



Flagstone Village Shopping Centre Flood Impact Assessment

Hope Island Consortium Pty Ltd c/o TLPC Pty Ltd
0740-04-B, 25 June 2015

DECISION NOTICE

The Approved Plan of Development for Development Approval

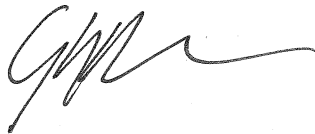
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Report Title	Flagstone Village Shopping Centre Flood Impact Assessment
Client	Hope Island Consortium Pty Ltd c/o TLPC Pty Ltd L20/307 Queen Street, Brisbane Qld 4000
Report Number	0740-04-B

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1 Introduction

1.1 OVERVIEW

Hope Island Consortium Pty Ltd (the Developer) has previously obtained approval to develop 1-17 Bushman Drive, Flagstone in Logan City Council for commercial purposes. The approved development is located on Lot 157 on RP848032 (17-21 Bushman Drive), the undeveloped portion of Lot 922 on RP912582 (1-15 Bushman Drive) and will be amalgamated with the existing shopping centre on Lot 922 on RP912582. The developer proposes to expand the development to include the neighbouring lots 156 and 155 on RP848032 (23-27 and 29-33 Bushman Drive). The proposed development will include shops, a supermarket, roads and car parks. Figure 1.1 shows the location of the proposed development site. The proposed development site drains in a northerly direction to Sandy Gully, a tributary of the Logan River.

WRM Water & Environment Pty Ltd was requested by Hope Island Consortium Pty Ltd to undertake a flood impact assessment for the proposed development in accordance with the Logan Planning Scheme 2015 Version 1.1 (LCC 2015) as part of the operational works approval. This report presents the methodology and results of the hydrologic and hydraulic modelling to estimate design discharges the design flood levels and assess the potential flood level impacts on surrounding properties and infrastructure due to the proposed development up to the defined flood event (in this case a 1% annual exceedance probability (AEP)).

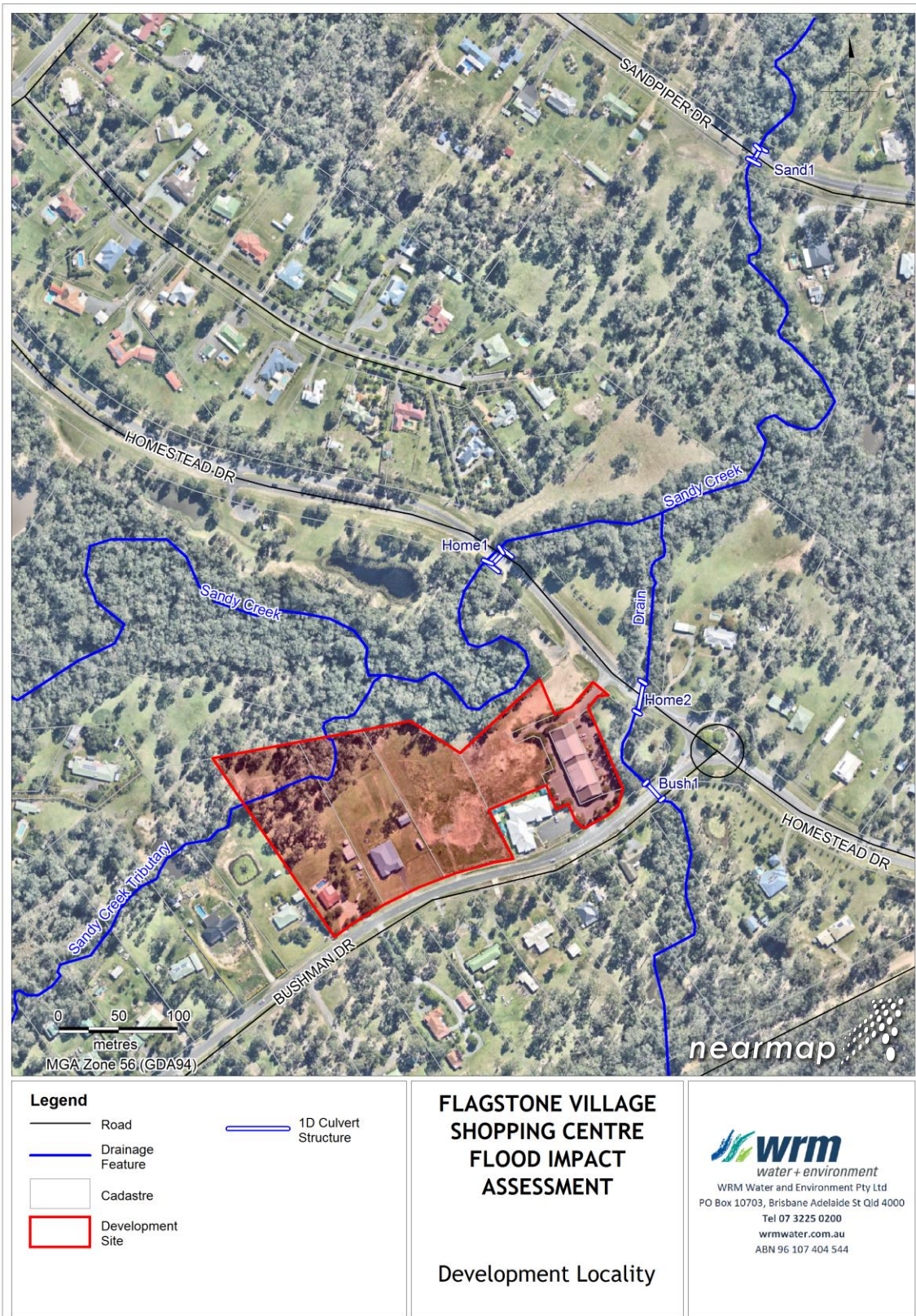


Figure 1.1 - Development site locality map

2 Drainage characteristics

2.1 OVERVIEW

Figure 1.1 shows the drainage characteristics in the vicinity of the development site. A tributary of Sandy Creek drains past the western side of the development site and discharges into Sandy Creek immediately upstream of the development site. The tributary has a catchment area of about 84 ha.

A constructed drain flows in a north-easterly direction to the east of the development site and may have been constructed as part of the existing commercial development next to the development. The constructed drain crosses both Bushman Drive and Homestead Drive before discharging into Sandy Creek about 150 m downstream. The constructed drain has a catchment area of about 57 ha to Homestead Drive.

2.2 EXISTING HYDRAULIC INFRASTRUCTURE

A number of key culverts in the vicinity of the development site are shown in Figure 1.1 and summarised in Table 2.1.

Please note that the road deck levels reported are the lowest point on the road deck in the vicinity of the culverts, and may not be representative of the road deck level immediately above the culverts. It is also of note that there is a solid block wall barrier along Homestead Drive at the Sandy Creek crossing, the crest of which is about 1.2 m higher than the deck of the road.

