Due Diligence Report

Kogarah Public School

Prepared for NSW Department of Education / 17 January 2025

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Rev	Date	Prepared By	Approved By	Remarks
1	19/08/2024	LC	Philip McAteer	Draft
2	17/01/2025	LC	Jamie Marshall	Final – site plan updated

1.0 Introduction

TTW has been engaged on behalf of NSW Department of Education to prepare this Due Diligence Report for Kogarah Public School, located in Kogarah, within the Georges River Local Government Area (LGA). As part of the NSW Government's plan to rebuild essential services, the 2023-24 Budget is delivering a record $8.8 billion for new and upgraded schools, including an upgrade to Kogarah Public School.

This report outlines the existing constraints of flooding and overland flow paths at the school site. The details of this report are based on currently available information and correspondence undertaken at the time of writing. This investigation forms part of a broader educational infrastructure improvement program based on the Election Commitment upgrade program.

1.1 Guidance Documents

The following documents have been reviewed and referenced in preparing this report:

- Australian Institute of Disaster Resilience (AIDR) Guideline 7-3: Flood Hazard (2017)
- Bayside Council Online Mapping System, Available at: https://maps.bayside.nsw.gov.au/Intramaps98/
- Considering Flooding in Land Use Planning Guideline DPE 2021
- Georges River Council (2020) Stormwater Management Policy – Chapter 6: Flooding and Overland Flow
- Georges River Council (2021) Georges River Development Control Plan – Part 3: General Planning Considerations
- Georges River Council Online Mapping System, Available at: https://intramaps.georgesriver.nsw.gov.au/intramaps80/#
- NSW Department of Environment and Heritage – Flood Risk Management Guideline LU01, June 2023
- NSW Department of Planning and Environment (2023) Flood Risk Management Manual https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-manual
- NSW Department of Planning, Housing and Infrastructure – Planning Circular PS 24-001, Update on addressing flood risk in planning decisions, 1st March 2024
- NSW Planning Portal Spatial Viewer – https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address
- Rockdale City Council (2017) Spring Street Drain, Muddy Creek and Scarborough Ponds Catchments Flood Study Review, prepared by BMT WMB Pty Ltd. Available at: https://www.bayside.nsw.gov.au/area/environment/floodplain-management/spring-street-muddy-creek-and-scarborough-ponds-catchments

1.2 Proposed Activity Description

The proposed Kogarah Public School upgrade works include the following:

- Demolition of existing playground facilities and Covered Outdoor Learning Area (COLA) in addition to footings and services associated with former demountable buildings;
- Tree removal;
- Construction of a new three storey Classroom building and attached amenities facilities;
- Construction of a single storey Hall with attached Covered Outdoor Learning Area;
- New pedestrian pathway connections providing access throughout the site;
- Service upgrades; and
- Site landscaping works.

An extract of the proposed Site Plan is provided in Figure 1 below

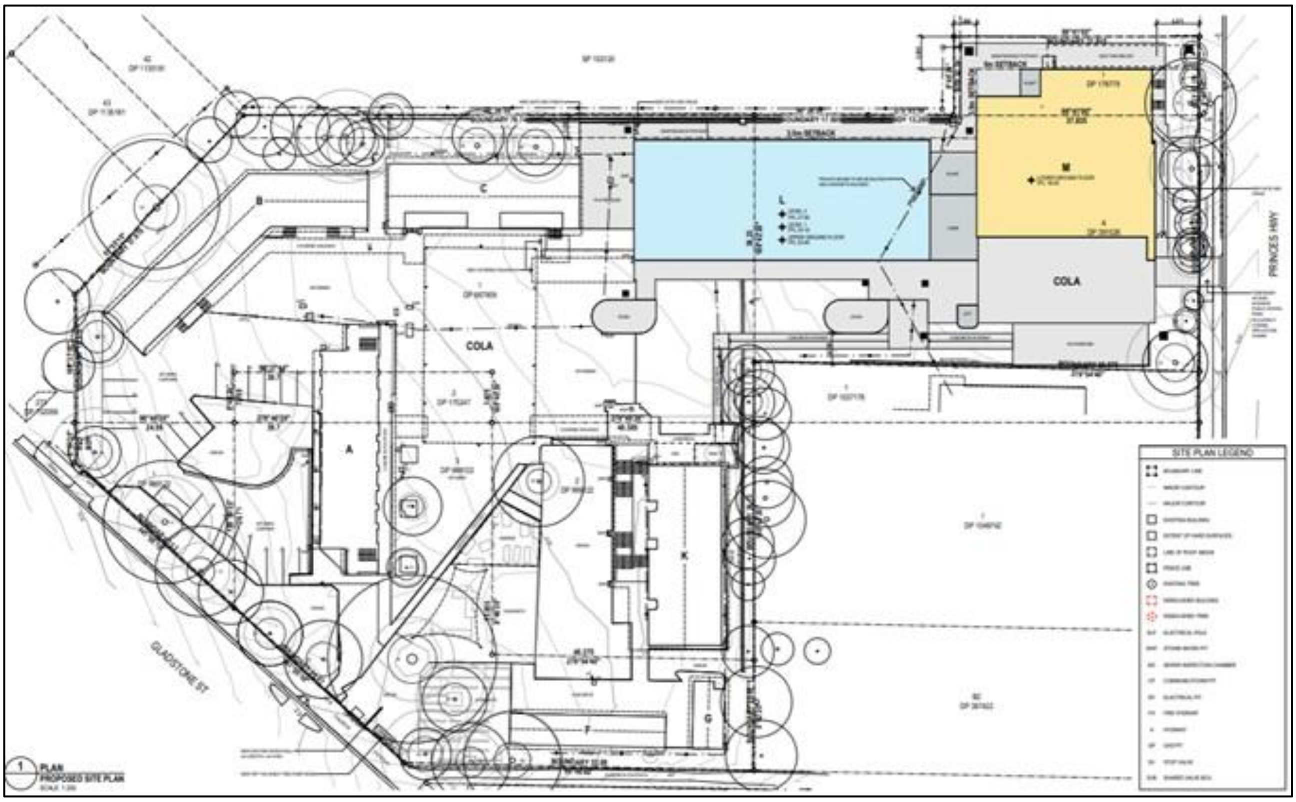

Figure 1: Extract of proposed Site Plan (Fulton Trotter, 2024)

2.0 Site Characteristics

2.1 Site Location

Kogarah Public School is located at 24B Gladstone Street in the suburb of Kogarah, NSW 2217, approximately 11 km from Sydney CBD. The site is situated within the following lots, with a total area of approximately 1.22 hectares:

- Lot 1 DP 179779
- Lot 1 DP 667959
- Lot 1 DP 999122
- Lot 2 DP 175247
- Lot 2 DP 999122
- Lot 3 DP 999122
- Lot A DP 391026

Figure 2 presents the site location, bounded by Princes Highway to the east, which marks the LGA boundary with Bayside Council, Gladstone Street to the southwest, and residential developments to the north and south. A pathway runs along the southern boundary of the site, providing pedestrian access to Princes Highway and Gladstone Street. The site is currently occupied by eight permanent buildings, 11 demountable buildings, external play areas, two sports courts and landscaping. Trees and planted vegetation are scattered along all frontages. Although the site has two road frontages, there is only one singular vehicular access point via Gladstone Street. The existing site plan for the school is shown in Figure 3.

