Robert Bird Group

Flood Study

New Primary School at Gregory Hills

Issue: 4

27 October 2022

Prepared For: Schools Infrastructure NSW

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Report Amendment Register

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REVISION/ISSUE AUTHOR:

Charlene Huang

Signing for and on behalf of
Robert Bird Group Pty Ltd
Date: 27 October 2022

REVIEWER:

Chris Waite

Signing for and on behalf of
Robert Bird Group Pty Ltd
Date: 27 October 2022

Executive Summary

Robert Bird Group (RBG) have been engaged by School Infrastructure NSW to undertake a flood study to inform the concept design associated with a development application for the proposed new Gregory Hills Primary School development at 28 Wallarah Circuit, Gregory Hills NSW 2557.

The purpose of this report is to identify and discuss existing flooding conditions, design requirements and opportunities for flood immunity as well as the implications in the context of the development proposal, which also satisfies the Secretary's Environmental Assessment Requirements (SEARs) NO.14 relating to Flood Risk.

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1 Introduction

Robert Bird Group (RBG) have been engaged by School Infrastructure NSW to undertake a flood study to inform the concept design associated with a state significant development application (SSDA for the proposed new Gregory Hills Primary School development site at 28 Wallarah Circuit, Gregory Hills NSW 2557(the subject site).

This Flood Study report accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act), in support of a State Significant Development Application (SSDA) for the construction and operation of a new primary school at Gregory Hills (SSD-41306367).

This report addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably:

SEARs Requirement	Response
14. Flooding Risk • Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Floodplain Development Manual. • Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required.	RBG undertook a detailed 2D TUFLOW flood model based on an existing flood model of Camden Council's Upper South Creek Flood Study 2019 and assessed the flooding impact of the proposed development of Gregory Hills Primary School in the 1% AEP and PMF critical storms. The model outputs have shown that the proposed development will have negligible effect on the flooding risk of the surrounding areas with the current architectural concept design.

1.1 Proposal

The proposal is for a new primary school at Gregory Hills that generally comprises the following:

- 44 General Learning Spaces.
- 4 Support Learning Spaces.
- Administration, staff hub, amenity and building service areas.
- Library, communal hall and canteen.
- Outside School Hours Care (OSHC) services.
- Sport courts, outdoor play space, a Covered Outdoor Learning Area (COLA) and site landscaping.
- Dedicated bicycle and scooter parking.
- Three (3) kiss and drop spaces for Supported Learning Students (SLS) located on Wallarah Circuit.
- On-site car parking.
- Signage.
- Footpath widening on Wallarah Circuit.

Figure 1-1 Architectural Site Layout Plan *(Source: Bennett and Trimble)*

1.2 Site Description and Location

The site is located in Dharawal Country at 28 Wallarah Circuit, Gregory Hills NSW 2557, and is legally described as Lot 3257 DP1243285.

The site is located within the Camden Local Government Area and is within the Turner Road Precinct of the South-West Growth Centre.

The site has an area of approximately 2.926ha (by Deposited Plan). This will be reduced to 2.907ha under approved DA2022/742/1 once Long Reef Circuit has been widened.

Topography is minimal with a fall from the south-east corner (RL116.5) to the north- west corner (RL113).

The site has three (3) street frontages:

- Wallarah Circuit (southern boundary)
- Gregory Hills Drive (northern boundary)
- Long Reef Circuit (eastern Boundary)

The site is primarily vacant land, with the exception of an existing group of trees in the southwest corner of the site that pre-date the subdivision and development of the precinct. There is also an existing electrical substation located on the south-eastern boundary.

There are easements of varying widths located to the northern boundary identified for drainage.

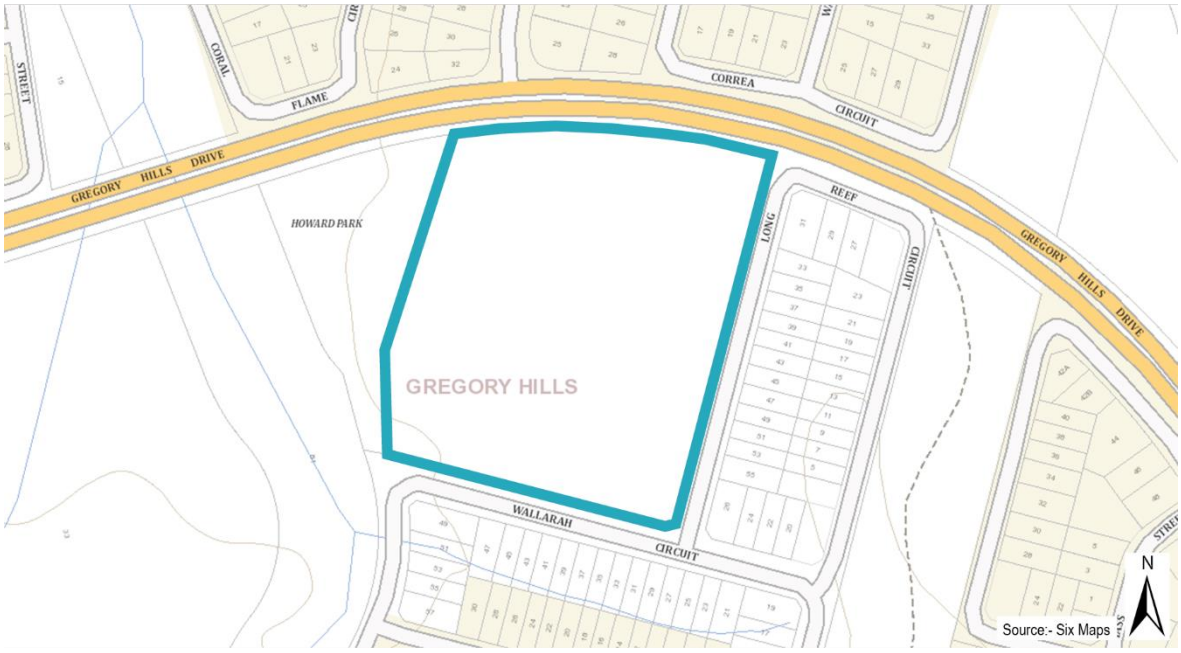


Figure 1-2 – Locality Map *(Source: Six Maps)*

Figure 1-3 – Site Aerial Map *(Source: Bennet and Trimble)*

1.3 Surrounding Development

To the north, east and south of the site is emerging and recently completed residential development.

To the east of the residential area fronting Long Reef Circuit are high voltage power lines within an easement which include pedestrian paths and cycleways.

To the west of the site, beyond Sykes Creek and Howard Park, is the Gregory Hills town centre. A pedestrian bridge links Wallarah Circuit with the town centre across Sykes Creek.

Figure 1-4 – Surrounding Development *(Source: Nearmap)*

1.4 Purpose of Report

The purpose of this report is to identify and discuss existing flooding conditions, design requirements and opportunities for flood immunity as well as the implications in the context of the development proposal and concept design, which also satisfies the Secretary's Environmental Assessment Requirements (SEARs) NO.14 relating to Flood Risk.

2 Existing Drainage Infrastructure

An existing drainage easement with grassed swale and stormwater line of 600mm diameter is located at northern end of the site, which capture approximate half of the existing overland flow within the site.

A separate existing stormwater drainage pit is sitting at the north-western corner of the site behind the stormwater easement.

Figure 2-1 below shown the locations of the existing drainage infrastructure.

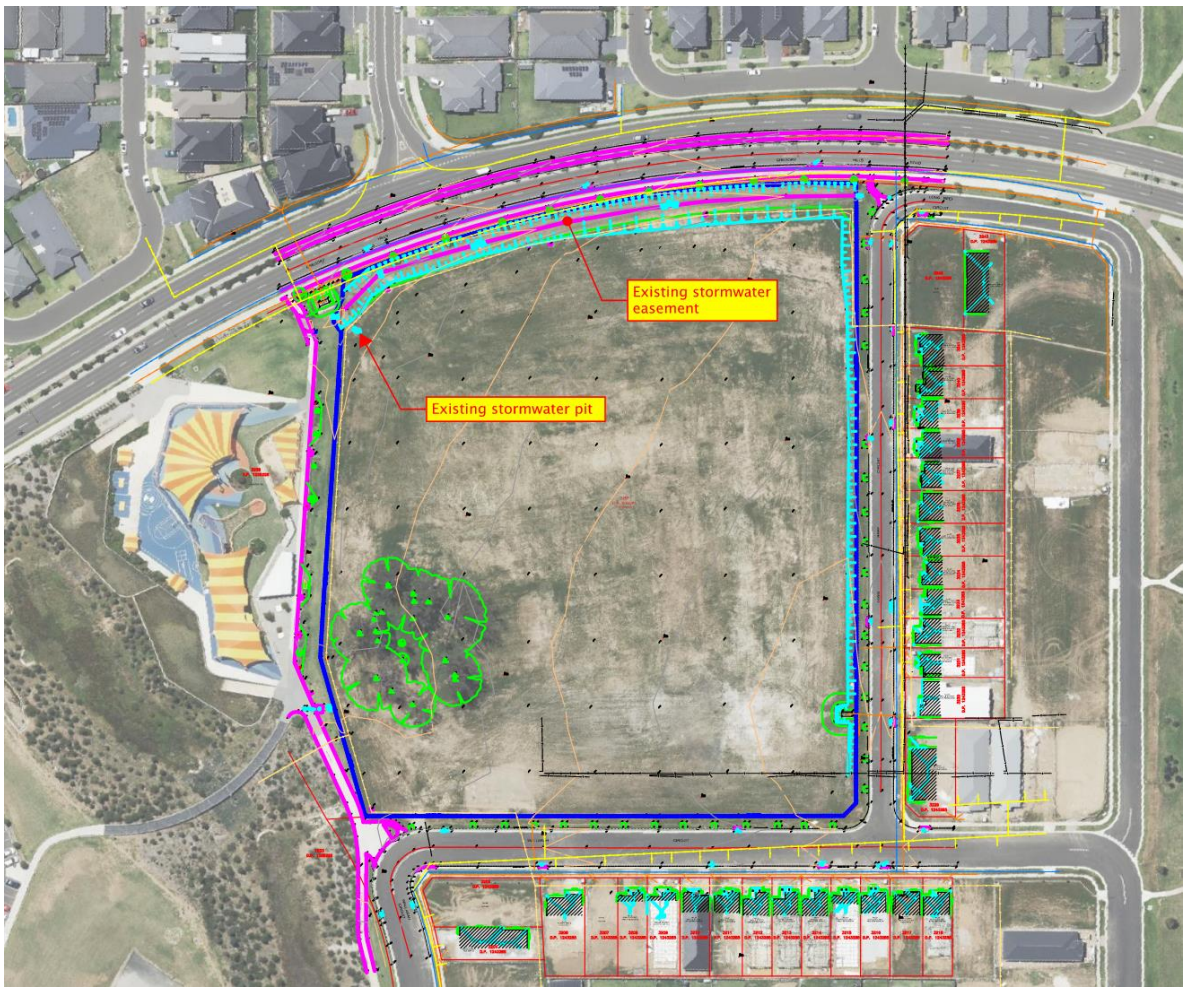


Figure 2-1 – Existing Drainage Infrastructure

3 Flooding Planning Level

According to Camden Council's Flood Risk Management Policy, the Flood Planning Level (FPL) used for general planning control purposes is derived from a combination of the 1% Annual Exceedance Probability (AEP) flood event plus a freeboard of 600mm.