Table 2.1 - Existing culvert details

ID	Dimensions	No. Barrels	Upstream Invert (mAHD)	Downstream Invert (mAHD)	Road / deck level (mAHD)	Culvert length (m)
Home1	3.55Wx2.7H RCBC	4	27.43	27.32	30.62	12.7
Home2	1.5 RCP	3	28.8	28.48	32.26	15
Bush1	1.75 RCP	2	29.36	29.04	30.6	17
Sand1	3.55Wx3.3H RCBC	3	25.49	25.37	29.77	9.65

3 Hydrologic model development

3.1 GENERAL

The XP-RAFTS rainfall runoff-routing model (XP Software, 2013) was used to estimate the existing conditions design discharges along Sandy Creek, and its tributaries for a range of design events from the 63% AEP to 1% AEP. The XP-RAFTS model discharges were verified against Rational Method discharge estimates for a number of model subcatchments.

The XP-RAFTS model included the external catchment areas draining past the development site, extending downstream to Sandpiper Drive (location 'N1' in Figure 3.1). The XP-RAFTS model was configured to be consistent with the land use conditions shown in council's planning scheme zoning and precincts map for the Sandy Creek catchment.

As part of the stormwater management plan for the development (being developed by Farr Engineers Pty Ltd), detention basins were proposed to mitigate developed conditions peak discharges back to existing conditions. Therefore developed conditions discharges for the development site were assumed to be equal to existing conditions discharges for the purposes of this assessment.

The following section presents the methodology and results of the hydrological modelling of the Sandy Creek catchment.

3.2 XP-RAFTS MODEL CONFIGURATION

3.2.1 Model setup

Figure 3.1 shows the configuration of the XP-RAFTS model. Sandy Creek sub-catchments were delineated based on DNRM LiDAR survey data. The sub-catchments were generally broken down in an attempt to create a homogenous land use for each sub area and boundaries were located to provide inflow hydrographs to the TUFLOW hydraulic model (described in Section 5). The Sandy Creek catchment areas to Homestead Drive (node 'N4' in Figure 3.1) and Sandpiper Drive (node 'N1' in Figure 3.1) are 931 ha and 1,073 ha respectively.

3.2.2 Model parameters

XP-RAFTS model parameters for each subcatchment were determined based on the mix of land uses occurring within each subcatchment (and resulting overall fraction impervious). Topographic maps, aerial photography and council's planning scheme maps were used to identify existing conditions land uses in each subcatchment.

Table 3.1 and Table 3.2 show the adopted XP-RAFTS parameters for each land use in the Sandy Creek XP-RAFTS model. Table 3.1 also shows the adopted fraction impervious for each land use based on the Queensland Urban Drainage Manual (QUDM) (DEWS, 2013) recommendations. The XP-RAFTS model percentage impervious values and catchment PERN 'n' values, which represent the average sub-catchment roughness, were used as a calibration parameter.

Table 3.3 shows the adopted sub-catchment parameters for the Sandy Creek XP-RAFTS model. Where there was more than one land use in each sub-catchment, the percentage impervious and PERN 'n' was factored in proportion to catchment area.

A global 'Bx' factor of 1.0 was adopted. The adopted channel routing parameters were assigned based on the physical channel characteristics including channel length and slope. A flow velocity of 0.9 m/s and channel storage factor (X) of 0.2 was adopted for determining all XP-RAFTS routing links.

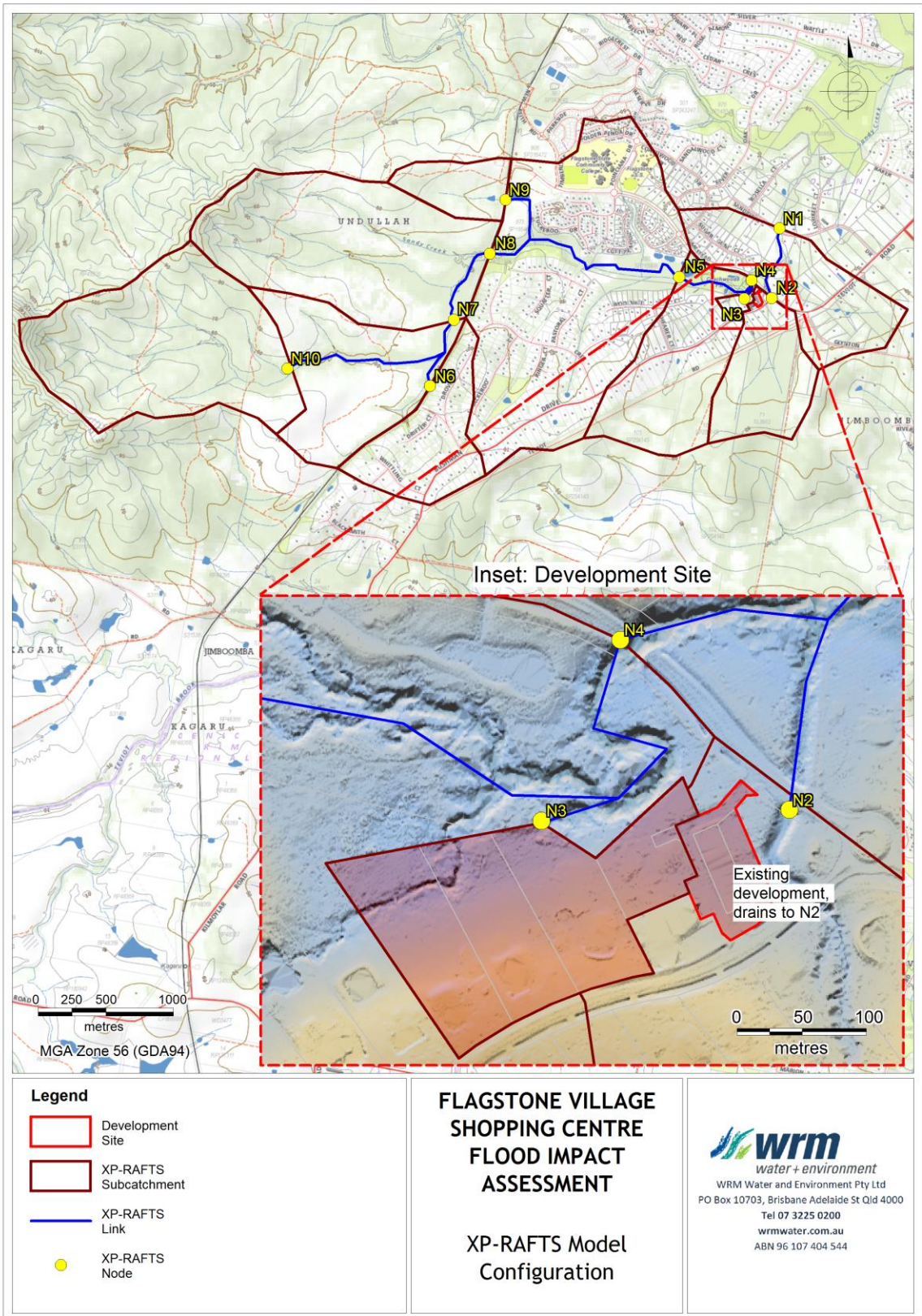


Figure 3.1 - XP-RAFTS model configuration

Table 3.1 - Adopted land use parameters - Sandy Creek XP-RAFTS model

Land Usage	Typical Lot Size (ha)	Fraction Impervious (fi)	Adopted Parameters	
			Percent Impervious (%)	Catchment PERN 'n'
Commercial/Industrial	Varies	0.90	70	0.020
Special Purpose	Varies	0.75	55	0.030
Urban Res (Med Density)	0.04 to 0.1	0.70	50	0.035
Urban Res (Low Density)	0.1 to 0.2	0.50	40	0.040
Rural Res (High Density)	0.2 to 1.0	0.40	30	0.045
Rural Res (Low Density)	1.0 to 10	0.20	20	0.050
Rural	>10	0.10	10	0.060
Open Space	Varies	0.00	0	0.065

