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Greenview Consulting Pty Ltd
A.B.N 32 600 067 338

SARM Architects

Date
27th May 2025

Job Number
230473

Flood Update for proposed Residential Development for Stage C [Rev#1]
12-16 Stuart Rd, WARRAWONG NSW

Dear Sir/Madam,

Please find following our flood report update at the site 12-16 Stuart Rd, Warrawong. The subject site is situated on the western side of Stuart Rd and comprises Lots #10-12 DP 35004 and has an approximate area of 1985m^2. The site falls from the west corner (+12.3 mAHD) to the east corner (+8.9 mAHD). The site is subject to very shallow overland flows in the 1%AEP (100yr ARI) event from a relatively small upstream catchment.

Greenview have undertaken a site-specific flood model using WBNM for hydrology and TUFLOW (2D) for hydraulics. Our latest flood model and full report is Revision #2 (dated 13th February 2025) and was based on the SARM Architects drawings Revision G dated 10th January 2025. Subsequent to this report, minor architectural changes have been undertaken; these changes have been reviewed by Greenview and are detailed on the SARM drawings Revision H dated 16th May 2025. We note that the main change is the addition of a passing bay at the start of the driveway.

The proposed passing bay is parallel with the driveway and perpendicular to the Stuart Rd frontage boundary. Please refer figure 1 below showing the proposed passing bay from SARM drawings Revision H dated 16th May 2025.

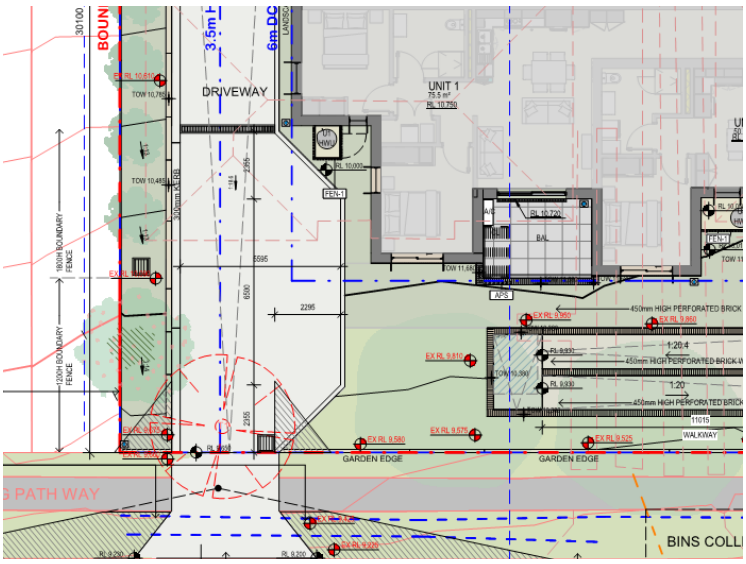


Figure 1 - Proposed Passing Bay on Architectural Plans Rev H dated 16.05.2025

Figure 2 below from the Stage C Flood Report Rev B show the flood depths on the site with the proposed flood mitigation measures. The flood flows run from the rear boundary towards the front Stuart Rd boundary. The area of the proposed passing bay is within an area of shallow to no flood depths, is downstream of the proposed building, and would maintain the flood flows being directed towards the street. The adjacent building wall is also noted as a solid wall. We would consider the proposed addition of a passing bay as a minor change in this part of the site and we believe this would not affect the flood behaviour we have modelled in this area.

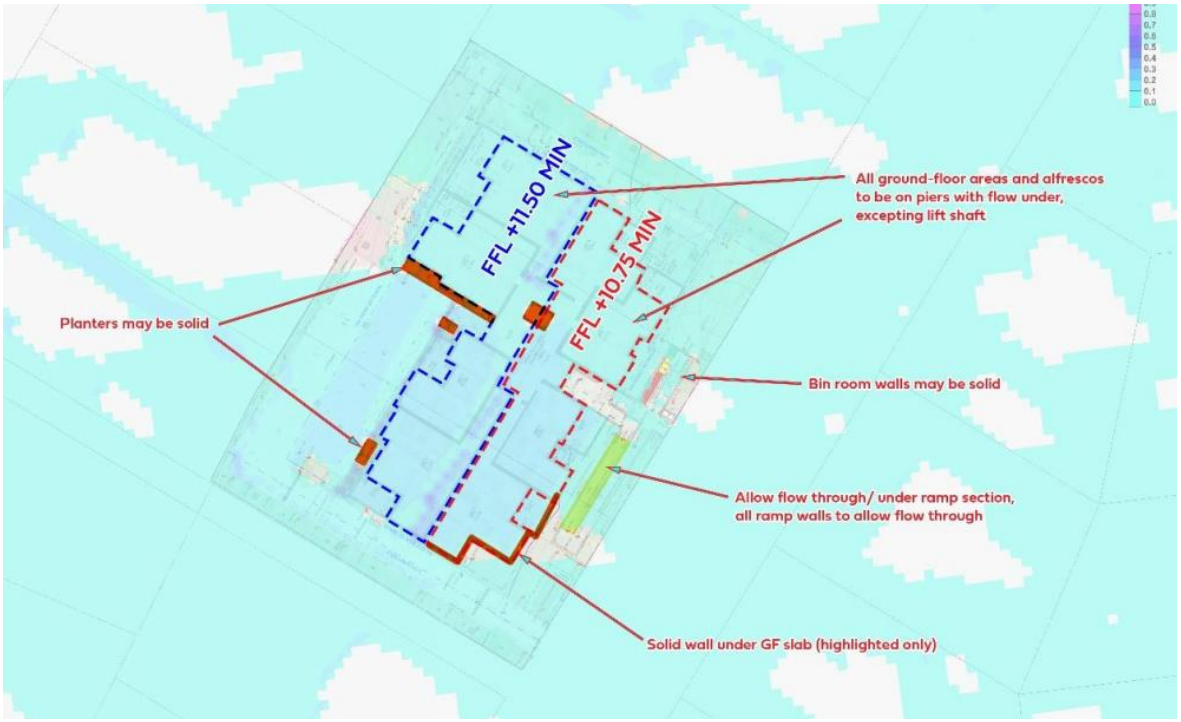


Figure 2 - Excerpt from Flood Report Rev B Figure 4.3

At this stage, we do not believe that a full flood model update is required, given the minor nature of the architectural changes. As such, we believe that our report revision #2 is still valid with respect to flood behaviour at the subject site; that is, the modelled 1%AEP water levels, depths, velocities and hazards should not significantly deviate from that as modelled and documented in our revision #2 report. We do not believe that the minor architectural changes will result in significant differences to our calculations, and subsequently cause lowered freeboard for the proposed units, cause adverse flood affectation, or otherwise negatively impact on local flood behaviour.

If further architectural changes are made, additional modelling and reporting may be required.

Yours faithfully,

Andrew Wiersma
BE (Hons) MEng MIEAust CPENG (NPER)
Senior Design Engineer
NPER no. 2428975

Alistair McKerron
BE MIEAust CPENG (NPER)
Senior Project Engineer
NPER no. 2220277

FLOOD STUDY

RESIDENTIAL DEVELOPMENT AT 12-16 STUART RD, WARRAWONG NSW

PREPARED FOR HOMES NSW

IN COORDINATION WITH SARM ARCHITECTS

DATE: 13TH FEBRUARY 2025

OUR REFERENCE: 230473

BY: ANDY WIERSMA

Author	**Andy Wiersma**	
Approved by	**Alistair McKerron**	
REVISION	**DATE**	**DESCRIPTION**
A	22nd October 2024	Stage C Issue
B	13th February 2025	Updated Stage C Issue

TABLE OF CONTENTS

1 INTRODUCTION

1.1 GENERAL

Greenview Consulting has been engaged by the client to undertake a review of flooding at the subject site. This report must be read in conjunction with the other Application documents and other relevant information, including:

- SARM Architectural drawings (February 2025)
- Wollongong Council DCP 2009 Chapter E13 "Floodplain Management"

This purpose of this report is to:

- Undertake hydrologic WBNM modelling to determine flowrates in the local vicinity.
- Undertake hydraulic TUFLOW modelling of the existing and proposed cases in order to demonstrate compliance with Council objectives.

2 EXISTING CONDITIONS & DATASETS

2.1 SITE DESCRIPTION

The subject site is situated on the western side of Stuart Rd, refer **Figure 2.1**. The site comprises Lots #10-12 DP 35004 and has an approximate area of 1985m^2. The site falls from the west corner (+12.3 mAHD) to the east corner (+8.9 mAHD). The site is subject to very shallow overland flows in the 1%AEP (100yr ARI) event from a relatively small upstream catchment.

Figure 2.1: Site Location

2.2 DATASETS

Hydrologic model inputs and all mapping presented in this report were undertaken using the GIS MapInfo and Global Mapper. These are geographical database systems that allow detailed cadastral, topological and flood data to be displayed and manipulated. Subarea data and other statistics were generated using inbuilt GIS functions and exported directly to the hydraulic model.

The datasets used to construct the models included:

- 1m contours derived from the ALS 2021 dataset.
- Aerial photography (circa June 2024) Metromap.
- Survey 3D TIN as digitised from Norton Survey Partners (April 2022).
- Aerial Laser Survey (ALS) 1m DEM from LPI for areas outside of the survey (fly date June 2021).
- Pipe sizes from Council's Online maps.

The MGA56 coordinate system was used for datasets wherever possible. We note that pipe sizes were taken from Council's GIS mapping system and will not be as accurate as formal survey; all pipes were assumed to be at 300mm minimum cover with assumed minimum grade of 0.7%.

2.3 LIMITATIONS

All data, observations and opinions contained in this report pertain to hydraulic assessment of flood flows at or in the vicinity of the site. This report neither purports to be nor is an investigation into any other aspect of flooding within the site or surrounding catchment.

This report and the results contained within are only as accurate as the survey information provided. Greenview Consulting Pty Ltd takes no responsibility or liability for incorrect survey information. The report is only valid for the development as proposed and detailed in this report and is not valid for any other design, layout or development.

2.4 EXISTING FLOOD STUDIES

The proposed site falls within the extents of Wollongong City Councils Kully Bay Catchment. The most recent adopted flood study for this catchment is the "*Kully Bay Overland Flow Study*" [RHELM 2019], and we have adopted similar model parameters to this study (where possible) for the sake of consistency. We note that the main difference is that the RHELM model is configured on a 2m grid, and we have adopted a 1m grid for finer resolution. Model results are very similar between both models.

2.5 REPORT REVISIONS

This is the version #2 of our report; this update incorporates minor architectural changes.

2.6 PROPOSED DEVELOPMENT

The proposed development consists of a new housing development for LAHC. In order to manage offsite flood impacts and maintain conveyance, the majority of the ground floor is proposed to be suspended, with flow allowed to pass through the undercroft area.

3 HYDROLOGIC ANALYSIS (WBNM MODEL)

3.1 CATCHMENT DETAILS

The catchment draining towards the subject site is relatively small and almost entirely residential development. The RHELM [2019] used a rainfall on-grid hydrologic model, and we have adopted a subarea approach as per other models within the Wollongong LGA. Sub-catchment delineation is depicted in **Figure 3.1** and **Table 3.1** following.

3.2 CATCHMENT DETAILS AND FLOWRATES

Hydrological Modelling was undertaken using iWBNM 2019, an updated interface to the WBNM hydrological engine. WBNM ('Watershed Bounded Network Model' Boyd et al, 2007) is an advanced storage-routing model developed in conjunction with the University of Wollongong that allows simulation of complex catchment behaviour.

A summary of the adopted modelling parameters is provided below:

- Lag Parameter: 1.60 (recommended default)
- Stream Routing: 0.5 (urban flow paths, mostly done in TUFLOW however)
- Initial Loss: 0 [mm] (to conservatively account for antecedent rainfall)
- Continuing Loss Rate: 2.5 [mm/hr] (as per Rhelm Flood Study 2019)
- Raingauges: Warrawong (1 total)

The WBNM hydrographs were then used as inputs for the TUFLOW model.

Australian Rainfall Runoff (ARR) 2019

As far as we are aware, Wollongong City Council currently prefer that ARR1987 methodology be adopted, and hence we have adopted the 1987 methodology for hydrograph simulation, as per the Rhelm [2019] flood study.

WBNM Results & Critical Duration

WBNM results are presented in their entirety in the appendices. As a check, the following 1%AEP durations were run in a preliminary hydraulic model: 25 / 90 & 120 minutes. These checks confirmed the 90-minute produced the highest water level near the subject site. We have therefore adopted the 90-minute duration storm for hydraulic modelling for the 1%AEP event and the 15-minute for the PMF event.

Table 3.1: Subarea Statistics

Subarea ID	Downstream Subarea	Area [ha]	Impervious%
S01	S05	0.521	70
S02	S03	0.463	70
S03	S06	1.048	70
S04	S07	0.796	70
S05	S07	0.526	70
S08	S07	0.636	70
S07	S06	0.625	70
S06	S09	0.893	70
S09	S11	1.142	70
S10	S11	0.731	70
S11	Dummy	0.364	70

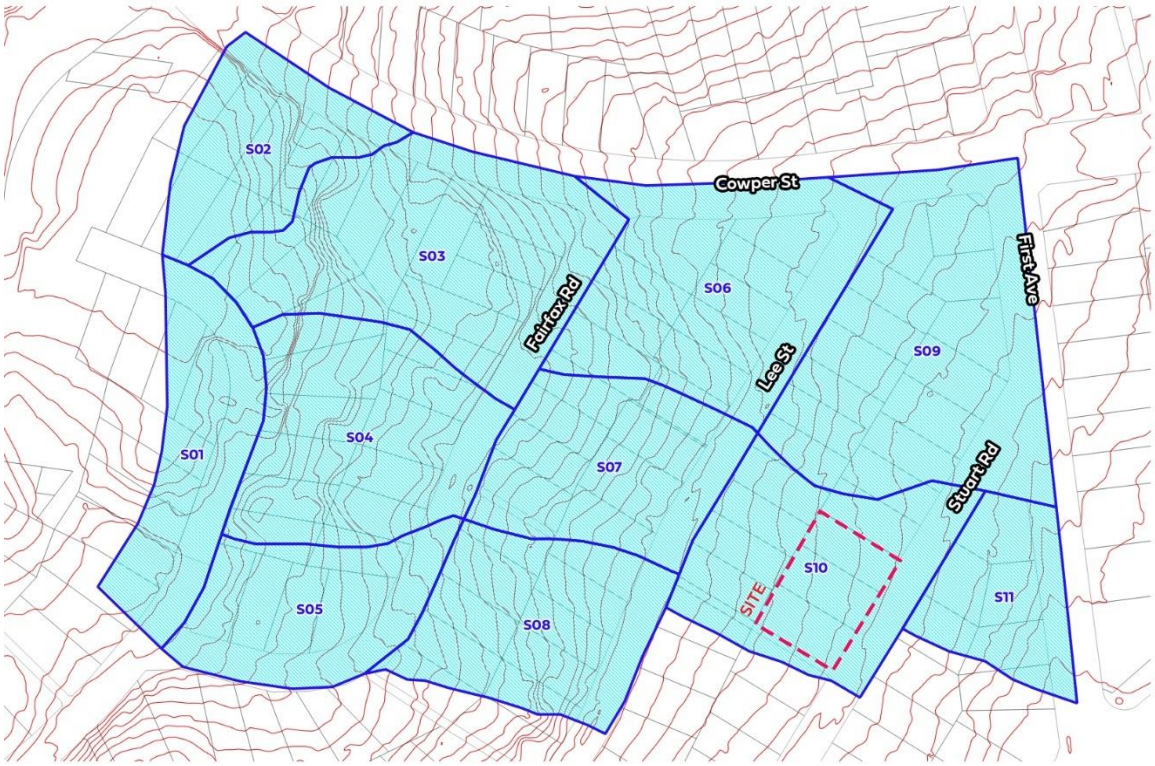


Figure 3.1: Sub-catchment Delineation

4 HYDRAULIC (TUFLOW) ANALYSIS

4.1 MODEL SETUP

TUFLOW is a 1D / 2D grid model that performs hydro-dynamic analysis in river and floodplain systems. TUFLOW allows the user to model a range of structures common in urban environments. The 64-bit double precision version of TUFLOW (2013 AC) was used as the hydraulic model for this report.

TUFLOW model parameters were as follows:

- Grid cell size: 1.0m
- 2D Timestep: 0.4s
- 1D Timestep: 0.5s

Additional parameters were generally left at the recommended default values.

Material zones and roughness values are summarised in **Table 4.1** and were generally identical to the RHELM 2019 study. The model extents are depicted in **Figure 4.2** at the end of this chapter. TUFLOW was allowed to calculate the downstream water level at the model boundary.

Table 4.1: Material Zones / Roughness Values

Material	Manning's n
Roads / pavements	0.02
Open space	0.03
Urban yards (excl. buildings)	0.05
Light vegetation	0.05
Buildings	Raised

The following scenarios were modelled:

1. Existing.
2. Proposed, including revised building footprint and sections of elevated slabs (refer also Figure 4.3 following).

Pits / Pipes & Blockage Factors

A portion of the pipe network in the local vicinity was modelled as shown in **Figure 4.2**. All pits were modelled with a 50% inlet blockage factor applied; this was slightly more conservative than the RHELM [2019] study which applied 50% blockage to sag pits and 20% blockage to on-grade pits.

The proposed elevated undercroft area was blocked 50% using a layered flow constriction as per the recommendations of DCP 2009 Chapter E13. Allowances were also made for energy losses from the proposed piers in the undercroft area.

4.2 MODEL RESULTS

Full model results are contained in the appendices, and we highlight the following:

- The site itself is subject to very shallow inundation during the 1%AEP flood event with typical depths around 20-40mm under existing conditions.
- 1%AEP flow velocities are typically around 0.5 m/s through the subject site.
- Conveyance impacts are minor as discussed below.
- 1%AEP hazards are low, as discussed below.

4.3 CONVEYANCE IMPACTS

The proposed design has been deliberately designed to convey flow (with an elevated ground floor) and, as such, the offsite impacts on adjacent private lots are less than the allowed +20mm. Thus, overall, the development has a very minor impact on local flood behaviour.

PMF impacts are mapped in the appendices and are typically limited to the site itself. Some areas of road reserve experience isolated spot-areas of up to +45mm and #5 Stuart Rd to the south of the subject site experiences a small increase of +29mm along the western wall of the dwelling. We highlight that the impact mapping and results show that:

- There are no additional lots affected by the PMF extents under proposed conditions.
- We do not have floor level survey of #5 Stuart Rd, but Street View seems to indicate that the western wall is around 500mm above ground level. PMF depths are around 150-200mm and thus, the extra 29mm along the western wall is not additional over-floor flooding.
- We cannot see that there will be any impact on flood warning times or flood evacuation routes, given that the PMF impacts are typically less than 50mm and isolated spot-impacts (rather than large scale swathes of increased water levels that could potentially cut evacuation routes).

4.4 FLOOD STORAGE IMPACTS

Loss of floodplain storage can affect hydrograph routing such that there is a corresponding loss of flood attenuation. That is, flowrates downstream may increase due to the loss of storage. Hence Council's requirement to demonstrate no loss of storage within the floodplain.

The subject site is only inundated to a shallow depth during the 1%AEP event and we do not believe that flood storage is a significant issue at this site. Flood storage volumes were approximated in Global Mapper as shown below. There is an increase in flood storage under proposed conditions, as a result of the buildings being removed, proposed elevated slabs, and proposed sections of cut.

- Volume 1%AEP (existing): $60m^3$
- Volume PMF (existing): $136m^3$
- Volume 1%AEP (proposed): $146m^3$
- Volume PMF (proposed): $274m^3$

4.5 FLOOD RISK PRECINCTS & HAZARD MAPPING

ARR2019 provides updated Hazard curves as described in Table 6.7.3 and 6.7.4 of ARR2019 Chapter 6. We have provided mapping of the 6 hazard categories, with the definitions as follows:

H1: Generally safe for vehicles, people and buildings.
H2: Unsafe for small vehicles.
H3: Unsafe for vehicles. children and the elderly.
H4: Unsafe for vehicles and people.
H5: Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6: Unsafe for vehicles and people. All building types considered vulnerable to failure.

