Structural Civil Flood

Minor Hydraulic Flood Report

Zedz Consultants

115 King Avenue

Willawong

Job Reference Number – 10115

Date: 2 September 2025

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TABLE OF CONTENTS

1 Introduction 5

1.1. Purpose and Scope 5

1.2. Report Limitations 5

2 Site Characteristics 6

2.1. Location 6

2.2. Topography 7

2.3. Proposed Development 7

3 Flood Data 8

3.1. Floodwise Property Data 8

3.2. Oxley Creek Flood Study 9

4 Hydrology 10

4.1. Adopted Hydrograph 10

5 Hydraulic Analysis 11

5.1. Objectives 11

5.2. Model Setup 11

5.3. Boundary Conditions 12

5.4. Model Sensitivity 12

5.5. Results 13

6 Flood Impact Assessment 14

7 Council Guidelines for Flooding 15

7.1. Minimum Floor Levels 15

7.2. Undercroft Requirements 16

7.3. Recommended Design Levels 16

8 Conclusions 17

9 References 18

APPENDICES

APPENDIX A – FLOOD AWARENESS MAPPING

APPENDIX B – SITE SURVEY

APPENDIX C – PROPOSED PLANS

APPENDIX D – CATCHMENT PLAN

APPENDIX E – XPSWMM MODELLING EXTENT

APPENDIX F – XPSWMM RESULTS (EXISTING SCENARIO)

APPENDIX G – IMPACT ASSESSMENT RESULTS

APPENDIX H – COUNCIL CODES

1 Introduction

1.1. Purpose and Scope

Inertia Engineering has been commissioned by Zedz Consultants to prepare a Minor Hydraulic Flood Report for 115 King Avenue, Willawong (the subject site).

The principal objectives of this study are to determine the applicable flood levels for the subject site and to assess the impacts of the filling of the site on the flooding characteristics in the surrounding area.

The findings of this report are based on data on rainfall, drainage and local topography obtained from several sources as referenced.

Detailed 2D modeling has been undertaken to confirm the above objectives.

1.2. Report Limitations

This report has been prepared by Inertia Engineering Pty Ltd for Zedz Consultants and may only be used and relied on by Zedz Consultants for the purpose agreed between Inertia Engineering and Zedz Consultants as detailed within this report.

Inertia Engineering otherwise disclaims responsibility to any person other than Zedz Consultants arising in connection with this report. Inertia Engineering also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by Inertia Engineering in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. Inertia Engineering has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by Inertia Engineering described in this report. Inertia Engineering disclaims liability arising from any of the assumptions being incorrect.

Inertia Engineering has prepared this report on the basis of information provided by Zedz Consultants and others who provided information to Inertia Engineering (including Government authorities), which Inertia Engineering has not independently verified or checked beyond the agreed scope of work. Inertia Engineering does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2 Site Characteristics

The land contained within the site is described as follows:

Title Details:	Lot 14 on RP77622
Street Address:	115 King Avenue, Willawong
Site Area:	1.7148 ha

2.1. Location

The subject site is located in Willawong, approximately 14km south of Brisbane's CBD. The site is bound by King Avenue to the south, dense vegetation to the east and north and an upcoming industrial development to the west.

The subject site and all surrounding properties are zoned as Environmental Management areas under City Plan 2014. The purpose of the Environmental management zone code is to recognise environmentally sensitive areas and may provide for houses on lots and other low impact activities where suitable.

Figure 2-1 – Location Plan

2.2. Topography

The site grades from 8.0m to 8.80m AHD in the east to west direction. The current site levels are generally lower than King Avenue.

2.3. Proposed Development

The proposed development will consist of new hardstand to the rear of the site and the utilisation of the existing dwelling as a new office, with the proposed uses of the site proposed as a medium industry/warehouse/transport yard.

Please refer to Appendix C for the proposed architectural plans and bulk earthworks plan.

3 Flood Data

3.1. Floodwise Property Data

Brisbane City Council's Floodwise Property Report (BCC 2017a) has flagged the subject site to be susceptible to Brisbane River and creek/waterway flooding. The flood levels from the Floodwise Property Report have been reproduced below in Table 3-1.

Table 3-1 - Floodwise Property Report flood levels (BCC, 2017a)

Description	Level (m AHD)	Flooding Source
5% AEP	9.0	Creek/Waterway
2% AEP	9.1	Creek/Waterway
1% AEP	9.7	River
1% AEP	9.1	Creek/Waterway
January 2011	9.2	River
DFL	8.0	River
RFL	9.7	River

The subject site lies within Brisbane River flood planning area (FPA) 2b and generally within the creek/waterway flooding FPA 4. The way these FPA's have been categorised for river and creek/waterway flooding has been outlined below.

Table 3-2 - Flood planning area sub-categories (BCC, 2014)

	Brisbane River flooding		Creek/waterway flooding
FPA 1 sub-category	Within the 10% AEP Brisbane River flood extent; and DV>1.2m^2/s in RFL		Within the 10% AEP flood extent; and DV>1.2m^2/s in 1% AEP flood
FPA 2 sub-category	>1.2m deep; or DV>1.2m^2/s in RFL	FPA2A sub-category >2m deep in RFL	Deeper than 1.2m in 1% AEP flood; or DV>1.2m^2/s in 1% AEP flood
		FPA2B sub-category 1.2m to 2m deep in RFL	
FPA 3 sub-category	0.6-1.2m deep in RFL; or DV between 0.6m^2/s and 1.2m^2/s in RFL		0.6-1.2m deep in 1% AEP flood; or DV between 0.6m^2/s and 1.2m^2/s in 1% AEP flood
FPA 4 sub-category	0-0.6m deep in RFL; or DV less than 0.6m^2/s in RFL		0-0.6m deep in 1% AEP flood; or DV less than 0.6m^2/s in 1% AEP flood
FPA 5 sub-category	From the RFL extent to the 0.2% AEP flood extent		1% AEP flood extent to the 0.2% AEP flood extent

* RFL – Residential Flood Level, AEP – Annual Exceedance Probability, DV – Depth Velocity Product

3.2. Oxley Creek Flood Study

The Oxley Creek Flood Study was undertaken by Aurecon on behalf of Brisbane City Council in June 2014. The Oxley Creek catchment is approximately 258km^2 in size and covers the flooding characteristics of major tributaries including the Blunder Creek catchment which the subject site falls into.

The hydrologic (RAFTS) and hydraulic (TUFLOW) model from the Oxley Creek Flood Study were provided by Brisbane City Council under a license agreement for the purposes of assessing the impact of the fill pad on the flooding characteristics in the area.

4 Hydrology

The RAFTS model from Oxley Creek Flood Study was provided by Council for the purposes of assessing the impacts of the proposed filling on the flooding characteristics in the area.

4.1. Adopted Hydrograph

The RAFTS model was amended to include only the Blunder Creek catchments that influence the flooding on site and run for the full range of storm durations for the 1% AEP event.

Please refer to Appendix C showing the catchments contributing to the subject site.

The 180-minute storm was nominated as the critical duration for the 1% AEP event hydrograph for the King Avenue crossing in the Oxley Creek Flood Study. The one storm duration was adopted for use in the hydraulic model.

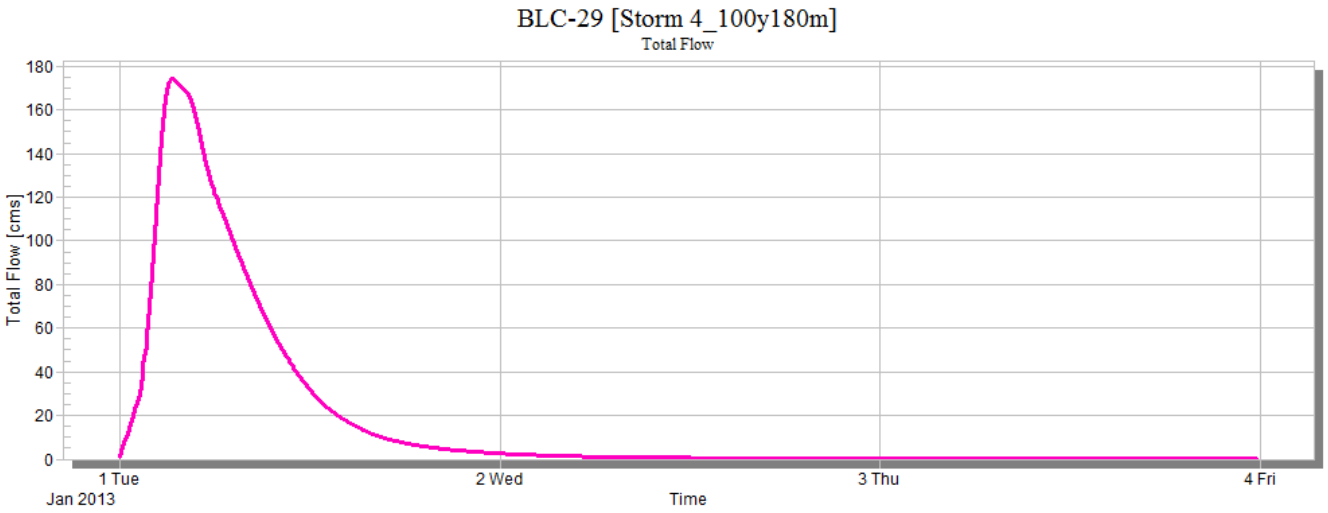


Figure 4-1 – 1% AEP 180min storm event from Oxley Creek Flood Study

5 Hydraulic Analysis

5.1. Objectives

The objectives for the assessment have been set in accordance with Brisbane City Council's City Plan 2014 - Flood Planning Scheme Policy and Flood Overlay Code (BCC, 2014), and the Queensland Urban Drainage Manual (QUDM, 2017).

XPSWMM has been used for this analysis. XPSWMM is an industry accepted two-dimensional analysis model used to estimate flood characteristics such as level, velocity and depth and the impacts of development on surrounding properties.

5.2. Model Setup

5.2.1. Model Extent, Grid Size and Time

The XPSWMM model was established to estimate the flood depths across the subject site and the following is of note;

- The extent of the model is from 700m upstream and 500m downstream of the subject site;
- The XPSWMM model adopted a grid cell size of 3m;
- A time step of 1 second was adopted for model stability; and
- The model was run for a 24-hour duration.

Refer to Appendix D showing the model configuration.

5.2.2. Topography

The XPSWMM model topography has been created from LIDAR data supplied by the Department of Natural Resources and Mines (DNRM). The LIDAR data provided was from the 2014 South East Queensland capture project within the Brisbane City Council Local Government Area (LGA).

5.2.3. Mannings 'n' Roughness

The following Manning's n values have been adopted:

- Roads = 0.02
- Dense vegetation = 0.15
- Medium vegetation = 0.07
- Lowset building = 0.2
- Bare Earth = 0.023
- Average Grass = 0.035

5.2.4. Hydraulic Structures

The concrete bridge on King Avenue was included in the hydraulic model. The structure was represented as a 2D flow constriction in the model with the applicable invert, obvert, deck and handrail

levels taken from the Hydraulic Structure Reference Sheet and the applicable blockage factors and form loss coefficients taken from the Oxley Creek TUFLOW model.

5.3. Boundary Conditions

5.3.1. Hydrologic Inputs

The 1% AEP 180min duration hydrograph extracted from the Oxley Creek Flood Study RAFTS model for the upstream catchment was input into the hydraulic model as a 2D flow boundary. The hydrograph is shown in Figure 4-1. The flow boundary was applied approximately 700m upstream of the subject site.

5.3.2. Tailwater Conditions

A 2D head boundary has been applied to the XPSWMM model 500m downstream of the subject site. The 2D head boundary is a polyline representing a time-dependent head within the XPSWMM model.

To simulate free outfall conditions within the XPSWMM model, the 2D head boundary was set to a level one metre lower than the DTM (7.5m AHD) for the duration of the simulation.

5.4. Model Sensitivity

The following scenarios were run within the XPSWMM to test the sensitivity of the model:

- Adjustments to the 2D inflow boundary location;
- Adjustments to Mannings roughness values;
- Adjustments to tailwater conditions between free outfall and a fixed tailwater of 7.5m AHD;

The adjustments to the inflow boundary location have an impact on flood levels directly downstream of the flow boundary. The flow boundary was eventually placed 700m upstream of King Avenue to ensure that the location did not influence the flooding conditions in the area of concern.

Mannings values had minor impacts on the flood levels and the velocity of floodwaters within the model.

The adjustment to tailwater levels had some effect on flood levels downstream of King Avenue due to the majority of the flood storage in the channel and the overbank area being lost when the peak of the event flowed over King Avenue. The free outfall conditions were found to be a good fit for the results of the Oxley Creek Flood Study with the tailwater boundary applied far enough downstream that is had no influence on the flooding conditions on site.

The model characteristics shown in Sections 5.2 and 5.3 were eventually adopted.

5.5. Results

Appendix E shows the results of the flood model for the existing condition in a 1% AEP flood event.

The 1% AEP creek flood level across the subject site varies from 8.96m AHD at the south-western corner of the property to 8.44m AHD at the north-western corner.

The maximum flooding depths on site are ranging from 0.55m at the southwest corner to approximately 0.15m at the northeast corner. The maximum velocity of floodwaters is approximately between 0.15m/s to 0.30m/s within the property and around 0.8m/s on King Avenue in frontage to the site.

The majority of the subject site is prone to hydraulic hazards of less than $0.3m^2/s$ with hazards on a small area exceeding to $0.35m^2/s$.

As earth fill is proposed on the site, a flood impact assessment has been undertaken to determine if the filling has any impact on the conveyance of flood waters, increases flood levels or concentrates flows towards upstream, downstream or neighboring properties. The outcome of this assessment is provided in the next section.

6 Flood Impact Assessment

To assess the flood impact that the proposed development will have on surrounding properties, the XPSWMM model has been run for both the existing and developed scenarios and the results are compared to determine the impacts on flooding characteristics in the area.