The site is zoned SP2 Infrastructure (Educational Establishment) under the Georges River Local Environmental Plan (LEP) 2021. As an educational facility, the proposal is permissible in the SP2 zone under the provisions of Section 3.36(1) of the T&I SEPP. Based on a desktop review of the area, the character of the surrounding locality can be summarised as follows:

- The site is surrounded primarily by R4 High Density Residential zoning.
- Existing land uses in the area include high density residential, commercial premises, and place of worship. St. Paul's Anglican Church (a Local Heritage Item) is situated immediately southeast of the school.
- The surrounding area is an existing built-up urban suburb, with high rise developments and limited open spaces around the site.
- The site is located in close proximity to the Illawarra railway, with Kogarah Train Station situated within 400m walking distance of the pedestrian entry to the school.
- There are several educational establishments in the region, including Kogarah High School (approximately 130m northwest of Kogarah Public School) and St George Girls High School (200m north of the site).

Figure 2: Kogarah Public School site location (Source: Nearmap imagery dated 18 June 2024)

Figure 3: Existing site plan for Kogarah Public School

2.2 Site Topography

As depicted in the Digital Elevation Model (DEM) obtained from Elevation Information System (ELVIS) (dated April–May 2020), there is a predominant slope from the higher elevation ground in the west towards Princes Highway at the eastern frontage of the site.

Updated survey data for the site was obtained in January 2024 by Astrea Surveying Consulting Services using laser scanning of the site and street frontage, in conjunction with traditional survey. Situated on the eastern flank of a local hill, ground surface within the site boundary varies from a high of 23.33m AHD at its most westerly extent, to a low of 17.35m AHD at the northeast corner, according to Astrea's topographical survey mapping.

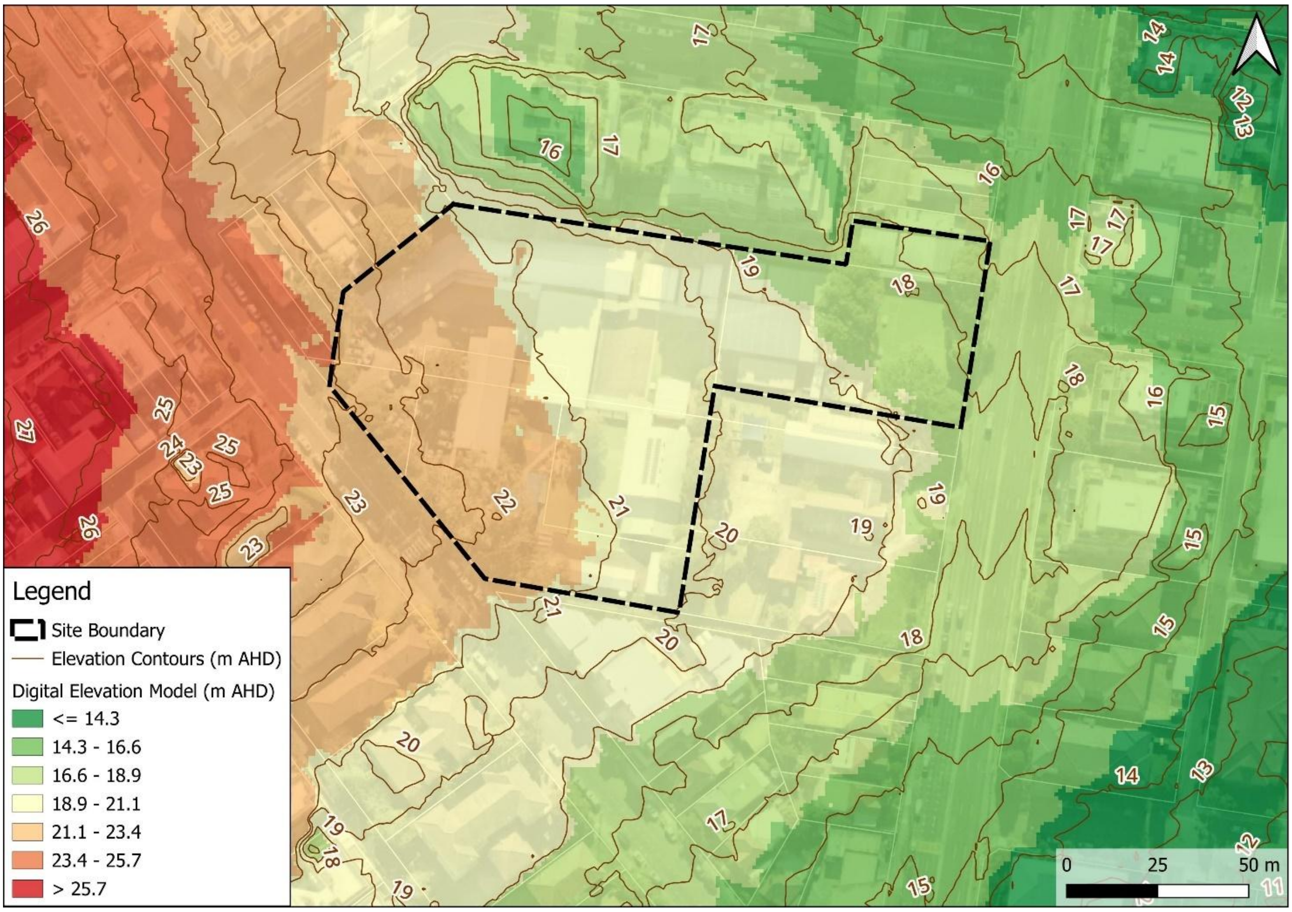

Figure 4: Topography of the site and surrounding area (Source: DEM obtained from ELVIS, dated April–May 2020)

3.0 Stormwater and Overland Flow

3.1 Local Catchment

Given the urban environment of the site, it is necessary to review the risks associated with stormwater and overland flow within the site, as the associated impervious surfaces typically result in concentrated flow paths, and impacts to roads are common.

The approximate local catchment contributing to runoff flows within the site boundary is shown in blue hatching in Figure 5, with the total contributing area estimated as 2.90 hectares. Some overland sheet flow is expected to run across the school boundary, flowing primarily in an easterly direction. Further assessment of the significance of this overland flow is outlined in Section 3.2 and Section 4.2.