Under both existing and proposed conditions, the site is almost entirely H1 Hazard category in the 1%AEP event, with some isolated grid cells at H2. We therefore conclude that the subject site is generally subject to low-hydraulic hazard in the 1%AEP event.

The NSW Flood Risk Management Manual (Department of Planning & Environment, 2023) categorises the floodplain into three groups as noted below:

Floodways areas of the floodplain which generally convey a significant discharge of water during floods and are sensitive to changes that impact flow conveyance. They often align with naturally defined channels or form elsewhere in the floodplain.

Flood Storage Areas of the floodplain that are outside floodways which generally provide for temporary storage of floodwaters during the passage of a flood and where flood behaviour is sensitive to changes that impact on temporary storage of water during a flood.

Flood Fringe That part of the flood extents for the event remaining after the flood function areas of floodway and flood storage areas have been defined.

We highlight that the NSW Flood Risk Management Manual does not provide specific criteria for ascertaining or defining these areas; these are typically determined by the flood modeller / hydraulic consultant based on the specific nature of flooding in the creek or waterway. As far as we are aware Council's provided mapping in the RHELM 2019 did not include hydraulic category mapping; our flood

modelling shows flood depths to be shallow and hazards low. Thus, the site is best described as Flood Fringe and does not contain floodway areas.

Wollongong Council's revised DCP 2009 Chapter E13 defines Flood Precincts as follows:

High Risk:

- Areas greater than H3 hazard conditions during a 1% AEP flood
- Land within 10m from the top of a watercourse bank
- Floodways.

Medium Risk: land below the 1% AEP level plus 0.5 m that is not High Risk

Low Risk:

- All other areas within the floodplain (i.e. within the extent of the PMF)
- All areas within the 2100 Coastal Zone Inundation Extent not classified Medium Flood Risk

Given that the site does not contains H4 or higher hazard categories, or a Floodway, or is located near a defined watercourse, the site does not contain High Flood Risk areas. The site is subject to low hydraulic hazard during a 1%AEP event and is thus best classified as Medium Flood Risk.

4.6 PRACTICAL CONSIDERATIONS

Wollongong Council typically require:

a. Habitable floors to be set at the Flood Planning Level (FPL) being the 1%AEP + 500mm level.
b. Garages and other non-habitable internal floors to be at the 1%AEP – 300mm level, or 300mm above finished external ground levels.
c. Outdoor parking areas must be no more than H1 hazard in the 1%AEP event.
d. Basement carparking to be protected via a crest to the 1%AEP + 200mm level.

With respect to the proposed design, we note the following [refer **Figure 4.3** for further details]:

A. The highest adjacent 1%AEP flood level to the rear segment is +11.0 mAHD and therefore the FPL for the rear segment is +11.5 mAHD. The proposed design meets this requirement.
B. The highest adjacent 1%AEP flood level to the front segment is +10.25 mAHD and therefore the FPL for the front segment is +10.75 mAHD. The proposed design meets this requirement.
C. The proposed carparking area is entirely H1 hazard in the 1%AEP event and therefore satisfies the requirement as noted above.
D. There are no proposed garages or basement parking areas.
E. The majority of the undercroft area should be open to allow the free passage of floodwaters, as shown in Figure 4.3. Open-style screening should be provided.
F. The lift cores, some planters and other ramp areas may be solid / on-ground as required.
G. The proposed bin room walls may be solid.
H. The highest adjacent PMF flood level to the rear segment is +11.2 mAHD which is below the proposed ground floor level of the rear segment.
I. The highest adjacent PMF flood level to the front segment is +10.4 mAHD which is below the proposed ground floor level of the front segment.

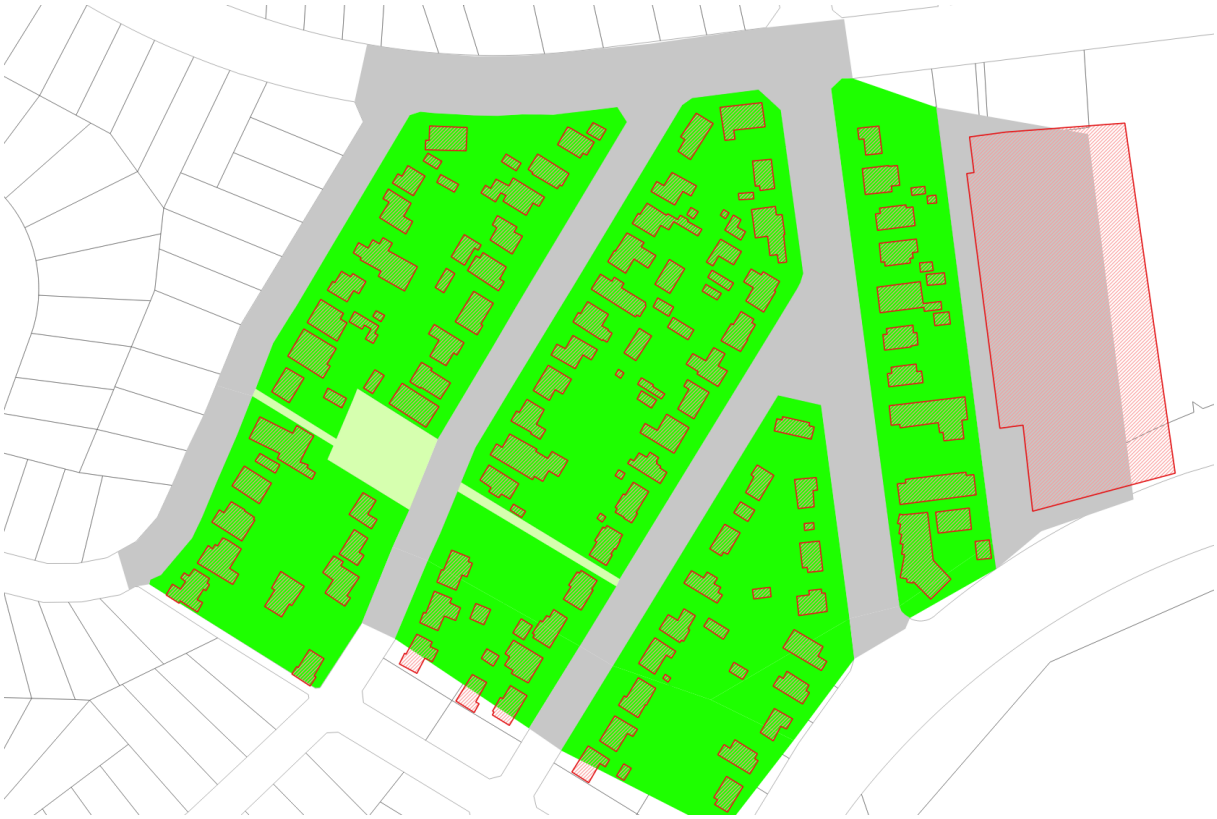


Figure 4.1: Material Zones [Existing]
[bright green = urban yard, grey = road reserve, light green = open space, red hatch = buildings]

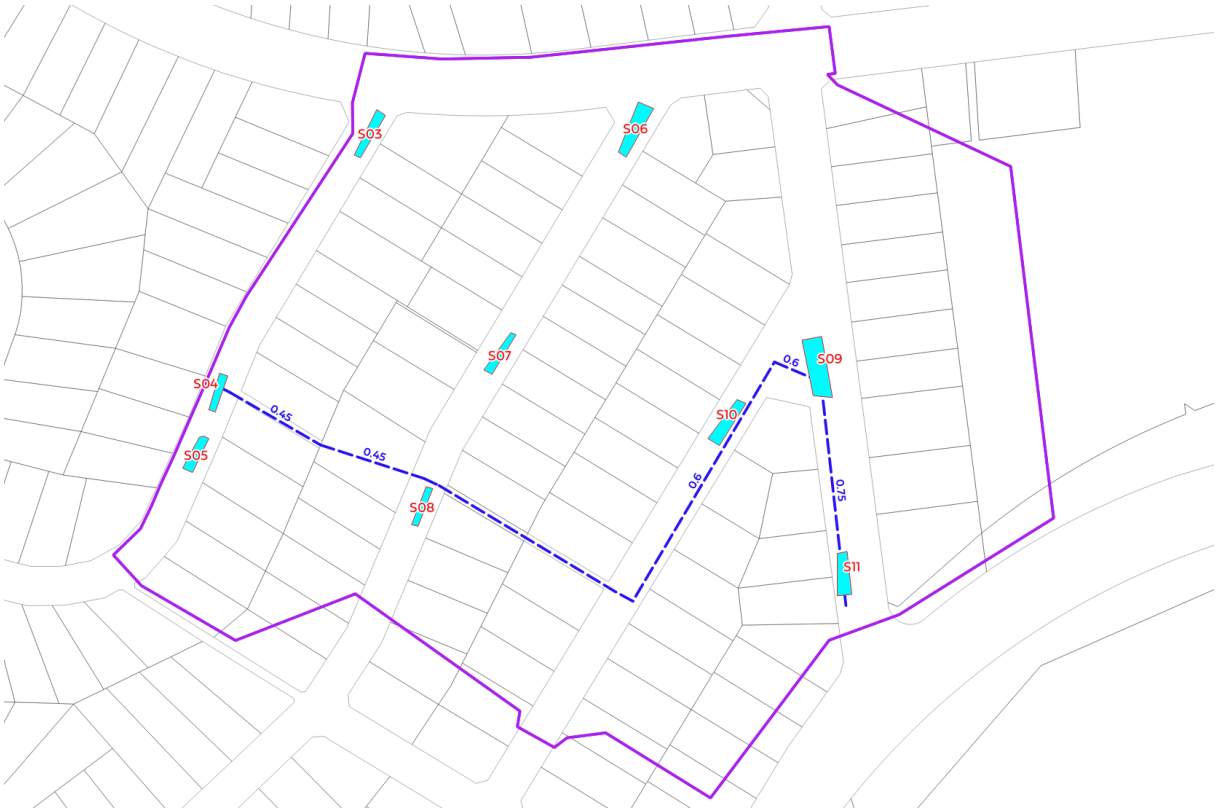


Figure 4.2: TUFLOW Extents & SA polygons & 1D network
[orange dots = inlet pits, dashed blue line = 1D pipes / culverts, red line = model boundary]

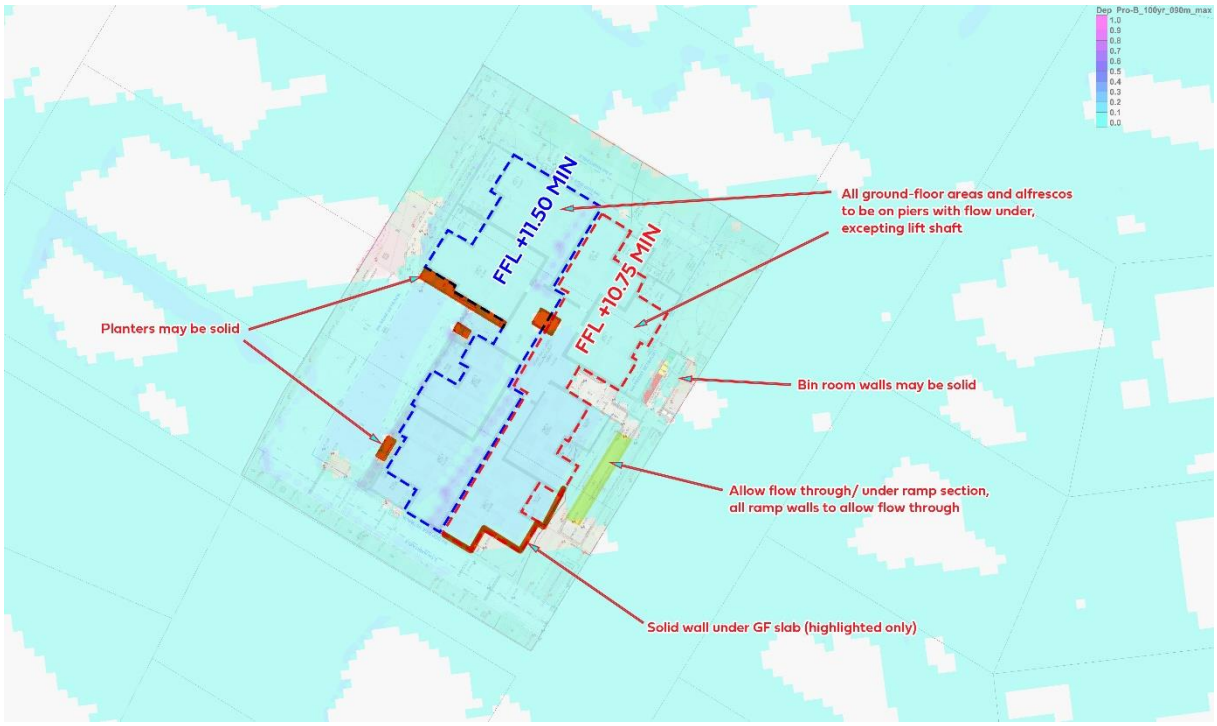


Figure 4.3: Proposed Flood Risk Mitigation Measures

Figure 4.4: Proposed Finished Ground Levels under slab in mAHD

5 ASSESSMENT - DCP 2009 CH.E13

Wollongong Council would typically require any development to be assessed against its DCP 2009 Chapter E13 section. We believe the proposal meets or exceeds the requirements of DCP2009 for a "Residential – Medium Risk" development noting that:

A. **Floor Levels:** refer comments previously, all habitable floors are at least 500mm above the 1%AEP level.
B. **Building Components & Structural Soundness:** all structures will have flood compatible materials below the relevant FPL. We also note that a structural engineer can readily certify at CC stage that the proposed new structures can withstand flood forces such as hydrostatic loading, debris impact and uplift.
C. **Flood Effects:** this report demonstrates that, under proposed conditions:
    a. there are no significant offsite conveyance impacts; and,
    b. there is no loss of flood storage.
D. **Carparking:** the proposed external carparking is no more than H1 hazard during the 1%AEP event, as required.
E. **Evacuation**: all proposed ground floor levels are above the PMF levels; thus, specific evacuation is not required, as all occupants may wait safely within any level during a large storm event.

6 CONCLUSIONS

We conclude that:

- The site is subject to very shallow inundation during the 1%AEP flood event.
- The development as proposed does not have any impact on the conveyance ability / capacity of the local floodplain or reduce flood storage volumes provided the recommendations of this report are adhered to.
- The site is best classified as Medium Flood Risk.
- The proposal meets the requirements of DCP 2009 Chapter E13 “Floodplain Management”.

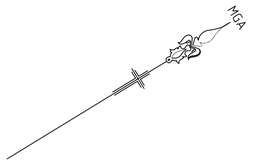
Yours faithfully,
For & on behalf of Greenview,

Andrew Wiersma
BE (Hons) MEng MIEAust CPENG (NER)
Senior Design Engineer

Alistair McKerron
BE MIEAust CPENG (NER)
Senior Project Engineer
NPER no. 2220277

APPENDIX A: Supplementary Information

L.G.A. WOLLONGONG



BOUNDARY CO-ORDINATES

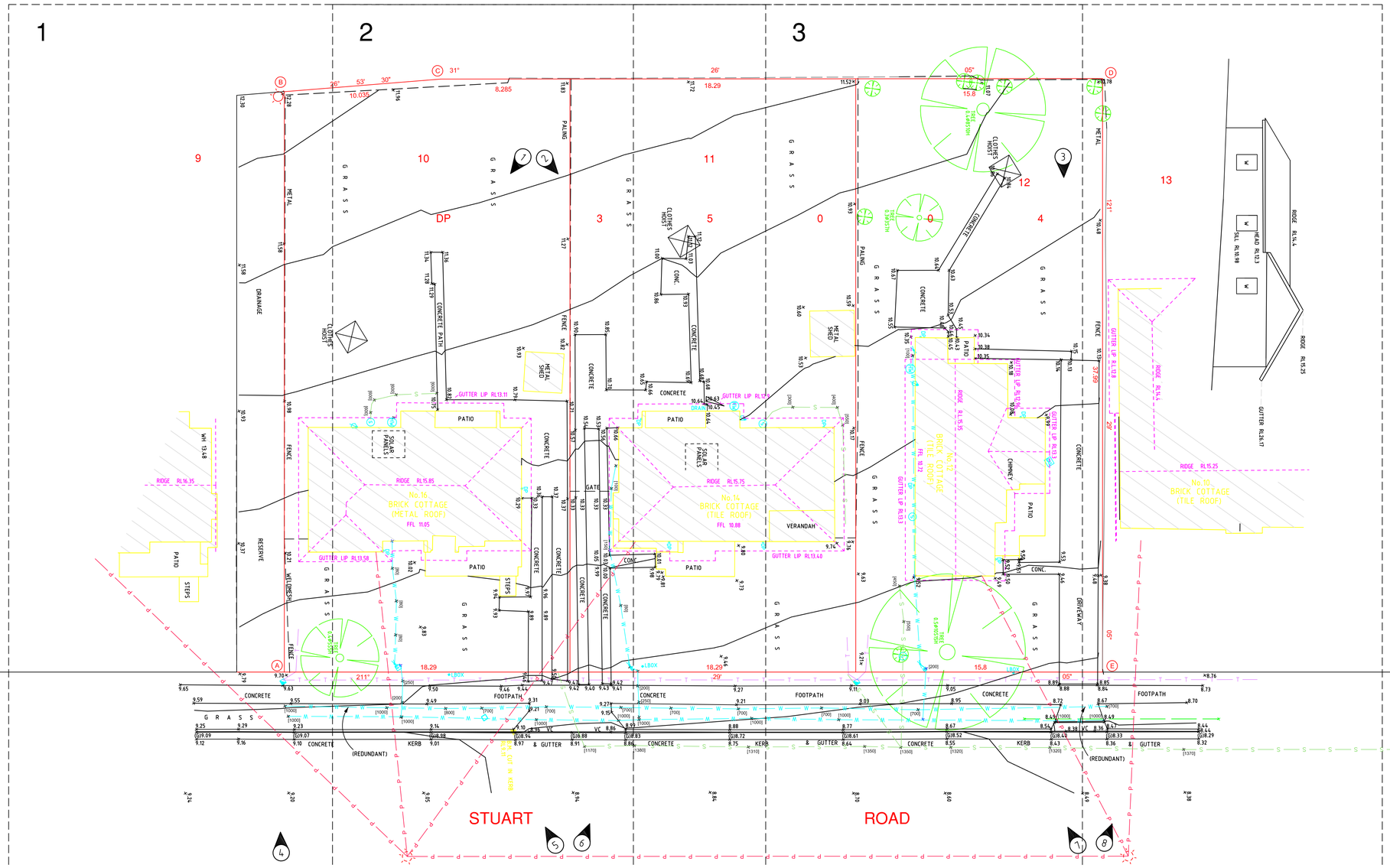
BDY CNR	EASTING	NORTHING
A	305 666.613	6 181 757.177
B	305 634.927	6 181 776.585
C	305 639.467	6 181 785.535
D	305 661.571	6 181 821.687
E	305 693.969	6 181 801.845

LEGEND :

- (P) - DENOTES PHOTO LOCATION
- (A) - DENOTES BOUNDARY CORNER

NOTES:

1) TITLE BEARINGS AND DIMENSIONS ARE SHOWN. BOUNDARIES DETERMINED FROM PLANS AVAILABLE ON PUBLIC RECORD.
2) THIS SURVEY HAS BEEN MADE PURSUANT TO SECTION 9 OF THE SURVEYING & SPATIAL INFORMATION REGULATION 2017.
2) ORIGIN OF LEVELS: SSM 163463 RL 7.02
3) SITE COMPRISES LOTS 10, 11 & 12 DP 35004
4) SITE AREA 1985 m^2 BY TITLE DIMENSIONS.
5) UNDERGROUND SERVICES HAVE NOT BEEN INVESTIGATED.
6) TREE SIZES ARE INDICATIVE
0.3Ø10S,8H DENOTES INDICATIVE TREE SIZE
0.3 TRUNK DIAMETER 10 SPREAD, 8 HIGH.
(G) - DENOTES INVERT OF GUTTER.
7) TREE NAMES SHOWN CONSTITUTE OUR OPINION ONLY IF TREE SPECIES IDENTIFICATION IS IMPORTANT THEY SHOULD BE DETERMINED BY A QUALIFIED ARBORIST.
8) UNDERGROUND (NON VISIBLE) SERVICE LINES HAVE BEEN SHOWN FROM "DIAL BEFORE YOU DIG" SERVICE AUTHORITY RECORDS & ARE DIAGRAMMATIC ONLY IN REGARD TO THEIR POSITION & WIDTH UNLESS STATED OTHERWISE.



