

Civil Engineering Report

Loreto Normanhurst Concept Plan and Stage 1

Prepared for Allen Jack and Cottier / 23 April 2021

181202 CAAA, CMWE + 201435 CAAA

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1.0 Introduction

This report supports a State Significant Development Application (SSDA) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This application is SSD by way of Clause 8 and Schedule 1 under *State Environmental Planning Policy (State and Regional Development) 2011*, on the basis that the development is for the purpose of an existing school and has a Capital Investment Value of more than \$20 million.

Specifically, this application relates to a staged SSDA within the meaning of Section 4.12 of the EP&A Act, with this application being the Concept Proposal for a new site wide masterplan for the existing Loreto Normanhurst School at 91 – 93 Pennant Hills Road, Normanhurst. In addition, consent is also sought for the Stage 1 detailed design works for a new on campus student boarding facility, landscaping works, new through site link, new car parking, demolition works to the buildings between Mary Ward and existing dining room building, and associated works to make good existing.

This report has been prepared having regard to the Secretary's Environmental Assessment Requirements issued for the project by DPE, ref no SEAR 8996 issued on 12 January 2018 listed below.

- **16. Drainage**

Detail drainage associated with the proposal, including stormwater and drainage infrastructure.

- **17. Flooding**

Assess any flood risk on site (detailing the most recent flood studies for the project area) and consideration of any relevant provisions of the NSW Floodplain Development Manual (2005), including the potential effects of climate change, sea level rise and an increase in rainfall intensity.

1.1 Background

1.1.1 Need for a Campus Masterplan

Loreto Normanhurst is an independent, Catholic day and boarding school for girls from Years 5 to 12. The existing school campus was established in 1897 and has evolved in an organic and ad-hoc manner across a span of 120 years.

A new campus wide planning approach offers the opportunity to strategically review and plan for the campus' future in a sustainable and efficient manner such that the campus' unique aesthetic and ecological values are best preserved. The preparation of a campus wide masterplan is also consistent with the School's 'Loreto Normanhurst 2016 - 2020 Strategic Plan' which identified the need for a broader strategic plan to coordinate renewal and orderly development in a feasible and staged manner.

1.1.2 Early Learning Centre

A separate DA (D/1227/2018) has been approved by Hornsby Shire Council for an 80 place Early Learning Centre (ELC) building. The ELC building is consistent with the overall concept masterplan, and was prepared concurrently with the final preferred campus masterplan. However, to meet the School's operational timeframe requirements for the ELC, a separate application was seen to be best pathway to allow the building to be built, fitout and operational by 2021.

1.1.3 Previous Submission

This report has been updated to reflect changes that have been made to the detailed Stage 1 Development Approval scope of works following responses received on the previous unapproved submission.

1.2 Relevant Documents

The following documents have been reviewed in preparing this document:

- Hornsby Shire Council (HSC) Development Control Plan (DCP) 2013
- HSC Local Environment Plan (LEP) 2013
- HSC Development Design Specification 0074 – Stormwater Drainage July 2016
- HSC Sea Level Rise Maps
- Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom NSW)
- NSW Floodplain Development Manual
- Hornsby Floodplain Risk Management Study and Plan

2.0 The Site

Loreto Normanhurst is located within the suburb of Normanhurst on Sydney's Upper North Shore approximately 3km south of Hornsby and 25km north of Sydney CBD. The school is located in the local government area of Hornsby Shire Council, approximately 750m south of the Normanhurst Railway Station. The locational context of the site is illustrated at Figure 2.1.

The site comprises the existing campus grounds of the Loreto Normanhurst school at 91 – 93 Pennant Hills Road, Normanhurst. The northern part of the site accommodates much of the school's existing built form, while the rear extent consists of the school's sporting fields, and a portion of largely undeveloped land covered in remnant vegetation.

The campus itself is bound by Pennant Hills Road (to the north), Osborn Road (to the west) and Mount Pleasant Avenue (to the east). Detached dwellings on individual residential lots abut the southern boundary of the site. An aerial photograph of the site is provided at Figure 2.2 provides an aerial map of the site and its immediate surrounds.

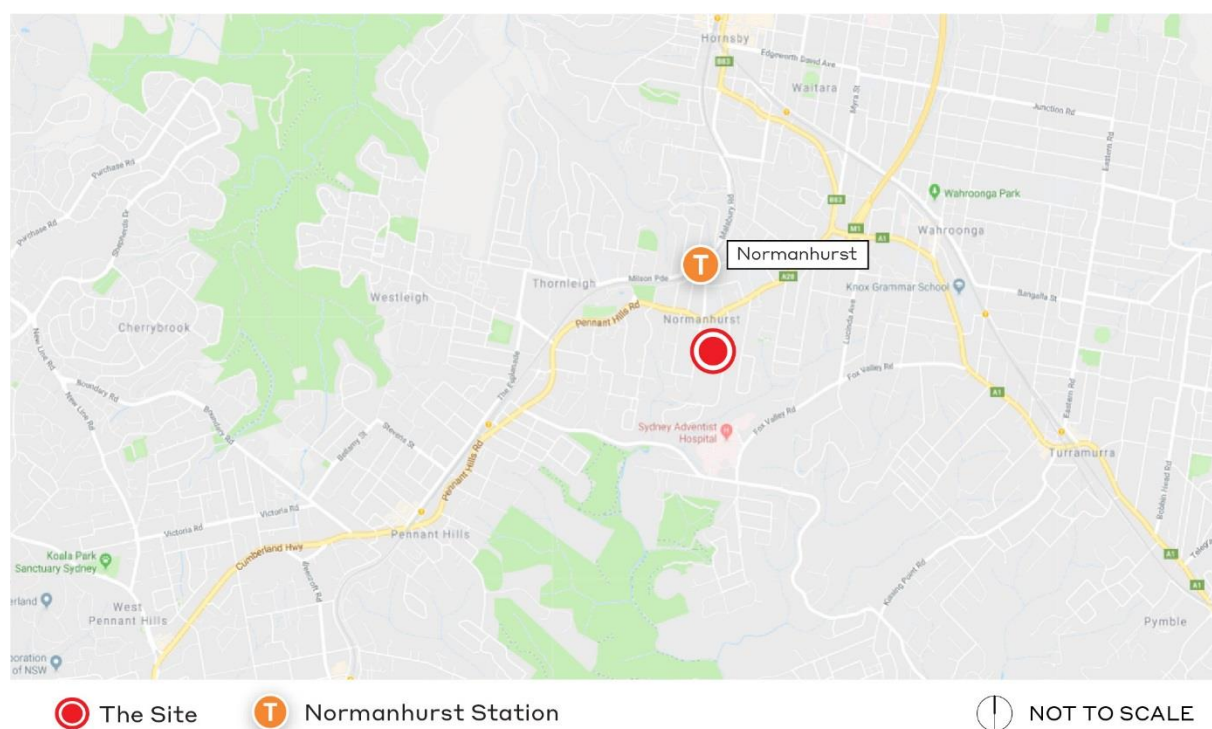


Figure 2.1: Loreto Normanhurst Campus Location Context Plan
Source: Ethos Urban



Figure 2.2: Aerial Map of the Loreto Normanhurst Campus
Source: AJ+C Architects

3.0 Overview of Proposed Development

This application sets out a new campus masterplan for the existing school campus that will guide and shape the development of the school campus for the next 30 years. This SSDA also includes detailed plans for the first stage of the concept proposal (Stage 1 works). Refer to the Environmental Impact Statement prepared by Ethos Urban for a detailed description of the proposed works.

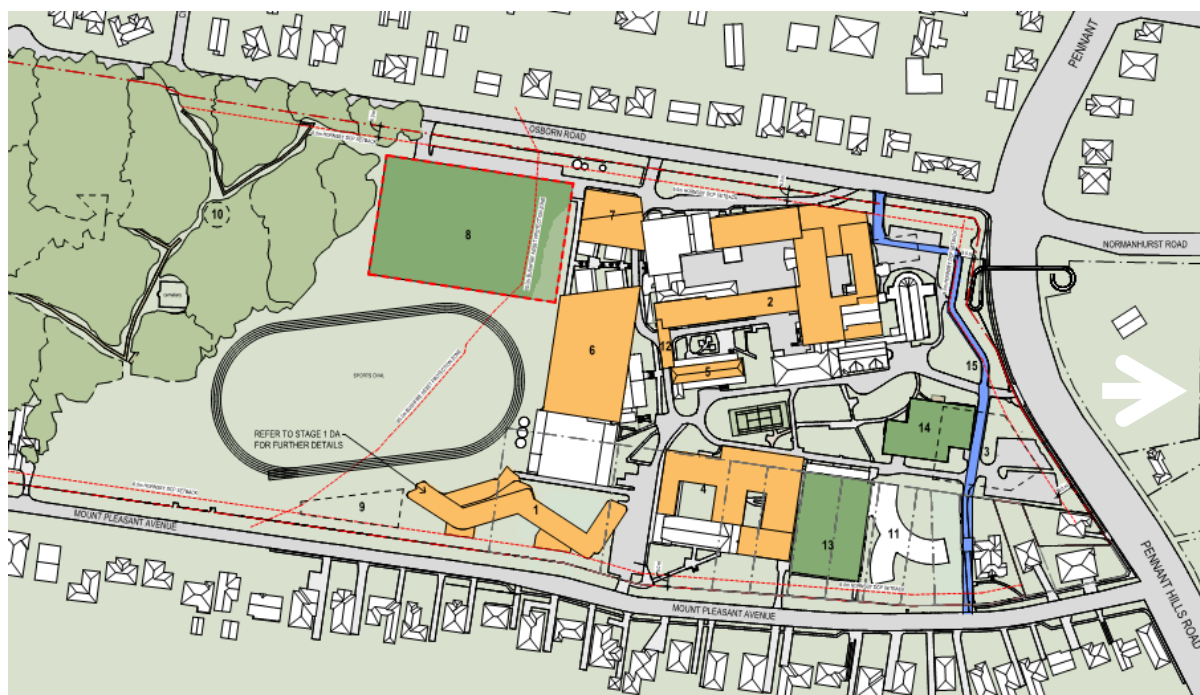


Table 3.1: Proposed Concept Building Envelope Site Plan
(Source: AJ+C Architects)

4.0 Concept Design

4.1 Stormwater Quantity

In general, all new roof stormwater will be collected in roof gutters and downpipes and conveyed to the in-ground pipe system. Surface stormwater will be conveyed through site grading and collected in surface inlet pits. If required this in-ground stormwater will be connected to water quality treatment measures and onsite stormwater detention (OSD).

In accordance with Hornsby Shire Council's Development Control Plan (DCP) on site detention will be provided where required under Council's Specifications for Stormwater Drainage. The Specifications for Stormwater Drainage state, *"stormwater detention is required on redevelopment sites within the shire where under capacity drainage systems exist. A redevelopment site is defined as a site which used to have or was originally zoned to have a lower density development than is proposed"*. We have not been advised of any capacity issues within the current stormwater system on Mount Pleasant Avenue and Osborn Road.

Where the concept developments propose a significant increase in impervious area such that the downstream stormwater network has insufficient capacity for the increased flows, OSD will be included to reduce the post-development peak flows up to and including the 1 in 20 year Average Recurrence Interval (ARI) to the maximum flow rate generated during a 1 in 5 year ARI storm event pre-development. Where the downstream stormwater network does not have capacity issues, stormwater outflows from the site entering Council's stormwater system will be maintained post development.

