

Flood Impact and Risk Assessment

New Primary School in Worrigee

NSW Department of Education

21 April 2026





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ACKNOWLEDGEMENT OF COUNTRY

The Board and employees of Water Technology acknowledge and respect the Aboriginal and Torres Strait Islander Peoples as the Traditional Custodians of Country throughout Australia. We specifically acknowledge the Traditional Custodians of the land on which our offices reside and where we undertake our work.

We respect the knowledge, skills and lived experiences of Aboriginal and Torres Strait Islander Peoples, who we continue to learn from and collaborate with. We also extend our respect to all First Nations Peoples, their cultures and to their Elders, past and present.



Artwork by Maurice Goolagong 2023. This piece was commissioned by Water Technology and visualises the important connections we have to water, and the cultural significance of journeys taken by traditional custodians of our land to meeting places, where communities connect with each other around waterways.

The symbolism in the artwork includes:

- Seven circles representing each of the States and Territories in Australia where we do our work
- Blue dots between each circle representing the waterways that connect us
- The animals that rely on healthy waterways for their home
- Black and white dots representing all the different communities that we visit in our work
- Hands that are for the people we help on our journey



CONTENTS

1	INTRODUCTION	6
1.1	Activity Description	7
1.2	Activity Site	9
2	DETAILED SITE INFORMATION	10
2.1	Location Overview	10
2.2	Site Topography	10
3	ASSESSMENT METHODOLOGY	15
4	PROPOSED ACTIVITY DETAILS	16
5	OVERLAND FLOOD MODELLING	18
5.1	Hydrology	18
5.1.1	Storm Burst Rainfall	19
5.1.2	Pre-Burst Rainfall	19
5.1.3	Infiltration Losses	20
5.1.4	Climate Change Sensitivity	21
5.2	Hydraulics	21
5.2.1	Model Extent and Topography	21
5.2.2	Hydraulic Roughness	21
5.2.3	Boundary Conditions	22
5.2.4	Building Representation	22
5.2.5	Below Ground Stormwater Network	22
6	RESULTS	25
6.1	Critical Storm Duration	25
6.2	Overland Flood Behaviour	26
6.2.1	Catchment Extent	26
6.2.2	Site and Surroundings	27
6.2.3	Off-site Flood Impacts	29
7	DISCUSSION AND RECOMMENDATIONS	30
7.1	Finished Floor Level	30
7.2	Local Roads Flood Hazard	30
7.3	Flood Emergency Response Measures	33
7.3.1	Riverine Flood Event	33
7.3.2	Overland Flood Event	33



8	RISK ASSESSMENT	34
9	MITIGATION MEASURES	35
10	SIGNIFICANCE OF ENVIRONMENTAL IMPACTS	36
11	CONCLUSION	37

APPENDICES

Appendix A Existing Flood Behavior – Catchment Context
Appendix B Existing and Developed Flood Behaviour - Site Context
Appendix C Critical Storm Durations
Appendix D Afflux Maps

LIST OF FIGURES

Figure 1-1	Indicative Site Plan	8
Figure 1-2	Aerial Photograph	9
Figure 2-1	Site Location	11
Figure 2-2	Site Topography	12
Figure 2-3	Greenwell Point Road Frontage (Google Maps, April 2024), North-East corner looking to West	13
Figure 2-4	Worrigeer Road Frontage (Google Maps, March 2024), North-West corner looking to South	13
Figure 2-5	Booligal Road Frontage (Google Maps, April 2023), South-West corner looking to East	13
Figure 2-6	Regional Topography	14
Figure 4-1	Proposed Activity Details	17
Figure 5-1	ARR 2019 Conceptual Design Storm Pattern	18
Figure 5-2	TUFLOW Model Setup	23
Figure 5-3	Proposed Landform and Stormwater Network	24
Figure 6-1	ARR 2019 Hazard Categories	26
Figure 7-1	Local Roads - Flood Hazard Duration, PMF event – Location 1 PMF 15-min	31
Figure 7-2	Local Roads - Flood Hazard Duration, PMF event – Location 2 PMF 45-min	31
Figure 7-3	Local Roads - Flood Hazard Duration, PMF event – Location 3 PMF 30-min	32
Figure 7-4	Local Roads - Flood Hazard Duration, PMF event – Location 4 PMF 15-min	32

LIST OF TABLES

Table 1-1	Summary of Relevant Section of the Guidelines and EP&A Regulation	6
Table 5-1	ARR 2019 Datahub Parameters	18
Table 5-2	Intensity-Frequency-Duration (IFD) Rainfall Depths (mm)	19
Table 5-3	Transformational Pre-Burst Depths (mm)	20
Table 5-4	Infiltration Losses	20
Table 5-5	Probability Neutral Burst Initial Loss (mm)	20
Table 5-6	Mannings Roughness coefficient	22



Table 6-1	Critical Durations and Temporal Patterns	25
Table 6-2	Maximum Flood Characteristics across the Site	27
Table 7-1	Duration of PMF Flood Hazard (minutes)	33
Table 8-1	Risk Assessment	34
Table 9-1	Mitigation Measures	35



1 INTRODUCTION

This Flood Impact and Risk Assessment (FIRA) report has been prepared to accompany a Review of Environmental Factors (REF) for the Department of Education (the department) for the construction and operation of a New Primary School in Worrigee (the activity) under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act) and State Environmental Planning Policy (Transport and Infrastructure) 2021 (TI SEPP).

This document has been prepared in accordance with the Guidelines for Division 5.1 assessments (DPHI, December 2025) (the Guidelines). This report examines and takes into account the relevant environmental factors in the Guidelines and Section 170, Section 171 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) as outlined in Table 1-1.

Table 1-1 Summary of Relevant Section of the Guidelines and EP&A Regulation

Environmental factor	Division Factors for school developments Guidelines for Division 5.1 assessments - Consideration of environmental factors for health services facilities and schools, Attachment B, dated December 2025	Response	Report Section
a) the environmental impact on the community	(a2) impact post-construction (including from any development, activity, public-address systems and sirens, signage, events, hours of operation, or out of hours use of facilities, helicopter facilities, emergency facilities): - flooding impact, flood evacuation routes, changes to flood risk and patterns. - impact, during a flood or bushfire event, on existing infrastructure such as roads, etc.	A Flood Impact and Risk Assessment has been prepared to assess potential overland flood impact the proposed activity has on existing conditions within the site, in adjacent properties, local roads and downstream areas	6 Results 6.2 Overland Flood Behaviour
(h) long-term effects on the environment	(h1) Long-term effects on: - flood and bushfire behaviour, flooding and the flood plain, bushfire prone land. - climate change.	A review of potential impact due to climate change during the 1% AEP flood event has been undertaken in this FIRA	6 Results 6.2 Overland Flood Behaviour
(j) risk to the safety of the environment	(j1) whether the development will have adverse environmental impacts (flood or stormwater runoff, storm surge, bushfire, ongoing maintenance of landscaping within the Asset Protection Zone, contamination leak, wind speeds, extreme heat, urban heat, climate change adaptation) on the surrounding area, particularly in sensitive environmental, cultural areas or residential neighbourhoods. (j2) impacts on soil resources and related infrastructure and riparian lands on and near the site, soil erosion, salinity and acid sulphate soils, surface water resources (quality and quantity), hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses, groundwater resources.	A Flood Impact and Risk Assessment has been prepared to assess potential overland flood impact the proposed activity has on existing conditions within the site, in adjacent properties, local roads and downstream areas	6 Results 6.2 Overland Flood Behaviour 8 Risk Assessment

School Infrastructure has requested a flood impact risk assessment for the site which should include the following:

- Due Diligence Investigations on the Proposed Activity.



- Existing Flood Behaviour Assessment.
- Post Development Flood Behaviour.
- Flood Risk Emergency Assessment.

Water Technology previously completed an initial memo detailing the site flood affection. The memo outlined that the site remains unaffected within the riverine flood event up to the PMF, however, there was no information pertaining to overland flooding. As such, a Flood Impact and Risk Assessment (FIRA) was required reviewing overland flooding impacts on the site and surrounding area for both the existing case and potential development case scenario. This report outlines the hydraulic modelling and results for the overland flood review.

1.1 Activity Description

The activity is for the construction and operation of a New Primary School in Worrigeer under Chapter 2 and Chapter 3 of TI SEPP comprising:

- permanent classroom buildings including a support learning unit
- hall
- canteen
- covered outdoor learning area
- library
- administration
- sports field
- waste storage facility
- landscaping
- car parking
- public domain works
- infrastructure upgrades
- a capacity of 582 students

The proposed activity does not include the new public preschool or roundabout. The new public preschool is subject to a separate planning pathway and environmental assessment. The roundabout is to be delivered by Council. Figure 1-1 shows an indicative site plan and distinguishes the indicative extent of the proposed activity in relation to the new public preschool and roundabout.

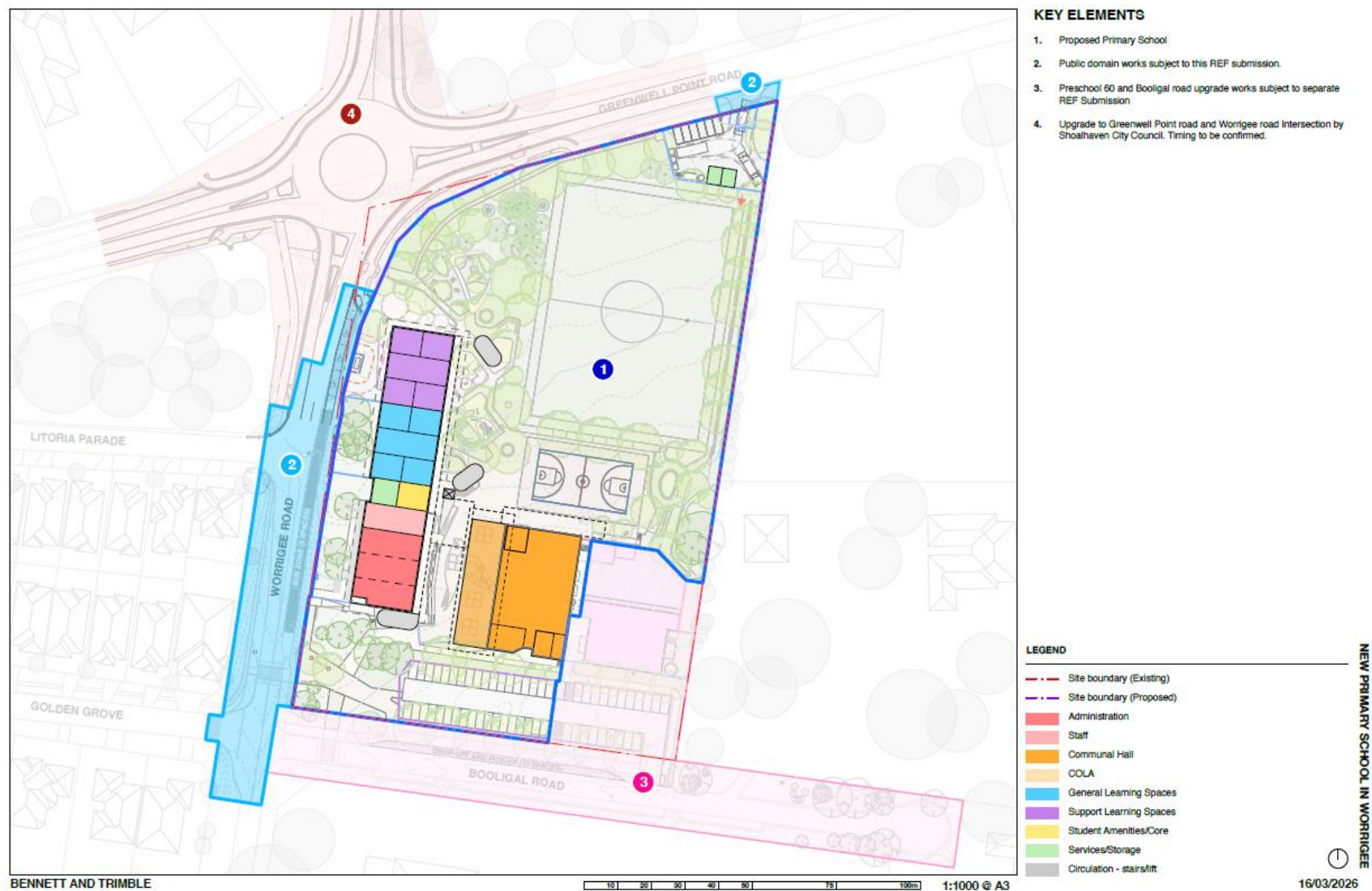


Figure 1-1 Indicative Site Plan



1.2 Activity Site

The site is known as 9 Worrigea Road, Worrigea. The site has a frontage of 125.23m to Greenwell Point Road, 149.87m to Worrigea Road and 114.89m to Booligal Road (including the preschool frontage). The site is legally described as Lot 1 in Deposited Plan 576975 and is 2 hectares (by title). Off-site works are also proposed in the adjacent road reserves. Figure 1-2 provides an aerial photograph of the site.



Figure 1-2 Aerial Photograph



2 DETAILED SITE INFORMATION

2.1 Location Overview

The site is located within the Shoalhaven City Council (SCC) Local Government Area (LGA) at 9 Worrigee Road, Worrigee NSW 2540. The site location overview is presented in Figure 2-1 and includes local catchment boundary (study catchment) and maximum riverine inundation extent (Shoalhaven River) during Probable Maximum Flood (PMF) event. The site is subject to the Shoalhaven Local Environmental Plan (LEP) and the Shoalhaven Development Control Plan (DCP).

2.2 Site Topography

The site has an area of two (2) hectares (ha) with terrain elevation ranges from approximately 8.0 metres (m) Australian Height Datum (AHD) to 11.5 m AHD. An average slope of approximately two (2) percent is observed across the site. The surrounding elevations show the site lies at high point with a slope to the southeast towards low lying land east of Worrigee. The review of the site elevation data is based on Light Detection and Ranging (LiDAR) survey dated by April 2011. The site topography is presented in Figure 2-2.

The subject site land use is Large Lot Residential (R5), and it currently contains a residential dwelling and ancillary structures (sheds, garage, swimming pool).

The site is bordered by low density residential property to the east and has frontages adjacent to Greenwell Point Road (regional road) to the north, Worrigee Road (local road) to the west and Booligal Road (local road) to the south, respectively. The typical existing site frontage is presented in Figure 2-3, Figure 2-4 and Figure 2-5 below.

The site lies approximately 700m south of the Crookhaven Creek which has an approximate bank height of 2.9m AHD at this location compared to the site found at an elevation of 11m AHD. Crookhaven Creek flows southeast towards Crookhaven River. Shoalhaven River is found approximately 3 kilometres (km) north of the site. Figure 2-6 presents topographical details across the areas surrounding the subject site.

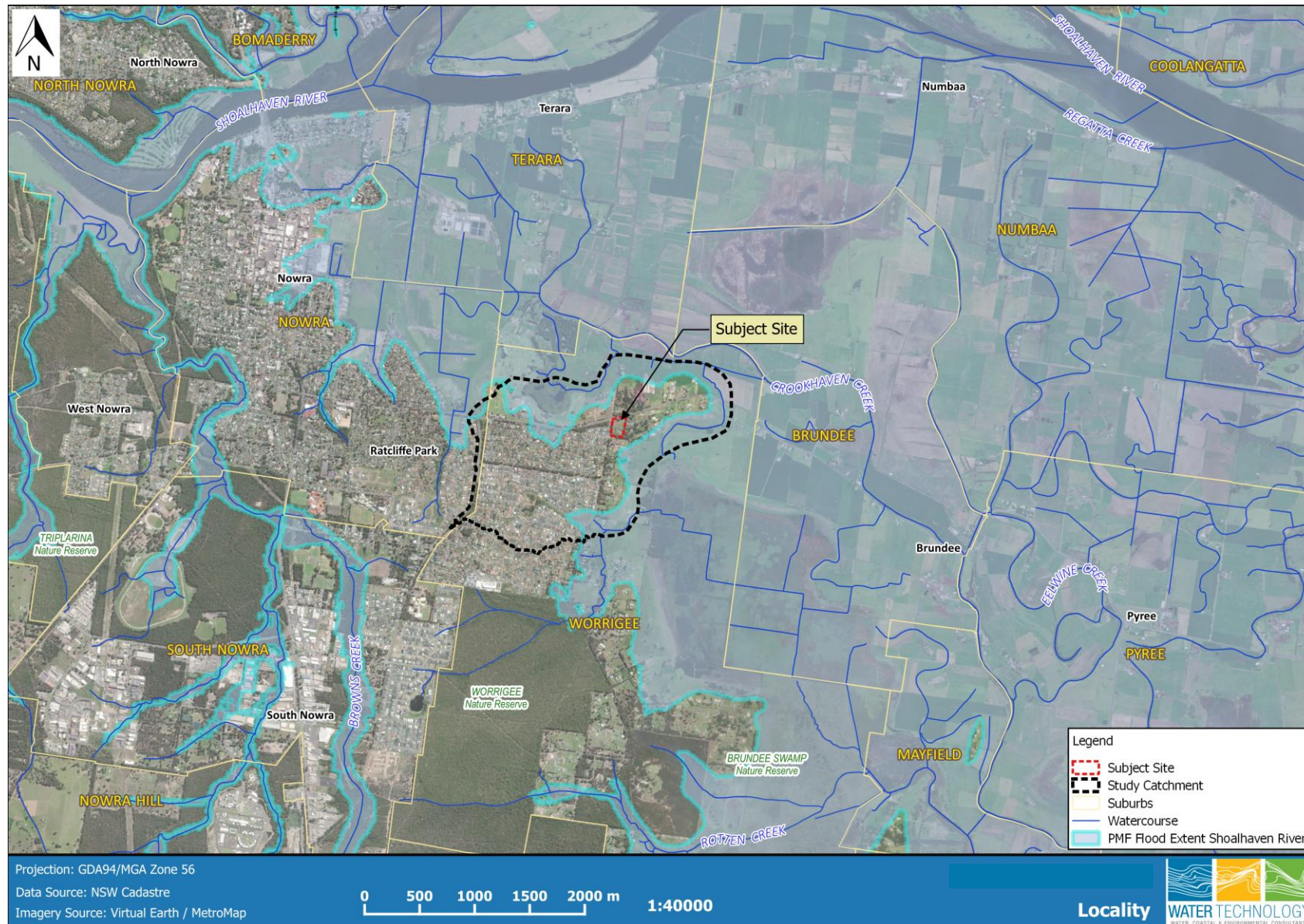


Figure 2-1 Site Location



Figure 2-2 Site Topography



Figure 2-3 Greenwell Point Road Frontage (Google Maps, April 2024), North-East corner looking to West

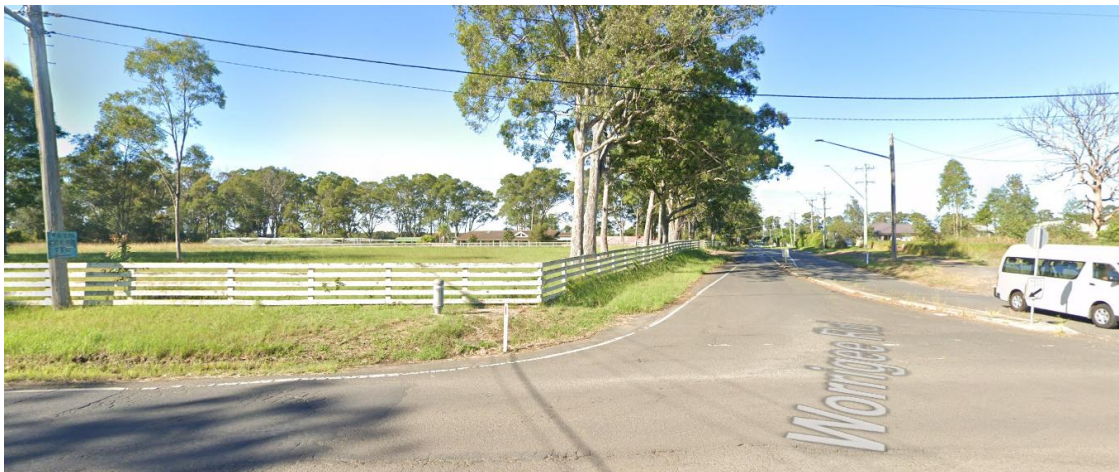


Figure 2-4 Worrigeer Road Frontage (Google Maps, March 2024), North-West corner looking to South



Figure 2-5 Booligal Road Frontage (Google Maps, April 2023), South-West corner looking to East

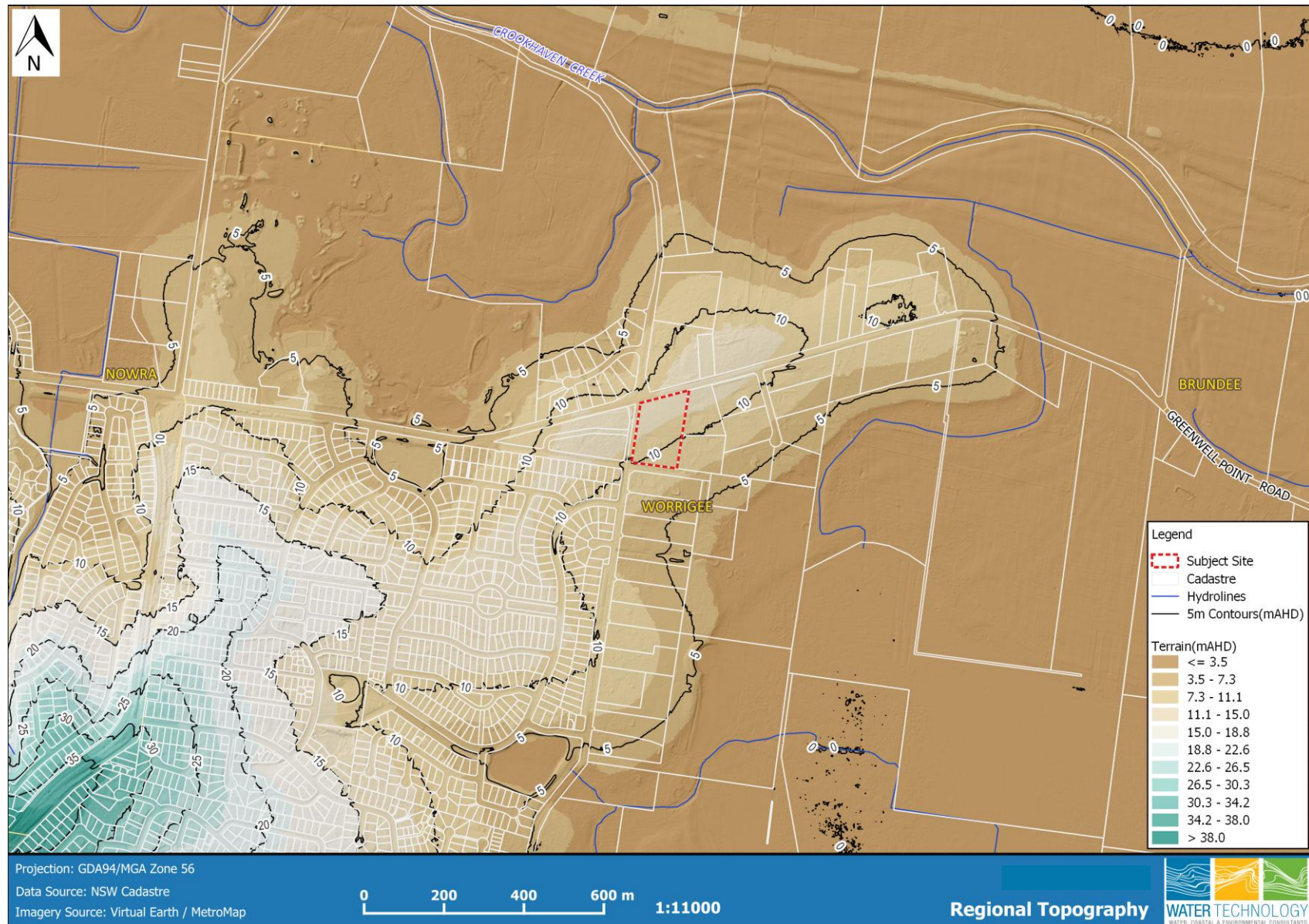


Figure 2-6 Regional Topography



3 ASSESSMENT METHODOLOGY

This assessment has been undertaken generally using the following approach:

- Desktop review of available information including LiDAR and survey data, stormwater infrastructure, land use classifications and design plans.
- Preparation of a Rainfall-on-Grid (RoG), Existing Case two-dimensional (2D) TUFLOW hydraulic model to quantify the existing overland flood behaviour across the local catchment extent.
- Modification of the Existing Case TUFLOW hydraulic model to include the proposed activity layout and terrain, creating the Developed Case scenario.
- Simulation of the Existing and Developed Case models for the 5%, 1%, 1% Climate Change, 1 in 500, 1 in 2000 Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF) design flood events.
- Review of the Existing and Developed case modelling results across the site and local catchment extent.
- Undertake a comparison of pre-to-post overland flood behaviour during the modelled design flood events to understand any potential flood impacts created by the proposed activity on the existing flood behaviour on-site, in adjacent properties and downstream areas.

The assessment has been prepared with consideration to the following guidelines, policies, reports and plans:

- Australian Rainfall and Runoff 2019 Guidelines (ARR 2019).
- Flood Risk Management Manual – The Management of Flood Liable Land (NSW Government June 2023 - “The Manual”).
- Shoalhaven Development Control Plan (DCP, 2014).
- Shoalhaven Local Environmental Plan (LEP, 2014).
- Planning Circular PS 24-001 (NSW DPI, 2024).
- Detailed topographic survey prepared by Stantec (12/05/2025).
- Architectural plans prepared by Bennet and Trimble (16/03/2026).
- Civil design plans prepared by Indesco (19/01/2026).
- Civil design plans prepared by Tonkin (29/01/2026)
- Initial Flood Review – Nowra New Public School (WT, Sep 2025)
- Lower Shoalhaven River Flood Study (Cardno, 2022)



4 PROPOSED ACTIVITY DETAILS

The existing site will be redeveloped to form two educational establishments: New Primary School in Worrigee (PS) and Worrigee Preschool (subject of a separate planning pathway).

The activity consists of:

- Demolition of existing dwelling and ancillary structures.
- Construction of two school facilities:
 - One-storey building (Communal Hall).
 - Three-storey split-level building:
 - Lower level - Administration, Staff space
 - Upper level - General Learning Spaces (GLS), Support Learning Units (SLU).
- Construction of opens space play areas and sport courts.
- Construction of access driveways, carparking, pedestrian footpaths and associated landscaping.
- Construction of stormwater management infrastructure including on-site stormwater detention.
- As part of the activity, Worrigee Road across the frontage of the site will also be upgraded.

