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2 Karingal Drive, Pimpama

Hydraulic Impact Assessment

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Executive Summary

Burchills Engineering Solutions were engaged by BJS Gets Richer Pty Ltd to prepare a Hydraulic Impact Assessment (HIA) for the design of the 71 lot multi-unit townhouse development over 2 Karingal Drive, Pimpama properly described as Lot 19 on RP 152380.

This HIA aims to show that the proposed development meets the requirements set out by the Gold Coast City Plan (Version 7). This has been achieved through hydraulic modelling of the pre and post-development scenario, and through adjusted earthworks designs to achieve flood storage balance.

This HIA has made the following conclusions relating to flooding at the subject site:

- The proposed development has no adverse impacts on existing regional hydraulic conditions;
- Afflux is generally contained within the subject site, and any afflux external to the site is within acceptable limits; and
- Flood storage is maintained.

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1. Introduction

Burchills Engineering Solutions were engaged by BJS Gets Richer Pty Ltd to prepare a Hydraulic Impact Assessment (HIA) for the design of the 71 lot multi-unit townhouse development over 2 Karingal Drive, Pimpama properly described as Lot 19 on RP 152380.

This HIA will detail the impacts of the proposed works on the existing flooding regime in relation to the proposed development.

1.1 Scope

This HIA has been undertaken in accordance with the following scope:

- Assessment of Existing Flooding Conditions
- Regional Model Development
    - Construct a RAFTS model for contributing catchments;
    - Construct a TUFLOW model to asses the impact of the proposed works;
- Review of Model Results
    - Review of modelling results, including water level impacts, velocity impacts, hazards and modelling inefficiencies.
- Report and Mapping
    - Presentation of pre-development and post-development flood extents, depths, and velocities (where applicable);
    - Impact assessment including afflux contours; and
    - Review of any impacts resulting from the proposal in the context of whether such afflux may give rise to changes in flood damage, risk or hazard.

1.2 Development Description

The proposed development consists of 71 multi-unit residential townhouses to be established under a Community Title Scheme. The development proposes a series of internal private roadways and associated car parking; where the development is generally positioned around the central waterway.

An overview plan of the design prepared by Brian Johnston Plan Design Pty LTD is shown in Figure 1.1 below. For further details regarding the plan of redesign, please refer to the complete design drawing prepared by Brian Johnston Plan Design Pty LTD for the proposed development attached as Appendix B of this report.

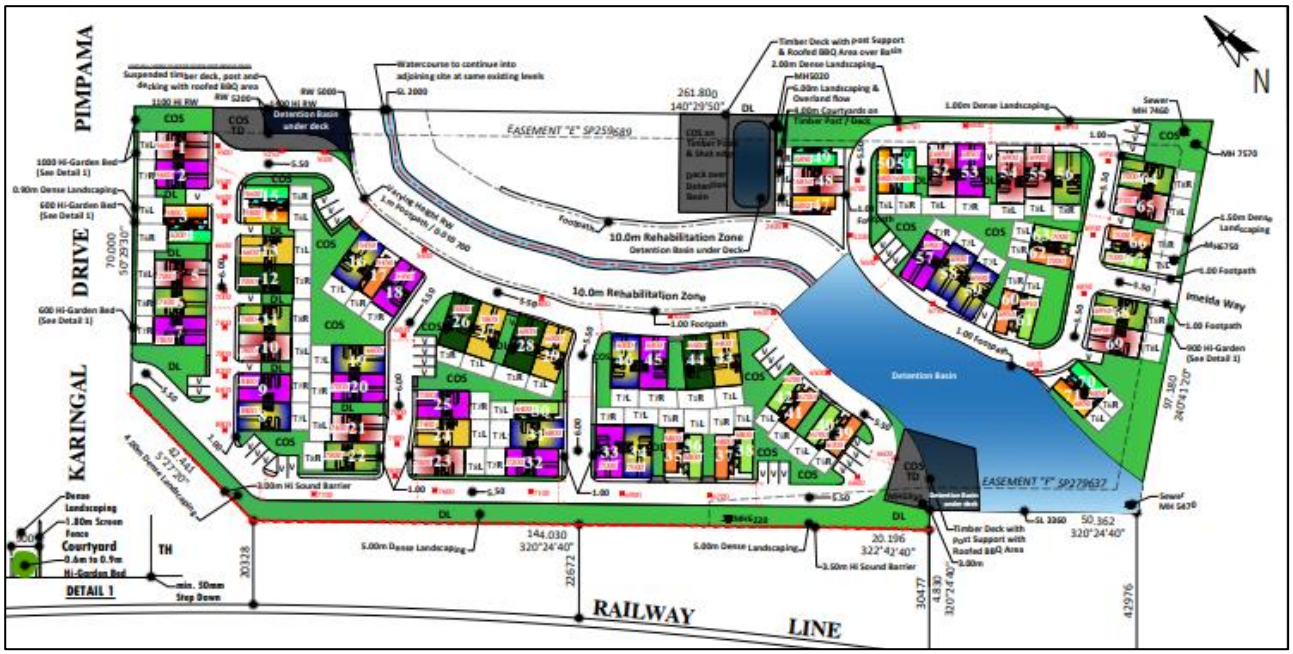


Figure 1.1 Overview Plan (Courtesy: Brian Johnston Plan Design Pty LTD)

1.3 Designated Flood Level

Councils Defined Flood Level model does not cover the subject site, so a hydrological a RAFTS model has been developed and calibrated using the Rational Method to validate runoff from the sub-catchments. The hydrology was then used in a 2Dimensional TUFLOW model to establish peak flood levels across the site and assess impacts of the proposed development.

Figure 1.2 (below) provides an extract of the City Plan's Flood Overlay depicting the extent of flooding in relation to the subject site and the surrounding road network.

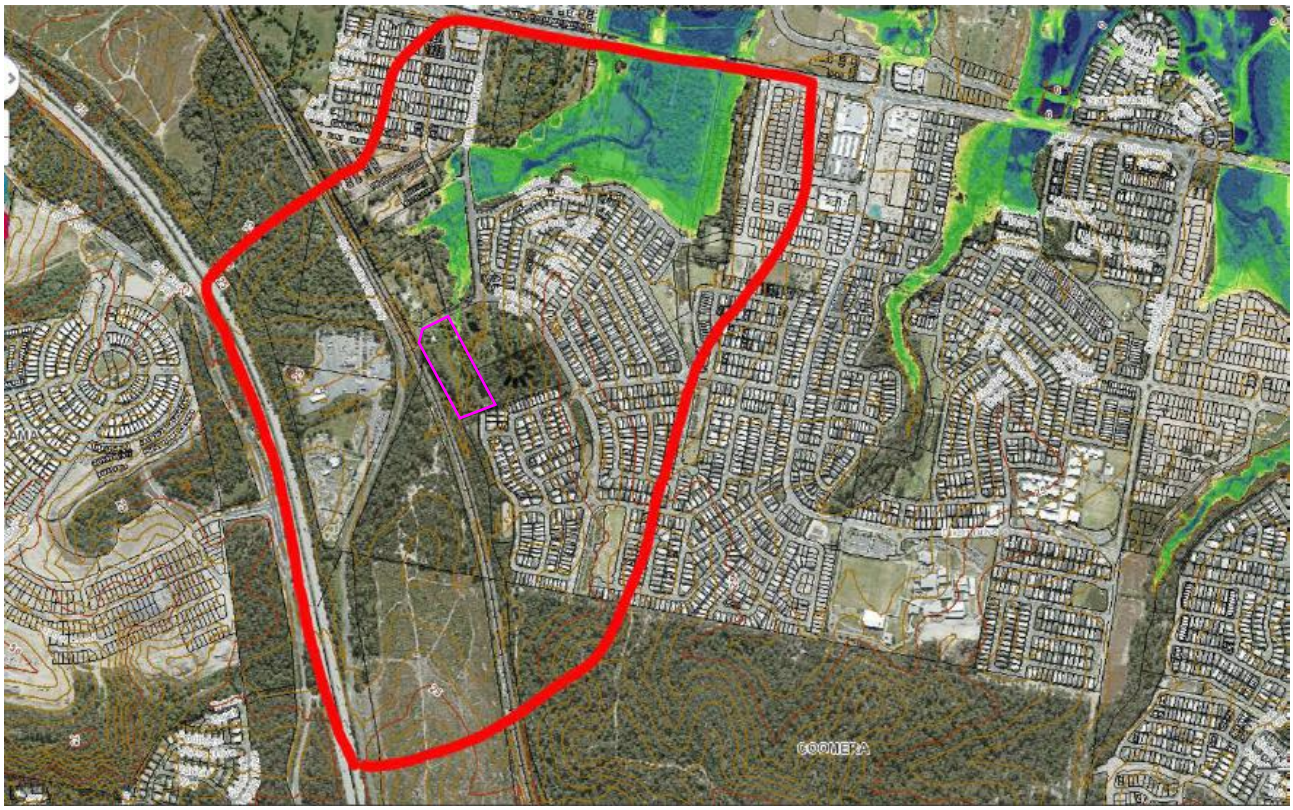


Figure 1.2 Gold Coast City Plan Flood Depth Overlay Map

2. Local Catchment Hydrology

A catchment plan for the local catchments have been prepared and presented in Appendix C.

Flows from the upstream catchments are conveyed to the site through a drainage system under the Pacific Motorway, Old Pacific Motorway and the Railway Line. The catchment details are summarised in Table 2.1 and Table 2.2 shows the comparison of XP-RAFTS and Rational Method peak flows from the 1% AEP event. The upstream catchment permeability has been set using the current land use plan published in the City Plan.

A RAFTS runoff hydrologic model has been set up and calibrated to the Rational Method to validate runoff from the sub-catchments for the 1% AEP event.