5.11 STORMWATER DETENTION

1. Installation of Stormwater Detention is required on redevelopment sites within the Shire where under capacity drainage systems exist. A redevelopment site is defined as a site which used to have or was originally zoned to have a lower density development than is proposed.

2. Council's policy on OSD is being reviewed. The current OSD requirements for developments are that the Q20 post development outflow from the site is restricted to the Q5 predevelopment flow.

Note: Council may require additional storage for OSD systems for all storms up to Q100 in areas known to be subject to flood inundation.

Figure 4.1: HSC OSD Requirements

Source: HSC Specifications for Stormwater Drainage 0074

4.2 Stormwater Quality

Hornsby Shire Council's DCP states, *"developments are required to achieve water quality targets for major redevelopment on sites greater than 2,000m² or other development that increases the impermeable area on a site by more than 2,000m²."*

Where sites do not increase the impermeable area by more than 2,000m², water quality treatment measures will not be proposed. Where they do increase impermeable area they will meet Hornsby Shire Council's stormwater quality targets as follows:

- 90% reduction in the post development mean annual load of total gross pollutants (GP).
- 80% reduction in the post development mean annual load of total suspended solids (TSS).
- 60% reduction in the post development mean annual load of total phosphorus (TP).
- 45% reduction in the post development mean annual load of total nitrogen (TN).

As the site is developed, water quality modelling will be conducted using the Model for Urban

Stormwater Improvement Conceptualisation (MUSIC) for relevant sites to determine that the stormwater treatment train has been designed in accordance with Council's water quality requirements.

It is likely that water quality treatment will include a combination of Water Sensitive Urban Design practices (such as grassed swales and rainwater re-use) and proprietary products (such as pit inserts and filter cartridge units).

Water Quality

i. In urban areas, the following development types should be designed to achieve the water quality targets in Table 1C.1.2(b);

- major redevelopment on sites greater than 2000m², and
- other development that increases the impermeable area on a site by more than 2000m².

Table 1C.1.2(b) Urban Stormwater Quality Targets

Pollutant Type	Performance Target Reduction Loads
Gross Pollutants	90% reduction in the post development mean annual load of total gross pollutants
Total Suspended Solids	80% reduction in the post development mean annual load of total suspended solids
Total Phosphorous	60% reduction in the post development mean annual load of total phosphorous
Total Nitrogen	45% reduction in the post development mean annual load of total nitrogen.

j. Medium and high density residential developments with a site area of between 1000m² and 2000m² should demonstrate that they achieve the water quality targets in Table 1C.1.2(b) above, or utilise one of the following deemed to comply solutions:

- 80% of the roof area of the development is to drain to a tank(s) that has a capacity of 3,000 litres per 100m² of roof area of the development. The tank(s) is to be connected to the communal water system, and to all dwellings for toilet flushing and laundry, or
- provide a bioretention system(s) which is at least 1.5% of the total impervious area and drains all of the impervious areas.

Figure 4.2: HSC Water Quality Requirements

Source: HSC DCP

4.2.1 Stormwater Quality During Construction

During the construction stage of the project, sediment and erosion control measures will be installed and maintained until construction is completed. The proposed sedimentation and erosion control measures will prevent sediment laden stormwater from flowing into adjoining properties, bushland, roadways or receiving water bodies. Stormwater controls onsite are detailed in an erosion and sediment control plan which is in accordance with relevant regulatory authority guidelines including Hornsby Shire Council's DCP, and Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book").

Erosion and sediment control plans will be prepared for each site as part of the schematic design process.

4.3 Flooding

In accordance with Hornsby Shire Council's DCP, the site is not subject to flood planning controls according the flood planning map within the LEP (refer to Figure 4.3 for the location of the site within the Flood Planning Map) and Council's DCP (Section 1C.3.2 Flooding).

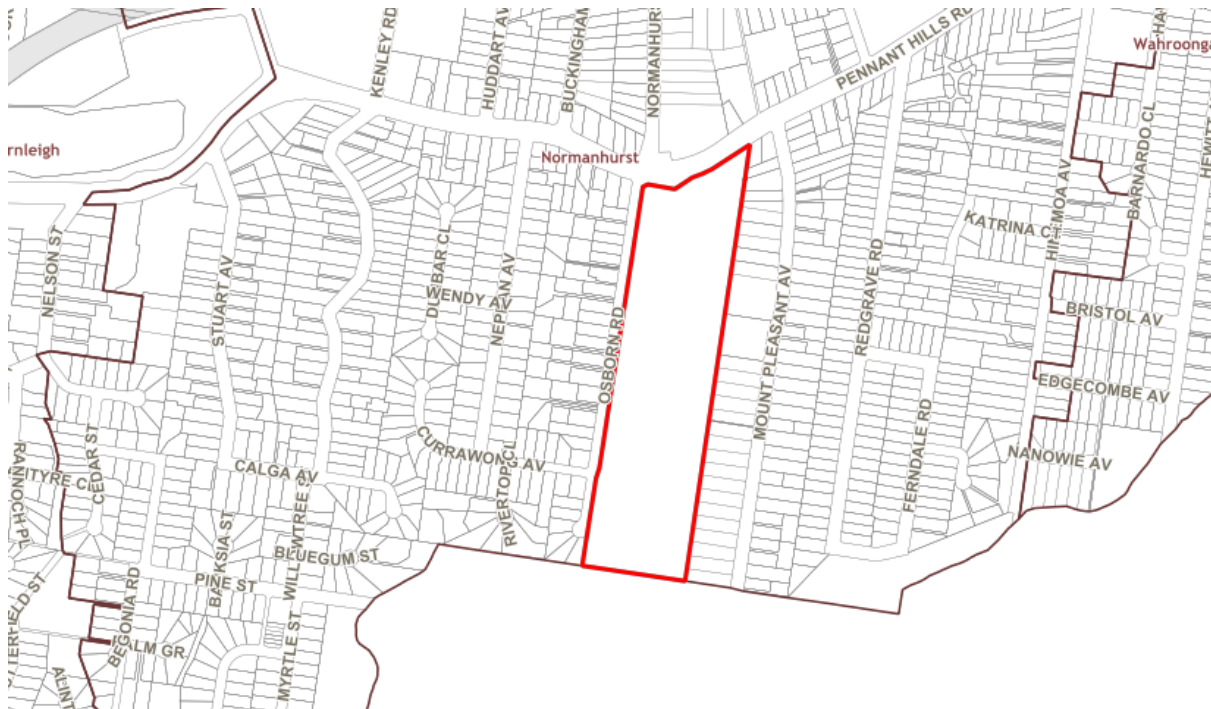


Figure 4.3: Flood Planning Map

Source: Hornsby Shire Council Local Environmental Plan 2013

A draft flood study was prepared by Cardno for Hornsby Shire Council in 2015 to assess localised overland flooding within the LGA. This study is available on the SES Website, with no reference made to it within Hornsby Shire Council's LEP or DCP. Within this study it was identified that there is a portion of the site in the south-west corner that is impacted by overland flow in the 100 year and Probable Maximum Flood (PMF) storm events.

The flood affectation for the 1 in 100 year ARI storm event is located in a densely vegetated area of the site which is approximately 230 metres from habitable buildings and at a reduced level of approximately 169 metres. The habitable flood level of the boarding house site is at a finished floor level of 185.30.

During the PMF storm event, some low hazard affectation is shown at the School oval at a reduced level of approximately 181.10m. Habitable buildings proposed in the concept plan are however located away from this extent or are proposed extensions or replacements of the existing buildings on site which are placed above the oval level at a reduced level of 184.00m.