Table 3-1 below has shown the detailed maximum 1% AEP flood levels at four different locations shown in Figure 3-1.

Figure 3.2 shows the building levels in more detail. It is noted that minimal flooding starts in the adjacent street, however 600mm freeboard has still conservatively been provided and thus it is confirmed that the Finished Floor Levels of the School are indeed acceptable from the flood assessment.

Figure 3-1 – Locations of Extracted 1% AEP Flood Levels

Table 3-1 – Extracted Maximum 1% AEP Flood Levels

Locations	Maximum 1% AEP Flood Levels	Flood Planning Level (FPL)
A	RL 115.2m	RL 115.8m
B	RL 115.1m	RL 115.7m
C	RL 114.9m	RL 115.5m
D	RL 114.5m	RL 115.1m

Figure 3-2 – Proposed Building Finished Floor Levels

4 Flood Emergency Assessment

The flood impact to the site in major events is noted as very minor with only small ingress in select locations around the site boundary.

Egress from the site in a flooding scenario can occur for pedestrians via Long Reef Circuit (the high point of the site).

For vehicles, egress on to Wallarah Circuit in an eastern direction and then to the south is possible in events up to the 1% AEP with dv results displayed in the flood maps not reaching the critical unsafe value of 0.4 m^2/s. In the PMF event, driving on the northern side of Wallarah Circuit remains a safe option as well as a Stay In Place scenario.

5 Preliminary Flood Study

5.1 Model Setup

In order to assess the flooding impacts of the proposed development, a 2-dimensional flood model has been developed using the existing TUFLOW model that WMA Water prepared as part of Camden Council's Upper South Creek Flood Study 2019. The existing TUFLOW model was provided by WMA Water with Council's authorisation for the sole purpose of analysis of the flooding impact for this site. RBG take no responsibility to validate the existing model.

As part of this preliminary flood study, the existing TUFLOW model has been rerun with the site-specific survey topographic levels as the baseline scenario for the flood impact study of the proposed development.

5.2 Hydrological Data

The critical storm durations have been identified below as part of the existing TUFLOW model provided by WMA Water, see Table 5-1 below.

Table 5-1 Critical Storm Durations

Design Storms	Critical Storm Duration
1% AEP	30 minutes
PMF	60 minutes

5.3 Hydraulic Roughness

Different land uses have been assigned different hydraulic roughness values in the existing TUFLOW model. The hydraulic roughness is measured using the Manning's 'n' value (dimensionless constant) as follows:

Table 5-2 Manning Coefficients

Surface Types	Manning Coefficient 'n'
Bare earth	0.02
Maintained grass / parks / ovals	0.03
Floodplain grass / pasture	0.04
Light vegetation	0.045
Medium vegetation	0.06
Dense vegetation	0.08
Dense riparian vegetation	0.12
Creeks and open water	0.03
Roads	0.02
Road corridor	0.035
Paved areas (carparks, etc)	0.02
Low density residential (rural and primary production)	0.045
Medium density residential (suburban development)	0.06
Industrial / Commercial / Schools (primarily concrete with some obstructions)	0.03
Railway	0.06

In the proposed development model, the proposed buildings, landscaping, carparks, and driveways at ground level have been assigned the same 'n' values as above.

5.4 Site Topography

The existing Council flood model utilised topography from 1m LIDAR survey. The site-specific survey topographic levels were also adopted in the baseline study of the existing conditions. The resultant flood levels are consistent with the flood levels from the original Council's flood model for the subject site and its surrounding areas.

The buildings were modelled as inactive areas, which allows the model to force flowing water to find a flow path around the buildings. The same modelling principal for proposed buildings had been used in the proposed development models to ensure consistency and allow results to be compared directly.

5.5 Results and Analysis

Outputs from the TUFLOW model are provided in Appendix A for each of the existing and design scenarios for both the 1% AEP and PMF flood events. The outputs show graphically:

- Peak Flood Height (H)
- Peak Flood Depth (D)
- Peak Flood Velocity (V)
- Maximum DxV (measure of flood hazard); and
- Afflux (difference in maximum flood levels between developed and existing state)

The flood hazard is determined by the product of the maximum depth and velocity of flow. Within properties and pedestrian areas within road reserves, the maximum DxV product for safety of children and vehicles is 0.4 m^2/s.

5.5.1 Pre-Development Scenario

The pre-development flood model was updated with the incorporation of the existing site-specific survey information, from which it has shown a crest along the pathway near the south-western corner of the site. The flood water was cut off entering the subject site from the south-western corner during the 1% AEP storms.

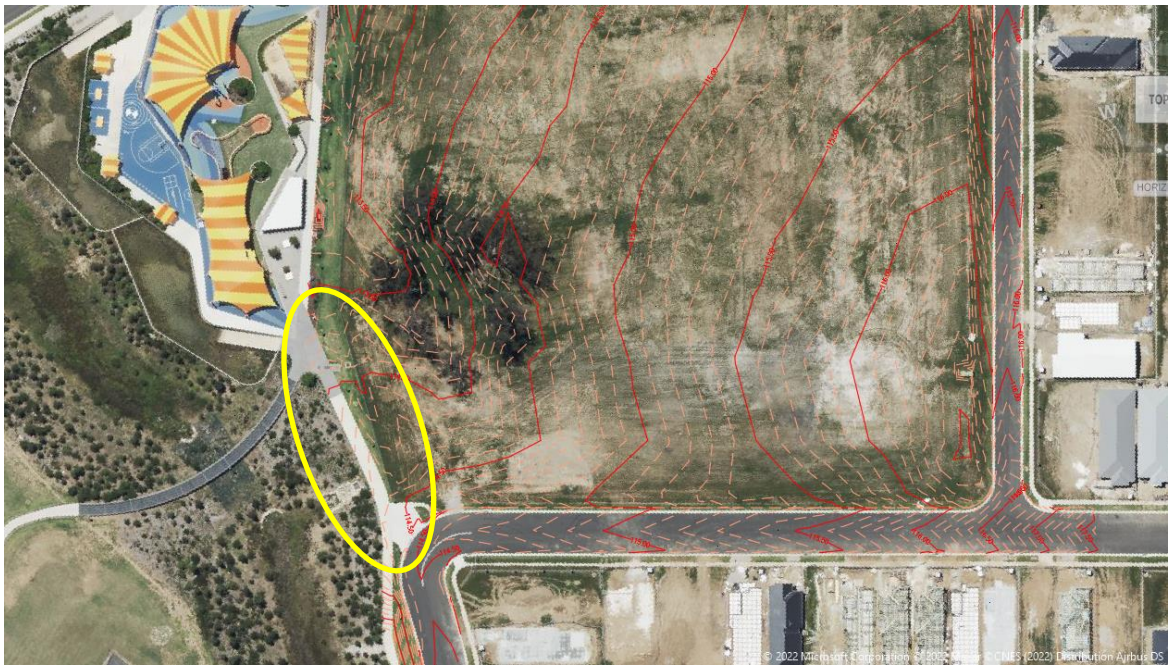


Figure 5-1 Existing Survey Contours *(Source: Rygate Survey Plan Dated 16/03/2022)*

5.5.2 Post-Development Impact Study

The following afflux maps have shown the impact of flood levels from post-development minus pre-development. The resultant afflux levels have demonstrated the negligible flood impact from the proposed development to the surrounding areas with post-development flood levels generally being <+/-1mm compared to the pre-development levels in both the 1% AEP and PMF flood events. The maximum change of flood level was found no increase in the 1% AEP and 84mm increase in the PMF event, close to the south-western corner of the development site.

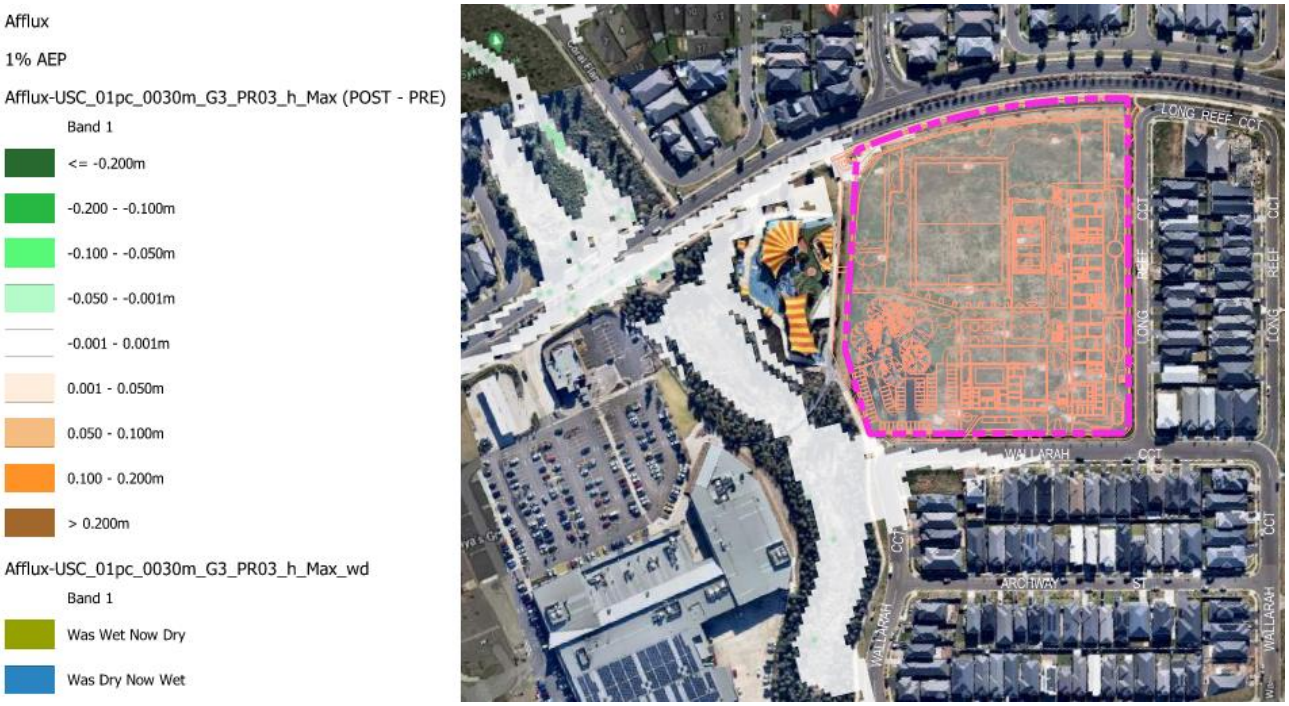


Figure 5-2 - 1% AEP Afflux Map (Post Minus Pre-Development Flood Levels)

