or
 - b) Have sill heights of 1.5m above floor level; or
 - c) Are covered by fixed obscure glazing in any part of the window below 1.5m above floor level; or
 - d) Have fixed external screens
13. Development for houses and Duplexes greater than one storey in height that results in a direct view from balconies, terraces decks or roof decks into windows of habitable rooms, balconies, terraces and decks in an adjacent dwelling, ensures that the view is screened from floor level to a height of 1.5m above floor level.
14. Where screening is used, it:
 - a) is a solid translucent window or screen; or
 - b) perforated or slated panels; or
 - c) a fixed louvre, translucent window or screen which has a maximum 25% opening; and
 - d) is permanently fixed, durable and designed to complement the development.



Garages & Driveways

12. On villa lots double garages are permitted only on 2 storey dwellings. Single or tandem garages are permitted on single storey dwellings.
13. Maximum driveway width where crossing the street verge is: 4.5m for double or larger garages and 3m for single or tandem garages.
14. Where the building is:
 - a. 1 storey, the garage door is recessed from the primary road frontage behind the outmost projection of the house by at least 1.0m. This does not apply to a secondary road frontage for a corner lot.
 - b. 2 storeys, the garage door is recessed a minimum 1.0m beneath the upper storey of the dwelling.
15. Each house or multiple residential dwelling (3 or more bedrooms) must be provided with 2 car parks, one (1) of which must be undercover (e.g. carport or garage).
16. One (1) or two (2) bedroom house or multiple residential dwellings must be provided with one undercover car park.
17. Minimum dimensions for onsite parking provision meet the requirements of AS 2890.1
18. Car parking spaces may be in tandem, provided the spaces are contained within the lot.

Car parking

Fencing

- Fencing constructed on a street frontage or adjacent to public open space is:
- a. a maximum height of:
 - i. 1.2m, where fence construction is solid or less than 50% transparent; or
 - ii. 1.5m, where fence construction is at least 50% transparent; or
 - iii. 1.5m and solid where it screens the dwelling's private open space area.
 - b. not provided; or
 - c. street frontage fences or walls with less than 25% transparency do not exceed 10 metres in length without some articulation or detailing to provide visual interest.

Waste management

- Refuse container storage areas are provided which:
- a. are enclosed or screened from public view, by a minimum 1.2m high solid fence or wall or dense vegetation; and
 - b. are large enough to accommodate at least two standard sized refuse containers per dwelling; and
 - c. have easy access from the container storage area to the street boundary.

Plan of Development Table									
Allotment Topology		Villa Allotments		Premium Villa Allotments		Courtyard Allotments		Traditional Allotments	
Typical Allotment Widths		10.5m		12.5m		14.0m & 16.0m		18.0m+	
Elevation		Ground Floor	First Floor	Ground Floor	First Floor	Ground Floor	First Floor	Ground Floor	First Floor
Front Setback									
Front Wall		3.0m	3.0m	3.0m	3.0m	3.0m	3.0m	3.0m	3.0m
Porch (OMP)*		2.0m	2.0m	2.0m	2.0m	2.0m	2.0m	2.0m	2.0m
Garage		5.0m	n/a	5.0m	n/a	5.0m	n/a	5.0m	n/a
Rear Setback									
Rear		1.5m	1.5m	1.5m	1.5m	1.5m	2.0m	1.5m	2.0m
Side Setback									
Built to Boundary		0.0m	1.5m	0.0m	1.5m	0.0m	2.0m	0.0m	2.0m
Non Built to Boundary		1.2m	1.5m	1.2m	1.5m	1.5m	2.0m	1.5m	2.0m
Corner Allotments									
Secondary Street Frontage		2.0m	2.0m	2.0m	2.0m	2.5m	2.5m	2.5m	2.5m
Secondary Frontage to a Laneway		1.2m	1.5m	1.2m	1.5m	1.5m	2.0m	1.5m	2.0m
Site Coverage (maximum)		60%		60%		60%		60%	
* OMP:	Porches, covered front decks and terraces, and bay windows								
Outermost projection									

Legend

- Site Boundary
- Design Contour 0.5m Interval
- Bushfire APZ
- Possible Duplex
- Built to Boundary Wall
- Primary Frontage
- Secondary Frontage

**FLINDERS LAKES
NEIGHBOURHOOD 3B & 3C
PLAN OF DEVELOPMENT**

PLAN REF: AU416385 – 14
Rev No: E
DATE: 22 May 2026
CLIENT: PACIFIQ
DRAWN BY: SE
CHECKED BY: CC



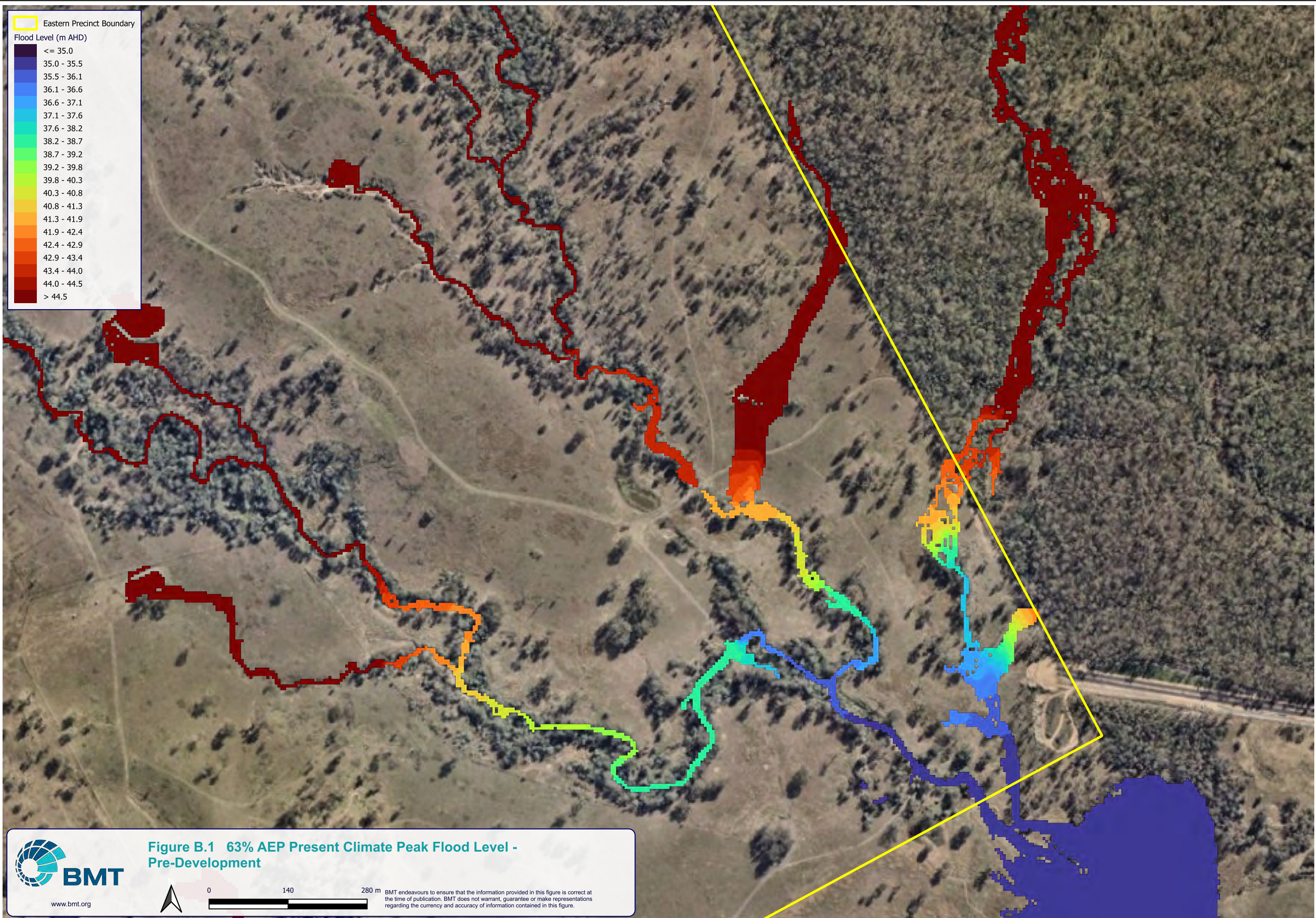
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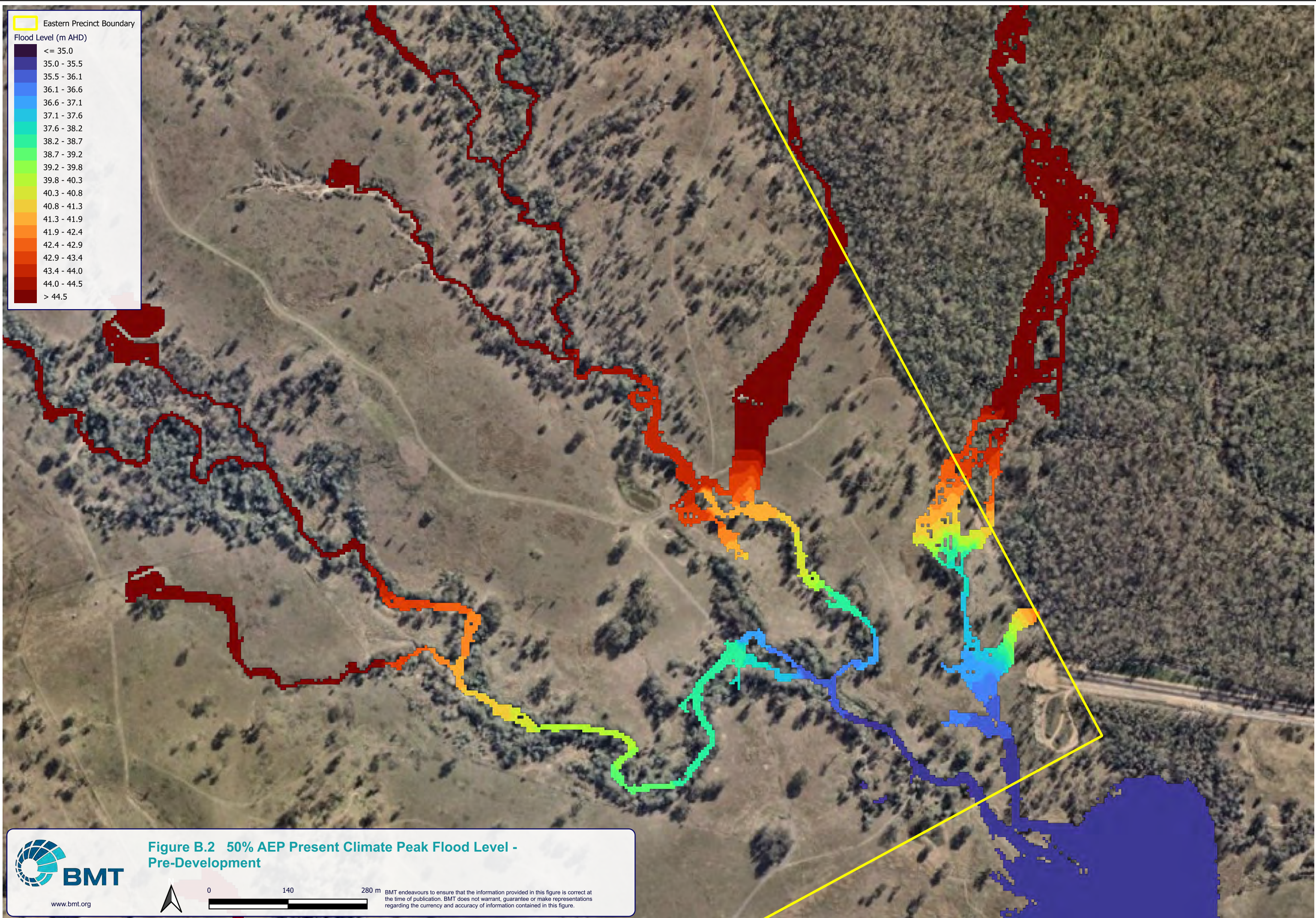
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Level 4 HQ South
520 Wickham Street
PO Box 1559
Fortitude Valley QLD 4006
T +61 7 3539 5500
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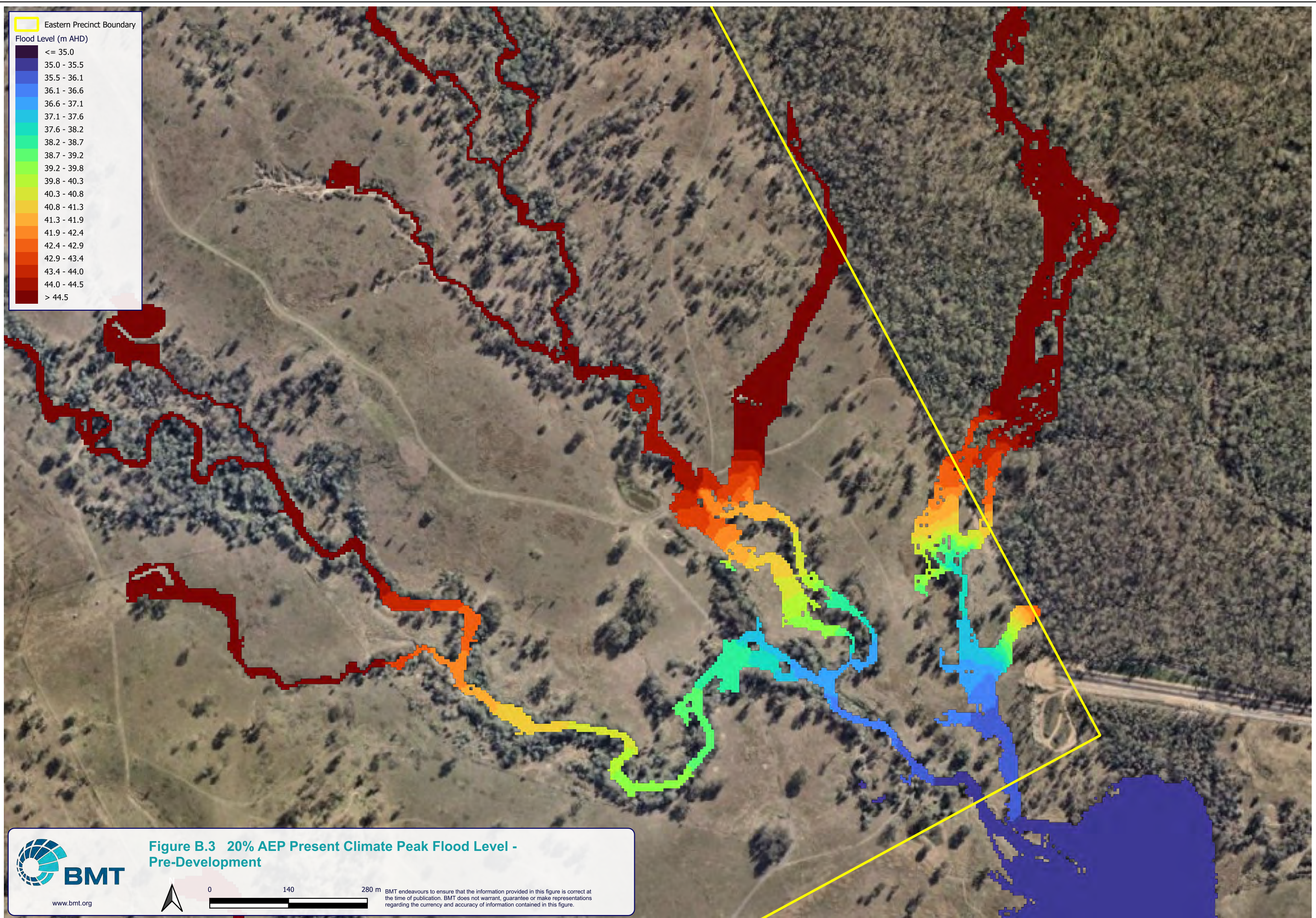
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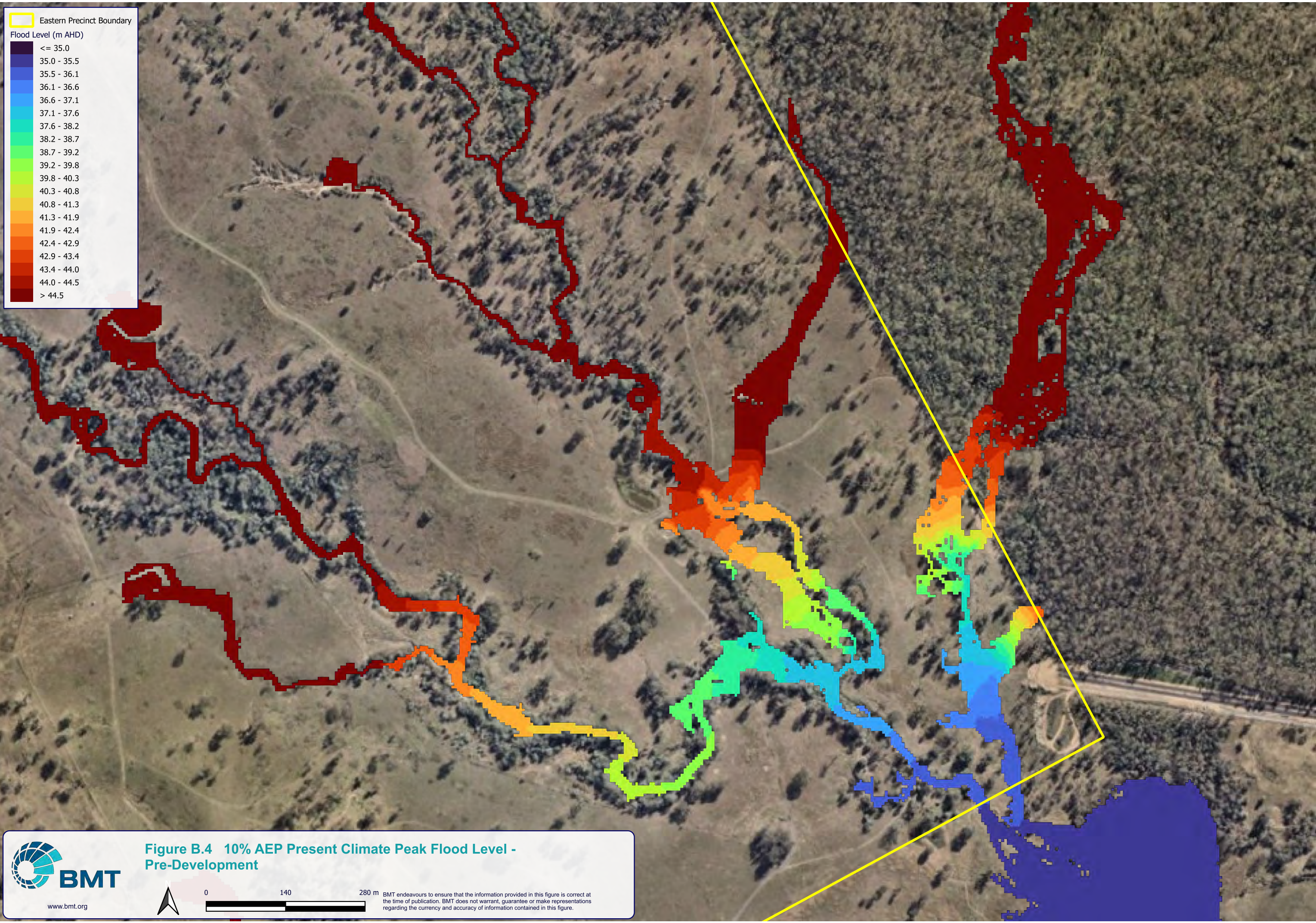


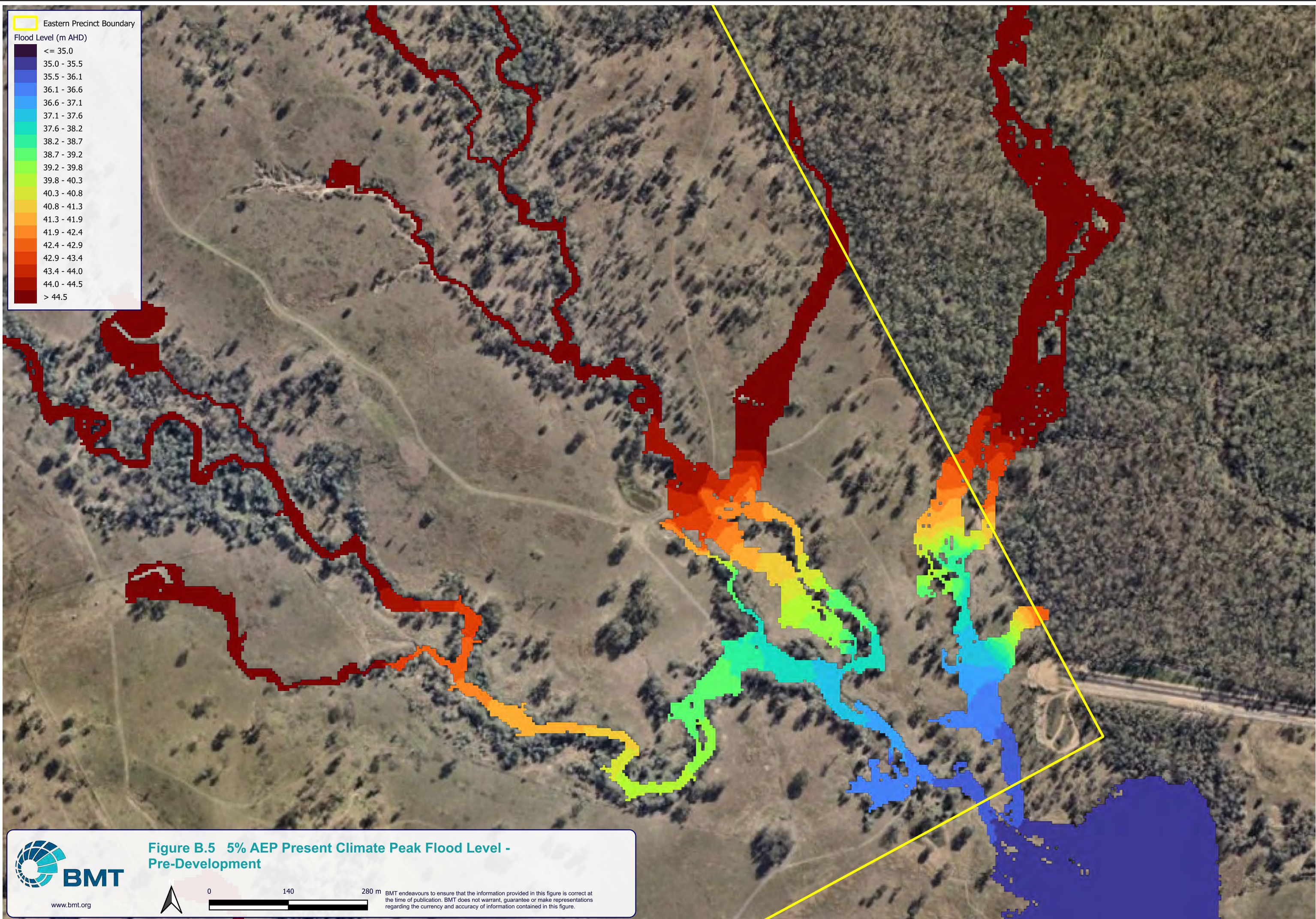
Annex B Existing Case Hydraulic Model Results

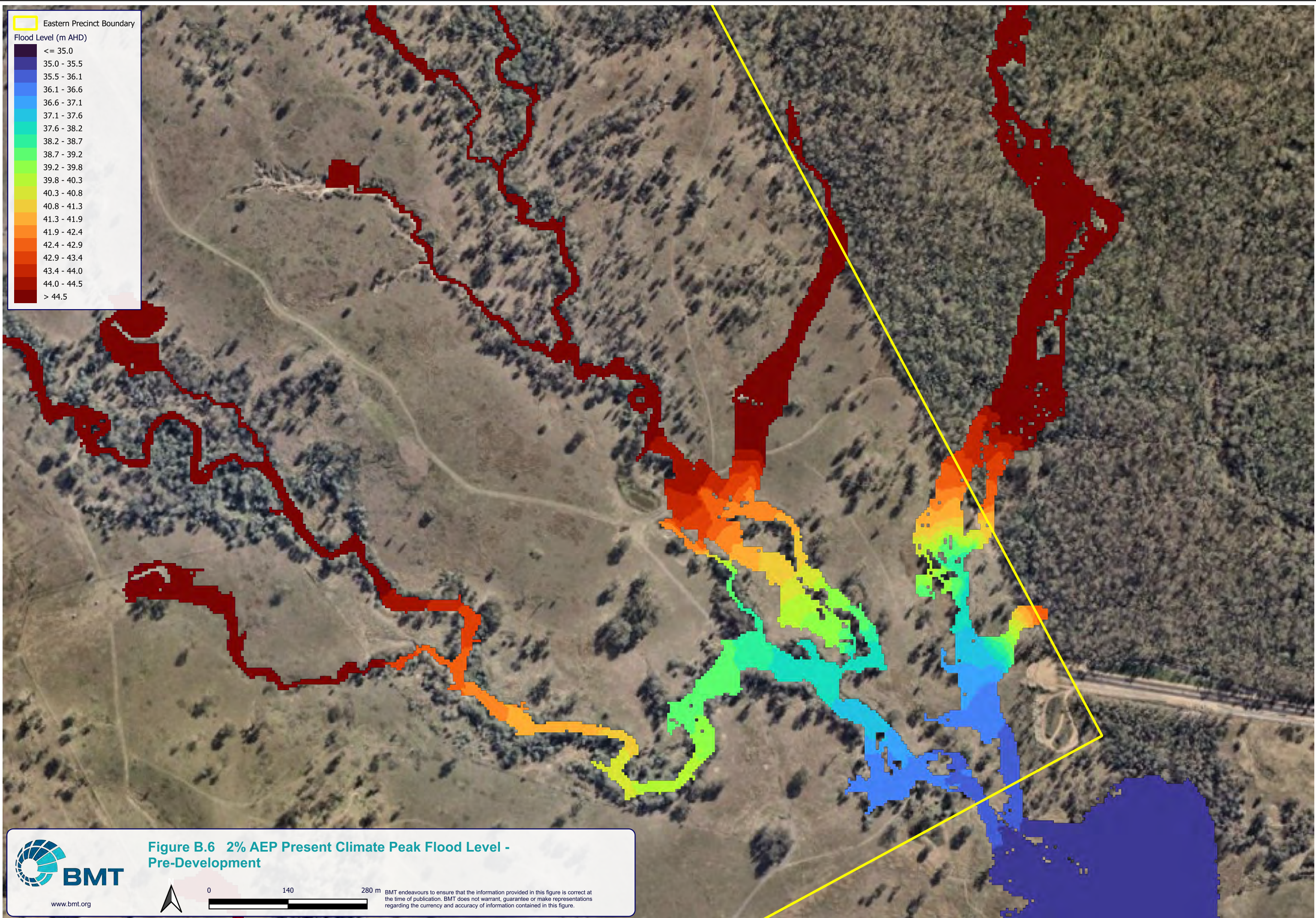


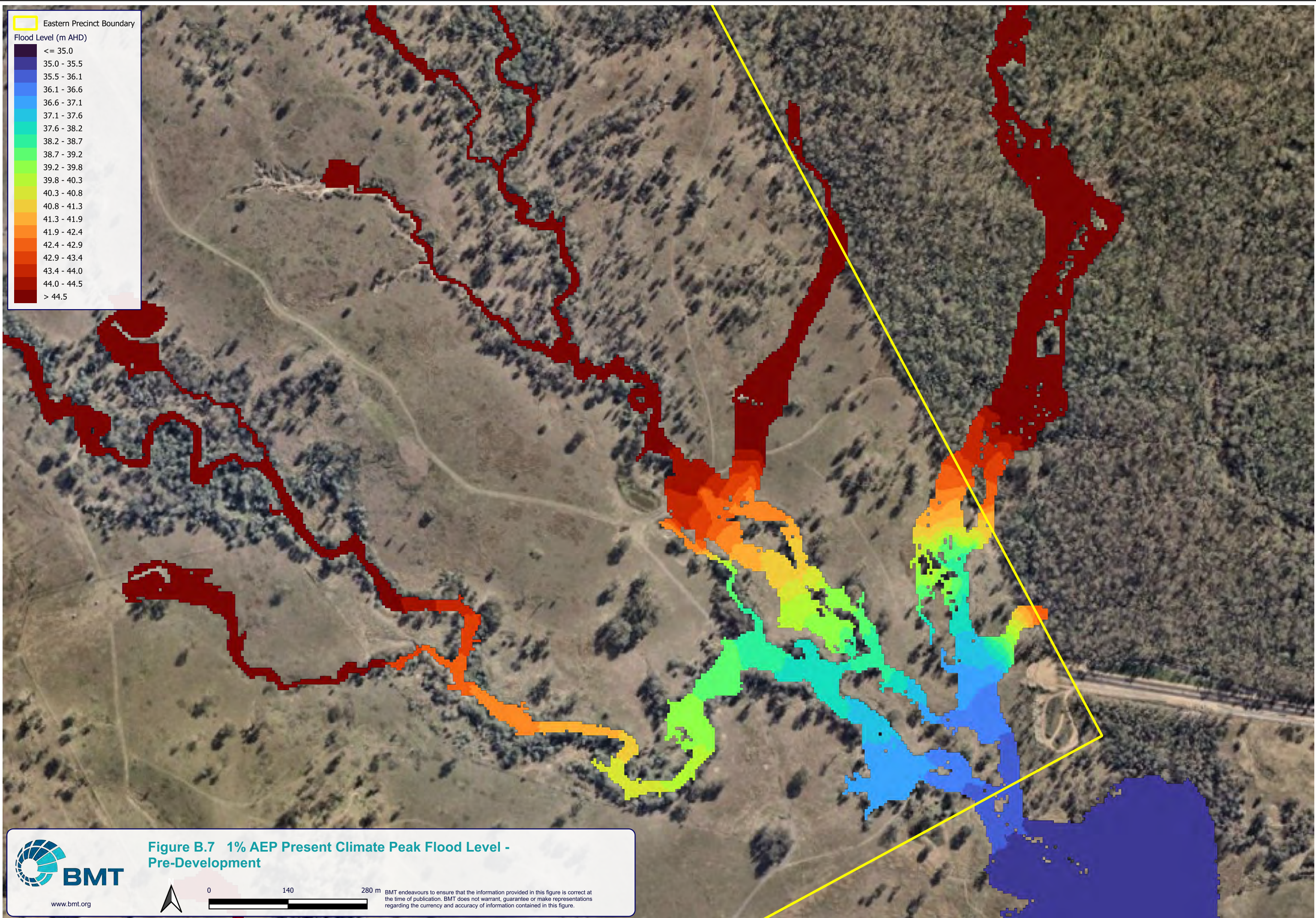


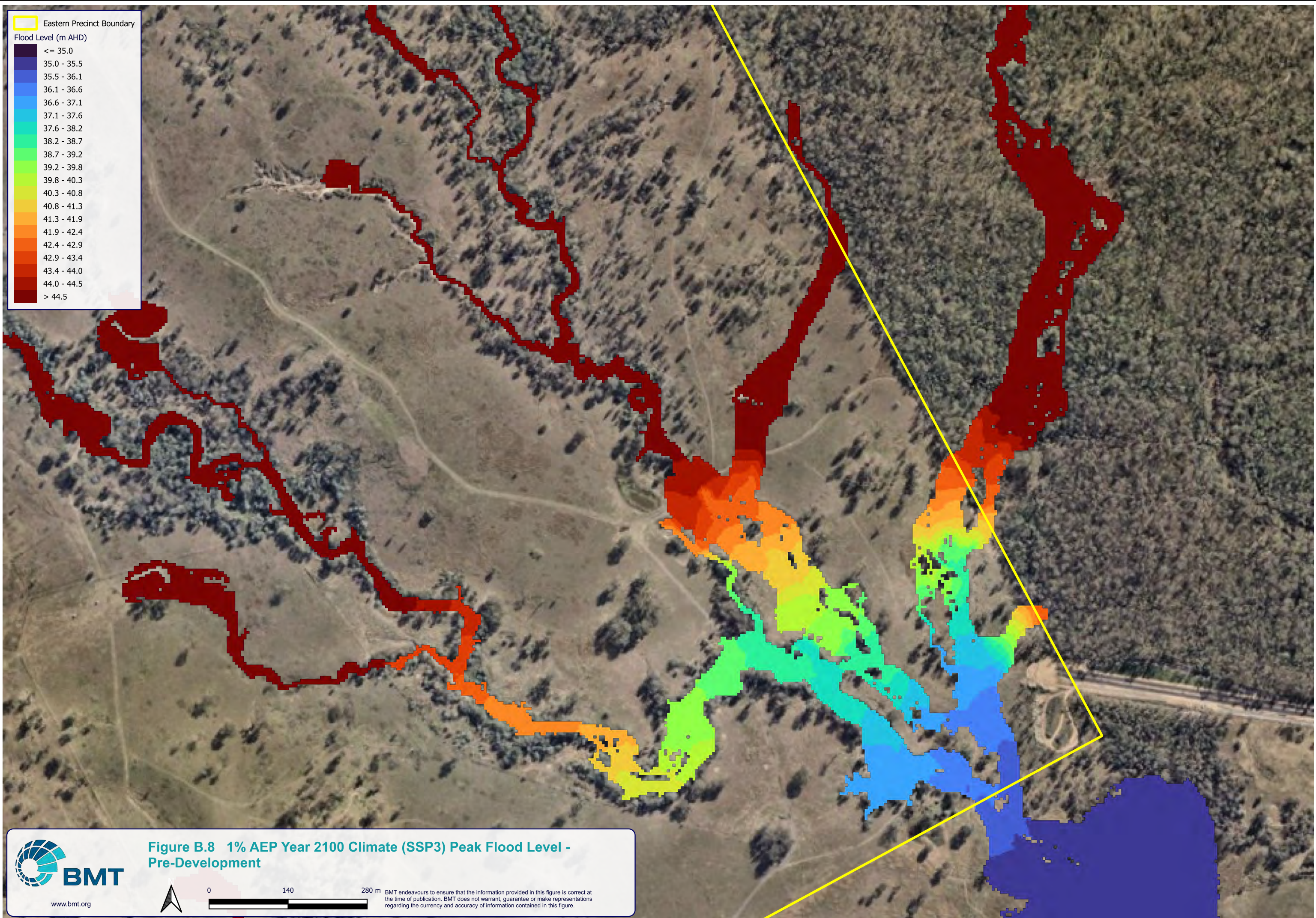


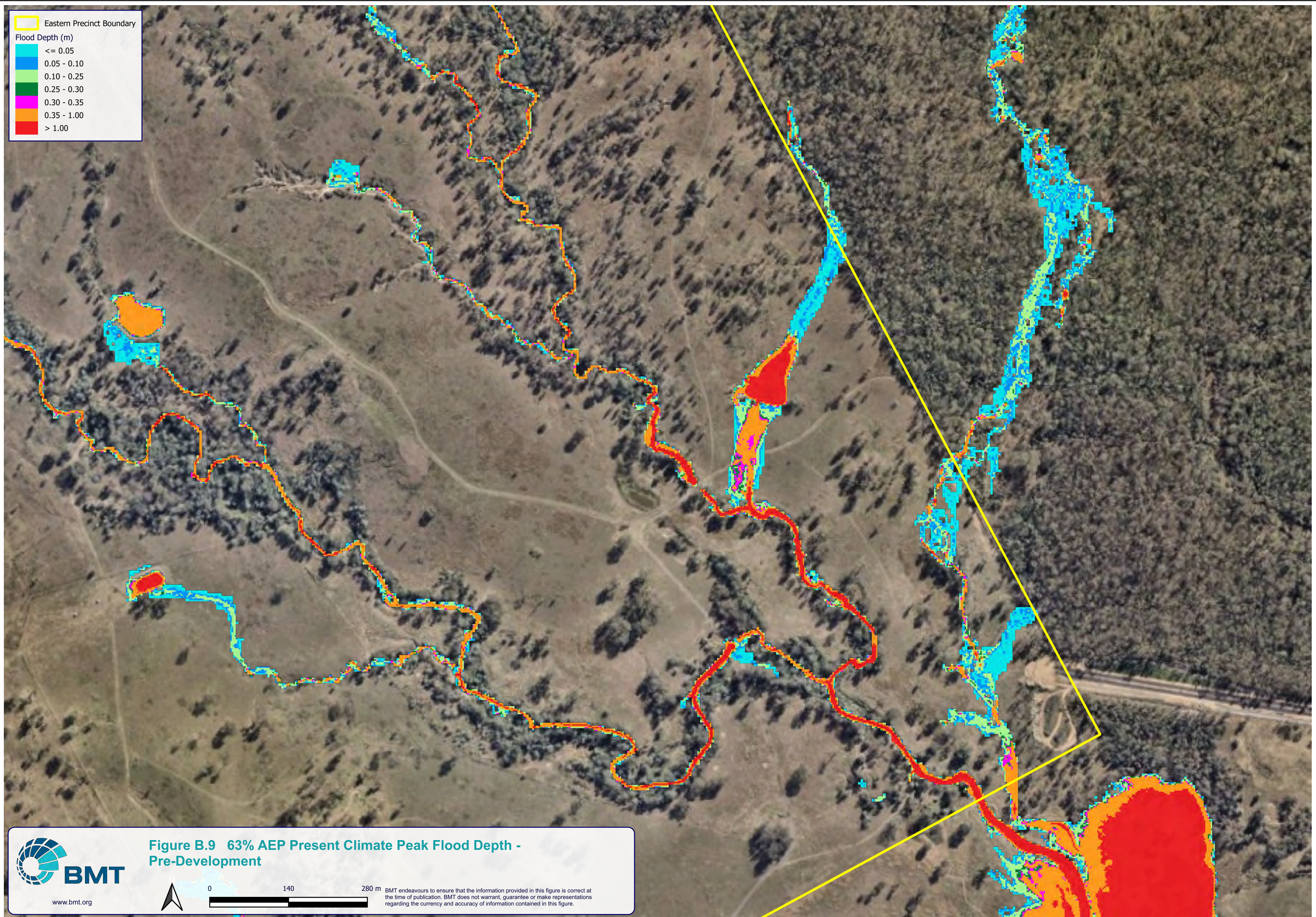


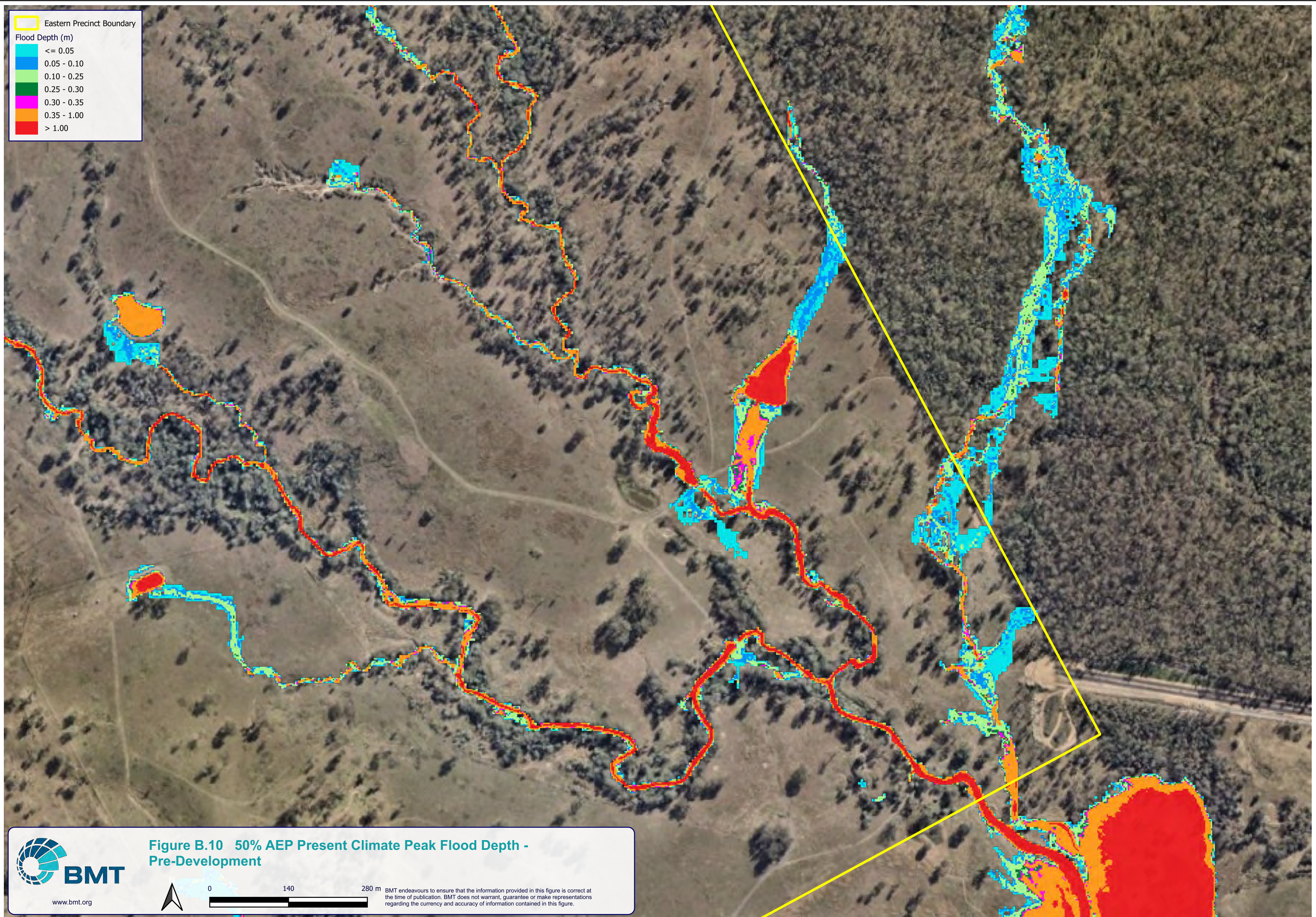




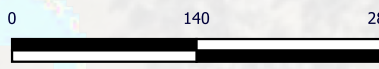








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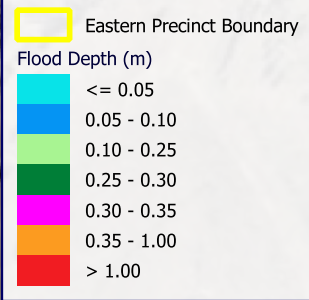
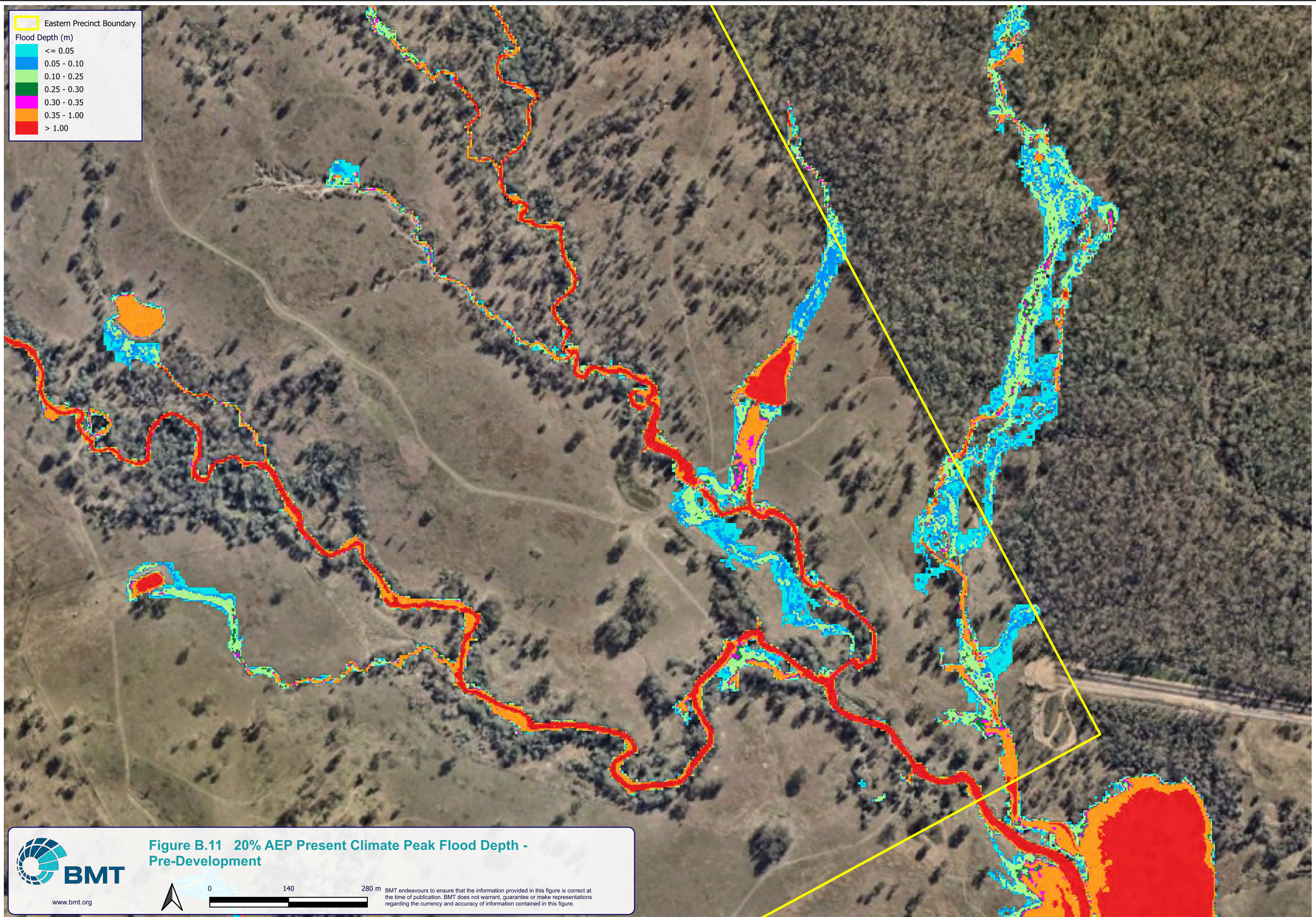
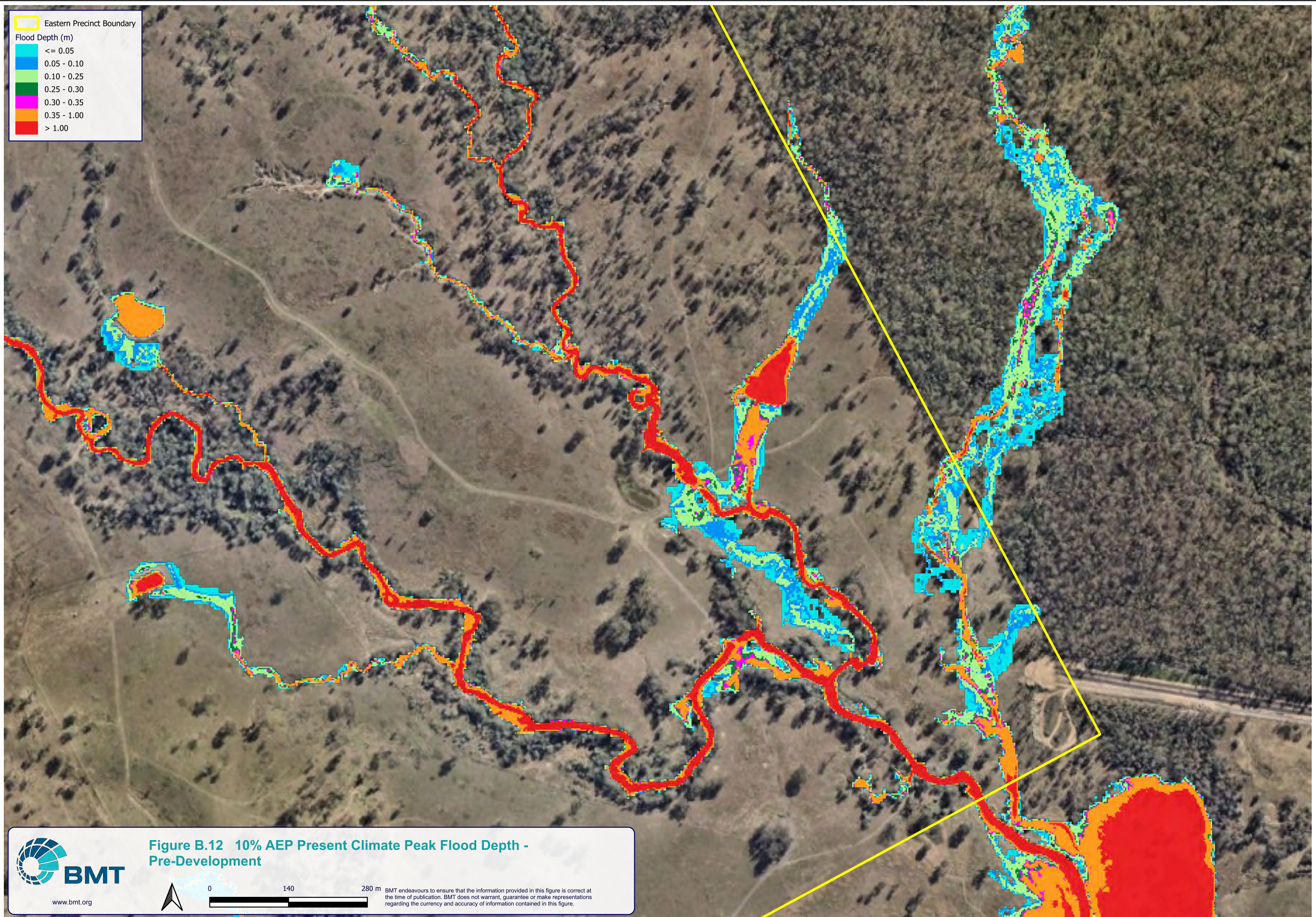