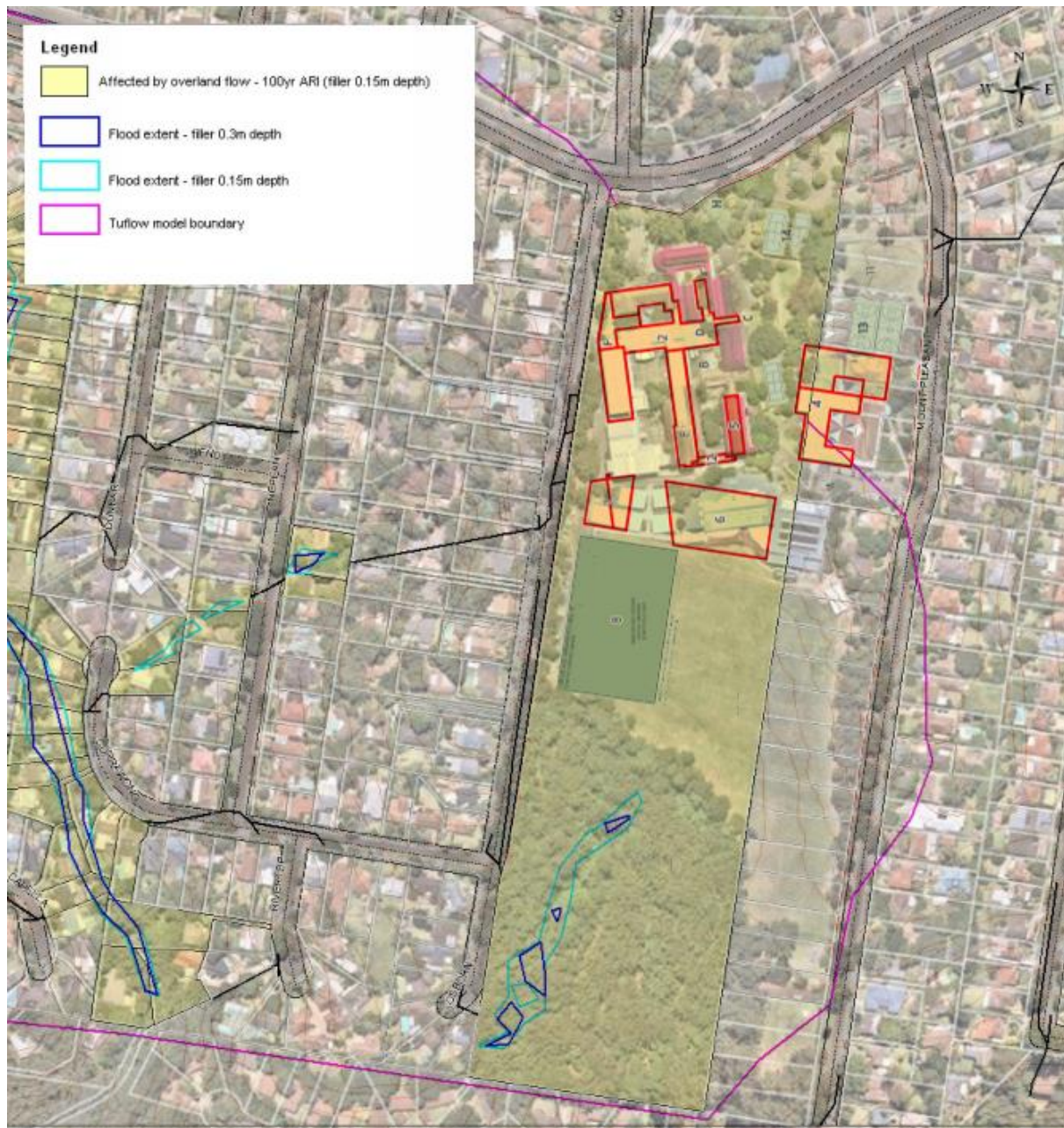


Figure 4.4: 1% AEP Flood Extent Overlaid on Concept Plan

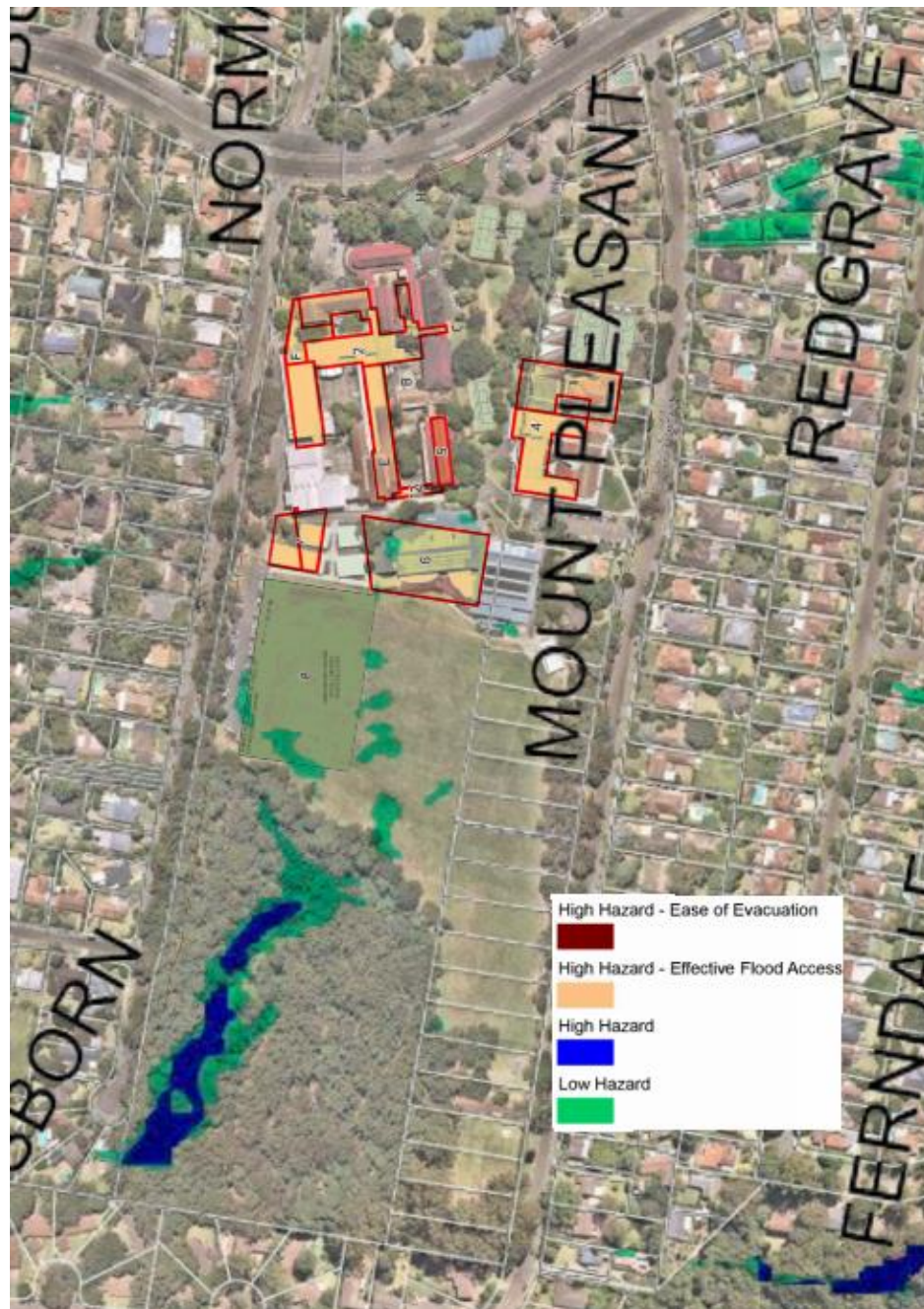


Figure 4.5: PMF Hazard Extent Overlaid on Concept Plan

Envelope 8 shows some flood affectation in the PMF storm event, however the intended use of this is as a below ground carpark with entry located from Osborn Road and sportsfield at ground level. As such it will not be a habitable building.

Envelope 6 shows minor flood affectation; however this is likely due to the coarse grid of the flood model as at this location the buildings at the school are raised above the level of the oval by some 1.5 metres as shown in Figure 4.6.



Figure 4.6: Existing Raised Building at Envelope 5

The buildings seeking approval as part of the detailed development application show no flood affectation in either the 1% or PMF storm events, and therefore no flood impact assessment is required at this stage.

4.3.1 Sea Level Rise

The CSIRO has undertaken coastal inundation modelling of those areas that would be affected by future sea level rise including the Hornsby Shire Council area. The Sea Level Rise Map that was prepared following the study indicates that the site will not be impacted due to its distance from the coastline.

4.4 Pavement

The proposed pavement areas will be designed to withstand proposed loads, suit structural demands, geotechnical conditions, and accessibility. It is expected that the majority of pavements proposed will be reinforced concrete.

5.0 Building A: Boarding House Development

5.1 Development Site

The Boarding House site and associated Garden Plaza are located within Hornsby Shire Council's (HSC) Local Government Area and covers an area of approximately 5,600 square metres.

The site comprises of 24 Mount Pleasant Avenue, and an existing small building, on grade carpark and roadway within the grounds of Loreto Normanhurst (91-93 Pennant Hills Road, Normanhurst). The site is bounded by Mount Pleasant Ave to the east; and school grounds to the north, west and south. Refer to Figure 5.1 for the location of the site.

The existing site generally falls towards the south into existing stormwater pits within the site and the school oval.



Figure 5.1: Site Location (Source: Nearmap)

5.2 Proposed Development

The proposed works include (refer to Figure 5.2) construction of the following:

- Car parking built into the hill;
- A multi-level, tiered boarding house (including kitchen, dining hall and communal areas);
- New driveways to Mount Pleasant Avenue; and
- Associated landscaping works.

The civil works involved include the installation of a new in-ground pit and pipe system, the provision of onsite stormwater detention (OSD) and stormwater quality measures. Refer to the civil engineering drawings in Appendix A for the concept civil engineering plans.

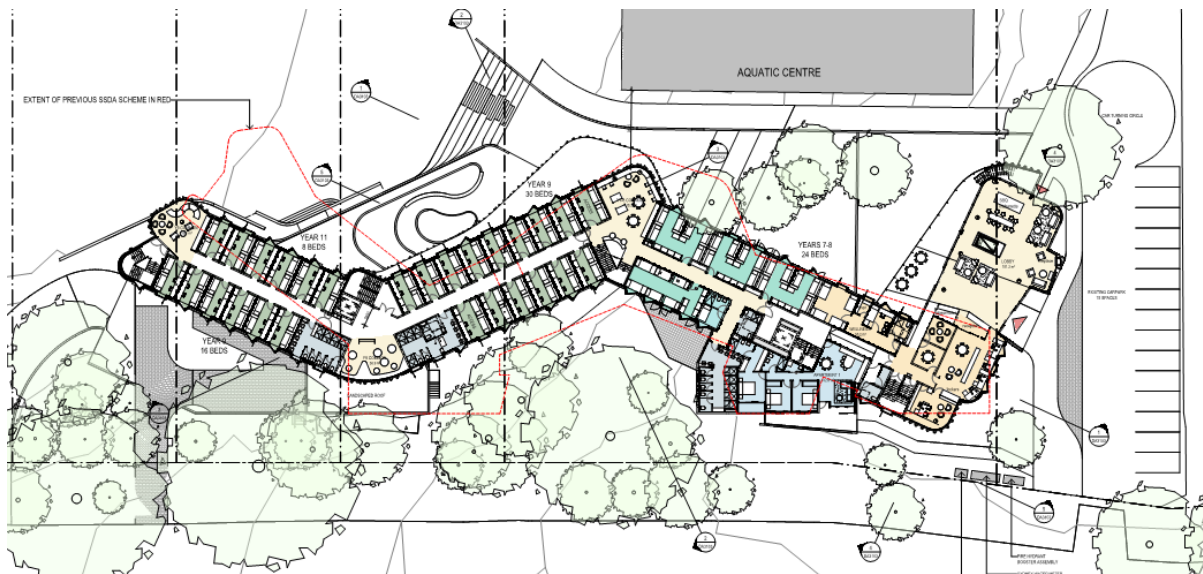


Figure 5.2 Architectural Level 3 Floor Plan
(Prepared by AJ+C)

5.3 Stormwater Quantity

5.3.1 Onsite Stormwater Detention (OSD)

Hornsby Shire Council requires OSD when significant redevelopment works are undertaken to ensure that the post-development peak flows up to and including the 1 in 20 year Average Recurrence Interval (ARI) do not exceed the maximum flow rate generated during a 1 in 5 year ARI storm event pre-development.

The restricted flow from the OSD system is to be conveyed by the proposed inground drainage system and connected to the existing stormwater system within the School. The total OSD volume is equal to 115 m³ with an orifice diameter of 150mm. The OSD storage has been sized to cater for the minor storm event with an allowance for some 1,200m² of potential bypass given the constraints of the site and the existing stormwater network. Its capacity has been modelled and analysed in DRAINS modelling software to ensure the proposed OSD system complies with Council's stormwater related requirements. A comparison of the pre and post development flows has been shown in Table 5.1. Note that the methodology for calculating stormwater flows has been based on the methods detailed in Australian Rainfall and Runoff 2016.

Table 5.1: Comparison of Pre and Post Development Flows

Storm Event (ARI)	Pre Development Flow	Post Development Flow (m ³ /s)	Post Development Flow with OSD including bypass (m ³ /s)
1 in 5	0.116	0.194	0.087
1 in 20	0.193	0.267	0.114
1 in 100	0.247	0.353	0.256

5.4 Flooding

As discussed in Section 4.3, the site is not identified as being flood affected according to flood studies conducted by Hornsby Shire Council. The site is also not identified as being impacted by sea level rise.