Under the developed condition, a bulk earthworks surface was created to represent the filling on site along with the proposed shed and highset dwelling. The shed pad has been raised to 9.1m AHD to ensure adequate flood immunity from the creek 1% AEP event. The driveway and the building pad will be raised to 8.8m AHD with the building located on a suspended slab above 1% AEP flood level. More details regarding the approach to defining the development levels in relation to flooding are provided in Section 7.

Please refer to the proposed bulk earthworks plan in Appendix B for further information. Also, please refer to Appendix F which shows flood extent and hydraulic hazard under proposed conditions. Appendix F also includes an afflux map showing the changes in flood levels after the development at the site.

The afflux map shows that there are increases in peak flood levels of up to 60mm on small areas of the property located to the west of the site, No. 125 King Avenue. The created afflux is not considered an adverse impact as:

- No. 125 King Avenue is under development. Information regarding the development plan and propsosed construction levels on No. 125 can be found in the flood report dated 8th November 2019 by Inertia Engineering. Similar to the current site, the construction levels on 125 King Avenue are defined as higher than flood levels generated in a creek source flooding and will not be affected by the above afflux.
- Undeveloped parts of No. 125 King Avenue are within an environmental protection zone, will not be developable in foreseeable future and for development in the future will have to be similarly filled to above creek flood levels.

The afflux map in Appendix F also shows that there is an increase in peak flood levels of 50mm on the verge of King Ave. However, The created afflux is not considered an adverse impact as:

- The increase in peak flood level in creek source flooding does not change the condition of King Avenue from trafficable to non-trafficable. In addition, the road is already non-trafficable in a 1% AEP river source flood.
- It is also noted that there is no change to the time of closure or flood hazard on King Ave in site post development condition.

Any development on 115 King Ave under the current zoning would be limited to a new dwelling and would be located near the eastern boundary where flooding depths are less than 300mm deep. Additionally, the Brisbane River residential flood level (RFL) of 9.2m AHD governs when setting minimum habitable floor levels for new dwellings in the area.

7 Council Guidelines for Flooding

7.1. Minimum Floor Levels

7.1.1. Proposed Dwelling

In accordance with Brisbane City Council's City Plan 2014 Flood Overlay Code (BCC, 2014), Table 8.2.11.3.B, the required minimum floor levels for a dwelling house are described in Table 7-1 below.

Table 7-1 - Flood planning levels for a dwelling house (BCA Class 1a)

Flooding Source	Minimum Habitable Floor Level	Minimum Non-habitable Floor Level
Brisbane River	RFL + 500mm	2% AEP flood level + 300mm
Creek/waterway	1% AEP flood level + 500mm	1% AEP flood level + 300mm
Overland flow	2% AEP flood level + 500mm	2% AEP flood level + 300mm

The site flood levels are defined in Section 3. The governing flood source for the habitable floors on the subject site is from Brisbane River flooding at 9.7m AHD and creek/waterway flooding at 9.1m AHD for non-habitable floors.

The proposed dwelling must achieve a 500mm freeboard above 9.2m AHD and non-habitable rooms must achieve a 300mm freeboard above 9.1m AHD for an acceptable level of flood immunity.

7.1.2. Proposed Shed

Brisbane City Council's City Plan 2014 Flood Overlay Code (BCC, 2014), Table 8.2.11.3.D nominates the flood planning category relevant to each building classification of the Building Code of Australia. The BCC flood category nominated for sheds (BCA Building Class 10a) Is Category D.

The minimum floor levels should be set in accordance with BCC's City Plan 2014 Flood Overlay Code (BCC, 2014), Table 8.2.11.3.L. The required minimum design levels for the proposed shed are described in Table 7-2 below.

Table 7-2 - Minimum design levels for flood categories

Flooding Source	Minimum design floor or pavement levels (m AHD)				
	Category A	Category B	Category C	Category D	Category E
Brisbane River	RFL + 500mm	RFL + 300mm	DFL	5% AEP level	5% AEP level
Creek/waterway	1% AEP level + 500mm	1% AEP level + 300mm	1% AEP level	1% AEP level	5% AEP level
Overland flow	2% AEP level + 500mm	2% AEP level + 300mm	2% AEP level	2% AEP level	5% AEP level

For creek/waterway flooding, the shed floor level must be at or above the 1% AEP flood level for an acceptable level of flood immunity. The applicable 1% AEP creek flood level adjacent to the shed under developed conditions is 9.10m AHD.

7.2. Undercroft Requirements

In accordance with Brisbane City Council's City Plan 2014 Flood Overlay Code (BCC, 2014), Table 8.2.11.3.E, the required building undercroft clearances are described in Table 7-3.

Table 7-3 - Building undercroft clearances

Flooding Source	Minimum Clearance Requirements
Overland flow– Hydraulic Hazard (DV <0.6 m^2/s and depth <600mm in 2% AEP flood event)	Lowest floor level is to be 1.5m above the highest ground elevation in undercroft area
Overland flow– Hydraulic Hazard (DV >0.6 m^2/s or depth >600mm in 2% AEP flood event)	Lowest floor level is to be 2.5m above the highest ground elevation in undercroft area
Creek/waterway (Flood planning area 1, 2 or 3 sub-categories)	Lowest floor level is to be 2.5m above the highest ground elevation in undercroft area
Creek/waterway (Flood planning area 4 sub-category)	Lowest floor level is to be 1.5m above the highest ground elevation in undercroft area

To achieve an acceptable outcome for the undercroft requirements in the Flood overlay code, the lowest floor level of any suspended dwelling would be required to be 2.5m above the highest ground elevation in the undercroft area.

The proposed building undercroft is 3.0m high and satisfies the undercroft requirements.

7.3. Recommended Design Levels

The following minimum design levels are recommended for the proposed development:

- The minimum floor level for a suspended dwelling is 11.0m AHD;
- The minimum floor level for the shed is 9.1m AHD (1% AEP creek flood level adjacent to shed);
- 8.8m AHD for the driveway and vehicle maneuvering areas as BCC will allow up to a 300mm depth of flooding in these areas.

8 Conclusions

Inertia Engineering was commissioned by Zedz Consultants to prepare a Minor Hydraulic Flood Report for the proposed development at 115 King Avenue, Willawong to support the development application.

Brisbane City Council's Floodwise Property Report has flagged the subject site to be susceptible to Brisbane River and creek/waterway flooding.

The following minimum design levels are recommended for the proposed development:

- The minimum floor level for a suspended dwelling is 11.0m AHD;
- The minimum floor level for the shed is 9.1m AHD (1% AEP creek flood level adjacent to shed);

It is noted that the existing buildings have been built in consideration of the minimum floor levels which achieve flood immunity. Based on the plans received from Architectural Design and Drafting, the proposed development achieves the minimum levels for flood immunity.

A flood impact assessment was undertaken and determined that the proposed filling will cause an increase in water levels in a relatively small area to the west and south of the property. However, as discussed in detail in Section 6, the increase in water levels will not create an adverse impact.

Please refer to Appendix G for responses to Council's compliance tables.

The maximum velocities of the 1% AEP creek/waterway flood waters adjacent to the proposed buildings are estimated to be less than 0.4m/s, with flooding depths up to 0.5m deep. It is recommended that the appropriate professionals are engaged to ensure that the design of the structural elements for the proposed buildings takes into consideration the characteristics of the floodwaters.

Provided that the minimum design levels and earthworks are undertaken in accordance with the proposed plans, the proposed development can comply with BCC's City Plan 2014 (BCC, 2014) with regard to flooding.

9 References

BCC (2014) – Brisbane City Plan 2014 – Schedule 6.11 Flood Planning Scheme Policy and Part 8.2.11 Flood Overlay Code

BCC (2022) – Brisbane City Council Flood Wise Property Report, extracted March 2022

BCC (2022 – Brisbane City Council Flood Awareness Mapping, extracted March 2022

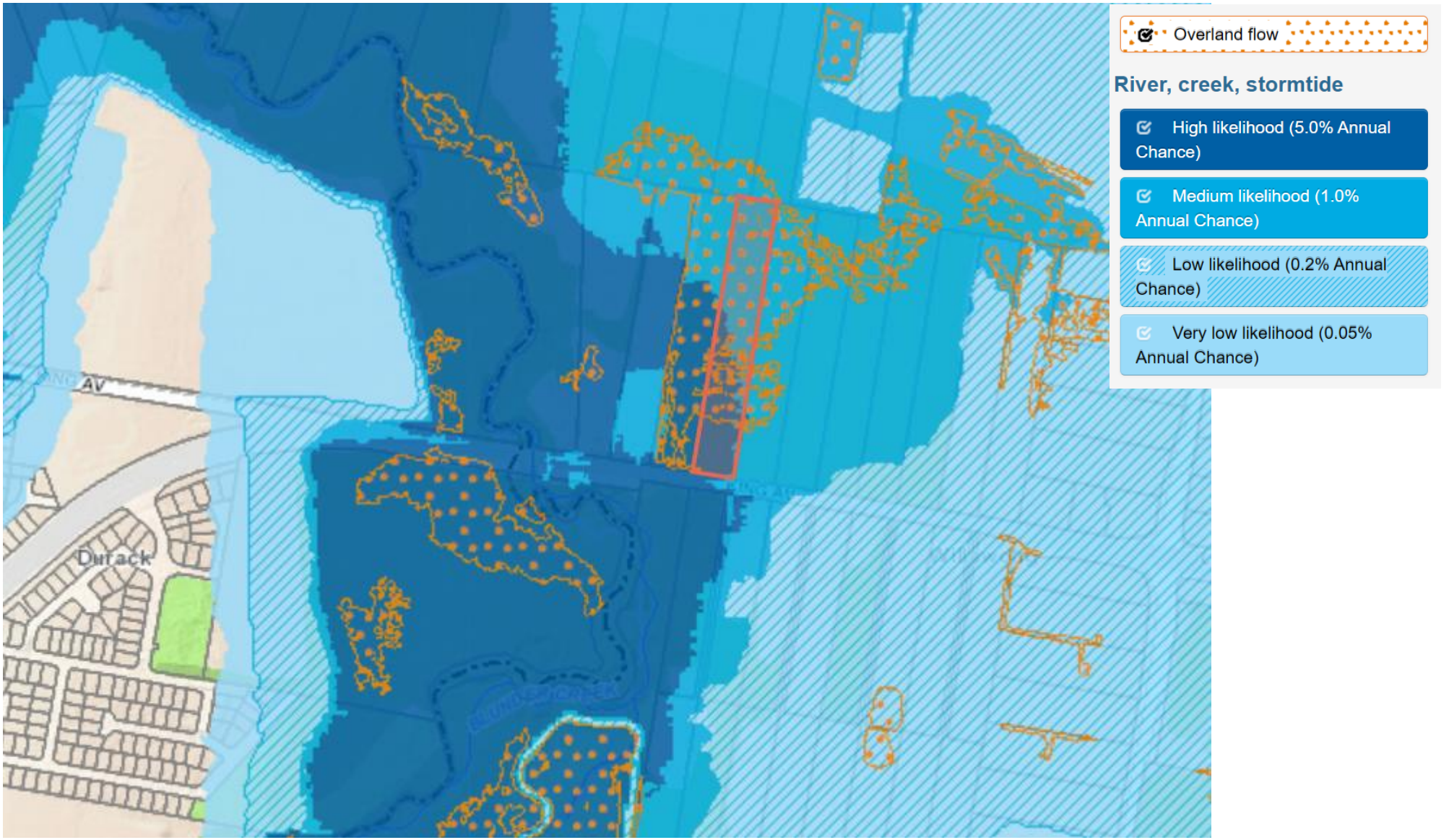
BCC (2022) – Brisbane City Council eBimaps, extracted March 2022

DNRM (2016) – Department of Natural Resources and Mines LIDAR Data

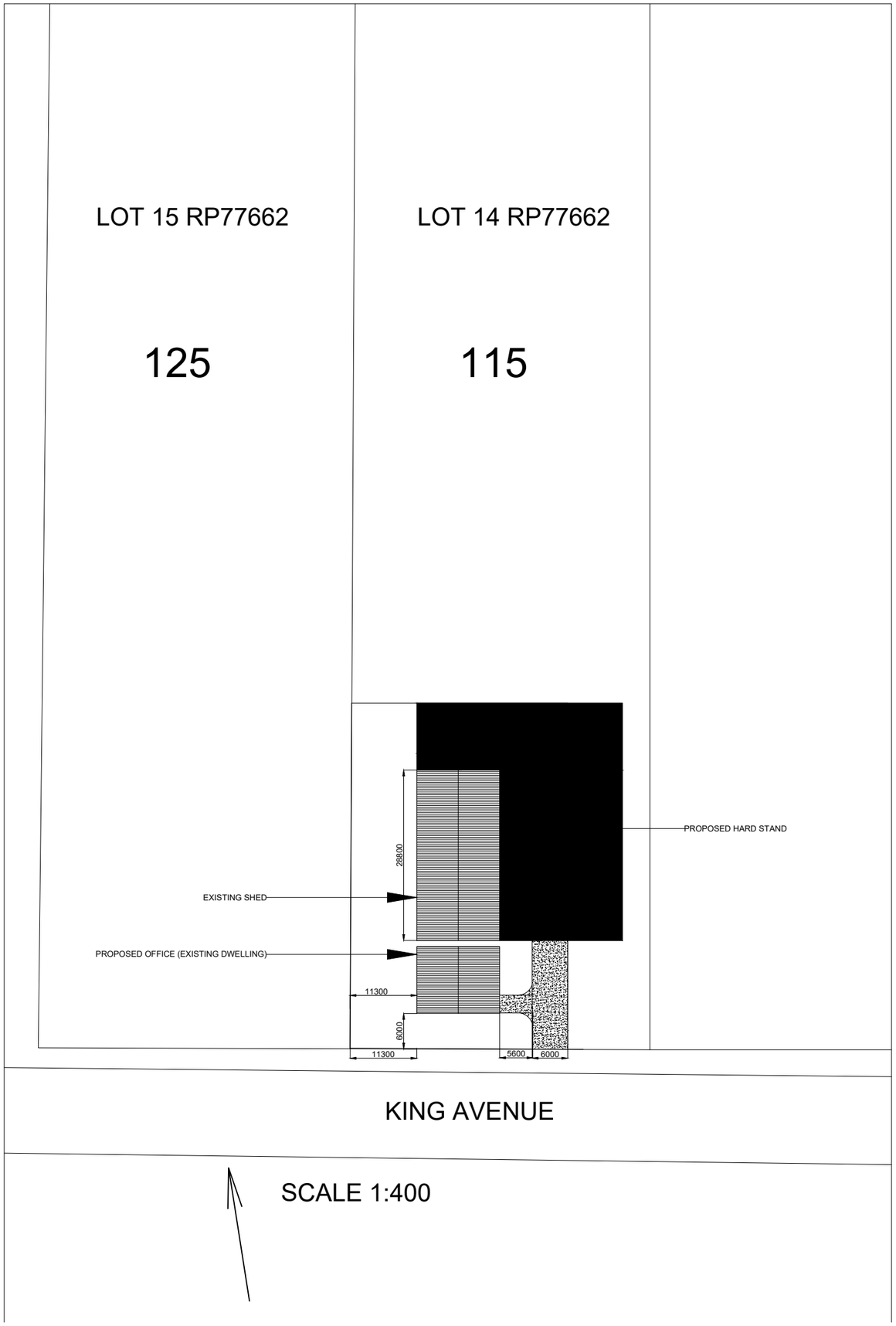
QUDM (2017) – Queensland Urban Drainage Manual 2017