Figure B.11 20% AEP Present Climate Peak Flood Depth - Pre-Development



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 Eastern Precinct Boundary

Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.30
	0.30 - 0.35
	0.35 - 1.00
	> 1.00

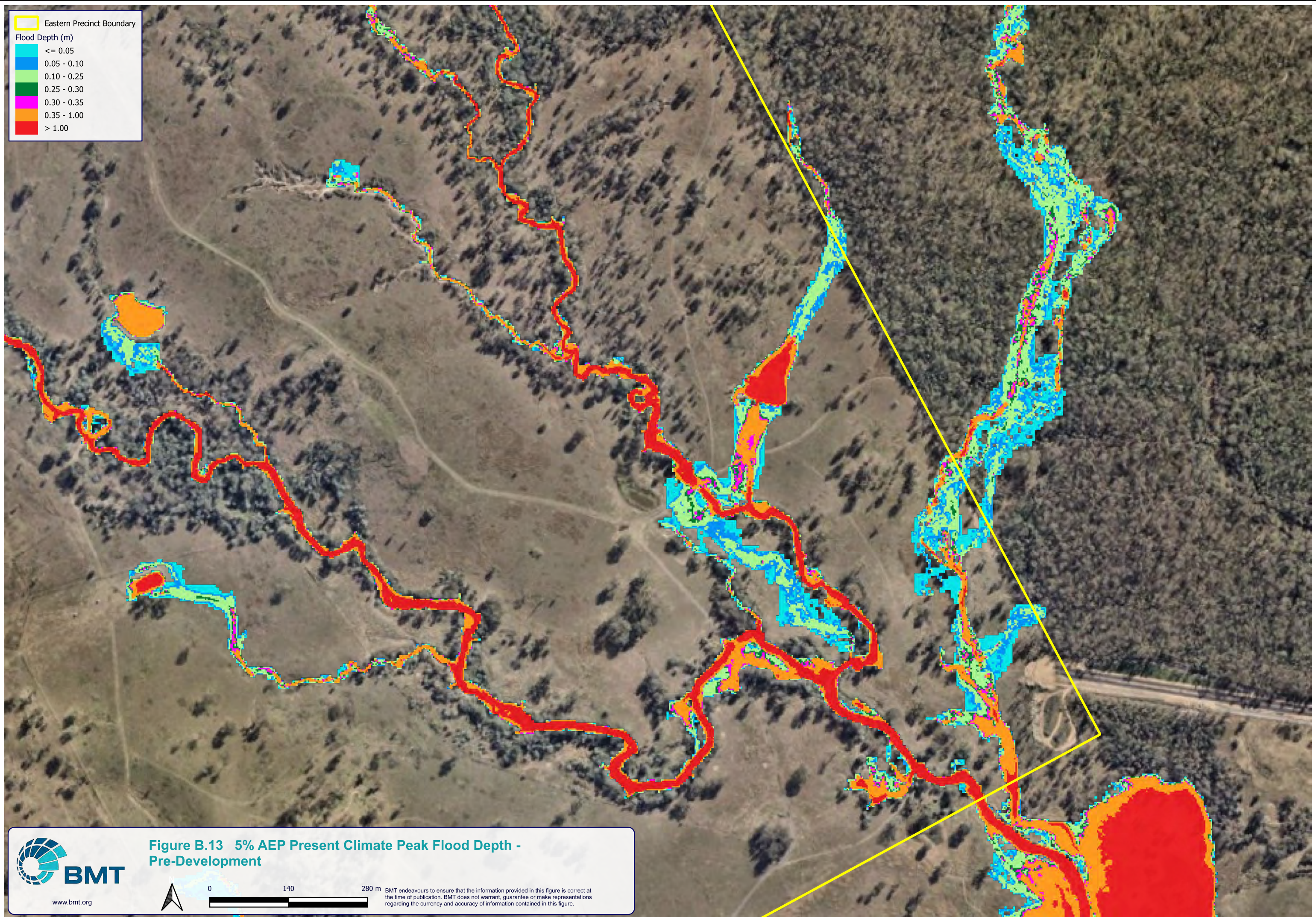


Figure B.12 10% AEP Present Climate Peak Flood Depth - Pre-Development

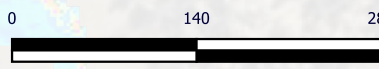


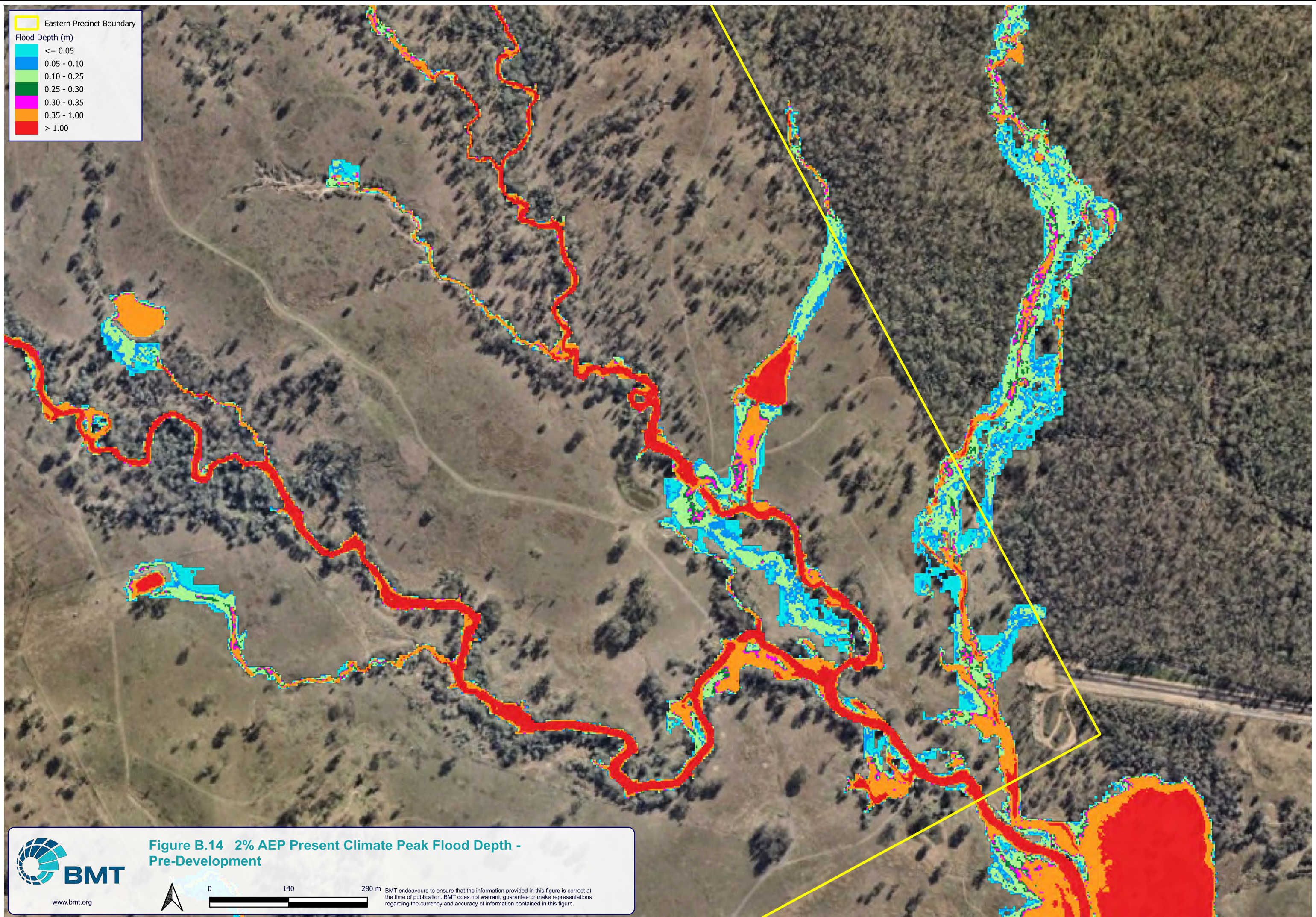
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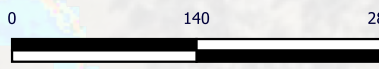


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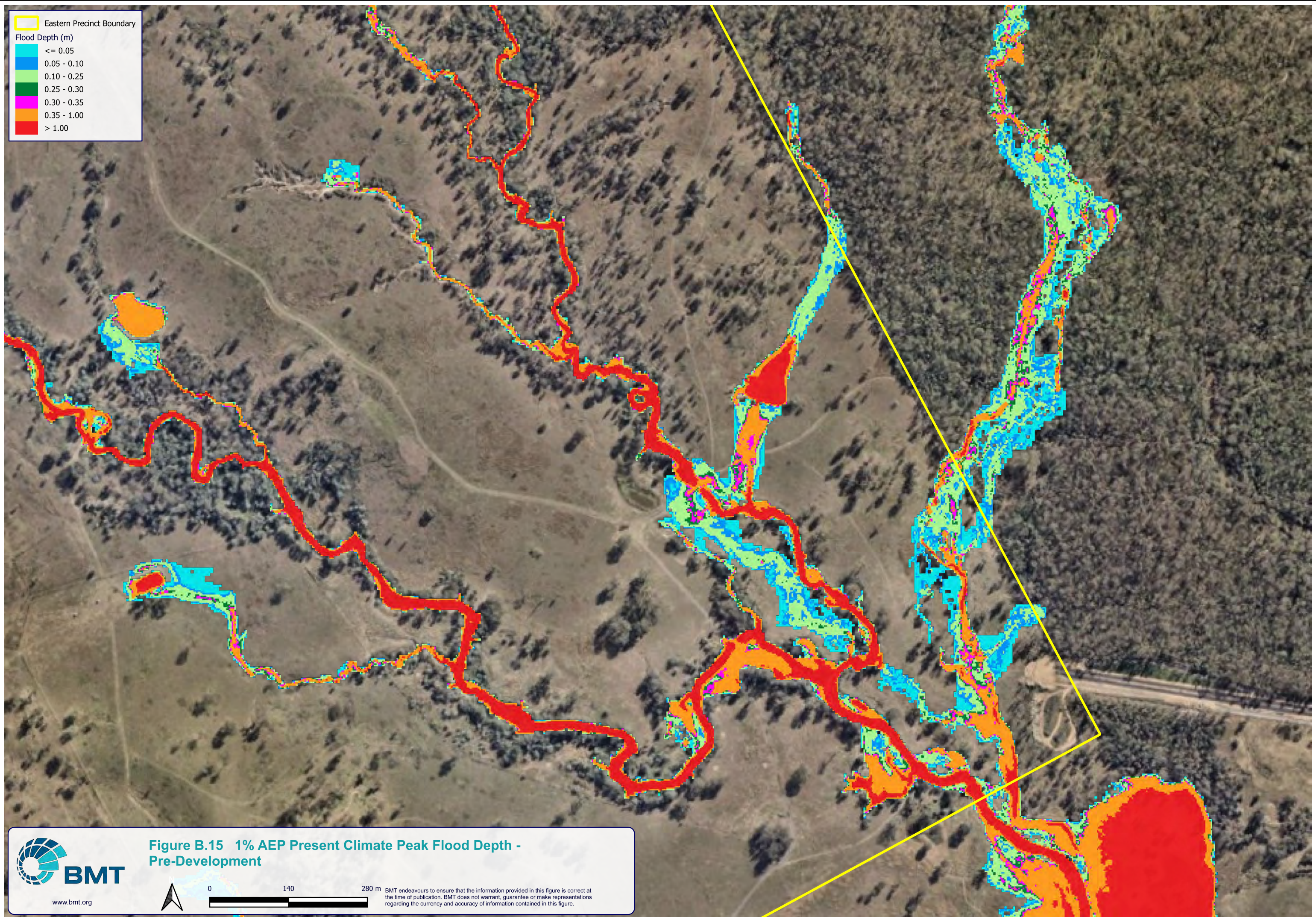




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Eastern Precinct Boundary

Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.30
	0.30 - 0.35
	0.35 - 1.00
	> 1.00



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Figure B.15 1% AEP Present Climate Peak Flood Depth - Pre-Development

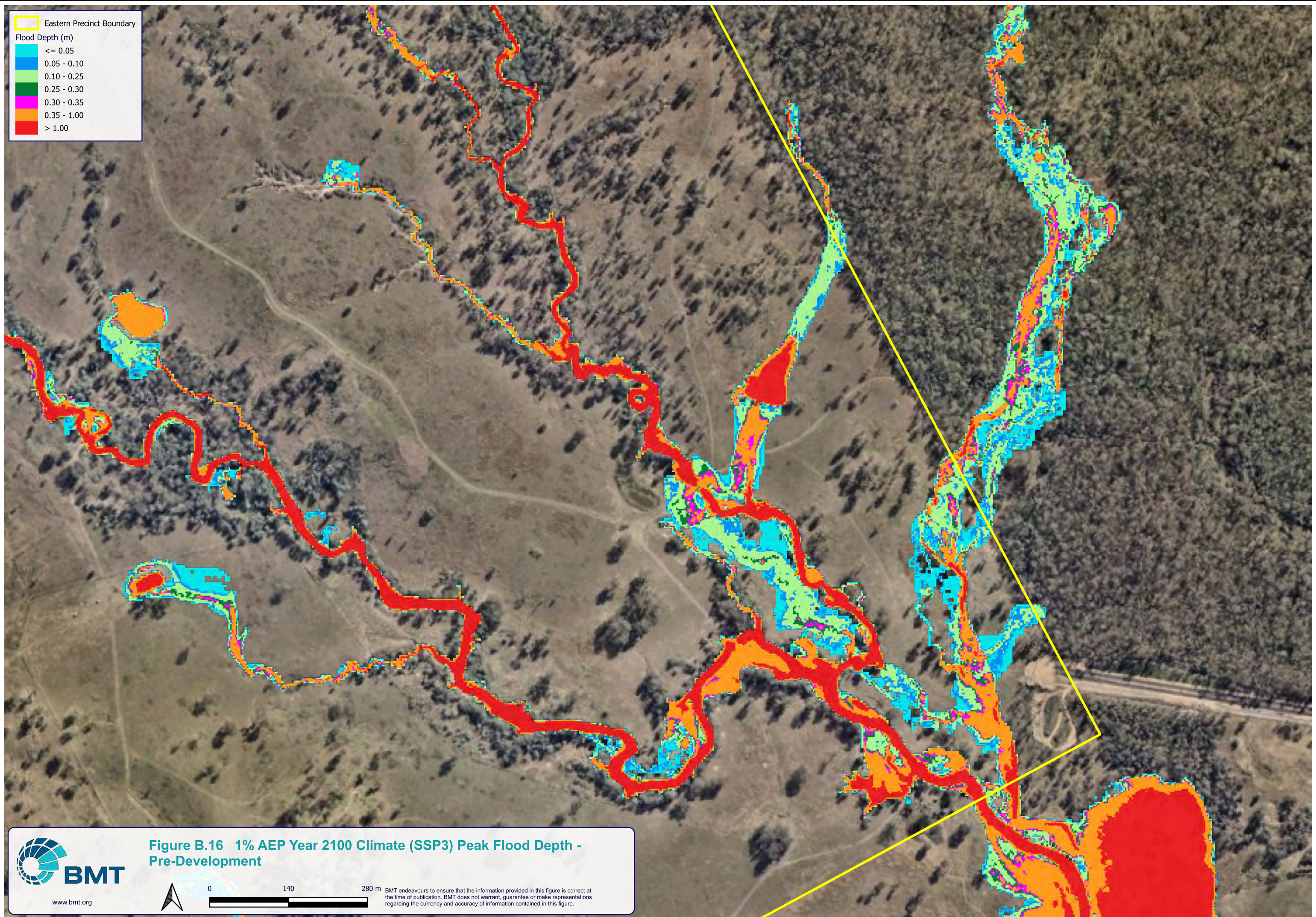
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140

280 m

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Eastern Precinct Boundary

Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.30
	0.30 - 0.35
	0.35 - 1.00
	> 1.00



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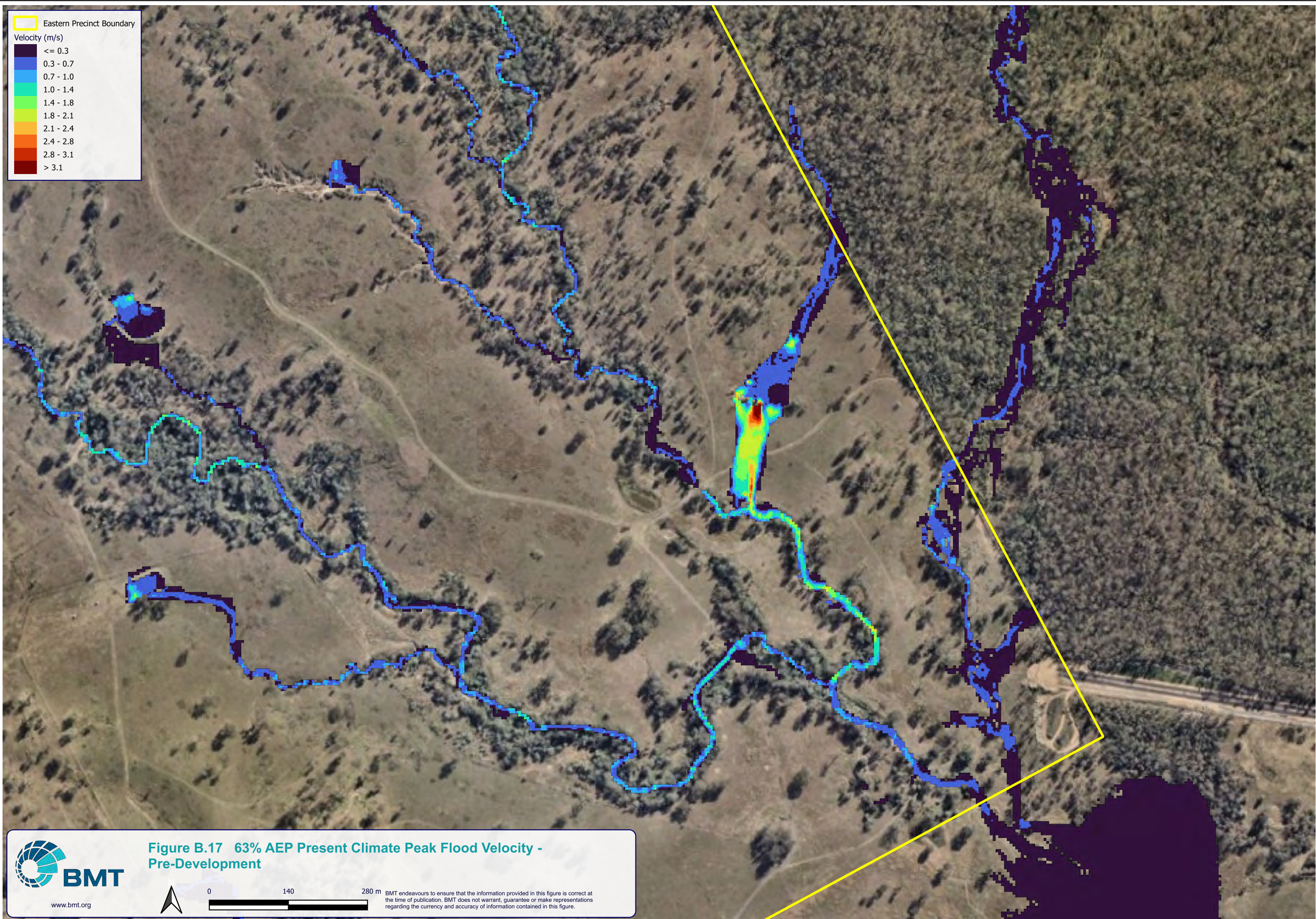


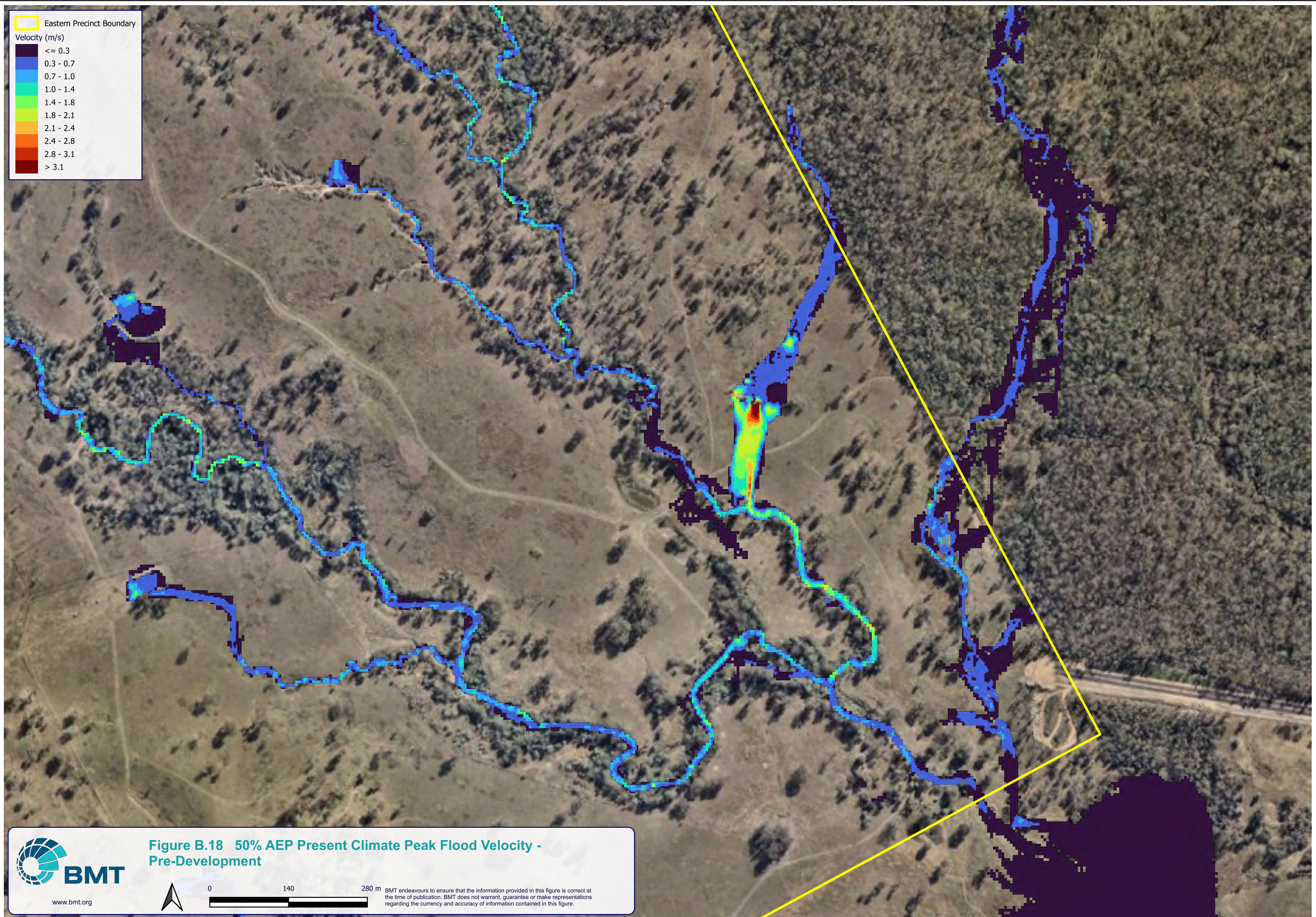
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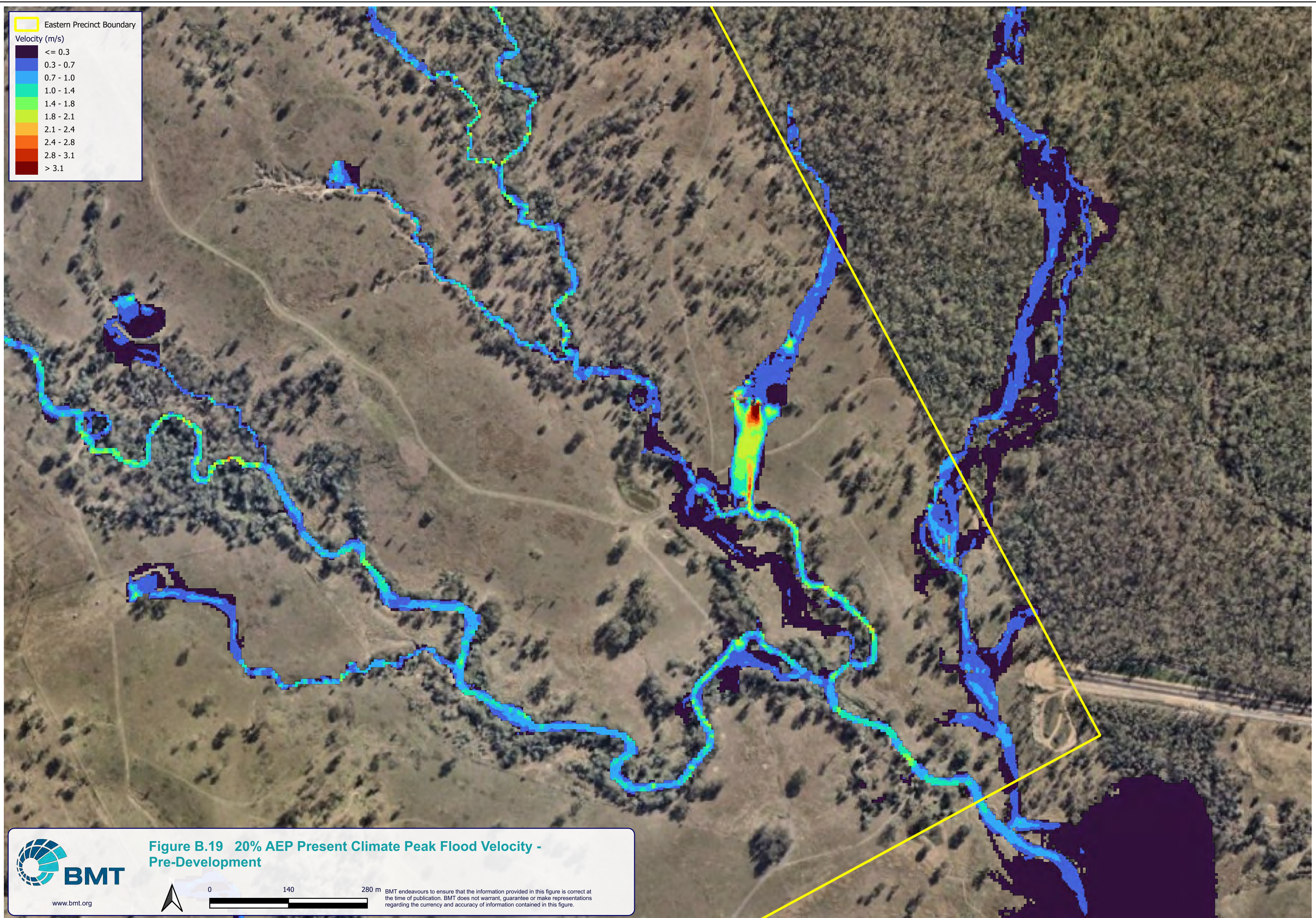
Figure B.16 1% AEP Year 2100 Climate (SSP3) Peak Flood Depth - Pre-Development

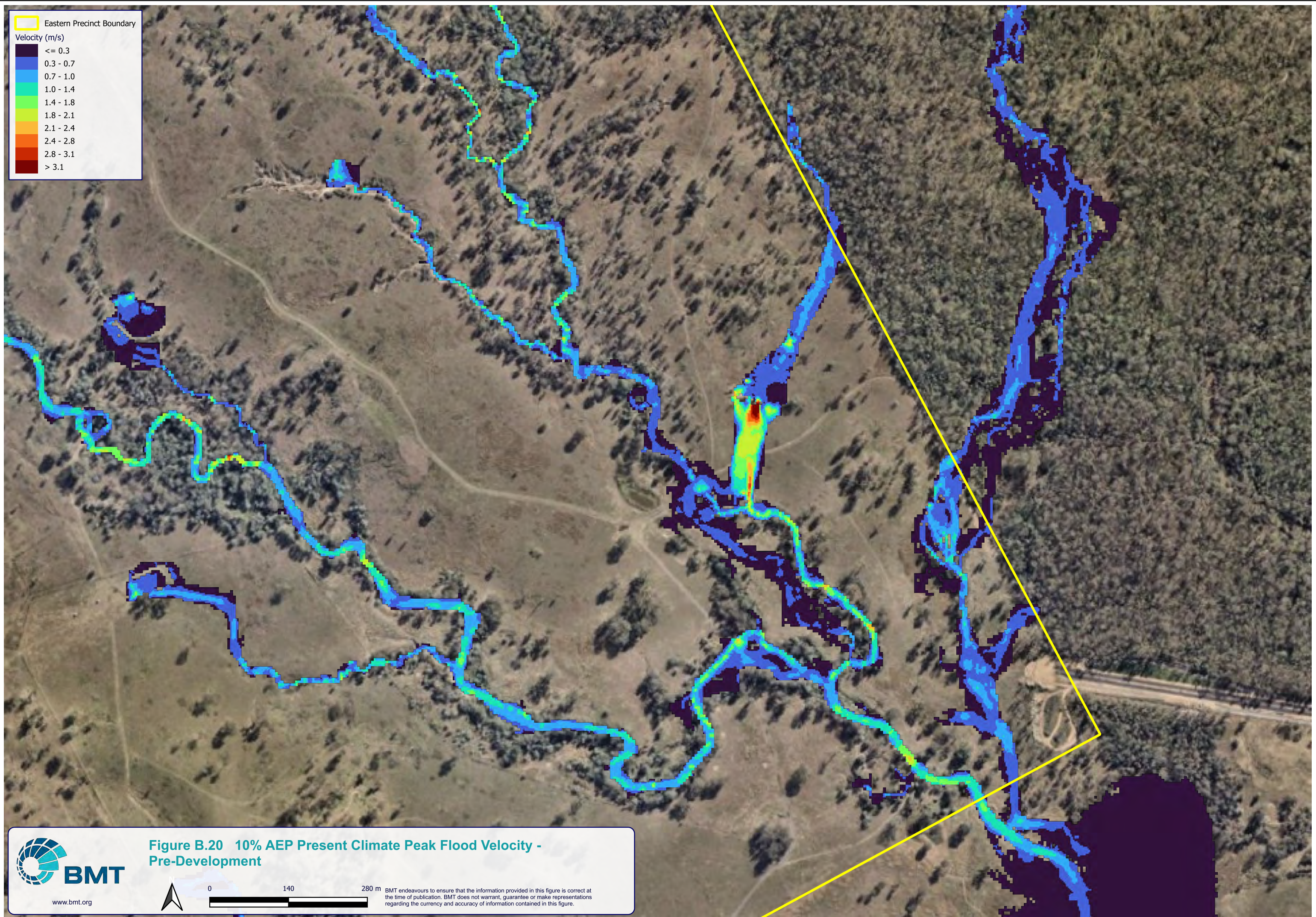
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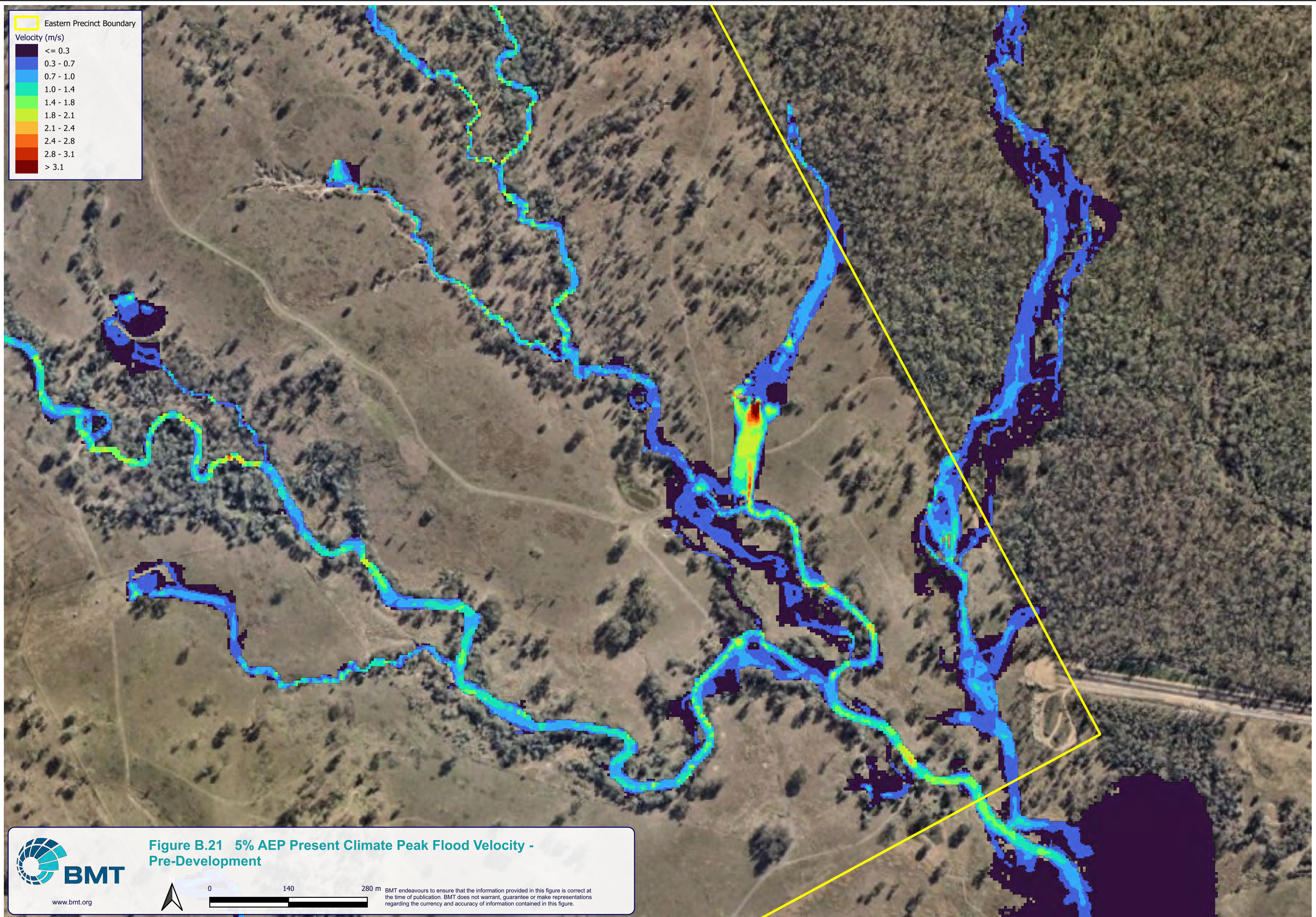
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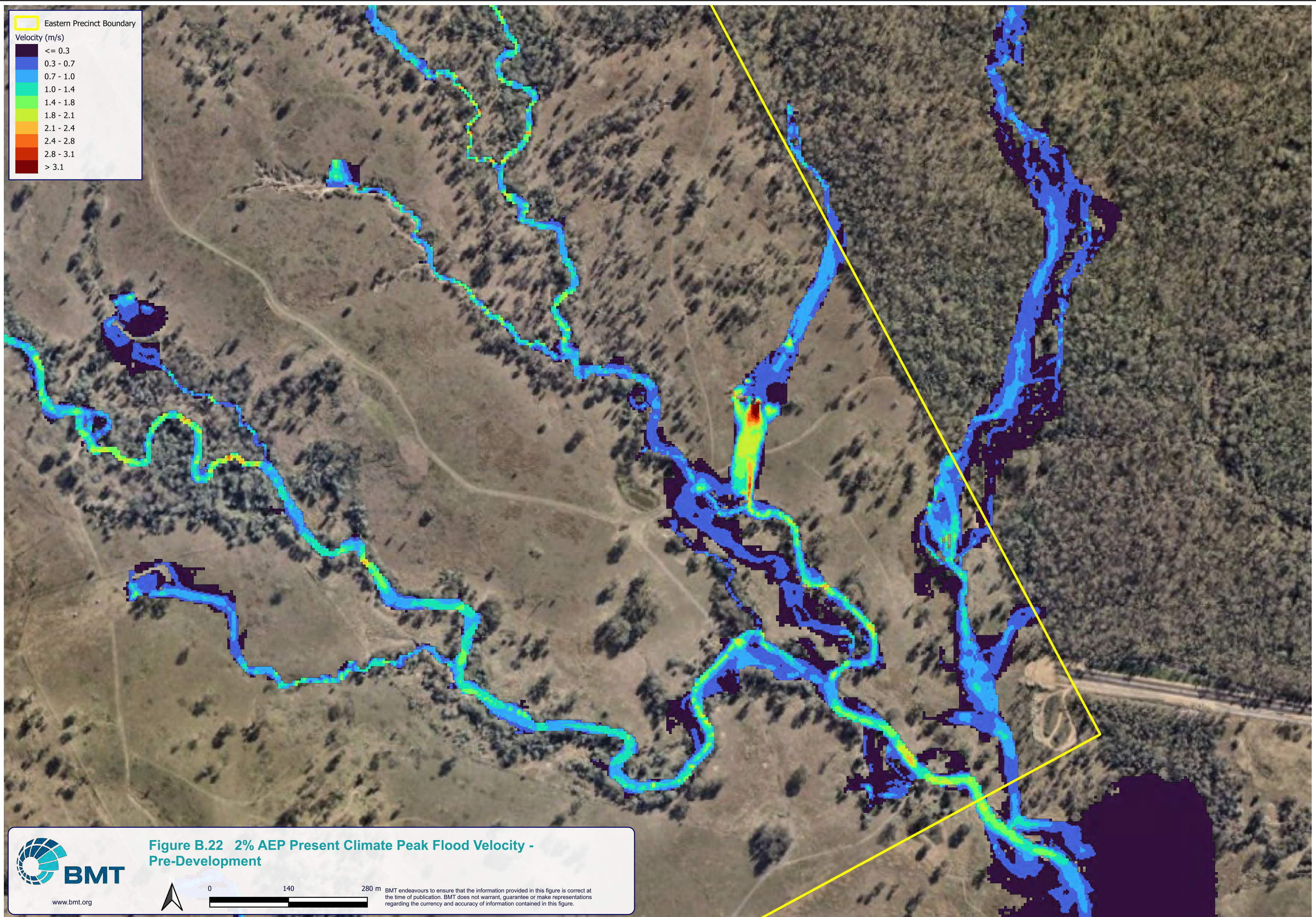