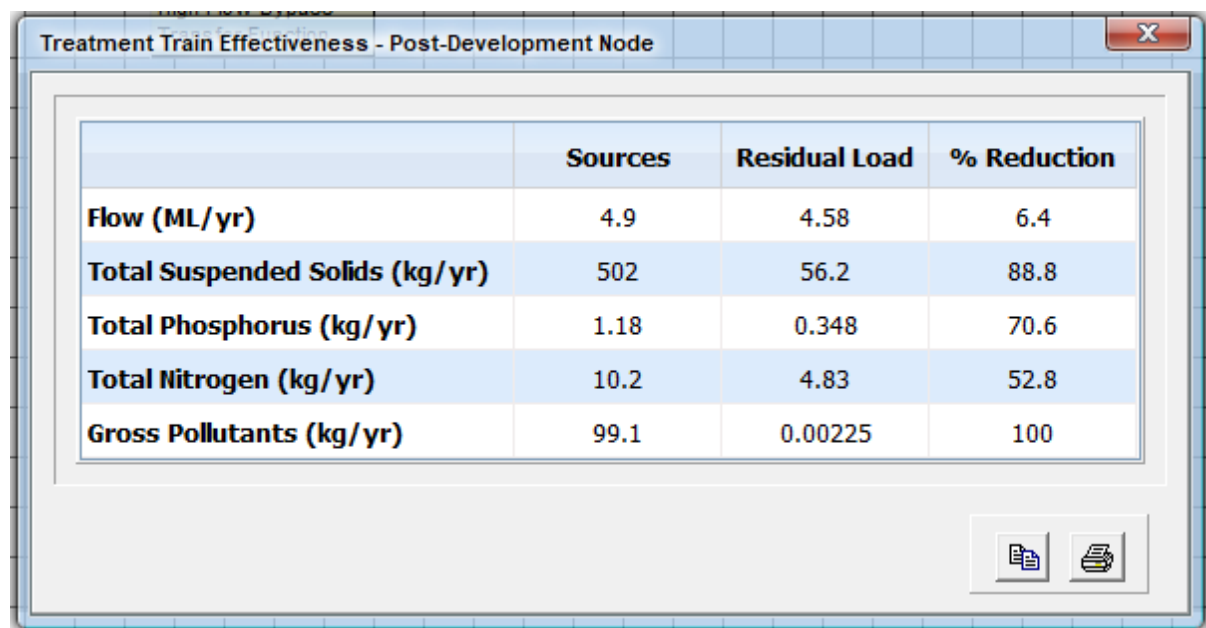
5.5 Stormwater Quality

Hornsby Shire Council's Development Control Plan requires the following stormwater quality targets to be met:

- 90% reduction in the post development mean annual load of total gross pollutants.
- 80% reduction in the post development mean annual load of total suspended solids.
- 60% reduction in the post development mean annual load of total phosphorus.
- 45% reduction in the post development mean annual load of total nitrogen.

Stormwater quality measures were modelled using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). The treatment train proposed for the site consists of OceanProtect's OceanGuards in multiple grated surface inlet pits, Stormfilter cartridges, a vegetated swale within the landscaped area to the east and a 100kL rainwater tank for rainwater capture and re-use. Stormwater bypassing the treatment system has been taken into account in the calculations. Refer to Appendix A for the location of these stormwater quality control measures.

Pollution removal rates are shown in Figure 5.3 and demonstrate compliance with the pollution removal targets within Hornsby Shire Council's Development Control Plan.



The screenshot shows a software window titled "Treatment Train Effectiveness - Post-Development Node". Inside the window is a table with four columns: "Sources", "Residual Load", and "% Reduction". The table lists five rows of data: Flow (ML/yr), Total Suspended Solids (kg/yr), Total Phosphorus (kg/yr), Total Nitrogen (kg/yr), and Gross Pollutants (kg/yr). The values for each row are: Flow (4.9, 4.58, 6.4), Total Suspended Solids (502, 56.2, 88.8), Total Phosphorus (1.18, 0.348, 70.6), Total Nitrogen (10.2, 4.83, 52.8), and Gross Pollutants (99.1, 0.00225, 100). There are also icons for printing and saving at the bottom right of the window.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	4.9	4.58	6.4
Total Suspended Solids (kg/yr)	502	56.2	88.8
Total Phosphorus (kg/yr)	1.18	0.348	70.6
Total Nitrogen (kg/yr)	10.2	4.83	52.8
Gross Pollutants (kg/yr)	99.1	0.00225	100

Figure 5.3: MUSIC Modelling Results

5.5.1 Rainwater Reuse

A 100kL rainwater tank is proposed to provide an alternative source for non-potable uses for the proposed development. In general, all roof water will be collected in roof gutters and downpipes and conveyed to the rainwater tank, the overflow from the rainwater tank will be collected by the OSD tank.

Refer to Appendix A for indicative rainwater tank size and location, further detailing is to be undertaken in later stage by the hydraulic engineer.

5.5.2 Stormwater Quality During Construction

During the construction stage of the project, sediment and erosion control measures will be installed and maintained until construction is completed. The proposed sedimentation and erosion control measures will prevent sediment laden stormwater from flowing into adjoining properties, bushland, roadways or receiving water bodies. Stormwater controls onsite are detailed in an erosion and sediment control plan which is in accordance with relevant regulatory authority guidelines including Hornsby Shire Council's DCP and Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book"). Refer to the attached civil engineering plans in Appendix A for the proposed concept sediment and erosion control plan.

5.6 Earthworks

The building is located on a steep gradient change with existing levels ranging from 191.40m at the northern end of the site to 181.20m at the southern end of the site. The building consists of a number of half levels to manage this height change, with significant cut and fill required on site.

5.7 Summary

The Loreto Normanhurst Boarding House Development includes collection of stormwater onsite using a pit and pipe stormwater system, with flowrates controlled using an in-ground OSD. The total proposed onsite detention volume is equal to 115 m³. Captured stormwater will be treated using water quality measures including a 100kL rainwater tank, vegetated swale, OceanProtect's OceanGuard and Stormfilter cartridges (or equivalent). An erosion and sediment control plan has been prepared for the site detailing the management of stormwater during construction.

6.0 Building B: Mary Ward Wing

6.1 Development Site

The Mary Ward Wing is located within Hornsby Shire Council's (HSC) Local Government Area and covers an area of approximately 1,500 square metres.

The site comprises of an existing loading dock and the existing Mary Ward Wing within the grounds of Loreto Normanhurst (91-93 Pennant Hills Road, Normanhurst). The site is bounded by school grounds to the north, east, west and south. Refer to Figure 6.1 for the location of the site.

The existing site generally falls towards the south into existing stormwater pits within the site and the school oval.



Figure 6.1: Site Location

6.2 Proposed Development

The Mary Ward Wing includes reconfiguration and some associated landscaping works to replace an existing loading dock with a new courtyard. The Boarding House and Garden Plaza works are to the east of the Mary Ward Wing development.

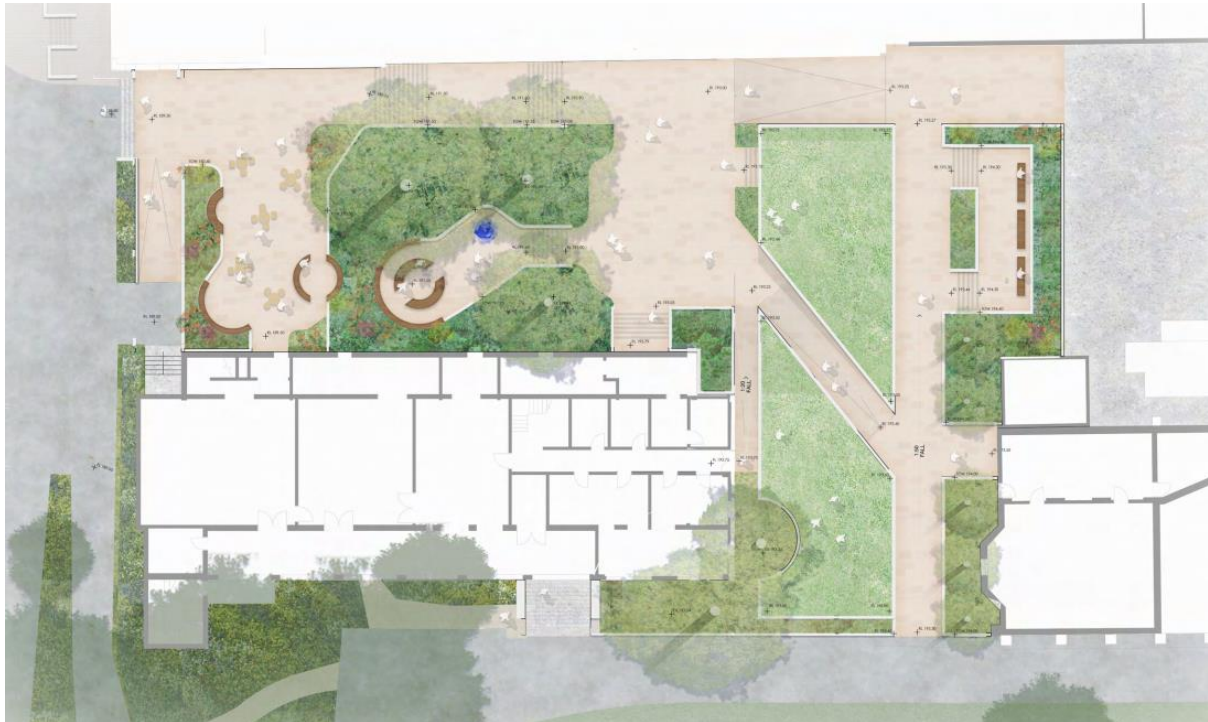


Figure 6.2: Mary Ward Courtyard

Source: Landscape Architectural Drawings prepared by Oculus

6.3 Stormwater Quantity

The total site area is equal to 1,494 m² and currently consists of 72% impervious area due to the existing loading dock. As the proposed development intends to reduce hardstand and introduce over 200 m² of additional landscaped areas, the site impervious area will decrease to 56% of the total area. Pre and post catchment plans are included within Appendix B.

As a result of the increased pervious area, onsite stormwater detention is not proposed as site run off will be reduced by the development (refer to Table 6.1). We have been advised by Council that this is acceptable approach.

Table 6.1: Pre and Post Development Flowrates from DRAINS

Storm Event (ARI)	Pre Development Flow (m ³ /s)	Post Development Flow (m ³ /s)
1 in 5 Year	0.042	0.033
1 in 20 Year	0.058	0.052
1 in 100 Year	0.076	0.071

Stormwater onsite will discharge through the existing in-ground pit and pipe system within the school grounds.

6.4 Flooding

As discussed in Section 4.3, the site is not identified as being flood affected according to flood studies conducted by Hornsby Shire Council. The site is also not identified as being impacted by sea level rise.

6.5 Stormwater Quality

As discussed in Section 6.3, the development will increase pervious area at the site and reduce the amount of hardstand. This is in line with Council's approach to Water Sensitive Urban Design. It has been advised by Council that as the pervious area is increasing and less pollutants are expected; no additional water quality treatment measures will be required.

6.5.1 Stormwater Quality During Construction

During the construction stage of the project, sediment and erosion control measures will be installed and maintained until construction is completed. The proposed sedimentation and erosion control measures will prevent sediment laden stormwater from flowing into adjoining properties, bushland, roadways or receiving water bodies. Stormwater controls onsite are detailed in an erosion and sediment control plan which is in accordance with relevant regulatory authority guidelines including Hornsby Shire Council's DCP and Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book"). Refer to the attached civil engineering plans in Appendix B for the proposed concept sediment and erosion control plan.

6.6 Earthworks

As the works are largely landscaping, only minor cut and fill is required, with maximum level changes of up to 1.5m to construct the works.

6.7 Summary

The Loreto Normanhurst Mary Ward Development includes collection of stormwater onsite using a pit and pipe stormwater system. No additional onsite detention or permanent water quality measures have been proposed as the development will increase pervious area within the site by developing an existing loading dock into a landscaped courtyard. An erosion and sediment control plan has been prepared for the site detailing the management of stormwater during construction.

7.0 P1A, P3A and P4A Car Parks and Through Site Link

7.1 Development Site

To increase on site parking and provide additional pick up and drop off facilities, a number of proposed developments are located across the site as follows (refer to Figure 7.1):

- The through site link is located at the north portion of the site and provides access from Osborn Road to Mount Pleasant Avenue.
- P1A car park is located at the existing tennis courts in the north-east of the site and will be accessed from the through site link.
- P3A car park is in the south-west of the site and is accessed by Osborn Road.
- P4A car park is in the east of the site and is accessed by Mount Pleasant Avenue.