Table 2.1 Local Sub-Catchment Hydrology

Catchment Name	Percentage Impervious (%)	Catchment Slope (%)	Area (ha)
1	58.8	2.7	5.42
2	13.6	3.3	3.37
3	11.9	7.2	5.72
4	53.3	4.4	9.67
5	3.0	4.3	16.90
6	30.0	10.4	16.01
7	15.0	3.5	12.74
8	5.6	5.8	15.33
9	3.0	6.7	13.90
10	0.0	2.1	7.58
11	39.4	3.6	4.00
12	15.0	7.9	15.77
13	17.4	5.7	13.24
14	60.0	4.6	8.49
15	7.6	9.0	13.65
16	60.0	6.8	4.44
17	2.9	5.7	3.41
18	11.6	5.9	25.54
19	65.0	5.7	14.97
20	60.0	2.9	15.29
21	41.3	4.4	11.08
22	50.0	4.1	12.22
23	7.0	0.6	8.38
24	18.4	2.9	7.12

Table 2.2 Comparison of XP-RAFTS and Rational Method Estimated Peak Flow Of 1%AEP

Sub-Catchment	Estimated Peak Flow (m3/s)		% Diff
	RAFTS	Rational Method	
1	2.75	3.22	14.6
2	1.20	1.32	9.1
3	2.45	2.58	5.0
4	4.39	5.51	20.2
5	5.09	6.11	16.6
6	7.70	8.87	13.2
7	5.64	4.49	-20.4
8	4.99	4.64	-7.0
9	4.37	4.55	4.0
10	2.17	2.26	4.1
11	1.71	2.04	16.0
12	6.97	6.13	-12.1
13	5.16	4.37	-15.2
14	5.17	5.31	2.7
15	6.03	5.93	-1.8
16	2.52	2.95	14.4
17	1.11	1.38	19.6
18	7.58	9.12	16.8
19	7.98	9.61	17.0
20	7.06	8.63	18.2
21	4.66	5.65	17.5
22	6.39	6.83	6.5
23	1.32	1.17	-11.1
24	2.50	2.32	-7.0

3. Hydraulic Impact Requirements

3.1 Hydraulic Impact Assessment

The purpose of this report is to assess the hydraulic impact of the proposed 71 lot multi-unit development. The regional flooding conditions within the catchment have been modelled to ensure that the proposed development results in no adverse impacts upon adjoining properties. When undertaking a HIA, the Gold Coast City Plan Flood Overlay Code specifies the following events to be modelled and assessed by an RPEQ when addressing the Performance Outcomes of **PO6** of the code:

Table 3.1 Flood Events Required

AO6.2 a)	Minimum Local Floods:	50%, 20%, 10%, 5%, 2% and 1% Annual Exceedance Probability (AEP) for local flood events
AO6.2 b)	Minimum Regional Floods:	5%, 2%, and 1% AEP floods
AO6.2 c)	Additional Regional Floods	0.2% AEP (on Request by the Assessment Manager)

The AEP's simulated for this HIA were the 50% (approx. 2 year), 20%, 10%, 5%, 2%, and 1% events for this development. As there is a plethora of potential event durations for each AEP, the critical durations for the respective regional floods were simulated. Due to the site's location, local floods (short durations) would directly drain to the main river and any drainage issues are generally addressed in a stormwater management plan. Therefore, for this site, only the regional flood events were assessed for impacts.

The critical durations were determined by interrogating the result files from the TUFLOW model providing the event duration which produced the peak water level at site.

3.2 Regulatory Requirements and Technical Guidelines

This report assesses the proposed development against the requirements set out in the following City of Gold Coast City Plan Version 7 (Council) City Plan Codes:

- 8.2.8 Flood Overlay Code – The proposed development is situated within the flood assessment area and as such must meet all relevant requirements of the code.

The strategies proposed in this HIA have been developed to address the requirements of the Gold Coast City Plan, and have also been prepared in accordance with the following guidelines:

- Queensland Urban Drainage Manual (QUDM) – Fourth Edition (IPWEAQ, 2017); and
- Australian Rainfall and Runoff – A Guide to Flood Estimation (Ball, et al., 2016).

3.2.1 Flood Storage Balance

A requirement of City of Gold Coast as stated in the Flood Overlay Code, is that flood storage is to be maintained to the Designated Flood Level (DFL) in the post-developed condition.

4. Hydraulic Model

4.1 Overview

The software package TUFLOW has been used to undertake the hydraulic modelling presented in this report. For further information about TUFLOW, please refer to Appendix A.

4.2 Hydraulic Modelling Parameters

The details of the parameters used for the TUFLOW model are presented in Table 4.1. The pre-development and post-development model feature maps along with roughness maps are presented in Appendix B.

Table 4.1 Hydraulic Modelling Parameters

Parameters	**Details**
Scenarios	• Pre-development; and • Post-development.
Events and Critical Durations Modeled	• 40% AEP – 3hr; • 20% AEP – 3hr; • 10% AEP – 3hr; • 5% AEP – 3hr; • 2% AEP – 1hr; and • 1% AEP – 1hr.

Topography	Pre-Development
	• 2014 1m LiDAR
	  ○ Vertical data: Spatial Accuracy: 0.15m @ 67 % CI (95% confidence level or 2 sigma)
	  ○ Horizontal Data: Spatial Accuracy: 0.40m @ 67 % CI (95% confidence level or 2 sigma)
	• Tin Survey
	
	Post-Development
	• DEM of the proposed residential lots

Initial Water Level	Pre-Development • Lakes level survey in site.
2D Resolution	• 2m grid.

Parameters	Details
Timestep	• Adaptive timestep. (HPC)

Inflows	• Regional Catchment Inflows represented at 2D boundary conditions
	  ○ 2 inflows represented as flow-time boundary conditions – taken from XP RAFTS model
	  ○ 22 inflow represented from as a source area inflow – taken from XP RAFTS model
	• 4 mitigated inflow of the site taken from XP-SWMM model in post developed case

Downstream Boundary Condition	• A normal depth condition with a slope of 0.003 was adopted for the TUFLOW's downstream boundary

Hydraulic Structures	• 1D Link Network representing:
	  ○ Total 23 culvert located in 2D model extent as presented in Appendix C
	  ○ For the post development case, 3x1.2x1.2m RCBC culvert is to be proposed under the proposed bund.

Surface Roughness (reflected as Manning's 'n')	• n = 0.15 – Sugar Cane/Trees • n = 0.030 – Water body • n = 0.075 – Medium Trees • n = 0.022 – Road • n = 1.0 – Building • n = 0.035 – Grass (Remaining/default model area)

5. Results

5.1 Flood Behaviour Pre-Development

Figure 5.1 to Figure 5.3 below show the maximum floodwater levels, depths and velocity for Q100 event.