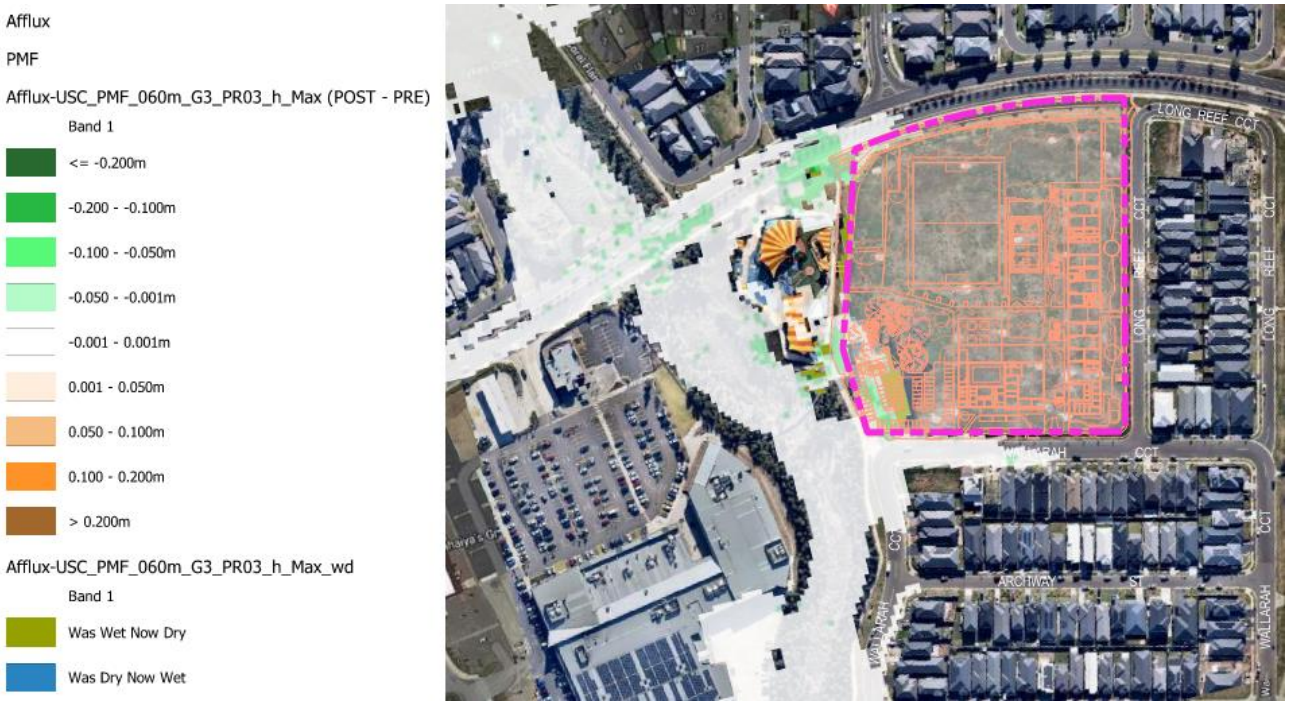


Figure 5-3 – PMF Afflux Map (Post Minus Pre-Development Flood Levels)

Also, no increase of flood hazard was found in vicinity of the site where the hazard is greater than 0.4m^2/s. More pre and post-development flood maps of 1% AEP and PMF storms can be found in Appendix A.

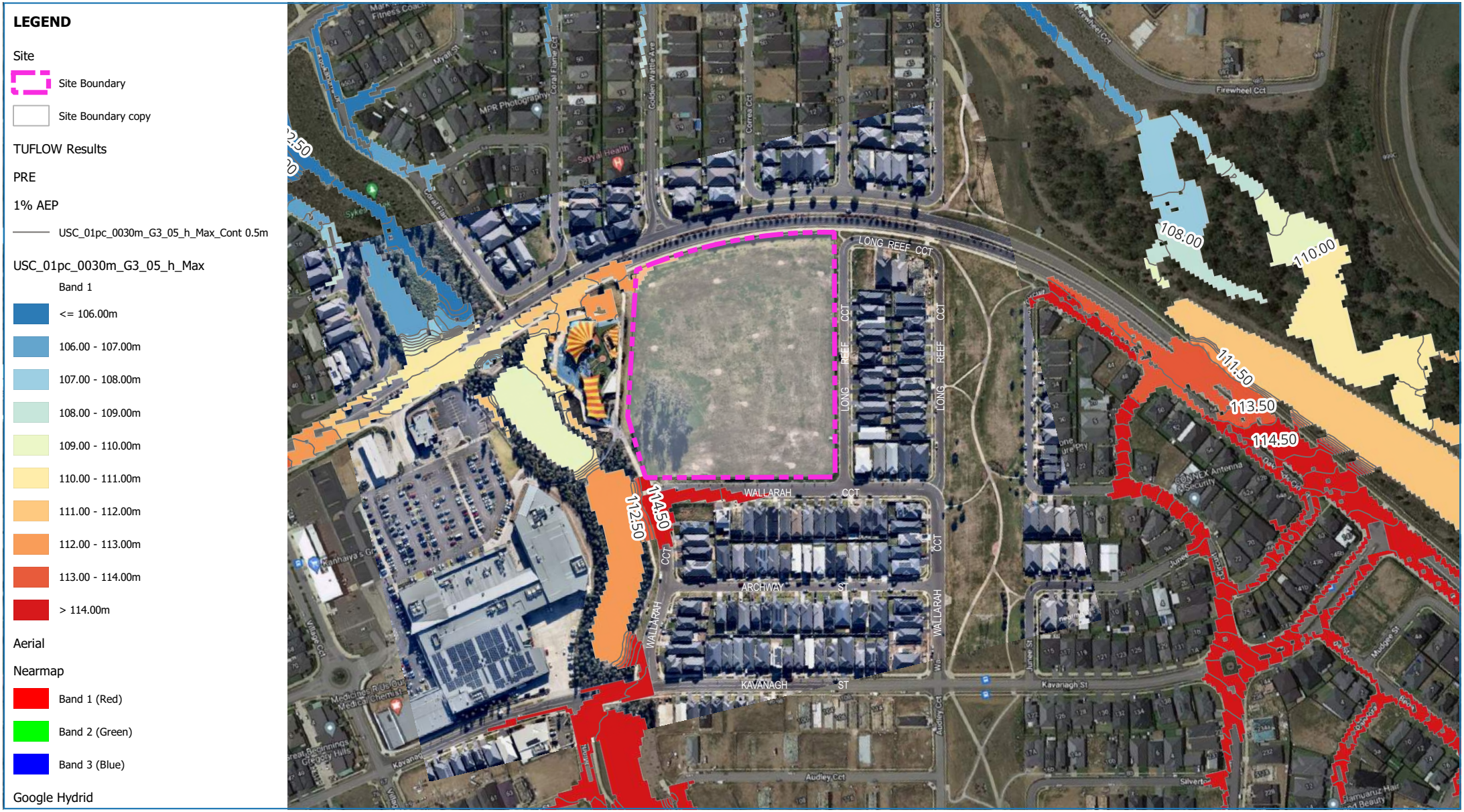
6 Conclusion and Recommendations

This report outlines the flood modelling exercise undertaken by RBG to assess the flooding impact of the proposed development of Gregory Hills Primary School in the 1% AEP and PMF critical storms.

The model outputs have shown that the proposed development will have negligible effect on the flooding risk of the surrounding areas with the current architectural concept design.

APPENDICES

Appendix A Flood Maps



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CONSULTANT:

Robert Bird Group

CLIENT:

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0 75 150 m

N

CONSULTANT:

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CLIENT:

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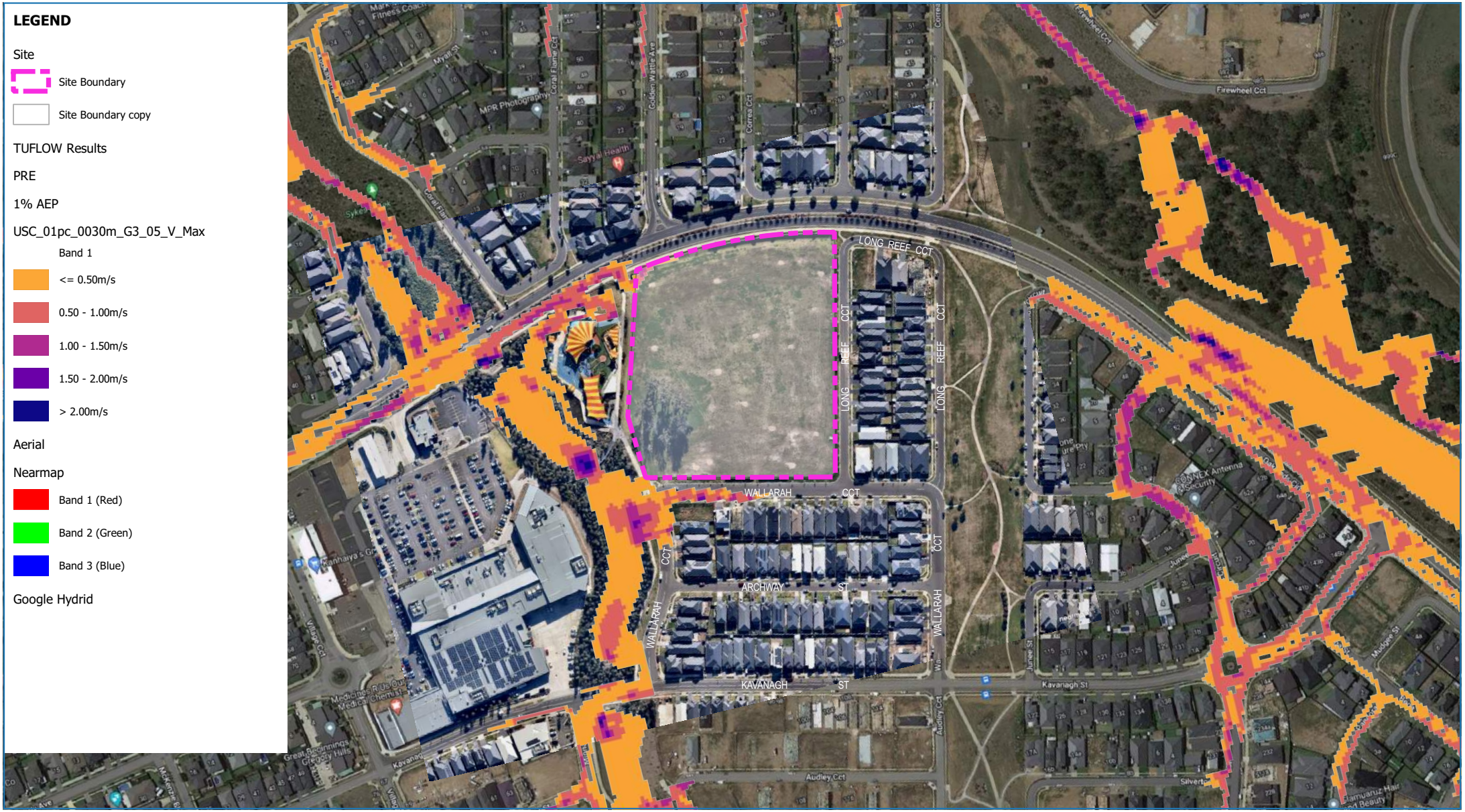

