

Flood Due Diligence Report

Vincentia High School Upgrade

Prepared for the NSW Department of Education (DoE) / 31 March 2025

232045

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Rev	Date	Prepared By	Approved By	Remarks
A	29/04/2024	DJ	PM	Due Diligence
B	12/11/2024	LC	JM	Added Section 3.3
C	12/12/2024	LC/JM	JM	Updated to Urbis format
D	17/02/2025	LC/JM	EC	Updated Section 3.3/4.3
E	27/03/2025	LC	EC	Updated preamble
F	31/03/2025	LC	EC	Final

Glossary and Abbreviations

Annual Exceedance Probability	AEP	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage
Australian Height Datum	AHD	A common national surface level datum often used as a referenced level for ground, flood and flood levels, approximately corresponding to mean sea level.
Average Recurrence Interval	ARI	The long-term average number of years between the occurrence of a flood equal to or larger in size than the selected event. ARI is the historical way of describing a flood event. AEP is generally the preferred terminology.
Bureau of Meteorology	BOM	An executive agency of the Australian Government responsible for providing weather services to Australia and surrounding areas.
Development Control Plan	DCP	A Development Control Plan is a document prepared by the Council which provides detailed guidelines which assist a person proposing to undertake a development. A DCP must be consistent with the provisions and objectives of a Local Environmental Plan (LEP).
Flood Emergency Management Plan	FEMP	A step-by-step sequence of agreed roles, responsibilities, actions and management arrangements for the conduct of emergency operations. The objective is to ensure a coordinated response by all agencies having responsibilities and functions in emergencies.
Flood Emergency Response Plan	FERP	Set of instructions outlining the emergency response strategy (e.g. evacuation or stay-in-place approach) and defined responses during a flood emergency.
Finished Floor Level	FFL	The level, or height, at which the floor of a building or structure (including alterations and additions) is proposed to be built.
Flood hazard		A source of potential harm or a situation with a potential to cause loss of life, injury and economic loss due to flooding. Flood hazard is defined as a function of the relationship between flood depth and velocity.
Flood Planning Level	FPL	The combination of the flood level from the defined flood event and freeboard selected for flood risk management purposes.
Freeboard		A factor of safety typically used in relation to the setting of floor levels or levee crest levels. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour etc.
Local Environmental Plan	LEP	LEPs provide a framework that guides planning decisions for local government areas through zoning and development controls. Zoning determines how land can be used (for example, for housing, industry, or recreation).
New South Wales State Emergency Service	NSW SES	The NSW SES is an agency of the Government of New South Wales, is an emergency and rescue service dedicated to assisting the community in times of natural and man-made disasters.

Probable Maximum Flood	PMF	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain.
Representative Concentration Pathways	RCP	RCPs make predictions of how concentrations of greenhouse gases in the atmosphere will change in future as a result of human activities. The four RCPs range from very high (RCP8.5) through to very low (RCP2.6) future concentrations.

1.0 Introduction

This Flood Due Diligence Report has been prepared to support a Review of Environmental Factors (REF) for the NSW Department of Education (DoE) for Vincentia High School upgrade (the activity).

The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by *State Environmental Planning Policy (Transport and Infrastructure) 2021* (T&I SEPP) as “development permitted without consent” on land carried out by or on behalf of a public authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37 of the T&I SEPP.

This document has been prepared in accordance with the *Guidelines for Division 5.1 assessments* (the Guidelines) by the Department of Planning, Housing and Infrastructure (DPHI) as well as the *Addendum Division 5.1 guidelines for schools*.

This purpose of this report is to assess the flooding behaviour of the proposed site and surrounding area under existing site conditions, as well as any flood planning controls relevant to the level of flood risk. The details of this report are based on current available information and correspondence undertaken at the time of writing.

1.1 Reference Documents

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

- Department of Planning and Environment (2023) Flood Impact and Risk Assessment – Flood Risk Management Guide LU01
- NSW Maps Viewer ([Spatial Collaboration Portal - Map Viewers \(nsw.gov.au\)](https://spatialcollaborationportal.nsw.gov.au/mapviewers))
- NSW Planning Portal Spatial Viewer (<https://www.planningportal.nsw.gov.au/spatialviewer/>)
- NSW SES (2022) Shoalhaven City Flood Emergency Sub Plan – A Sub Plan of the Local Emergency Management Plan (EMPLAN) (<https://www.ses.nsw.gov.au/media/5902/shoalhaven-city-local-flood-emergency-sub-plan-oct-2022.pdf>)
- Shoalhaven City Council (2014) Shoalhaven Local Environmental Plan (SLEP)
- Shoalhaven Development Control Plan (2014) – Chapter G9: Development on Flood Prone Land, Part 5.1: General controls
- Shoalhaven Development Control Plan (2014) – Dictionary
- Shoalhaven Flood Maps (<https://maps.shoalhaven.nsw.gov.au/SCCViewer/index.html?Viewer=extSLEP>)
- New South Wales Department of Infrastructure, Planning and Natural Resources (2005). Floodplain Development Manual [Floodplain Development Manual \(nsw.gov.au\)](https://www.nsw.gov.au/floodplain-development-manual)

1.2 Site Description

The site is located at 142 The Wool Road, Vincentia, NSW, 2540 and has an approximate site area of 8.09 hectares. The site is comprised of two lots, legally referred to as Lot 1 Deposited Plan P809057 and Lot 1 Deposited Plan 550361 and is located within the Shoalhaven Local Government Area (LGA). An aerial photograph of the site is provided at Figure 1.

The site is zoned SP2 Educational Establishment and existing development comprises various buildings, a car park, landscaping, a sports field and sports courts associated with Vincentia High School. Vincentia High School currently comprises 49 permanent teaching spaces (PTS) and 17 demountable teaching spaces (DTS). The eastern portion of the site contains natural bushland.

The site is an irregularly shaped lot. Vehicle access is provided to The Wool Road via a driveway that connects to a signalised intersection. There is a footpath and cycleway along The Wool Road. The surrounding land consists of extensive natural bushland (Jervis Bay National Park).



Figure 1: Aerial Photograph of the Site. Urbis, January 2024

1.3 Proposed Activity Description

The proposed activity relates to upgrades to Vincentia High School. Specifically, the proposed activity comprises the following:

- Construction of a new two-storey home base building.
- Installation of solar panels.
- Construction of new stairs and covered walkways.
- Internal road upgrade which involves providing a new drop off zone, parking spaces and pedestrian pathway.
- Relocation of existing shade structure.
- External landscape works.

- Tree removal.

Any works relating to the existing demountables or associated with substations will be undertaken via a separate planning pathway. **Figure 2** provides an extract of the proposed site plan.