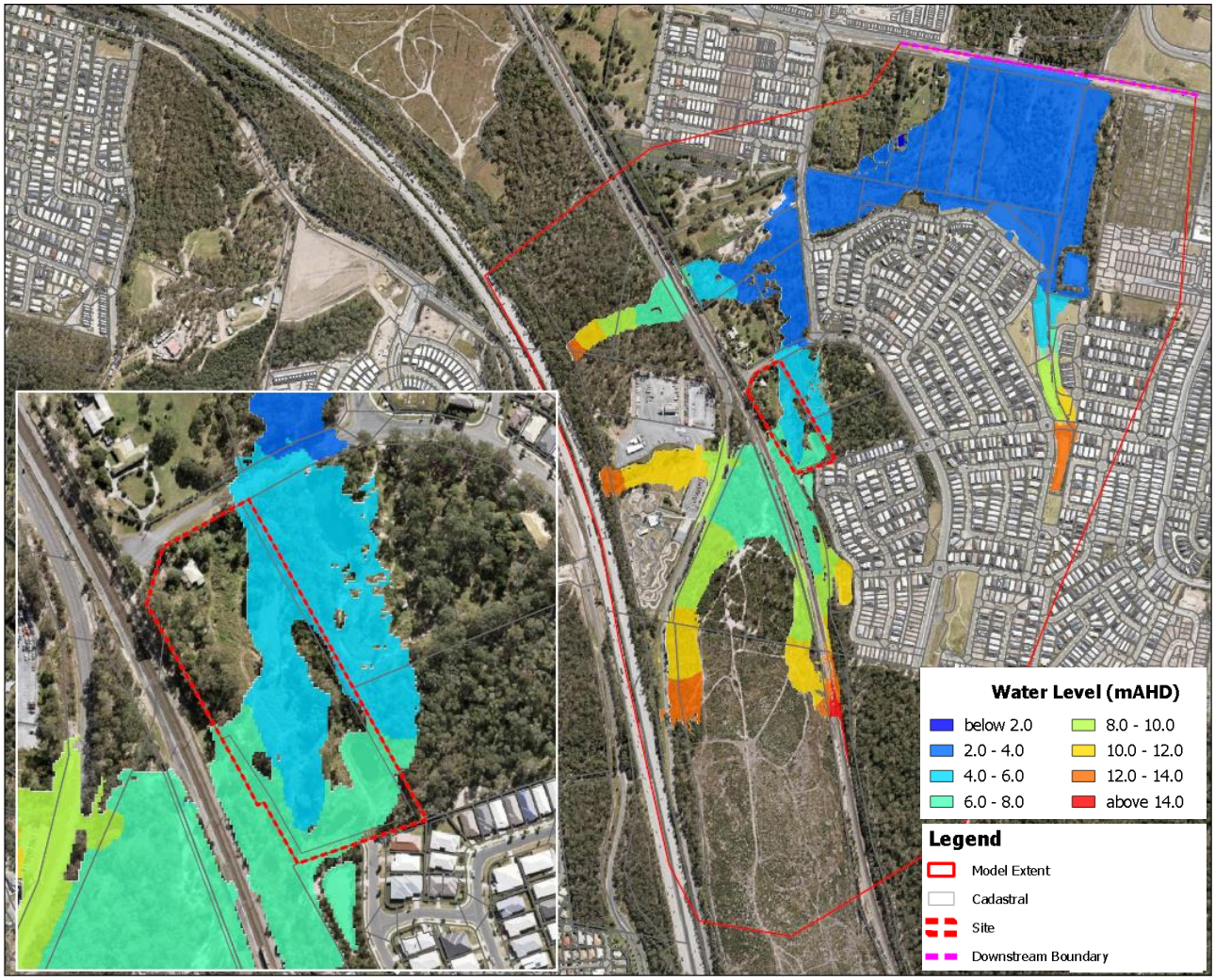


Figure 5.1 Pre-Development 1% AEP Peak Flood Level

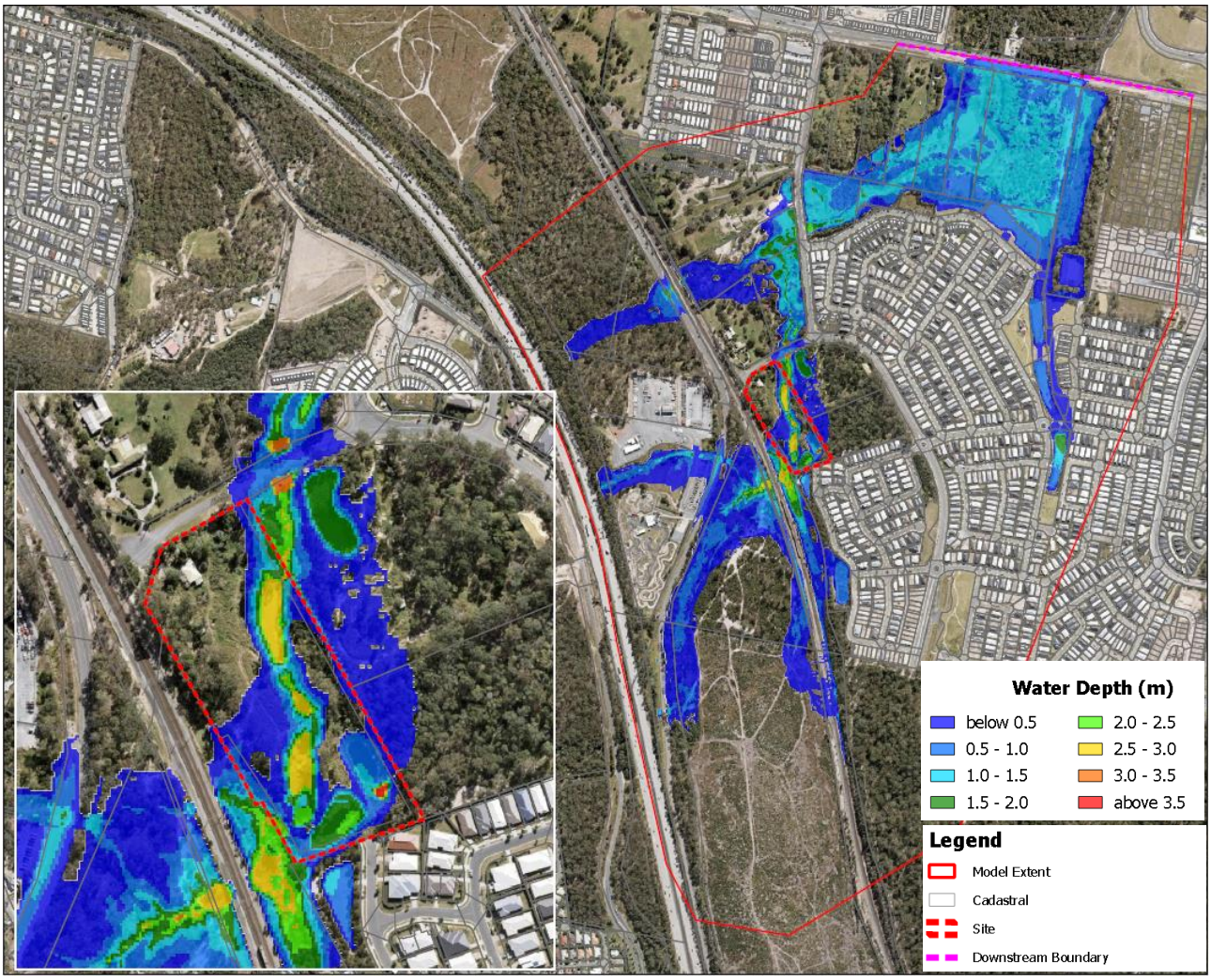


Figure 5.2 Pre-Development 1% AEP Peak Flood Depth

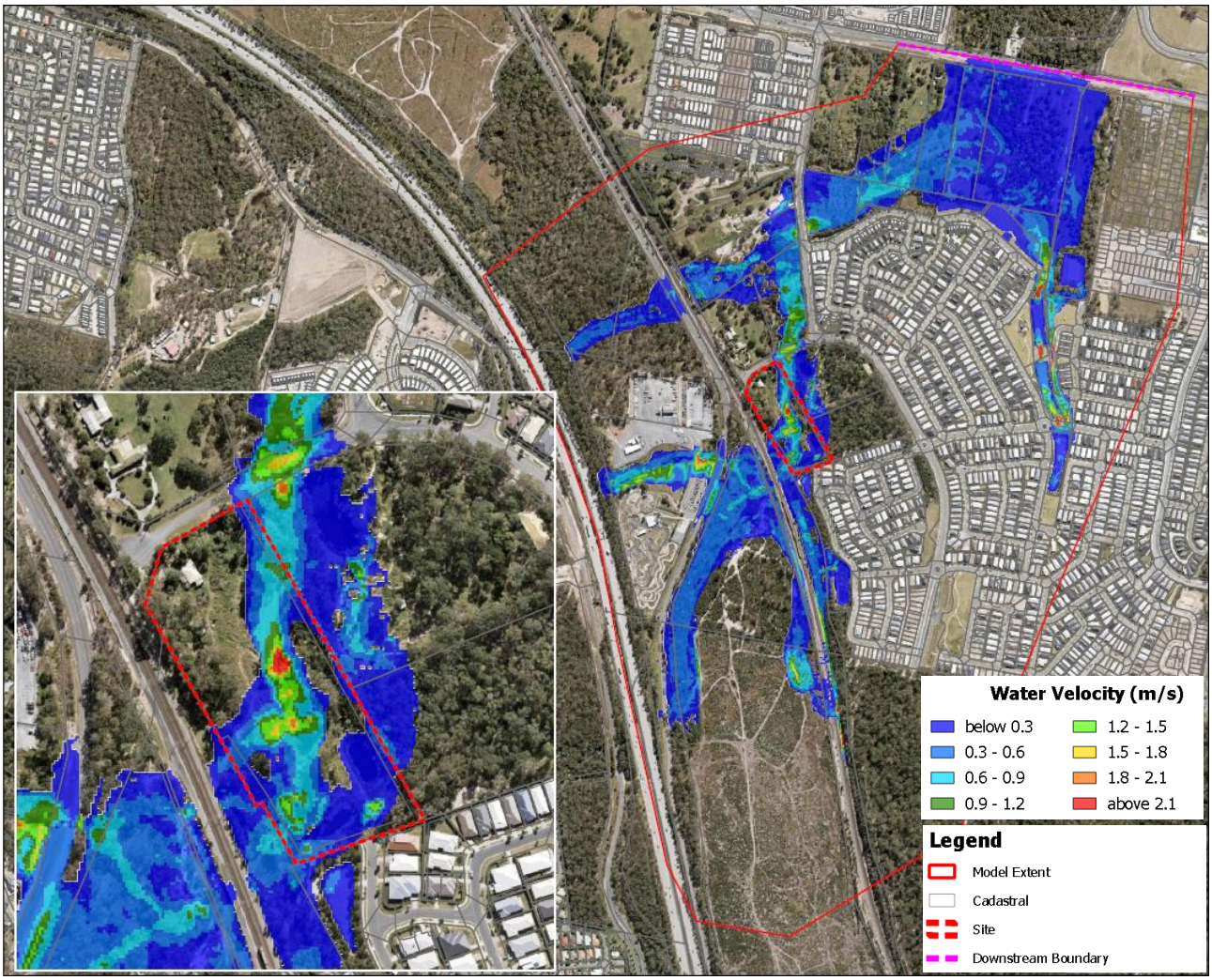


Figure 5.3 Pre-Development 1% AEP Peak Flood Velocity

5.2 Flood Behaviour Post-Development

The post development TUFLOW model was used to assess whether the proposed development causes any change to flood damage, risk or hazard.

To negate the impacts of the increased conveyance downstream, the earthworks propose engineered flow bunding at specific locations. The external catchment enters the site on its western boundary via the adjacent railway culverts where it is then detained via a proposed on-line detention basin positioned within the bounds of the waterway.

No increased water level (afflux) external to the subject site is experienced in any event, excluding the 2% AEP. In the 2% AEP, a minor increase in flood level at the north of the site is experienced. The minor increases are within a flooded area, do not increase the defined flood level for the area, and are not anticipated to cause any increase to damage, risk or hazard. This afflux can therefore be considered as negligible. See the below figure for reference.

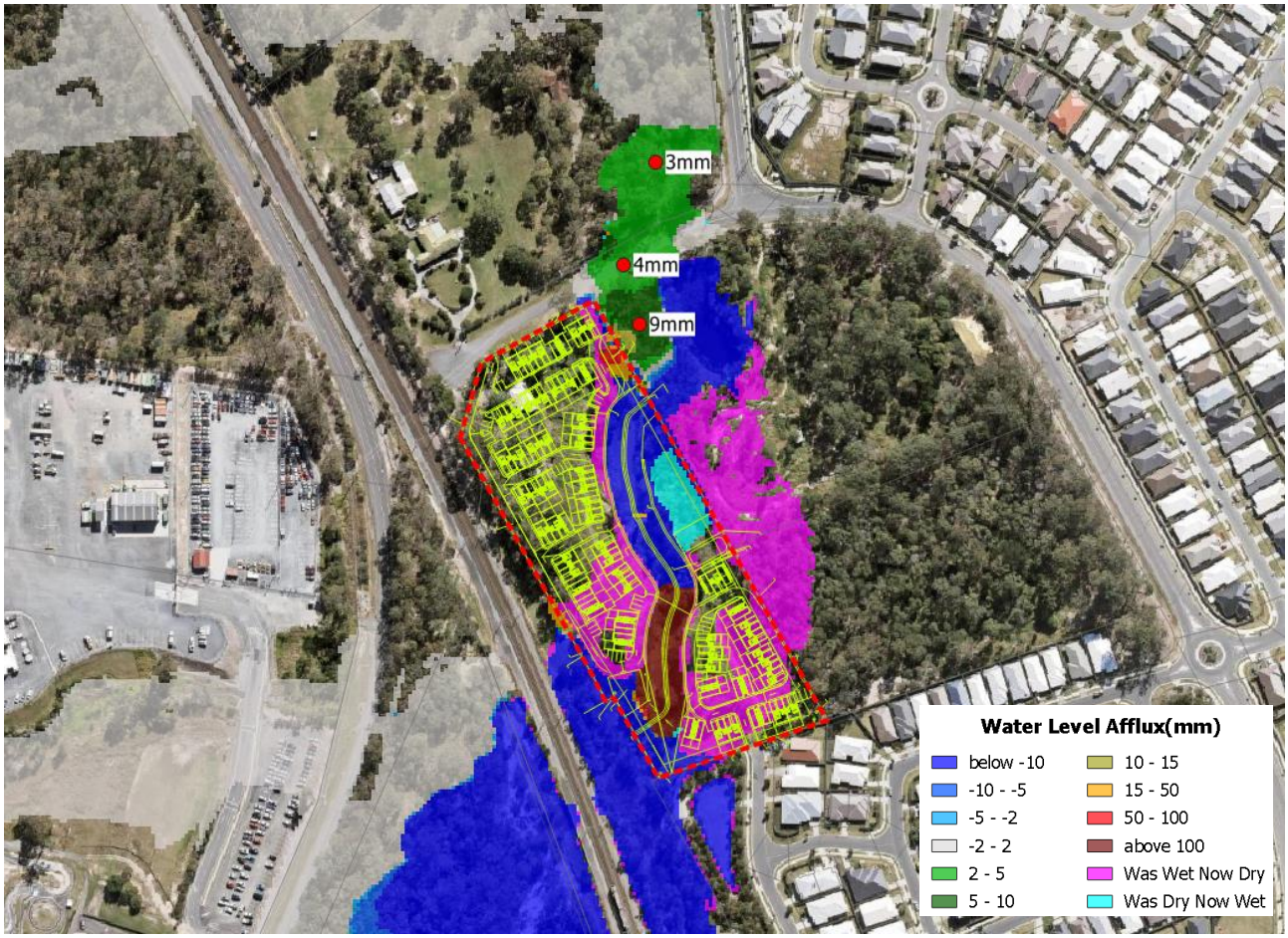


Figure 5.4 Post-Development 2% AEP Flood Level Afflux

5.2.1 Hydraulic Impact Mapping

Afflux maps (change in water level) have been prepared to depict impacts resulting from the proposed development, and are included within Appendix D. Table 5.1 presents an index of the afflux mapping prepared for proposed residential development and golf course redesign.

