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CIVIL ENGINEERING REPORT

BROADWATER SCHOOL

9 Byrnes Street, BROADWATER NSW 2472

Revision 4.0

October 2023

Our Ref No. 230889

henry&hymas

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Preface

Henry & Hymas has been engaged by ADCO Constructions NSW PTY LTD to prepare this Civil Engineering Report (The Report) to satisfy civil engineering matters in support of the Development Application (DA) for the proposed reconstruction of the Broadwater Public School.

In February and March 2022 extreme flood events occurred in the local floodplain, with the lower Richmond River flooding. Floodwaters resulted in significant inundation of the school resulting in damage and rendering the school unfit for use.

This Report aims to provide a summary of key civil engineering design elements of the proposed reconstruction for the purpose of seeking development approval:

- General site locality, topography, and existing characteristics
- The proposed site works – earthworks and site access
- Stormwater management
- Flooding
- Sediment and Erosion

This Report has been prepared in conjunction with a set of Civil Engineering Drawings which show the general proposed civil and stormwater design for the development. The drawings are available for review in Appendix A of this Report.

The following principles have been adopted as part of the design process:

- Consideration of design intent in relation to functionality, expectations and requirements of the end user.
- Compliance with relevant Council and authority standards and policies.
- Compliance with the Education Facilities Standards and Guidelines (EFSG).
- Design coordination with the project team.
- A design philosophy sympathetic to the site constraints, environment, terrain, and landform.
- Retention of existing infrastructure where suitable.

The civil engineering component of the aforementioned project has been designed in accordance with the following council codes and policies:

- Richmond Valley Council Development Control Plan 2012
- Richmond Valley Local Environmental Plan 2012

This civil engineering report also draws on previous expert reporting discussing flooding specific to the proposed redevelopment as well as the greater floodplain in general. These will be periodically introduced and addressed throughout the report where necessary. The main reports relating to the flooding for the development and the wider catchment are listed below:

- Broadwater Public School - Flood and Civil Engineering Assessment prepared for School Infrastructure NSW by ACOR Consultants (QLD) Revision 1.
- Broadwater Public School - Flood Emergency Response Plan prepared for School Infrastructure NSW by ACOR Consultants (QLD) Revision 1.
- Draft Richmond Valley Flood Study (2023) by BMT.
- Richmond River Flood Mapping Study (2010) by BMT.
- Ballina Floodplain Risk Management Study 2012 by BMT

Response to Council Comments:

The following changes have been made to this report in order to resolve comments from Council, or in order to resolve co-ordination items between the other disciplines and their respective reports.

1. Clarification and justification has been provided in regards to the design flood levels detailed in Section 6.2 of this report.
   • A PMF level of 9.37m will be adopted for the site, since this is the level provided at Broadwater in the 2023 Richmond River Flood Study. It is understood that this level may be conservative as it represents the PMF level at the Broadwater gauge (upstream of the site) and not the school, however the level of 9.37m will be adopted unless Council's engineering department can clarify the exact level.
   • A 0.2% AEP flood level of 5.23m will be adopted for the site, since this is the level provided at Broadwater in the 2023 Richmond River Flood Study. It is understood that this level supersedes any flood levels provided in previous flood studies.
2. It should be noted that the proposed FFL of 5.50m is above the aforementioned 0.2% AEP flood level of 5.23m. Refer to Section 6.2 of this report.
3. It has been clarified that the structure has not been designed to withstand the flooding forces associated with the PMF storm event. Refer to Section 6.5.
4. Adjustments have been made to Section 6.1 of this report to co-ordinate with the updated flood reports and documentation by ACOR.
5. The historical flood level from 2022 has been updated to 5.20m AHD to reflect new information provided by Council via email correspondence. Refer to Section 6.1
6. Clarification has been provided in regards to the flood hazard category of the site. The site is classified as hazard category H5 in the 1% AEP storm, and H6 in the PMF.
7. The flood velocity for the various storm events has been updated. Refer to Section 6.1

1. Project Description

The existing buildings at Broadwater Public School, 9 Byrnes Street, Broadwater (Lot 4 & 5, Deposited Plan (DP) 1043232 and Lot 501 DP 755624) were significantly inundated during the February 2022 floods and most of the structures are no longer habitable due to the damages caused by the flood waters. As a result, the NSW Department of Education is proposing to demolish the existing school buildings and construct a new elevated school building to replace it. The floor level of the new building will be located above the design flood level to increase flood resistance and create useable undercroft spaces.
A development application will be submitted to Richmond Valley Council for these works.
Works will comprise the following:

- Site preparation including site establishment works, earthworks and relocation of heritage bell.
- Demolition of existing school buildings.
- Construction of a new elevated school building, with at-grade (undercroft) amenities and storage, including:

<u>Ground Level:</u>

- Open undercroft space for covered outdoor learning and play
- Male and female amenities and accessible toilet / change room facility.
- Cleaners Store.
- Sports Store.
- Equipment and general store.

Elevated Level:

- New administration comprising interview room, clerical spaces, Principal's office, staff room, sick bay, store and male, female and accessible amenities.
- School library with computer room, store, main communications room and library office.
- Three (3) General Learning Spaces (GLS) with learning commons and multi-purpose space.
- Canteen with open servery space.
- Store.
- Male, female and accessible amenities.
- Mechanical plant.

- New hard and soft landscaping including replacement playing field, playground, half games court and vegetable garden and new yarning circle.

It is not proposed to increase staff or student numbers as a result of these works.

2. Site Overview

The site is located within Broadwater in the municipality of Richmond Valley Council at 9 Byrnes Street, Broadwater NSW 2472. It is surrounded by agricultural properties to the east and Blackwall Drive to the west, which is immediately adjacent to the Richmond River.

The subject site is legally identified as Lot 5 DP DP1043232 and Lot 501 DP 755624 and is approximately 0.8838 ha in area. The locality of the site and surroundings are shown below in Figure 1.

Figure 1: Exiting site locality sketch, annotations by H&H, Nearmaps images

The existing site falls at a slight grade from the western boundary towards the eastern boundary. The western part of the site discharges to a stormwater pit in Travelers Arm Lane. This stormwater pipe discharges to a swale that runs parallel to the subject site's eastern boundary (within the adjacent site). The remainder of the site discharges directly across the subject site's eastern boundary into this swale.

The existing site features a number of small buildings as well as associated open play areas and smaller storage sheds/containers.

From a stormwater drainage perspective there is stormwater infrastructure within Travelers Arm Lane, however these stormwater pipes are very shallow. The majority of the site will not be able to be directed to this stormwater piped system. This piped system discharges to the swale adjacent to the eastern boundary (outside of the subject site). The majority of the site discharges directly into this swale, which can be considered the stormwater discharge point for the site. This swale directs stormwater further north before discharging under Baraang drive into Richmond River. Refer to the survey plan included in Appendix B, as well as Figure 2 below which demonstrates the location of the stormwater piped system and swale.

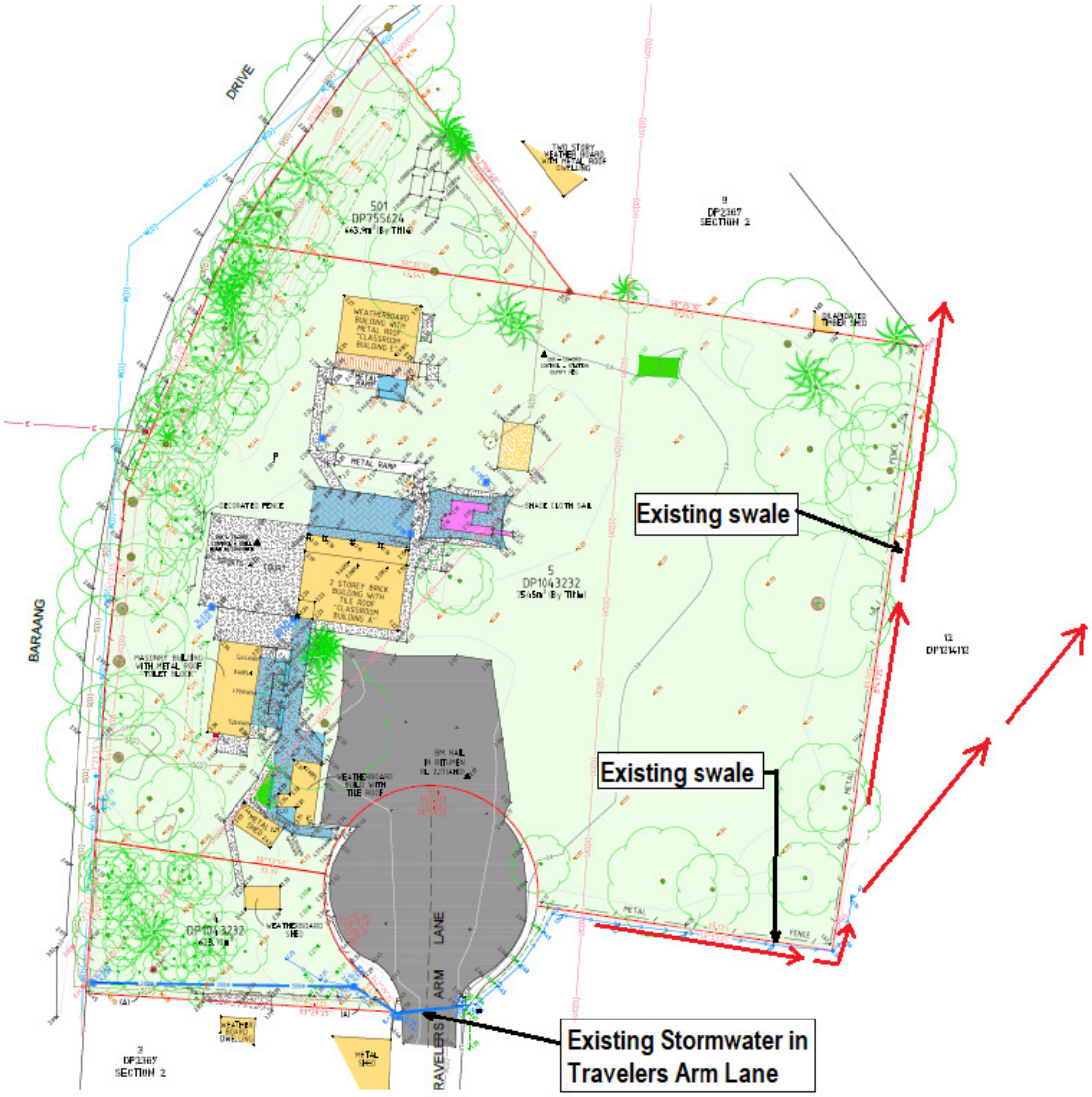

Figure 2: Feature survey by Beveridge Williams, annotations by H&H

3. Proposed Redevelopment

The proposed redevelopment of the school comprises the removal of all existing buildings within the western part of the site wit the exception of the shed in the southern western part of the site. The existing car park that ties into the Travelers Arms Lane Cul-de-sac is also proposed to remain.

The proposed developed consists of a new two storey building in the eastern part of the site. A key feature of the proposed new main building is habitable areas such as administration and teaching spaces are located on a raised level to provide better flood immunity. The significance of the raised level and the developments interaction with the local flood plain is detailed in Chapter 6 - Flooding. The lower undercroft level is provided for storage and supporting building amenities. A section showing the raised level and undercroft is shown below in Figure 4.

Architectural concept plans can be found in Appendix C of this report, and excerpt of the site plan is shown below in Figure 3 and Figure 4.

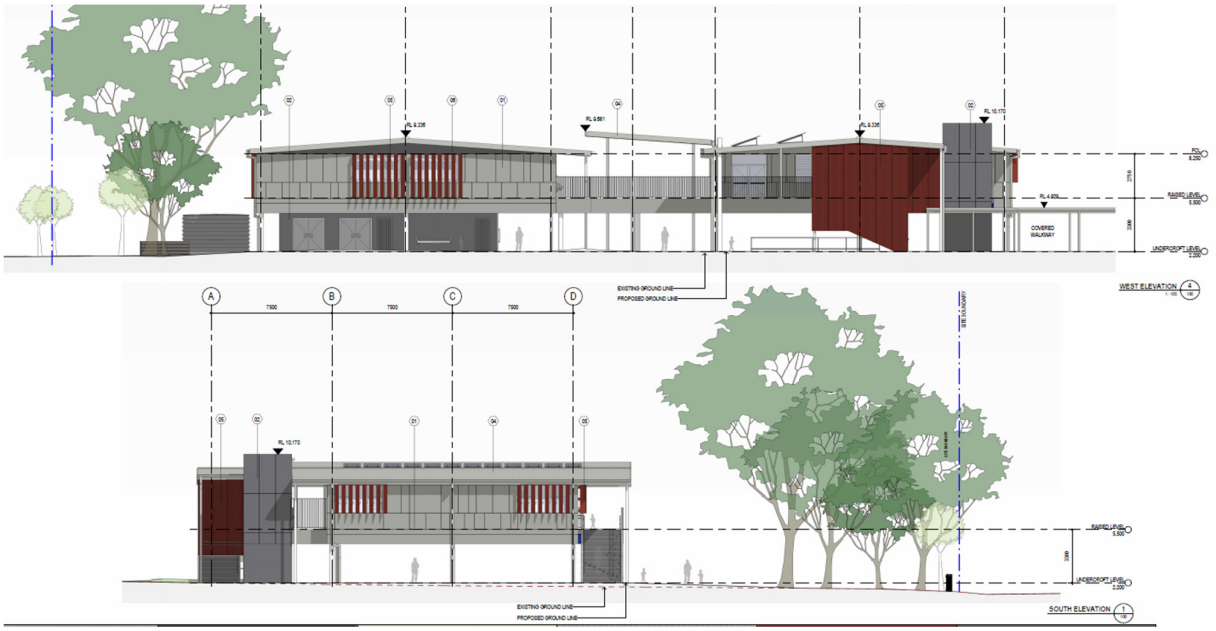

Figure 3 (top) and 4 (bottom) : Architectural site plan and section (respectively) of the proposed development. Pedavoli Architects 2023

4. Site Works

3.1 Site grading

Proposed grading has been undertaken to generally the existing sites topography. The western part of the site is predominantly landscaped and effectively pervious. Flows from these areas are directed towards the east, which find its way into a swale that runs around the perimeter of the proposed building. Hardstand areas adjacent to the proposed building direct flows towards stormwater pits, which discharges flows towards the eastern boundary.

Site grading has also been undertaken in such a way as to improve drainage onsite ensure that overland flow will be directed away from buildings with no impact on proposed or surrounding habitable areas.

Where suitable grading has been undertaken to rectify areas of poor drainage as determined by visual site inspection and as noted in the Flood and Civil Engineering Assessment by ACOR Consultants (Revision 1).

Grading has generally been undertaken in accordance with the EFSG, however due to the flat slope of the site and the shallow stormwater discharge point, a 1:60 slope could not be achieved in many places.

Proposed grading for the development is shown on engineering drawing BRO-CIV-PP-DWG-0100 in Appendix A.

3.2 Retaining walls and site stability

No significant level changes from existing surface levels are proposed onsite. Proposed site grading has been undertaken in manner to match the existing topography and no retaining walls are proposed for this development. No significant existing retaining walls are located onsite.

The existing topography onsite is gentle with no significant batters requiring stablisation. Proposed site grading has been undertaken to minimise earthworks batters. Minor earthworks batters (less than 0.3m) are provided wherever required as part of the grading design for the site. Earthworks batters will be provided at maximum slopes of 1(H) in 4(V) in accordance with the current geotechnical understanding for the development and where short-term construction batters are implemented, these will be protected from erosion by appropriately installed sediment and erosion control measures.

3.3 Bulk earthworks

As previously noted, proposed site levels have been generally designed to match the existing topography and marry with existing hardstands and structures. As such, a detailed bulk earthworks assessment has not been undertaken at the DA phase. It should be noted that given that the grading has been designed with consideration to the existing levels, it is not anticipated that the development will result in a large imbalance of cut or fill.

5. Stormwater Management

4.1 Existing System

Stormwater for the western portion of the site, which is where the existing school buildings are located, is directed to an in-ground piped system which discharges to the pit and pipe system within Travelers Arm Lane. This piped system is very limited in depth and does not have compliant falls. This stormwater system discharges flows towards a swale adjacent to the eastern boundary of the site. Refer to Figure 2 for more details. This existing system will not function as an appropriate discharge point for the proposed development. Existing stormwater infrastructure in the western portion of the site that lies outside of the proposed redeveloped area is proposed to remain.

The eastern part of the site, which is where the playing field is located, discharges overland towards the eastern boundary into a swale within the adjacent property. In addition to the flows discharging overland to this easter swale, there is a 150 diameter RCP pipe which discharges to the eastern swale in the south-eastern part of this site. This headwall is proposed to be replaced with a larger pipe and headwall in the same location. Refer to the survey plan and civil engineering plans in Appendices A and B for further details.

4.2 Proposed Stormwater System

The proposed stormwater management system has been designed to reduce the overall impact of the development on the existing onsite and surrounding stormwater systems and flow regime. The proposed stormwater management system responds to the architectural layout and incorporates the natural topography and site constraints to produce a cost-effective layout that meets best industry practices and water quality and quantity objectives.

The stormwater management system for the proposed development has been designed to collect all concentrated flows from the proposed impervious areas as well as stormwater runoff generated by pervious areas such as landscaping and earthworks batters.

The EFSG dictates that the piped system should cater for the 1 in 20yr ARI storm event, however the site conditions do not make this possible. The site will be completely inundated in the 20yr storm by mainstream flooding of Richmond River. The proposed piped system has therefore been sized to cater for the 1 in 5yr ARI storm event. It is expected that the piped system will not be functional in greater storm events, given the site's flooding conditions. Overland flow routes have been provided throughout the site to ensure stormwater can be conveyed to the site's discharge point in the event of a complete pipe blockage or a significant storm event greater than the 5yr ARI storm.

The proposed stormwater system for the development has been designed in accordance and in consideration of the following:

- Institution of Engineers, Australia publication "Australian Rainfall and Runoff" (2019 Edition), Volumes 1 and 2 (AR&R).
- AS 3500.3: National Plumbing and Drainage Code Part 3 – Stormwater Drainage.
- Richmond Valley Council Development Control Plan 2021

Catchment analysis has been undertaken to assess the change in predevelopment and post development catchments. Pre and post development catchments are shown on Proposed grading for the development is shown on engineering drawing BRO-CIV-PP-DWG-0250 and 0251 in Appendix A. The total site area is 8838m2.The pre development site has an impervious area of 1441m^2. The post development site has an impervious area of 1782m^2. The post development site has an increase in impervious area of 341m^2. It should be noted that the majority of the increase in

impervious area is roof area which is appropriately managed in terms of stormwater detention, water quality and water conservation.

The Richmond Valley Council DCP Part I-9 Water Sensitive Urban Design dictates that water quality and stormwater detention is addressed in the design. On-site detention is required to ensure that post-developed flows in the 2yr ARI and 5yr AÎ storm events do not exceed pre-developed rates. Additionally, the mean annual stormwater post developed volumes (ML/yr) is to be recued by 10% compared to pre-developed values.

Richmond Valley Council also has stormwater quality targets which are required to be addressed in the design. This includes the management of nitrogen, phosphorus, suspended solids and gross pollutant from the development. This has been addressed further in section 4.3.

Where possible, given the existing site constraints, the proposed stormwater system design has been undertaken to be in accordance with the EFSG.