Figure 7.1: Site Location

7.2 Proposed Development

The proposed works include (refer to Figure 7.2) construction of the following:

- A roadway connection from Osborn Road to Mount Pleasant Avenue inclusive of a pick up and drop off bay and accessible pedestrian connections.
- A partial basement car park with tennis court structure above accessed from the roadway connection.
- Stacked car parking from an existing at grade car park and provision of an additional

pick up and drop off bay.

- A partial basement car park with basketball court structure above accessed from Mount Pleasant Avenue.



Figure 7.2: Proposed Stage 1 Site Plan
(Prepared by AJ+C Architects)

7.3 Stormwater Quantity

7.3.1 P1A Car Park and Through Site Link

The total site area is equal to 3,678 m² and currently consists of 72% impervious area due to the existing tennis courts, car parking and roadways. As the proposed development intends to reduce hardstand and introduce additional landscaped areas, the site impervious area will decrease to 69% of the total area. Stormwater outflows from the site will therefore decrease as a result of the development and therefore no OSD is proposed.

This is in line with Council advice provided for the Mary Ward Wing project discussed in Section 6.3.

Table 7.1: Comparison of Pre and Post Development Flowrates from DRAINS

Storm Event (ARI)	Pre Development Flow (m ³ /s)	Post Development Flow (m ³ /s)
1 in 5 Year	0.103	0.100
1 in 20 Year	0.141	0.137
1 in 100 Year	0.187	0.181

7.3.2 P3A Car Park

The extension to the existing P3 car park results in an increase in impervious area of 465 m² with an increase in stormwater flows as shown in Table 7.2.

There is an existing OSD tank to the south of the car park that was built during the construction of the car park in 2005. Site survey has indicated this tank is approximately 2.2m deep with a total volume of approximately 9m³ (refer to Figure 7.3).

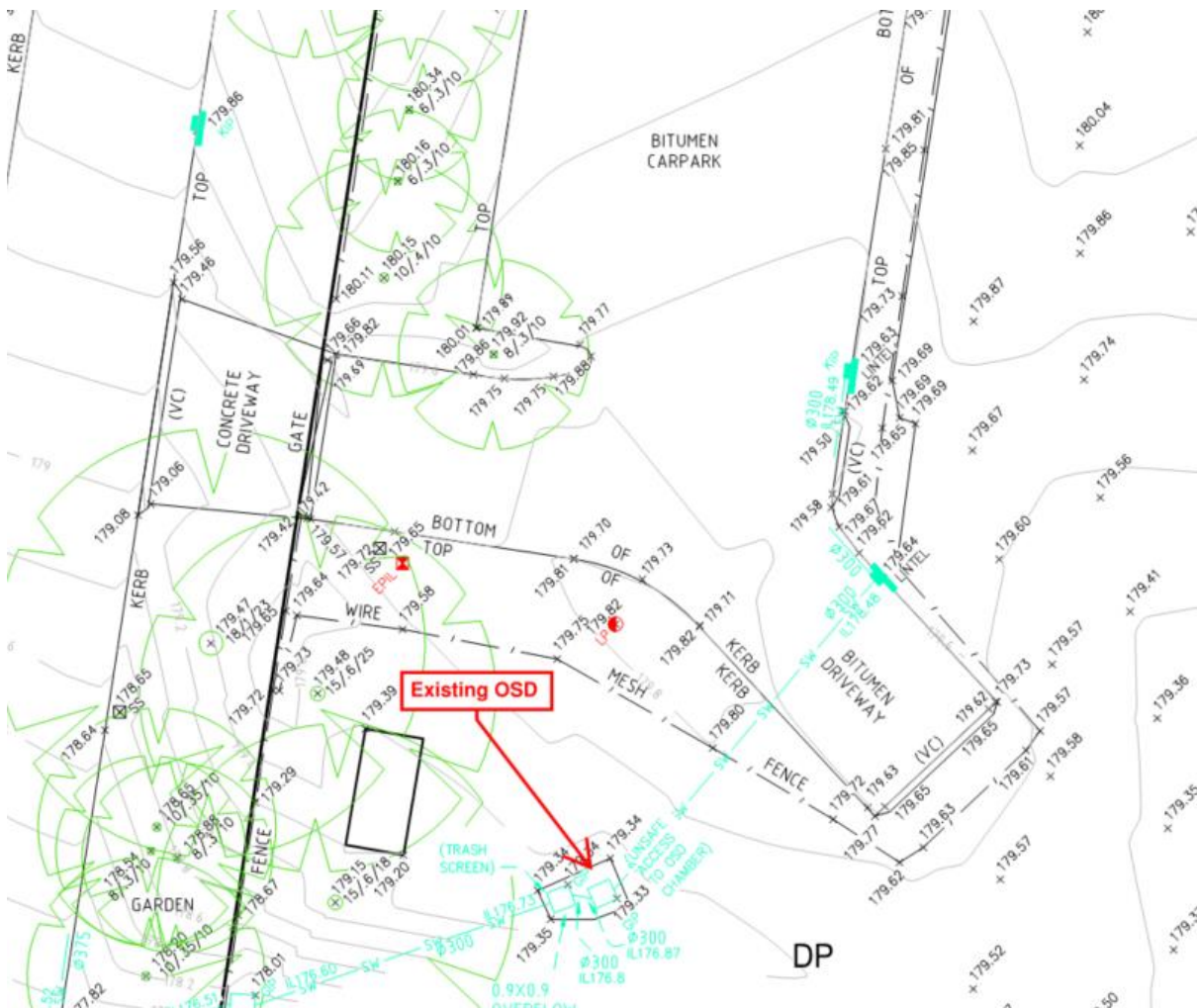


Figure 7.3: Existing OSD Identified on Survey

Hornsby Shire Council's Specifications for Stormwater Drainage state, "*stormwater detention is required on redevelopment sites within the shire where under capacity drainage systems exist. A redevelopment site is defined as a site which used to have or was originally zoned to have a lower density development than is proposed*".

As the site results in a minor increase in impervious area, the existing stormwater network has been modelled in DRAINS software to determine whether the stormwater network has sufficient capacity for the additional catchment.

The introduction of an orifice plate with diameter of 150mm within the existing OSD tank will restrict the piped stormwater post development flows to the pre development flow rate as shown in Table 7.2. This will ensure no increase in stormwater flows entering the Council stormwater system.

Table 7.2: Comparison of Pre and Post Development Flowrates from DRAINS

Storm Event (ARI)	Pre Development Flow (m ³ /s)	Post Development Flow (m ³ /s)	Post Development Flow with Orifice Plate (m ³ /s)
1 in 5 Year	0.054	0.077	0.059
1 in 20 Year	0.074	0.107	0.073
1 in 100 Year	0.095	0.141	0.073 piped 0.043 overflow

7.3.3 P4A Car Park

The P4A car park site is located at the existing basketball courts and has a total area of 2,223m². The proposed development will increase impervious area by 104m² with an increase in flowrates as shown in Table 7.3.

As the site proposes a minor increase in impervious area and no significant change in use, on site detention is proposed to reduce post development stormwater flows to pre development flows to ensure no increase in stormwater flows into the Council stormwater system. A 15m³ above ground detention basin with a 200mm orifice plate is proposed to the east of the site. This will discharge to the stormwater network proposed as part of the approved Early Learning Centre Development Application.

Table 7.3: Comparison of Pre and Post Development Flowrates from DRAINS

Storm Event (ARI)	Pre Development Flow (m ³ /s)	Post Development Flow (m ³ /s)	Post Development Flow with OSD (m ³ /s)
1 in 5 Year	0.080	0.084	0.076
1 in 20 Year	0.111	0.116	0.097
1 in 100 Year	0.147	0.154	0.142

7.4 Flooding

As discussed in Section 4.3, the site is not identified as being flood affected according to flood studies conducted by Hornsby Shire Council. The site is also not identified as being impacted by sea level rise.

7.5 Stormwater Quality

7.5.1 P1A Car Park and Through Site Link

As discussed in Section 7.3.1, the development will increase pervious area at the site and reduce the amount of hardstand. This is in line with Council's approach to Water Sensitive Urban Design. As for the Mary Ward Wing project, the pervious area is increasing and less pollutants are expected; therefore, no additional water quality treatment measures will be required.

7.5.2 P3A Car Park

Hornsby Shire Council's development control plan states, "*developments are required to achieve water quality targets for major redevelopment on sites greater than 2,000m² or other development that increases the impermeable area on a site by more than 2,000m².*" As the site only increases the impermeable area by 465 m², no additional water quality treatment is proposed.

7.5.3 P4A Car Park

As for P3A, as the site only increases impermeable area by 104m², no additional water quality treatment is proposed.

7.5.4 Stormwater Quality During Construction

During the construction stage of the project, sediment and erosion control measures will be installed and maintained until construction is completed. The proposed sedimentation and erosion control measures will prevent sediment laden stormwater from flowing into adjoining properties, bushland, roadways or receiving water bodies. Stormwater controls onsite are detailed in an erosion and sediment control plan which is in accordance with relevant regulatory authority guidelines including Hornsby Shire Council's DCP and Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book"). Refer to the attached civil engineering plans in Appendices C, D and E for the proposed concept sediment and erosion control plan

7.6 Earthworks

7.6.1 P1A Car Park and Through Site Link

The through site link will require minimal cut and fill, with the most significant level difference occurring to the west of the site of up to 1.5m from the existing paving. The P1A car park will require a change in level of 3m from existing to construct the basement.

7.6.2 P3A Car Park

As the P3A car park project extends the existing car park, minimal cut and fill is required.

7.6.3 P4A Car Park

To accommodate the basement car park, cut and fill will be required of up to 3m on the site.

7.7 Summary

A number of minor car park projects are proposed as part of the Stage 1 development application. Each car park proposes to collect stormwater onsite using a pit and pipe system. The P4A and P3A car parks result in a minor increase in impervious area, on site detention has been proposed to reduce stormwater outflows to the pre-development flows. No additional permanent water quality measures have been proposed as each development will not result in an increase in impervious area greater than 2,000m². An erosion and sediment control plan has been prepared for the site detailing the management of stormwater during construction.

8.0 Conclusion

This report provides a summary of the proposed concept civil engineering and stormwater management for the Loreto Normanhurst Concept Plan and Stage 1 Development. Stormwater is proposed to comply with Hornsby Shire Council's requirements including the provision of onsite stormwater detention, erosion and sediment control, and stormwater quality treatment. Concept engineering plans for the Boarding House/Garden Plaza, Mary Ward Wing, P3A car park/through site link, P3A car park, and P4A car park have been prepared and are attached in Appendices A, B, C, D and E respectively.

