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**Marsden Park new high school and Melonba new primary school,
20 Kaluta Avenue and 10 Swallowtail Street, Melonba (Lot 30 DP
1237735)**

Stormwater & Flooding SSD Report

SSD-41372302

Prepared by **Taylor Thomson Whitting (TTW)**

For School Infrastructure NSW

Revision 6, 14 February 2023



Education
School Infrastructure



Artist's impression of Marsden Park High School (Source: NBRS Architecture)

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Melonba new primary school**

Prepared for School Infrastructure NSW / 14 February 2023

221021 & 221022

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2	08/09/2022	ML	TM	SSDA
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1.0 Introduction

Taylor Thomson Whitting Pty Ltd (TTW) has been engaged by School Infrastructure NSW to provide civil engineering consulting services for the proposed design and construction of two new schools Marsden Park new high school and Melonba new primary school.

This report will address the Secretary's Environmental Assessment Requirements (SEARS) relevant to flooding and stormwater in relation to the Marsden Park new high school and Melonba new primary school development. The site is referenced under SSD-41372302 and will consist of a new primary school and high school to cater for 3,000 students and 219 staff. The relevant requirements of Blacktown City Council's Development Control Plan (DCP) and engineering specifications are also referenced.

1.1 Existing Site

The site is located at 20 Kaluta Avenue and 10 Swallowtail Street, Melonba, which is within the Central River City Precinct and Blacktown Local Government Area (LGA). The site is irregular in shape and is sited between two tributaries of Little Creek. The site is generally level but has a gentle fall from the south-eastern corner (RL23) to the north western corner (RL19.5). The site contains no vegetation other than grass and is currently fenced to prevent unauthorised access.

To the north, east and south of the site is emerging and recently completed low density residential development comprising one and two storey dwellings. To the west of the site is an open space area which serves a drainage function and beyond this is Little Creek, a tributary to South Creek that flows north to the Hawkesbury River. Further to the south is an area zoned as B2 Local Centre, which has not yet been developed. The next phase of residential development in the area is located on the western side of Little Creek and is currently in the bulk earthworks phase to create the street network.



Figure 1.1- Site Location within the Marsden Park North West Growth Area

1.2 Proposed Works

The proposed works will consist of the construction of two new schools, Marsden Park new high school and Melonba new primary school, located at 20 Kaluta Avenue and 10 Swallowtail Street, Melonba.

Marsden Park High School is a new secondary school comprising:

- 97 general learning areas (GLS) and specialist teaching spaces,
- Three supported education learning unit (SELU) rooms,
- Schools hall, and lecture and movement studio,
- Administration spaces,
- Staff and student facilities,
- Library,
- Canteen,
- Sports Courts,
- Playing field,
- Landscaping and outdoor learning areas,
- Covered outdoor learning area (COLA), and
- Car parking (shared with Melonba new primary school).

Melonba (new public school) will comprise:

- 44 GLS,
- Three SELU rooms,
- Administration and staff facilities,
- Canteen,
- Multi-purpose hall,
- Library,
- Out of School Hours Care (OSHC),
- COLA,
- Outdoor play areas including sports courts, and
- Landscaped outdoor learning areas.

1.3 SEARS Requirements

The development falls under a State Significant Development (SSD) application and is identified as SSD-41372302. The stormwater and flooding related requirements for school developments required as part of the Industry Specific Planning Secretary's Environmental Assessment Requirements (SEARS) issued 28 April 2022 are included in **Table 1.1** below.

These are addressed in the subsequent sections of this report to support the SSD submission.

- Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines, downstream assets and watercourses.

Table 1.1- Industry Specific (schools) SEARS

SEARs Response Table		
SEARs Reference	SEARs Requirement	Location in Report
12. Ground and Water Conditions	Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines, downstream assets and watercourses.	Section 3.0
13. Stormwater and Wastewater	Provide an Integrated Water Management Plan for the development that: • Is prepared in consultation with the local council and any other relevant drainage or water authority. • Details the proposed drainage design for the site including any on-site treatment, reuse and detention facilities, water quality measures, and the nominated discharge points. Demonstrates compliance with the local council or other drainage or water authority requirements and avoids adverse impacts on any downstream properties.	Section 3.0
	Where drainage infrastructure works are required that would be handed over to local council, or other water drainage authority, provide full hydraulic details and detailed plans and specification of proposed works that have been prepared in consultation with, and comply with the relevant standards of, the local council or other drainage or water authority	Section 3.0

SEARs Reference	SEARs Requirement	Location in Report
14. Flooding Risk	Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Floodplain Development Handbook.	Section 2.0
	Assess the impacts of the development, including any changes to the flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required	Section 2.0

In the accompanying letter from NSW Department of Planning and Environment (DPE), the below requirements were identified in addition to the industry specific SEARs.

- Provide a flood impact and risk assessment prepared in accordance with the NSW Floodplain Development Manual, and existing councils and government studies and guidance.
- Identify flood behaviour, flood constraints and risks on the site and its surrounding including the potential impacts of climate change for the full range of events i.e. up to and including the probable maximum event (PMF).
- Assess the impacts of the development, including any changes to flood behaviour and risk, impacts of flooding on the development and its future community and on existing community for the full range of events.
- Propose management measures required to minimise the impacts of flooding on the development and minimise flood risks to the community, including an Emergency Management Plan considering access to and from the site, and evacuation issues during significant flood events including the PMF, from both local catchments and/or regional catchments.

These additional requirements have been considered in design of site and are outlined in further detail within Section 3.0 – Flood Design of this report.

1.4 Guidance Documents

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

- Blacktown City Council (BCC) Development Control Plan (DCP) 2011;
- BCC Engineering Guide for Development 2018;
- BCC WSUD Standard Drawings Revision D;
- BCC Works Specification Civil 2005;
- BCC WSUD developer handbook 2020;
- Blacktown City Council Section 7.11 Contributions Plan N0.21- Marsden Park 2021;
- Blue Book – Managing Urban Stormwater Soils and Construction (Landcom NSW);
- NSW Department of Education - Educational Facilities Standards and Guidelines (EFSG);
- NSW Floodplain Development Manual 2005; and
- Australian Rainfall and Runoff 2019.

1.5 Authority Consultation

This report has been prepared following consultation with Blacktown City Council (BCC) and NSW State Emergency Services (SES). Consultation events and outcomes occurred as follows:

- **25 February 2022 – Blacktown City Council**
 - A teleconference meeting was held with Tony Merrilees and other representatives from Blacktown City Council.
 - Discussion of Council design parameters for water quality, water quantity, OSD requirements, and flooding design for the design of site.
 - Key feedback included that no Section 7.11 contribution was available for provision of an offsite OSD system and on-site provision will be required up to the 1% AEP. Primary point of discharge was identified in work as executed (WAE) plans as an existing 825mm pipe connecting to an existing pit to the north of the site.
- **25 July 2022 – Blacktown City Council**
 - A teleconference meeting was held with Laith Almoil and other representatives from Blacktown City Council. Further email correspondence continued to the 06/09/2022.
 - Discussion of appropriate DRAINS hydrological modelling input parameters for an ILSAX model. A supplementary email sent to Laith on 29/08/22 was also sent detailing inconsistencies between modelled DRAINS OSD volumes and BCC OSD Deemed to Comply tool were also covered.
 - Key feedback included confirmation that a DRAINS model could be adopted for OSD design following review by Laith. DRAINS hydrological modelling parameters provided by Laith via email correspondence dated 02/08/22 have been adopted for Section 3.2 of this report. Confirmed that above ground OSD is acceptable and is to be designed as per the WSUD Developer Handbook and is to align with the BCC WSUD Standard Drawings.
 - Laith confirmed that geo-cellular tanks would not be permitted and concrete/blockwork tanks would be required.
- **25 July 2022**
 - A teleconference meeting was held with Peter Cinque and Elspeth O'Shannessy from NSW State Emergency Services.
 - Discussion of an appropriate Flood Emergency Response Plan (FERP) for the site. It was agreed that evacuation be prioritised over shelter in place due to adequate lead times and early warning systems as well as complete inundation of site by over 7.5m of floodwater from the Hawkesbury-Nepean basin.
 - Key feedback included confirmation that SES supported TTW's approach that the evacuation of site should be the primary flood response for site. It was agreed that evacuation from the site occur south from Kaluta Avenue to Abell Street through to the primary escape route on Richmond Road. Early warning times issued in the FERP report were provided directly from SES.

1.6 Response to Submissions

The Environmental Impact Statement (EIS) was publicly exhibited on the NSW Planning Portal from 18 October 2022 to 14 November 2022. All submissions have been placed on the Planning Portal website.

Table 1.2 below lists the submissions related to the civil design of the proposed development and provides responses to each of the key items raised.

Table 1.2 – Response to Submissions

Item	Key Items	Comments and References
NSW State Emergency Services (SES)		
1	Development should not result in an increase in risk to life, health or property of people living on the floodplain.	A Flood Evacuation Response Plan (FERP) has been compiled in consultation with SES to ensure development will not result in increased risk to life, health, or property of people attending the proposed development.
2	Risk assessment should consider the full range of flooding, including events up to the Probable Maximum Flood (PMF) and not focus only on the 1% AEP flood. This has to be considered in the risk assessment.	The original Stormwater and Flooding Report submitted with the EIS and updated Stormwater and Flooding Report included with the RtS considered flood risk associated with the PMF in addition to the 1%AEP. To ensure that all available flooding information is considered, a Supplementary Flooding Report has been compiled and is to be read in conjunction with this Stormwater and Flooding SSDA Report. The Supplementary Flooding Report document incorporates the following additional flood events. It is noted that these do not materially impact the findings of the previous reports or design proposals. ▪ 0.5% AEP ▪ 0.2% AEP ▪ 0.1% AEP
3	Risk assessment should have regard to flood warning and evacuation demand on existing and future access/egress routes. Evacuation must not require people to drive or walk through flood water.	Site evacuation management solutions were coordinated with advice and recommendations made directly by SES. This route is provided in Section 5.2 of the FERP.
4	In the context of future development, self-evacuation of the community should be achievable in a manner which is consistent with the NSW SES's principles for evacuation. Future development must not conflict with the NSW SES's flood response and evacuation strategy for the existing community.	Site evacuation management solutions were coordinated with advice and recommendations made directly by SES. Evacuation route proposed in Section 5.2 passes through Abell Road in line with current SES evacuation strategy for area. The FERP prepared in consultation with SES outlines that flood warning times of 12 hours are applicable for the site. The school will therefore be closed prior to flooding and will therefore not impact the evacuation strategy for the existing community.
5	Development strategies relying on deliberate isolation or sheltering in buildings surrounded by flood water are not	Site evacuation management solutions were coordinated with advice and recommendations made directly by SES. Site will be evacuated prior to the flooding of site. This approach was reached

	equivalent, in risk management terms, to evacuation.	with recommendation by SES based on adequate flood warning times. No shelter in place is proposed due to extent of PMF event as outlined in Section 4.4 of the FERP.
6	The Flood Emergency Response Plan (section 4, 5 and 6) should be updated to reflect the current terminology used by NSW SES. Specifically, this is Watch and Act, Advice and Emergency Warning. For further information please refer to the Hazard Watch website.	Phrasing used within the FERP has been updated to incorporate the current terminology used by NSW SES. This includes Australian Warning System (AWS), new warning levels and action statements. Refer to Sections 4, 5, and 6 of the FERP.
7	The NSW SES is opposed to the imposition of development consent conditions requiring private flood evacuation plans rather than the application of sound land use planning and flood risk management.	The FERP outlines flood evacuation plans from the proposed development site in Section 5.2 using existing flood evacuation routes provided by SES for the Melonba and Marsden Park areas. This aligns with the existing evacuation strategy and routes currently utilised by SES for the region.
8	Development strategies relying on an assumption that mass rescue may be possible where evacuation either fails or is not implemented are not acceptable to the NSW SES. This may occur if caregivers are unable to safely reach the children prior to the commencement of flooding.	Strategy does not rely on mass rescue. Site is to be evacuated prior to flooding of site based on flood warning lead times. This approach has been determined in direct consultation with SES and is outlined in Section 4.4 of the FERP.
9	Consent authorities should consider the cumulative impacts any development will have on risk to life and the existing and future community and emergency service resources in the future.	Location of site was planned and zoned for construction of a school development during precinct planning. Relevant consent authorities have provided input for flood planning of site within other sections of this RtS and outline that compatibility with SES strategies are required for site.
10	The RtS must also be accompanied by an updated Flood Emergency Response Plan developed by a suitably qualified flood risk and emergency management consultant in consultation with NSW SES and be in accordance with current best practise flood emergency management. The Flood Emergency Management Plan must provide clear, quantifiable triggers for each emergency management action.	Consultation with Peter Cinque from SES was performed Monday 25th of July to cover the evacuation plan for site. Quantifiable triggers aligning with NSW SES terminology is provided in Section 4 of the FERP.
Blacktown City Council (BCC)		
11	The proposal to remove and not replacing the affected stormwater kerb inlet pits along	All impacted Kerb Inlet Pits (KIP) impacted by the proposed bus parking bay extensions will be