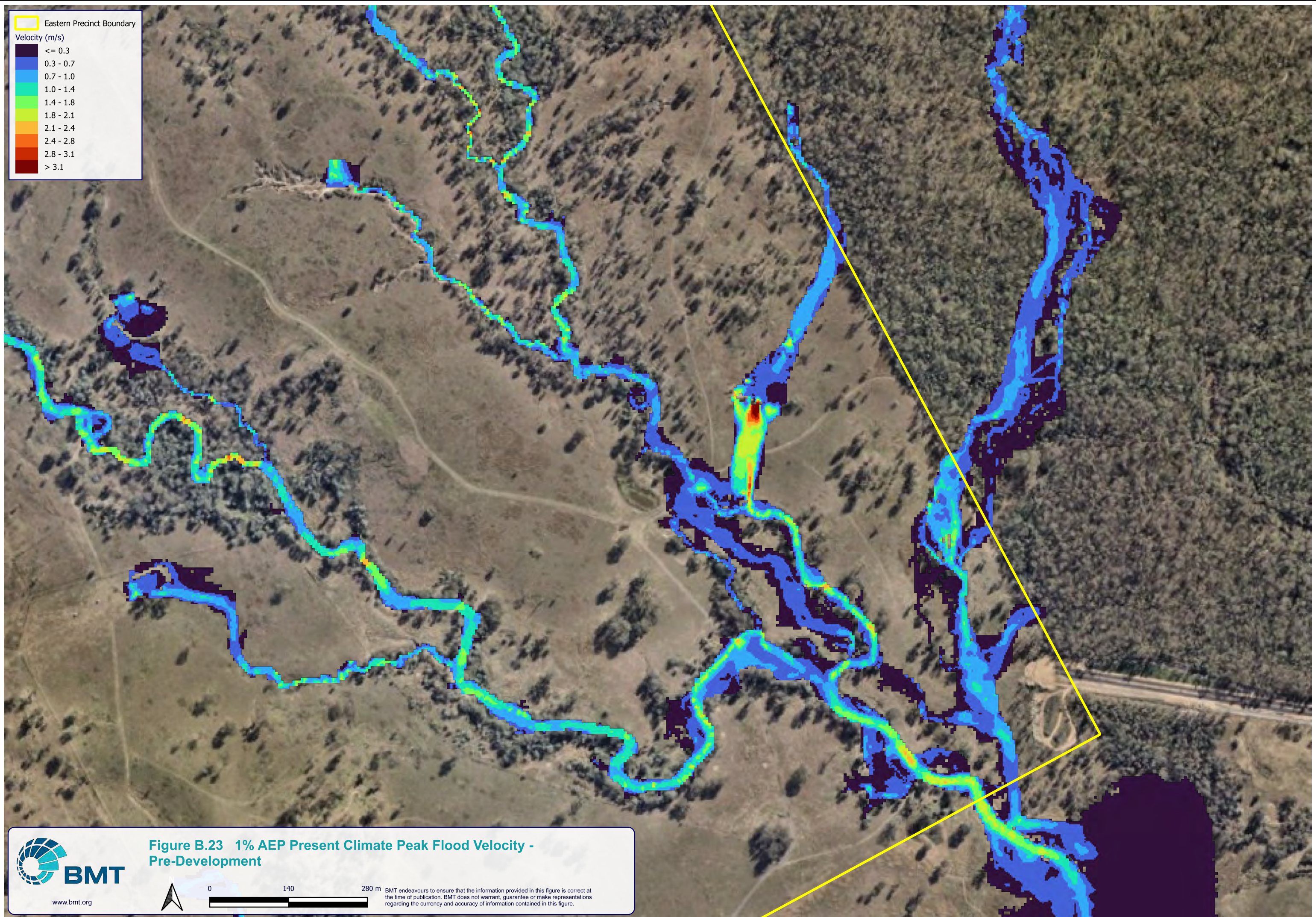








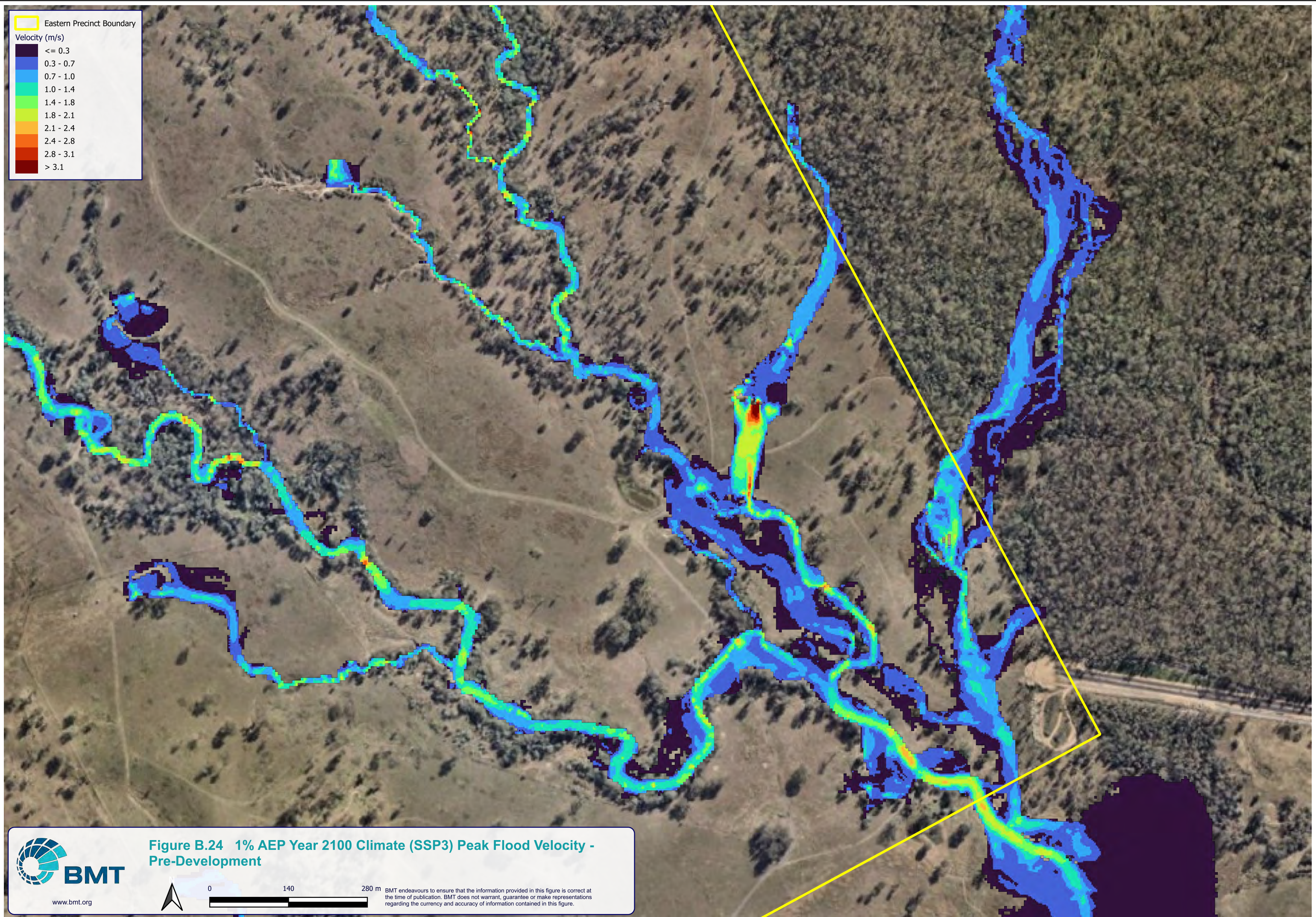


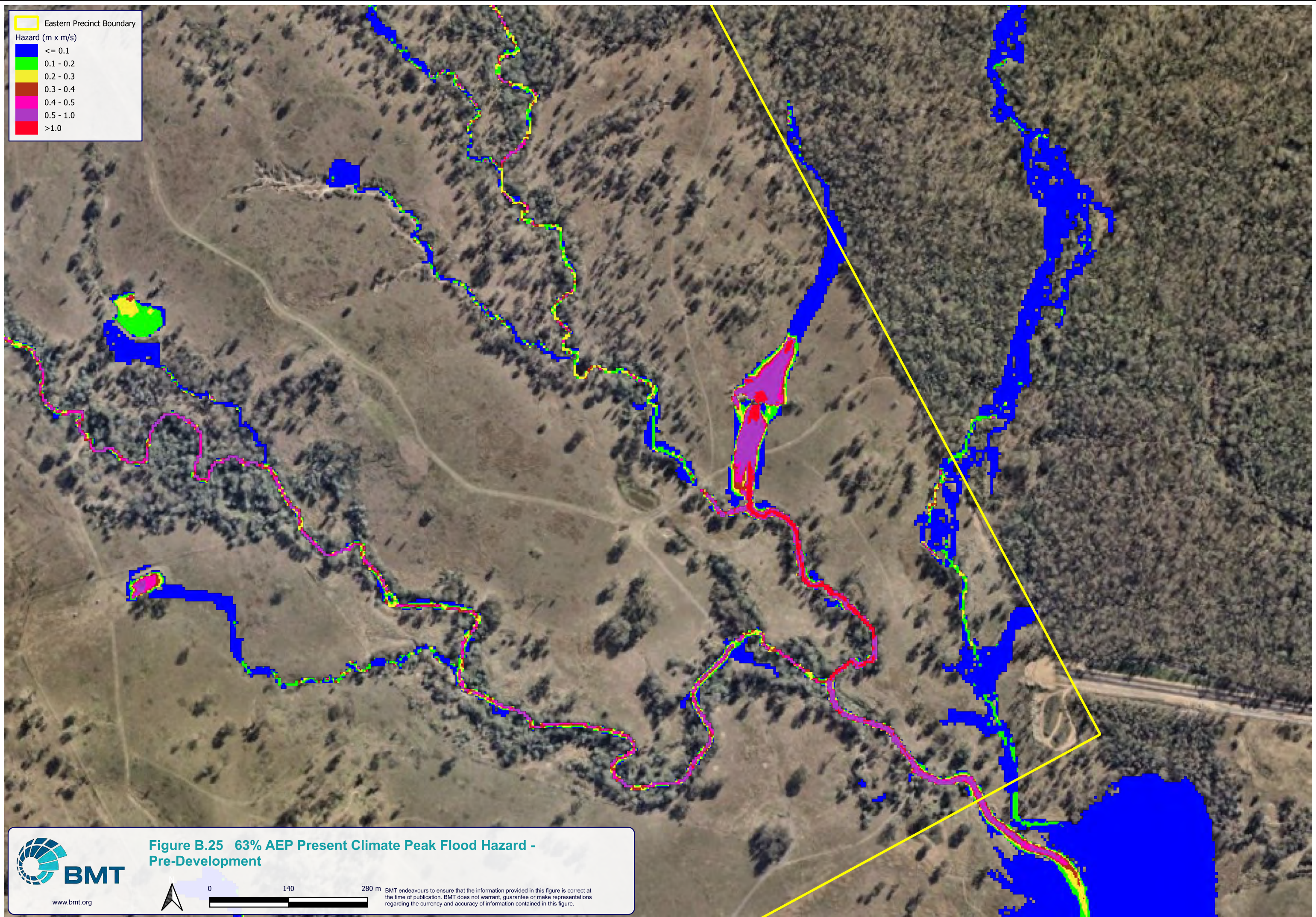


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 Eastern Precinct Boundary

Hazard (m x m/s)

	<= 0.1
	0.1 - 0.2
	0.2 - 0.3
	0.3 - 0.4
	0.4 - 0.5
	0.5 - 1.0
	>1.0



Figure B.25 63% AEP Present Climate Peak Flood Hazard - Pre-Development



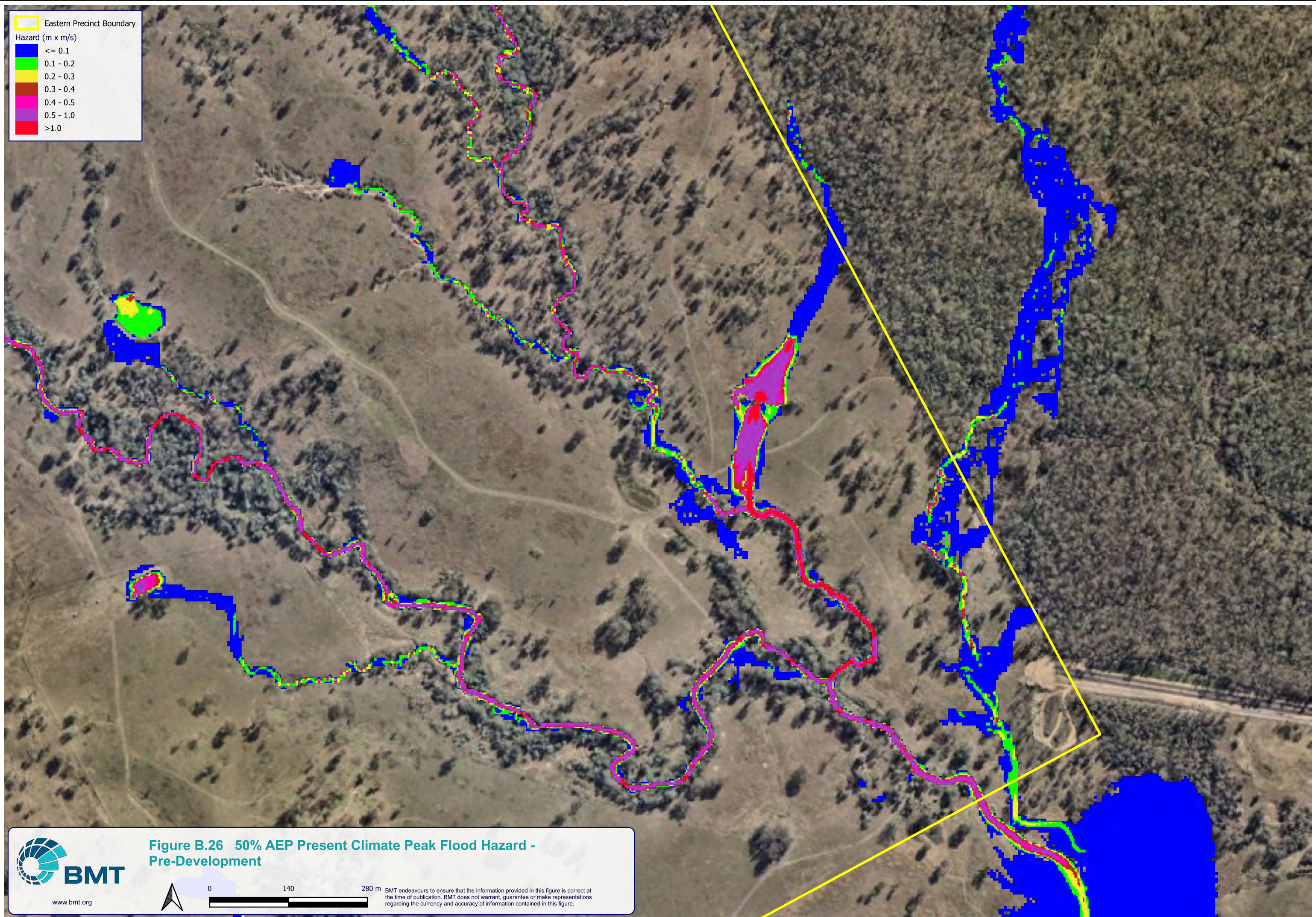
0

140

280 m

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Eastern Precinct Boundary

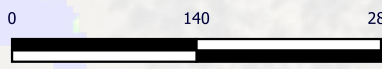
Hazard (m x m/s)

Blue	<= 0.1
Green	0.1 - 0.2
Yellow	0.2 - 0.3
Brown	0.3 - 0.4
Pink	0.4 - 0.5
Purple	0.5 - 1.0
Red	>1.0

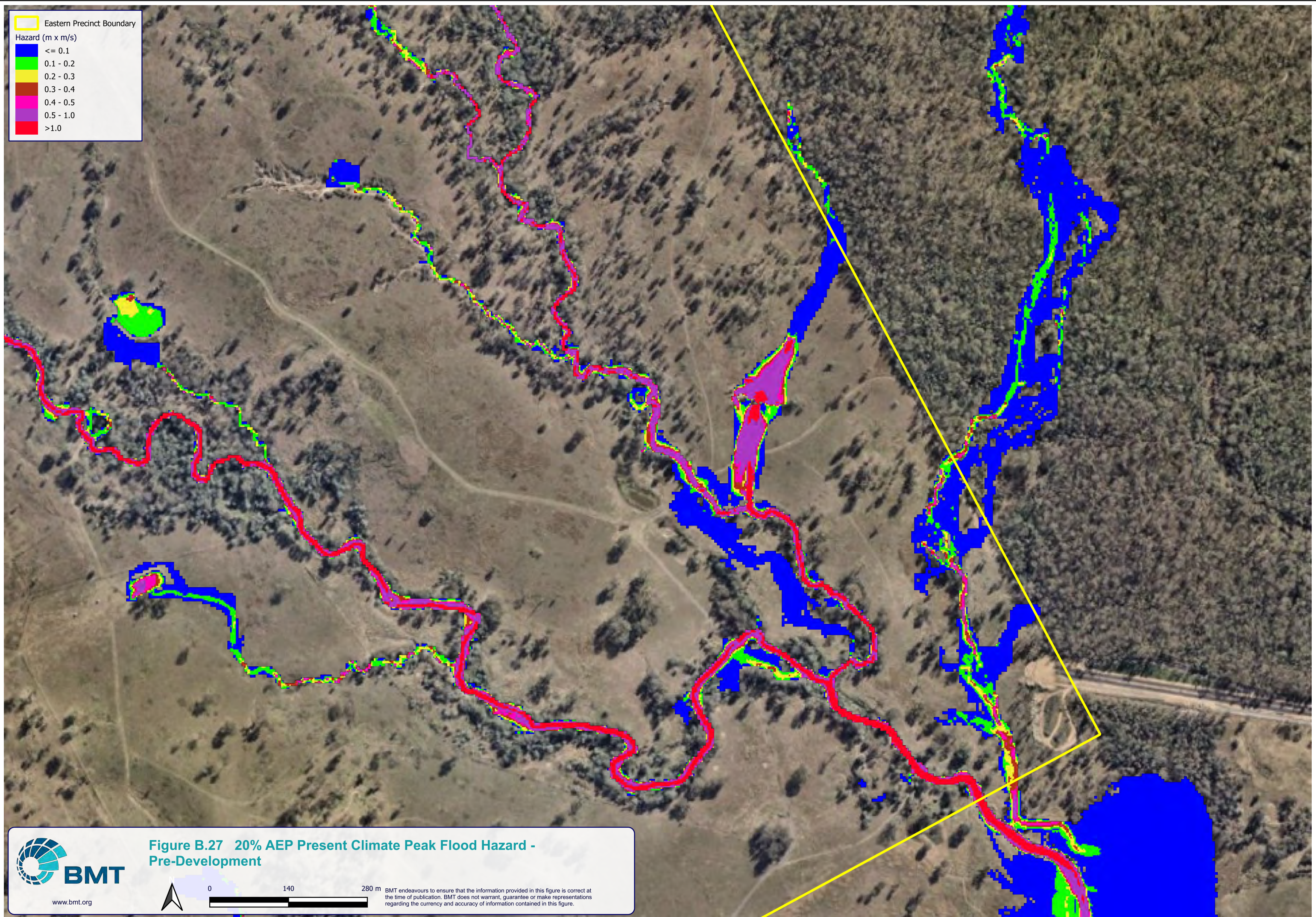
 **BMT**

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Figure B.26 50% AEP Present Climate Peak Flood Hazard - Pre-Development



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Eastern Precinct Boundary

Hazard (m x m/s)

	<= 0.1
	0.1 - 0.2
	0.2 - 0.3
	0.3 - 0.4
	0.4 - 0.5
	0.5 - 1.0
	>1.0



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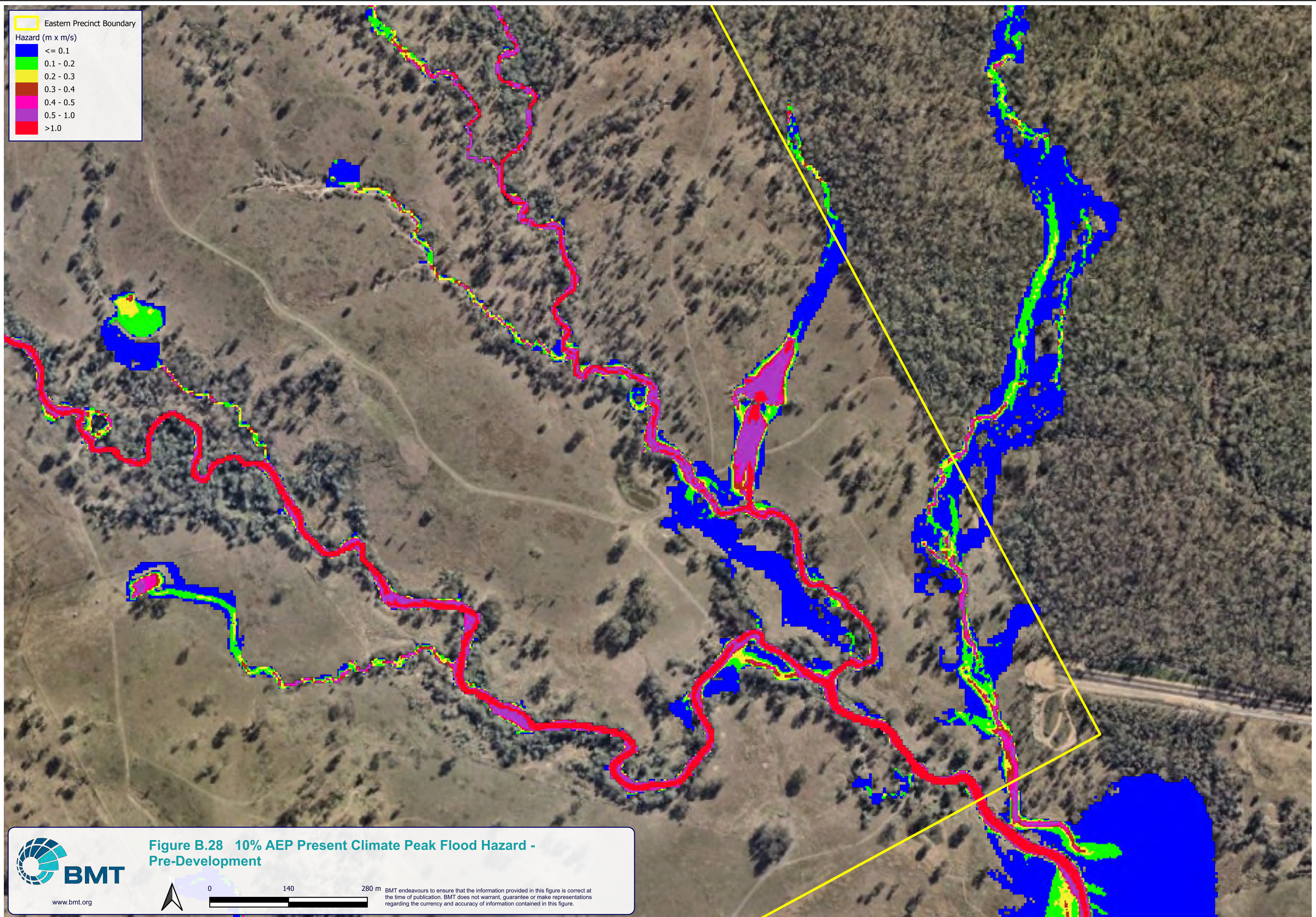
Figure B.27 20% AEP Present Climate Peak Flood Hazard - Pre-Development



0140280 m

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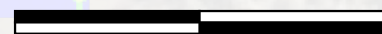


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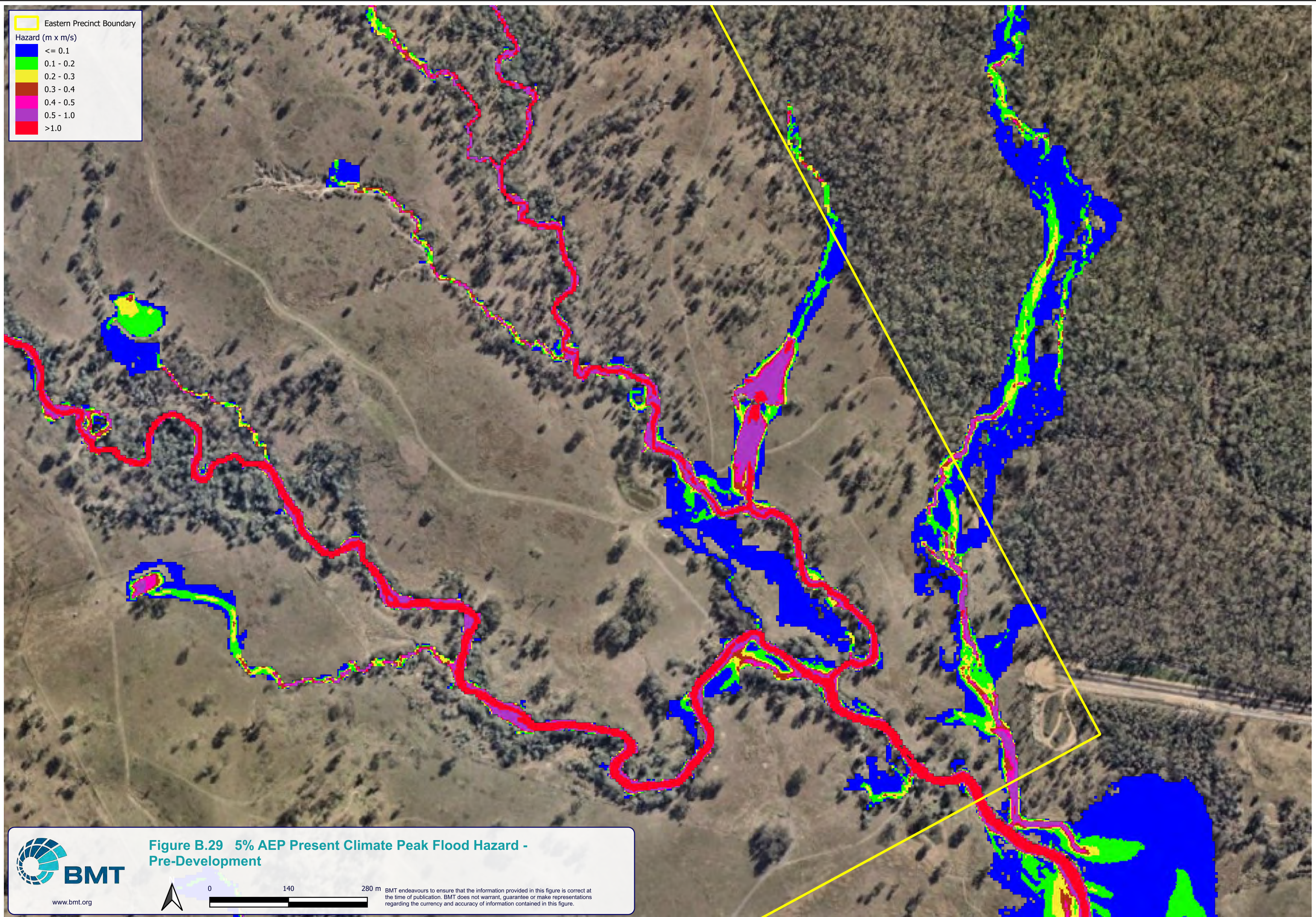
Figure B.28 10% AEP Present Climate Peak Flood Hazard - Pre-Development



0 140 280 m



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Eastern Precinct Boundary

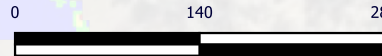
Hazard (m x m/s)

Blue	<= 0.1
Green	0.1 - 0.2
Yellow	0.2 - 0.3
Brown	0.3 - 0.4
Pink	0.4 - 0.5
Purple	0.5 - 1.0
Red	>1.0



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Figure B.29 5% AEP Present Climate Peak Flood Hazard - Pre-Development



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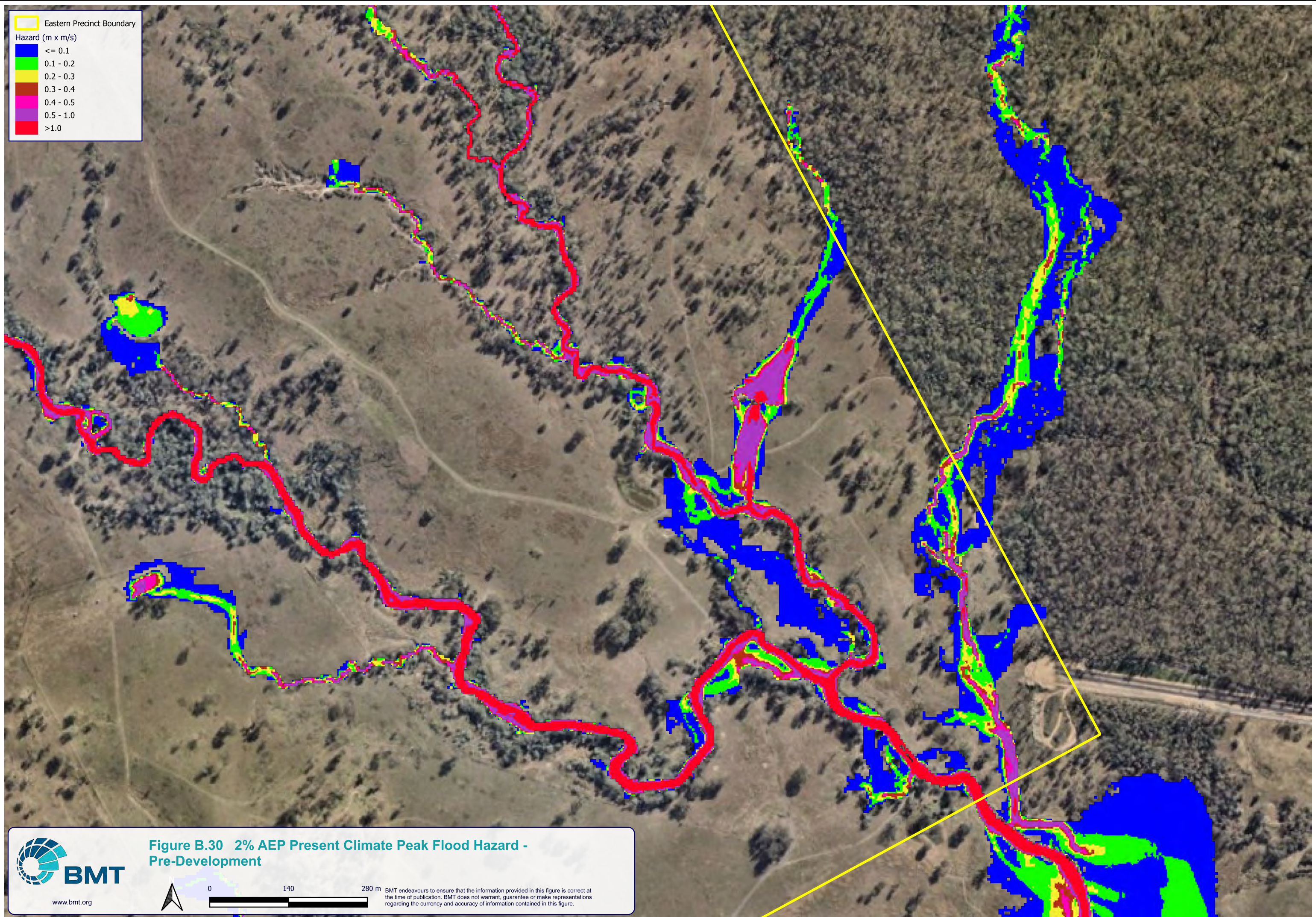
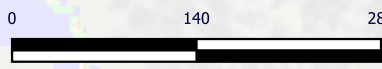


Figure B.30 2% AEP Present Climate Peak Flood Hazard - Pre-Development



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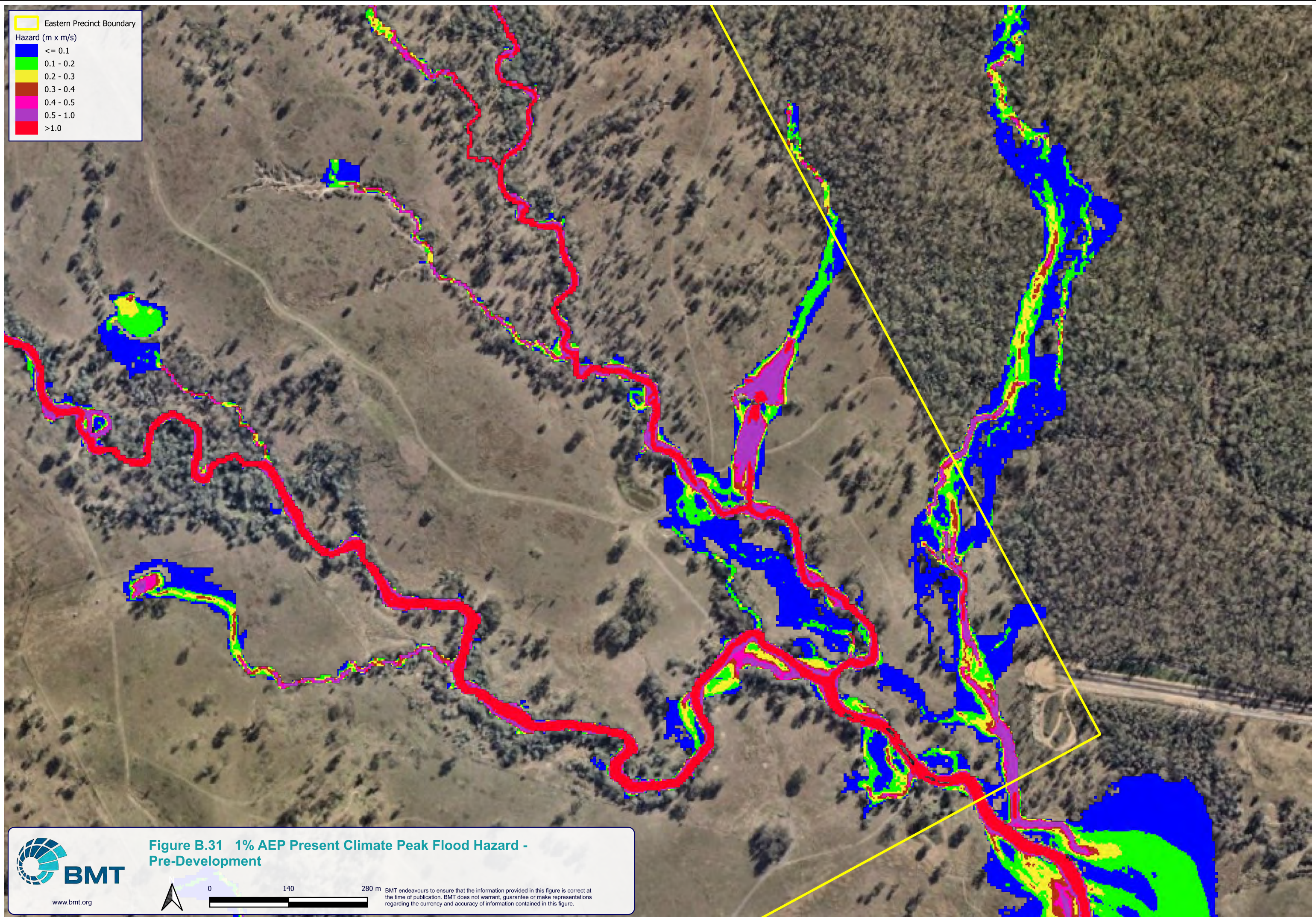
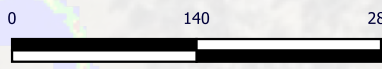
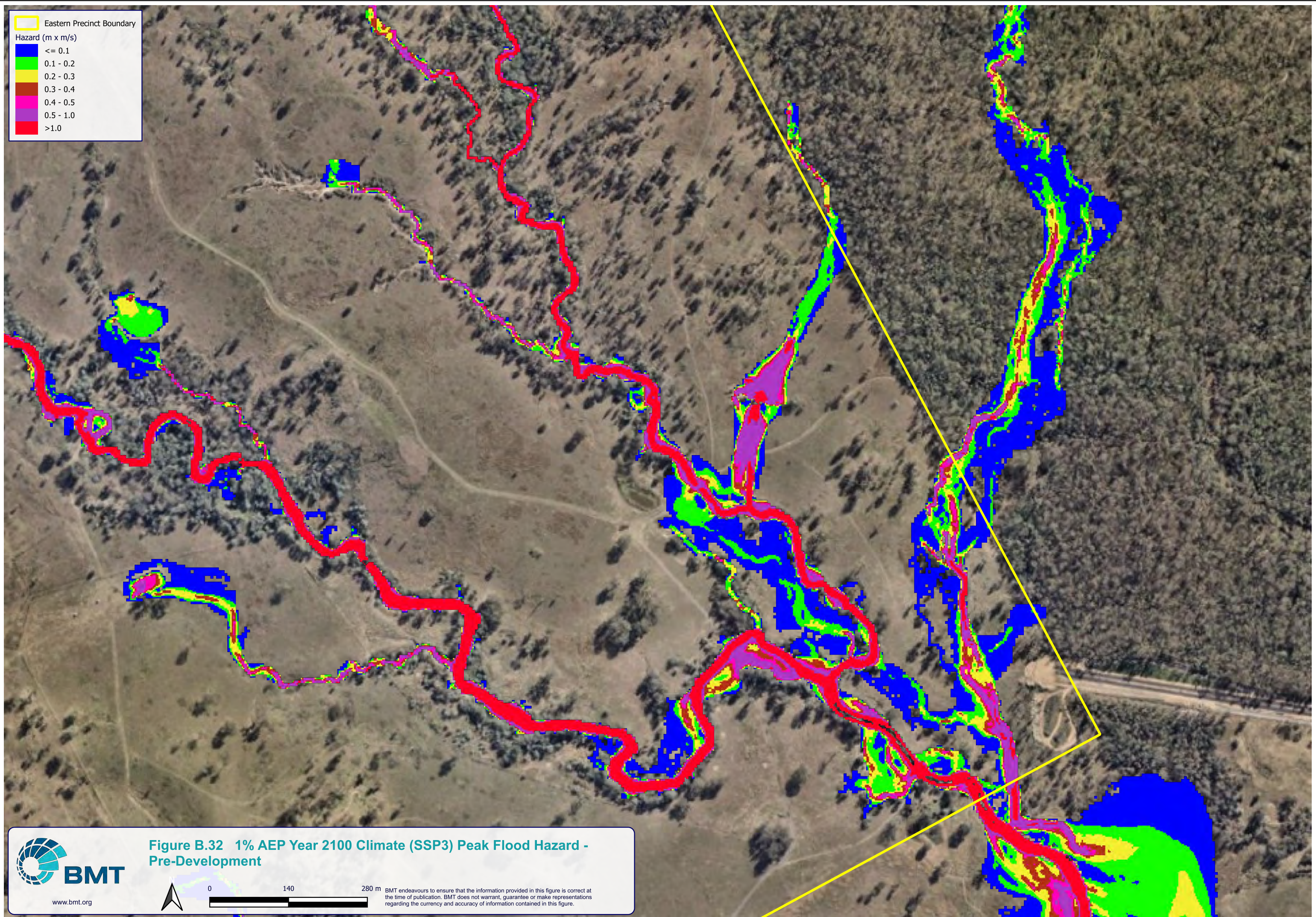


Figure B.31 1% AEP Present Climate Peak Flood Hazard - Pre-Development



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 Eastern Precinct Boundary

Hazard (m x m/s)

	<= 0.1
	0.1 - 0.2
	0.2 - 0.3
	0.3 - 0.4
	0.4 - 0.5
	0.5 - 1.0
	>1.0



Figure B.32 1% AEP Year 2100 Climate (SSP3) Peak Flood Hazard - Pre-Development



0

140

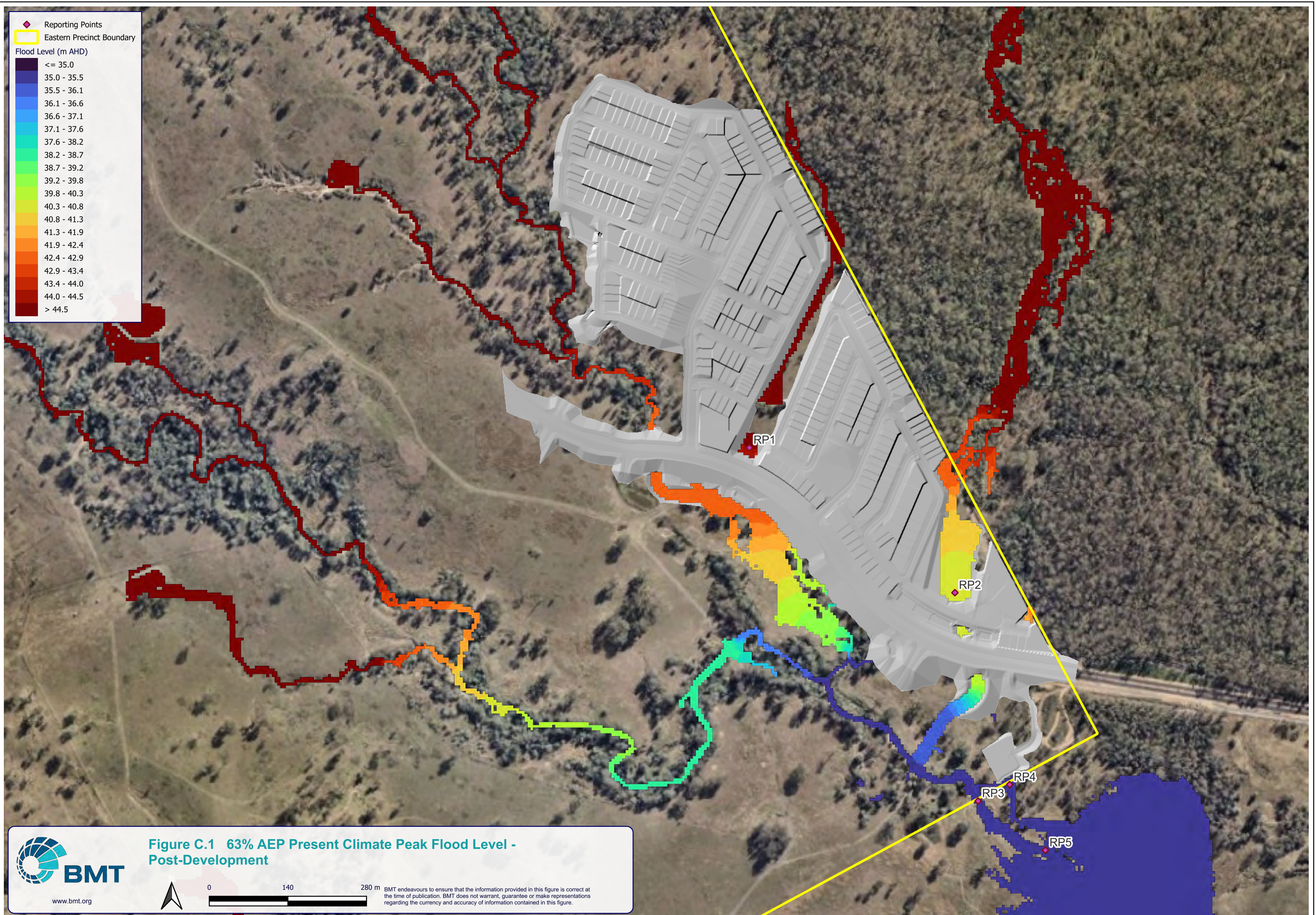
280 m



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K:\003466.knh.Flinders\3_GIS\Flood_Mapping\003466_Flinders_Results_EX_052\003466_Flinders_Results_EX_052.qgz

Annex C Developed Case Hydraulic Model Results



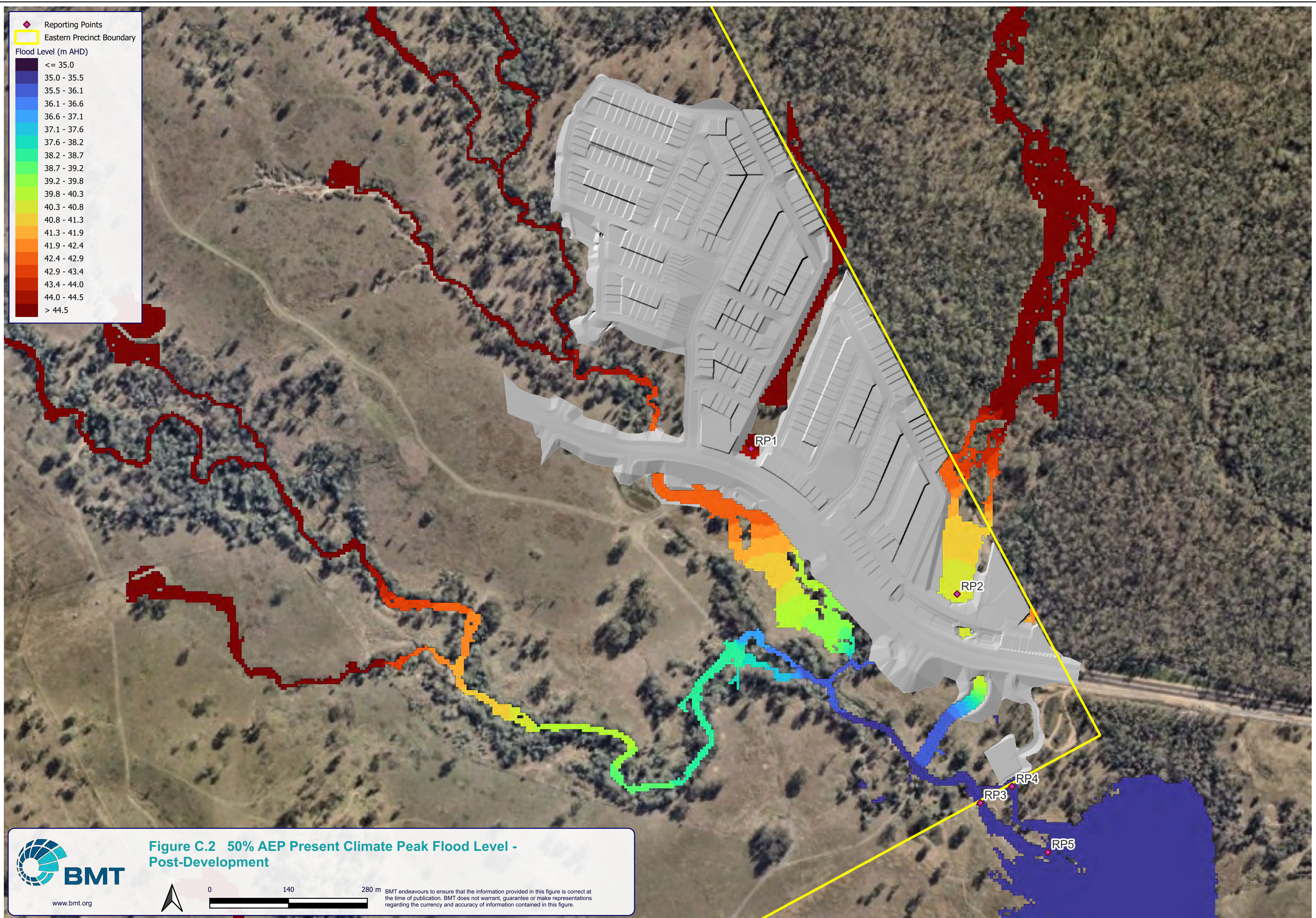
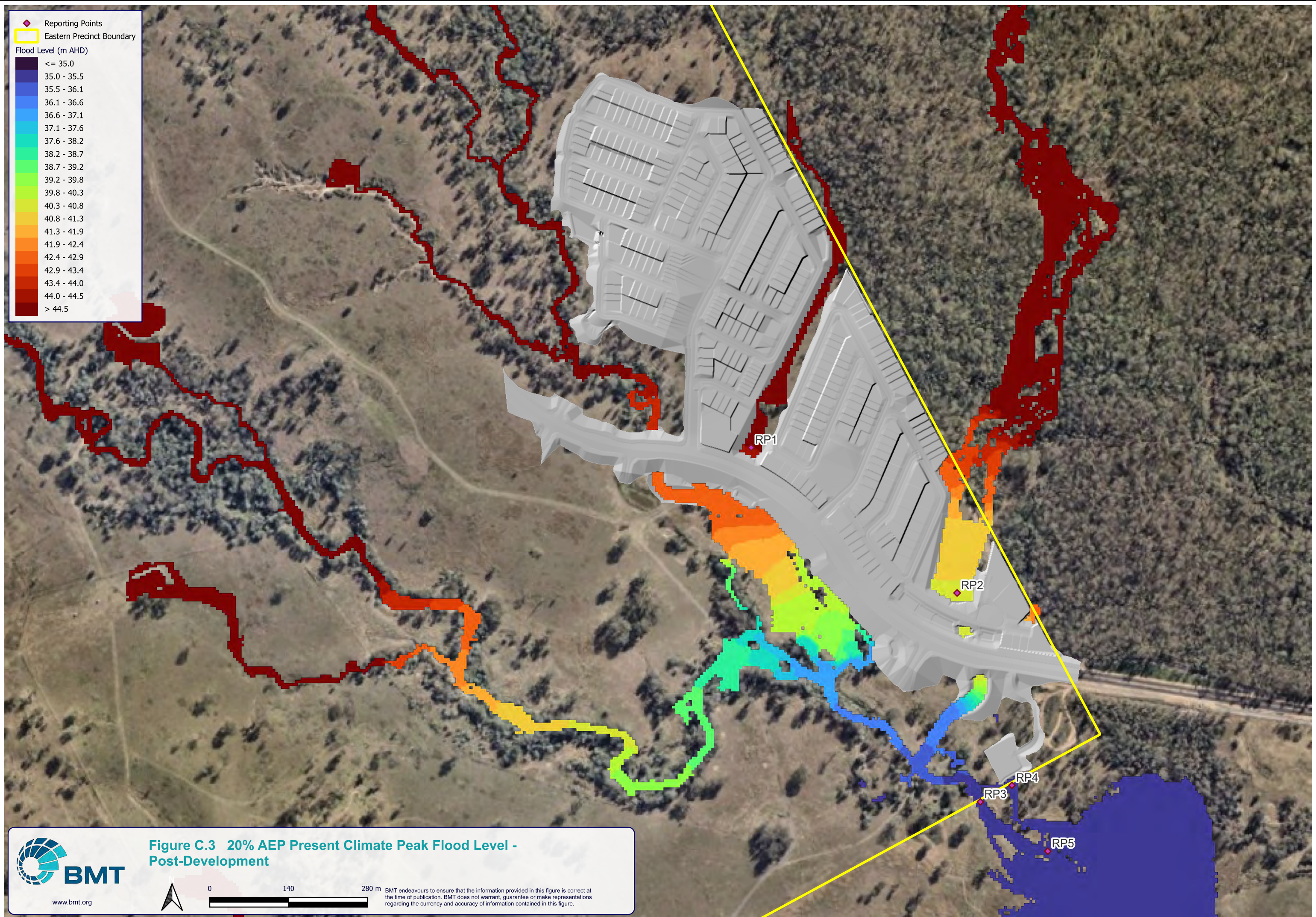
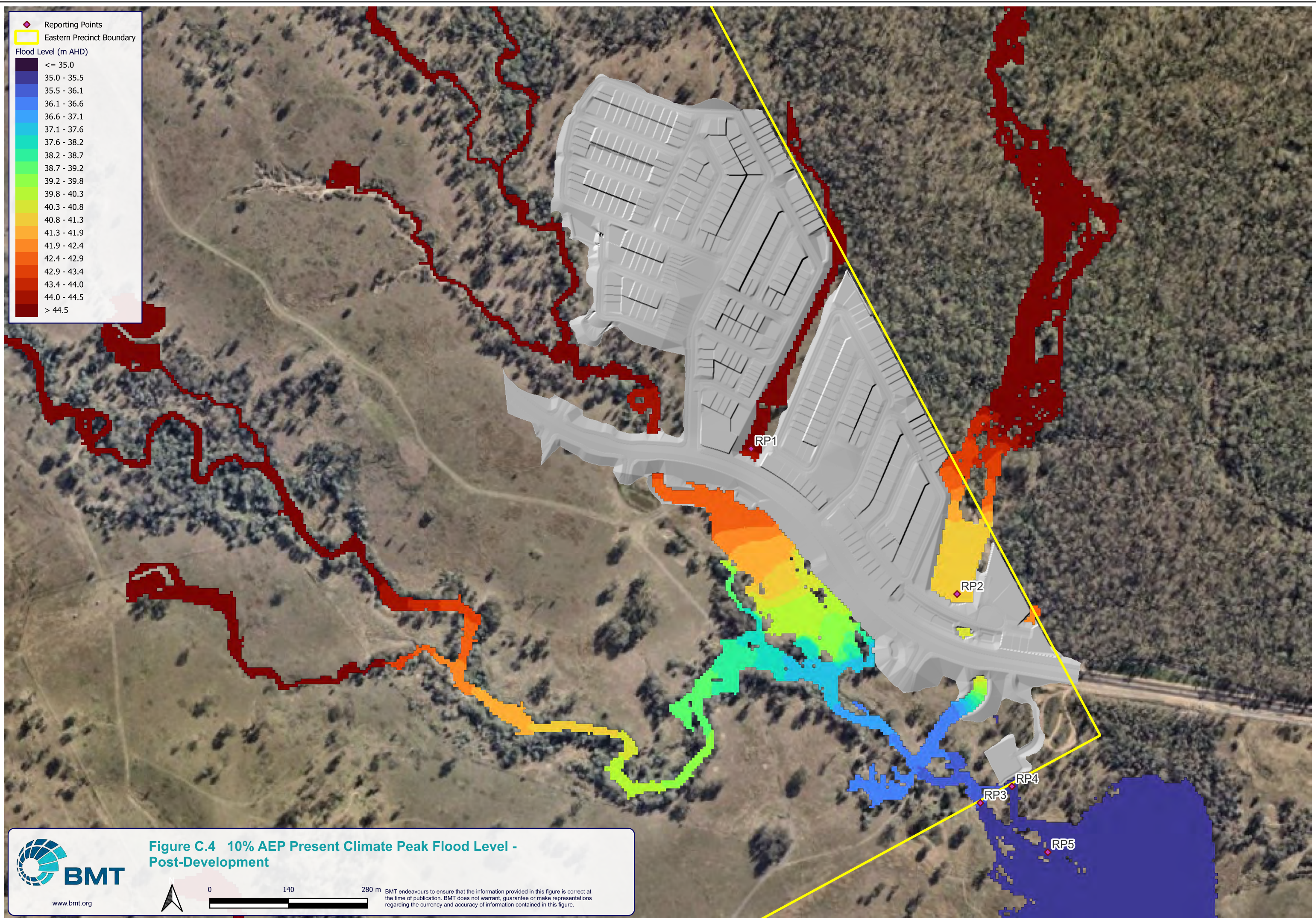