The proposed activity architectural plan is shown in below Figure 4-1.

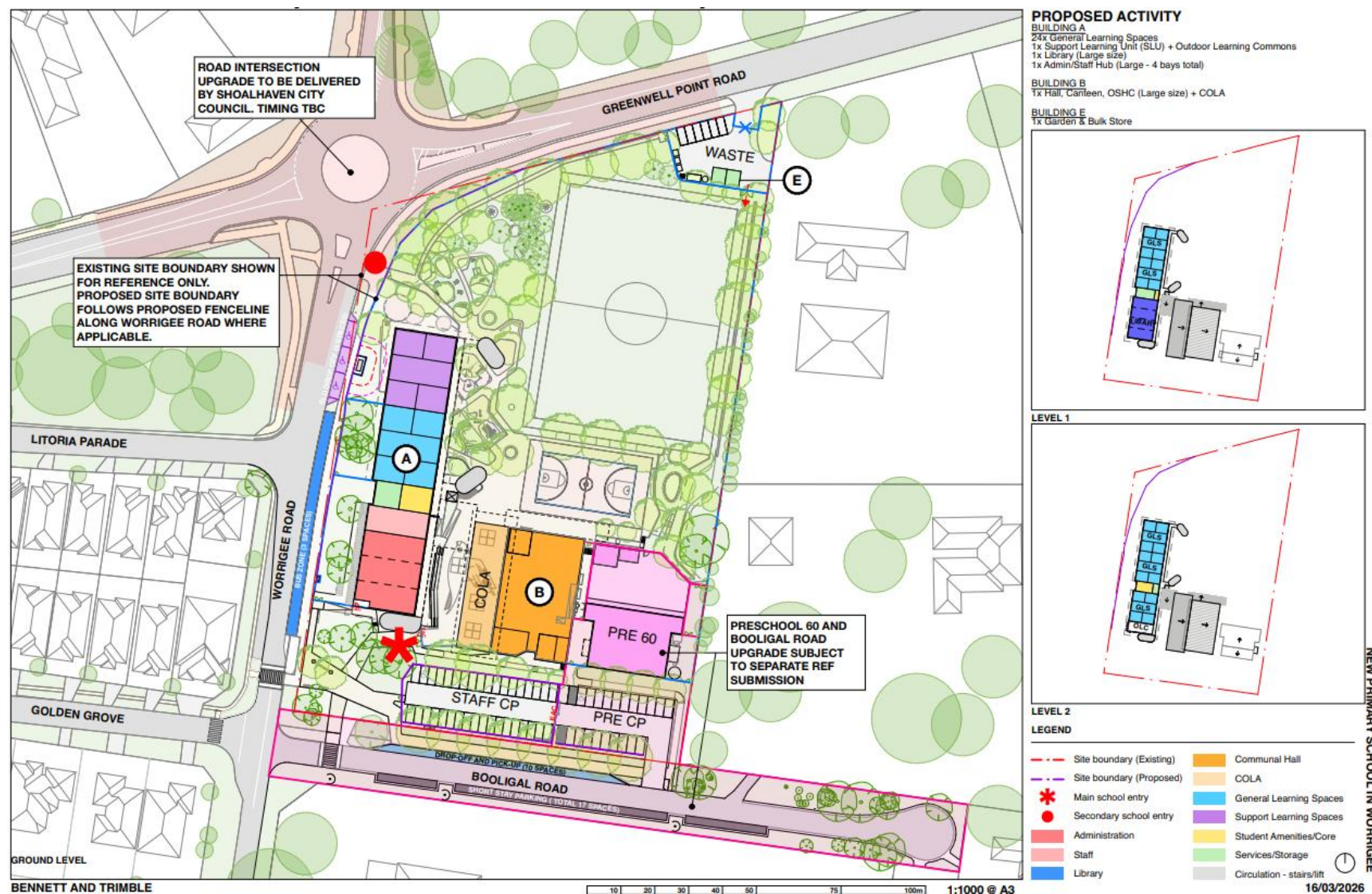


Figure 4-1 Proposed Activity Details

5 OVERLAND FLOOD MODELLING

Detailed two-dimensional hydraulic modelling was undertaken using the TUFLOW hydrodynamic modelling software. The latest TUFLOW version 2025-0-0 with Heavy Parallel Compute (HPC), Graphic Processing Unit (GPU) solver was used for the assessment. Presented below are hydraulic model parameters used in preparation of the TUFLOW model.

5.1 Hydrology

Direct Rainfall (DR) or Rainfall-on-Grid (RoG) hydrology has been adopted for this assessment. Applying rainfall directly to the two-dimensional grid is expected to provide the most realistic representation of the distributed nature of the runoff based on the terrain when compared to a traditional lumped hydrology method.

As per the latest ARR 2019 guidelines, initial loss, continuing loss, pre-burst and storm burst rainfall portions of the entire storm event have been considered as part of this assessment as shown in the below Figure 5-1.

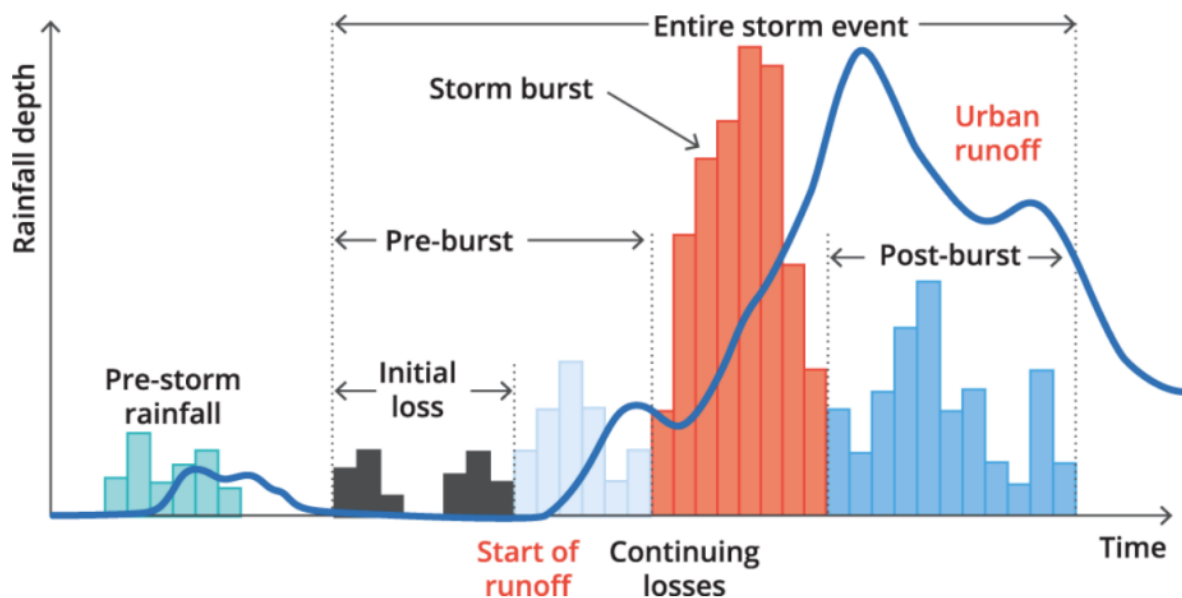


Figure 5-1 ARR 2019 Conceptual Design Storm Pattern

The design rainfall depths have been obtained from the Bureau of Meteorology (BoM) while the accompanying rainfall temporal patterns, pre-burst values, infiltration losses and areal reduction factors were obtained from the ARR 2019 Data Hub. Parameters were obtained near the centroid of the catchment and are presented in Table 5-1.

Table 5-1 ARR 2019 Datahub Parameters

Parameter	Value
Longitude	150.638500
Latitude	-34.891300
River Region	Division, Southeast Coast
River Name	Shoalhaven River



Parameter	Value
ARF parameters	SE Coast
Storm Initial Losses (mm)	37.0 mm
Storm Continuing Losses (mm/h)	4.0 mm/hr
Temporal Patterns	Southern Slopes (Vic/NSW)

5.1.1 Storm Burst Rainfall

ARR 2019 recommends the use of the storm ensemble method using 10 temporal patterns for each storm duration. For this investigation, storm durations ranging from the 10-minute through to 180-minute events were simulated for the 5%, 1%, 1 in 500, 1 in 2000 AEP design storm events. Areal Reduction Factors (ARF) were not applied to design rainfall due to the size of the local catchment.

Similarly, durations ranging from the 15-minute to 180-minute were reviewed for the PMF event. The PMF design storm event rainfall depth and temporal pattern were estimated using the Generalised Short-Duration Method (BoM 2003).

A uniform spatial pattern was adopted for all modelled events.

A summary of the burst rainfall depths is listed in Table 5-2 below.

Table 5-2 Intensity-Frequency-Duration (IFD) Rainfall Depths (mm)

Duration (min)	5% AEP	1% AEP	1 in 500 AEP	1 in 2000 AEP	PMF
10	23.3	32.5	41.2	47.6	-
15	29	40.4	51	58.8	149.6
20	33.1	46.2	58.1	67.2	-
25	36.4	50.8	63.8	73.9	-
30	39.2	54.6	68.6	79.5	219.5
45	45.8	63.5	79.8	92.7	279.2
60	51.1	70.4	88.5	103	329.2
90	60.1	82	103	120	409.1
120	67.9	92.1	115	134	468.8
150	-	-	-	-	518.4
180	82	110.1	137	159	558.7

5.1.2 Pre-Burst Rainfall

The latest NSW Specific Transformational pre-burst rainfall depths have also been used as part of the investigation. Modelled pre-burst rainfall values are outlined in Table 5-3 below.

As a conservative approach, pre-burst depth of 35.1 mm was considered for the 1 in 500 and 1 in 2000 AEP flood events for all modelled durations. Pre-burst for the PMF event was not considered as initial infiltration losses are also excluded from the analysis.



Table 5-3 Transformational Pre-Burst Depths (mm)

Duration (min)	5% AEP	1% AEP	1 in 500 AEP	1 in 2000 AEP
10	34.8	35.1	35.1	35.1
15	33.7	34.1	35.1	35.1
20	32.6	33.1	35.1	35.1
25	31.5	32.2	35.1	35.1
30	30.5	31.2	35.1	35.1
45	27.18	28.3	35.1	35.1
60	23.9	25.4	35.1	35.1
90	26.9	28.2	35.1	35.1
120	25.1	28.2	35.1	35.1
180	25.5	29.8	35.1	35.1

5.1.3 Infiltration Losses

A summary of the Initial (IL) and Continuous Losses (CL) used in this assessment is presented in Table 5-4 below. The latest ARR 2019 and Office of Environment and Heritage (OEH) guidelines recommend reducing the continuing loss values provided by the ARR Data Hub, by a factor 0.4 for un-calibrated models within NSW. As such, modelled continuing losses have been reduced accordingly. For the PMF event, zero initial and continuing loss was adopted.

Table 5-4 Infiltration Losses

Loss Parameter	Value	Comments
ARR Data Hub IL (mm)	37.0	
ARR Data Hub CL (mm/hr)	4.0	
Modelled IL (mm)	Variable	Probability Neutral Burst Initial Loss (Refer to Table 4-5 below)
Modelled 1 in 500 and 1 in 2000 AEP IL (mm)	1.9	
Modelled CL (mm/hr)	1.6	0.4 factor applied as per ARR 2019 and OEH guidelines
Modelled Impervious IL (mm)	1.5	
Modelled Impervious CL (mm/hr)	0.0	
Modelled PMF Pervious and Impervious IL (mm)	0.0	
Modelled PMF Pervious and Impervious CL (mm/hr)	0.0	

The Probability Neutral Burst Initial Losses used in the modelling are presented in Table 5-5 below. The initial loss was varied for each storm by subtracting the pre-burst values from the ARR Data Hub initial loss value.

Table 5-5 Probability Neutral Burst Initial Loss (mm)

Duration (min)	5% AEP	1% AEP	1 in 500 AEP	1 in 2000 AEP
10	2.2	1.9	1.9	1.9



Duration (min)	5% AEP	1% AEP	1 in 500 AEP	1 in 2000 AEP
15	3.3	2.9	1.9	1.9
20	4.4	3.9	1.9	1.9
25	5.5	4.8	1.9	1.9
30	6.6	5.8	1.9	1.9
45	9.8	8.7	1.9	1.9
60	13.1	11.6	1.9	1.9
90	10.1	8.8	1.9	1.9
120	11.9	8.8	1.9	1.9
180	11.5	7.2	1.9	1.9

5.1.4 Climate Change Sensitivity

Climate Change sensitivity analysis for the 1% AEP event has been undertaken in this investigation using the latest ARR2019 advice on climate change. A moderate projection for the 2100 planning horizon has been used with an increase factor of 1.2.

The 1% AEP climate change rainfall depth corresponds to the 1 in 500 AEP event current climate conditions. The projected 20% rainfall increase is higher than the CSIRO estimate of 16% for RCP8.5 in 2100 and generally consistent with the ARR2019 SSP3-7.0 medium reference scenario (double CO₂ emission) in 2100 for short storm durations.

5.2 Hydraulics

5.2.1 Model Extent and Topography

The site is located on relatively high ground compared to the surrounding terrain, as a result, there is minimal upstream catchment. The flood model domain covers approximately 2.84 km² covering the local upstream and adjacent local catchments. TUFLOW model terrain was developed using a combination of one (1) m resolution Digital Elevation Model (DEM) from the LiDAR survey flown in 2011, detailed topographical survey and a design surface for developed conditions. A one-metre model grid size was adopted in this flood assessment as it was determined to provide a reasonable balance between model run time and overland flow behaviour across the study catchment. Figure 5-2 below presents the model extent topography.

The study catchment predominantly falls from the south to the north and from the east to the west and directs runoff towards the Crookhaven Creek floodplain. The catchment terrain elevations range from approximately 37.5 m AHD to 1.5 m AHD with an average slope of approximately three (3) percent observed across the catchment area. The land use typically includes residential lots, sealed roads, open space and grassland.

Two large council-managed detention basins, which manage runoff from nearby residential allotments (known as Worrigee Residential Area), are located within the model extent at:

- Greenwell Point Road frontage, upstream; and
- Worrigee Road frontage, upstream.

5.2.2 Hydraulic Roughness

The hydraulic model used Manning's 'n' to represent the surface hydraulic roughness, determining how land use impacted overland flow. Amendments to the roughness spatial distribution were made using aerial imagery



and engineering judgement. highlights the distribution of material types across the modelled domain. The roughness values (Table 5-6) were taken from the existing Lower Shoalhaven River hydraulic model developed for Council to provide consistency across the modelling approach.

Table 5-6 Mannings Roughness coefficient

Land Use	Manning's 'n' Value
Open space, grassland	0.045
Sealed roads, concrete surfaces	0.018
Road reserves	0.030
Roofs	0.018
Residential rural	0.070
Residential medium density	0.080
Residential high density	0.090
Wetlands	0.060
Dense Vegetation	0.075
Open Water	0.020

5.2.3 Boundary Conditions

Inflows into the model were generated using the RoG method. Rainfall was applied directly to the two-dimensional grid with rainfall losses removed from the model based on the land use assigned to each grid cell. This approach is particularly beneficial for overland flow based studies. Direct rainfall is assumed to be spatially uniform across the entirety of the catchment.

A series of stage-discharge (HQ) curves were applied to sections of the model domain perimeter to remove flow from the model. Each of these discharge curves was automatically generated by TUFLOW based on a slope derived from local ground topography.

5.2.4 Building Representation

Buildings were incorporated into the model based on building footprints and were delineated using high resolution aerial imagery. A low roughness ("roofs" as shown in the above Table 3-1) with the topography raised 300 mm across the building footprint was used where upstream flow through buildings was expected. This allows rainfall falling directly onto the building footprints to run off quickly while still providing the appropriate representation of the building blockage.

5.2.5 Below Ground Stormwater Network

Below ground stormwater structures were included into the TUFLOW model as one-dimensional (1D) elements. Major culverts were entered into the model based on an analysis of the latest aerial imagery, high resolution terrain, Google and Apple Maps street photography. All street stormwater drainage (underground pits and pipes) was conservatively assumed 100% blocked. A blockage factor of 50% was applied to the proposed site stormwater infrastructure (pit and pipe network). Two OSD tanks were incorporated into the developed case scenario, with capacities of 60 cubic metres (m³) and 50 m³ respectively. Figure 5 3 presents the modelled design surface and stormwater layout.

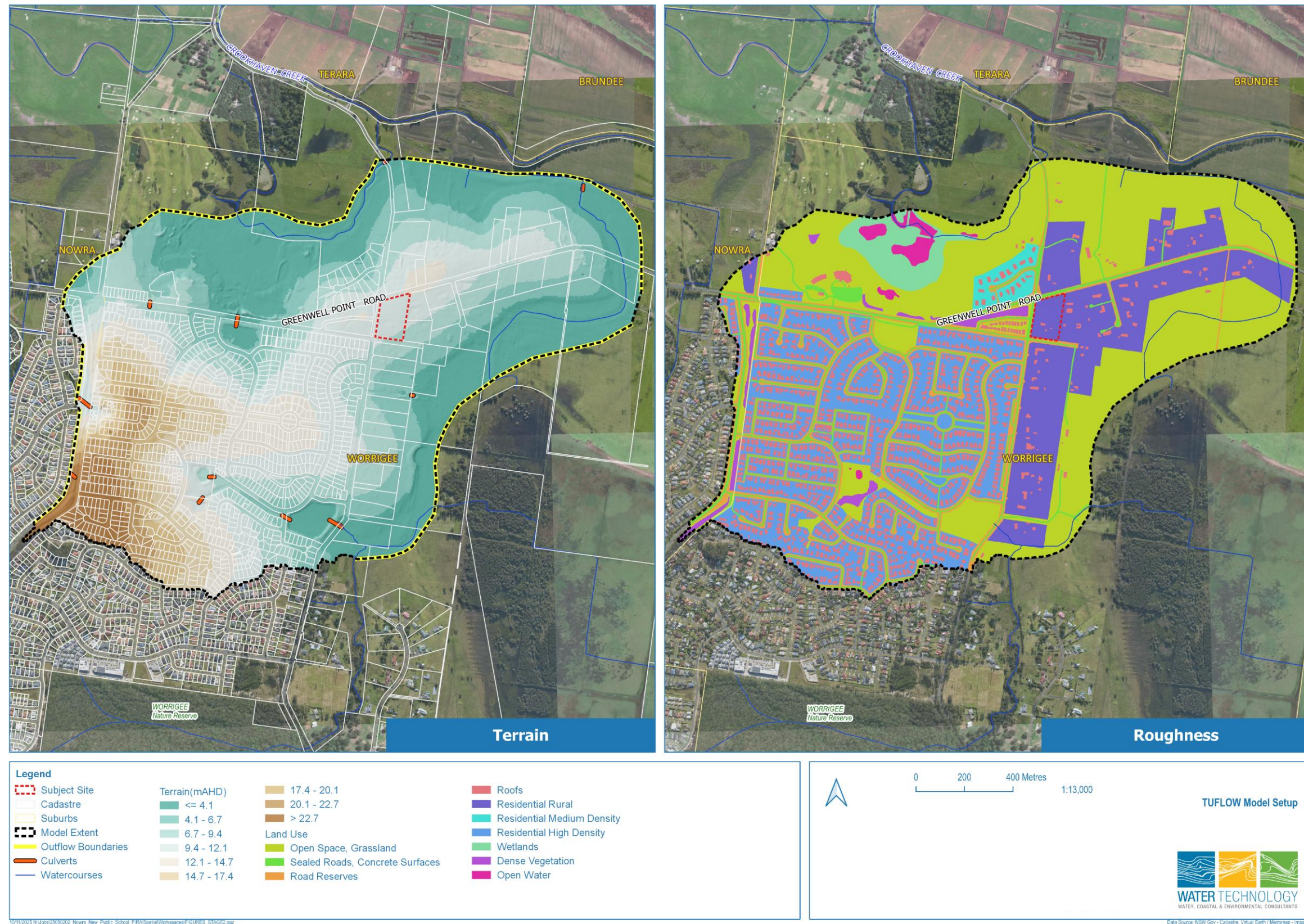


Figure 5-2 TUFLOW Model Setup



Figure 5-3 Proposed Landform and Stormwater Network



6 RESULTS

The maximum flood level, depth, velocity and hazard for each modelled AEP were determined across the modelled event durations. Note that flood depths less than 50 mm were filtered from all surface water results.

6.1 Critical Storm Duration

The critical storm duration is typically defined as the duration of rainfall which produces the greatest flood extent and flood depth. Critical duration can vary due to several factors, including topography, land use, size of the upstream catchment and nature of the drainage system.

The latest ARR 2019 guidelines were considered to determine the critical storm durations across the study catchments:

- Selection of the median flood elevation of the ten temporal patterns (TP) for each storm duration.
- Selection of the duration that produces the maximum median flood elevation for each AEP.

All ten rainfall patterns for the standard 10, 15, 20, 25, 30, 45-minute, 1, 1.5, 2, 3-hour durations were entered into the hydraulic model to determine the critical storm duration for the 5%, 1%, 1 in 500 and 1 in 2000 AEP flood events. Similarly, the 15, 30, 45-minute and 1, 1.5, 2, 2.5 and 3-hour durations were used to determine the critical duration for the PMF event.

Table 6-1 presents the representative critical durations and rainfall temporal patterns modelled during the existing case scenario for the 5%, 1%, 1 in 500, 1 in 2000 AEP and PMF design flood events across the study catchment extent.

Table 6-1 Critical Durations and Temporal Patterns

5% AEP	1% AEP	1 in 500 AEP	1 in 2000 AEP	PMF
15min TP6	10min TP6	10min TP6	10min TP6	15min
15min TP8	20min TP3	20min TP5	20min TP6	30min
20min TP8	20min TP7	20min TP7	20min TP7	45min
25min TP7	20min TP8	20min TP8	180min TP5	
30min TP3	90min TP8	180min TP5		
30min TP8	180min TP6			
45min TP9				
90min TP3				
180min TP5				

Figures in Appendix C present spatial distribution of the critical durations and rainfall temporal patterns across the study catchment.



6.2 Overland Flood Behaviour

6.2.1 Catchment Extent

Modelled (maximum envelopes) flood depth, velocity and hazard for the 5%, 1%, 1% Climate Change, 1 in 500, 1 in 2000 AEP and PMF design flood events for the existing conditions across the model extent are presented in figures in Appendix A.

Flood hazard conditions have been assessed based on the latest ARR 2019 guidelines and Australian Institute of Disaster Resilience (AIDR) hazard categories presented in Figure 6-1 below.

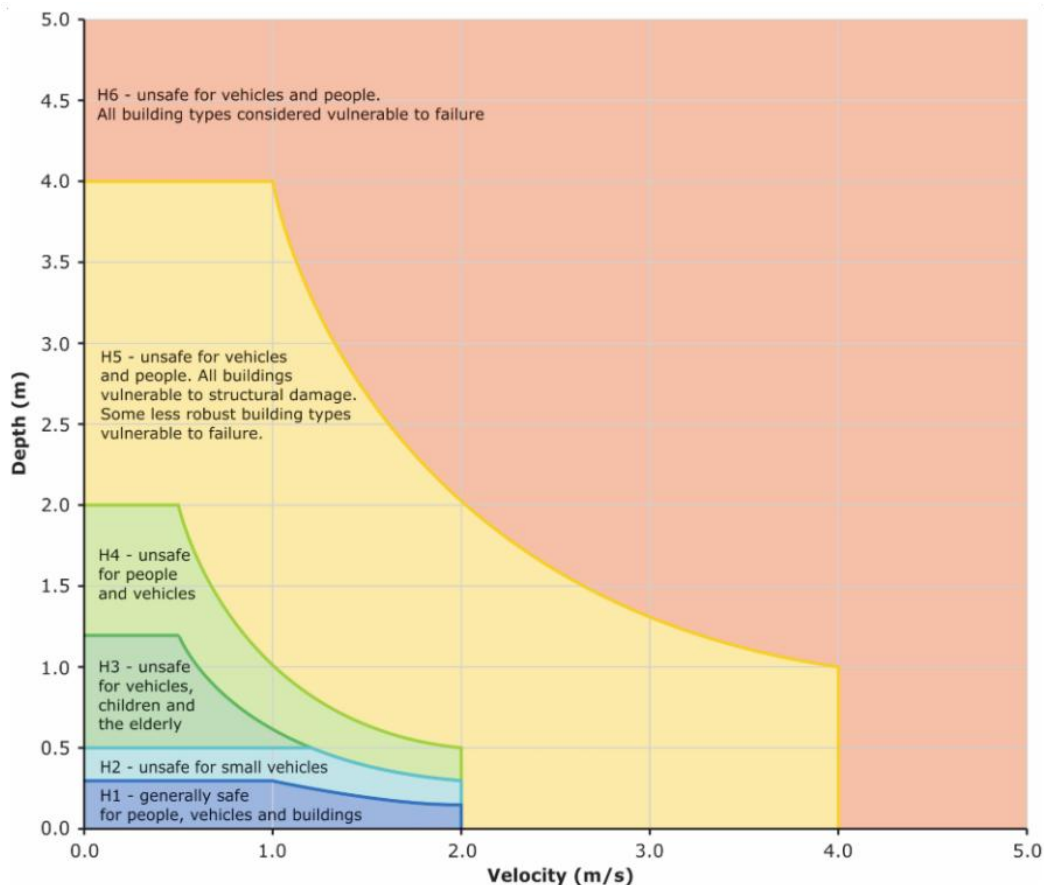


Figure 6-1 ARR 2019 Hazard Categories

Modelling indicates that local roads across the study catchment, are potentially be inundated and non-trafficable (H3 to H5 flood hazard categories) for a short period of time (approximately up to 30 minutes) during the extreme 1 in 2000 AEP and PMF overland flood events. These include:

- Greenwell Point Road
- Worrigea Road
- Old Southern Road
- Peppermint Drive
- Reyleigh Drive
- Robinia Way
- Illawarra Circuit
- Sullivan Street
- Sophia Road
- Almond bark Road
- Riveroak Road
- Juniper Place



Modelling also indicates that during the very rare 1% and 1 in 500 AEP overland flood events, the following local roads exceed the “unsafe for vehicles and pedestrians” (H3 to H5 flood hazard categories):

- Riveroak Road
- Sullivan Street
- Sophia Road
- Reyleigh Drive
- Peppermint Drive
- Robinia Way
- Juniper Place

6.2.2 Site and Surroundings

Modelled (maximum envelopes) flood depth, velocity and hazard for the 5%, 1%, 1% Climate Change, 1 in 500, 1 in 2000 AEP and PMF design flood events for the existing and developed conditions across the site and the vicinity are presented in Appendix B.

A summary of the existing and developed flood characteristics (peak values) within the site boundary are listed in Table 6-2 below.