4.3. On Site Detention, Water Sensitive Urban Design and Water Conservation

Detention

The Richmond Valley Council DCP Part I-9 Water Sensitive Urban Design dictates that post developed flows is required to be reduced to pre-developed values in the 2yr and 5yr ARI storm events. Stormwater detention has been provided as part of the above-ground rainwater tank structure. A 100mm diameter PVC outlet will be provided halfway up the rainwater tank to separate the volume above this outlet as detention, and the volume below this outlet as rainwater storage. 14kL of detention is proposed, with 20kL of rainwater storage provided under. The roof structure for the new school building is proposed to connect to the rainwater/detention tank, with all other parts of the site bypassing the tank.

DRAINS modelling has been undertaken to estimate pre and post-developed flow rates. Refer to the DRAINS model *230889[03].drn* which has been submitted supplementary to this report. Refer to the below table which demonstrates that Council's detention targets have been achieved.

Storm ARI	Pre-developed flows (L/s)	Post-developed flows (L/s)
2yr	138	136
5yr	217	207

In addition to the above, Richmond Valley Council requires the post-developed site to reduce mean annual stormwater volumes by 10% in comparison to pre-developed values. This has been achieved through the incorporation of a 20kL rainwater tank into the stormwater design. Refer to the MUSIC model *BROADWATER DA [02].sqz* and the table below which demonstrates that this requirement has been satisfied.

Pre-developed Mean Annual Volume (ML/yr)	7.91
Post Developed Mean Annual Volume (ML/yr)	7.10
Reduction	10.3%

Water Quality

Pollution and contamination dislodged or inherent to and in stormwater and stormwater run-off from urban developments have the potential to damage the ecology and health of local creeks and waterways. As such stormwater quality improvement devices (SQIDs) that aim to minimise pollution during construction and operation of the development have been incorporated into the overall stormwater management design.

The Richmond Valley Council DCP Part I-9 Water Sensitive Urban Design requires the following reduction of pollutants in post-developed conditions.

Contaminant	Target
Coarse Sediment	80% reduction
Fine Particles	50% reduction
Total Phosphorus	45% reduction
Total Nitrogen	45% reduction
Litter	70% reduction
Hydrocarbons and Oils	90% reduction

It should be noted that Council's DCP dictates that the above targets may vary where environmental or infrastructure factors require alternative performance targets.

The site is in fact limited in a number of ways:

- Very flat site with little fall across the site.
- Limited depth of stormwater discharge point in relation to the rest of the site.
- Site is within the floodplain, which limits any opportunity in relation to filling of the site.
- The stormwater discharge point (swale) is affected by the Highest Astronomical Tide (HAT).

These above site constraints ensure that a bio-filtration system or underground filter cartridge system is not able to be implemented on site, given the insufficient depth of stormwater infrastructure.

When taking a holistic view of the proposed development, there is expected to be a decrease in the generation of pollution associated with the area external to the proposed building. The proposed basketball half court will act as an effectively pervious surface since it will discharge towards a turfed area and filter into the subsoil system in smaller rain events. Similarly, the proposed playing field will direct flows through the soil media and into the subsoil system under, acting as a sort of sand filtration system. In light of this, and the fact that there is insufficient depth for standard water quality infrastructure, water quality treatment has only been proposed to be provided for the proposed building.

The roof area for the new building is proposed to discharge to the 20kL above ground rainwater tank. This rainwater has been sized to accommodate the irrigation associated with the proposed garden and playing field. The proposed water quality strategy regarding the rainwater tank and associated irrigation reuse is considered generally in accordance with Richmond Valley Council's DCP, in that although it does not meet the target pollutant reduction, the stormwater system has been designed in a way as to best provide treatment whilst working to the site constraints and not disrupting the safe conveyance of stormwater to the site discharge point.

Water Conservation

A 20kL rainwater tank has been proposed to resolve the aforementioned detention and water quality requirements from Richmond Valley Council. The requirements for a rainwater tank is also stipulated in the EFSG documentation, which calls for rainwater tanks to be connected for irrigation reuse and toilet flushing reuse where feasible (EFSG 0816 – Tanks).

A total area of 1082m^2 is proposed to be connected to the 20kL rainwater tank. The rainwater tank is to be connected to an irrigation system for the new planting, garden and sports field areas, in addition to the proposed toilets within the new building. Refer to the MUSIC model *BROADWATER DA [02].sqz* for more details.

6. Sediment and Erosion Controls

During construction, appropriate sediment and erosion control measures need to be implemented to ensure that downstream receiving waters are not adversely impacted as a result of construction activities. The engineering drawings BRO-CIV-PP-DWG-0900 and 0901 by Henry & Hymas outline appropriately designed and detailed measures to mitigate against this risk. These measures have been designed in accordance with the requirements of the publication "Landcom – Managing Urban Stormwater - Soils and Construction, Volume 1, 4th Edition March 2004" and Ballina Shire requirements.

7. Flooding

As previously noted, in February and March 2022 extreme flood events occurred in the local floodplain, the lower Richmond River flooding. Floodwaters resulted in significant inundation of the school resulting in damage and rendering the school unfit for use.

6.1 Review of existing flood assessments

On 3rd August 2022, Acor consultants undertook a site inspection to assess the severity of the local flooding and provide context on the flood levels in relation to the existing development and the frequency of the storm. The findings of the site inspection following the extreme flood event as well as review of other expert reporting and consultant consultation related to the flooding is documented in the Broadwater Public School - Flood and Civil Engineering Assessment prepared for School Infrastructure NSW by ACOR Consultants (QLD) Revision 1 (ACOR, 2022).

The following historical flood information has also been provided in the ACOR, 2023 Flood Emergency Response Plan (FERP) report revision 04. Refer to the below summary:

- 1954 Flood Event = 3.72m AHD Peak flood level at Broadwater
- 1962 Flood Event = 2.69m AHD Peak flood level at Broadwater
- 1974 Flood Event = 3.25m AHD Peak flood level at Broadwater
- 1988 Flood Event = 2.43m AHD Peak flood level at Broadwater
- 2017 Flood Event = 2.08m AHD Peak flood level at Broadwater
- *2022 Flood Event = 5.20m AHD Peak flood level at Broadwater

*2022 historical flood level provided by Council via email correspondence.

- Richmond Valley Council has advised that the subject property is in an area where the year 2100 climate change scenario applies to set minimum habitable floor levels.
- Flood characteristics for the site obtained from Richmond Valley Council documentation is as follows:

  - 1% AEP flood velocity is 0.5m/s to 1.0 m/s.
  - The PMF flood velocity is 1.0m/s to 2.0m/s
- The school site is defined as hazard category H5 in the 1% AEP storm, and hazard category H6 in the PMF event.
- Tidal inundation:
  - The site is not affected by the tidal inundation during the highest astronomical tide (HAT) for current climate conditions. The recorded HAT (1995-2014) at Ballina Breakwall is 1.16 m AHD (NSW Office of Environment and Heritage, 2017) (ACOR, 2022). It should be noted that the swale to the east of the site is affected by the HAT.
  - The site may also be impacted by tidal inundation under Climate Change conditions for the year 2100. The high scenario is in line with recent global emissions and observations of sea-level rise. This high scenario aligns to RCP 8.5, which has a median sea level rise of 0.84 metres by 2100 (Coastal Risk Australia, 2021).

The information detailed above is summarised on the letter by Acor dated 14th March 2023 included in Appendix D. Henry & Hymas strongly recommends the letter and all preceding are reviewed in conjunction with this summary.

Henry & Hymas has undertaken an independent review of the available literature and confirm the information presented above, based on the available literature, is accurate and suitable to undertake detailed design of the development. Available literature reviewed is listed below:

- Richmond Valley Council Flood Maps (https://rous.nsw.gov.au/richmond-river-flood-mapping-study)
- Richmond River Flood Mapping Study by BMT WBM (2010).
- Ballina Floodplain Risk Management Study by BMT WBM (2012).
- Ballina Shire – Local Flood Plan by the NSW State Emergency Service (SES).

6.2 Design Flood Levels

It should be noted that since the preparation of the ACOR Flood and Civil Engineering Assessment and Flood Emergency Response Plan, a draft version of the Richmond River Flood Study 2023 has been issued. This report has now been adopted by Richmond Valley Council. The following levels have been taken from the Richmond River Flood Study 2023, and represent the design flood levels for the subject site:

Peak Design Flood Levels for Broadwater:

5% AEP	2.22 m AHD
2% AEP	3.40 m AHD
1% AEP	4.07 m AHD
2100 1% AEP	4.60 m AHD*
0.2% AEP	5.23 m AHD
PMF	9.37 m AHD

*Site specific flood level provided by Council via email correspondence (Sep 2023).

Based on the information above, the flood planning level for the site is confirmed to be 5.10m AHD (which is the 2100 1% AEP flood level + 500mm freeboard). The proposed L1 FFL complies with this requirement, with a proposed FFL of 5.50m AHD. It should be noted that this proposed floor level is also above the 1 in 500yr flood level of 5.23m AHD.

The PMF level for the site is 9.37m AHD. It is understood that the proposed L1 floor level of 5.50m AHD is significantly below this PMF level. This is understood to be acceptable, given the below key design approaches that the design has adhered to:

- The proposed habitable floor levels have been designed to be above of the 1% AEP flood level + freeboard, as per Council's planning controls.
- Evacuation of the site is required in a significant flood event as a shelter in place strategy is not possible. Site evacuation is considered the preferred strategy from the SES. Given an evacuation strategy is adopted, there is no requirement for the L1 FFL to be above the PMF.

Refer to Section 6.2 for further details in relation to the evacuation strategy and flood emergency response plan.

6.3 Review of Flood Emergency Response Plan

Acor Consultants have also prepared a Flood Emergency Response Plan that details the arrangements that provide a framework for management of a flood emergency. The flood emergency response plan provides and adaptable framework that outlines the progression of emergency management functions and the parts that each party will play, including defined the roles and responsibilities of different agencies and outlining the strategies for the performance of key flood management capabilities (ACOR, 2023).

The main features of the Flood Emergency Response Plan are detailed below (ACOR, 2023):

- An evacuation strategy is adopted for Broadwater Public School due to the flood warning time being approximately 12 hours, and the effective warning time being at least 6 hours.
- In an emergency, a direction to evacuate is made by the Incident Controller (NSW SES) in consultation, where possible, with the NSW Police Force. The Department of Education is to co-ordinate the evacuation of schools if not already closed. The school principal may close the school for the purpose of evacuation.
- Closure and evacuation of Broadwater Public School is recommended when the river height at Coraki River gauge is forecast to exceed Minor level or approach Moderate level. It is important to understand that the first Flood Warning issued by the BOM may refer to Major flood level being reached (and not refer to Minor or Moderate level). BOM Flood Classifications (metres at gauge) Minor 3.40m AHD, Moderate 5.00m AHD and Major 5.70m AHD.
- Further, As a consequence of the high flood risk, all school occupants must be evacuated prior to the onset of flooding. The preferred emergency response for this school is early closure prior to the commencement of flooding and preferably school closure before the start of the school day
- The primary vehicular evacuation route from Broadwater to higher ground is via Barang Drive (Blackwall Drive), Macdonald Street, Broadwater-Evans Head Road and the Pacific Highway over Richmond River towards Alstonville.
- The preferred evacuation destination for students is to their homes or homes of relatives if they are not flood prone. Evacuation centres in the vicinity of Broadwater are in Alstonville, Goonellabah and Woodburn.
- Students are largely unable to self-evacuate and require assistance from parents/carers and multiple methods of evacuation must be available for the FERP to be effective, such as:
    - Arrangement with a local bus service to be on-call and available for the evacuation of all students toa pre-determined evacuation location is required.
    - By parents and carers

    - By teachers and school staff
- Evacuation to safe areas must be complete within 6 hours of receiving an 'Evacuate now' warning from the SES.
- Procedures for contacting NSW SES if transportation cannot be achieved.
- The Flood Emergency Response Plan provides further information around roles and responsibilities of different actors for different stages of the flood responses.

It should be noted the above is simply a summary of the Flood Emergency Response Plan prepared by ACOR. It is strongly recommended the full Flood Emergency Response Plan is reviewed in conjunction with this summary.

Henry & Hymas have undertaken an independent review of the available literature and generally support the actions detailed in the current flood emergency response plan. Available literature reviewed is listed below:

- Richmond Valley Council (https://richmondvalley.nsw.gov.au/services/flood/) flood mapping.
- Ballina Floodplain Risk Management Study by BMT WBM (2012).
- Richmond Valley Flood Emergency Sub Plan – Local Flood Plan by the NSW State Emergency Service (SES).
- Richmond River Flood Mapping Study by BMT WBM (2010).

6.4. Further recommendations on Flood Assessment and Flood Emergency Response plan.

The Flood Assessment and Flood Emergency Response plan should be regularly, and consistency updated for the most recent and accurate flood data. It is understood the Draft Richmond Valley Flood Study 2023 by BMT at the time of writing this report (July 2023) is currently under exhibition for community feedback. It is recommended the draft report is reviewed for consistency and accuracy of current flood information and updates to the Flood Assessment and Flood Emergency Response Plan are made if required. The Flood Impact Assessment detailed below is based on flood reporting and assessment undertaken by others, namely Flood Assessment (ACOR, 2022) and Flood Emergency Response Plan (ACOR, 2023) by Acor. Any updates/changes to the report revision referenced in this report should be provided to Henry & Hymas to update the Flood Impact Assessment Accordingly.

The long-term suitability of this site as use for an educational facility should be considered given potential sea level rise due to climate change. 2100 sea level rise will potentially raise the HAT to approximately 2.00m AHD which will effectively inundate large parts of the site and leave other parts of the site boggy. Most of the in-ground drainage will not be fully function in the 2100 climate change scenario. Understanding of the impact of climate change on potential tidal levels and sea-level rise should be incorporated into any life cycle or costing analysis prepared for the development.

6.5. Flood Impact Assessment

The flood impact assessment detailed below has been prepared in conjunction with the aforementioned Flood Assessment and Flood Emergency Response Plan by Acor. The Flood impact assessment detailed below provides a simple assessment in regards to the impacts of the development on flood behavior and the impacts flooding has on the design of the building in terms of built form, material selection and flood proofing etc.

The impact of the proposed development on flood behavior has been assessed. Given the scale of the proposed development within the floodplain, the location of the development within the floodplain, the proposed site levels being generally consistent with the existing site levels and the overall

reduction in built area, the proposed development is not expected to have any measurable impact on flood behavior.

It has been determined that any impact on flooding is negligible, and that the proposed development is in accordance with the framework of relevant regulatory guidelines such as the Department of Planning and Environment (DPE) recommendations as detailed in Flood impact and risk assessment - Flood risk management guideline LU01 (DPE1, 2023).

The Flood Impact Assessment is in accordance with the framework of relevant regulatory guidelines such as the Department of Planning and Environment (DPE) recommendations as detailed in Flood impact and risk assessment - Flood risk management guideline LU01 (DPE1, 2023). The actions and recommendations below also comply with Richmond Valley Council requirements as outlined in the Richmond Valley Development Control Plan 2021 – Part I – Natural Resources and Hazards. In particular, the proposed habitable floor levels have been set above the flood planning level. Additionally, flood compatible materials and methods have been incorporated into the design to maintain consistency with the design of the other proposed Northern River Public Schools (Wardell Public Schol and Empire Vale Public School), which have been designed in accordance with the Ballina Shire Council's requirements. It should be noted that Richmond Valley Council DCP remains silent on recommended flood resilient materials and practices for structures in the floodplain.

To provide context on the flood levels and frequencies mentioned in this report the CSIRO provides estimation on the flood frequency of the 2022 event. The CISRO states "The 2022 peak flow was estimated to be significantly higher than the 1% Annual Exceedance Probability event at seven gauging stations in the region and for the Lismore partial inflows (a partial estimate of streamflow at Lismore based on the sum of flows at two upstream stations). A high degree of uncertainty is associated with these frequency estimates which were found to vary between slightly less than a 1 in 100 year frequency (1% AEP) to 1 in several thousand years (up to 0.01% AEP for one station)." (CISRO, 2022).

To provide general context on the duration of flooding in the 2022 flood event, at the closest reporting station at Wardel Flood water in the Richmond River rose to 'major flood event level' over a period of 1-2 days and remained at 'major flood event levels' for a period of 4-6 days peaking at the flood level of RL 3.15m AHD (reported at Empire Vale School (ACOR, 2023)) (CISRO, 2022). Water levels across the Richmond River system for the 2022 flood event are shown in Figure 5 below. The hydrograph for the Wardel River gauge is shown in Figure 5 below in light green.

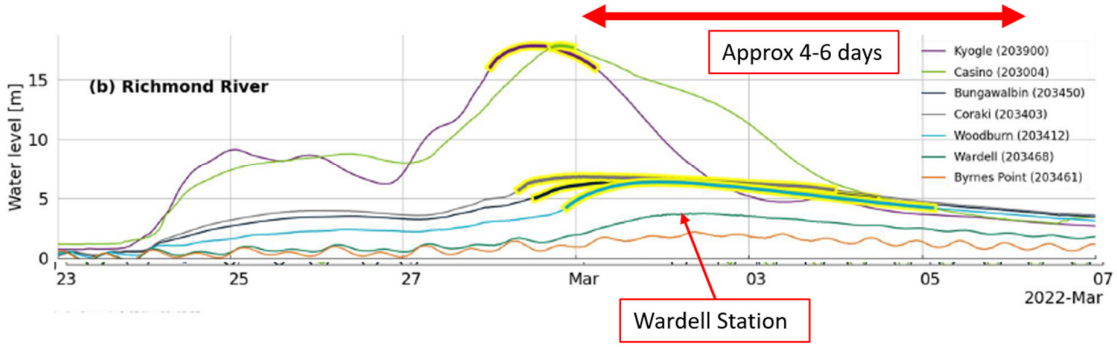

Figure 4: Hydrograph for the 2022 flood levels across Richmond River (CISRO, 2022)

<u>The developments interaction with flooding</u>

As detailed in Section 3, the proposed site works will only generate minor modifications to existing topography. The extend of building structures within the floodplain is proposed to be reduced when

compared to the existing structures on site. The development site in general is located outside of the major flow paths, flood conveyance zones and other highly flood constrained locations (flow constraint) which typically follow the main channel of the Richmond River.

The proposed building has an undercroft area without enclosed sides to allow flood water to pass beneath the suspended structure. Stairwells, lifts and the enclosed building amenities undercroft area (toilets and store rooms) have minimal footprints that results in a reduced total built form when compared to the existing structures on site. The proposed superstructure for the raised floor is proposed to have a soffit height at (or above) the 2100 1% AEP flood level of 4.60m AHD.

A comparison of buildings and significant structures was undertaken to assess the impact of the development on flood plain storage. Comparison confirmed a reduction in total building and significant structure building plan area from 462m^2 in the predevelopment scenario to 168m^2 post development scenario.