Table 3.2 - Initial and continuing losses - Sandy Creek XP-RAFTS model

Percent Impervious (%)	Initial loss (mm)	Continuing loss (mm/hr)
<20	15	2.5
20 to 30	15	1.5
>30	5	1.0

Table 3.3 - Adopted Sandy Creek XP-RAFTS model parameters

Sub-catchment	Catchment Area (ha)	Percent Imp. (%)	'PERN' 'n'	Catchment Slope (%)
N1	85.58	16.5	0.053	1.18
N2	56.68	13.9	0.057	2.33
N3	3.07	30.0	0.045	4.50
N4	94.02	13.2	0.056	1.20
N5	271.45	26.4	0.048	1.05
N6	61.49	26.6	0.047	2.23
N7	105.04	0.0	0.065	0.94
N8	183.00	0.0	0.065	1.02
N9	29.17	0.0	0.065	1.90
N10	182.85	0.0	0.065	1.41

3.3 XP-RAFTS VALIDATION AGAINST THE RATIONAL METHOD

3.3.1 General

The Sandy Creek XP-RAFTS model discharge estimates from the open space and rural residential land uses were validated against the Rational Method estimates at 3 locations using the methodology recommended in QUDM assuming the same homogenous land use. The XP-RAFTS model was validated to the following locations (see Figure 3.1):

- Node N4: Sandy Creek to Homestead Drive assuming fully open space land use, that is, it was assumed that the land use in subcatchments N4, N5 and N6 is open space;
- Node N2: Open drain to Homestead Drive assuming existing rural and rural residential land use; and
- Node N1: Sandy Creek to Sandpiper Drive assuming the entire catchment land use is open space.

The catchment parameters were then adjusted to reflect the actual land use given in Table 3.3 to determine the design discharges for the study (see Section 4).

3.3.2 Design rainfalls

Design rainfall intensity-frequency-duration (IFD) data for Sandy Creek was obtained from the Bureau of Meteorology website. The IFD data is derived in accordance with the methodology described in Australian Rainfall & Runoff - A Guide to Flood Estimation (IEAust, 1987). Table 3.4 shows the adopted rainfall IFD data for the study.

Table 3.4 - Intensity-frequency-duration data (mm/hour)

Duration (hours)	Annual Exceedance Probability (AEP) (mm/hr)						
	63%	39%	18%	10%	5%	2%	1%
0.08	110	141	177	198	227	266	296
0.1	103	132	165	185	212	248	276
0.17	84	108	135	152	174	204	227
0.33	62.1	79.6	100	113	130	152	169
0.5	50.6	64.9	82.1	92.3	106	125	139
1	33.6	43.2	54.8	61.7	71.2	83.8	93.5
2	20.9	26.8	34.1	38.5	44.4	52.3	58.4
3	15.5	19.9	25.3	28.5	32.9	38.7	43.3
6	9.17	11.8	15	16.9	19.5	23	25.7
12	5.52	7.11	9.09	10.3	11.9	14	15.7

3.3.3 Rational Method estimates

Table 3.5 shows the Rational Method estimates of 63% to 1% AEP events at the above 3 locations. The Rational Method discharges were calculated assuming the following:

- A catchment-weighted fraction impervious and equal area slope based on undeveloped / open space conditions for nodes N4 and N3 and existing conditions for node N02;
- A catchment-weighted C_{10} value was assigned to each catchment based on the values recommended in QUDM (2013). The 10% AEP 1-hour duration rainfall intensity for Sandy Creek is 61.7mm/hr;
- A C_{10} value of 0.59 was assigned to all catchments (except for N2) assuming they are all open space (with a catchment weighted fraction impervious of 20% or less). A C_{10}

value of 0.63 was assigned to the N2 catchment as it is a mixture of rural and rural residential land use; and

- The time of concentration for open space catchments (N1 and N4) was calculated using the Bransby-Williams equation for rural catchments. The time of concentration for rural residential catchments (N2) was calculated using the modified Friend's equation and Manning's 'n' Equation.

Table 3.5 - Rational Method design discharges

	N04	N02	N01
Catchment Area (ha)	931	56.7	1073
Travel Time			
<i>Bransby-Williams / Manning's 'n' equation</i>			
Stream Length (km)	7.9	1.1	8.5
Stream Equal Area Slope (m/m)	0.0049	0.0209	0.0046
Manning's 'n'	n/a	0.06	n/a
<i>Friend's equation</i>			
Length (m)	n/a	180	n/a
Overland slope (m/m)	n/a	0.02	n/a
Horton's 'n'	n/a	0.06	n/a
Overland travel time (mins)	n/a	31.5	n/a
Time of Concentration (mins)	266.8	43.0 (1%AEP) - 50.1 (63%AEP)	286.6
Coefficient of Discharge			
Fraction Impervious (%)	0	11	0
C ₁₀ (no units)	0.59	0.63	0.59
63% AEP Discharge (m³/s)	15.2	3.1	16.5
39% AEP Discharge (m³/s)	20.7	4.4	22.6
18% AEP Discharge (m³/s)	29.5	6.3	32.1
10% AEP Discharge (m³/s)	34.9	7.6	38.0
5% AEP Discharge (m³/s)	42.4	9.3	46.1
2% AEP Discharge (m³/s)	54.6	12.1	59.5
1% AEP Discharge (m³/s)	63.7	14.2	69.4

3.3.4 Comparison of Rational Method and XP-RAFTS estimates

Table 3.6 compares the 63% AEP to 1% AEP peak discharges estimated using the Rational Method with XP-RAFTS model predicted peak discharges for the two open space

catchments to N4 and N1 and the rural/rural residential land use catchment (N2). The comparison shows that the XP-RAFTS peak discharges for the open space and rural residential land use sub-catchments to N1 (Outlet), N2 and N4 match reasonably well with the Rational Method discharges and that the differences are generally less than 10% for all design events up to and including the 1% AEP event.

Note that the open space XP-RAFTS model parameters given in Table 3.1 and Table 3.2 were adopted for Nodes N3, N4, N5 and N6 and not those given in Table 3.3. For N2, the XP-RAFTS parameters given in Table 3.3 were adopted.