Figure C.2 50% AEP Present Climate Peak Flood Level - Post-Development





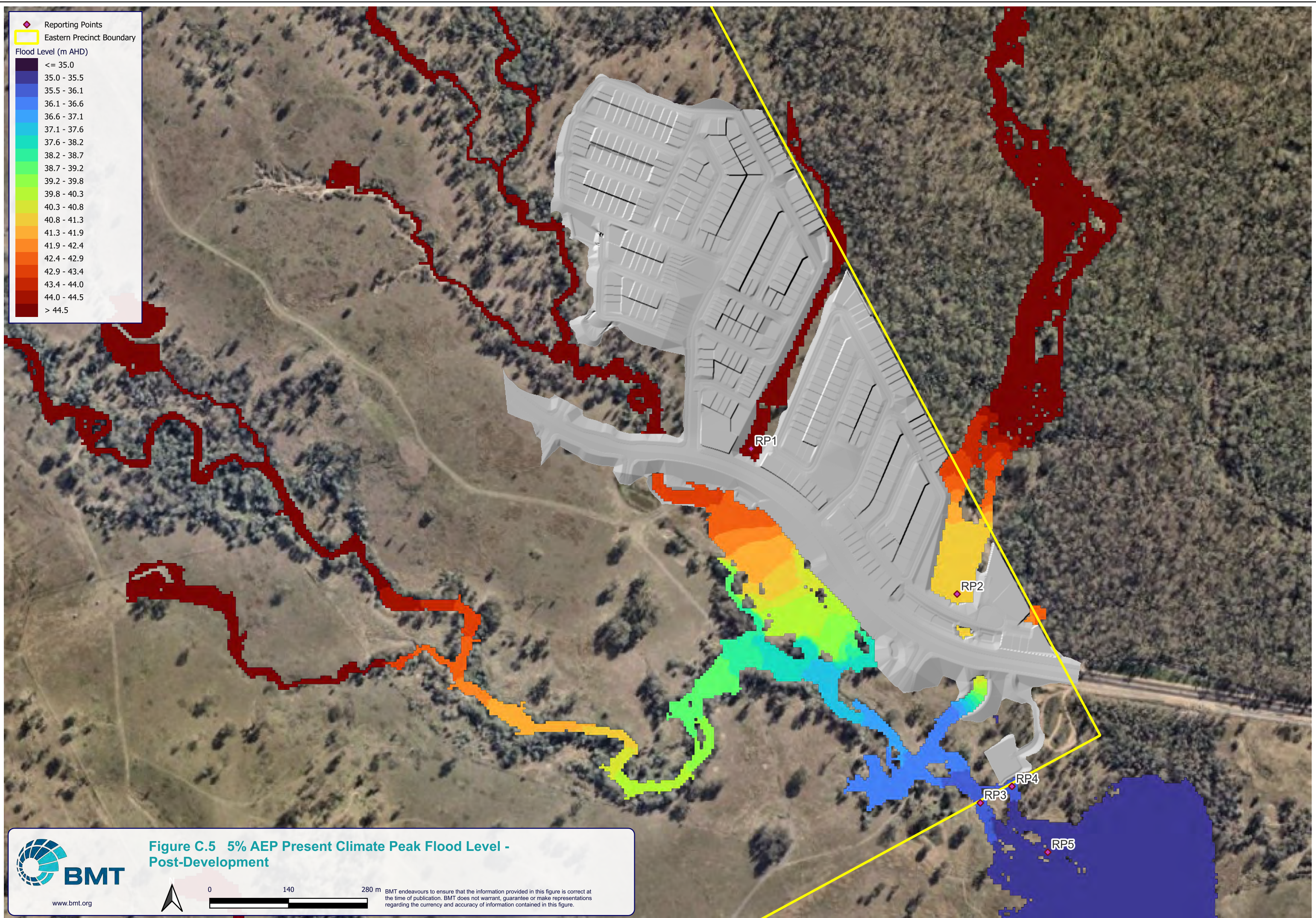
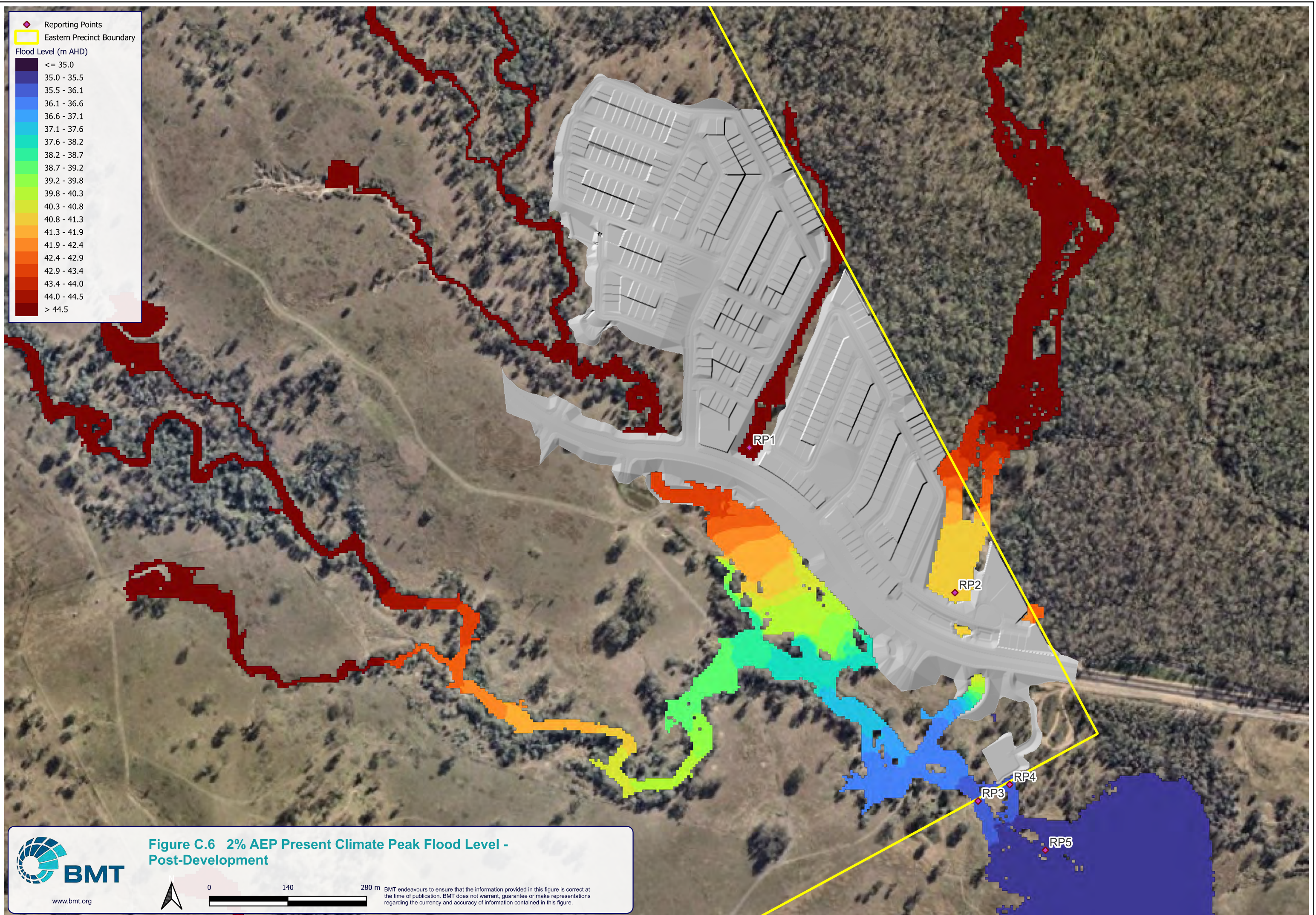
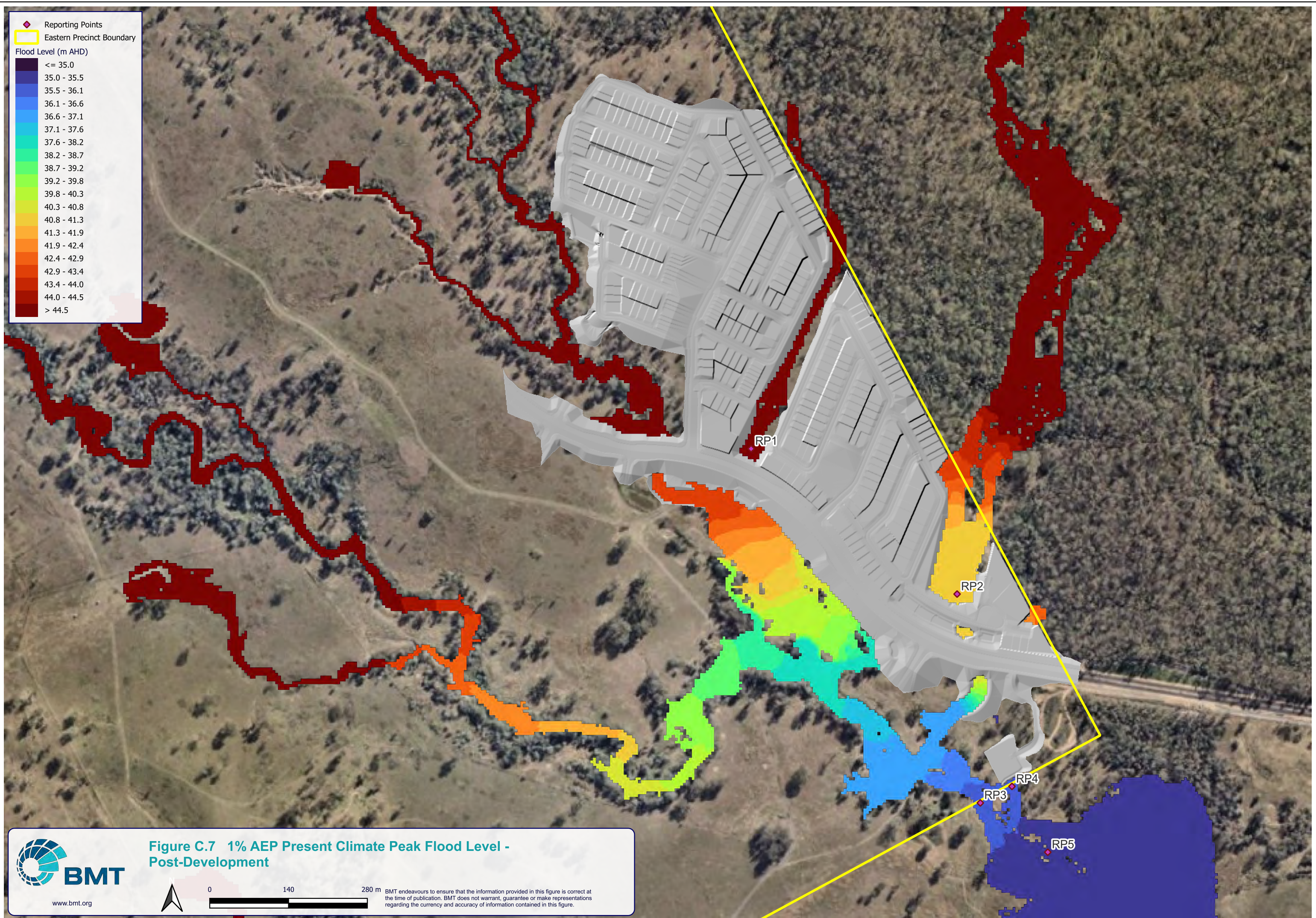
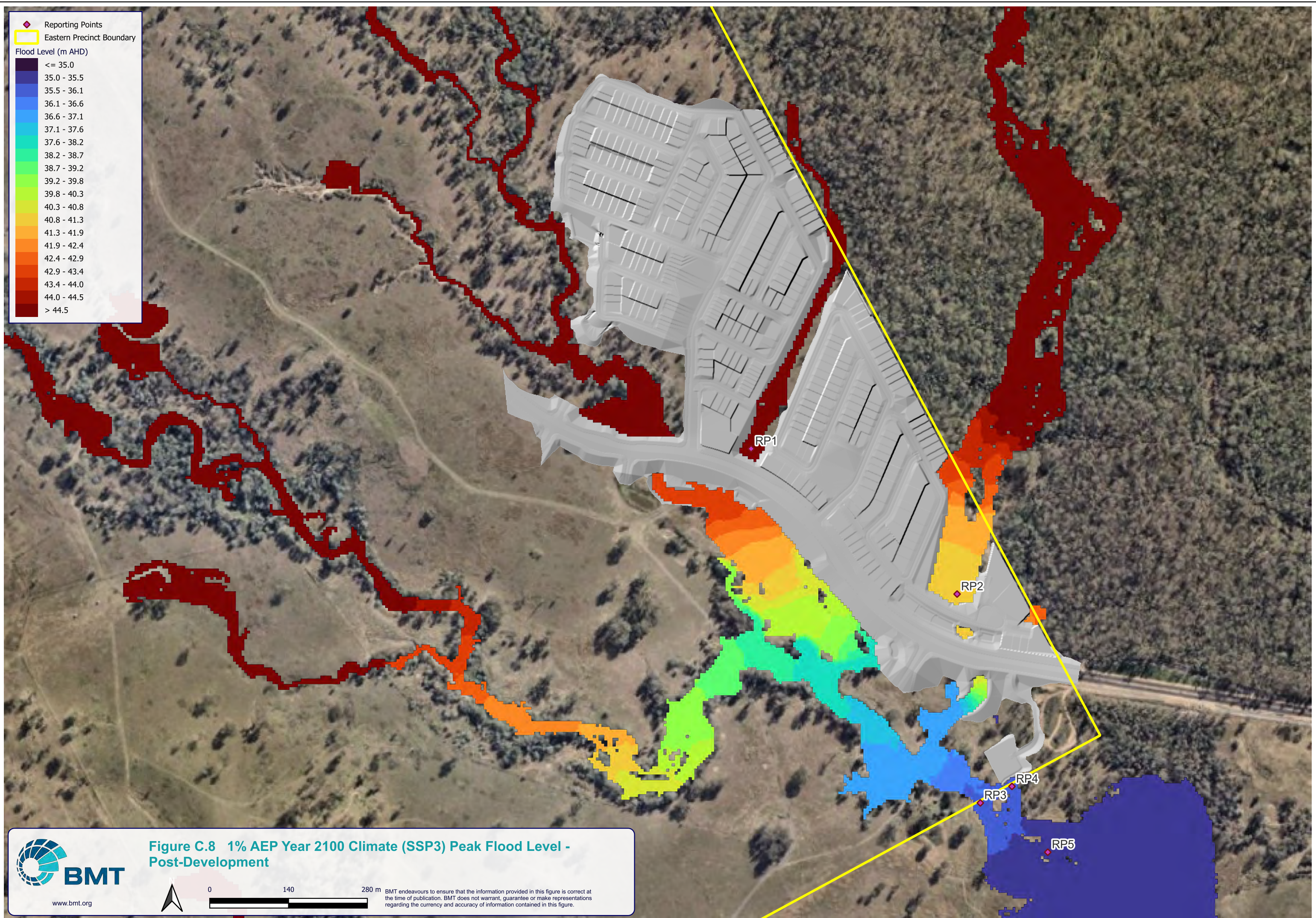
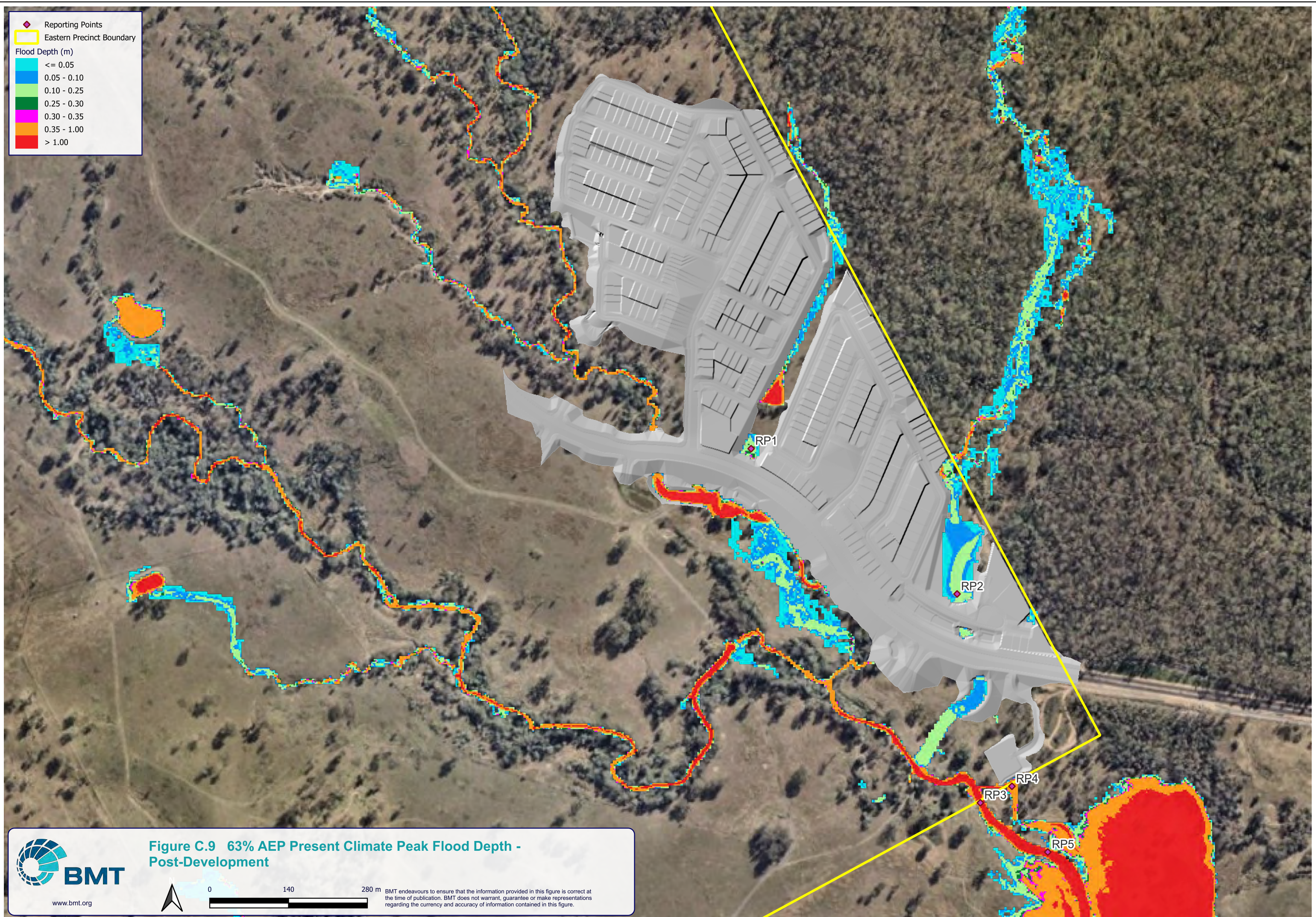


Figure C.5 5% AEP Present Climate Peak Flood Level - Post-Development









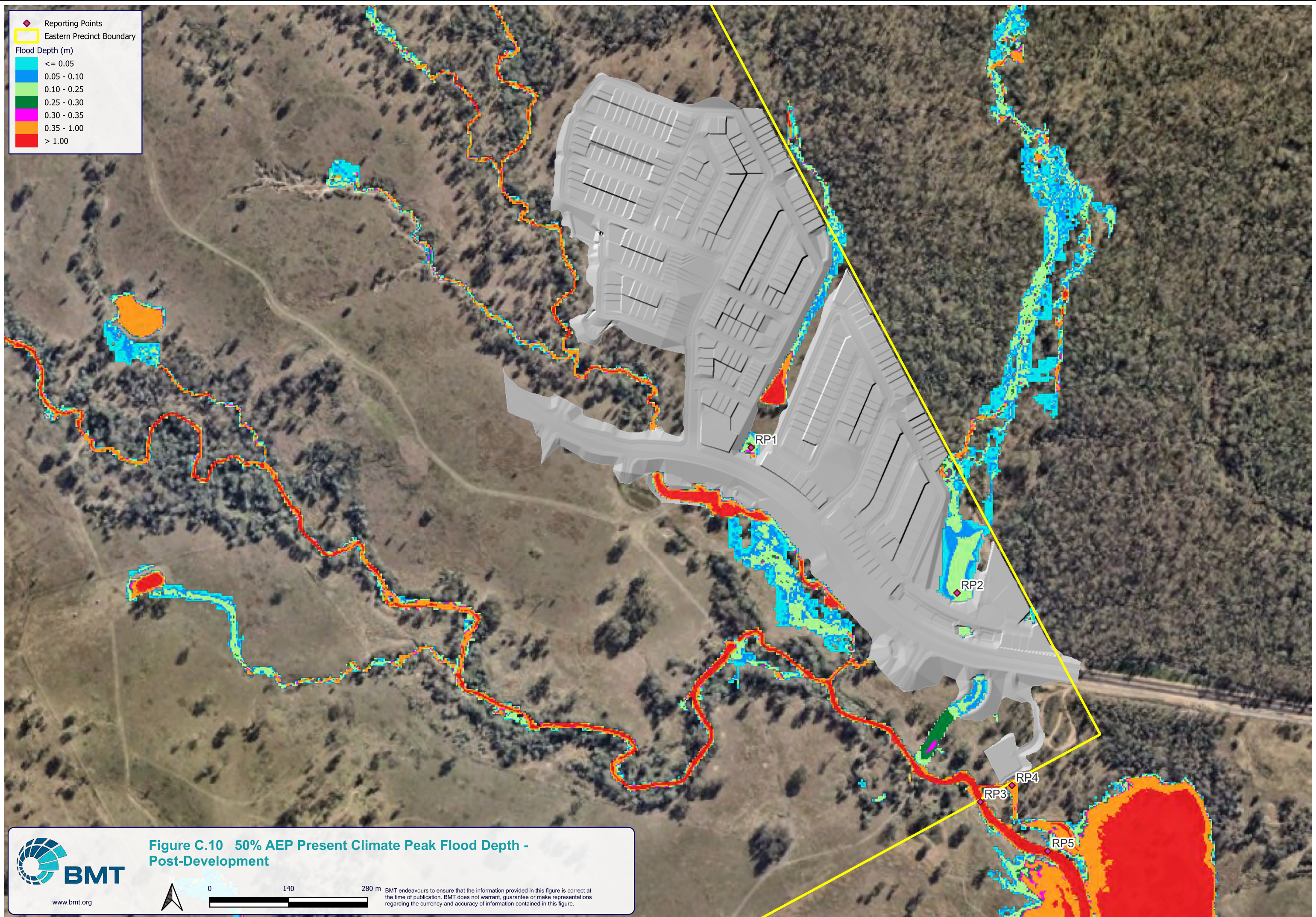
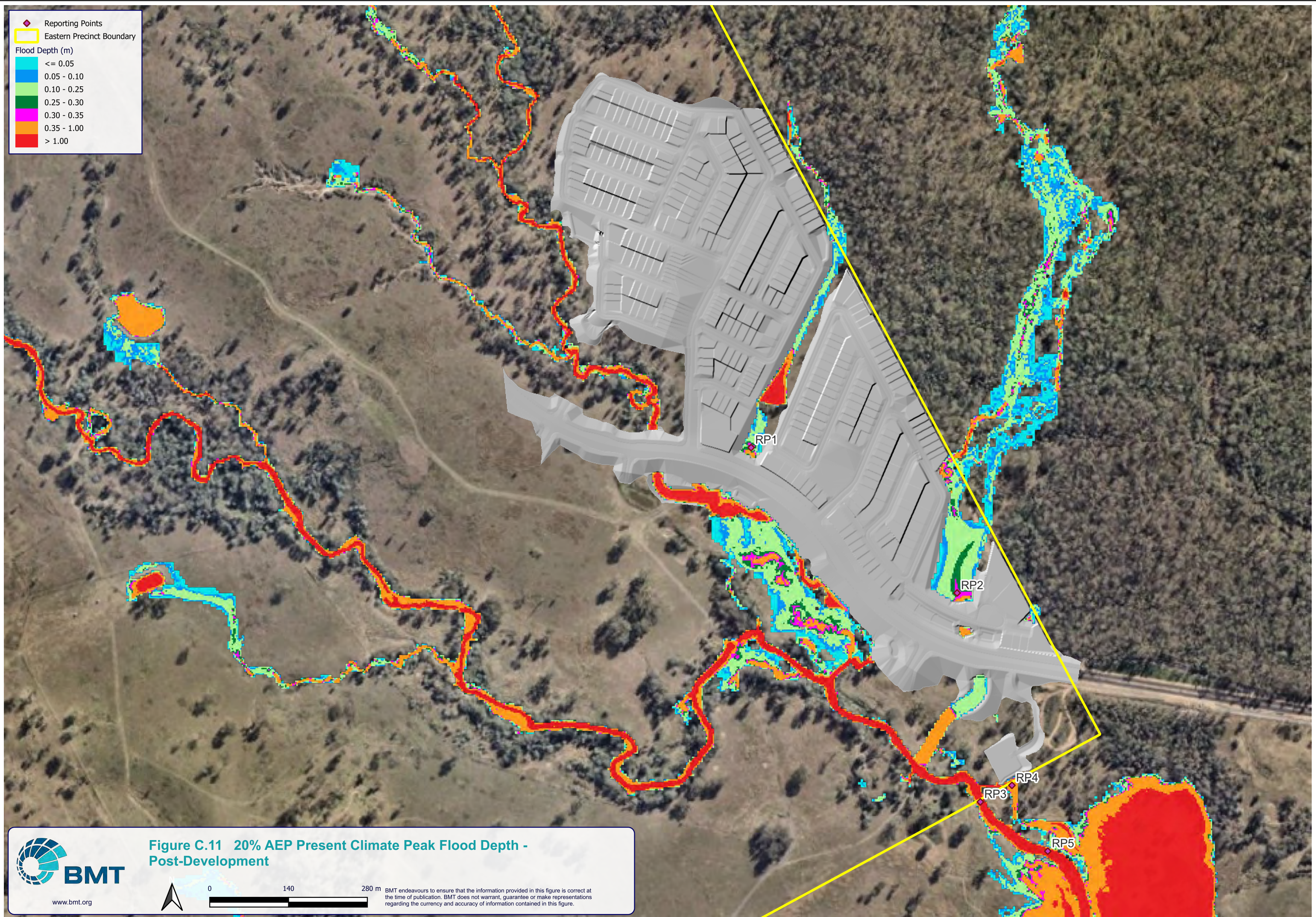


Figure C.10 50% AEP Present Climate Peak Flood Depth - Post-Development

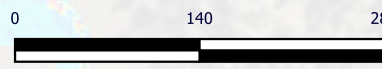


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Figure C.11 20% AEP Present Climate Peak Flood Depth - Post-Development



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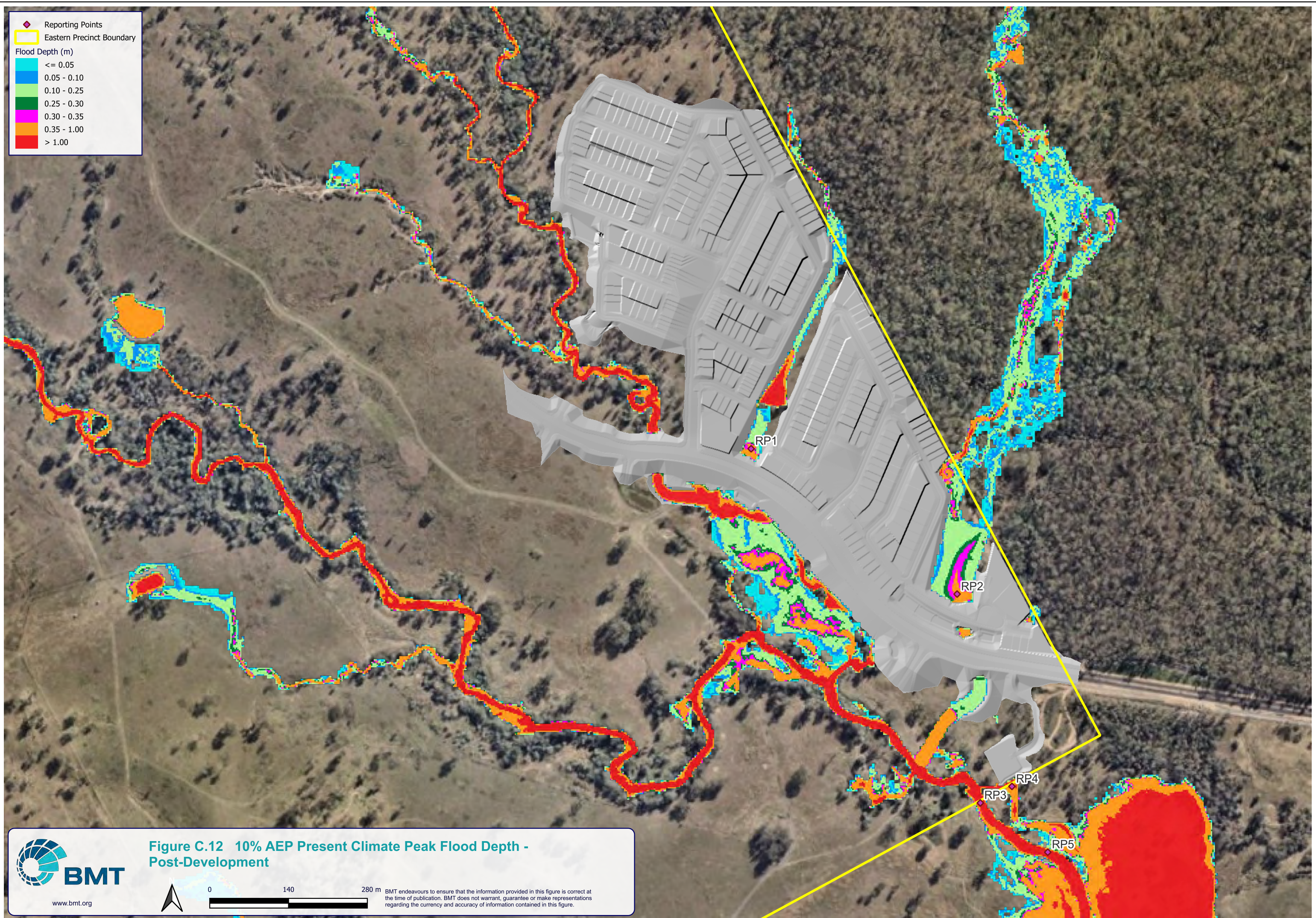
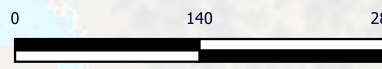
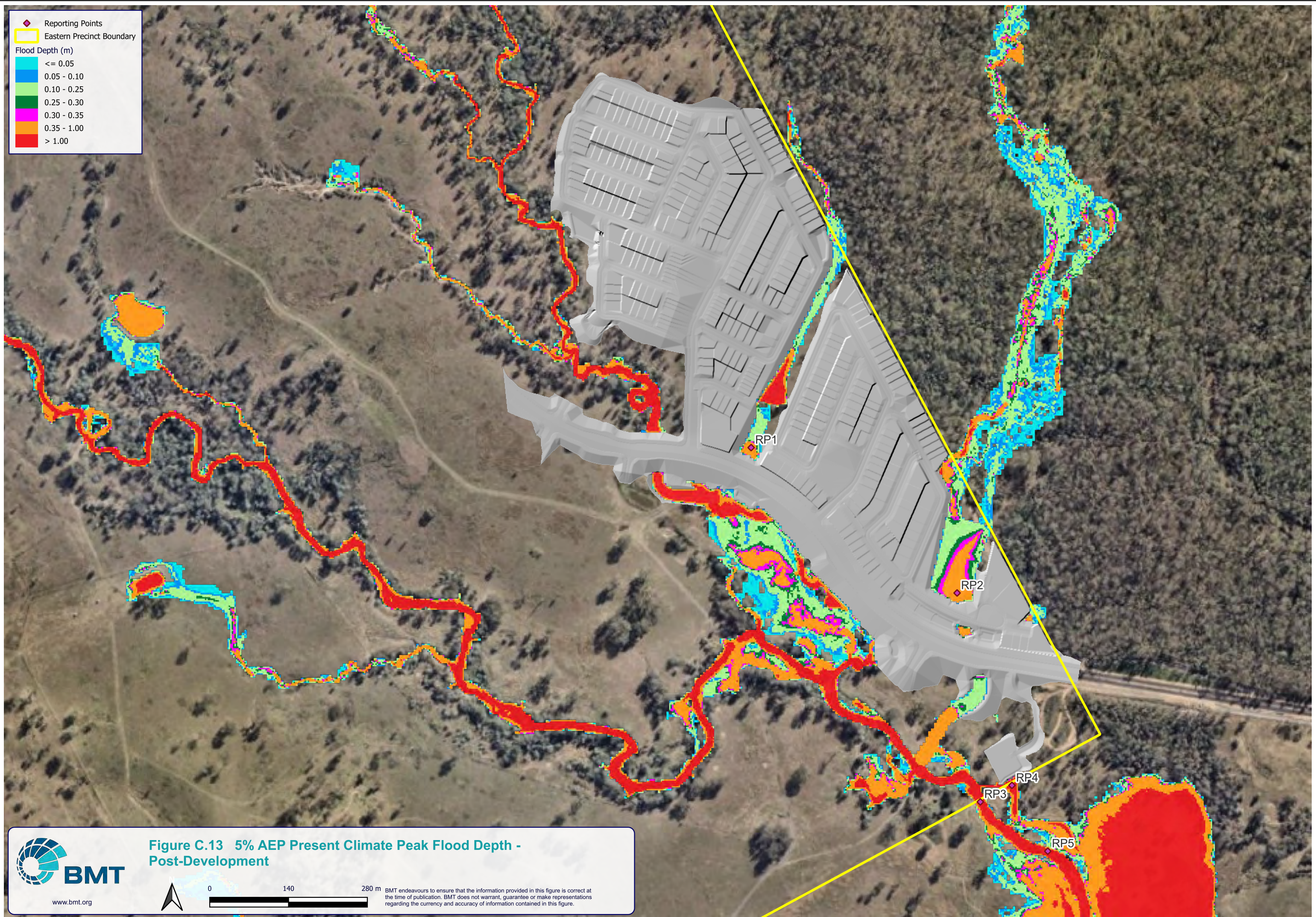


Figure C.12 10% AEP Present Climate Peak Flood Depth - Post-Development



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Figure C.13 5% AEP Present Climate Peak Flood Depth - Post-Development



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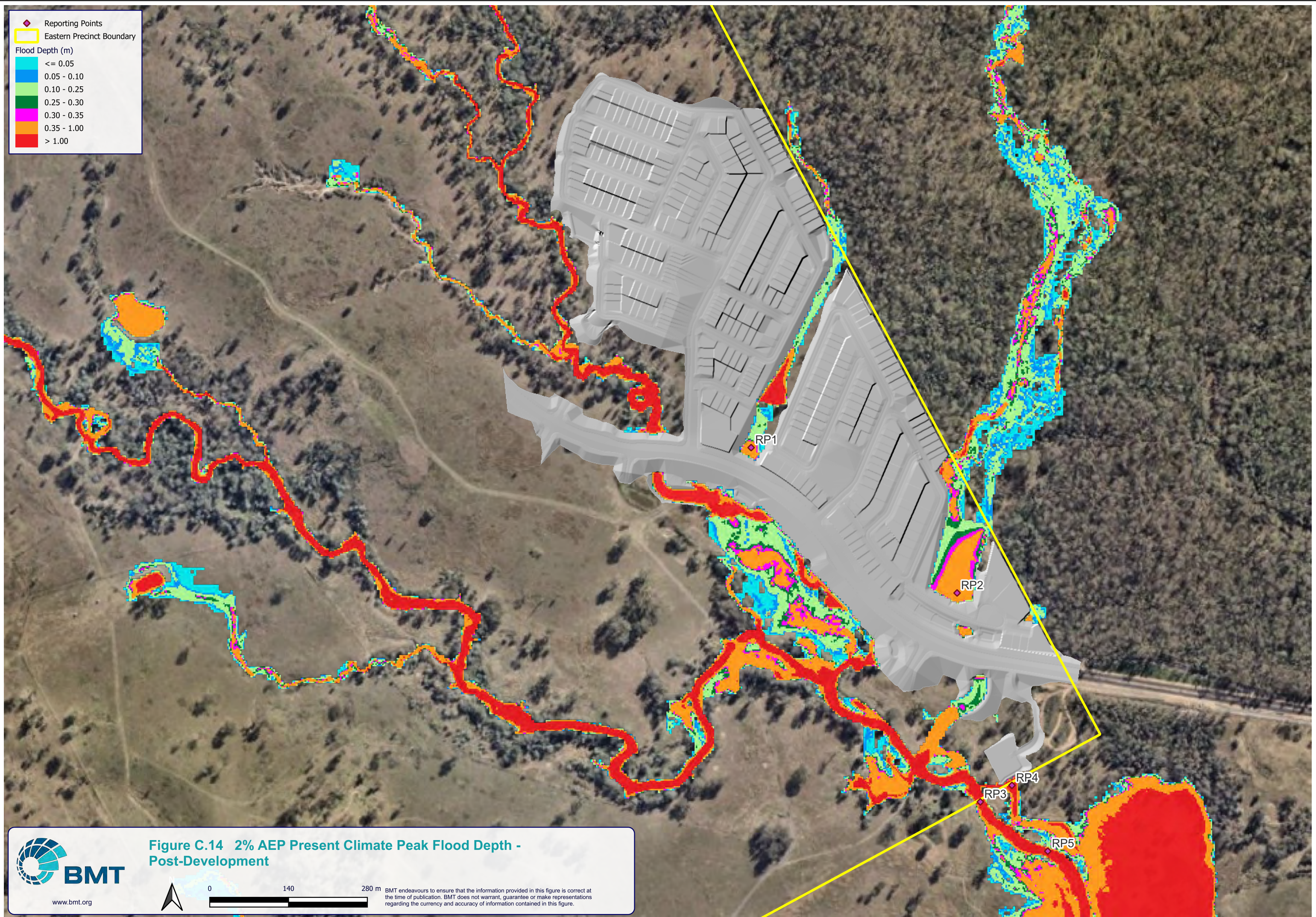
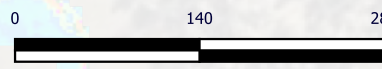
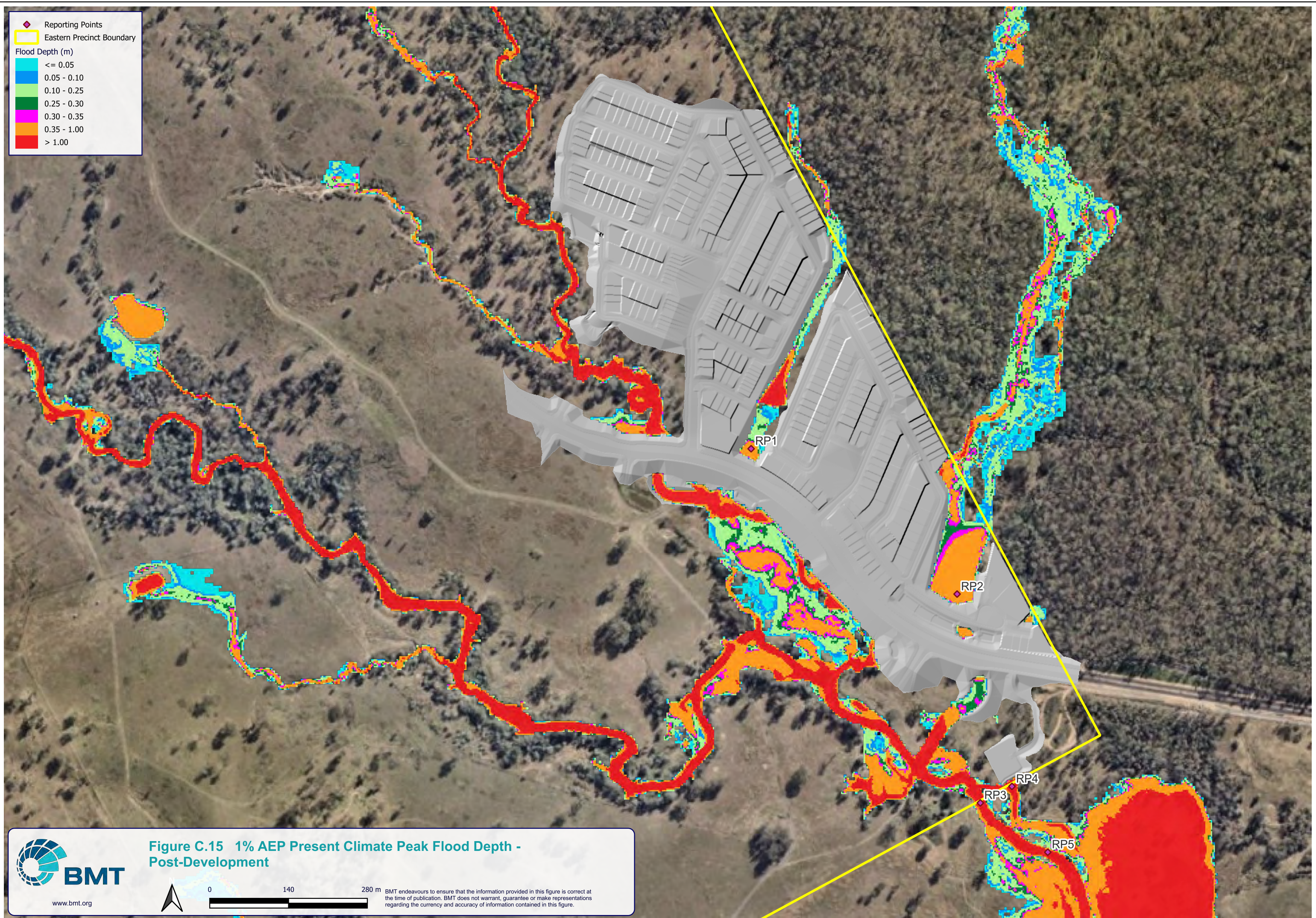
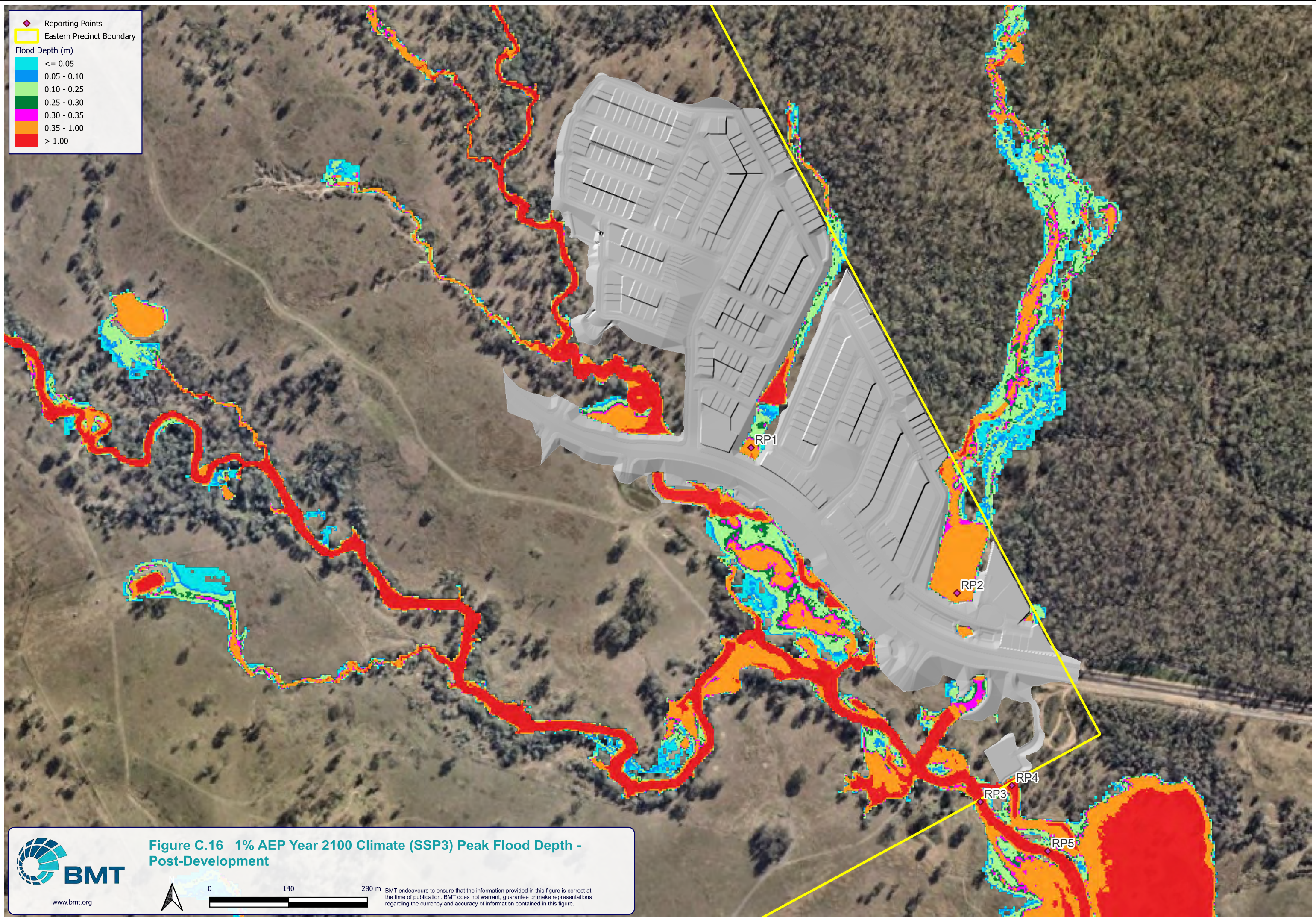