Prepared by
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GRACE CARPP
Civil Engineer

Authorised By
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TIM MOORE
Associate

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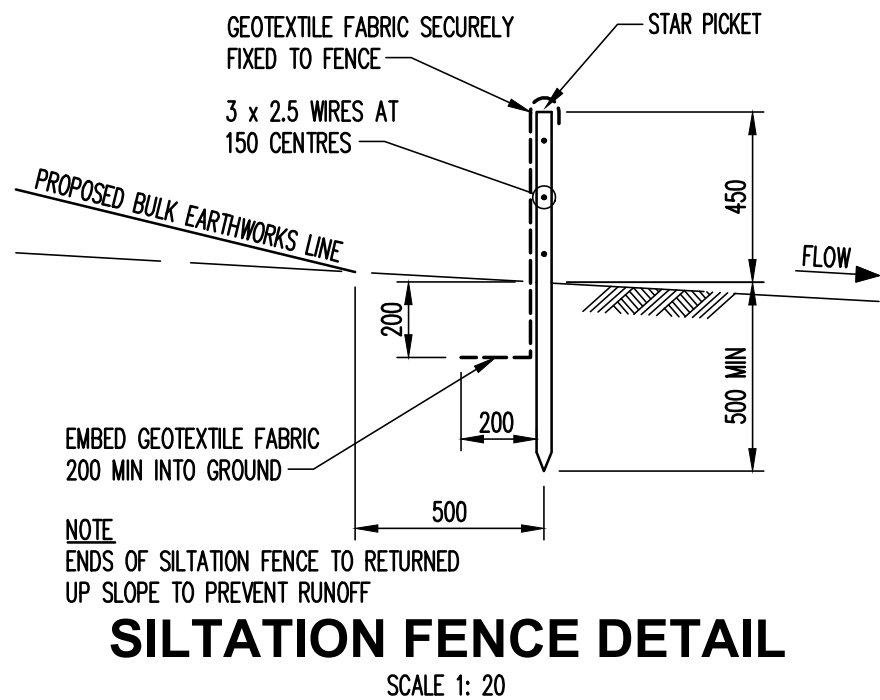
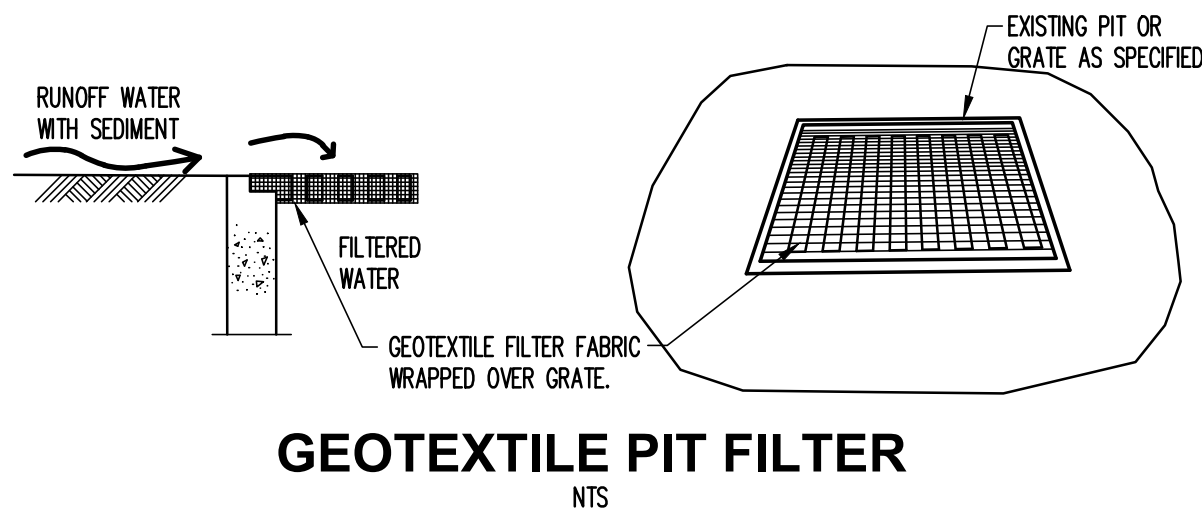
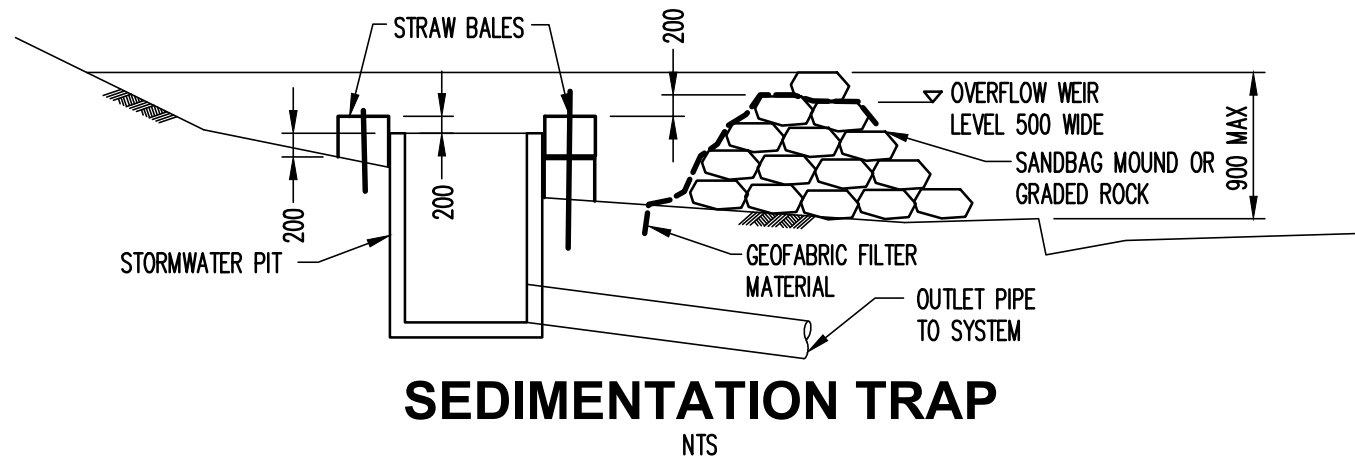
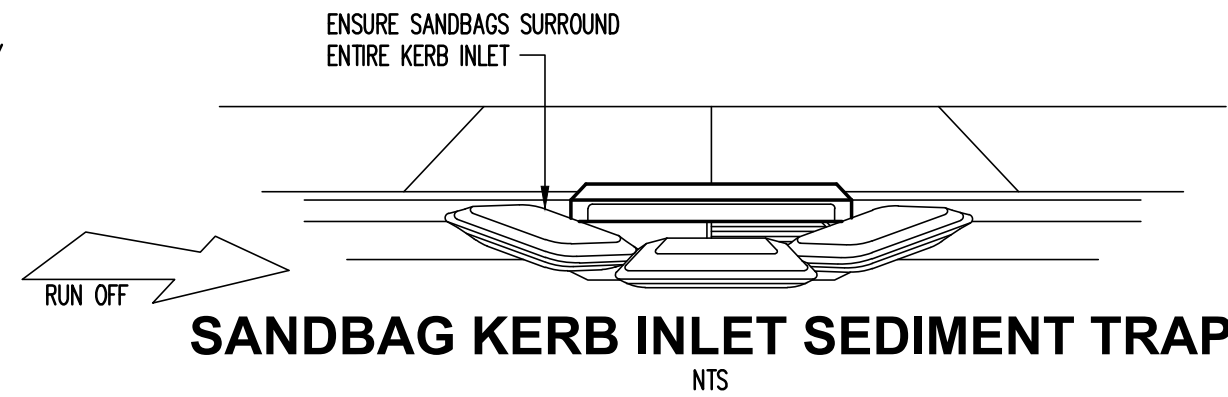
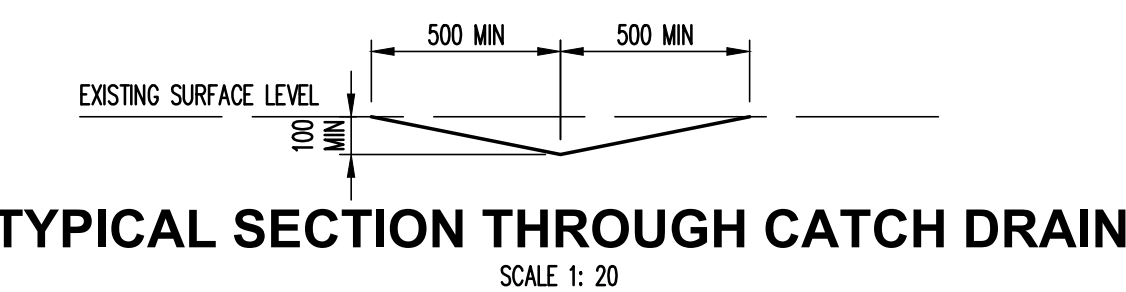
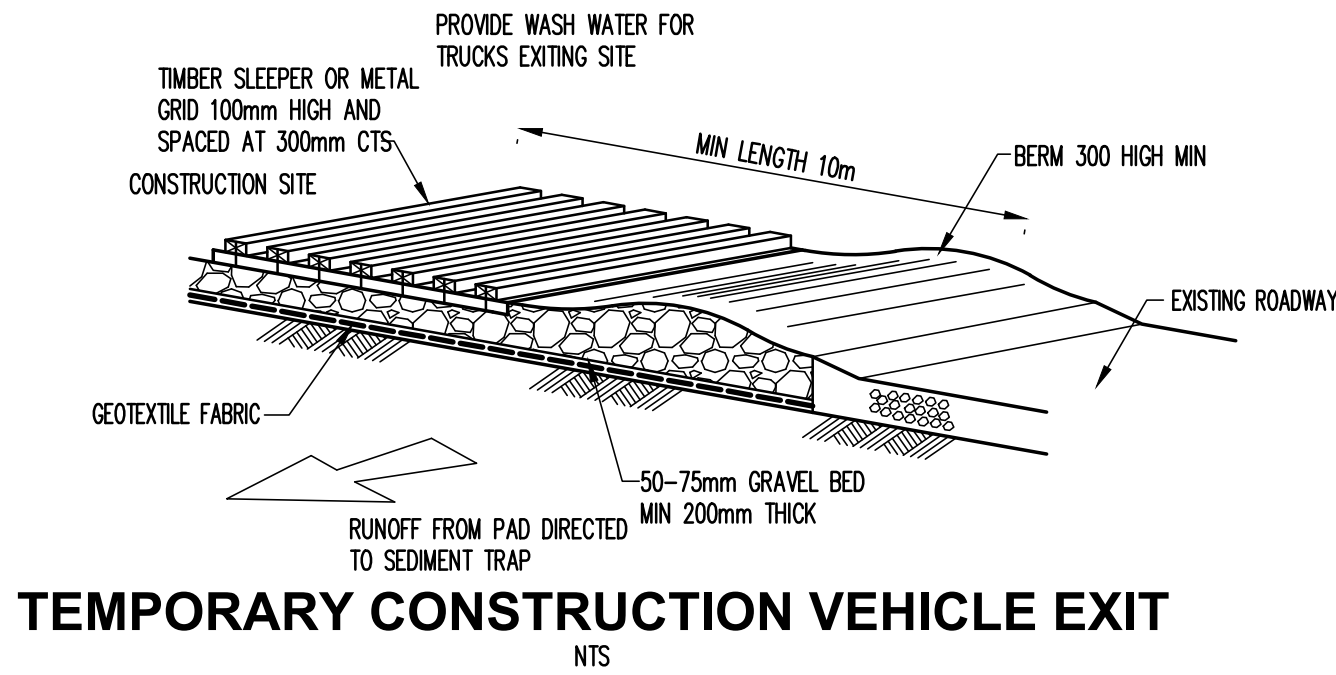
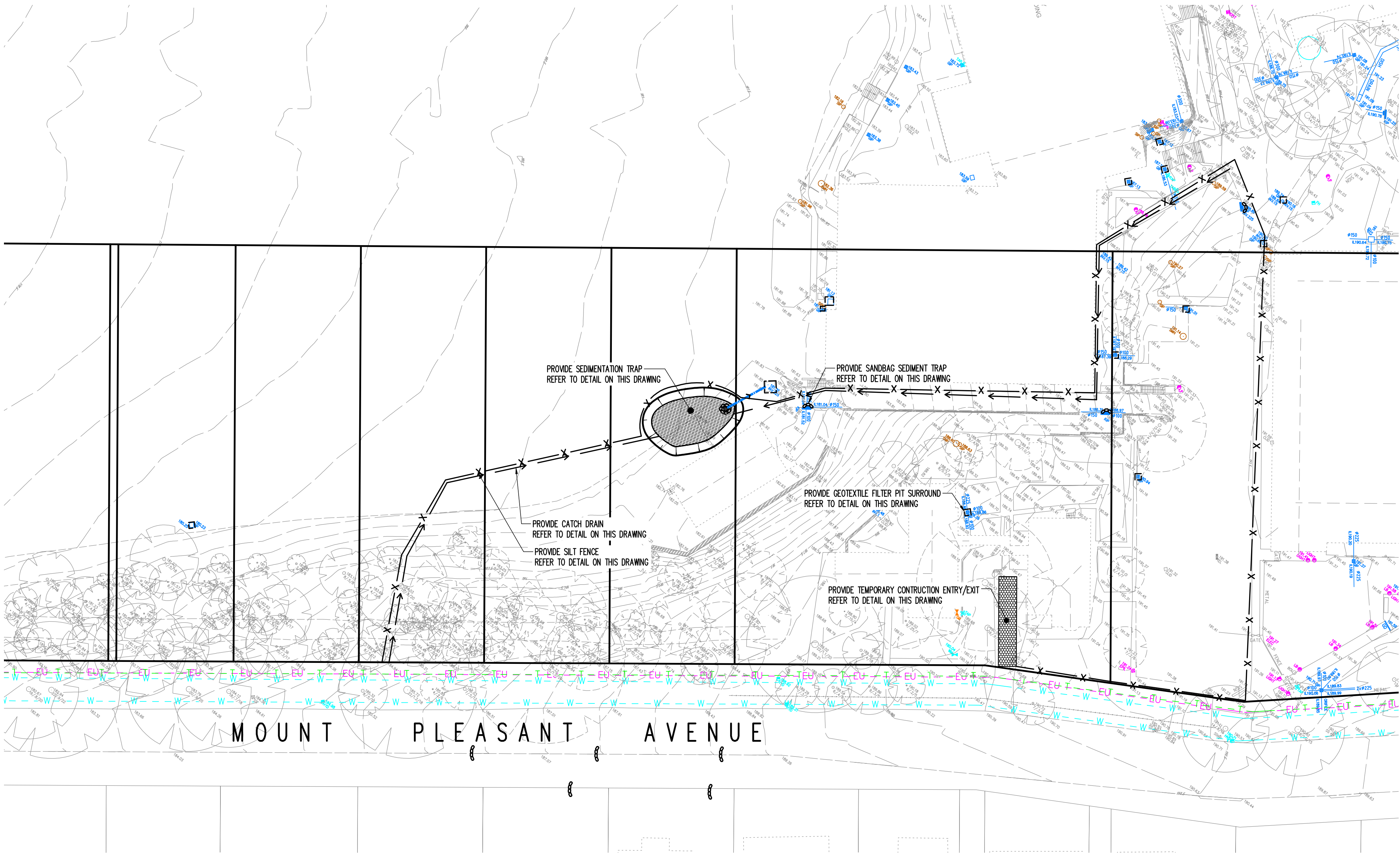
Appendix A