Table 3.6 - Comparison of Rational Method and XP-RAFTS model peak discharges

AEP (%)	N4		N2		N1	
	XP-RAFTS	RM	XP-RAFTS	RM	XP-RAFTS	RM
63	13.6	15.2	2.4	3.1	15.5	16.5
39	20.8	20.7	3.8	4.4	23.7	22.6
18	29.6	29.5	6.0	6.3	33.6	32.1
10	35.7	34.9	7.4	7.6	40.5	38.0
5	44.3	42.4	9.4	9.3	50.1	46.1
2	54.6	54.6	11.9	12.1	61.8	59.5
1	64.6	63.7	14.1	14.2	72.4	69.4

4 Design discharge estimation

The XP-RAFTS model updated using the actual catchment land use was used to determine the peak design discharges and critical durations in the vicinity of the development site. The XP-RAFTS parameters given in Table 3.3 were adopted for determining design discharges. Table 4.1 summarises existing conditions peak design discharges at a range of locations. Please note:

- The critical duration along Sandy Creek to Homestead Drive and Sandpiper Drive (nodes N4 & N1) is
 - 180 minutes for the 63% AEP design event, and
 - 120 minutes for the 39% to 1% AEP events;
- The critical duration along the drain crossing Homestead Drive (node N2) is
 - 120 minutes for the 63% and 39% AEP design events, and
 - 60 minutes for the 18% to 1% AEP events;
- The Sandy Creek 1% AEP design discharge of 72.2 m³/s adjacent to the development site (N4) is approximately 12% greater than for the validation event assuming the entire catchment is open space.

Table 4.1 - XP-RAFTS model design discharges

AEP (%)	N4		N2		N1	
	Peak discharge (m ³ /s)	Critical duration (hours)	Peak discharge (m ³ /s)	Critical duration (hours)	Peak discharge (m ³ /s)	Critical duration (hours)
63	15.6	3.0	2.4	2.0	18.9	3.0
39	23.8	2.0	3.8	1.0	29.2	2.0
18	34.6	2.0	6.0	1.0	43.0	2.0
10	41.3	2.0	7.4	1.0	51.4	2.0
5	50.6	2.0	9.4	1.0	63.5	2.0
2	62.1	2.0	11.9	1.0	78.3	2.0
1	72.2	2.0	14.1	1.0	90.8	2.0

5 Hydraulic model development

5.1 GENERAL

The TUFLOW two-dimensional hydraulic model (WBM, 2010) was used to assess the impact of the development on peak flood levels and extents along Sandy Creek and its tributary for developed conditions for the 10% AEP and 1% AEP design flood events.

The TUFLOW model was configured to represent two scenarios:

- Approved conditions; and
- Developed conditions

In the absence of validation data, design flood levels along Sandy Creek were estimated using published Manning's 'n' values. Design inflows to the TUFLOW model for each AEP were obtained from the XP-RAFTS model as described in Section 4.

5.2 TUFLOW MODEL CONFIGURATION

5.2.1 Model configuration

The TUFLOW model extends about 200 m upstream of the development site to the west, Sandpiper Drive to the north, and Bushman Drive to the south, as shown in Figure 5.1. The hydraulic model area covers approximately 37 ha and includes Sandy Creek, its tributary and the drain through the existing commercial development.

A 2 m grid cell size and 0.5 second timestep were adopted for the model.

5.2.2 Topography

The existing conditions topographic data for the study area was provided from a number of sources including:

- ground survey by Jensen Bowers shown in drawing no. S-7011-001 Issue C dated 7 July 2013 of the development site and Bushman Drive and Homestead Drive including part of Sandy Creek, roads, drains, and culverts within the study area;
- additional survey by Jensen Bowers in 2014 which consists of surveyed cross sections of the Sandy Creek channel provided in 12da format (7701 BUSHMAN DRIVE MGA DTM[140822].12da) as well as surveyed levels at the Homestead Drive and Sandpiper Drive culvert crossings of Sandy Creek provided in Drawing S-7701-004; and
- LiDAR aerial survey by the Queensland Government Department of Natural Resources and Mines (DNRM) captured in 2010 Sandy Creek and its catchment.