XPSWMM (2021) – XP Solutions, V2021

Appendix A – Flood Awareness Mapping


Overland flow
River, creek, stormtide
High likelihood (5.0% Annual Chance)
Medium likelihood (1.0% Annual Chance)
Low likelihood (0.2% Annual Chance)
Very low likelihood (0.05% Annual Chance)
AV
Durack

Appendix B – Proposed Plans


LOT 15 RP77662
125
LOT 14 RP77662
115
PROPOSED HARD STAND
28800
EXISTING SHED
PROPOSED OFFICE (EXISTING DWELLING)
11300
6000
11300
5600
6000
KING AVENUE
SCALE 1:400

LEGEND

(solid line)	SITE BOUNDARY
(dash-dot line)	EXISTING PROPERTY BOUNDARY
XX.XX (dashed line)	EXISTING CONTOURS (AT 0.50m INTERVALS)
XX.XX (dashed line)	DESIGN CONTOUR (INTERVAL 0.10m)
(hatched line)	EXISTING BUILDING
(thick grey line)	PROPOSED RETAINING WALL
XX.XXXm ✖	FINISHED SURFACE ELEVATION LABEL
XX.XXXm ✖	EXISTING SURFACE ELEVATION LABEL

EARTHWORKS LEVELS

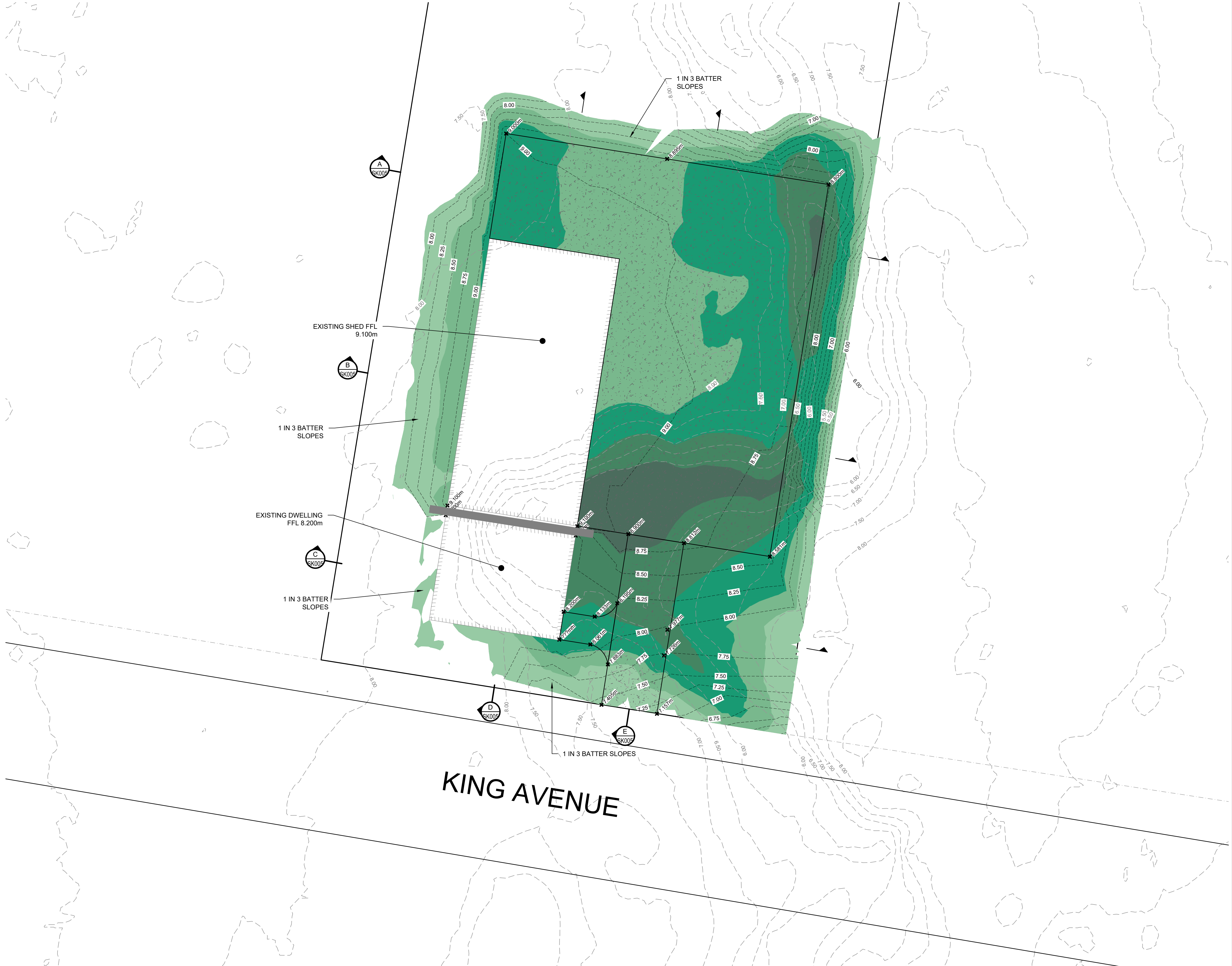
1. PRELIMINARY EARTHWORKS VOLUMES AND LEVELS BASED ON SLAB THICKNESS OF 150mm. REFER STRUCTURAL DESIGN DRAWINGS AT DETAILED DESIGN STAGE FOR FINAL PAD THICKNESS.
2. ALL RETAINING WALL HEIGHTS ARE TO EARTHWORKS SURFACE LEVELS AND TO NEAREST 100mm HEIGHT.

EARTHWORKS VOLUMES (EXISTING SURFACE TO EARTHWORKS SURFACE)	
TOTAL CUT	1.275m³
TOTAL FILL	2747.859m³
TOTAL BALANCE (CUT TO SPOIL)	2746.584m³

CUT & FILL LEGEND

EXCAVATION	FILLING
NO EARTHWORKS	NO EARTHWORKS
	0.0m - 0.5m
	0.5m - 1.0m
	1.0m - 2.0m
	2.0m - 3.0m
	3.0m - 3.70m

NOTES:
- CUT AND FILL IS PROVIDED FOR GUIDANCE ONLY AND DENOTES LEVEL DIFFERENCE BETWEEN EARTHWORKS SURFACE AND EXISTING SURFACE (AFTER 100mm ASSUMED TOPSOIL STRIP).
- AREAS NOT REQUIRING EARTHWORKS ARE TO REMAIN UNDISTURBED.
- FINAL EXTENTS OF CUT/FILL ARE TO BE DETERMINED BY THE CONTRACTOR ON SITE IN CONJUNCTION WITH THE EARTHWORKS DESIGN.



NOTES:
- CUT AND FILL IS PROVIDED FOR GUIDANCE ONLY AND DENOTES LEVEL DIFFERENCE BETWEEN DESIGN SURFACE AND EXISTING SURFACE .
- AREAS NOT REQUIRING EARTHWORKS ARE TO REMAIN UNDISTURBED.
- CUT/FILL IS TO ULTIMATE FINISHED INCLUDING TOPSOIL AND ROAD SURFACE AND DOES NOT CONSIDER EXCAVATION NEEDED FOR ROAD PAVEMENTS, TOPSOIL ETC.
- FINAL EXTENTS OF CUT/FILL ARE TO BE DETERMINED BY THE CONTRACTOR ON SITE IN CONJUNCTION WITH THE EARTHWORKS DESIGN.

FOR INFORMATION

REV	DESCRIPTION	DATE	DRAWN	REVIEW
B	ISSUED FOR INFORMATION	02.09.2025	MS	WB
A	ISSUED FOR INFORMATION	06.05.2022	IM	IM

DESIGNER: M.SHAHID
DRAFTING QA: M.SHAHID
DESIGN QA: M.SHAHID
QA CHECKED: E.CLEMENTS

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CLIENT: TONI WARD ARCHITECTURE

ASSOCIATED CONSULTANT: MARJALLA PTY LTD

NORTH POINT: N

SCALE BARS: 0 20 40 60 80m SCALE 1:1500 @ A1

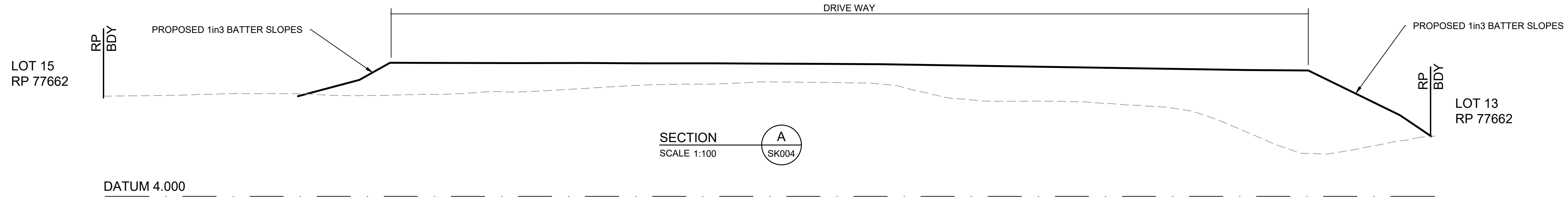
THIS DRAWING IS TO BE PRINTED IN COLOUR. REPRODUCTION OR READING OF THIS DRAWING IN OTHER THAN FULL COLOUR MAY IMPART FALSE OR MISLEADING INFORMATION

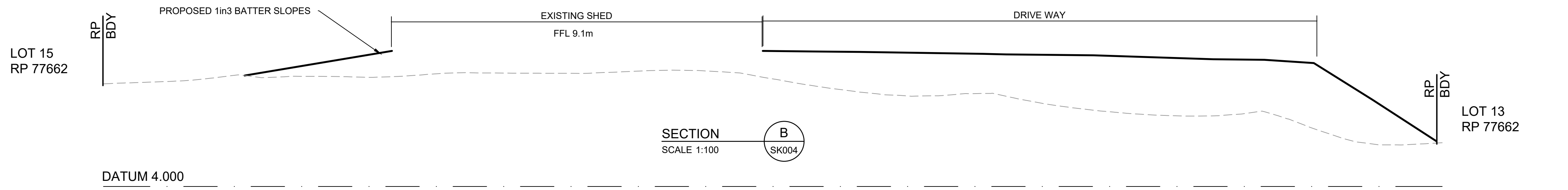
PROJECT: PROPOSED DEVEOPMENT 115 KING AVENUE WILLAWONG

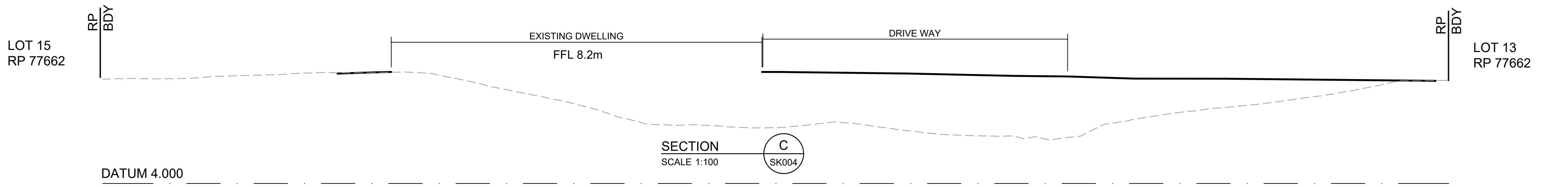
DRAWING TITLE: BULK EARTHWORKS LAYOUT PLAN

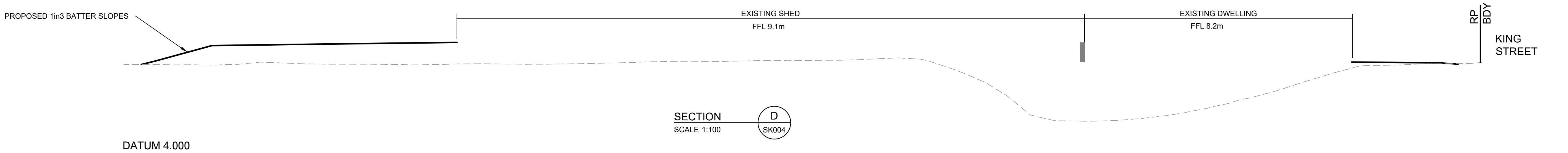
FOR INFORMATION

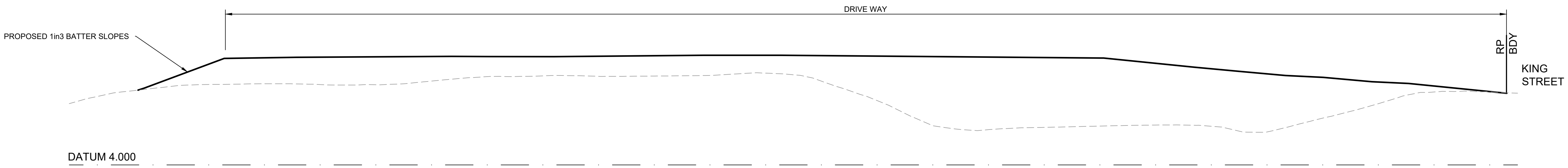
JOB No	DWG No	REV
10115	SK004	B











SECTION E
SCALE 1:100
SK004

FOR INFORMATION

REV	DESCRIPTION	DATE	DRAWN	REVIEW
B	ISSUED FOR INFORMATION	02.09.2025	MS	WB
A	ISSUED FOR INFORMATION	06.05.2022	IM	IM

DESIGNER: M.SHAHID
DRAFTING QA: M.SHAHID
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CLIENT: TONI WARD ARCHITECTURE