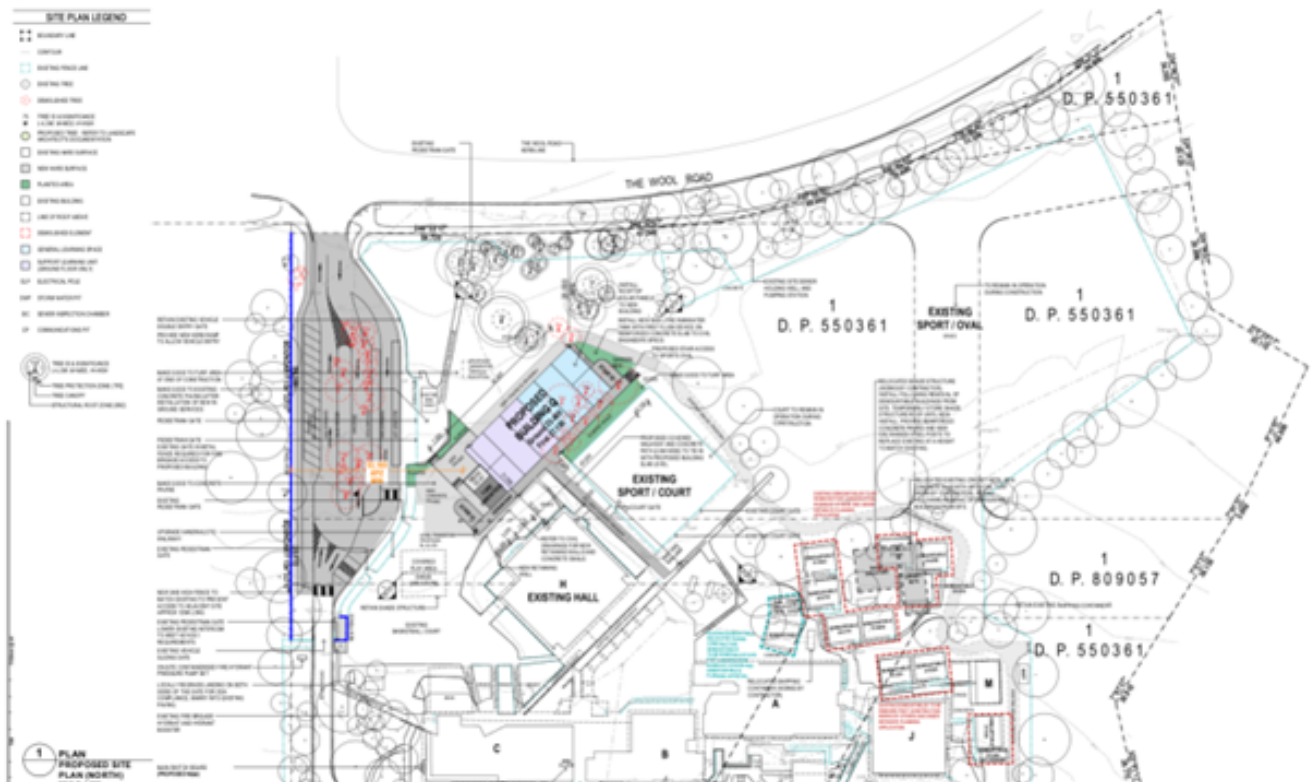


Figure 2: Site Plan (Source: Fulton Trotter 2025)

2.0 Site Characteristics

2.1 Site Location

The site has direct frontage onto The Wool Rd and sits directly opposite the Bay and Basin Leisure Centre. Both properties are surrounded by the Jervis Bay National Park (C1) and an environmental conservation area (C2). Maps of the surrounding area and zoning are provided in Figures 3-5.

As seen in Figure 5, the site is located in close proximity to an unnamed second order creek. The creek is a tributary of Moona Moona Creek and runs as close as 75m to the east of the site.



Figure 3: Map of the site and wider surrounding area. Source: Google Satellite Imagery (dated 23 Dec 2023).

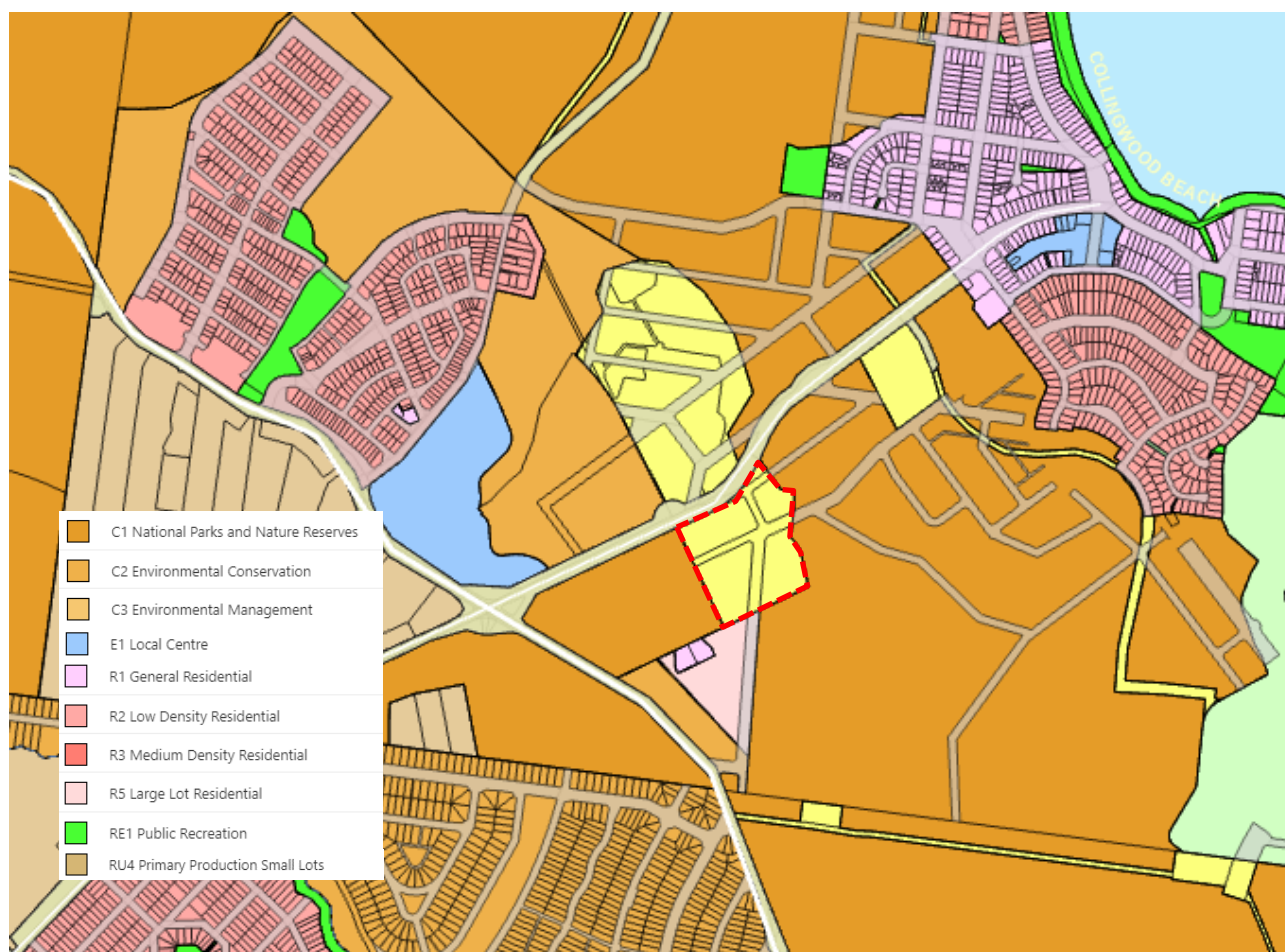


Figure 4: Land zoning around the site. Site boundary outlined in red. Source: Shoalhaven LEP (2014)