Boarding House and Garden Plaza Civil Engineering Drawings

OSD TANK DETAILS SHEET

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EROSION AND SEDIMENT CONTROL NOTES

- All work shall be generally carried out in accordance with
(A) Local authority requirements,
(B) EPA - Pollution control manual for urban stormwater,
(C) LANDCOM NSW - Managing Urban Stormwater: Soils and Construction ("Blue Book").
- Erosion and sediment control **drawings and notes** are provided for the whole of the works. Should the Contractor stage these works then the design may be required to be modified. Variation to these details may require approval by the relevant authorities.
The erosion and sediment control **plan** shall be implemented and adapted to meet the varying situations as work on site progresses.
- Maintain all erosion and sediment control devices to the satisfaction of the superintendent and the local authority.
- When stormwater pits are constructed prevent site runoff entering the pits unless silt fences are erected around pits.
- Minimise the area of site being disturbed at any one time.
- Protect all stockpiles of materials from scour and erosion. Do not stockpile loose material in roadways, near drainage pits or in watercourses.
- All soil and water control measures are to be put back in place at the end of each working day, and modified to best suit site conditions.
- Control water from upstream of the site such that it does not enter the disturbed site.
- All construction vehicles shall enter and exit the site via the temporary construction entry/exit.
- All vehicles leaving the site shall be cleaned and inspected before leaving.
- Maintain all stormwater pipes and pits clear of debris and sediment. Inspect stormwater system and clean out after each storm event.
- Clean out all erosion and sediment control devices after each storm event.

Sequence Of Works

- Prior to commencement of excavation the following soil management devices must be installed.
- Construct silt fences below the site and across all potential runoff sites.
- Construct temporary construction entry/exit and divert runoff to suitable control systems.
- Construct measures to divert upstream flows into existing stormwater system.
- Construct sedimentation traps/basin including outlet control and overflow.
- Construct turf lined swales.
- Provide sandbag sediment traps upstream of existing pits.
- Construct geotextile filter pit surround around all proposed pits as they are constructed.
- On completion of pavement provide sand bag kerb inlet sediment traps around pits.
- Provide and maintain a strip of turf on both sides of all roads after the construction of kerbs.

WATER QUALITY TESTING REQUIREMENTS

Prior to discharge of site stormwater, groundwater and seepage water into council's stormwater system, contractors must undertake water quality tests in conjunction with a suitably qualified environment consultant outlining the following:

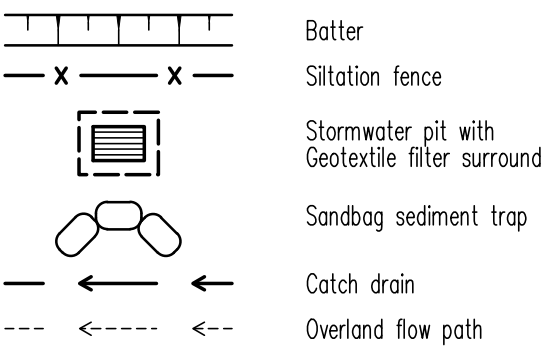
- Compliance with the criteria of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)
- If required subject to the environmental consultants advice, provide remedial measures to improve the quality of water that is to be discharged into Councils storm water drainage system. This should include comments from a suitably qualified environmental consultant confirming the suitability of these remedial measures to manage the water discharged from the site into Councils storm water drainage system. Outlining the proposed, ongoing monitoring, contingency plans and validation program that will be in place to continually monitor the quality of water discharged from this site. This should outline the frequency of water quality testing that will be undertaken by a suitably qualified environmental consultant.

EROSION AND SEDIMENT CONTROL PUMP OUT NOTES

Any accumulated water contaminated with sediment, from a sediment basin or excavation pit, is to be flocculated or filtered in order to lower the suspended solid load to less than 50mg per litre. gypsum or other approved flocculant should be applied within 24 hours of the end of the storm event. The gypsum must be spread evenly over the entire water surface. Pumping is not to occur for at least 36 hours and preferably 48 hours after application. Clean water is to be discharged to the water table via a hole bail sediment filter in a way that does not pick up sediment that has dropped to the bottom.

Note: gypsum is a hydrated form of calcium sulphate and is available at many swimming pool shops and hardware stores.

EROSION AND SEDIMENT CONTROL LEGEND



A12 1 2 3 4 5 6 7 8 9 10

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P4	ISSUE FOR DRAFT SSDA	GC	JH	30.11.20					
P3	ISSUE FOR APPROVAL	GC	JH	20.12.18					
P2	ISSUE FOR COORDINATION	GC	JH	12.12.18					
P1	ISSUE FOR DEVELOPMENT APPROVAL	KH	JH	31.08.18					

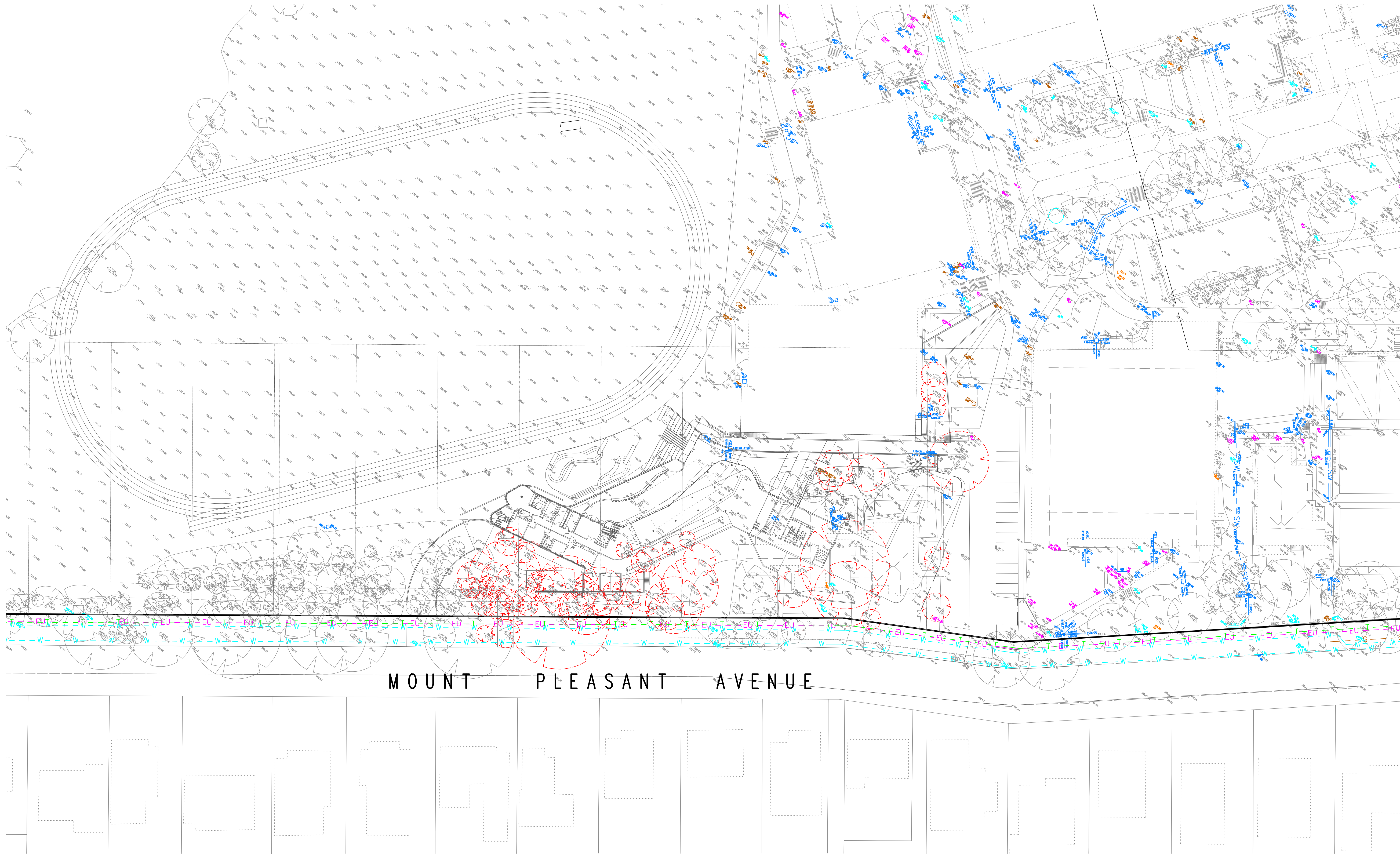
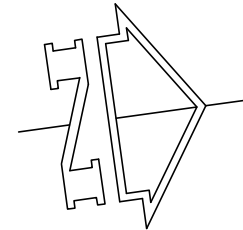
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Project
**LORETO NORMANHURST,
91-93 PENNANT HILLS ROAD
SITE A, BOARDING HOUSE**