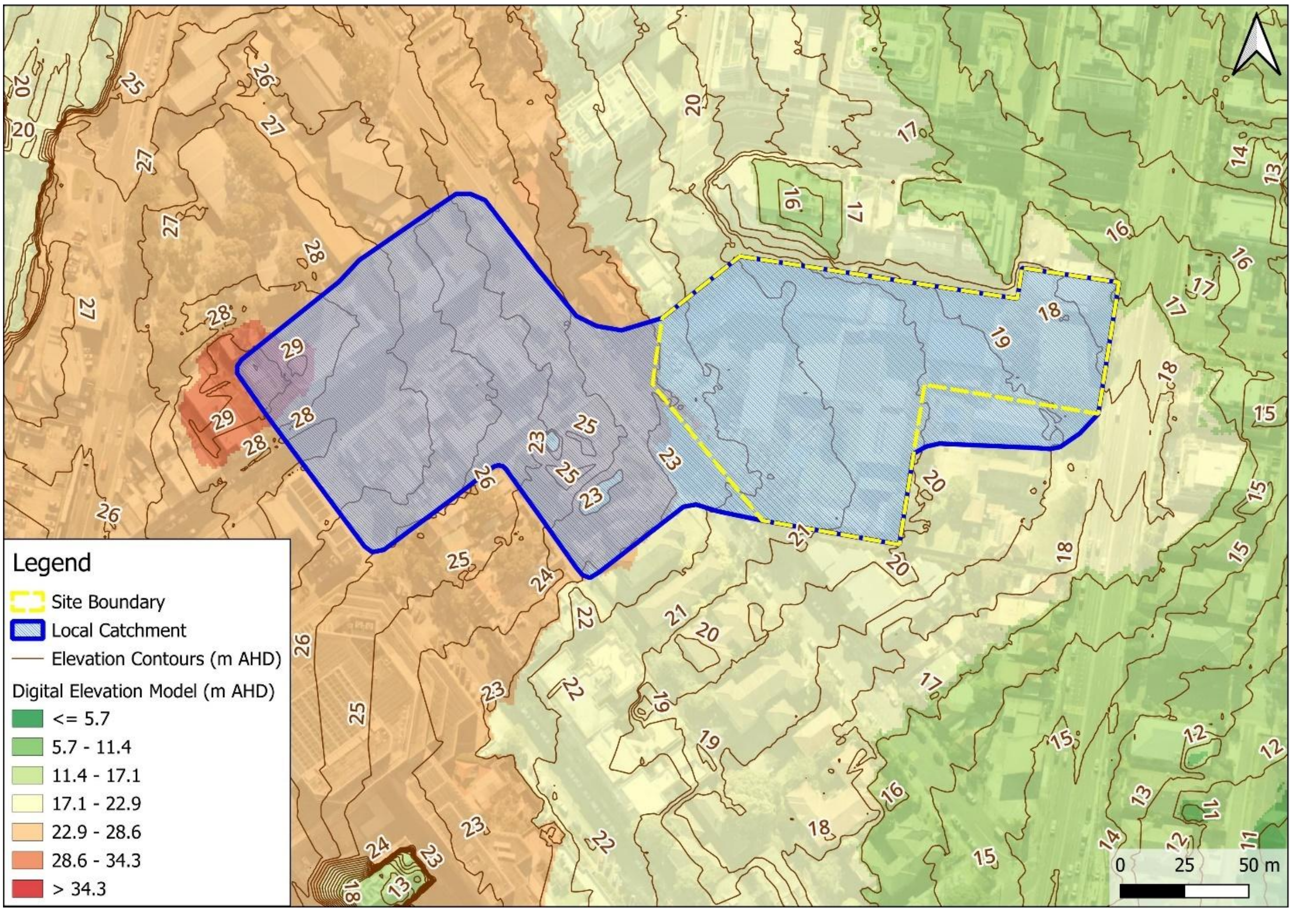

Figure 5: Local catchment contributing to overland flow within the Kogarah Public School boundary

3.2 Rainfall Runoff Peak Flows – Rational Method

Preliminary calculations can be used to estimate overland flow across the catchment using the Rational Method. The overland flow travel time was calculated using the Friend equation:

$$t_o = \frac{107 \ x \ n \ x \ L^{0.333}}{S^{0.2}}$$

Where:

- t_o = overland flow travel time (mins)
- L = flow path length (m)
- n = Manning's n roughness

- S = slope of surface (%)

The overland flow travel time was calculated at approximately 9.5 minutes. This then informed the rainfall-runoff equation to calculate flow for the 1% Annual Exceedance Probability (AEP) 10-min duration storm. The rainfall-runoff equation is as follows:

$$Q = CiA$$

Where:

- C = the runoff coefficient (in this case, estimated as 0.96);
- i = the rainfall intensity (in this case, 180 mm/hr for the 1% AEP 10-min storm, taken from the BOM website);
- A = the area of the contributing catchment (2.90 hectares)

$$Q = 0.96\ x\ 180\ x\ 2.90/360$$

$$Q = 1.39\ m^3/s$$

It is assumed that most of the smaller event runoff would be diverted into the existing stormwater network, including the pit and pipe system located on Gladstone Street, west of the site. Figure 6 presents a utility map of the site in existing conditions (obtained from Astrea), with stormwater pipes in dark blue. In addition to stormwater pipes along the perimeter of the site, there is an OSD tank north of Building K that will store stormwater runoff, further reducing the rate of runoff.

Overall, the local catchment area is relatively small, and overland flows in the 1% AEP event are not a concern.

It should be noted that these preliminary calculations are provisional approximations of the conditions onsite. More detailed hydraulic modelling of the local drainage systems would be needed to verify whether the site is vulnerable to overland flows. This is addressed further in Section 4.2.

Figure 6: Utility asset map for Kogarah Public School, including stormwater pipes (Source: obtained from Astrea)

4.0 Available Flood Information

4.1 Georges River LGA

Georges River Council was formed on 12 May 2016 following the merger of the Hurstville City Council and Kogarah City Council, with the school site located within the former Kogarah LGA. Georges River Council are currently preparing a Flood Study for Blakehurst and Kogarah May Wards, which is expected to be completed by 2025.

However, as shown in Figure 7, there is no current flood study within the LGA covering the northern portion of Kogarah. TTW lodged a flood advice application with Georges River Council on the 6 August 2024 to confirm the existing flood risk to the site. As there is no adopted flood study covering the site, Council was unable to provide a flood advice letter.