Table 6-2 Maximum Flood Characteristics across the Site

Flood Event	Existing Conditions			Developed Conditions		
	Depth(m)	Velocity(m/s)	Hazard	Depth(m)	Velocity(m/s)	Hazard
5% AEP	0.17	0.46	H1	0.18	0.78	H1
1% AEP	0.21	0.52	H1	0.23	0.88	H1
1% AEP Climate Change	0.22	0.57	H1	0.26	1.06	H1
1 in 500 AEP	0.23	0.59	H1	0.27	1.07	H1
1 in 2000 AEP	0.24	0.62	H1	0.28	1.12	H1
PMF	0.31	0.78	H1	0.42	1.33	H2

The hydraulic model results indicate that the site is slightly affected by shallow overland flooding and remains predominantly flood-free during events up to the 1 in 2000 AEP for both existing and developed conditions.

The modelling results also indicate that the PMF event causes partial inundation of the site, covering a significantly larger area than the more frequent modelled events for both existing and developed conditions.

6.2.2.1 Existing Conditions

- 5% AEP
 - The site is slightly affected within the 5% AEP event, with a minor flow path visible from the eastern boundary to south. There are some small areas of ponding around the existing buildings on the site reaching depths of up to 0.17 m and velocities less than 0.5 m/s. H1 flood hazard is observed across the site.
 - Greenwell Point Road and Worrigee Road intersection experiences localised flooding within the 5% AEP event reaching depths of up to approximately 0.35 m, while flood depth to the south-east corner of the site on Booligal Road reach up to 0.3 m but displays velocities of up to 1.0 m/s.
- 1% AEP



- The 1% AEP event shows a slightly larger flood extent on the site compared to the 5% AEP event; however, flood depths and velocities remain generally less than 0.21 m and 0.5 m/s, respectively. The site remains at a hazard category of H1.
- Flood depths and velocities across Greenwell Point Road, Worrigee Road and Booligal Road also increase with some areas of up to approximately 0.40 m visible and a larger extend of velocity up to 1.8 m/s. Hazard rating within Worrigee Road to the south reaches up to H2.
- 1 in 500 AEP
 - Results from the 1 in 500 AEP event led to a marginally larger flood extent across the site compared to the 1% AEP event. Flood depths and velocities on the site generally remain low, with depths below 0.23 m and velocities under 0.6 m/s. H1 hazard remains unchanged.
 - Across Greenwell Point Road, Worrigee Road and Booligal Road both flood depths and velocities increase, with depths of up to 0.40 m and velocities reaching approximately 1.9 m/s in location south on Worrigee Road. Hazard ratings within the interchange between Rayleigh Drive and Worrigee Road reach up to H5 while Greenwell Point Road reaches a maximum of H2 north-west of the site.
- 1 in 2000 AEP
 - The 1 in 2000 AEP results demonstrate a larger flood extent compared to the 1 in 500 AEP with flood depth and velocities remain typically less than 0.24 m and 0.6 m/s, respectively. The site remains at H1 hazard category.
 - Flood depths and velocities across Greenwell Point Road and Worrigee Road also increase in some areas of up to 0.40 m visible and a larger extend of velocity up to 2.0 m/s. Hazard categories within the interchange between Rayleigh Drive and Worrigee Road and Greenwell Point Road remain unchanged at H5 and H2, respectively.
- PMF
 - The flood extent during the PMF flood event shows a notable increase over the previous flood events detailed. The site remains affected with larger extent covering flow paths from north to south. Depths on the site remain low, with a maximum of 0.31 m present however velocities show a slight increase to a maximum of 0.8 m/s.
 - Greenwell Point Road and Worrigee Road experience larger flood extents within this event with a large span of 0.50 m flood depths present near the school site. Hazard categories within the intersection of Rayleigh Drive with Worrigee Road and Greenwell Point Road remain unchanged at H5 and H2, respectively.

6.2.2.2 Developed Conditions

The presented developed conditions modelling results show generally a reduction in flood extent across the site for all modelled design flood events.

- 5% AEP - the site is predominantly flood-free. There are localised areas of ponding generally in the proposed swale along the south-eastern boundary of the site reaching depths of up to 0.18 m and velocities less than 0.78 m/s.
- 1% AEP to 1 in 2000 AEP - the site is subject to low-level, localised inundation, with overland flow ponding generally around the proposed building footprints, games court and along the eastern site boundary. The peak flood depth and velocity slightly increase across the site from more to less frequent flood events (refer to Table 5-2 for values). H1 flood hazard is observed across the site.
- PMF – the site is impacted by minor overland flow, with localised ponding anticipated around the proposed structures, games court, sport field, carparking and along the eastern boundary of the site. The modelled flood depth and velocity are typically less than 0.40 m and 1.3 m/s, respectively. H1 flood hazard is



generally observed across the site. Flood hazard category of H2 is also observed in the proposed swale along the eastern boundary of the proposed pre-school. This hazard is localised within the swale, minor in extent and not expected to create a significant adverse impact in this location.

No significant changes in flood characteristics are observed across the local roads surrounding the site under developed conditions for all modelled events.

6.2.2.3 Climate Change Sensitivity

A 20% increase in rainfall intensity has been considered for climate change impact for the 1% AEP event. The sensitivity modelling indicates the projected rainfall intensity increase due to climate change will not result in a significant impact on overland flood behaviour. Given there is minimal impact on the site and surrounding area in the existing conditions, the increase in rainfall intensity is unlikely to affect the proposed activity.

6.2.3 Off-site Flood Impacts

Figures in Appendix D present the impact to maximum flood levels for all modelled design flood events. The presented results show only minor changes in flood levels are expected to occur during all modelled events downstream of the proposed activity:

- A decrease in flood levels is typically observed across private properties and road reserves adjacent to the site.
- During PMF event, localised increases in flood level of up to approximately 15 mm are observed in Worrigee Road at the south-west corner of the site and on the private property adjacent to the proposed preschool.

These increases are not considered significant in extent and magnitude as there are no changes in the existing flood hazard conditions and flow velocity regime. This is not expected to create a significant adverse impact in these locations.

Based on the above, the proposed activity is not expected to create a significant adverse impact on overland flow behaviour in adjacent private properties or downstream areas.



7 DISCUSSION AND RECOMMENDATIONS

7.1 Finished Floor Level

A review of the Shoalhaven City Council DCP 2014 (Chapter G9: Development on Flood Prone Land) has been undertaken to determine what the most appropriate Finished Floor Level (FFL) is for the proposed buildings.

As per Schedule 1 (Land Use Categories) of the DCP, schools, childcare centres and educational establishments fall under land use Category H - "Buildings and activities requiring special evacuation consideration". According to Schedule 2 (Flood Related Development Controls) of the DCP, Category H land uses are permitted on areas above Flood Planning Level (FPL) but below the PMF level. The proposed activity is outside Council's Flood Planning Area (FPA) and unaffected by riverine (mainstream) flooding but is located within a low-risk overland PMF extent.

Based on the above, the proposed activity has been classified as Category H:

- Development Purpose - Building and activities require special evacuation consideration
- Land Use Type - Educational establishment.
- Outside flood planning area (above the flood planning level but below the PMF) - FFL must be built to the PMF level.

Based on the activity classification, the PMF overland flood level is recommended as an FFL for the proposed school buildings across the site:

- One-storey building (Communal Hall) – FFL equal to or greater than 10.45 m AHD.
- Three-storey split-level building:
 - Administration, Staff space – FFL equal to or greater than 11.22 m AHD
 - GLS, SLU – FFL equal to or greater than 11.52 m AHD.

The detailed design ensures that sufficient drainage and grading provision provided along the western side of the split-level building to manage overland stormwater flows away from the building footprint.

7.2 Local Roads Flood Hazard

The following figures (Figure 7-1 - Figure 7-4) presents PMF flood hazard durations and rate of rise at key local road locations across the study catchment. The results presented in the below figures are based on the critical storm durations considered herein. Four locations have been considered for the assessment (Refer Figure A6-3 of Appendix A for locations), as follows:

- Location 1 - Intersection of Worrigee Road and Rayleigh Drive, PMF 15-minute Storm Duration.
- Location 2 - Worrigee Road downstream Detention Basin, PMF 45-minute Storm Duration.
- Location 3 - Greenwell Point Road downstream Detention Basin, PMF 30-minute Storm Duration.
- Location 4 - Intersection of Old Southern Road and Carrington Park Drive, PMF 15-minute Storm Duration.

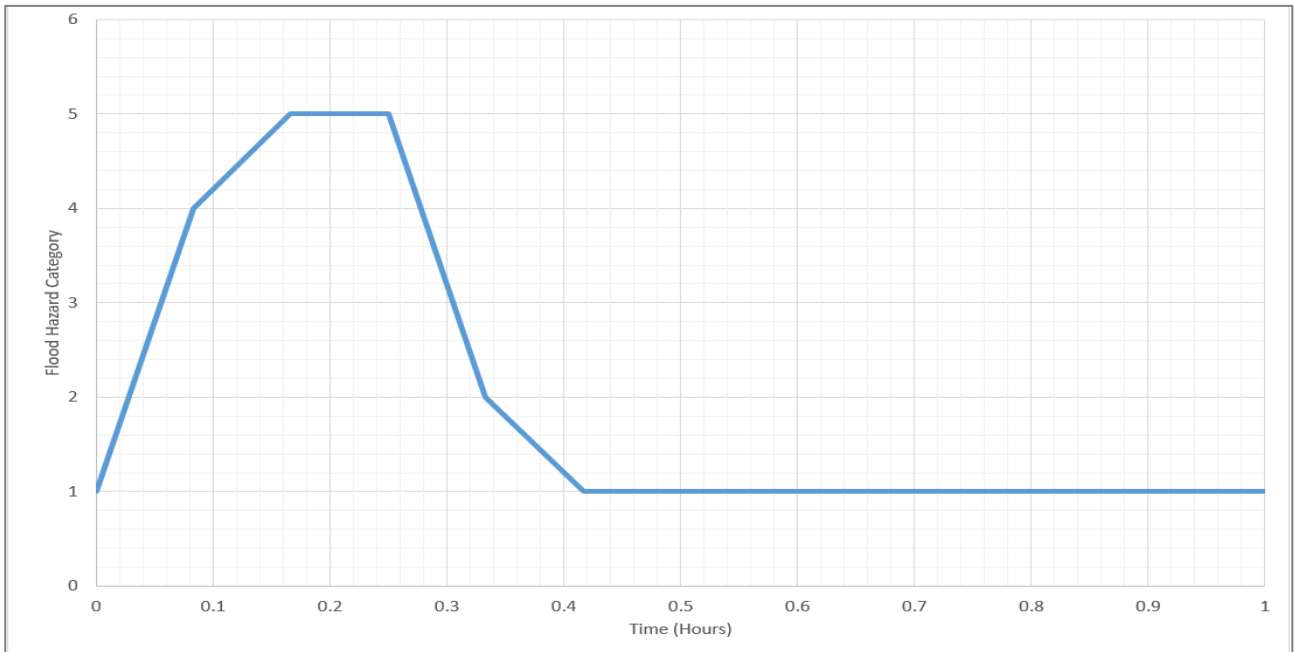


Figure 7-1 Local Roads - Flood Hazard Duration, PMF event – Location 1 PMF 15-min

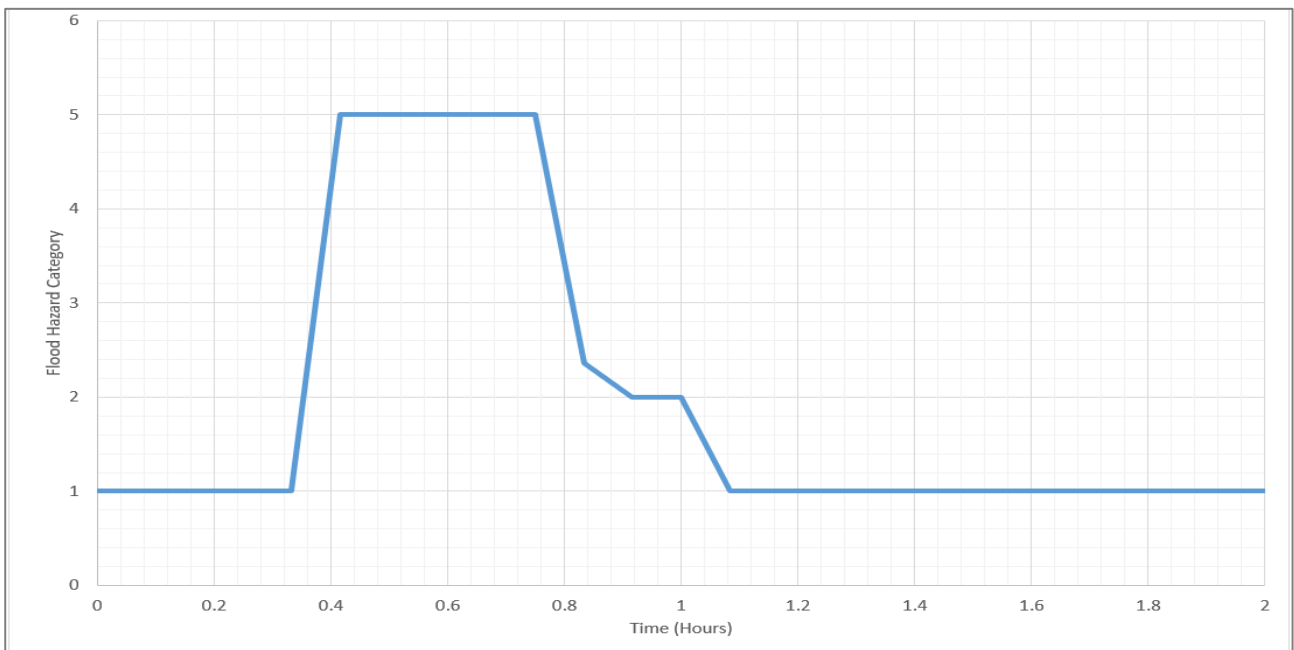


Figure 7-2 Local Roads - Flood Hazard Duration, PMF event – Location 2 PMF 45-min

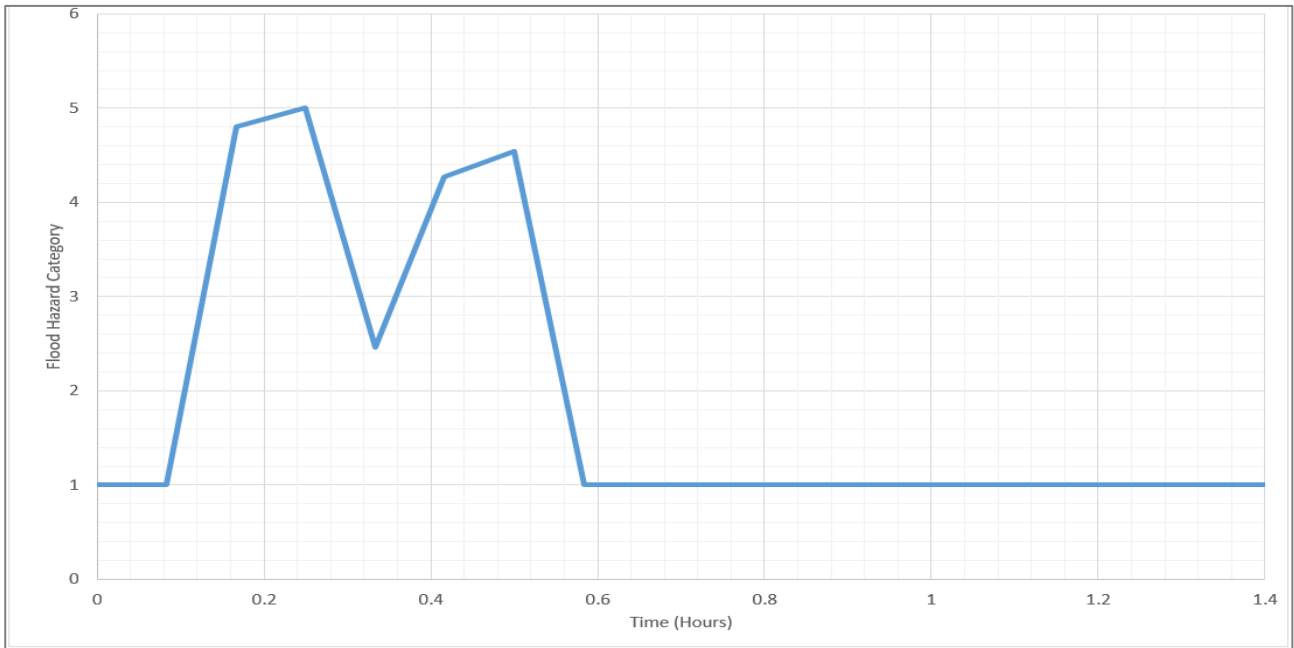


Figure 7-3 Local Roads - Flood Hazard Duration, PMF event – Location 3 PMF 30-min

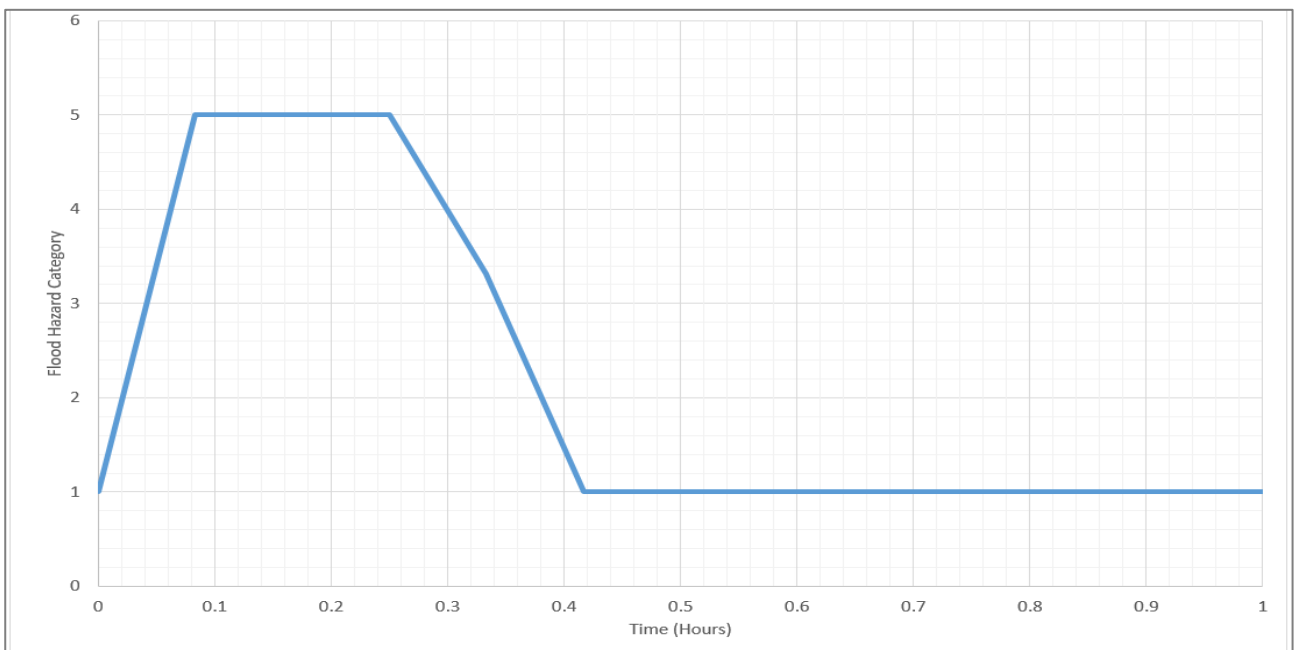


Figure 7-4 Local Roads - Flood Hazard Duration, PMF event – Location 4 PMF 15-min



The following Table 7-1 presents a summary of the expected duration of flood hazard categories at each road location noted above.

Table 7-1 Duration of PMF Flood Hazard (minutes)

Location	Greater than H1	Greater than H2	Greater than H3	Greater than H4
Intersection of Worrigee Road and Rayleigh Drive	25	19	14	12
Worrigee Road downstream Detention Basin	46	34	26	23
Greenwell Point Road downstream Detention Basin	30	28	23	14
Intersection of Old Southern Road and Carrington Park Drive	25	22	18	11

Analysis of the above table indicates that “non-trafficable” flood hazard conditions for all vehicles (equal to or greater H2 hazard category) are expected to last approximately up to 34 minutes at Worrigee Road during the PMF event. Similarly, “non-trafficable” flood hazard conditions for all vehicles (equal to or greater H2) are expected to last approximately up to 19 minutes and 22 minutes at Greenwell Point Road and Old Southern Road, respectively.

7.3 Flood Emergency Response Measures

7.3.1 Riverine Flood Event

As previously mentioned, the proposed activity site is located on a relatively high-ground and is not subject to inundation by riverine flooding up to the PMF event. However, emergency access/egress routes are likely to be cut off by floodwaters during events exceeding 1% AEP, resulting in temporary isolation of the site.

Evacuation Capability Assessment (ECA) and Flood Emergency Response Plan (FERP) will formalise the evacuation procedures and assist in reducing risk to life and property on the site. The risk to life is expected to be reduced through preparation including enhanced awareness and education for the users of the facility, clear triggers for response, and designated responsibilities for recovery.

7.3.2 Overland Flood Event

To minimise a risk to life, on-site refuge / shelter-in-place is recommended for a major and extreme overland flood event. Modelling indicates the local road network has the potential to be compromised during a 1% AEP and less frequent flood events. It is also recommended that egress from the site not attempted during a major overland flood event.

The local catchment is relatively small, and the flood behaviour is expected to rise and fall typically within a couple of hours of rainfall commencing and ceasing.



8 RISK ASSESSMENT

The potential risks for the proposed activity from a floodplain risk management perspective are addressed in Table 8-1 below.

Table 8-1 Risk Assessment

Risk					Comments on Measures to Manage Risk	Risk Mitigated
Category	Description	Likelihood	Consequence	Rating		
Risk to Property	Flood levels affecting proposed facility	Rare	Major	Low	Recommended FFLs set at overland PMF level.	Yes
Risk to Property	Flood impacts on surrounding properties	Rare	Major	Low	Modelling demonstrates the post-developed flood behaviour does not create significant adverse impact on surrounding private properties and downstream areas.	Yes
Risk to Life	Fatality, permanent injury due to entering or travelling through riverine floodwaters	Rare	Significant	Low	The site is above PMF riverine flooding. Flood warning / emergency response measures, evacuation routes, off-site refuge and shelter to be considered in FERP to avoid isolation during riverine flood event.	Yes
Risk to Life	Fatality, permanent injury due to entering or travelling through overland floodwaters	Rare	Significant	Low	To minimise a risk to life on-site refuge / shelter in place recommended for a major and extreme overland flood event as local road network has the potential to be compromised during a 1% AEP and less frequent flood events.	Yes



9 MITIGATION MEASURES

The standard and bespoke mitigation measures are outlined in Table 9-1 below.

Table 9-1 Mitigation Measures

ID	MM Name	Mitigation Measure	Timing
C11*	Flood – Finished Floor Levels and Overland Flow	All proposed building finished floor levels must be elevated at the local overland PMF level or above as detailed in this report. Sufficient drainage and grading provisions must be provided (subject to detailed civil design) along the western side of the three-storey split-level building to manage overland stormwater flows away from the building footprint.	Design
OM5	Flood Emergency Response Plan	A Flood Emergency Response Plan (FERP) is to be prepared for incorporation within the School's Emergency Management Plan and include the following: (a) During riverine flooding events - prioritise evacuation and avoid shelter-in-place by closing the school before the school day if flood events are forecasted and SES advises, (b) During overland flooding events – prioritise shelter-in-place as the primary emergency response strategy, (c) School administration must undertake annual evacuation preparations and an evacuation drill prior to the commencement of the wet season (typically November to April), (d) School administration to undertake responsibilities as set out in the FERP, and (e) Ensure that the Flood Warning Notice is maintained and permanently visible.	Prior to commencement of Operations
OM6	Flood Emergency Response Plan	The Flood Emergency Response Plan must be implemented.	During Operations



10 SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

A Flood Impact and Risk Assessment (FIRA) has been prepared for the proposed New Primary School in Worrigeer located at 9 Worrigeer Road, Worrigeer NSW 2540.

It was concluded the proposed activity:

- Is located on a low flood risk land, with minor, temporary, and shallow overland flooding occurring during major and extreme (exceeding 5% AEP) events.
- Is not expected to create a significant adverse impact to the existing flood behaviour on the site, in the surrounding and downstream areas of the site.
- Will include appropriate measures to manage risk to property.
- Will Include appropriate measures to manage risk to life.

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed activity, it was determined that:

- The extent and nature of potential flood impacts are low and are unlikely to have significant effects on the environment from flood risk management perspective.
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal effect on the locality, community and environment.



11 CONCLUSION

Subject to implementing the mitigation measures set out in Section 9 of this report, the conclusion of this assessment is that the proposed activity is not likely to significantly affect the environment from flood risk management perspective.