Table 5.1 List of Hydraulic Impact Assessment Mapping

Appendix No.	Figure No.	AEP (%)	Critical Duration (h)	Result
Appendix D	D01	40	3	Water Level Afflux
	D02	20	3	Water Level Afflux
	D03	10	3	Water Level Afflux
	D04	5	3	Water Level Afflux
	D05	2	1	Water Level Afflux
	D06	1	1	Water Level Afflux

5.3 Flood Storage Balance

The proposed development has maintained flood storage across the site. This has been achieved through adjustment of the proposed design finished surface. The proposed developments finished surface levels are detailed in design drawings contained in Appendix B.

6. Conclusion

Based on the hydraulic modelling results presented in this report, the following conclusions have been made:

- The proposed development maintains flood plain storage, as described in the Burchills Earthworks Drawing (presented in Appendix B);
- The proposed development has no adverse impacts on existing regional hydraulic conditions; and
- Afflux is generally contained within the subject site, and any afflux external to the site is within acceptable limits.

This report has analysed the sites regional flooding and shows that the proposed development has no adverse impacts on flood conditions for the simulated AEP events.

7. General Issues and Uncertainty

Design floods are hypothetical floods used for planning and floodplain management investigations. They are based on having a probability of occurrence specified either as:

- Annual Exceedance Probability (AEP) expressed as a percentage; or
- An Average Recurrence Interval (ARI) expressed in years.

This report uses the both ARI and AEP terminology. The table below provides a definition of AEP and the ARI equivalents mentioned in this report.

Table 7.1 AEP and ARI Terminology

	AEP	ARI	Comments
Medium to Large Floods	20%	5 year	A hypothetical flood or combination of floods which is likely to have a 20% chance of occurring in any one year or, in other words, is likely occur once every 5 years on average.
	10%	10 year	A hypothetical flood or combination of floods which is likely to have a 10% chance of occurring in any one year or, in other words, is likely occur once every 10 years on average.
	5%	20 year	A hypothetical flood or combination of floods which is likely to have a 5% chance of occurring in any one year or, in other words, is likely occur once every 20 years on average.
	2%	50 year	A hypothetical flood or combination of floods which is likely to have a 2% chance of occurring in any one year or, in other words, is likely occur once every 50 years on average.
	1%	100 year	A hypothetical flood or combination of floods which is likely to have a 1% chance of occurring in any one year or, in other words, is likely occur once every 100 years on average.
Rare to Extreme Floods	0.2%	500 year	A hypothetical flood or combination of floods which is likely to have a 0.2% chance of occurring in any one year or, in other words, is likely occur once every 500 years on average.
Probable Maximum Flood	0%	1,000,000 year[1]	A hypothetical flood or combination of floods which represent a theoretical 'worst case' scenario. It is only used for special purposes (e.g. design of a dam spillway) where a high factor of safety is recommended, or in consideration of floodplain planning (e.g. evacuation and isolation of communities).

The interpretation of the flood maps and other design modelling results presented in this report should be done with an appreciation of any limitations in their accuracy. While the points below highlight these limitations, it is important to note that the results presented provide an up-to-date reliable and accurate prediction of design flood behaviour. Key elements are:

- Recognition that no two floods behave in exactly the same manner;

- Design floods are a best estimate of an ‘average’ flood for their probability of occurrence;
- The DEM has been generated from ALS data with a reported vertical accuracy of +/- 0.25 metre and interpolated in areas of dense vegetation. As flood depths and flood extents are determined using the DEM, their accuracy should be interpreted accordingly;
- The purpose of the Hydraulic Impact Assessment is to represent regional flooding behaviour. Hence the resolution of the model is limited in urban areas. In particular, the flood model generally does not account for minor stormwater drainage infrastructure, such as street drainage. As such, urban areas may also experience local stormwater flooding in addition to the regional flooding presented in the flood maps; and
- The results are based on available data and numerical tools at the time of this report. Changes in technology and improved data collection may provide more accurate modelling in the future.

The accuracy of the hydrologic and hydraulic computer models is dependent on the amount and range of reliable rainfall and flood level recordings for model calibration. An uncalibrated model’s results have a greater error margin than a calibrated model. The error margin in this Hydraulic Impact Assessment is regarded as ‘moderate’ based on the following factors:

- The flood models were verified against another two events;
- The model parameters are generally typical of those used elsewhere; and
- The vertical accuracy of the ALS data used to develop the DEM.

8. References

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Syme, W.J., Nielsen, C.F., Charteris, A.B. (1998) *Comparison of Two-Dimensional Hydrodynamic*

WBM (2000) *Byron Shire Coastline Hazard Definition Study – Final Report*, WBM Oceanics Australia, November 2000.

Appendix A Further Information and Methods

A.1 TUFLOW

The 2D hydraulic modelling software package TUFLOW has been used to undertake the hydraulic modelling undertaken as part of this report.

TUFLOW solves the full 2D shallow water equations based on the scheme developed by Stelling (1984) and improved by Syme (1991) and Syme et al (1999). The solution is based around the alternating direction implicit finite difference method. A square grid is used to define the discretisation of the computational domain.

Improvements to the Stelling scheme (Stelling, 1984), including a robust wetting and drying algorithm and greater stability at oblique boundaries, and the ability to dynamically link a quasi-2D model were developed by Syme (1991). Further improvements including the insertion of 1D elements or quasi-2D models inside a 2D model, the modelling of constrictions on flow such as bridges and large culverts and automatic switching to upstream controlled weir flow have been developed subsequently.

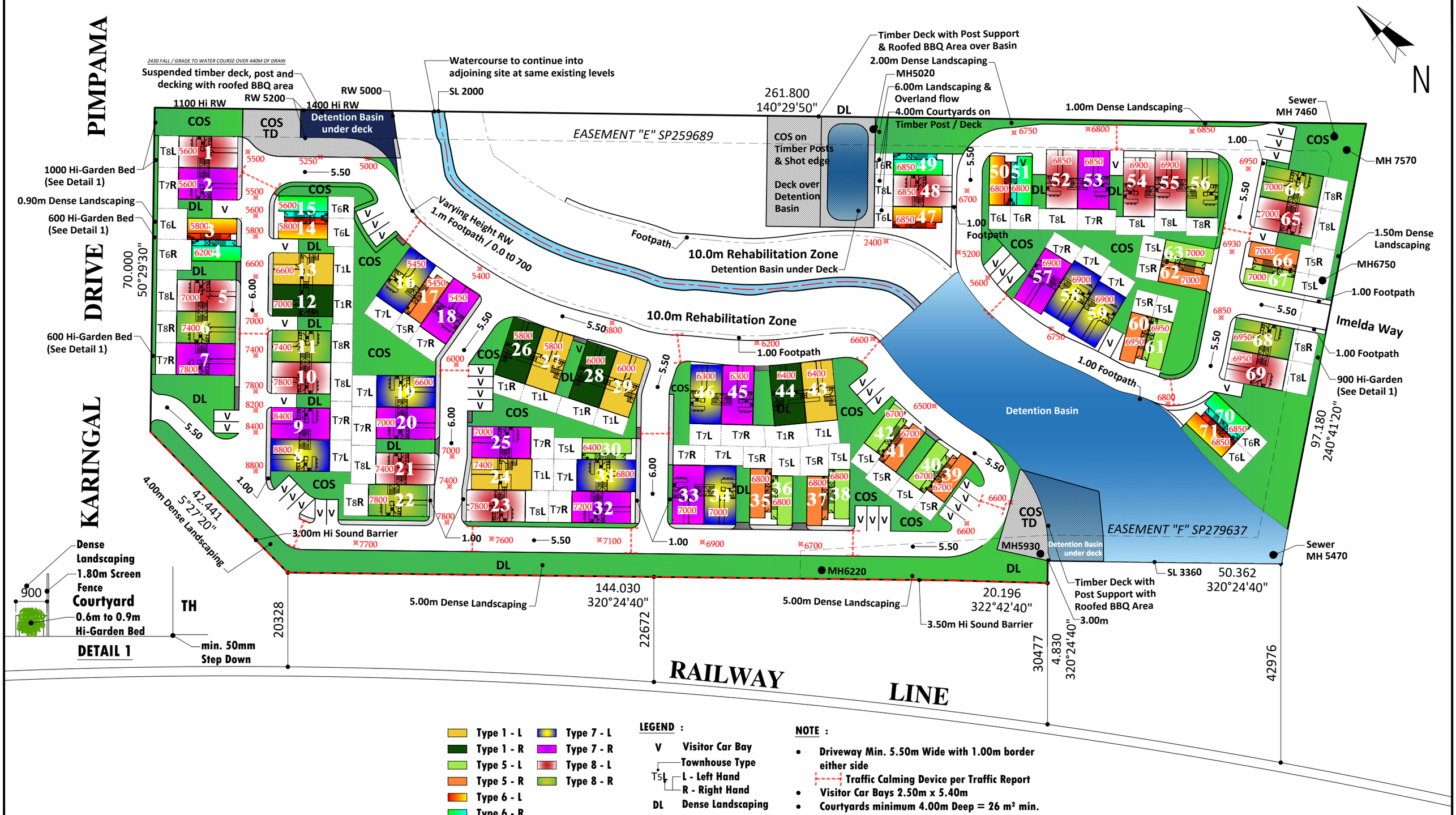
TUFLOW models have been successfully checked against rigorous test cases (Syme 1991, Syme et al 1998 and WBM 2000), and calibrated and applied to a large range of real-world tidal and flooding applications. TUFLOW has the capability to dynamically link 2D domains to quasi-2D models as well as having numerous 2D domains with varying grid sizes dynamically nested.