SYMBOL LEGEND

- HW HOT WATER
- S SEWER INSPECTION HOLE
- SEWER VENT PIPE
- TELSTRA
- GAS GAS
- TAP
- WATER METER
- DP DOWN PIPE
- SEWER MAN HOLE

No.	DATE	NOTATION/AMENDMENT
1	21.04.22	ISSUED

No.	DATE	NOTATION/AMENDMENT

FILE	FILE SIZE (MB)	CHECKED BY

CONTOUR INTERVAL:

DATUM: A.H.D.

ORIGIN OF DATUM: SSM163463 RL 7.02 (SCIMS)

100 YEAR FLOOD RL: N/A

RECOMMENDED MINIMUM FLOOR RL: N/A

SOURCE OF FLOOD INFO: N/A

LEGEND OF COMMONLY USED SYMBOLS

WATER — W — W — W — W — W — W

SEWER — S — S — S — S — S — S

ELECTRICITY O/H — P — P — P — P — P — P

ELECTRICITY U/G — E — E — E — E — E — E

TELECOM O/H U/G — T — T — T — T — T — T

GAS — G — G — G — G — G — G

STORMWATER — SW — SW — SW — SW — SW — SW

BENCH MARK △ SURVEY CONTROL MARK ◯ PM SSM

REDUCTION RATIO 1 : 150 (A1)

0 5 10 15 20

LAND TITLE INFORMATION

LOTS: 10, 11 & 12

PLAN NOs : D.P 35004

OTHER:

AREA:

DATE OF SURVEY: 08.04.22
SURVEY CONSULTANT: JH

Norton Survey Partners
SURVEYORS & LAND TITLE CONSULTANTS
PH +61 2 9555 2744
office@nspartners.com.au
SUITE 1 /505 BALMAIN ROAD
LILYFIELD N.S.W. 2040
REGISTERED SURVEYOR JACK HUGHES

REF: 56005-1.DWG

NSW GOVERNMENT Family & Community Services Land & Housing Corporation

DRAWING TITLE

DETAIL & LEVEL SURVEY

LOCATION

WARRAWONG

STREET ADDRESS

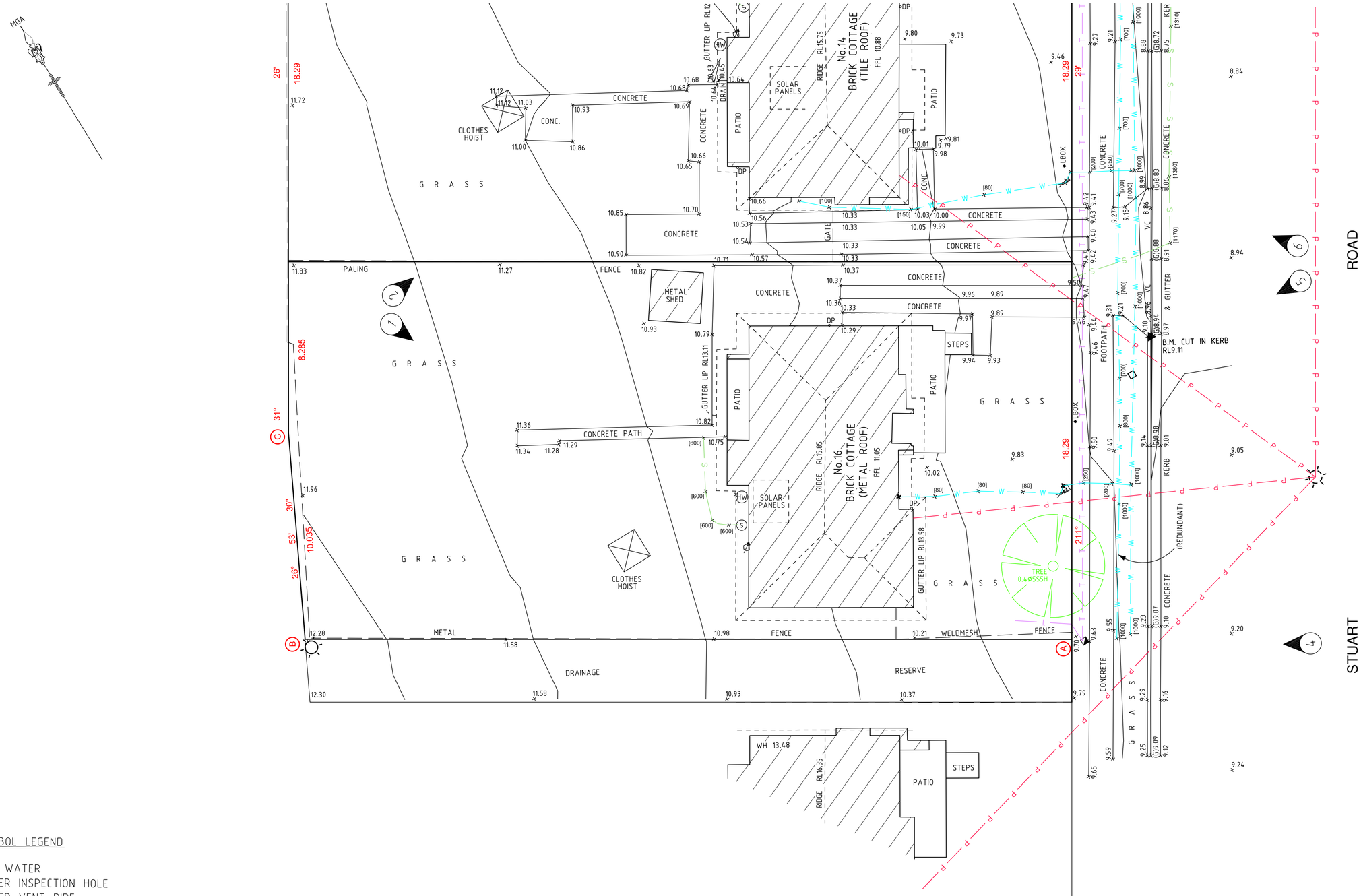
12-16 STUART ROAD, WARRAWONG

TYPE S

JOB NUMBER 56005

SHT. 1 OF 4

L.G.A. WOLLONGONG



SYMBOL LEGEND

- HW HOT WATER
- S SEWER INSPECTION HOLE
- SEWER VENT PIPE
- TELSTRA
- GAS GAS
- TAP
- WATER METER
- DP DOWN PIPE
- SEWER MAN HOLE

No.	DATE	NOTATION/AMENDMENT
1	21.04.22	ISSUED

No.	DATE	NOTATION/AMENDMENT

FILE	FILE SIZE (MB)	CHECKED BY

CONTOUR INTERVAL:

DATUM: A.H.D.

ORIGIN OF DATUM: PM 292230 RL 64.190 (SCIMS)

100 YEAR FLOOD RL: N/A

RECOMMENDED MINIMUM FLOOR RL: N/A

SOURCE OF FLOOD INFO: N/A

LEGEND OF COMMONLY USED SYMBOLS

WATER W
SEWER S
ELECTRICITY O/H P
ELECTRICITY U/G E
TELECOM O/H T U/G T
GAS G
STORMWATER SW

BENCH MARK

SURVEY CONTROL MARK PM SSM

REDUCTION RATIO 1 : 100 (A1)

0 5 10 15 20

LAND TITLE INFORMATION

LOTS: 10, 11 & 12

PLAN NOs : D.P 35004

OTHER:

AREA:

DATE OF SURVEY: 08.04.22

SURVEY CONSULTANT: RW

Norton Survey Partners
SURVEYORS & LAND TITLE CONSULTANTS
PH +61 2 9555 2744
office@nspartners.com.au
SUITE 1 /505 BALMAIN ROAD
LILYFIELD N.S.W. 2040

REGISTERED SURVEYOR
RYAN WILLS

REF: 09358-1.DWG

NSW GOVERNMENT Family & Community Services Land & Housing Corporation

DRAWING TITLE

DETAIL & LEVEL SURVEY

LOCATION

WARRAWONG

STREET ADDRESS

12-16 STUART ROAD, WARRAWONG

TYPE S

JOB NUMBER 56005

SHT. 2 OF 4

L.G.A. WOLLONGONG

MGA

[700] DENOTES DEPTH TO SERVICE
(G) DENOTES GUTTER INVERT

SYMBOL LEGEND

- (HW) HOT WATER
- (S) SEWER INSPECTION HOLE
- SEWER VENT PIPE
- TELSTRA
- GAS
- TAP
- WATER METER
- DP DOWN PIPE
- SEWER MAN HOLE

No.	DATE	NOTATION/AMENDMENT	No.	DATE	NOTATION/AMENDMENT
1	21.04.22	ISSUED			

FILE	FILE SIZE (MB)	CHECKED BY

CONTOUR INTERVAL:
DATUM: A.H.D.
ORIGIN OF DATUM: PM 292230 RL 64.190 (SCIMS)
100 YEAR FLOOD RL: N/A
RECOMMENDED MINIMUM FLOOR RL: N/A
SOURCE OF FLOOD INFO: N/A

LEGEND OF COMMONLY USED SYMBOLS

WATER — W — W — W — W
SEWER — S — S — S — S
ELECTRICITY O/H — P — P — P — P
ELECTRICITY U/G — E — E — E — E
TELECOM O/H — T — T — T — T / U/G — T — T — T — T
GAS — G — G — G — G
STORMWATER — SW — SW — SW — SW
BENCH MARK ▲ SURVEY CONTROL MARK ⬢ PM SSM

REDUCTION RATIO 1 : 100 (A1)
0 5 10 15 20

LAND TITLE INFORMATION
LOTS: 10, 11 & 12
PLAN NOs : D.P 35004
OTHER:
AREA:

DATE OF SURVEY: 08.04.22
SURVEY CONSULTANT: RW

Norton Survey Partners
SURVEYORS & LAND TITLE CONSULTANTS
PH +61 2 9555 2744
office@nspartners.com.au
SUITE 1 /505 BALMAIN ROAD
LILYFIELD N.S.W. 2040
REGISTERED SURVEYOR RYAN WILLS

REF: 09358-1.DWG

NSW GOVERNMENT Family & Community Services Land & Housing Corporation

DRAWING TITLE: DETAIL & LEVEL SURVEY

LOCATION: WARRAWONG

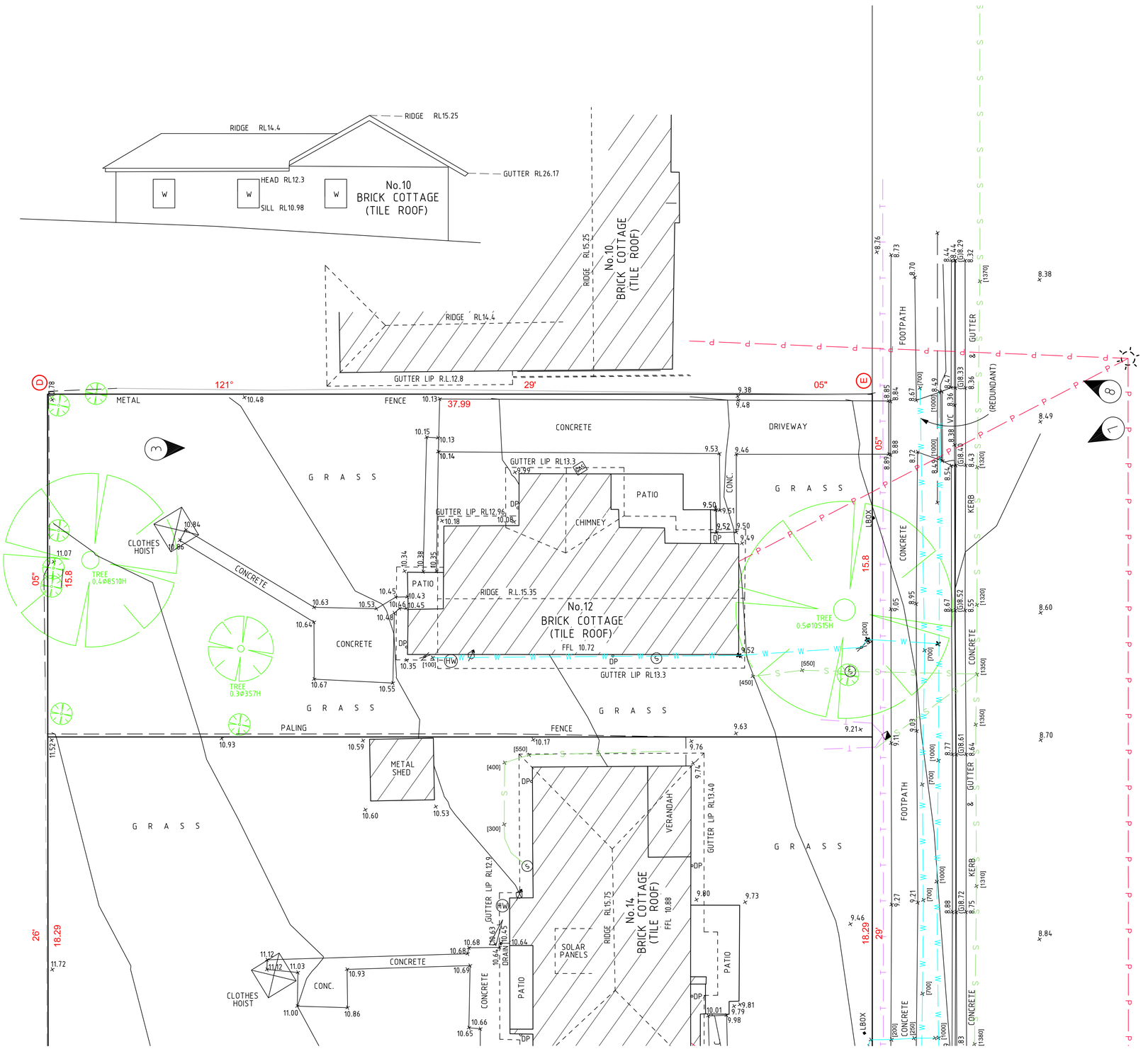
STREET ADDRESS: 12-16 STUART ROAD, WARRAWONG

TYPE: S

JOB NUMBER: 56005

SHT. 3 OF 4

L.G.A. WOLLONGONG



SYMBOL LEGEND

- HW — HOT WATER
- S — SEWER INSPECTION HOLE
- SEWER VENT PIPE
- TELSTRA
- GAS — GAS
- TAP
- WATER METER
- DP — DOWN PIPE
- SEWER MAN HOLE

No.	DATE	NOTATION/AMENDMENT
1	21.04.22	ISSUED

No.	DATE	NOTATION/AMENDMENT

FILE	FILE SIZE (MB)	CHECKED BY

CONTOUR INTERVAL:

DATUM: A.H.D.

ORIGIN OF DATUM: PM 29Z230 RL 64.190 (SCIMS)

100 YEAR FLOOD RL: N/A

RECOMMENDED MINIMUM FLOOR RL: N/A

SOURCE OF FLOOD INFO: N/A

LEGEND OF COMMONLY USED SYMBOLS

WATER — W — W — W — W

SEWER — S — S — S — S

ELECTRICITY O/H — P — P — P — P

ELECTRICITY U/G — E — E — E — E

TELECOM O/H U/G — T — T — T — T

GAS — G — G — G — G

STORMWATER — SW — SW — SW — SW

BENCH MARK

SURVEY CONTROL MARK PM SSM

REDUCTION RATIO 1 : 100 (A1)

0 5 10 15 20

LAND TITLE INFORMATION

LOTS: 10, 11 & 12

PLAN NOs : D.P 35004

OTHER:

AREA:

DATE OF SURVEY: 08.04.22

SURVEY CONSULTANT: RW

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SUITE 1 /505 BALMAIN ROAD
LILYFIELD N.S.W. 2040