Figure C.14 2% AEP Present Climate Peak Flood Depth - Post-Development



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◆ Reporting Points

□ Eastern Precinct Boundary

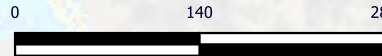
Flood Depth (m)

<= 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.30
0.30 - 0.35
0.35 - 1.00
> 1.00

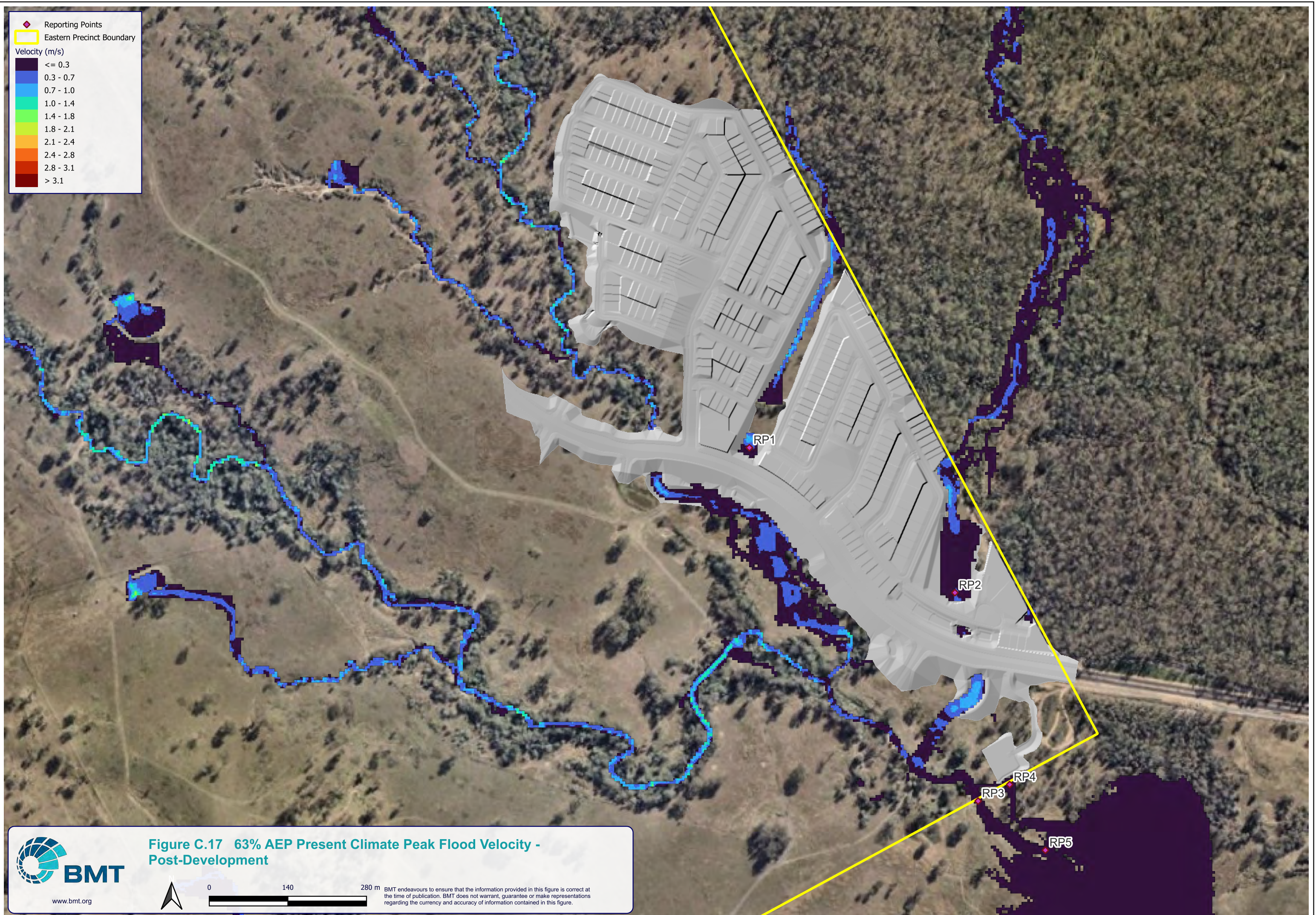
Figure C.16 1% AEP Year 2100 Climate (SSP3) Peak Flood Depth - Post-Development

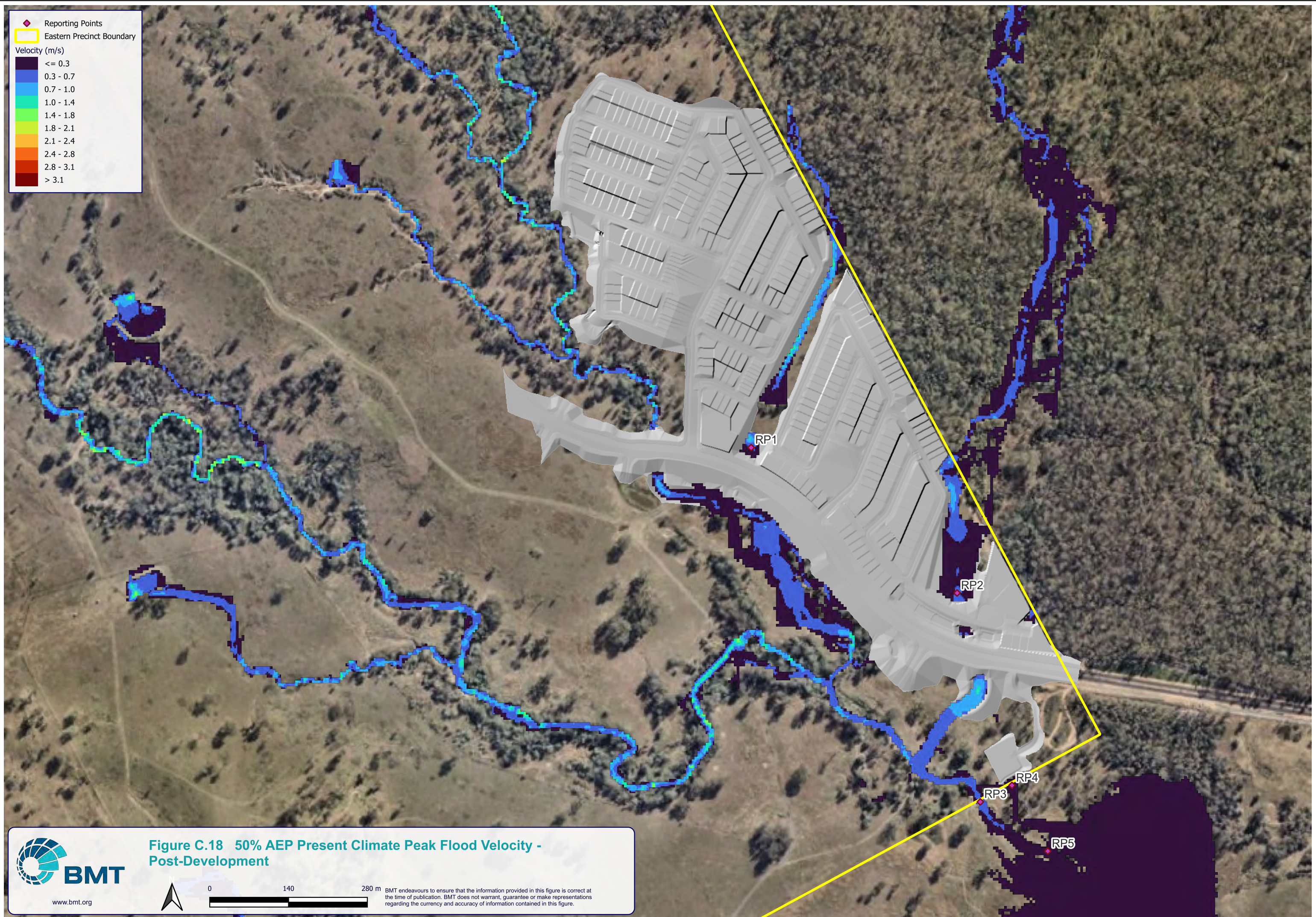


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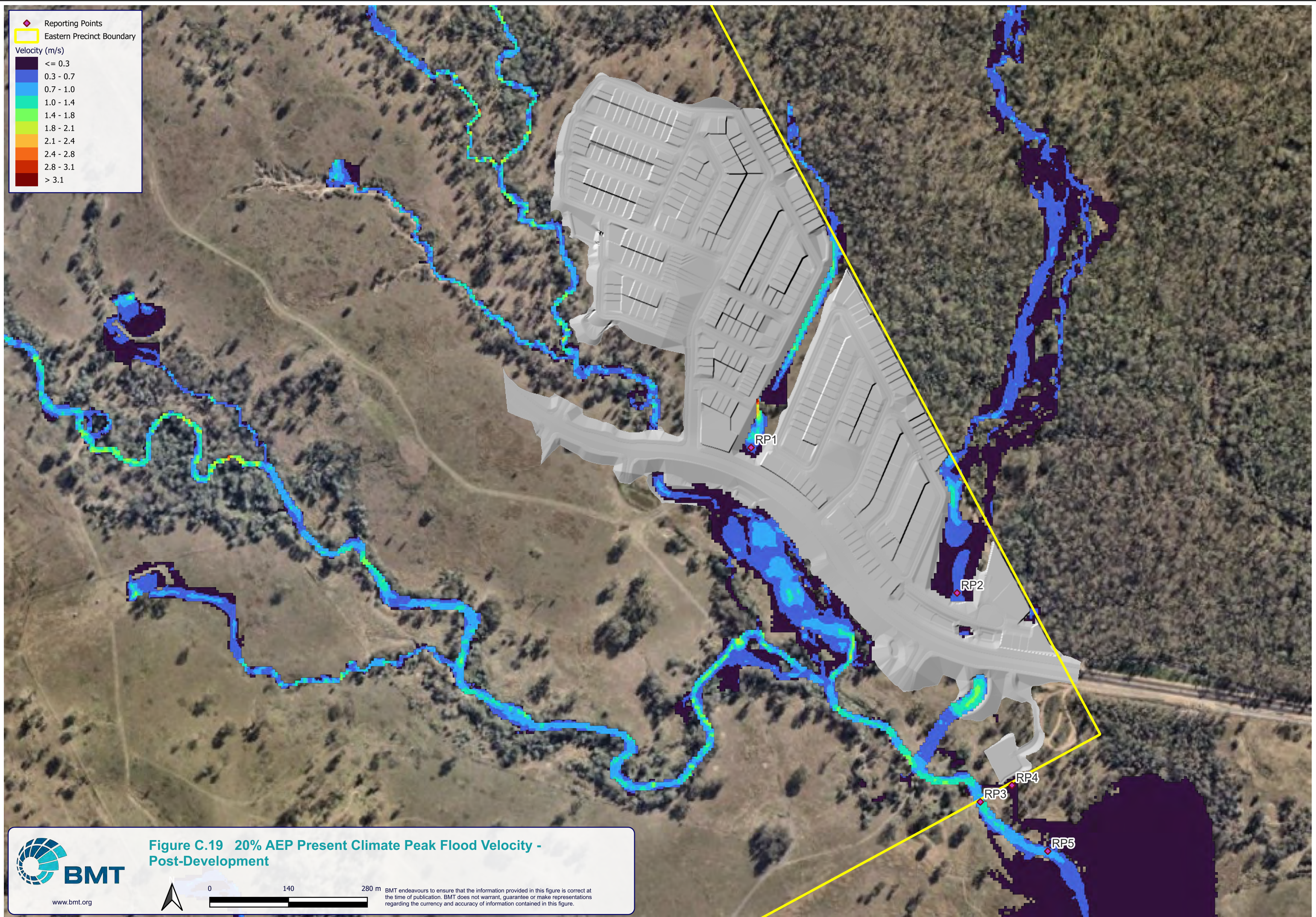
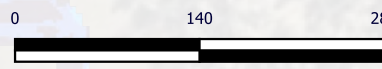
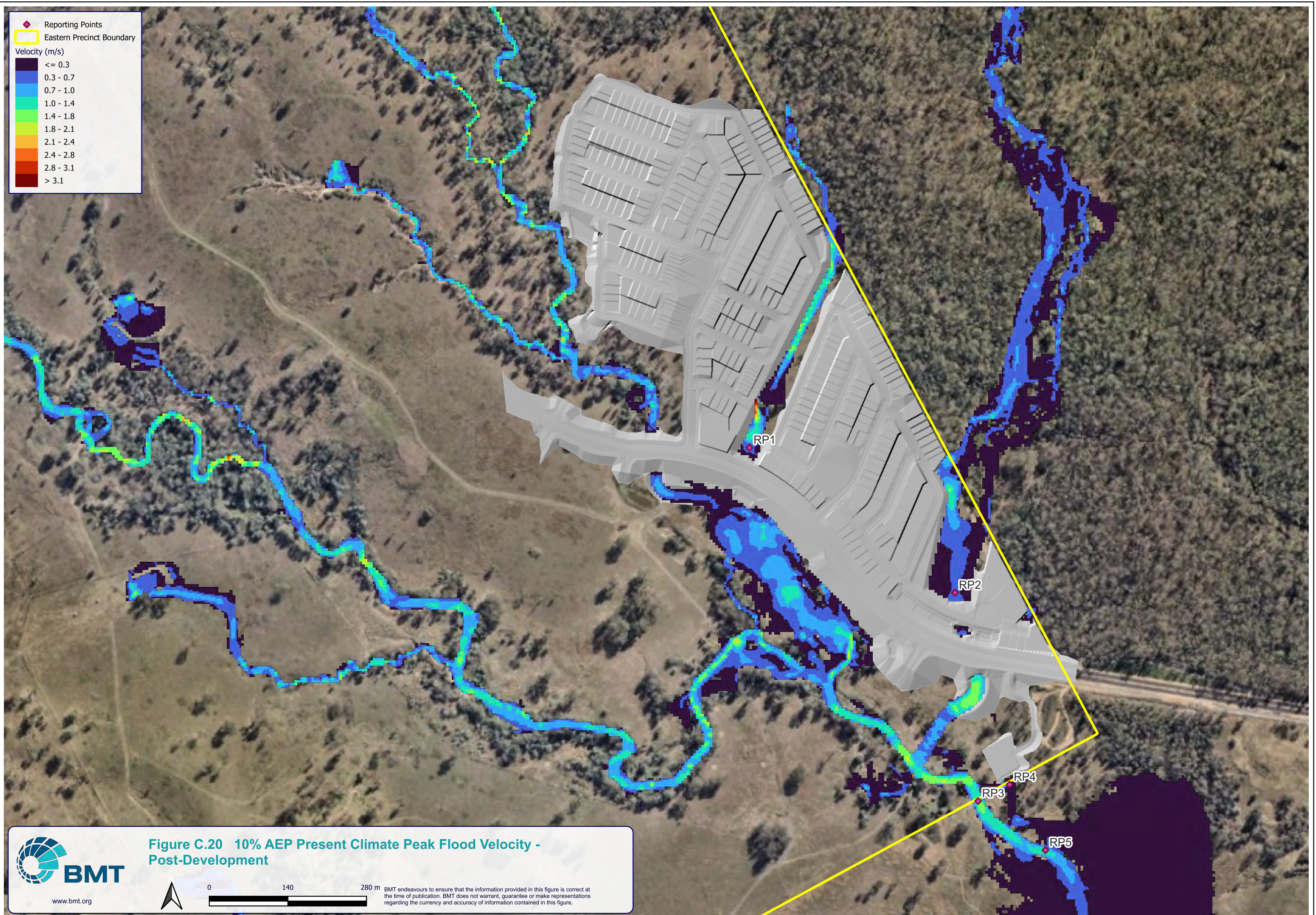


Figure C.19 20% AEP Present Climate Peak Flood Velocity - Post-Development



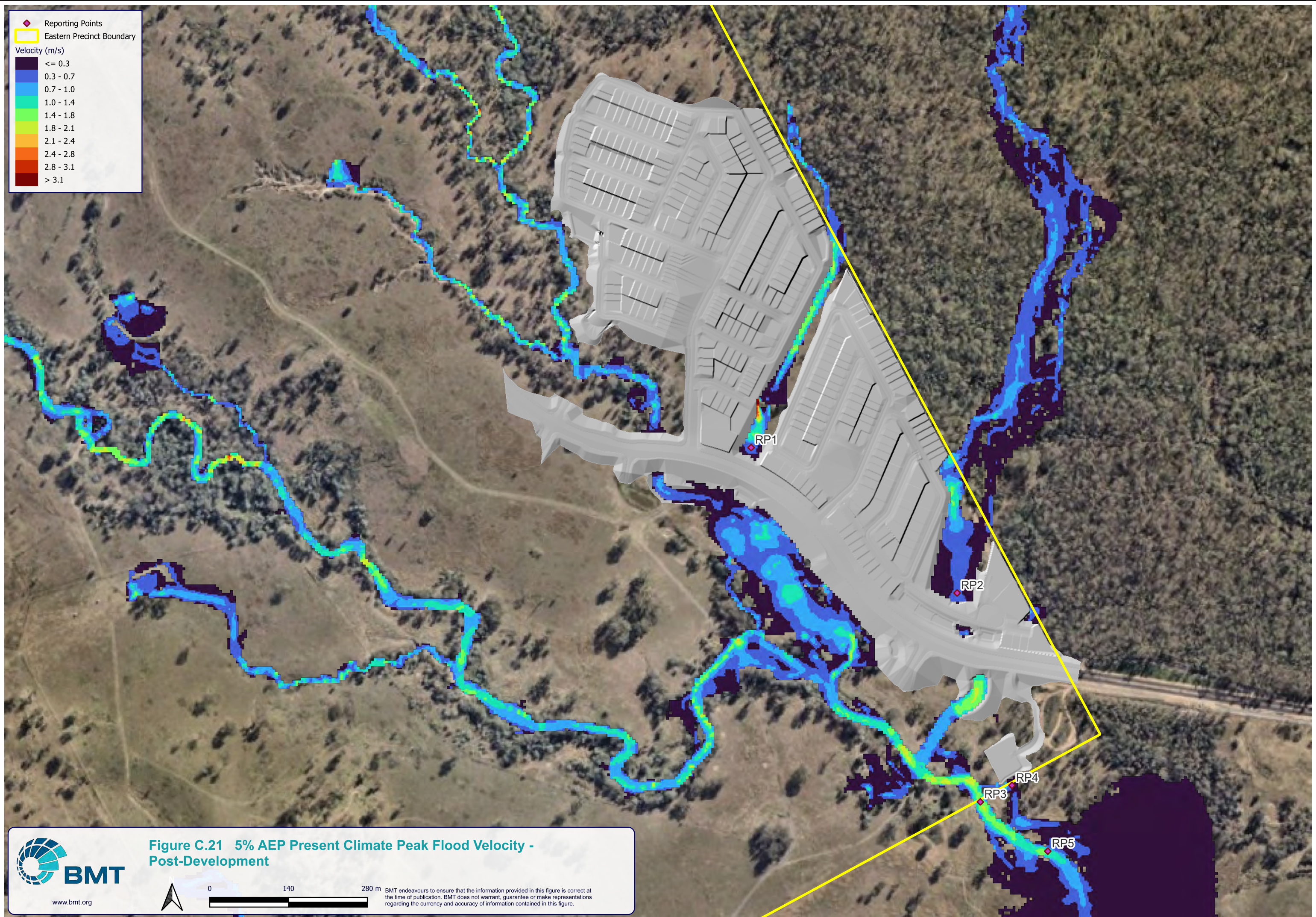
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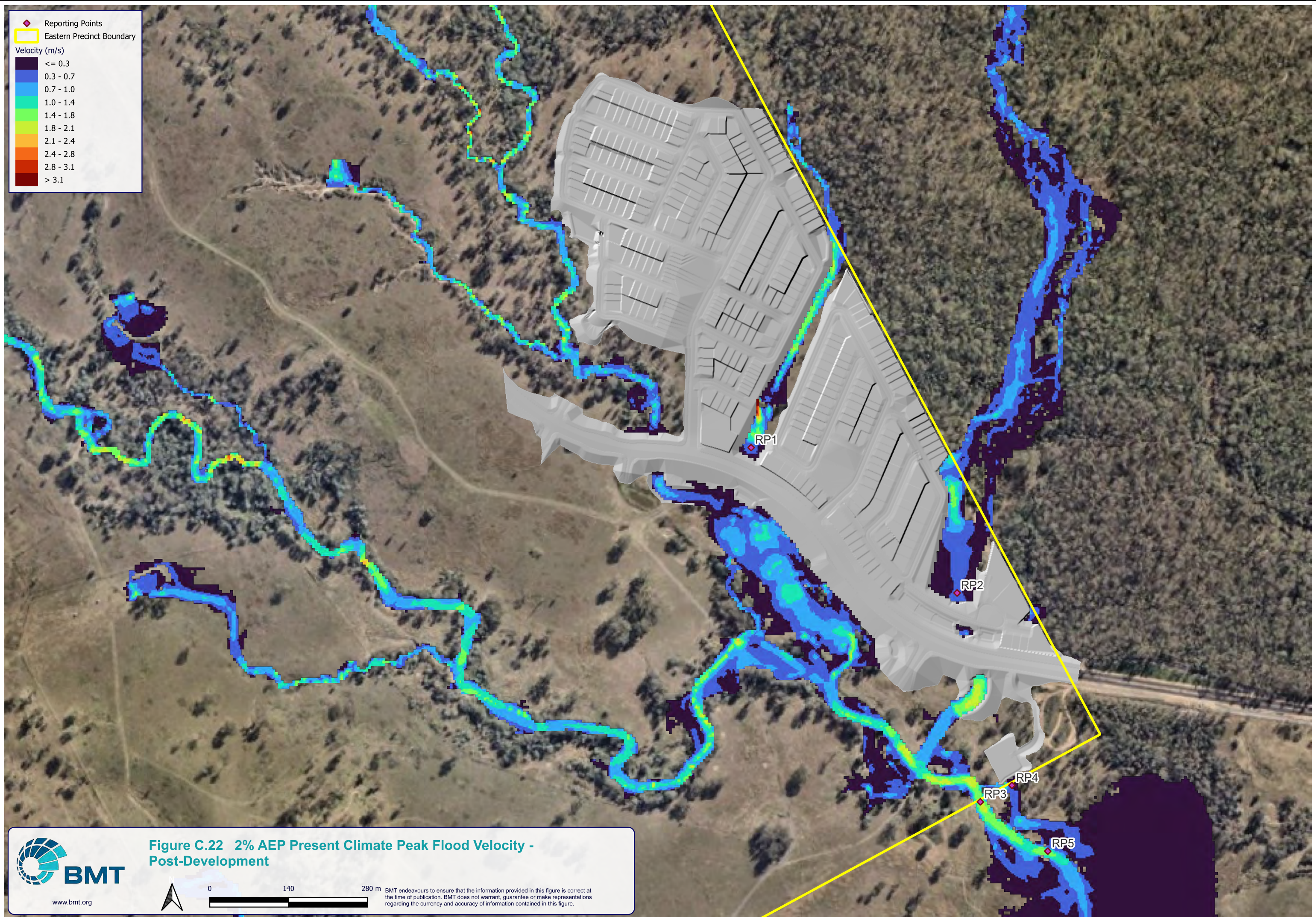
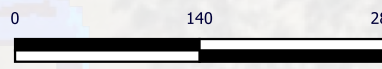
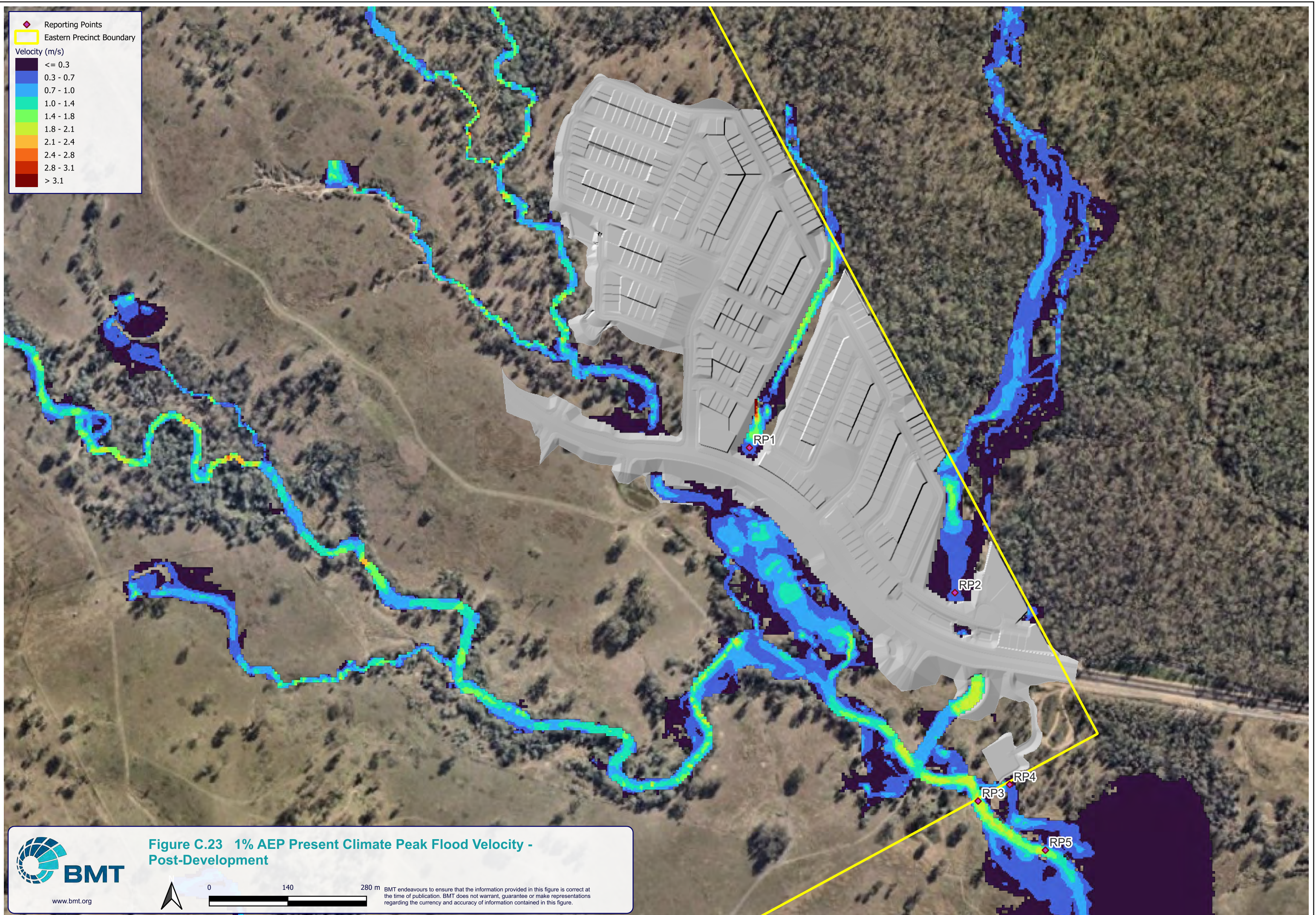


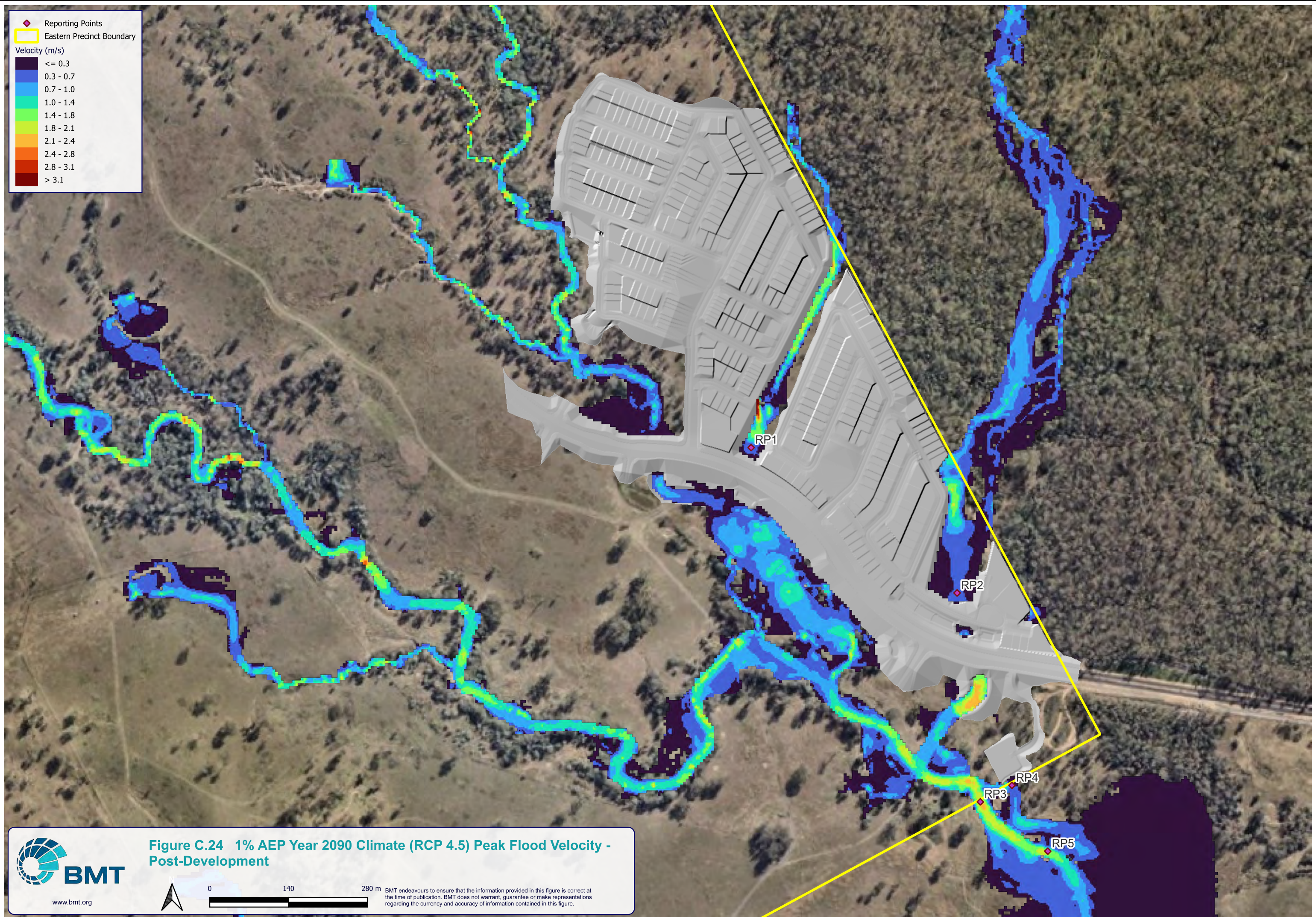
Figure C.22 2% AEP Present Climate Peak Flood Velocity - Post-Development

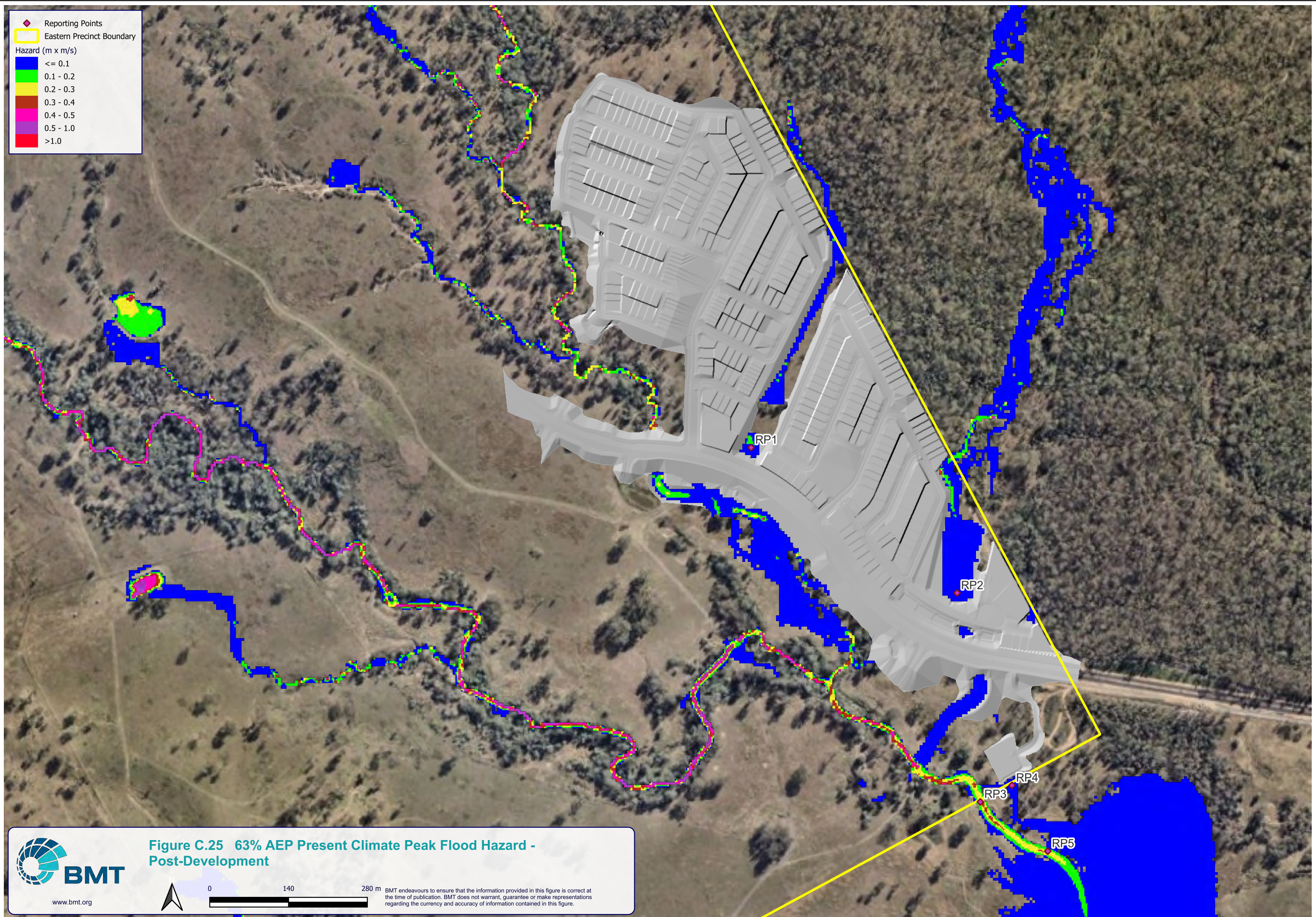


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BMT endeavours to ensure that the information provided in this figure is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this figure.





◆ Reporting Points

□ Eastern Precinct Boundary

Hazard (m x m/s)

Blue	<= 0.1
Green	0.1 - 0.2
Yellow	0.2 - 0.3
Orange	0.3 - 0.4
Red	0.4 - 0.5
Purple	0.5 - 1.0
Dark Red	>1.0

RP1

RP2

RP3

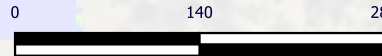
RP4

RP5



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Figure C.25 63% AEP Present Climate Peak Flood Hazard - Post-Development



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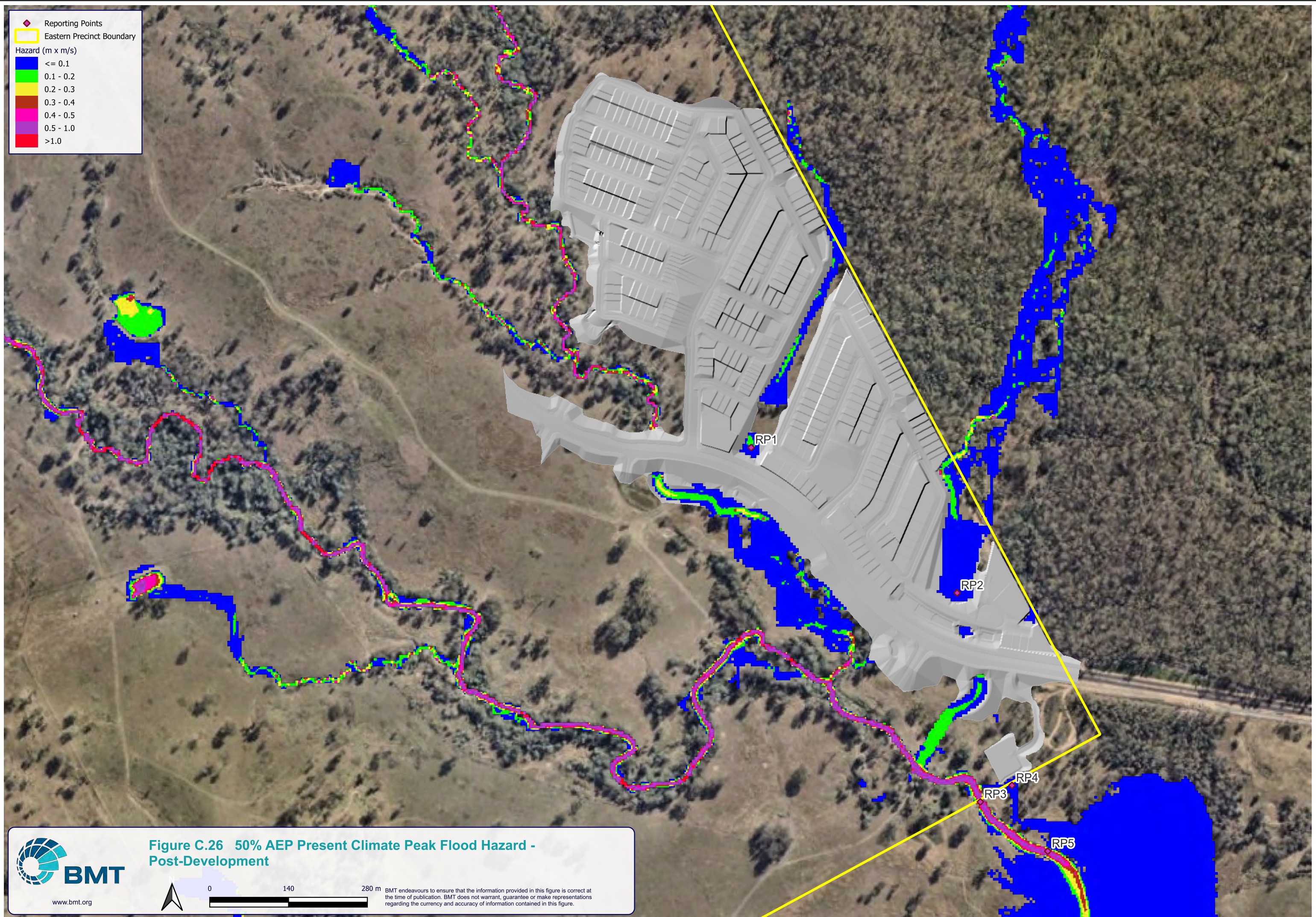
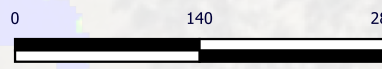
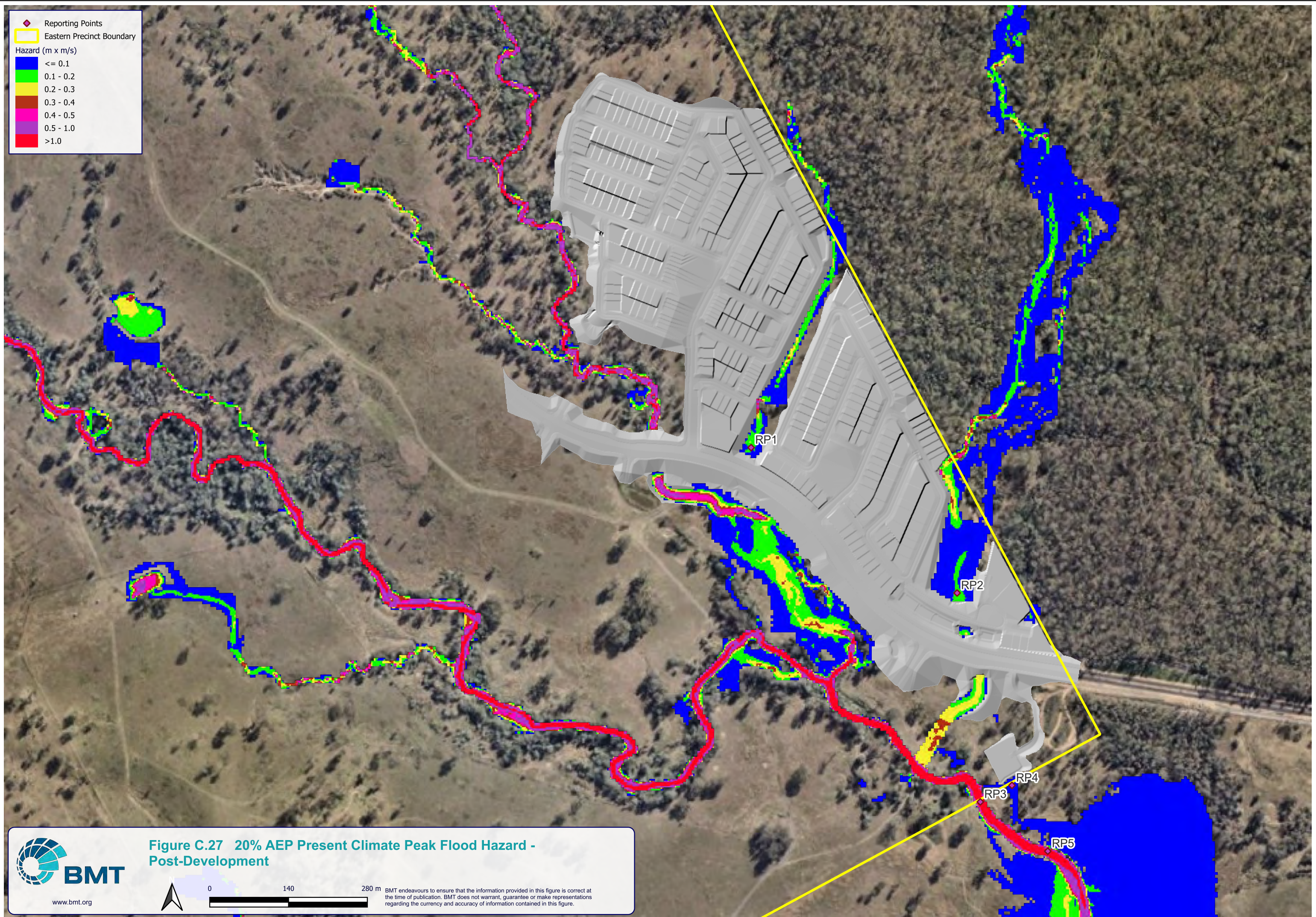


Figure C.26 50% AEP Present Climate Peak Flood Hazard - Post-Development



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◆ Reporting Points

□ Eastern Precinct Boundary

Hazard (m x m/s)

Blue	<= 0.1
Green	0.1 - 0.2
Yellow	0.2 - 0.3
Orange	0.3 - 0.4
Red	0.4 - 0.5
Purple	0.5 - 1.0
Dark Red	>1.0

RP1

RP2

RP3

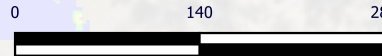
RP4

RP5



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Figure C.27 20% AEP Present Climate Peak Flood Hazard - Post-Development