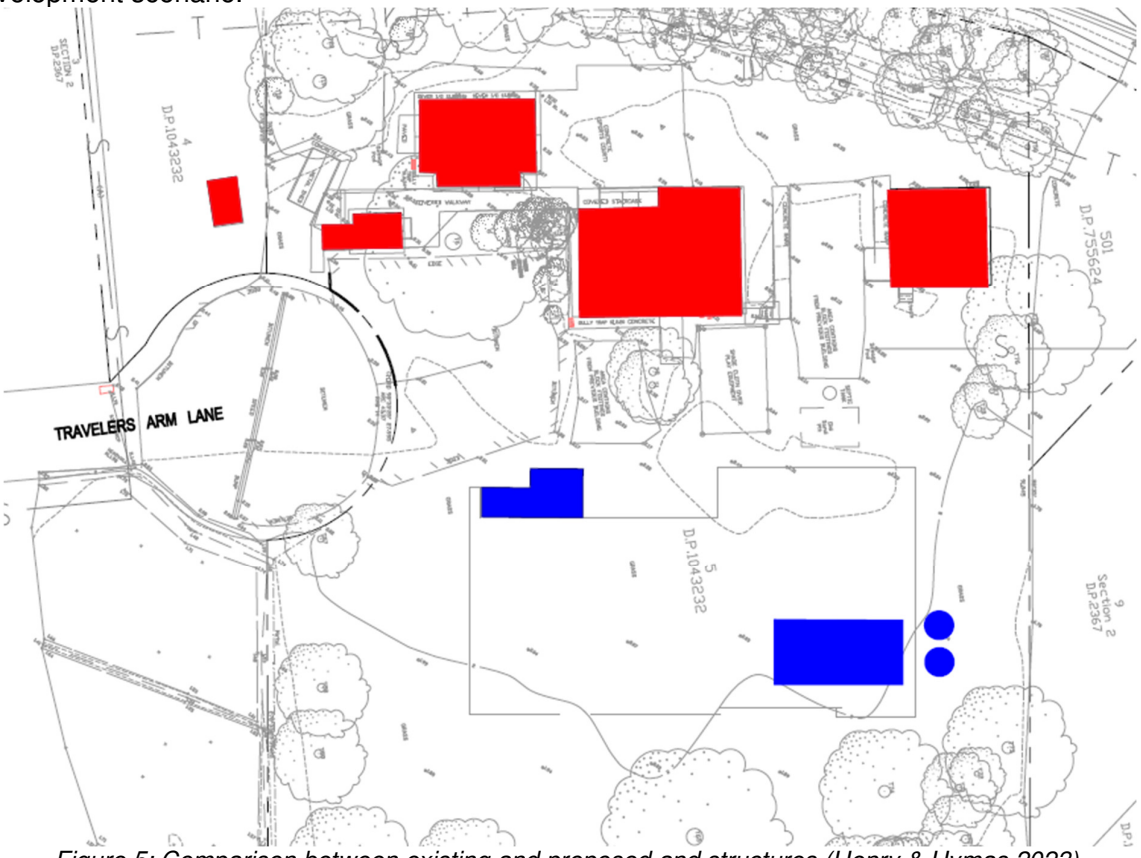

Figure 5: Comparison between existing and proposed and structures (Henry & Hymas 2023).

Given the context of the development in the floodplain, the minor changes in topography and built form will have a negligible impact on local flood conveyance and storage and will have negligible adverse impact on existing flood behavior. The following impact considerations under the DPE's Flood impact and risk assessment - Flood risk management guideline LU01 are made:

- The proposed development will not result in significant changes to the existing flood level.
- The proposed development will not result in significant changes to the existing the duration of flooding.
- The proposed development will not result in meaningful or significant changes to existing flood velocity or existing flow path.

- The proposed development does not decrease available warning time and time available for evacuation.
- The proposed development does not increase the frequency of inundation.

Flood Resilience - structural design and flood compatible materials.

It is understood that flood risk assessment and the decision on evacuation is detailed in the FERP completed by Acor Consultants. It is accepted that the risk and endangerment to life is a main priority and that this risk is addressed in the response strategy detailed in the FERP. The following portion of the Flood Impact Assessment addresses lesser risks, such as the risk to property, and provides measures to ensure the school will suffer minimal damage during a flood event and can quickly be repaired and cleaned for operation following a major flood event.

The proposed flood proofing methodology is adopted from the NCC and associated reference materials such as the (ABCB,2012). The core of the methodology is such that different flood proofing methods are applied to different components of the building depending on where these building components sit relative the flood level and depending on how these elements need to perform structurally. Building area and components can be designed for 'dry flood proofing'. For dry flood proofing, the building or relevant parts of the building envelope are made substantially impermeable to flood water. If this method is used, care must be taken to ensure the structural adequacy of the envelope of the dry flood proofing part of the building to carry the differential hydrostatic pressure (in addition to the hydrodynamic action) created by the flood water. This pressure is quite severe and could cause major structural damage if not properly accounted for (ABCB, 2012). Given the depth of the water relative to the ground flood undercroft areas, the imposed loading by flood waters would be an unnecessary risk that could cause damage to the building.

For the undercroft area of the new building (including the undercroft storage areas and amenities) a 'wet flood proofing' methodology has been adopted. With wet flood proofing, the water is allowed to enter the building to reduce the build up of hydrostatic pressure between the flood water and the inside of the building. The structural materials used below the flood level must therefore be water resistant to minimise the resulting damage (ABCB, 2012).

Structural design will take into account all relevant provisions of the Australian Standards, the National Construction Code (NCC) and Building Code of Australia (BCA) relating to design of building subject to flooding.

Structural design and material selection incorporates relevant industry documentation relating to construction within flood plains such as "Flood risk management manual, The policy and manual for the management of flood liable land by Department of Planning and Environment" dated June 2023 and "Construction of Buildings in Flood Hazard Areas" by the Australian Building Codes Board dated 2012 (ABCB, 2012). All materials used in the construction of the building are proposed to conform to the appropriate requirements of the NCC, including its referenced documents. In addition, materials that are exposed to water inundation have been given further consideration of their properties when wet in deciding whether they are suitable for use (ABCB, 2012). These include:

- Likely duration of exposure to wetness.
- Changes to dimensions and strength when wet.
- Water absorption rate and required drying time.
- Cost and feasibility of replacement of components.

A detailed assessment of the materials and their arrangement in building systems is provided in the below section titled 'Material Selection'.

Another valuable source of guidance on flood compatible materials design and construction techniques is the "Reducing vulnerability of buildings to flood damage - Guidance On Building In Flood Prone Areas by the Hawkesbury-Nepean Floodplain Management Steering Committee, 2006" (HNFMSC, 2006). Material selection, structural design and construction methodology has been undertaken in accordance with this guideline. Lastly, the structural design and material selection has been undertaken to be consistent with the design of the other Northern River Public Schools (Wardell Public Schol and Empire Vale Public School), which have been designed in accordance with the Ballina Shire Development Control Plan 2012 - Chapter 2b – Floodplain Management dated 2012. (BSC, 2012).

The structure proposed has been designed in consideration of all additional forces and loads imposed from flood waters including hydrostatic actions (e.g. buoyancy), hydrodynamic (e.g. drag forces), debris actions, log impact, wave actions, erosion and scour and combinations of these actions. In addition to standard design requirements for flooding for buildings of this nature (listed above), structural design considers relevant provisions of the Australian Standard for Bridge Design, Part 2: Design loads where related to the design of the superstructure and supporting columns, including and not limited to:

- Loading from impacts of debris in particular impacts from logs and floating debris.
- Additional drag forces from accumulating debris mat in superstructure (if relevant considering flood level).
- Additional drag forces from accumulating debris mat including entanglement around columns and other structures.

Based on the current design methodology, structural design of the building has been undertaken to incorporate the aforementioned additional forces and loading by floodwaters has been undertaken up to the sofit of the ground floor at RL 4.6m AHD. For the Broadwater School Site, this means structural design of the school has been undertaken to withstand floodwater for the 2100 1% AEP flood, which has a maximum flood level of 4.60m AHD (BMT 2023). The structural design has not considered the design loads and forces of the PMF flood event, which has a corresponding maximum flood level of 9.37m AHD (BMT 2023). The flood management strategy for this site is proposed to be evacuation and not shelter in place, hence there is no expected risk to safety by designing the structure to cater for forces associated with the 1 in 100yr event, rather than the PMF event.

Structural design of the building takes into account the flood information present in Acor's flood assessment (ACOR, 2023) as well as other key documentation surrounding the attributes of flooding, in particularly, flood velocity and level. The key attributes relevant from the current flood impact assessment and other key documentation is detailed below:

- 1% AEP flood velocity is up to 1.0 m/s.
- FPL of RL 5.1m AHD.

<u>Undercroft area - Design methodology</u>

Following review of the aforementioned industry guidelines around flood resilient design the proposed undercroft area (toilets and storerooms) has been designed with the following 'wet proof' design methodology;

- Reinforced concrete ground floor slab designed for potential uplift forces due to receding flood waters. The ground flood slab is proposed to include a subsurface drainage system to mitigate uplift forces from receding floodwaters. The selection of the reinforced concrete ground floor slab is supported by (BSC, 2012) and a preferred flood resilient design option in both the (HNFMSC, 2006) and (ABCB, 2012).
- Reinforced & core filled blockwork external and internal blockwork walls extending to the underside of the super structure (min RL 4.4m AHD). The selection of this method of

construction is supported by the (BSC, 2012) and a preferred flood resilient design option in both the (HNFMSC, 2006) and (ABCB, 2012).

Modular design and flood resilience

A major challenge for providing a flood resilient design is to incorporate the EFSG design methodology to incorporate modular design. To provide a flood resilient modular undercroft solution, consultation between ADCO constructions, Henry & Hymas and the Modscape was undertaken to ensure any solutions are buildable, coordinated and appropriately flood resilient. Following extensive consultation it was determined better outcomes in terms of flood resilience could be achieved by reverting to a conventional construction methodology. The main features of this design include:

- The wall structure is comprised of external and internal reinforced and core-filled block walls.
- The external reinforced blockwork has been designed to resist the forces imposed by floodwaters and debris impact.
- The external reinforced block walls have been designed to include regular removeable vent blocks or weep holes to equalise water pressures.
- The undercroft floor is proposed to be reinforced concrete raft slab supported on screw piles. External and internal reinforced block walls will be built off this raft slab. The ground flood slab is proposed to include a subsurface drainage system to mitigate uplift forces from receding floodwaters.
- The internal wall system has been designed using approved flood resilient material and strength suitable to withstand pressure differential forces that will occur between the internal and external water levels. Internal and external walls are proposed to include small weepholes to relieve pressure between external and internal areas minimising pressure differential between internal and external walls. Cavities and internal wall linings (excluding render) are not proposed due to the additional burden of maintenance following a flood event.
- As recommended in the NCC and reference documentation. The design has been undertaken to reduce moisture traps in design of the building. I.e. avoid non ventilated or non free draining cavities etc.

Material Selection

Similar with the general design methodology, the proposed building materials were reviewed against the aforementioned reference documentation to ensure base material selection is suitable. The *(ABCB, 2012)* notes in regards to material section, the Limited (or nil) use of Materials:

- That are weakened when wet.
- Materials that are stable but porous that will need drying out after the flood.
- Material prone to absorption
- Material prone to fouling, rusting, rotting when exposed to water.

(HNFMSC, 2006) is also an excellent source of information regarding materials section and and provides detailed information on the vulnerability, absorbency and suitably following prolonged immersion.

The results of the review for each key building material, and commentary on suitability, are provided below.

Floor: Concrete ground floor slab:

- Supported by Council Schedule for (BSC, 2012).
- **Low** vulnerability classification as defined in (HNFMSC, 2006).
- Materials 96-Hour Immersion classification as **suitable** *(these materials or products are relatively unaffected by submersion and flood exposure and are the best available for the particular application)* as defined in (HNFMSC, 2006).

- Material absorbency classification **A** *(minimal damage under most circumstances)* as defined in (HNFMSC, 2006).

Internal and External walls: Reinforced & core filled blockwork

- Supported by Council Schedule for (BSC, 2012).
- **Lowest** vulnerability classification as defined in (HNFMSC, 2006).
- Materials 96-Hour Immersion classification as **suitable** as defined in (HNFMSC, 2006).
- Material absorbency classification **A** *(minimal damage under most circumstances)* as defined in (HNFMSC, 2006).
- Structural reasons, refer earlier chapter regarding structural design.
- Blockwork unaffected by immersion.
- Minimal clean-up and repair.
- No chance of decay, distortion or rusting of supporting frame.
- Normally no wall insulation required.
- Skirtings and architraves not required.
- Cement render finish is durable.

Non Load Carrying Component Interior Lining of Walls: Cement Render

- Supported by Council Schedule for (BSC, 2012).
- **Lowest** vulnerability classification as defined in (HNFMSC, 2006).
- Materials 96-Hour Immersion classification as **suitable** as defined in (HNFMSC, 2006).
- Material absorbency classification **C** *(subject to damage after prolonged immersion, but will recover when effectively dried)* (HNFMSC, 2006).
- Unaffected by water immersion.
- Not prone to impact damage.
- Easy to clean or repaint.

The materials listed above are consistent with the approach for the other proposed Northern River Public Schools (Wardell Public School and Empire Vale Public School), which have been designed in accordance with Ballina Shire Council's schedule of Flood Compatible Materials and Methods (schedule C) detailed in Ballina Shire Development Control Plan 2012 - Chapter 2b – Floodplain Management (BSC, 2012).

Similarly to structure and material design, consultation was held between Henry & Hymas and services engineers JHA to develop services solutions for the development which are flood resilient. Review of the services focuses on those located beneath the FPL or have the possibility of being either directly or indirectly impacted by a flood event. The following recommendations were provided for incorporation into the services design for the development. The recommendations focus on improving flood resilience, minimising damage during a flood event and reducing required replacement, maintenance and cleaning of key infrastructure following a flood event.

In addition to incorporation of the items mentioned below it is recommended the services designers undertake and assessment of the flood resilience of the respective services designs against current industry regulatory and guidelines relating to flood resilience. For guidance, the relevant document reference is shown *(in brackets)* with the proposed recommendation.

Lighting and Electrical:

- The most effective flood-resistant option for electrical systems in new buildings in flood prone areas is elevation of electrical components to the highest practical or regulatory level. *(HNFMSC, 2006)*
- Where possible, wiring should be placed above the FPL. A practical option could be to place wiring in the roof space or the floor above and extend down the wall. The power points and switches in particular should be elevated above the FPL to gain extra protection. Conduits

should be installed to ensure that water will be drained freely if subject to immersion. *(ABCB, 2012)*,

- Sensor lighting should be provided in the undercroft toilets and store rooms to prevent additional switches below the FPL.
- Fixed electrical equipment such as non submergible pumps, water filtration units, air conditioners and hot water systems should be mounted above the FPL to reduce the chance of inundation. *(ABCB, 2012)*,
- Where possible, electrical switches must be placed above the FPL. Electrical conduits and cables installed below the FPL must be waterproofed or placed in waterproofed enclosures. *(ABCB, 2012)*.
- In two-storey construction, lighting and power on each level on separate circuits, any electrical power outlets below the FPL should be provided on a separate circuit. Ground and first floor electrical services should be provided on a separate circuit. Note: This control relates to lift electrical. *(HNFMSC, 2006),*
- Where possible, all cable runs should be of one length. If junction boxes are unavoidable, they should be located in easily accessible, yet elevated, locations. *(HNFMSC, 2006),*
- Conduits should be installed in such a manner to ensure any water will drain freely as the floodwaters recede. Similarly, where the mains supply is located underground, it should be installed to ensure that water can drain from the conduit. Sag points in any conduits should be avoided. (HNFMSC, 2006)
- All wiring, power outlets, switches, etc., should, to the maximum extent possible, be located above the relevant flood level. All electrical wiring installed below the relevant flood level should be suitable for continuous submergence in water and should contain no fibrous components. Earth core leakage systems (or safety switches) are to be installed. Only submersible-type splices should be used below the relevant flood level. All conduits located below the relevant designated flood level should be so installed that they will be self-draining if subjected to flooding. *(BSC, 2012)*
- All equipment installed below or partially below the relevant flood level should be capable of disconnection by a single plug and socket assembly. *(BSC, 2012)*
- Should any electrical device and/or part of the wiring be flooded it should be thoroughly cleaned or replaced and checked by an approved electrical contractor before reconnection. *(BSC, 2012)*
- Buried systems must be placed at a depth sufficient to prevent damage due to scour and erosion during the flood event. Exposed systems must be designed to withstand the flood related actions (buoyancy, flow, debris and wave) *(ABCB, 2012).*

Stormwater:

- Selection of water quality management system, refer Chapter 4.3
- Provision of Onsite Stormwater Detention (OSD), refer Chapter 4.2
- Consideration of flood levels for hydraulic modelling.

Hydraulic, Fire and other services:

- Water filtration and non-submergible pump equipment should be located above the FPL.
- Buried systems must be placed at a depth sufficient to prevent damage due to scour and erosion during the flood event. Exposed systems must be designed to withstand the flood related actions (buoyancy, flow, debris and wave) (ABCB, 2012).
- Both above and under ground tanks need to be designed for any likely buoyancy forces. All tanks need to be designed with appropriate hold down capability and to resist impact loads from debris. (HNFMSC, 2006)

- Any restraints should be of corrosion resistant material to reduce the chance of corrosion weakening the support. The number and capacity of these restraints required can be calculated after determining the net buoyancy force. (HNFMSC, 2006)
- Where feasible, above ground tanks should be designed to resist the forces. The supporting posts or columns should have deep concrete footings embedded below expected erosion and scour lines. (HNFMSC, 2006)
- During a flood, settlement of a structures such as pits can occur, especially those placed on fill, can occur due to soil saturation. This can lead to breakage of pipework and or the connections. Accordingly, pipework connections should have some flexibility to reduce the chance of breakage. (HNFMSC, 2006)
- To reduce the possibility of the water in rainwater tanks becoming contaminated, the inlet should be located as high as possible so it does not become submerged. (HNFMSC, 2006)
- Exposed components or pipework at risk from flowing water and debris should be securely fastened or located in sheltered areas to reduce the chance of damage. (HNFMSC, 2006)
- Hot water heaters are likely to need replacing if immersed in water and should be mounted as high as practical. (HNFMSC, 2006)
- Rainwater tanks (both in ground and below ground) are design for all relevant flood forces e.g. buoyancy and dynamic forces from flood waters. (HNFMSC, 2006)
- The main issue with sewerage systems during flooding is the potential for the backflow of sewage into the building. Refer to plumbing regulations or separate State/Territory requirements to determine whether backflow protection devices should be fitted for this purpose. *(ABCB, 2012)*
- The main issue with storage tanks is the possibility that they may float or pop out of the ground due to buoyancy and therefore they should be designed to resist the uplift forces. Above ground tanks should be placed above the FHL if possible. *(ABCB, 2012)*

Other considerations

The design has been undertaken to reduce introducing additional debris into flood waters. Undercroft areas should not be used for storage of vulnerable equipment or assets in cages or otherwise. Floatable items such as tables and bench seating should be fixed securely (such that movement is not easily possible) to an undercroft ground slab or surrounding footpaths (ACOR, 2022).

8. Conclusion

In general, the engineering objectives of civil design and stormwater management elements mentioned above are to create a system that is coordinated with the architectural layout and incorporates the natural topography and site constraints to produce a cost-effective and appropriate drainage system that meets best industry practices and governing water quality and quantity objectives.

We trust the information provided in this report satisfies matters relating to civil, stormwater design and flooding.

9. References

(ACOR, 2022), Broadwater Public School - Flood and Civil Engineering Assessment prepared for School Infrastructure NSW by ACOR Consultants (QLD) Revision 1, dated August 2022.

(ACOR, 2023), Broadwater Public School - Flood Emergency Response Plan prepared for School Infrastructure NSW by ACOR Consultants (QLD) Revision 4 dated October 2023.

(DPE1, 2023) Flood impact and risk assessment - Flood risk management guideline LU01 by Department of Planning and Environment dated June 2023.

(DPE2, 2023) Flood risk management manual, The policy and manual for the management of flood liable land by Department of Planning and Environment dated June 2023.