Melbourne

15 Business Park Drive
Notting Hill VIC 3168

Brisbane

Level 5, 43 Peel Street
South Brisbane QLD 4101

Perth

Level 1, 21 Adelaide Street
Fremantle WA 6160

Wangaratta

First Floor, 40 Rowan Street
Wangaratta VIC 3677

Wimmera

597 Joel South Road
Stawell VIC 3380

Darwin

Unit 40/29 Woods Street
Darwin City NT 0800

Sydney

Suite 3, Level 1, 20 Wentworth Street
Parramatta NSW 2150

Adelaide

1/198 Greenhill Road
Eastwood SA 5063

New Zealand

7/3 Empire Street
Cambridge New Zealand 3434

Geelong

51 Little Fyans Street
Geelong VIC 3220

Gold Coast

Suite 37, Level 4, 194 Varsity Parade
Varsity Lakes QLD 4227

Sunshine Coast

Office #4 of the Regatta 1 Business Centre
2 Innovation Parkway
Birtinya QLD 4575

1300 198 413



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APPENDIX A EXISTING FLOOD BEHAVIOR – CATCHMENT CONTEXT





Legend

- Subject Site
- Suburbs
- Water Level (mAHD)

Depth(m)

 <= 0.05	 0.25 - 0.50
 0.05 - 0.15	 0.50 - 1.00
 0.15 - 0.25	 1.00 - 1.50
	 > 1.50



0100200 Metres

1:7,500

Figure A1-1

5% AEP Flood Depth and Elevation
Existing Conditions



WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Worrigeer New Public School

28/1/2026 N:\Jobs\25050202_Nowra_New_Public_School_FIRAI\Spatial\Workspaces\FIGURES_STAGE2_v2.qgz

Data Source: NSW Gov - Cadastre, Virtual Earth / MetapMap - Image



Legend

Subject Site

Suburbs

Velocity(m/s)

< 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 3.0

> 3.0

0

100

200 Metres

1:7,500

Figure A1-2

5% AEP Flood Velocity

Existing Conditions

WATER TECHNOLOGY

WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Worrigeer New Public School

28/1/2026 N:\Jobs\25050202_Nowra_New_Public_School_FIRAI\Spatial\Workspaces\FIGURES_STAGE2_v2.qgz

Data Source: NSW Gov - Cadastre, Virtual Earth / MetrpMap - Image



Legend

 Subject Site
 Suburbs

Hazard Category

	H1
	H2
	H3

	H4
	H5
	H6

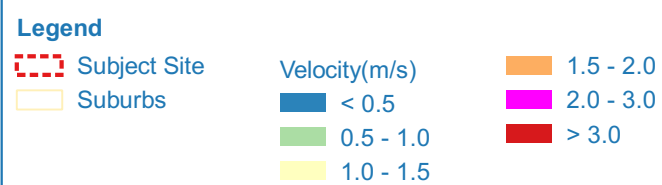


Figure A1-3
5% AEP Flood Hazard
Existing Conditions



Worrigee New Public School

Data Source: NSW Gov - Cadastre, Virtual Earth / MetrpMap - Imagery





Worrigee New Public School



Legend

Subject Site

Suburbs

Water Level (mAHD)

Depth(m)

<= 0.05

0.05 - 0.15

0.15 - 0.25

0.25 - 0.50

0.50 - 1.00

1.00 - 1.50

> 1.50

0100200 Metres

1:7,500

Figure A3-1

1% AEP Climate Change Flood Depth and Elevation
Existing Conditions

WATER TECHNOLOGY

WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Worrige New Public School

28/1/2026 N:\Jobs\25050202_Nowra_New_Public_School_FIRAI\Spatial\Workspaces\FIGURES_STAGE2_v2.qgz

Data Source: NSW Gov - Cadastre, Virtual Earth / MetrpMap - Image



Legend

Subject Site

Suburbs

Velocity(m/s)

< 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 3.0

> 3.0

0100200 Metres

1:7,500

Figure A3-2

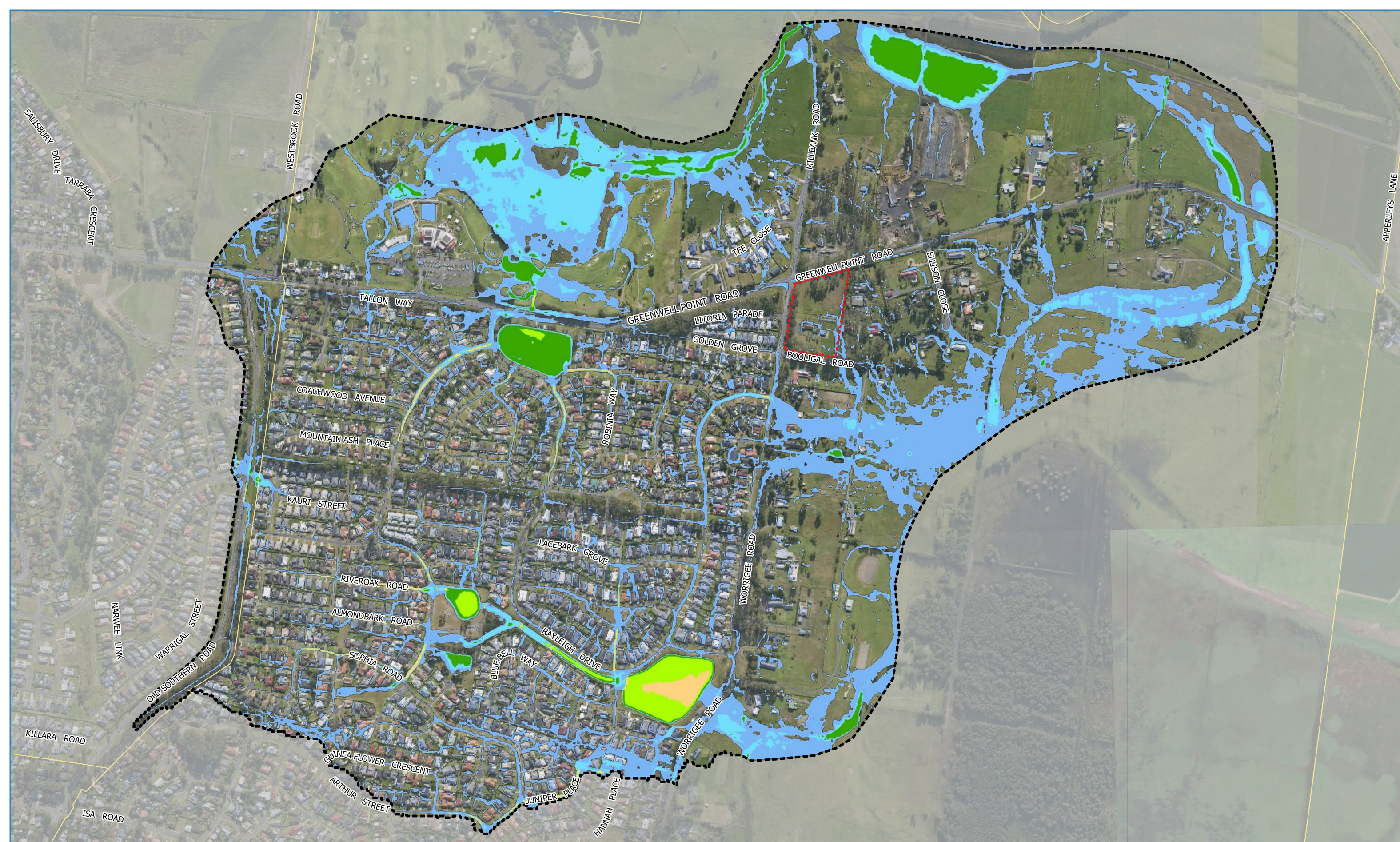
1% AEP Climate Change Flood Velocity
Existing Conditions

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Worrigeer New Public School

28/1/2026 N:\Jobs\25050202_Nowra_New_Public_School_FIRAI\Spatial\Workspaces\FIGURES_STAGE2_v2.qgz

Data Source: NSW Gov - Cadastre, Virtual Earth / MetapMap - Image



Legend

 Subject Site
 Suburbs

Hazard Category

	H1
	H2
	H3

	H4
	H5
	H6



Figure A3-3
1% AEP Climate Change Flood Hazard
Existing Conditions



Worrigee New Public School

Data Source: NSW Gov - Cadastre, Virtual Earth / MetrpMap - Imagery



Legend

- Subject Site
- Suburbs
- Water Level (mAHD)

Depth(m)

<= 0.05	0.25 - 0.50
0.05 - 0.15	0.50 - 1.00
0.15 - 0.25	1.00 - 1.50
	> 1.50

0100200 Metres

1:7,500

Figure A4-1
1 in 500 AEP Flood Depth and Elevation
Existing Conditions



Legend

Subject Site

Suburbs

Velocity(m/s)

< 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 3.0

> 3.0

0100200 Metres

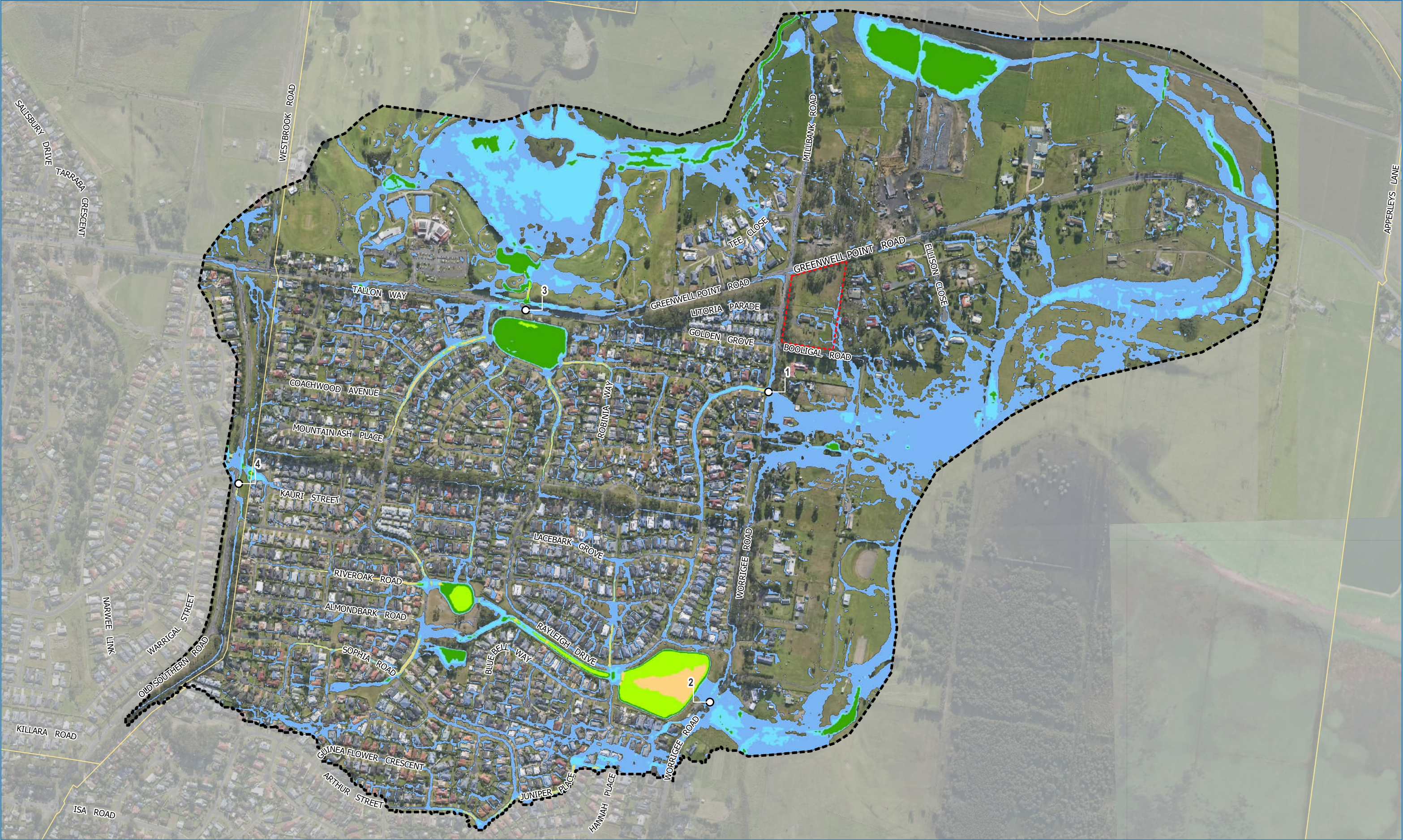
1:7,500

Figure A4-2
1 in 500 AEP Flood Velocity
Existing Conditions

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Worrgee New Public School

28/1/2026 N:\Jobs\25050202_Nowra_New_Public_School_FIRAI\Spatial\Workspaces\FIGURES_STAGE2_v2.qgz



Legend

- Subject Site
- Suburbs
- Flood Hazard Duration Reporting Locations

- Hazard Category
- | | |
|----|----|
| H1 | H4 |
| H2 | H5 |
| H3 | H6 |



Figure A4-3
1 in 500 AEP Flood Hazard
Existing Conditions





Legend

- Subject Site
- Suburbs
- Water Level (mAHD)

Depth(m)

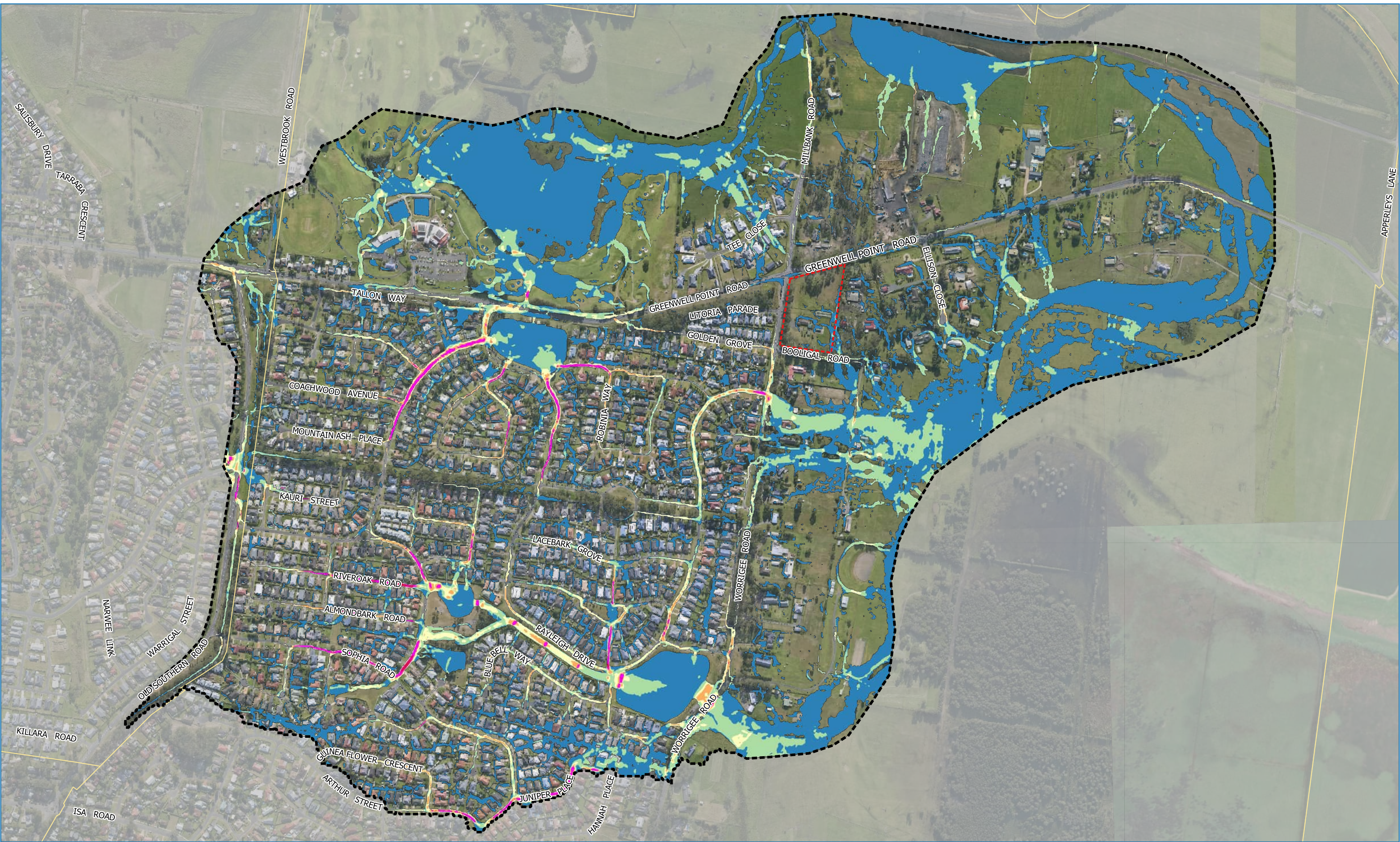
<= 0.05	0.25 - 0.50
0.05 - 0.15	0.50 - 1.00
0.15 - 0.25	1.00 - 1.50
	> 1.50

0100200 Metres
1:7,500

Figure A5-1
1 in 200 AEP Flood Depth and Elevation
Existing Conditions

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Worrige New Public School



Legend

Subject Site

Suburbs

Velocity(m/s)

< 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 3.0

> 3.0

0100200 Metres

1:7,500

WATER TECHNOLOGY

WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Figure A5-2

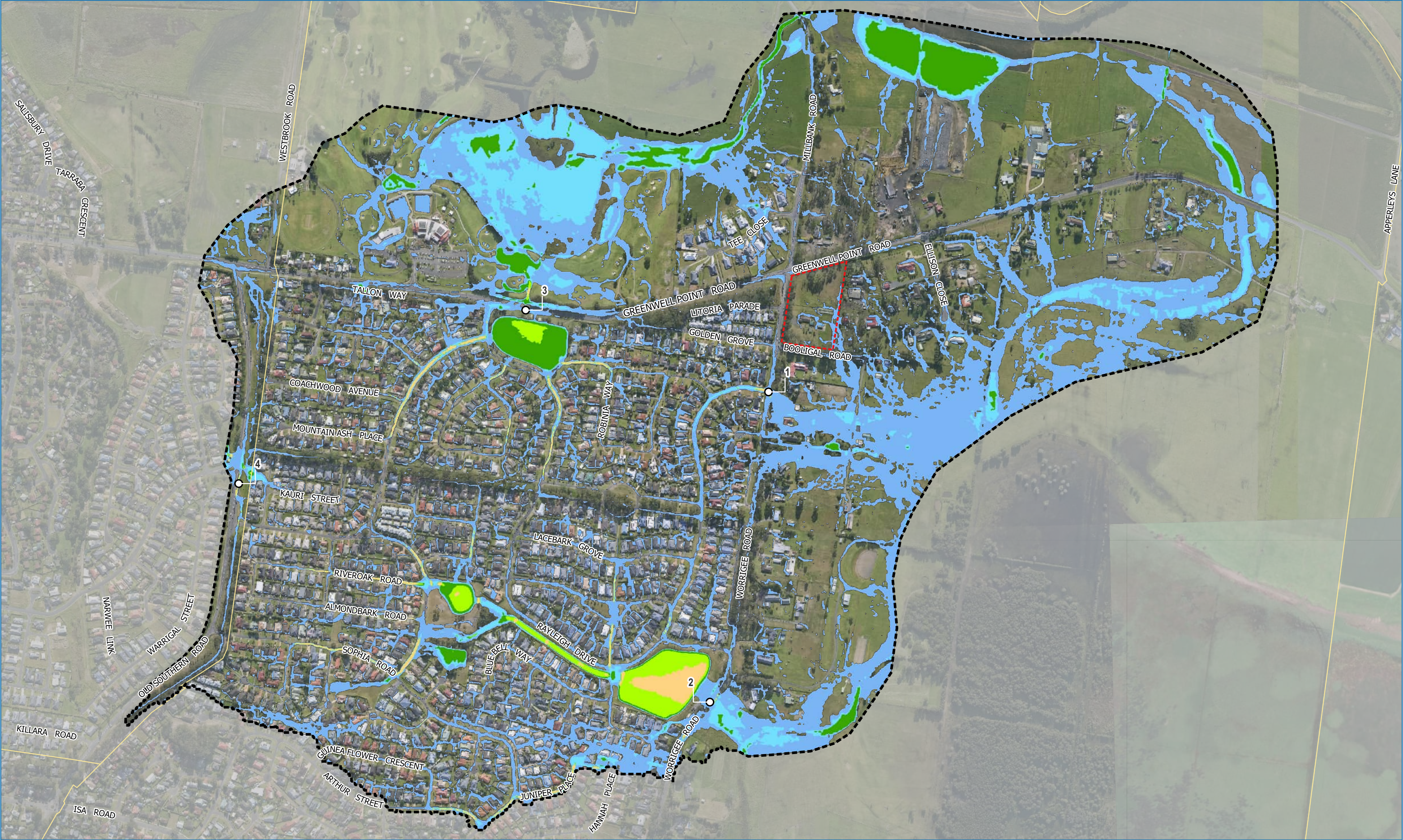
1 in 2000 AEP Flood Velocity

Existing Conditions

Worrige New Public School

28/1/2026 N:\Jobs\25050202_Nowra_New_Public_School_FIRAI\Spatial\Workspaces\FIGURES_STAGE2_v2.qgz

Data Source: NSW Gov - Cadastre, Virtual Earth / MetrpMap - Image



Legend

- Subject Site
- Suburbs
- Flood Hazard Duration Reporting Locations

Hazard Category

- H1
- H2
- H3
- H4
- H5
- H6

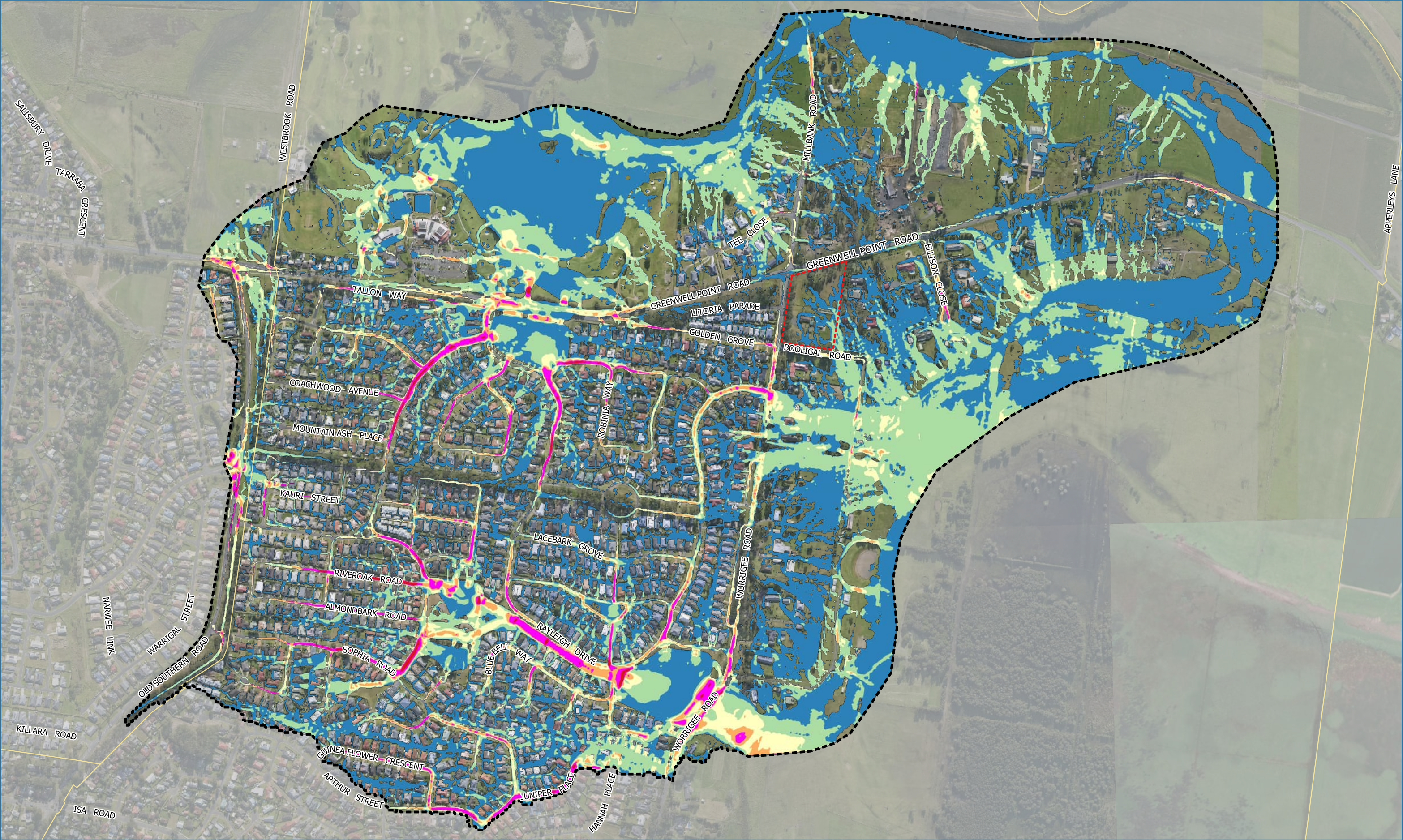
0100200 Metres

1:7,500

Figure A5-3
1 in 2000 AEP Flood Hazard
Existing Conditions

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Worrige New Public School



Legend

Subject Site

Suburbs

Velocity(m/s)

< 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 3.0

> 3.0

0100200 Metres

1:7,500

WATER TECHNOLOGY

WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Figure A6-2

PMF Flood Velocity

Existing Conditions

Worrige New Public School



APPENDIX B EXISTING AND DEVELOPED FLOOD BEHAVIOUR - SITE CONTEXT





Legend

- Subject Site

Cadastre

Extent of Works

Proposed Buildings

Water Level (mAHD)
- Depth(m)