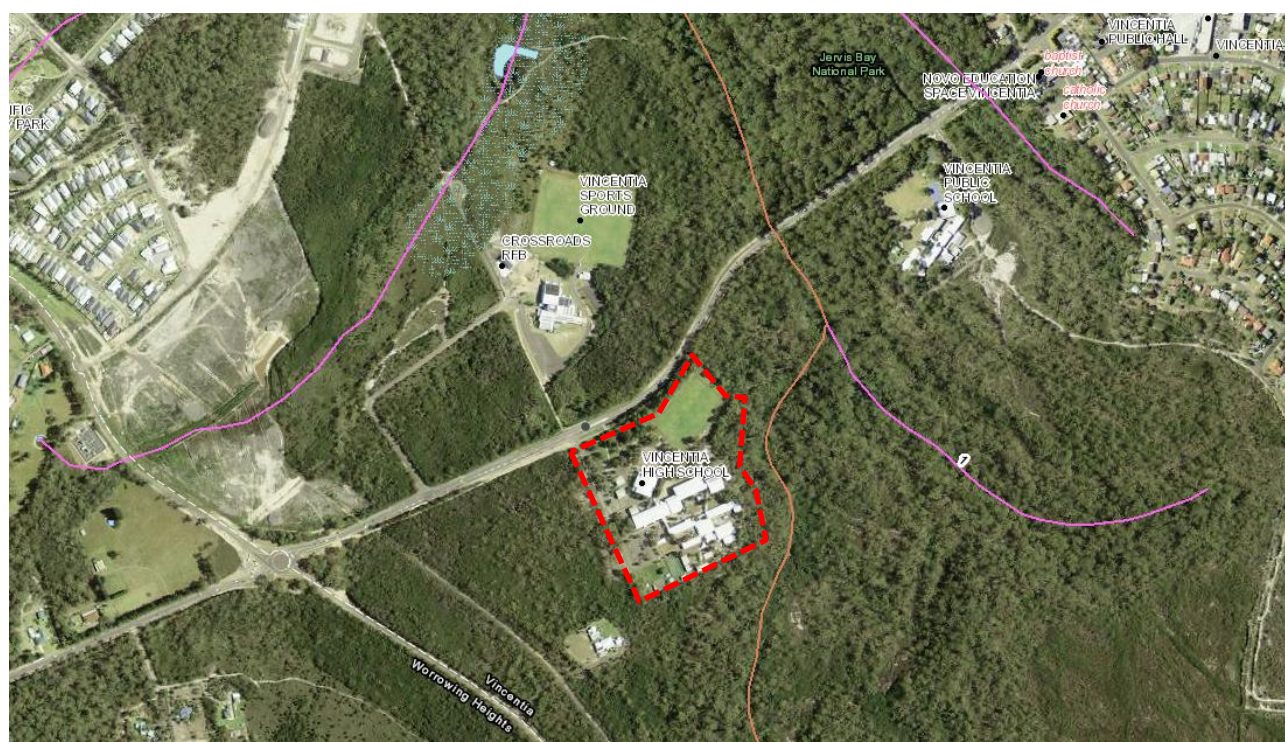


Figure 5: Watercourses and basins around the site. Approximate site boundary outlined in red. Source: ARCGIS NSW Web Map

2.2 Site Topography

Topographic data was taken from the most recent 2010 LIDAR survey, as obtained from the Elevation Information System (ELVIS).

The overall topographic context around the site is varied and uneven. The site is located just west of a large plateau associated with Jervis Bay National Park, at the start of a ridgeline that continues further west. This ridgeline separates the Moona Moona Creek and St Georges Bay catchments. Two channels separate the site from the plateau – one long, shallow channel adjacent to the site, and one short, steep channel further to the east. A topographic map of the wider area is provided in Figure 6.

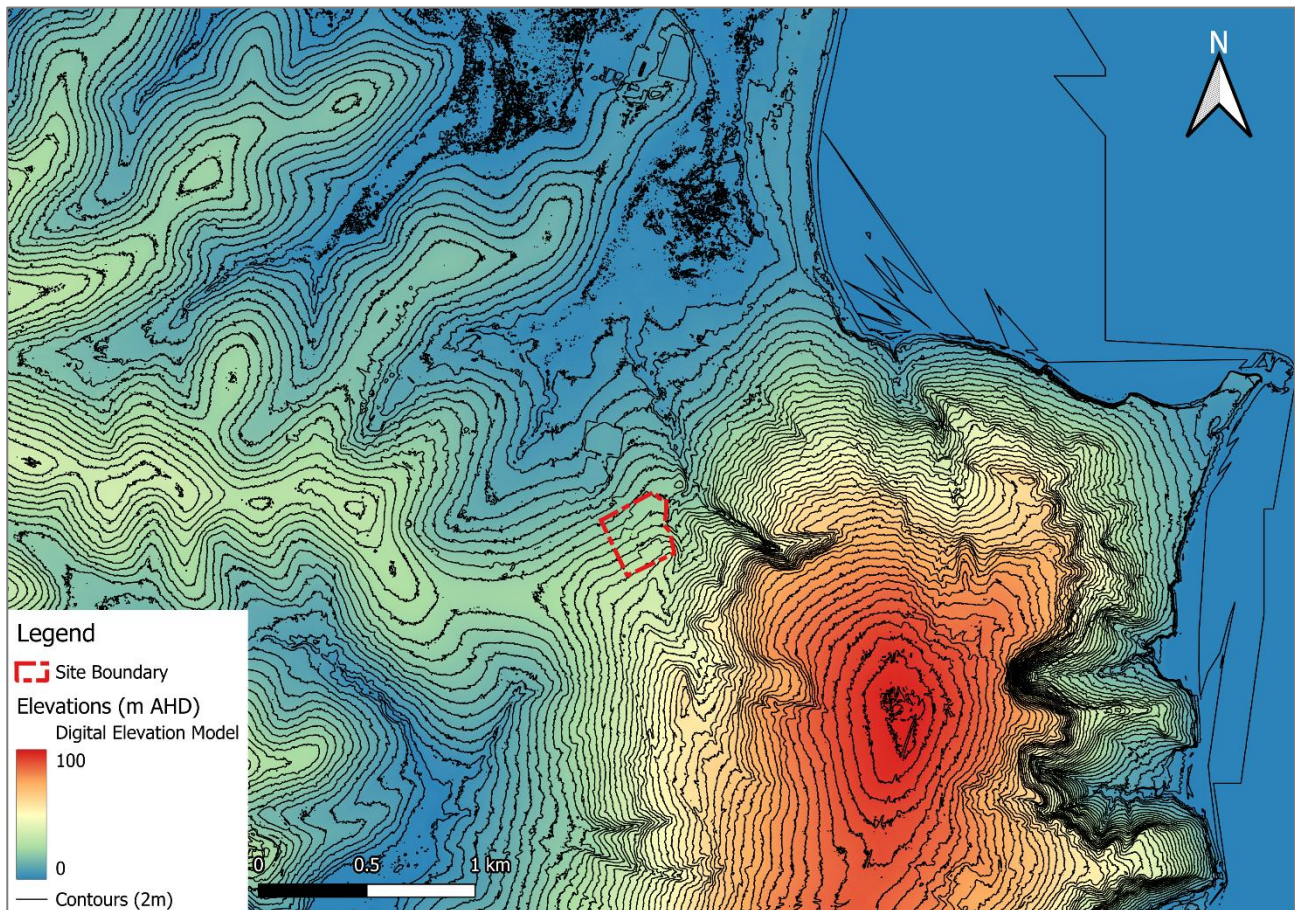


Figure 6: Topographic context around the VHS site. Source: DEM obtained from ELVIS

At the site itself, elevation data shows an overall steady slope upwards to the southeast. Site elevations vary from 19.2m AHD at a low point in the northwest, to 34.5m at a high point in the southeast. Topography at the site itself is presented in Figure 7. Along the indicated section line, elevations rise 13m over a distance of 285m with an average gradient of 4.6% (see Figure 8).