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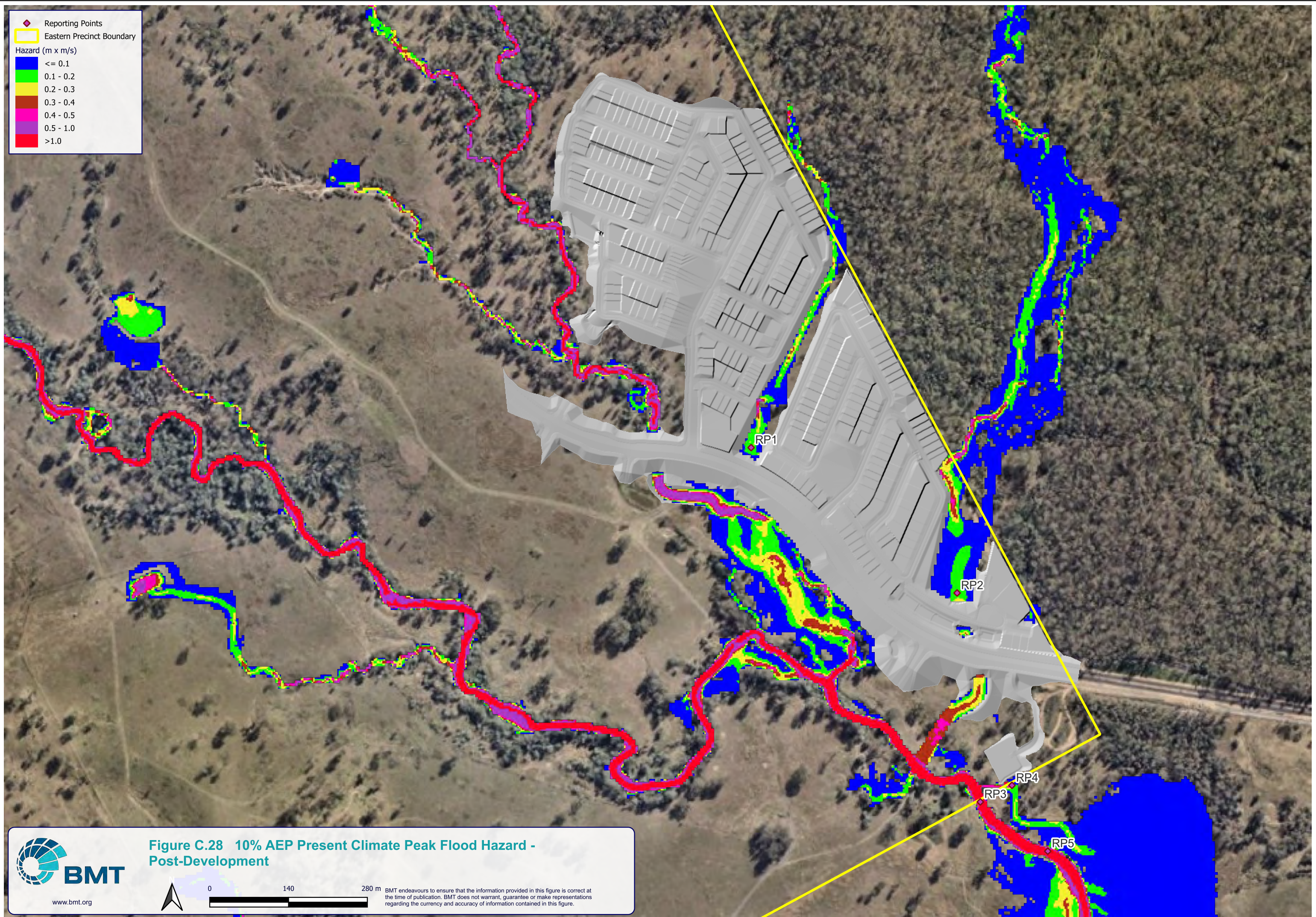
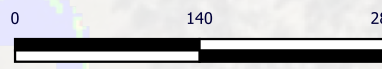


Figure C.28 10% AEP Present Climate Peak Flood Hazard - Post-Development



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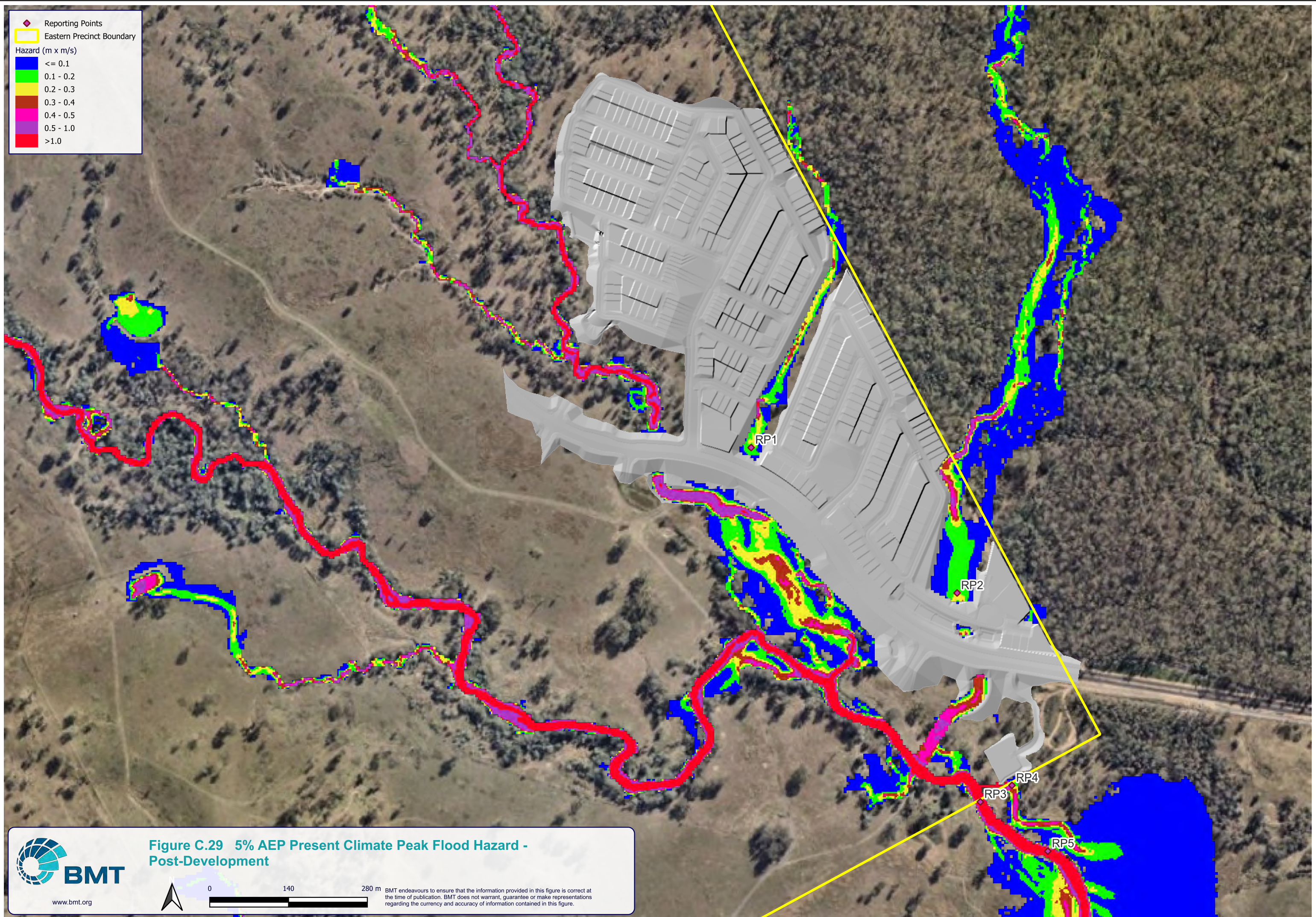
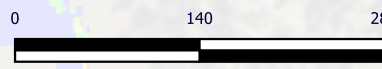


Figure C.29 5% AEP Present Climate Peak Flood Hazard - Post-Development



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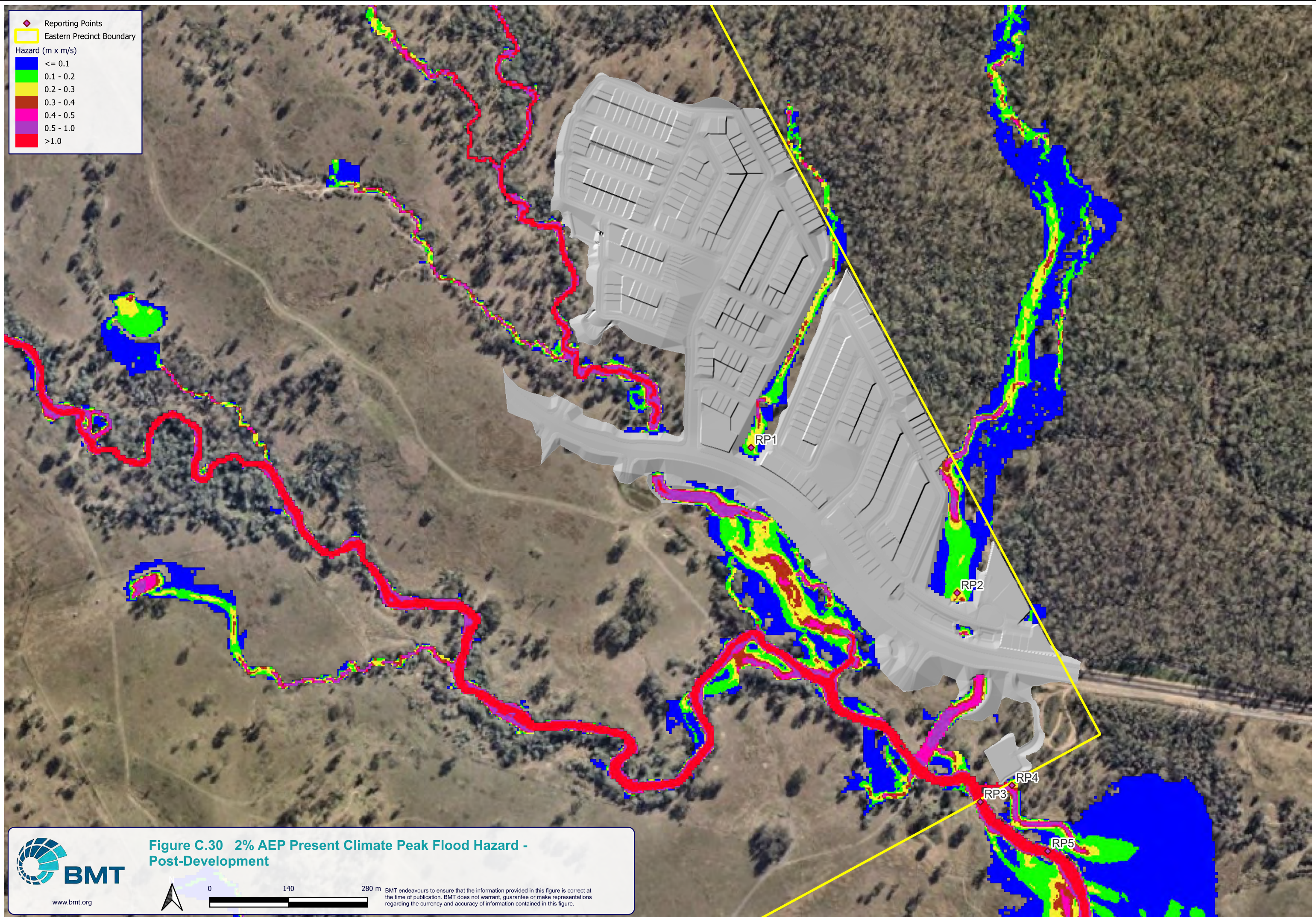
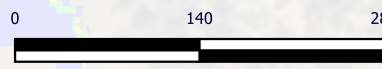
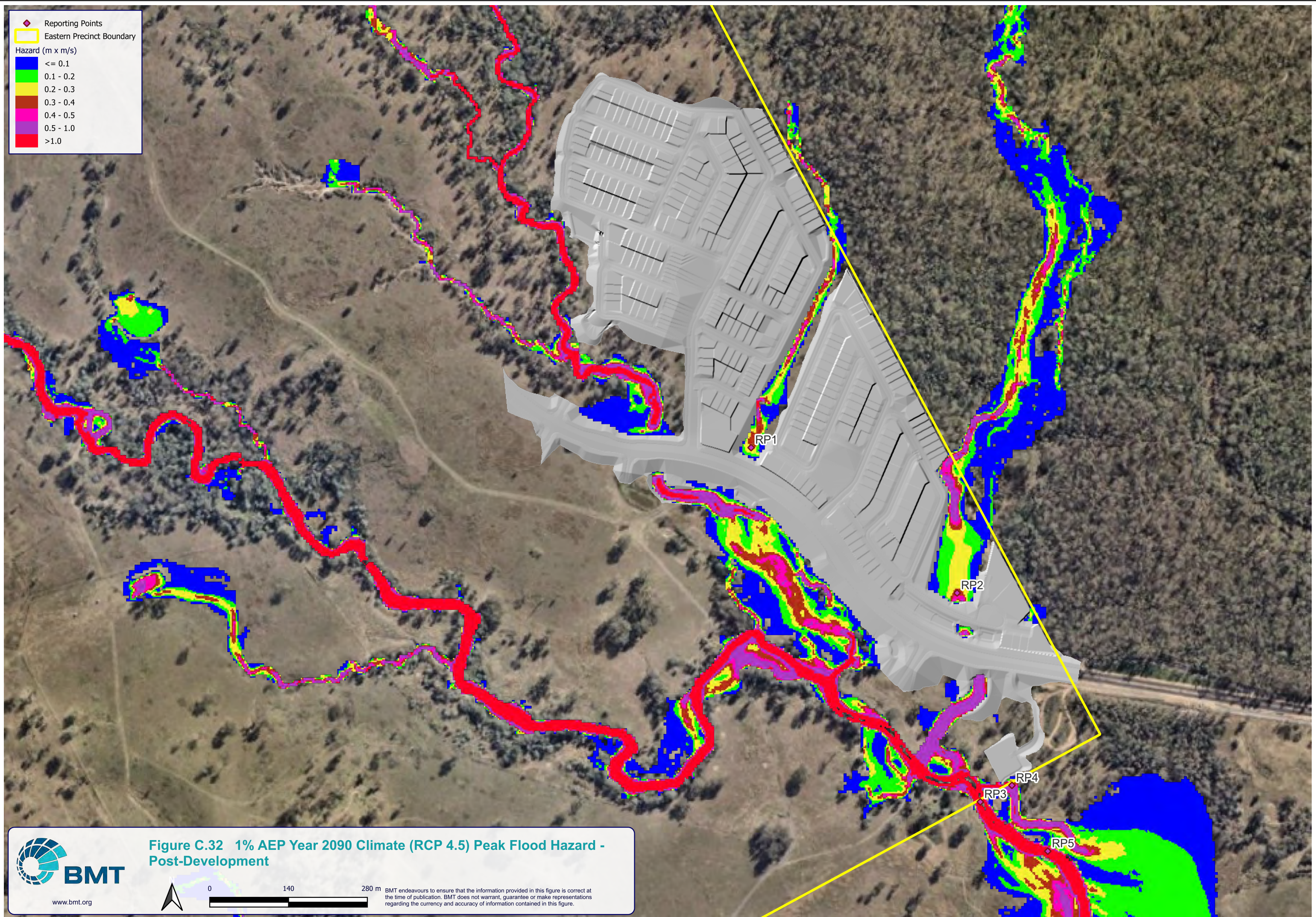


Figure C.30 2% AEP Present Climate Peak Flood Hazard - Post-Development



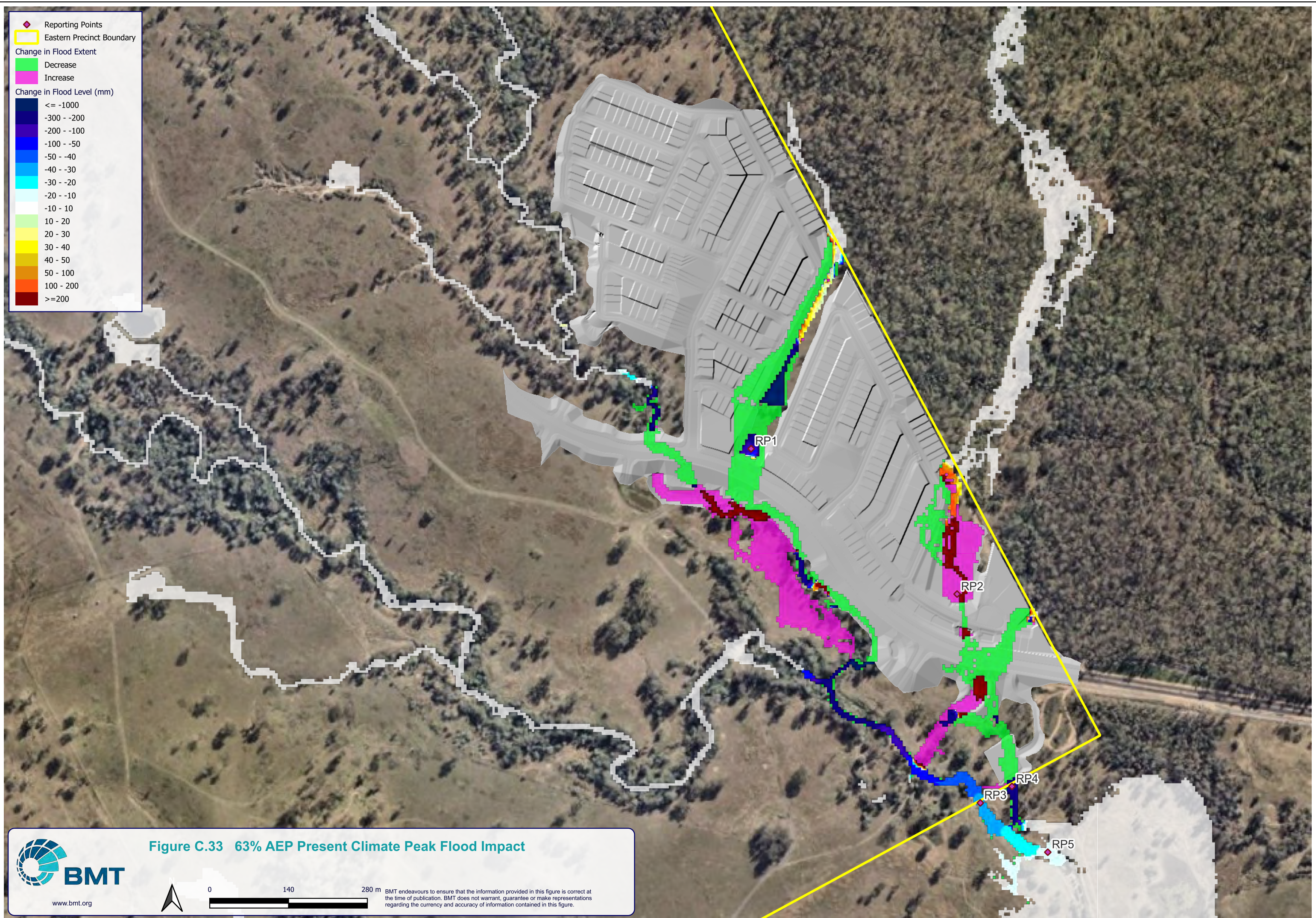
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Figure C.32 1% AEP Year 2090 Climate (RCP 4.5) Peak Flood Hazard - Post-Development

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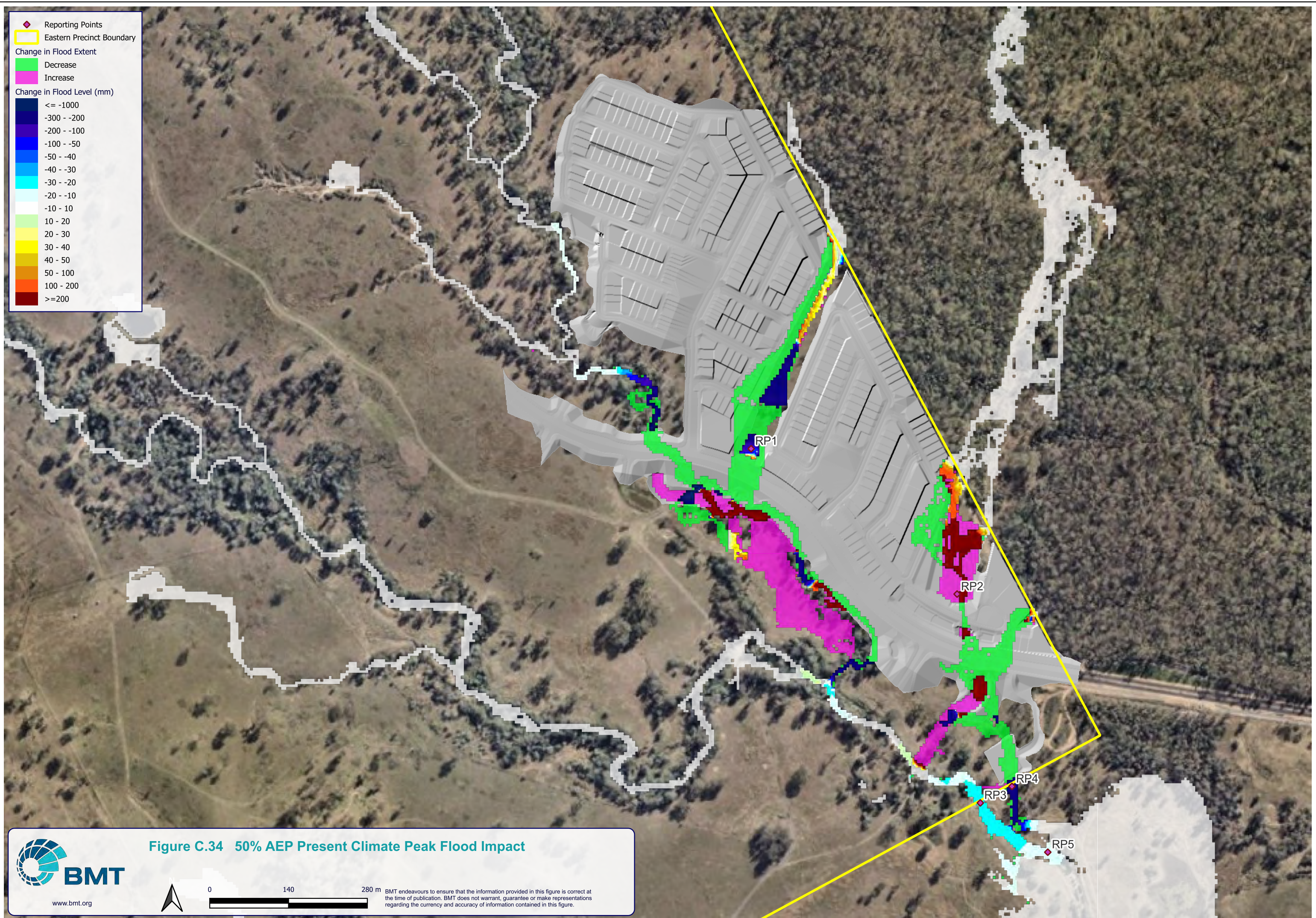
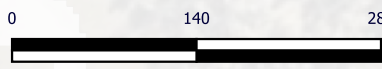


Figure C.34 50% AEP Present Climate Peak Flood Impact



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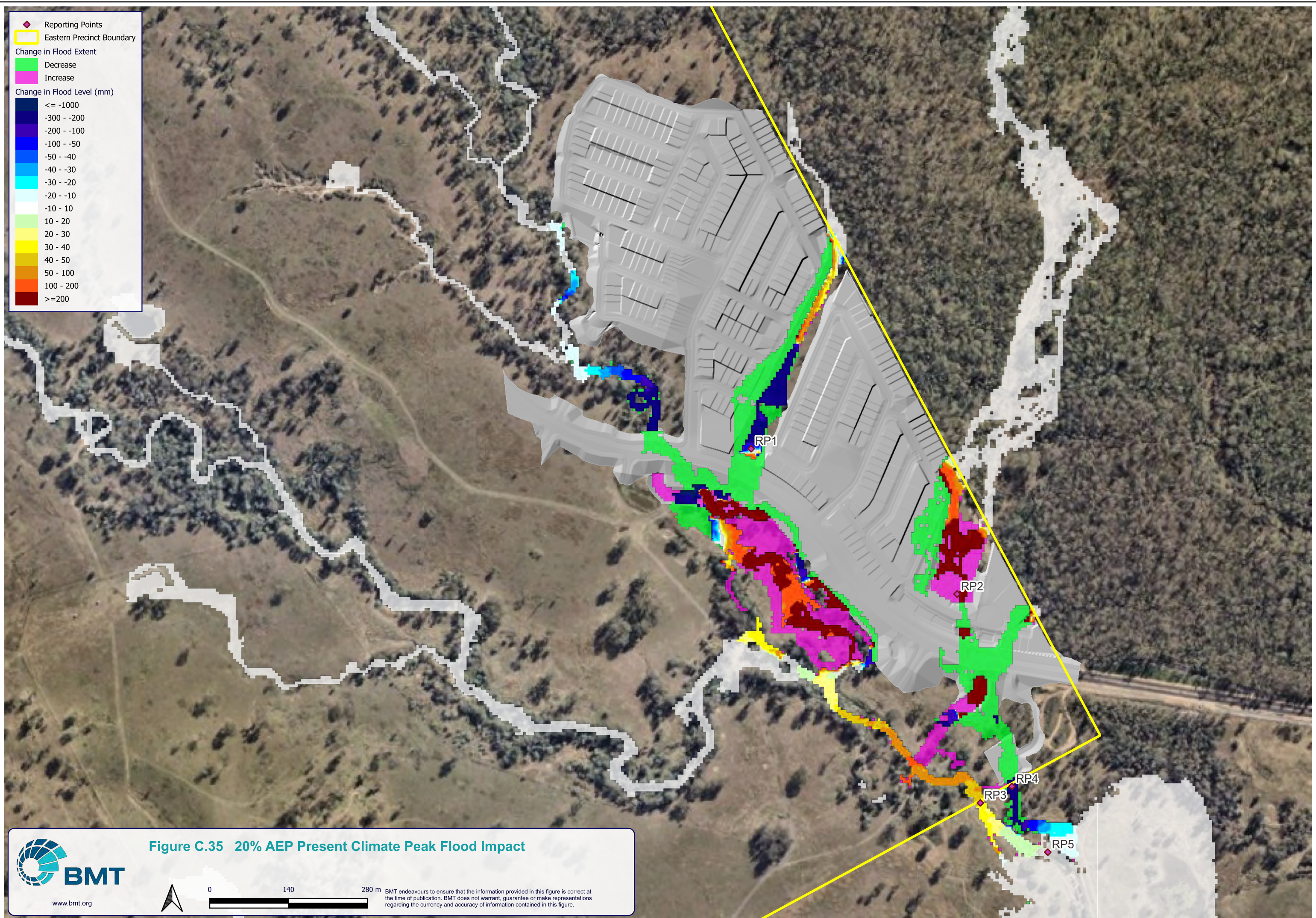
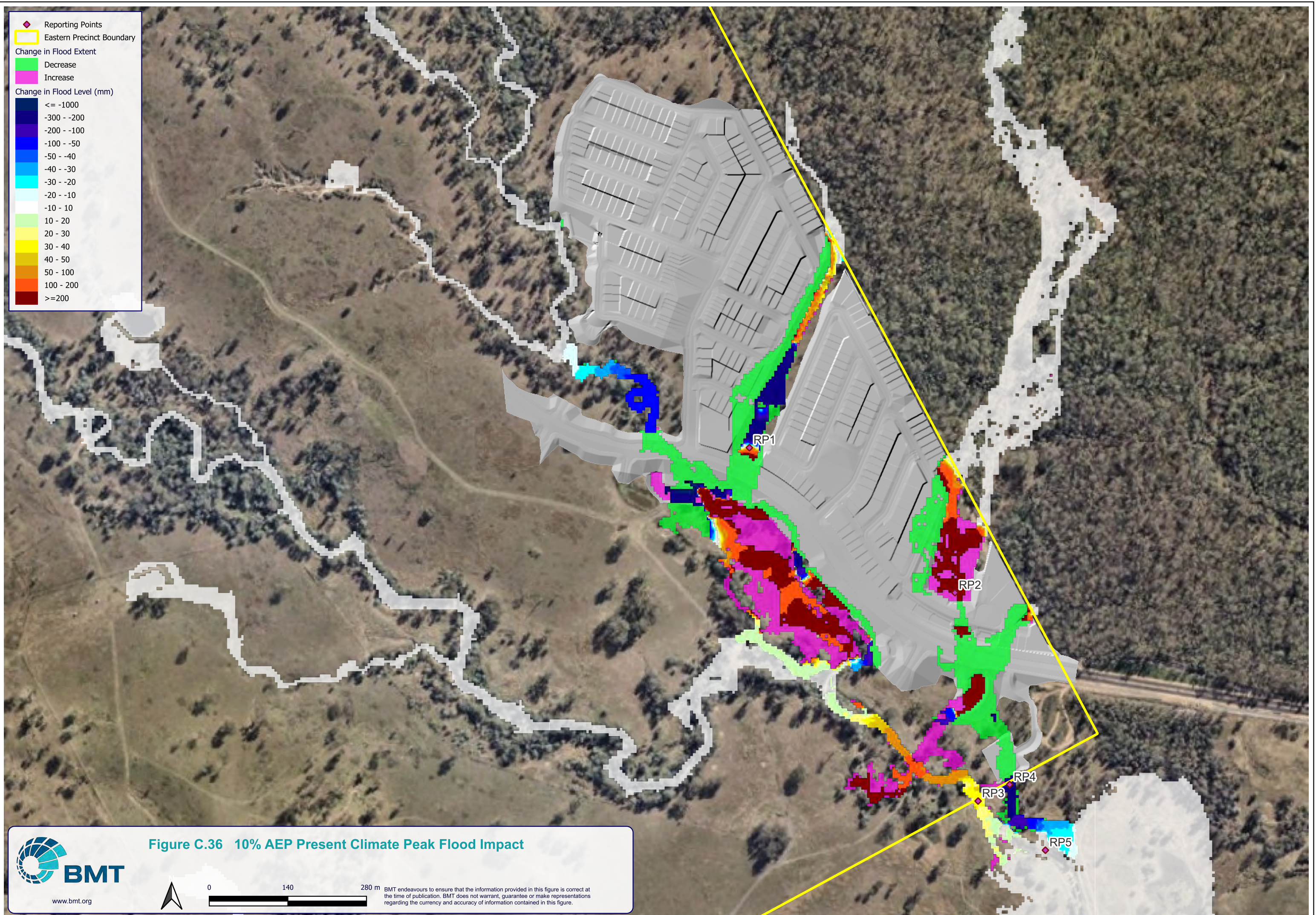
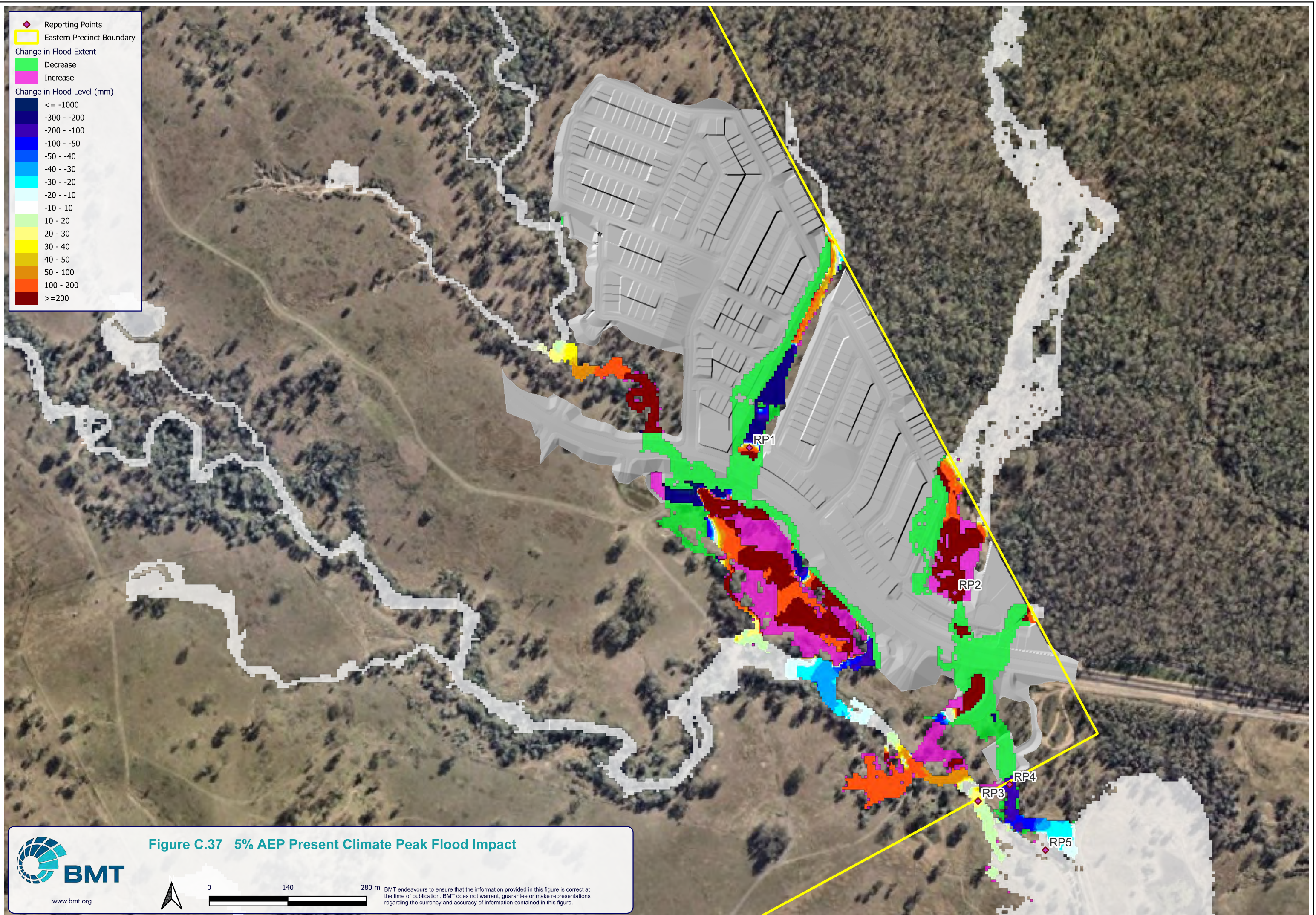


Figure C.35 20% AEP Present Climate Peak Flood Impact



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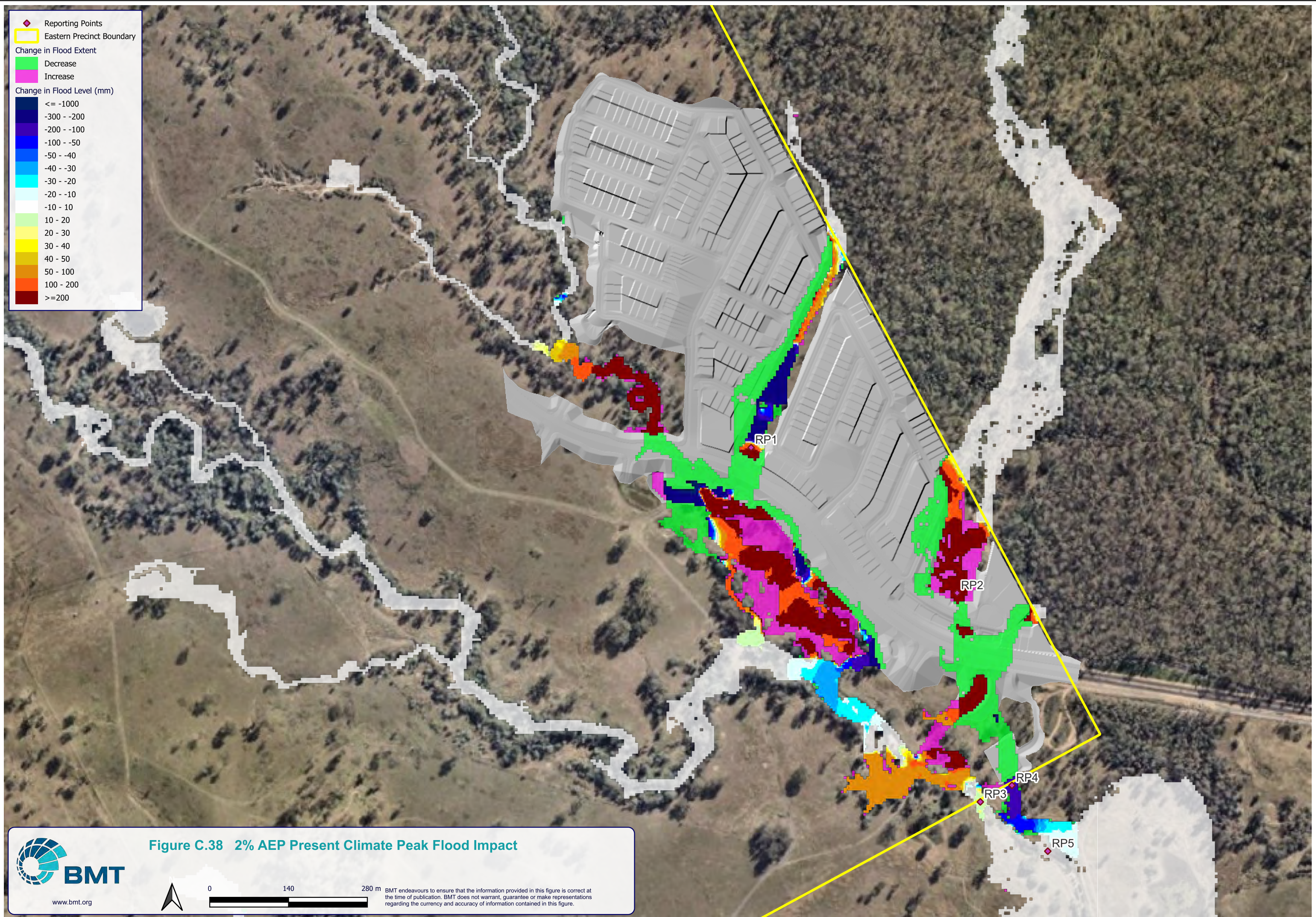
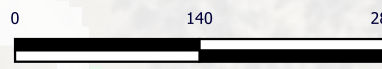


Figure C.38 2% AEP Present Climate Peak Flood Impact



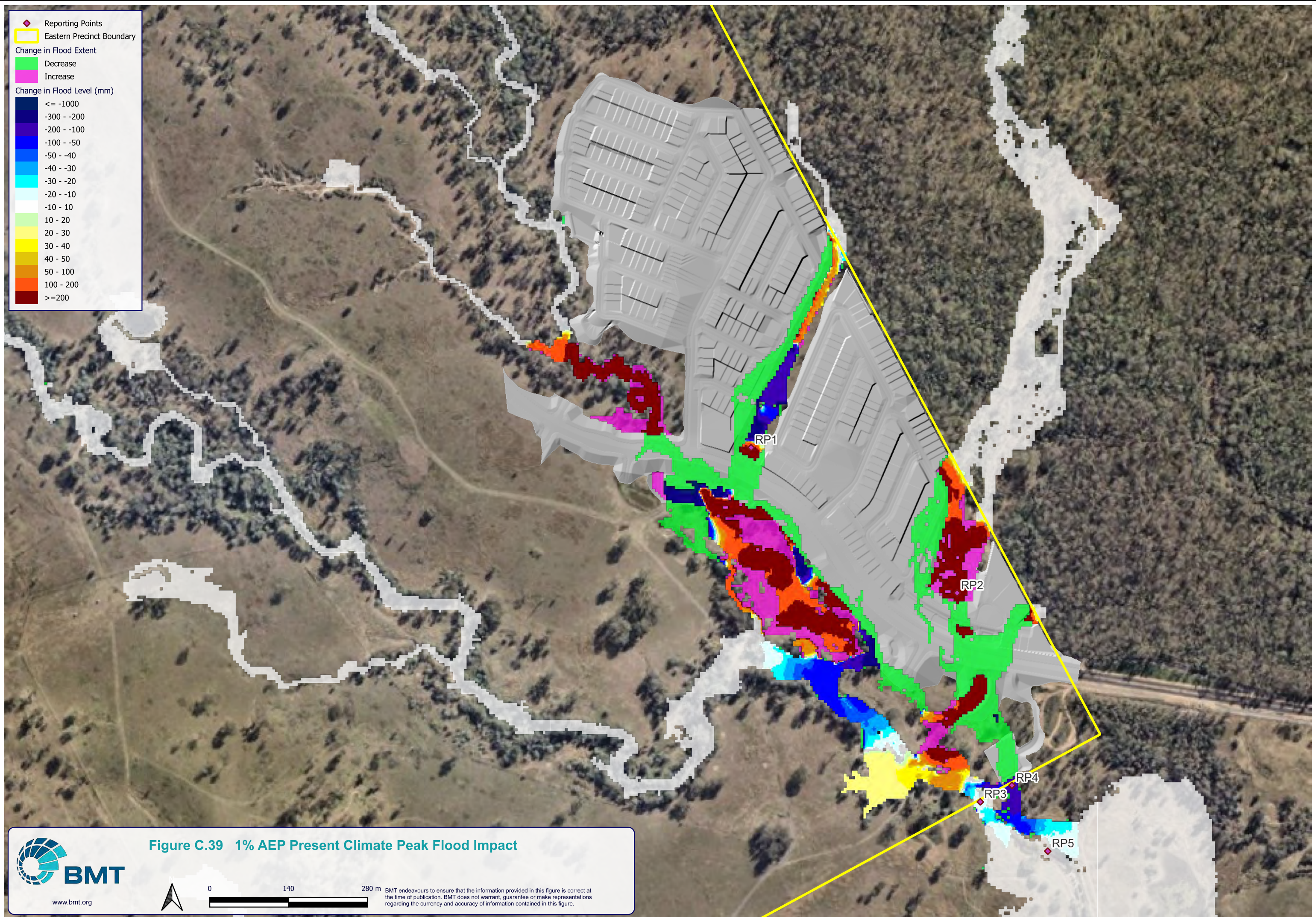
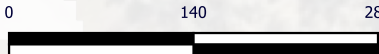
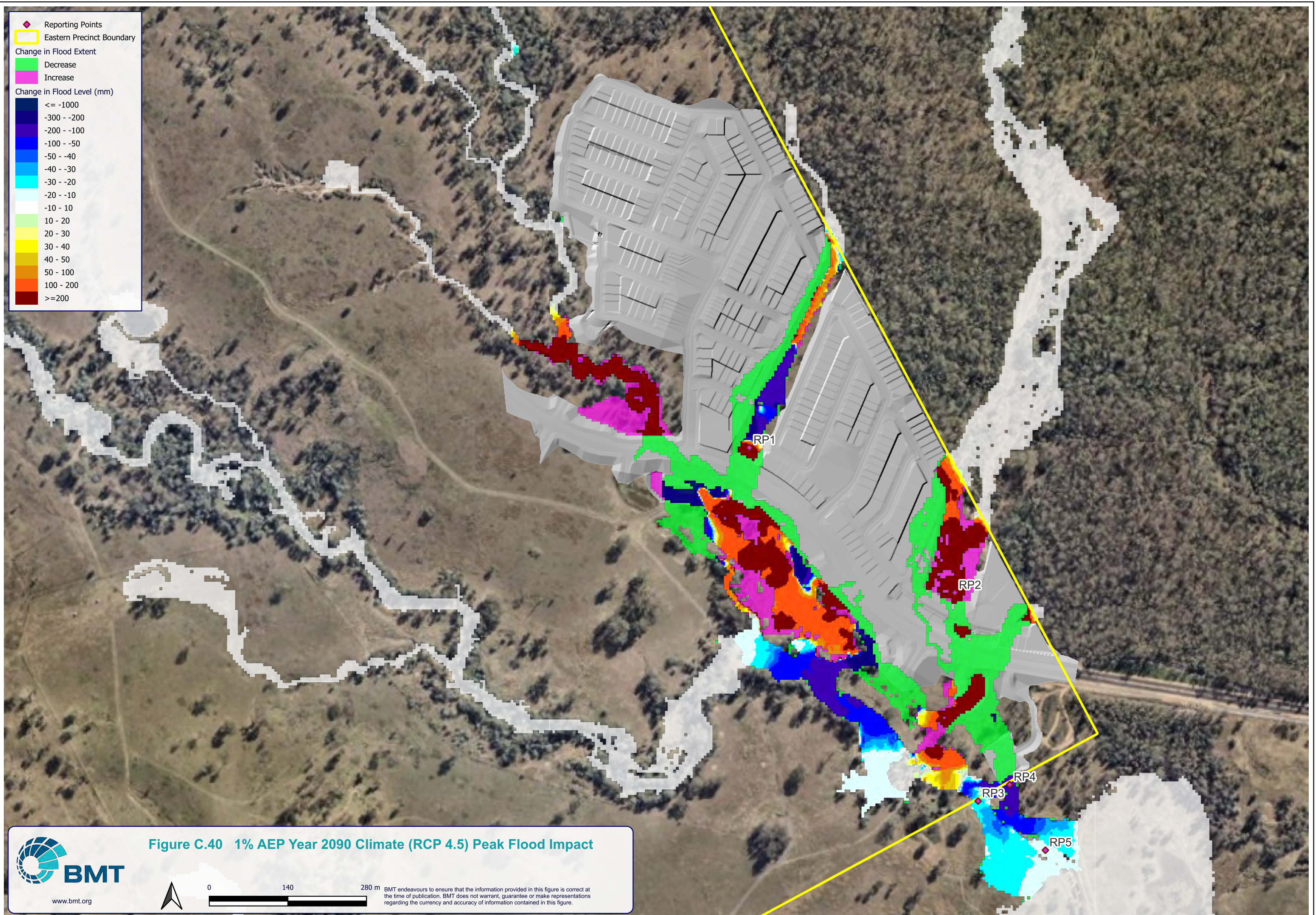
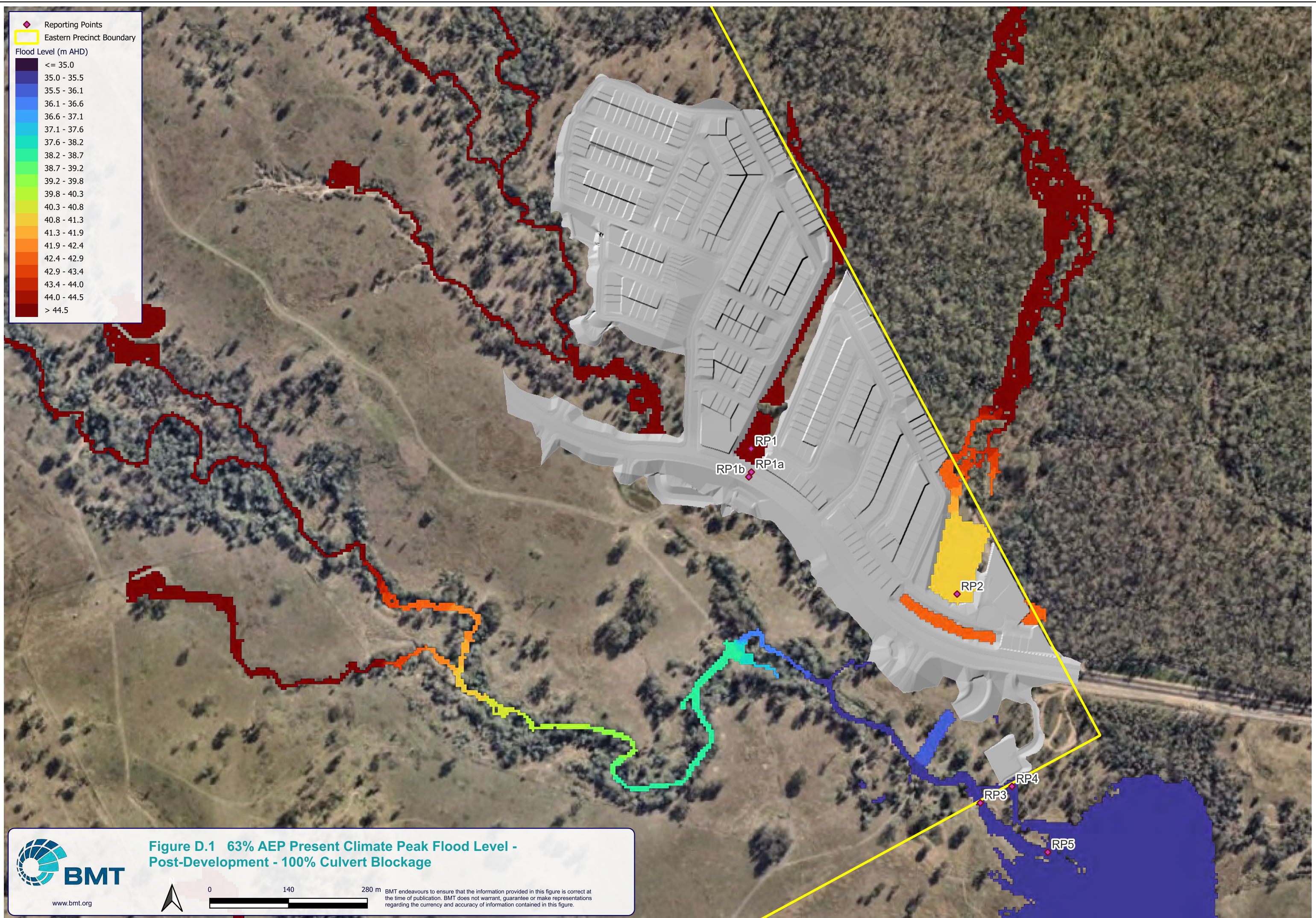


