MOTT MACDONALD

80 Betty Cuthbert Drive, Lidcombe Master Plan

Water Cycle Management Assessment

Planning Proposal

09 March 2022
Confidential

Property and Development NSW

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Issue and Revision Record

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Contents

1 Introduction

Mott MacDonald has been engaged by Property and Development NSW (PDNSW) to prepare a Water Cycle Management Assessment to guide the planning proposal for 80 Betty Cuthbert Drive, Lidcombe. The water cycle management assessment will explore the opportunities and constraints when considering the concept master plan with regards to stormwater and flooding.

1.1 Purpose of Report

This report is a preliminary stormwater assessment for the 80 Betty Cuthbert Drive site. This report seeks the following objectives:

- Review existing relevant reports;
- Use identified constraints and opportunities as the basis to prepare a stormwater network which conveys flows throughout the site; and
- Review and summarise NSW, and local government requirements for the proposed development with respect to OSD provision and Water Quality requirements.

The report assesses the stormwater and drainage of the site via a water cycle management assessment. The water cycle management works considers the stormwater system in relation to water quantity (stormwater detention) and water quality. The purpose of this component of the works is to outline the strategies to be implemented, including sizing.

1.2 Scope of Works

This report has been prepared to demonstrate the concept design is prepared in support of the master planning works. Designs will consider all appropriate measures to satisfy Council and all relevant authority's water quantity and quality requirements.

To assist in the finalisation of the master plan, Mott MacDonald has undertaken the following tasks:

- Reviewed publicly available flooding analysis, water-sensitive urban design (WSUD) and site-specific requirements;
- Undertaken a site inspection to confirm desktop information, where necessary;
- Summarised planning requirements and compliance with Council's DCP;
- Design a stormwater network to collect flows from the site, including detention basins, where required;
- DRAINS modelling of the existing and proposed scenarios to determine site detention requirements;
- MUSIC modelling to determine baseline water quality requirements of the site; and
- Prepared a Stormwater Management Concept Plan in accordance with Council standards to show how on-site detention and water quality treatment initiatives could be implemented.

1.3 Limitations

This assessment is limited to the preliminary assessments completed for other components affecting this study, including, but not limited to; civil and utilities, transportation, geotechnical, and contamination studies completed. Survey was limited to topographical features without identifying invert levels of existing drainage and other utilities.

1.4 Regional Context

The site is located within the suburb of Lidcombe, approximately 15km west of Sydney CBD and within the Cumberland local government area. The closest major interchange station is Lidcombe Station, 1.5km north of the site, and Berala Station is the nearest station, 1.2km west of the site. The site is surrounded by a mixture of land uses and facilities, with residential land to the north, east and south, an educational site to the south east and the Carnarvon Golf Course to the west.

In March 2018 the NSW Government released the Greater Sydney Region Plan which outlined a vision of three cities; a western parkland city, a central river city and an eastern harbour city. The study area lies within the Central City District as shown in

Figure 1 below. It is within close proximity to Lidcombe North and Berala Local Centres, which have been identified for urban renewal.

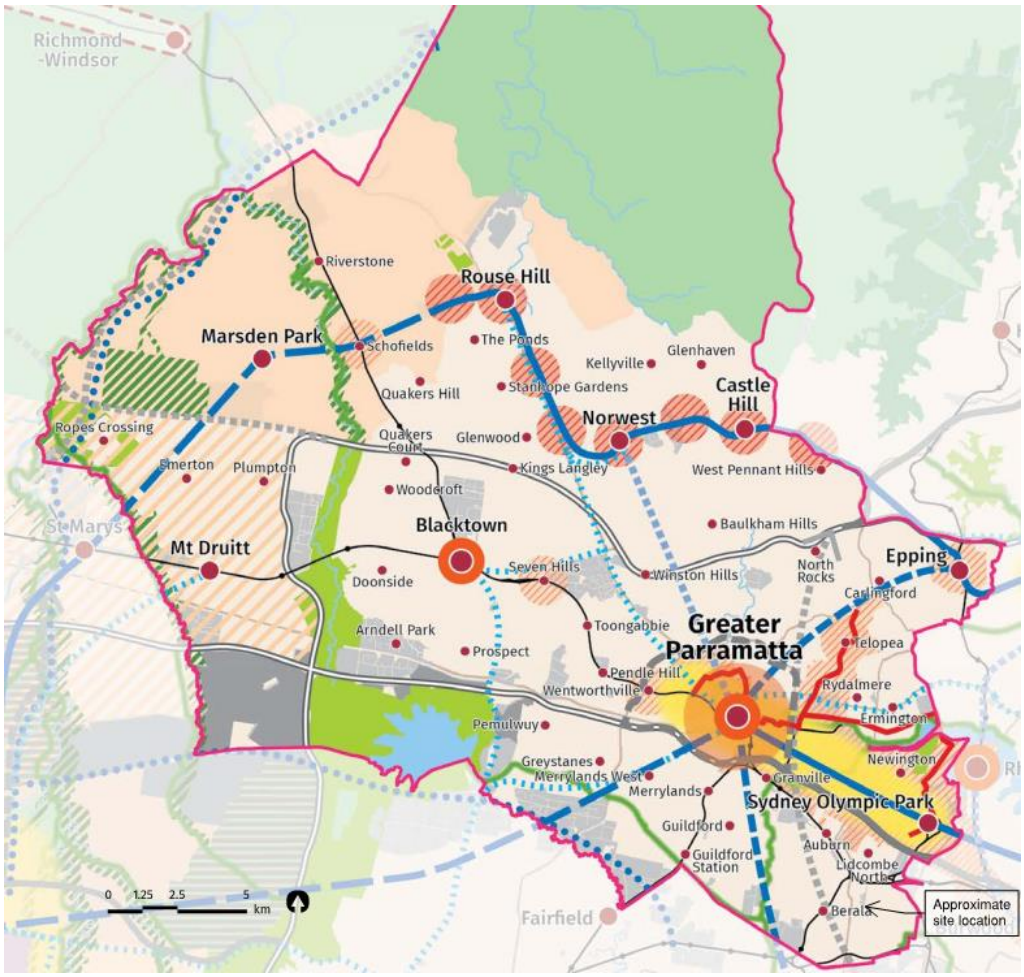


Figure 1: Central City Plan

Source: Central City District Plan (Greater Sydney Commission, March 2018)

1.5 Local Context

The site is located at 80 Betty Cuthbert Drive, Lidcombe, refer to Figure 2 which shows a local overview of site. It has a primary frontage to Joseph Street between Georges Avenue to the north and Botanica Drive to the south. The site is 5.8ha in size and is currently occupied by Multiple Sclerosis Limited (MSL). The site improvements include a 1970's circa 4,300m^2 brick building that provides office space, treatment facilities and respite care facilities to support the operations of MSL. The existing MSL facilities cover approximately 12% of the site and the remainder of the site is underutilised.

The site is surrounded by a mixture of land uses and facilities, with residential land to the north, east and south, an educational site to the southeast and the Carnarvon Golf Course to the west. Existing vehicle access to the site is via the intersection of Joseph Street and Botanica Drive. An access road extends from Betty Cuthbert Drive, through the existing residential subdivision located to the south of the site.

The site is heavily vegetated, with a number of trees located around the site boundary and bordering the existing MSL building. The existing MSL building is located within a high point on the site and the surrounding landscape slopes primarily towards the south-west and eastern sides of the site.

Figure 2: Site Overview

1.6 Proposed Development

In 2017, DPIE prepared a master plan for the site which allocated land for a future educational establishment, health facility and for residential use. The masterplan has been developed with key stakeholders, Department of Education (DE) and Multiple Sclerosis Limited (MSL). The future educational establishment will be developed by the DE and the health facility by MSL.

The future educational establishment will be located on a 1.85 ha parcel in the central western portion of the site. The education establishment, for the purpose of this assessment, has been assumed as a 1,000 student primary school, to accommodate a maximum capacity scenario for development of that land. It should be noted that this is an assumption made for this assessment and the establishment may be a different type of school.

A 0.95 ha site adjacent Joseph Street will be used for a new health facility, and the surplus land (approx. 1.78 ha) will be rezoned to medium density residential land (excluding road and drainage areas) and divested. The concept indicative layout plan (ILP) is shown in Figure 3 below.

Figure 3: Concept Indicative Layout Plan

Source: 80 Betty Cuthbert Drive, Lidcombe – Indicative Layout Plan (02 August 2021)

2 Design Controls and Guidelines

This Water Cycle Management Report was prepared in conjunction with relevant standards and requirements of various agencies. The documents used as part of the design control are detailed within this section.

2.1 Cumberland Council Development Control Plans

An integral part of the Planning Proposal process, Development Control Pans (DCP), provides the necessary controls for the development of the site. Relevant Council DCPs include:

- Cumberland Local Environmental Plan 2021 (5 November 2021)
- Flood Risk Management Policy (5 November 2021)

Cumberland Council is the amalgamation of previously Auburn, Parramatta and Holroyd Councils. As our site is within the previous Auburn Council boundary, the Auburn DCP has been implemented as part of this design. Parramatta and Holroyd DCP's will be used in areas where the Auburn DCP does not specify relevant guidelines.

2.2 Australia Rainfall Runoff – Volume 1 (2016)

Prepared by Engineers Australia, Australian Rainfall and Runoff – A Guide to Flood Estimation was written to "provide Australian designers with the best available information on design flood estimation". It contains procedures for estimating stormwater runoff for a range of catchments and rainfall events and design methods for urban stormwater drainage systems.

This is the updated version of the previous ARR 1987. The ARR2016 design methodology will be adopted for the purpose of this project

According to the document, good water management Master Planning should take into account:

- Hydrological and hydraulic processes.
- Multiple Temporal Patterns.
- Land capabilities.
- Present and future land uses.
- Public attitudes and concerns.
- Environmental matters.
- Costs and finances.
- Legal obligations and other aspects.

3 Stormwater Management

Water cycle management relates to all planning, strategy development, operational and tactical decisions to optimise the water cycle to satisfy human or environmental objectives, such as water quantity and water quality objectives.

This water cycle management assessment is comprised of the following:

1. Review of site topography and hydraulic features.
2. Review of Council's Water Quantity objectives, planning controls, and a discussion of potential strategies.
3. Review of Council's Water Quality objectives, planning controls, and a discussion of potential strategies.
4. Development of a Stormwater Management Concept Plan to satisfy council objectives and requirements.

3.1 Topography and Hydraulic Features

As indicated in Figure 4, the site falls into five (5) catchments as defined by the respective low points and separated by a ridge line running in a north-south direction through the middle of the site (Catchments A to E). The northern catchments consist of Catchments B and C, which drain to two low points located on the northern site boundary and drain northwards towards Haslams Creek.

The western catchment (Catchment A) drains to a low point located on the western site boundary adjacent Joseph Street. Stormwater drains to an existing detention basin and likely enters the pit and pipe network on Joseph Street.

The eastern catchments consist of Catchments D and E, which drain to two low points. The first one nearest the northern site boundary (Catchment D), drains towards a localised low point at Norman May Park before then being diverted to the creek traversing Rookwood Cemetery. The second low point on the eastern side (Catchment E) drains through the TAFE facility towards East Street and the creek traversing Rookwood Cemetery.

Two drainage easements exist within the site, indicated in Figure 4. These easements allow stormwater from upstream properties to drain through the site to the low point in Catchment A before being diverted under Joseph Street via the pit and pipe network.These easements will need to be considered in the development of the master plan.