REGISTERED SURVEYOR RYAN WILLS

REF: 09358-1.DWG

NSW GOVERNMENT Family & Community Services Land & Housing Corporation

DRAWING TITLE

DETAIL & LEVEL SURVEY

LOCATION

WARRAWONG

STREET ADDRESS

12-16 STUART ROAD, WARRAWONG

TYPE S

JOB NUMBER 56005

SHT. 4 OF 4

WBNM QA results

```
#####START_QA_SUMMARY_FILE################################################

D:\Projects\GV 2024 Projects\Warrawong - Stuart 12-16 [Flood SW]\WBNM\100yr_Spec.wbn
Program run at 15:13 on   6  8 2024  (ddmmyy)

 Your Organisation
 Organisations Specialisation
 Street Address
 City Address
 State Address
 Country
 Zipcode
 Phone Number
 Fax Number
 Your email address
 Default user name
 IFD_in_runfile

 out_metafile= T
 out_culverts= F
 out_scourable= F
 sum_catchments= T
 sum_volumes= T
 sum_outlet_structures= T
 sum_local_structures= T
 sum_subareas= F
 sum_depths= F
 sum_Qpeaks= T
 sum_Tpeaks= T
 sum_multiStorms= F
 dbg_run= F
 dbg_echo= F
 dbg_edit= F
 dbg_ifd= F
 trig_flowmin= 5

#####START_PREAMBLE_BLOCK##########|###########|###########|###########|
Project Number: Comment:
Project Description: Comment:
Comment:
RUNFILE: D:\Projects\GV 2024 Projects\Warrawong - Stuart 12-16 [Flood SW]\WBNM\100yr_Spec.wbn
DES Storm ARI (Env ARI):     100()      100()      100()      100()      100()      100()
100()      100()      100()
DES Burst Dura (Env Dura):   5()        10()       15()       20()       25()       30()
45()       60()       90()
Constructed using iWBNM_2012
Max 8 lines of text
#####END_PREAMBLE_BLOCK############|###########|###########|###########|


#####START_STATUS_BLOCK############|###########|###########|###########|

last edited on 6/08/2024 3:13:22 PM
by Andy
2012_000
#####END_STATUS_BLOCK##############|###########|###########|###########|


#####START_DISPLAY_BLOCK###########|###########|###########|###########|
         0.0         0.0         0.0         0.0
         none
         0.0         0.0         0.0         0.0         0.0         0.0
#####END_DISPLAY_BLOCK#############|###########|###########|###########|


#####START_TOPOLOGY_BLOCK##########|###########|###########|###########|
          12
S01                  0.0         0.0         0.0         0.0 S05
S02                  0.0         0.0         0.0         0.0 S03
S03                  0.0         0.0         0.0         0.0 S06
S04                  0.0         0.0         0.0         0.0 S07
S05                  0.0         0.0         0.0         0.0 S07
```

```
S08                  0.0         0.0         0.0         0.0 S07
S07                  0.0         0.0         0.0         0.0 S06
S06                  0.0         0.0         0.0         0.0 S09
S09                  0.0         0.0         0.0         0.0 S11
S10                  0.0         0.0         0.0         0.0 S11
S11                  0.0         0.0         0.0         0.0 Dummy
Dummy                0.0         0.0         0.0         0.0 SINK
#####END_TOPOLOGY_BLOCK############|###########|###########|###########|


#####START_SURFACES_BLOCKS##########|###########|###########|###########|
        0.77
      -99.90
S01                0.52        70.0        1.60        0.10
S02                0.46        70.0        1.60        0.10
S03                1.05        70.0        1.60        0.10
S04                0.80        70.0        1.60        0.10
S05                0.53        70.0        1.60        0.10
S08                0.64        70.0        1.60        0.10
S07                0.62        70.0        1.60        0.10
S06                0.89        70.0        1.60        0.10
S09                1.14        70.0        1.60        0.10
S10                0.73        70.0        1.60        0.10
S11                0.36        70.0        1.60        0.10
Dummy              0.00         0.0        1.60        0.10
#####END_SURFACES_BLOCK############|###########|###########|###########|


#####START_FLOWPATHS_BLOCKS#########|###########|###########|###########|
          12
S01
#####ROUTING
        0.50
S02
#####ROUTING
        0.50
S03
#####ROUTING
        0.50
S04
#####ROUTING
        0.50
S05
#####ROUTING
        0.50
S08
#####ROUTING
        0.50
S07
#####ROUTING
        0.50
S06
#####ROUTING
        0.50
S09
#####ROUTING
        0.50
S10
#####ROUTING
        0.50
S11
#####ROUTING
        0.50
Dummy
#####ROUTING
        0.50
#####END_FLOWPATHS_BLOCK###########|###########|###########|###########|


#####START_LOCAL_STRUCTURES_BLOCK##|###########|###########|###########|
            0
#####END_LOCAL_STRUCTURES_BLOCK####|###########|###########|###########|


#####START_OUTLET_STRUCTURES_BLOCK#|###########|###########|###########|
```

```
           0
#####END_OUTLET_STRUCTURES_BLOCK###|###########|###########|###########|


#####START_STORM_BLOCK#############|###########|###########|###########|
          11
#####START_STORM#1
100 Year ARI 5 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
          100           5        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#1

#####START_RESULTS_STORM_1




#####START_CATCHMENT_SUMMARY################################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =        22.34
Excess rainfall        (mm) =        22.28
Calc. runoff depth     (mm) =        22.14  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         2.572 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY##################################################


#####START_VOLUME_SUMMARY#############################################################################
SUBAREA DIRECTED IMPORTED      LOCAL       LOCAL    DIRECTED    IMPORTED     OUTFLOW     BALANCE
          TO TOP   TO TOP   PERVIOUS  IMPERVIOUS   TO BOTTOM   TO BOTTOM
         (Volumes in thousands m3)
S01
       0.000       0.000       0.034       0.081       0.000       0.000       0.115       0.000
S02
       0.000       0.000       0.030       0.072       0.000       0.000       0.103       0.000
S03
       0.103       0.000       0.069       0.164       0.000       0.000       0.334       0.001
S04
       0.000       0.000       0.052       0.124       0.000       0.000       0.176       0.000
S05
       0.115       0.000       0.034       0.082       0.000       0.000       0.231       0.000
S08
       0.000       0.000       0.042       0.099       0.000       0.000       0.141       0.000
```

```
S07
       0.549       0.000       0.041       0.098       0.000       0.000       0.687       0.000
S06
       1.021       0.000       0.058       0.140       0.000       0.000       1.219       0.000
S09
       1.219       0.000       0.075       0.178       0.000       0.000       1.472       0.000
S10
       0.000       0.000       0.048       0.114       0.000       0.000       0.162       0.000
S11
       1.634       0.000       0.024       0.057       0.000       0.000       1.714       0.000
Dummy
       1.714       0.000       0.000       0.000       0.000       0.000       1.714       0.000
#####END_VOLUME_SUMMARY#########################################################################


#####START_PEAK_SUMMARY#########################################################
SUBAREA OUT_STR     STREAM    STREAM     LOCAL     LOCAL    DIRECTED  OUTLET_STRUCTURE
        1=exist        TOP    BOTTOM  PERVIOUS IMPERVIOUS  TO BOTTOM  INFLOW   OUTFLOW
                 including                                 including
               imported to                               imported to
                      TOP                                    BOTTOM
                                                                  (Discharges in m3/s)
S01          0       0.000     0.000     0.082     0.240     0.000     0.322     0.322
S02          0       0.000     0.000     0.075     0.215     0.000     0.290     0.290
S03          0       0.290     0.201     0.141     0.456     0.000     0.777     0.777
S04          0       0.000     0.000     0.114     0.355     0.000     0.469     0.469
S05          0       0.322     0.259     0.083     0.242     0.000     0.574     0.574
S08          0       0.000     0.000     0.096     0.289     0.000     0.385     0.385
S07          0       1.428     1.213     0.095     0.284     0.000     1.536     1.536
S06          0       2.313     1.956     0.125     0.394     0.000     2.325     2.325
S09          0       2.325     2.023     0.150     0.493     0.000     2.333     2.333
S10          0       0.000     0.000     0.107     0.328     0.000     0.435     0.435
S11          0       2.547     2.484     0.062     0.172     0.000     2.572     2.572
Dummy        0       2.572     2.572     0.000     0.000     0.000     2.572     2.572
#####END_PEAK_SUMMARY##########################################################################


#####START_TIME_SUMMARY#########################################################
SUBAREA OUT_STR   STREAM   STREAM    LOCAL    LOCAL   DIRECTED  OUTLET_STRUCTURE
        1=exist      TOP   BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW   OUTFLOW
                (Times in minutes)
S01          0        0.0      0.0      5.0      5.0      0.0      5.0      5.0
S02          0        0.0      0.0      5.0      5.0      0.0      5.0      5.0
S03          0        5.0      6.0      5.0      5.0      0.0      5.0      5.0
S04          0        0.0      0.0      5.0      5.0      0.0      5.0      5.0
S05          0        5.0      6.0      5.0      5.0      0.0      5.0      5.0
S08          0        0.0      0.0      5.0      5.0      0.0      5.0      5.0
S07          0        5.0      6.0      5.0      5.0      0.0      5.0      5.0
S06          0        5.0      6.0      5.0      5.0      0.0      6.0      6.0
S09          0        6.0      8.0      5.0      5.0      0.0      7.0      7.0
S10          0        0.0      0.0      5.0      5.0      0.0      5.0      5.0
S11          0        7.0      8.0      5.0      5.0      0.0      7.0      7.0
Dummy        0        7.0      7.0      0.0      0.0      0.0      7.0      7.0
#####END_TIME_SUMMARY##########################################################################


#####START_OUTLET_STRUCTURE_SUMMARY#########################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                            STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY###########################################


#####START_LOCAL_STRUCTURE_SUMMARY##########################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                            STORAGE
                      (Volumes in thousands m3)
```

```
SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY##########################################

#####END_RESULTS_STORM_1

#####START_STORM#2
100 Year ARI 10 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100          10        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#2

#####START_RESULTS_STORM_2



#####START_CATCHMENT_SUMMARY##############################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =        35.55
Excess rainfall        (mm) =        35.43
Calc. runoff depth     (mm) =        35.27  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         3.696 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY################################################


#####START_VOLUME_SUMMARY#################################################################################
SUBAREA DIRECTED IMPORTED      LOCAL       LOCAL    DIRECTED    IMPORTED     OUTFLOW     BALANCE
          TO TOP   TO TOP   PERVIOUS  IMPERVIOUS   TO BOTTOM   TO BOTTOM
        (Volumes in thousands m3)
S01
       0.000       0.000       0.054       0.130       0.000       0.000       0.184       0.000
S02
       0.000       0.000       0.048       0.115       0.000       0.000       0.163       0.000
S03
       0.163       0.000       0.110       0.261       0.000       0.000       0.533       0.001
S04
       0.000       0.000       0.083       0.198       0.000       0.000       0.281       0.000
S05
       0.184       0.000       0.055       0.131       0.000       0.000       0.369       0.000
```

```
S08
       0.000       0.000       0.066       0.158       0.000       0.000       0.224       0.000
S07
       0.875       0.000       0.065       0.155       0.000       0.000       1.095       0.000
S06
       1.628       0.000       0.093       0.222       0.000       0.000       1.943       0.000
S09
       1.943       0.000       0.119       0.284       0.000       0.000       2.346       0.000
S10
       0.000       0.000       0.076       0.182       0.000       0.000       0.258       0.000
S11
       2.604       0.000       0.038       0.091       0.000       0.000       2.732       0.000
Dummy
       2.732       0.000       0.000       0.000       0.000       0.000       2.732       0.000
#####END_VOLUME_SUMMARY########################################################################


#####START_PEAK_SUMMARY#########################################################################
SUBAREA OUT_STR     STREAM    STREAM     LOCAL     LOCAL    DIRECTED  OUTLET_STRUCTURE
        1=exist        TOP    BOTTOM  PERVIOUS IMPERVIOUS  TO BOTTOM  INFLOW   OUTFLOW
                 including                                  including
               imported to                                imported to
                      TOP                                     BOTTOM
                                                                 (Discharges in m3/s)
S01          0       0.000     0.000     0.081     0.206     0.000     0.280     0.280
S02          0       0.000     0.000     0.072     0.185     0.000     0.250     0.250
S03          0       0.250     0.237     0.153     0.399     0.000     0.789     0.789
S04          0       0.000     0.000     0.119     0.305     0.000     0.423     0.423
S05          0       0.280     0.277     0.081     0.208     0.000     0.560     0.560
S08          0       0.000     0.000     0.097     0.248     0.000     0.341     0.341
S07          0       1.324     1.308     0.096     0.244     0.000     1.643     1.643
S06          0       2.431     2.363     0.132     0.340     0.000     2.836     2.836
S09          0       2.836     2.693     0.165     0.434     0.000     3.243     3.243
S10          0       0.000     0.000     0.110     0.282     0.000     0.390     0.390
S11          0       3.633     3.515     0.057     0.148     0.000     3.696     3.696
Dummy        0       3.696     3.696     0.000     0.000     0.000     3.696     3.696
#####END_PEAK_SUMMARY#########################################################################


#####START_TIME_SUMMARY#########################################################################
SUBAREA OUT_STR   STREAM   STREAM    LOCAL    LOCAL   DIRECTED  OUTLET_STRUCTURE
        1=exist      TOP   BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW   OUTFLOW
                (Times in minutes)
S01          0        0.0      0.0     10.0      5.0      0.0     10.0     10.0
S02          0        0.0      0.0     10.0      5.0      0.0     10.0     10.0
S03          0       10.0     10.0     10.0     10.0      0.0     10.0     10.0
S04          0        0.0      0.0     10.0      5.0      0.0     10.0     10.0
S05          0       10.0     10.0     10.0      5.0      0.0     10.0     10.0
S08          0        0.0      0.0     10.0      5.0      0.0     10.0     10.0
S07          0       10.0     10.0     10.0      5.0      0.0     10.0     10.0
S06          0       10.0     10.0     10.0     10.0      0.0     10.0     10.0
S09          0       10.0     11.0     10.0     10.0      0.0     10.0     10.0
S10          0        0.0      0.0     10.0      5.0      0.0     10.0     10.0
S11          0       10.0     11.0     10.0      5.0      0.0     10.0     10.0
Dummy        0       10.0     10.0      0.0      0.0      0.0     10.0     10.0
#####END_TIME_SUMMARY#########################################################################


#####START_OUTLET_STRUCTURE_SUMMARY#############################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY###############################################


#####START_LOCAL_STRUCTURE_SUMMARY##############################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)
```

```
SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY##############################################

#####END_RESULTS_STORM_2

#####START_STORM#3
100 Year ARI 15 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100          15        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#3

#####START_RESULTS_STORM_3




#####START_CATCHMENT_SUMMARY##################################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =        45.67
Excess rainfall        (mm) =        45.48
Calc. runoff depth     (mm) =        45.34  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         4.117 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY####################################################


#####START_VOLUME_SUMMARY#########################################################################
SUBAREA DIRECTED IMPORTED      LOCAL       LOCAL    DIRECTED    IMPORTED     OUTFLOW     BALANCE
          TO TOP   TO TOP   PERVIOUS  IMPERVIOUS   TO BOTTOM   TO BOTTOM
        (Volumes in thousands m3)
S01
       0.000       0.000       0.070       0.166       0.000       0.000       0.236       0.000
S02
       0.000       0.000       0.062       0.148       0.000       0.000       0.210       0.000
S03
       0.210       0.000       0.141       0.335       0.000       0.000       0.685       0.001
S04
       0.000       0.000       0.107       0.254       0.000       0.000       0.361       0.000
```

```
S05
       0.236       0.000       0.070       0.168       0.000       0.000       0.474       0.000
S08
       0.000       0.000       0.085       0.203       0.000       0.000       0.288       0.000
S07
       1.124       0.000       0.084       0.200       0.000       0.000       1.407       0.000
S06
       2.092       0.000       0.120       0.285       0.000       0.000       2.497       0.000
S09
       2.497       0.000       0.153       0.365       0.000       0.000       3.015       0.000
S10
       0.000       0.000       0.098       0.234       0.000       0.000       0.332       0.000
S11
       3.347       0.000       0.049       0.116       0.000       0.000       3.511       0.000
Dummy
       3.511       0.000       0.000       0.000       0.000       0.000       3.511       0.000
#####END_VOLUME_SUMMARY########################################################################


#####START_PEAK_SUMMARY#########################################################################
SUBAREA OUT_STR     STREAM    STREAM     LOCAL     LOCAL    DIRECTED  OUTLET_STRUCTURE
        1=exist        TOP    BOTTOM  PERVIOUS IMPERVIOUS  TO BOTTOM  INFLOW   OUTFLOW
                 including                                  including
               imported to                                imported to
                      TOP                                     BOTTOM
                                                                   (Discharges in m3/s)
S01          0       0.000     0.000     0.098     0.249     0.000     0.347     0.347
S02          0       0.000     0.000     0.088     0.222     0.000     0.310     0.310
S03          0       0.310     0.271     0.180     0.489     0.000     0.934     0.934
S04          0       0.000     0.000     0.142     0.376     0.000     0.518     0.518
S05          0       0.347     0.321     0.099     0.252     0.000     0.672     0.672
S08          0       0.000     0.000     0.117     0.303     0.000     0.419     0.419
S07          0       1.609     1.511     0.115     0.297     0.000     1.923     1.923
S06          0       2.857     2.699     0.157     0.419     0.000     3.186     3.186
S09          0       3.186     3.044     0.194     0.531     0.000     3.590     3.590
S10          0       0.000     0.000     0.132     0.346     0.000     0.478     0.478
S11          0       3.982     3.950     0.071     0.176     0.000     4.117     4.117
Dummy        0       4.117     4.117     0.000     0.000     0.000     4.117     4.117
#####END_PEAK_SUMMARY#########################################################################


#####START_TIME_SUMMARY#########################################################################
SUBAREA OUT_STR   STREAM   STREAM    LOCAL    LOCAL   DIRECTED  OUTLET_STRUCTURE
        1=exist      TOP   BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW   OUTFLOW
                (Times in minutes)
S01          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S02          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S03          0       10.0     11.0     10.0     10.0      0.0     10.0     10.0
S04          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S05          0       10.0     10.0     10.0     10.0      0.0     10.0     10.0
S08          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S07          0       10.0     10.0     10.0     10.0      0.0     10.0     10.0
S06          0       10.0     11.0     10.0     10.0      0.0     11.0     11.0
S09          0       11.0     12.0     10.0     10.0      0.0     12.0     12.0
S10          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S11          0       11.0     12.0     10.0     10.0      0.0     12.0     12.0
Dummy        0       12.0     12.0      0.0      0.0      0.0     12.0     12.0
#####END_TIME_SUMMARY#########################################################################


#####START_OUTLET_STRUCTURE_SUMMARY#############################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY#############################################


#####START_LOCAL_STRUCTURE_SUMMARY#############################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
```

```
                      STORAGE                          STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY##############################################

#####END_RESULTS_STORM_3

#####START_STORM#4
100 Year ARI 20 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100          20        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#4

#####START_RESULTS_STORM_4



#####START_CATCHMENT_SUMMARY##################################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =        54.08
Excess rainfall        (mm) =        53.83
Calc. runoff depth     (mm) =        53.69  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         4.375 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY####################################################


#####START_VOLUME_SUMMARY#########################################################################
SUBAREA DIRECTED IMPORTED      LOCAL       LOCAL    DIRECTED    IMPORTED     OUTFLOW     BALANCE
          TO TOP   TO TOP   PERVIOUS  IMPERVIOUS   TO BOTTOM   TO BOTTOM
        (Volumes in thousands m3)
S01
       0.000       0.000       0.083       0.197       0.000       0.000       0.280       0.000
S02
       0.000       0.000       0.073       0.175       0.000       0.000       0.249       0.000
S03
       0.249       0.000       0.167       0.397       0.000       0.000       0.811       0.001
```

```
S04
       0.000       0.000       0.126       0.301       0.000       0.000       0.428       0.000
S05
       0.280       0.000       0.083       0.199       0.000       0.000       0.562       0.000
S08
       0.000       0.000       0.101       0.241       0.000       0.000       0.342       0.000
S07
       1.331       0.000       0.099       0.237       0.000       0.000       1.666       0.000
S06
       2.478       0.000       0.142       0.338       0.000       0.000       2.957       0.000
S09
       2.957       0.000       0.181       0.432       0.000       0.000       3.570       0.000
S10
       0.000       0.000       0.116       0.277       0.000       0.000       0.393       0.000
S11
       3.963       0.000       0.058       0.138       0.000       0.000       4.158       0.000
Dummy
       4.158       0.000       0.000       0.000       0.000       0.000       4.158       0.000
#####END_VOLUME_SUMMARY#########################################################################


#####START_PEAK_SUMMARY#########################################################
SUBAREA OUT_STR     STREAM    STREAM     LOCAL     LOCAL    DIRECTED  OUTLET_STRUCTURE
        1=exist        TOP    BOTTOM  PERVIOUS IMPERVIOUS  TO BOTTOM  INFLOW   OUTFLOW
                 including                                  including
               imported to                              imported to
                      TOP                                     BOTTOM
                                                                 (Discharges in m3/s)
S01          0       0.000     0.000     0.094     0.246     0.000     0.340     0.340
S02          0       0.000     0.000     0.085     0.220     0.000     0.304     0.304
S03          0       0.304     0.269     0.170     0.478     0.000     0.891     0.891
S04          0       0.000     0.000     0.135     0.368     0.000     0.503     0.503
S05          0       0.340     0.317     0.095     0.248     0.000     0.646     0.646
S08          0       0.000     0.000     0.112     0.298     0.000     0.409     0.409
S07          0       1.558     1.489     0.110     0.293     0.000     1.870     1.870
S06          0       2.755     2.690     0.149     0.411     0.000     3.197     3.197
S09          0       3.197     3.143     0.183     0.518     0.000     3.773     3.773
S10          0       0.000     0.000     0.126     0.340     0.000     0.465     0.465
S11          0       4.180     4.174     0.068     0.174     0.000     4.375     4.375
Dummy        0       4.375     4.375     0.000     0.000     0.000     4.375     4.375
#####END_PEAK_SUMMARY##########################################################################


#####START_TIME_SUMMARY#########################################################
SUBAREA OUT_STR   STREAM   STREAM    LOCAL    LOCAL   DIRECTED  OUTLET_STRUCTURE
        1=exist      TOP   BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW   OUTFLOW
                (Times in minutes)
S01          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S02          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S03          0       10.0     13.0     10.0     10.0      0.0     10.0     10.0
S04          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S05          0       10.0     11.0     10.0     10.0      0.0     10.0     10.0
S08          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S07          0       10.0     11.0     10.0     10.0      0.0     11.0     11.0
S06          0       11.0     13.0     10.0     10.0      0.0     13.0     13.0
S09          0       13.0     15.0     15.0     10.0      0.0     15.0     15.0
S10          0        0.0      0.0     10.0     10.0      0.0     10.0     10.0
S11          0       14.0     15.0     10.0     10.0      0.0     15.0     15.0
Dummy        0       15.0     15.0      0.0      0.0      0.0     15.0     15.0
#####END_TIME_SUMMARY##########################################################################


#####START_OUTLET_STRUCTURE_SUMMARY#############################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                            STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY###############################################
```

```
#####START_LOCAL_STRUCTURE_SUMMARY##########################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                            STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY############################################

#####END_RESULTS_STORM_4

#####START_STORM#5
100 Year ARI 25 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100          25        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#5

#####START_RESULTS_STORM_5



#####START_CATCHMENT_SUMMARY################################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =        61.38
Excess rainfall        (mm) =        61.06
Calc. runoff depth     (mm) =        60.91  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         4.505 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY##################################################


#####START_VOLUME_SUMMARY#####################################################################
SUBAREA DIRECTED IMPORTED      LOCAL       LOCAL    DIRECTED    IMPORTED     OUTFLOW     BALANCE
          TO TOP    TO TOP   PERVIOUS  IMPERVIOUS   TO BOTTOM   TO BOTTOM
        (Volumes in thousands m3)
S01
       0.000       0.000       0.094       0.224       0.000       0.000       0.317       0.000
S02
       0.000       0.000       0.083       0.199       0.000       0.000       0.282       0.000
```

```
S03
       0.282       0.000       0.189       0.450       0.000       0.000       0.920       0.001
S04
       0.000       0.000       0.143       0.342       0.000       0.000       0.485       0.000
S05
       0.317       0.000       0.095       0.226       0.000       0.000       0.638       0.000
S08
       0.000       0.000       0.114       0.273       0.000       0.000       0.388       0.000
S07
       1.510       0.000       0.112       0.268       0.000       0.000       1.891       0.000
S06
       2.811       0.000       0.161       0.384       0.000       0.000       3.355       0.001
S09
       3.355       0.000       0.206       0.491       0.000       0.000       4.051       0.000
S10
       0.000       0.000       0.132       0.314       0.000       0.000       0.445       0.000
S11
       4.496       0.000       0.065       0.156       0.000       0.000       4.718       0.000
Dummy
       4.718       0.000       0.000       0.000       0.000       0.000       4.718       0.000
#####END_VOLUME_SUMMARY#########################################################################


#####START_PEAK_SUMMARY#########################################################################
SUBAREA OUT_STR     STREAM    STREAM     LOCAL     LOCAL    DIRECTED  OUTLET_STRUCTURE
        1=exist        TOP    BOTTOM  PERVIOUS IMPERVIOUS  TO BOTTOM  INFLOW   OUTFLOW
                  including                                 including
                imported to                               imported to
                       TOP                                    BOTTOM
                                                                (Discharges in m3/s)
S01          0       0.000     0.000     0.102     0.252     0.000     0.355     0.355
S02          0       0.000     0.000     0.092     0.225     0.000     0.316     0.316
S03          0       0.316     0.287     0.194     0.498     0.000     0.980     0.980
S04          0       0.000     0.000     0.151     0.382     0.000     0.533     0.533
S05          0       0.355     0.337     0.103     0.255     0.000     0.695     0.695
S08          0       0.000     0.000     0.123     0.307     0.000     0.430     0.430
S07          0       1.657     1.591     0.121     0.301     0.000     2.013     2.013
S06          0       2.993     2.845     0.168     0.427     0.000     3.418     3.418
S09          0       3.418     3.267     0.210     0.542     0.000     3.894     3.894
S10          0       0.000     0.000     0.140     0.351     0.000     0.491     0.491
S11          0       4.385     4.315     0.073     0.178     0.000     4.505     4.505
Dummy        0       4.505     4.505     0.000     0.000     0.000     4.505     4.505
#####END_PEAK_SUMMARY##########################################################################


#####START_TIME_SUMMARY#########################################################################
SUBAREA OUT_STR   STREAM   STREAM    LOCAL    LOCAL   DIRECTED  OUTLET_STRUCTURE
        1=exist      TOP   BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW   OUTFLOW
                (Times in minutes)
S01          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S02          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S03          0       15.0     15.0     15.0     15.0      0.0     15.0     15.0
S04          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S05          0       15.0     15.0     15.0     15.0      0.0     15.0     15.0
S08          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S07          0       15.0     15.0     15.0     15.0      0.0     15.0     15.0
S06          0       15.0     16.0     15.0     15.0      0.0     15.0     15.0
S09          0       15.0     16.0     15.0     15.0      0.0     15.0     15.0
S10          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S11          0       15.0     16.0     15.0     15.0      0.0     16.0     16.0
Dummy        0       16.0     16.0      0.0      0.0      0.0     16.0     16.0
#####END_TIME_SUMMARY##########################################################################


#####START_OUTLET_STRUCTURE_SUMMARY#############################################
SUBAREA              INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                     STORAGE                            STORAGE
                     (Volumes in thousands m3)


SUBAREA               INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                        PEAK       PEAK     VOLUME     STORED  ELEVATION
                      (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY###############################################
```

```
#####START_LOCAL_STRUCTURE_SUMMARY##########################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                            STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY############################################

#####END_RESULTS_STORM_5

#####START_STORM#6
100 Year ARI 30 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100          30        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#6

#####START_RESULTS_STORM_6



#####START_CATCHMENT_SUMMARY################################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =        67.83
Excess rainfall        (mm) =        67.46
Calc. runoff depth     (mm) =        67.32  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         4.368 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY##################################################


#####START_VOLUME_SUMMARY#####################################################################
SUBAREA DIRECTED IMPORTED      LOCAL       LOCAL    DIRECTED    IMPORTED     OUTFLOW     BALANCE
          TO TOP   TO TOP   PERVIOUS  IMPERVIOUS   TO BOTTOM   TO BOTTOM
        (Volumes in thousands m3)
S01
       0.000       0.000       0.103       0.247       0.000       0.000       0.351       0.000
```

```
S02
       0.000       0.000       0.092       0.220       0.000       0.000       0.312       0.000
S03
       0.312       0.000       0.208       0.497       0.000       0.000       1.017       0.001
S04
       0.000       0.000       0.158       0.378       0.000       0.000       0.536       0.000
S05
       0.351       0.000       0.104       0.250       0.000       0.000       0.704       0.000
S08
       0.000       0.000       0.126       0.302       0.000       0.000       0.428       0.000
S07
       1.669       0.000       0.124       0.297       0.000       0.000       2.089       0.000
S06
       3.106       0.000       0.178       0.424       0.000       0.000       3.707       0.000
S09
       3.707       0.000       0.227       0.542       0.000       0.000       4.476       0.000
S10
       0.000       0.000       0.145       0.347       0.000       0.000       0.492       0.000
S11
       4.969       0.000       0.072       0.173       0.000       0.000       5.214       0.000
Dummy
       5.214       0.000       0.000       0.000       0.000       0.000       5.214       0.000
#####END_VOLUME_SUMMARY#########################################################################


#####START_PEAK_SUMMARY#########################################################################
SUBAREA OUT_STR     STREAM    STREAM     LOCAL     LOCAL    DIRECTED  OUTLET_STRUCTURE
        1=exist        TOP    BOTTOM  PERVIOUS IMPERVIOUS  TO BOTTOM  INFLOW   OUTFLOW
                 including                                 including
               imported to                               imported to
                      TOP                                    BOTTOM
                                                                (Discharges in m3/s)
S01          0       0.000     0.000     0.098     0.241     0.000     0.338     0.338
S02          0       0.000     0.000     0.087     0.214     0.000     0.302     0.302
S03          0       0.302     0.277     0.187     0.476     0.000     0.940     0.940
S04          0       0.000     0.000     0.145     0.364     0.000     0.509     0.509
S05          0       0.338     0.324     0.099     0.243     0.000     0.665     0.665
S08          0       0.000     0.000     0.118     0.292     0.000     0.410     0.410
S07          0       1.585     1.530     0.116     0.288     0.000     1.934     1.934
S06          0       2.874     2.742     0.161     0.408     0.000     3.302     3.302
S09          0       3.302     3.168     0.202     0.518     0.000     3.786     3.786
S10          0       0.000     0.000     0.134     0.335     0.000     0.469     0.469
S11          0       4.256     4.185     0.070     0.169     0.000     4.368     4.368
Dummy        0       4.368     4.368     0.000     0.000     0.000     4.368     4.368
#####END_PEAK_SUMMARY##########################################################################


#####START_TIME_SUMMARY#########################################################################
SUBAREA OUT_STR   STREAM   STREAM    LOCAL    LOCAL   DIRECTED  OUTLET_STRUCTURE
        1=exist      TOP   BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW   OUTFLOW
                (Times in minutes)
S01          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S02          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S03          0       15.0     15.0     15.0     15.0      0.0     15.0     15.0
S04          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S05          0       15.0     15.0     15.0     15.0      0.0     15.0     15.0
S08          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S07          0       15.0     15.0     15.0     15.0      0.0     15.0     15.0
S06          0       15.0     16.0     15.0     15.0      0.0     15.0     15.0
S09          0       15.0     16.0     15.0     15.0      0.0     15.0     15.0
S10          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S11          0       15.0     16.0     15.0     15.0      0.0     16.0     16.0
Dummy        0       16.0     16.0      0.0      0.0      0.0     16.0     16.0
#####END_TIME_SUMMARY##########################################################################


#####START_OUTLET_STRUCTURE_SUMMARY#############################################
SUBAREA              INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                     STORAGE                            STORAGE
                     (Volumes in thousands m3)


SUBAREA               INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                        PEAK       PEAK     VOLUME     STORED  ELEVATION
                      (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)
```

```
#####END_OUTLET_STRUCTURE_SUMMARY##########################################


#####START_LOCAL_STRUCTURE_SUMMARY#########################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                            STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY###########################################

#####END_RESULTS_STORM_6

#####START_STORM#7
100 Year ARI 45 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100          45        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#7

#####START_RESULTS_STORM_7




#####START_CATCHMENT_SUMMARY##############################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =        84.11
Excess rainfall        (mm) =        83.54
Calc. runoff depth     (mm) =        83.44  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         4.082 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY################################################


#####START_VOLUME_SUMMARY#################################################################################
SUBAREA DIRECTED IMPORTED      LOCAL       LOCAL    DIRECTED    IMPORTED     OUTFLOW     BALANCE
          TO TOP    TO TOP   PERVIOUS  IMPERVIOUS   TO BOTTOM   TO BOTTOM
        (Volumes in thousands m3)
```

```
S01
       0.000       0.000       0.128       0.307       0.000       0.000       0.435       0.000
S02
       0.000       0.000       0.114       0.273       0.000       0.000       0.386       0.000
S03
       0.386       0.000       0.258       0.617       0.000       0.000       1.260       0.000
S04
       0.000       0.000       0.196       0.469       0.000       0.000       0.664       0.000
S05
       0.435       0.000       0.129       0.310       0.000       0.000       0.873       0.000
S08
       0.000       0.000       0.156       0.374       0.000       0.000       0.531       0.000
S07
       2.068       0.000       0.154       0.368       0.000       0.000       2.589       0.000
S06
       3.849       0.000       0.220       0.526       0.000       0.000       4.595       0.000
S09
       4.595       0.000       0.281       0.672       0.000       0.000       5.549       0.000
S10
       0.000       0.000       0.180       0.430       0.000       0.000       0.610       0.000
S11
       6.159       0.000       0.089       0.214       0.000       0.000       6.462       0.000
Dummy
       6.462       0.000       0.000       0.000       0.000       0.000       6.462       0.000
#####END_VOLUME_SUMMARY#########################################################################


#####START_PEAK_SUMMARY#########################################################################
SUBAREA OUT_STR     STREAM    STREAM     LOCAL     LOCAL    DIRECTED  OUTLET_STRUCTURE
        1=exist        TOP    BOTTOM  PERVIOUS IMPERVIOUS  TO BOTTOM  INFLOW   OUTFLOW
                 including                                  including
               imported to                                imported to
                      TOP                                     BOTTOM
                                                                (Discharges in m3/s)
S01          0       0.000     0.000     0.088     0.226     0.000     0.314     0.314
S02          0       0.000     0.000     0.079     0.201     0.000     0.281     0.281
S03          0       0.281     0.252     0.163     0.442     0.000     0.842     0.842
S04          0       0.000     0.000     0.128     0.340     0.000     0.468     0.468
S05          0       0.314     0.296     0.089     0.228     0.000     0.604     0.604
S08          0       0.000     0.000     0.105     0.274     0.000     0.379     0.379
S07          0       1.451     1.395     0.104     0.269     0.000     1.748     1.748
S06          0       2.577     2.516     0.142     0.379     0.000     2.997     2.997
S09          0       2.997     2.940     0.175     0.480     0.000     3.528     3.528
S10          0       0.000     0.000     0.119     0.313     0.000     0.432     0.432
S11          0       3.906     3.895     0.064     0.160     0.000     4.082     4.082
Dummy        0       4.082     4.082     0.000     0.000     0.000     4.082     4.082
#####END_PEAK_SUMMARY##########################################################################


#####START_TIME_SUMMARY#########################################################################
SUBAREA OUT_STR   STREAM   STREAM    LOCAL    LOCAL   DIRECTED  OUTLET_STRUCTURE
        1=exist      TOP   BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW   OUTFLOW
                (Times in minutes)
S01          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S02          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S03          0       15.0     17.0     15.0     15.0      0.0     15.0     15.0
S04          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S05          0       15.0     16.0     15.0     15.0      0.0     15.0     15.0
S08          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S07          0       15.0     16.0     15.0     15.0      0.0     16.0     16.0
S06          0       16.0     17.0     15.0     15.0      0.0     17.0     17.0
S09          0       17.0     19.0     15.0     15.0      0.0     19.0     19.0
S10          0        0.0      0.0     15.0     15.0      0.0     15.0     15.0
S11          0       19.0     19.0     15.0     15.0      0.0     19.0     19.0
Dummy        0       19.0     19.0      0.0      0.0      0.0     19.0     19.0
#####END_TIME_SUMMARY#########################################################################


#####START_OUTLET_STRUCTURE_SUMMARY#############################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                            STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
```

```
                        PEAK       PEAK     VOLUME     STORED  ELEVATION
                      (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY##########################################


#####START_LOCAL_STRUCTURE_SUMMARY#########################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                      (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY###########################################

#####END_RESULTS_STORM_7

#####START_STORM#8
100 Year ARI 60 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100          60        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#8

#####START_RESULTS_STORM_8



#####START_CATCHMENT_SUMMARY##############################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =        97.43
Excess rainfall        (mm) =        96.68
Calc. runoff depth     (mm) =        96.58  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         4.280 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY################################################


#####START_VOLUME_SUMMARY#################################################################################
SUBAREA DIRECTED IMPORTED      LOCAL       LOCAL    DIRECTED    IMPORTED     OUTFLOW     BALANCE
          TO TOP   TO TOP   PERVIOUS  IMPERVIOUS   TO BOTTOM   TO BOTTOM
```