(HNFMSC, 2006), Reducing vulnerability of buildings to flood damage - Guidance On Building In Flood Prone Areas by the Hawkesbury-Nepean Floodplain Management Steering Committee, 2006" (HNFMSC, 2006).

Richmond Valley Council DCP 2021

(ABCB, 2012), Construction of Buildings in Flood Hazard Areas" Version 2012.3 by the Australian Building Codes Board (ABCB) dated 2012.

Ballina Floodplain Risk Management Study by BMT WBM (2012).

Richmond Valley Flood Plan Emergency Sub Plan – Local Flood Plan by the NSW State Emergency Service (SES).

Richmond River Flood Mapping Study by BMT WBM (2010).

Draft Richmond Valley Flood Study (2023) by BMT.

NSW Office of Environment and Heritage (2017). NSW ocean and river entrance tidal levels annual summary 2016–2017. Report MHL2574. December 2017.

Coastal Risk Australia (2021). Predicted Coastal Flooding Resulting from Climate Change. IPCC Sixth Assessment Report Update 2021.

(CSIRO, 2022) Characterisation of the 2022 floods in the Northern Rivers Region by the CSIRO Australia dated 2022.

(BSC, 2012) Ballina Shire Development Control Plan 2012 - Chapter 2b – Floodplain Management dated 2012.

10. Appendices

Appendix A: Civil Engineering Drawings by Henry & Hymas Engineers

Appendix B: Site Survey

Appendix C: Architectural concept drawings – Site plan

Appendix D: Acor letter dated 14th March 2023 summarising flooding information.

Appendix A: Civil Engineering Drawings by Henry & Hymas Engineers

BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472
CIVIL ENGINEERING WORKS

GENERAL NOTES:

1. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH RICHMOND VALLEY COUNCIL'S SPECIFICATION. CONTRACTOR TO OBTAIN AND RETAIN A COPY ON SITE DURING THE COURSE OF THE WORKS.
2. ALL NEW WORKS ARE TO MAKE A SMOOTH JUNCTION WITH EXISTING CONDITIONS AND MARRY IN A 'WORKMANLIKE' MANNER.
3. THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL SERVICES WITH EACH RELEVANT AUTHORITY. ANY DAMAGE TO SERVICES SHALL BE RECTIFIED BY THE CONTRACTOR OR THE RELEVANT AUTHORITY AT THE CONTRACTOR'S EXPENSE. SERVICES SHOWN ON THESE PLANS ARE ONLY THOSE EVIDENT AT THE TIME OF SURVEY OR AS DETERMINED FROM SERVICE DIAGRAMS. H & H CONSULTING ENGINEERS PTY. LTD CANNOT GUARANTEE THE INFORMATION SHOWN NOR ACCEPT ANY RESPONSIBILITY FOR INACCURACIES OR INCOMPLETE DATA.
4. SERVICES & ACCESSES TO THE EXISTING PROPERTIES ARE TO BE MAINTAINED IN WORKING ORDER AT ALL TIMES DURING CONSTRUCTION.
5. ADJUST EXISTING SERVICE COVERS TO SUIT NEW FINISHED LEVELS TO RELEVANT AUTHORITY REQUIREMENTS WHERE NECESSARY.
6. REINSTATE AND STABILISE ALL DISTURBED LANDSCAPED AREAS.
7. MINIMUM GRADE OF SUBSOIL SHALL BE 0.5% (1:200) FALL TO OUTLETS.
8. ALL TEMPORARY SEDIMENT AND EROSION CONTROL DEVICES ARE TO BE CONSTRUCTED, PLACED AND MAINTAINED IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS, EROSION AND SEDIMENTATION CONTROL PLAN AND RICHMOND VALLEY COUNCIL'S REQUIREMENTS WHERE APPLICABLE.
9. CONTRACTOR TO CHECK AND CONFIRM SITE DRAINAGE CONNECTIONS ACROSS THE VERGE PRIOR TO COMMENCEMENT OF SITE DRAINAGE WORKS.
10. PROPERTIES AFFECTED BY THE WORKS ARE TO BE NOTIFIED IN ADVANCE WHERE DISRUPTION TO EXISTING ACCESS IS LIKELY.

EXISTING SERVICES & FEATURES

- THE CONTRACTOR SHALL ALLOW FOR THE CAPPING OFF, EXCAVATION AND REMOVAL (IF REQUIRED) OF ALL EXISTING SERVICES IN AREAS AFFECTED BY WORKS WITHIN THE CONTRACT AREA OR AS SHOWN ON THE DRAWINGS UNLESS DIRECTED OTHERWISE BY THE SUPERINTENDENT.
- THE CONTRACTOR SHALL ENSURE THAT AT ALL TIMES SERVICES TO ALL BUILDINGS NOT AFFECTED BY THE WORKS ARE NOT DISRUPTED.
- PRIOR TO COMMENCEMENT OF ANY WORKS THE CONTRACTOR SHALL GAIN APPROVAL OF HIS PROGRAM FOR THE RELOCATION/ CONSTRUCTION OF TEMPORARY SERVICES.
- CONTRACTOR SHALL CONSTRUCT TEMPORARY SERVICES TO MAINTAIN SUPPLY TO EXISTING BUILDING REMAINING IN OPERATION DURING WORKS TO THE SATISFACTION AND APPROVAL OF THE SUPERINTENDENT. ONCE DIVERSION IS COMPLETE AND COMMISSIONED, THE CONTRACTOR SHALL REMOVE ALL SUCH TEMPORARY SERVICES AND MAKE GOOD TO THE SATISFACTION OF THE SUPERINTENDENT.
- INTERRUPTION TO SUPPLY OF EXISTING SERVICES SHALL BE DONE SO AS NOT TO CAUSE ANY INCONVENIENCE TO THE PRINCIPAL. CONTRACTOR TO GAIN APPROVAL FROM THE SUPERINTENDENT FOR TIME OF INTERRUPTION.
- EXISTING SERVICES, BUILDINGS, EXTERNAL STRUCTURES AND TREES SHOWN ON THESE DRAWINGS ARE EXISTING FEATURES PRIOR TO ANY DEMOLITION WORKS.
- EXISTING SERVICES UNLESS SHOWN ON SURVEY PLAN HAVE BEEN PLOTTED FROM SERVICES SEARCH PLANS AND AS SUCH THEIR ACCURACY CANNOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COMPLETE A 'DIAL BEFORE YOU DIG' SEARCH AND TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE SUPERINTENDENT. CLEARANCES SHALL BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY.
- ALL BRANCH GAS AND WATER SERVICES UNDER DRIVEWAYS AND BRICK PAVING SHALL BE LOCATED IN Ø80 uPVC SEWER GRADE CONDUITS EXTENDING A MINIMUM OF 500mm BEYOND EDGE OF PAVING.

LOCALITY SKETCH

SCALE: N.T.S.

SITEWORKS NOTES

- DATUM : A.H.D.
- ORIGIN OF LEVELS : REFER TO BENCH OR STATE SURVEY MARKS WHERE SHOWN ON PLAN.
- CONTRACTOR MUST VERIFY ALL DIMENSIONS AND EXISTING LEVELS ON SITE PRIOR TO THE COMMENCEMENT OF WORK.
- ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH THE DETAILS SHOWN ON THE DRAWINGS & THE DIRECTIONS OF THE SUPERINTENDENT.
- EXISTING SERVICES UNLESS SHOWN ON THE SURVEY PLAN HAVE BEEN PLOTTED FROM SERVICES SEARCH PLANS AND AS SUCH THEIR ACCURACY CANNOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE SUPERINTENDENT. CLEARANCES SHALL BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY.
- WHERE NEW WORKS ABUT EXISTING THE CONTRACTOR SHALL ENSURE THAT A SMOOTH EVEN PROFILE, FREE FROM ABRUPT CHANGES IS ACHIEVED.
- THE CONTRACTOR SHALL ARRANGE ALL SURVEY SETOUT TO BE CARRIED OUT BY A REGISTERED SURVEYOR.
- CARE IS TO BE TAKEN WHEN EXCAVATING NEAR EXISTING SERVICES. NO MECHANICAL EXCAVATION IS TO BE UNDERTAKEN OVER TELSTRA OR ELECTRICAL SERVICES. HAND EXCAVATE IN THESE AREAS.
- CONTRACTOR TO OBTAIN AUTHORITY APPROVALS WHERE APPLICABLE.
- MAKE SMOOTH TRANSITION TO EXISTING SURFACES AND MAKE GOOD.
- THESE PLANS SHALL BE READ IN CONJUNCTION WITH APPROVED LANDSCAPE, ARCHITECTURAL, STRUCTURAL, HYDRAULIC AND MECHANICAL DRAWINGS AND SPECIFICATIONS OR WRITTEN INSTRUCTIONS THAT MAY BE ISSUED RELATING TO DEVELOPMENT AT THE SITE.
- TRENCHES THROUGH EXISTING ROAD AND CONCRETE PAVEMENTS SHALL BE SAWCUT TO FULL DEPTH OF CONCRETE AND A MINIMUM OF 50mm IN BITUMINOUS PAVING.
- ALL BRANCH GAS AND WATER SERVICES UNDER DRIVEWAYS AND BRICK PAVING SHALL BE LOCATED IN Ø80 uPVC SEWER GRADE CONDUITS EXTENDING A MINIMUM OF 500mm BEYOND EDGE OF PAVING.
- GRADES TO PAVEMENTS TO BE AS IMPLIED BY RL'S ON PLAN . GRADE EVENLY BETWEEN NOMINATED RL'S. AREAS EXHIBITING PONDING GREATER THAN 5mm DEPTH WILL NOT BE ACCEPTED UNLESS IN A DESIGNATED SAG POINT.
- ALL COVERS AND GRATES ETC TO EXISTING SERVICE UTILITIES ARE TO BE ADJUSTED TO SUIT NEW FINISHED SURFACE LEVELS WHERE APPLICABLE.

DRAWING SCHEDULE

BRO-CIV-PP-DWG-0000	COVER SHEET, DRAWING SCHEDULE, NOTES & LOCALITY SKETCH
BRO-CIV-PP-DWG-0100	DETAIL PLAN
BRO-CIV-PP-DWG-0200	STORMWATER MISCELLANEOUS DETAILS & PIT LID SCHEDULE
BRO-CIV-PP-DWG-0201	RAINWATER/ DETENTION TANK PLAN AND SECTION
BRO-CIV-PP-DWG-0250	PRE-DEVELOPMENT CATCHMENT PLAN
BRO-CIV-PP-DWG-0251	POST-DEVELOPMENT CATCHMENT PLAN
BRO-CIV-PP-DWG-0901	SEDIMENT & EROSION CONTROL PLAN
BRO-CIV-PP-DWG-0910	SEDIMENT & EROSION CONTROL TYPICAL SECTIONS & DETAILS

SURVEY NOTES

THE EXISTING SITE CONDITIONS SHOWN ON THE FOLLOWING DRAWINGS HAVE BEEN INVESTIGATED BY THE SURVEYOR SPECIFIED IN THE TITLE BLOCK.
THE INFORMATION IS SHOWN TO PROVIDE A BASIS FOR DESIGN. HENRY AND HYMAS PTY. LTD. DOES NOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THE SURVEY BASE OR ITS SUITABILITY AS A BASIS FOR CONSTRUCTION DRAWINGS.
SHOULD DISCREPANCIES BE ENCOUNTERED DURING CONSTRUCTION BETWEEN THE SURVEY DATA AND ACTUAL FIELD DATA, CONTACT HENRY AND HYMAS PTY. LTD. THE FOLLOWING NOTES HAVE BEEN TAKEN DIRECTLY FROM ORIGINAL SURVEY DOCUMENTS.

ORIGIN OF LEVELS	PM43027 RL2.099
DATUM	A.H.D.
CONTOUR INTERVAL	0.2m

FOR DA ONLY

SURVEY INFORMATION
SURVEYED BY
BEVERIDGE WILLIAMS
DATUM: A.H.D.
ORIGIN OF LEVELS: PM 43027 RL 2.099

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
03	ISSUED FOR DA ONLY	AFe	NH	19.10.2023
02	ISSUED FOR REF	MP	NH	18.07.2023
01	ISSUED FOR CO-ORDINATION	MP	NH	26.06.2023

Client
-

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H&H Job No: 230889

DRAWING TO BE PRINTED IN COLOUR

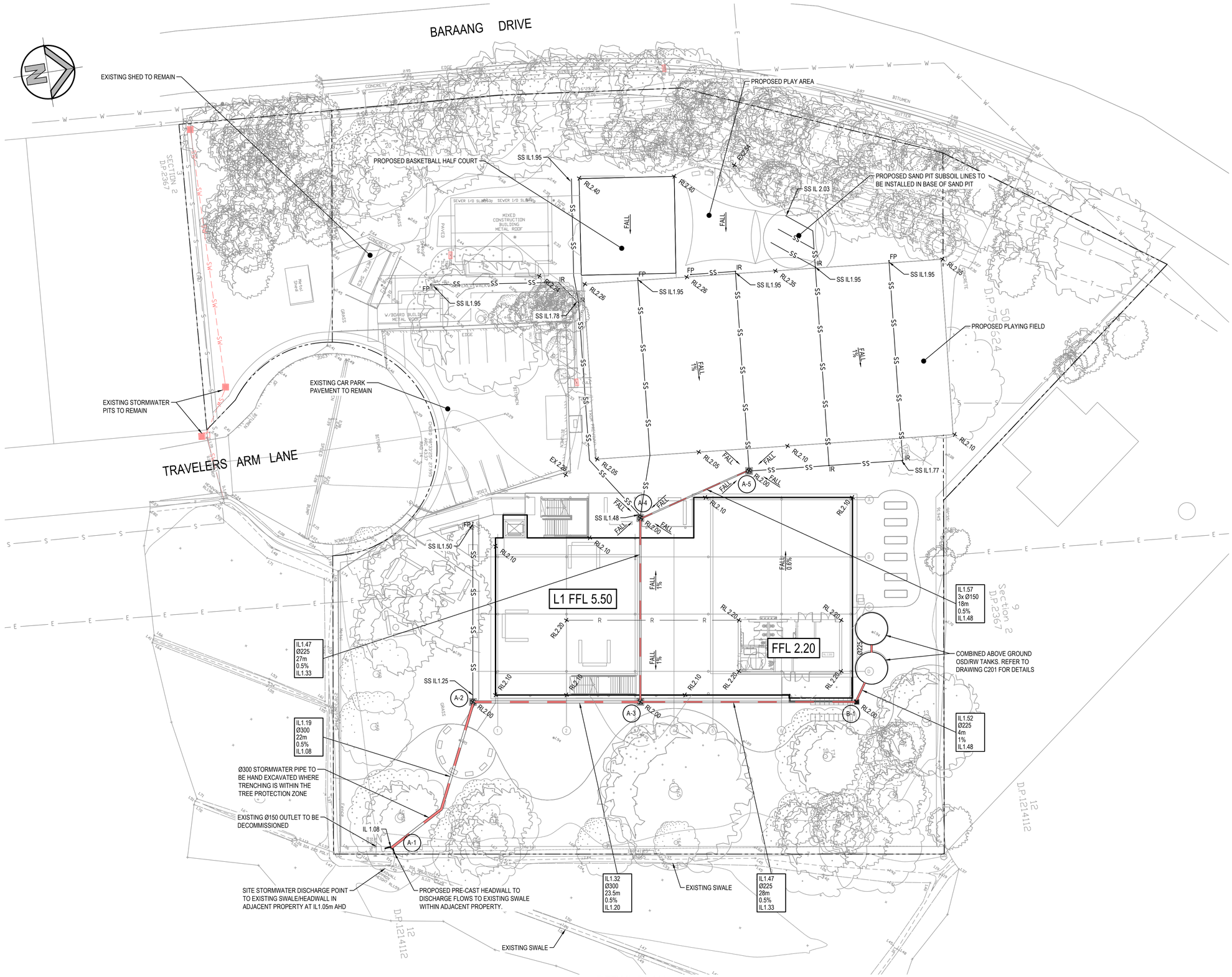
henry&hymas

Project
BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472

Title
COVER SHEET, DRAWING SCHEDULE, NOTES & LOCALITY SKETCH

Drawn	Designed	Original issue date
M.Pereira	N.Heazlewood	JUNE
Checked	**Approved**	**Scale @A1**
N.Heazlewood	A.Francis	NTS

Drawing number: BRO-CIV-PP-DWG-0000
Revision: 03



LEGEND

- PROPERTY LEASE LINE
- PROPOSED RIDGE LINE
- PROPOSED SUBSOIL LINE
- PROPOSED STORMWATER PIPE
- PROPOSED SURFACE INLET PITS
- PROPOSED PIT TAG (LINE LETTER / PIT NUMBER)
- STORMWATER UPSTREAM INVERT RL. (IL97.19)
- STORMWATER PIPE DIAMETER & CLASS (Ø300)
- STORMWATER PIPE LENGTH (30m)
- STORMWATER PIPE GRADE (1%)
- STORMWATER DOWNSTREAM INVERT RL. (IL96.89)
- PROPOSED SPOT LEVEL (RL2.30)
- EXISTING SPOT LEVEL (EX2.10)
- PROPOSED HEADWALL
- EXISTING PIT
- EXISTING STORMWATER LINE
- EXISTING WATER LINE
- EXISTING SEWER LINE
- EXISTING TELECOM LINE
- EXISTING ELECTRICITY LINE
- PROPOSED FLUSHING POINT (FP)
- PROPOSED INTERMEDIATE RISER (IR)

0 5 10 15 20 25m
5 4 3 2 1
SCALE 1:250

DETAIL PLAN

SCALE: 1:250

FOR DA ONLY

SURVEY INFORMATION
SURVEYED BY
BEVERIDGE WILLIAMS
DATUM: A.H.D.
ORIGIN OF LEVELS: PM 43027 RL 2.099

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
05	ISSUED FOR DA ONLY	NH	NH	20.10.2023
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03	ISSUED FOR REF	MB	NH	24.07.2023
02	ISSUED FOR REF	MP	NH	18.07.2023
01	ISSUED FOR CO-ORDINATION	MP	NH	26.06.2023

Client: -

Architect: PEDAVOLI ARCHITECTS PTY LTD

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H&H Job No: 230889

DRAWING TO BE PRINTED IN COLOUR

henry&hymas

Project: BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472

Title: DETAIL PLAN

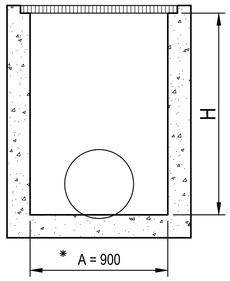
Drawn	Designed	Original issue date
M.Pereira	N.Heazlewood	JUNE
Checked	**Approved**	**Scale @A1**
N.Heazlewood	A.Francis	1:250

Drawing number: BRO-CIV-PP-DWG-0100

Revision: 05

TYPICAL PIT CHAMBER SIZES
IT IS THE CONTRACTORS RESPONSIBILITY TO SELECT PIT CHAMBER SIZE WITH REGARDS TO PIPE SIZE, DEPTH TO INVERT AND SKEW ANGLE. REFER SKETCHES BELOW.