Hydraulic structure flows (i.e. through large culverts and bridges) are modelled in 2D and include the effects of bridge decks and submerged culvert flow. Flow over roads, levees, bunds, etc is modelled using the broad-crested weir formula when the flow is upstream controlled. For smaller hydraulic structures such as pipes, 1D elements can be inserted at any points inside the 2D model area. Flow over a bridge or culvert that is modelled in 2D can be represented using a 1D weir equation.

Setting up a hydraulic model involves:

- Determining appropriate model extents;
- Creating a DEM of the model domain using a combination of ALS data (DNRM, 2014) for the pre-development conditions including a detailed survey of the subject site;
- Incorporating the post development floodplain roughness values as well as the topographic conditions post development;
- Allocation of model flow boundaries; and
- Application of appropriate flow resistance values (Manning's Coefficient of Roughness).
    - The manning's roughness coefficients are developed with respect to the information provided in Open Channel Hydraulics (Chow, 1959), Natural Channel Design (Brisbane City Council, 2003), and the Road Drainage Manual (DTMR, 2010).

Appendix B Proposed Lot 19 on RP 152380 - 2 Karingal Drive, Pimpama



Type 1 - L
Type 1 - R
Type 5 - L
Type 5 - R
Type 6 - L
Type 6 - R
Type 7 - L
Type 7 - R
Type 8 - L
Type 8 - R

LEGEND :

- V — Visitor Car Bay
- T5L — Townhouse Type; L - Left Hand; R - Right Hand
- DL — Dense Landscaping
- COS — Community Open Space
- TD — Timber Deck

NOTE :

- Driveway Min. 5.50m Wide with 1.00m border either side
  - Traffic Calming Device per Traffic Report
- Visitor Car Bays 2.50m x 5.40m
- Courtyards minimum 4.00m Deep = 26 m² min.

Total Area (sqm) : 24,592

Dence Landscaping = 1,566 sqm
Community Open Space = 3,174 sqm
20.0m Rehabilitation Zone = 4,118.19 sqm
Timber Deck = 1414 sqm

NOTE :
HRV / GARBAGE TRUCK MANOEUVRING MIN. 10.5m KERB TO KERB PER J.J. RICHARDS DESIGN

1:750
15m 0 15m 30m 45m 60m 75m

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Verify all dimensions on site and from the dimension on the plans. Do not scale from drawings

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Drawn by
John C.

Checked by
JPD, Brian Johnston plan design P/L

Client

SITE LAYOUT

RAY SUGARS
2 Karingal Drive Pimpama
Lot 19 on RP 152380

Drawing Scale
1:750

Layout ID
JPD-P24-KDP-01

Status

Paper Size
@A3

Appendix C Hydraulic Model Features

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2 Karingal Drive

FIG 01 CATCHMENT PLAN



Location of the site within the City of Gold Coast

Legend

- Cadastral
- Flowpath
- Site
- Sub_Catchment

Surface Elevation (mAHD)

0	40
10	50
20	60
30	70

Project:	BE200223
Date:	Oct 2020
Scale:	1:8000 at A3
Projection:	
Data Sources:	

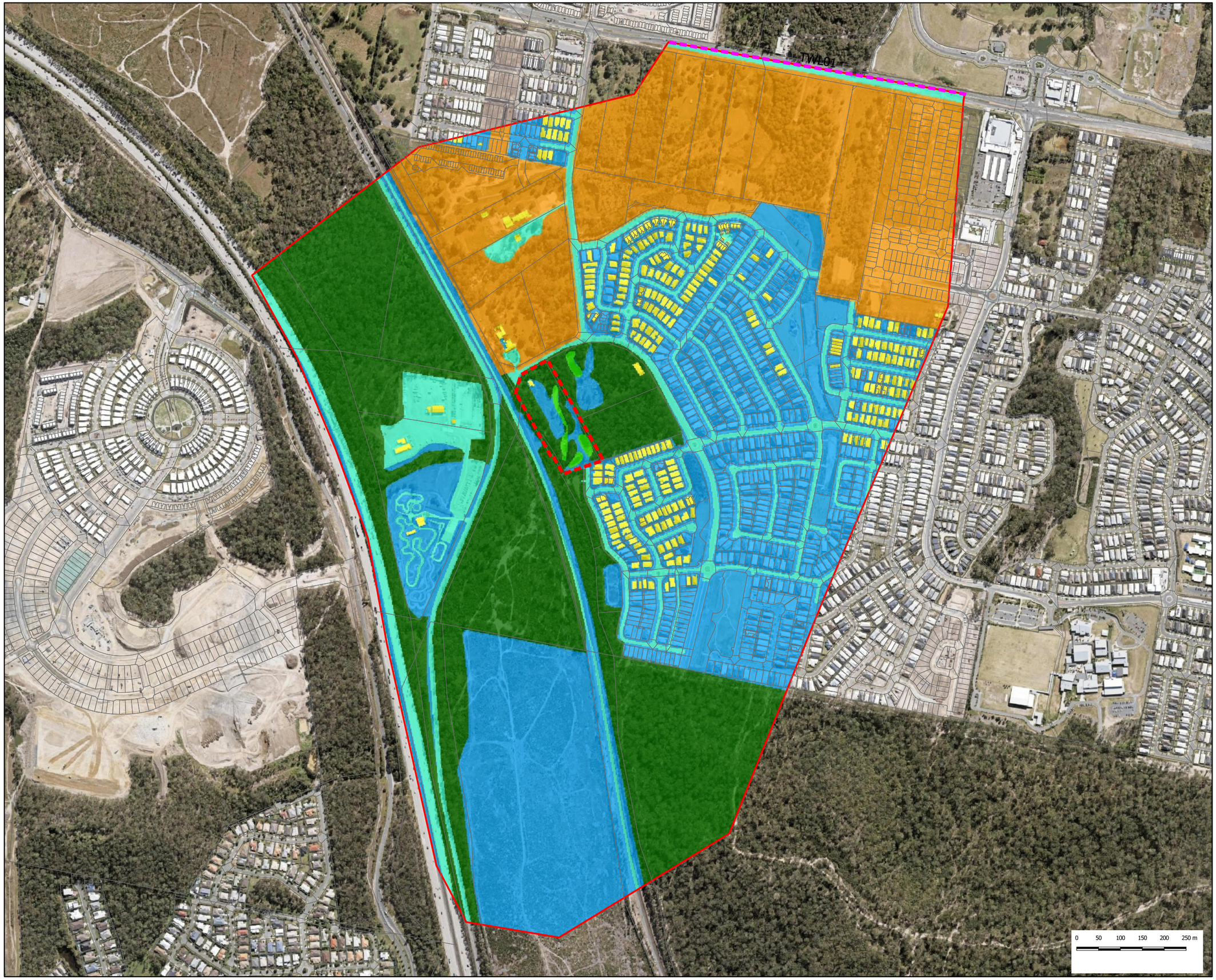
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2 Karingal Drive

FIG 03 PRE DEVELOPMENT
TUFLOW MANNING MAP

N



Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary

Manning Value

- Sugar Cane/Trees (n=0.15)
- Water Body (n=0.03)
- Road (n=0.022)
- Buildings (n=1)
- Grass (n=0.035)
- Medium Trees (n=0.075)

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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FIG 05 POST DEVELOPMENT TUFLOW MANNING MAP



Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary

Manning Value

- Sugar Cane/Trees (n=0.15)
- Water Body (n=0.03)
- Road (n=0.022)
- Buildings (n=1)
- Grass (n=0.035)
- Medium Trees (n=0.075)

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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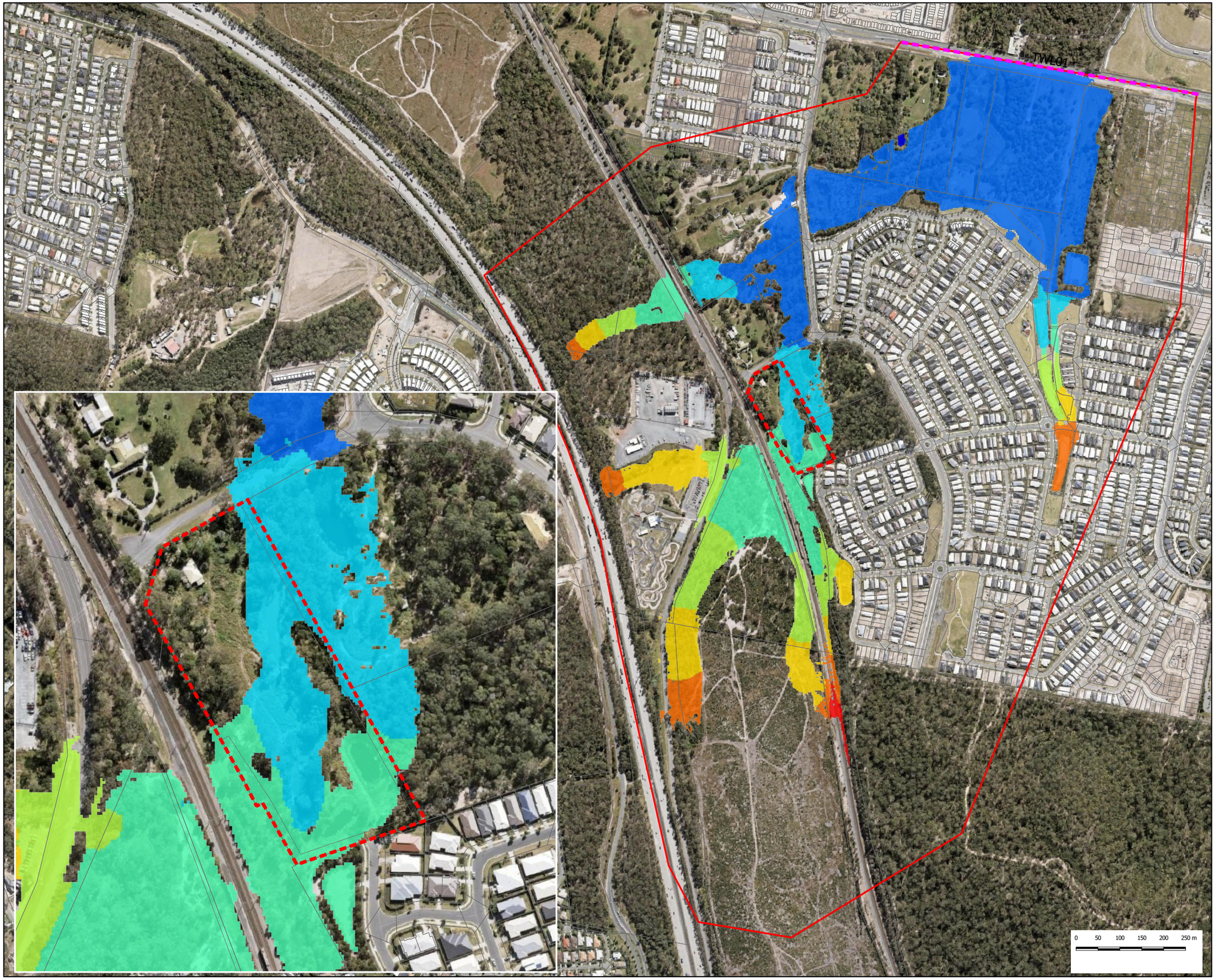
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Appendix D Hydraulic Mapping Results