<= 0.05

0.05 - 0.15

0.15 - 0.25

0.25 - 0.50
- 0.50 - 1.00

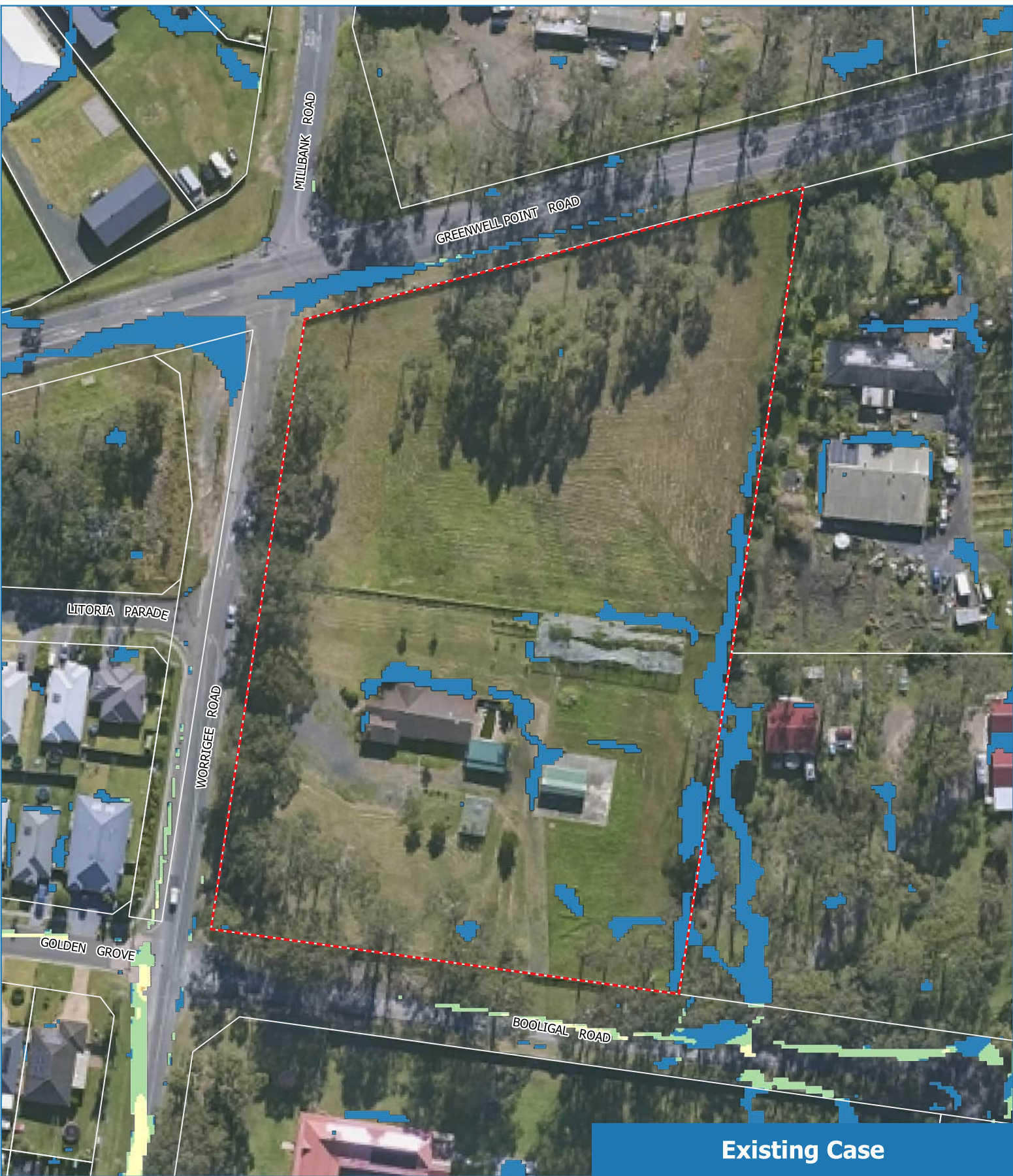
1.00 - 1.50

> 1.50



0 20 40 Metres
1:1,200

Figure AB1-1
5% AEP Flood Depth and Elevation



Legend

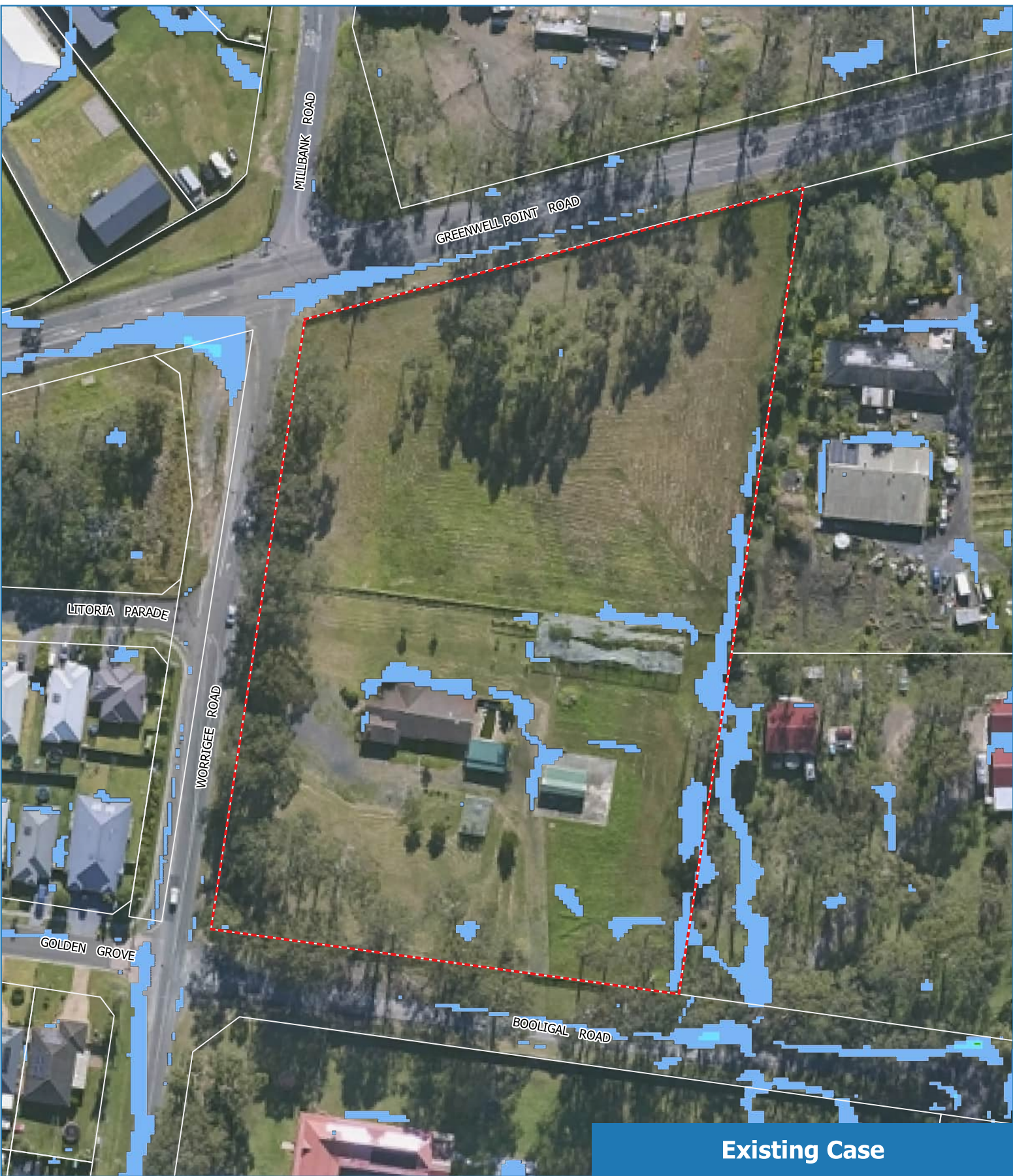
	Subject Site	Velocity(m/s)		1.5 - 2.0	
	Cadastre		< 0.5		2.0 - 3.0
	Extent of Works		0.5 - 1.0		> 3.0
	Proposed Buildings		1.0 - 1.5		

02040 Metres

1:1,200

Figure AB1-2
5% AEP Flood Velocity

Worrigee New Public School



Existing Case



Developed Case

Legend

- | | | |
|--------------------|-----------------|----|
| Subject Site | Hazard Category | H4 |
| Cadastre | H1 | H5 |
| Extent of Works | H2 | H6 |
| Proposed Buildings | H3 | |



0 20 40 Metres

1:1,200

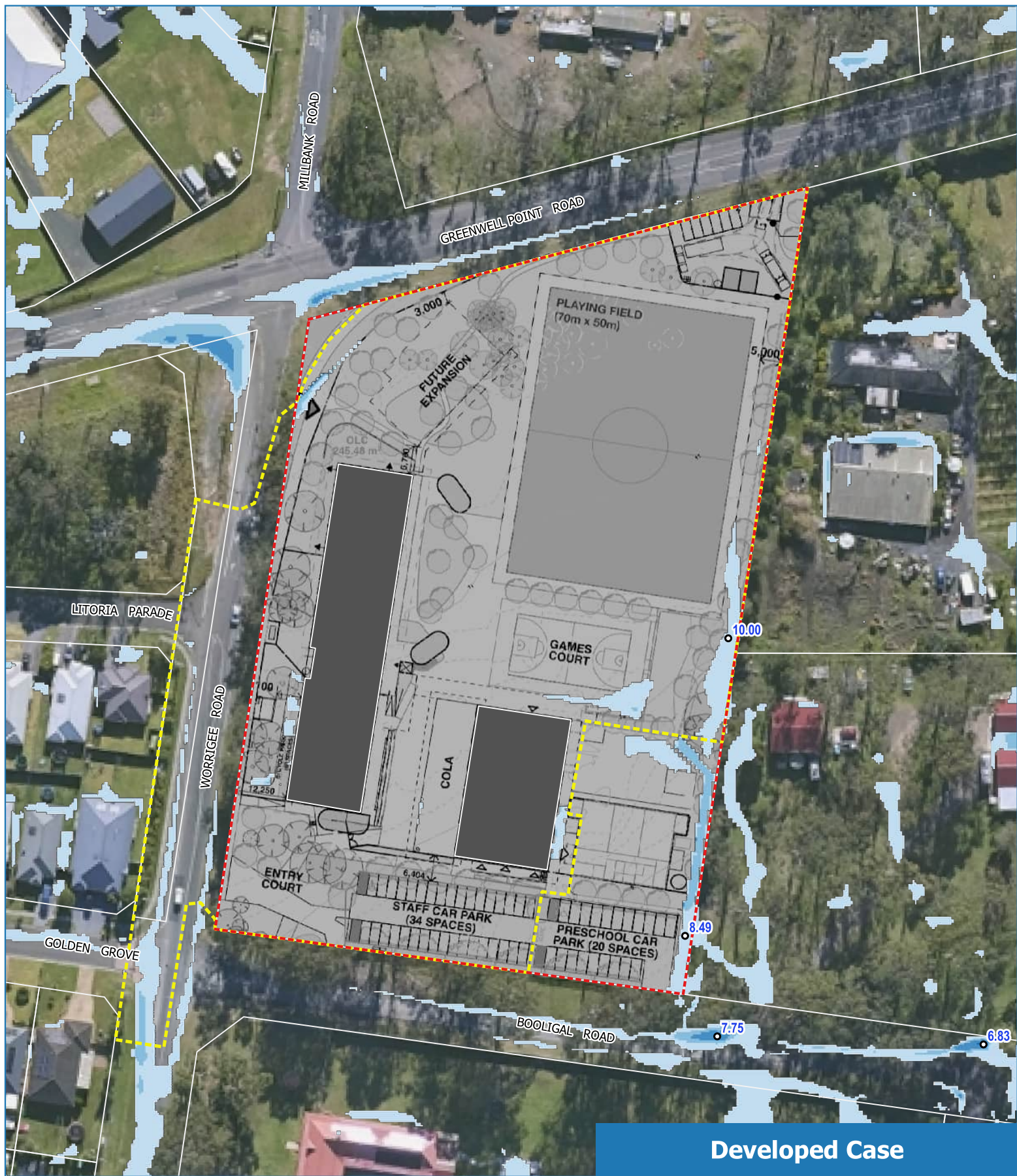
Figure AB1-3

5% AEP Flood Hazard



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Legend

- Subject Site
- Cadastre
- Extent of Works
- Proposed Buildings
- Water Level (mAHD)

Depth(m)

<= 0.05	0.50 - 1.00
0.05 - 0.15	1.00 - 1.50
0.15 - 0.25	> 1.50
0.25 - 0.50	

0 20 40 Metres

1:1,200

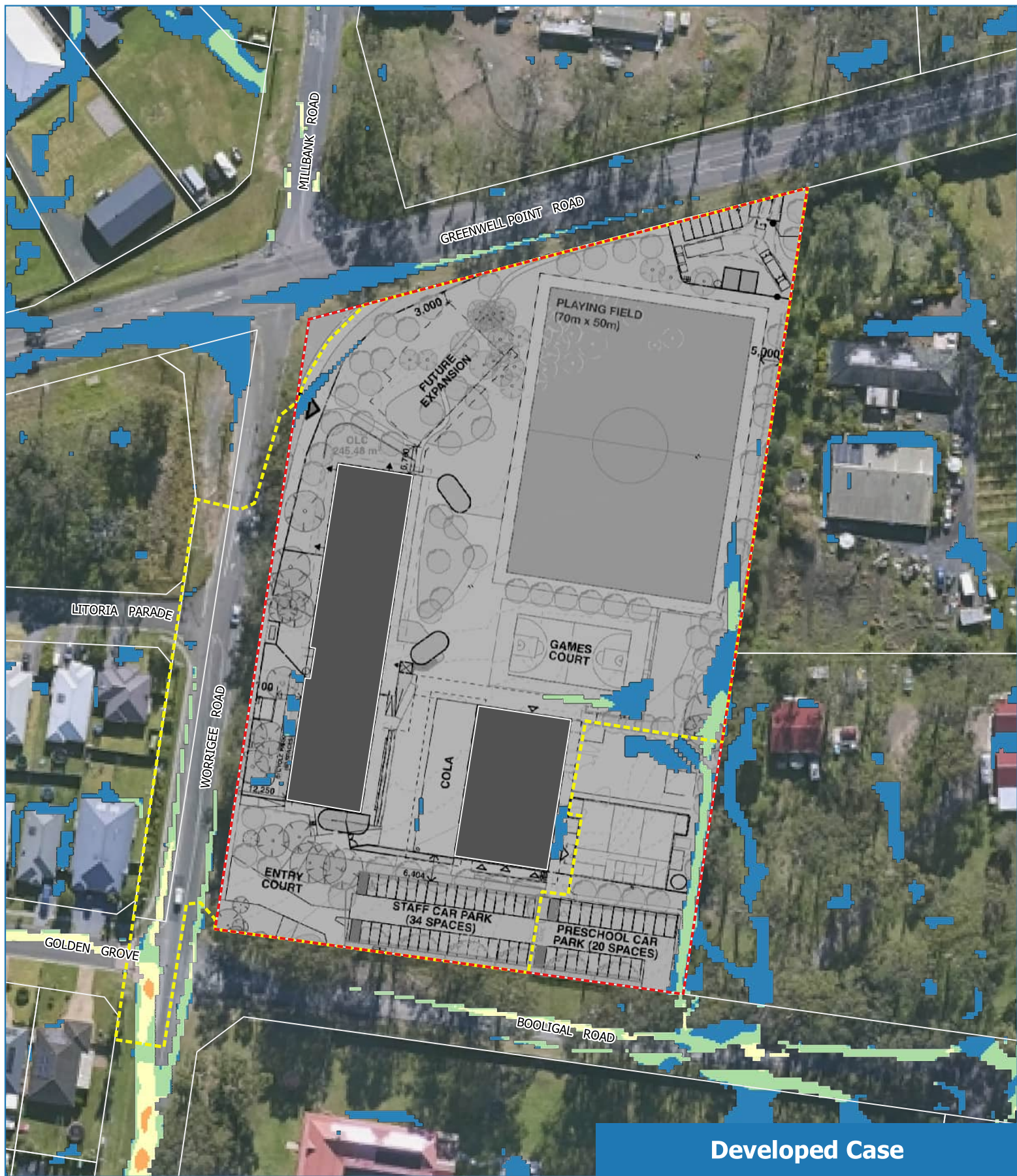
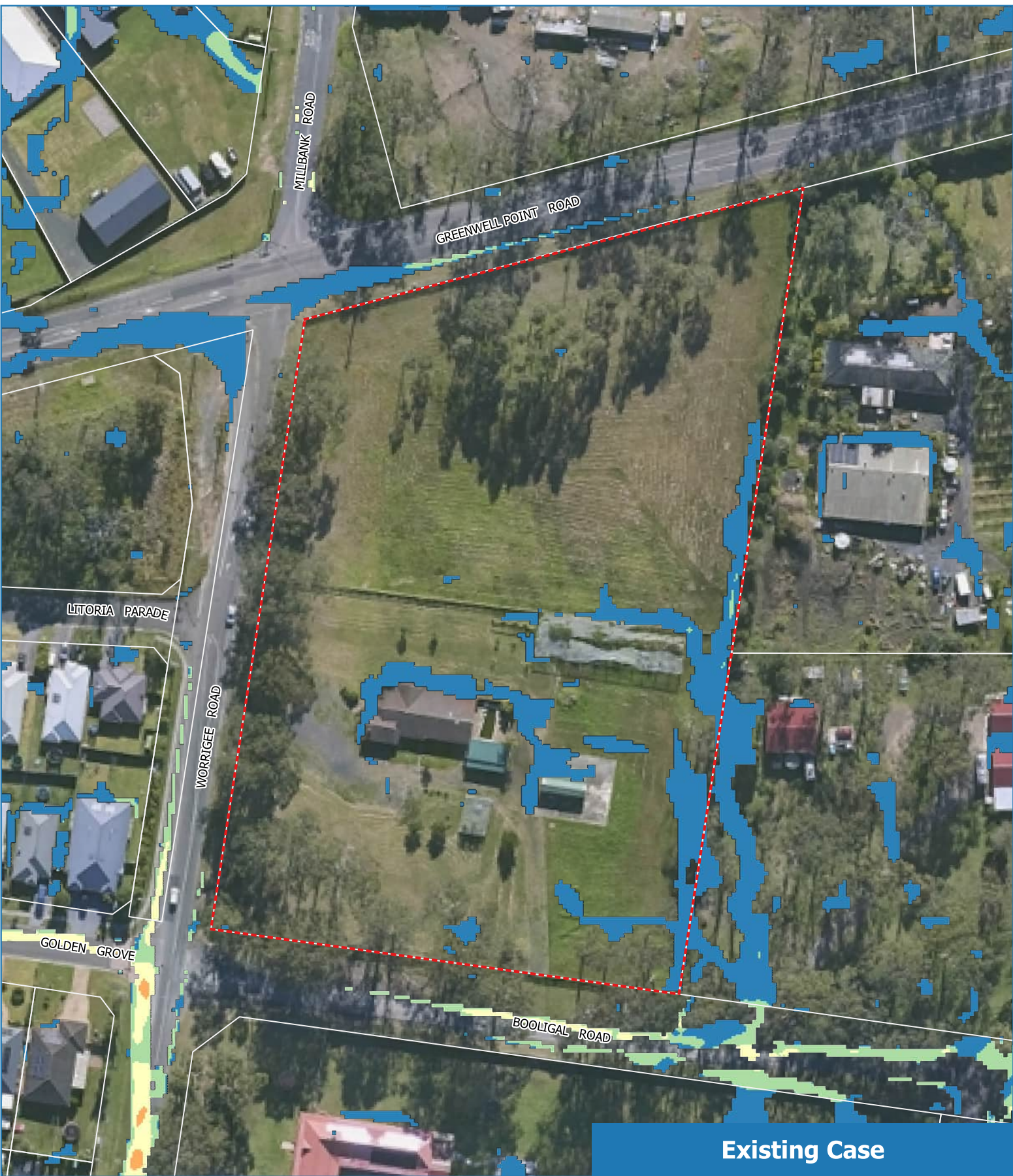
Figure AB2-1

1% AEP Flood Depth and Elevation

Worrigee New Public School

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Data Source: NSW Gov - Cadastre, Virtual Earth / Metromap - Imagery



Legend

- Subject Site
- Cadastre
- Extent of Works
- Proposed Buildings

Velocity(m/s)

- < 0.5
- 0.5 - 1.0
- 1.0 - 1.5

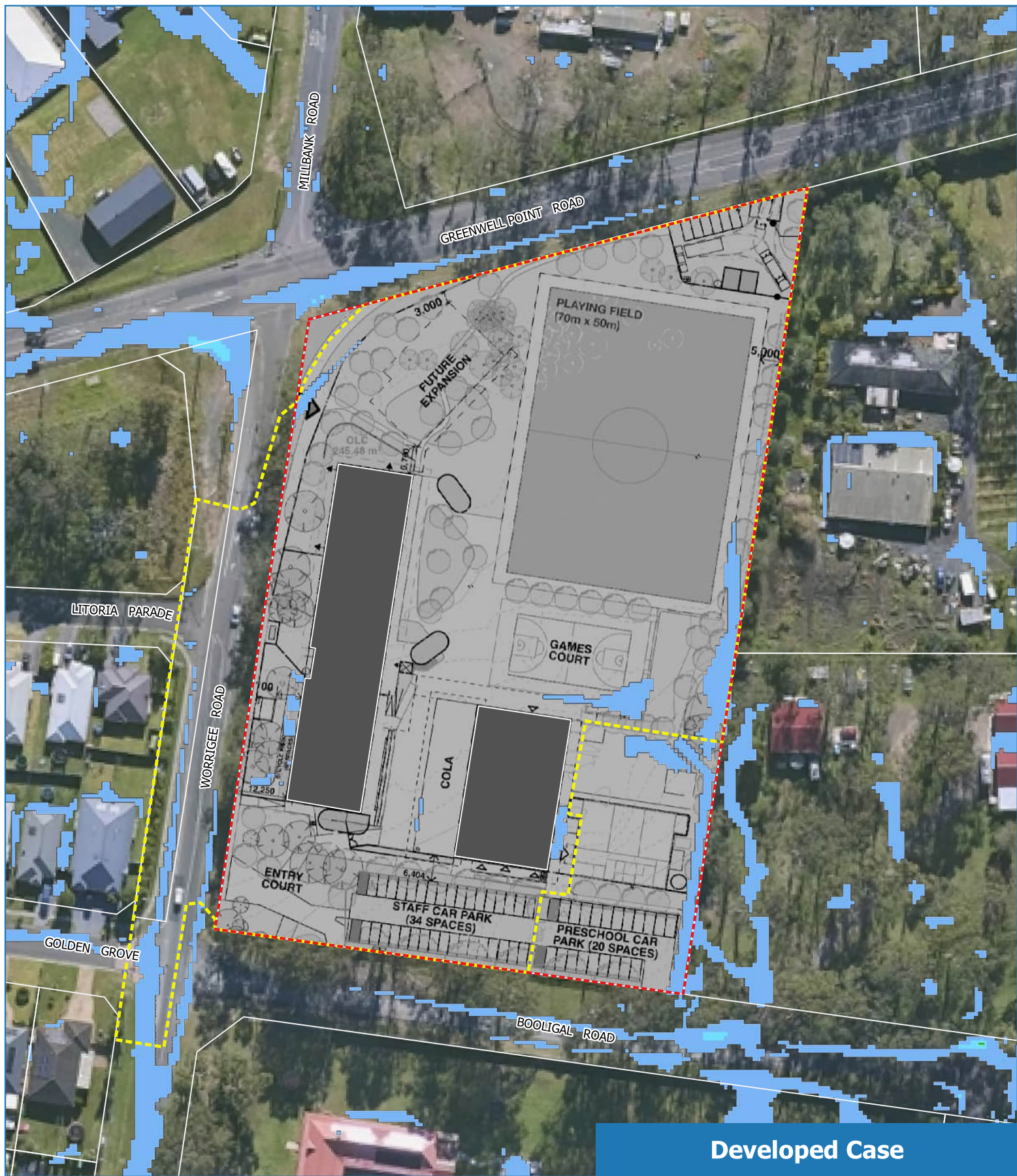
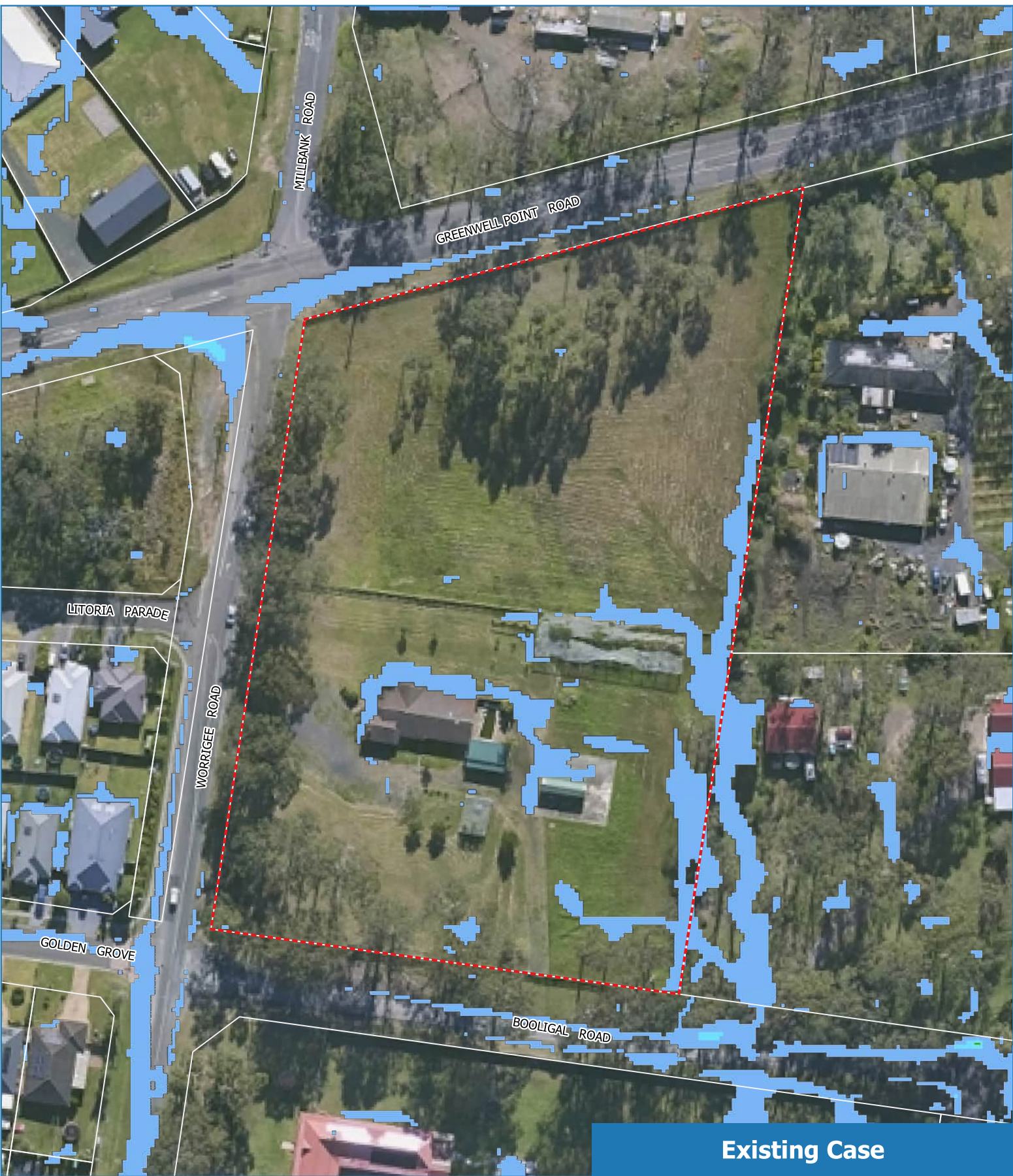
- 1.5 - 2.0
- 2.0 - 3.0
- > 3.0

0 20 40 Metres

1:1,200

Figure AB2-2

1% AEP Flood Velocity



Legend

- | | | |
|--------------------|-----------------|----|
| Subject Site | Hazard Category | H4 |
| Cadastre | H1 | H5 |
| Extent of Works | H2 | H6 |
| Proposed Buildings | H3 | |



0 20 40 Metres
1:1,200

Figure AB2-3
1% AEP Flood Hazard



Legend

Subject Site

Cadastre

Extent of Works

Proposed Buildings

Water Level (mAHD)

Depth(m)