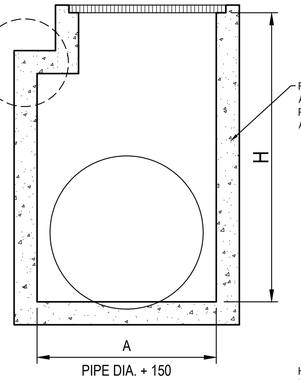
1. SELECT PIT CHAMBER USING THE STEPS BELOW:
2. SELECT PIT CHAMBER SIZE DEPENDING ON THE PIPE DIAMETERS.
3. CHECK PIT CHAMBER SIZE TO SATISFY DEPTH TO INVERT REQUIREMENTS.
   CHECK PIT CHAMBER DIMENSIONS TO SATISFY THE SKEW ANGLE IN THE TABLE.



SECTION
NTS

*A = 600 FOR PIPES UP TO 375 DIA.

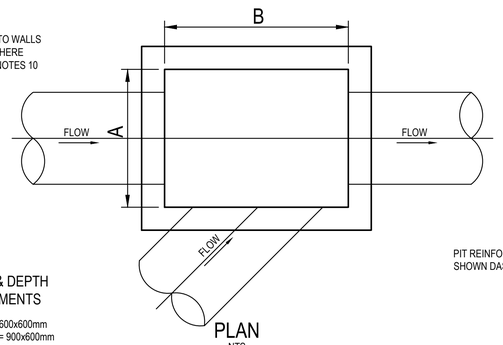
1 PIT CHAMBER DIMENSIONS FOR PIPES UP TO 600 DIA.



SECTION
NTS

1 PIT CHAMBER FOR PIPES GREATER THAN 600 DIA.

FOR B = 600mm - MAX. SIDE ENTRY PIPE AT 45° SKEW = 225mm
FOR B = 900mm - MAX. SIDE ENTRY PIPE AT 45° SKEW = 375mm
FOR B = 1200mm - MAX. SIDE ENTRY PIPE AT 45° SKEW = 600mm
FOR B = 1500mm - MAX. SIDE ENTRY PIPE AT 45° SKEW = 825mm
FOR B = 1900mm - MAX. SIDE ENTRY PIPE AT 45° SKEW = 1050mm

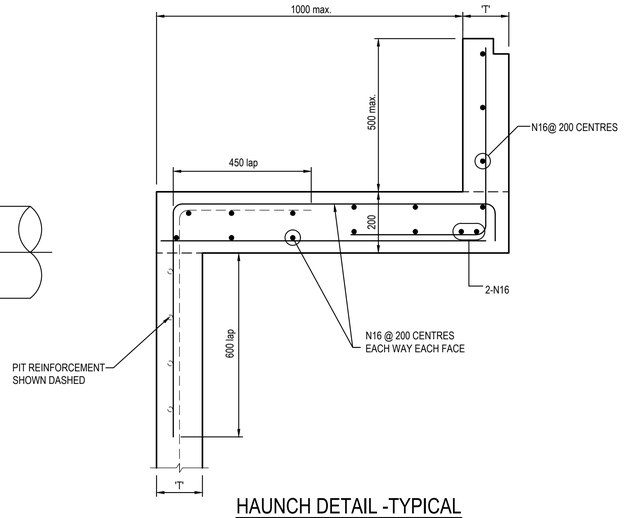


PLAN
NTS

3 PIT CHAMBER FOR SIDE ENTRY ON SKEW

2 PIT SIZE & DEPTH REQUIREMENTS

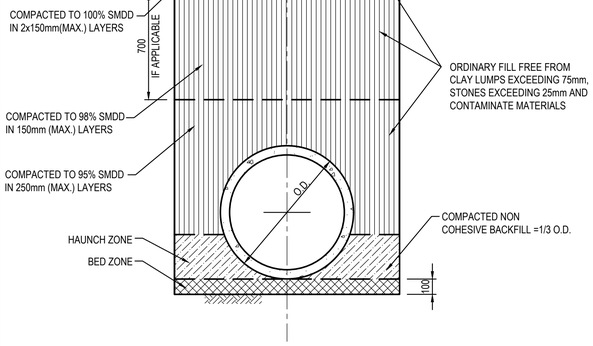
H = 0-900mm - AxB = 600x600mm
H = 900-1200mm - AxB = 900x600mm
H = >1200mm - AxB = 900x900mm



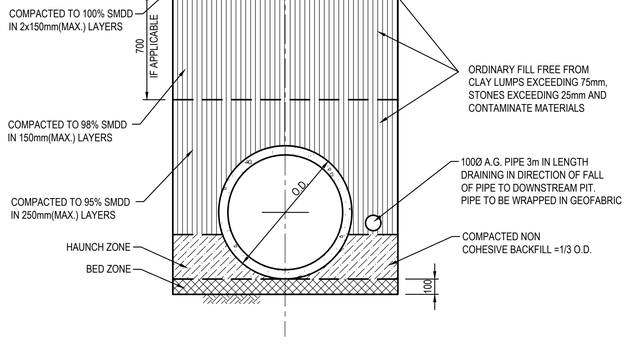
HAUNCH DETAIL -TYPICAL
SCALE 1:10

PIT LID SCHEDULE

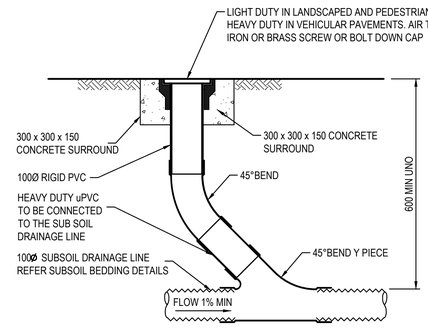
PIT/STRUCTURE NUMBER	DESCRIPTION
A-1	PRE CAST HEADWALL
A-2 A-3 A-4 A-5	PROPOSED INLET PIT WITH 600x600 HINGED MEDIUM DUTY GRATED LID CLASS "C" IN ACCORDANCE WITH RICHMOND VALLEY COUNCIL'S REQUIREMENTS.
B-1	PROPOSED INLET PIT WITH 450x450 HINGED MEDIUM DUTY GRATED LID CLASS "C" IN ACCORDANCE WITH RICHMOND VALLEY COUNCIL'S REQUIREMENTS.



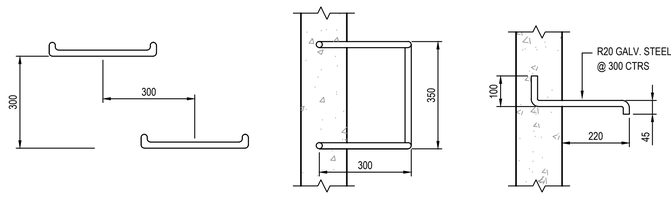
PIPE TRENCH INSTALLATION BENEATH PAVEMENT
(H1 & H2 SUPPORT)
SCALE 1:20



PIPE TRENCH INSTALLATION IN LANDSCAPE AREAS
(H1 & H2 SUPPORT)
SCALE 1:20

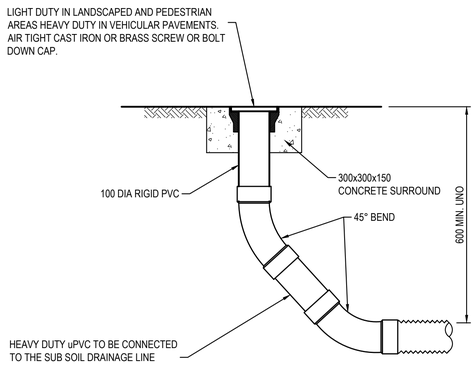


INTERMEDIATE RISER (IR)
SCALE 1:10
NOTE: SLOTTED RIGID PVC PIPE AND FITTINGS MAY BE USED



ELEVATION PLAN SECTION

TYPICAL STEP IRON DETAIL
SCALE 1:10



FLUSHING POINT (FP)
SCALE 1:10
NOTE: SLOTTED RIGID PVC PIPE AND FITTINGS MAY BE USED

0 200 400 600 800 1000mm
200 100
SCALE 1:10

0 400 800 1200 1600 2000mm
400 200
SCALE 1:20

DRAINAGE NOTES:

1. ALL STORMWATER WORK TO COMPLY WITH AS 3500 PART 3.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE MINIMUM COVER OF 600mm ON ALL PIPES.
3. PROTECTION OF PIPES DUE TO LOADS EXCEEDING W7 WHEEL LOAD SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
4. BEDDING TYPE SHALL BE TYPE H2 FOR RCP. WHERE NECESSARY THE OVERLAY ZONE SHALL BE REDUCED TO ACCOMMODATE PAVEMENT REQUIREMENTS. REFER TO THIS DRAWING FOR DETAILS.
5. MINIMUM COVER OVER EXISTING PIPES FOR PROTECTION DURING CONSTRUCTION SHALL BE 800mm.
6. NO CONSTRUCTION LOADS SHALL BE APPLIED TO PLASTIC PIPES.
7. FINISHED SURFACE LEVELS SHOWN ON LAYOUT PLAN DRGS TAKE PRECEDENCE OVER DESIGN DRAINAGE SURFACE LEVELS.
8. ALL PIPES UP TO AND INCLUDING 300 DIA. SHALL BE SOLVENT OR RUBBER RING JOINTED PVC CLASS SH PIPE TO AS1260. ALL OTHER PIPES TO BE RCP USING CLASS 2 RUBBER RING JOINTED PIPE. HARDIES FRC PIPE MAY BE USED IN LIEU OF RCP IF DESIRED IN GROUND. ALL AERIAL PIPES TO BE PVC CLASS SH.
9. ALL PITS IN NON TRAFFICABLE AREAS TO BE PREFABRICATED POLYESTER CONCRETE "POLYCRETE" WITH "LIGHT DUTY" CLASS B GALV. MILD STEEL GRATING AND FRAME.
   ALL PITS IN TRAFFICABLE AREAS (CLASS "D" LOADING MAX) TO HAVE 150mm THICK CONCRETE WALLS AND BASE CAST IN-SITU f'c=32 MPa, REINFORCED WITH N12-200 BOTH LOADING WAYS CENTRALLY PLACE .U.N.O. ON SEPARATE DESIGN DRAWINGS IN THIS SET. GALV.MILD STEEL GRATING AND FRAME TO SUIT DESIGN LOADING. PRECAST PITS, RECTANGULAR OR CIRCULAR IN SHAPE, MAY BE USED IN LIEU AND SHALL COMPLY WITH RELEVANT AUSTRALIAN STANDARDS.
10. ALL PITS, GRATINGS AND FRAMES SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATION AND TO BE IN ACCORDANCE WITH AS3500.3 AND AS3996.
11. PIT CHAMBER DIMENSIONS ARE TO BE SELECTED TO SATISFY THE FOLLOWING:
    - PIPE SIZE
    - DEPTH TO INVERT
    - SKEW ANGLE
    REFER TYPICAL PIT CHAMBER DETAILS BELOW
    IF PIT LID SIZE IS SMALLER THAN THE PIT CHAMBER SIZE THEN THE PIT LID IS TO BE CONSTRUCTED ON THE CORNER OF THE PIT CHAMBER WITH THE STEP IRONS DIRECTLY BELOW. ALTERNATIVELY THE PIT LID TO BE USED, IS TO BE THE SAME SIZE AS THE PIT CHAMBER.
12. FOR PIPE SIZES GREATER THAN Ø300mm, PIT FLOOR IS TO BE BENCHED TO FACILITATE FLOW.
13. GALVANISED STEP IRONS SHALL BE PROVIDED AT 300 CTS FOR PITS HAVING A DEPTH EXCEEDING 1200mm. SUBSOIL DRAINAGE PIPE SHALL BE PROVIDED IN PIPE TRENCHES ADJACENT TO INLET PIPES. (MINIMUM LENGTH 3m).
14. ALL SUBSOIL PIPES SHALL BE 100mm SLOTTED PVC IN A FILTER SOCK, UNO, WITH 3m INSTALLED UPSTREAM OF ALL PITS.
15. ALL PIPEWORK SHALL HAVE MINIMUM DIAMETER 100.
16. MINIMUM GRADE FOR ROOFWATER DRAINAGE LINES SHALL BE 1%.
17. ALL PIPE JUNCTIONS AND TAPER UP TO AND INCLUDING 300 DIA. SHALL BE VIA PURPOSE MADE FITTINGS.
18. ALL DRAINAGE TO BE INSTALLED IN ACCORDANCE WITH AS3500, PART 3. TESTING TO BE UNDERTAKEN AND REPORTS PROVIDED TO THE SUPERINTENDENT.
19. LOCATION OF THE DIRECT DOWN PIPE CONNECTIONS MAY VARY ON SITE TO SUIT SITE CONDITIONS, WHERE CONNECTION SHOWN ON LONG SECTIONS CHAINAGES ARE INDICATIVE ONLY.
20. PITS IN EXCESS OF 1.5 m DEEP TO HAVE WALL AND FLOOR THICKNESS INCREASED TO 200mm. REINFORCED WITH N12@200 CTS CENTRALLY PLACED BOTH WAYS THROUGHOUT U.N.O.ON SEPARATE DESIGN DRAWINGS IN THIS SET. IF DEPTH EXCEEDS 5m CONTACT ENGINEER.
21. SUBSOIL DRAINAGE LINES FOR LANDSCAPE AREA NOT SHOWN ON THESE DRAWINGS. REFER TO LANDSCAPING DRAWINGS FOR ANY ADDITIONAL SUBSOIL LINES IN LANDSCAPING AREAS THAT ARE NOT SHOWN ON THESE CIVIL DRAWINGS.
22. ALL STORMWATER PITS TO HAVE Ø100 uPVC SLOTTED SUBSOIL PIPES CONNECTED TO THEM. THESE SUBSOILS TO EXTEND 3m UPSTREAM OF THE PIT AT A MINIMUM GRADE.

FOR DA ONLY

SURVEY INFORMATION
SURVEYED BY
BEVERIDGE WILLIAMS
DATUM: A.H.D.
ORIGIN OF LEVELS: PM 43027 RL 2.099

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
03	ISSUED FOR DA ONLY	AFe	NH	19.10.2023
02	ISSUED FOR REF	MP	NH	18.07.2023
01	ISSUED FOR CO-ORDINATION	MP	NH	26.06.2023

Client
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H&H Job No: 230889

DRAWING TO BE PRINTED IN COLOUR

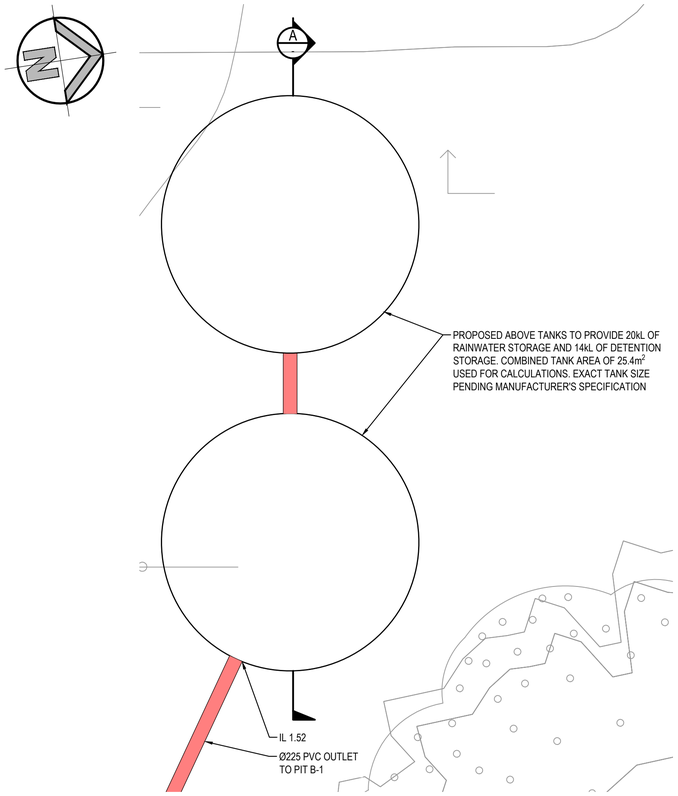
henry&hymas

Project
BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472

Title
STORMWATER MISCELLANEOUS DETAILS

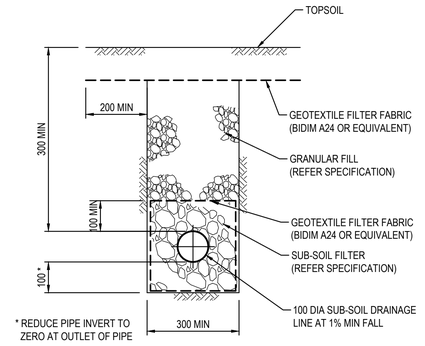
Drawn	Designed	Original issue date
M.Pereira	N.Heazlewood	JUNE
Checked	**Approved**	**Scale @A1**
N.Heazlewood	A.Francis	AS NOTED

Drawing number: BRO-CIV-PP-DWG-0200
Revision: 03



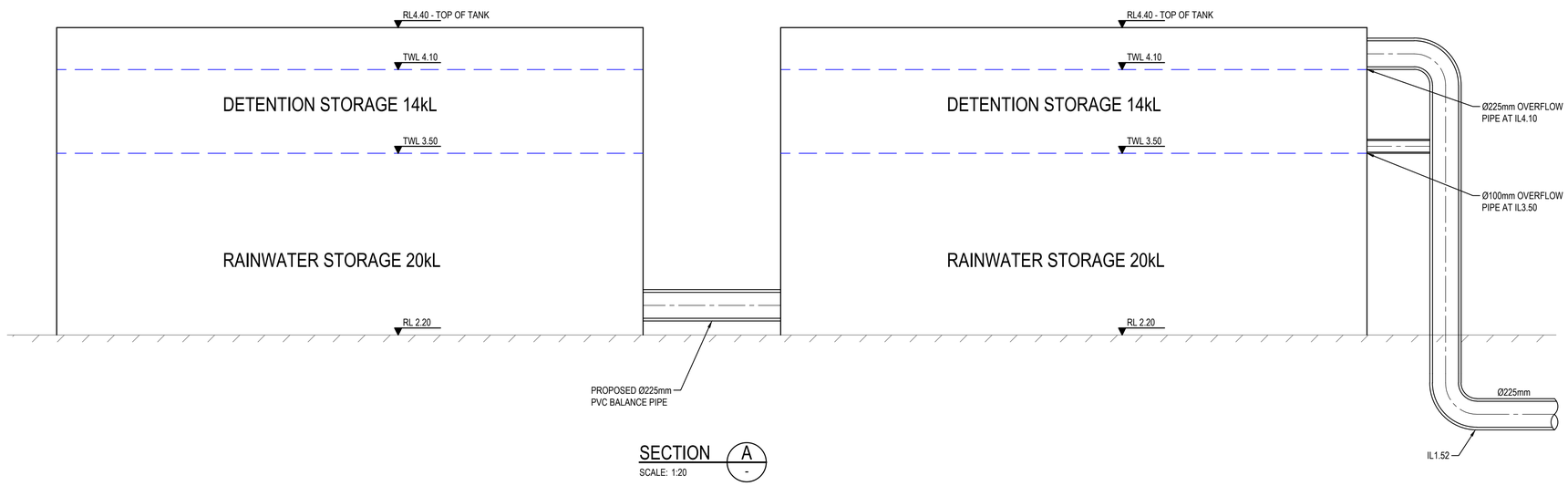
RAINWATER/DETENTION TANK PLAN

SCALE: 1:50



SUB-SOIL IN LANDSCAPED AREAS

SCALE 1:10



SECTION A

SCALE: 1:20

0 400 800 1200 1600 2000mm
400 200
SCALE 1:20

0 1000 2000 3000 4000 5000mm
1000 600 200
SCALE 1:50

FOR DA ONLY

SURVEY INFORMATION
SURVEYED BY
BEVERIDGE WILLIAMS
DATUM: A.H.D.
ORIGIN OF LEVELS: PM 43027 RL 2.099

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE	REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
04	ISSUED FOR DA ONLY	AFe	NH	19.10.2023					
03	ISSUED FOR REF	MB	NH	24.07.2023					
02	ISSUED FOR REF	MP	NH	18.07.2023					
01	ISSUED FOR CO-ORDINATION	MP	NH	26.06.2023					