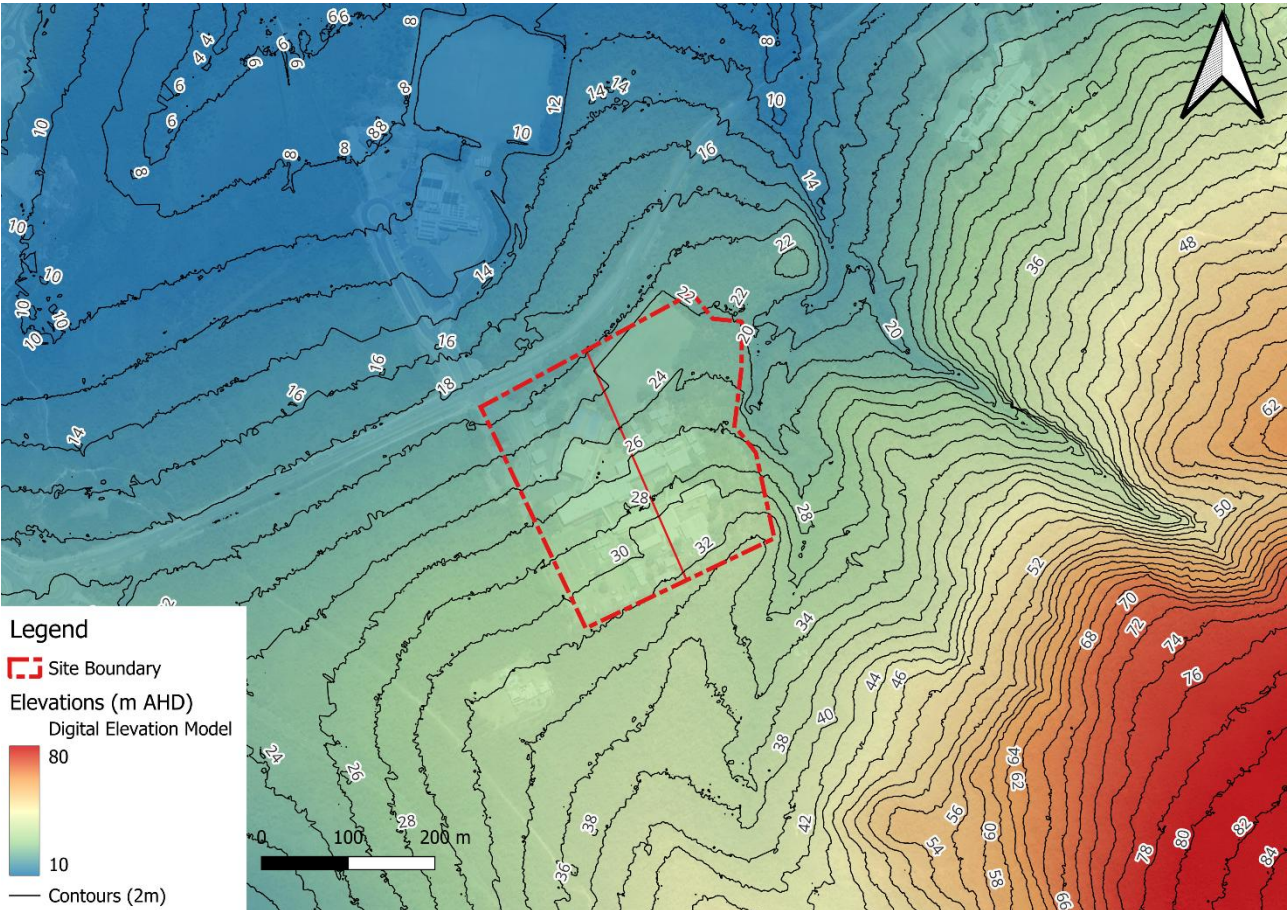


Figure 7: Topography at and around the site. Site boundary is outlined in red. Source: DEM obtained from ELVIS

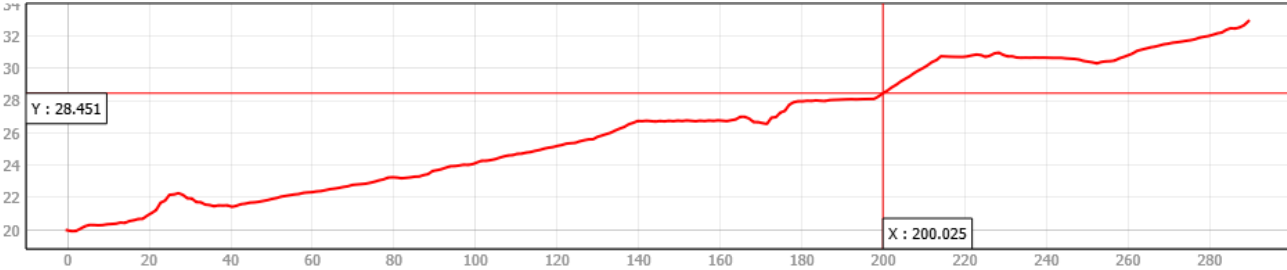


Figure 8: Elevation (m AHD) along the section indicated in Figure 7.

3.0 Available Flood Information

3.1 Flood Studies

Shoalhaven Council's online flood maps (see Figure 9) show that the VHS site is not covered by any flood studies. The two nearest relevant flood studies are the 2016 Currumbene and Moona Moona Creek Floodplain Risk Management Study and Plan to the north, and the 2022 St Georges Basin Flood Study to the south.

As seen in Figure 9, the site is not affected by mainstream flooding from either study area, even during the most severe PMF event with climate change conditions at 2100. However, the site may still be subject to flooding originating outside of these study areas.