ASSOCIATED CONSULTANT: MARJALLA PTY LTD

NORTH POINT:

SCALE BARS: 0 2 4 6m
SCALE 1:100 @ A1

THIS DRAWING IS TO BE PRINTED IN COLOUR REPRODUCTION OR READING OF THIS DRAWING IN OTHER THAN FULL COLOUR MAY IMPART FALSE OR MISLEADING INFORMATION

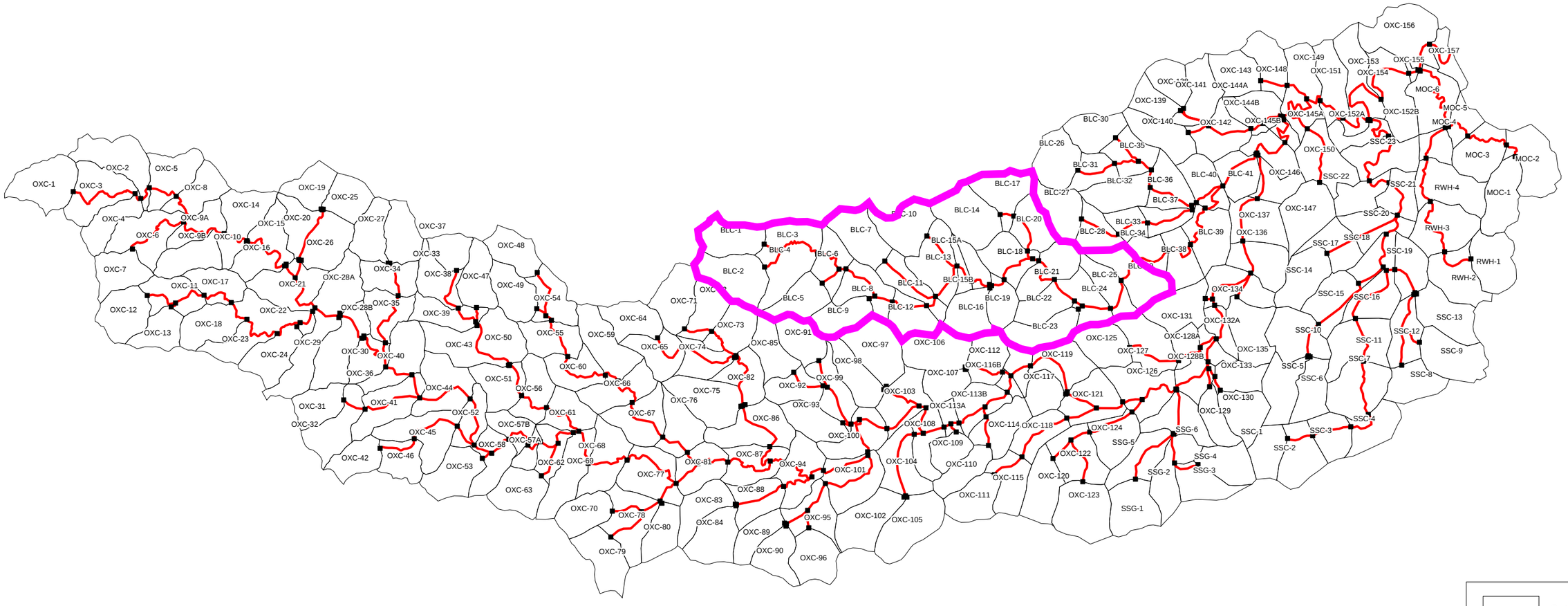
PROJECT: PROPOSED DEVEOPMENT
115 KING AVENUE
WILLAWONG

DRAWING TITLE: BULK EARTHWORKS
SITE SECTIONS

FOR INFORMATION

JOB No		DWG No		REV
10115	-	SK005	-	B

Appendix C – Catchment Plan



Disclaimers and Notes: 1. Creek alignment approximate only. 2. Gauge locations as provided by BoM, DNRM & BCC.	Logo:	Client: BRISBANE CITY COUNCIL	Project: OXLEY CREEK FLOOD STUDY	Scale: 0 2,500 5,000 Scale 1:100,000 (A3)	Figure Title: FIGURE 4-1 RAFTS MODEL LAYOUT	Figure No. Figure 4-1 Revision. 2 Date. 29/05/2013

Appendix D – XPSWMM Modelling Extent

Figure D.1- Model Configuration

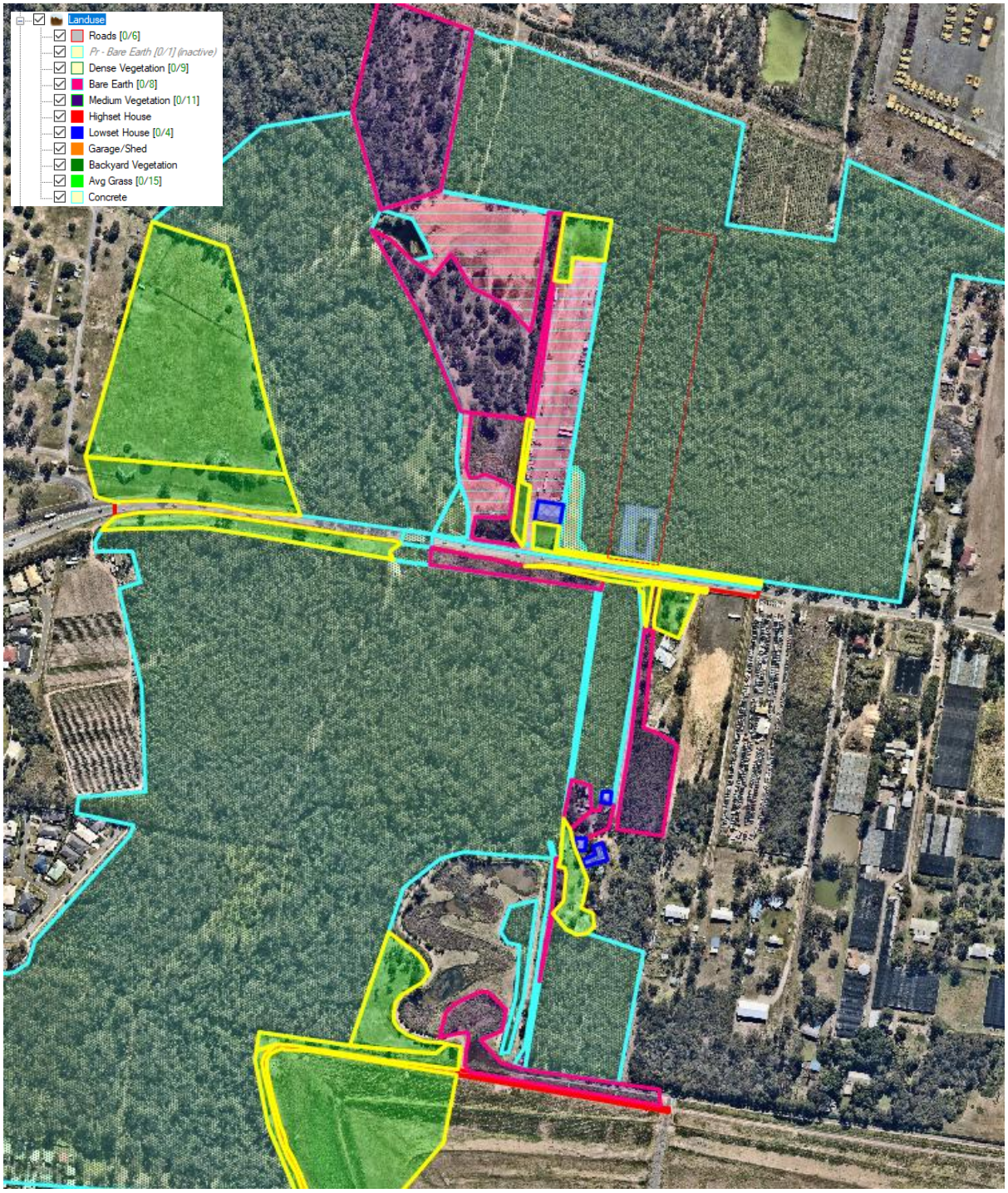


Figure D.2- Landuses

Appendix E – XPSWMM Results (Existing Scenario)