Client
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Architect
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Web www.henryandhymas.com.au

H&H Job No: 230889

DRAWING TO BE PRINTED IN COLOUR

henry&hymas

Project
BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472

Title
RAINWATER/ DETENTION TANK PLAN AND SECTION

Drawn	Designed	Original issue date
M.Pereira	N.Heazlewood	JUNE
Checked	**Approved**	**Scale @A1**
N.Heazlewood	A.Francis	AS NOTED

Drawing number
BRO-CIV-PP-DWG-0201

Revision
04

BARAANG DRIVE

TRAVELERS ARM LANE

PRE-DEVELOPMENT - TOTAL SITE =8838m²

EXISTING IMPERVIOUS AREA
AREA = 1441m²

EXISTING PERVIOUS AREA
AREA = 7397m²

PRE-DEVELOPMENT CATCHMENT PLAN

SCALE: 1:250

0 5 10 15 20 25m

SCALE 1:250

FOR DA ONLY

SURVEY INFORMATION
SURVEYED BY
BEVERIDGE WILLIAMS
DATUM: A.H.D.
ORIGIN OF LEVELS: PM 43027 RL 2.099

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
03	ISSUED FOR DA ONLY	AFe	NH	19.10.2023
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Architect
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H&H Job No: 230889

DRAWING TO BE PRINTED IN COLOUR

henry&hymas

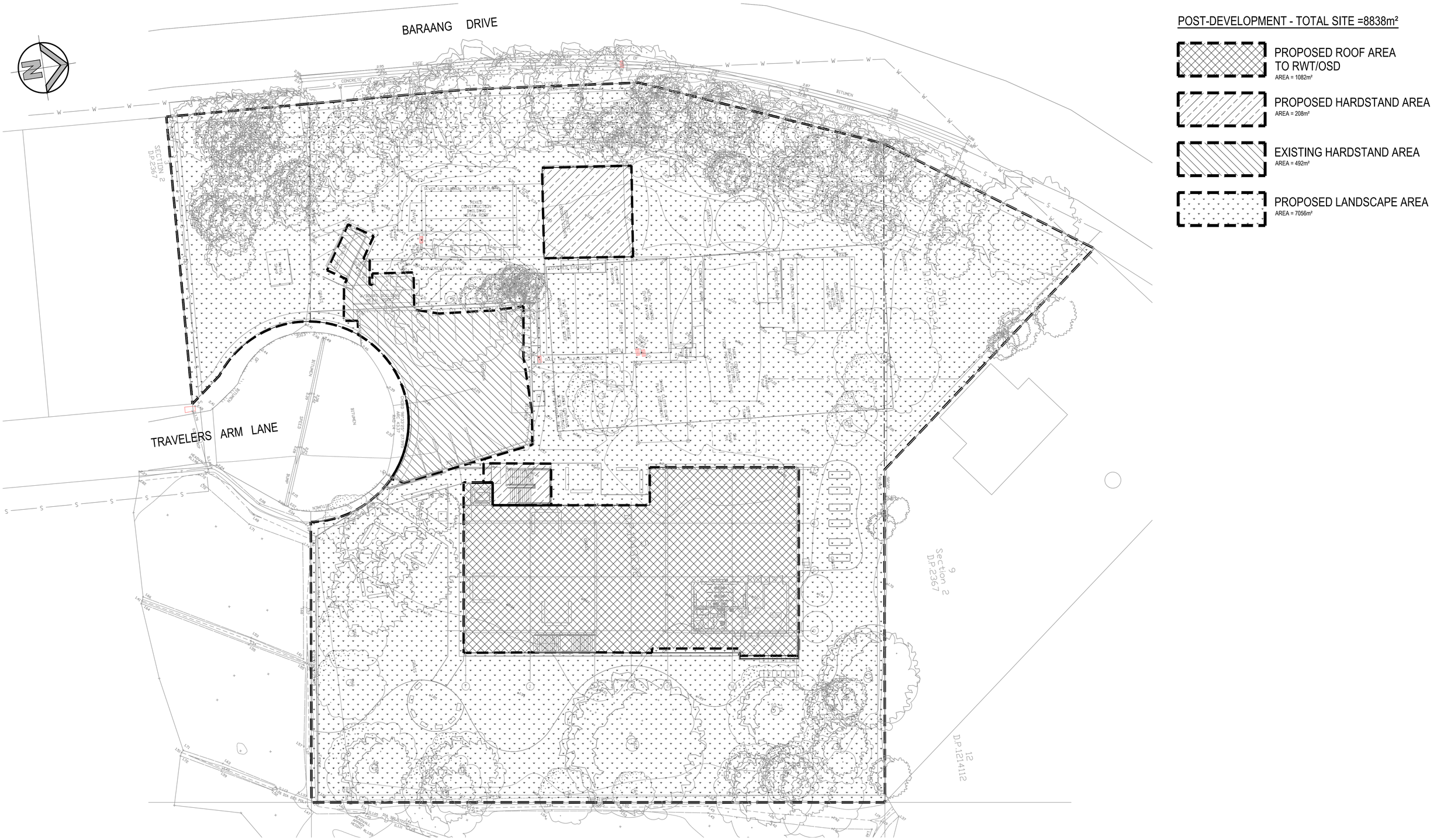
Project
BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472

Title
PRE-DEVELOPMENT CATCHMENT PLAN

Drawn	Designed	Original issue date
M.Pereira	N.Heazlewood	JUNE
Checked	Approved	Scale @A1
N.Heazlewood	A.Francis	1:250

Drawing number: BRO-CIV-PP-DWG-0250

Revision: 03



POST-DEVELOPMENT - TOTAL SITE =8838m²

- PROPOSED ROOF AREA TO RWT/OSD
  AREA = 1082m²
- PROPOSED HARDSTAND AREA
  AREA = 208m²
- EXISTING HARDSTAND AREA
  AREA = 492m²
- PROPOSED LANDSCAPE AREA
  AREA = 7056m²

POST-DEVELOPMENT CATCHMENT PLAN

SCALE: 1:250

0 5 10 15 20 25m

5 4 3 2 1

SCALE 1:250

FOR DA ONLY

SURVEY INFORMATION

SURVEYED BY BEVERIDGE WILLIAMS

DATUM: A.H.D.

ORIGIN OF LEVELS: PM 43027 RL 2.099

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
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01	ISSUED FOR CO-ORDINATION	MP	NH	26.06.2023

Client: -

Architect: PEDAVOLI ARCHITECTS PTY LTD

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H&H Job No: 230889

DRAWING TO BE PRINTED IN COLOUR

henry&hymas

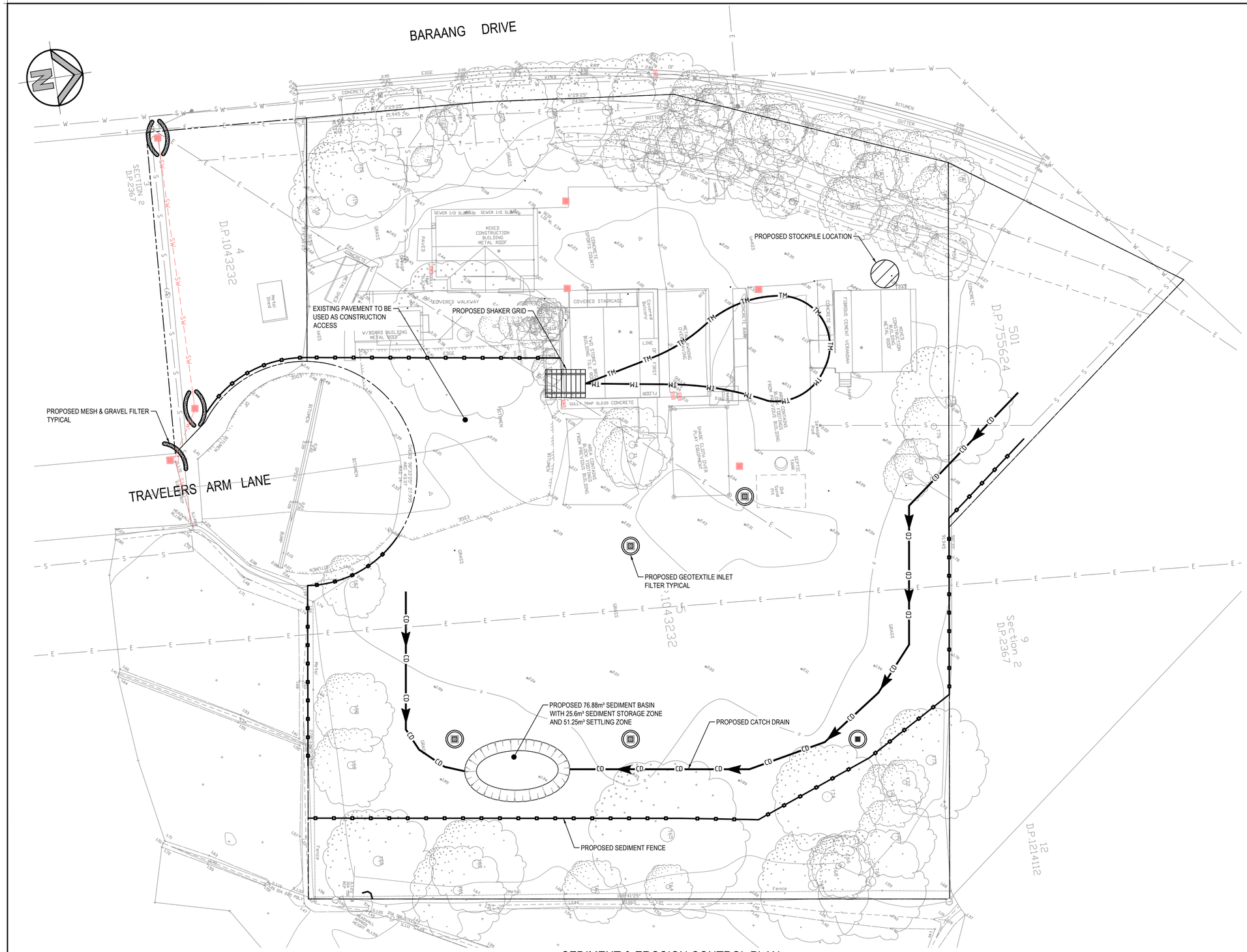
Project: BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472

Title: POST-DEVELOPMENT CATCHMENT PLAN

Drawn	Designed	Original issue date
M.Pereira	N.Heazlewood	JUNE
Checked	**Approved**	**Scale @A1**
N.Heazlewood	A.Francis	1:250

Drawing number: BRO-CIV-PP-DWG-0251

Revision: 04



LEGEND

- TRAFFIC MANOEUVRING
- CATCH DIVERSION DRAIN
- PROPOSED SEDIMENTATION FENCE
- PROPOSED VEHICLE SHAKER GRID
- PROPOSED STOCKPILE LOCATION
- GEOTEXTILE INLET FILTER
- PROPOSED MESH & GRAVEL INLET FILTER
- PROPOSED HAYBALE FILTER

SEDIMENT & EROSION CONTROL PLAN

SCALE: 1:250

0 5 10 15 20 25m

5 4 3 2 1

SCALE 1:250

SEDIMENT & EROSION CONTROL NOTES

- ALL SEDIMENT CONTROL DEVICES ARE TO BE CONSTRUCTED, PLACED AND MAINTAINED IN ACCORDANCE WITH CITY OF RYDE COUNCIL SPECIFICATIONS AND LANDCOM'S "SOIL AND CONSTRUCTION" MANUAL.
- ALL PERIMETER & SILTATION CONTROL MEASURES ARE TO BE PLACED PRIOR TO, OR AS THE FIRST STEP IN EARTH WORKS AND/OR CLEARING.
- THE SEDIMENT & EROSION CONTROL PLAN MAY REQUIRE FUTURE ADJUSTMENT TO REFLECT CONSTRUCTION STAGING. IT IS ALSO THE CONTRACTORS RESPONSIBILTY TO PREPARE THEIR OWN SEDIMENT AND EROSION CONTROL PLAN WHICH SUITS THE DESIGNED CONSTRUCTION STAGING.
- FILTRATION BUFFER ZONES ARE TO BE FENCED OFF AND ACCESS PROHIBITED TO ALL PLANT AND MACHINERY.
- ALL TEMPORARY EARTH BERMS, DIVERSIONS & SILT DAM EMBANKMENTS ARE TO BE MACHINE COMPACTED, SEEDED & MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED.
- ALL SEDIMENT TRAPPING STRUCTURES AND DEVICES ARE TO BE INSPECTED AFTER STORMS FOR STRUCTURAL DAMAGE OR CLOGGING. TRAPPED MATERIAL IS TO BE REMOVED TO A SAFE LOCATION.
- ALL TOPSOIL IS TO BE STOCKPILED ON SITE FOR REUSE (AWAY FROM TREES AND DRAINAGE LINES). MEASURES SHALL BE APPLIED TO PREVENT EROSION OF THE STOCKPILES.
- ALL EARTHWORK AREAS SHALL BE ROLLED EACH EVENING TO SEAL THE EARTHWORKS.
- ALL FILLS ARE TO BE LEFT WITH A LIP AT THE TOP OF THE SLOPE AT THE END. ALL CUT AND FILL SLOPES ARE TO BE SEEDED AND STRAW MULCHED WITHIN 14 DAYS OF COMPLETION OF FORMATION U.N.O. BY LANDSCAPE ARCHITECTS.
- UPON COMPLETION OF ALL EARTHWORKS OR AS DIRECTED BY COUNCIL SOIL CONSERVATION TREATMENTS SHALL BE APPLIED SO AS TO RENDER AREAS THAT HAVE BEEN DISTURBED, EROSION PROOF WITHIN 14 DAYS.
- EROSION AND SILT PROTECTION MEASURES ARE TO BE MAINTAINED AT ALL TIMES.

FOR DA ONLY

SURVEY INFORMATION
SURVEYED BY
BEVERIDGE WILLIAMS
DATUM: A.H.D.
ORIGIN OF LEVELS: PM 43027 RL 2.099

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
03	ISSUED FOR DA ONLY	AFe	NH	19.10.2023
02	ISSUED FOR REF	MP	NH	18.07.2023
01	ISSUED FOR CO-ORDINATION	MP	NH	26.06.2023

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DRAWING TO BE PRINTED IN COLOUR

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Project
BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472

Title
SEDIMENT & EROSION CONTROL PLAN

Drawn	Designed	Original issue date
M.Pereira	N.Heazlewood	JUNE
Checked	Approved	Scale @A1
N.Heazlewood	A.Francis	1:250

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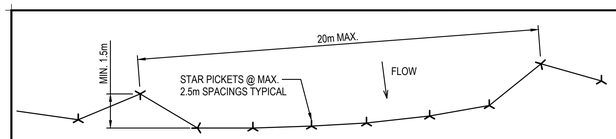
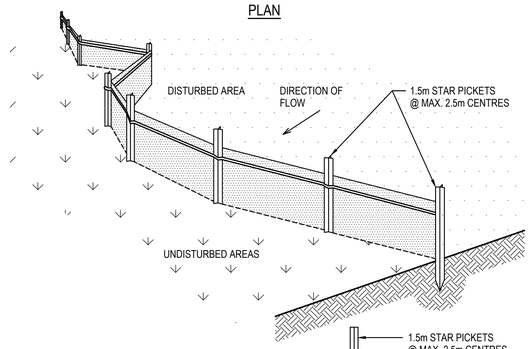
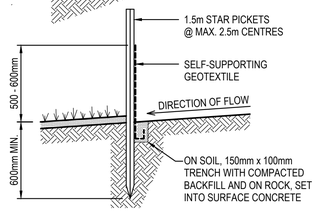
Revision: 03



PLAN





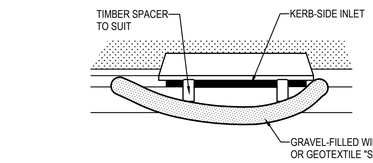
SECTION DETAIL

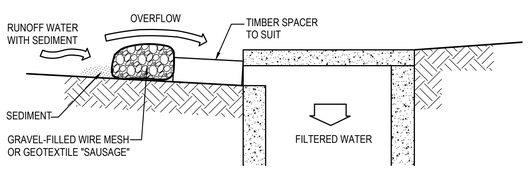
SEDIMENT FENCE

N.T.S.

SEDIMENT FENCE CONSTRUCTION NOTES:

1. CONSTRUCT SEDIMENT FENCES AS CLOSE AS POSSIBLE TO BEING PARALLEL TO THE CONTOURS OF THE SITE, BUT WITH SMALL RETURNS AS SHOWN IN THE DRAWING TO LIMIT THE CATCHMENT AREA OF ANY ONE SECTION. THE CATCHMENT AREA SHOULD BE SMALL ENOUGH TO LIMIT WATER FLOW IF CONCENTRATED AT ONE POINT TO 50 LITRES PER SECOND IN THE DESIGN STORM EVENT, USUALLY THE 10-YEAR EVENT.
2. CUT A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
3. 3. DRIVE 1.5m LONG STAR PICKETS INTO GROUND @ 2.5m INTERVALS (MAX.) AT THE DOWNSLOPE EDGE OF THE TRENCH. ENSURE ANY STAR PICKETS ARE FITTED WITH SAFETY CAPS.
4. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE POSTS ENSURING IT GOES TO THE BASE OF THE TRENCH. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.



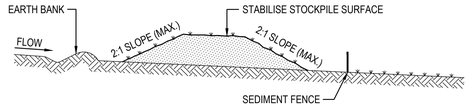


MESH & GRAVEL INLET FILTER CONSTRUCTION NOTES:

1. FABRICATE A SLEEVE MADE FROM GEOTEXTILE OR WIRE MESH LONGER THAN THE LENGTH OF THE INLET PIT AND FILL IT WITH 25mm TO 50mm GRAVEL.
2. FORM AN ELLIPTICAL CROSS-SECTION ABOUT 150mm HIGH x 400mm WIDE.
3. PLACE THE FILTER AT THE OPENING LEAVING AT LEAST A 100mm SPACE BETWEEN IT AND THE KERB INLET. MAINTAIN THE OPENING WITH SPACER BLOCKS.
4. FORM A SEAL WITH THE KERB TO PREVENT SEDIMENT BYPASSING THE FILTER.
5. SANDBAGS FILLED WITH GRAVEL CAN SUBSTITUTE FOR THE MESH OR GEOTEXTILE PROVIDING THEY ARE PLACED SO THAT THEY CAN FIRMLY ABUT EACH OTHER AND SEDIMENT / LADEN WATERS CANNOT PASS BETWEEN.

MESH & GRAVEL INLET FILTER

N.T.S.



STOCKPILE CONSTRUCTION NOTES:

1. PLACE STOCKPILES MORE THAN 2 (PREFERABLY 5) METRES FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2 METRES IN HEIGHT.
4. WHERE THEY ARE TO BE PLACED FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED E.S.C.P. OR S.W.M.P. TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES 1 TO 2 METRES DOWNSLOPE.