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FIG A01 PRE DEVELOPMENT
1%AEP
FLOOD WATER LEVEL




Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary

Water Level (mAHD)

below 2.0	8.0 - 10.0
2.0 - 4.0	10.0 - 12.0
4.0 - 6.0	12.0 - 14.0
6.0 - 8.0	above 14.0

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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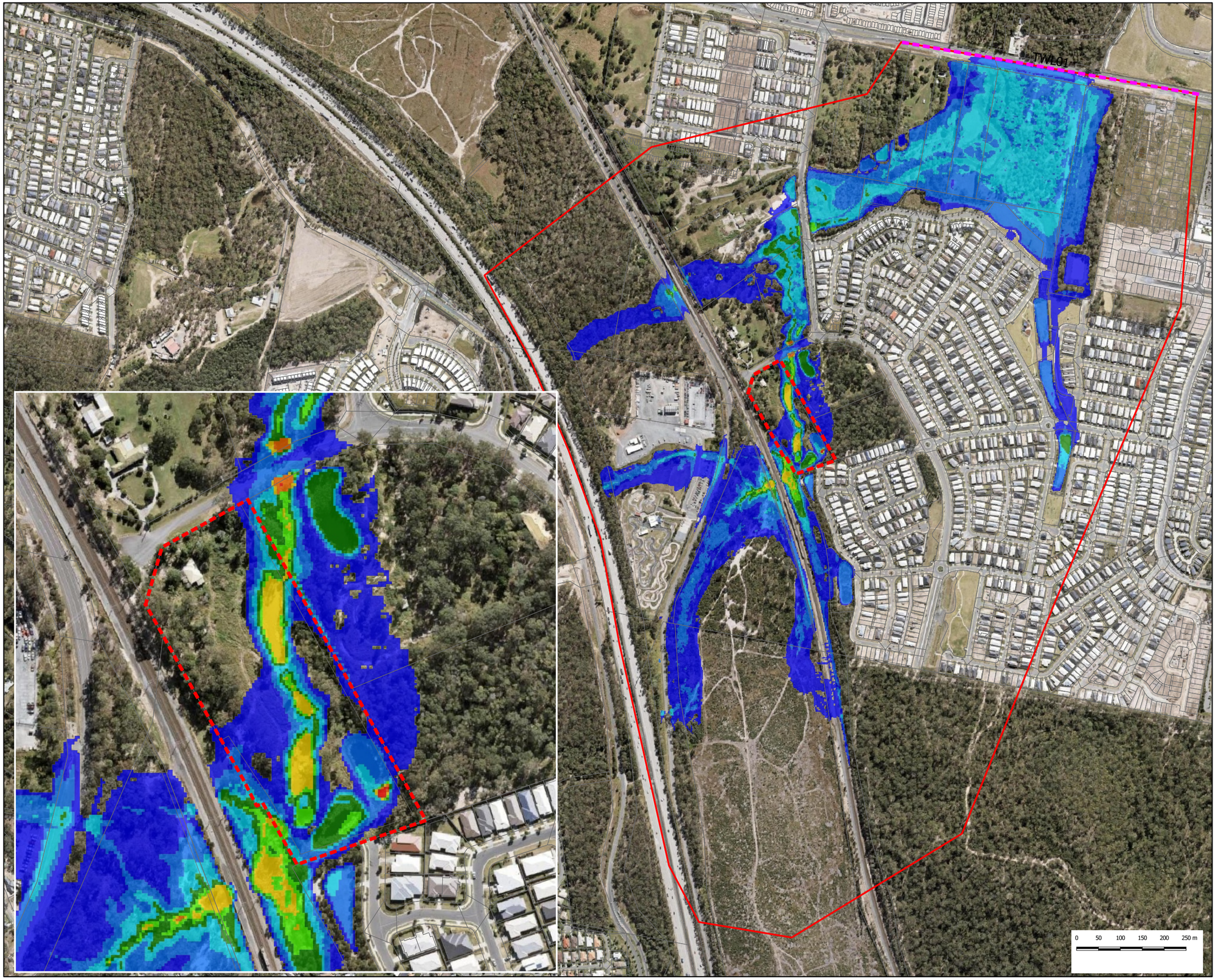
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FIG A02 PRE DEVELOPMENT
1%AEP
FLOOD WATER DEPTH





Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary

Water Depth (m)

below 0.5	2.0 - 2.5
0.5 - 1.0	2.5 - 3.0
1.0 - 1.5	3.0 - 3.5
1.5 - 2.0	above 3.5

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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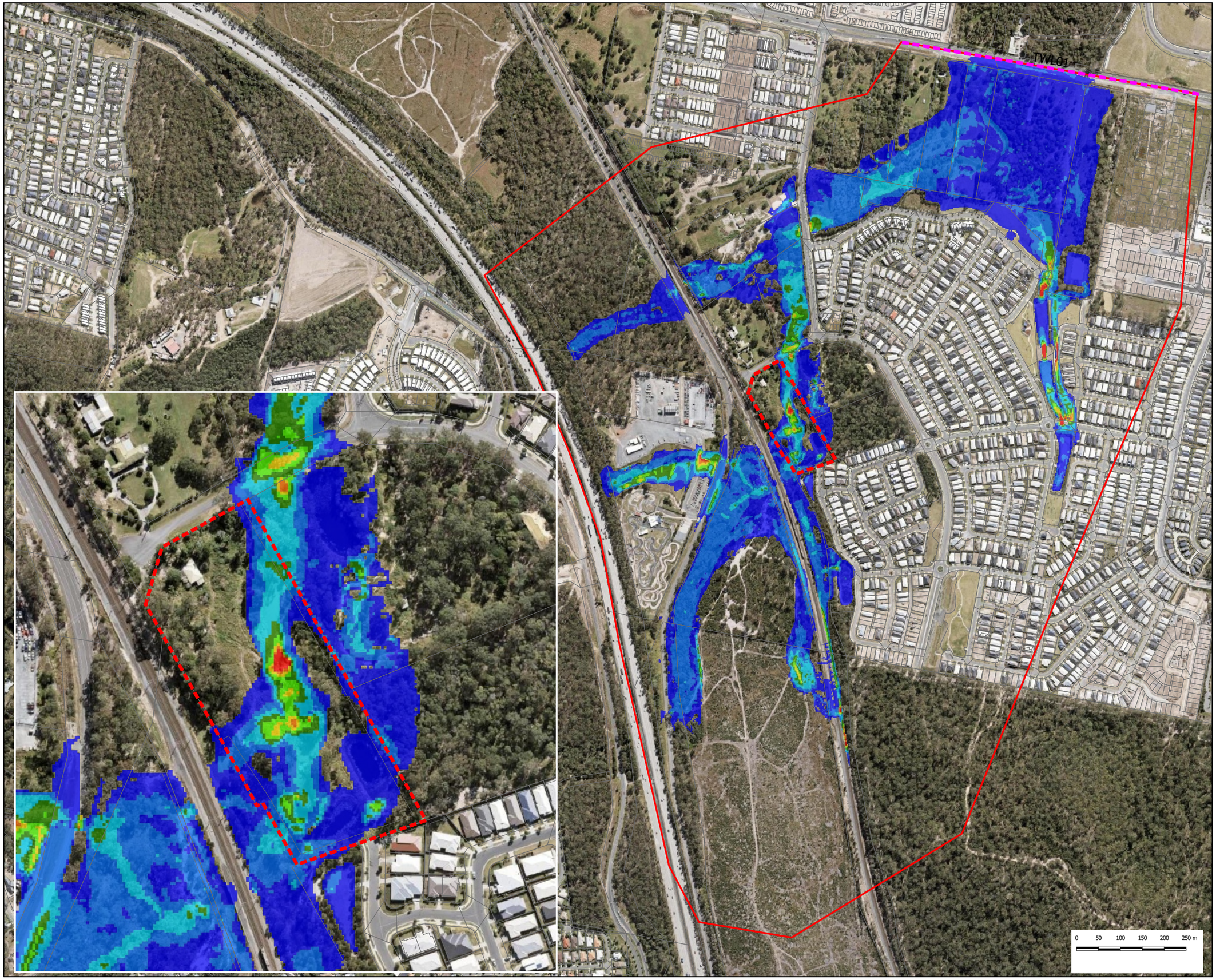
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FIG A03 PRE DEVELOPMENT
1%AEP
FLOOD WATER VELOCITY





Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary

Water Velocity (m/s)

below 0.3	1.2 - 1.5
0.3 - 0.6	1.5 - 1.8
0.6 - 0.9	1.8 - 2.1
0.9 - 1.2	above 2.1

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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TWL01

0 50 100 150 200 250 m

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FIG B01 POST DEVELOPMENT
1%AEP
FLOOD WATER LEVEL

N



Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Level (mAHD)

- below 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- 10.0 - 12.0
- 12.0 - 14.0
- above 14.0