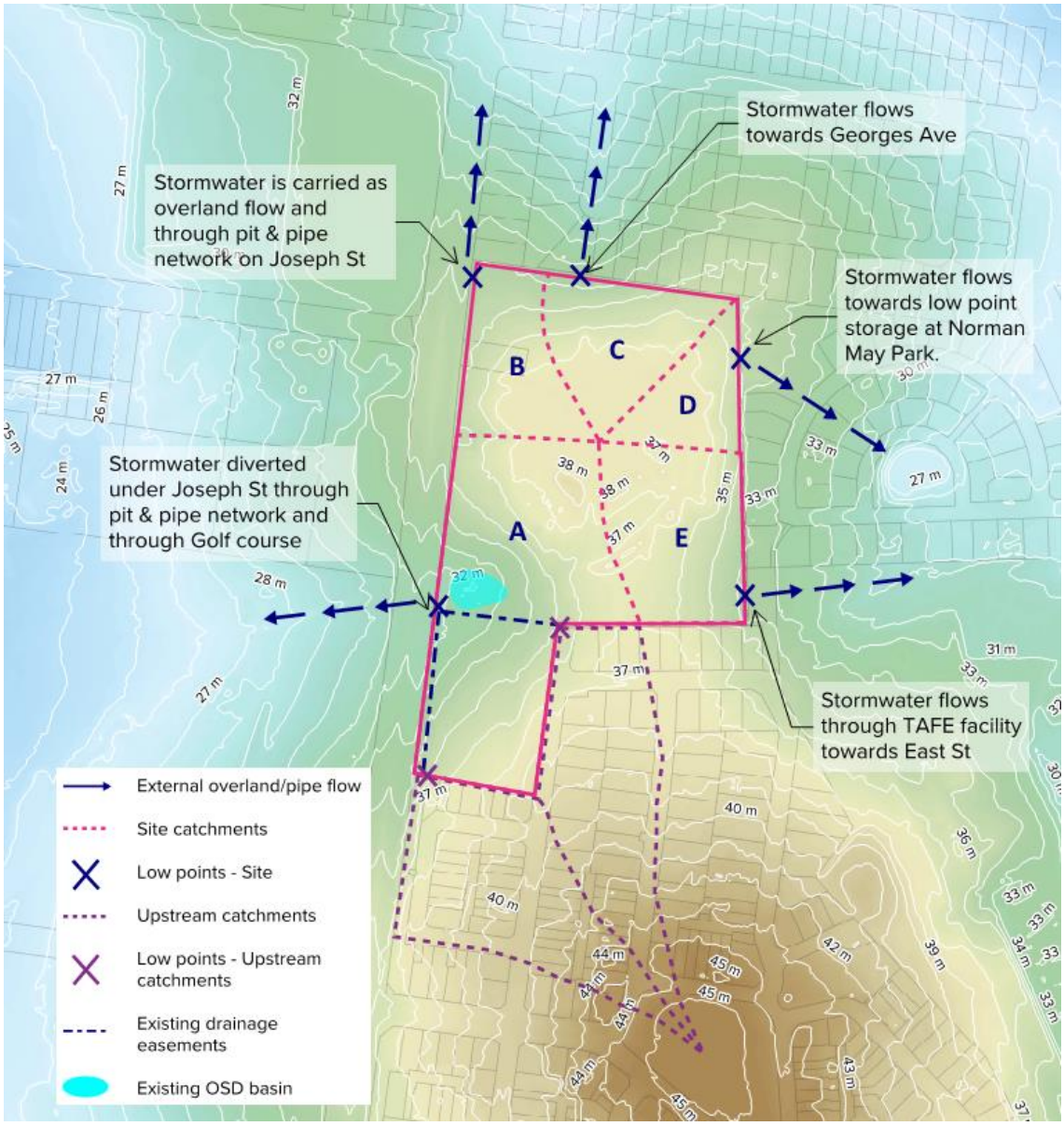


Figure 4: Existing Site Topography and Hydraulic Features

Source: 80 Betty Cuthbert Drive, Lidcombe – Mott MacDonald Catchment Analysis (23 Sep 2020)

3.2 Water Quantity Management

3.2.1 Water Quantity Objectives

A large portion of Sydney's suburban areas are undergoing redevelopment as a result of Sydney's growing population, particularly in areas around major centres and transport nodes. Within these areas considerable changes in development typology are being observed with low density housing being intensified to incorporate higher density land uses. These medium and high-density developments can lead to more intensive site usage and less efficient stormwater drainage systems. Without compensatory measures, the cumulative impacts of the increased stormwater runoff and loss of flood storage across development sites would increase the flooding risk to downstream properties.

To manage the intensified land uses, stormwater detention systems are generally required to be provided for all new developments. Stormwater detention is the temporary storage of stormwater, traditionally within a development footprint, to ensure that peak runoff from a development site does not incur adverse impacts to downstream properties.

In accordance with Council's Development Control Plan (DCP), the onsite detention policy seeks to reduce the rate of stormwater runoff discharged to the public drainage network from development to the predevelopment discharge rate. This policy ensures that the development does not result in higher stormwater discharge onto downstream properties and increase the risk of flooding.

3.2.2 Water Quantity Planning Controls

On-site detention (OSD) basins are required to be designed to ensure peak flow rates at any point within the downstream drainage system do not increase as a result of development during all storm events up to the 100-year ARI.

Council have adopted catchment-based rates for the permissible site discharge (PSD) and site storage requirement (SSR) to be adopted when designing OSD. The development site falls within the Nottinghill Road Catchment, and therefore the proposed detention systems will be required to meet a maximum PSD of 100L/s/Ha and a minimum SSR of 455m^3/Ha. These requirements have been incorporated into the detention modelling.

It should be noted that the proposed site drainage is discharging to Joseph Street which is an RMS road. As such, RMS requirements must be met for all stormwater discharged to the existing Joseph Street stormwater drainage. To meet these requirements, post development flows are required to be restricted to predevelopment flow rates.

The following general detention design requirements are implemented by Council:

- Stormwater runoff from all new roof areas shall be routed through the OSD system. Runoff entering the site from upstream properties shall be directed bypassing the on-site detention system.
- A portion of the new impervious areas (excluding roof areas) shall discharge directly to Council's system if it cannot be drained to the storage facility, provided the PSD is reduced to compensate for the smaller catchment.
- No more than 15% of the total site area shall be permitted to bypass the basin.
- The maximum desirable extent of impervious surfaces bypassing the detention system is 15% of the total impervious site area.

Above ground detention basins have been incorporated as part of the proposed designs to meet the relevant requirements. In addition, the super lots have been proposed to include combined stormwater detention and retention tanks to detain stormwater flows at each property before connecting to the road drainage.

3.2.2.1 Existing Drainage Connection Assumption

Due to limited survey information several assumptions were made as to the existing stormwater network on Joseph St. Upon the review of RMS documents received on 14/11/2019 titled "*0190.012.RC2930.0180" and "0190.012RC2918.0780 (WAE)"* survey Invert Levels (IL) and Surface Levels (SL) were considered to be unreliable in comparison to detailed topographic survey. Due to this the assumption was made to take the depth of stormwater pipes identified in previous RMS survey and translate this upon updated topographical survey to allow interpolation.

Connection Point	Indicated RMS IL	Indicated RMS SL	Survey SL	Assumed IL
C11	31.455 m (103.20 ft)	32.309 m (106.00 ft)	31.638 m	30.760 m
C14	33.802 m (110.90 ft)	34.650 m (113.68 ft)	33.930 m	33.080 m

For the discharge to existing drainage infrastructure at location F2, the invert levels of the existing drainage were interpolated between the referenced connection points as follows;

- F2 Invert Level = RL 32.00 m; and

For the discharge to existing drainage infrastructure at location B2, the invert level was sourced from RMS survey "*0190.012.RC2930.0180*."

- B2 Invert Level = RL 30.30 m.

K2 Invert Level was sourced from Stuart Denett Lan Surveyors completed on 20/11/2020.

- K2 Invert Level = RL 30.64 m.

Prior to Construction Certificate, detailed survey of the surrounding pipe network to ensure an adequate connection point is identified accurately.

3.2.2.2 Above Ground Detention Basins

An above ground detention basin refers to a basin provided within a landscaped area which allows water to pool during storm events and slowly discharges to the pit and pipe network. Basins are generally built to a maximum depth of 1.2m and an average batter slope of 1V:6H. In the case where this cannot be achieved, an absolute maximum slope of 1V:4H can be considered. Steeper slopes may be considered but will require additional safety measures, such as fences.

Above ground basins allow a larger development area to be detained in a single system, however they require a larger land take than a below ground system and therefore can reduce the overall developable area of a site.

3.2.2.3 Stormwater Detention and Retention Tanks

On-site stormwater detention and retention tanks are another viable detention option for the proposed development. The detention basin is combined with a regular residential rainwater tank to operate as a both a rainwater retention device for water reuse and a detention device to control stormwater runoff for each proposed development lot. Refer to Figure 5 below for an illustration of a typical residential stormwater detention and retention tank.

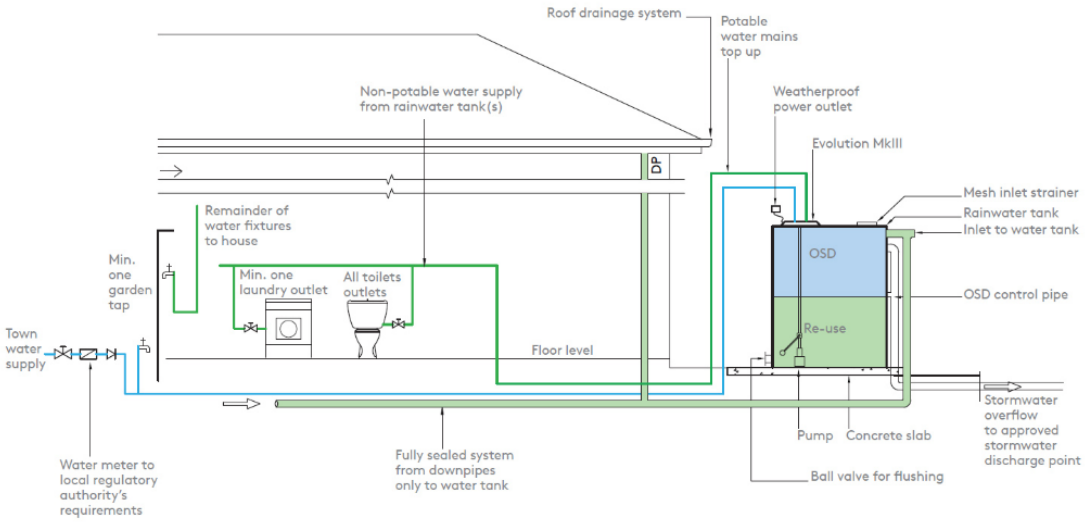


Figure 5: Typical Rainwater Tank OSD System

Source: Kingspan (https://www.kingspan.com/au/en-au/products-brands/water-management-solutions/solutions/stormwater-management)

It should be noted that use of these devices would not eliminate the need for regional detention basins. These devices will significantly reduce the size of the regional basins, however, development such as roadways will still create runoff that will require detention.

3.3 Water Quality Management

The subject site is located within the Haslams Creek catchment and similar to many other urbanised areas in Sydney, poor water quality can result from roads and open spaces, particularly after heavy rain. This untreated runoff in the localised catchment also contributes to the overall water quality in Haslams Creek.

The site is located within the former Auburn LGA, however the Auburn DCP 2010 does not provide target removal rates for pollutants. For the purpose of this assessment the water quality objectives outlined in the Holroyd DCP 2013 have been adopted. The water quality objectives to be adopted for the proposed development will be confirmed with Council in the next stage of the project.

The Holroyd DCP 2013 requires improved water quality from stormwater flows generated from site development prior to discharge into the local drainage network. This allows Council to mitigate the effects of urban development on the existing water cycle by removing excess pollutants caused by the changing landscape.