(Volumes in thousands m3)

S01								
	0.000	0.000	0.148	0.355	0.000	0.000	0.503	0.000
S02								
	0.000	0.000	0.131	0.316	0.000	0.000	0.447	0.000
S03								
	0.447	0.000	0.298	0.715	0.000	0.000	1.459	0.000
S04								
	0.000	0.000	0.226	0.543	0.000	0.000	0.769	0.000
S05								
	0.503	0.000	0.149	0.359	0.000	0.000	1.011	0.000
S08								
	0.000	0.000	0.180	0.434	0.000	0.000	0.614	0.000
S07								
	2.393	0.000	0.177	0.426	0.000	0.000	2.997	0.000
S06								
	4.456	0.000	0.254	0.609	0.000	0.000	5.319	0.000
S09								
	5.319	0.000	0.324	0.779	0.000	0.000	6.422	-0.001
S10								
	0.000	0.000	0.207	0.498	0.000	0.000	0.706	0.000
S11								
	7.128	0.000	0.103	0.248	0.000	0.000	7.480	0.000
Dummy								
	7.480	0.000	0.000	0.000	0.000	0.000	7.480	0.000

#####END_VOLUME_SUMMARY#####

#####START_PEAK_SUMMARY#####

SUBAREA	OUT_STR 1=exist	STREAM TOP including imported to TOP	STREAM BOTTOM	LOCAL PERVIOUS	LOCAL IMPERVIOUS	DIRECTED TO BOTTOM including imported to BOTTOM	OUTLET_STRUCTURE INFLOW	OUTFLOW
							(Discharges in m3/s)	
S01	0	0.000	0.000	0.098	0.244	0.000	0.342	0.342
S02	0	0.000	0.000	0.088	0.217	0.000	0.305	0.305
S03	0	0.305	0.273	0.188	0.479	0.000	0.937	0.937
S04	0	0.000	0.000	0.146	0.367	0.000	0.513	0.513
S05	0	0.342	0.318	0.099	0.246	0.000	0.663	0.663
S08	0	0.000	0.000	0.119	0.296	0.000	0.414	0.414
S07	0	1.590	1.500	0.117	0.291	0.000	1.907	1.907
S06	0	2.844	2.710	0.163	0.411	0.000	3.206	3.206
S09	0	3.206	3.101	0.204	0.520	0.000	3.697	3.697
S10	0	0.000	0.000	0.135	0.338	0.000	0.473	0.473
S11	0	4.111	4.082	0.070	0.172	0.000	4.280	4.280
Dummy	0	4.280	4.280	0.000	0.000	0.000	4.280	4.280

#####END_PEAK_SUMMARY#####

#####START_TIME_SUMMARY#####

SUBAREA	OUT_STR 1=exist	STREAM TOP	STREAM BOTTOM	LOCAL PERVIOUS	LOCAL IMPERVIOUS	DIRECTED TO BOTTOM	OUTLET_STRUCTURE INFLOW	OUTFLOW
		(Times in minutes)						
S01	0	0.0	0.0	25.0	25.0	0.0	25.0	25.0
S02	0	0.0	0.0	25.0	25.0	0.0	25.0	25.0
S03	0	25.0	26.0	25.0	25.0	0.0	25.0	25.0
S04	0	0.0	0.0	25.0	25.0	0.0	25.0	25.0
S05	0	25.0	25.0	25.0	25.0	0.0	25.0	25.0
S08	0	0.0	0.0	25.0	25.0	0.0	25.0	25.0
S07	0	25.0	25.0	25.0	25.0	0.0	25.0	25.0
S06	0	25.0	26.0	25.0	25.0	0.0	25.0	25.0
S09	0	25.0	27.0	25.0	25.0	0.0	26.0	26.0
S10	0	0.0	0.0	25.0	25.0	0.0	25.0	25.0
S11	0	25.0	26.0	25.0	25.0	0.0	26.0	26.0
Dummy	0	26.0	26.0	0.0	0.0	0.0	26.0	26.0

#####END_TIME_SUMMARY#####

#####START_OUTLET_STRUCTURE_SUMMARY#####

SUBAREA	INITIAL STORAGE	INFLOW	OUTFLOW	FINAL STORAGE	BALANCE
	(Volumes in thousands m3)				

```
SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY##########################################


#####START_LOCAL_STRUCTURE_SUMMARY##########################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY############################################

#####END_RESULTS_STORM_8

#####START_STORM#9
100 Year ARI 90 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100          90        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                0.00        2.50        0.00
S02                0.00        2.50        0.00
S03                0.00        2.50        0.00
S04                0.00        2.50        0.00
S05                0.00        2.50        0.00
S08                0.00        2.50        0.00
S07                0.00        2.50        0.00
S06                0.00        2.50        0.00
S09                0.00        2.50        0.00
S10                0.00        2.50        0.00
S11                0.00        2.50        0.00
Dummy              0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#9

#####START_RESULTS_STORM_9




#####START_CATCHMENT_SUMMARY###############################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =       116.65
Excess rainfall        (mm) =       115.52
Calc. runoff depth     (mm) =       115.42  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         4.398 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY#################################################


#####START_VOLUME_SUMMARY#####################################################################
```

SUBAREA	DIRECTED TO TOP	IMPORTED TO TOP	LOCAL PERVIOUS	LOCAL IMPERVIOUS	DIRECTED TO BOTTOM	IMPORTED TO BOTTOM	OUTFLOW	BALANCE
	(Volumes in thousands m3)							
S01	0.000	0.000	0.176	0.425	0.000	0.000	0.601	0.000
S02	0.000	0.000	0.156	0.378	0.000	0.000	0.534	0.000
S03	0.534	0.000	0.354	0.856	0.000	0.000	1.743	0.000
S04	0.000	0.000	0.269	0.650	0.000	0.000	0.919	0.000
S05	0.601	0.000	0.178	0.429	0.000	0.000	1.208	0.000
S08	0.000	0.000	0.215	0.519	0.000	0.000	0.734	0.000
S07	2.861	0.000	0.211	0.510	0.000	0.000	3.582	0.000
S06	5.325	0.000	0.302	0.729	0.000	0.000	6.356	0.000
S09	6.356	0.000	0.386	0.932	0.000	0.000	7.675	0.000
S10	0.000	0.000	0.247	0.597	0.000	0.000	0.844	0.000
S11	8.518	0.000	0.123	0.297	0.000	0.000	8.939	-0.001
Dummy	8.939	0.000	0.000	0.000	0.000	0.000	8.939	0.000