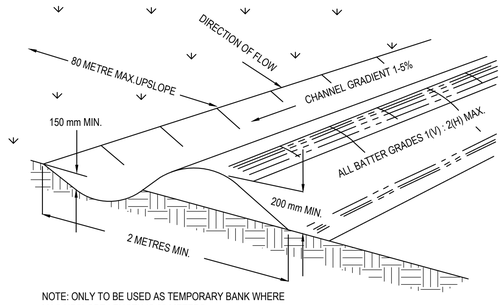
STOCKPILES

N.T.S.

CONSTRUCTION SEQUENCE

WORKS SHALL BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:

1. INSTALL SEDIMENT FENCING AND CUT DRAINS TO MEET THE REQUIREMENTS OF THE SEDIMENT AND EROSION CONTROL PLAN. WASTE COLLECTION BINS SHALL BE INSTALLED ADJACENT TO SITE OFFICE.
2. CONSTRUCT STABILISED SITE ACCESS IN ACCORDANCE WITH LOCAL COUNCIL'S REQUIREMENTS.
3. REDIRECT CLEAN WATER AROUND THE CONSTRUCTION SITE.
4. INSTALL SEDIMENT CONTROL PROTECTION MEASURES AT ALL NATURAL AND MAN-MADE DRAINAGE STRUCTURES. MAINTAIN UNTIL ALL THE DISTURBED AREAS ARE STABILISED.
5. CLEAR AND STRIP THE WORK AREAS. MINIMISE THE DAMAGE TO THE GRASS AND LOW GROUND COVER OF NON-DISTURBED AREAS.
6. ANY DISTURBED AREAS, OTHER THAN BUILDING PAD AREAS, SHALL IMMEDIATELY BE COVERED WITH SITE TOPSOIL WITHIN 7 DAYS OF CLEARING. BUILDING PAD AREAS SHALL BE COVERED WITH BITUMEN EMULSION AS SPECIFIED.
7. APPLY PERMANENT STABILISATION TO SITE (LANDSCAPING).



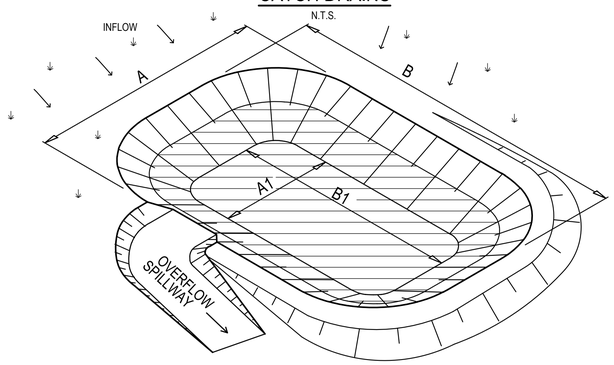
NOTE: ONLY TO BE USED AS TEMPORARY BANK WHERE MAC.UPSLOPE LENGTH IS 80 METERS.

CATCH DRAIN CONSTRUCTION NOTES:

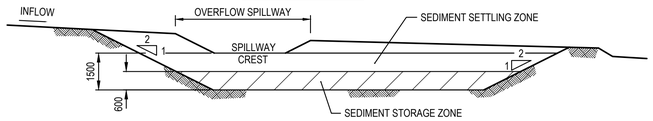
1. CONSTRUCT ALONG GRADIENT AS SPECIFIED.
2. MAXIMUM SPACING BETWEEN BANKS SHALL BE 80 METRES.
3. DRAINS TO BE OF PARABOLIC OR TRAPEZOIDAL CROSS SECTION NOT V-SHAPED.
4. EARTH BANKS TO BE ADEQUATELY COMPACTED IN ORDER TO PREVENT FAILURE.
5. CONSTRUCTION IS OF A TEMPRORARY NATURE AND SHALL BE COMPACTED AT THE END A DAYS WORK OR IMMEDIATELY PRIOR RAIN.
6. ALL OUTLETS FROM DISTURBED LANDS ARE TO FEED INTO SEDIMENT BASIN OR SIMILAR.
7. DISCHARGE RUNOFF COLLECTED FROM UNDISTURBED LANDS ONTO EITHER A STABILISED OR AN UNDISTURBED DISPOSAL AISTE WITHIN THE SAME SUBCATCHMENT AREA FROM WHICH THE WATER ORIGINATED.
8. COMPACT WITH A SUITABLE IMPLEMENT IN SITUATIONS WHERE THEY ARE REQUIRED TO FUNCTION FOR MORE THAN FIVE DAYS.
9. EARTH BANKS TO BE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT WILL IMPEDE NORMAL FLOW.

CATCH DRAINS

N.T.S.



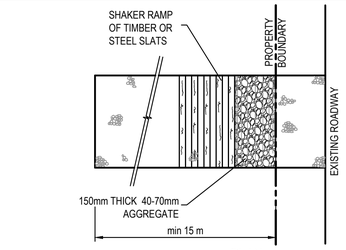
PERSPECTIVE VIEW



TYPICAL SECTION

TYPE 'D' & 'F' SEDIMENTATION BASIN

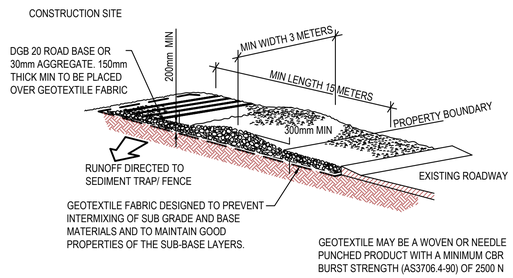
N.T.S.



PLAN

STABILISED SITE ACCESS WITH SHAKER RAMP

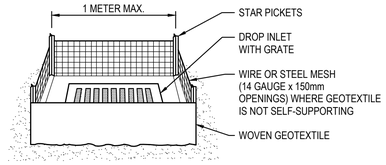
N.T.S.

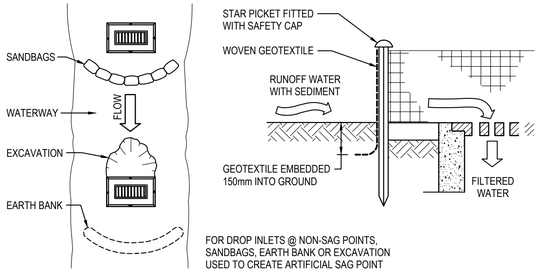


STABILISED SITE ACCESS WITH SHAKER RAMP

N.T.S.

NOTES:
1. THIS DEVICE IS TO BE LOCATED AT ALL EXITS FROM CONSTRUCTION SITE.
2. THIS DEVICE IS TO BE REGULARLY CLEANED OF DEPOSITED MATERIAL SO AS TO MAINTAIN A 50mm DEEP SPACE BETWEEN PLANKS.
3. ANY UNSEALED ROAD BETWEEN THIS DEVICE AND NEAREST ROADWAY IS TO BE TOPPED WITH 100mm THICK 40-70mm SIZE AGGREGATE.
4. ALTERNATIVELY, THREE(3) PRECAST CONCRETE CATTLE GRIDS (AS MANUFACTURED BY "HUMES CONCRETE MAY BE USED. 1, 2 & 3 ABOVE ALSO APPLY.





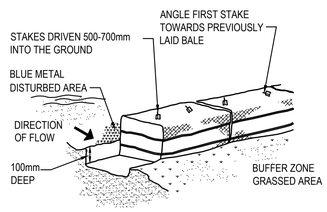
FOR DROP INLETS @ NON-SAG POINTS, SANDBAGS, EARTH BANK OR EXCAVATION USED TO CREATE ARTIFICIAL SAG POINT

GEOTEXTILE INLET FILTER CONSTRUCTION NOTES:

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE.
2. PICKET SPACING TO BE MAXIMUM 1.0m.
3. IN WATERWAYS, ARTIFICIAL SAG POINTS CAN BE CREATED WITH SANDBAGS OR EARTH BANKS AS SHOWN IN THE DRAWING.
4. DO NOT COVER THE INLET WITH GEOTEXTILES UNLESS THE DESIGN IS ADEQUATE TO ALLOW FOR ALL WATERS TO BYPASS IT.

GEOTEXTILE INLET FILTER

N.T.S.



HAYBALE BARRIERS

N.T.S.

SEDIMENT BASIN SIZING

1. THE SEDIMENT BASIN SHALL BE CONSTRUCTED ON A RATE PER HECTARE BASIS AND HAS BEEN IN ACCORDANCE WITH THE REQUIREMENTS OF THE LANDCOM MANUAL "MANAGING URBAN STORMWATER - SOILS AND CONSTRUCTION", FOR SEDIMENTATION **TYPE D** SOILS. THE DISTURBED AREA WITHIN THIS CATCHMENT AT ANY ONE TIME SHOULD BE LIMITED TO AN AREA FOR WHICH EACH SEDIMENT BASIN CAN HANDLE. EACH BASIN SHALL BE SIZED IN ACCORDANCE WITH THE TABLE BELOW.

SEDIMENT BASIN SIZING TYPE D SOILS	
VOLUMETRIC RUNOFF COEFFICIENT, CV	0.56 (APPENDIX F - TABLE F2)
75TH PERCENTILE 5 DAY TOTAL RAINFALL DEPTH, R	28.6 mm
CATCHMENT AREA, A	0.32
SETTLING ZONE VOLUME (PER HECTARE) 10 CV A R	51.25 m³
DISTURBED CATCHMENT AREA	0.32
R K LS P C	68.20 m³
SEDIMENT ZONE VOLUME (0.17 A (R K LS P C)/1.3	50% SETTLING VOL.ADOPT 25.6 m³ PER HECTARE
TOTAL SEDIMENT BASIN VOLUME REQUIRED :	76.88 m³

* (LANDCOM MANAGING URBAN STORMWATER MANUAL REFERENCE)

2. THE FOLLOWING DESIGN PARAMETERS HAVE BEEN ASSESSED FOR THE SITE:

CONSTRAINT	VALUE	(SOURCE)*
RAINFALL EROSIVITY (R-FACTOR)	4300	APPENDIX B
LENGTH/SLOPE GRADIENT FACTOR, LS	0.2	APPENDIX A - TABLE A1
SOIL ERODIBILITY (K-FACTOR)	0.061	(ASSUMED BASED ON SOIL TYPE)
EROSION CONTROL PRACTICE FACTOR (P-FACTOR)	1.3 (COMPACTED)	APPENDIX A - TABLE A2
COVER FACTOR (C-FACTOR)	1.0 (DURING EARTHWORKS)	APPENDIX A - FIGURE A5
CALCULATED SOIL LOSS, A (RUSLE EQUATION)	68.20	A = R K LS P C
SOIL HYDROLOGIC GROUP	-	(ASSUMED BASED ON SOIL TYPE)
SEDIMENT TYPE	28.6	(ASSUMED BASED ON SOIL TYPE)
75TH PERCENTILE 5-DAY RAINFALL EVENT	29.5 mm (LISSMORE)	TABLE 6.3A

* (LANDCOM MANAGING URBAN STORMWATER MANUAL REFERENCE)

BASIN MANAGEMENT

1. THE CAPTURED STORMWATER IN THE SETTLING ZONE SHOULD BE DRAINED TO MEET THE MINIMUM STORAGE CAPACITY REQUIRED WITHIN A FIVE (5) DAY PERIOD FOLLOWING RAINFALL, PROVIDED THE ACCEPTABLE WATER QUALITY (NFR) AND TURBIDITY HAVE BEEN ACHIEVED.
2. CHEMICAL FLOCCULENT SUCH AS GYPSUM MAY BE DOSED TO AID SETTLING WITHIN 24 HOURS OF CONCLUSION OF EACH STORM. THE APPLIED DOSING RATES SHOULD ACHIEVE THE TARGET QUALITY WITHIN 36 TO 72 HOURS OF THE STORM EVENT.
3. INSPECT THE SEDIMENT BASINS AFTER EACH RAINFALL EVENT AND/OR WEEKLY. ENSURE THAT ALL SEDIMENT IS REMOVED ONCE THE SEDIMENT STORAGE ZONE IS FULL (REFER TO PEGS INSTALLED IN BASINS IN ACCORDANCE WITH THE SWMP). ENSURE THAT OUTLET AND EMERGENCY SPILLWAY WORKS ARE MAINTAINED IN A FULLY OPERATIONAL CONDITION AT ALL TIMES.

SOWING SEASON	SEED MIX
AUTUMN/WINTER	OATS@40KG/Ha + JAPANESE MILLET@10kg/Ha
SPRING/SUMMER	OATS@20kg/Ha + JAPANESE MILLET@20kg/Ha

NOTE : THESE PLANT SPECIES ARE FOR TEMPORARY REVEGETATION ONLY. THEY WILL ONLY PROVIDE PROTECTION FROM EROSION FOR SIX MONTHS. WHERE THE LOTS ARE TO BE LEFT UNDEVELOPED FOR A LONGER PERIOD, THE CONTRACTOR SHALL SEEK ADVICE FROM THE SITE SUPERINTENDENT AS TO MORE APPROPRIATE REVEGETATION METHODS.

REVEGETATION IN ACCORDANCE WITH THE ABOVE TABLE WILL BE ENHANCED BY ADDING LIME AT A RATE OF 4kg/TONNE OF TOPSOIL AND 7.5kg/TONNE OF SUBSOIL.

4. THE LONG TERM GROUND COVER FACTORS FOR THE CONSTRUCTION WORKS IS NOT TO EXCEED THE FOLLOWING LIMITS:

LAND	MAXIMUM C-FACTOR	REMARKS
WATERWAYS AND OTHER AREAS OF CONCENTRATED FLOWS, POST CONSTRUCTION	0.05	APPLIES AFTER TEN WORKING DAYS OF COMPLETION OF FORMATION AND BEFORE CONCENTRATED FLOWS ARE APPLIED. FOOT AND VEHICULAR TRAFFIC IS PROHIBITED IN THIS AREA AND 70% GROUND COVER IS REQUIRED.
STOCKPILES, POST CONSTRUCTION	0.10	APPLIES AFTER TEN WORKING DAYS FROM COMPLETION OF FORMATION. 60% GROUND COVER IS REQUIRED.
ALL LANDS, INCLUDING WATERWAYS AND STOCKPILES, DURING CONSTRUCTION.	0.15	APPLIES AFTER 20 DAYS OF INACTIVITY, EVEN THOUGH WORKS MAY BE INCOMPLETE. 50% GROUND COVER IS REQUIRED.

FOR DA ONLY

SURVEY INFORMATION
SURVEYED BY
BEVERIDGE WILLIAMS
DATUM: A.H.D.
ORIGIN OF LEVELS: PM 43027 RL 2.099

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DRAWING TO BE PRINTED IN COLOUR

henry&hymas

Project: BROADWATER PUBLIC SCHOOL
9 BYRNES STREET, BROADWATER NSW 2472

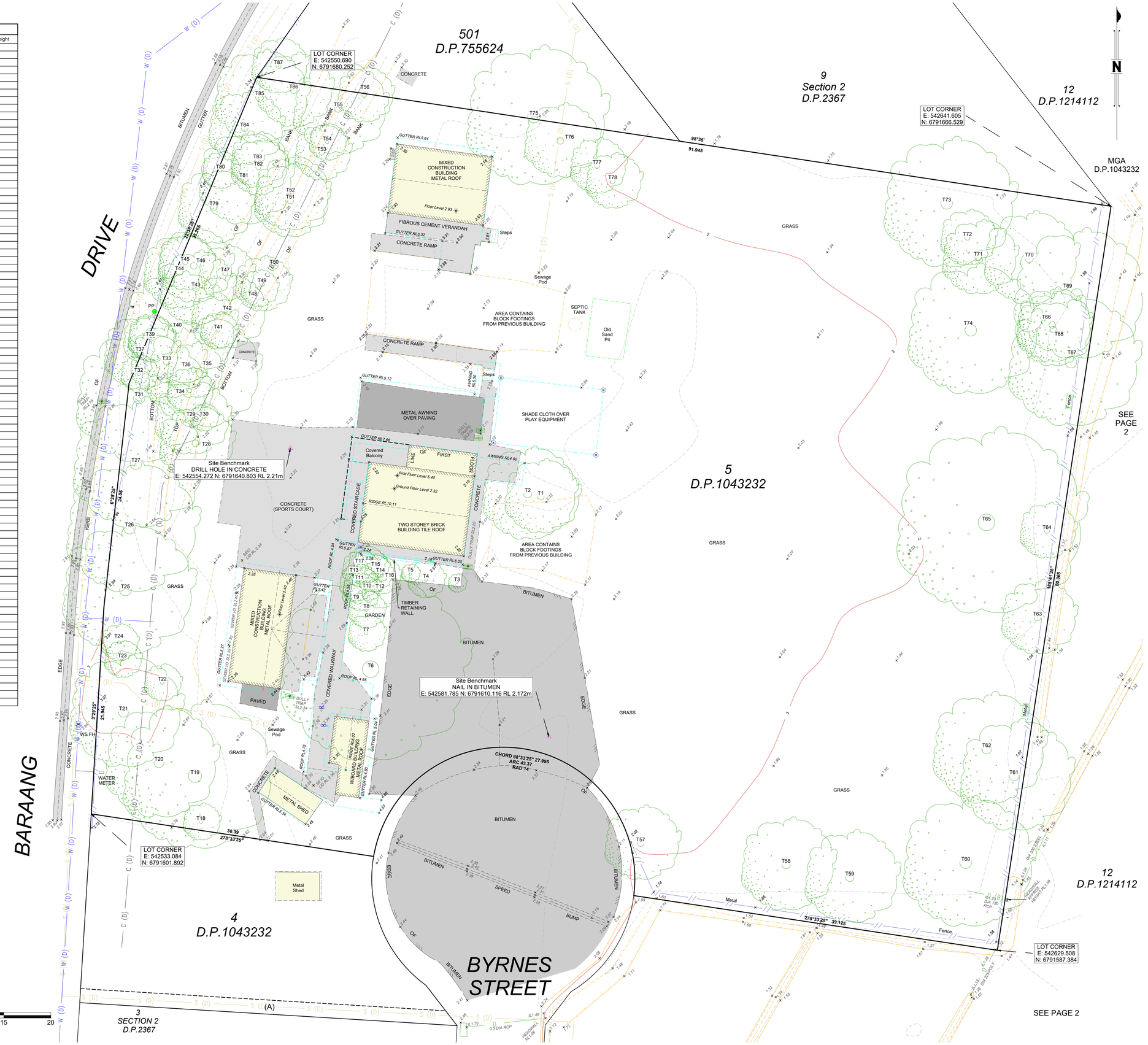
Title: SEDIMENT & EROSION CONTROL TYPICAL SECTIONS & DETAILS

Drawn	Designed	Original issue date
M.Pereira	N.Heazlewood	JUNE
Checked	Approved	Scale @A1
N.Heazlewood	A.Francis	NTS