	Swallowtail Street is not accepted. The same provision needs along Kaluta Avenue needs to be made, that is, changing the kerb inlet pits to a double butterfly gated pit subject to satisfactory analysis to demonstrate the change does not adversely impact on the inlet capacity of these pits and pavement design. This will need to be provided on engineering plans for assessment.	reconstructed to match the new proposed kerb line. Refer to Drawings: 221022-TTW-SITE-C-0441 221022-TTW-SITE-C-0443 221022-TTW-SITE-C-0444
12	No civil engineer plan was located in the submission.	Civil Engineering Plans have been included as part of Appendix A of this Stormwater and Flooding SSDA report submission.
13	The drainage system is to be designed in accordance with Council's Water Sensitive Urban Design Developer Handbook 2020, Engineering Guide for Development 2005 and Council's Water Sensitive Urban Design Standard Drawings.	These Council guidelines have been integrated into the design of site.
14	Submit DRAINS and Model for Urban Stormwater Improvement Conceptualisation electronically for review.	DRAINS and MUSIC models provided for review. Preliminary DRAINS model and ILSAX parameters submitted to Laith Almoil from BCC and approved on 06/09/22.
15	Engineering Plans: All Ocean Guards are to be clearly notated as "200 micron Ocean Guards". Provide a pit schedule clearly identifying pits with any number of Ocean Guards.	Pit schedule detailing provision of all OceanGuards is provided on Drawing 221022-TTW-SITE-C-0335. Refer to Appendix A. OceanGuards labelled as "200 micron Oceanguard".
16	Engineering Plans: Provide an onsite stormwater detention catchment plan.	Catchment Plan for both MUSIC and DRAINS is provided in Appendix E of this Stormwater and Flooding SSDA Report.
17	Engineering Plans: Provide a model for Urban Stormwater Improvement Conceptualisation catchment plan that shows both the land use and the areas contributing to each specific device. Ensure that a minimum fraction impervious of 85% is adopted for land-use in the Model for Urban Stormwater Improvement Conceptualisation.	A minimum land use of 85% impervious area has been adopted for use in the provided MUSIC model. A catchment plan showing individual device catchment has been included in Appendix E of this Flooding and Stormwater report.
18	Engineering Plans: Detailed design is to be provided for the onsite stormwater detention, Storm filter Chamber, Ocean Safe OS-1112 and Rainwater tank which includes sections, dimensions, levels, depths, catchments,	Refer to the following Civil Engineering Drawings in Appendix A of this Stormwater and Flooding Report. 221022-TTW-SITE-C-0340 221022-TTW-SITE-C-0360

	Storm filter cartridges details, floatable baffles etc. This is to ensure that the stormwater system is designed in accordance with Council's guidelines and is effective in operation.	221022-TTW-SITE-C-0362 221022-TTW-SITE-C-0365 Refer to the Hydraulic drawings for the rainwater tank.
19	Engineering Plans: The 1% Annual Exceedance Probability flows from the site are to be directed to the onsite stormwater detention. Demonstrate how the surface flows in excess of the pipe capacity are directed to the onsite stormwater detention system.	Overland flow generated from the 1%AEP storm event are captured on site and directed to the OSD by associated grated inlet pits and the in ground stormwater network. Refer to the following Civil Engineering Drawings in Appendix A of this Stormwater and Flooding Report and DRAINS model: 221022-TTW-SITE-C-0331 221022-TTW-SITE-C-0332 221022-TTW-SITE-C-0333 221022-TTW-SITE-C-0334
20	Engineering Plans: All pits deeper than 1.2m must provide step irons at 300 cts.	Refer to Drawing 221022-TTW-SITE-C-0360 in Appendix A of this Stormwater and Flooding Report.
21	Engineering Plans: On Drawing 0340 to be corrected as detailed in the Council submission	Refer to new Site Strip Levels on Drawing 221022-TTW-SITE-C-0350 in Appendix A of this Stormwater and Flooding Report.
22	Stormwater & Flooding Report (by TTW revision 3 dated 16 September 2022) is to be amended as detailed in the Council submission	This document has been amended as per Council response.
23	Flood Emergency Response Plan by TTW (dated 16 September 2022) is to be amended to include the following: - Provide and indicate permanent fail-safe, low maintenance measures incorporated in the development to ensure timely, orderly and safe evacuation of students and staff from the area. Provide details when the evacuation will occur once the flood reaches a particular location, depth, extent etc. Additionally, demonstrate that the displacement of staff and students during times of flood will not significantly add to the overall community cost and community disruption caused by the flood. - Evacuation route north of the site as shown in Figure 5.1 of the report is not accepted. The route should include evacuating on higher ground along Kaluta Avenue and follow the local ridge along Abell Road. The route should extend east along Abell Road	Consultation with Peter Cinque from SES was performed Monday 25th of July to cover the evacuation plan for site. This informed the evacuation strategy and route provided in Section 4 and 5 of the FERP. Section 5.2 of the FERP has been updated to show primary evacuation route across Abell Road. Section 2.4 of the Supplementary Flooding Report shows that evacuation along Kaluta Avenue to Abell Road remains unimpacted for all storm events up to and including the 0.1%AEP. Consultation with Peter Cinque and SES recommended operation of a second evacuation point from site along Elara Boulevard should early flood evacuation warning be issued. This would remain unimpeded up to and including the 0.5%AEP as demonstrated in Section 2.2 of the Supplementary Flooding report. Warning times of 15 hours provided for site provided in Section 2.2 and 4.1 were confirmed by NSW SES. Solutions adopted in the FERP were made from direct consultation with Peter Cinque from SES. Flood evacuation routes, flood warning times, and

	towards Richmond Road. An alternate route should include east along Abell Road and cut off across Glengarie Road and head south towards South Street if there are any issues with Richmond Road during the flood event. Detailed consultation with State Emergency Services is required to address their flooding concerns and an Emergency Response Plan from State Emergency Services will also be required for the site and implemented into the development.	Flood Response Actions reflect comments made by SES during direct consultation sessions.
DPE (Social and Infrastructure)		
24	The RtS must also be accompanied by an updated Flood Emergency Response Plan developed by a suitably qualified flood risk and emergency management consultant in consultation with NSW SES and be in accordance with current best practise flood emergency management. The Flood Emergency Management Plan must provide clear, quantifiable triggers for each emergency management action.	Site evacuation management solutions were coordinated with advice and recommendations made directly by SES. Quantifiable triggers are outlined in Section 4.0 of the FERP.
DPE (Environment Heritage Group)		
25	The flood assessment does not accurately address existing flood behaviour, risk or constraints on the site. The report does not accurately outline or map existing flood behaviour, flood risk and flood constraints in the vicinity of the site from both the Hawkesbury-Nepean (HN) River regional flooding and Little Creek flooding (Catchment Simulation Solution, 2017). The report should provide this information for the full range of flooding including 0.2% AEP, 0.1 % AEP and the PMF. The report does not assess the appropriateness of the proposed development type, as it does not address the impacts of flooding for the full range of flooding on the proposed vulnerable development and its users.	The original Stormwater and Flooding Report submitted with the EIS and updated Stormwater and Flooding Report included with the RtS outlines the flood behaviour and mapping from HN Flood Study, refer to Section 2.2. The Little Creek flooding (Catchment Simulation Solution, 2017) does not cover the development site and stops south of Ropes Crossing and about 5km south of the site. Updated Flooding for the HN river regional flooding has been provided to TTW by Infrastructure NSW. To ensure that all available flooding information is considered, a Supplementary Flooding Report has been compiled to present this information and is to be read in conjunction with the Stormwater and Flooding Report. This document outlines the full range of flooding between the 1%AEP and PMF and includes the following flood events. 0.5% AEP 0.2% AEP 0.1% AEP

		Location of site was planned and zoned for construction of a school development during precinct planning. The Flood Advice Letter in Appendix C of the Stormwater and Flooding Report provided by BCC states that the FPL for a school is the 1% AEP + 0.5m freeboard. Additional modelling for larger storm events provided in the Supplementary Flooding Report show that evacuation routes via Kaluta Avenue and Abell Road as requested by SES remain accessible for all storm events prior to the PMF.
26	Impacts of flooding on the proposed school for 3,000 vulnerable children has not been assessed nor the risks to the rest of the school community including parents and carers.	Development meets the flood planning requirements confirmed by Council and the FERP requirements agreed with SES. Lead times for evacuation at Windsor provided in Section 2.2 of the FERP is 15 hours for flood levels exceeding 13.7m. Provision of 12 hours' notice for school closure was therefore considered achievable and this approach was developed in consultation with Peter Cinque from SES on Monday 25th of July to cover the evacuation plan for site. It is expected that the school will be evacuated prior to inundation by flood waters which was an approach supported by SES. The length of lead times will allow sufficient time to pick up students and staff by parents and caretakers should flood warnings be issued during operational school hours. This will not impact the evacuation strategy of the existing community. Location of site was planned and zoned for construction of a school development during precinct planning. The Flood Advice Letter in Appendix C of the Stormwater and Flooding Report provided by BCC states that the FPL for a school is the 1% AEP + 0.5m freeboard. Additional modelling for larger storm events provided in the Supplementary Flooding Report show that evacuation routes via Kaluta Avenue and Abell Road as requested by SES remain accessible for all storm events prior to the PMF. Flooding of site during storm events between the 1%AEP and PMF have been included as part of the Supplementary Flooding Report. This modelling demonstrates that evacuation of site is still possible during the 0.1% AEP and prior to the PMF via the south of site along Abell Road in line with Section

		5.0 of the Flood Emergency Response Plan (FERP).
27	EHG notes that both the Stormwater and Flooding report and Section 6.8.1 of the EIS do not refer to the HN Regional Flood Study and instead rely on the J Wyndham Prince Precinct Wide Flood Plan (J Wyndham Prince, 2013) which was prepared for the development of the Marsden Park Precinct. EHG considers that the J Wyndham Prince study is not valid in addressing flood risk for the proposal for the following reasons: ▪ The assessment is limited to local flooding from Little Creek and its tributary only. It does not address local flooding behaviour which is relevant to the proposal as it doesn't account for the vulnerability of various users (students, staff and the community) to flooding, nor does it address the emergency management constraints for two schools due to the local flooding.	The report outlines the flood behaviour and mapping from HN Flood Study refer to Section 2.2. The J Wyndham Prince flood study was adopted for the design of site in addition to the HN Regional Flood Study as well as a Flood Advice Letter for site developed by Blacktown City Council. Flood levels from the J. Wyndham Prince study were originally adopted as the Flood Planning Level (FPL) of site as these exceeded levels provided by Blacktown City Council in their flood application letter. The report refers to both local flooding from Little Creek and Regional flooding from HN. Flood mapping provided by Infrastructure NSW has been modelled to show flooding from the wider HN basin for storms between the 1%AEP and PMF with particular reference on the 0.5% AEP, 0.2% AEP, and 0.1% AEP. This has been included in the Supplementary Flooding Report. Findings from this report show that the 1%AEP flood level for the HN regional basin align with the 1%AEP flood level provided in the J. Wynhan Prince study (17.50m vs 17.55m). These are satisfied by filling of site during precinct planning.
28	The emergency response plan is based on inaccurate assumptions, does not address emergency management constraints on the site. EHG considers that the Flood Emergency Response Plan (FERP) prepared by Taylor Thompson Whitting (16 September 2022) is inadequate to address emergency management during flood events for the following reasons: ▪ As it relies on the J Wyndham Prince study it inaccurately describes the site as not being impacted by the 1% AEP + 0.5m freeboard and therefore does not present flood behaviour for the full range of flooding within the vicinity of the development site (Section 2.1.2). ▪ Section 2.2 states: 'The site will remain unaffected by floodwaters during the 1% AEP and inundated during the PMF', which is an incomplete statement that indicates that the site is only inundated in the PMF event. As previously noted, the	Flooding of site during storm events between the 1%AEP and PMF has been modelled and included as part of the Supplementary Flooding Report. The 1%AEP flood level from this model is 17.55m AHD and generally aligns with the J. Wyndham Prince value of 17.50m. As the minimum elevation of site is at approximately 19.20m AHD, the comment that the site is not affected by the 1%AEP + 500mm freeboard level of 18.05m due to filling of the subdivision remains true. Modelling for flood events between the 1%AEP and PMF have been included in the Supplementary Flooding Report. The development only becomes impacted by floodwaters during the 0.2%AEP flood event and flooding is constrained to the north west of site. Evacuation via Kaluta Avenue and Abell Road is possible in all events up to the 0.1% AEP but excluding the PMF. Flood warning and evacuation response times presented in the Flood Emergency Response Plan