To meet water quality guidelines the site must meet percentage reduction rates outlined in the DCP. All targets are measured in the post development mean annual load as per Table 1 below:

Table 1: Stormwater Treatment Targets

Pollutant	Performance Target Reduction Loads
Gross Pollutants	70%
Total Suspended Solids	80%
Total Phosphorus	45%
Total Nitrogen	45%

Source: Holroyd DCP 2013

3.3.1 Water Quality Planning Controls

Council requires water quality treatment targets to be met through the development of a Model for Urban Stormwater Improvement Conceptualisation (MUSIC) model, which incorporates water treatment devices such as rainwater tanks, gross pollutant traps and bioretention in a series to provide a treatment train.

The software simulates urban stormwater systems operating at a range of temporal and spatial scales. MUSIC models the total amounts of gross pollutants and nutrients produced within various types of catchments. It allows the user to simulate the removal rates expected when implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

Potential water quality devices which may be utilised to meet Council targets include:

- Bioretention Systems.
- Swales.
- Wetlands.
- Gross Pollutant Traps.
- Cartridges.

These water quality improvement devices are explained in the following sections.

3.3.1.1 Bioretention System

A Bioretention system (Raingarden) is proposed as an end-of-line treatment prior to discharge. Raingardens are planted filtration systems where water is allowed to temporarily pond and permeate through the ground allowing pollutants to be removed through natural processes.

Bioretention systems are planted with nutrient removing plants which provide an effective means of extracting dissolved nitrates and phosphates.

“Flow splitting” pits will direct flows up to and including the 400% AEP to the treatment facilities, while higher flows up to and including the 1% AEP storm event will bypass the system and drain to the downstream detention basin. An example of a bioretention system designed by Mott MacDonald is show in Figure 6.

Figure 6: Bioretention System

3.3.1.2 Swales

Swales are vegetated channels used to collect and treat stormwater before it enters the pit and pipe network, refer to Figure 7 for a typical example. They are effective at removing gross pollutants and course and medium sized sediments. They are also efficient at slowing the velocity of stormwater flows. Swales can be used as an alternative to conventional median or verge strips and require minimal maintenance once established.

Figure 7: Vegetation Swale
Source: Google Images

3.3.1.3 Wetlands

Constructed wetlands reduce fine particles and associated contaminates, refer to Figure 8 for a typical example. They are modelled in MUSIC as surface wetlands with permanent bodies in the

upstream inlet (sediment pond) and main wetland (macrophyte) zone. Constructed wetlands have a higher shallow water zone in comparison to ponds and the vegetation is distributed more widely. They have a low flow and high flow bypass channels with the low flow bypass channel offtake located upstream of the wetland zone and high flow bypass located within the inlet pond and is operational when the wetland zone is full.

Figure 8: Wetlands
Source: Google Images

3.3.1.4 Gross Pollutant Traps

Gross Pollutant Trap (GPT) is a term applied to either in-situ or propriety units that remove litter, vegetative matter and sediments. GPTs come in a range of sizes, with larger units able to effectively treat large catchment areas and high flow rates. They are usually sized based on their maximum treatable flow being equal to greater than the 400% AEP storm event, an example is shown in Figure 9.

GPTs are generally used to treat rainwater runoff before discharging to raingardens to efficiently reduce gross pollutants and total suspended solids.

Figure 9: Gross Pollutant Trap
Source: Google Images

3.3.1.5 Cartridge Based Stormwater Treatment

Cartridge based stormwater treatments are precast concrete underground treatment systems which are used to remove suspended solids and other pollutants from stormwater runoff. Each filtration cartridge provides a membrane surface area which allows runoff to travel through the membrane while removing the pollutants. This system can be used as an alternative to

raingardens. Off the shelf products are advantageous when there is limited space in the project site, however the use of raingardens is preferred as a more sustainable solution. An example of a cartridge-based system is shown in **Figure 10** below.

Figure 10: Cartridge Device
Source: Google Images

3.3.2 Alternative Servicing Options

Developments within the Site will be required to provide water quality treatment measures to meet the minimum requirements outlined in Table 1. Alternative options are available to further promote environmental sustainability and showcase WSUD best practice. These could include implementation of an integrated water cycle management scheme or a water capture and reuse scheme, as described in the following sections.

3.3.2.1 Integrated Water Cycle Management Scheme

Integrated Water Cycle Management (IWCM) systems minimise water wastage by treating and purifying wastewater so it can be reused. These systems can save 40-70% of potable water usage per household in both urban renewal and high-rise developments.

In these systems wastewater is harvested from the sewer mains and transferred to a membrane filtration system. This then purifies the wastewater to a standard acceptable for toilet flushing, garden irrigation and other non-potable uses. The biosolids created during this process can be reused as fertiliser or to produce gas which can be used to create energy.

Implementation of these networks are beneficial for reducing dependency on the utilities network however they are generally managed by a private company and maintained through strata levies.

To implement an ICWM system a filtration and storage system would need to be provided for each sewer catchment. Wastewater would drain to a membrane filtration plant where it is treated. Treated water is then stored on site for use.

As recycled water is not suitable for drinking, potable water mains would still need to be provided for all dwellings. Should an IWCM system be implemented, dwellings would be fitted with dual reticulation mains. Potable water would be provided to internal fittings, while both recycled and potable water would be provided for outdoor uses.

3.3.2.2 Rainwater Harvesting and Reuse

Rainwater harvesting must be included for all residential developments to comply with BASIX requirements. Rainwater tanks can be further utilized for building cooling systems and as an alternate potable water source. Rainwater filtration and disinfection systems can be used to

provide safe potable drinking water from stormwater runoff. This will reduce the required water demand from potable water mains by providing an alternative means of supply.

Alternatively, there is potential to provide further harvesting throughout The Site via basins or ponds. This is dependent on the availability of open space areas. Captured rainwater or stormwater could be used to irrigate passive and active open space, reducing the demand on the potable water network.

3.3.2.3 Green Roofs

Providing green roofs for a minimum of 30% of the available rooftop will aid in reducing high nutrient loaded runoff from the roof space. Additional advantages include providing heating and cooling insulation, improved air quality, increase renewable energy efficiency, and increasing biodiversity in the area.

3.3.3 Proposed Water Quality Strategy

Water quality treatment facilities will be implemented in each catchment within the site. The water quality facilities are proposed to be located within proximity of the proposed detention basins and located within areas that showed high levels of wildlife on the site visit conducted by Mott MacDonald. Water quality requirements will be confirmed through detailed modelling undertaken in the next stage of the project.

4 Flooding Investigation

The analysis described below outlines the flood affectation pertaining to the existing site and the impact of existing flow paths on any potential development. The analysis was carried out, using Council's flood maps, and assessed against Council's Flood Risk Management Policy (2021).

As per Council's *Map 1 – Flood Controls Lots*, the subject site is classed as a property within the flood planning level area but does not require a flood study for development. Assessment of Council's flood maps also show that the subject site is not within a flood storage area or a floodway area; is not within a flow path; and is of low flood hazard and low flood risk. Thus, the site should be considered suitable for development as per Section 1 of the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

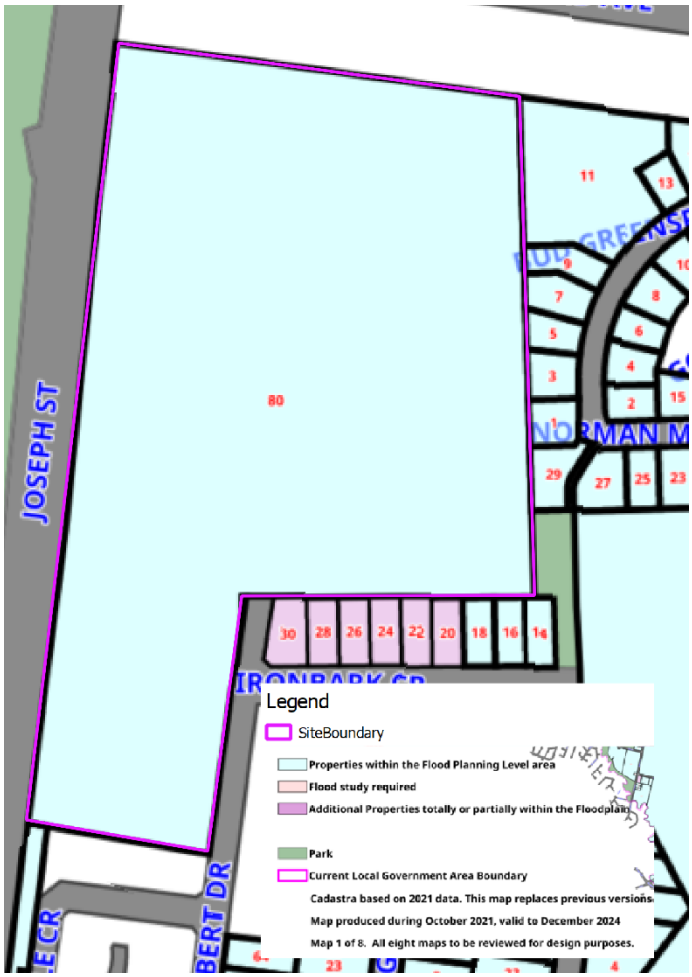


Figure 4.1: Flood Controls Lots Map

Source: Cumberland City Council Stormwater and Flood Maps

4.1 Flooding Impacts

Analysis of Council's flood maps show ponding at the sag point of Joseph Street adjacent to the site. The extent of the ponding overtops the curb and partially impacts the western boundary of the subject site, although is largely contained to the Joseph Street road reserve, as shown below on Figure 4.2. This likely cause of flood affectation is runoff accumulation at the existing low points within the Joseph Street in excess of the downstream stormwater pipe capacity rather than by any active overland flow path. The remainder of the site is largely unaffected by flooding during the 1% AEP Event.

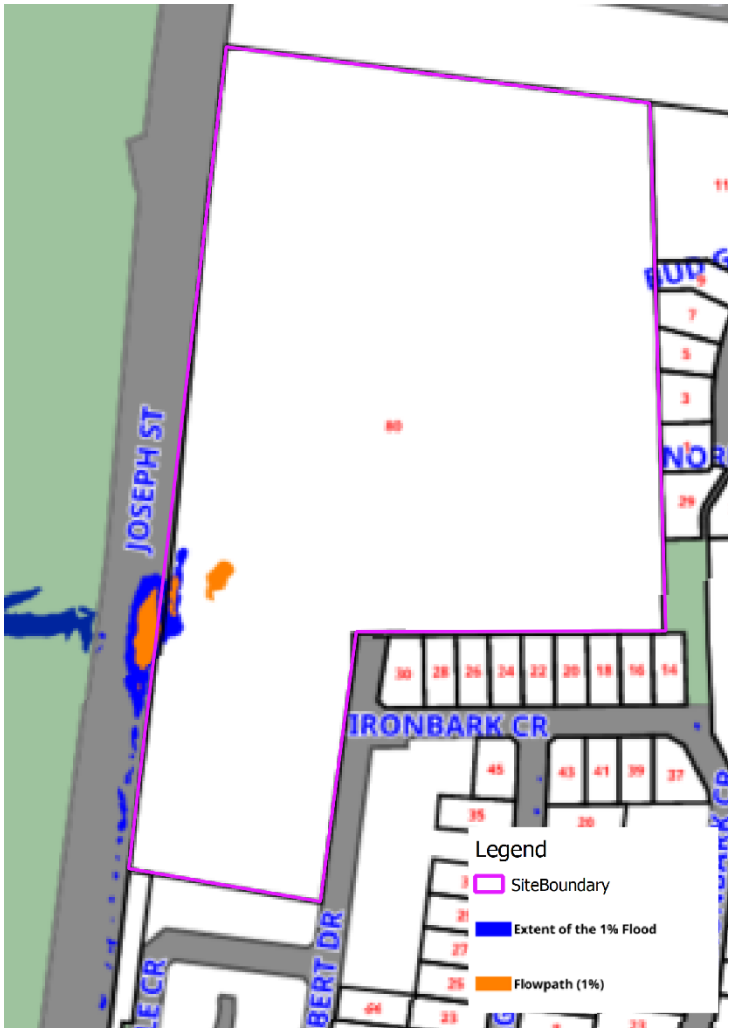


Figure 4.2: 1% AEP Flood Depth

Source: Cumberland City Council Stormwater and Flood Maps

The extent of the Probable Maximum Flood (PMF) is shown by Council's flood risk mapping in Figure 4.3. The flood extent illustrates a clear and defined flow path through the subject site during the PMF event which flows westwards into the neighbouring Carnarvon Golf Club and then northwest towards Haslams Creek. The majority of this flooded extent is classed as Low Risk in the PMF event, with only the limited area of flood ponding within the 1% AEP extent (discussed above) at the Joseph Street low point classed as Medium Risk.