#####END_VOLUME_SUMMARY#####

#####START_PEAK_SUMMARY#####

SUBAREA	OUT_STR 1=exist	STREAM TOP including imported to TOP	STREAM BOTTOM	LOCAL PERVIOUS	LOCAL IMPERVIOUS	DIRECTED TO BOTTOM including imported to BOTTOM	OUTLET_STRUCTURE INFLOW	OUTLET_STRUCTURE OUTFLOW
							(Discharges in m3/s)	
S01	0	0.000	0.000	0.105	0.261	0.000	0.365	0.365
S02	0	0.000	0.000	0.094	0.232	0.000	0.326	0.326
S03	0	0.326	0.284	0.199	0.510	0.000	0.992	0.992
S04	0	0.000	0.000	0.155	0.392	0.000	0.547	0.547
S05	0	0.365	0.336	0.106	0.263	0.000	0.704	0.704
S08	0	0.000	0.000	0.126	0.316	0.000	0.442	0.442
S07	0	1.693	1.584	0.124	0.311	0.000	2.018	2.018
S06	0	3.010	2.828	0.172	0.438	0.000	3.360	3.360
S09	0	3.360	3.189	0.216	0.554	0.000	3.801	3.801
S10	0	0.000	0.000	0.143	0.361	0.000	0.504	0.504
S11	0	4.259	4.203	0.075	0.184	0.000	4.398	4.398
Dummy	0	4.398	4.398	0.000	0.000	0.000	4.398	4.398

#####END_PEAK_SUMMARY#####

#####START_TIME_SUMMARY#####

SUBAREA	OUT_STR 1=exist	STREAM TOP	STREAM BOTTOM	LOCAL PERVIOUS	LOCAL IMPERVIOUS	DIRECTED TO BOTTOM	OUTLET_STRUCTURE INFLOW	OUTLET_STRUCTURE OUTFLOW
		(Times in minutes)						
S01	0	0.0	0.0	30.0	30.0	0.0	30.0	30.0
S02	0	0.0	0.0	30.0	30.0	0.0	30.0	30.0
S03	0	30.0	31.0	30.0	30.0	0.0	30.0	30.0
S04	0	0.0	0.0	30.0	30.0	0.0	30.0	30.0
S05	0	30.0	30.0	30.0	30.0	0.0	30.0	30.0
S08	0	0.0	0.0	30.0	30.0	0.0	30.0	30.0
S07	0	30.0	30.0	30.0	30.0	0.0	30.0	30.0
S06	0	30.0	31.0	30.0	30.0	0.0	30.0	30.0
S09	0	30.0	32.0	30.0	30.0	0.0	31.0	31.0
S10	0	0.0	0.0	30.0	30.0	0.0	30.0	30.0
S11	0	30.0	31.0	30.0	30.0	0.0	31.0	31.0
Dummy	0	31.0	31.0	0.0	0.0	0.0	31.0	31.0

#####END_TIME_SUMMARY#####

#####START_OUTLET_STRUCTURE_SUMMARY#####

SUBAREA	INITIAL STORAGE	INFLOW	OUTFLOW	FINAL STORAGE	BALANCE
	(Volumes in thousands m3)				

```
SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY##############################################


#####START_LOCAL_STRUCTURE_SUMMARY#############################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY###############################################

#####END_RESULTS_STORM_9

#####START_STORM#10
100 Year ARI 120 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100         120        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#10

#####START_RESULTS_STORM_10


#####START_CATCHMENT_SUMMARY##################################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =       132.13
Excess rainfall        (mm) =       130.63
Calc. runoff depth     (mm) =       130.50  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         4.373 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY####################################################


#####START_VOLUME_SUMMARY#####################################################################
```

SUBAREA	DIRECTED TO TOP	IMPORTED TO TOP	LOCAL PERVIOUS	LOCAL IMPERVIOUS	DIRECTED TO BOTTOM	IMPORTED TO BOTTOM	OUTFLOW	BALANCE
	(Volumes in thousands m3)							
S01	0.000	0.000	0.198	0.482	0.000	0.000	0.680	0.000
S02	0.000	0.000	0.176	0.428	0.000	0.000	0.604	0.000
S03	0.604	0.000	0.399	0.969	0.000	0.000	1.972	0.001
S04	0.000	0.000	0.303	0.736	0.000	0.000	1.039	0.000
S05	0.680	0.000	0.200	0.486	0.000	0.000	1.366	0.000
S08	0.000	0.000	0.242	0.588	0.000	0.000	0.830	0.000
S07	3.235	0.000	0.238	0.578	0.000	0.000	4.051	0.000
S06	6.022	0.000	0.340	0.826	0.000	0.000	7.188	0.000
S09	7.188	0.000	0.435	1.056	0.000	0.000	8.678	0.000
S10	0.000	0.000	0.278	0.676	0.000	0.000	0.954	0.000
S11	9.632	0.000	0.138	0.337	0.000	0.000	10.107	0.000
Dummy	10.107	0.000	0.000	0.000	0.000	0.000	10.107	0.000

#####END_VOLUME_SUMMARY#####

#####START_PEAK_SUMMARY#####

SUBAREA	OUT_STR 1=exist	STREAM TOP including imported to TOP	STREAM BOTTOM	LOCAL PERVIOUS	LOCAL IMPERVIOUS	DIRECTED TO BOTTOM including imported to BOTTOM	OUTLET_STRUCTURE INFLOW	OUTLET_STRUCTURE OUTFLOW
							(Discharges in m3/s)	
S01	0	0.000	0.000	0.097	0.248	0.000	0.344	0.344
S02	0	0.000	0.000	0.087	0.221	0.000	0.308	0.308
S03	0	0.308	0.271	0.182	0.481	0.000	0.914	0.914
S04	0	0.000	0.000	0.142	0.371	0.000	0.513	0.513
S05	0	0.344	0.319	0.098	0.250	0.000	0.653	0.653
S08	0	0.000	0.000	0.116	0.299	0.000	0.415	0.415
S07	0	1.581	1.505	0.114	0.294	0.000	1.887	1.887
S06	0	2.784	2.704	0.158	0.413	0.000	3.222	3.222
S09	0	3.222	3.155	0.196	0.522	0.000	3.784	3.784
S10	0	0.000	0.000	0.132	0.342	0.000	0.473	0.473
S11	0	4.186	4.174	0.070	0.176	0.000	4.373	4.373
Dummy	0	4.373	4.373	0.000	0.000	0.000	4.373	4.373

#####END_PEAK_SUMMARY#####

#####START_TIME_SUMMARY#####

SUBAREA	OUT_STR 1=exist	STREAM TOP	STREAM BOTTOM	LOCAL PERVIOUS	LOCAL IMPERVIOUS	DIRECTED TO BOTTOM	OUTLET_STRUCTURE INFLOW	OUTLET_STRUCTURE OUTFLOW
		(Times in minutes)						
S01	0	0.0	0.0	35.0	35.0	0.0	35.0	35.0
S02	0	0.0	0.0	35.0	35.0	0.0	35.0	35.0
S03	0	35.0	37.0	35.0	35.0	0.0	35.0	35.0
S04	0	0.0	0.0	35.0	35.0	0.0	35.0	35.0
S05	0	35.0	36.0	35.0	35.0	0.0	35.0	35.0
S08	0	0.0	0.0	35.0	35.0	0.0	35.0	35.0
S07	0	35.0	36.0	35.0	35.0	0.0	36.0	36.0
S06	0	36.0	37.0	35.0	35.0	0.0	37.0	37.0
S09	0	37.0	39.0	35.0	35.0	0.0	39.0	39.0
S10	0	0.0	0.0	35.0	35.0	0.0	35.0	35.0
S11	0	39.0	39.0	35.0	35.0	0.0	39.0	39.0
Dummy	0	39.0	39.0	0.0	0.0	0.0	39.0	39.0

#####END_TIME_SUMMARY#####

#####START_OUTLET_STRUCTURE_SUMMARY#####

SUBAREA	INITIAL STORAGE	INFLOW	OUTFLOW	FINAL STORAGE	BALANCE
	(Volumes in thousands m3)				

```
SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY##############################################


#####START_LOCAL_STRUCTURE_SUMMARY#############################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)


SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY###############################################

#####END_RESULTS_STORM_10

#####START_STORM#11
100 Year ARI 180 Mins Duration DESIGN STORM
        1.00
        1.00
#####START_DESIGN_RAIN
         100         180        1.00
IFD_COEFFS_IN_THIS_FILE
           1
WARRAWONG              1         xxx  6182978.00  6182978.00       50.00       45.49        9.18
2.77       87.85       20.83        7.40        4.28       15.81        0.00     1400.00
0        0.67 Design 34.475S 150.875E
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
S01                 0.00        2.50        0.00
S02                 0.00        2.50        0.00
S03                 0.00        2.50        0.00
S04                 0.00        2.50        0.00
S05                 0.00        2.50        0.00
S08                 0.00        2.50        0.00
S07                 0.00        2.50        0.00
S06                 0.00        2.50        0.00
S09                 0.00        2.50        0.00
S10                 0.00        2.50        0.00
S11                 0.00        2.50        0.00
Dummy               0.00        2.50        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
           0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
           0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#11

#####START_RESULTS_STORM_11




#####START_CATCHMENT_SUMMARY##################################################
Catchment area   (hectares) =         7.74
Impervious percent      (%) =        70.00
Rainfall depth         (mm) =       157.07
Excess rainfall        (mm) =       154.82
Calc. runoff depth     (mm) =       154.46  - from bottom subarea
Recd. runoff depth     (mm) =         0.00  - from bottom subarea
Calc. peak discharge (m3/s) =         3.109 - from bottom subarea
Recd. peak discharge (m3/s) =         0.000 - from bottom subarea
#####END_CATCHMENT_SUMMARY####################################################
```

#####START_VOLUME_SUMMARY###
SUBAREA DIRECTED IMPORTED LOCAL LOCAL DIRECTED IMPORTED OUTFLOW BALANCE
TO TOP TO TOP PERVIOUS IMPERVIOUS TO BOTTOM TO BOTTOM
(Volumes in thousands m3)

S01								
	0.000	0.000	0.233	0.573	0.000	0.000	0.806	0.000
S02								
	0.000	0.000	0.207	0.509	0.000	0.000	0.716	0.000
S03								
	0.716	0.000	0.469	1.152	0.000	0.000	2.337	0.001
S04								
	0.000	0.000	0.356	0.875	0.000	0.000	1.231	0.000
S05								
	0.806	0.000	0.235	0.578	0.000	0.000	1.619	0.000
S08								
	0.000	0.000	0.285	0.699	0.000	0.000	0.984	0.000
S07								
	3.834	0.000	0.280	0.687	0.000	0.000	4.800	0.001
S06								
	7.137	0.000	0.400	0.982	0.000	0.000	8.515	0.004
S09								
	8.515	0.000	0.511	1.256	0.000	0.000	10.274	0.008
S10								
	0.000	0.000	0.327	0.804	0.000	0.000	1.131	0.000
S11								
	11.405	0.000	0.163	0.400	0.000	0.000	11.963	0.005
Dummy								
	11.963	0.000	0.000	0.000	0.000	0.000	11.963	0.000

#####END_VOLUME_SUMMARY###

#####START_PEAK_SUMMARY###
SUBAREA OUT_STR STREAM STREAM LOCAL LOCAL DIRECTED OUTLET_STRUCTURE
1=exist TOP BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW OUTFLOW
including including
imported to imported to
TOP BOTTOM
(Discharges in m3/s)

S01	0	0.000	0.000	0.062	0.149	0.000	0.211	0.211
S02	0	0.000	0.000	0.056	0.132	0.000	0.188	0.188
S03	0	0.188	0.187	0.125	0.299	0.000	0.611	0.611
S04	0	0.000	0.000	0.095	0.227	0.000	0.322	0.322
S05	0	0.211	0.211	0.063	0.150	0.000	0.424	0.424
S08	0	0.000	0.000	0.076	0.182	0.000	0.258	0.258
S07	0	1.004	1.003	0.075	0.179	0.000	1.256	1.256
S06	0	1.867	1.861	0.106	0.255	0.000	2.223	2.223
S09	0	2.223	2.211	0.136	0.326	0.000	2.673	2.673
S10	0	0.000	0.000	0.087	0.209	0.000	0.296	0.296
S11	0	2.969	2.961	0.044	0.104	0.000	3.109	3.109
Dummy	0	3.109	3.109	0.000	0.000	0.000	3.109	3.109

#####END_PEAK_SUMMARY###

#####START_TIME_SUMMARY###
SUBAREA OUT_STR STREAM STREAM LOCAL LOCAL DIRECTED OUTLET_STRUCTURE
1=exist TOP BOTTOM PERVIOUS IMPERVIOUS TO BOTTOM INFLOW OUTFLOW
(Times in minutes)

S01	0	0.0	0.0	45.0	45.0	0.0	45.0	45.0
S02	0	0.0	0.0	45.0	45.0	0.0	45.0	45.0
S03	0	45.0	45.0	45.0	45.0	0.0	45.0	45.0
S04	0	0.0	0.0	45.0	45.0	0.0	45.0	45.0
S05	0	45.0	45.0	45.0	45.0	0.0	45.0	45.0
S08	0	0.0	0.0	45.0	45.0	0.0	45.0	45.0
S07	0	45.0	45.0	45.0	45.0	0.0	45.0	45.0
S06	0	45.0	45.0	45.0	45.0	0.0	45.0	45.0
S09	0	45.0	45.0	45.0	45.0	0.0	45.0	45.0
S10	0	0.0	0.0	45.0	45.0	0.0	45.0	45.0
S11	0	45.0	45.0	45.0	45.0	0.0	45.0	45.0
Dummy	0	45.0	45.0	0.0	0.0	0.0	45.0	45.0

#####END_TIME_SUMMARY###

#####START_OUTLET_STRUCTURE_SUMMARY###
SUBAREA INITIAL INFLOW OUTFLOW FINAL BALANCE

```
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)

SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_OUTLET_STRUCTURE_SUMMARY##########################################


#####START_LOCAL_STRUCTURE_SUMMARY#########################################
SUBAREA               INITIAL     INFLOW    OUTFLOW      FINAL    BALANCE
                      STORAGE                           STORAGE
                      (Volumes in thousands m3)

SUBAREA                INFLOW    OUTFLOW     INFLOW    MAX.VOL  MAX.WATER
                         PEAK       PEAK     VOLUME     STORED  ELEVATION
                       (m3/s)     (m3/s)    (m3 E3)    (m3 E3)   (metres)

#####END_LOCAL_STRUCTURE_SUMMARY###########################################

#####END_RESULTS_STORM_11

#####END_QA_SUMMARY_FILE###################################################
```

APPENDIX B: TUFLOW Results

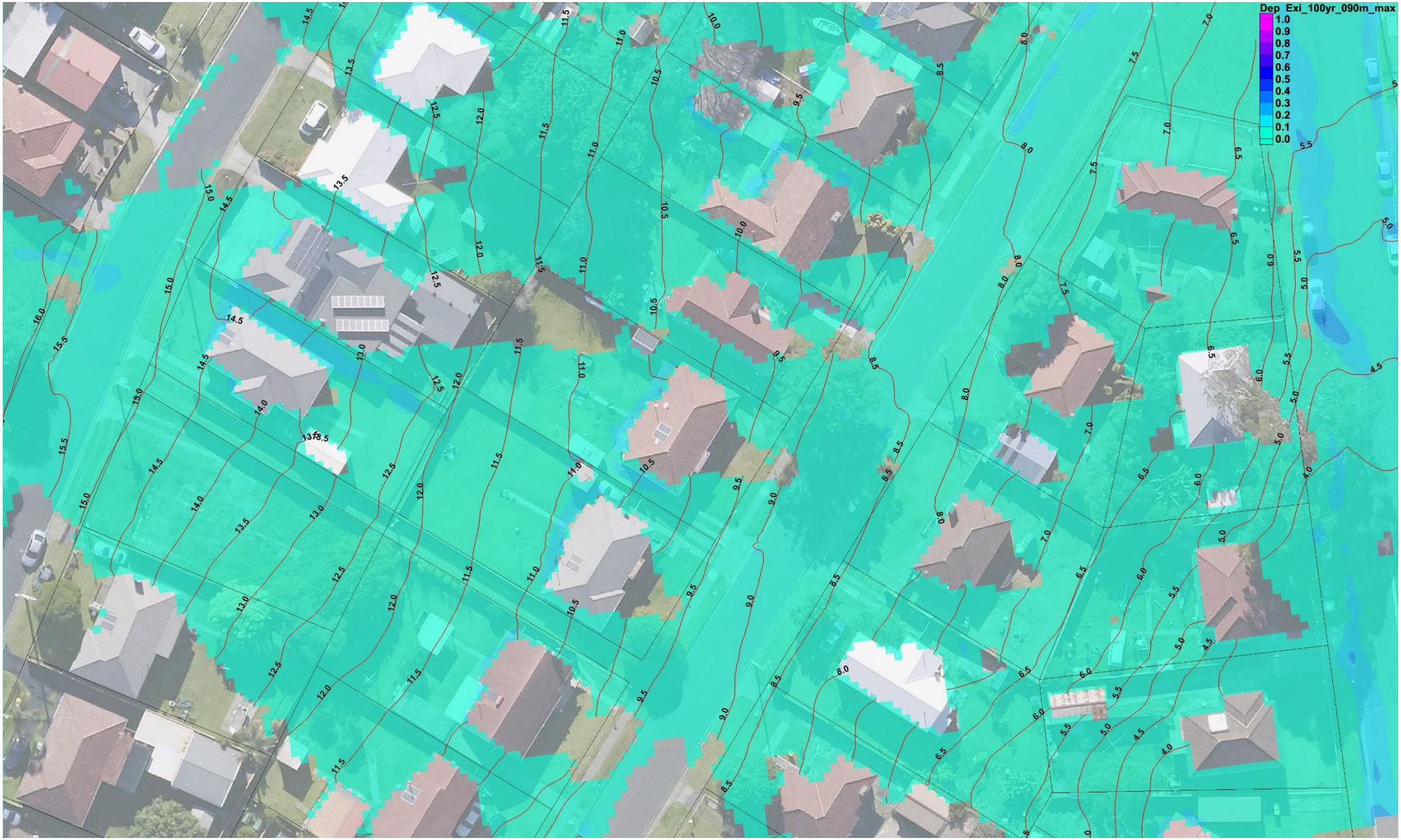

Figure A01: Existing 100yr 90min Depths [m] & Levels [mAHD]