	site is partially inundated in the 0.2% AEP flood and fully inundated in all flood events above the 0.2% AEP. ▪ Inadequate consideration of emergency management constraints to ensure emergency management arrangements for the proposed development and its users. ▪ Inadequate consideration of emergency management impacts to the existing community. Overestimation of the time available for flood warning and response. EHG recommends that the FERP be revised in consultation with the NSW State Emergency Service (SES) to address the above.	were prepared in consultation with SES and based on their comments and recommendations.
29	Specific comments on the FERP are as follows. Section 3.2 - 'Sufficient warning times will allow closure of the school prior to inundation of the site by floodwaters. It is therefore expected that students and staff will not be located on site during a PMF flood event'. This incorrectly assumes that firstly there will be sufficient warning time to close the school and evacuate students, and secondly that inundation of the site is limited to the PMF event. Regarding the first assumption, EHG understands that the Bureau of Meteorology can provide up to 15-hour flood level predictions for large flood events in the HN Valley. This short prediction time may force the closure of the school site and its evacuation based on an uncertain prediction. If the flood exceeds the prediction, lives could be at risk. Alternatively, if the flood does not reach the predicted level, the school community could be evacuated unnecessarily, which could mean they may be reluctant to follow future evacuation orders. Regarding the second assumption, access to and from the site is cut by HN regional flooding in events above the 0.5% AEP. The site is partially inundated in the 0.2% AEP flood and fully inundated in all flood events above the 0.2% AEP. In the PMF event the site is inundated by flow depth of up to 7m. Therefore, the arrangements should consider	The FERP has been developed in consultation with SES and Council advice. Warning and response times were adopted based on advice received from SES, and both SES and Council recommended evacuation from site as the preferred viable strategy for the FERP. Additional flood maps based on the latest information from Infrastructure NSW have been included in the Supplementary Flooding Report. These show that inundation during the 0.1% AEP flood event is limited to only the north western half of site. Evacuation from the south of site via Abell Road is therefore still possible during all floods up to and including the 0.1%AEP. FERP has been updated to reflect that evacuation would only be undertaken in consultation with the SES. The SES advice would always take priority over the Chief Warden. Assistant Wardens would be assigned as required.

	all HN flood events above the 0.5% AEP, not merely the PMF. In addition, rarer events of local flooding that cut access to the site must also be considered. Section 3.2, Table 3.1 - Staff Responsibilities. The responsibilities allocated in Table 3.1 related to the flood response indicate a lack of understanding of emergency management arrangements in NSW and current HN regional evacuation planning arrangements. For example, they allow the chief warden of the school to make the decision to evacuate prior to receiving warning from the SES. This approach may conflict with the responsibilities of the SES for the safety of the wider community. EHG recommends that the proponent clarify: ▪ arrangements for circumstances where the SES and chief warden don't agree on whether the school should be evacuated ▪ Consider whether a single chief warden is sufficient for the safety of 3,000 vulnerable students plus 219 staff, and provide for an alternative warden if the chief warden is absent from the site ▪ Address minimum training requirements for the chief warden. Section 4.4 - 'Peak flood levels occur after about 70 hours. This would allow sufficient time to organise the closure of the school site, thus removing all staff and visitors from flood risk associated with the development site'. This section demonstrates an over reliance on assumptions relating to the evacuation timeline that do not consider the realities of a flood event. Nor does it consider the application of SES timelines for emergency response and flood evacuation, and the uncertainties associated with each action within the timeline.	
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2.0 Flooding

This section of the report addresses the SEARS requirement 14: Flooding Risk together with the additional matters set out in the DPE correspondence accompanying the SEARs and dated 28 April 2022 as listed below.

14. Flooding Risk

Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Floodplain Development Handbook.

Assess the impacts of the development, including any changes to the flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required

The precinct flood study prepared by J. Wyndham Prince dated 14 October 2020 and included as Appendix B identifies that the 1% AEP Flood Level adjacent to site is 17.5m AHD, placing the topography of site above the 1% AEP + 0.5m freeboard level. The report makes an allowance for climate change through a 15% increase in rainfall intensities. The report states that this approach was discussed and agreed with Council.

The wider site is situated within a Low Flood Risk Precinct, due to the inundation of the north west corner of the site in a PMF event. Blacktown City Council defines Low Flood Risk Precincts as land falling above the 1% AEP and extending to the Probable Maximum Flood (PMF). The site is not flood affected during the 1% AEP but is impacted by the local overland PMF event.

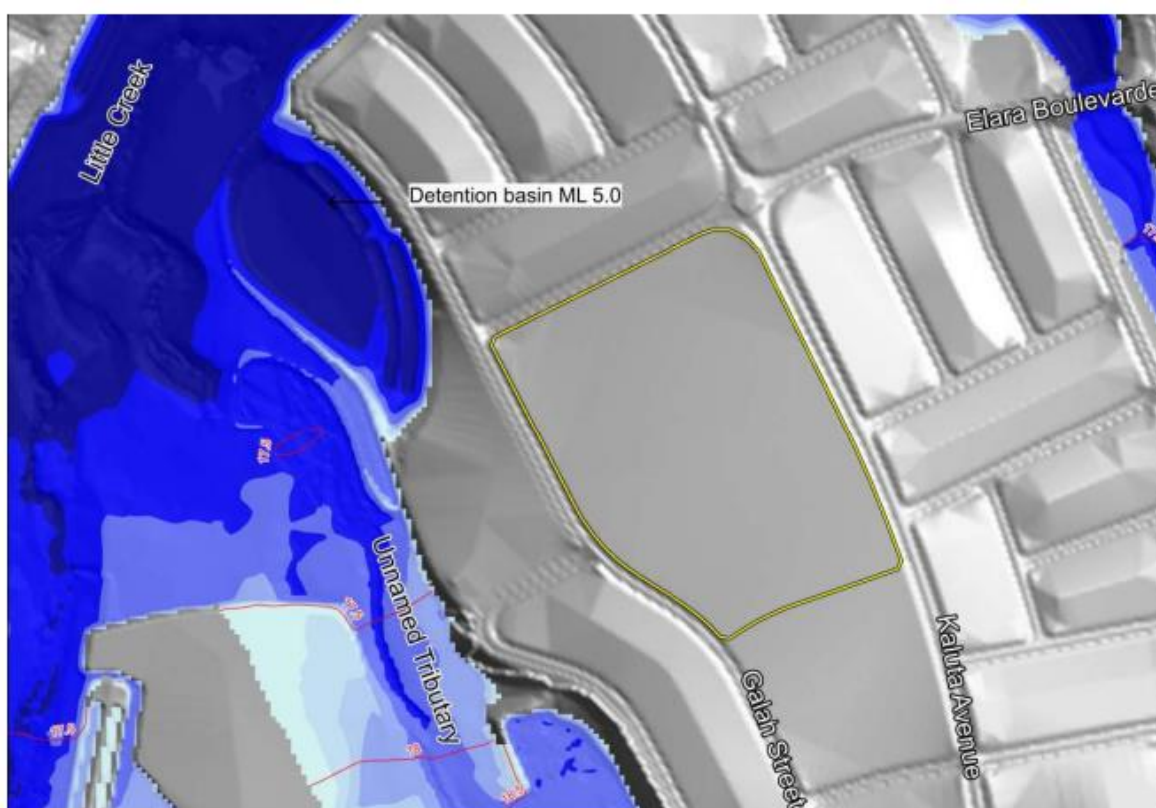


Figure 2.1- 1% AEP flood Levels (Source: J Wyndham Prince – Melonba Primary School Local 1%AEP Flood Depths and Levels dated 28/10/2020)



Figure 2.2- PMF Flood Levels (Source: J Wyndham Prince – Melonba Primary School Local PMF Flood Depths and Levels dated 28/10/2020)

2.1 SES Hawkesbury-Nepean Flood Extent Map

The NSW State Emergency Service (SES) provides flood maps outlining the extent and depths of flood waters impacted by the flooding of the Hawkesbury and Nepean rivers. These maps were taken from the SES Flood Risk interactive map using data from the Hawkesbury-Nepean Valley Regional Flood Study 2019 and indicate the flood extents for the Hawkesbury-Nepean Basin and are adopted in the SEPP (Sydney Region Growth Centres) 2006. It should be noted the mapping does not reflect the latest site levels following the sub-division earthworks.

The maps show the site is marginally flood affected to the north boundary during the 1% AEP event to depths of up to 1.2m with a flood level of 17.3m. During the PMF event the site will become completely inundated by flood waters, with flood depths between 3.2m and 7.2m based on a flood level of 26.4m. This mapping shows the mainstream flooding from the Hawkesbury River vastly exceeds the localised PMF extent provided in the J Wyndham Prince Precinct Study Plan.



Figure 2.3- SES Hawkesbury-Nepean Basin 1%AEP Flood Depth Extents



Figure 2.4- SES Hawkesbury-Nepean Basin PMF Flood Depth Extents

2.2 Blacktown City Council Flood Advice Letter

An application was submitted to obtain a Flood Advice Letter from Blacktown Council and has been included for reference within Appendix C of this report. It identified that the site currently falls within the Medium Flood Risk Precinct of the Little Creek Floodplain. It has been advised that the Flood Planning Level (FPL) for site should be the 1% AEP level plus 500mm freeboard. As outlined in the excerpt in **Figure 2.5** below, Council has advised that filling of the subdivision has already satisfied this minimum FPL requirement.

Recommendations

Council's Asset Design section would require for the construction of an educational establishment (Primary School and High School) the preliminary minimum floor level to be the highest adjacent 1% Annual Exceedance Probability (AEP) plus 500mm. However, based on the filling for the subdivision this has already been considered.

Figure 2.5 – Council Flood Advice Outlining that Filling of Site Above FPL has Already been Performed

Council has advised that the preliminary 1% AEP flood level is 17.3m AHD. Including the 500mm freeboard requirement, the FPL of the site is 17.8m AHD. As the minimum level of the site is about 19.4m AHD at the north-west corner, the minimum FPL requirement is satisfied. The PMF has been identified as 26.4m AHD, inundating the site with between 3.2m and 7.2m of water.

The preliminary 1% Annual Exceedance Probability (AEP) flood level for the subject property is 17.3 metres to Australian Height Datum (AHD).

The preliminary Probable Maximum Flood (PMF) level for the subject property is 26.4 metres to AHD.

Figure 2.6 – Council Flood Advice Outlining 1%AEP and PMF Flood Water Levels

Council has also outlined that sensitive developments including schools will require a higher standard of flood protection due to the age and potential risk to the occupants. Due to significant depths of 3.2m and 7.2m of water during the PMF event, it is proposed that the schools would close in advance of major flooding. Based on excerpts from the Warragamba Dam Raising Environmental Impact Statement (EIS) 2021 provided by Infrastructure NSW and referenced in appendix D, peak flood levels are produced after 70 hours during a major storm event. SES have confirmed a 15-hour warning time for flood levels above 13.7m downstream of site at Windsor. These should allow sufficient time for the closure of site, thus removing students, staff, and visitors from floodwaters associated with site. This strategy is supported by Council and SES given surrounding properties are completely inundated by the PMF event.

A Flood Emergency Response Plan (FERP) detailing the flood response of site has been prepared in consultation with Council and SES and has been submitted in support of this report.

Sensitive developments such as primary schools and high schools require a higher standard of flood protection due to the age of and potential risk to the occupants. In most of these, sufficient area above the Probable Maximum Flood (PMF) may need to be demonstrated for all occupants to shelter-in-place. Emergency back-up generators (if provided) and flood related infrastructure are to be installed above the PMF.

Figure 2.7 – Council Flood Advice Outlining Additional Requirements for Sensitive Use Facilities

It is to be noted that the Flood Risk Map released by Council within the Flood Advice Letter does not align with the written advice provided in **Figure 2.5** above. Council has noted that the flood modelling map does not reflect the filling within the subdivision and therefore results show similar mapping to the SES Hawkesbury-Nepean Flood Extent Maps. Written Council advice has therefore been adopted for the design of site in line with the Blacktown Flood Advice letter and therefore additional flood modelling is not required.