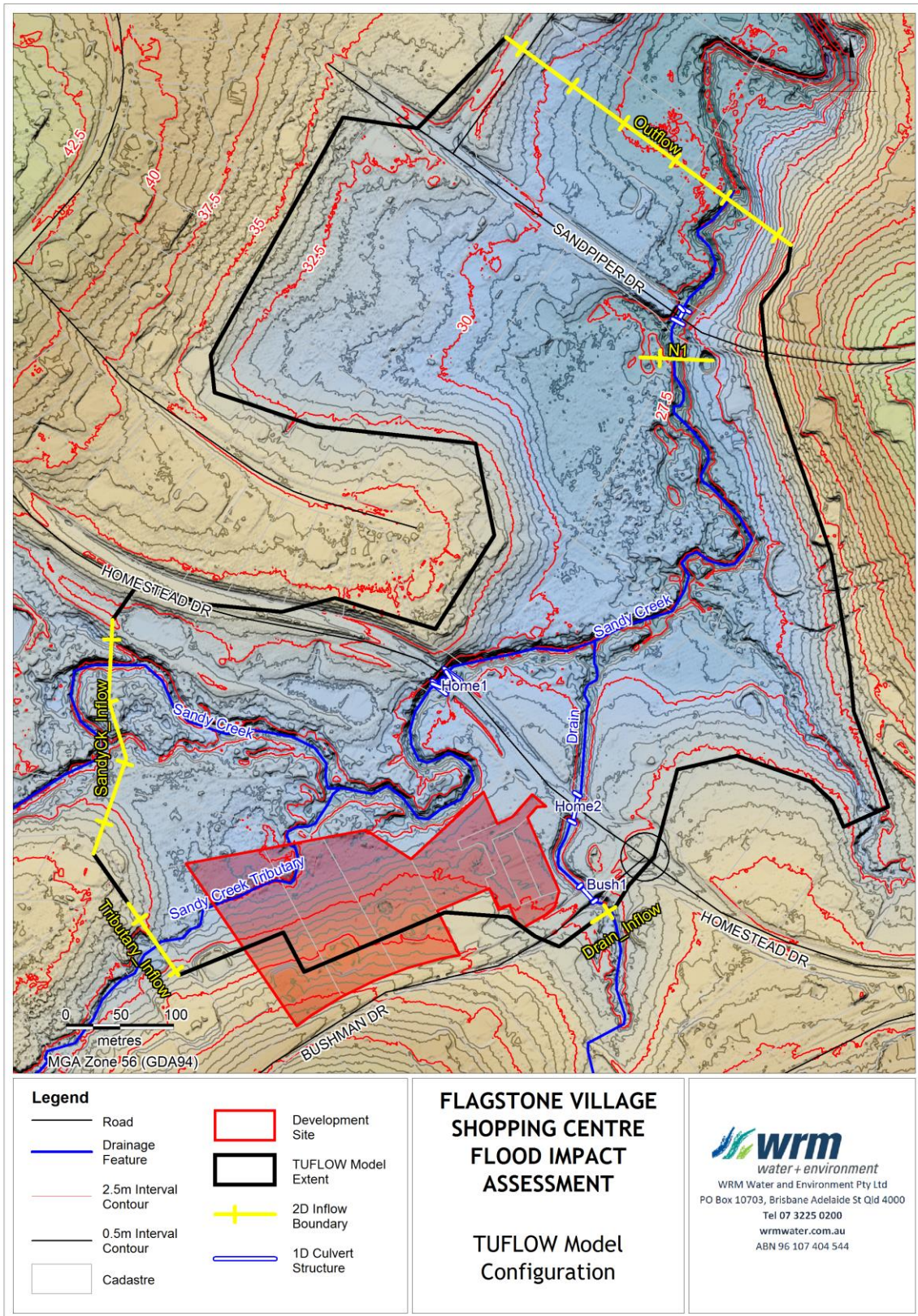


Figure 5.1 - TUFLOW model configuration

5.2.3 Modifications to the Sandy Creek channel and flood plain

The Sandy Creek channel adjacent to the development site was modified based on the surveyed cross sections provided by Jensen Bowers using TUFLOW Z-shape files. The surveyed cross sections along Sandy Creek indicate that the flood plain levels are also lower than the DNRM's LiDAR survey information. However, the ground levels on the overbank areas were not modified because the available survey information of the overbank was limited to cross sections. The use of the higher LiDAR data is likely to produce conservatively high design flood levels at the development site.

5.2.4 Manning's 'n'

The TUFLOW model uses Manning's 'n' values to represent hydraulic resistance across the study area. An orthophotograph of the area captured in April 2015 (obtained from Nearmap) was used to determine the spatial location of each ground cover and vegetation characteristics within the study area. A site visit undertaken in July 2014 was used to assess the characteristics of the open drainage network, road culverts and overbank areas. The Manning's 'n' values for each ground cover were estimated according to guidelines given in Chow (1973).

Table 5.1 shows the adopted Manning's 'n' values for different ground covers. Figure 5.2 shows the spatial extent of each ground cover adopted in the model.

Table 5.1 - Adopted Manning's 'n' values

Ground cover type	Adopted Manning's 'n'
Concrete / Pavement / Culvert approach	0.02
Mown Grass	0.03
Waterbodies	0.04
Sparsely vegetated/Long grass	0.05
Creek channel	0.07
Moderate vegetation	0.08
Dense vegetation	0.10

5.2.5 Inflow and outflow boundaries

Figure 5.1 shows the locations of the inflow boundaries used in the TUFLOW model. Local and total inflow boundaries were added to the TUFLOW model as 2D QT (discharge vs time).

One outflow boundary called "Outflow" (see Figure 5.1) was added to the TUFLOW model. A normal depth tailwater boundary condition with a slope of 0.5% was adopted. This is consistent with the flood slope in the area of interest. The downstream boundary is far enough downstream to not impact on design flood levels at the site. The hydraulic model was run for the critical storm durations for all design events ranging from 38% to 1% AEP. Based on available mapping, the model extent is not tailwater affected from the Logan River for any of the AEP events investigated in this study.

5.2.6 Culvert structures

Road stormwater culverts were embedded within the 2D domain of the TUFLOW model as 1D structures. Details of existing culvert structures were obtained from detailed survey provided by Jensen Bowers. Table 2.1 shows the hydraulic characteristics for each existing culvert in the model. Figure 5.1 shows the locations of the existing 1D culverts in the TUFLOW model. The ESTRY 1D hydraulic model, a built-in feature of TUFLOW, was used to undertake the hydraulic calculations of structures within the 1D domain.

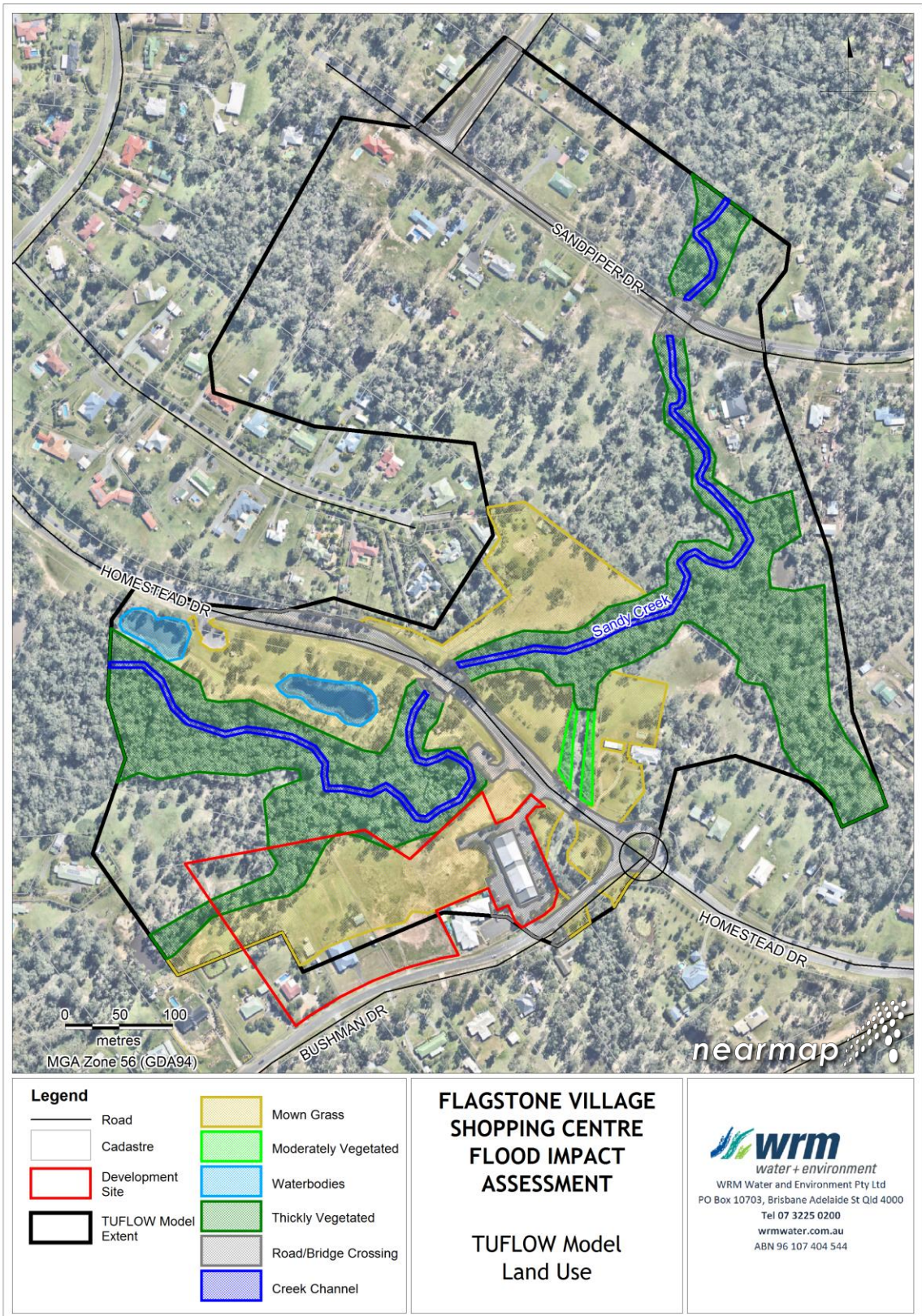


Figure 5.2 - TUFLOW model ground cover distribution

6 Flood impact assessment

6.1 OVERVIEW

The TUFLOW model was used to assess the impact of the development on peak flood levels and extents along Sandy Creek and its tributary for post development conditions, and for design events up to 1% AEP.