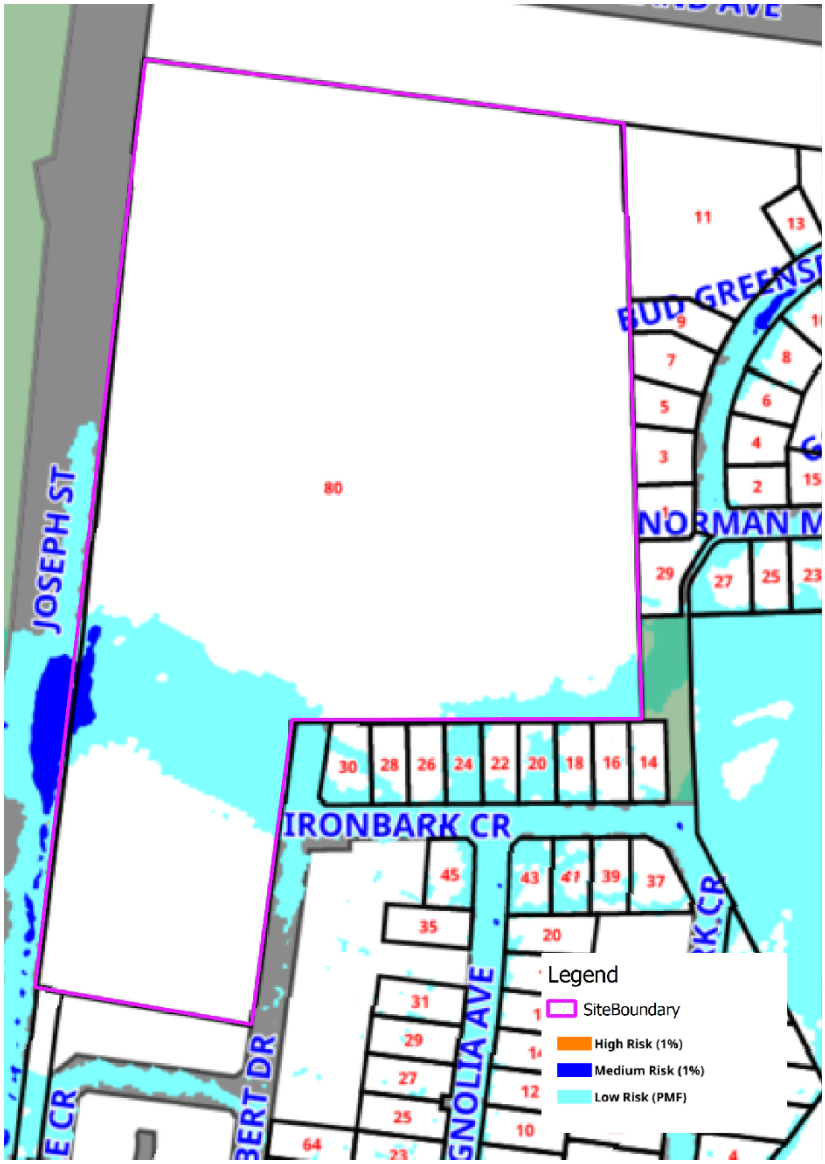


Figure 4.3: Flood Risk

Source: Cumberland City Council Stormwater and Flood Maps

It is to be noted that safe vehicle ingress and egress from the site may be compromised by the presence of the flood extent in the PMF event on Ironbark Crescent and along Joseph Street south of the proposed intersection, within the existing sag point of the road. However, safe access could be provided by Joseph Street, heading to/from the northerly direction. Any future development should therefore utilise Joseph Street (north) as the main point for emergency pedestrian and vehicle evacuation and access.

4.2 Design Controls and Guidelines

Based on the assessment of Council's flood maps, the results indicate sparse amounts of flood affectation in the 1% AEP Event, and the presence of a flow path of low flood risk within the PMF event extent. Any future redevelopment of the site that may alter existing levels or involve construction of a basement or underground carpark, will require compliance with Council's flood planning controls, including:

- Cumberland City Council Development Control Plan (2021)

- Cumberland City Council Flood Risk Management Policy (2021)
- Haslams Creek Flood Risk Management Report (2003)
- NSW Flood Development Manual (2005)
- NSW State Government's Flood Prone Land Policy

4.2.1 Flood Planning Controls

If redevelopment of the site were to alter existing terrain profiles, Cumberland City Council's Flood Risk Management Policy (2021) outlines a series of controls that need to be met which are outlined below in Figure 4.4.

Floor level	
1	All floor levels to be equal to or greater than the 5 year ARI flood level plus freeboard unless justified by site specific assessment.
2	Floor levels of open car parking areas to be equal to or greater than the 20 year ARI flood plus freeboard. This may be achieved with a suspended floor which allows the continued passage of flood waters or filling if justified by a site specific assessment, as required with reference to flood affectation and other controls below. Enclosed car parking (e.g. garages or basement car parking) must be protected from the 100 year ARI flood.
3	Habitable floor levels to be equal to or greater than the 100 year ARI flood plus freeboard.
4	Below ground swimming pools should be free from inundation from storms up to the 5 year ARI. Where required, the private open space of a dwelling should be a usable outdoor recreation area which, during storm events equal to less than the 5 year ARI, is free from inundation by overland flows exceeding 50mm.
5	All floor levels to be equal to or greater than the probable maximum flood plus freeboard.
6	Floor levels to be as close to the design floor level (the level nominated above that would apply if not concessional development) as practical and no lower than the existing floor level when undertaking alterations or additions.

Figure 4.4: Flood Risk Management Policy Floor Level Requirements
Source: Cumberland City Council Flood Risk Management Policy (2021)

As flood affected areas within the site are classed as low flood risk, only critical utilities are subject to Floor Level Requirement 5 as shown above in Figure 4.4. For areas of the site deemed medium flood risk; residential development will need to satisfy Floor Level Requirements 2,3 and 4, whilst Commercial and Industrial Developments will need to satisfy Floor Level Requirements 2 and 3.

Flood affectation	
1	Engineers report required to certify that the development will not increase flood affectation elsewhere.
2	The impact of the development on flooding elsewhere to be considered.

Note: When assessing flood affectation the following must be considered:
1. Loss of storage area in the floodplain (except for filling occurring up to the 20 year ARI.
2. Changes in flood levels caused by alteration of conveyance of flood waters.
3. Filling between the 20 year and 100 year ARI flood levels will not be permitted.

Figure 4.5: Flood Risk Management Policy Floor Affectation Requirements
Source: Cumberland City Council Flood Risk Management Policy (2021)

With respect to Flood Affectation, critical utilities within the subject site deemed as low flood risk will need to satisfy Flood Affectation Requirement 2, shown above in Figure 4.5. For areas deemed medium flood risk, Residential, Industrial and Commercial Developments will also need to satisfy Flood Affectation Requirement 2.

Figure 4.6: Flood Risk Management Policy Floor Level Requirements

Evacuation	
1	Reliable access for pedestrians required during a 5 year ARI flood.
2	Reliable access for pedestrians and vehicles required during a PMF flood.
3	Reliable access for pedestrians or vehicles is required from the dwelling, commencing at a minimum flood level equal to the lowest habitable floor level to an area of refuge above the PMF level, either on-site of off-site.
4	Applicant to demonstrate that the development is to be consistent with any relevant DISPLAN or flood evacuation strategy.

Source: Cumberland City Council Flood Risk Management Policy (2021)

With respect to Evacuation, critical utilities within the subject site deemed as low flood risk will need to satisfy Evacuation Requirements 2 and 4, shown above in Figure 4.6. For areas deemed me medium flood risk, Residential, Industrial and Commercial Developments will also need to satisfy Evacuation Requirements 3 and 4.

4.2.2 Flood Planning Levels

As the subject site falls within the Haslams Creek catchment, it is subject to variable freeboard requirements which are specified by the Haslams Creek Flood Plan Risk Management Study and Plan. Examination of this study revealed that the subject site does not fall within the defined PMF flood extent for Haslams Creek for the purpose of specifying freeboard. Thus a 0.5m freeboard requirement to the 1% AEP will be adopted as is consistent with Council's freeboard requirements for the Duck and Cooks River floodplains.

4.3 Flooding Context

The existing MSL building is located within a high point on the site and the surrounding landscape slopes primarily towards the south-west and eastern sides of the site. As outlined below in **Error! Reference source not found.**, the area of the proposed development sits north of the PMF flood extent. The area of the site proposed for development is largely flood free and appropriate access provided by the roadway is not impacted in the PMF event. The area of the site south of the PMF flow path will be subject to a separate Development Application and will not be assessed within this analysis.

5 Water Quantity and Quality Modelling

The analysis described in Section 4 addresses the Council requirements for the construction of the road reserves and associated stormwater infrastructure as detailed in civil drawing numbers 1401 to 1404. This report supports the Planning Proposal for the construction of road network to facilitate development, but does not address the individual lot based requirements for stormwater quantity and quality management. Future development will address the stormwater management requirements on an individual lot basis, described in Section 3.2.2.

5.1 Water Quantity Modelling

A hydrological model of the catchment was formulated using the DRAINS software package and was analysed to assess the performance of the site stormwater network. The DRAINS program typically performs design and analysis calculations for urban stormwater systems and models the flood behaviour on both rural and urban catchments.

The user data inputs required by DRAINS include catchment areas, flow path lengths, time of concentration, pervious and impervious areas, IFD rainfall intensities and flow path roughness. Modelling is performed through the development of a network of pipes, pits and nodes to represent both the proposed and existing scenarios on site.

For the purposes of this project the ARR2016 design methodology has been adopted.

5.1.1 Design Storms

The minor drainage system comprises of the below ground pit and pipe network and is designed to control nuisance flooding and enable effective stormwater management for the site. Council's DCP requires that the minor system be designed for the 20 Year ARI (5% AEP) Storm Event for property drainage systems.

The major drainage system incorporates overland flow routes through the proposed road, hardstand and landscaped areas and is assessed against the 100 Year ARI (1% AEP) Storm Event.

5.1.2 Impervious Percentage

Table 2 below shows impervious percentages used for water quantity modelling purposes. As Council guidelines do not specify impervious percentages for the type of catchment, the values below have been adopted as per general engineering practice. The impervious percentage for the MSL site was estimated based on the provided initial sizing of the building and allows for additional impervious areas such as driveways.

As per Section 3.2.2, it is proposed that the future lots will include their own detention system to detain stormwater flows at each property back to pre-development flow rates. To account for these detention systems, all Residential areas will be considered as 0% impervious for the water quantity modelling.