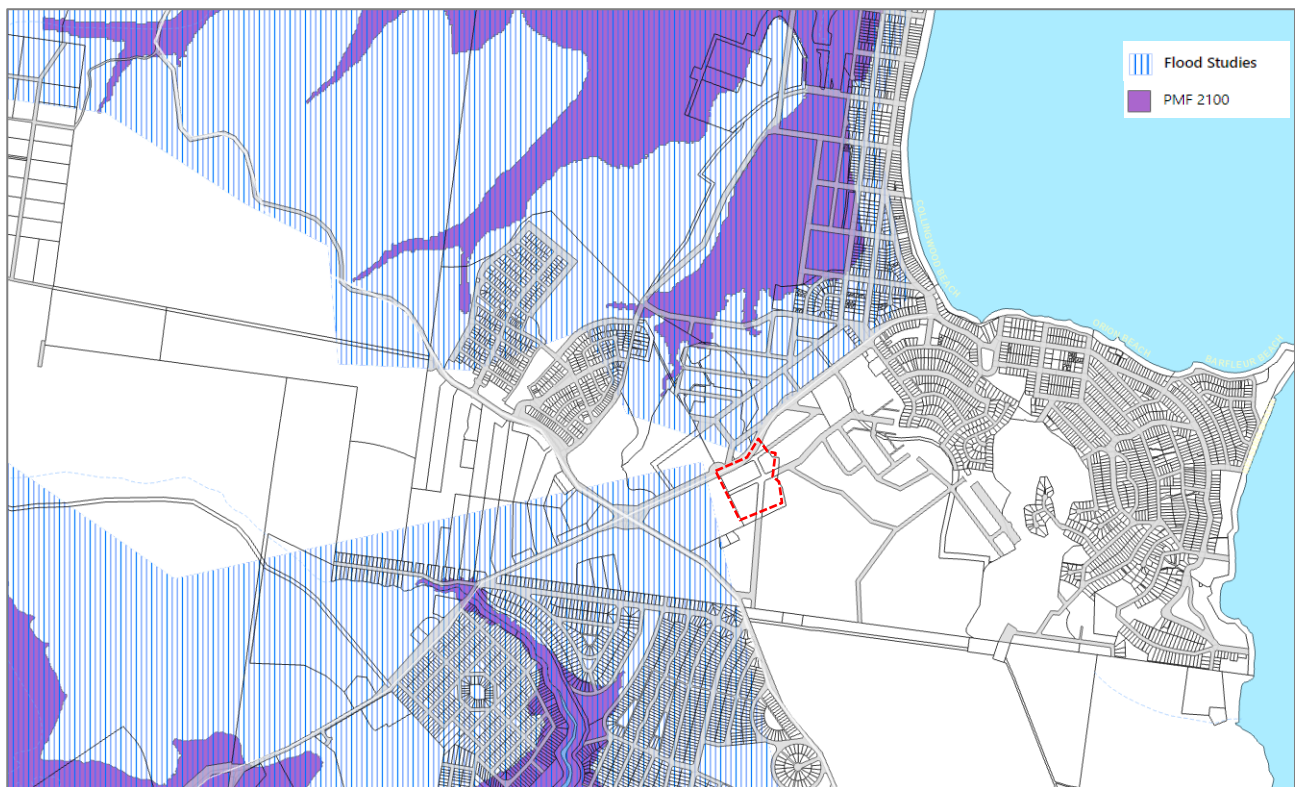


Figure 9: Extract of the Shoalhaven Council's online flood map. Site boundary outlined in red. Source: Shoalhaven City Council

3.2 Estimated Flooding Behaviour

The local catchment contributing to runoff flows within the site boundary is shown in blue hatching in Figure 10. The upstream boundary is marked by a natural crest in the local topography. The majority of upstream flows from the southeast of the site are expected to be redirected into the second order creek, which acts as the main drainage point, and will not reach the site. The total contributing area is estimated as 10.8 hectares.

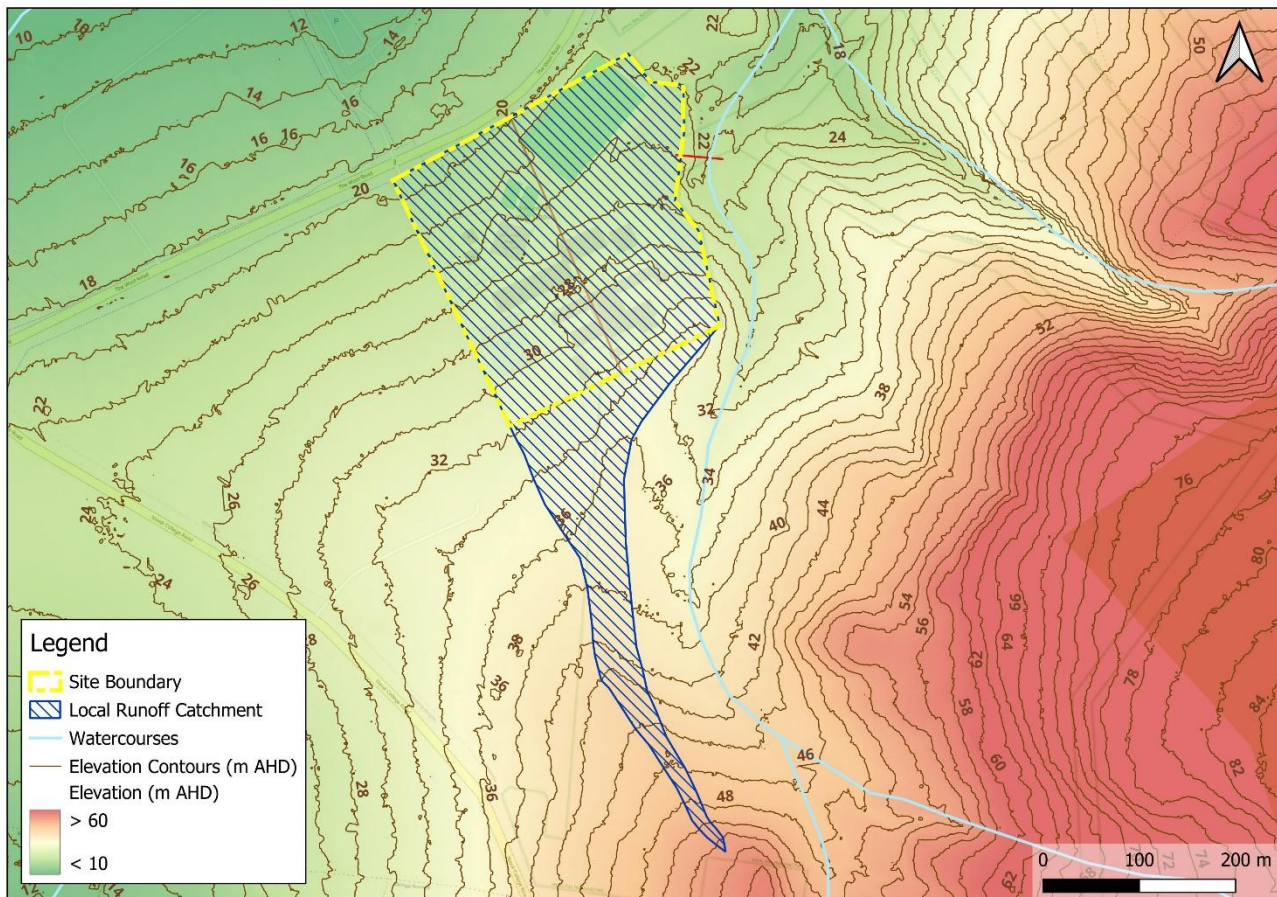


Figure 10: Local runoff catchment contributing to overland flow within the Vincentia High School Boundary

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:

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

Where:

t_o = overland flow travel time (mins)

L = flow path length (500 m)

n = Manning's n roughness (0.065)

S = slope of surface (6%)

The overland flow travel time was calculated at approximately 24 minutes. This then informed the rainfall-runoff equation to calculate flow for the 1% 25-min duration storm. The rainfall-runoff equation is as follows:

$$Q = CiA$$

Where:

C = the runoff coefficient (in this case, estimated as 0.528);

i = the rainfall intensity (in this case, 140 mm/hr for the 1% 25-min storm, taken from the BOM website);

A = the area of the contributing catchment (10.8 hectares)

$$Q = 0.528 \times 140 \times 10.8 / 360$$

$$Q = 2.22 \text{ m}^3/\text{s}$$

Generally, the site is not expected to suffer from any overland flooding. Due to the sloping terrain described in Section 2.2, rainwater will naturally flow away from the site and either into one of the two creeks, north into the Moona Moona Creek catchment, or south into the St. Georges Basin. As shown in the calculation above, the remaining overland flows that occur are minimal, and should be contained by the stormwater pit-and-pipe system at the site.

It should be noted that these preliminary calculations are provisional approximations of the conditions onsite. More detailed hydraulic modelling of the local drainage systems and site would be needed to assess this accurately. In addition, it is possible that mainstream flooding could impact the site during an extreme rainfall event, in the unlikely event that the adjacent creek overflows its banks. Figure 11 presents a cross-sectional profile of the creek.