6.2 APPROVED CONDITIONS FLOODING

Figure 6.1 and Figure 6.2 show the results for the approved conditions peak water surface contours and extents for the 10% and 1% AEP design flood events. The approved conditions scenario is based on the site configuration given in the previous development approval (COM/7/2011). The model results show the northwestern portion of the development site is inundated for the 10% AEP and 1% AEP events.

6.3 PROPOSED DEVELOPMENT

The proposed development was included in the 'developed' conditions model by placing a 'z-shape' (a TUFLOW element used to modify model topography) along the perimeter of the proposed retaining wall to the north of the development. The retaining wall was positioned along the edge of the 10% AEP approved conditions flood extent on the new development areas (23-33 Bushman Drive) and on the approved development area further to the south (1-21 Bushman Drive). The retaining wall has a minimum crest level of 33.36 mAHD based on the revised site plan (Earthworks Key Plan - drawing number CKS-100 2) prepared by Farr Engineers Pty Ltd on 23 June 2015.

6.4 DEVELOPED CONDITIONS FLOOD IMPACTS

Figure 6.3 and Figure 6.4 show flood level impact results for the 10% and 1% AEP design flood events respectively. Table 6.1 shows the modelled existing and developed 10% and 1% AEP flood levels and the relative difference between the two cases. Under post-development conditions, minor flood level decreases of up to 0.01 m for the 10% AEP and up to 0.06 m for the 1% AEP design flood events were predicted on the lot immediately upstream of the development site because the proposed development does not extend as far into the floodplain as the approved development. No flood levels impacts were predicted downstream of the development site.

Specific outcome O1 of Table 8.2.5.3.1 of the Logan Planning Scheme (LCC 2015) requires that "A building has a finished habitable floor level a minimum of 500 mm above the defined flood event". The defined flood event for this development is the 1% AEP flood. The original flood level for the site as advised by Logan City Council was 32.0 mAHD. It should be noted that this level is about 0.5 m higher than the modelled 1% AEP flood level at the upstream end of the development site at reporting 'Loc3' (see Table 6.1).

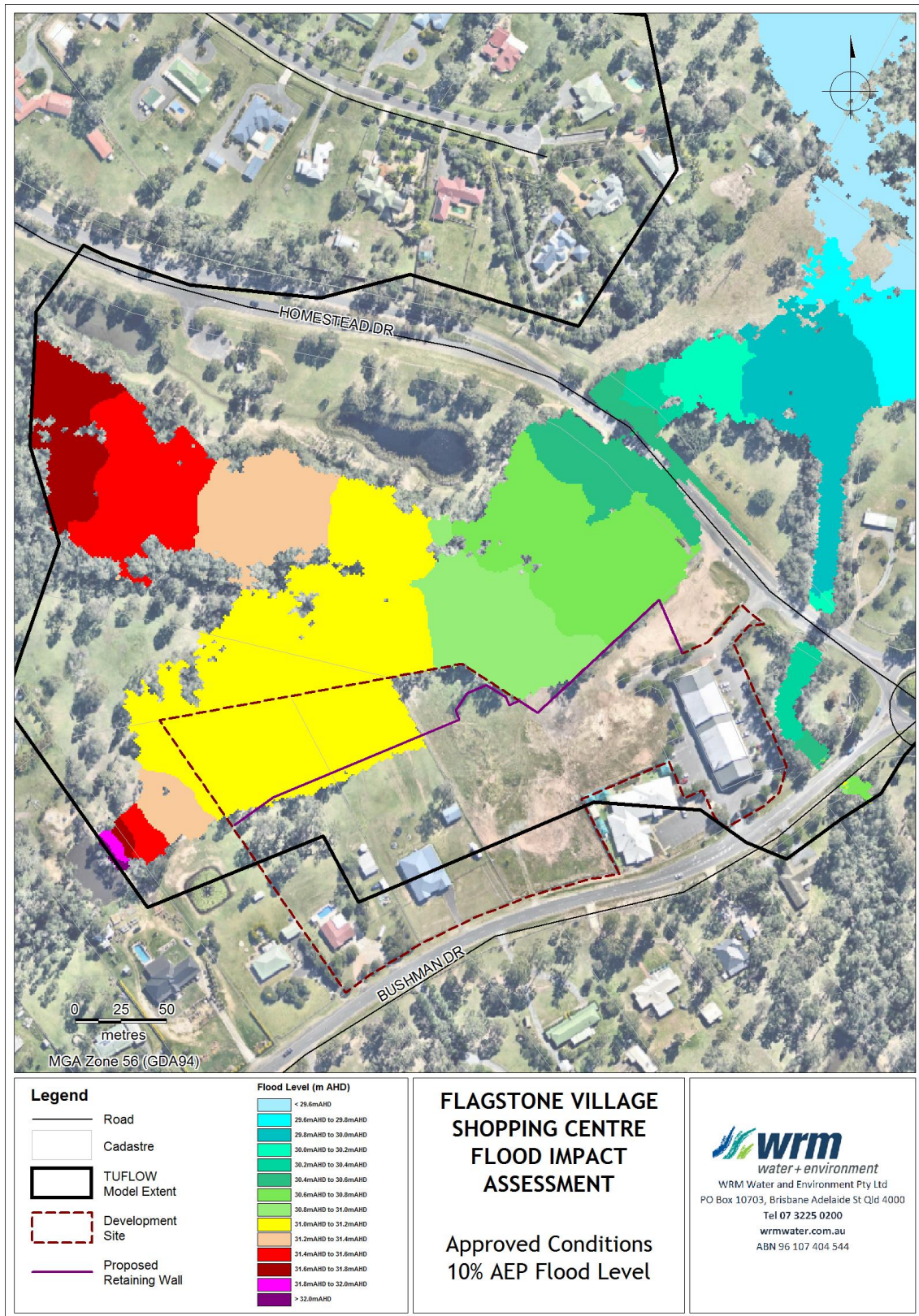


Figure 6.1 - Sandy Creek 10% AEP flood levels and extent - approved development conditions