Table 2: Water Quantity Impervious Percentages

	Impervious Percentage (%)
Residential	0
Sealed Road	95
Landscape	0
MSL Site	95

5.1.3 Time of Concentration (TOC)

Catchments within the subject site with areas less than 1ha were given a time of concentration of 5 minutes for impervious surfaces and 10 minutes for pervious surfaces. Catchments larger than 1ha and existing catchments time of concentration was calculated using the catchment lengths, slopes and manning's 'n' values in DRAINS.

5.1.4 Intensity-Frequency-Duration (IFD) and Temporal Patterns

Cumberland Council do not provide any IFD information in their Auburn DCP. IFD information was taken from the Bureau of Meteorology (BoM) website using the coordinated provided below. The 5% and 1% AEP storm events were used for storm durations including the 5, 10, 15, 20, 25, 30, 45, 60, 90 and 120 minutes storm events, with the rainfall depths Table 3.

- Proposed Site Coordinates: -33.874653, 151.042989

Table 3: Rainfall Depth (mm)

DURATION	5% AEP	1% AEP
5 mins	13.6	17.1
10 mins	22.3	28.1
15 mins	27.9	35.2
20 mins	31.8	40
25 mins	34.7	43.7
30 mins	37.1	46.7
45 mins	42.3	53.3
1 hour	46.2	58.3
1.5 hours	52.4	66.4
2 hours	57.8	73.6

Source: Bureau of Meteorology (BoM), 2019

ARR2016 analyses storm events against multiple temporal patterns to ensure the worst-case storm event is considered in designs. Temporal patterns have been provided from the ARR Data Hub website.

5.1.5 Loss Parameters

The loss parameters utilised in the DRAINS model are identified in Table 4.

Table 4: DRAINS Model Loss Parameters

Parameter	Value
Impervious (Paved) Depression Storage	1 mm
Pervious (Grassed) Depression Storage	5 mm
Soil Type	3

5.1.6 Tailwater Levels

Tailwater levels at the outflow to the existing downstream drainage network at Joseph Street have been set at the surface level minus 150mm for the minor event and at surface level for the major event in accordance with general engineering practice. Levels specified were considered conservative as the proposed drainage is connecting to the head of the receiving drainage system in Joseph Street. This level was specified to simulate a charged system downstream and to verify the capacity of the proposed piped network during the design storm events.

5.1.7 Overland Flow Paths

Typical cross-sections based on the gutter shape and pavement type were input to DRAINS representing the overland flow paths. Slopes were derived from the design levels in-between concurrent pits. Flows within the gutter have been restricted to a maximum D x V of 0.4m^2/s in accordance with general engineering practice.

5.1.8 Upstream Catchments

Due to the site's existing topography, there is only one upstream catchment falling towards the site. This catchment is located along the southern boundary where Betty Cuthbert Drive meets the site boundary. Flows from this upstream catchment are collected in two (2) pits just south of the site boundary. As such, it is not expected that flows will enter the site and hence no upstream catchments have been considered in this case.

5.1.9 MSL Catchment

Upstream of the proposed site there will be the construction of an MSL facility, this proposed area is broken up into three catchments;

- Bypass Area,
- Area to Underground OSD; and
- Area to above ground Basin.

The proposed above ground basin is in the same location as the proposed Basin B1. It is likely that the MSL facility above ground basin will be constructed prior to the development and subsequently increased in size when the wider site is being constructed. This additional runoff from the MSL facility to their proposed above ground basin has been accounted for within the PSD and SSR calculations for Basin B1, seen in Table 6 below .

Table 5: MSL Catchment

Catchment	MSL Bypass Area (ha)	MSL Catchment to Underground OSD (ha)	MSL Catchment to Above Ground Basin (ha)	Total Additional Catchment to Basin B1 (ha)
MSL Facility	0.945	0.6662	0.2560	0.1620

Of the MSL catchment to the above ground basin 0.094 Ha accounted for within the design catchments, thus the remaining catchment flowing into Basin B1 is 0.1620 ha.

5.1.10 Permissible Site Discharge (PSD)

As mentioned in Section 3.2.2, Council have adopted a catchment-based PSD and SSR minimum requirements. These requirements have been based on the existing catchments for each discharge point as outlined in Figure 4, and are shown in Table 6 below. The school area is proposed to have its own detention requirements and has been removed from the existing catchment areas calculating the PSD and SSR. Whilst the residential lots have been included in the PSD calculation to ensure an accurate PSD requirement for the interim layout of the site prior to the construction of integrated rainwater tanks.

The site is located within the Nottinghill Rd Catchment, hence;

- PSD=100 L/s/ha; and
- SSR=455 m^3/ha.

Table 6: PSD Requirements

Existing Catchment (less School Site)	Area (Ha)	PSD (L/s)
B1	1.05	105
K1 (inc. MSL runoff)	2.41	241

5.1.11 Site Storage Requirements (SSR)

To calculate the SSR for the enabling works development, the orange and pink catchments (shown in Figure 7) were used as these catchments were proposed to be treated by the above ground basins. As mentioned, the SSR for the remainder of the site (the future education establishment and residential lots) will be catered for within the separate lot-based tanked systems identified in Section 3.2.2.3.

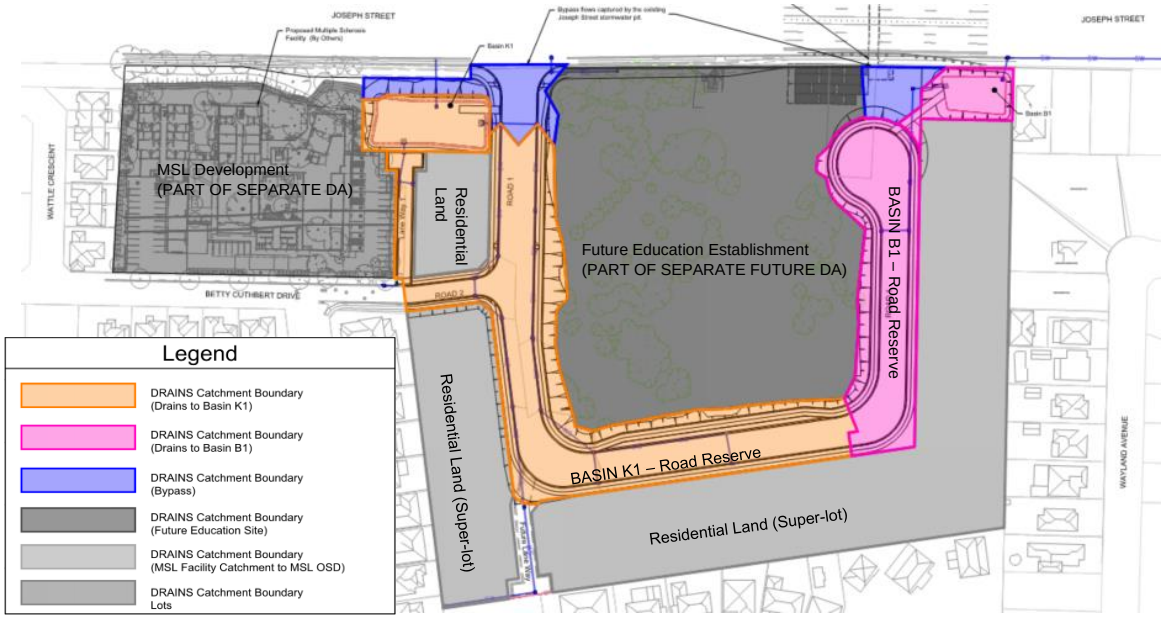


Figure 7: Proposed Catchment Areas to be treated by Above Ground Basins

Table 7: SSR

Existing Catchment (less School Site)	Area (Ha)	SSR (m^3)
B1	0.5025	228.6
K1 (inc. MSL runoff)	1.23	672.9

5.1.12 Existing Scenario Model

A DRAINS model of the existing site was prepared using the parameters specified in Section 5.1.1 to Section 5.1.10 of this report, in order to calculate the pre-development flows created by the site (refer Table 8 below). This will be compared to the post development flows at each discharge point in order to satisfy RMS requirements when connecting into RMS infrastructure.

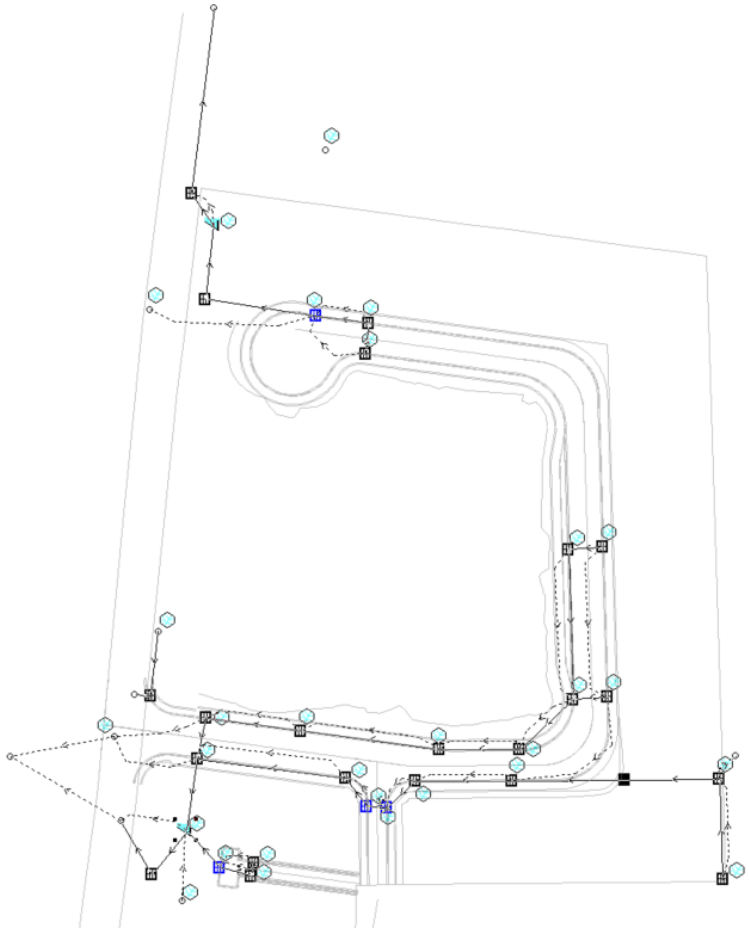
Table 8: Existing Site Peak Discharge

Existing Catchment (less School Site)	Existing Discharge Minor 5% AEP (m^3/s)	Existing Discharge Minor 1% AEP (m^3/s)
A	0.283	0.403
B (inc. MSL runoff)	0.818	1.083

5.1.13 Proposed Scenario Model

A DRAINS model of the proposed site was built using the parameters specified in Section 5.1.1 to Section 5.1.10 above, as per Cumberland Council requirements and general engineering practice. The layout of the developed scenario DRAINS model is shown in Figure 8 below.

Figure 8: DRAINS Model



Note: Pit and Catchment Labels have not been shown for clarity

Iterations were performed in the DRAINS model to determine the size of the proposed piped network and required on-site detention to satisfy Cumberland Council's major and minor system requirements (Section 5.1.1) and Council's PSD and SSR requirements (Section 5.1.10).

Two (2) permanent above ground basins have been proposed, located in the following areas of the site:

- **Basin B1** – In the north western corner of the site discharging to the existing Joseph Street RMS drainage system travelling north from the site;
- **Basin K1** – South of basin F1 along the western boundary and south of proposed Road 1. This basin will discharge to the existing Joseph Street RMS drainage system travelling south from the site.