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0 75 150 m

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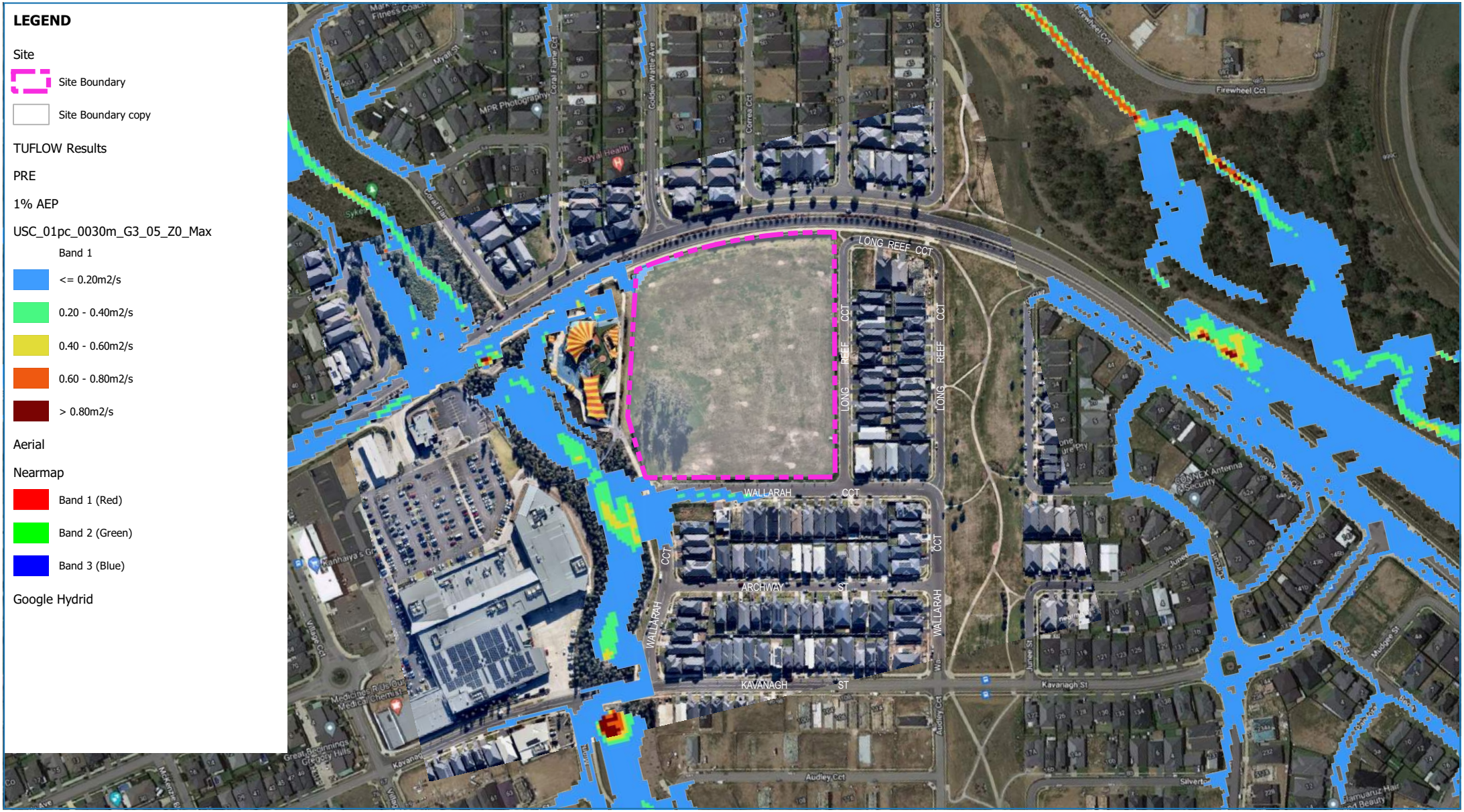

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0 75 150 m

N

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LEGEND

Site

Site Boundary

Site Boundary copy

TUFLOW Results

Post

1% AEP

USC_01pc_0030m_G3_PR03_h_Max_Cont 0.5m

USC_01pc_0030m_G3_PR03_h_Max

Band 1

<= 106.00m

106.00 - 107.00m

107.00 - 108.00m

108.00 - 109.00m

109.00 - 110.00m

110.00 - 111.00m

111.00 - 112.00m

112.00 - 113.00m

113.00 - 114.00m

> 114.00m

Aerial

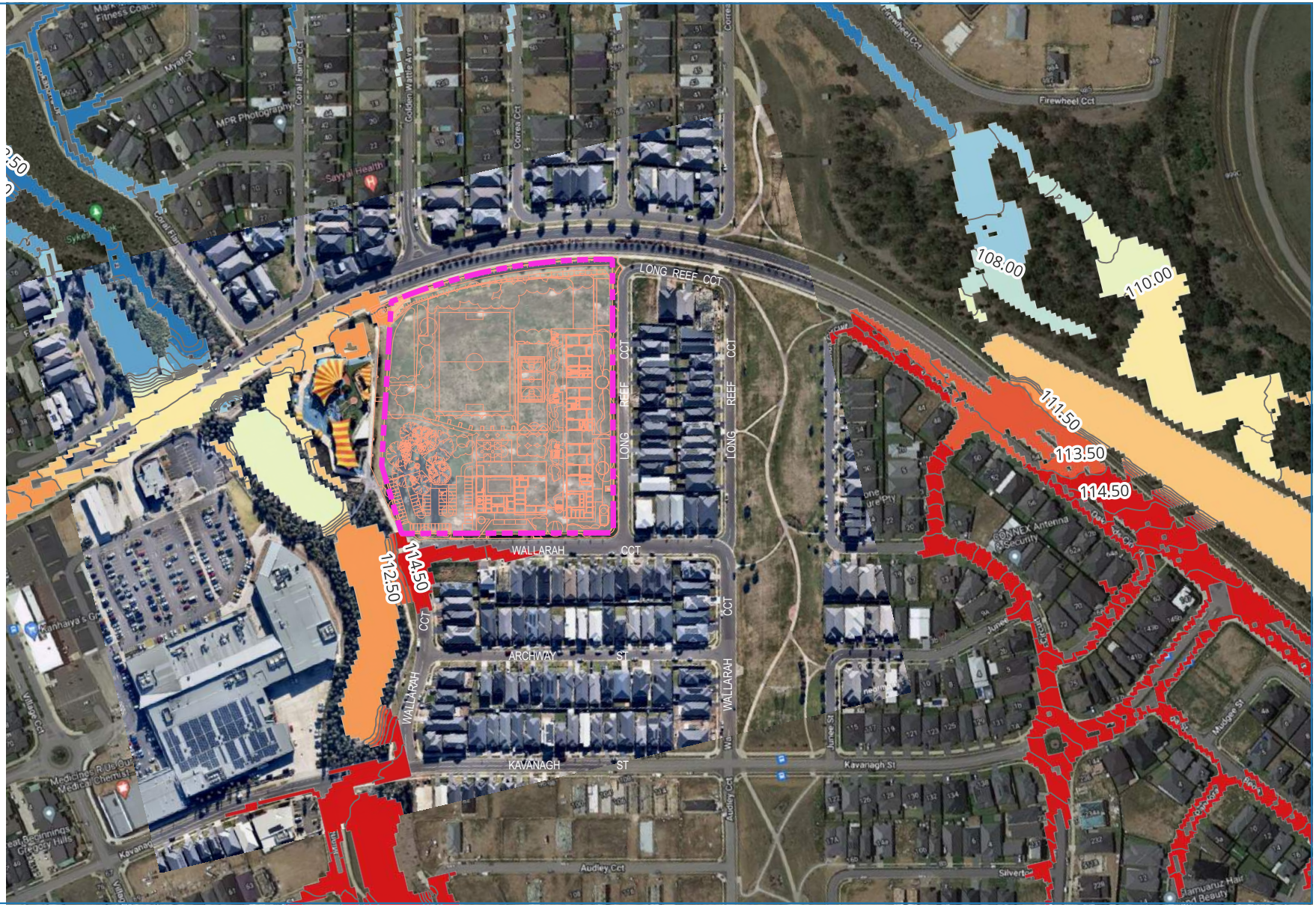
Nearmap

Band 1 (Red)

Band 2 (Green)

Band 3 (Blue)