<= 0.05

0.05 - 0.15

0.15 - 0.25

0.25 - 0.50

0.50 - 1.00

1.00 - 1.50

> 1.50

0

20

40 Metres

1:1,200

Figure AB3-1

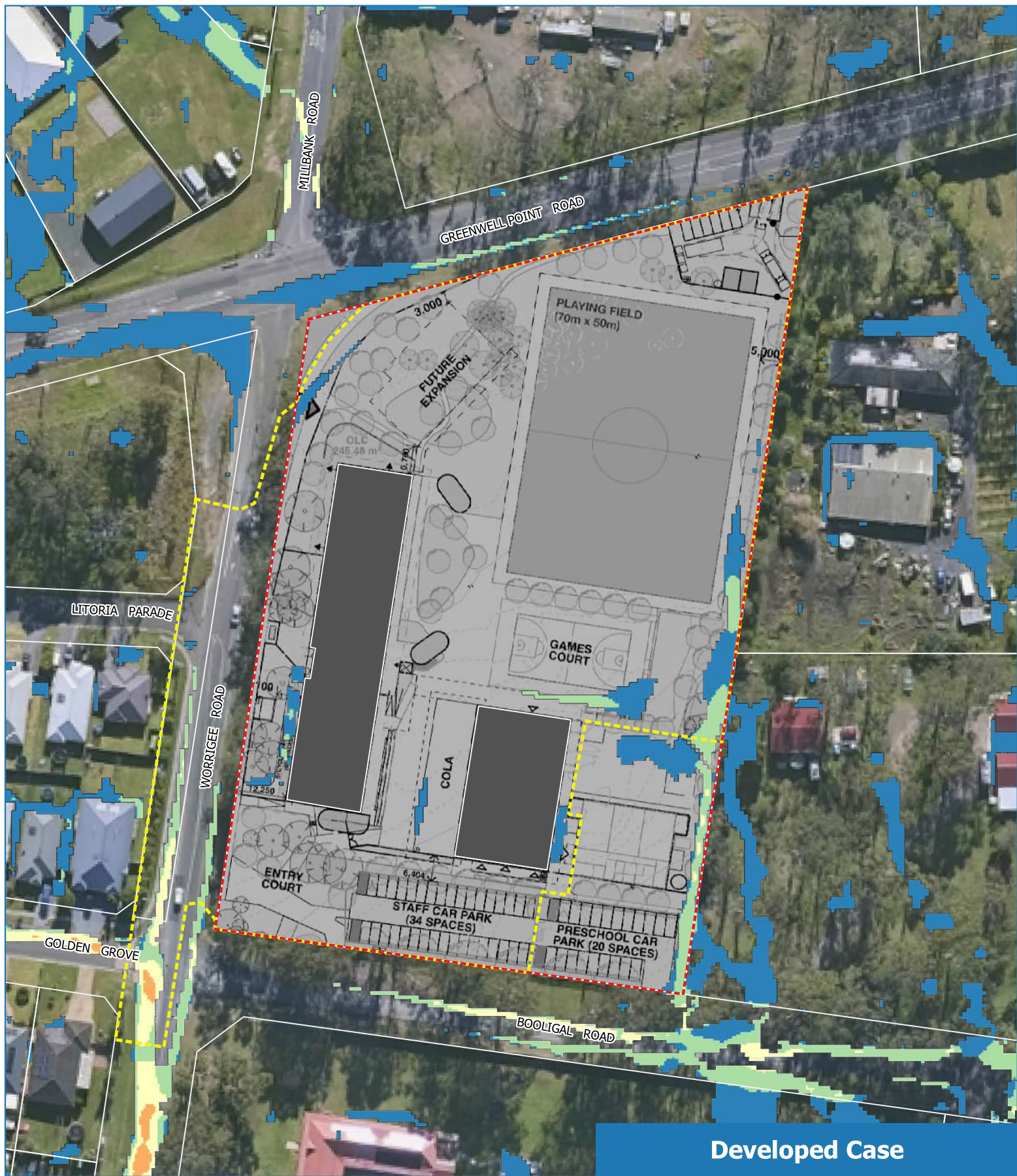
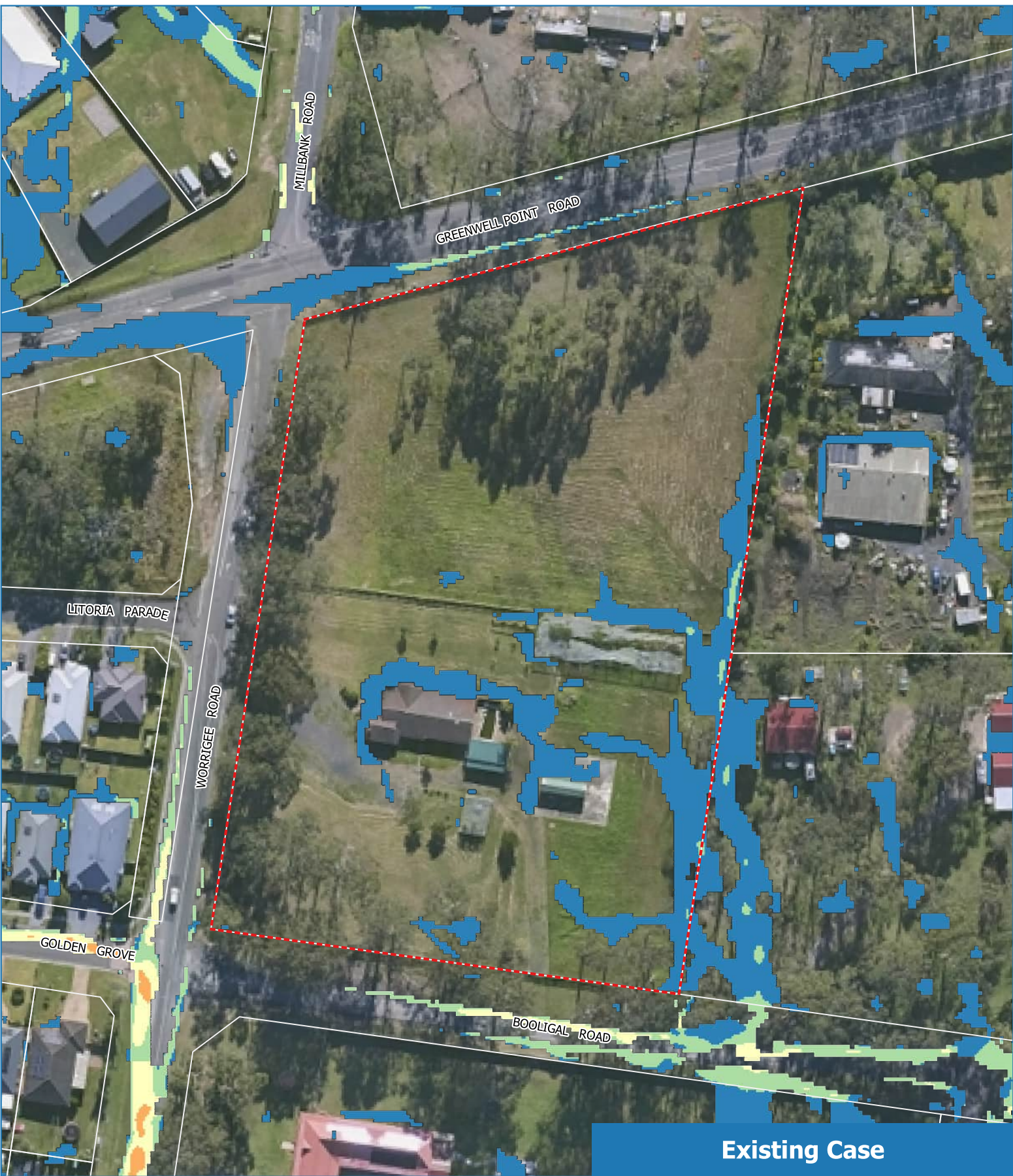
1% AEP Climate Change
Flood Depth and Elevation

Worrigee New Public School

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14/2/2026 N:\Jobs\25050202_Nowra_New_Public_School_FIRA\Spatial\Workspaces\FIGURES_STAGE2_v2.qgz

Data Source: NSW Gov - Cadastre, Virtual Earth / Metromap - Imagery

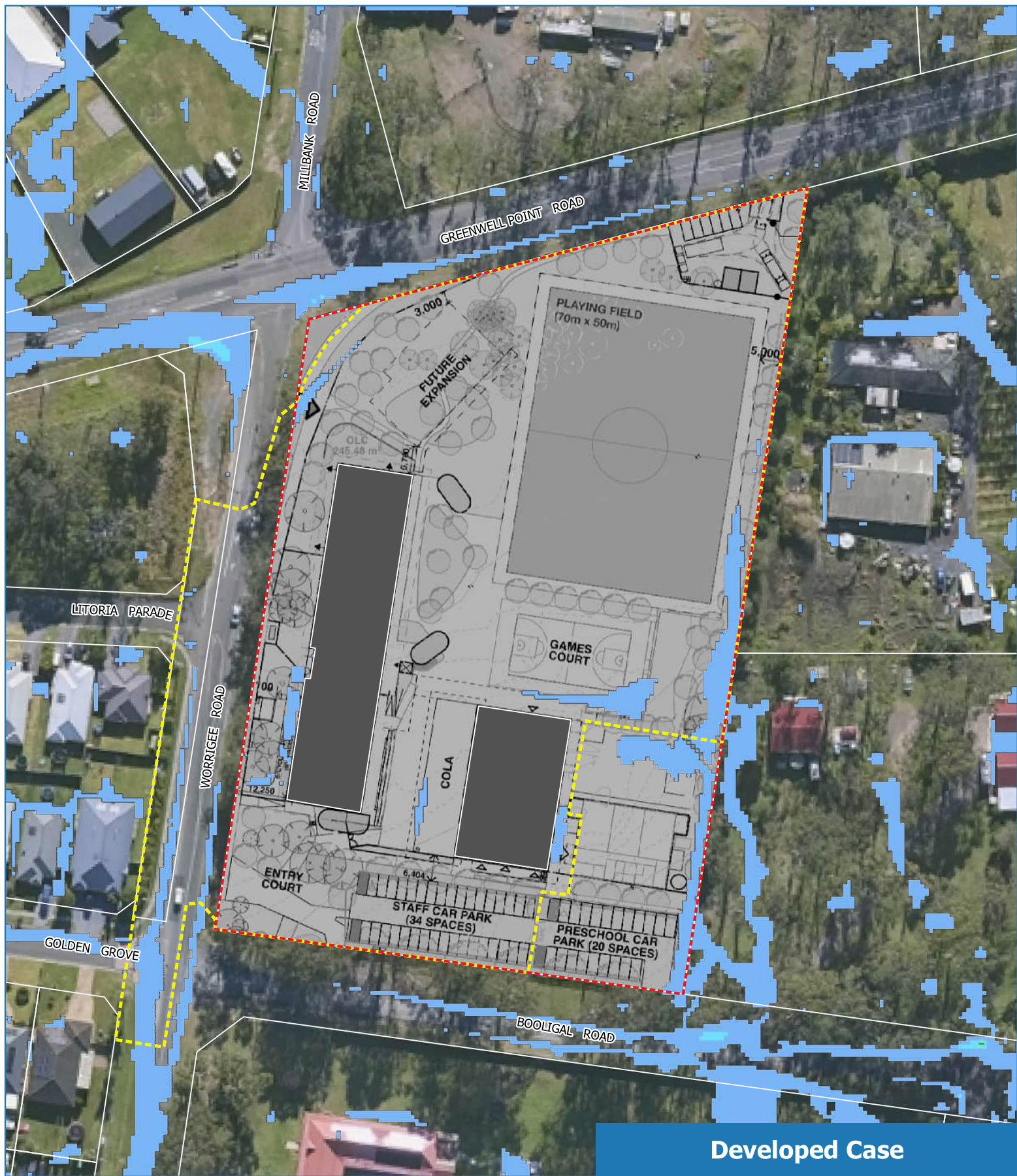


- Legend**
- Subject Site
 - Cadastre
 - Extent of Works
 - Proposed Buildings
- Velocity(m/s)
- < 0.5
 - 0.5 - 1.0
 - 1.0 - 1.5
 - 1.5 - 2.0
 - 2.0 - 3.0
 - > 3.0



0 20 40 Metres
1:1,200

Figure AB3-2
1% AEP Climate Change Flood Velocity



- Legend**
- Subject Site
 - Cadastre
 - Extent of Works
 - Proposed Buildings
- Hazard Category**
- H1
 - H2
 - H3
 - H4
 - H5
 - H6



0 20 40 Metres
1:1,200

Figure AB3-3
1% AEP Climate Change Flood Hazard





Legend

- Subject Site
- Cadastre
- Extent of Works
- Proposed Buildings
- Water Level (mAHD)

Depth(m)

- <= 0.05
- 0.05 - 0.15
- 0.15 - 0.25
- 0.25 - 0.50

- 0.50 - 1.00
- 1.00 - 1.50
- > 1.50

02040 Metres

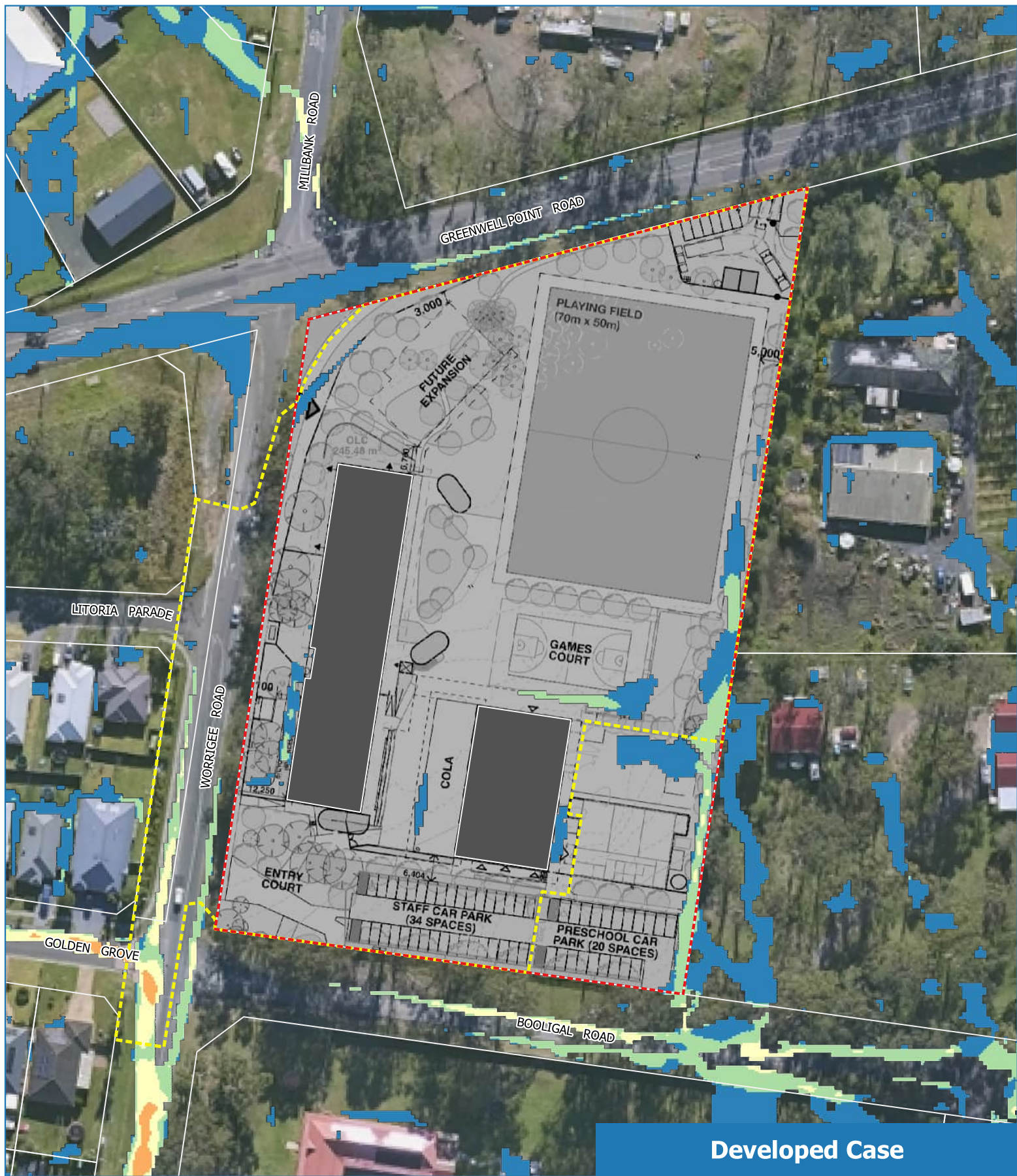
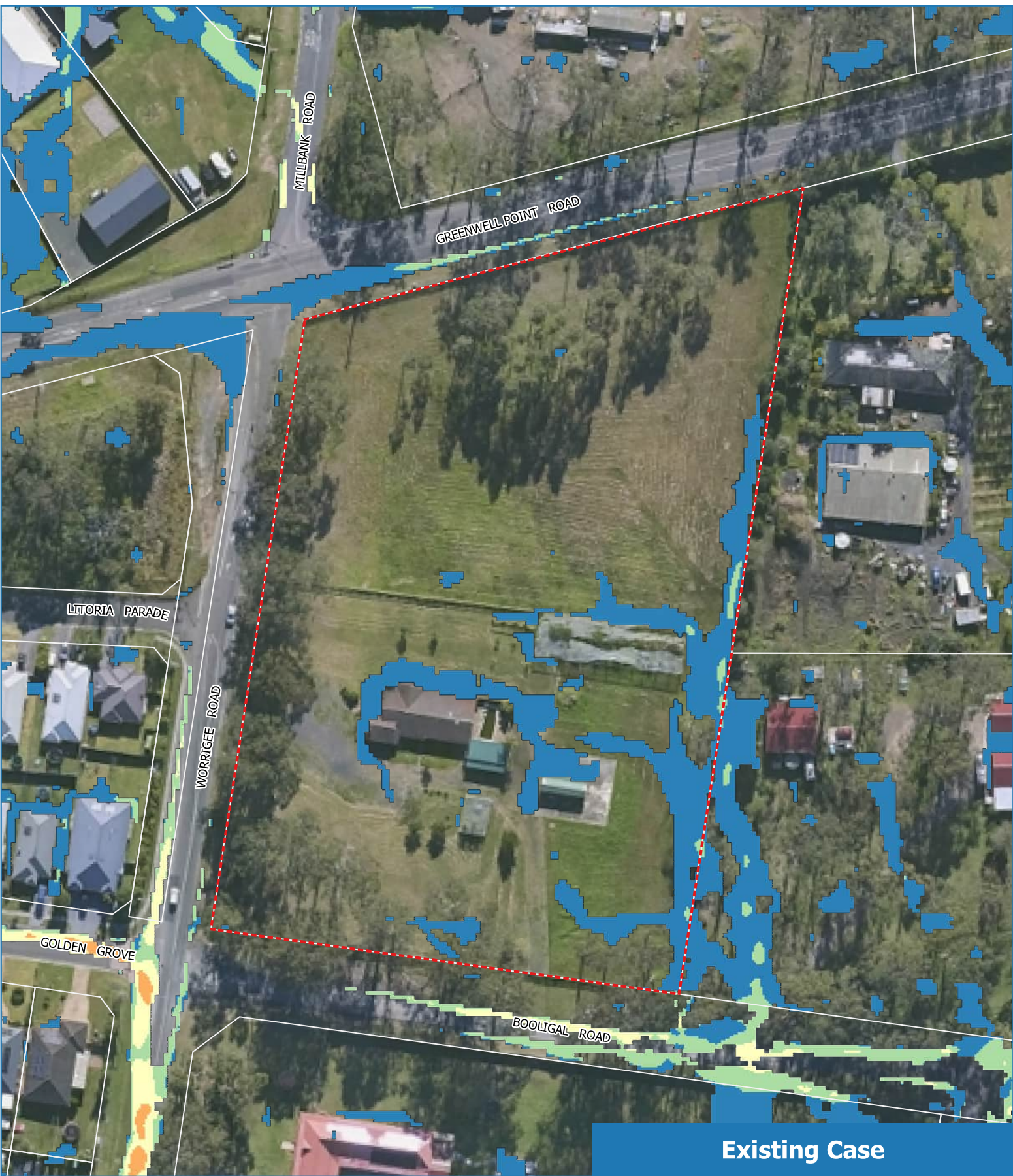
1:1,200

Figure AB4-1

1 in 500 AEP Flood Depth and Elevation

Worrigee New Public School

Data Source: NSW Gov - Cadastre, Virtual Earth / Metromap - Imagery



Legend

- Subject Site
- Cadastre
- Extent of Works
- Proposed Buildings

Velocity(m/s)

- < 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- > 3.0

02040 Metres

1:1,200

Figure AB4-2

1 in 500 AEP Flood Velocity

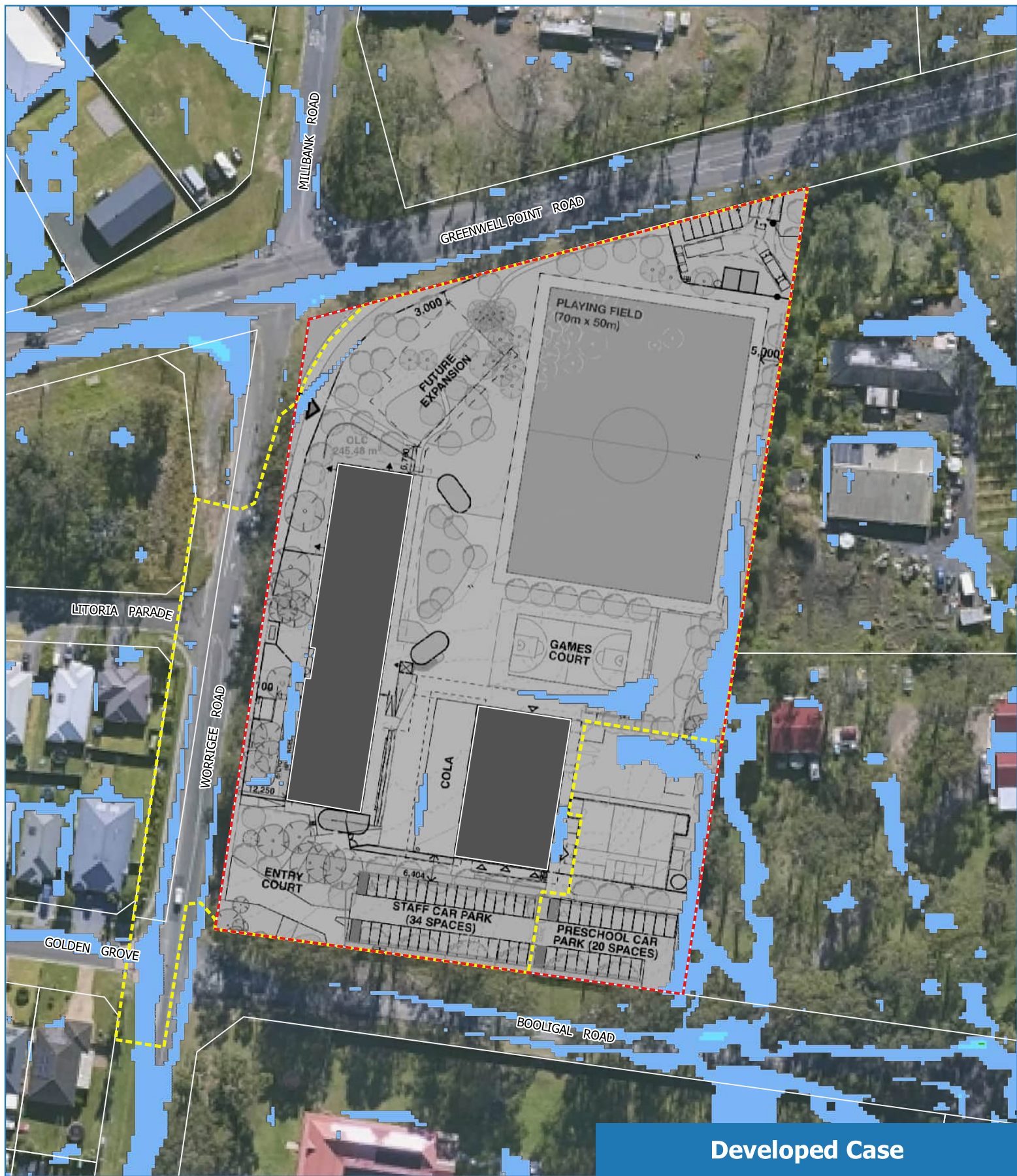
Worrigee New Public School

WATER TECHNOLOGY

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Existing Case



Developed Case

Legend

- | | | |
|--------------------|-----------------|----|
| Subject Site | Hazard Category | H4 |
| Cadastre | H1 | H5 |
| Extent of Works | H2 | H6 |
| Proposed Buildings | H3 | |



0 20 40 Metres
1:1,200

Figure AB4-3

1 in 500 AEP Flood Hazard



Worricee New Public School



Legend

- Subject Site

Cadastre

Extent of Works

Proposed Buildings

Water Level (mAHD)
- Depth(m)