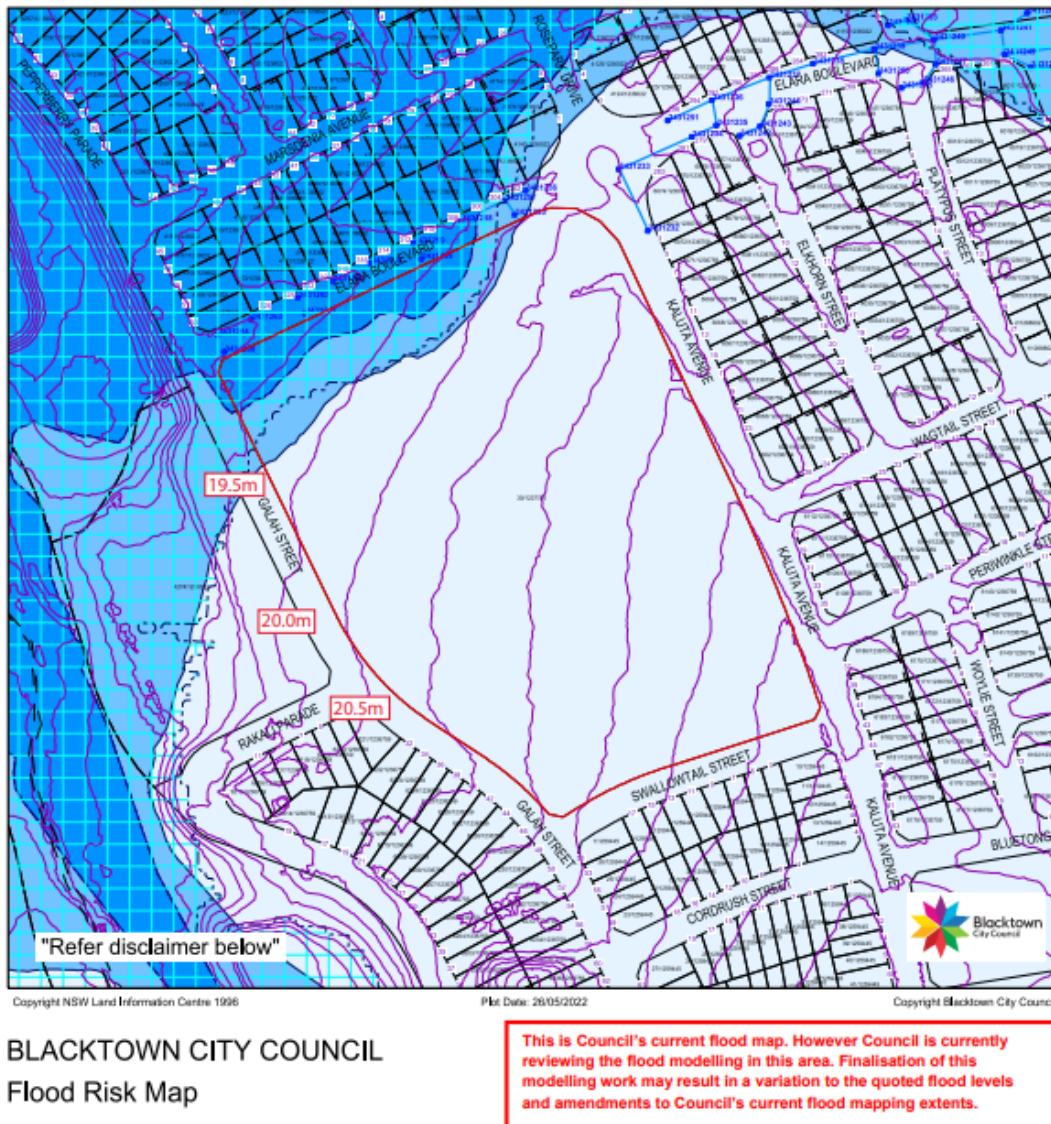


Figure 2.8 – Council Flood Advice Flood Map

2.3 Flooding Summary

The following summarises the key flooding risks associated with site. Flood levels have been assumed as the worst-case scenario and therefore have been adopted from the J Wyndham Prince precinct wide flood study as the provided 1%AEP flood levels exceed values provided by Council for the wider Hawkesbury-Nepean basin. The following flood planning levels have therefore been adopted for the design of site:

- 17.5m = 1% AEP flood
- 18.00m = Flood Planning Level (1% AEP + 500mm freeboard)
- 26.4m = PMF flood level

Design for the site has incorporated these flood planning levels through the following:

- Previous filling of the subdivision by Council has placed minimum elevation of site at 19.40m AHD and

is therefore located above the FPL.

- Site is located within a Low Flood Risk Precinct with depths of 3.2m and 7.2m across the site during the PMF event only.
- The latest flood studies which were accepted and allowed the subdivision to progress have not been formally adopted by Council or reflected in the SEPP maps.
- The J.Wyndham Prince report makes an allowance for climate change through a 15% increase in rainfall intensities which was discussed and agreed with Council.
- As the site sits above the FPL it will not materially impact flood risk on-site or off-site.
- A Flood Emergency Response Plan has been produced in support of this document and details that lead times provide sufficient warning for the schools to be closed during flood warnings, therefore removing students, staff, and visitors from site prior to site flooding. Personnel located on-site during site closure are to follow the precinct wide flood evacuation strategy currently adopted by SES. This report has been prepared in consultation with SES and has adopted their advice and feedback supporting this strategy.
- The site will not materially impact flood conditions and thus the existing flood impact and risk assessments developed for the subdivision works are still valid.

3.0 Stormwater Design

This section of the report addresses the SEARS requirement 12: Ground and Water Conditions and requirement 13. Stormwater and Wastewater. Stormwater quantity is covered in Section 3.1 and stormwater quality is covered in Section 3.2.

12. Ground and Water Conditions
Where drainage infrastructure works are required that would be handed over to local council, or other water drainage authority, provide full hydraulic details and detailed plans and specification of proposed works that have been prepared in consultation with, and comply with the relevant standards of, the local council or other drainage or water authority
13. Stormwater and Wastewater
Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines, downstream assets and watercourses.
Provide an Integrated Water Management Plan for the development that: • Is prepared in consultation with the local council and any other relevant drainage or water authority. • Details the proposed drainage design for the site including any on-site treatment, reuse and detention facilities, water quality measures, and the nominated discharge points. Demonstrates compliance with the local council or other drainage or water authority requirements and avoids adverse impacts on any downstream properties.

3.1 Stormwater Quantity

Stormwater quantity controls are outlined in the Blacktown City Council Growth Centre Precincts Development Control Plan 2010, Section 2.3.1- Flooding and Water Cycle Management. Stormwater discharge is to replicate pre-development flows where appropriate and is to be conveyed around the site using site grading, surface inlet pits (SIP's) and in-ground pipes in accordance with Council's Water Sensitive Urban Design (WSUD) Development Control Plan. Overland flow will be directed to inlet pits with exceedance flows directed safely through to the northwest corner of the site. Roof catchments are to be collected using gutters and downpipes and directed to a 250 cubic metre rainwater tank.

Stormwater conveyance around site has been designed in accordance with major and minor storm events as outlined under Section 1.1 Piped Drainage of the BCC Engineering Guide for Development and DG95.03 Stormwater Design Principles of the NSW DOE EFSG. Minor systems will be conveyed through inground pipe systems and be designed up to the 20-year ARI (5%AEP), whilst major systems up to the 1%AEP will be safely conveyed via overland flow paths once capacity for the minor system is exceeded.

Stormwater detention will be included as per Council requirements. OSD requirements and design for the site are covered in Section 5.1.1 of this report.

A summary of land usage for the proposed development has been provided below in line with Section 9 of the BCC WSUD Developer Handbook. The site is to be converted from the existing 0% impervious area grassed vacant lot to approximately 70% impervious area. Discharge from site is to be conveyed to an OSD chamber prior to discharge from site via an existing 825mm reinforced concrete pipe as advised in correspondence with Blacktown Council. A breakdown land usage and split between pervious and impervious area is provided in **Figure 3.1** and tabulated in

Table 3.1 below.

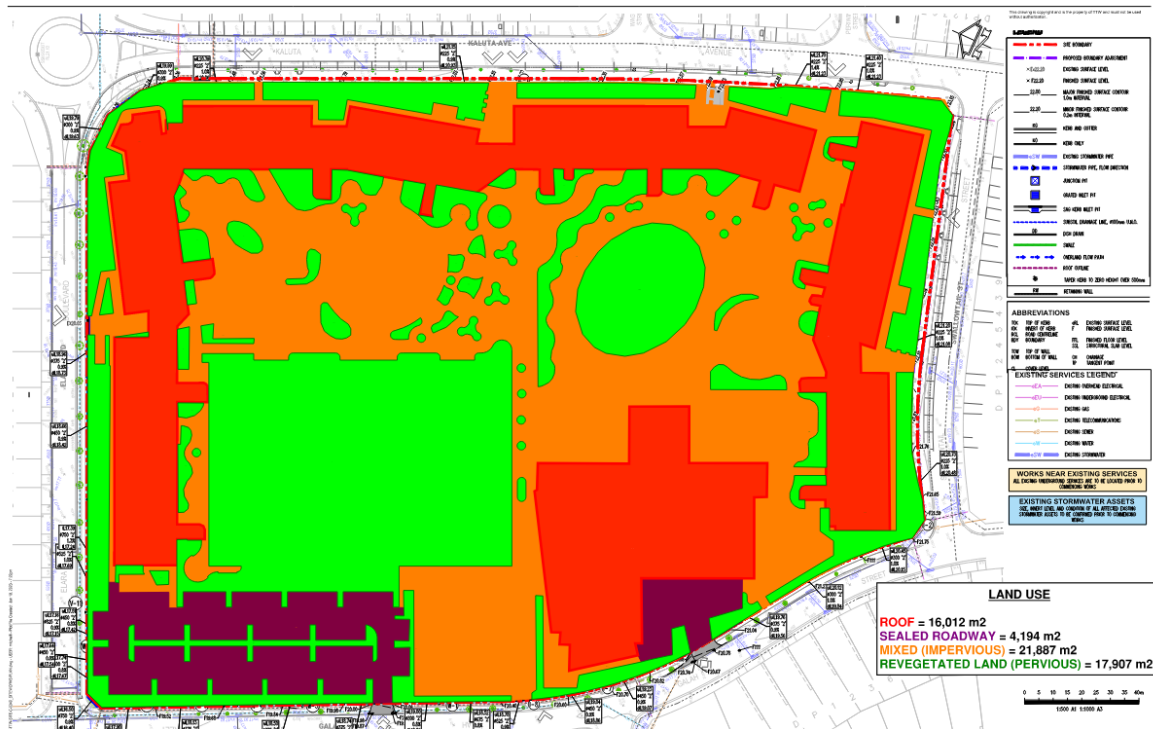


Figure 3.1- Catchment Plan Detailing Site Land Use and Impervious-Pervious Split

Table 3.1- Tabulated Land Use of Site and Impervious-Pervious Split

Land Use	Total Area (m ²)	Percentage of Site Catchment (%)
Roof	16,012	26.7
Sealed Roadway	4,194	7.0
Other Impervious Area	21,887	36.4
Pervious Area	17,907	29.8
Sum Impervious	42,093	70.2
Sum Pervious	17,907	29.8

3.1.1 Onsite Stormwater Detention (OSD) Requirements

The map “Land Zoned under the North West Growth Area SEPP- Onsite Stormwater Detention (OSD) Requirements” outlines the zones requiring no permanent or temporary Onsite Stormwater Detention system as defined in the Blacktown City Council North West Growth Area Development Plan. The site is identified as requiring “no permanent or temporary OSD required (regional facilities provided)”. A summary of this map as relates to the subject site is provided in **Figure 3.2** below.

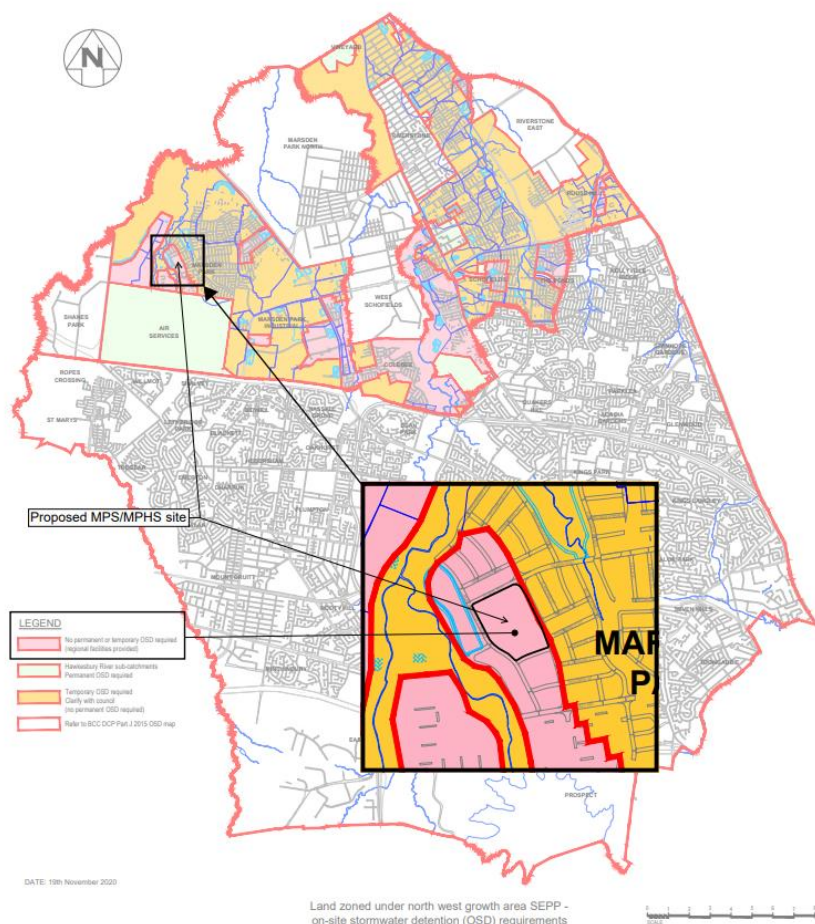


Figure 3.2- Blacktown City Council North West Growth Area Development Plan OSD Requirement Zones

However, the WSUD Developer Handbook produced by Blacktown City Council outlines that permanent OSD is required for all Sydney Water sites and NSW Government developments. As the development proposal consists of the design and implementation of two school sites for School Infrastructure NSW, design of site will therefore require integration of OSD to Blacktown Council specifications as per the below.