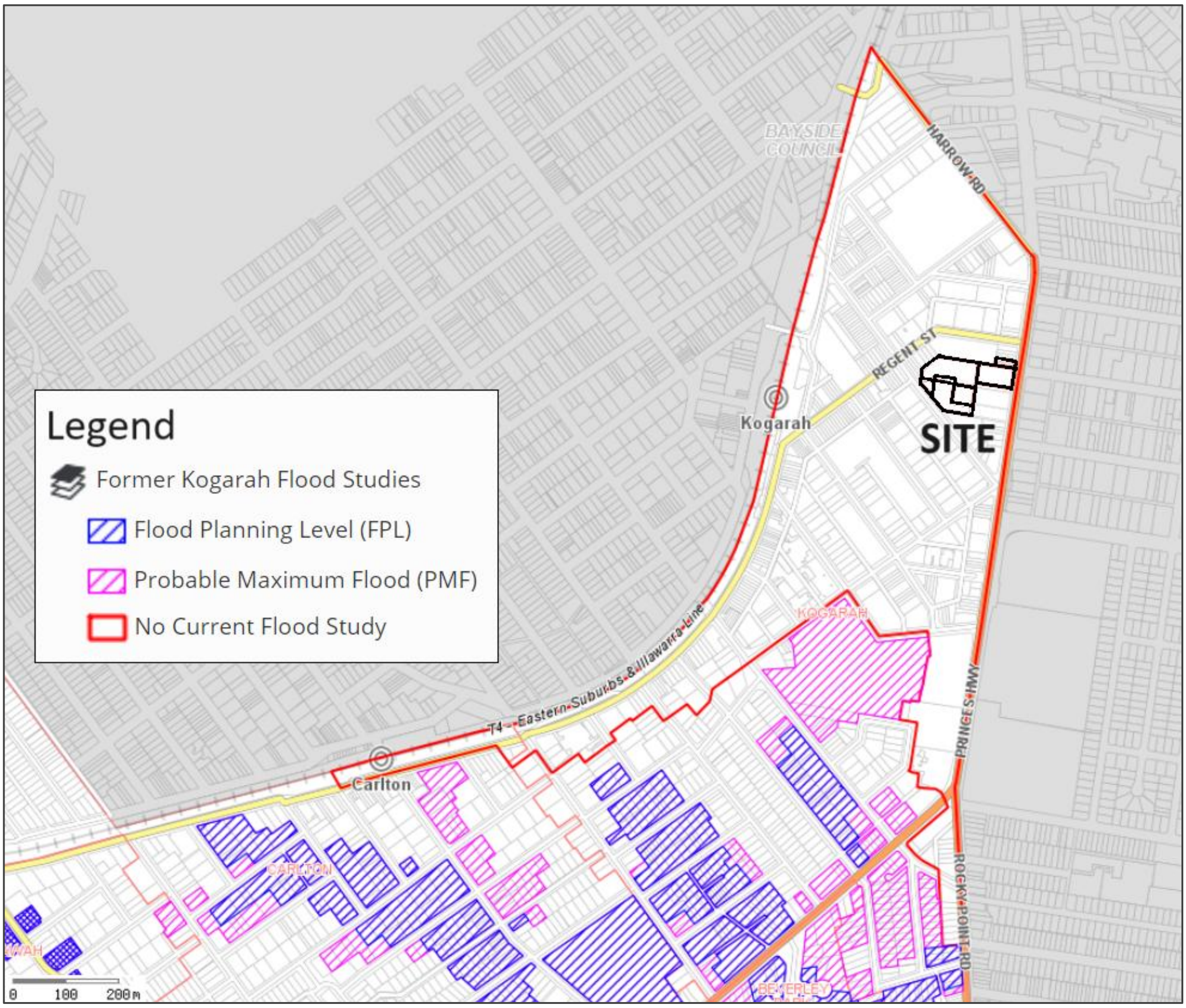

Figure 7: Currently available flood information for the site from Georges River Council (Source: Georges River Council online mapping system)

4.2 Bayside LGA

As aforementioned, Kogarah Public School is situated directly west of the Bayside LGA border. Figure 8 depicts the watercourses surrounding the site, with the school situated approximately 0.4 km south of Muddy Creek. A 4.3km portion of the creek has been converted into a brick and concrete lined stormwater channel, owned by Sydney Water, that forms the main drainage system in the catchment. The creek flows northeast, eventually discharging into the Cooks River estuary. Aside from a 120m stretch of channel at Hogben Park that crosses the LGA boundary, Muddy Creek falls within the Bayside Council LGA. Also situated within Bayside LGA is the Scarborough Ponds, a series of dredged ponds and semi-natural wetlands which have formed in Scarborough Park. The ponds discharge to Botany Bay via an artificial outlet constructed in the 1970s, comprised of three 1350m diameter pipes. The ponds are approximately 0.8km east of Kogarah Public School.