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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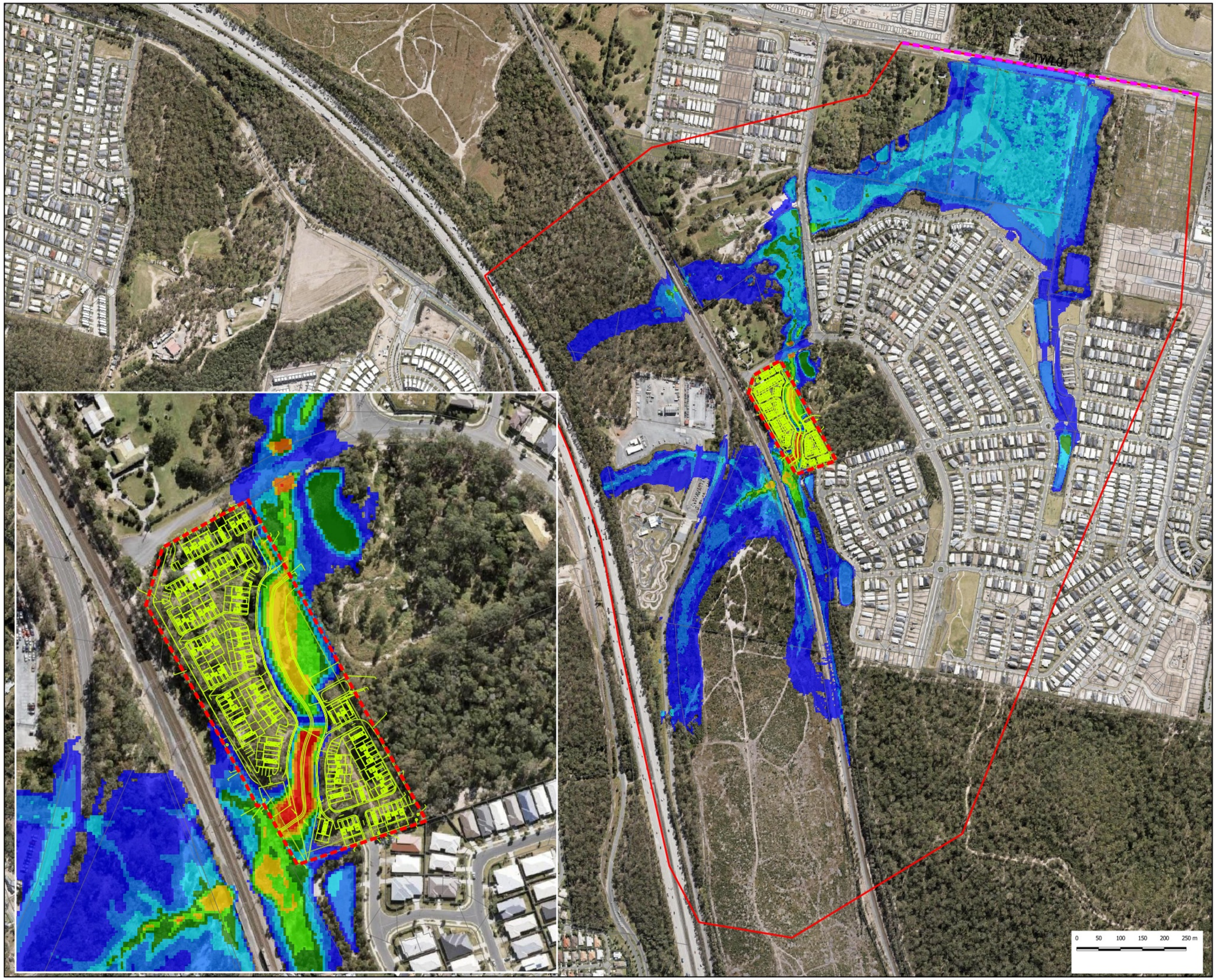
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FIG B02 POST DEVELOPMENT
1%AEP
FLOOD WATER DEPTH





Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Depth (m)

below 0.5	2.0 - 2.5
0.5 - 1.0	2.5 - 3.0
1.0 - 1.5	3.0 - 3.5
1.5 - 2.0	above 3.5

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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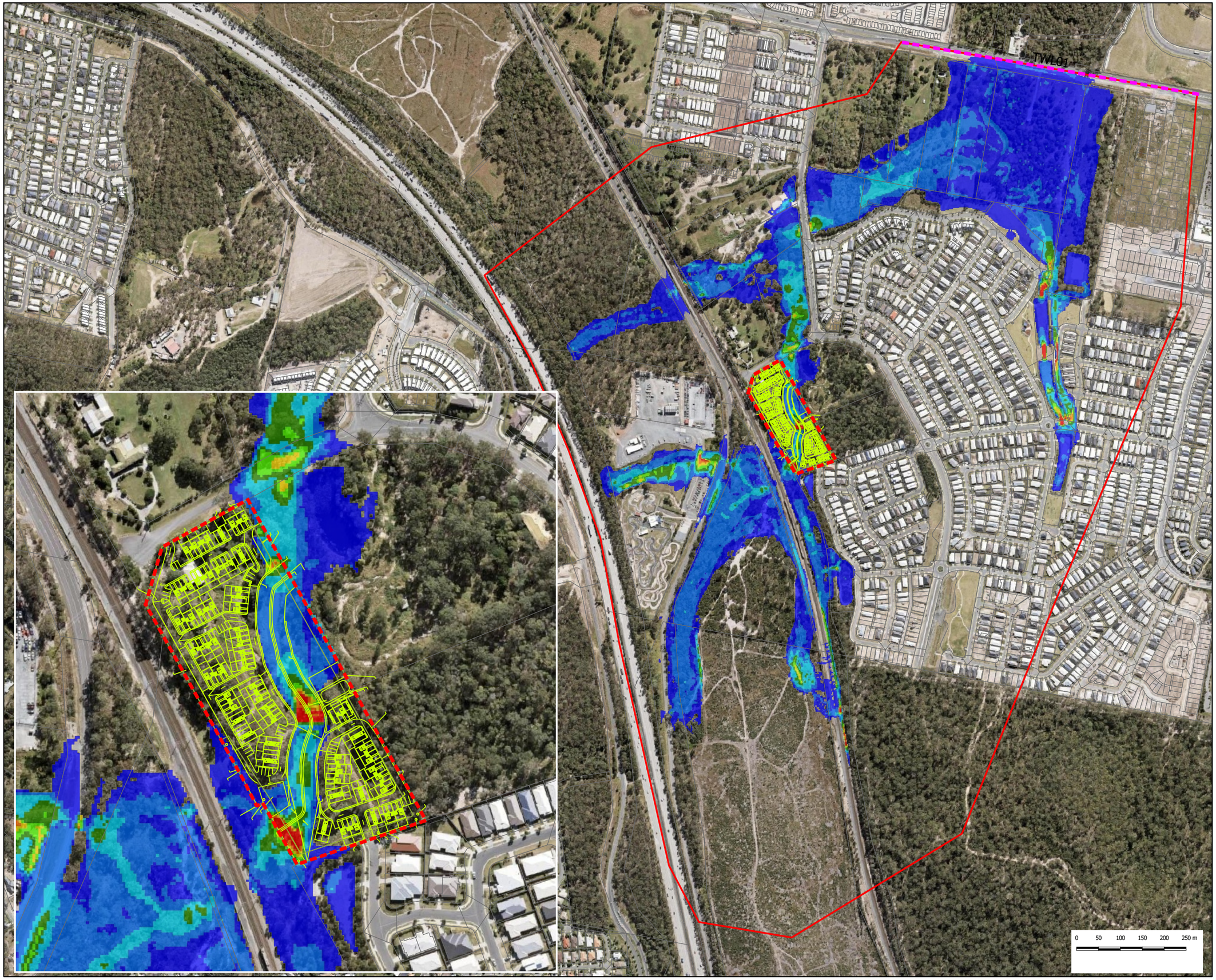
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FIG B03 POST DEVELOPMENT
1%AEP
FLOOD WATER VELOCITY





Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Velocity (m/s)

below 0.3	1.2 - 1.5
0.3 - 0.6	1.5 - 1.8
0.6 - 0.9	1.8 - 2.1
0.9 - 1.2	above 2.1

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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TWL01

0 50 100 150 200 250 m

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FIG C01 POST DEVELOPMENT
1%AEP
FLOOD WATER LEVEL AFFLUX



Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Level Afflux(mm)

below -10	10 - 15
-10 - -5	15 - 50
-5 - -2	50 - 100
-2 - 2	above 100
2 - 5	Was Wet Now Dry
5 - 10	Was Dry Now Wet

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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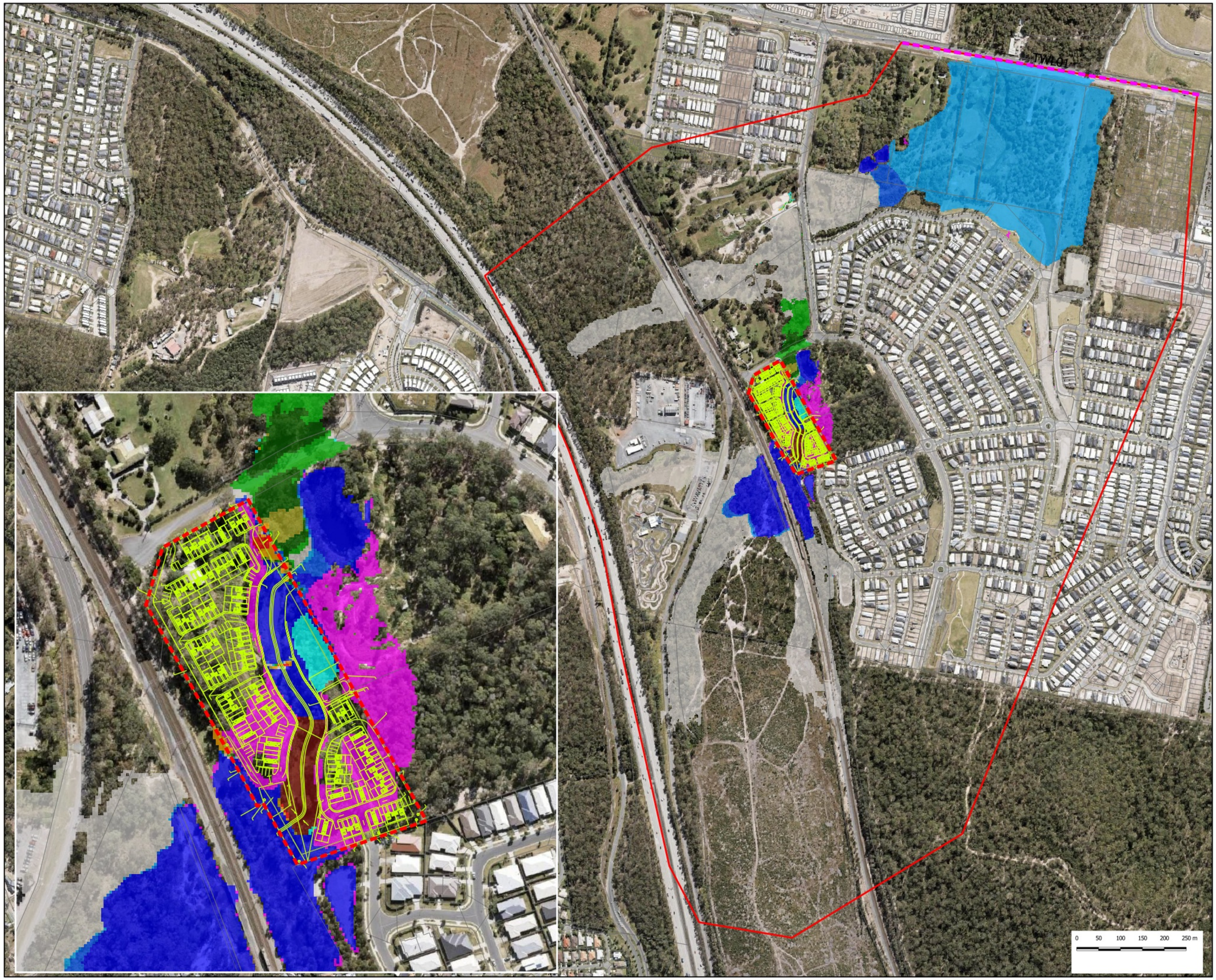
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FIG C02 POST DEVELOPMENT
2%AEP
FLOOD WATER LEVEL AFFLUX





Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Level Afflux(mm)

below -10	10 - 15
-10 - -5	15 - 50
-5 - -2	50 - 100
-2 - 2	above 100
2 - 5	Was Wet Now Dry
5 - 10	Was Dry Now Wet

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

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FIG C03 POST DEVELOPMENT
5%AEP
FLOOD WATER LEVEL AFFLUX



Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Level Afflux(mm)

below -10	10 - 15
-10 - -5	15 - 50
-5 - -2	50 - 100
-2 - 2	above 100
2 - 5	Was Wet Now Dry
5 - 10	Was Dry Now Wet

Project: BE200223
Date: Dec 2020
Scale: 1:8000 at A3
Projection:
Data Sources:

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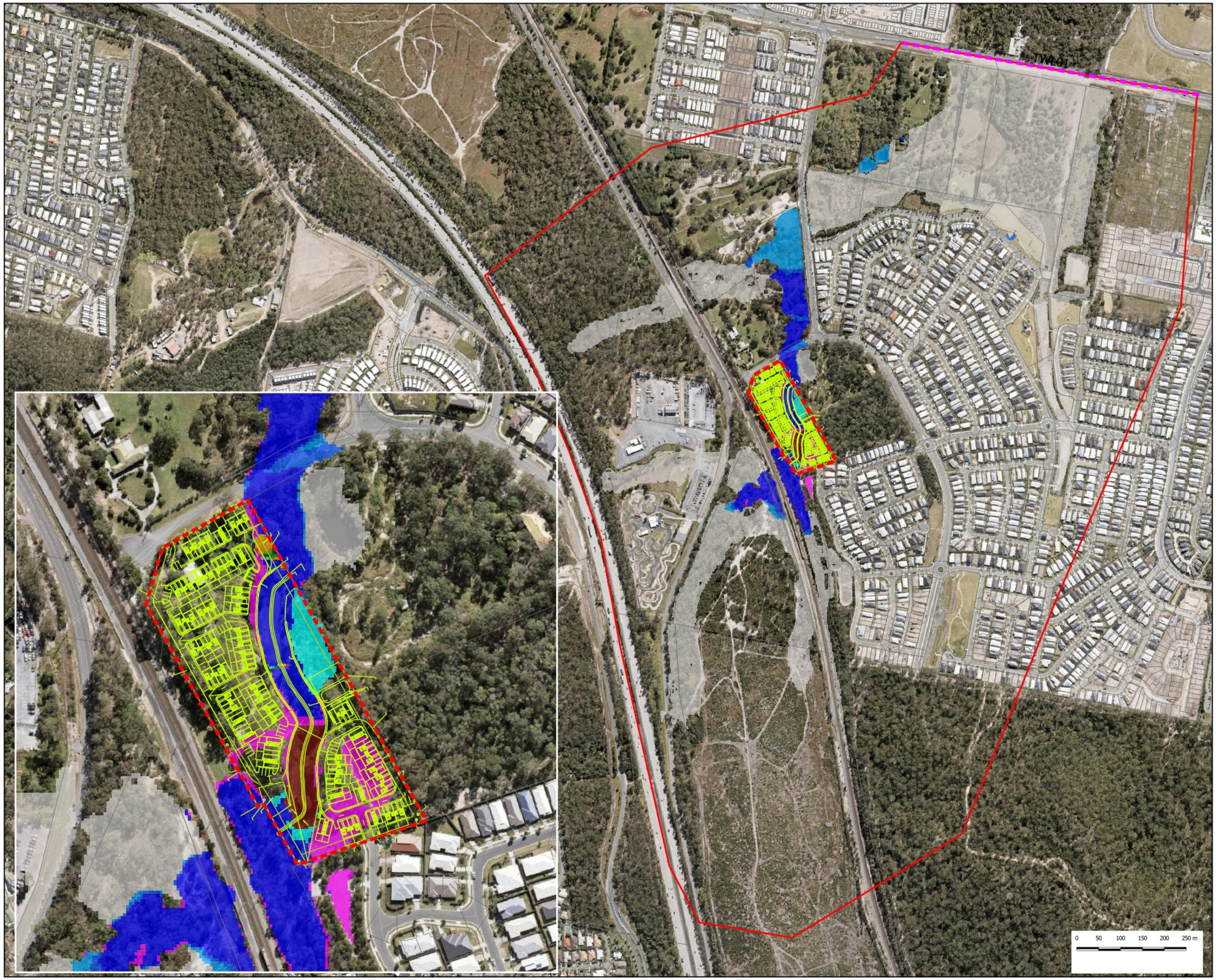
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FIG C04 POST DEVELOPMENT
10%AEP
FLOOD WATER LEVEL AFFLUX





Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Level Afflux(mm)

below -10	10 - 15
-10 - -5	15 - 50
-5 - -2	50 - 100
-2 - 2	above 100
2 - 5	Was Wet Now Dry
5 - 10	Was Dry Now Wet

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

Data Sources:

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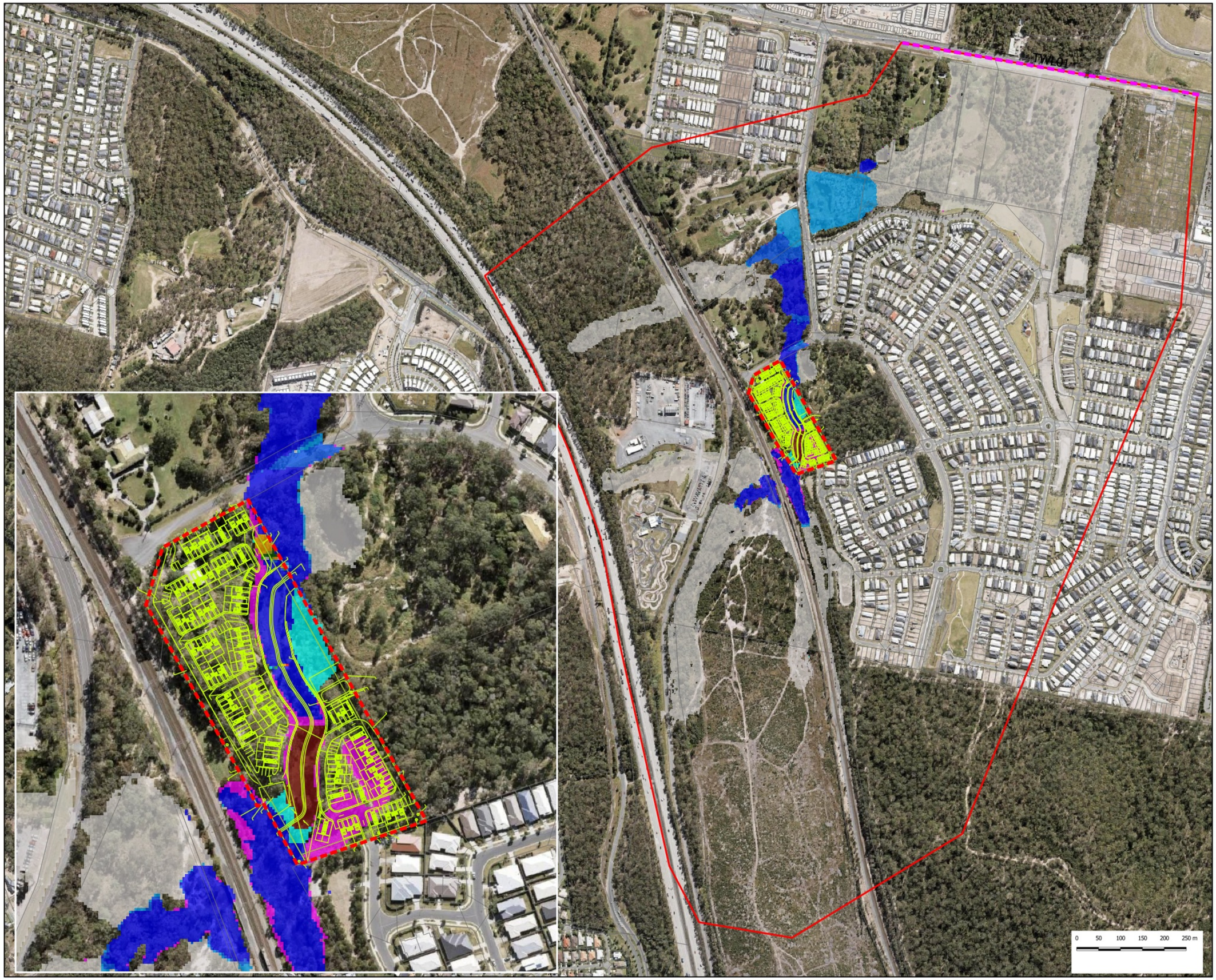
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FIG C05 POST DEVELOPMENT
20%AEP
FLOOD WATER LEVEL AFFLUX





Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Level Afflux(mm)

below -10	10 - 15
-10 - -5	15 - 50
-5 - -2	50 - 100
-2 - 2	above 100
2 - 5	Was Wet Now Dry
5 - 10	Was Dry Now Wet

Project: BE200223

Date: Dec 2020

Scale: 1:8000 at A3

Projection:

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FIG C06 POST DEVELOPMENT
39%AEP
FLOOD WATER LEVEL AFFLUX



Location of the site within the City of Gold Coast

Legend

- Model Extent
- Cadastral
- Site
- Downstream Boundary
- Proposed Layout

Water Level Afflux(mm)

below -10	10 - 15
-10 - -5	15 - 50
-5 - -2	50 - 100
-2 - 2	above 100
2 - 5	Was Wet Now Dry
5 - 10	Was Dry Now Wet

Project: BE200223
Date: Dec 2020
Scale: 1:8000 at A3
Projection:
Data Sources:

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