Permanent OSD is required for Sydney Water sites and NSW Government development, for example, schools, prisons and hospitals. Alternatively, a specific written agreement can be negotiated with Blacktown Council for payment of the appropriate Section 7.11 contribution. In addition, there are some sites within the growth centres and western Sydney employment areas that require permanent OSD.

Figure 3.3- OSD Requirements Outlined in the BCC WSUD Developer Handbook

Permanent OSD will need to be provided on site and comply with Appendix B- On-Site Detention General Guidelines and Checklist of the BCC Engineering Guide for Development (EGD) 2005. OSD is to be designed in line with the Council WSUD Developer Handbook requirement below as agreed with Laith Almoil from BCC.

3.5.1 Special modelling requirements for the growth centres or other DCPs that allow pre to post modelling

Where agreed to by Blacktown Council the following parameters can be considered for computer modelling. This is based on satisfying the pre to post modelling for all storms from 50% AEP (2 year ARI) to 1% AEP (100 year ARI), with particular reference to the 5% AEP (20 year ARI).

Based on the 1987 version of *Australian Rainfall and Runoff (ARR)* the parameters for the pre-development catchments are:

DRAINS

ILSAX or ILCL hydrology and kinematic wave can only be used for sites where the length of overland flow paths is less than 500 m. Where the length of the overland flow path is longer than 500 m use Laurensen Hydrology within DRAINS using the RAFTS parameters identified in the RAFTS section below.

- Pervious area depression storage 15 mm.
- Travel time use Kinematic Wave with n^* retardance coefficient. Allow:
 - Open Space (Natural Bushland) $n^* = 0.3$
 - Rural development (no dams) $n^* = 0.4$
 - Rural development (with dams) $n^* = 0.5$
 - The post developed criteria are as per Blacktown Council's *Engineering guide for development*.

Figure 3.4- Excerpt from the BCC WSUD Developer Handbook Outlining Pre vs Post Modelling for OSD

3.1.2 DRAINS Modelling

The proposed stormwater network of the site has been modelled using the hydraulic analysis program DRAINS in line with requirements outlined in the BCC WSUD Developer Handbook 2020, BCC Engineering Guide for Development 2005, and BCC WSUD Standard Drawings 2022. The following design parameters have been incorporated into the DRAINS model to demonstrate that operation of the OSD chamber is sufficient in meeting Blacktown City Council requirements under worst case scenarios.

- Total impervious area of site has been increased to a minimum 85% of site total (51,000 m²) as outlined in the BCC WSUD Developer Handbook. This represents an increase of 9,000 m² to impervious area in comparison to the actual 70% impervious area site split provided in **Figure 3.1**.
- All bypass has been included as impervious area to represent stormwater flows unable to be directed to the OSD due to site grading at boundaries not caught by swales or dish drains.
- The allowable discharge in DRAINS has been reduced from the actual allowable discharge rate to account for maximum flows for 32x ZPG StormFilter cartridges housed within the water quality chamber located immediately upstream of the proposed 50% AEP storage volume within the OSD chamber. This value has been calculated utilising the StormFilter Flow calculator provided to TTW by Ocean Protect.
- A tailwater level of 17.5m AHD has been adopted for design of the 1% AEP discharge to represent the 1% AEP flood water levels as outlined in the J Wyndham Precinct Wide Flood Study, 2013.
- Maximum ponding depths have been adopted from the BCC Engineering Guide for Development 2005. Where appropriate, maximum ponding depth is to be limited to 50mm for pedestrian areas, 200mm for driveways and parking, and 600mm for gardens and vegetated areas.
- Hydrological modelling within DRAINS has been performed using parameters provided in Table 10.2 of the BCC Engineering Guide for Development. These parameters have been provided in **Figure 3.4** below.

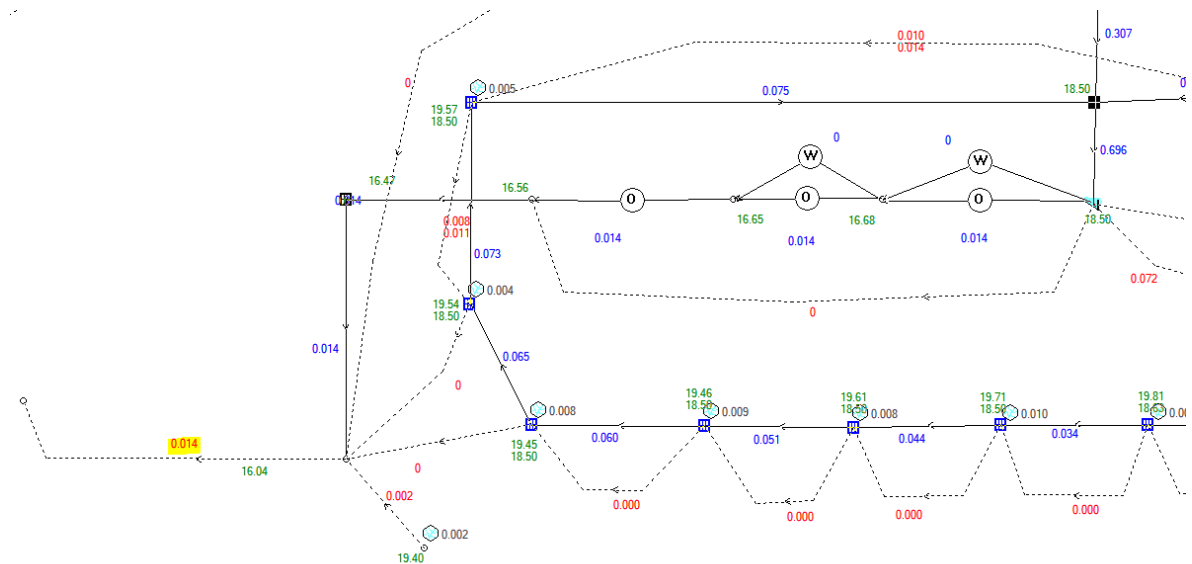
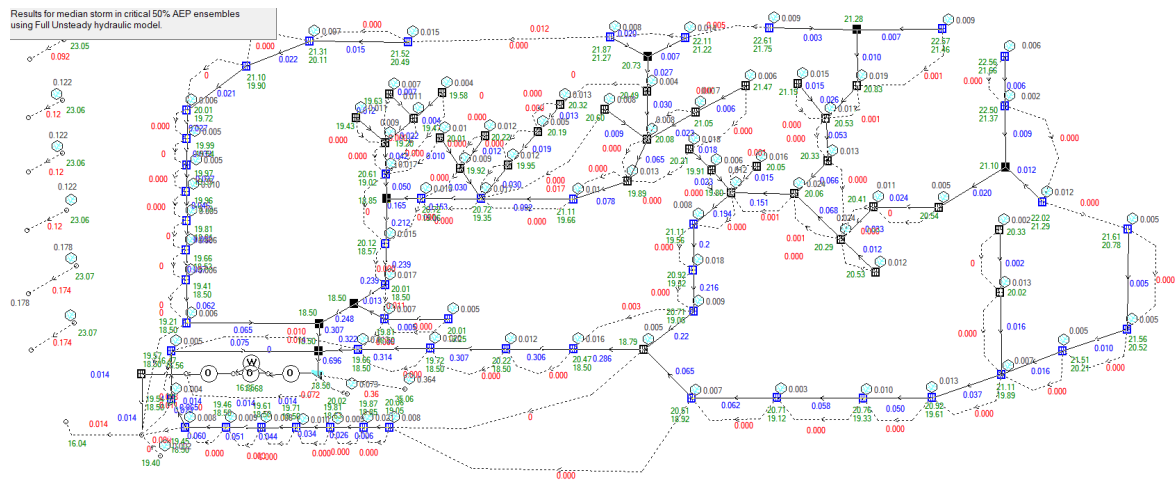
Parameter	Description	Value	Unit
Ilsax or Drains Models			
Model	Model for Design and Analysis run	Rational Method	
	Rational Method Procedure	ARR87	
	Soil Type - Normal	3.0	
	Paved (Impervious) Area Depression Storage	1	mm
	Supplementary Area Depression Storage	1	mm
	Grassed (Pervious) Area Depression Storage	5	mm
AMC	Antecedent Moisture Condition (ARI = 1-5 years)	2.5	
AMC	Antecedent Moisture Condition (ARI = 10-20 years)	3.0	
AMC	Antecedent Moisture Condition (ARI = 50-100 years)	3.5	
	Sag Pit Blocking Factor (Minor systems)	0	0 = No Blockage
	On Grade Pit Blocking Factor (Minor Systems)	0	
	Sag Pit Blocking Factor (Major systems)	0.5	
	On Grade Pit Blocking Factor (Major Systems)	0.2	
	Inlet Pit Capacity	(see figures 4.1-4.5)	

Figure 3.5- BCC Parameters for DRAINS Hydrological Modelling

The DRAINS results for the 50% AEP, 5% AEP and 1% AEP storm events are provided below along with a summary table. Stormwater discharge from site is met for all design storm events

Table 3.2- Summary of OSD Discharge Parameters and OSD Design

Storm Event (% AEP)	Permissible Site Discharge (L/s)	32x ZPG StormFilter Cartridge Flow (L/s)	DRAINS Allowable Discharge (L/s)	Design Discharge (L/s)	Orifice (mm)	Site Storage Volume (m ³)
50%	92	78	14	92	70	1490
5%	587	90	497	587	423	2000
1%	1056	94	962	1016	750	2350