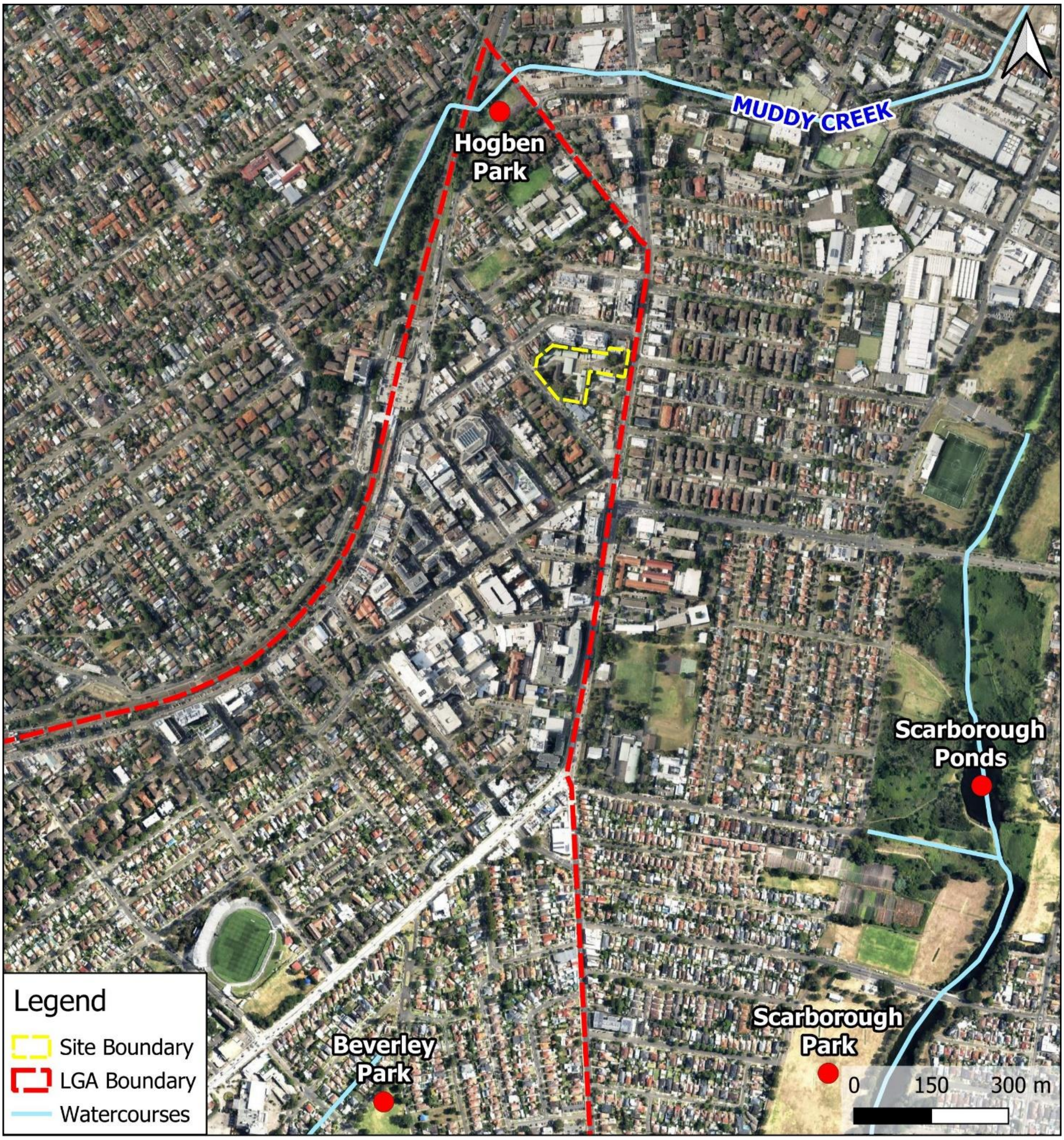

Figure 8: Watercourses in the surrounding area

The former Rockdale City Council (now Bayside Council) commissioned BMT WBM to investigate flood behaviour in both catchments as part of the Spring Street Drain, Muddy Creek and Scarborough Ponds Catchments (SSMCSPC) Flood Study in 2017, which assessed a total area of 13.1 km^2. As depicted in the flood study area map in Figure 9, the school is situated at the crest between the Muddy Creek and Scarborough Ponds Catchments.

The flood study assessed flood behaviour by producing information on flood flows, velocities, levels and extents for a range of flood event magnitudes, up to and including the Probable Maximum Flood (PMF). The study included an assessment of both mainstream flooding from creeks, alongside overland flooding from local catchment flows, and found that flooding within the catchment is principally overland flow, with limited out-of-bank mainstream flooding.

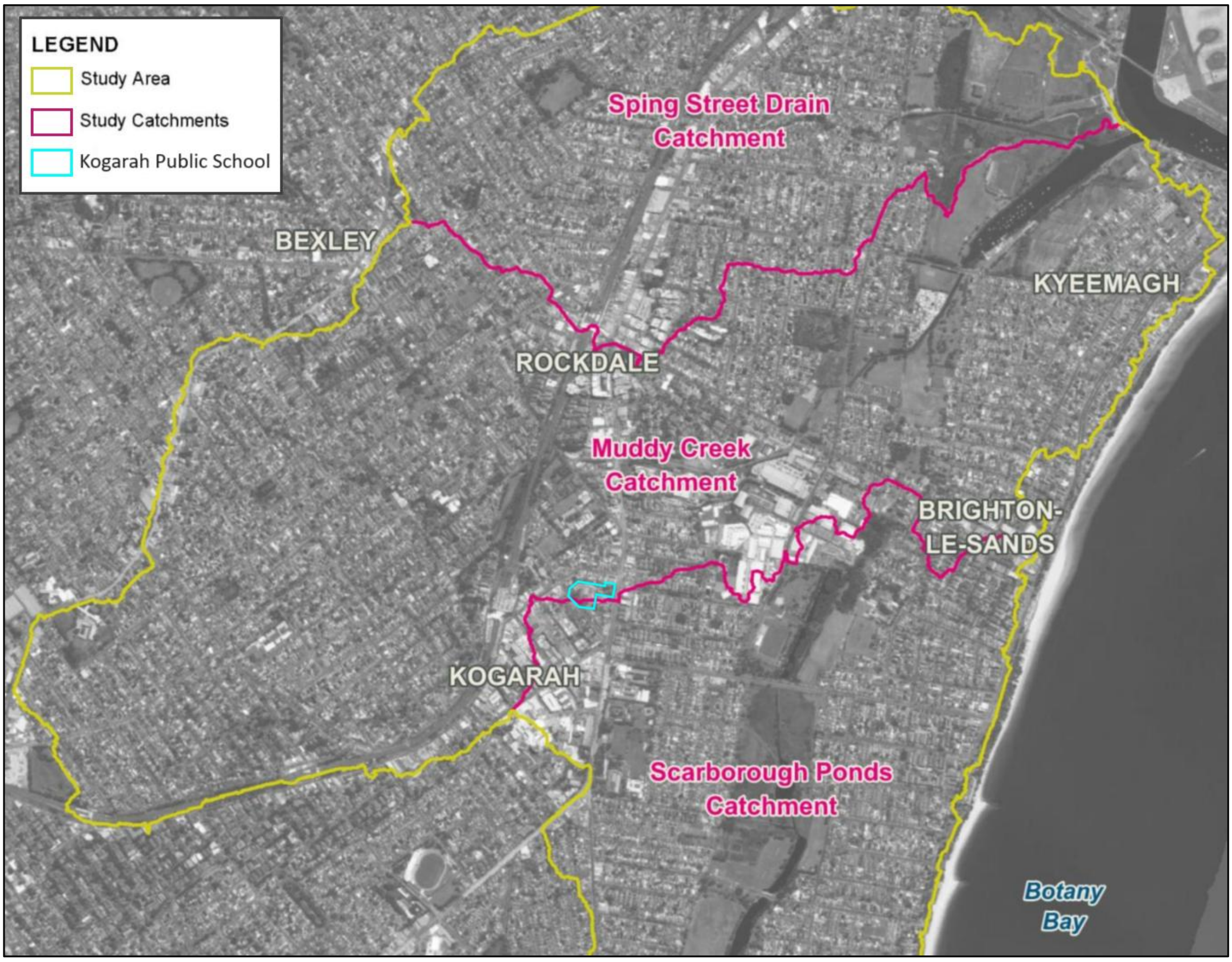

Figure 9: Kogarah Public School in relation to the SSDMCDPC Flood Study Area

4.2.1 Flood Depths and Extent

Figure 10 depicts the 1% AEP flood depths surrounding Kogarah Public School, while PMF depths are presented in Figure 11. In both events, the school site is unaffected by flooding, with no intrusion of floodwaters across the site boundary. However, surrounding roads are impacted by flooding, including the intersection of Gladstone Street and Princes Highway, which is inundated by floodwaters of up to 0.5m depth in the 1% AEP event, and 1m depth in the PMF.

In addition, Kogarah Train Station is affected by floodwaters exceeding 1.5m depth over the railway lines, with potential restrictions on staff and student travel during significant flood events.