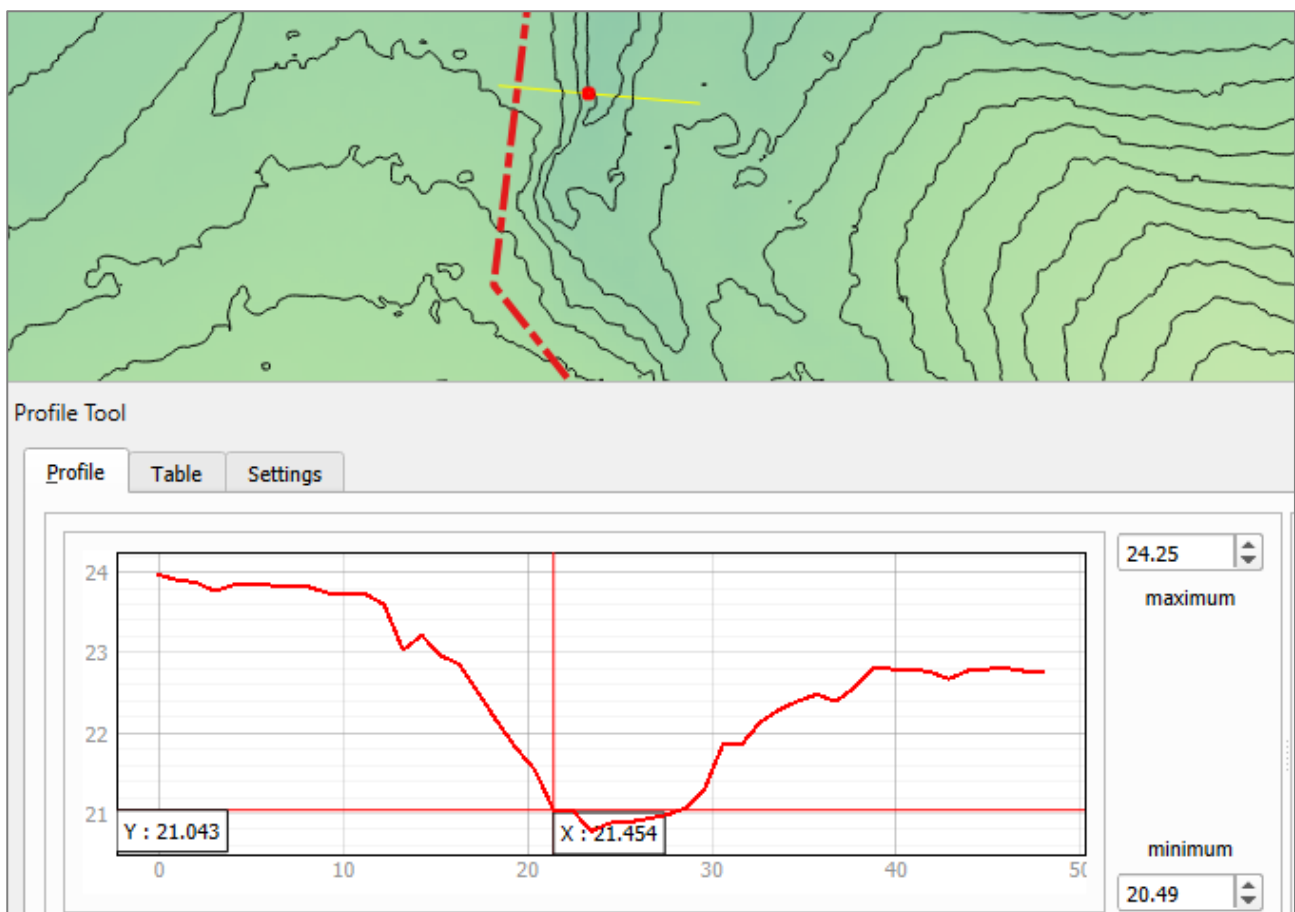


Figure 11: Cross-sectional profile of the creek east of the site

3.3 Site Accessibility

Council's flood studies indicate that there is access to the east of the site via The Wool Road into Vincentia. In addition, Vincentia Public School (located approximately 500 metres northeast of the high school site) is listed as an evacuation centre in the NSW SES Local Flood Plan, indicating that this road is expected to be trafficable towards the east.

However, it is noted that Wool Road may be overtopped at the crossing to the northeast of the site and any flow overtopping this road will be conveyed further in a northeasterly direction, based on the available topography data (see Figure 12). There is no risk of flows travelling westward from this crossing and reaching the school site.

However, overtopping of this crossing would isolate the school from an eastern evacuation route during the time the road was inundated. To confirm whether the road will be overtopped in extreme events, hydraulic modelling would be required to assess the area during a range of storm events as well as to determine the time until inundation of the crossing (from onset of the storm), and the duration of inundation of the crossing until flood waters have lowered.

It is noted that there is currently no Council modelling of this area and creek and that a new hydraulic model would need to be created of the catchments to carry out such an assessment.

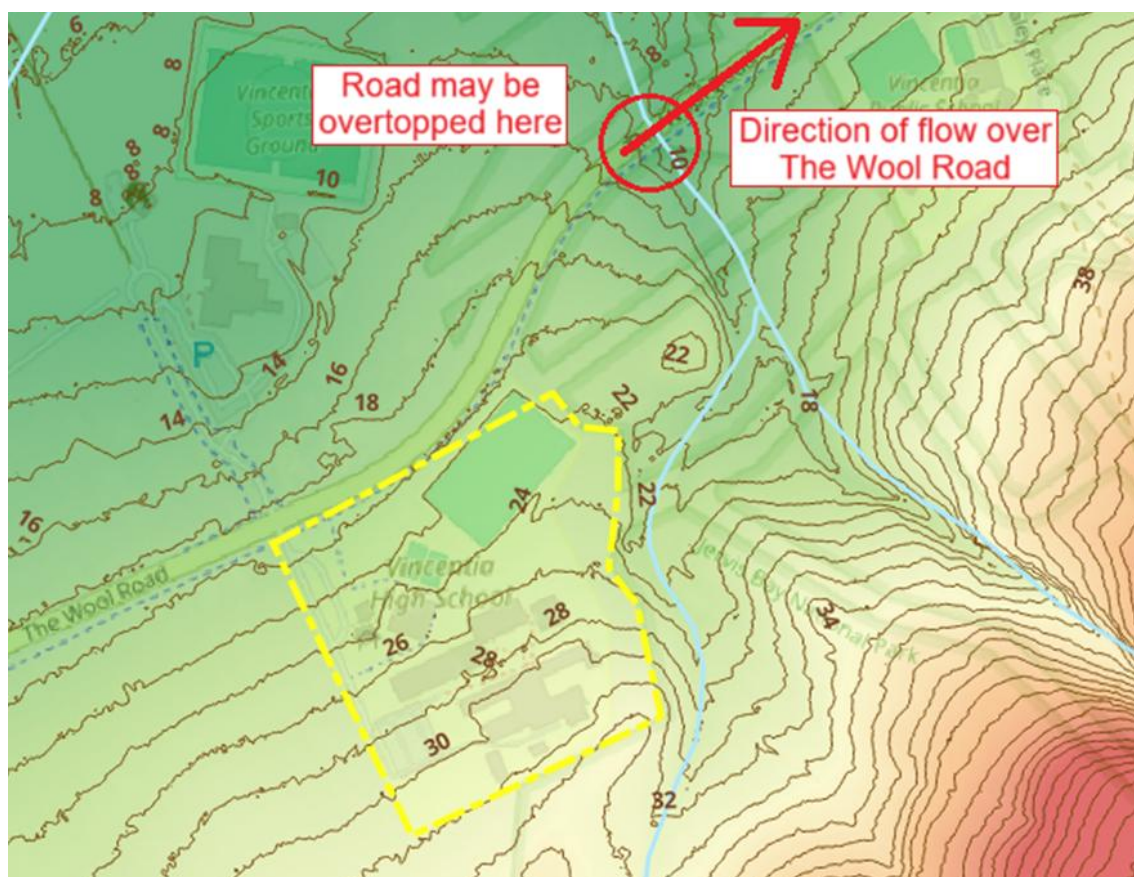


Figure 12: Potential access road flooding point on Wool road, West of the site

To the west and northwest, Naval College Road and The Wool Road are potentially cut off by flooding, as shown in Figure 13. The Wool Road is intersected by the Worrowing Waterway approximately 1.5 km to the west of Vincentia High School. Further assessment of bridge heights and flood levels would be required to determine whether the road would be cut off by floodwaters.