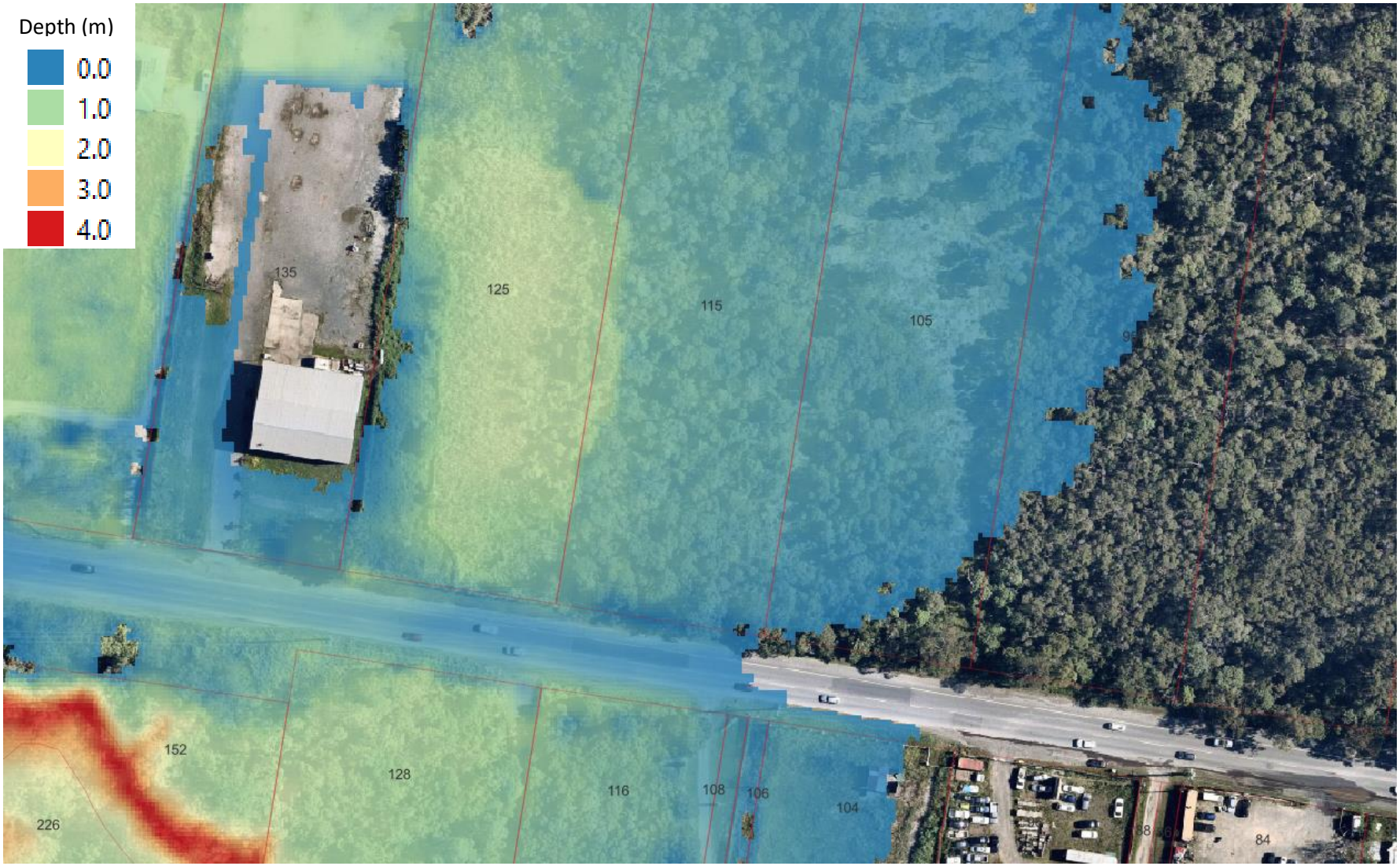


Figure E.1 – 1% AEP Flood Depths in Existing Condition

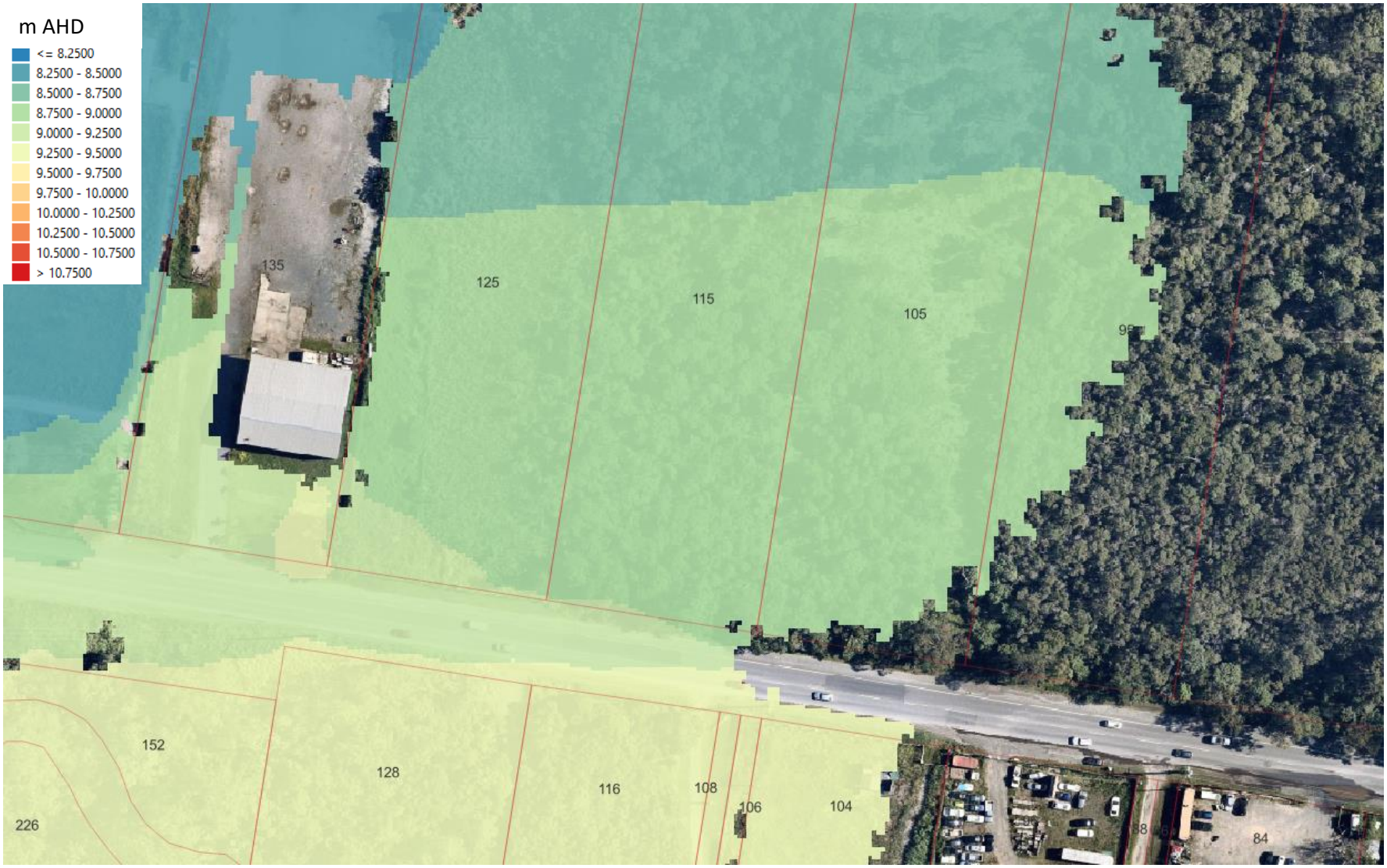


Figure E.2 – 1% AEP Flood Levels in Existing Condition

Figure E.3 – Flooding Hazards in a 1% AEP Event – Existing Condition

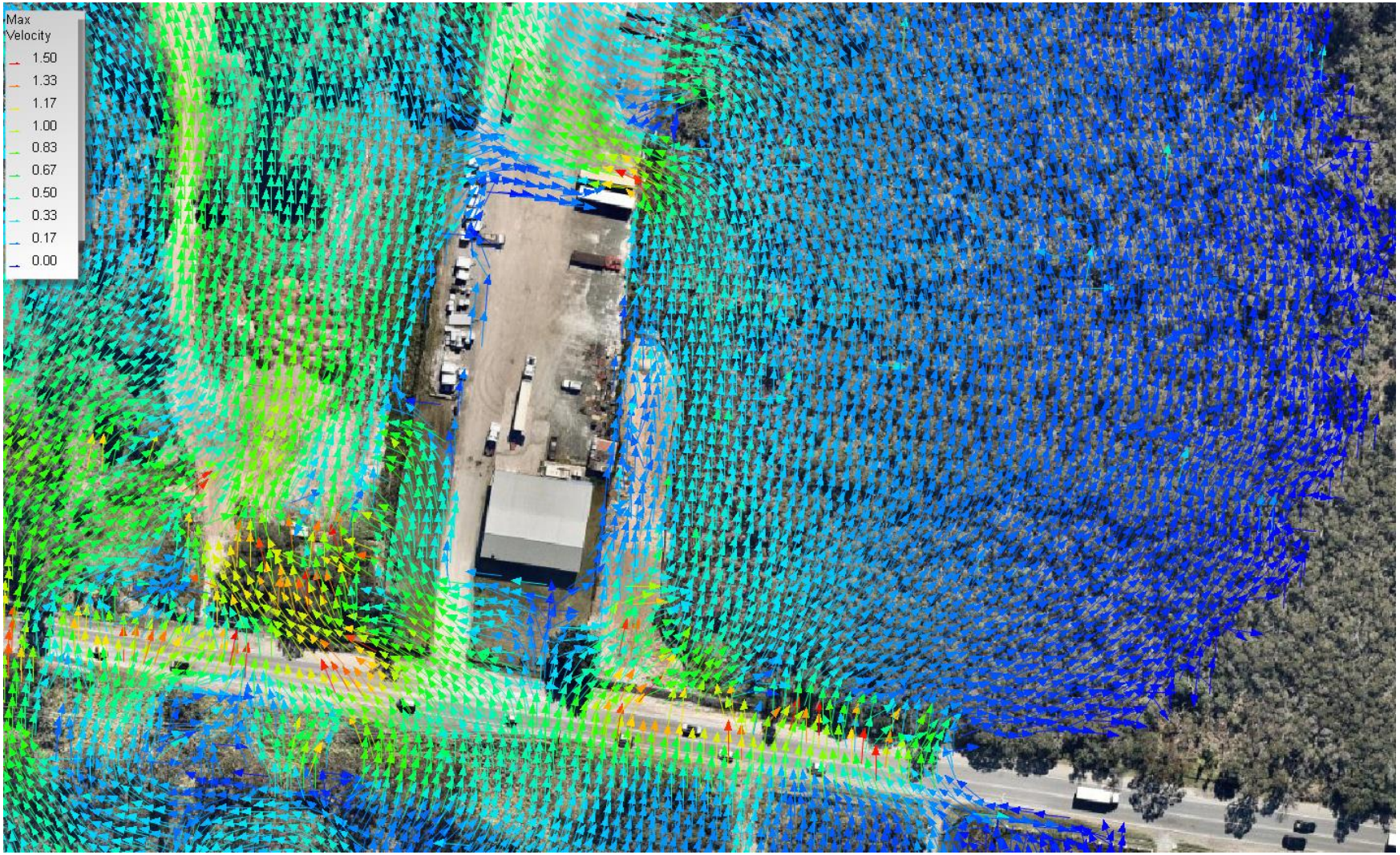


Figure E.4 – Flood Velocities in a 1% AEP Event – Existing Condition

Appendix F – Impact Assessment Results

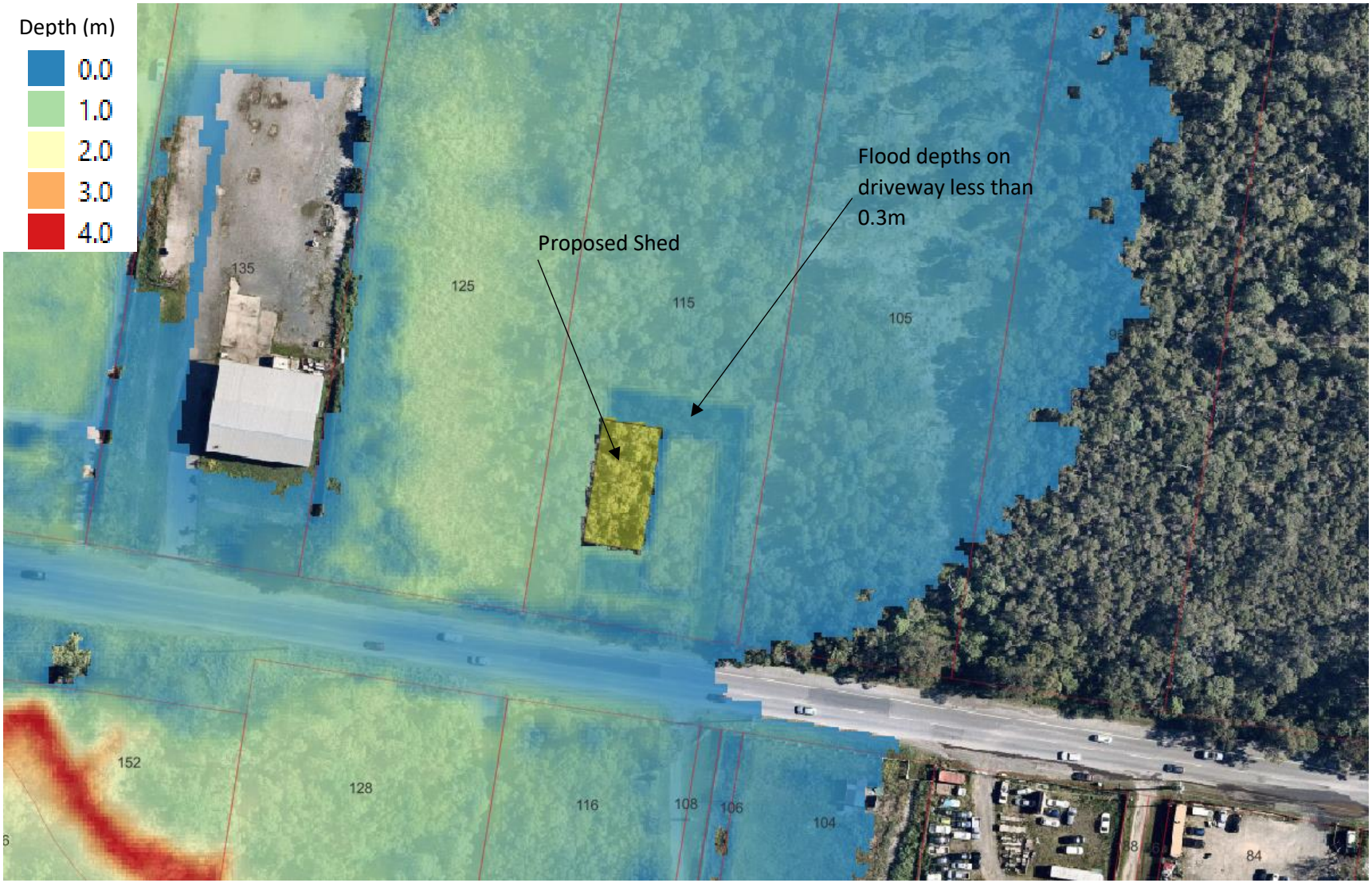


Figure F.1 – Flood depths in a 1% AEP design event – Developed condition

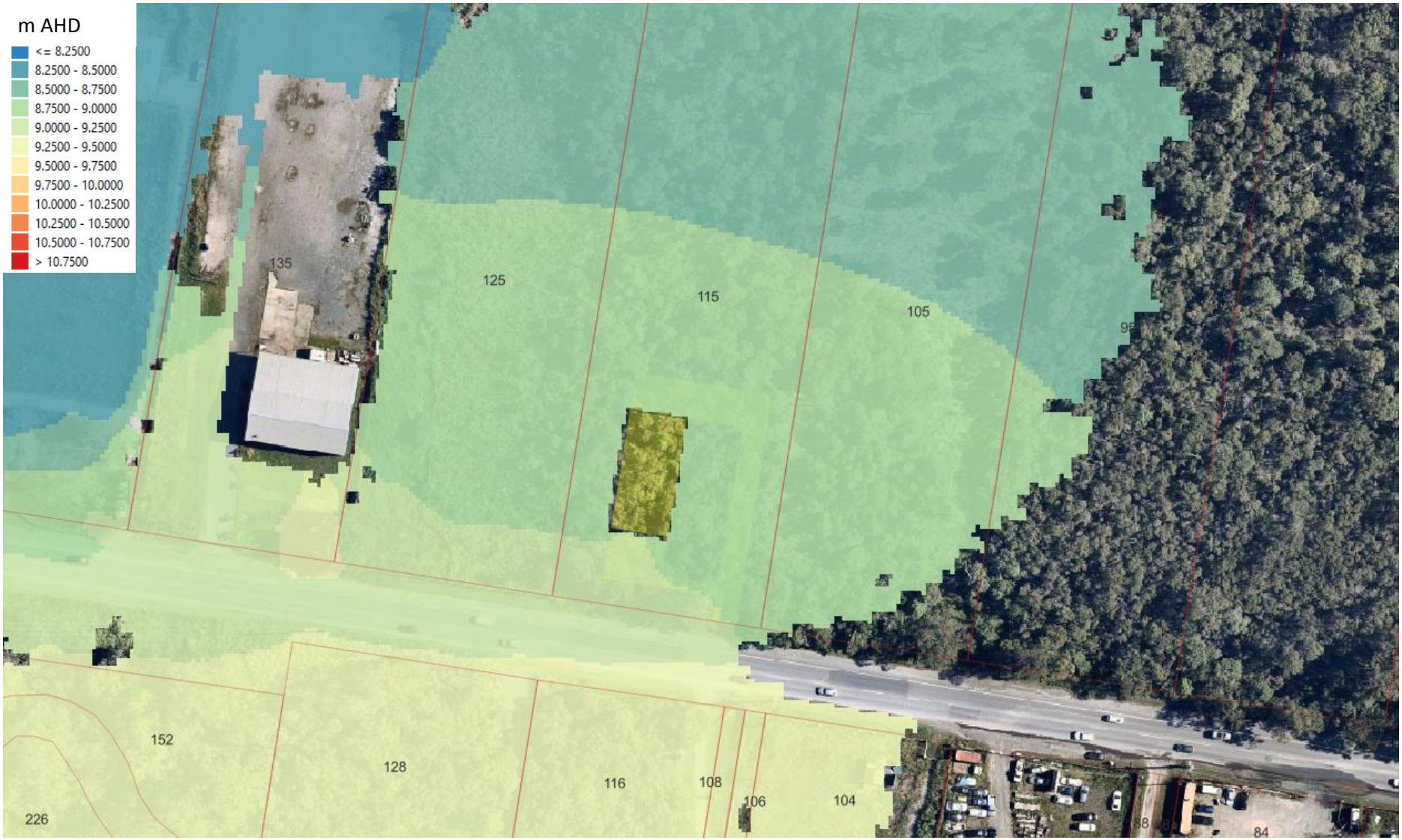


Figure F.2 – Flood levels in a 1% AEP Design Event – Developed condition

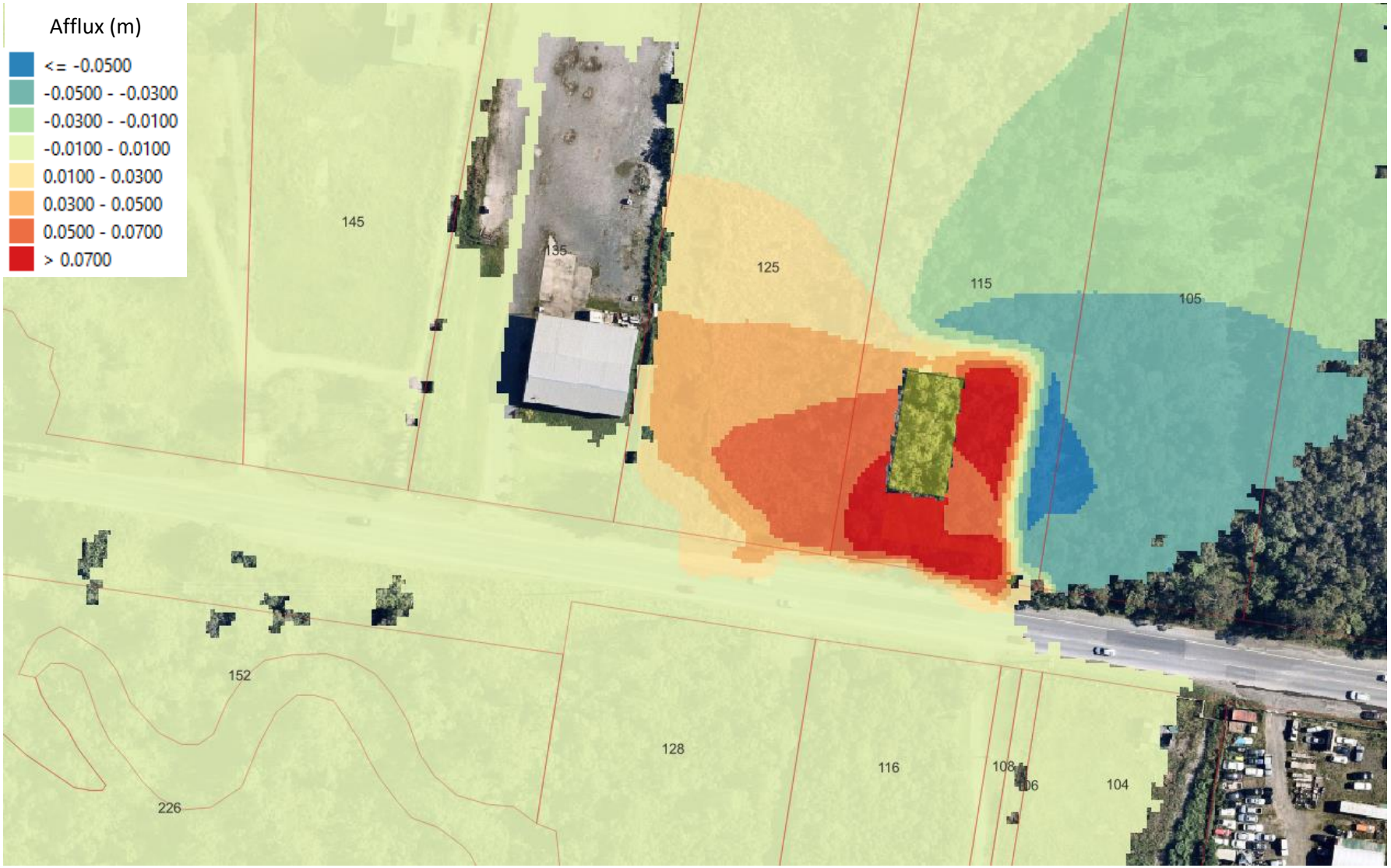


Figure F.3– Post Development Afflux in a 1% AEP Design Event

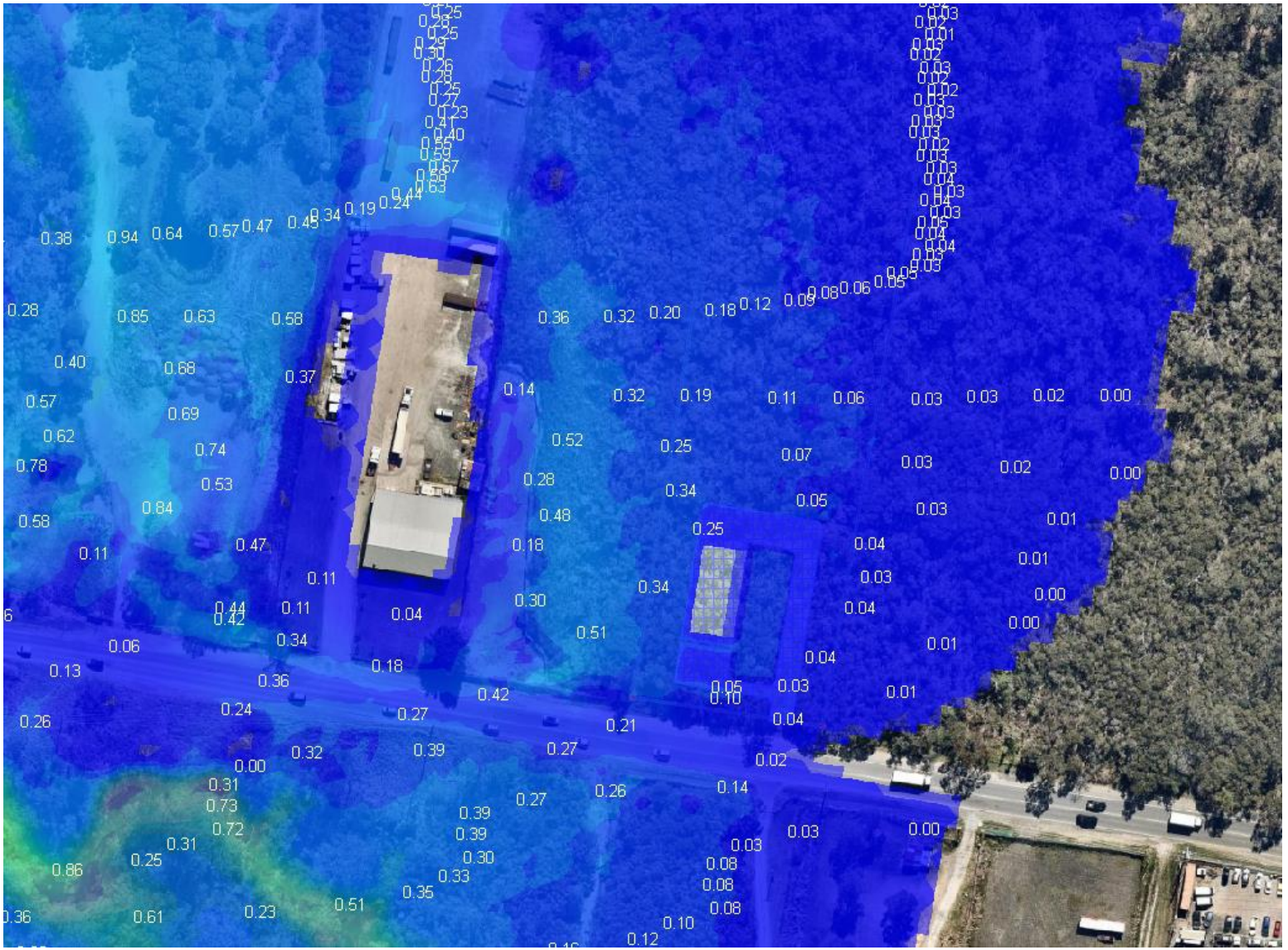


Figure F.4– Flood Hazard Map in a 15 AEP Event – Developed Condition

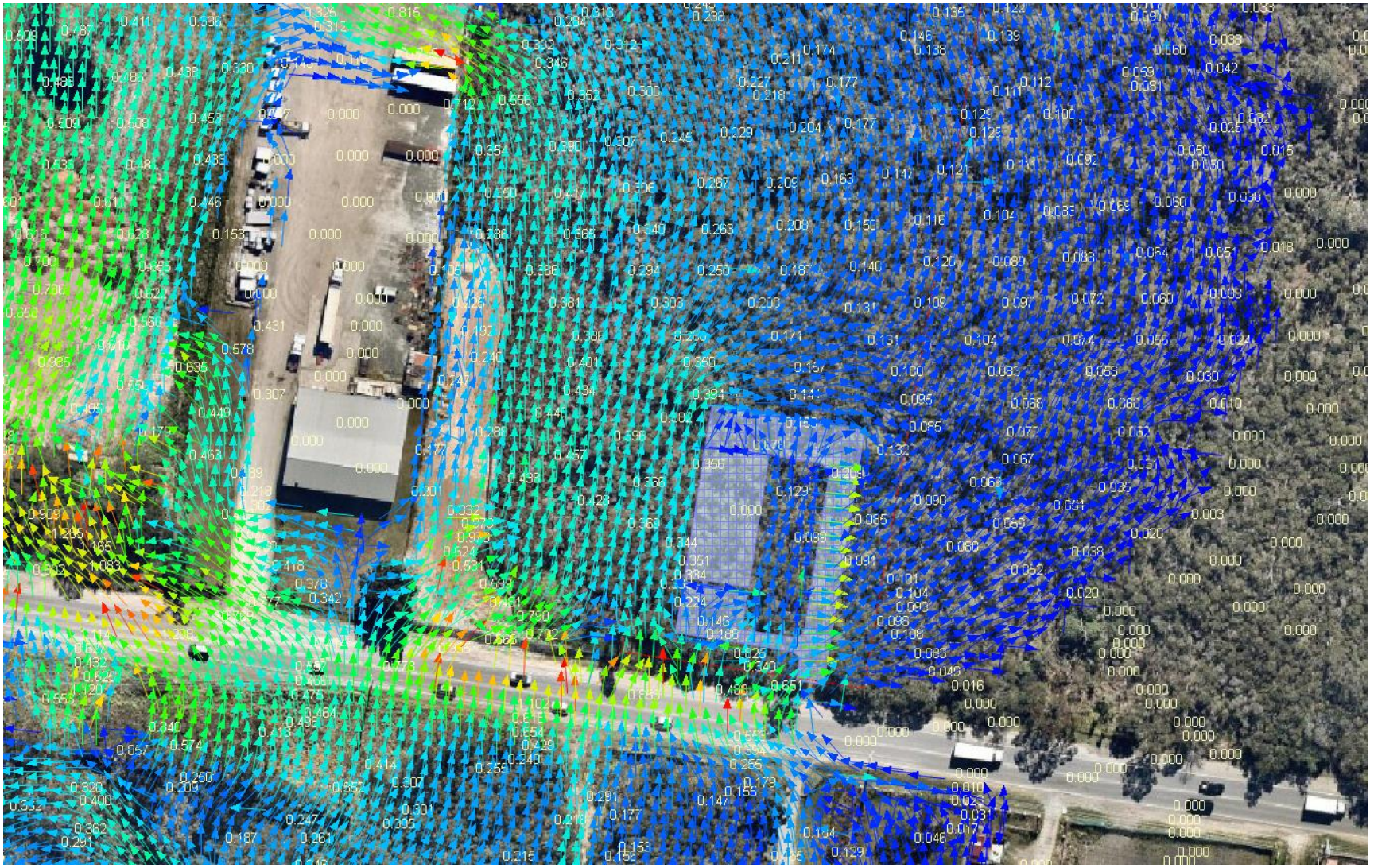


Figure F.5– Flood Velocities in a 1% AEP Event – Developed Condition

Appendix G – Council Code Tables

Project Location: 115 King Ave, Willawong Job Reference: 10115

BCC - Flood Overlay Code

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
Section A—If for accepted development subject to compliance with identified requirements (acceptable outcomes only) or assessable development for a dwelling house including any secondary dwelling Note—Development for a dwelling house does not require assessment against any other sections of this code.				
PO1 Development involving any habitable or non-habitable part of a dwelling house, including any secondary dwelling, is located and designed to: a) minimise the risk to people from flood hazard; b) achieve acceptable flood immunity; c) minimise property impacts from a flood event up to and including the defined flood event; d) minimise disruption to residents, recovery time and rebuilding or restoration costs after a flood event up to and including the defined flood event.	**AO1.1** Development for a dwelling house including any secondary dwelling: (a) is not located in the Brisbane River flood planning area 1, 2a or 2b sub-categories or the Creek/waterway flood planning area 1 or 2 sub-categories; or (b) is only located in these sub-categories, if a Registered Professional Engineer Queensland certifies that the dwelling house and any secondary dwelling are structurally designed to be able to resist hydrostatic and hydrodynamic loads associated with flooding up to and including the defined flood event.	**N/A**	The proposed development will not involve any new buildings. The site is not located within creek/waterway FPA 1 or 2.	
	AO1.2 Development for a dwelling house and any secondary dwelling complies with the minimum flood planning levels in Table 8.2.11.3.B.	**N/A**	The proposed development will not involve any new buildings.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