Google Hydrid



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0 75 150 m

N

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LEGEND

Site

Site Boundary

Site Boundary copy

TUFLOW Results

Post

1% AEP

USC_01pc_0030m_G3_PR03_d_Max_Cont 0.5m

USC_01pc_0030m_G3_PR03_d_Max

Band 1

<= 0.25m

0.25 - 0.50m

0.50 - 0.75m

0.75 - 1.00m

1.00 - 1.25m

1.25 - 1.50m

1.50 - 1.75m

> 1.75m

Aerial

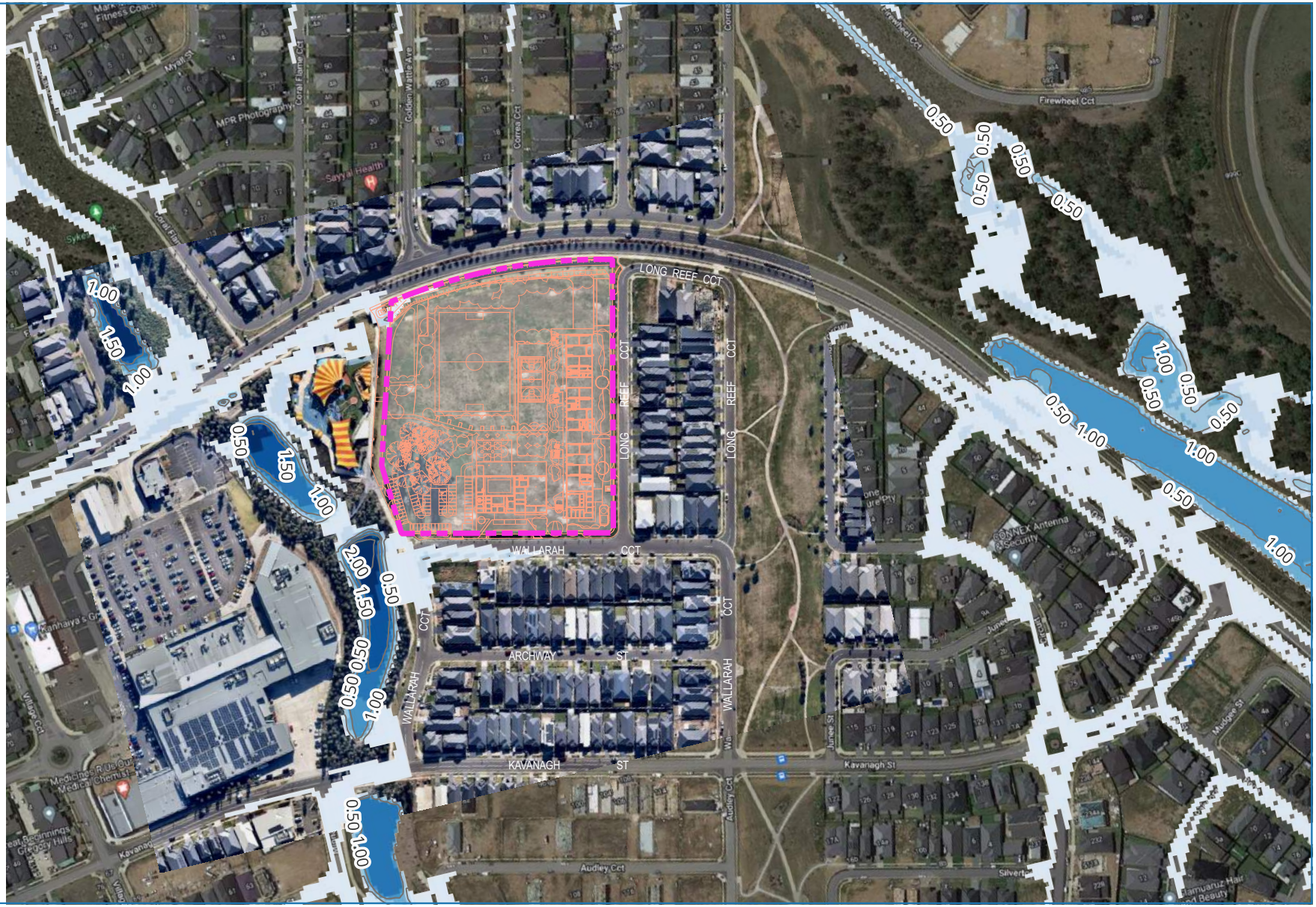
Nearmap

Band 1 (Red)

Band 2 (Green)

Band 3 (Blue)

Google Hydrid



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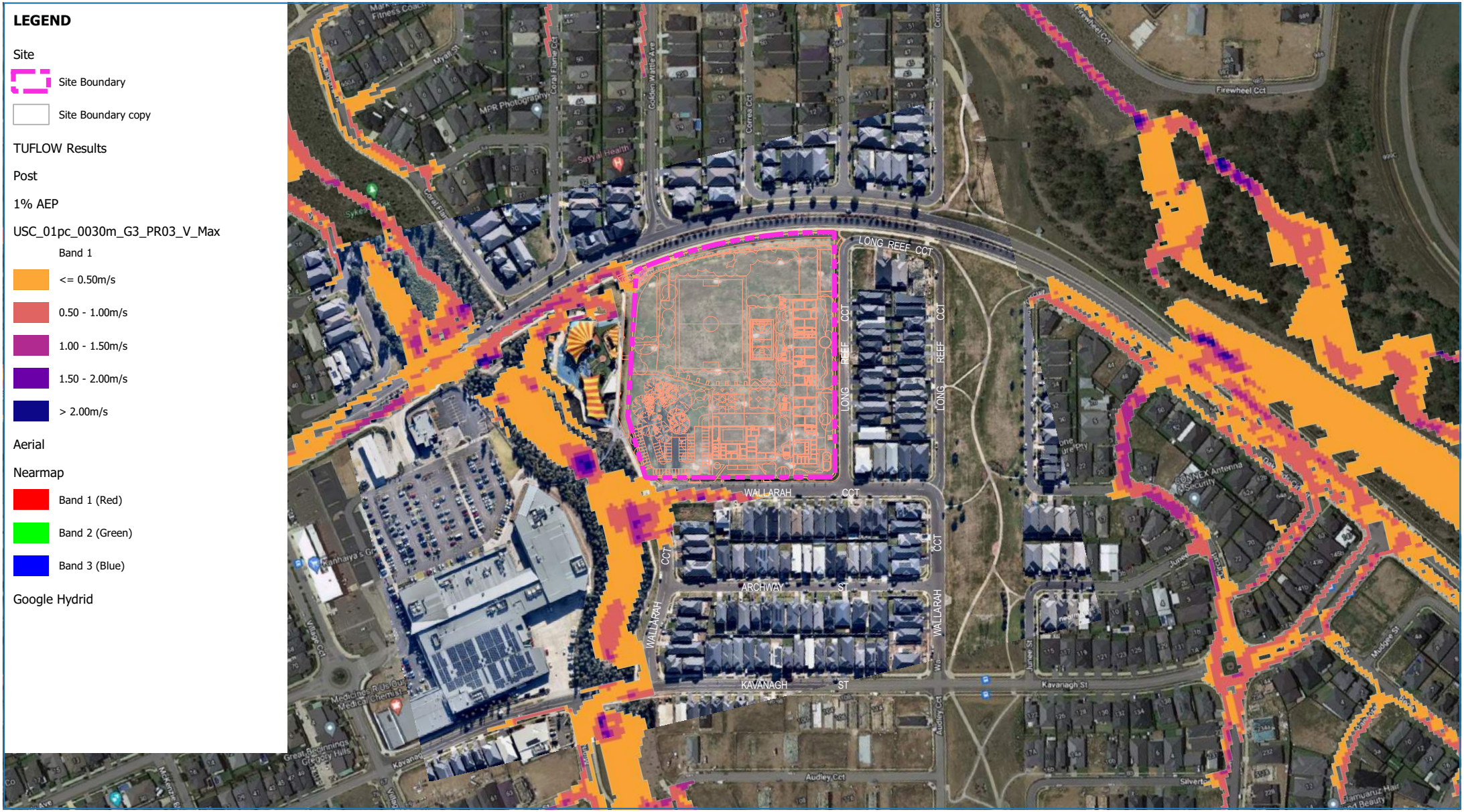

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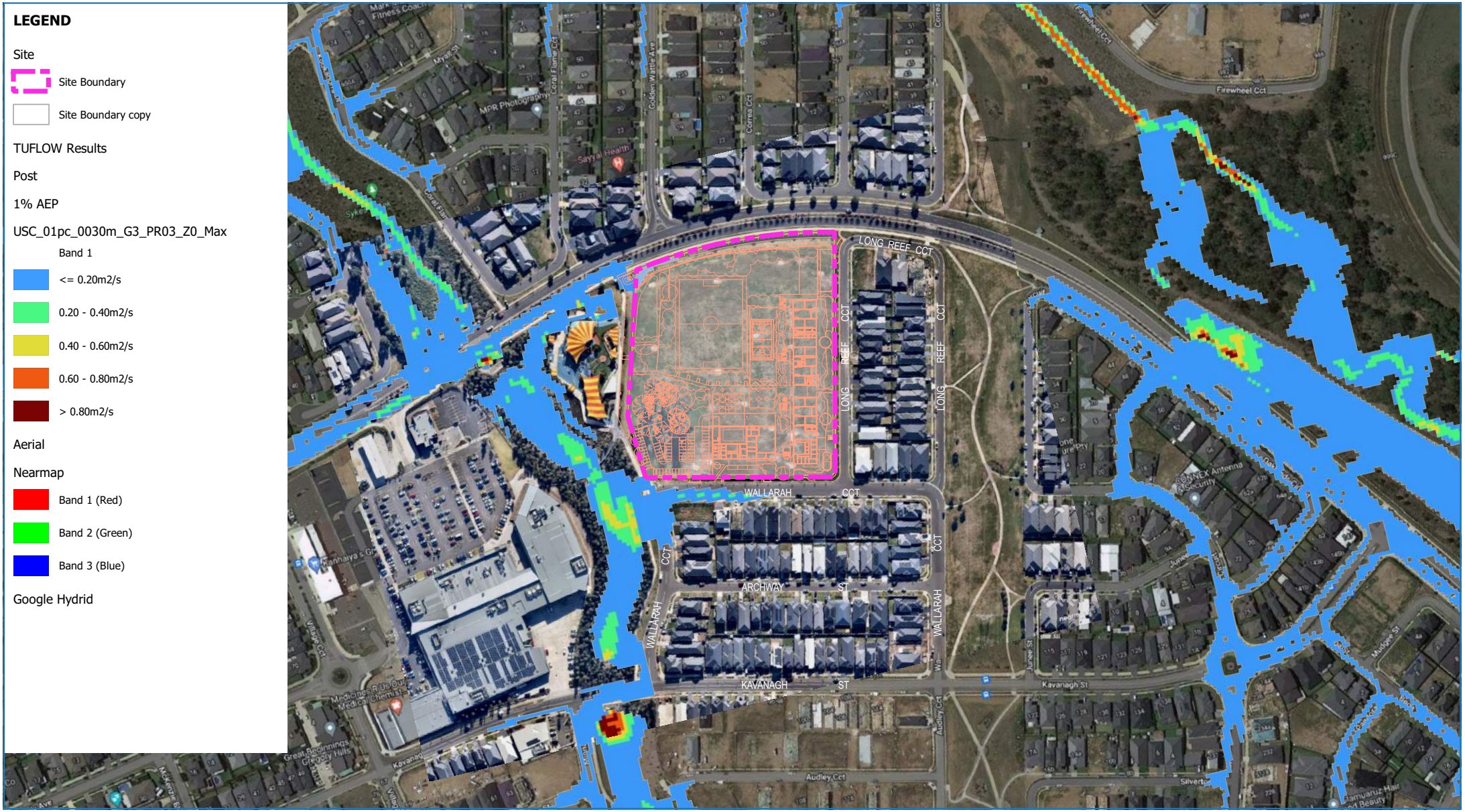