Despite this, any flooding from this watercourse would not reach the school site, given that the site is located in a different catchment, separated by a ridgeline that is approximately 20 metres above the bed level of the watercourse. This is presented in the elevation profile along the road in Figure 14.

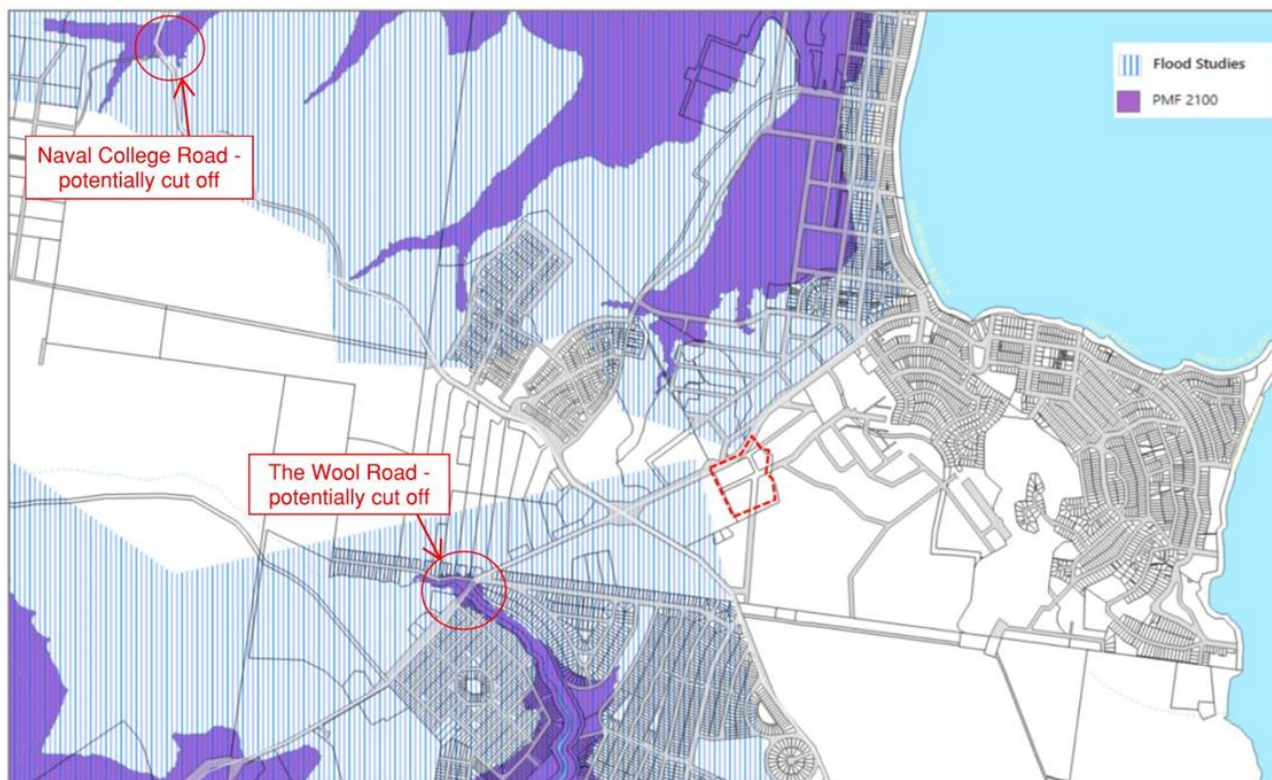


Figure 13: Site access considerations during significant flood events west of the site

If Wool Road is cut off by flood waters to the west of the site this would isolate the school from a western evacuation route during the time the road was inundated. To confirm whether the road will be overtopped in extreme events, hydraulic modelling would be required to assess the area during a range of storm events as well as to determine the time until inundation of the crossing (from onset of the storm), and the duration of inundation of the crossing until flood waters have lowered.

In the event that, both the sites eastern and western access/egress routes are inundated during PMF events the site may be temporarily isolated from Vincentia or St Georges Basin, and access by SES and emergency services may be delayed and alternative routes may need to be taken during a flood event.

The current Emergency Management Plan for the school uses the Bay and Basin Leisure Centre as the dedicated off site evacuation location, on the north side of The Wool Road, directly opposite the school.

Pre-emptive evacuation before a flood event should be the primary flood emergency response. A shelter in place strategy with alternative off-site evacuation to Bay and Basin Leisure Centre is the recommended strategy if widespread flooding is imminent or has already commenced, for temporary shelter during an extreme flood or the PMF. This flood emergency response should be included in the School Emergency Management Plan and should detail the evacuation routes and procedures or 'shelter in place' procedures which would require adequate areas for refuge, adequate provisions and adequate management and responsibilities to be delegated.

For secondary emergency to the site in the event of widespread flooding and potential inundation of The Wool Road, specific routes for emergency services would need to be coordinated between the emergency services and SES.