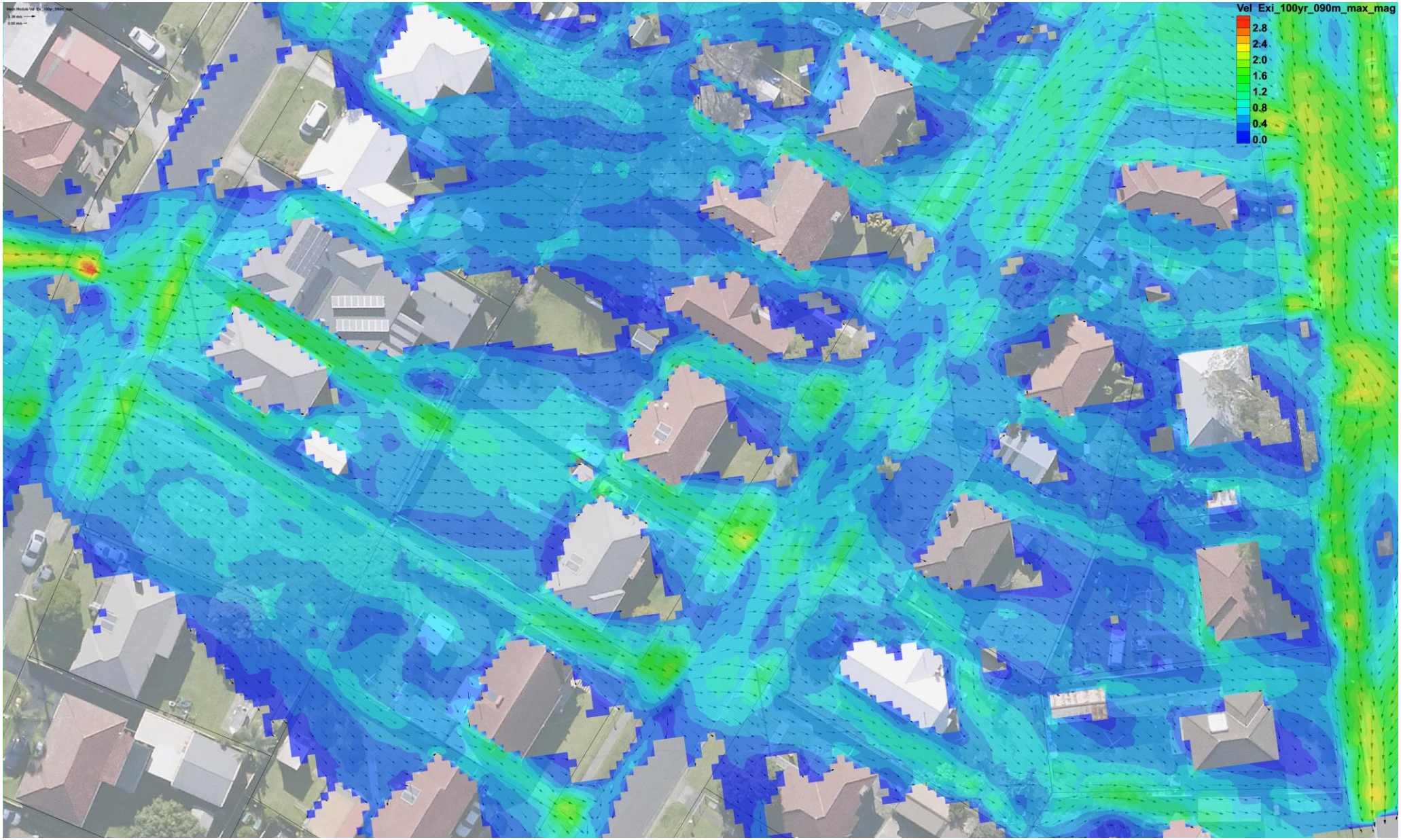

Figure A02: Existing 100yr 90min Velocities [m/s]

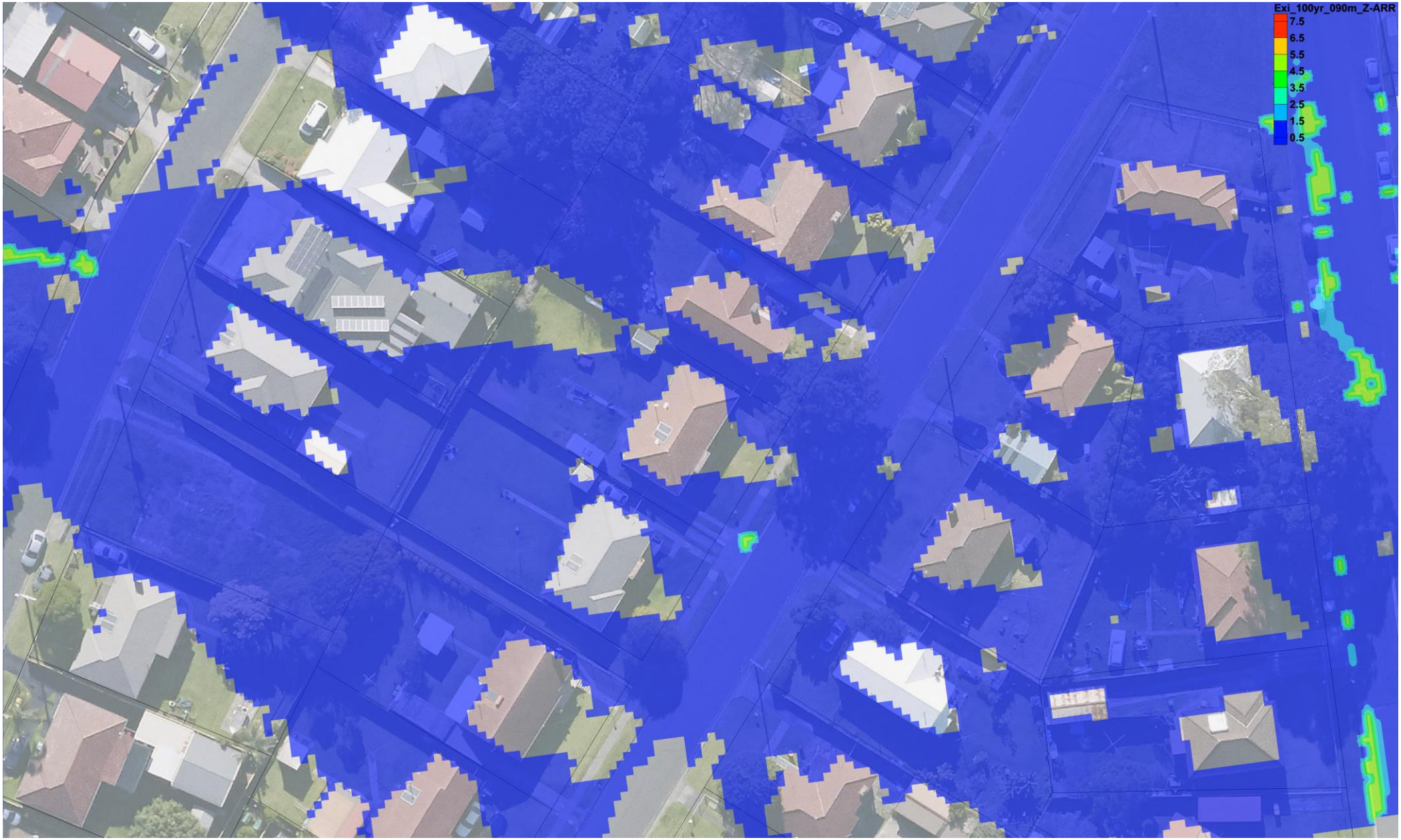

Figure A03: Existing 100yr 90min ARR2019 Hazard

H1-H6 blue-red gradient

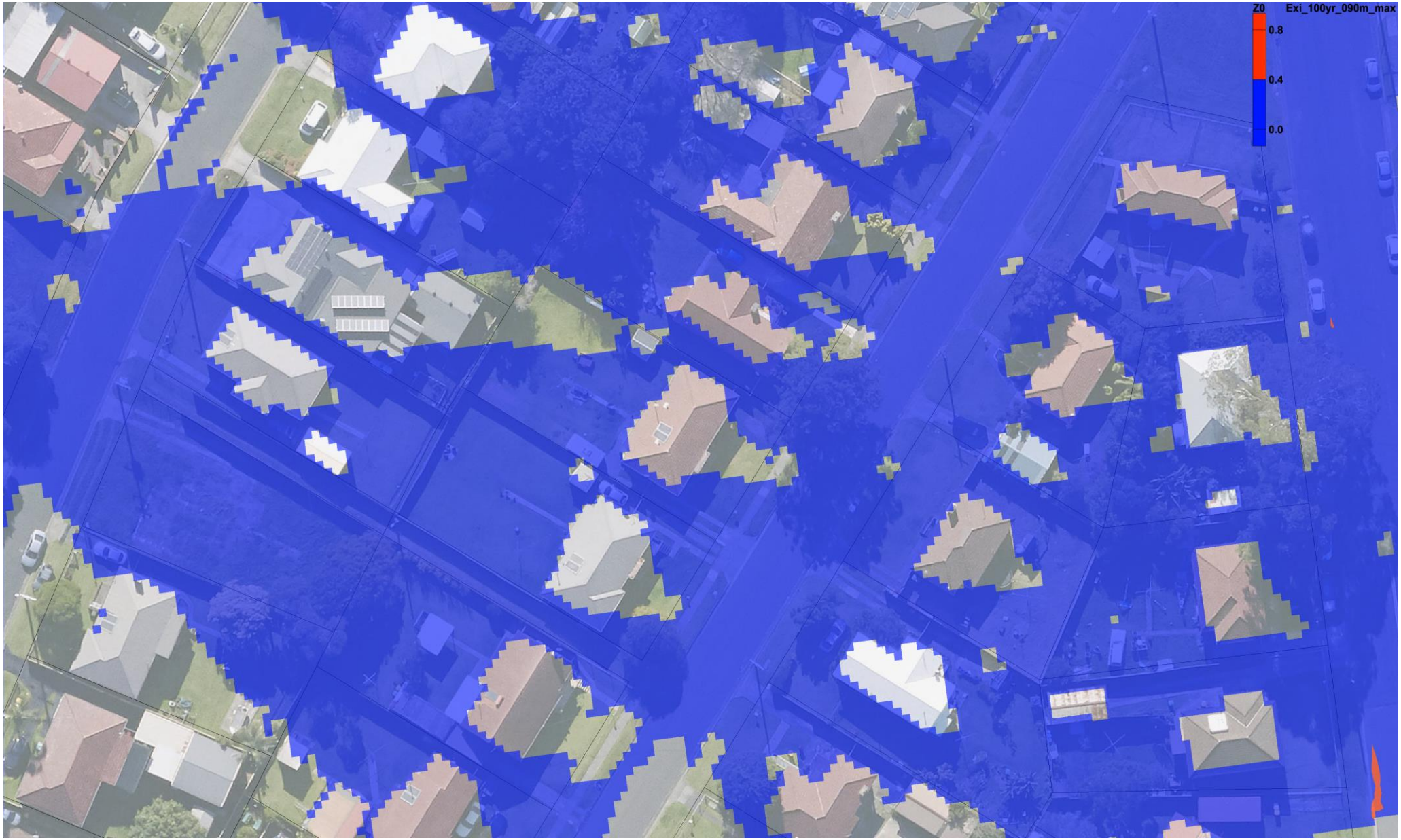

Figure A04: Existing 100yr 90min V*D > 0.4

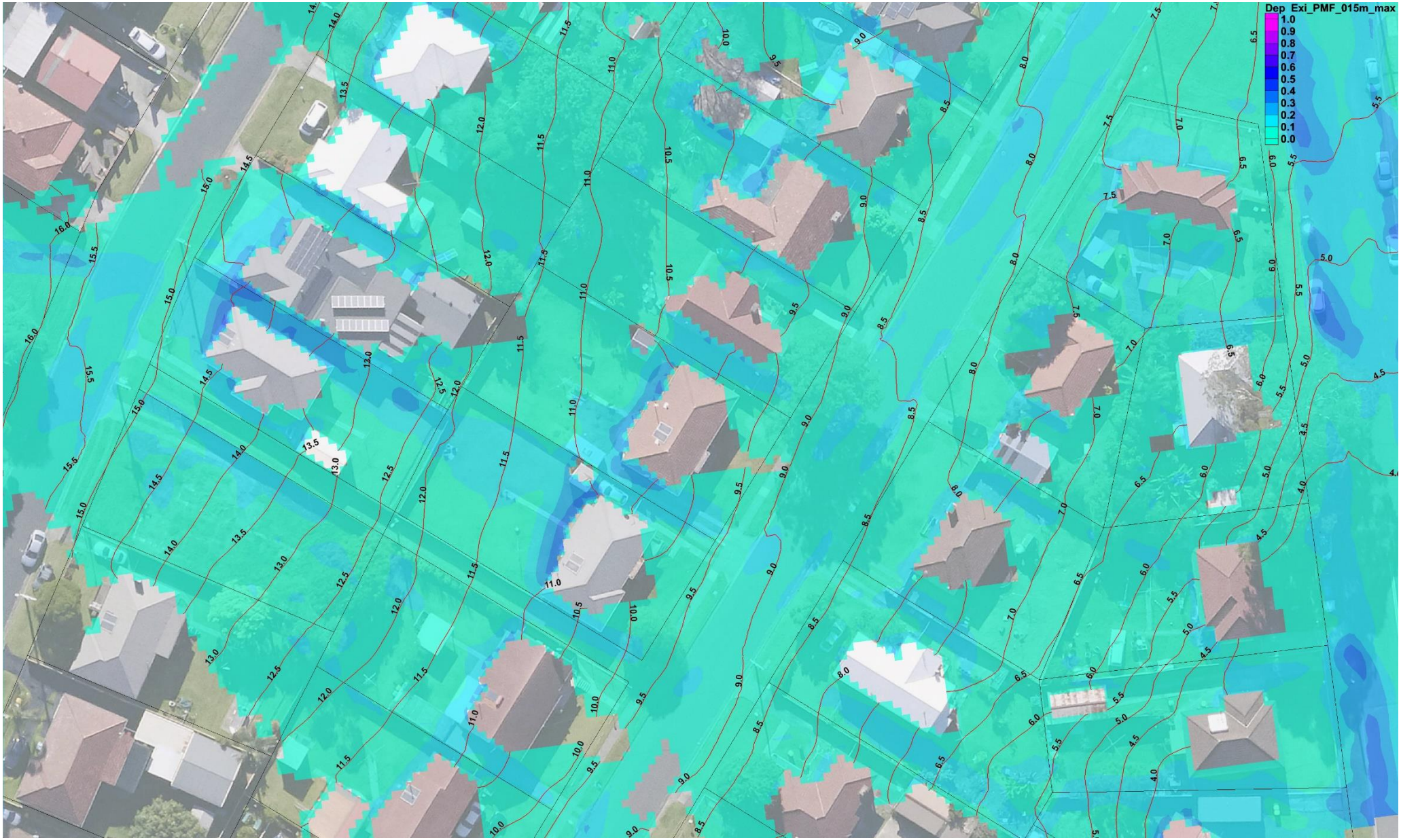

Figure A05: Existing PMF 15min Depths [m] & Levels [mAHD]

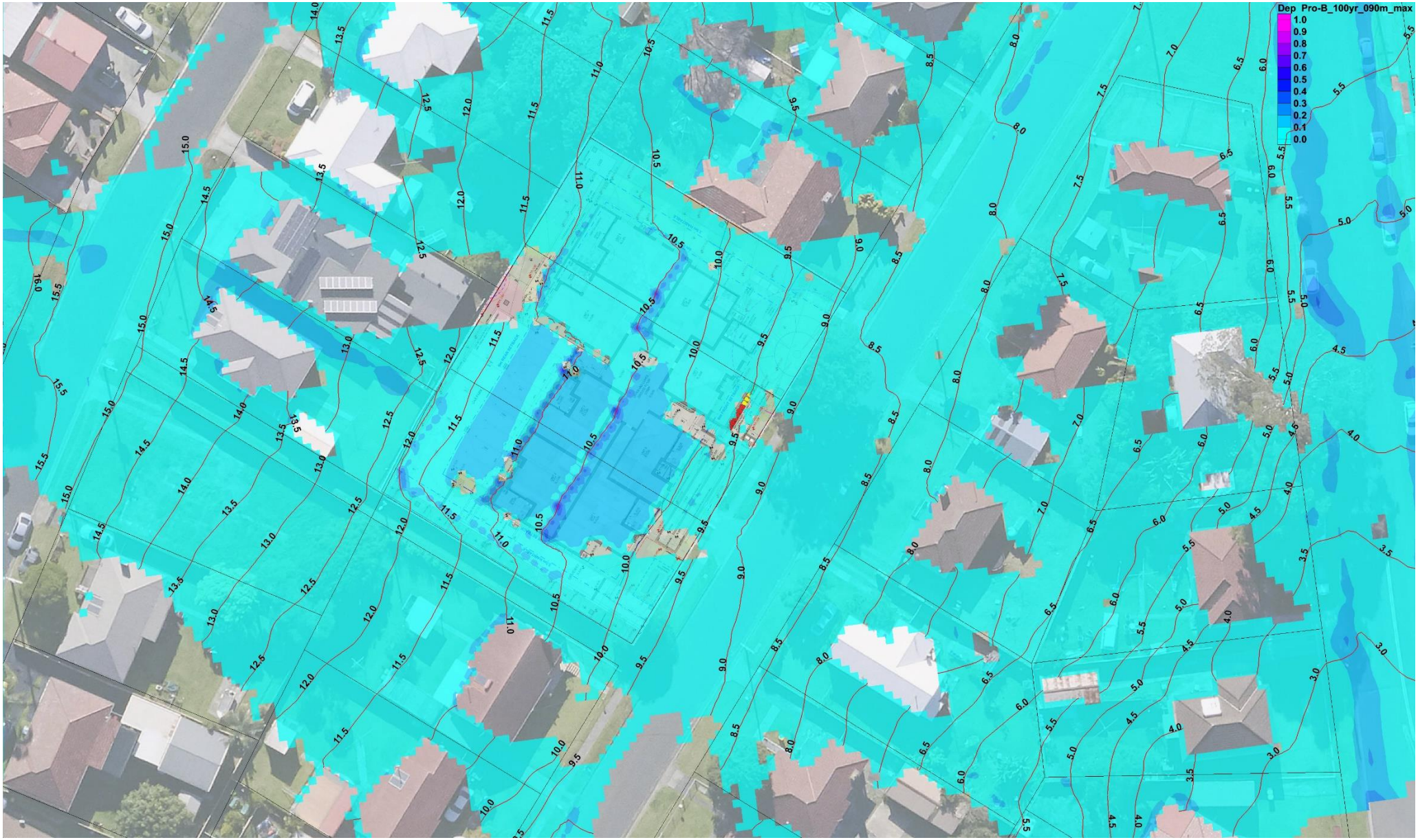

Figure B01: Proposed 100yr 90min Depths [m] & Levels [mAHD]

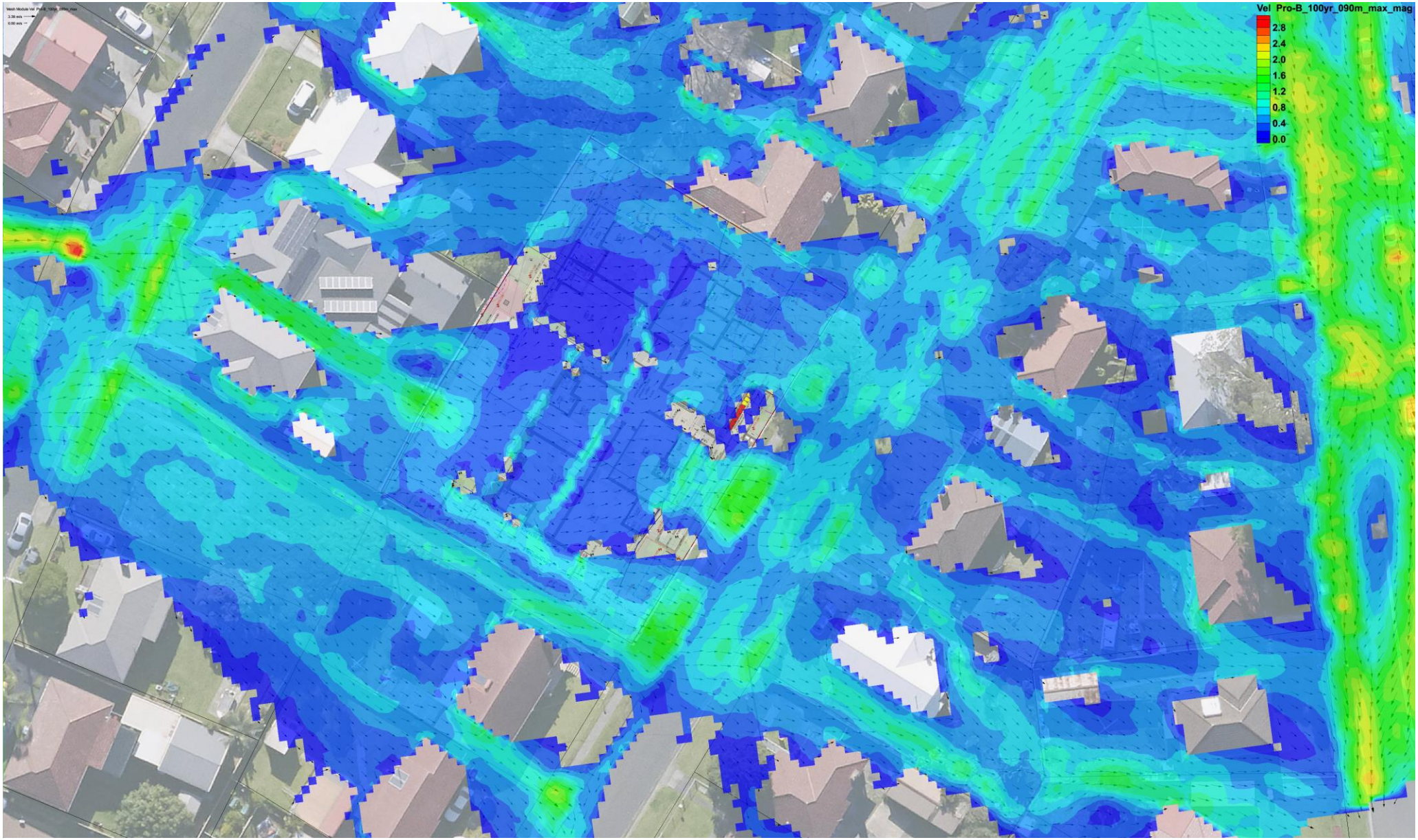

Figure B02: Proposed 100yr 90min Velocities [m/s]