	Note—If located in an area that has no flood level information available from the Council such as an overland flow path, a Registered Professional Engineer of Queensland with expertise in undertaking flood studies is to certify that the flood level and development levels for the dwelling house and any secondary dwelling achieve the required flood planning levels in Table 8.2.11.3.B.			
	AO1.3 Development involving a building undercroft complies with the minimum clearance requirements in Table 8.2.11.3.E. Editor's note—For creek/waterway, storm-tide and river flooding, applicable flood planning information is available from Council'sFloodWise Property Report. Note—The Flood planning scheme policy provides guidance on undercroft design.	**N/A**	The proposed development will not involve any new buildings.	
PO2 Development within the Creek/waterway flood planning area sub-categories or Overland flow flood planning area sub-category: a) maintains the conveyance of flood waters to allow flow and debris to pass predominantly unimpeded through the site; b) does not concentrate, intensify or divert floodwater onto	**AO2** Development: (a) is not located within the Creek/waterway flood planning area 1, 2 or 3 sub-categories or the Overland flow flood planning area sub-category; or (b) provides an open undercroft area from natural ground level to habitable floor level for any area inundated by the defined flood event; or Note—This undercroft area is not suitable for providing non-habitable rooms, secure storage	**AO**	The development is not within the Creek/waterway flood planning area 1, 2 or 3 sub-categories or the Overland flow flood planning area sub-category;	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
upstream, downstream or adjacent properties; c) will not result in a material increase in flood levels or flood hazard on upstream, downstream or adjacent properties.	of valuables, or future enclosing for storage or car parking. The clear area may include structural elements such as columns and floor substructure. The Flood planning scheme policyprovides guidance on undercroft design. Editor's note—An open undercroft design may be achieved through a 'valance' treatment around the perimeter of an otherwise internally clear undercroft. Editor's note—For Creek/waterway, storm-tide and river flooding, applicable flood planning information is available from Council'sFloodWise Property Report. (c) a report from a Registered Professional Engineer Queensland certifies that the development in the Creek/waterway flood planning area or Overland flow flood planning area sub-categories will not result in a material increase in flood level or flood hazard on upstream, downstream or adjacent properties. Note—Flood studies demonstrate that the development and engineering design methods conform to the principles within the Flood planning scheme policy and the Infrastructure design planning scheme policy.			