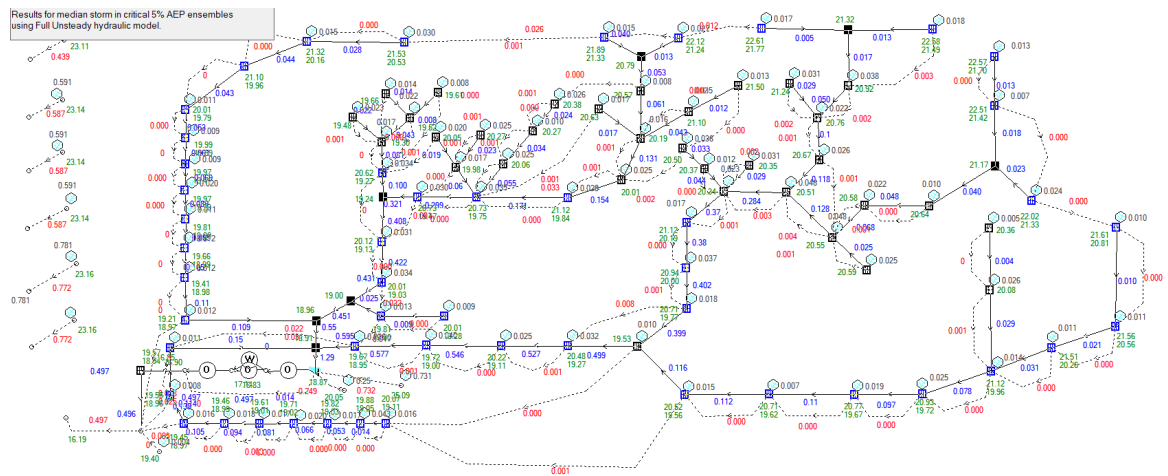


Figure 3.8- DRAINS 5% AEP Model

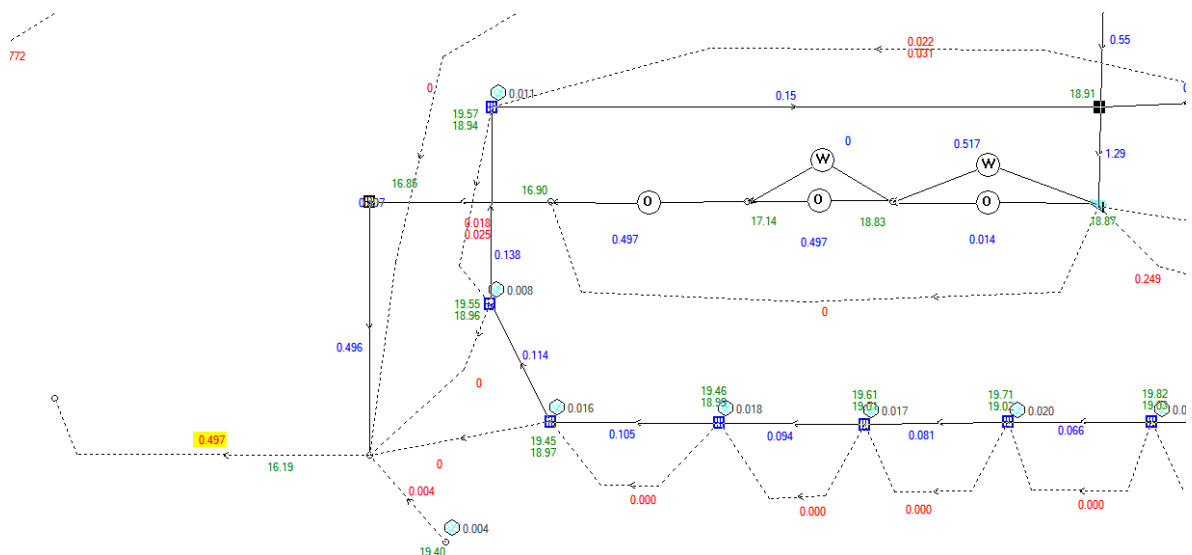


Figure 3.9- DRAINS 5% AEP OSD and Discharge

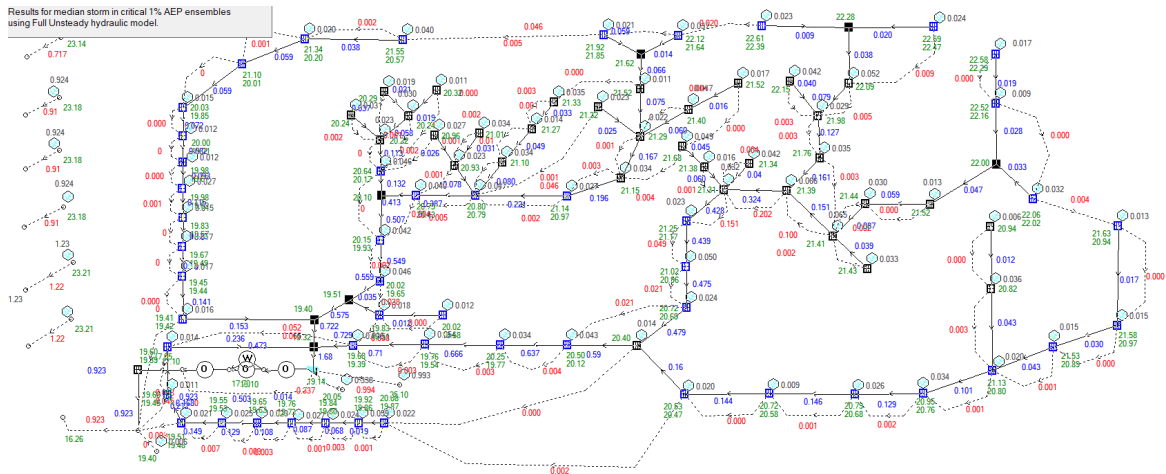


Figure 3.10- DRAINS 1% AEP Model

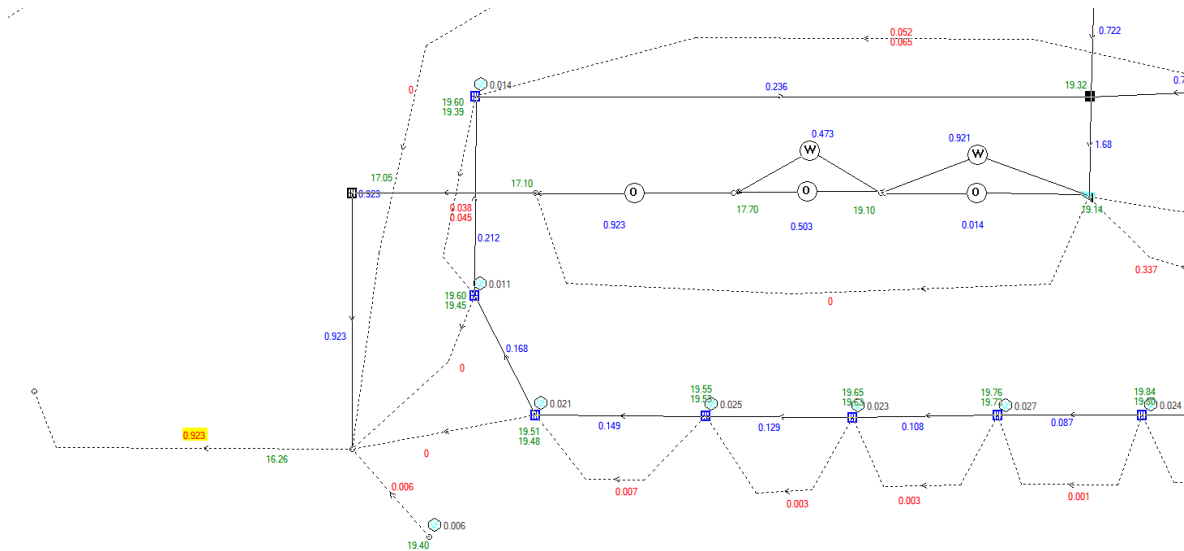


Figure 3.11- DRAINS 1% AEP OSD and Discharge

Stormwater flows generated from site catchments are to be conveyed through in-ground pits and pipes and overland flow to the OSD located to the north-west corner of site. Design of OSD is to comply with details listed on plan A(BS)175M of the Blacktown Council WSUD Standard Drawings.

3.2 Stormwater Quality

Stormwater quality treatment is required to comply with the requirements outlined in Table 2 of the Blacktown City Council Growth Precincts Development Control Plans 2015, Part J- Water Sensitive Urban Design and Integrated Water Management. Water quality treatment devices on site must therefore achieve the water quality targets outlined in Table 5.4.

The Blacktown City Council developer handbook for Water Sensitive Urban Design (WSUD) also specifies that industrial or commercial developments with carparks or manoeuvring areas greater than 1,000m² must provide a device that specifically targets hydrocarbons from the treatment train. Council requires the post development average annual load reduction of 90% total hydrocarbons.

4.2 Water quality

All developments shall achieve a minimum percentage reduction of the post development average annual load of pollutants in accordance with Table 2.

Table 2 Required pollutant reduction targets

Pollutant	% post development average annual load reduction
Gross pollutants	90
Total suspended solids	85
Total phosphorous	65
Total nitrogen	45
Total hydrocarbons	90

Table 3.3- Required Pollution Reduction Targets for Blacktown City Council

3.2.1 MUSIC Modelling

A proposed treatment train has been modelled in line with the Blacktown Guide to Music Modelling as well as the Blacktown City Council Music Link to ensure pollutant reduction load requirements are being met by site. This currently consists of the following treatment train devices:

- 32x Ocean Protect ZPG High-Flow Stormfilter Cartridges as per Blacktown Council specifications or equivalent product.
- 80x Oceanguard pit inserts or equivalent product.
- Ocean Protect Ocean Save OS-2324 or equivalent product:
- 250m³ rainwater tank with first flush system.
- Swales.
- Sand media filtration associated with the natural turf ovals.

Design of the MUSIC model has been conducted in line with requirements outlined in the Blacktown WSUD Developer Handbook 2020. Setup of the model was performed using the Blacktown MUSIC-link as recommended under Section 2.3.1 as well as the following design parameters.

- Total impervious area of site has been increased to a minimum 85% of site total (51,000 m²) as outlined in the BCC WSUD Developer Handbook. This represents an increase of 9,000 m² to impervious area in comparison to the actual 70% impervious area site split provided in **Figure 3.1**.
- All bypass has been included as impervious area to represent stormwater flows unable to be directed to the OSD due to site grading at boundaries not caught by swales or dish drains.
- Catchments draining to swales have been split into three separate sub-catchments for the purposes of modelling in line with recommendations provided under Section 11.13.
- An irrigation rate of 0.4 kL/m²/year has been adopted for all landscaping works not associated with the natural turf playing fields as detailed in Section 11.14.3. An irrigation rate of 0.27 kL/m²/year has been adopted for modelling of the playing fields in line with recommendations provided by the irrigation specialist. This relates to an annual reuse rate of 6300 kL/year for the entirety of site.
- Treatment nodes for proprietary treatment products such as the ZPG Storm Filter Cartridges,

Oceanguard GPT pit inserts, and OS2324 treatment nodes have been obtained directly from the manufacturer Ocean Protect and comply with requirements provided under Section 12.0

A summary of the treatment train system in addition to the annual pollution reduction load rates is provided in **Figure 3.7** and **Figure 3.13** below.

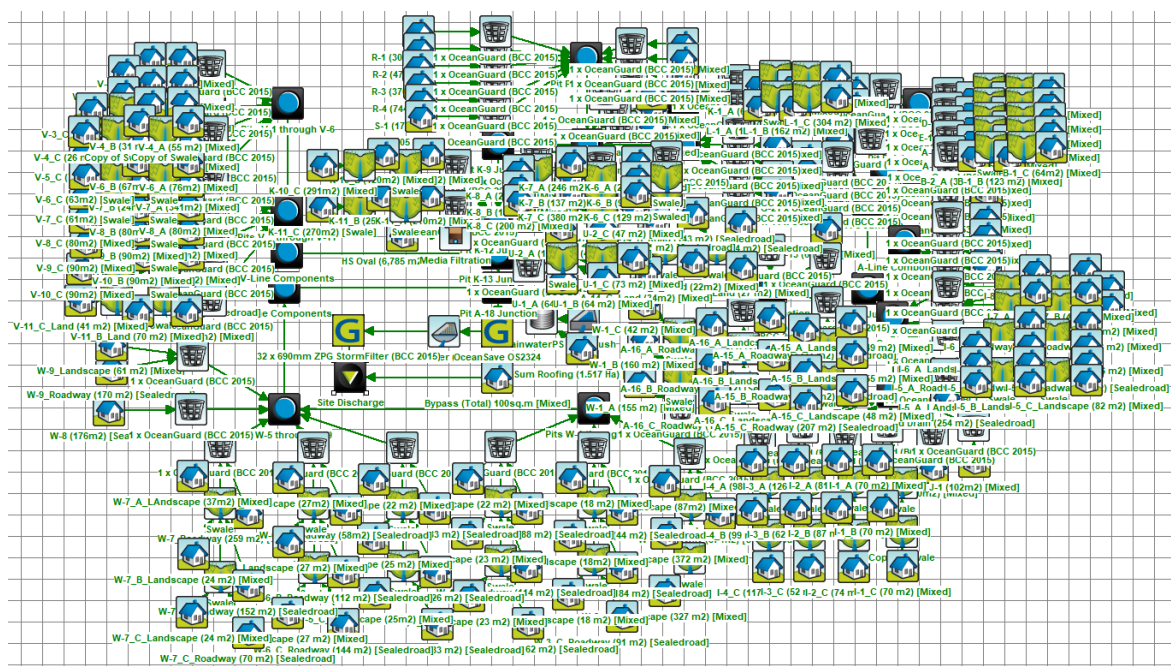


Figure 3.12- MUSIC Model of Site Showing the Proposed Treatment Train

	Sources	Residual Load	% Reduction
Flow (ML/yr)	32.9	28.4	13.8
Total Suspended Solids (kg/yr)	4470	264	94.1
Total Phosphorus (kg/yr)	8.74	2.38	72.8
Total Nitrogen (kg/yr)	71.1	39.1	45
Gross Pollutants (kg/yr)	819	1.91	99.8

Figure 3.13- MUSIC Model Showing Pollutant Reduction Targets for Site are Met

A summary of BCC DCP pollutant reduction targets required to be met for site in addition to the proposed pollutant reduction loads for the proposed treatment train as modelled in MUSIC is provided in **Table 3.4**. It should be noted that modelling for Hydrocarbon is not currently possible within MUSIC and therefore has been excluded from the table below. Hydrocarbon will be treated through the provision of the Ocean Protect OS-2324 treatment device and floatable baffles located within the Stormfilter water quality chamber as shown in the Appendix A. A MUSIC-link summary report has been generated and included in Appendix F of this Report.