Figure 10: 1% AEP flood depths surrounding the site (Source: adapted from SSDMCSPC Flood Study)

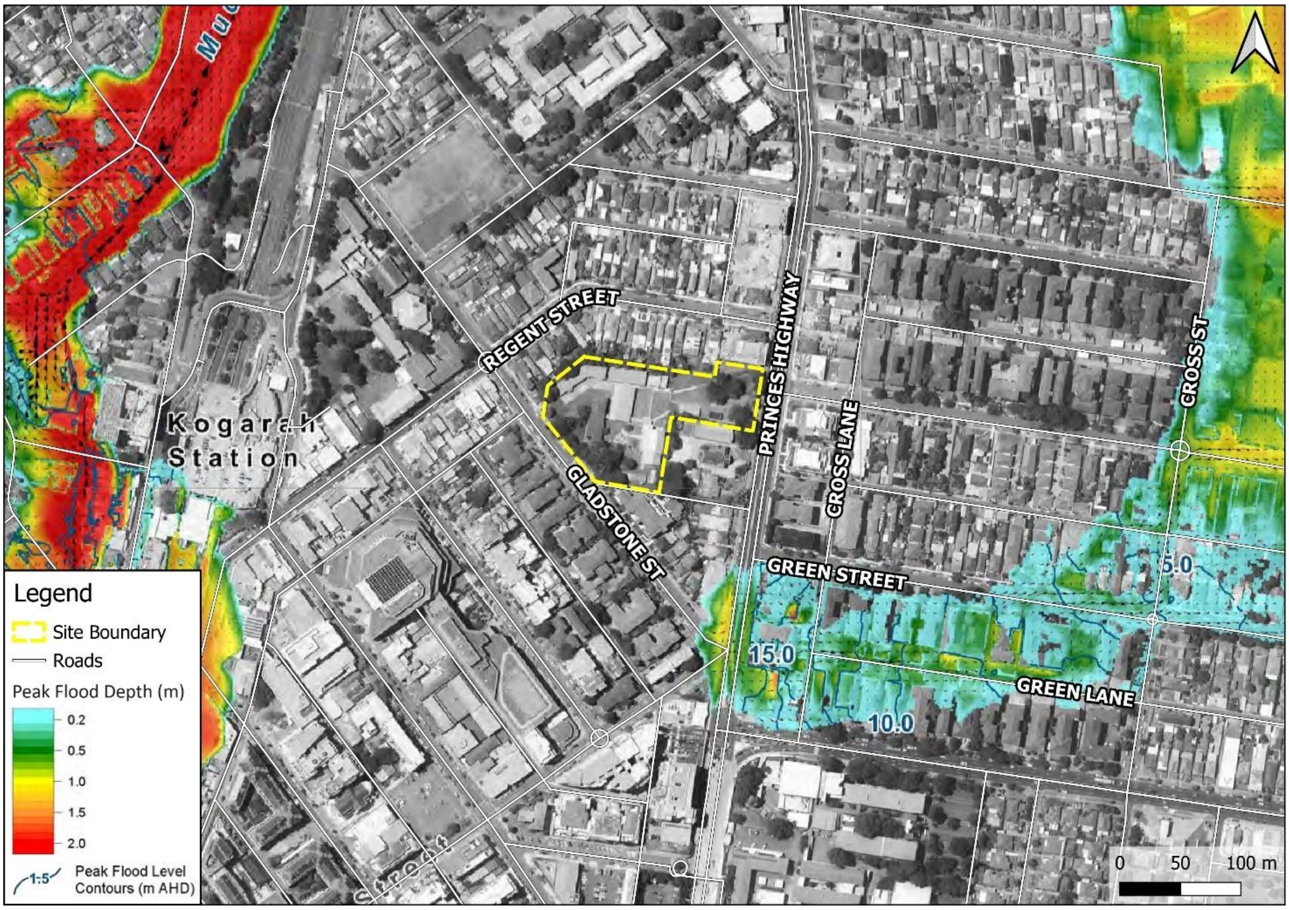

Figure 11: PMF depths surrounding the site (Source: adapted from SSDMCSPC Flood Study)

4.2.2 Site Access and Flood Hazard

Although the site itself is unaffected by flooding in all design events, there are potentially significant impacts to the roads surrounding the site. To understand the impact of this on the site's accessibility and evacuation potential during rare flood events, it is necessary to review the flood hazard. Flood hazard is determined through the relationship between the depth and velocity of floodwaters.

'*Handbook 7 – Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia*', part of the Australian Disaster Resilience Handbook Collection (2017), presents a set of hazard curves which assess the vulnerability of people, vehicles and buildings to flooding based on the velocity and depth of flood flows. This flood hazard vulnerability curve is shown in Figure 12, with 6 classes ranging from a level of H1 (generally safe for people, vehicles and buildings) to H6 (unsafe for vehicles and people, with all buildings considered vulnerable to failure).

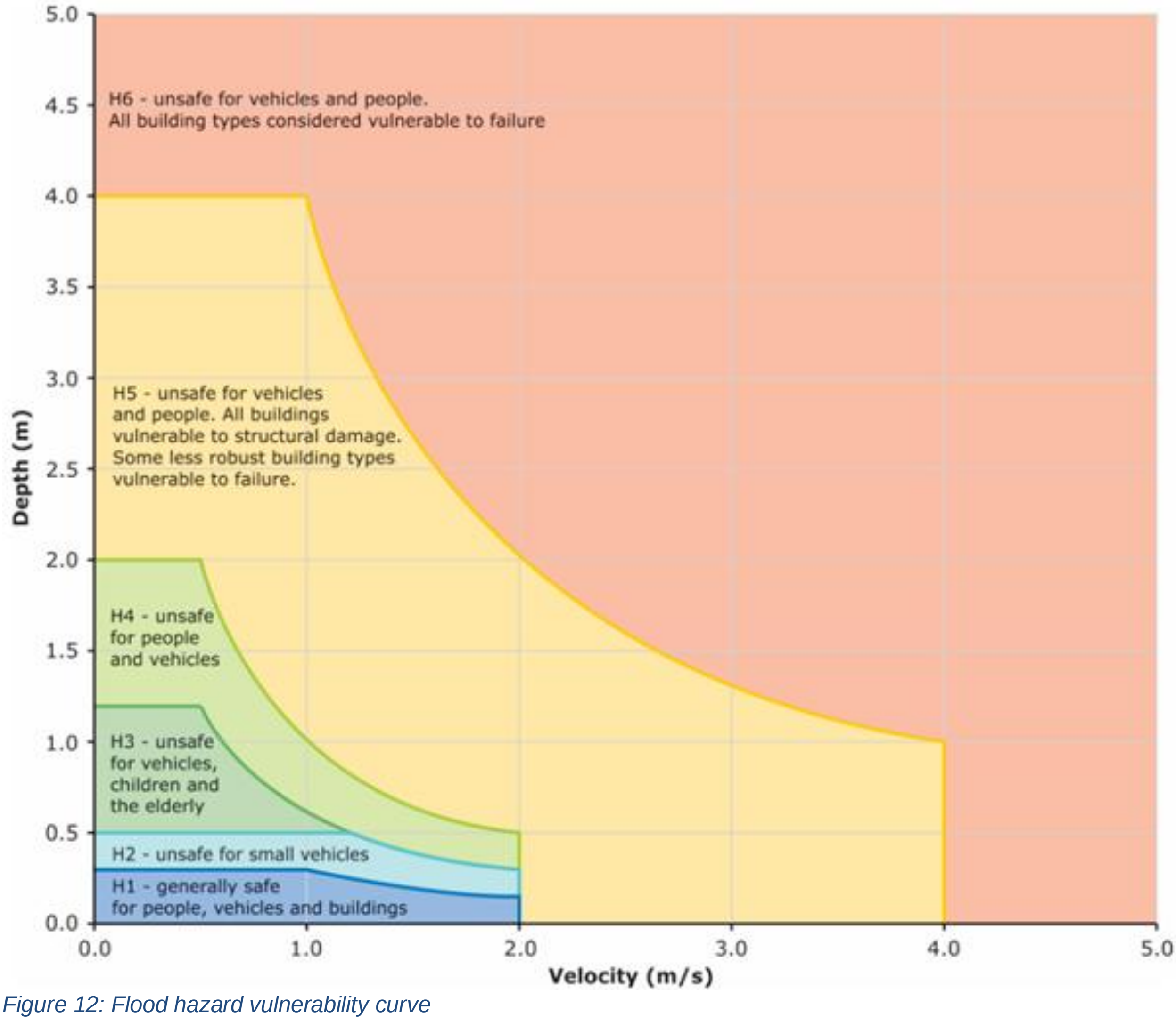

Figure 12: Flood hazard vulnerability curve

The SSDMCSPC Flood Study provides hazard maps based on these classifications. Figure 13 presents the flood hazard categorisation of flows during the PMF event. The following observations can be made:

- In the PMF event, flows from Muddy Creek overtop the bridge onto Princes Highway, with flows reaching a hazard category of H6 (unsafe for people and vehicles, all buildings vulnerable to failure) along this route, approximately 550m north of the site.
- At the intersection between Gladstone Street and Princes Highway, both lanes of the highway are affected by flows categorised as H3 hazard (unsafe for vehicles, children and the elderly). Alternative egress from the site is recommended via Post Office Lane, which has low hazard access onto the more southern portion of Princes Highway, which is affected by trafficable H1-H2 hazard flows west of Lachal Avenue.

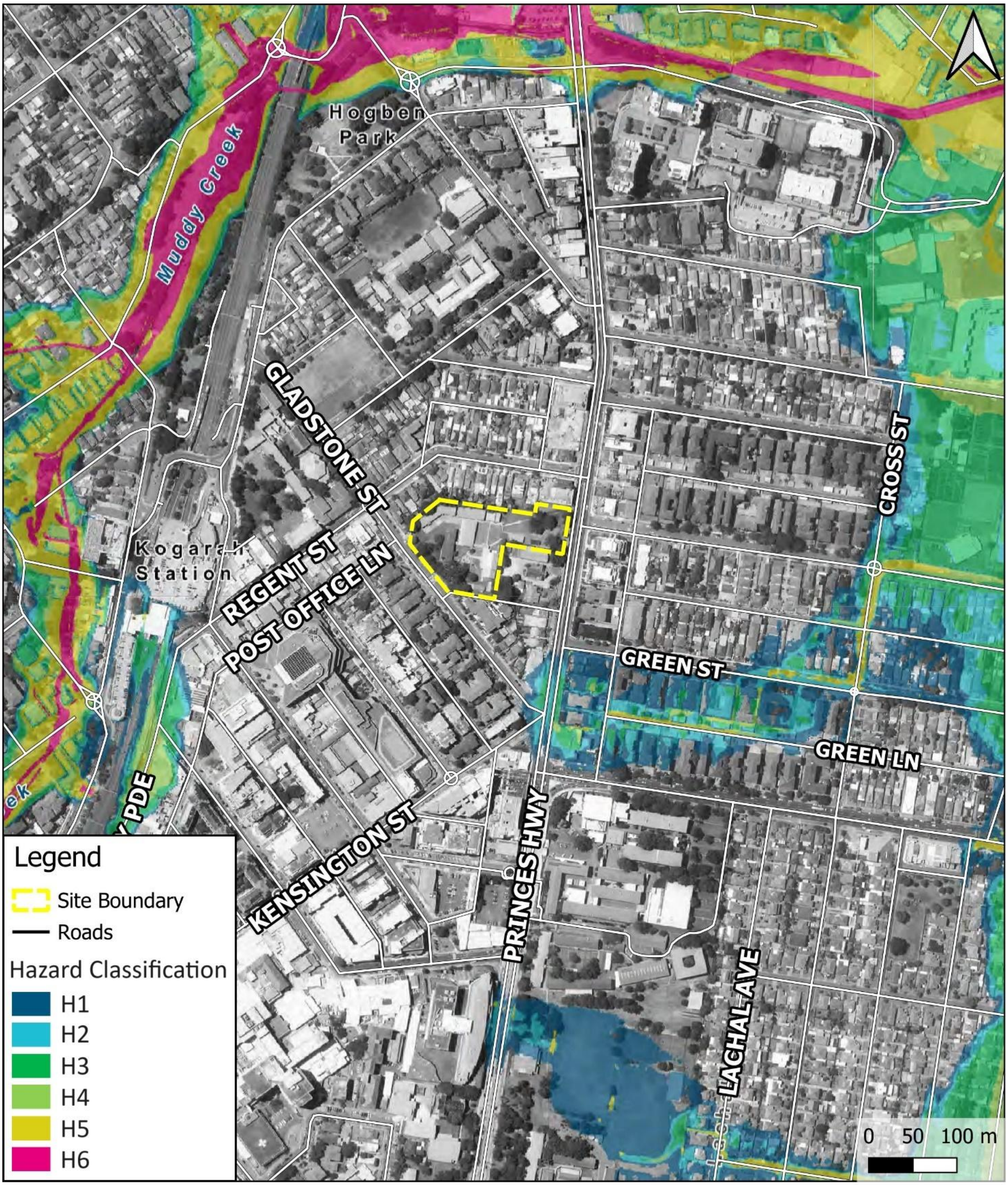

Figure 13: Flood hazard categorisation at the site during the PMF event (Source: adapted from SSDMCSPC Flood Study)

4.2.3 Climate Change

The Department of Planning, Housing and Infrastructure (DPHI)'s updated planning circular (released March 2024) highlights the importance of taking a more proactive, risk-based approach to flooding in planning decisions, including greater consideration of the potential impact of climate change on future flood frequency and levels. Current research indicates that a likely outcome of climate change is an increase in both rainfall intensity and the frequency of extreme events.

The SSDMCSPC Flood Study included an assessment of climate change via a 10% and 30% increase in design rainfall intensities. Although there was no mapping of the change in flood levels or extents, spot levels were taken at 17 locations throughout the study area. Table 1 summarises the change in flood level at six locations closest to the site, marked in Figure 14. The largest impact is at Points 5 and 6, with a 500mm increase in level here. At Point 1 on Paine Street (approximately 410m from Kogarah Public School), flood level increases by 100mm, reaching 14m AHD. The ground level at the school site is a minimum of 4 metres above this.