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
Section B—If accepted development subject to compliance with identified requirements (acceptable outcomes only) or assessable development other than for a dwelling house or reconfiguring a lot Note—If development that is accepted development subject to compliance with identified requirements complies with the acceptable outcomes of this part, no further assessment against this code is required.				
PO3 Development: a) is compatible with flood hazard in a defined flood event; b) minimises the risk to people from flood hazard; c) does not reduce the ability of evacuation resources including emergency services to access and evacuate the site in a flood emergency, with consideration to the scale of the development; d) minimises impacts on property from flooding; e) minimises disruption to residents, business or site operations and recovery time due to flooding; f) minimises the need to rebuild structures after a flood event greater than the defined flood event. Note—Where Table 8.2.11.3.C identifies that a flood risk assessment is required, compliance with this performance outcome can be achieved by submitting a flood	**AO3** Development for a material change of use is identified in Table 8.2.11.3.C as compatible with the flood hazard in the relevant flood planning area.	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
risk assessment, which may be included within a flood study, addressing the criteria within this performance solution. Preparing flood risk assessments and flood studies is required to be in accordance with the Flood planning scheme policy. Note—An emergency management plan prepared in accordance with the Flood planning scheme policy, which sets out procedures for evacuation due to flooding may be used to demonstrate compliance with this performance outcome.				
PO4 Development for a park ensures that the design of a park and location of structures and facilities responds to the flood hazard and balances the safety of intended users with: a) maintaining continuity of operations; b) impacts of flooding on asset life and ongoing maintenance costs; c) efficient recovery after flood events; d) recreational benefits to the city; e) availability of suitable land within the park.	**AO4.1** Development involving a building or structure in a park complies with the flood planning levels specified in Table 8.2.11.3.D.	**N/A**	Not applicable to this development.	
	AO4.2 Development involving a building or structure in a park where Table 8.2.11.3.D does not apply: a) is not located within the 20% AEP flood extent of any creek/waterway or overland flow path; or b) is located above the 20% AEP flood level of any creek/waterway or overland flow path.	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
Section C—If for assessable development other than for a dwelling house				
PO5 Development is located and designed to: a) minimise the risk to people from flood hazard on the site; b) minimise flood damage to the development and contents of buildings up to the defined flood event; c) provide suitable amenity; d) minimise disruption to residents, recovery time and the need to rebuild structures after a flood event up to and including the defined flood event.	**AO5.1** Development complies with the flood planning levels specified in Table 8.2.11.3.D. Note—If located in an area with no Council-derived flood levels such as an overland flow path, a Registered Professional Engineer Queensland with expertise in undertaking flood studies is to derive the applicable flood level and certify that the development meets the required flood planning levels in Table 8.2.11.3.D. The study is to demonstrate that the development and engineering design methods conform to the principles within the Flood planning scheme policy and the Infrastructure design planning scheme policy.	**N/A**	The proposed development will not involve any new buildings.	
	AO5.2 Development is: a) not located in the: (i) Brisbane River flood planning area 1, 2a, or 2b sub-categories; (ii) Creek/waterway flood planning area 1 or 2 sub-categories; (iii) Overland flow flood planning area sub-category; or b) only located in these sub-categories if a Registered Professional Engineer Queensland with expertise in undertaking flood studies certifies that: (i) the development design, siting and any mitigation measures will ensure the	**N/A**	The proposed development will not involve any new buildings. The site is located within Brisbane River FPA 2b but the existing shed has been located above the flood planning level. A site specific flood study has been undertaken.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
	development is structurally adequate to resist hydrostatic, hydrodynamic and debris impact loads associated with flooding up to the defined flood event; and (ii) the risk to people is managed to an acceptable level.			
PO6 Development involving essential electrical services or a basement storage area is suitably located and designed to ensure public safety and minimise flood recovery and economic consequences of damage during a flood.	**AO6.1** Development ensures that: a) all areas containing essential electrical services comply with the flood planning levels in Table 8.2.11.3.D; or b) if a basement contains essential electrical services or a private basement storage area, the basement is a waterproof structure with walls and floors impermeable to the passage of water with all entry points and services located at or above the relevant flood planning level in Table 8.2.11.3.D. Note—A basement storage area does not include a bike storage room, change room, building maintenance storage and non-critical electrical services.	**N/A**	Not applicable to this development.	
	AO6.2 Development involving a basement that relies on a pumping solution to manage floodwater ingress or for dewatering after a flood provides a secondary pump system with a backup power source for the pump.	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
PO7 Development does not directly or indirectly create a material adverse impact on flood behaviour or drainage on properties that are upstream, downstream or adjacent to the development.	**AO7.1** Development: a) does not block, or divert floodwaters for any area affected by creek/waterway or overland flow flooding, excluding storm-tide flooding and Brisbane River flooding sources; or b) does not result in a material increase in flood level or hydraulic hazard on upstream, downstream or adjacent properties. Note—Compliance with this acceptable solution can be demonstrated by the submission of a flood study by a Registered Professional Engineer of Queensland with expertise in undertaking flood studies demonstrating that the development and engineering design methods conform to the principles within the Flood planning scheme policy and the Infrastructure design planning scheme policy.	**PO**	A flood impact assessment has been undertaken and confirmed that the proposal does not result in a material adverse impact to surrounding properties. Please refer to the report for further details.	
	AO7.2 Development retains existing overland flow paths and does not rely wholly on piped solutions to manage major flows.	**AO**	The development retains the existing overland flow path.	
	AO7.3 Development which creates a new overland flow path or significantly modifies an existing overland flow path via earthworks does not materially worsen hydraulic hazard on the site from existing conditions.	**N/A**	The development does not alter the existing overland flow path.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
	Note—Compliance with this acceptable solution can be demonstrated by the submission of a flood study by a Registered Professional Engineer of Queensland with expertise in undertaking flood studies demonstrating that the development and engineering design methods conform to the principles within the Flood planning scheme policy and the Infrastructure design planning scheme policy.			
PO8 Development for filling or excavation in an area affected by creek/waterway flooding does not directly, indirectly or cumulatively cause any material increase in flooding or hydraulic hazard or involve significant redistribution of flood storage from high to lower areas in the floodplain. Note—This can be demonstrated by undertaking earthworks in compliance with the Compensatory earthworks planning scheme policy. Note—This part of the code applies to all development other than a dwelling house and any secondary dwelling which involves filling or excavation, whether or not the development application comprises a separate development application for	**AO8** Development ensures that no filling or excavation greater than 100mm is located in the Creek/waterway flood planning area 1, 2 or 3 sub-categories if contained in the 5% AEP flood extent of any Creek/waterway flood planning area sub-category for which no waterway corridor has been mapped in the Waterway corridors overlay.	**PO**	A flood impact assessment has been undertaken and confirmed that the proposal does not result in a material adverse impact to flooding characteristics in surrounding properties. Please refer to the report for further details.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
operational work involving filling or excavation.				
PO9 Development ensures that the building and site design: a) maintains the conveyance capacity of existing overland flow paths and creek/waterways; b) ensures floodwaters and flood debris can pass predominantly unimpeded under a structure or building to minimise property or building damage, including for a flood larger than the defined flood event; c) mitigates flood impacts by ensuring that filling, excavation and location of services are designed to allow for the conveyance of floodwater across the site. Note—The Flood planning scheme policy provides guidance on relevant considerations in determining minimum undercroft clearances and treatment of ground level in undercroft areas where floodwater conveyance is	**AO9.1** Development involving a building undercroft in the Creek/waterway flood planning area sub-categories or the Overland flow flood planning area sub-category: a) complies with the minimum building undercroft clearance requirements in Table 8.2.11.3.E; b) not located directly above any part of a waterway corridor as mapped in the Waterway corridors overlay.	**N/A**	The proposed development will not involve any new buildings.	
	AO9.2 Development involving a building undercroft in the Creek/waterway flood planning area sub-categories or the Overland flow flood planning area sub category: (a) has a ground level within the undercroft area that is free draining; (b) does not involve excavation below ground level of more than 300mm within the undercroft area.	**N/A**	The proposed development will not involve any new buildings.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
required underneath development.				
PO10 Development for vulnerable uses, difficult to evacuate uses or assembly uses optimises vehicular access and efficient evacuation from the development to parts of the road network unaffected by flood hazard, in order to: a) protect safety of users and emergency services personnel; b) support efficient emergency services access and site evacuation with consideration to the scale of development. Note—A flood risk assessment may be required to address the performance outcomes or acceptable solutions which deal with evacuation and isolation arrangements, and the ability to take refuge. The Flood planning scheme policy provides information for undertaking flood risk assessments.	**AO10** Development for vulnerable uses, difficult to evacuate uses or assembly uses: a) is not isolated in any event up to the relevant flood planning level specified in Table 8.2.11.3.L; or b) has direct vehicle access to a critical route or interim critical route in the Critical infrastructure and movement network overlay for evacuation in a flood; or c) can achieve vehicular evacuation to a suitable flood-free location. Note—A suitable flood-free location is of a size and nature sufficient to provide for the size and characteristics of the population likely to need evacuation to that area.	**N/A**	The development is not for vulnerable, difficult to evacuate or assembly uses.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
PO11 Development has access which, having regard to hydraulic hazard, provides for safe vehicular and pedestrian movement and emergency services access to adjoining roads.	**AO11.1** Development provides an access or driveway into the site which is: a) trafficable during the defined flood event; b) not located in the Creek/waterway flood planning area 1 sub-category; c) not located in the Overland flow flood planning area sub-category if the hydraulic hazard is unsafe in the defined flood event; d) the access or driveway is not inundated by a 10% AEP flood.	**N/A**	Not applicable for a residential dwelling.	
	AO11.2 Development located in the Creek/waterway flood planning area 1, 2, 3 or 4 sub-categories locates any disabled access in the highest part of the site. Note—explanation of hydraulic hazard provided in the Flood planning scheme policy.	**N/A**	Not applicable for a residential dwelling.	
PO12 Development involving a new road, a bridge or culvert is designed to minimise impacts to flood behaviour, minimise disruption to traffic during a flood and allow for emergency access.	**AO12** Development involving a new road complies with the flood planning levels in Table 8.2.11.3.F.	**N/A**	Not applicable to this development.	
PO13 Development for pedestrian and cyclist paths:	**AO13.1** Development for cyclist and pedestrian facilities other than on public roads, including those traversing through a park and adjacent to a watercourse and overland flow path, are	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
a) provides a suitable level of trafficability; b) manages the impacts of flooding on asset life and ongoing maintenance costs; c) balances route availability with recreational and transport connectivity benefits to the city.	located above the 39% AEP (2 year ARI) flood immunity from all flooding sources. Note—If the site is subject to more than one type of flooding, the requirement that affords the greatest level of protection will apply.			
	AO13.2 All new on-road cyclist and pedestrian facilities comply with the flood planning levels and trafficability standards for the applicable category of road in Table 8.2.11.3.F or Table 8.2.11.3.K.	**N/A**	Not applicable to this development.	
PO14 Development which increases the residential population within the Brisbane River flood planning area sub-categories minimises the risk to people in all flood events with consideration to flood hazard, including warning time.	**AO14** Development in the Brisbane River flood planning area sub-categories in areas where the residential flood level is greater than 12.8m AHD involving: a) an increase in the number of residential dwellings; or b) additional residential lots is not subject to an unsafe hydraulic hazard in the 0.2% AEP flood event. Note—Explanation of a hydraulic hazard is provided in the Flood planning scheme policy.	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
Additional performance outcomes and acceptable outcomes for essential community infrastructure				
PO15 Development involving essential community infrastructure: a) remains functional to serve community need during and immediately after a flood event, or is part of a network that is able to maintain the function of the essential community infrastructure when parts of the development are unable to function during or after a flood; b) is designed, sited and operated to avoid adverse impacts on the community or the environment due to the impacts of flooding on infrastructure, facilities or access and egress routes; c) is able to remain functional or is part of a network which is able to remain functional even when other infrastructure or services (such as electricity supply) may be compromised in a flood event; d) contains mitigation measures which are not entirely dependent on human activation to respond to a flood event.	**AO15** Development involving essential community infrastructure: a) is ancillary to and not relied upon for the provision of the essential service during a flood; or b) is located above the flood planning levels in Table 8.2.11.3.G; c) has access to or provides the necessary back-up emergency electricity and communications supply in times of flood; d) is designed and constructed to resist hydrostatic and hydrodynamic forces as a result of inundation by the flood event listed for the development type in Table 8.2.11.3.G; e) that services a local area: (i) is able to be accessed in times of flood to service local community needs up to the event listed for that development type in Table 8.2.11.3.G; or (ii) has a service continuity plan that demonstrates the continued provision of service during the relevant flood event.	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
Note—Protection of function is required up to and including the flood event in Table 8.2.11.3.G.				
Additional performance outcomes and acceptable outcomes if development involves the processes in Table 8.2.11.3.H				
PO16 Development involving the storage and handling of hazardous materials avoids or minimises risks to public health and safety and the environment, by: a) protecting underground tanks for hazardous materials against the forces of buoyancy, velocity flow and debris impacts; b) securing above-ground tanks for hazardous materials against flotation and lateral movement; c) preventing damage to hazardous materials pipework or entry of floodwater into hazardous materials pipework; d) preventing damage to or off-site release of packages, drums or containers storing hazardous materials. Note—A chemical hazards flood risk report prepared in accordance with the Management of hazardous chemicals in flood	**AO16** a) Development does not include the storage or handling of hazardous chemicals that are equivalent to or exceed the threshold quantities in Table 8.2.11.3.M. b) Development involving the processes listed in Table 8.2.11.3.H: (i) where located in the Flood overlay area, occurs only in the Creek/waterway flood planning area 5 sub-category or the Brisbane River flood planning area 5 sub-category; or (ii) is consistent with the standards contained in the Management of hazardous chemicals in flood prone areas planning scheme policy and can operate without risk of environmental harm during a flood event. Note—The Management of hazardous chemicals in flood prone areas planning scheme policy sets out further information and processes including risk assessment for the management of hazardous chemicals in flood planning areas.	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
prone areas planning scheme policy can assist in demonstrating achievement of this performance outcome. Note—A pump drainage system is not an acceptable measure to meet the performance outcome.				
Additional performance outcomes and acceptable outcomes for reconfiguring a lot				
PO17 **PO17** Development locates and designs all lots resulting from reconfiguring a lot to: a) minimise the risk to people from flood hazard; b) minimise damage to property from flood hazard; c) facilitate safe and efficient evacuation. Note— • Consideration of all floods up to the probable maximum flood is relevant to minimising the risk to people. • Flood warning time is not considered sufficient in the Creek/waterway planning area sub-categories or the Overland flow flood planning area sub-category.	**AO17.1** Development creating new lots is identified in Table 8.2.11.3.I as suitable within the relevant flood planning area.	**N/A**	Not applicable to this development.	
	AO17.2 Development provides for reconfiguring a lot design that achieves a road and lot layout which: a) provides trafficable vehicular egress for evacuation during a defined flood event; b) optimises hazard-free movement away from sources of flood hazard within the development. Note—Further advice on road and lot layout is contained in theFlood planning scheme policy.	**N/A**	Not applicable to this development.	
	AO17.3 Development which creates a new residential lot in an area subject to Brisbane River flooding, if the residential flood level is greater than 12.8m AHD is not subject to a hydraulic	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
• Filling above the flood planning level for a flood event greater than the defined flood event cannot be assumed to mitigate the flood hazard.	hazard greater than 0.6m^2/s DV or 0.6m deep in a 0.2% AEP flood. Note—Refer to the Flood planning scheme policy for further explanation on the 0.2% AEP flood.			
PO18 Development involving reconfiguring a lot: a) minimises the risk to people from flood hazard; b) creates safe evacuation routes or avoids isolation of the development during a flood greater than the defined flood event; c) minimises damage to property and services; d) provides lots and roads that are not frequently flooded or subject to nuisance ponding or seepage; e) ensures lots created for park or private open space minimise the risk to people from flood hazard and are fit for purpose; f) provides a lot that is not substantially burdened by flood mitigation infrastructure.	**AO18.1** Development involving reconfiguring a lot ensures: (a) all lots comply with the flood planning levels in Table 8.2.11.3.J; (b) a new road complies with the flood planning levels in Table 8.2.11.3.F.	**N/A**	Not applicable to this development.	
	AO18.2 Development involving reconfiguring a lot creating more than 6 residential lots or a lot for industry ensures the flood planning levels of a dedicated road fronting the development or providing primary access within 200m of the development: a) complies with Table 8.2.11.3.K; or b) has acceptable trafficability in accordance with the requirements in the Flood planning scheme policy and the Queensland Urban Drainage Manual. Note—The Flood planning scheme policy contains supporting information about trafficability on existing roads and serviceability during floods.	**N/A**	Not applicable to this development.	