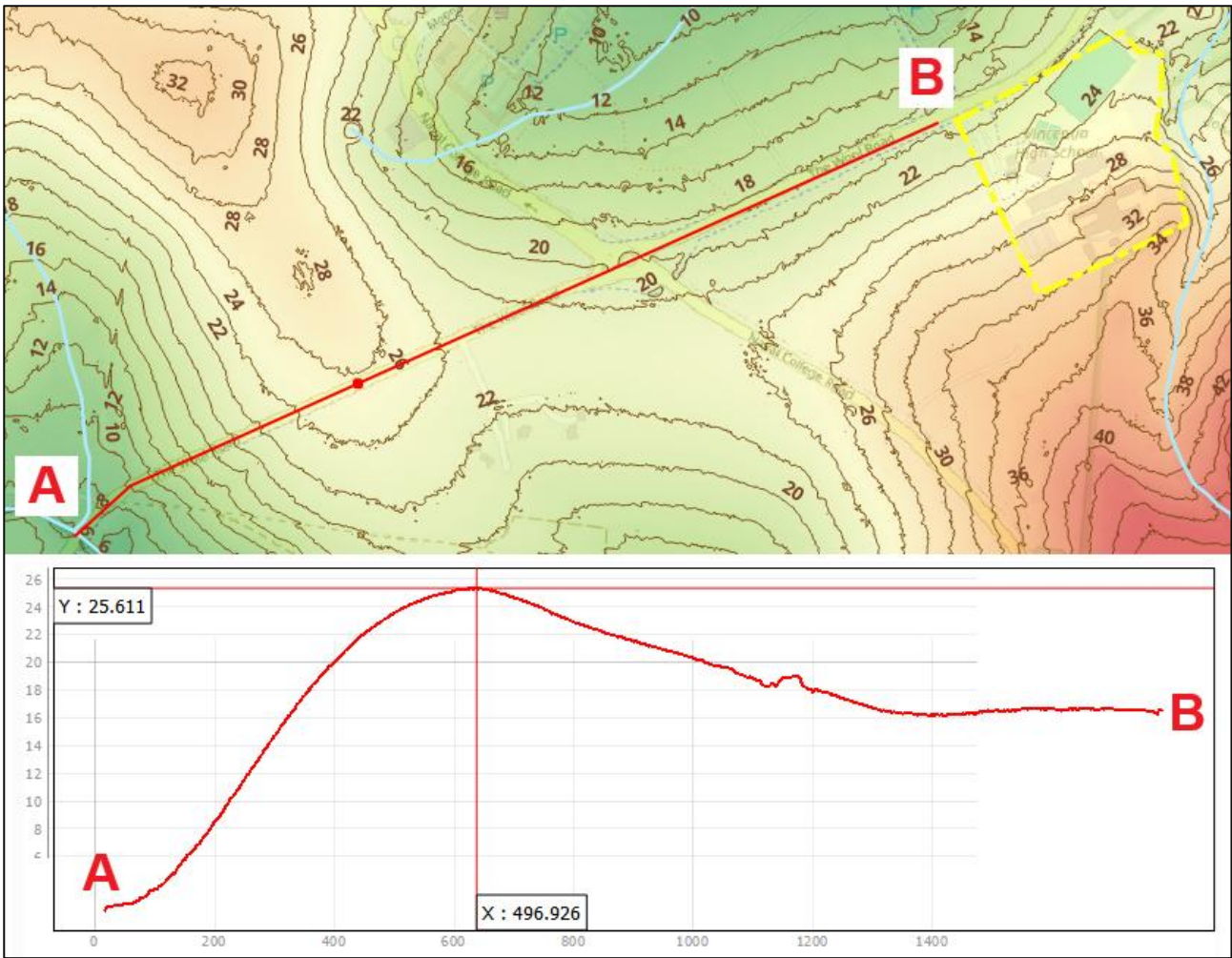


Figure 14: Elevation profile across The Wool Road at its crossing over the Worroving Waterway (Point A) to the Vincentia High School site (Point B)

4.0 Flood Planning Guidance and Requirements

4.1 Shoalhaven Development Control Plan

The current Development Control Plan (DCP) in place covering the VHS site was published in 2014, consolidating Shoalhaven's planning policies into a single DCP covering the entire Shoalhaven LGA. The DCP provides additional planning and design guidelines to support the aims and objectives of the Local Environment Plan (LEP). DCPs provide detailed controls and standards for addressing development issues at a local level and cover various development types, including residential, commercial and industrial.

Under Section 4.15 of the Environmental Planning and Assessment Act 1979, the consent authority is required to take into consideration the relevant provisions of the DCP in determining a development application. Chapter G9 (Development on Flood Prone Land) of Shoalhaven DCP (2014) provides controls for development on flood prone land and applies to all land susceptible to flooding by the PMF. The controls in this Chapter have been transferred from Development Control Plan 106.

The objectives of the Shoalhaven DCP (2014) in relation to flooding are to:

- Reduce risk to life and property resulting from floods.
- Ensure that the impacts of the full range of flood sizes up to and including the probable maximum flood (PMF) are considered when assessing development on flood prone land.
- Ensure that climate change is considered when assessing development on flood prone land.
- Ensure the future use of flood prone land does not cause undue distress to individuals or unduly increase potential flood liability to individuals or the community.
- Incorporate site specific floodplain management recommendations from local floodplain risk management plans into Council's overall planning framework.

The stringency of development controls is dependent on the land use type of the development alongside the flood hazard categorisation of the site.

4.1.1 Land Use Category

As per Schedule 1 (Land Use Categories) of the DCP, schools and educational facilities fall within land use category H, "Buildings and activities requiring special evacuation consideration".

4.1.2 Hazard Category

The hazard categories within the Shoalhaven DCP (2014) are defined according to the NSW Floodplain Development Manual 2005:

- **High hazard** is defined as: possible danger to personal safety; evacuation by trucks is difficult; able-bodied adults would have difficulty in wading to safety; potential for significant damage to buildings.
- **Low hazard** is defined as: if necessary, truck could evacuate people and their possession; able-bodied adults would have little difficulty in wading to safety.
- **Floodway** is defined as: the parts of the floodplain where a significant discharge of water occurs during floods. They are often aligned with natural defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood

levels (and/or velocities).

- **Flood storage** areas are the parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood.
- **Flood fringe** is the remaining floodplain after floodways and flood storage areas have been defined.
- As the site is situated outside of the PMF extent, it does not fall within any of the above hazard categories.

4.1.3 Applicable Flood Controls

The Dictionaries included with the Shoalhaven Council DCP and LEP defines the following terms:

- **Flood Prone Land:**
The land susceptible to flooding by the probably maximum flood (PMF) event. Flood prone land is synonymous with flood liable land.
- **Flood planning area:**
The area of land below the flood planning level (FPL) and thus subject to flood related development controls. The concept of flood planning area generally superseded the “flood liable lands” concept in the 1986 Manual.
- **Flood planning level:**
the level of a 1:100 ARI (average recurrent interval) flood event plus 0.5 metre freeboard.

According to the Shoalhaven Council flood map, the VHS is not part of the flood planning area or the affected by the PMF event, even considering the 2100 climate change scenario. As such, the site is not considered flood-prone land as far as the DCP is concerned, and **no development controls apply**.

4.2 SINSW Guidelines

School Infrastructure New South Wales (SINSW) have their own framework and guidelines for educational site selection and development which should also be met. For flooding, the framework provides the following guidelines:

- Site must be located above the 1-in-200 year (0.5% AEP) flood level,
- Site must provide flood free access for pedestrians and vehicles (in particular, emergency vehicles during a flood event),
- Buildings must be located on land above the Flood Prone Land Contour (i.e., land susceptible to flooding in the PMF) where possible.

As with the DCP requirements and controls, the available flood information does not indicate that the site is affected by flooding in the PMF event.

4.3 Mitigation Measures and Further Compliance Work Required

Although the site is not impacted by flooding, access routes to and from the site may be compromised during extreme flooding or the PMF although further hydraulic assessment would need to be completed to confirm this, which is outside the scope of this report.

As such, although the school site itself will not cause any environmental impacts in terms of flooding, the existing School Emergency Management Plan should be updated to include the procedures prior to, during and after a major flood event. The updated EMP will need to be prepared to ensure the safety of users of the site and mitigate any potential hazards. The proposed flood emergency strategy would be pre-emptive evacuation before widespread flooding, and shelter in place (with an alternative shelter at the Bay and Basin Leisure Centre) if widespread flooding is imminent or has already commenced.

Table 1 Mitigation Measures

Project Stage*	Mitigation Measures	Reason for Mitigation Measure	Section of Report
O	Update the existing School Emergency Management Plan with respect to flooding.	To ensure the safety of users to the site via a flood emergency strategy in terms of access to the site during severe widespread flood events	Section 3.3

*Note: Project stages include:

- (D) Design
- (C) Construction
- (O) Operation

4.4 Evaluation of Environmental Impacts

The site will not cause any environmental impacts in terms of flooding as the site is located outside of inundated areas, even in the rare significant events.

5.0 Conclusion and Recommendations

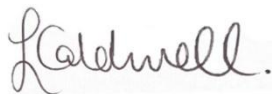
The Vincentia High School site, located at 142 The Wool Rd, Vincentia in the Shoalhaven City Council LGA, is not at risk of flooding from either the St George Basin or Moona Moona Creek catchments, even in a rare PMF event. The presence of the creek to the east of the site acts as the main discharge point for the local catchment, redirecting local runoff flows away from the site. As such, overland flows are unlikely to have a notable impact at the school site itself.

Overtopping of Wool Road in both easterly and westerly directions from the site may be possible during the PMF event. This may result in emergency access to or from the site being delayed whilst the routes are inundated, or alternative routes are found.

The existing Emergency Management Plan will need to be updated to include the flood emergency response and strategy prior to, during and after a flood. This updated would need to consider any advice and guidelines from NSW SES.

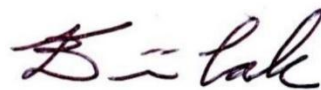
The proposed development is compliant with the requirements set out in the Shoalhaven DCP and no specific flood planning controls apply to this site.

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