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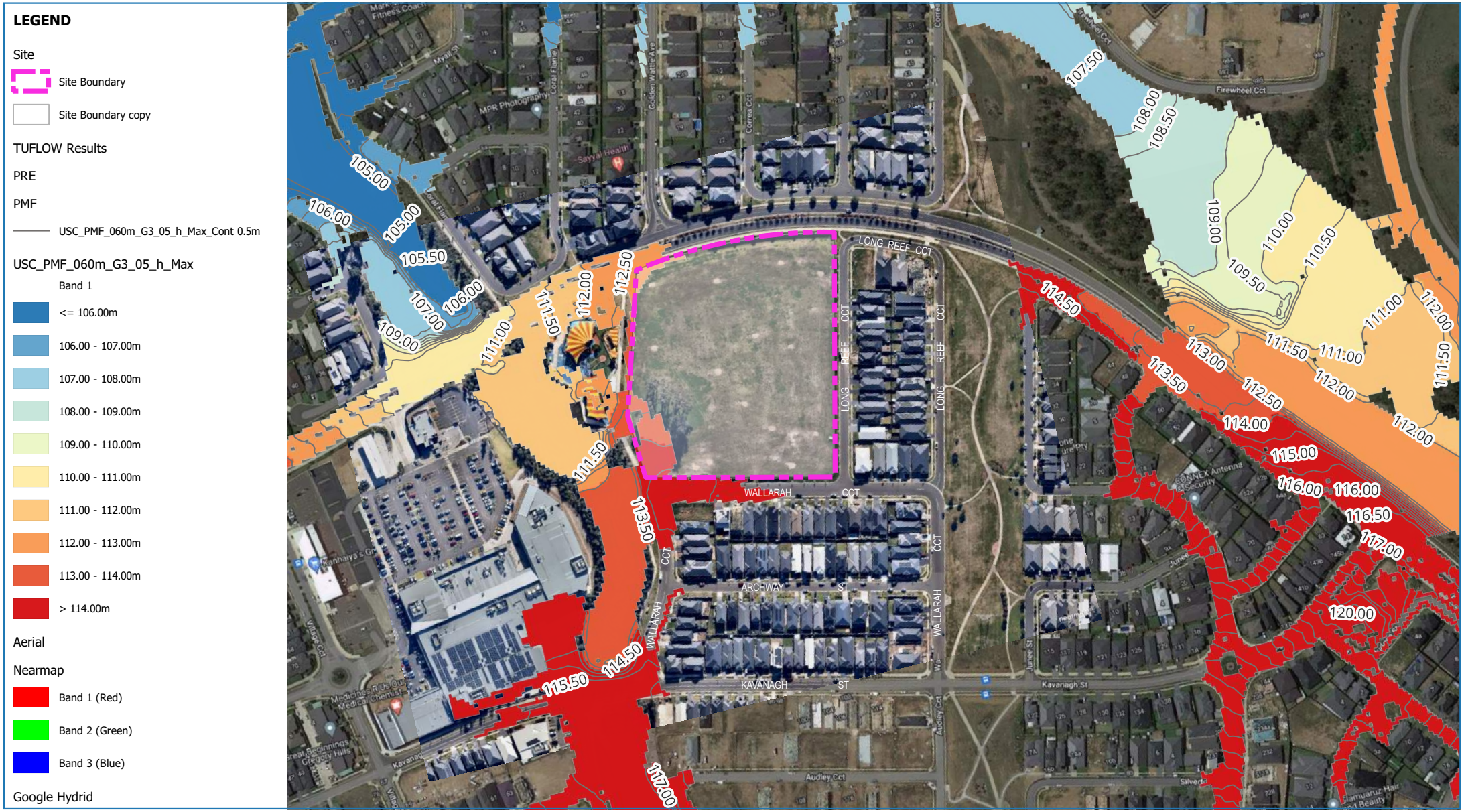

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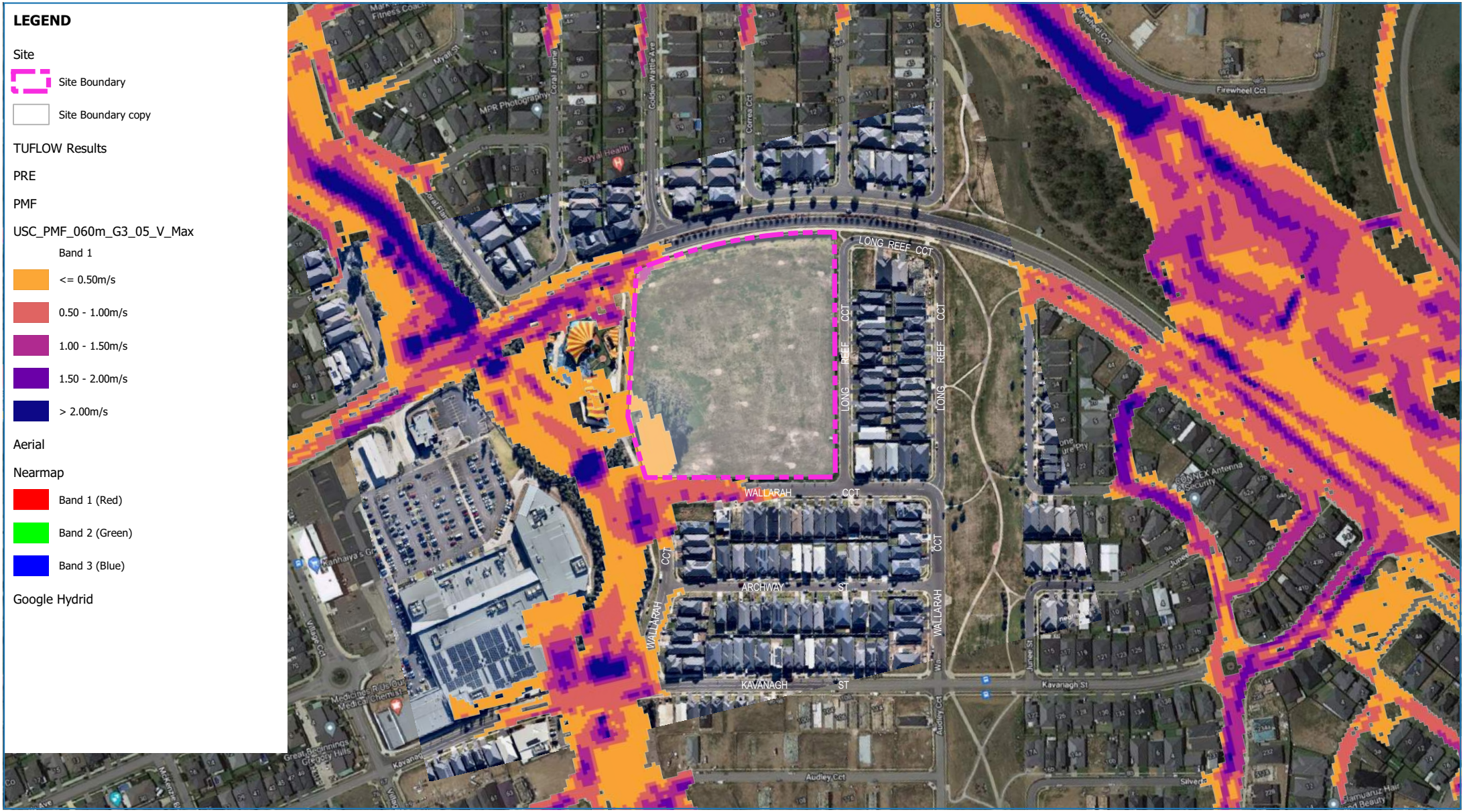

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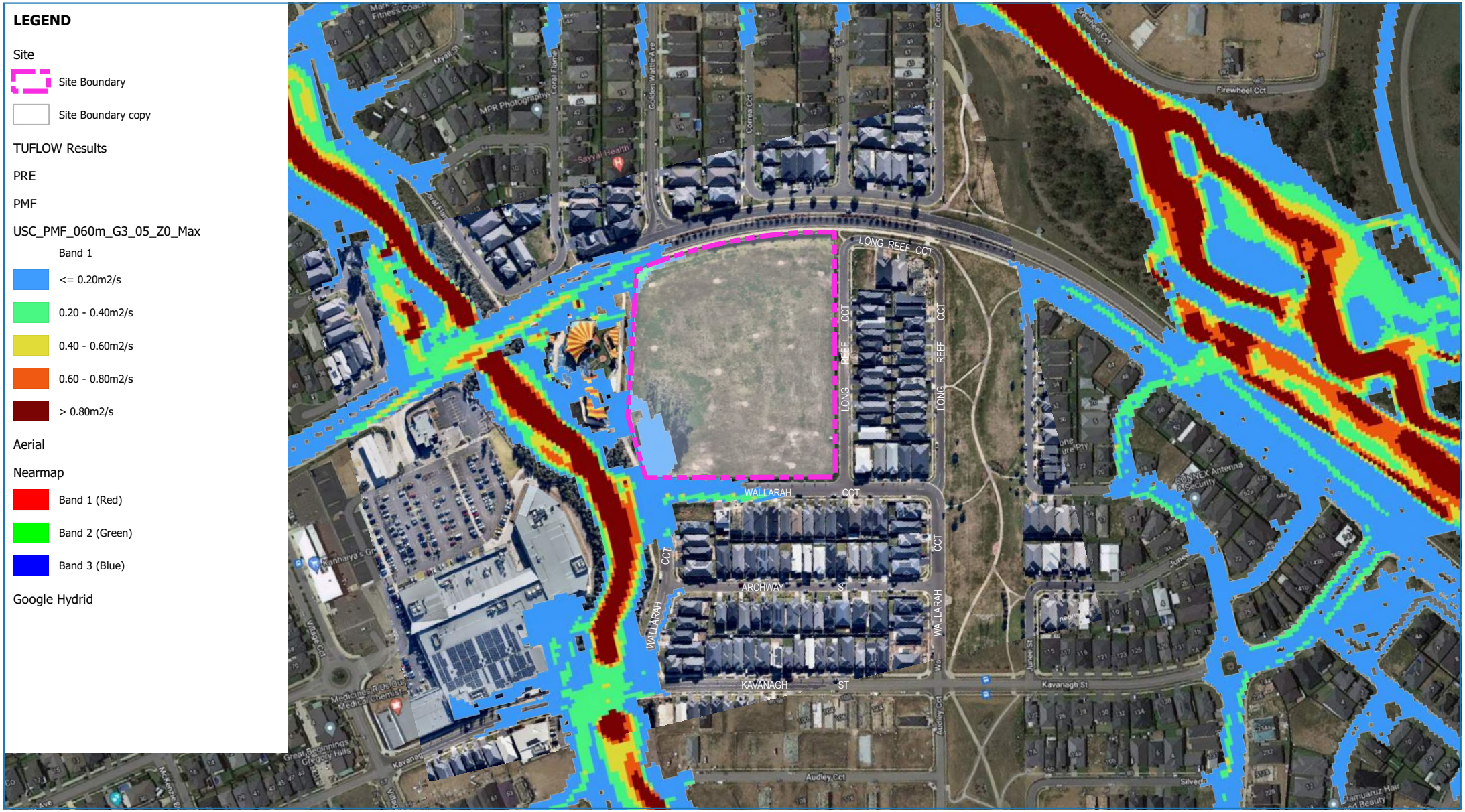