<= 0.05

0.05 - 0.15

0.15 - 0.25

0.25 - 0.50
- 0.50 - 1.00

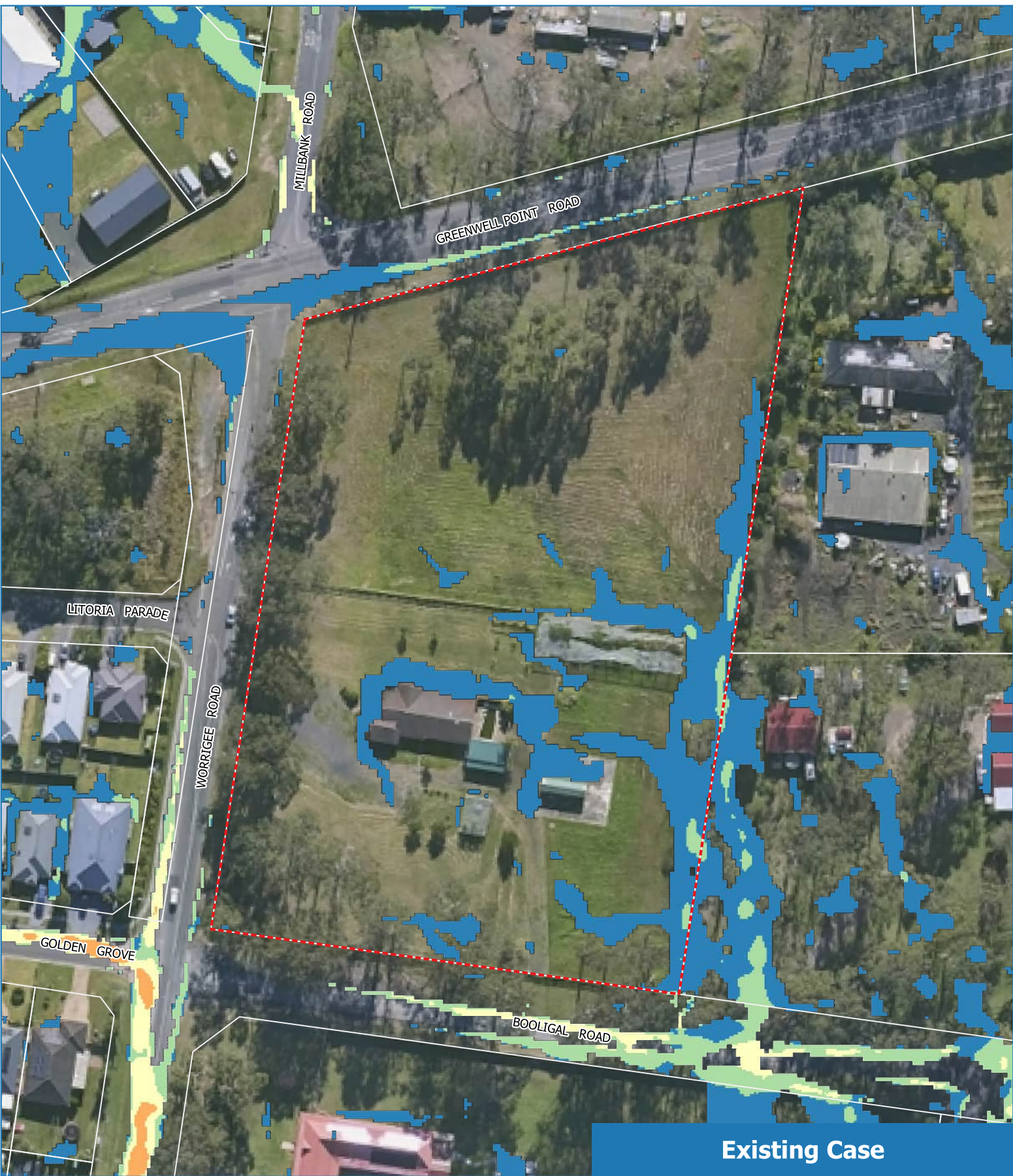
1.00 - 1.50

> 1.50

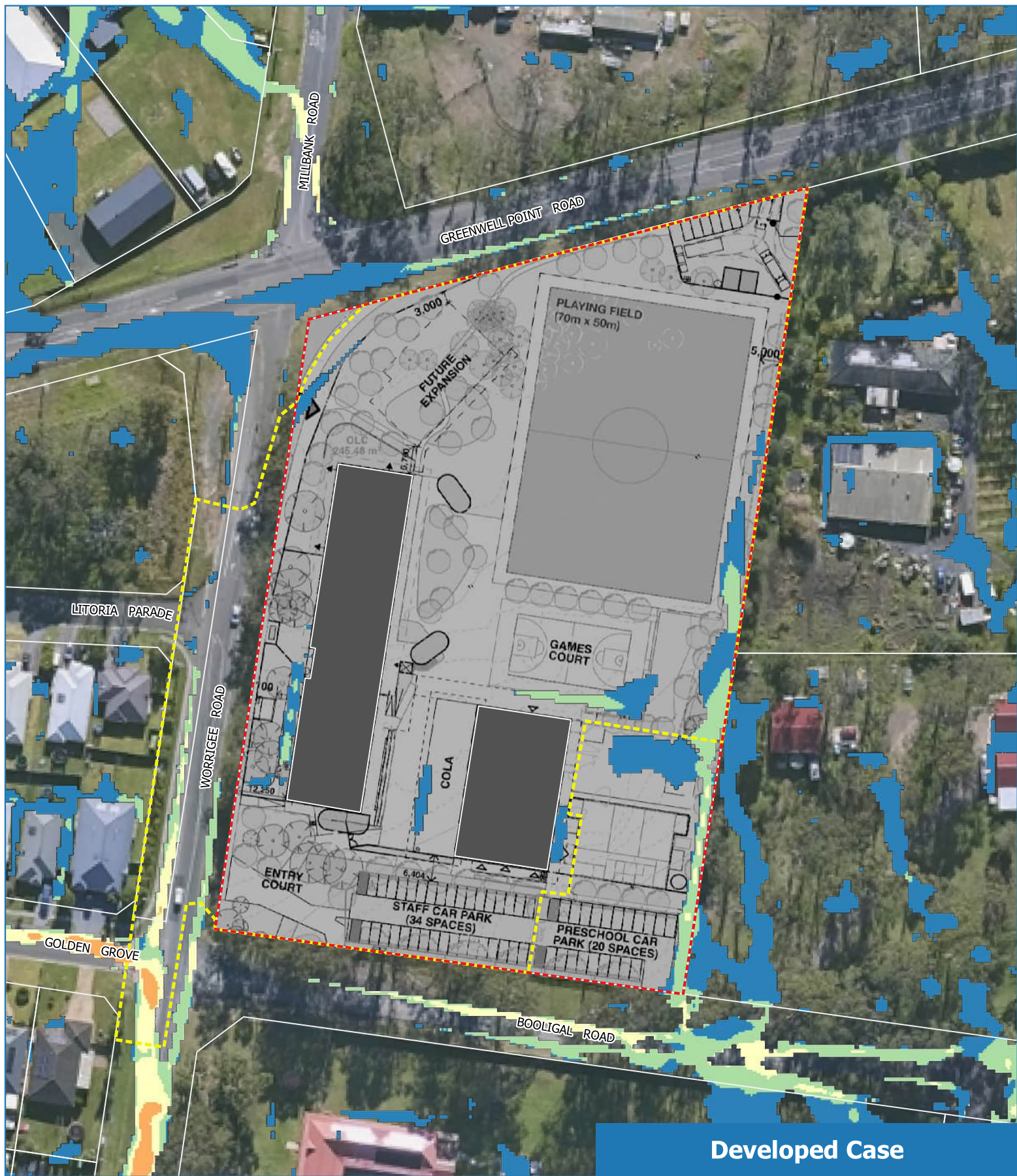


0 20 40 Metres
1:1,200

Figure AB5-1
1 in 2000 AEP Flood Depth and Elevation



Existing Case



Developed Case

Legend

- | | | | | | |
|--|--------------------|--|---------------------|--|-----------|
| | Subject Site | | Velocity(m/s) < 0.5 | | 1.5 - 2.0 |
| | Cadastre | | 0.5 - 1.0 | | 2.0 - 3.0 |
| | Extent of Works | | 1.0 - 1.5 | | > 3.0 |
| | Proposed Buildings | | | | |



0 20 40 Metres

1:1,200

Figure AB5-2

1 in 2000 AEP Flood Velocity

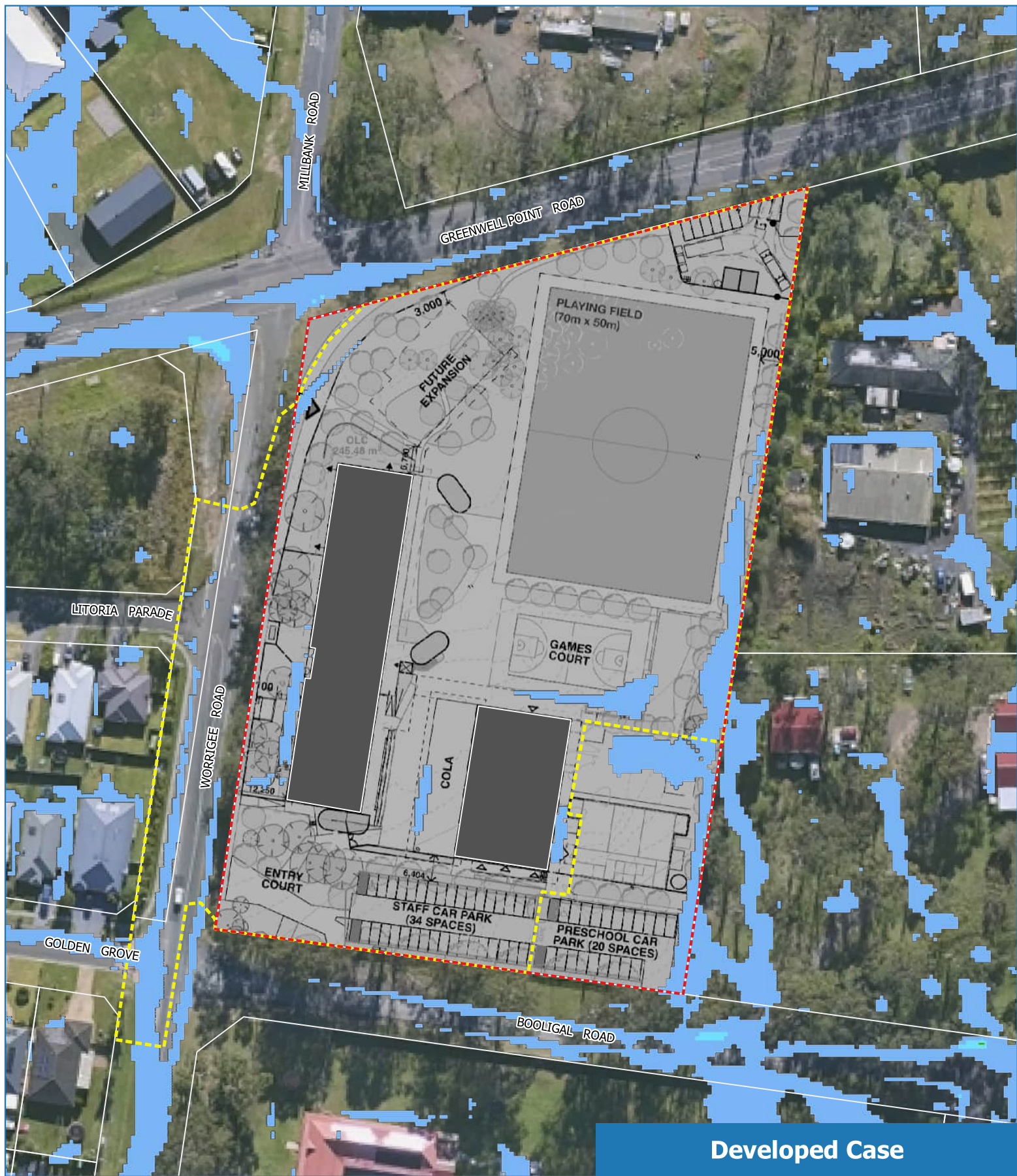


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Existing Case



Developed Case

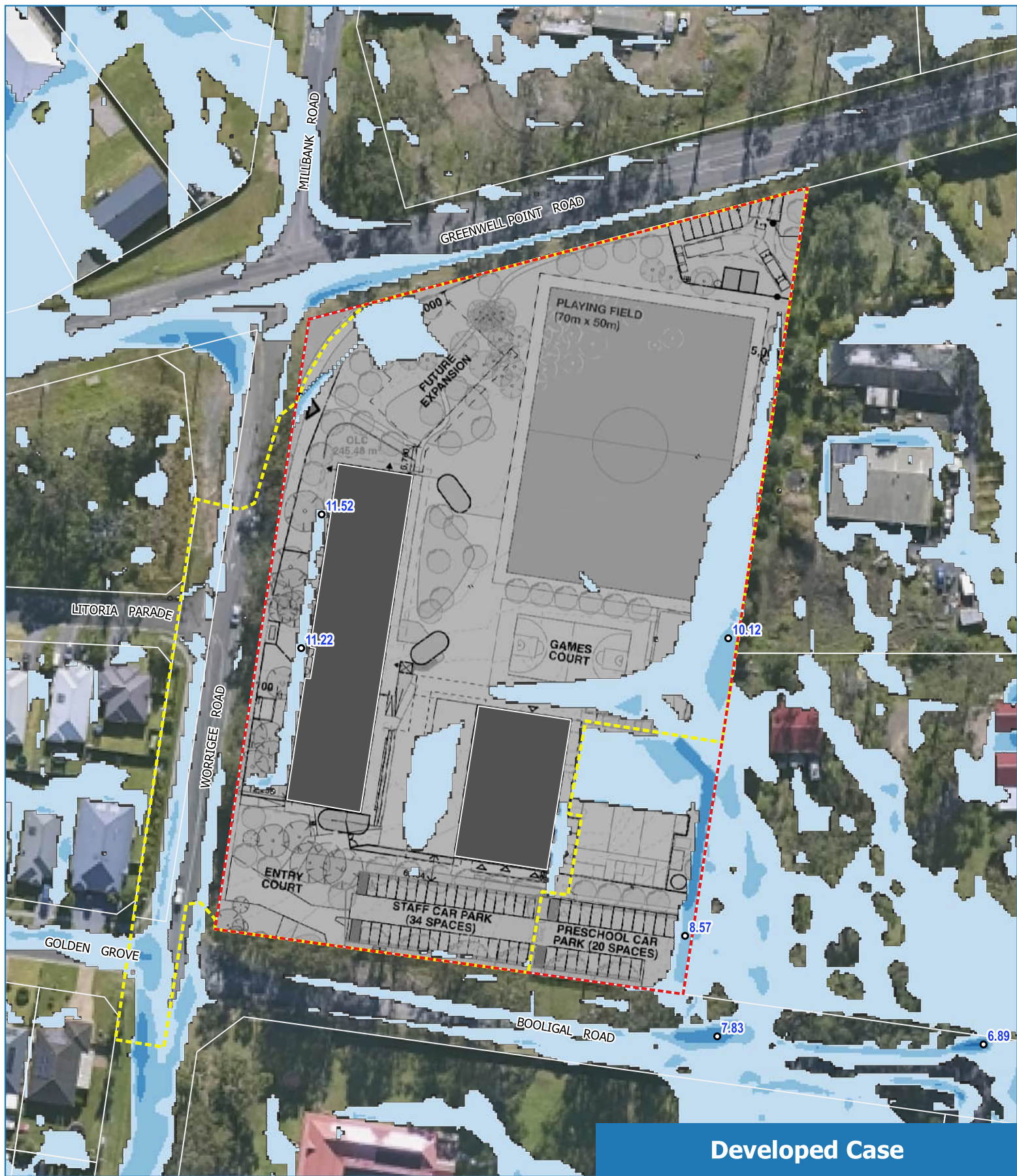
- Legend**
- | | | |
|--------------------|------------------------|----|
| Subject Site | Hazard Category | H4 |
| Cadastre | H1 | H5 |
| Extent of Works | H2 | H6 |
| Proposed Buildings | H3 | |



0 20 40 Metres

1:1,200

Figure AB5-3
1 in 2000 AEP Flood Hazard



Legend

- Subject Site
- Cadastre
- Extent of Works
- Proposed Buildings
- Water Level (mAHD)

Depth(m)

<= 0.05	0.50 - 1.00
0.05 - 0.15	1.00 - 1.50
0.15 - 0.25	> 1.50
0.25 - 0.50	

0 20 40 Metres

1:1,200

Figure AB6-1

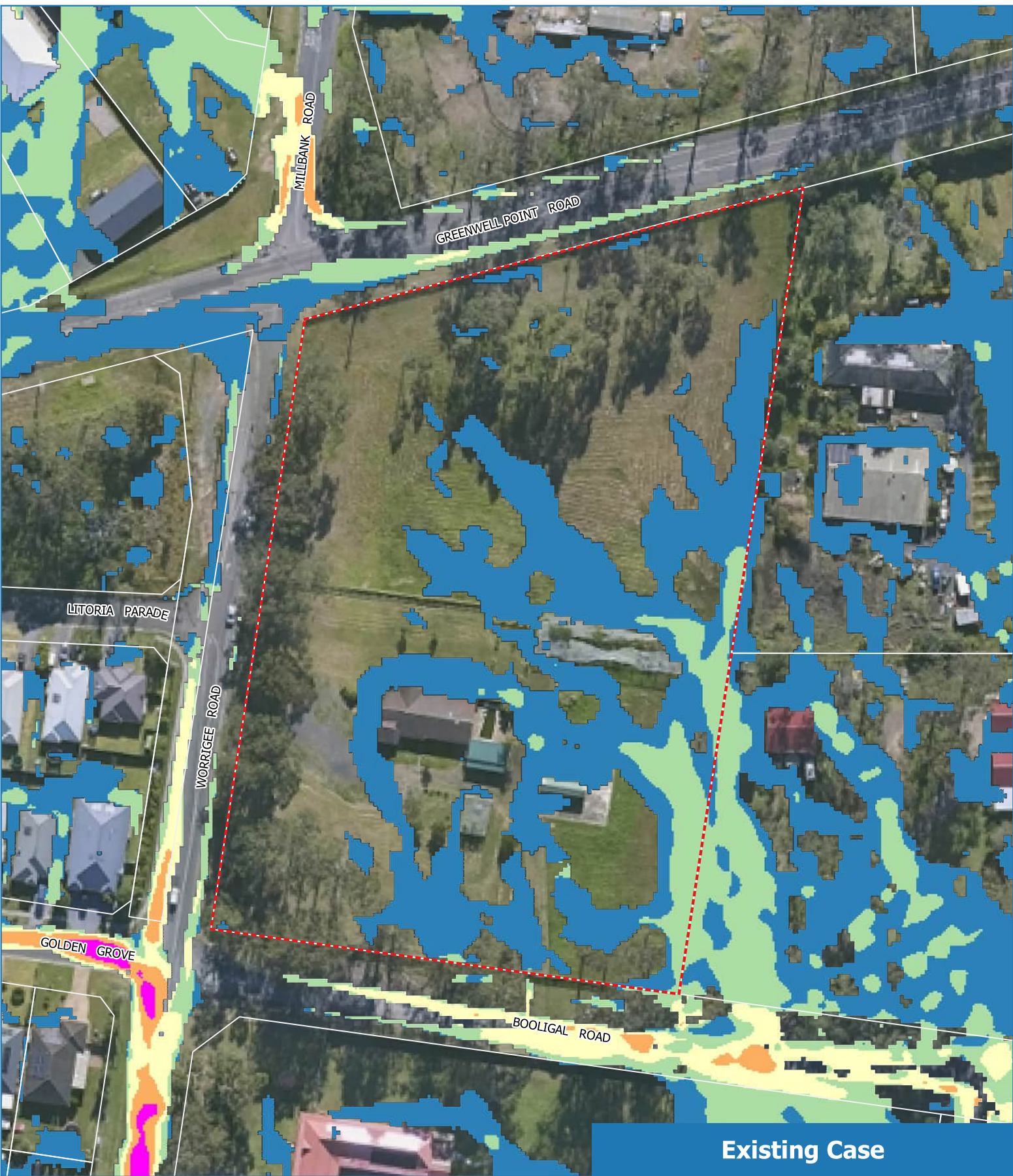
PMF Flood Depth and Elevation

Worrigee New Public School

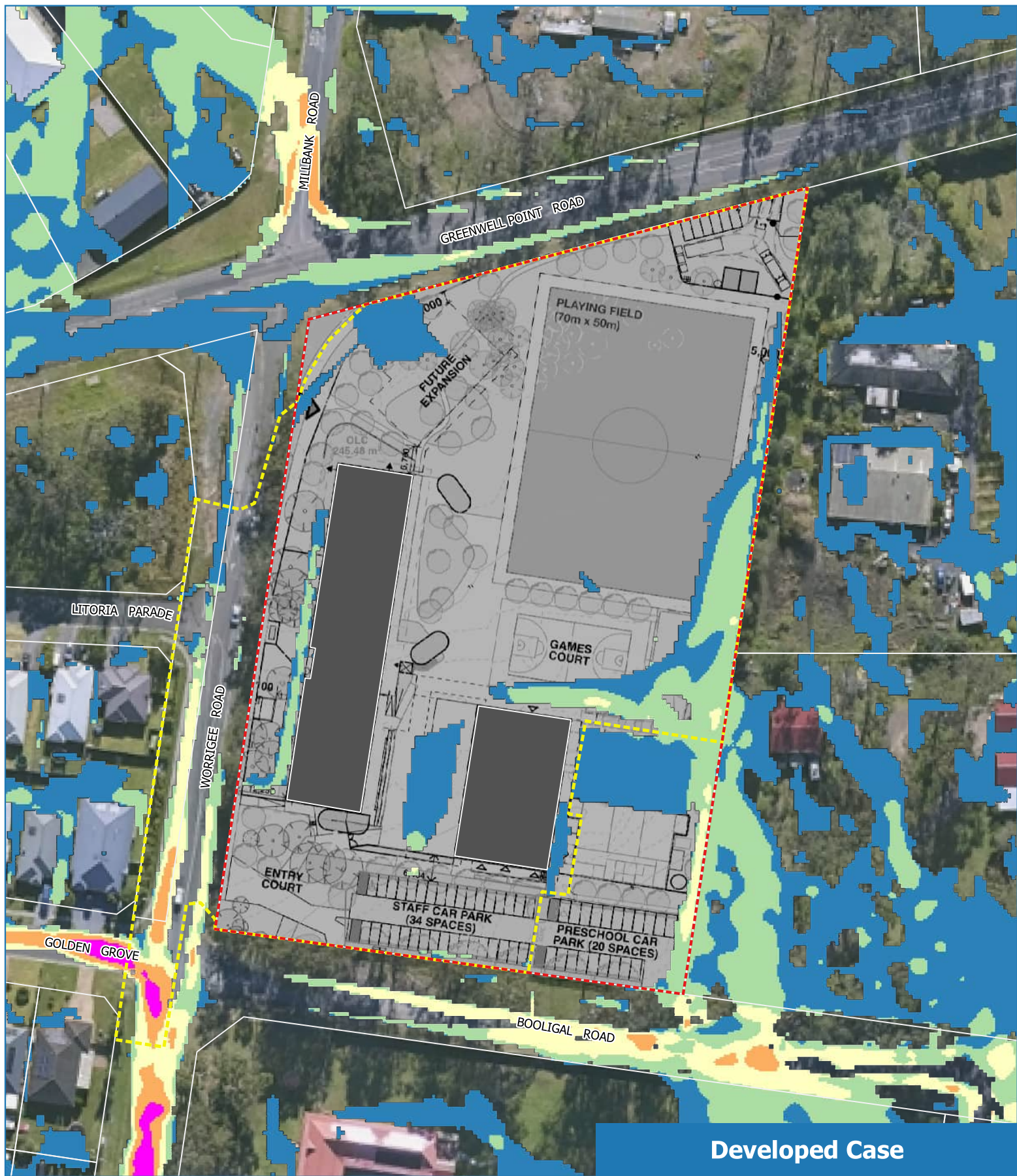
WATER TECHNOLOGY

WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Data Source: NSW Gov - Cadastre, Virtual Earth / Metromap - Imagery



Existing Case



Developed Case

Legend

- | | | |
|---|---|--|
| Subject Site | Velocity(m/s) | 1.5 - 2.0 |
| Cadastre | < 0.5 | 2.0 - 3.0 |
| Extent of Works | 0.5 - 1.0 | > 3.0 |
| Proposed Buildings | 1.0 - 1.5 | |



0 20 40 Metres
1:1,200

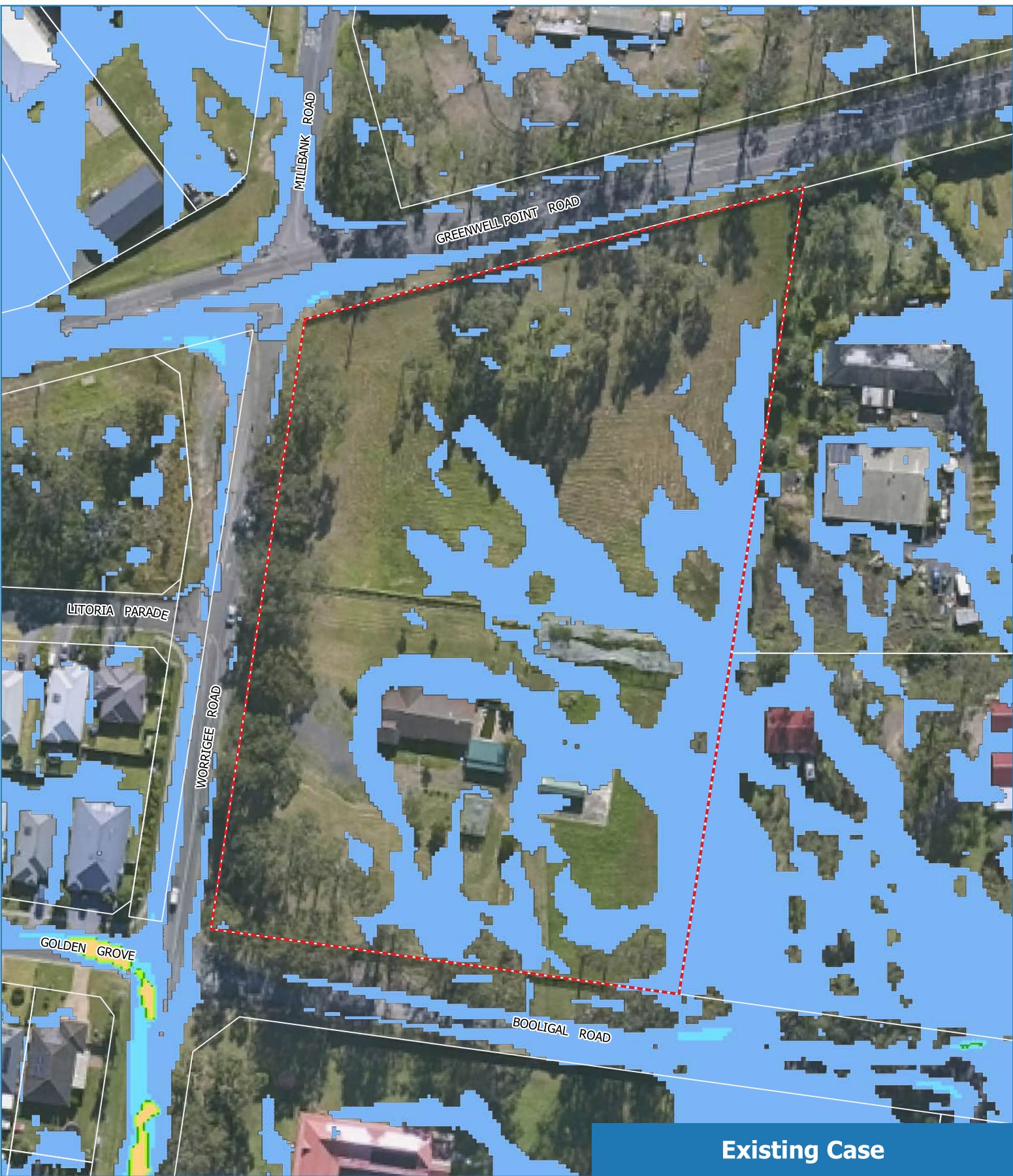
Figure AB6-2

PMF Flood Velocity

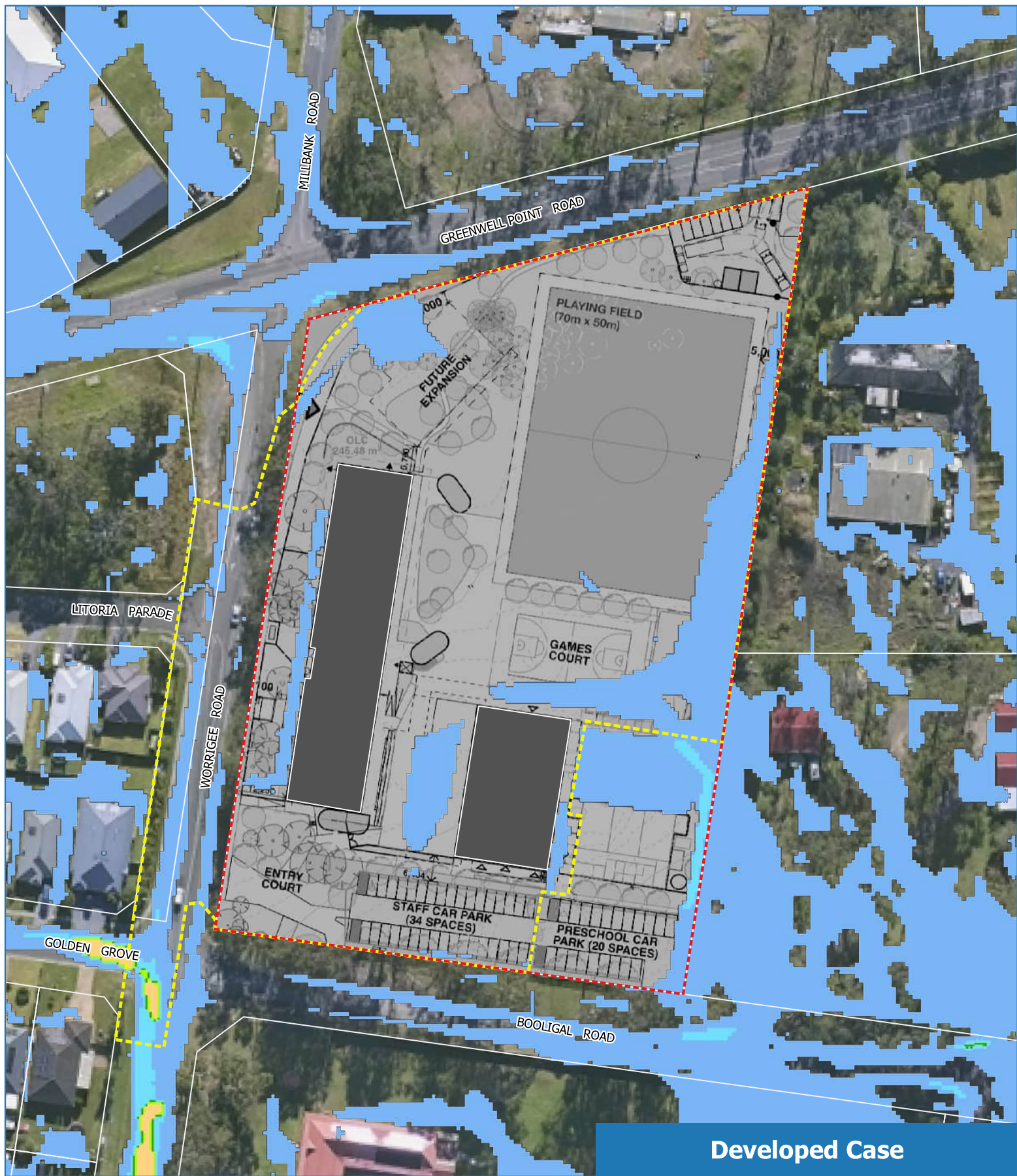


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Existing Case



Developed Case

Legend

- | | | | | | |
|--|--------------------|--|-----------------|--|----|
| | Subject Site | | Hazard Category | | H4 |
| | Cadastre | | H1 | | H5 |
| | Extent of Works | | H2 | | H6 |
| | Proposed Buildings | | H3 | | |