Table 3.4 – Pollutant Reduction Loads for the Proposed MUSIC Treatment Train

Pollutant Type	BCC DCP Pollutant Reduction Target	Proposed MUSIC Pollutant Reduction Target
Gross Pollutants (GP)	90%	99.8%
Total Suspended Solids (TSS)	85%	94.6%
Total Phosphorus (TP)	65%	73.7%
Total Nitrogen (TN)	45%	45.0%

3.3 Decline of Proposal for Contribution Under Section 7.11

The Blacktown City Council Section 7.11 Contributions Plan N0.21- Marsden Park outlines the water management facilities operated by Blacktown City Council as part of the North West Growth Area Development Plan. As outlined in the figure below, the site is bounded to the north-west by a nominated water management facility marked as a bioretention basin and channel.

Blacktown City Council have confirmed that no contribution under Section 7.11 will be available for either water quantity (OSD) or water quality control measures. OSD and WSUD systems will therefore be required to be implemented wholly within the site boundary and be designed in accordance with the requirements outlined earlier in this report.

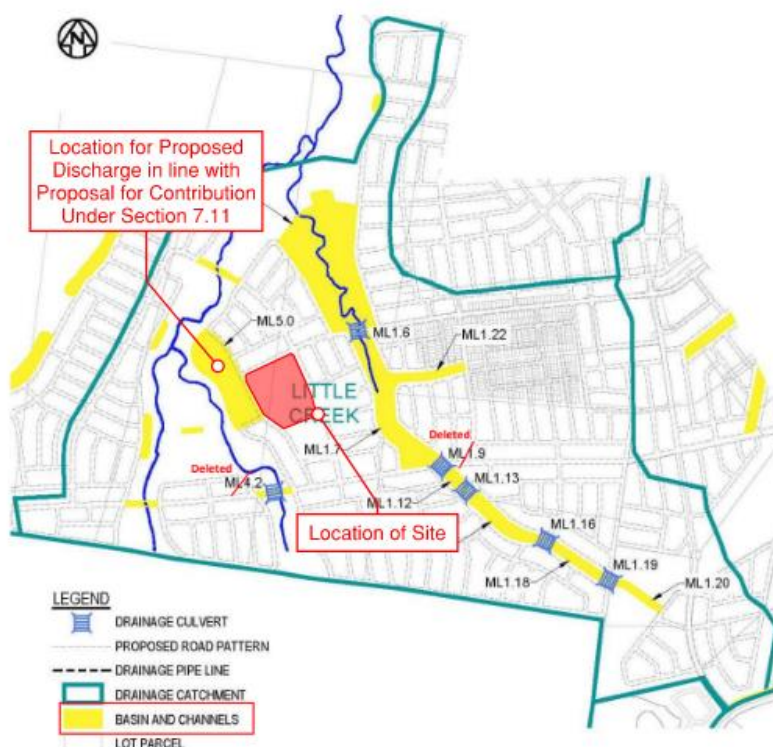


Figure 3.14- Existing Water Cycle Management Facilities under Section 7.11 Contributions Plan

3.4 Stormwater Quality During Construction

During the construction stage of the project, an erosion and sediment control plan will be implemented to prevent sediment laden stormwater from flowing into adjoining properties, bushland, roadways or receiving water bodies. Stormwater controls onsite are detailed in an Erosion and Sediment Control Plan which is in accordance with relevant regulatory authority guidelines including Northern Beaches Council's Development Control Plan and Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book"). Refer to the Civil Engineering drawings in Appendix A.

3.5 Stormwater Summary

The following summarises the response to SEARS 12.0 Groundwater and Water Conditions and 13.0 Stormwater and Wastewater:

- Consultation has been undertaken with the local authority Blacktown City Council through three pre-DA meetings and follow up phone and email correspondence. The content of this report aligns with the outcome of those meetings and follow up correspondence.
- OSD and on-site water quality treatment are outlined in sections 3.1 and 0 respectively.
- Discharge point is an existing 825mm diameter pipe located in the north west corner of the site as agreed with Council.
- Water quality targets of 85% TSS, 65% TP, and 45% TN have been achieved as demonstrated by the MUSIC modelling. 90% Hydrocarbon targets are met through the application of the Ocean Protect OceanSave GPT proprietary product.
- Amendments to off-site stormwater works will be dependent on the final traffic works (i.e. no, location and type of raised crossings. Once determined full documentation will be developed and submitted to Council for approval.
- Surface water is designed in accordance with the lot allowance with the wider subdivision so there will be no adverse impacts on downstream watercourses or drainage lines.
- Note that reference should be made to the hydraulic engineering report for information on water use and re-use including rainwater tanks.

4.0 Conclusion

This section summarises the key design developments of site.

- Flood planning of site has assumed a 1%AEP flood level of 17.5m which has been adopted from the J.Wyndham Prince flood study. However, previous filling of the subdivision by Council has placed the minimum elevation of site at 19.20m AHD and is therefore located above the FPL and is subject to the PMF extent only. A Flood Emergency Response Plan has been produced in support of this document and details that lead times provide sufficient warning for the schools to be closed during flood warnings, therefore removing students, staff, and visitors from site prior to site flooding. Personnel located on site during closure are to follow the precinct wide flood evacuation strategy currently adopted by SES.
- Stormwater quantity has been designed in accordance with BCC specifications and confirmed via direct correspondence. OSD is required for adoption on site and has been designed using the hydraulic analysis program DRAINS in line with requirements outlined in the Blacktown City Council WSUD Developer Handbook. Discharge from site is provided by an existing 825mm diameter pipe located in the north west corner of the site as agreed with Council.
- Stormwater water quality targets of 85% TSS, 65% TP, and 45% TN have been achieved as demonstrated by the MUSIC modelling. 90% Hydrocarbon targets are met through the application of the Ocean Protect OceanSave GPT proprietary product.
- Pavement for site has been designed in line with specifications provided in School Infrastructure's 'Educational Facilities Standards and Guidelines' (EFSG). Adoption of lime stabilisation to the top 0.3m of subgrade has been pursued to obtain a CBR of 5% in line with advice provided by Douglas Partners.
- The bulk earthworks requires further refinement at developed design stage to achieve a cut and fill balance across the site, taking account of site strip and pile arisings. This could be achieved by raising levels across the site by an average of about 250mm. Removal of the top 0.3m of topsoil will be utilised in mounding and associated soft landscaping with the potential to lose any excess beneath the building footprints.

Prepared by
TAYLOR THOMSON WHITTING (NSW) PTY LTD
in its capacity as trustee for the
TAYLOR THOMSON WHITTING NSW TRUST



MITCHELL LEIGHTON
Engineer

Authorised By
TAYLOR THOMSON WHITTING (NSW) PTY LTD
in its capacity as trustee for the
TAYLOR THOMSON WHITTING NSW TRUST



TIM MOORE
Associate Director

Appendix A

Civil Schematic Design drawings

**MARSDEN PARK NEW HIGH SCHOOL AND
MELONBA NEW PRIMARY SCHOOL,
20 KALUTA AVENUE AND 10 SWALLOWTAIL STREET, MELONBA**

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1. All work shall be generally carried out in accordance with:
 - (A) Local authority requirements,

1. **CONCEPT** "The body."
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REQUIREMENTS

 Site boundary
 Proposed boundary adjustment

- 
 Boiler

 Steam engine

 Steam locomotive

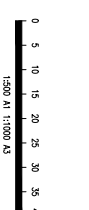
 Steamship

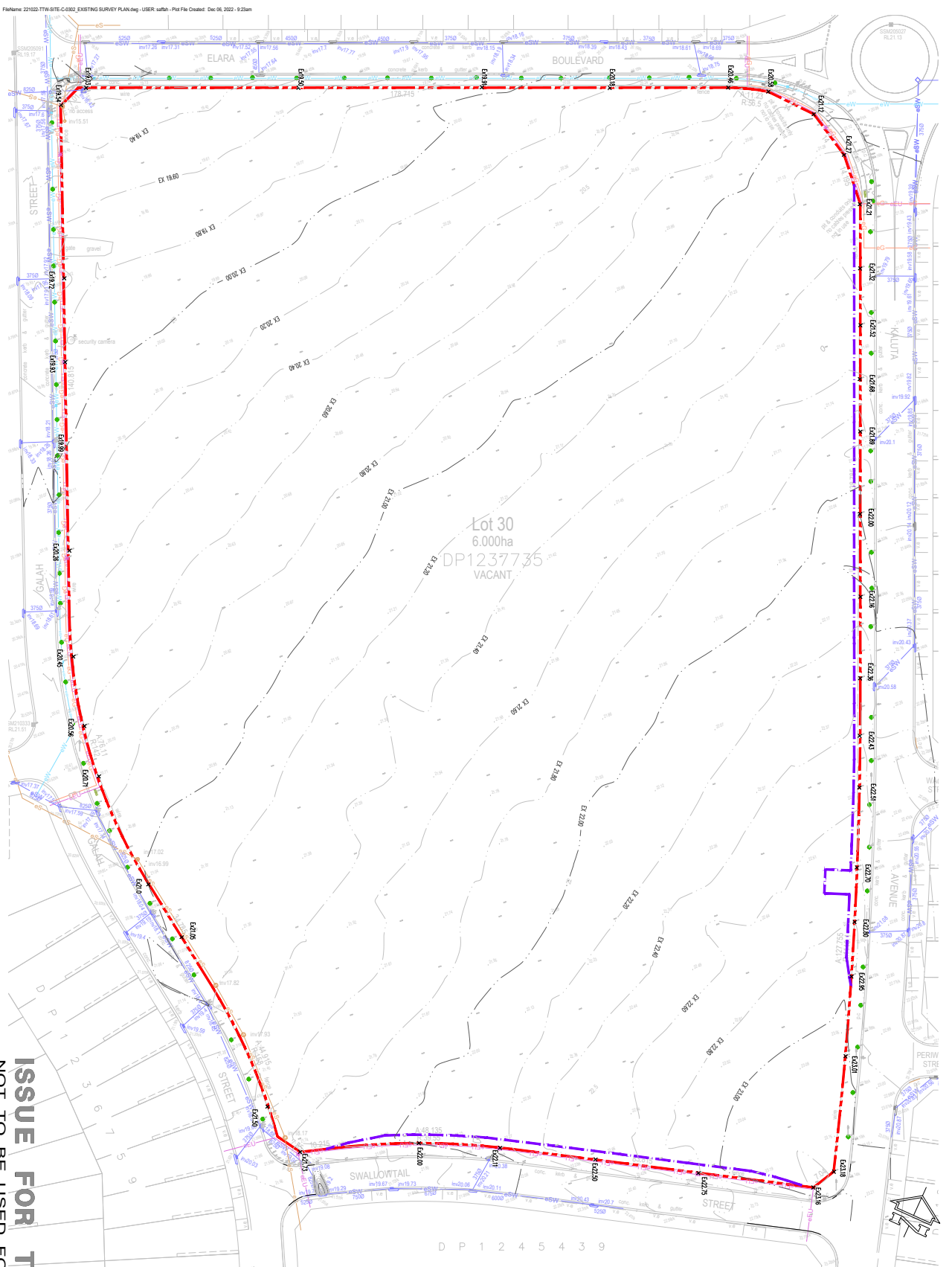
 Steam train

 Steam engine

 Steam locomotive

 Steamship

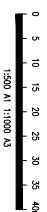




THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL
"RELEVANT" NOTES ON DRAWING C300

- | | |
|---|-------------------------------------|
|  | SITE BOUNDARY |
|  | PROPOSED BOUNDARY ADJUSTMENT |
|  | X 02/20 |
|  | EXISTING SURFACE LEVEL |
|  | EXISTING MAJOR SURFACE CONTROLDRAIN |
|  | 1.0m MINIMUM |
|  | EXISTING MAJOR SURFACE CONTROLDRAIN |
|  | 0.2m MINIMUM |
|  | EXISTING UNDERGROUND ELECTRICAL |
|  | EXISTING GAS |
|  | EXISTING TELECOMMUNICATIONS |
|  | EXISTING WATER |
|  | EXISTING STORMWATER |
|  | PROPOSED STORMWATER |