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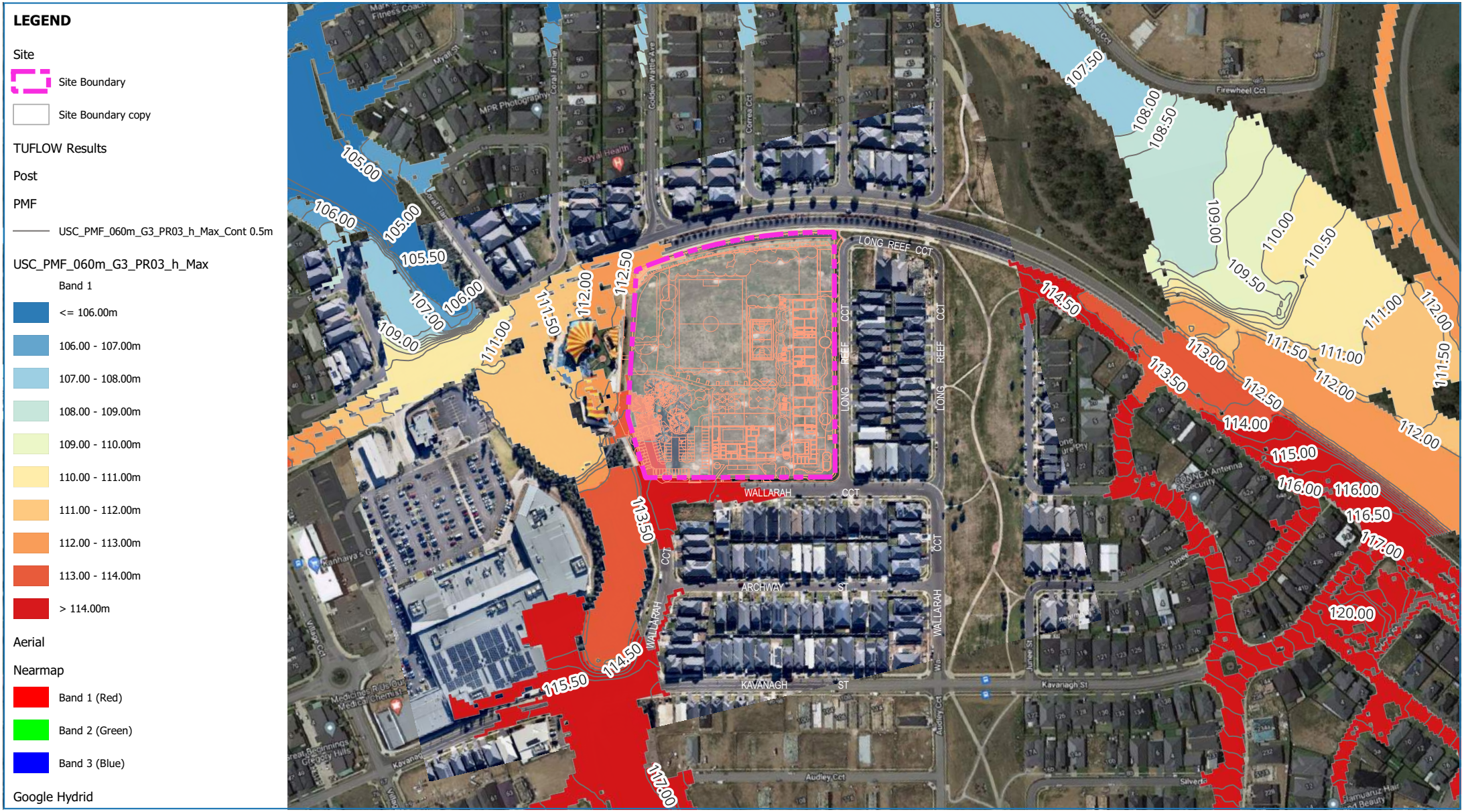

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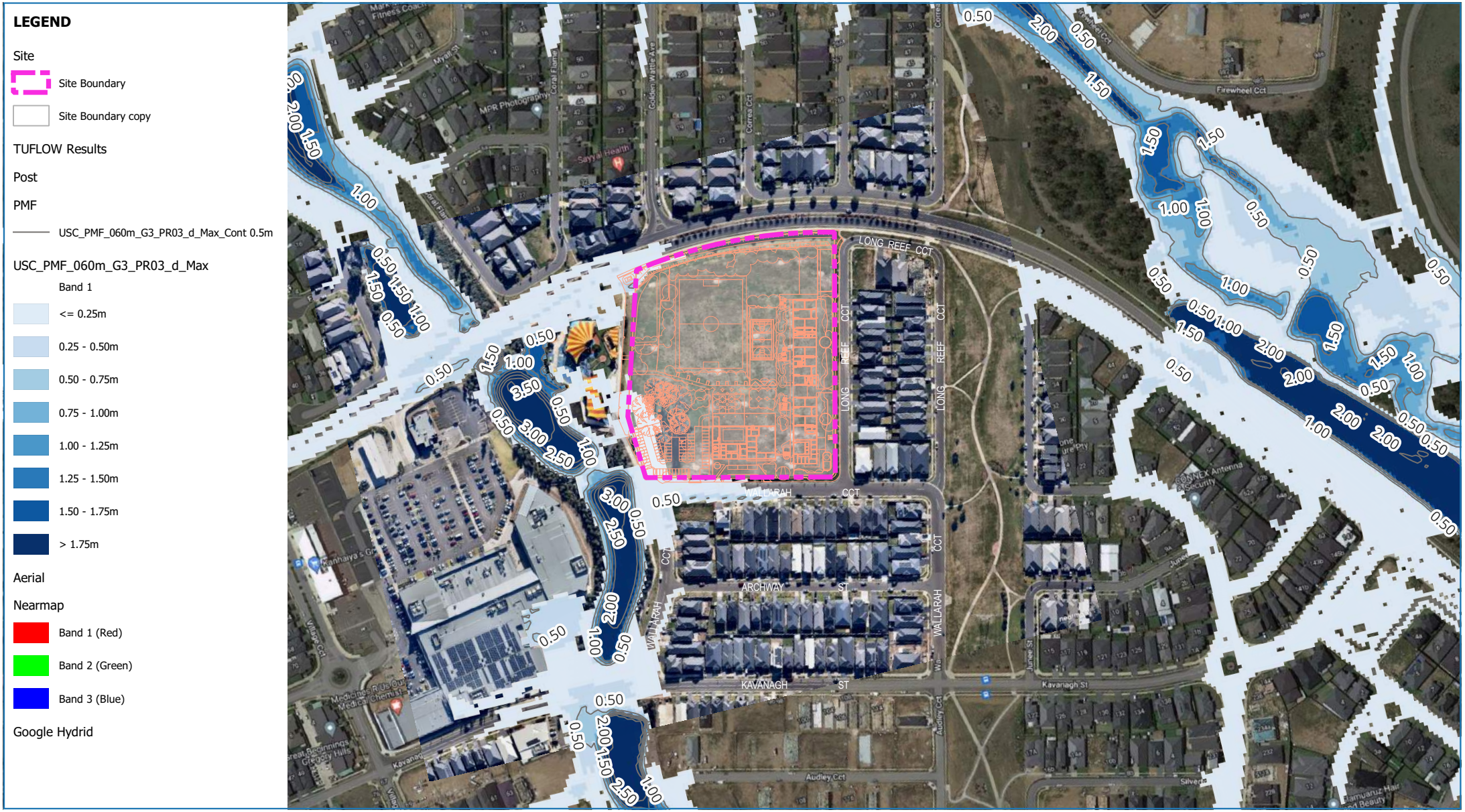

PROJECT NAME:	GREGORY HILLS PRIMARY SCHOOL	**REVISION:**	1
PROJECT NUMBER:	22061C	**DATE:**	28/09/2022
MAP TYPE:	MAXIMUM FLOOD DEPTHS	**CREATED BY:**	C.HUANG
MODEL SCENARIO:	POST-DEVELOPMENT	**NOTE:**	
STORM EVENT:	PMF 60MIN DURATION		
HYDRAULIC MODEL:	USC_~e1~_~e2~_~s1~_PR03.tcf		

0 75 150 m

N

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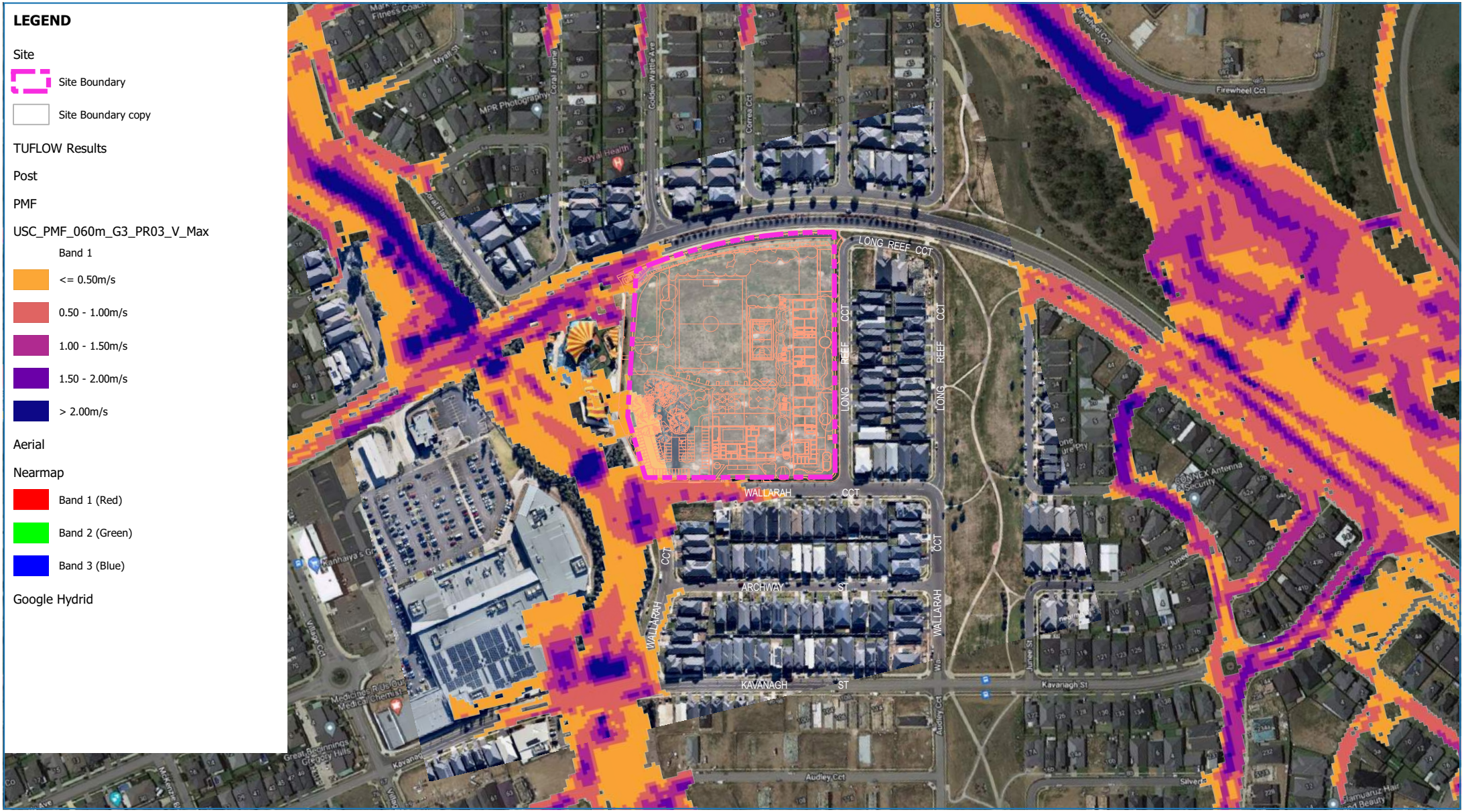