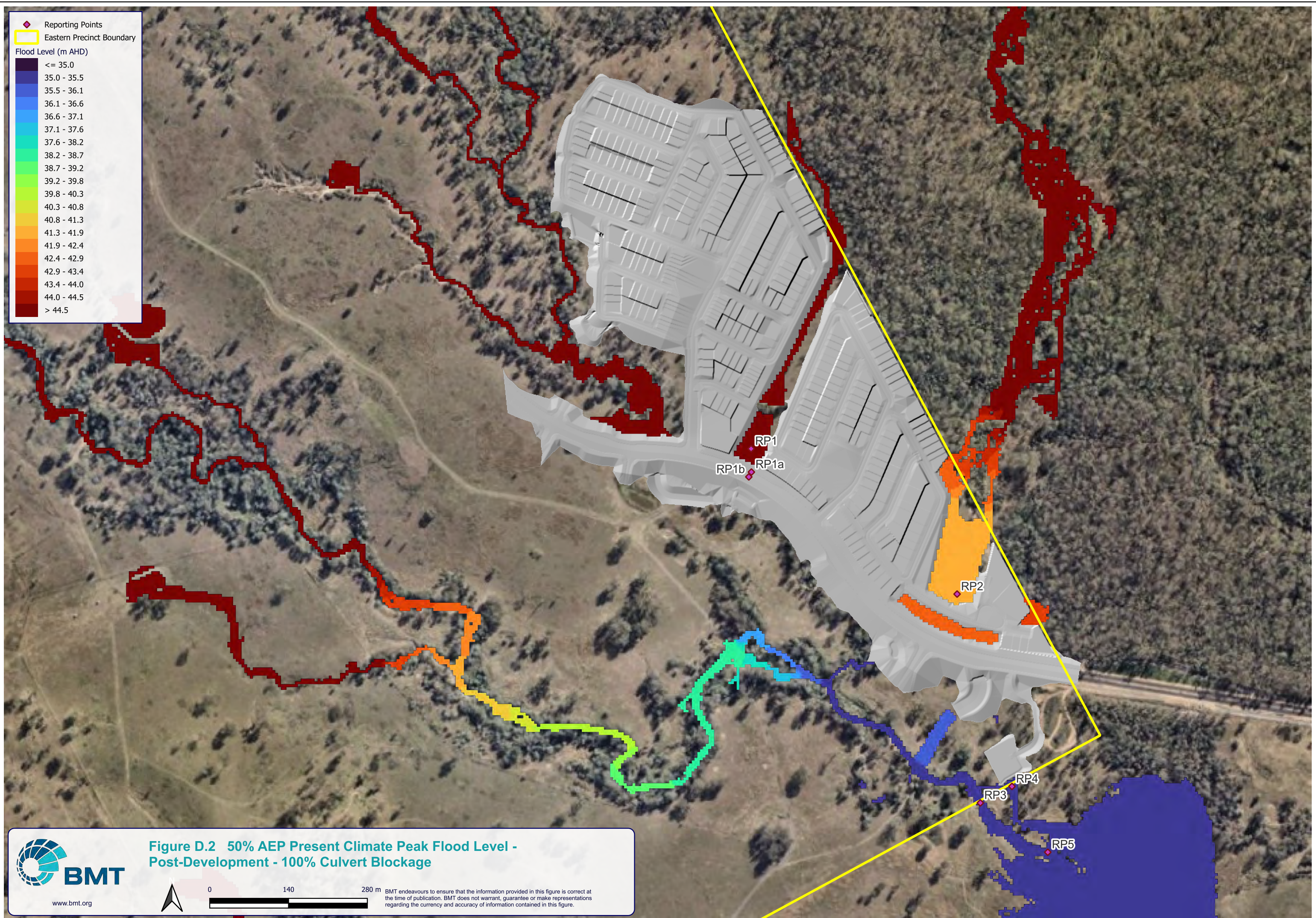
Figure C.39 1% AEP Present Climate Peak Flood Impact

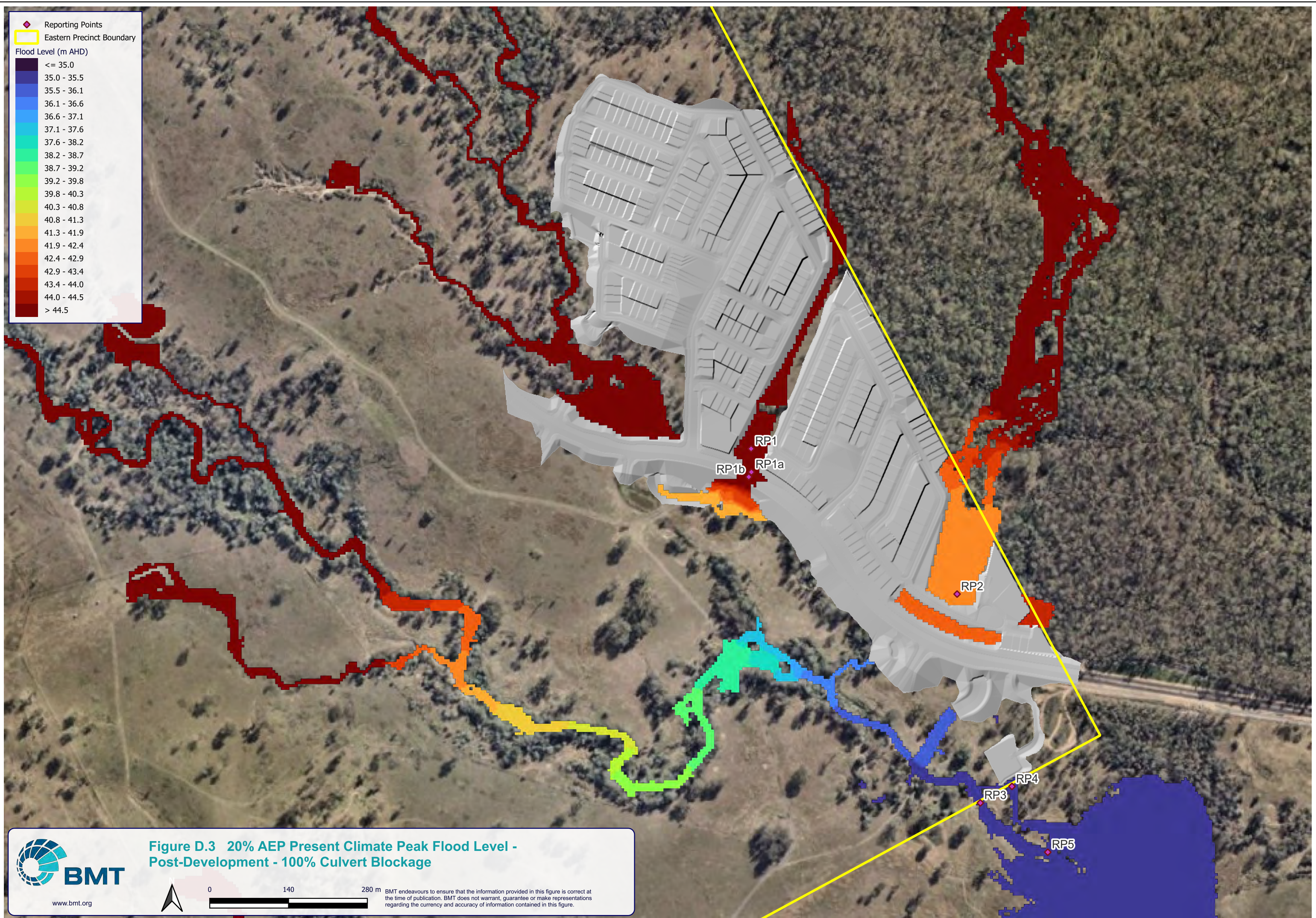


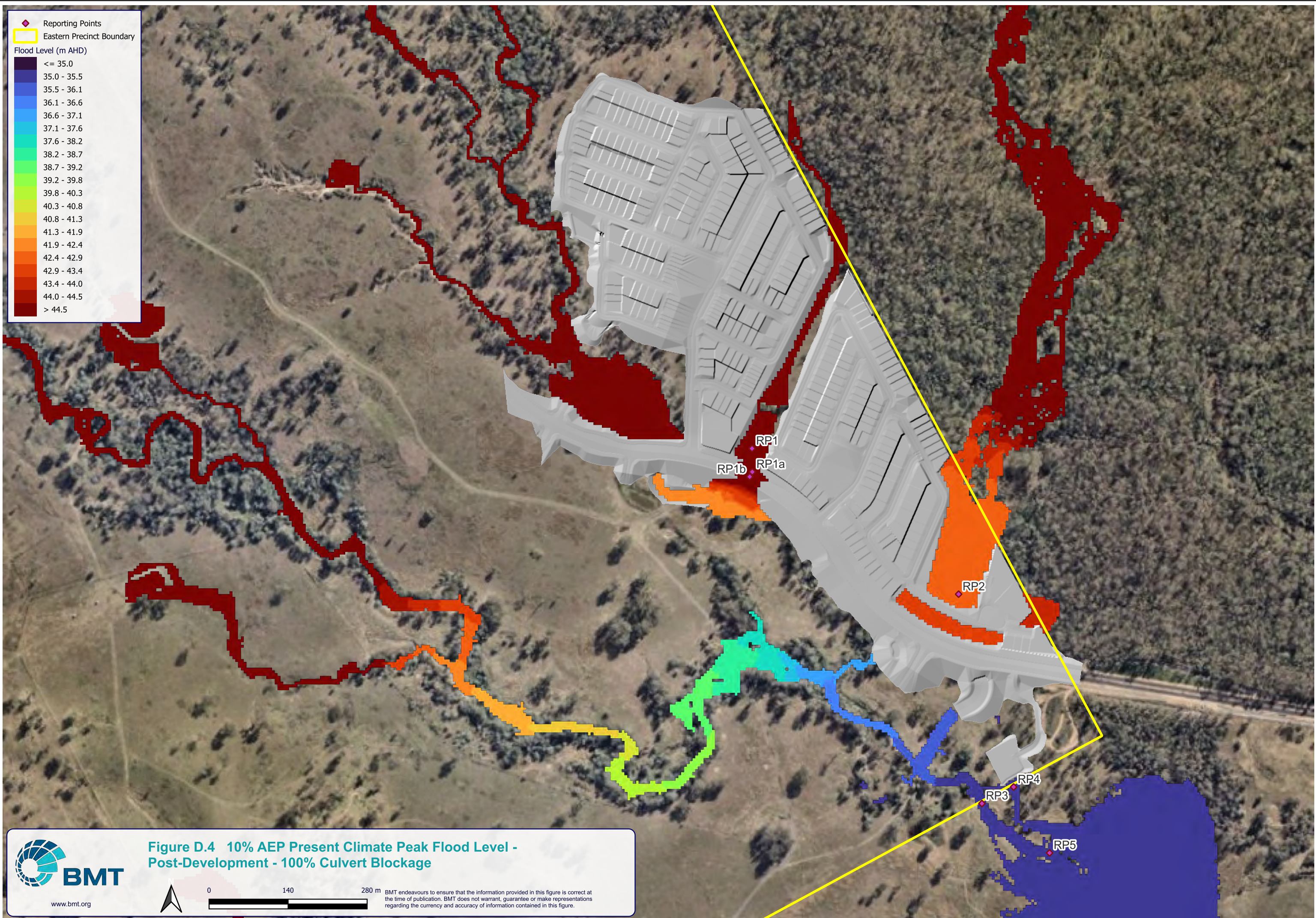


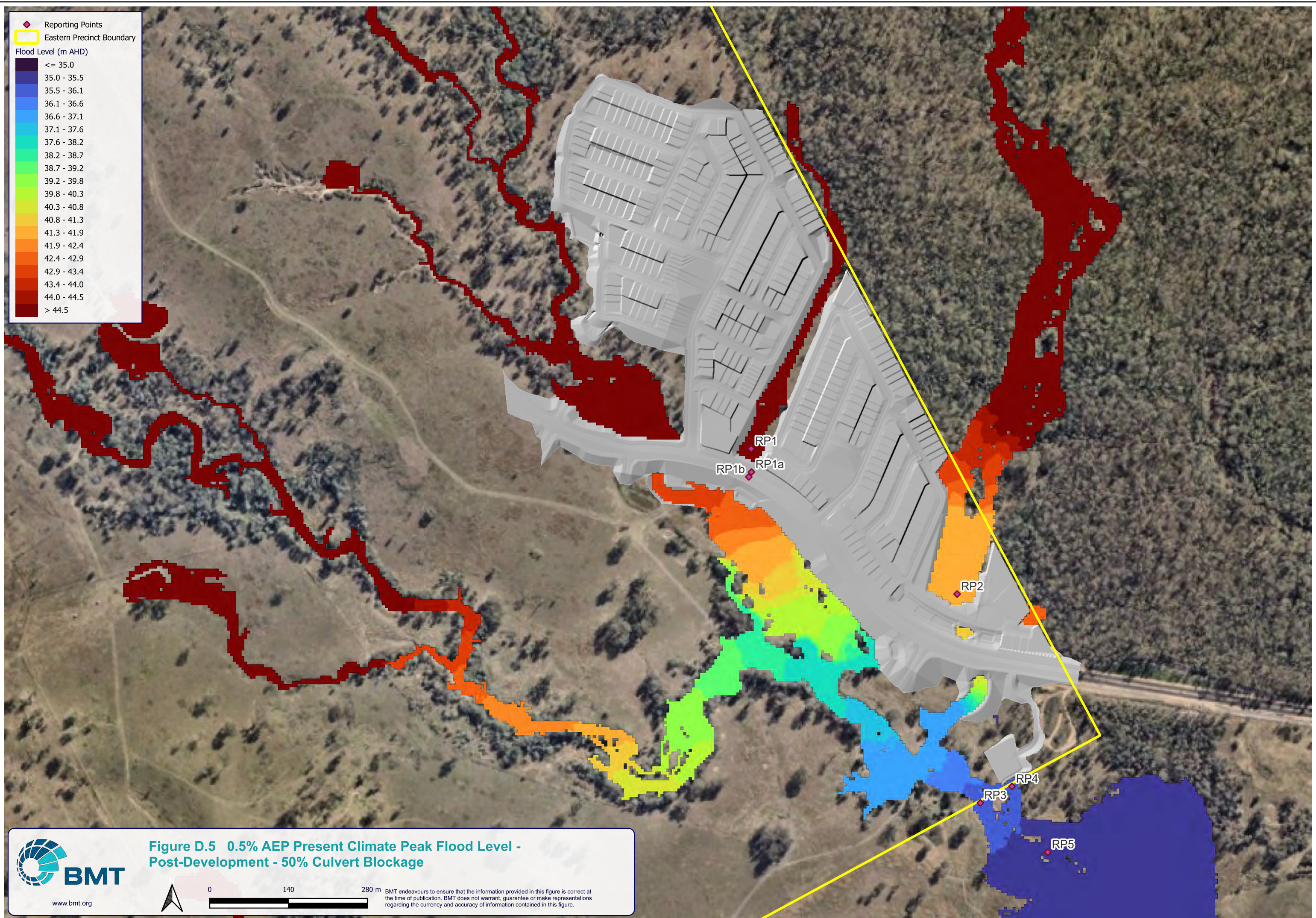
Annex D Severe Storm and Extreme Culvert Blockage Results

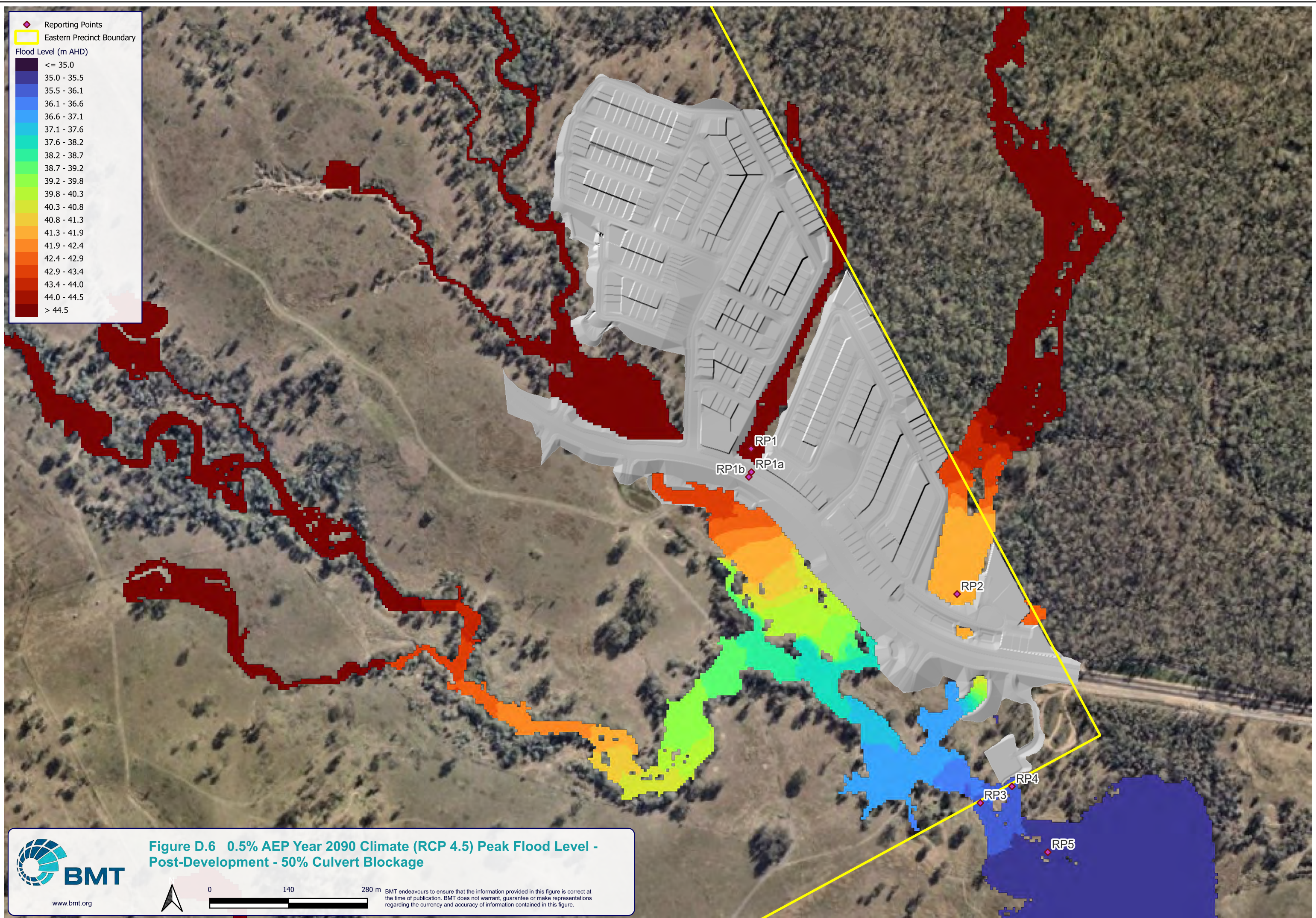


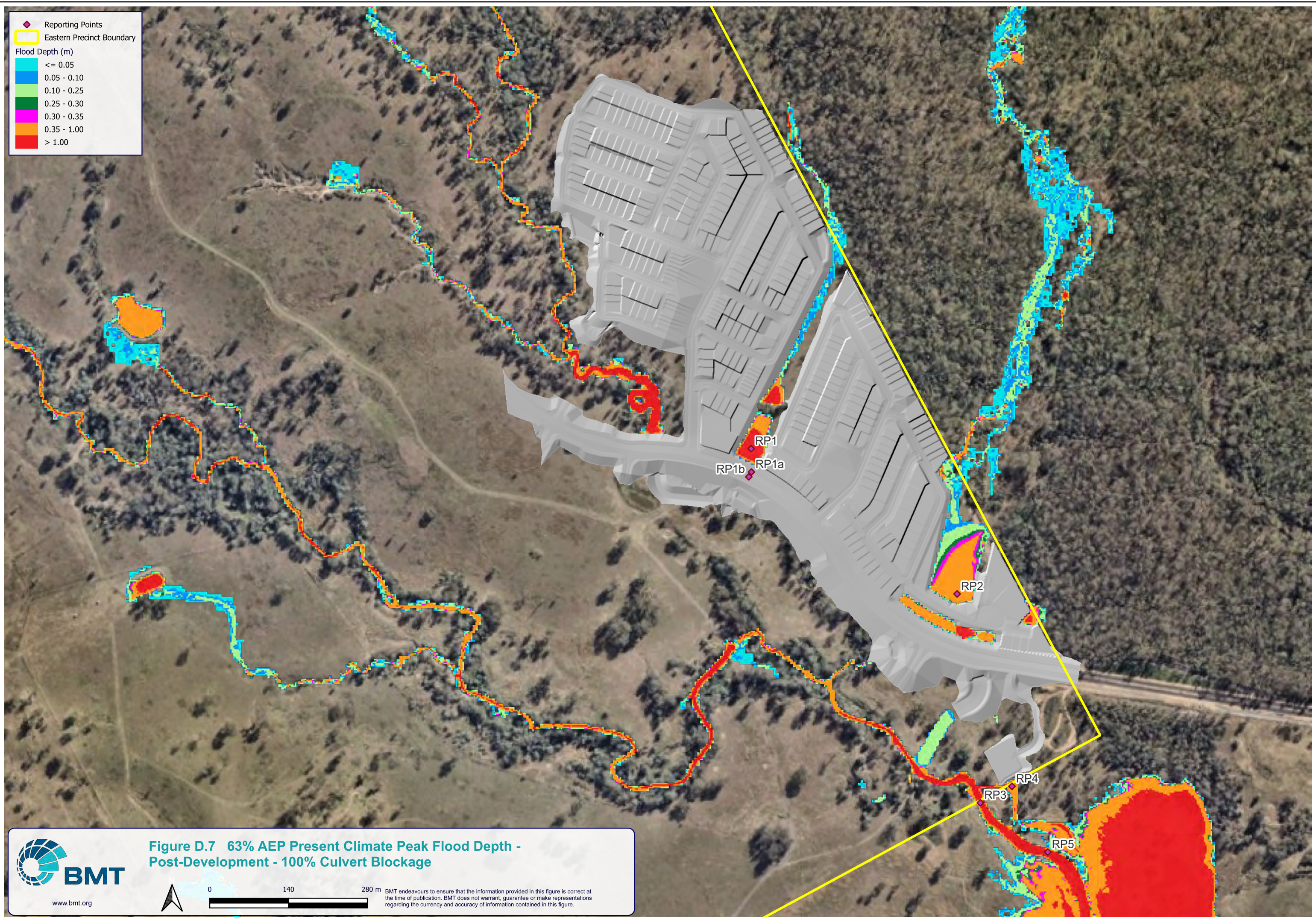


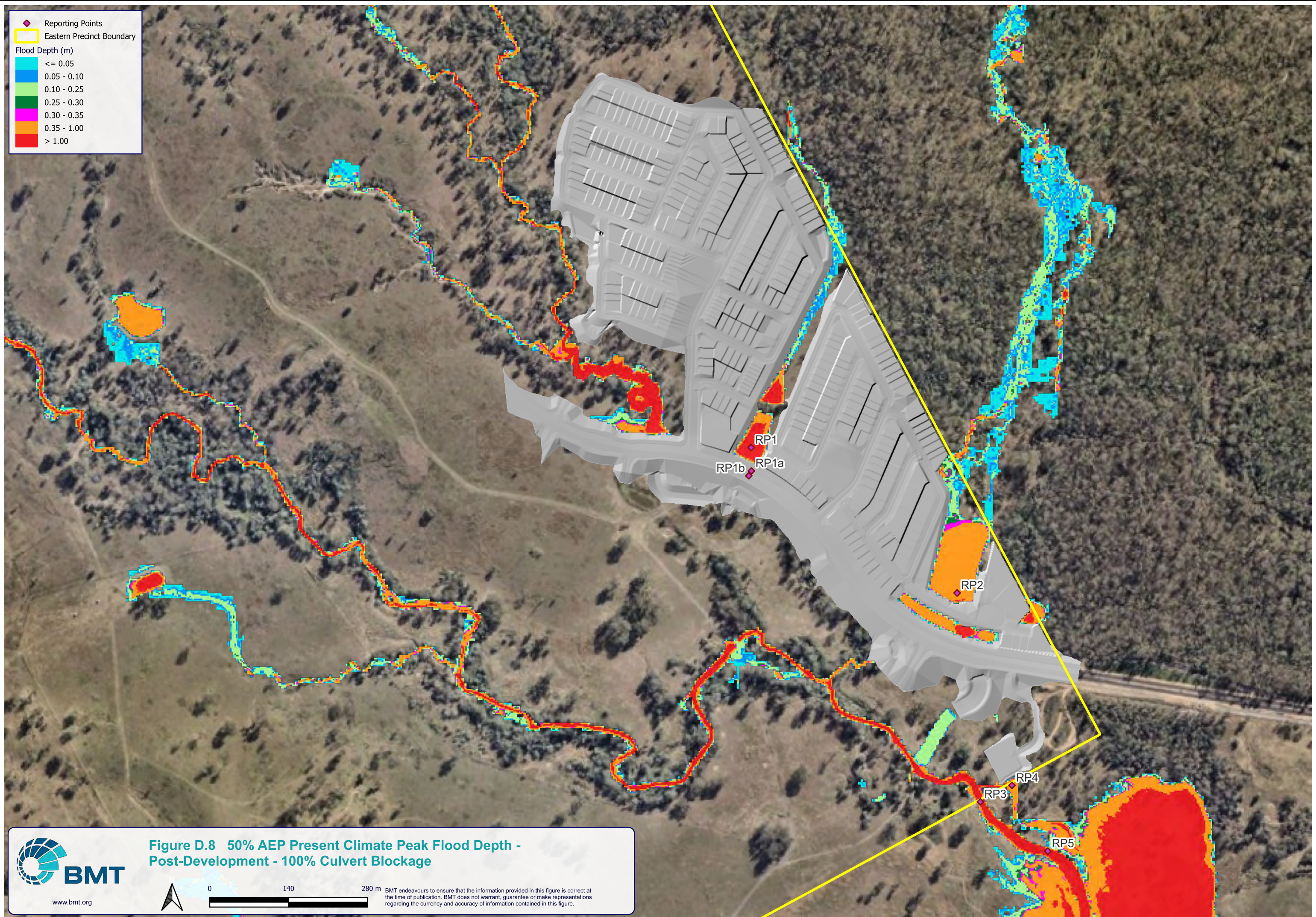












◆ Reporting Points

□ Eastern Precinct Boundary

Flood Depth (m)

Light Blue	<= 0.05
Blue	0.05 - 0.10
Green	0.10 - 0.25
Dark Green	0.25 - 0.30
Magenta	0.30 - 0.35
Orange	0.35 - 1.00
Red	> 1.00

RP1
RP1b RP1a

RP2

RP3 RP4

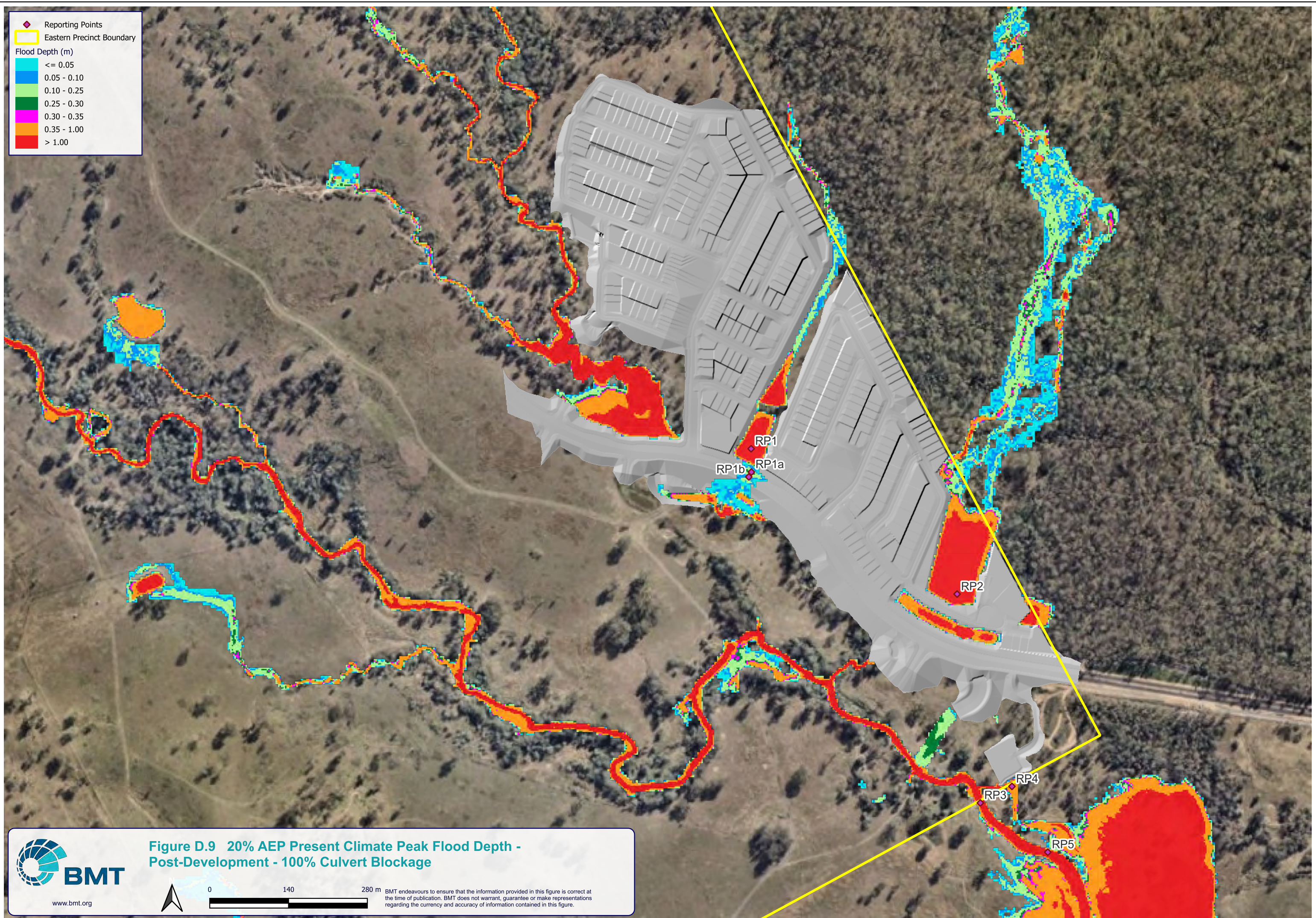
RP5

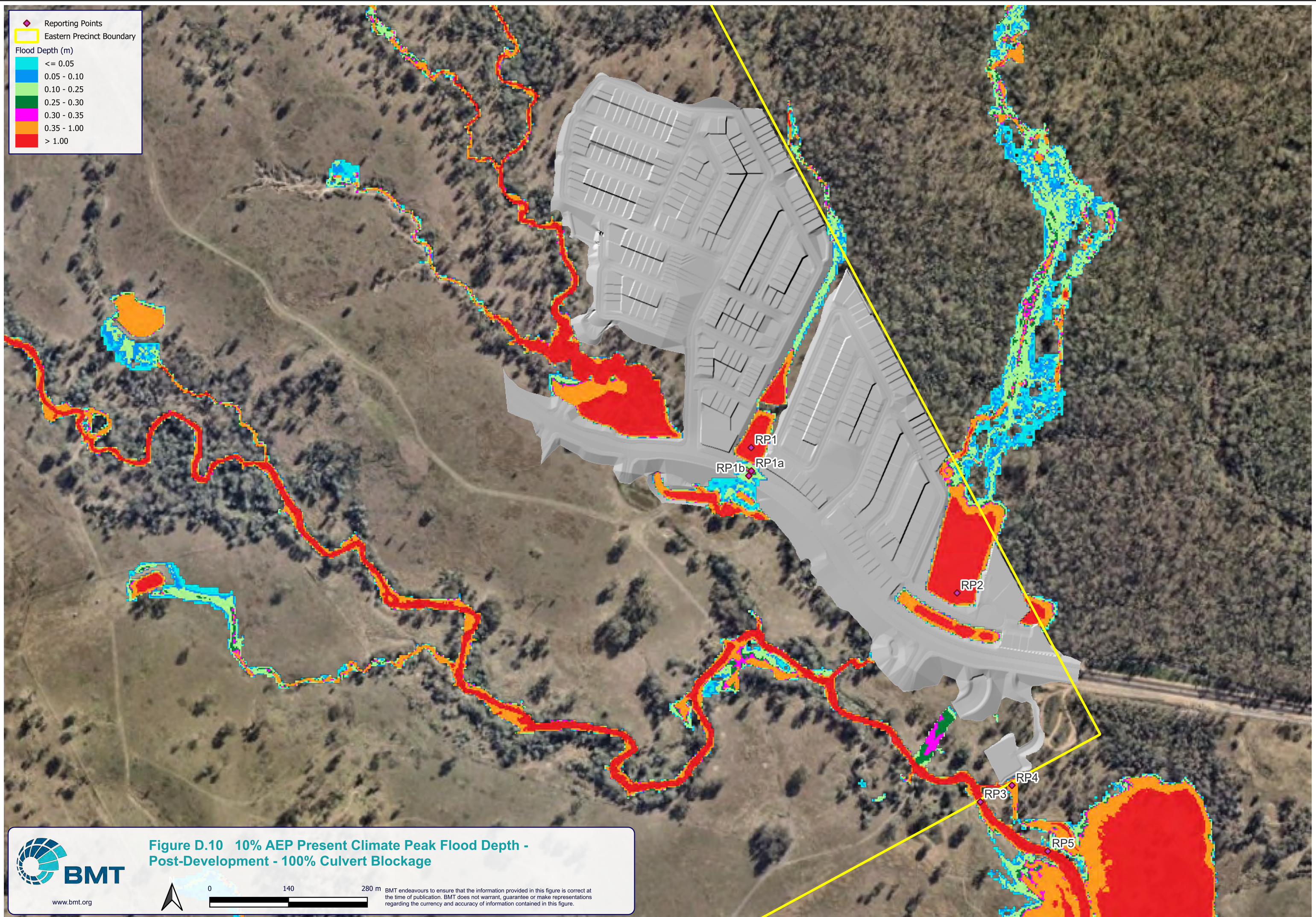


Figure D.8 50% AEP Present Climate Peak Flood Depth - Post-Development - 100% Culvert Blockage



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◆ Reporting Points

□ Eastern Precinct Boundary

Flood Depth (m)

≤ 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.30
0.30 - 0.35
0.35 - 1.00
> 1.00

RP1

RP1b RP1a

RP2

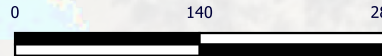
RP3 RP4

RP5

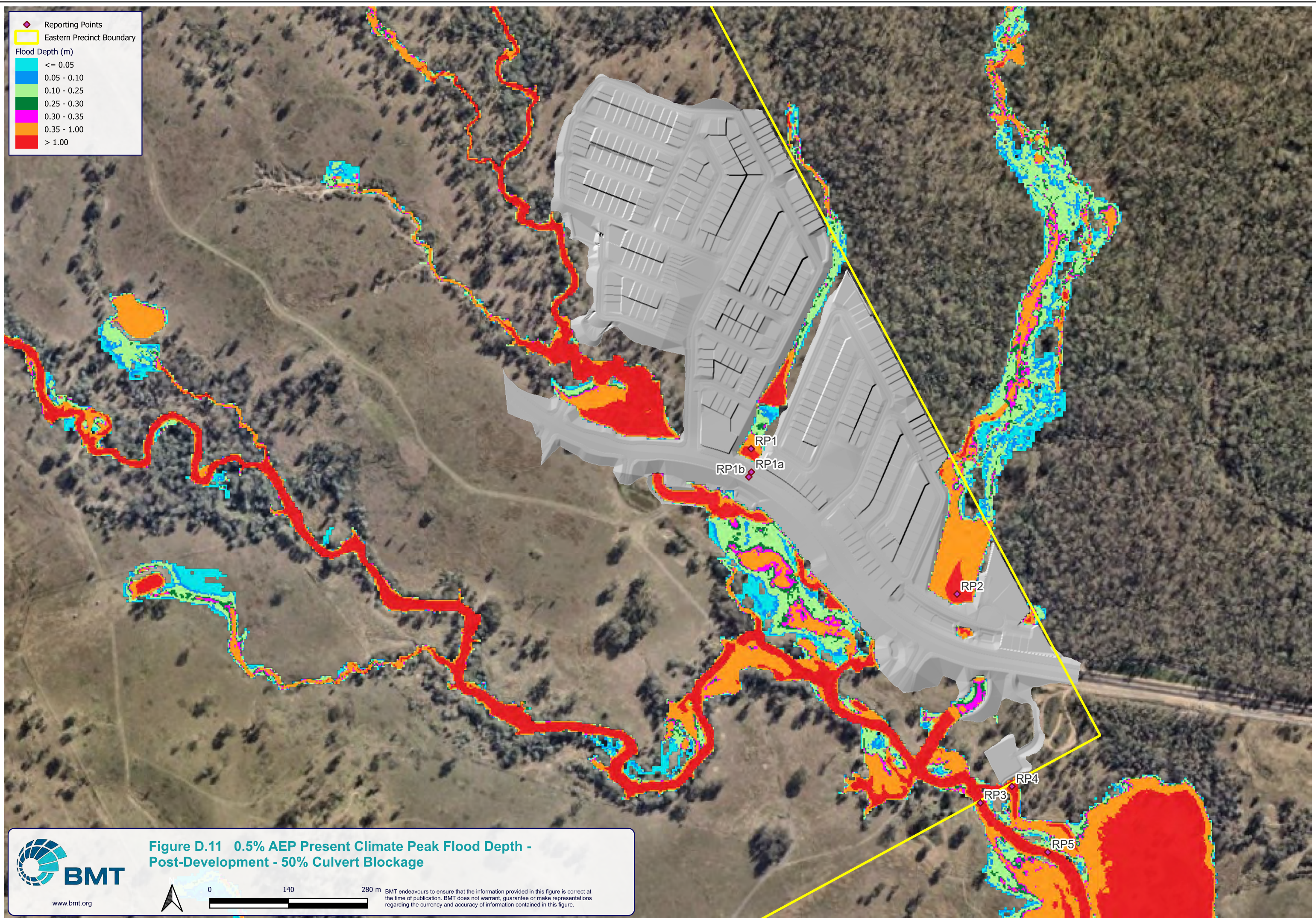


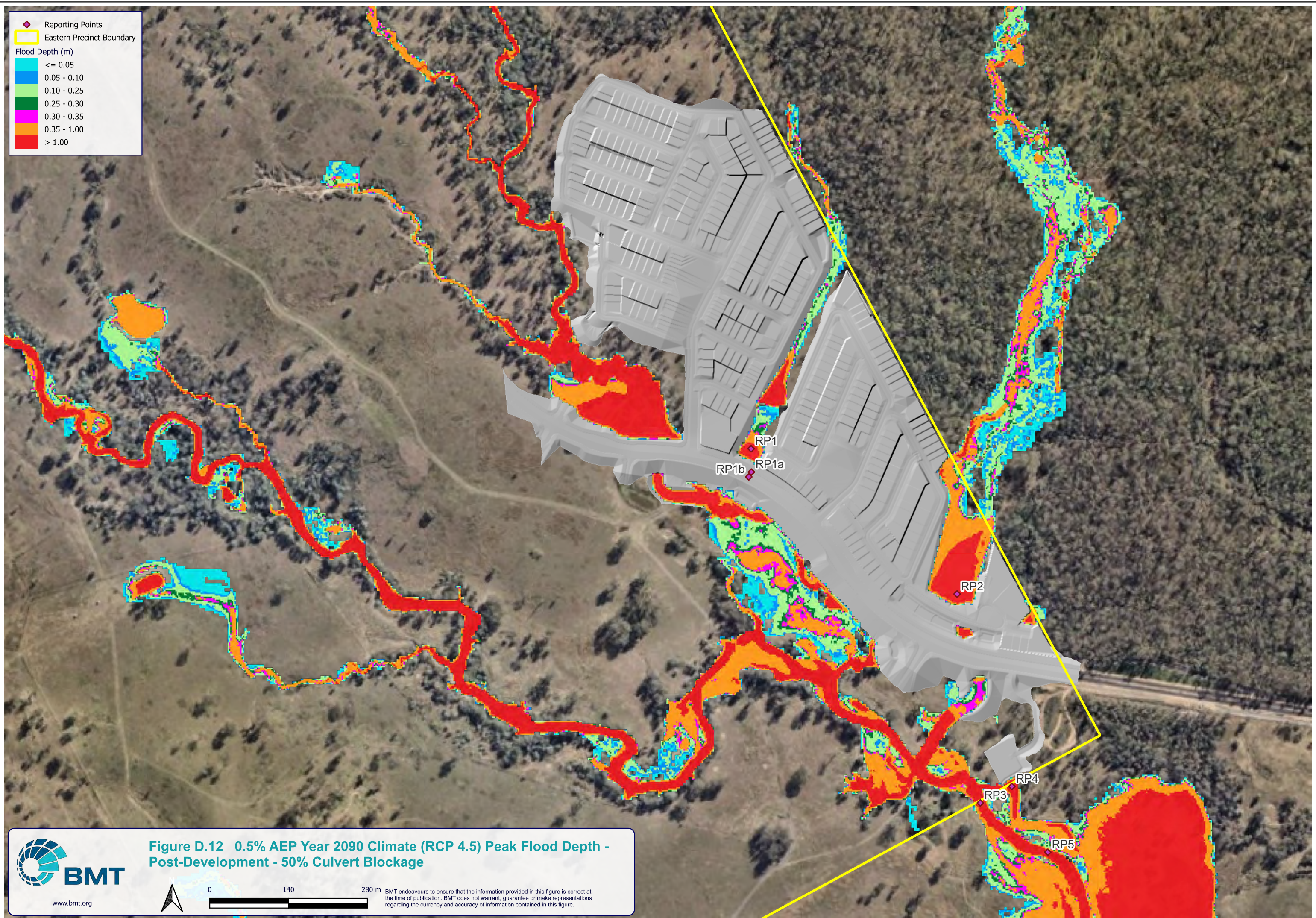
www.bmt.org

Figure D.10 10% AEP Present Climate Peak Flood Depth - Post-Development - 100% Culvert Blockage



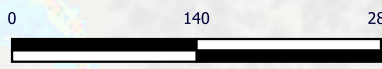
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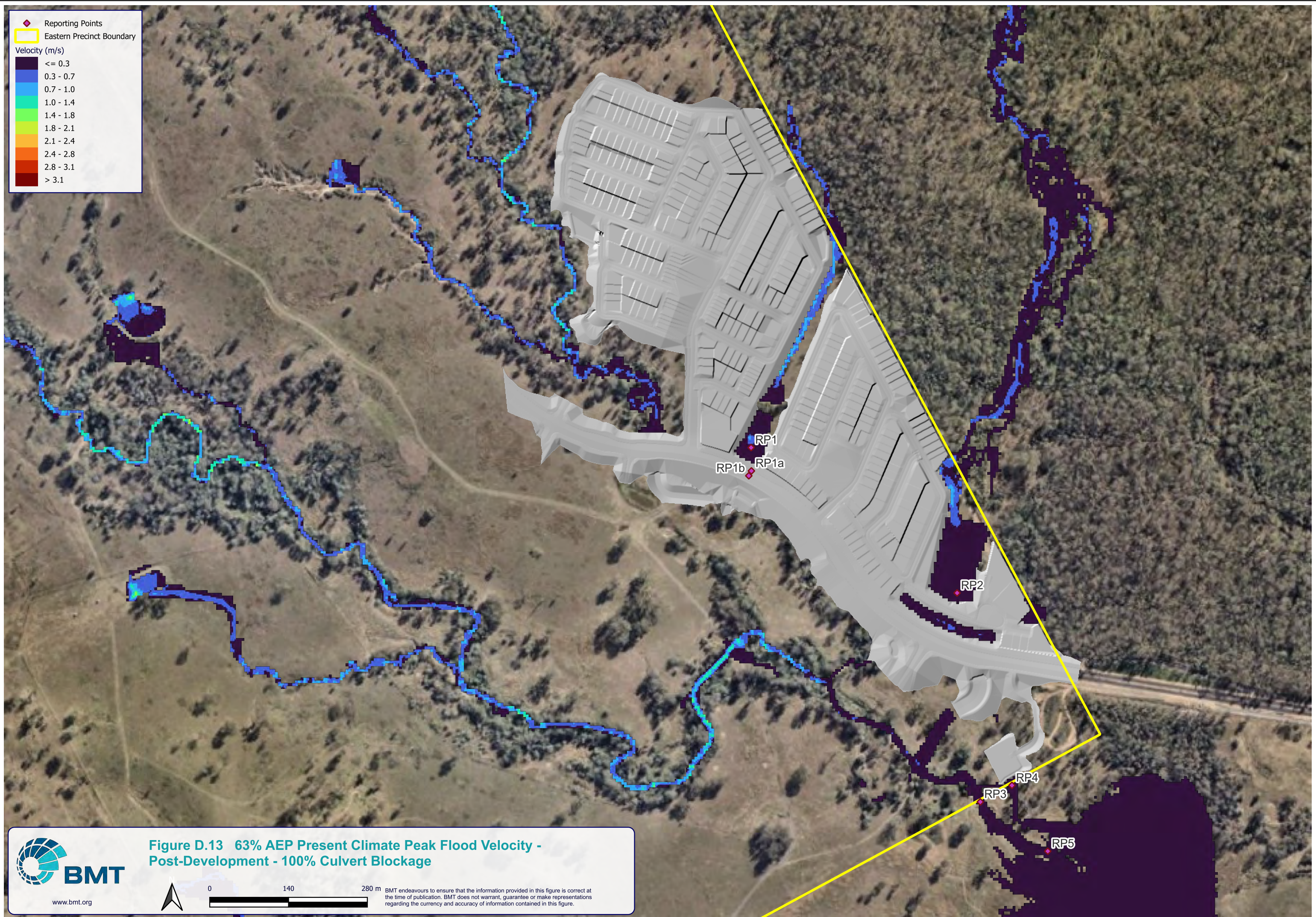