0 20 40 Metres

1:1,200

Figure AB6-3

PMF Flood Hazard



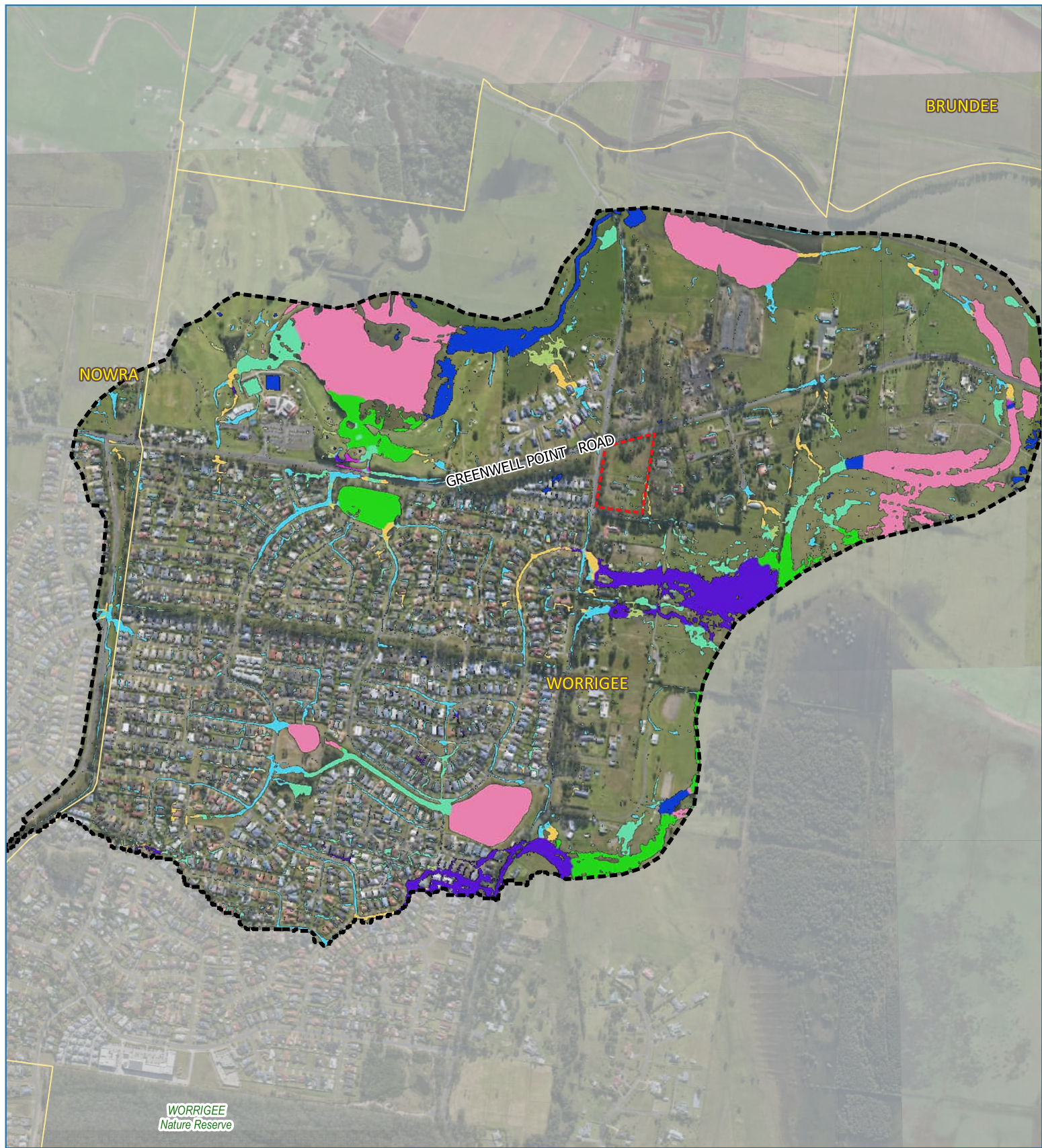
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APPENDIX C CRITICAL STORM DURATIONS





Legend

- Subject Site
- Suburbs
- Model Extent

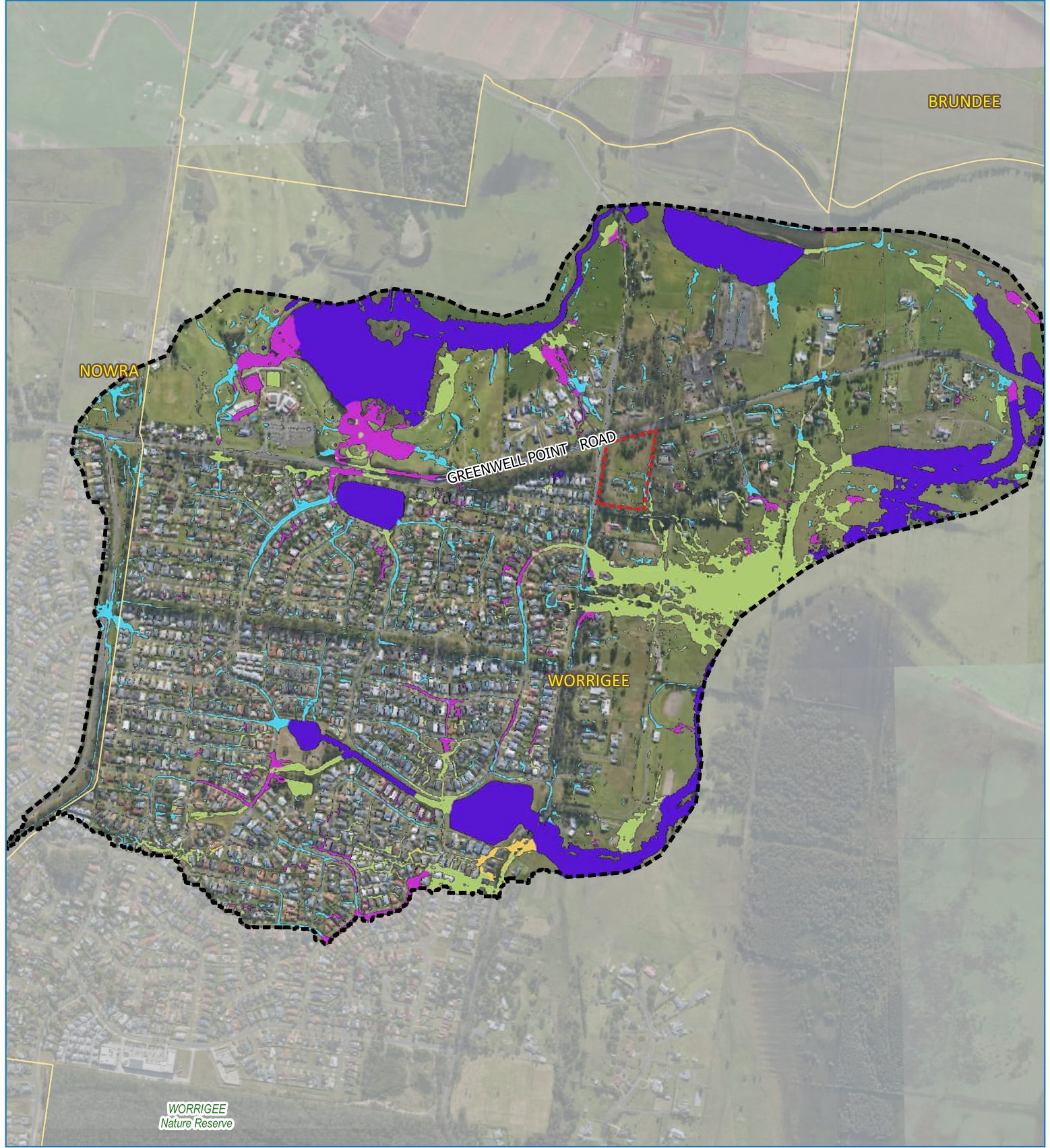
Durations

- 15 min tp6
- 15 min tp8
- 20 min tp8
- 25 min tp7
- 30 min tp3
- 30 min tp8
- 45 min tp9
- 1.5 hr tp3
- 3 hr tp5



0 200 400 Metres
1:12,500

Figure C1
5% AEP Flood Event
Critical Durations



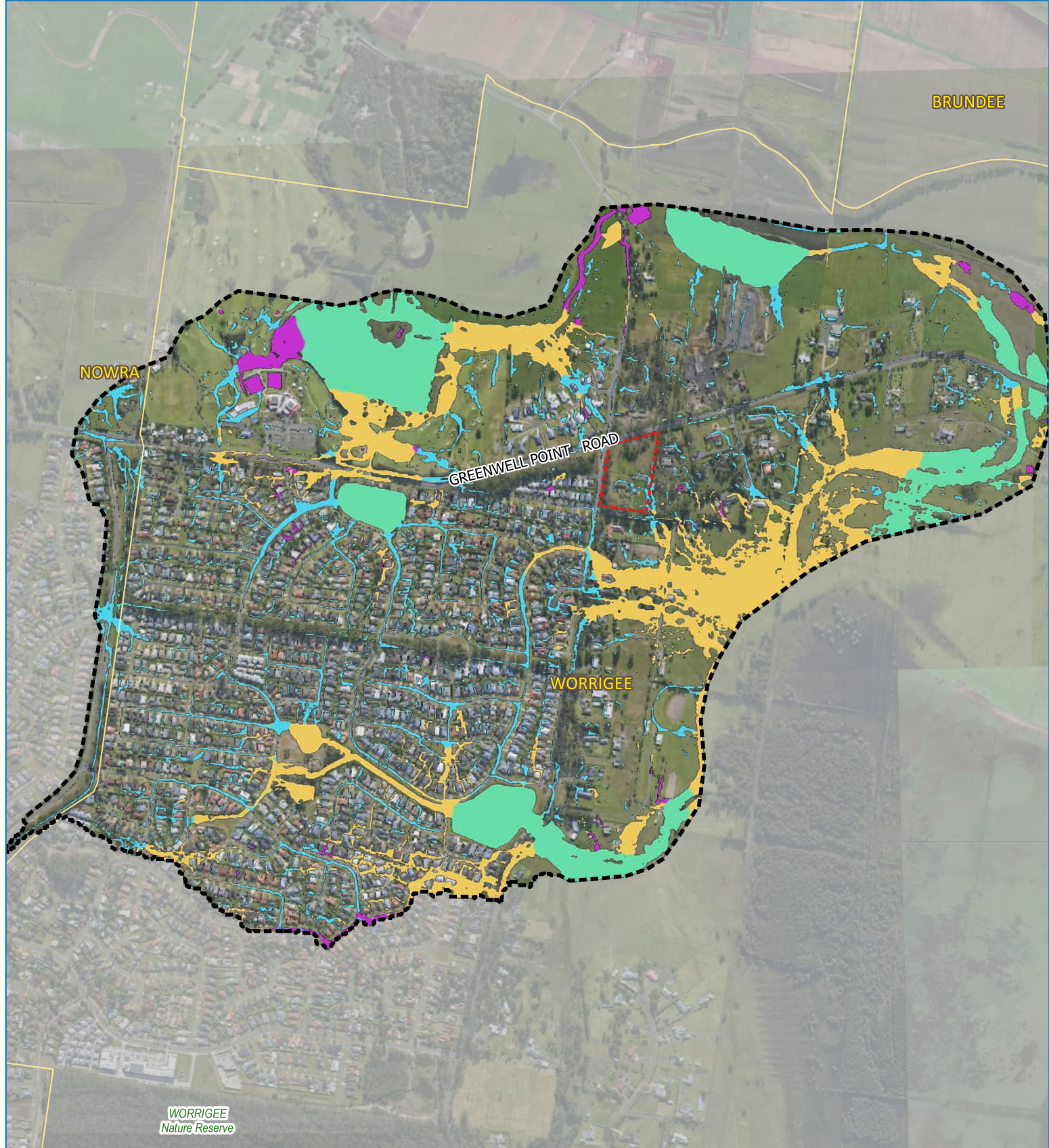
- Legend**
- Subject Site
 - Suburbs
 - Model Extent

- Durations**
- 10 min tp6
 - 20 min tp3
 - 20 min tp7
 - 20 min tp8
 - 1.5 hr tp8
 - 3 hr tp6



0 200 400 Metres
1:12,500

Figure C2
1% AEP Flood Event
Critical Durations



Legend

Subject Site

 Suburbs

 Model Extent

Durations

10 min tp6

20 min tp5

20 min tp7

20 min tp8

3 hr tp5

0 200 400 Metres

1:12,500

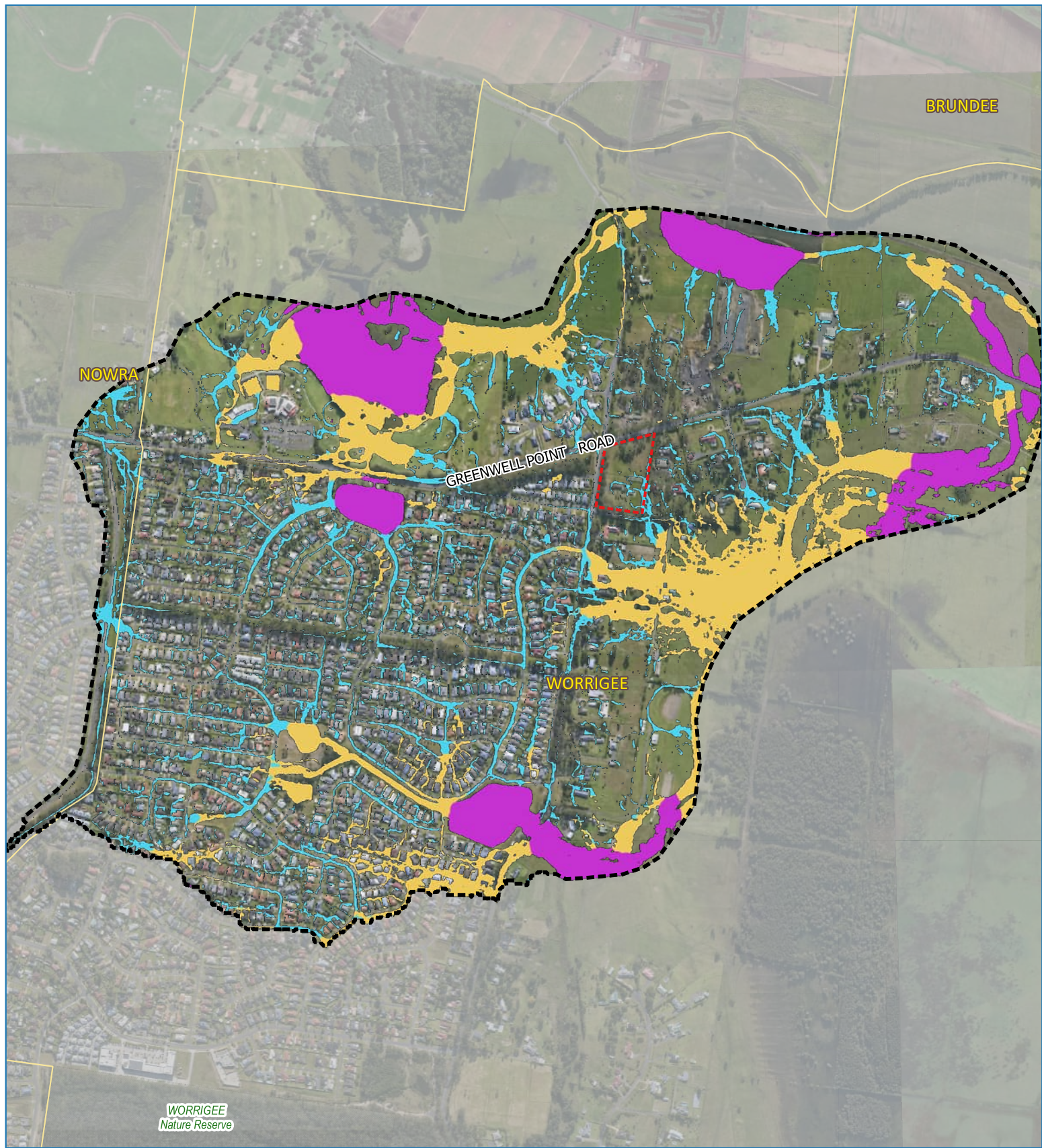
Figure C3

1 in 500 AEP Flood Event

Critical Durations

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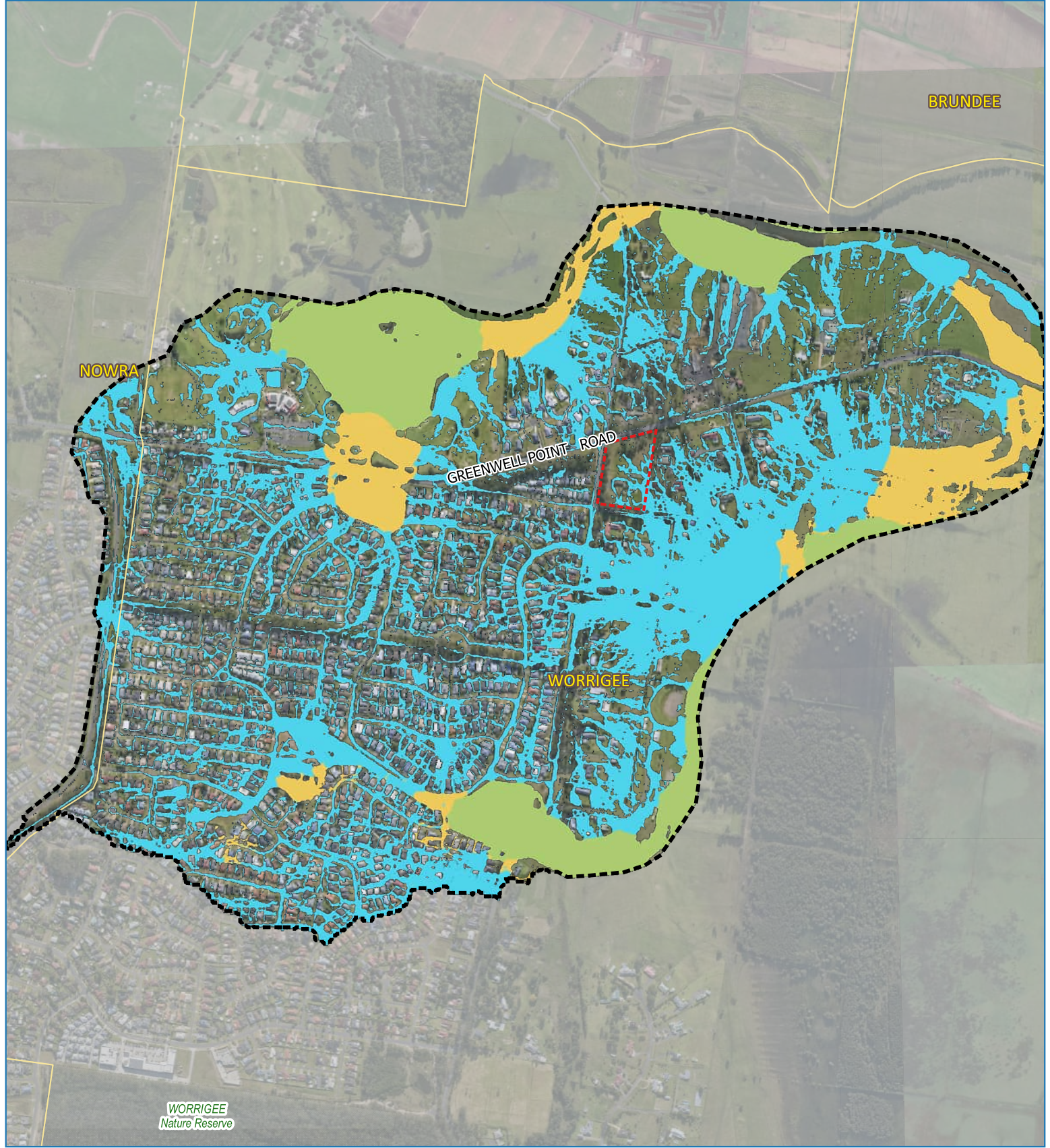
- Legend**
- Subject Site
 - Suburbs
 - Model Extent

- Durations**
- 10 min tp6
 - 20 min tp5
 - 20 min tp7
 - 3 hr tp5



0 200 400 Metres
1:12,500

Figure C4
1 in 200 AEP Flood Event
Critical Durations



- Legend**
- Subject Site
 - Suburbs
 - Model Extent

- Durations**
- 15 min
 - 30 min
 - 45 min



0 200 400 Metres
1:12,500

Figure C5
PMF Flood Event
Critical Durations



APPENDIX D AFFLUX MAPS





Legend

- Subject Site
- Extent of Works
- Proposed Buildings

Difference(m)

- <-0.10
- 0.10 - -0.05
- 0.05 - -0.03
- 0.03 - -0.01
- Less than +/-10mm
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.10
- >0.10

Wet/Dry Difference

- Was Wet Now Dry
- Was Dry Now Wet



0 30 60 Metres
1:1,750

Figure D1-1
5% AEP Flood Elevation Difference
Pre-to-Post Comparison



Legend

- Subject Site
- Extent of Works
- Proposed Buildings

Difference(m)

- <-0.10
- 0.10 - -0.05
- 0.05 - -0.03
- 0.03 - -0.01
- Less than +/-10mm
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.10
- >0.10

Wet/Dry Difference

- Was Wet Now Dry
- Was Dry Now Wet



0 30 60 Metres
1:1,750

Figure D2-1
1% AEP Flood Elevation Difference
Pre-to-Post Comparison



Legend

- Subject Site
- Extent of Works
- Proposed Buildings

Difference(m)

- <-0.10
- 0.10 - -0.05
- 0.05 - -0.03
- 0.03 - -0.01
- Less than +/-10mm
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.10
- >0.10

Wet/Dry Difference

- Was Wet Now Dry
- Was Dry Now Wet



0 30 60 Metres
1:1,750

Figure D3-1
1% AEP Climate Change
Flood Elevation Difference
Pre-to-Post Comparison



Legend

- Subject Site
- Extent of Works
- Proposed Buildings

Difference(m)

- <-0.10
- 0.10 - -0.05
- 0.05 - -0.03
- 0.03 - -0.01
- Less than +/-10mm
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.10
- >0.10

Wet/Dry Difference

- Was Wet Now Dry
- Was Dry Now Wet



0 30 60 Metres
1:1,750

Figure D4-1
1 in 500 AEP Flood Elevation Difference
Pre-to-Post Comparison



Legend

- Subject Site
- Extent of Works
- Proposed Buildings

Difference(m)

- <-0.10
- 0.10 - -0.05
- 0.05 - -0.03
- 0.03 - -0.01
- Less than +/-10mm
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.10
- >0.10

Wet/Dry Difference

- Was Wet Now Dry
- Was Dry Now Wet



0 30 60 Metres
1:1,750

Figure D5-1

1 in 2000 AEP Flood Elevation Difference
Pre-to-Post Comparison



Legend

- Subject Site
- Extent of Works
- Proposed Buildings

Difference(m)

- <-0.10
- 0.10 - -0.05
- 0.05 - -0.03
- 0.03 - -0.01
- Less than +/-10mm
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.10
- >0.10

Wet/Dry Difference

- Was Wet Now Dry
- Was Dry Now Wet



0 30 60 Metres
1:1,750

Figure D6-1
PMF Flood Elevation Difference
Pre-to-Post Comparison