PROJECT NAME:	GREGORY HILLS PRIMARY SCHOOL	**REVISION:**	1
PROJECT NUMBER:	22061C	**DATE:**	28/09/2022
MAP TYPE:	MAXIMUM FLOOD VELOCITIES	**CREATED BY:**	C.HUANG
MODEL SCENARIO:	POST-DEVELOPMENT	**NOTE:**	
STORM EVENT:	PMF 60MIN DURATION		
HYDRAULIC MODEL:	USC_~e1~_~e2~_~s1~_PR03.tcf		

0 75 150 m

N

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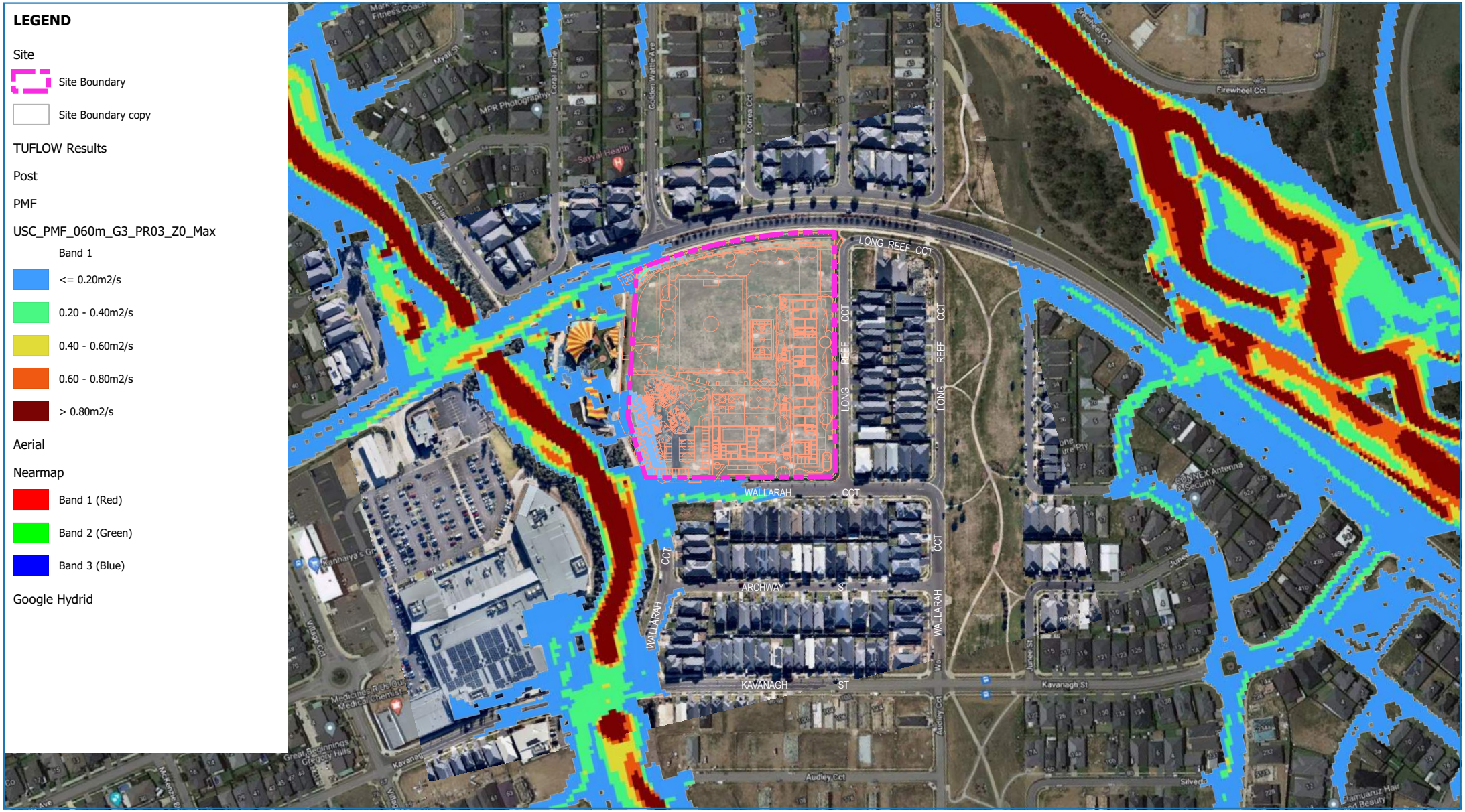

PROJECT NAME:	GREGORY HILLS PRIMARY SCHOOL	**REVISION:**	1
PROJECT NUMBER:	22061C	**DATE:**	28/09/2022
MAP TYPE:	MAXIMUM FLOOD HAZARDS (D x V)	**CREATED BY:**	C.HUANG
MODEL SCENARIO:	POST-DEVELOPMENT	**NOTE:**	
STORM EVENT:	PMF 60MIN DURATION		
HYDRAULIC MODEL:	USC_~e1~_~e2~_~s1~_PR03.tcf		

0 75 150 m

N

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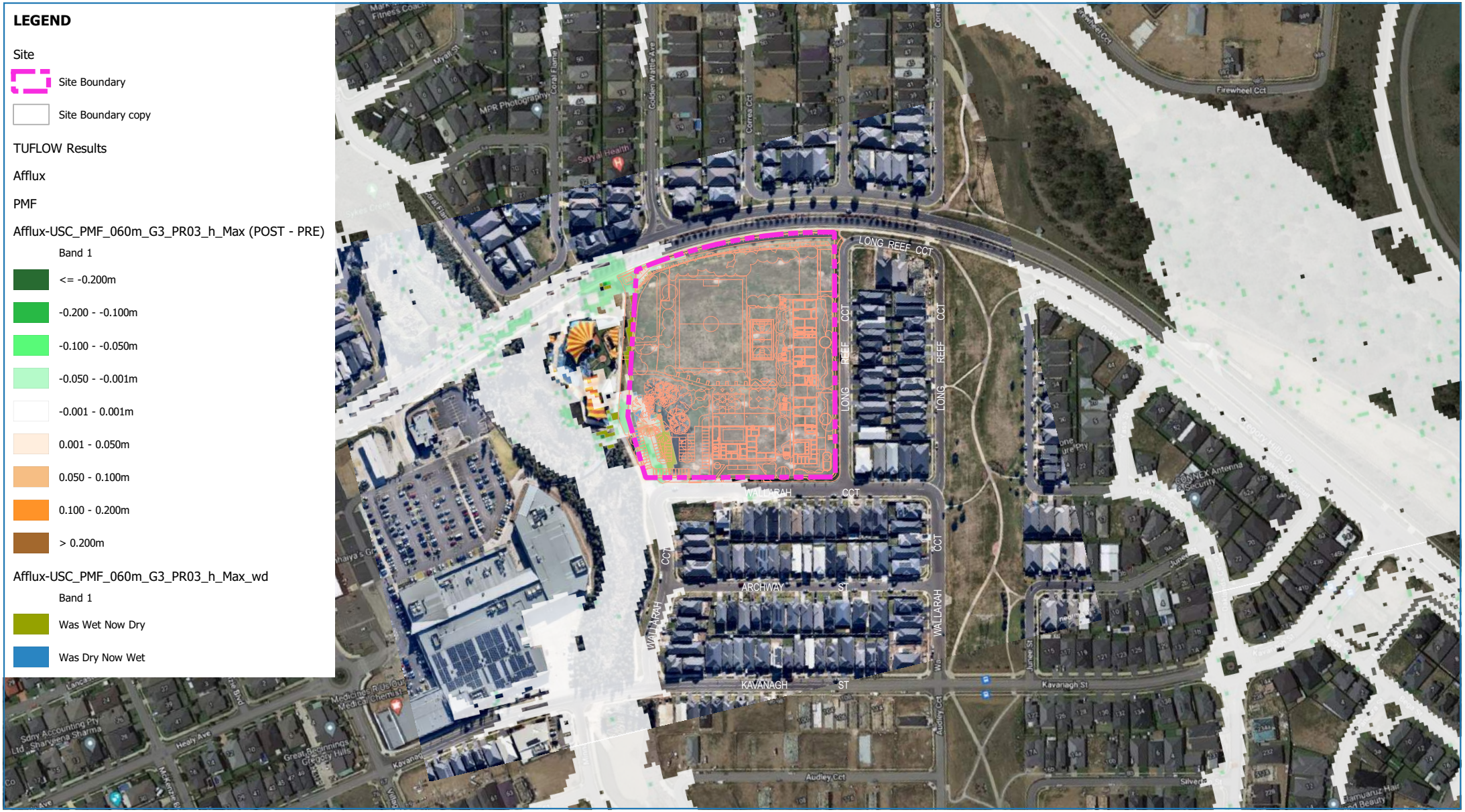

PROJECT NAME:	GREGORY HILLS PRIMARY SCHOOL	**REVISION:**	1
PROJECT NUMBER:	22061C	**DATE:**	28/09/2022
MAP TYPE:	AFFLUX - MAXIMUM FLOOD LEVEL COMPARISON	**CREATED BY:**	C.HUANG
MODEL SCENARIO:	POST MINUS PRE-DEVELOPMENT	**NOTE:**	
STORM EVENT:	PMF 60MIN DURATION		
HYDRAULIC MODEL:	USC_~e1~_~e2~_~s1~_PR03.tcf		

0 75 150 m

N

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