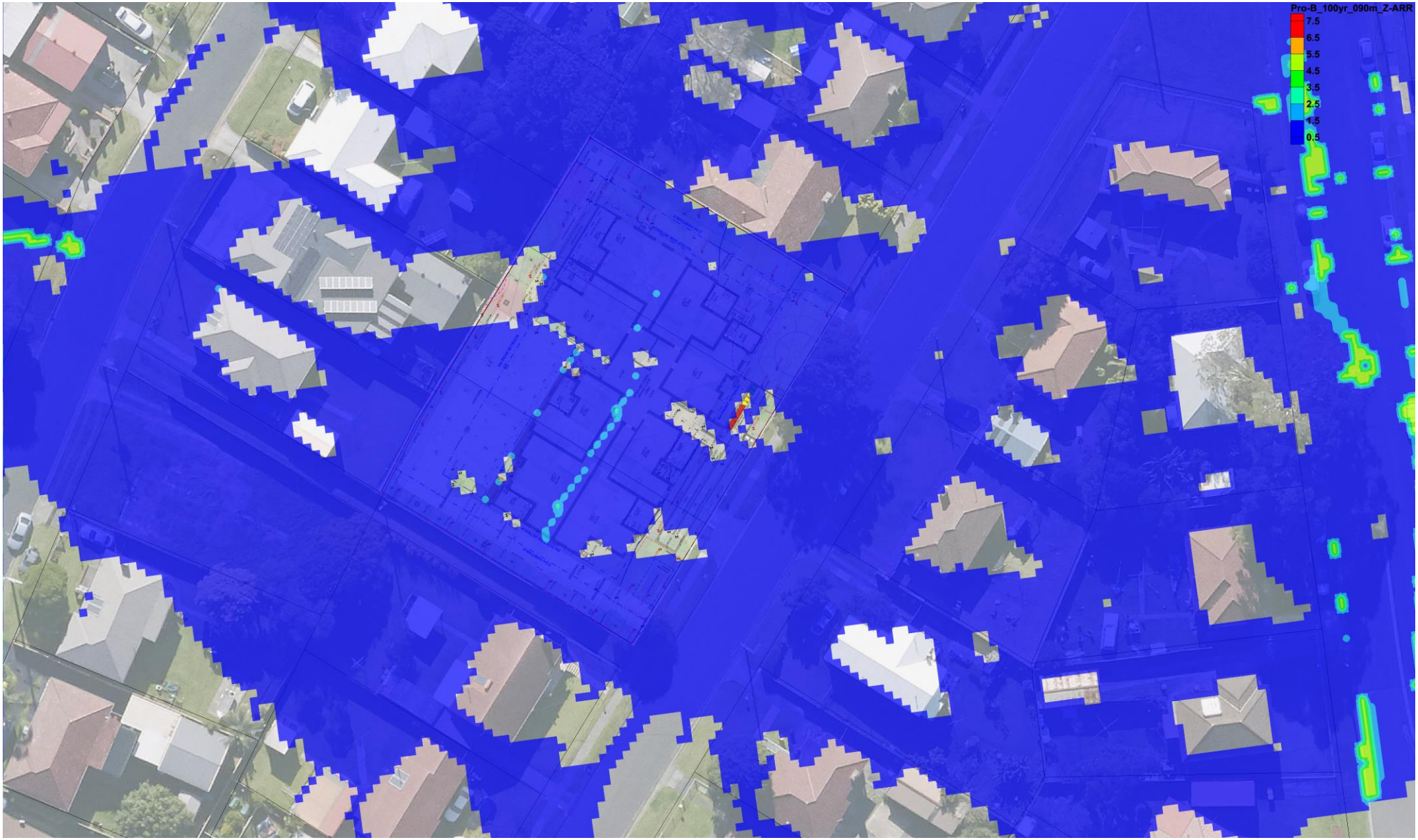

Figure B03: Proposed 100yr 90min ARR2019 Hazard
H1-H6 blue-red gradient

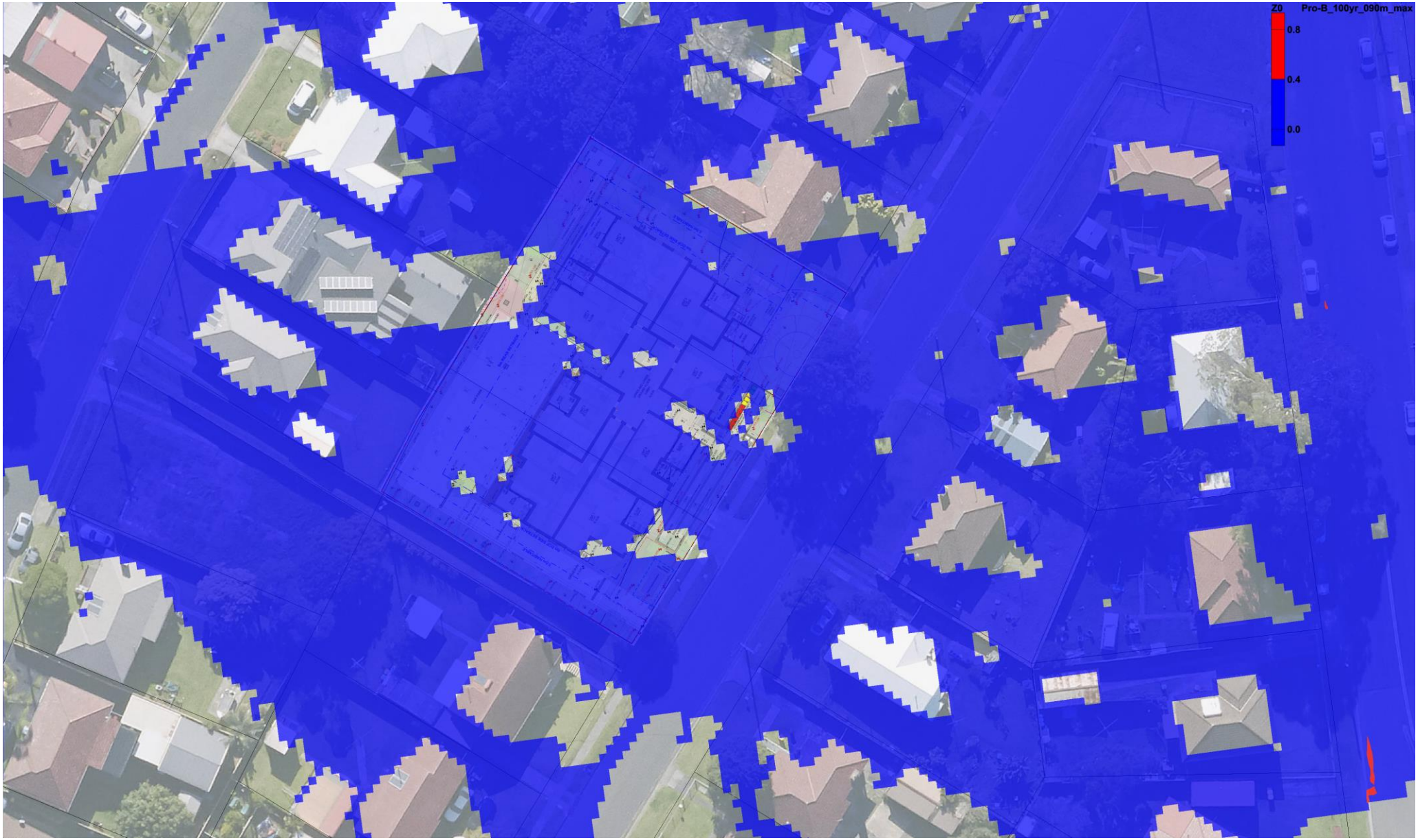

Figure B04: Proposed 100yr 90min V*D > 0.4

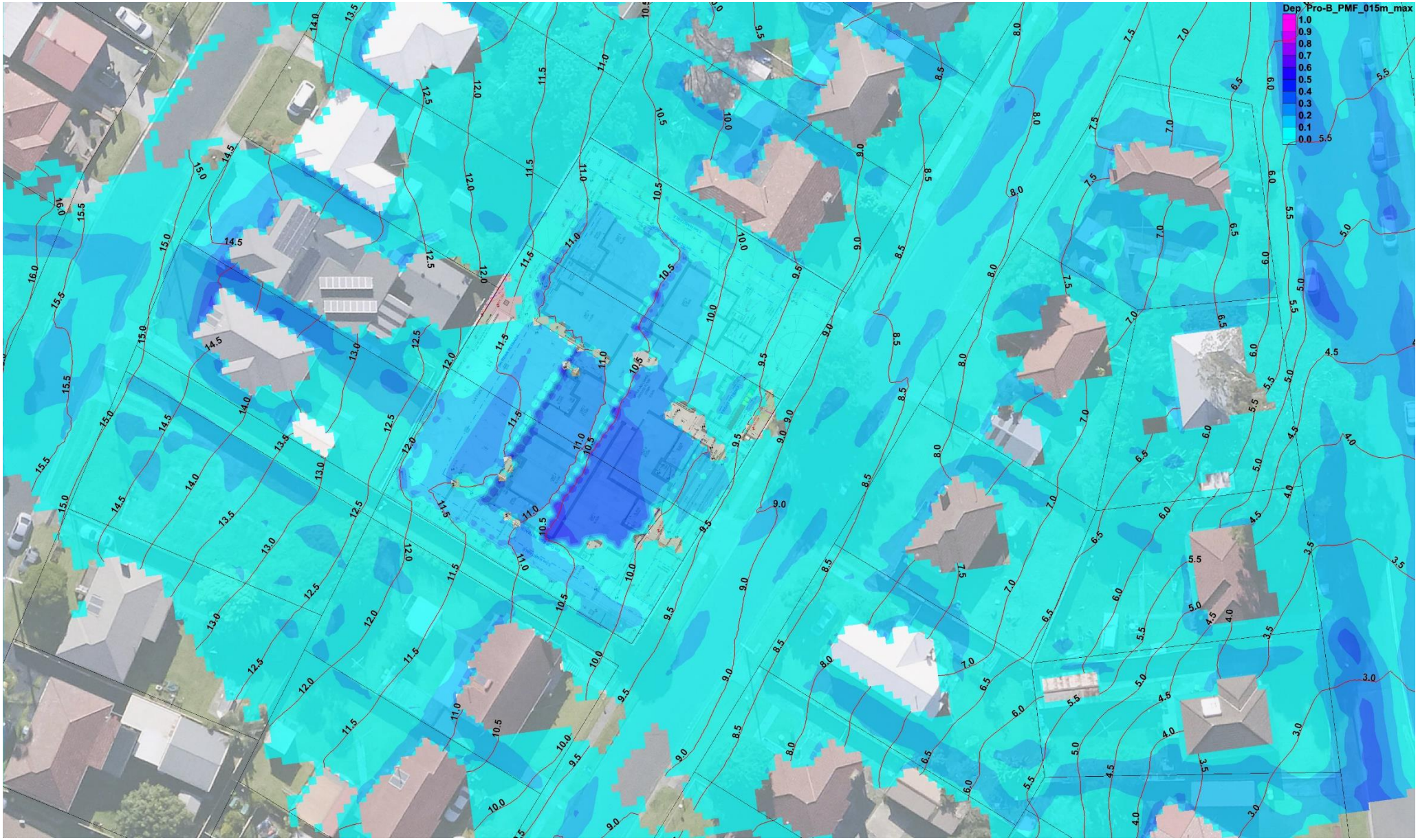

Figure B05: Proposed PMF 15min Depths [m] & Levels [mAHD]

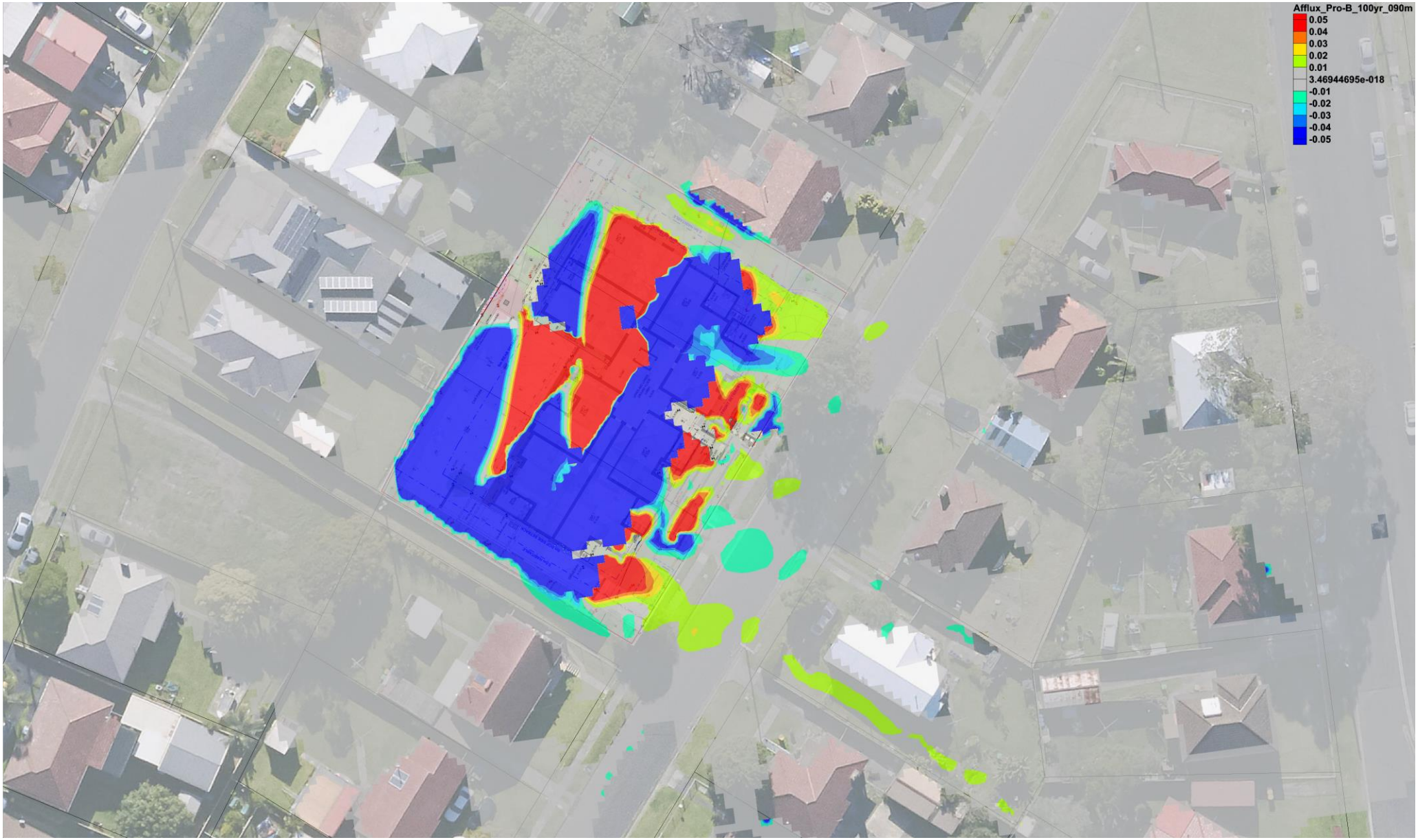

Figure B06: Proposed 100yr 90min Afflux

Proposed – Existing Surfaces

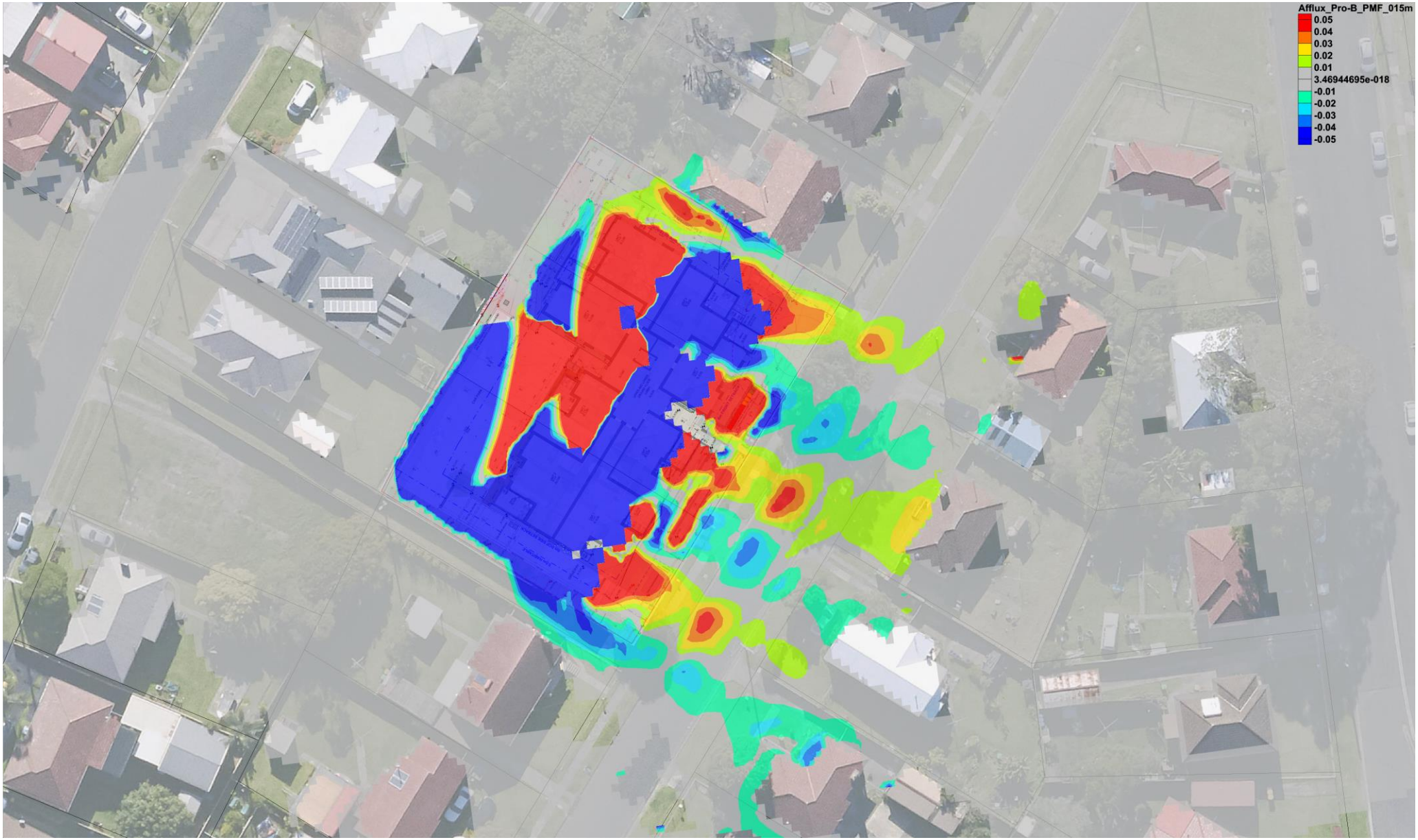

Figure B07: Proposed PMF 15min Afflux

Proposed – Existing Surfaces