Table 1: Modelled peak flood levels under future climate change (Source: levels taken from Table 8-2 of the SSDMCSPC Flood Study report)

ID	Location	Peak Flood Level (m AHD)		Change in Level (m)
		1% AEP	1% AEP + 30%	
1	Paine Street	13.9	14.0	0.1
2	Queen Victoria Street	14.5	14.5	0
3	Wolseley Street	12.4	12.5	0.1
4	Cadia Street	8.6	8.9	0.3
5	Warialda Street	8.2	8.7	0.5
6	Princes Highway	5.7	6.2	0.5

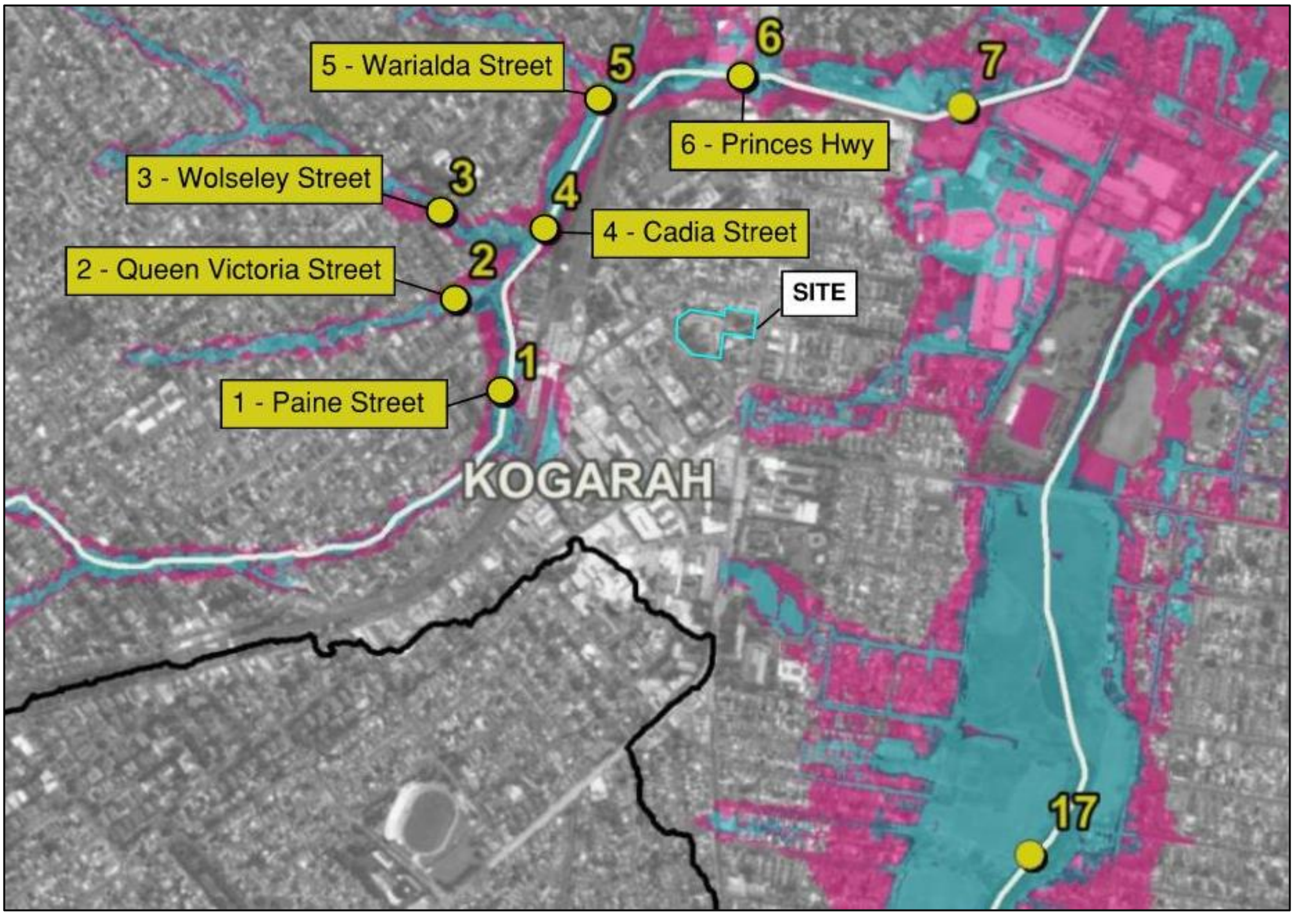

Figure 14: Flood level reporting locations (Source: adapted from SSDMCSPC Flood Study, 2017)

5.0 Flood Planning Requirements

5.1 Georges River Development Control Plan (2021)

The current Development Control Plan (DCP) in place in the Georges River LGA was published in 2021, providing additional planning and design guidelines to support the aims and objectives of the LEP. Section 3.10 of the DCP addresses controls relating to water management, including flood risk management.

The DCP states that development must comply with the Flooding and Overland Flow Section of Council's Stormwater Management Policy (2020), which provides guidelines of controlling developments in different flood risk areas.

5.2 Stormwater Management Policy (2020)

The Georges River Stormwater Management Policy was adopted by Council on 27 July 2020, with the aim of providing consistency in the application of stormwater control for private development across the Georges River Council area. Chapter 6 (Flooding and Overland Flow) of the policy provides Council's requirements for development upon flood liable land within the LGA.

The stringency of development controls is dependent on the land use type of the development alongside the Flood Risk Precinct the site is located in.

The Policy outlines eight major land use categories. As a school, the site is categorised under "sensitive uses and facilities". Table 2 summarises the three Flood Risk Precincts (FRPs) defined in the Policy. Although there is no Council-adopted flood study covering the site, results from the SSDMCSPC Flood Study (adopted in Bayside Council) demonstrate that the site is unaffected by both mainstream and overland flooding in all modelled design events, including the PMF. As such, the site is not located within any FRP, and hence no flood controls will apply to the proposed development.

However, as aforementioned, consideration should be given to the impact on surrounding access roads when planning for the evacuation of the school.

Table 2: Georges River Council Flood Risk Precincts

Flood Risk Precinct		Description
1	**High Flood Risk**	The area of land below the 1% AEP flood that is either subject to a high hydraulic hazard or where there are significant evacuation difficulties. Most development should be restricted in this precinct as development in high flood risk precinct is associated with higher risk to life and evacuation difficulties during the event of flood. In this precinct, there would be a significant risk of flood damages without compliance with flood related building and planning controls.
2	**Low Flood Risk**	Land below the 1% AEP flood that is not subject to a high hydraulic hazard and where there are no significant evacuation difficulties. There would still be a significant risk of flood damage in this precinct. However, these damages can be minimised by the application of appropriate development controls.
3	**Outside the 1% AEP flood extent but within the PMF**	All other land within the floodplain (within the extent of the PMF) but not identified within either the High Flood Risk or the Low Flood Risk Precinct. The risk of damages due to flooding in this precinct is low for most of the land uses.

6.0 Conclusions and Recommendations

Although Georges River Council do not have any currently adopted flood studies covering Kogarah Public School, the Spring Street Drain, Muddy Creek and Scarborough Ponds Catchments Flood Study (adopted by the neighbouring Bayside Council) provides sufficient insight into the mainstream and overland flood risk surrounding the school.

Flood mapping from the study demonstrates that Kogarah Public School is unaffected by flooding in all events, up to and including the PMF. As a result, the proposed development is compliant with the objectives of the Georges River DCP (2021) and Chapter 6 of the Georges River Stormwater Management Policy (2020) and will have no impact on flood behaviour in the region.

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