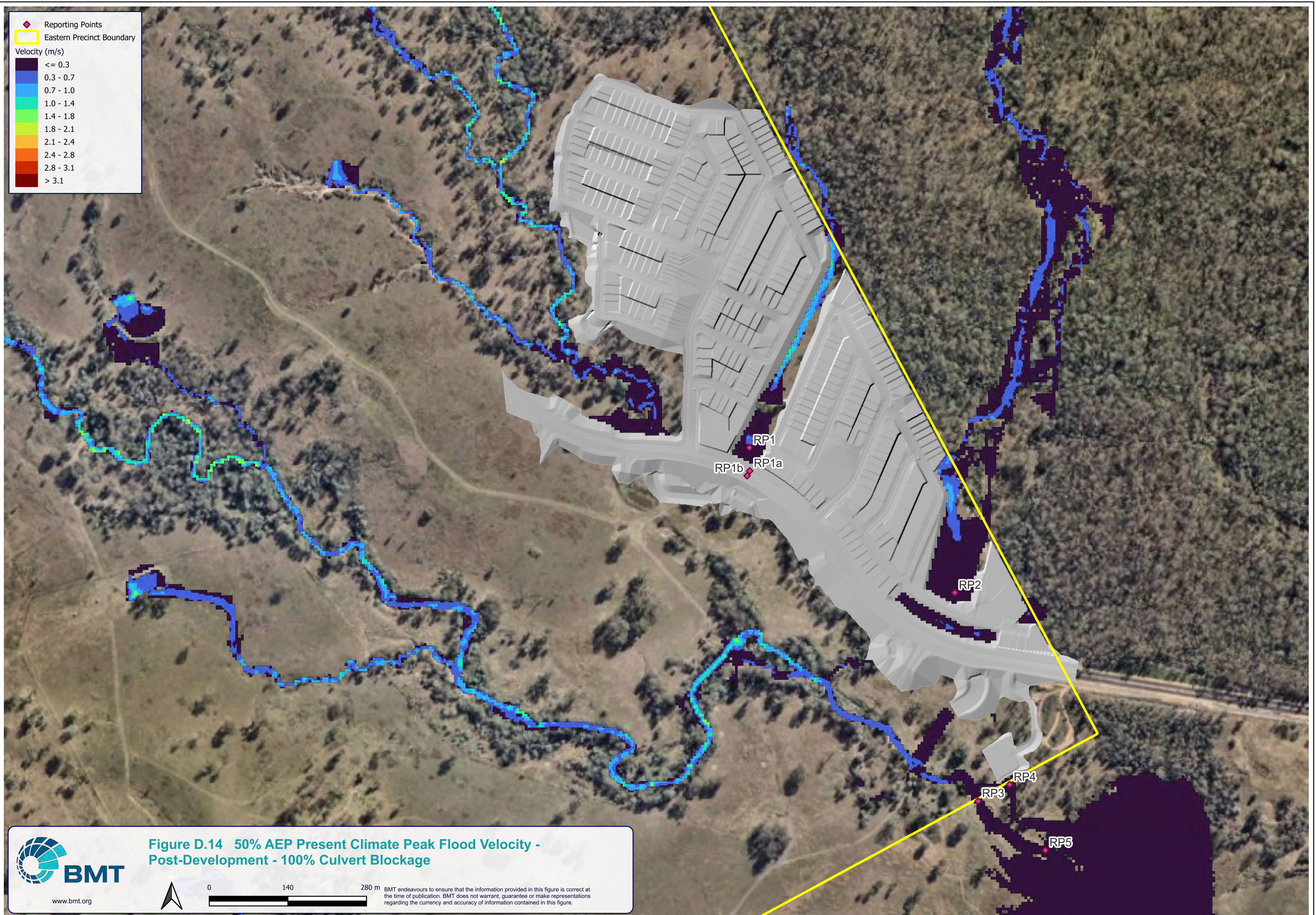
www.bmt.org

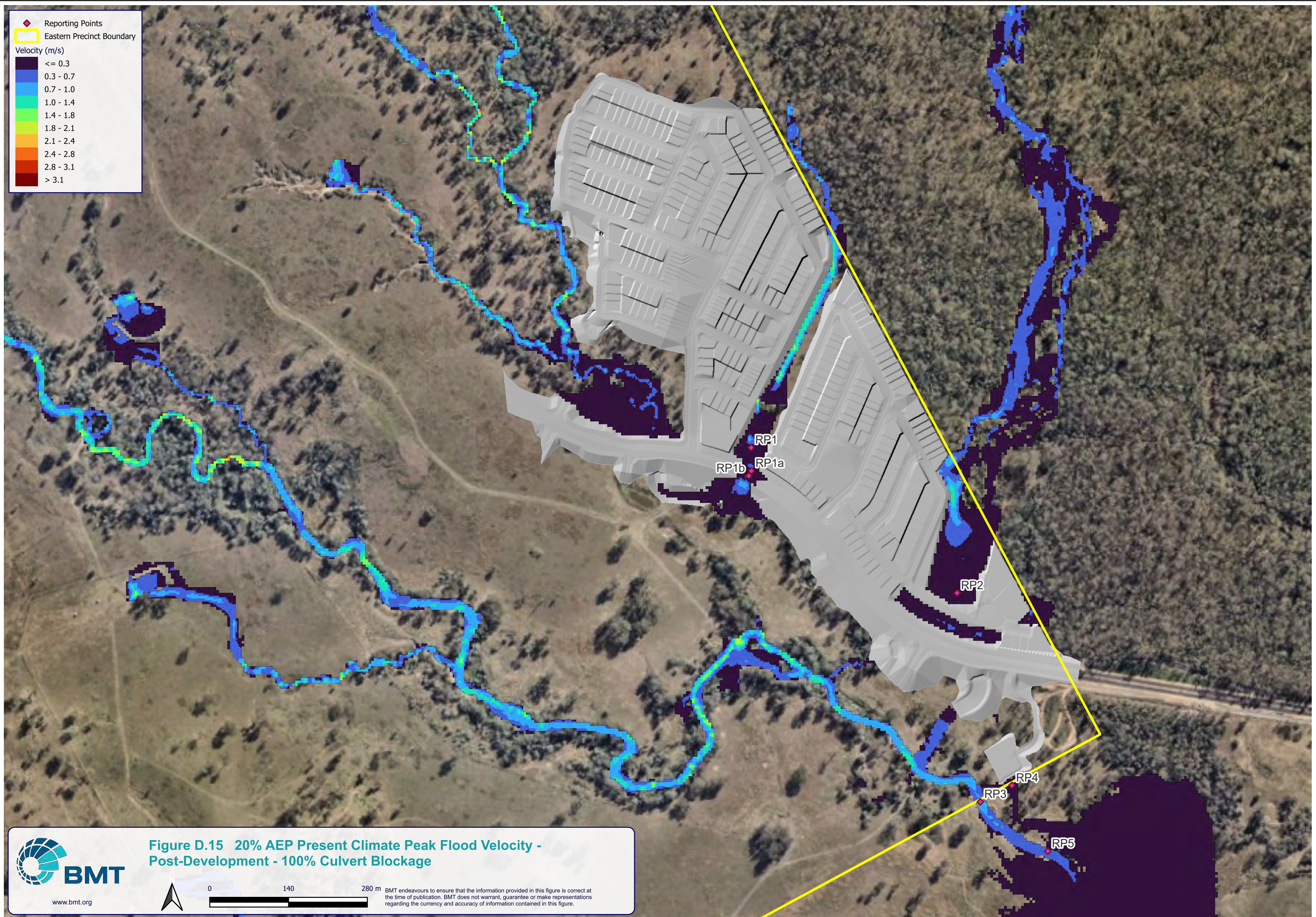
Figure D.12 0.5% AEP Year 2090 Climate (RCP 4.5) Peak Flood Depth - Post-Development - 50% Culvert Blockage



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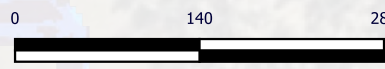




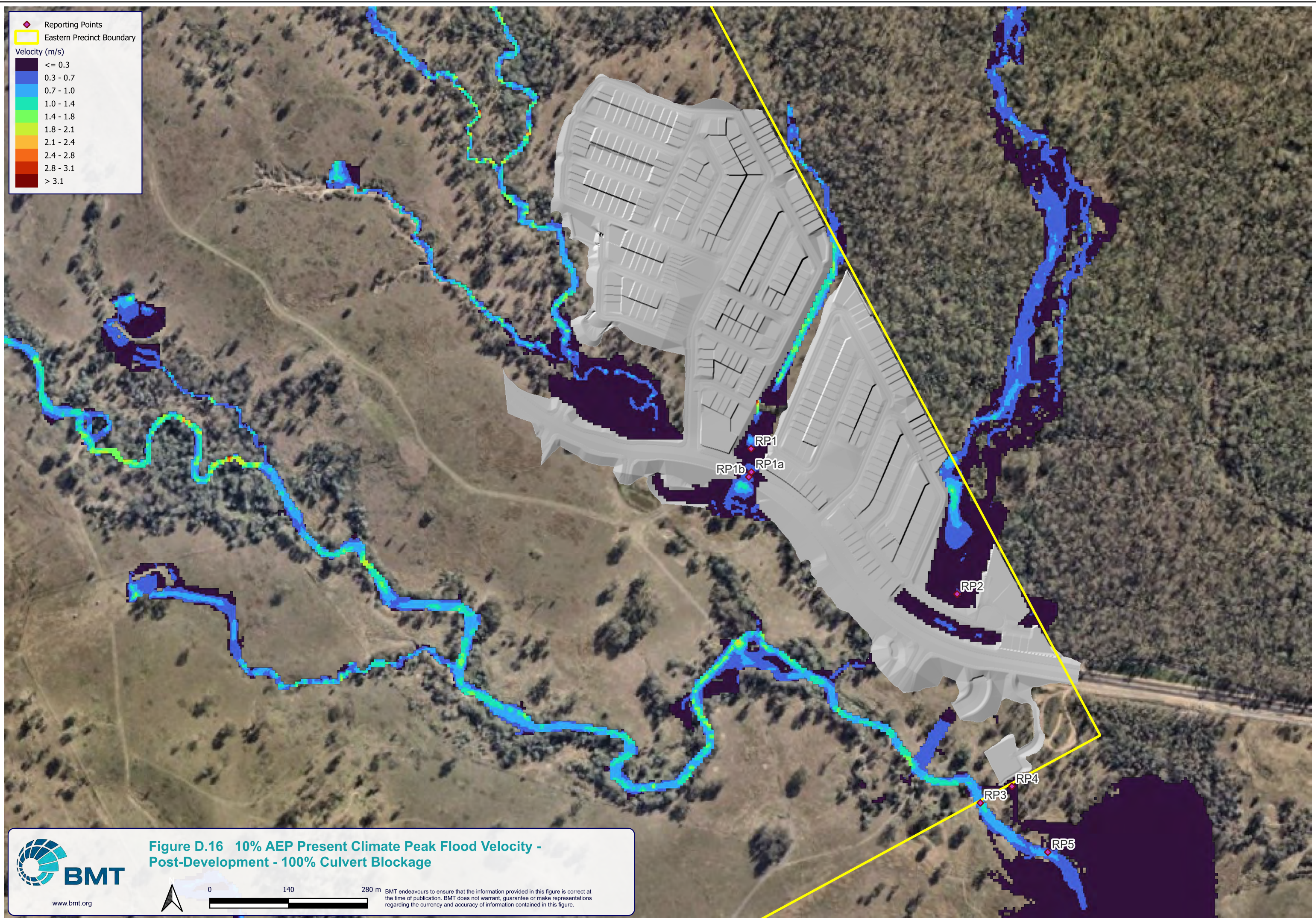


www.bmt.org

Figure D.15 20% AEP Present Climate Peak Flood Velocity - Post-Development - 100% Culvert Blockage



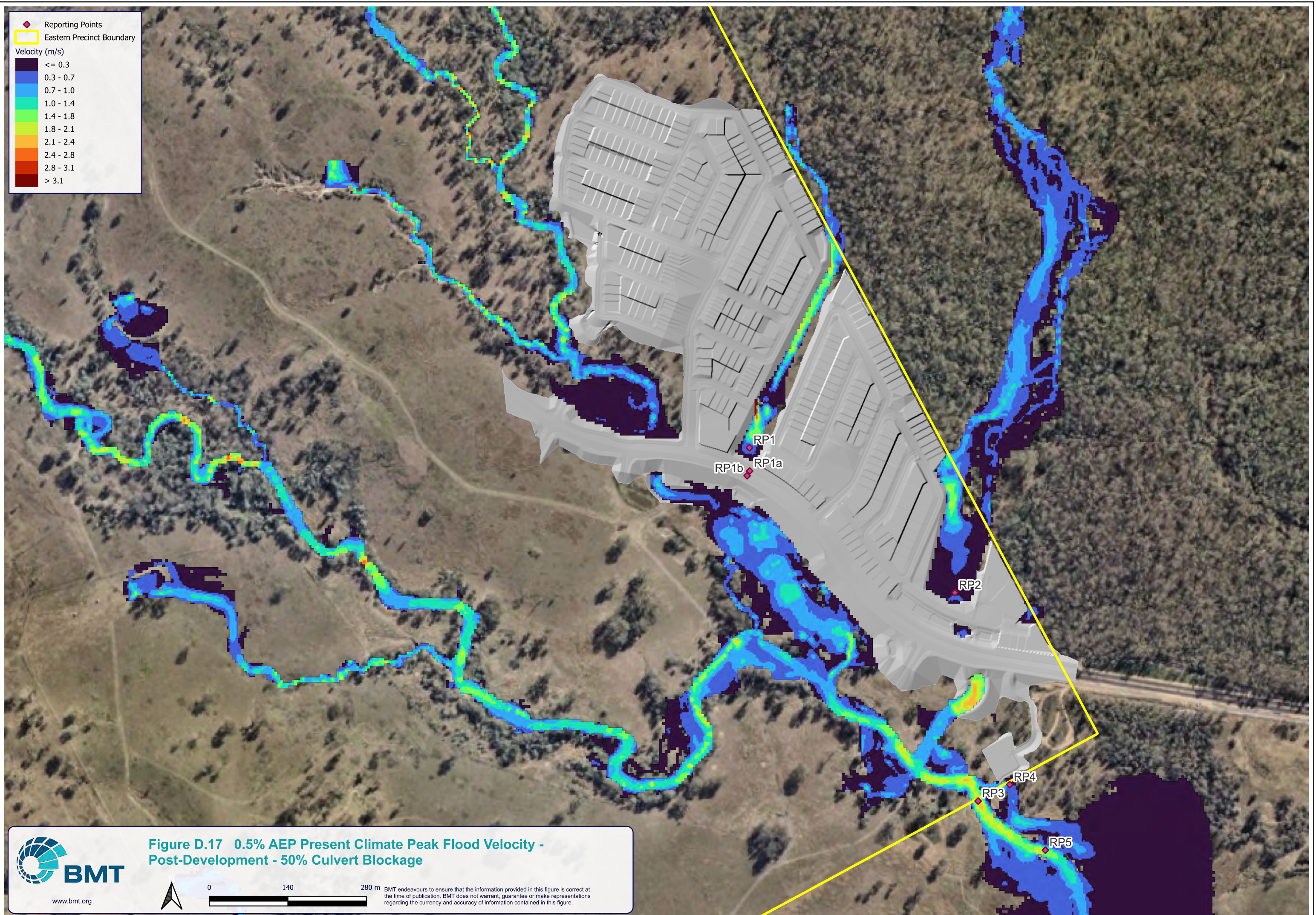
BMT endeavours to ensure that the information provided in this figure is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this figure.

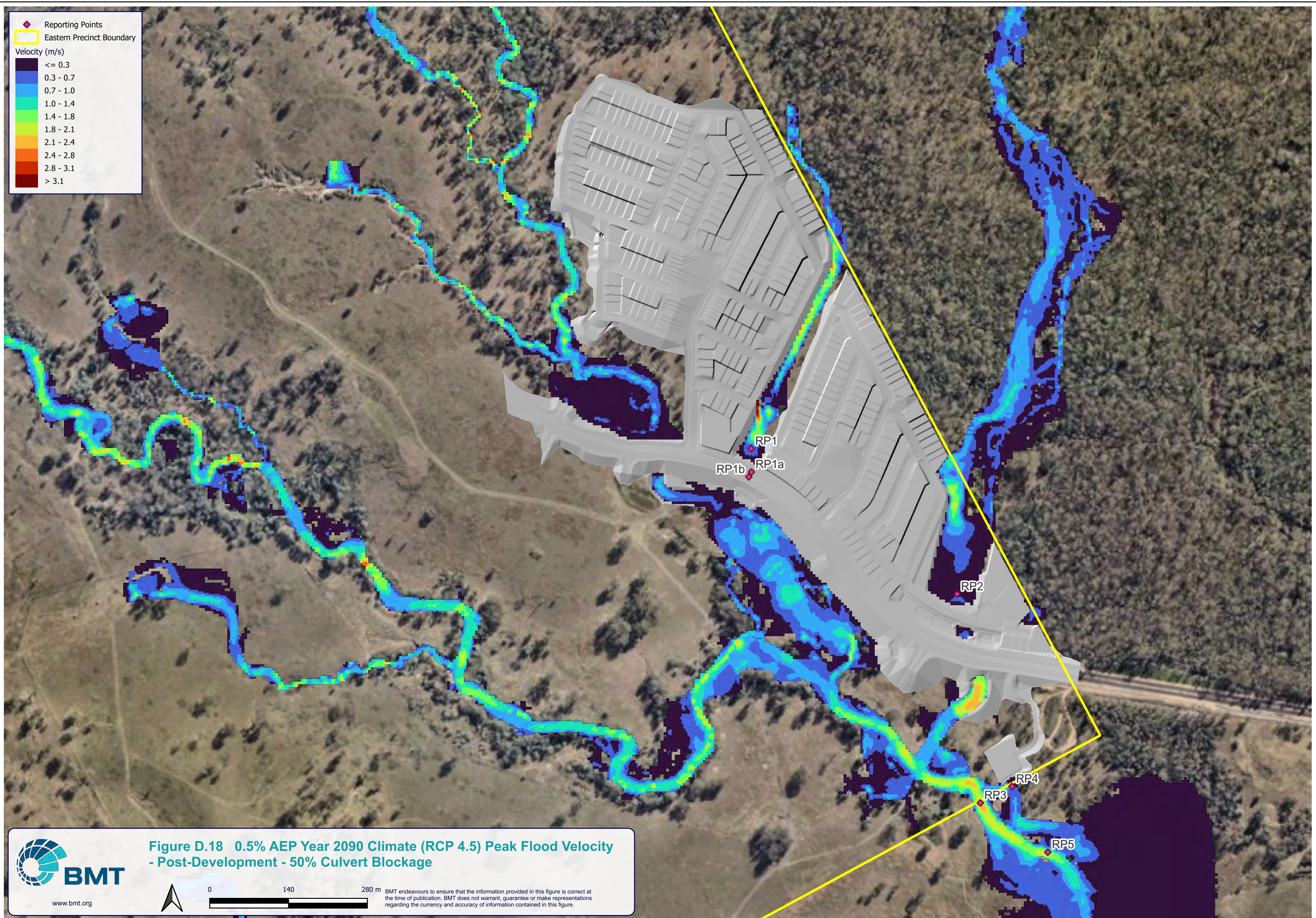


www.bmt.org



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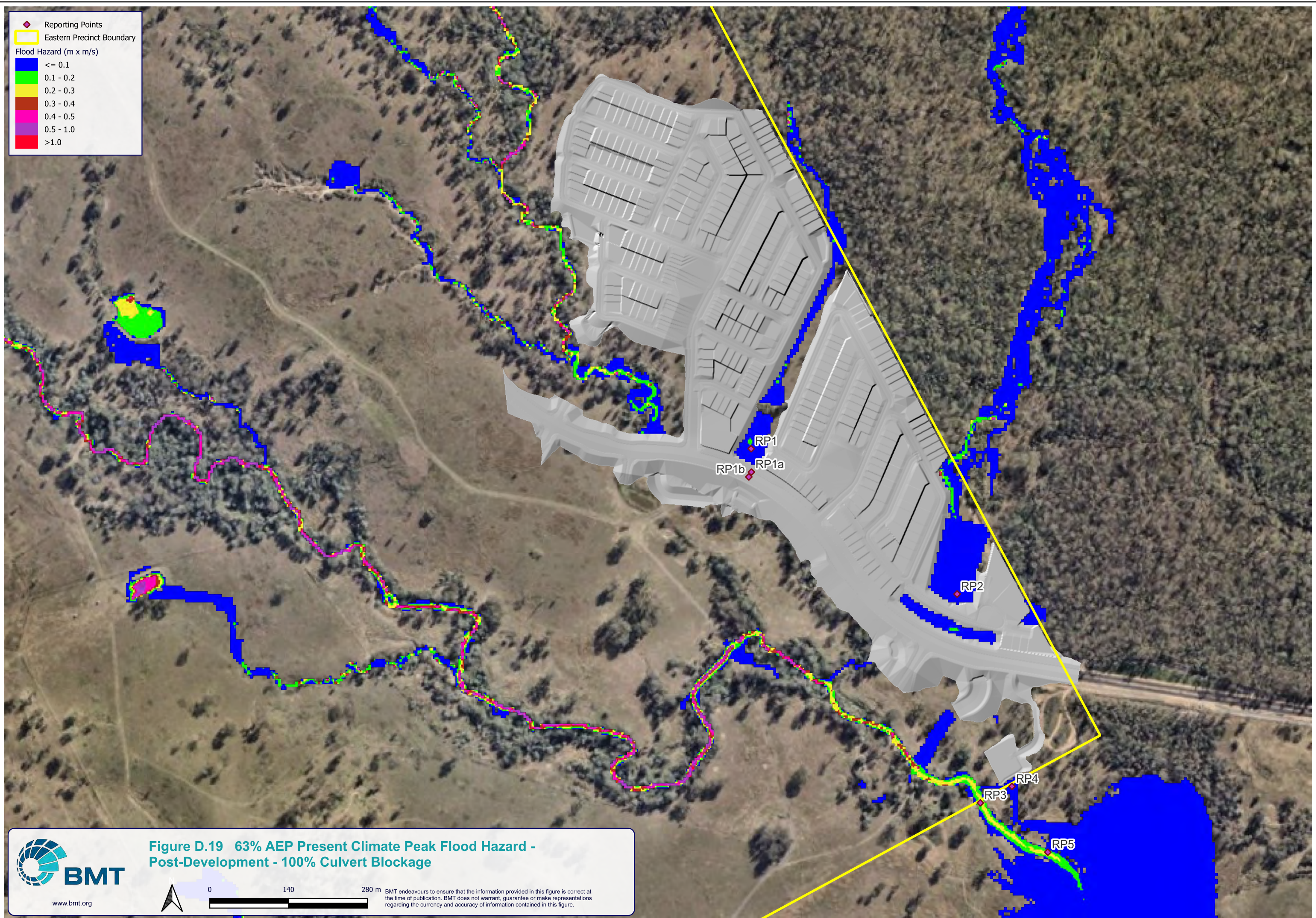




www.bmt.org

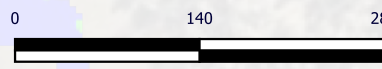


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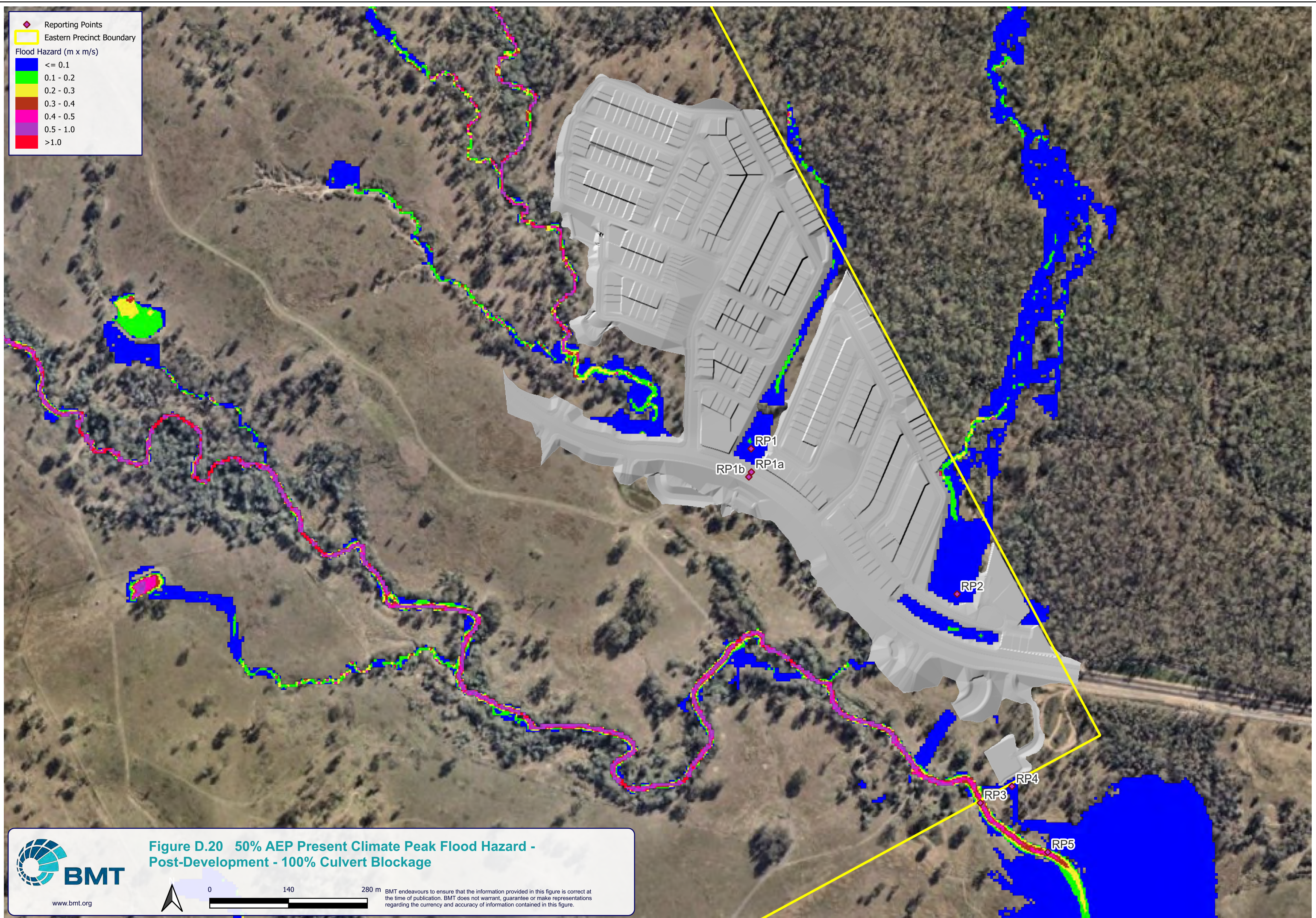


www.bmt.org

Figure D.19 63% AEP Present Climate Peak Flood Hazard - Post-Development - 100% Culvert Blockage

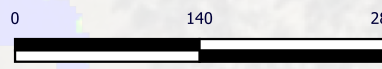


BMT endeavours to ensure that the information provided in this figure is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this figure.

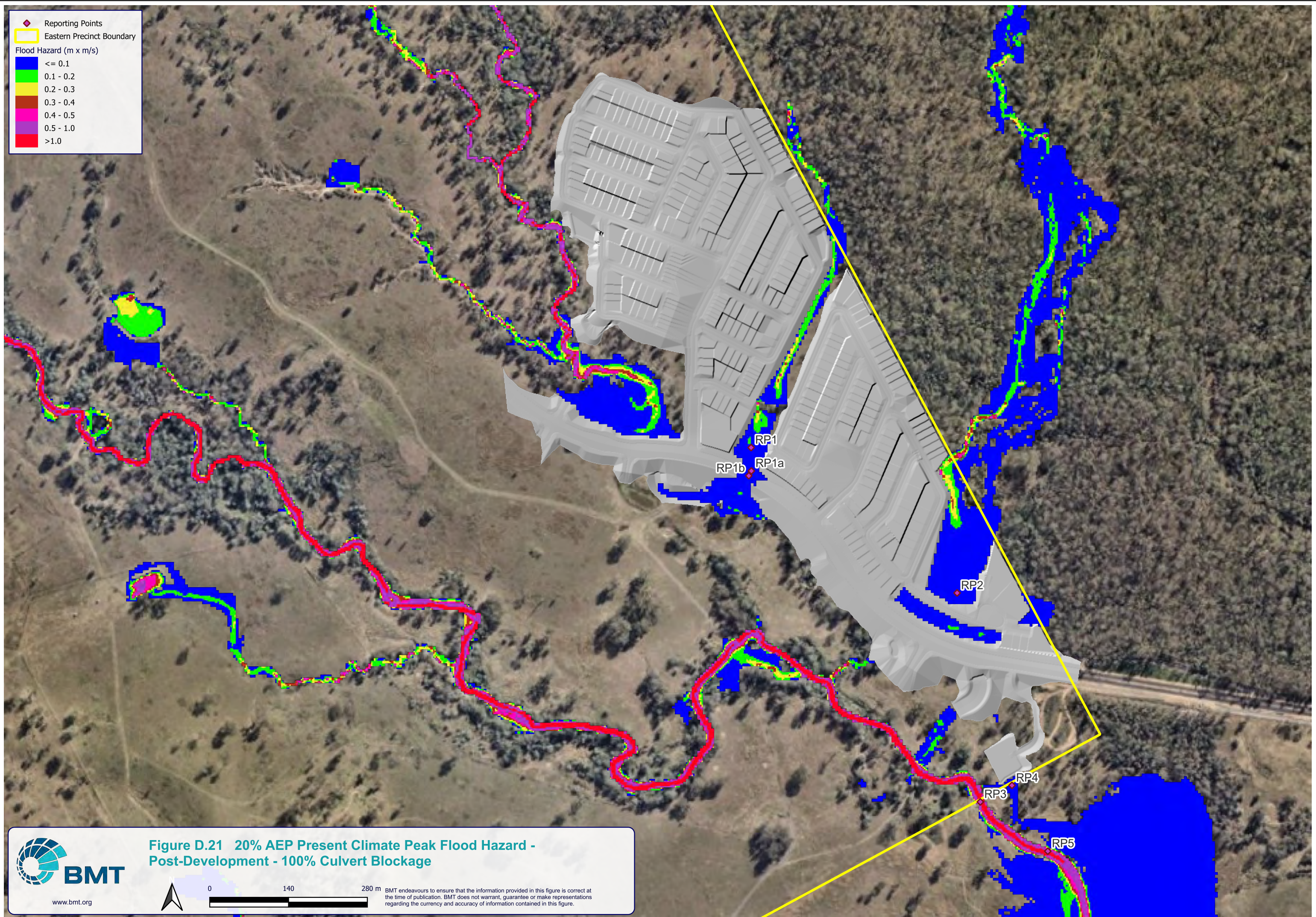


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Figure D.20 50% AEP Present Climate Peak Flood Hazard - Post-Development - 100% Culvert Blockage



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◆ Reporting Points

□ Eastern Precinct Boundary

Flood Hazard (m x m/s)

Blue	<= 0.1
Green	0.1 - 0.2
Yellow	0.2 - 0.3
Orange	0.3 - 0.4
Red	0.4 - 0.5
Purple	0.5 - 1.0
Dark Red	>1.0

RP1
RP1b RP1a
RP2
RP3
RP4
RP5

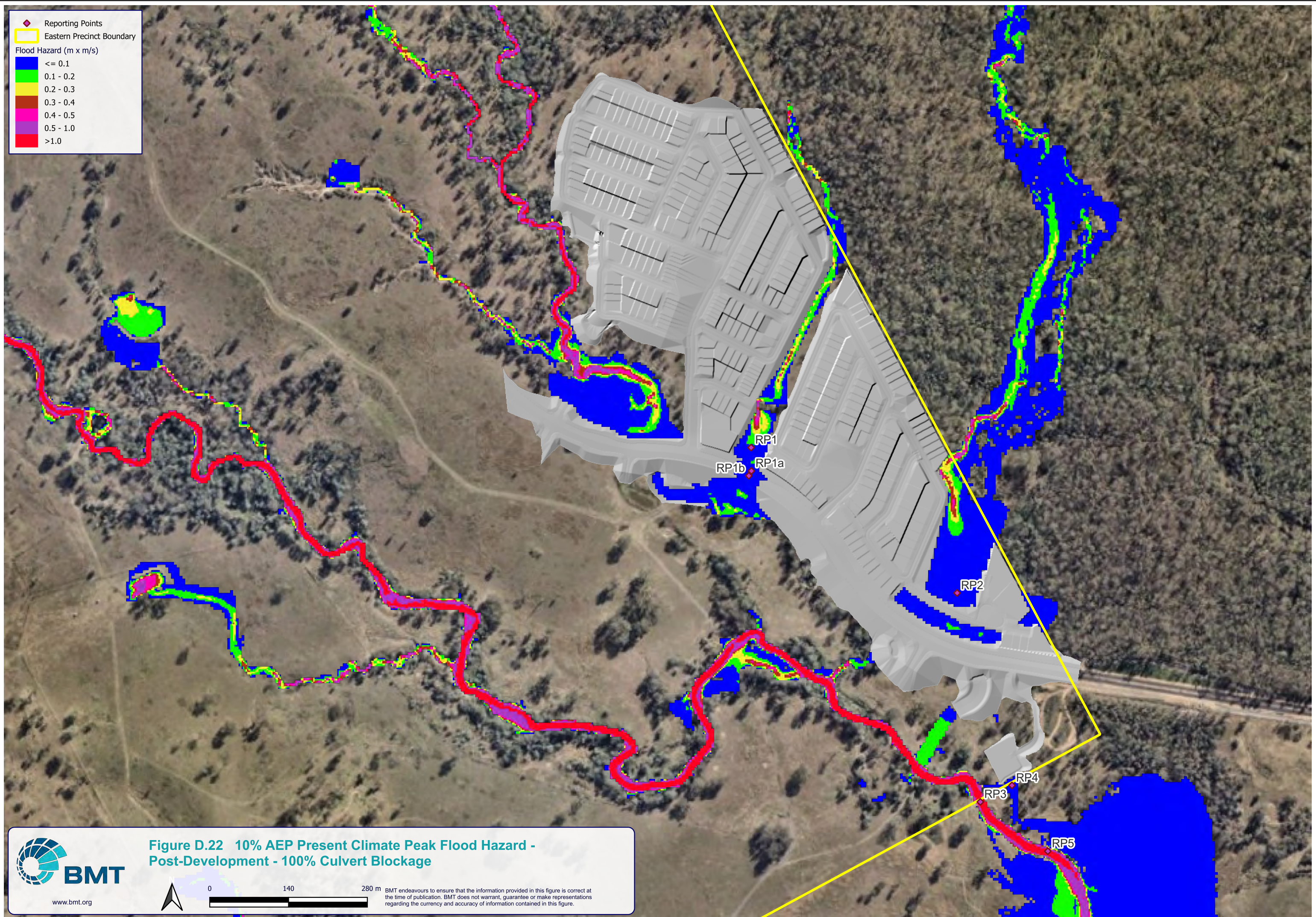


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Figure D.21 20% AEP Present Climate Peak Flood Hazard - Post-Development - 100% Culvert Blockage

0 140 280 m

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◆ Reporting Points

□ Eastern Precinct Boundary

Flood Hazard (m x m/s)

Blue	<= 0.1
Green	0.1 - 0.2
Yellow	0.2 - 0.3
Orange	0.3 - 0.4
Red	0.4 - 0.5
Purple	0.5 - 1.0
Dark Red	>1.0

RP1
RP1b RP1a
RP2
RP3
RP4
RP5



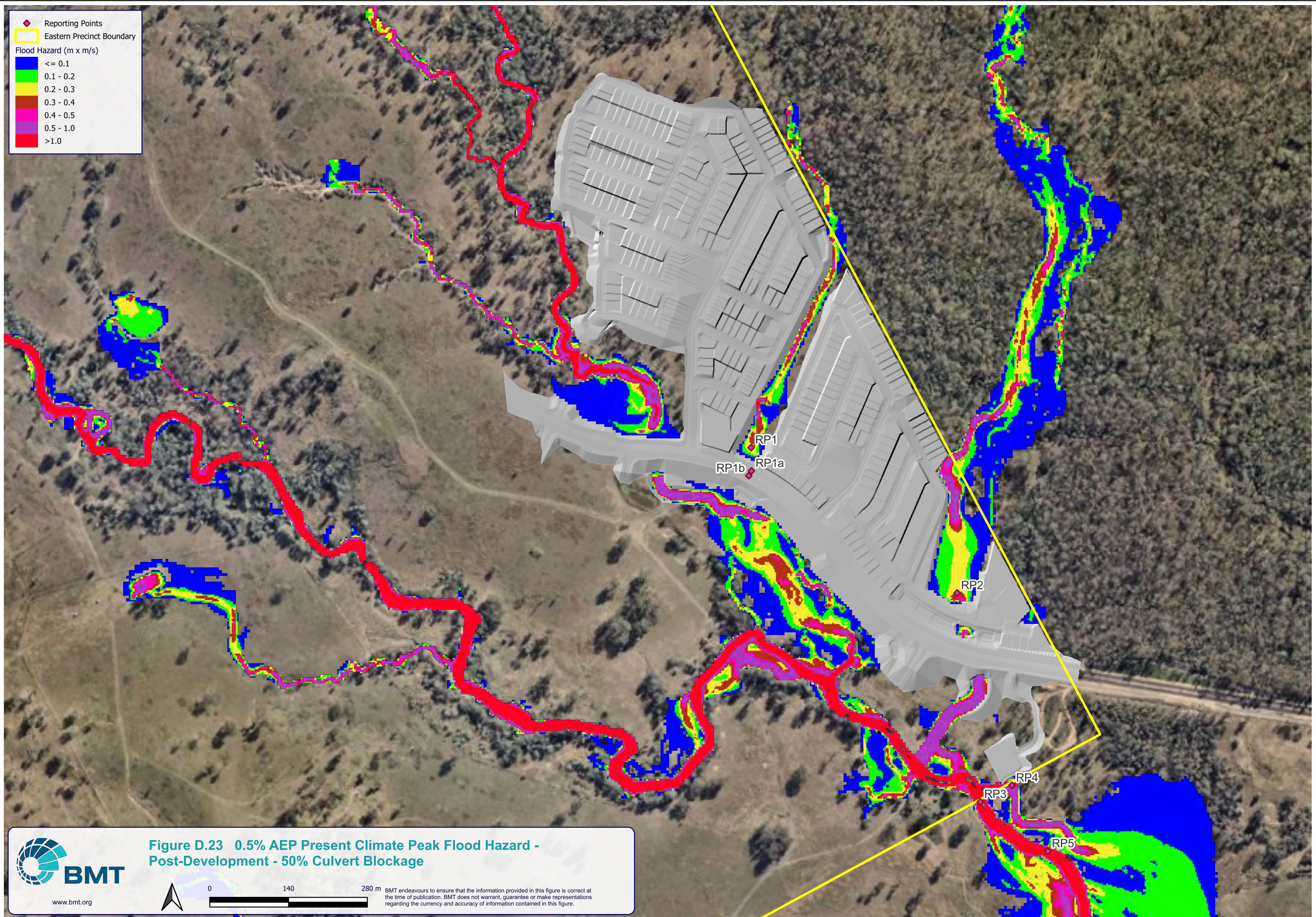
www.bmt.org

Figure D.22 10% AEP Present Climate Peak Flood Hazard - Post-Development - 100% Culvert Blockage



0 140 280 m

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- Reporting Points
- Eastern Precinct Boundary
- Flood Hazard (m x m/s)
- <= 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 1.0
- >1.0

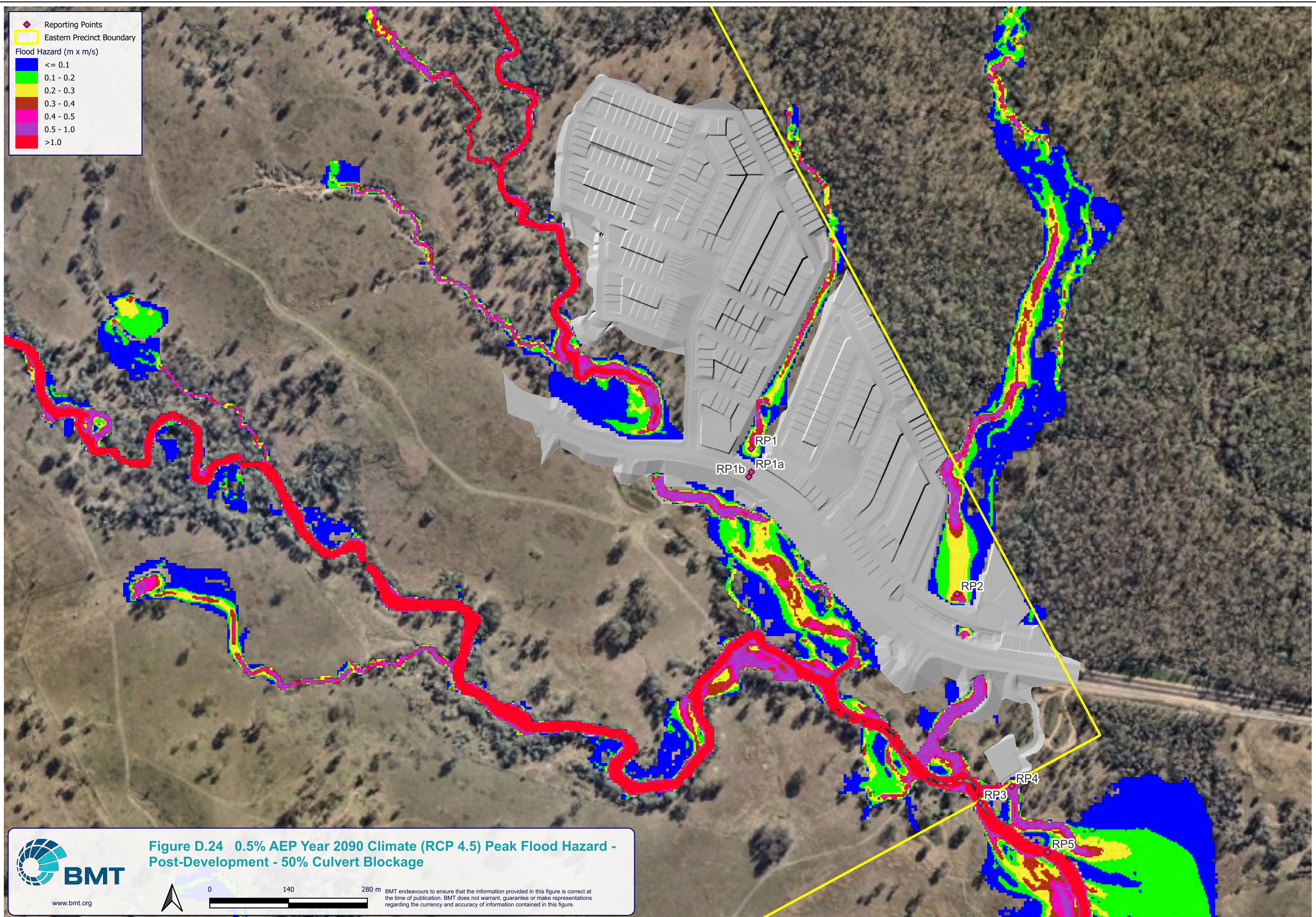
RP1
RP1b
RP1a
RP2
RP3
RP4
RP5

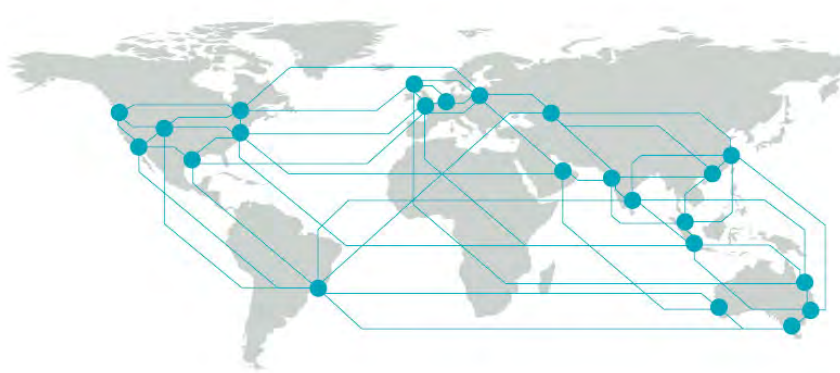


Figure D.23 0.5% AEP Present Climate Peak Flood Hazard - Post-Development - 50% Culvert Blockage



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Level 5
348 Edward Street
Brisbane
QLD 4000
Australia
+61 7 3831 6744

Registered in Australia
Registered no. 010 830 421
Registered office
Level 5, 348 Edward Street,
Brisbane QLD 4000 Australia

For your local BMT office visit www.bmt.org

Contact us

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