The proposed stormwater basins have been designed to the following parameters:

- Storage volumes are based on the 1% AEP storm event water level plus 300mm freeboard. Volumes must meet Council's minimum SSR requirements;

- Discharge is controlled by orifice plates at the outlet of the discharge control pit in order to satisfy Council's PSD and RMS's pre-post conditions;

Table 9: Basin Parameters

Basin	Orifice (mm)	Basin TWL 1% AEP (AHD)	Top of Basin (AHD)	Storage Volume (m^3)	Council SSR (m^3)
B1	165	33.369	33.972	373.6	228.6
K1	270	32.871	33.34	767.5	672.9

Each basin's design parameters have been outlined in Table 9 above, which shows that the proposed basins have met Council's minimum SSR requirements for each catchment. SSR is currently governing the volume of both basins whilst DRAINS analysis has confirmed that any peak discharges are mitigated. An emergency spillway is to be detailed at a later stage to add a further redundancy during extreme rain events.

5.1.14 DRAINS Results

Results indicate that the major / minor system requirements are satisfied at all proposed pits in the development area and that the piped system sufficiently conveys minor storm flows with safe provision for major system flows (refer to Appendix B for DRAINS results). Table 10 and Table 11 outline the results of the proposed DRAINS model for the 5% AEP and 1% AEP respectively.

Table 10: DRAINS 5% AEP Results

Basin	Peak Discharge (m^3/s)	OSD Bypass (m^3/s)	Post-Development Flows (m^3/s)	Pre-Development Flows (m^3/s)	Council PSD (m^3/s)
B1	0.067	0.021	0.088	0.283	0.105
K1	0.156	0.047	0.203	0.818	0.241

Table 11: DRAINS 1% AEP Results

Basin	Peak Discharge (m^3/s)	OSD Bypass (m^3/s)	Post-Development Flows (m^3/s)	Pre-Development Flows (m^3/s)	Council PSD (m^3/s)
B1	0.074	0.027	0.101	0.403	0.105
K1	0.168	0.060	0.228	1.083	0.241

The results of the DRAINS analysis above indicate that the detention basins provide sufficient flow retardation and attenuation to ensure that Council's PSD and RMS's pre-post requirements are satisfied for all storm durations.

5.2 Water Quality Modelling

Treatment removal loads were analysed using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) Version 6 Software. MUSIC is a water quality modelling tool which was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales. MUSIC models the total amount of gross pollutants, phosphorus, nitrogen and total suspended solids produced within various types of catchments. It allows the user to simulate the removal rates

expected when implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

5.2.1 MUSIC Model – Methodology and Catchment Breakdown

The following methodology and parameters were incorporated into the MUSIC modelling for the post-developed site:

- The water quality analysis requires historical rainfall data recorded by a pluviography station. As such, pluviograph data was taken from Parramatta Masons Dr was utilised for this site. This station was considered appropriate due to the proximity to the site.
- The developed site was consolidated into three main sub-catchment areas based on the proposed drainage system:
  - ‘B1’ – the catchment area directed to basin B1;
  - ‘K1’ - the catchment area directed to basin K1.

Each basin is proposed to include bioretention at the base as an end-of-line treatment. The sub-catchment areas are shown in **Figure 9** below and listed in Figure 9: MUSIC Sub-Catchment Plan

Table 12.

Figure 9: MUSIC Sub-Catchment Plan

Table 12: Area Breakdown per MUSIC Sub-Catchment

MUSIC Sub-Catchment	Area (ha)
B1	0.993
K1	2.286
Bypass	0.167
Total	3.446

- The potential future school catchment is to haven its own separate water quantity and quality treatment measures. As such, the school catchment has been not been included in the MUSIC model;
- The three catchments were separated into 'Road', 'Landscape' and 'Residential' areas based on the proposed site layout;
- Bypass areas have been based on areas that will not be treated by any treatment device;
- Table 13 below outlines the areas adopted for each sub-catchment:

Table 13: MUSIC Catchment Breakdown

MUSIC Sub-Catchment	Residential (ha)	Road (ha)	Landscape (ha)	MSL Site (ha)	Basin Landscape (ha)	Total (ha)
Basin B1	0.551	0.260	0.113	N/A	0.069	**0.993**
Basin K1	1.188	0.581	0.240	0.162	0.115	**2.286**
Bypass	N/A	0.142	0.025	N/A	N/A	**0.167**
Total	**1.739**	**0.9826**	**0.3771**	**0.162**	**0.1847**	**3.446**

- Impervious percentages for the site have been assumed based on general engineering practice for each land classification, refer to Table 14. This was assumed as Council's DCP has not provided typical impervious percentages for each land classification.

Table 14: Water Quality Impervious Percentages

Node Classification	Percentage Impervious (%)
Landscape	0
Residential	80
Road (sealed)	95
MSL Site	30

5.2.2 Stormwater Pollutant Parameters

The pollutant concentration parameters for the different land use categories were obtained from the NSW MUSIC Modelling Guidelines (2015). As details of residential lot subdivision and roof areas are not present at this stage, the MUSIC parameters for the generic 'Residential' classification, as provided in the NSW MUSIC Modelling Guidelines (2015), have been used in the model. These are summarised in Table 15 below:

Table 15: Stormwater Pollutant Parameters

Classification		TSS		TP		TN	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Residential	Base Flow	1.20	0.17	-0.85	0.19	0.11	0.12
	Storm Flow	2.15	0.32	-0.60	0.25	0.30	0.19
Road (Sealed)	Base Flow	1.20	0.17	-0.85	0.19	0.11	0.12
	Storm Flow	2.43	0.32	-0.30	0.25	0.34	0.19
Landscape	Base Flow	1.20	0.17	-0.85	0.19	0.11	0.12
	Storm Flow	2.15	0.32	-0.60	0.25	0.30	0.19

5.2.3 Pervious Area Rainfall Runoff Parameters

To identify the soil texture on site the NSW Department of Planning, Industry and Environment's 'eSPADE' tool was used to obtain a soil map. Soil profiles from nearby Rookwood Cemetery, Birrong and Auburn were available on the map and indicated the soil texture present in the area to be 'loam'. As such, loam soil texture has been utilised for the purposes of this report. Further detailed geotechnical investigations are to be carried out at the next stage of the project to confirm this.

Pervious area rainfall runoff parameters for the soil texture 'loam' was obtained from NSW MUSIC Modelling Guidelines (2015). Table 16 below shows the parameters used for MUSIC modelling:

Table 16: Pervious Area Rainfall Runoff Parameters

Soil Texture	Soil Storage Capacity (mm)	Field Capacity (mm)	Infiltration Capacity Co-Efficient 'a'	Infiltration Capacity Co-Efficient 'b'	Daily Recharge Rate (%)	Daily Baseflow Rate (%)	Daily Deep Seepage Rate (%)
Loam	97	79	250	1.3	60	45	0

5.2.4 Bioretention Parameters

Bioretention 'raingardens' have been proposed at the base of all three proposed basins as an end-of line treatment for each catchment. Guidance was sought from the NSW MUSIC Modelling Guidelines (2015) for the bioretention properties parameters, summarised in Table 17 below:

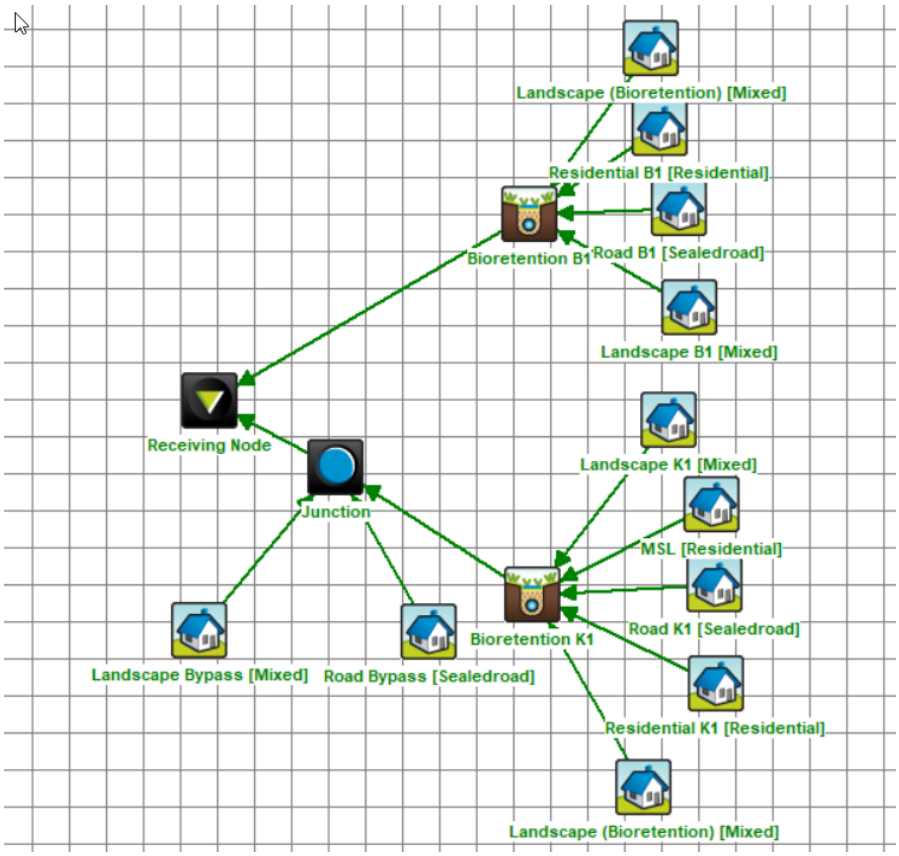
Table 17: Bioretention Parameters

Bioretention Properties	Value
Inlet Properties	
Low Flow By-pass (m^3/s)	0
High Flow By-pass (m^3/s)	100
Storage Properties	
Extended Detention Depth	0.10
Surface Area (m^2)	
– Basin B1	180
– Basin K1	500
Filter and Media Properties	
Filter Area (m^2)	
– Basin B1	180
– Basin K1	500
Unlined Filter Media Perimeter (m)	
– Basin B1	45
– Basin K1	68
Saturated Hydraulic Conductivity (mm/hr)	100
Filter Depth (m)	0.5
TN Content of Filter Media (mg/kg)	400
Orthophosphate Content of Filter Media (mg/kg)	40
Infiltration Properties	
Exfiltration Rate (mm/hr)	0

5.2.5 MUSIC Model Results

A snapshot of the MUSIC model is shown in Figure 10 below, followed by the model results.

Figure 10: MUSIC Model



As discussed in Section 3.3, the pollutant removal targets specified in the Holroyd Council DCP have been adopted for the site. Table 18 below states the pollutant removal targets and the results of the MUSIC model.

Table 18: Total MUSIC Model Results

Pollutant	Sources (kg/year)	Residual Load (kg/year)	Removal Rate (%)	Target Removal Rate (%)
Total Suspended Solids	4,840	789	83.7	80
Total Phosphorus	8.02	2.49	69	45
Total Nitrogen	45.5	21.2	53.3	45
Gross Pollutants	526	28.1	94.7	70

The MUSIC results indicate that the nominated treatment train described in this report for the developed site will meet the Holroyd Council's water quality removal targets for total suspended solids, total phosphorus, total nitrogen and gross pollutants for each catchment.

The proposed treatment train is regional in nature and does not include at source treatments. At detailed design stage, opportunities may be sought to incorporate more source treatment as a means of providing a more environmentally friendly and sustainable development. As discussed,

the potential future school catchment has been excluded from the model and its treatment will also need to be explored further at the detailed design stage. Furthermore, there may be opportunity to reduce the required bioretention areas and achieve higher standards by implementing lot-based rainwater tanks.

6 Drainage Maintenance Schedule

This section addresses the Council requirements to provide details of maintenance procedures necessary to ensure long-term effectiveness of both the existing and future stormwater systems.