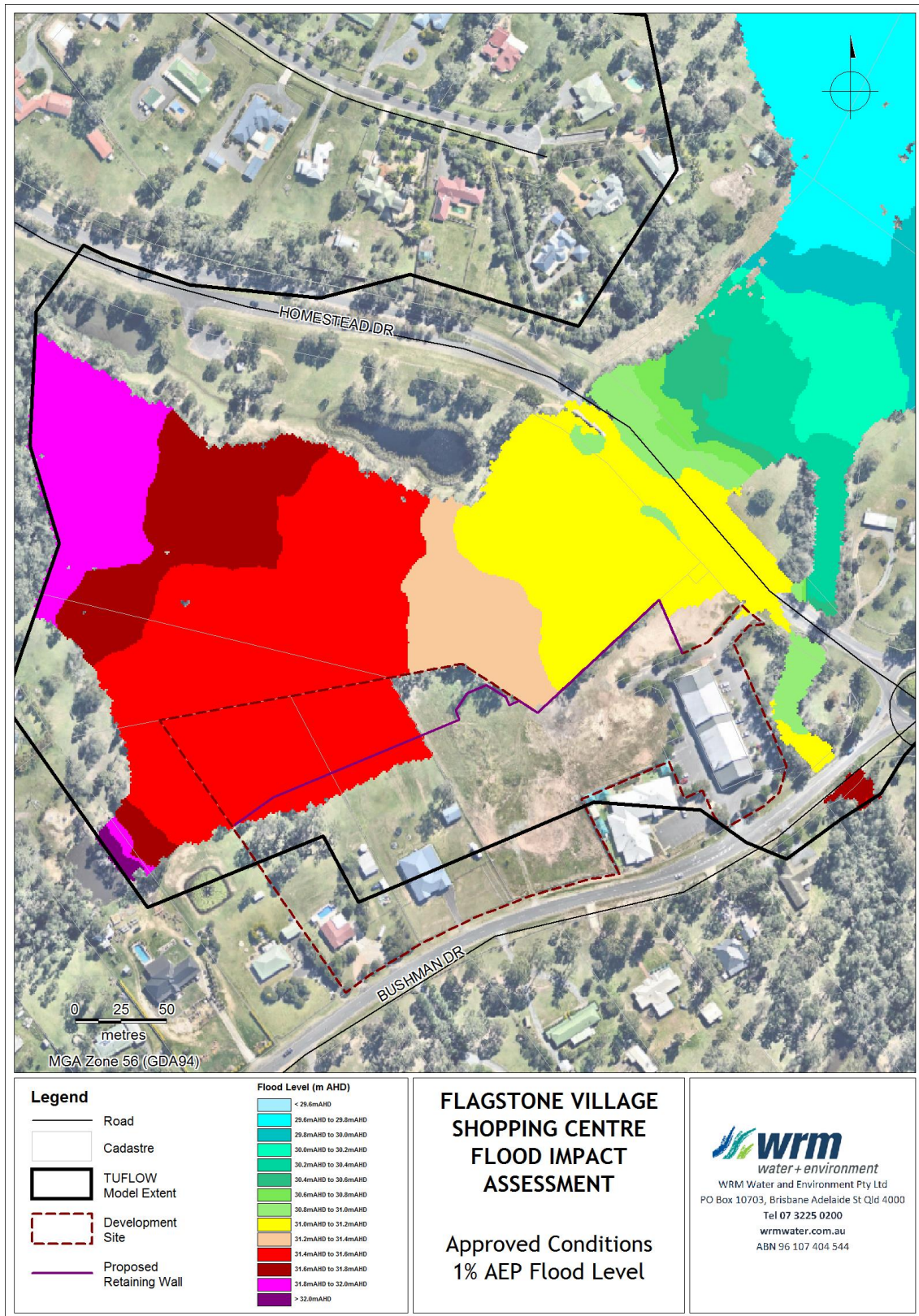


Figure 6.2 - Sandy Creek 1% AEP flood levels and extent - approved development conditions

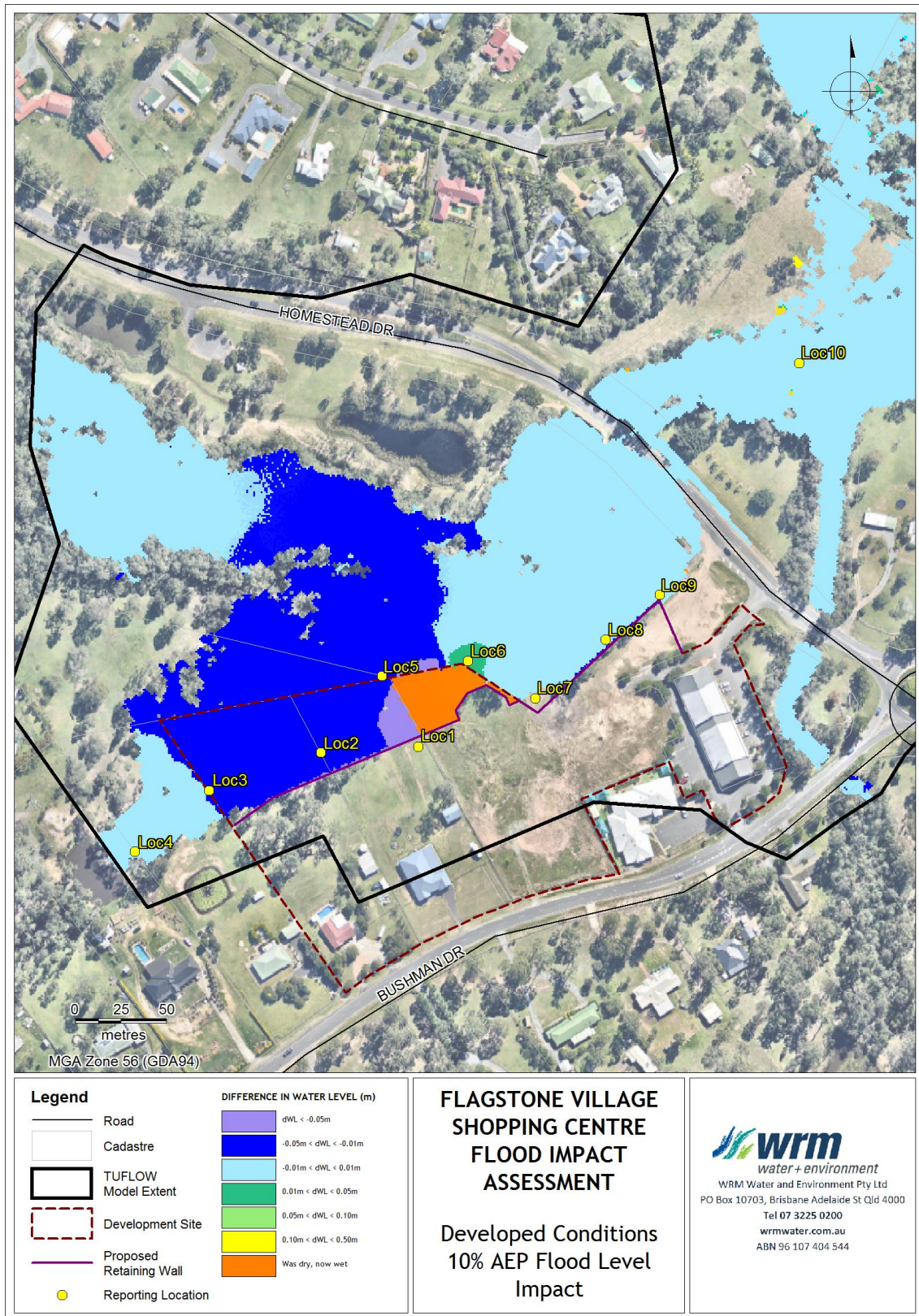


Figure 6.3 - Sandy Creek 10% AEP flood level impacts, developed - approved conditions