Sheet Subject
**EROSION & SEDIMENT
CONTROL PLAN AND DETAILS**

Scale : A1
1:400 U.N.O
Job No
181202
Drawing No
SKC101
Revision
P5
Plot File Created: Dec 17, 2020 - 3:42pm



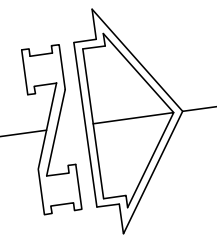
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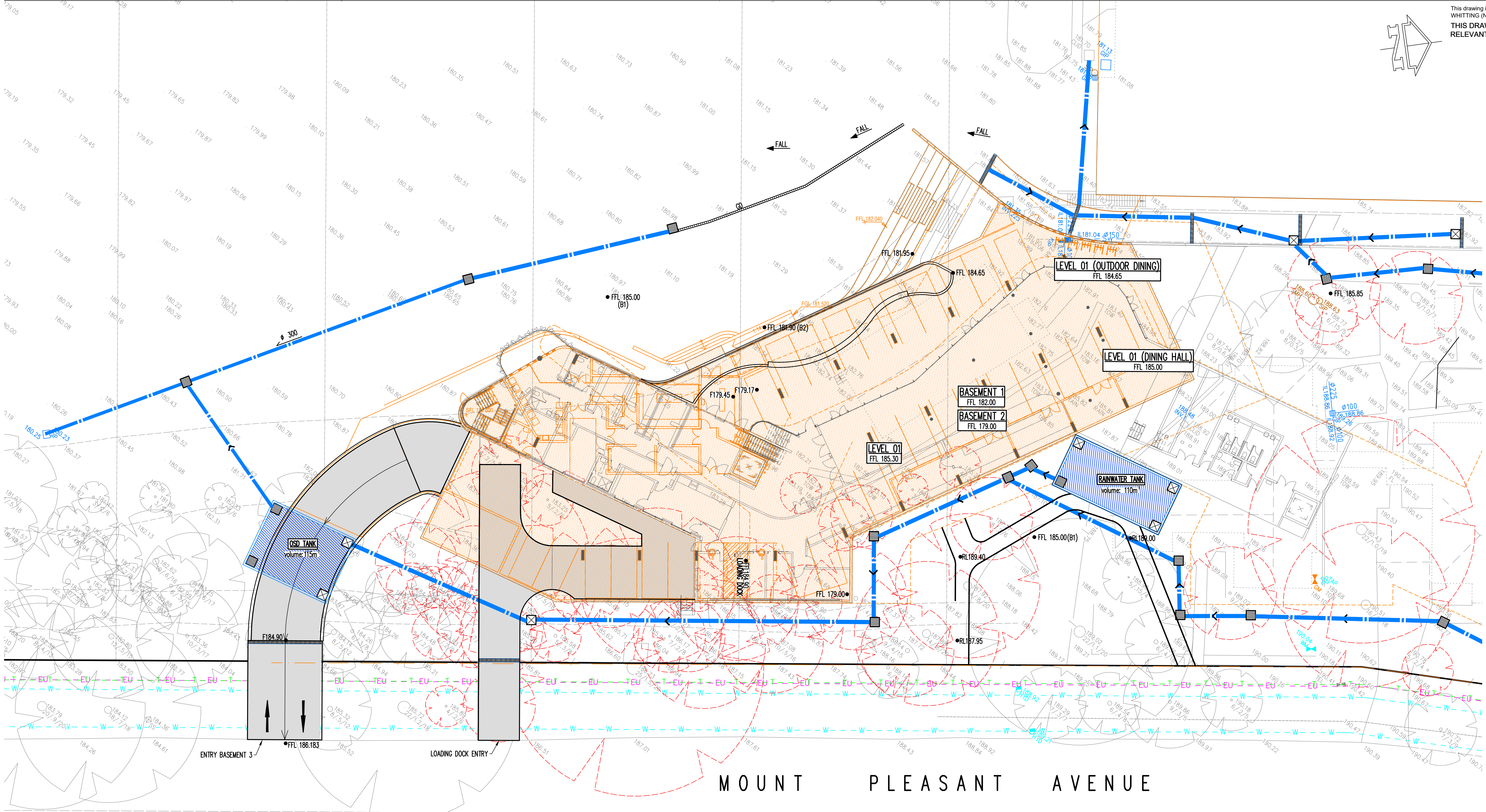
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OVERALL SITEWORKS PLAN		Job No		Drawing No		Revision	
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SITeworks LEGEND

- F22.20 Finished surface level
- K&G Kerb and gutter
- KO Kerb only
- Stormwater pit, flow direction and line with
Invert level upstream
Pipe size and class
Pipe grade
Flow (Litres per second)
Invert level downstream
- Grated drain

ARCHITECTURAL LEGEND

- LEVEL 01
- Basement
- Existing tree to be removed

* NOTE: CONTRACTOR TO CLEAN AND INVESTIGATE VIA CCTV EXISTING STORMWATER INFRASTRUCTURE TO BE CONNECTED INTO.

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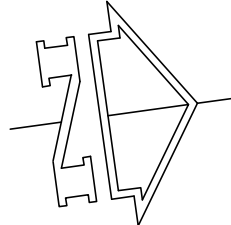
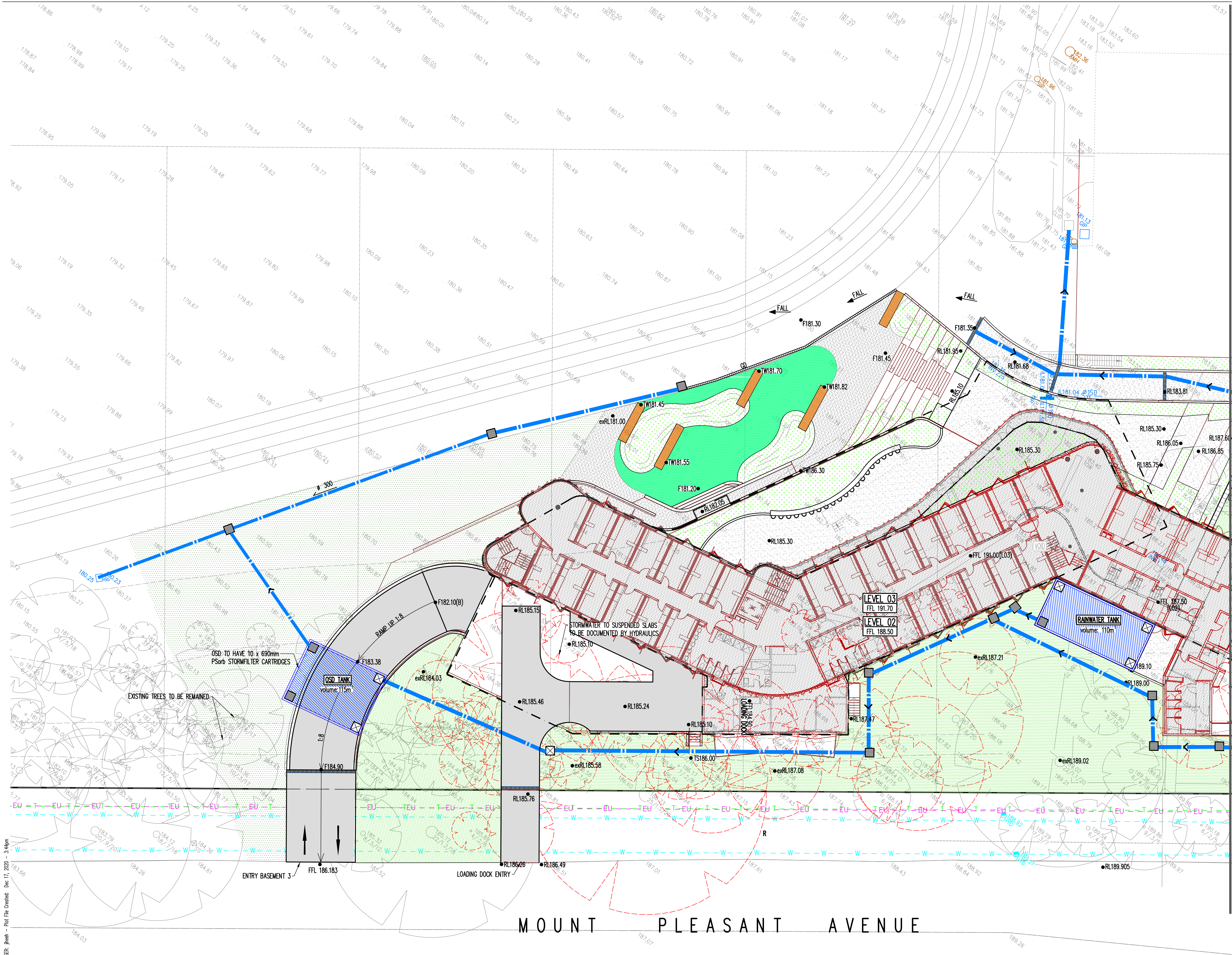
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SITE A, BOARDING HOUSE

Sheet Subject
SITeworks PLAN SHEET 1
(BASEMENT AND LEVEL 01)

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JH
Authorised
Job No
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Drawing No
SKC103
Revision
P7
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SITeworks LEGEND

- F22.20 Finished surface level
- K&G Kerb and gutter
- KO Kerb only
- Stormwater pit, flow direction and line with
Invert level upstream
Pipe size and class
Flow (Litres per second)
Invert level downstream
- Grated drain

ARCHITECTURAL LEGEND

- LEVEL 2
- LEVEL 3
- BASEMENT / LEVEL 01 BELOW

- Existing tree to be removed

PAVEMENT LEGEND

- Refer to Landscape

* NOTE: CONTRACTOR TO CLEAN AND INVESTIGATE VIA CCTV EXISTING STORMWATER INFRASTRUCTURE TO BE CONNECTED INTO.

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P1	ISSUE FOR APPROVAL	GC	JH	20.12.18					
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SITE A, BOARDING HOUSE

Sheet Subject
SITeworks PLAN SHEET 2
(LEVEL 02 AND 03)

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