6.1 Expected Maintenance Requirements

During detailed design submission a formalised maintenance schedule will be proposed across the proposed stormwater network to maximise the construction life of the site. During the DA phase an indicative maintenance schedule has been provided, see Table 19.

Table 19: Drainage System Maintenance Activities

Asset Group	Element	Frequency	Maintenance Activities
Drainage	Pits Pipes	Inspect system every six months and/or after heavy rainfall events.	Visual Inspection, note: Inlet blockages Debris along roadside kerb Damaged pit gratings Structural damage to pits Undermined outlets from scour or siltation Reporting and planning for repairs if required.
Open Drains	Swales	Inspect system every six months and/or after heavy rainfall events.	Visual Inspection, note: Scoured drains Silted drains Debris Vegetation overgrowth Reporting and planning for repairs if required.
Outlet structures	Headwalls	Inspect system every six months and/or after heavy rainfall events.	Visual Inspection, note: Debris and growth from inlets and outlets Scoured culvert outlets and behind wingwalls Reporting and planning for repairs if required.

6.2 Bioretention Basin Maintenance Requirements

An initial Bioretention Basin maintenance requirement schedule has been included in Appendix C, which outlines fundamental maintenance items, frequency of maintenance and general maintenance activities.

7 DCP Requirements

Below is a summary of the recommended DCP requirements for any developments on the residential super lots within subject site.

7.1.1 Water Quantity Planning Controls

On-site detention (OSD) is required to be designed for each lot to ensure peak flow rates at any point within the downstream drainage system do not increase as a result of development during all storm events up to the 100-year ARI, with the following requirements:

- Permissible site discharge (PSD) - 100L/s/Ha
- Site storage requirement (SSR) - Minimum of 455m^3/Ha

The following general detention design requirements are implemented:

- Stormwater runoff from all new roof areas shall be routed through the OSD system. Runoff entering the site from upstream properties shall be directed bypassing the on-site detention system.
- A portion of the new impervious areas (excluding roof areas) shall discharge directly to road drainage system if it cannot be drained to the storage facility, provided the PSD is reduced to compensate for the smaller catchment.
- No more than 15% of the total site area shall be permitted to bypass the detention system.
- The maximum desirable extent of impervious surfaces bypassing the detention system is 15% of the total impervious site area.

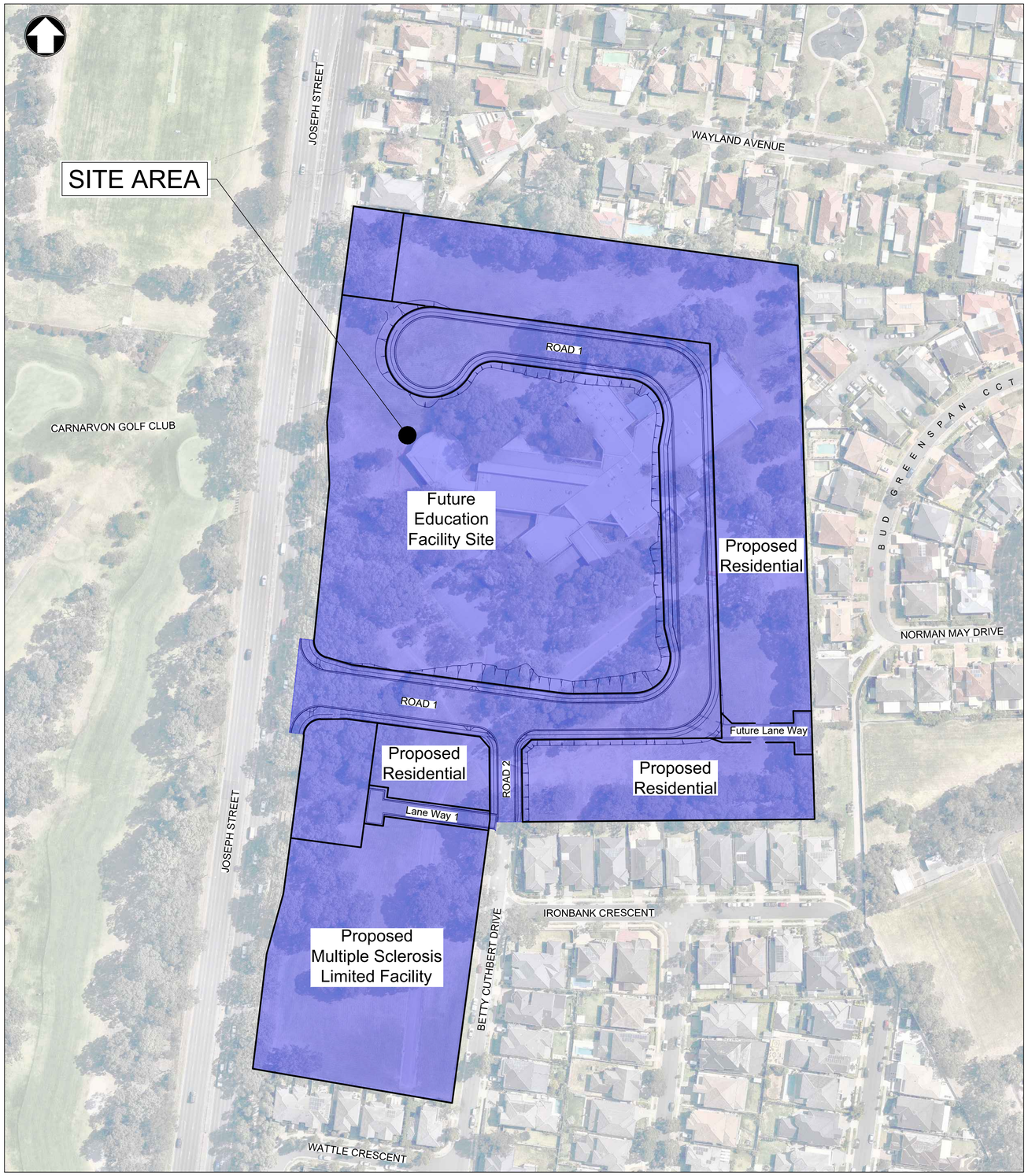
8 Conclusion

In summary, the results indicate that the proposed development will meet or exceed Council's stormwater requirements. The proposed pit and pipe network are adequately sized for both the major and minor system while the basins have been sized to detain the post developed discharge to the required PSD and SSR levels at each of the outlets for the site. Post developed flows have also been compared to the pre-development flow to ensure the proposed development does not exceed the existing discharge to the existing RMS drainage system on Joseph Street.

The proposed water quality treatment includes bioretention, located within the basins, which will provide suitable treatment to achieve Council's required water quality removal rates.

It should be noted that all water quantity basin sizing has assumed that the residential lands will provide their own On-Site Detention (OSD) via the dual use tanks. Basin sizes would need to be increased to accommodate additional OSD if these devices were not implemented. Rainwater tanks have not been considered in the water quality designs.

Appendix A – Concept Design Drawings



Locality Plan

MOTT MACDONALD

NSW GOVERNMENT | Planning, Industry & Environment

Property and Development NSW
(PDNSW)
4 Parramatta Square
12 Darcy Street
Parramatta NSW 2150

Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works

Planning Proposal Drawings

405675-MMD-00-XX-DR-C-0001 REV: P5
Date: 09/07/2021

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General Notes

GN1 All work to be carried out in accordance with Cumberland Council's standards and to the requirements of Council.

GN2 No work to be carried out on adjoining properties without written permission of property owner or responsible authority.

GN3 No trees are to be removed except for those noted on plan without written permission from Council.

GN4 All workmanship and materials shall comply with the National Construction Code of Australia and the relevant current Australian Standards.

GN5 Any discrepancies, omissions or errors shall be reported to the Superintendent for clarification before proceeding with the work.

GN6 Do NOT scale measurements from the drawings.

GN7 All compaction works for footpaths and pavements shall be done without the use of any form of vibrating machines or plant.

Siteworks Notes

SN1 Datum : Australian Height Datum (AHD)
Origin of levels : S.S.M.118773
Origin of co-ordinates : R.L. 34.634 A.H.D.
Survey prepared by : Rygate & Company Pty Ltd
Suite 904 Level 9, 89 York St
Sydney NSW 2000

SN2 The contractor must verify all dimensions and existing levels on site prior to commencement of work, and report any discrepancies to the superintendent.

SN3 All existing services (including any not shown on the plans) must be accurately located in position and level prior to any excavation. Any discrepancies shall be reported to the superintendent. minimum service clearances shall be maintained from the relevant service authority.

SN4 The contractor shall arrange for all setting out by a registered surveyor.

SN5 It is the contractors responsibility to notify the Department of Land and Property Information NSW, of any survey marks that will be destroyed in the construction of works.
Contact Head Office on 1300 052 637 www.lpi.nswgov.au and http://scims.lpi.nsw.gov.au/status_report_frames.html

SN6 The contractor shall obtain all regulatory authority approvals at their own expense.

SN7 Where new works abut existing, the contractor must ensure that a smooth and even profile, free from abrupt changes is obtained.

SN8 All disturbed areas shall be restored to their original condition, unless specified otherwise.

SN9 Excavated trenches shall be compacted to the same density as the adjacent natural material. Any subsidence's during the period to be rectified as directed by the superintendent.

SN10 Any existing trees which form part of the final landscaping plan will be protected from construction activities in accordance with the landscape architect's details and / or by -

Protecting them with barrier fencing or similar materials installed outside the drip line, ensuring that nothing is nailed to them, prohibiting paving, grading, sediment wash or placing of stockpiles within the drip line except under the following conditions -
Encroachment only occurs on one side and no closer to the trunk than either 1.5m or half the distance between the outer edge of the drip line and the trunk, which ever is the greater, a drainage system that allows air and water to circulate through the root zone (eg a gravel bed) is placed under all fill layers of more than 300mm care is taken not to cut roots unnecessarily nor to compact the soil around them.

SN11 Receptors for concrete and mortar slurries, paints, acid washings, light-weight waste materials and litter are to be emptied as necessary and disposal off-site to a lawful point of disposal.

Existing Services Notes

ES1 Existing services have been plotted from supplied data 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.

ES2 The contractor shall cap off all redundant existing services unless directed otherwise by the superintendent in accordance with the requirements of he relevant service authority and of the superintendent.

ES3 The contractor shall ensure that at all times services to all buildings not affected by the works are not disrupted.

ES4 If required, the contractor shall construct temporary services to maintain existing supply to buildings remaining in operation during works to the satisfaction 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 and the relevant service authority.

ES5 Prior to commencement of any works the Contractor shall gain approval of his programme for the relocation/construction of temporary services.

ES6 Interruption to supply of existing services shall be done so as not to cause any inconvenience to the relevant parties. The contractor is to gain approval from the relevant serivce authority and the superintendent for time of interruption - and the contractor is responsible for all liaison with the relevant stakeholders.

ES7 All branch gas and water services under driveways and brick paving shall be located in Ø80mm uPVC sewer grade conduits extending a minimum of 500mm beyond the edge of paving.

ES8 Clearance and cover requirements shall be obtained from the relevant service authority before commencement of works and shall be adhered to at all times.

ES9 Care is to be taken when excavating near existing services. No mechanical excavations are to be undertaken over telecom or electrical services. Hand excavate in these areas only.

Earthworks Notes

EW1 All work shall comply with AS3798 (2007) - Guidelines on earthworks for commercial and residential developments.

EW2 All work shall comply with the project geotechnical report.

EW3 Strip topsoil to expose naturally occurring engineering material and stockpile on site for reuse.

EW4 All soft, wet or unsuitable material to be removed and replaced with approved fill material.