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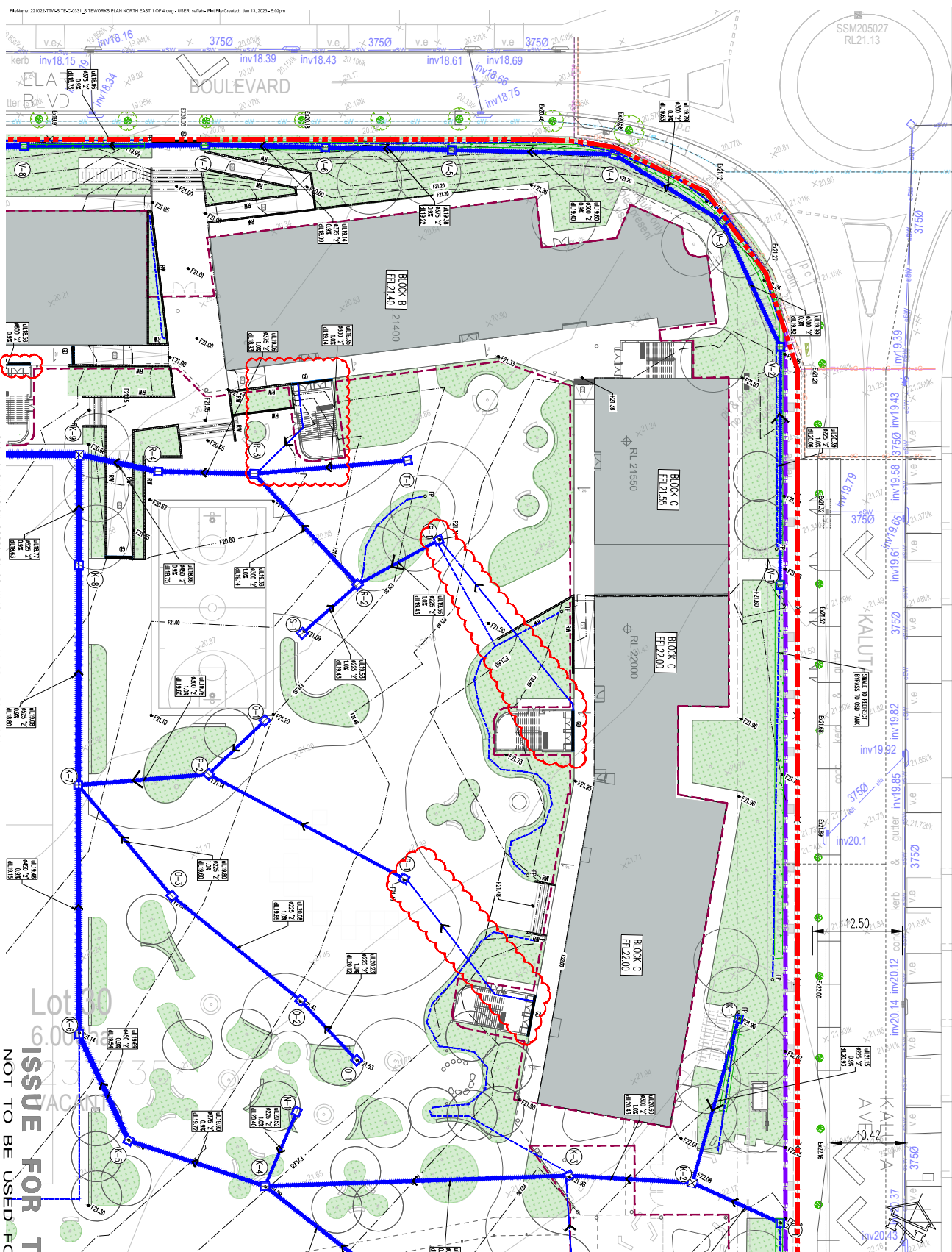


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Engineer	Architect	Project	Sheet Subject	Scale	Drawn	Authorized
 Structural Civil Traffic Facade	NBRS ARCHITECTURE	MARSDEN PARK NEW HIGH SCHOOL AND MELONBA NEW PRIMARY SCHOOL, MELONBA	EXISTING SURVEY PLAN	1:500	SH	TML
	612-9249-2244	612-9249-2244				

612-9249-2244 (Land & T) 1 Miller Street, North Sydney, NSW 2060	612-9249-2244 (Civil & Traffic) 1 Miller Street, North Sydney, NSW 2060
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FOR CONTINUATION REFER TO DRAWING No221022-TTW-SITE-C-0333

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ABBREVIATIONS	
TOP OF KEEL	REL. EXISTING SURFACE LEVEL
INT. OF KEEL	F. FINISHED SURFACE LEVEL
ROCK CHANGELINE	FF. FINISHED FLOOR LEVEL
BOY	SS. STRUCTURAL STEEL LEVEL
TOP OF WALL	CH. CHANGELINE
BOTTOM OF WALL	TP. THRESHOLD POINT
COVER LEVEL	TM. TOP WATER LEVEL
INVERT LEVEL	
OVERLAP LEVEL	

— 6E-A	EXISTING OVERHEAD ELECTRICAL
— 4E-U	EXISTING UNDERGROUND ELECTRICAL
— 6C	EXISTING GAS
— 6T	EXISTING TELECOMMUNICATIONS
— 6S	EXISTING SEWER
— 6W	EXISTING WATER
— 6SW	EXISTING STORMWATER

EXISTING STORMWATER ASSETS
SIZE, INVERT LEVEL, AND CONDITION OF ALL AFFECTED EXISTING STORMWATER ASSETS TO BE CONSIDERED PRIOR TO COMMENCING WORKS

NOTE:
ONLY MAJOR SUBSOIL LINES HAVE BEEN SHOWN
ON THE DRAWINGS. CONTRACTOR IS TO ALLOW FOR
SUBSOIL TO ALL PROPOSED LANDSCAPE AREAS

ENDER ONLY

CONSTRUCTION

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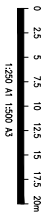
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ABBREVIATIONS	
TOP OF KEYS	4d
INVERT OF KEYS	f
ROLL CENTERLINE	FR
BOUNDARY	FS
TOP OF WALL	FT
BOTTOM OF WALL	FL
COVER LEVEL	CH
INVERT LEVEL	IP
DEBRIS LEVEL	TM
	WATER LEVEL

- **eEA** — DISTINGUISHED ELECTRICAL
- **eEU** — DISTINGUISHED ELECTRICAL
- **eG** — DISTINGUISHED CAS
- **eT** — DISTINGUISHED TELECOMMUNICATIONS
- **eS** — DISTINGUISHED SENIOR
- **eW** — DISTINGUISHED WINTER
- **eSW** — DISTINGUISHED SWIMMER

WORKS NEAR EXISTING SERVICES
ALL EXISTING UNDERGROUND SERVICES ARE TO BE LOCATED PRIOR TO COMMENCING WORKS

NOTE:
ONLY MAJOR SUBSOIL LINES HAVE BEEN SHOWN
ON THE DRAWINGS. CONTRACTOR IS TO ALLOW FOR
SUBSOIL TO ALL PROPOSED LANDSCAPE AREAS



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PT SCHEDULE FOR: Design Summary									
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A-1	# 225	20.10	# 225	21.00	0.967	21.00	15.33	# 225	21.00
A-2	# 225	20.15	# 225	21.30	1.277	21.30	15.33	# 225	21.30
A-3	# 225	20.85	# 225	20.79	1.568	20.79	15.33	# 225	20.79
A-4	# 225	20.67	# 300	20.42	1.536	20.42	15.33	# 300	20.42
A-5	# 300	20.30	# 315	20.70	1.643	20.70	15.33	# 315	20.70
A-6	# 315	20.11	# 450	20.03	1.305	20.03	15.33	# 450	20.03
A-7	# 315	19.86	# 425	19.55	1.600	19.55	15.33	# 425	19.55
A-8	# 300	19.87	# 600	19.45	1.640	19.45	15.33	# 600	19.45
A-9	# 600	19.36	# 600	19.20	1.886	19.20	15.33	# 600	19.20
A-10	# 600	19.04	# 600	19.44	1.975	19.44	15.33	# 600	19.44
A-11	# 600	18.40	# 600	18.80	2.089	18.80	15.33	# 600	18.80
A-12	# 425	18.30	# 315	18.35	2.085	18.35	15.33	# 315	18.35
A-13	# 675	18.23	# 675	18.20	2.332	18.20	15.33	# 675	18.20
A-14	# 675	17.81	# 350	17.66	2.402	17.66	15.33	# 350	17.66
A-15	# 750	17.44	# 425	17.49	2.387	17.49	15.33	# 425	17.49
A-16	# 825	17.27	# 350	17.20	2.480	17.20	15.33	# 350	17.20
A-17	# 350	17.20	# 350	17.20	2.530	17.20	15.33	# 350	17.20
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D-4	# 300	20.47	# 315	20.35	1.831	20.35	15.33	# 315	20.35
D-5	# 315	20.61	# 315	20.10	1.603	20.10	15.33	# 315	20.10
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E-1	# 225	20.10	# 225	20.10	1.801	20.10	15.33	# 225	20.10
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E-1	# 225	17.30	# 325	17.30	1.533	17.30	15.33	# 325	17.30

PT SCHEDULE FOR Design Stormwater						
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I-1	# 225	20.730	1.163	20.730	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
I-2	# 225	20.460	1.292	20.460	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
I-3	# 300	20.150	1.899	20.113	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
I-4	# 300	18.835	# 375	18.757	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
I-5	# 375	18.657	# 400	18.507	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
I-6	# 400	18.260	# 400	18.234	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
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K-7	# 400	18.155	# 525	18.075	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
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M-2	# 725		# 300	20.830	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
N-1	# 725		# 725	20.518	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
O-1	# 725	18.850	# 725	18.884	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	
000	# 400	17.115	# 750	16.500	THE T. SERVICE LEFT RT. NO. 300M CONC TO BE MADE BY ASPHALT EXISTING OR IMPROVED DRAINAGE.	

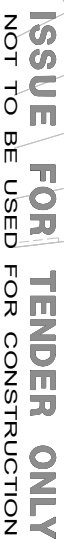
[illegible]

NOTE:

1. SCHEDULE DOES NOT INCLUDE GSI OR RAINWATER TANK ACCESS COVER. ALL COVERS TO BE 900 x 900mm CLASS D.
2. SCHEDULE DOES NOT INCLUDE PUBLIC REALM STORMWATER. REFER TO PUBLIC REALM STORMWATER PLAN AND BLACKTOWN CITY COUNCIL STANDARD DETAILS.
3. SCHEDULE DOES NOT INCLUDE GRATED DRAINS. REFER STORMWATER PLANS FOR GRATED DRAINS. ALLOW FOR 200mm WIDE AOD MALKSRKAN K200.

ISSUE FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION

Architect		Engineer		Steel Fabricator	
NBRS ARCHITECTURE		PIT SCHEDULE		Steel AT	
STONEY		MARSDEN PARK NEW HIGH SCHOOL AND MELONBA NEW PRIMARY SCHOOL, MELONBA		Galvalume	
01 2 0882 2344				SH	
				Drawn By	
				J20-BW	
				221022 221022-TTW-SITE-C-0300 01	
				Ref'd to Specs: Dec 07 2022 - 0506m	
R9 700X20		R9 700X20		R9 700X20	
Eng. Date: 2012/22		Eng. Date: 2012/22		Eng. Date: 2012/22	
Rev. Description		Rev. Description		Rev. Description	
01 2 0882 2344		01 2 0882 2344		01 2 0882 2344	
612 8430 7100 Level 6, 7/3 Melton Street, Melton, Victoria 3040		612 8430 7100 Level 6, 7/3 Melton Street, Melton, Victoria 3040		612 8430 7100 Level 6, 7/3 Melton Street, Melton, Victoria 3040	



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 PROPOSED ADJUSTED BOUNDARY
 PAVEMENT LEGEND

Unit Powers to Landscape architects specification on
30mm Thick mortar bed on
150mm Thick concrete with S192 on
100mm Thickness compacted fine crushed rock (08C20)

Prepave to landscape architect's specification on Asphalt to prepave installation detail
150mm Thickness compacted fine crushed rock (0/0820) on
lime stabilization of subgrade to achieve 300mm

PAY2b	100mm	Thickness compacted fine crushed rock (D0820) on
	300mm	lime stabilization of subgrade to obtain min. 5% CBR

Soft landscaping
Refer to Landscape Plan for Landscape finishes

1:500 A1 1:1000 A3

Scale: A1
Drawn: Author/and

[illegible]



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BULK EARTHWORKS NOTES

- [illegible]

Elevations Table

Elevations Table						
Number	Minimum Elevation	Maximum Elevation	Color			
1	-3.600	-3.600				
2	-3.600	-3.600				
3	-3.600	-3.200				
4	-3.200	-3.000				
5	-3.000	-2.800				
6	-2.800	-2.800				
7	-2.800	-2.400				
8	-2.400	-2.200				
9	-2.200	-2.000				
10	-2.000	-1.800				
11	-1.800	-1.600				
12	-1.600	-1.400				
13	-1.400	-1.200				
14	-1.200	-1.000				
15	-1.000	-0.800				
16	-0.800	-0.600				
17	-0.600	-0.400				
18	-0.400	-0.200				
19	-0.200	0.000				
20	0.000	0.200				
21	0.200	0.400				
22	0.400	0.600				
23	0.600	0.800				
24	0.800	1.000				
25	1.000	1.200				
BULK EARTHWORKS						
AREA	START	END	NET	Av. DEPTH		
(m ²)	(m)	(m)	(m)	(mm)		
19196	3033	-1514	2252	318	20mm	TLR
40531	8070	-7176	4536	-2052	55mm	OTF
59546	19189	-6550	7110	-2440	45mm	OTF

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FOR CONSTRUCTION

Job No	Drawing No	Rev'd
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Profile Created: Dec 07, 2022 - 11:57am