Performance outcomes	Acceptable outcomes	Outcome	Comments	Council Use
	AO18.3 Development protects the conveyance of flood hazard area by providing an easement over the: a) 2% AEP flood extent for overland flow flooding; b) (b) 1% AEP flood extent for creek/waterway flooding.	**N/A**	Not applicable to this development.	

* **SOLUTIONS**: A – Acceptable Solution; A/S – Alternate Solution; N/A – Not Applicable

BCC – Filling and Excavation Code

Performance outcomes	Acceptable outcomes	Solutions*	Comments	Council Use
PO1 Development for filling or excavation minimises visual impacts from retaining walls and earthworks.	**AO1** Development ensures that the total height of any cut and fill, whether or not retained, does not exceed: (a) 2.5m in a zone in the Industry zones category; (b) 1m in all other zones, or if adjoining a sensitive zone.	**PO**	The proposed earthworks will not create adverse visual impacts to the surrounding properties.	
PO2 Development of a retaining wall proposed as a result of filling or excavation: (a) is designed and constructed to be fit for purpose; (b) does not impact adversely on significant vegetation; (c) is capable of easy maintenance. Editor's note—A retaining wall also needs to comply with the Building Regulation and embankment gradients will need to comply with the Building Regulation. Note—Guidance on the protection of native vegetation is included in the Biodiversity areas planning scheme policy.	**AO2.1** Development of a retaining structure, including footings, surface drainage and subsoil drainage: a) is wholly contained within the site; b) if the total height to be retained is greater than 1m, then: (i) the retaining wall at the property boundary is no greater than 1m above the ground level; (ii) all further terracing from the 1m high boundary retaining wall is 1 vertical unit:1 horizontal unit; (iii) the distance between each successive retaining wall (back of lower wall to face of higher wall) is no less than 1m	**AO**	Retaining walls do not exceed 1m in height. No significant vegetation is located in or near the subject site. Retaining wall finishes will be acceptable to Council standards. Clean fill will be used where required.	

Performance outcomes	Acceptable outcomes	Solutions*	Comments	Council Use
	horizontally to incorporate planting areas.			
	AO2.2 Development of a retaining wall over 1m in height protects significant vegetation on the site and on adjoining land and is designed and constructed in accordance with the structures standards in the Infrastructure design planning scheme policy and certified by a Registered Professional Engineer Queensland.			
	AO2.3 Development provides a retaining wall finish that presents to adjoining land that is maintenance free if the setback is less than 750mm from the boundary.			
	AO2.4 Development for filling only uses clean fill that does not include any construction rubble, debris, weed seed or viable parts of plant species listed as an undesirable plant species in the Planting species planning scheme policy. .			

Performance outcomes	Acceptable outcomes	Solutions*	Comments	Council Use
PO3 Development ensures that a rock anchor is designed and constructed to be fit for purpose.	**AO3** Development ensures that a rock anchor: a) is constructed in accordance with the standards in the Infrastructure design planning scheme policy; b) where it extends beyond the property boundary, is supported by a letter of consent from the adjoining land and building owners.	**N/A**	No rock anchors are required as a part of this development	
PO4 Development protects all services and public utilities.	**AO4** Development protects services and public utilities and ensures that any alteration or relocation of services or public utilities meets the standard design specifications of the responsible service authorities.	**AO**	Construction of the development will take necessary precautions and actions to ensure the protection of existing services and public utilities.	
PO5 Development provides surface and sub-surface drainage to prevent water seepage, concentration of run-off or ponding of stormwater on adjacent land.	**AO5** Development ensures all flows and subsoil drainage are directed to a lawful point of discharge of a surface water diversion drain, including to the top or toe of a retaining wall in accordance with the stormwater drainage section of the Infrastructure design planning scheme policy.	**AO**	Acceptable surface drainage can be provided in accordance with the infrastructure design planning scheme policy. Appropriate subsoil drainage will be designed at the detailed design stage according to the infrastructure design planning scheme policy.	
PO6 Development ensures that the design and construction of all open drainage works is undertaken in accordance with natural channel	**AO6** Filling or excavation does not involve the construction of open drainage.	**AO**	No major open drainage works are proposed as a part of the development.	

Performance outcomes	Acceptable outcomes	Solutions*	Comments	Council Use
design principles, being the development of a stormwater conveyance system for major flows, by using a vegetated open channel or drain that approximates the features and functions of a natural waterway to enhance or improve riparian values of those stormwater conveyance systems. Editor's note—Guidance on natural channel design principles can be found in the Council's publication Natural channel design guidelines.				
PO7 Development for filling or excavation: a) does not degrade water quality or adversely affect environmental values in receiving waters; b) ensures site sediment and erosion control standards are best practice.	**AO7.1** Development for filling or excavation provides water quality treatment that complies with the stormwater drainage section of the Infrastructure design planning scheme policy. **AO7.2** Development provides erosion and sediment control standards that are in accordance with the stormwater drainage section of the Infrastructure design planning scheme policy.	**AO**	Water quality treatment will be designed in accordance with the infrastructure design planning scheme policy and the State Planning Policy. An erosion and sediment control plan will be designed at the detailed design stage and will be in accordance with the infrastructure design planning scheme policy.	
PO8 Development for filling or excavation is conducted such that adverse impacts at a sensitive use due to noise and dust are prevented or minimised. Note—A noise and dust impact management plan prepared in accordance with the Management plans planning scheme policy can assist in demonstrating achievement of this performance outcome.	**AO8.1** Development ensures that no dust emissions extend beyond the boundary of the site, including dust from construction vehicles entering and leaving the site. **AO8.2** Development for filling or excavation activity only occurs between the hours of	**AO**	Erosion and sediment control measures will be implemented on site to ensure no dust emissions. Earthworks will be restricted to the recommended working hours.	

Performance outcomes	Acceptable outcomes	Solutions*	Comments	Council Use
	6:30am and 6:30pm Monday to Saturday, excluding public holidays.			
PO9 Development ensures that vibration generated by the filling or excavation operation does not exceed the vibration criteria in Table 9.4.3.3.B, Table 9.4.3.3.C, Table 9.4.3.3.D and Table 9.4.3.3.E. Note—A noise management report prepared in accordance with the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.	**AO9** Development involving filling or excavation does not cause a ground-borne vibration beyond the boundary of the site.	**AO**	Filling and excavation activities undertaken on site will ensure that ground-borne vibration does not exceed the criteria set out by BCC.	
PO10 Development ensures that heavy trucks hauling material to and from the site do not affect the amenity of established areas and limits environmental nuisance impact on adjacent land.	**AO10** Development ensures that heavy trucks hauling material to and from the site: a) occur for a maximum of 3 weeks; b) use a major road to access the site; c) only use a minor road for the shortest-most-direct route that has the least amount of environmental nuisance if there is no major road alternative.	**AO**	Truck movements to and from site will be restricted as per BCC guidelines.	
PO11 Development for filling or excavation protects the environment and community health and wellbeing from exposure to contaminated land and contaminated material.	**AO11** Development does not involve: a) excavation on land previously occupied by a notifiable activity or on land listed on the Environmental Management Register or the Contaminated Land Register;	**AO**	Due to the existing nature of the site it is not expected that the site is listed on the contaminated land register. A search can be undertaken if requested.	

Performance outcomes	Acceptable outcomes	Solutions*	Comments	Council Use
	b) filling with material containing a contaminant.		All fill material sourced for the development will be free of contaminants.	
PO12 Development provides for: a) landscaping for water conservation purposes; b) water sensitive urban design measures which are employed within the landscape design to maximise stormwater use and to reduce any adverse impacts on the landscape; c) stormwater harvesting to be maximised and any adverse impacts of stormwater minimised.	**AO12.1** Development provides landscaping which is designed using the standards in the Landscape design guidelines for water conservation planning scheme policy.	**AO**	Landscaping areas are provided throughout the proposed development. Where appropriate, surface drainage has been provided to remove excess runoff from the site.	
	AO12.2 Development ensures that the design and requirements for irrigation are in compliance with the standards in the Landscape design guidelines for water conservation planning scheme policy.			
	AO12.3 Development provides areas of pavement, turf and mulched garden beds which are drained. Note—This may be achieved through the provision and/or treatment of swales, spoon drains, field gullies, sub-surface drainage and stormwater connections.			
PO13 Development ensures cutting and filling for the development of canals or artificial waterways avoids adverse impacts on coastal resources and processes.	**AO13** Development does not involve the creation of canals or artificial waterways.	**AO**	The development does not involve the creation of canals or artificial waterways.	

BCC – Potential and Actual Acid Sulfate Soils Overlay Code

Performance outcomes	Acceptable outcomes	Solutions*	Comments	Council Use
PO1 Development protects the environmental values and ecological health of receiving waters and does not subject assets to accelerated corrosion.	**AO1** Development ensures that: (a) no potential or actual acid sulfate soils are disturbed; or Note—This can be demonstrated through the submission of an acid sulfate soil investigation report with reference to the Potential and actual acid sulfate soils planning scheme policy. (b) the disturbance impacts in an area that hosts potential acid sulfate soils are appropriately managed, if less than 500m^3 of soil is disturbed and the watertable is not affected; or Note—This can be demonstrated through the submission of an acid sulfate soil investigation report and a preliminary acid sulfate soil management plan, with reference to the Potential and actual acid sulfate soils planning scheme policy. (c) impacts are appropriately managed if 500m^3 or more of soil is disturbed or the watertable in an area that hosts potential or actual acid sulfate soils is affected. Note—This can be demonstrated through the submission of an acid sulfate soil investigation report and a full acid sulfate soil management plan, with reference to the Potential and actual acid sulfate soils planning scheme policy using levels of testing commensurate with the level of risk. If the investigation demonstrates that an acid sulfate soil management plan is not required, only an investigation report is required.	**AO**	Any disturbance of acid sulphate soils can be appropriately managed during construction.	

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