Drawing number: BRO-CIV-PP-DWG-0910
Revision: 03

Appendix B: Site Survey

Tree Schedule				
Tree	Type	Diameter	Spread	Height
T1	WATTLE	0.4	8	10
T2	WATTLE	0.5	10	10
T3	EXOTIC	0.15	2	3
T4	PALM	0.3	4	4
T5	PALM	0.15	2	4
T6	NATIVE	1	20	18
T7	PALM	0.15	4	10
T8	PALM	0.15	4	10
T9	PALM	0.15	4	10
T10	PALM	0.15	4	10
T11	PALM	0.15	4	10
T12	PALM	0.15	4	10
T13	PALM	0.15	4	10
T14	PALM	0.15	4	10
T15	PALM	0.15	4	10
T16	PALM	0.15	4	10
T17	PALM	0.15	4	10
T18	EXOTIC	0.2	4	8
T19	MELALEUCA	0.6	16	20
T20	MELALEUCA	0.6	12	20
T21	NATIVE	1.7	12	20
T22	MELALEUCA	0.2	4	12
T23	NATIVE	0.25	4	18
T24	EXOTIC	0.2	4	10
T25	FIG	1.8	14	22
T26	FIG	1.5	14	22
T27	FIG	1.5	14	22
T28	NATIVE	0.4	8	20
T29	NATIVE	0.4	8	20
T30	EXOTIC	0.2	3	8
T31	FIG	1.4	14	22
T32	EXOTIC	0.3	4	8
T33	NATIVE	0.5	8	20
T34	NATIVE	0.1	5	14
T35	NATIVE	0.4	12	20
T36	NATIVE	0.15	6	16
T37	EXOTIC	0.15	8	12
T38	EXOTIC	0.1	5	10
T39	EXOTIC	0.15	5	10
T40	PINE	0.1	12	22
T41	EXOTIC	0.2	4	4
T42	NATIVE	0.3	8	20
T43	NATIVE	0.6	8	22
T44	NATIVE	0.3	8	20
T45	PALM	0.2	6	8
T46	NATIVE	0.3	8	12
T47	PALM	0.2	6	6
T48	NATIVE	0.2	4	16
T49	NATIVE	0.25	6	20
T50	EUCALYPTUS	0.25	0.8	10
T51	EUCALYPTUS	0.4	8	22
T52	NATIVE	0.15	8	18
T53	NATIVE	0.3	6	6
T54	NATIVE	0.15	4	6
T55	NATIVE	0.3	10	18
T56	NATIVE	0.1	6	10
T57	EXOTIC	0.6	8	8
T58	NATIVE	0.6	10	12
T59	NATIVE	0.6	10	12
T60	GUM	1	14	20
T61	GUM	0.5	12	16
T62	GUM	0.6	12	20
T63	GUM	0.3	8	8
T64	GUM	0.2	6	6
T65	FIG	2	20	22
T66	PINE	0.5	8	8
T67	GUM	1	14	22
T68	GUM	0.3	8	14
T69	GUM	0.6	14	22
T70	PINE	0.5	10	22
T71	PALM	0.5	8	14
T72	PALM	0.3	6	12
T73	PINE	1	14	24
T74	NATIVE	0.6	14	20
T75	FIG	2	15	20
T76	NATIVE	0.3	8	12
T77	PALM	0.3	6	10
T78	PALM	0.3	6	10
T79	NATIVE	0.5	8	12
T80	NATIVE	0.3	4	12
T81	MELALEUCA	0.5	10	18
T82	PALM	0.1	6	8
T83	PALM	0.1	6	8
T84	PALM	0.3	8	12
T85	NATIVE	0.5	10	10
T86	MELALEUCA	0.2	8	8
T87	PALM	0.2	6	10



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LEGEND:

Road
Kerb Back
Kerb Invert
Edge of Bitumen
Edge of Gravel
Road Crown
Traffic Park Meter
Traffic Light
Traffic Pit
Traffic Sign
Traffic Post Box

Structures
Building Line
Roof Ridgeline
Fence Line
Gate
Hand Rail
Cattle Grid
Bollard

Sewer
Sewer Line
Valve
Inspection Opening
Manhole

Electrical
Electricity Line
Overhead Line
Pits/Manholes
Pole
Street Light
Light In-Ground

Water
Water Line
Meter
Valve
Fire Hydrant
Tap
Sprinkler

Fuel
Fuel Line
Fitting

Terrain
Driveway
Footpath
Slab Edge
Retaining Wall Base
Retaining Wall Top
Change of Grade
Top of Bank
Toe of Bank
Waterline
Garden Edge
Creek Toe of Bank
Creek Top of Bank
Creek Invert
Creek Waterline
Tree
Tree Canopy
Control Point/PSM

Drainage
Drainage line
Open Drain
Manhole
Field Inlet
Downpipe

Communications
Communication Line
Overhead Line
Pits/Manholes
Pillar

Gas
Gas Line
Valve
Marker

General
Pothole

Subsurface Utility - QL
* QL-A (H±50mm,V±50mm)
* QL-B (H±300mm,V±500mm)
* QL-C (H±300mm,2D)
* QL-D (Exist Record)

NOTES:

1. Drawn to scale on an A1 sheet.
2. Contour Interval... 0.25m
3. All levels are in metres on the Australian Height Datum referred to PM43027 - RL 2.099 AHD situated in CNR Byrnes St & Baraang Dr.
4. All Boundaries are vide title and subject to confirmation by a redefinition survey.
5. The Location of Underground services are in accordance with AS5488:2019, the Australian Standard for classification of Subsurface Utility Information (SUI). The exact nature and location of these services should be confirmed prior to construction.
   Electrical Services not shown (very limited information on DYBD information).
6. Area vide Title : 7545m2
7. Field Survey Completed on 21.06.2023.
8. This Detail Survey is not a 'Survey' as defined by the Surveying Act 2002. If any construction is planned it would be advisable to carry out further survey work to determine the boundary dimensions.
9. Tree species should be verified by a suitably qualified professional. Tree spreads are diagrammatic only and may not be symmetrical. Heights and spreads are approximate only.

(A) Easement to drain sewage 1.5 wide by D.P.1186145.

Revision D:
Water Meter and additional detail of drainage swales.

Level datum: AHD Derived (PM43027)
Horiz datum: MGA Derived PLAN (D.P.1043232)
Coord Origin: PM (SCIMS) (PM85190)
GDA System: GDA2020 Coordinate System: Plane 1:1
Meridian: D.P.1043232

Title:

PARTIAL DETAIL SURVEY

Lot 5 D.P.1043232

BROADWATER PUBLIC SCHOOL

BYRNES ST, BROADWATER

Client:	**ADCO Constructions Pty Ltd**		
Locality:	Broadwater		
Local Gov:	Richmond Valley Council		
Surveyed By:	PB	Approved:	MTH
Date Created:	14/07/23	Scale:	1:200
File Ref:			230630
Plan No:	**230630_002_DET**	Rev:	**D**

A1

MGA
D.P.1043232

Tree Schedule				
Tree	Type	Diameter	Spread	Height
T1	WATTLE	0.4	8	10
T2	WATTLE	0.5	10	10
T3	EXOTIC	0.15	2	3
T4	PALM	0.3	4	4
T5	PALM	0.15	2	4
T6	NATIVE	1	20	18
T7	PALM	0.15	4	10
T8	PALM	0.15	4	10
T9	PALM	0.15	4	10
T10	PALM	0.15	4	10
T11	PALM	0.15	4	10
T12	PALM	0.15	4	10
T13	PALM	0.15	4	10
T14	PALM	0.15	4	10
T15	PALM	0.15	4	10
T16	PALM	0.15	4	10
T17	PALM	0.15	4	10
T18	EXOTIC	0.2	4	8
T19	MELALEUCA	0.6	16	20
T20	MELALEUCA	0.6	12	20
T21	NATIVE	1.7	12	20
T22	MELALEUCA	0.2	4	12
T23	NATIVE	0.25	4	18
T24	EXOTIC	0.2	4	10
T25	FIG	1.8	14	22
T26	FIG	1.5	14	22
T27	FIG	1.5	14	22
T28	NATIVE	0.4	8	20
T29	NATIVE	0.4	8	20
T30	EXOTIC	0.2	3	8
T31	FIG	1.4	14	22
T32	EXOTIC	0.3	4	8
T33	NATIVE	0.5	8	20
T34	NATIVE	0.1	5	14
T35	NATIVE	0.4	12	20
T36	NATIVE	0.15	6	16
T37	EXOTIC	0.15	8	12
T38	EXOTIC	0.1	5	10
T39	EXOTIC	0.15	5	10
T40	PINE	0.1	12	22
T41	EXOTIC	0.2	4	4
T42	NATIVE	0.3	8	20
T43	NATIVE	0.6	8	22
T44	NATIVE	0.3	8	20
T45	PALM	0.2	6	8
T46	NATIVE	0.3	8	12
T47	PALM	0.2	6	6
T48	NATIVE	0.2	4	16
T49	NATIVE	0.25	6	20
T50	EUCALYPTUS	0.25	0.8	10
T51	EUCALYPTUS	0.4	8	22
T52	NATIVE	0.15	8	18
T53	NATIVE	0.3	6	6
T54	NATIVE	0.15	4	6
T55	NATIVE	0.3	10	18
T56	NATIVE	0.1	6	10
T57	EXOTIC	0.6	8	8
T58	NATIVE	0.6	10	12
T59	NATIVE	0.6	10	12
T60	GUM	1	14	20
T61	GUM	0.5	12	16
T62	GUM	0.6	12	20
T63	GUM	0.3	8	8
T64	GUM	0.2	6	6
T65	FIG	2	20	22
T66	PINE	0.5	8	8
T67	GUM	1	14	22
T68	GUM	0.3	8	14
T69	GUM	0.6	14	22
T70	PINE	0.5	10	22
T71	PALM	0.5	8	14
T72	PALM	0.3	6	12
T73	PINE	1	14	24
T74	NATIVE	0.6	14	20
T75	FIG	2	15	20
T76	NATIVE	0.3	8	12
T77	PALM	0.3	6	10
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Scale 1:200
0m 5 10 15 20

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LEGEND:

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- Kerb Back
- Kerb Invert
- Edge of Bitumen
- Edge of Gravel
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- Traffic Park Meter
- Traffic Light
- Traffic Pit
- Traffic Sign
- Traffic Post Box

Structures
- Building Line
- Roof Ridgeline
- Fence Line
- Gate
- Hand Rail
- Cattle Grid
- Bollard

Sewer
- Sewer Line
- Valve
- Inspection Opening
- Manhole

Electrical
- Electricity Line
- Overhead Line
- Pits/Manholes
- Pole
- Street Light
- Light In-Ground

Water
- Water Line
- Meter
- Valve
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- Tap
- Sprinkler

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- Fitting

Terrain
- Driveway
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- Retaining Wall Top
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- Overhead Line
- Pits/Manholes
- Pillar

Gas
- Gas Line
- Valve
- Marker

General
- Pothole

Subsurface Utility - QL
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Horiz datum: MGA Derived PLAN (D.P.1043232)
Coord Origin: PM (SCIMS) (PM85190)
GDA System: GDA2020 Coordinate System: Plane 1:1
Meridian: D.P.1043232

Title:

PARTIAL DETAIL SURVEY

Lot 5 D.P.1043232

BROADWATER PUBLIC SCHOOL

BYRNES ST, BROADWATER

Client:	**ADCO Constructions Pty Ltd**		
Locality:	Broadwater		
Local Gov:	Richmond Valley Council		
Surveyed By:	PB	Approved:	MTH
Date Created:	14/07/23	Scale:	1:200
File Ref:			230630
Plan No:	**230630_002_DET**	Rev:	**D**

A1

Appendix C: Architectural concept drawings – Site plan

LEGEND

- EXISTING BUILDING AND PAVING TO BE RETANED
- PROPOSED BUILDING
- PROPOSED PAVING REFERR TO LANDSCAPE ARCHITECT'S & CIVIL ENG DRAWINGS
- EXISTING TREES TO BE RETAINED REFER TO LANDSCAPE ARCHITECT'S DRAWINGS
- PROPOSED NEW TREES SHOWN IN BLUE OUTLINE REFER TO LANDSCAPE ARCHITECT'S DRAWINGS
- EXISTING NEIGHBOURING TREES INDICATIVE ONLY

1.a	RELOCATED RAIN WATER TANK
1.b	RAIN WATER REUSE FILTRATION AND PUMPING SYSTEM
2	FIRE TANKS
3	HYDRANT PUMP HOUSE
4	PROPOSED HYDRANT BOOSTER ASSEMBLY AND EXTERNAL FIRE HYDRANT
5	PROPOSED YARNING CIRCLE, REFER TO LANDSCAPE ARCHITECT'S DRAWINGS
6	PROPOSED SANDED AREA AND PLAY EQUIPMENT, REFER TO LANDSCAPE ARCHITEC'S DRAWINGS
7	NEW LEVEL TURFED SPORTS FIELD, REFER TO LANDSCAPE ARCHITECT'S DRAWINGS
8	RELOCATED HERITAGE BELL
9	PROPOSED GROWING GARDENS, REFER TO LANDSCAPE ARCHITECT'S DRAWINGS
10	RE-INSTATED HALF BASKETBALL COURT
11	RE-INSTATED HALF NETBALL COURT
12	EXISTING GA SHED
13	DUAL FIRE HYDRANT
14	SEATING SPACE, REFER TP LANDSCAPE ARCHITECT'S DRAWINGS
15	IN GROUND SEWER PUMP STATION AS PER HYDRAULIC DRAWINGS
16	WASTE MANAGEMENT AREA

GFA CALCULATION

NAME	AREA
UNDERCROFT LEVEL	
AMENITIES / STORE BLOCK	81.03 m²
	81.03 m²
RAISED LEVEL	
GLS BLOCK GFA	405.00 m²
ADMIN / LIBRARY BLOCK GFA	270.00 m²
	675.00 m²
	756.03 m²

AMENDMENTS

REV	BY	DATE	DESCRIPTION
A	SG	14/07/2023	PRELIMINARY ISSUE
	SG	14/07/2023	ITEMS UNDER COORDINATION
B	SG	01/08/2023	ISSUE FOR COORDINATION
C	ML	10/09/2023	90% REF ISSUE

ADCO

MODULAR DESIGN & CONSTRUCTION Modscape 0393 166 020	PLANNING EPM 0294 528 300
STRUCTURAL & CIVIL H&H Engineers 0423 222 338	ACCESSIBILITY AND BCA MBC Group 0450 704 954
SERVICES JHA Consulting 0404 552 673	LANDSCAPE ARCHITECT Taylor Brammer 0418 264 111
FIRE ENGINEERING AND ESD E-Lab 0447 343 458	BUSHFIRE Blacksash Bushfire Consulting 0419 203 853

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PEDAVOLI ARCHITECTS

BROADWATER PUBLIC SCHOOL

9 BYRNES STREET BROADWATER NSW 2472

DRAWING NAME

PROPOSED SITE PLAN

TRUE NORTH

0 2500 5000 7500 10000 12500 25000

SCALE 1 : 250 @ A1

AUGUST 2023

DRAWING NUMBER

PROJECT	DISCIPLINE	PHASE	TYPE	SERIES NUMBER	REVISION
BRO	ARC	PP	DWG	010	C

Appendix D: Acor letter dated 14th March 2023 summarising flooding information

CONSULTANTS

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ENGINEERS

MANAGERS

INFRASTRUCTURE
PLANNERS

DEVELOPMENT
CONSULTANTS

Our Reference: BR220288
Your Reference: SINSW03401/22

14 March 2023

School Infrastructure NSW
Level 8, 259 George Street
Sydney NSW 2000
Australia

Attention: Beau Travers

Dear Beau

Re: Northern NSW Flood Recovery – Nominated floor levels for schools

ACOR has prepared the *Flood Emergency Response Plans* for six Northern NSW schools, being Blakebrook Public School, Condong Public School, Tumbulgum Public School, Broadwater Public School, Wardell Public School and Empire Vale Public School.

Based on flood likelihood, flood characteristics, flood warning time and effective warning time, and evacuation routes, Blakebrook Public School, Condong Public School, Tumbulgum Public School may be more suitable for a 'shelter in place' strategy rather than an evacuation strategy for flood emergency response.

Broadwater Public School, Wardell Public School and Empire Vale Public School have an effective warning time that is considered to support an evacuation strategy for flood emergency response.

The following table summarises the flood and floor levels, and flood warning times at each school.

Table 1 Summary of flood and floor levels, and flood warning times at each school

School	Minimum Habitable Floor Level (MHFL) (m AHD) required by Local Council	Design Flood Event (Local Council)	MHFL (m AHD) inc. Climate Change (Year 2100)	February/March 2022 peak flood level (m AHD)	Probable Maximum Flood (PMF) level (m AHD)	Usable undercroft floor level (m AHD)	Flood warning time	[1]Effective warning time	Minimum floor Level (m AHD) to be considered
Blakebrook Public School	Approx. 17.0 (if 1.0 m freeboard is applied as stated in advice by BMT WBM (26 July 2013). Approx. 17.5 (to allow for 1 in 500 AEP)	1% AEP **current climate** event	~17.5	~ 17.4	~ 18.5 – 19.2	19.2	< 6 hours (flash flooding)	Nominal (0 hours)	19.5 (0.3 m above PMF level) Subject to change upon receipt of potential new information.
Condong Public School	4.9	1% AEP **current climate** event	5.1	~ 4.9	9.2	7.3	6 hours (BOM minimum target warning lead time)	Nominal (0 hours)	9.5 (0.3 m above PMF level)
Tumbulgum Public School	4.4	1% AEP **current climate** event	4.7	~ 4.65	8.9	5.3	6 hours (BOM minimum target warning lead time)	Nominal (0 hours)	9.2 (0.3 m above PMF level)

School	Minimum Habitable Floor Level (MHFL) (m AHD) required by Local Council	Design Flood Event (Local Council)	MHFL (m AHD) inc. Climate Change (Year 2100)	February/March 2022 peak flood level (m AHD)	Probable Maximum Flood (PMF) level (m AHD)	Usable undercroft floor level (m AHD)	Flood warning time	[1]Effective warning time	Minimum floor Level (m AHD) to be considered
Broadwater Public School	4.9	1% AEP Climate Change Year 2100 event	4.9	~ 4.7	6.0	5.5	12 hours (BOM minimum target warning lead time)	6 hours	6.3 (0.3 m above PMF level) This level is nominated for consistency with Wardell Public School and Empire Vale Public School (floor level above PMF) despite a 'shelter in place' strategy not being nominated.
Wardell Public School	3.7	Council correspondence states the 1% AEP Climate Change Year 2050 event is the Design Flood Event.	4.1	3.6	5.0	5.9	12 hours (BOM minimum target warning lead time)	6 hours	5.3 (0.3 m above PMF level)
Empire Vale Public School	3.4	Council correspondence states the 1% AEP Climate Change Year 2050 event is the Design Flood Event.	3.7	3.15	4.4	5.1	12 hours (BOM minimum target warning lead time)	6 hours	4.7 (0.3 m above PMF level)

School	Minimum Habitable Floor Level (MHFL) (m AHD) required by Local Council	Design Flood Event (Local Council)	MHFL (m AHD) inc. Climate Change (Year 2100)	February/March 2022 peak flood level (m AHD)	Probable Maximum Flood (PMF) level (m AHD)	Usable undercroft floor level (m AHD)	Flood warning time	[1]Effective warning time	Minimum floor Level (m AHD) to be considered
Cabbage Tree Public School	4.1	Council correspondence states the 1% AEP Climate Change Year 2050 event is the Design Flood Event.	4.4	4.43	5.2	[2]Not yet determined.	12 hours (BOM minimum target warning lead time)	6 hours	5.5 (0.3 m above PMF level) This level is nominated for consistency with Wardell Public School, Empire Vale Public School and Broadwater Public School (floor level above PMF) despite a 'shelter in place' strategy not being nominated.

[1]Flood warning time is reduced by 6 hours to obtain effective warning time for schools other than Blakebrook Public School. Source: Tweed Valley Floodplain Risk Management Study. Final. October 2014 (BMT WBM, 2014).
[2]Masterplanning not yet undertaken.

Yours faithfully,
ACOR Consultants (Qld)

Karl Umlauff
Senior Water Resources Engineer