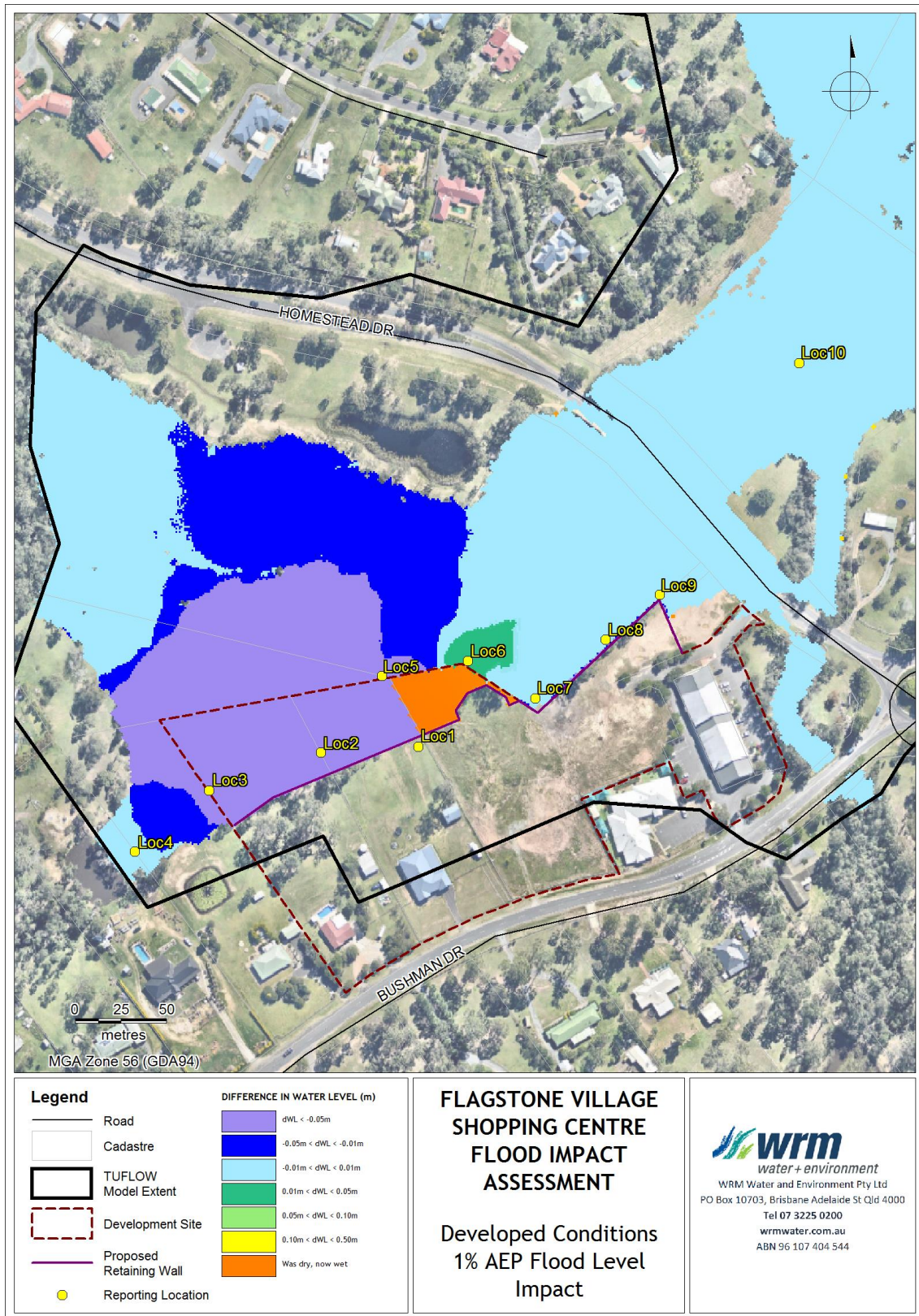


Figure 6.4 - Sandy Creek 1% AEP flood level impacts, developed - approved conditions

Table 6.1 - Sandy Creek 10% and 1% AEP flood levels and relative differences - approved and proposed development conditions

Reporting Location	Ground Level (mAHD)	10% AEP flood level (mAHD)			1% AEP flood level (mAHD)		
		Approv	Dev	Diff.	Approv	Dev	Diff.
Loc1	31.01	31.07	-.a	-0.06 ^a	31.47	-.a	-0.46 ^a
Loc2	29.66	31.07	31.04	-0.03	31.47	31.40	-0.07
Loc3	30.26	31.15	31.14	-0.01	31.49	31.43	-0.06
Loc4	30.68	31.59	31.59	0.00	31.78	31.77	-0.01
Loc5	30.39	31.06	31.03	-0.03	31.44	31.37	-0.06
Loc6	30.23	30.87	30.89	0.02	31.21	31.25	0.04
Loc7	31.06	-.b	-.b	-.b	31.21	31.22	0.01
Loc8	29.87	30.80	30.80	0.00	31.14	31.15	0.00
Loc9	30.32	30.77	30.78	0.00	31.11	31.11	0.00
Loc10	27.72	29.91	29.91	0.00	30.22	30.22	0.00

a. No longer inundated post-development. Difference equals depth of inundation under approved conditions

b. Not inundated during 10% AEP event

7 Summary and discussion

A flood impact assessment was undertaken for the proposed commercial development at 1-33 Bushman Drive, Flagstone in accordance with the Logan City Council's Logan Planning Scheme 2015 Version 1.1.

The TUFLOW two-dimensional hydraulic model (WBM, 2010) was used to assess the impact of the development on peak flood levels and extents along Sandy Creek and its tributary for post development conditions, up to the 1% AEP design flood event.

The model results show that under approved conditions, the northwestern portion of the development site is inundated for the 10% AEP and 1% AEP events. The proposed development has been located along the 10% AEP flood extent in the new areas (23-33 Bushman Drive) and reduced in the approved areas (1-21 Bushman Drive). Under post-development conditions, minor flood level decreases of up to 0.01 m for the 10% AEP and up to 0.06 m for the 1% AEP design flood events were predicted on the lot immediately upstream of the development site. No flood levels impacts were predicted downstream of the development site.

8 References

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- LCC 2015 Logan City Council 2015, Logan Planning Scheme 2015 Version 1.1, viewed June 2015, <<http://www.logan.qld.gov.au/planning-and-building/planning-and-development/logan-planning-scheme/logan-planning-scheme-2015-version-1.1>>
- WBM 2010 BMT-WBM 2010, *TUFLOW User Manual, GIS Based 2D/ 1D Hydrodynamic Modelling, Build 2010-10-AB*, Brisbane
- WRM 2014 WRM Water & Environment 2014, *Flagstone Shopping Centre Flood Impact Assessment*, Brisbane