EW5 All fill material shall comply with the following -
a) free from organic and perishable matter,
b) maximum particle size 75mm,
c) plasticity index - between 2% and 15%.

EW6 All fill material shall be placed in maximum 200mm thick layers and compacted at optimum moisture content (+ or - 2%) to achieve a dry density determined in accordance with AS1289.5.1.1 - 2003 - methods of testing soils for engineering purposes of not less than the following standard minimum dry density -

location	standard dry density
under building slabs	98%
vehicular paved areas	100%
non-vehicular paved areas	98%
landscaped areas	95%

EW7 The contractor shall program the earthworks operation so that the working areas are adequately drained during the period of construction. The surface shall be graded and sealed off to remove depressions, roller marks and similar which would allow water to pond and penetrate the underlying material. any damage resulting from the contractor not observing these requirements shall be rectified by the contractor at their own expense.

EW8 Testing of the fill material shall be carried out by an approved NATA registered laboratory at the contractors expense.

EW9 Where the subgrade is unable to support construction equipment, or it is not possible to compact overlying pavement layers, only because of the subgrade moisture content, then the contractor shall condition or replace the material at the contractors discretion and expense.

EW10 Earthworks calculations are volumetric only and do not allow for bulking of excavated material. It is the contractors responsibility to make allowances for these items as part of the tender / works.

EW11 No allowance has been made for footings or foundations, retaining walls or trenching. It is the contractors responsibility to make allowances for these items as part of the tender / works.

Stormwater Notes

SW1 For residential subdivisions and public roads -

All Ø375mm to Ø600mm drainage pipes shall be class 2 approved spigot and socket reinforced concrete pipes with rubber ring joints (UNO). All Ø675mm or larger drainage pipes shall be class 3 approved spigot and socket reinforced concrete pipes with rubber ring joints (UNO).

All uPVC drainage pipes in footways or accessways shall be DWV grade class SN8 in accordance with AS/NZS 1260:2009 - PVC-u pipes and fittings for drain, waste and vent application. heavy duty uPVC pipes to be in accordance with AS/NZS 1254 : 2010 - PVC pipes and fittings for storm and surface water applications may be used within allotments.

SW2 Equivalent strength fibrous reinforced concrete (F.R.C.) and / or High density polyethylene (H.D.P.E.) may be used subject to approval by the superintendent.

SW3 All pipe junctions up to and including Ø450mm and tapers, shall be via purpose made fittings (UNO).

SW4 Minimum grade to stormwater lines to be 1% (UNO).

SW5 Contractor to supply and install all fittings and specials including various pipe adaptors to ensure proper connection between dissimilar pipework.

SW6 All connections to existing drainage pits shall be made in a tradesman-like manner and the internal wall of the pit at the point of entry shall be cement rendered to ensure a smooth finish with no protrusions.

SW7 All in-situ concrete pits to be 32Mpa minimum at 28 days.

SW8 Pits and pipes in areas of salinity hazard shall have increased cover to any reinforcement.

SW9 Precast concrete pits may be installed in lieu of cast in-situ pits, when pipe junctions are accommodated within the overall dimensions of the pit, and approved by the superintendent.

SW10 Pits deeper than 1000mm shall have step irons installed in accordance with the local or statutory authority requirements.

SW11 Bedding shall be type H2 (UNO) for pipes not under pavements, and type HS2 for pipes under pavements in accordance with AS/NZS 3725 : 2007 - design for installation of buried concrete pipes.

SW12 Backfill trench with sand or approved granular backfill to 300mm (min) above the pipe. Where the pipe is under pavements backfill remainder of trench to pavement subgrade with sand or approved gravel sub-base compacted in 150mm layers to 98% standard maximum dry density. The contractor is to ensure compaction equipment is appropriate for the pipe class used.

SW13 Where stormwater lines pass under floor slabs DWV grade uPVC rubber ring joints are to be used (UNO).

SW14 Where subsoil drainage lines pass under floor slabs and vehicular pavements, unslotted uPVC DWV grade class SN8 pipe shall be used.

SW15 Provide 3m length of Ø100mm subsoil drainage line or 200 'Nylex' strip drain surrounded with 150mm of 20mm blue metal or gravel, and wrapped in 'Bidum' A24 geotextile filter fabric or approved equivalent, at invert of incoming upstream pipe on each pit.

Concrete Notes

General

CN1 Use "AS3972 - 2010 - General purpose and blended cements - Type GP" cement (UNO).

CN2 All concrete shall be subject to project control sample and testing to AS3600 - 2009 - concrete structures.

CN3 Consolidate all concrete, including footings and slabs on ground with mechanical vibrators.

CN4 Cure all concrete as follows -
- keep surfaces continuously wet for 3 days, then
- prevent moisture loss for the next 4 days using polythene sheeting or wet hessian protected from wind and traffic, and then allow drying out.
- curing compounds may be used provided that they comply with AS3799 and they do not affect floor finishes.
- PVA-based curing compounds are NOT acceptable.

CN5 Fix reinforcement as shown on drawings. The type and grade is indicated by a symbol as shown below -

N	hot rolled deformed bar, grade 500
R	plain round bar, grade 250
SL / RL	hard drawn wire fabric square or rectangular

following this symbol a numeral indicates the specified diameter.

CN6 Provide bar supports or spacers to provide concrete cover as detailed to all reinforcement.

Concrete Pavements

CN7 Concrete mix parameters -
maximum aggregate size 20mm
flexural strength at 28 days = 3.5 MPa, F'c= 32 MPa, (UNO)
flexural strength at 90 days = 3.85 MPa
max water/cement ratio = 0.55
max shrinkage limit = 650 micron strains (AS1012.13-1992)
min cement content = 300kg/m³
cement to be type "SL" (normal cement) to AS3972-2010
slump = 80mm

CN8 Early age saw cutting ('softcut') or similar shall be used for initial saw cut. It is to be performed as soon as the concrete has hardened sufficiently, to prevent excessive chipping, spalling, or tearing regardless of time or weather conditions.

CN9 Joint layout shall be as detailed on the plans.

CN10 Provide 10mm wide expansion joints between all buildings, other structures and pavements.

CN11 Bond breaker to be two (2) uniform coats of bitumen emulsion all over the exposed surface and on end.

CN12 Dowels and tie bars to meet strength requirements of structural grade steel in accordance with AS ISO 1302 - 2005 - geometrical product specifications.
Dowels and tie bars shall be -
straight,
to length specified,
all dowels to be hot dip galvanised,
sawn to length not cropped.

CN13 Dimensions of sealant reservoir dependant on the sealant type adopted. Superintendent approval to be obtained for sealant and reservoir dimensions and detail proposed by the contractor. Refer to plans for typical arrangement and sealant.

CN14 Prior to the placement of concrete in the adjacent slab, 'Ableflex' filler shall be adhered to the already cast and cleaned concrete face using an approved waterproof adhesive. Adhesive shall be liberally applied to the full face of the concrete slab to be covered by the filler, and on the full face of the filler to be adhered.

CN15 The base course shall be kept moist (not wet) by sprinkling with water immediately prior to pouring the concrete.

CN16 All work to be finished to satisfy its intended use as shown on the plans, and / or in accordance with the specification.

Kerbing Notes

CN17 All concrete kerbs to have a minimum characteristiccompressive strength F'c=25MPa (UNO).

CN18 All kerbs, dish drains, etc. to be constructed on 75mm minimum base course.(UNO on the Drawings)

CN19 Kerb expansion joints shall be formed from 10mm 'Ableflex' (or approved equivalent) for the full depth of the section.

CN20 Expansion joints shall be located at drainage pits, tangent points of curves and elsewhere at 12m maximum spacing (UNO).

CN21 Tooled joints shall be min 3mm wide and located at maximum 3m spacing.

CN22 Integral kerb joints shall match the location of the pavement jointing.

Linemarking Notes

LM1 All linemarking works to be in accordance with either the current Australian standard AS1742.2-2009-Manual Uniform Traffic Control Devices, or as shown on the plans or as directed by the superintendent.

LM2 The scope of work shall include all pavement markings to roads and carparks.

LM3 The work carried out and testing performed shall comply with the current, relevant Australian standards and RMS standards where necessary.

LM4 All markings shall be spotted out and verified by the contractors representative prior to application.

LM5 Paint shall be applied at a wet thickness of between 0.35mm - 0.45mm.

LM6 Paint shall only be applied to clean and dry surfaces.

LM7 All longitudinal lines shall be applied by a self-propelled machine.

LM8 Linemarking removal shall be carried out by grinding or sandblasting. Removal by burning will not be permitted.

LM9 The extent of linemarking to be eradicated shall be confirmed on site prior to removal. Any markings incorrectly removed shall be reinstated at the contractor's expense.

LM10 All markings shall be completed in a workmanlike manner and be straight, smooth and with even curves. Any non-conforming work, shall be removed and reinstated at the direction of the superintendent at the contractor's expense.

LM11 Linemarking on AC pavements to be provided no sooner than 7-10 days once the asphalt has set.

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P3	18/06/2021	BS	Issued for Information	ADS	JW
P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

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Client: NSW GOVERNMENT Planning, Industry & Environment

Title: Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
General Notes Sheet

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	

Scale at A1	Status	Rev	Security
NTS	PRE	P5	STD

Drawing Number: 405675-MMD-00-XX-DR-C-0011

Survey Legend

- 268°02'198.12 — Existing boundary, bearing and distance
- PINE — Existing road name
- SHED — Existing building
- 12.45 — Existing kerb and spot levels
- BLOCK WALL — Existing block wall
- MESH FENCE — Existing fence
- x 13.20 — Existing spot level
- Existing earth batter
- 12.00 TREE 0.3D 8H 4S — Existing tree, level, trunk diameter, height and spread
- ec — Existing electricity (underground)
- ee — Existing electricity (overhead)
- eg — Existing gas
- es — Existing sewer
- esw — Existing stormwater drainage
- ew — Existing water
- et — Existing telecommunications (underground)
- PT — Existing telstra and power
- Existing electricity pit, pole, pole with light and light pole
- Existing gas valve
- Existing sewer pit and maintenance hole
- Existing stormwater grate, maintenance hole and pit
- Existing water hydrant, stop valve and valve
- Existing telecommunications pit and pillar
- Existing maintenance hole (unspecified)
- Existing pole (unspecified)
- Existing pit (unspecified)
- Existing traffic signal

Abbreviations Legend

BM	BENCH MARK
C	CONCRETE
ELEC	ELECTRICITY KIOSK
GR	GRATE (PIT)
HYD	HYDRANT
KG	KERB AND GUTTER
KO	KERB ONLY
KOP	KERB OUTLET POINT
LNT	KERB INLET PIT LINTEL
LP	LIGHT POLE
PR	PRAM RAMP CROSSING
SIP	SEWER INSPECTION POINT
SMH	SEWER MANHOLE
SV	STOP VALVE
TEL	TELECOMMUNICATIONS PIT
TK	TOP KERB
VC	VEHICLE CROSSING
WM	WATER METER
5/0.3	TREE 5m SPREAD 0.3m TRUNK

Pavement Legend

- Asphaltic Concrete Pavement — To be confirmed during detailed design stage
- Concrete Footpath Pavement — In accordance with Cumberland Council requirements
- Concrete Shared Path Pavement — In accordance with Cumberland Council requirements
- Proposed Landscaping — In accordance with landscape drawings
- Concrete Driveway Pavement — In accordance with Cumberland Council requirements

All pavements are indicative only. To be confirmed on site by Geotechnical investigation, testing and design. All works in accordance with Geotechnical Engineers/Cumberland Council requirements

Civil Works Legend

- ROAD No1 — Road name / number
- CH 200 — Design control line and chainage
- Sawcut existing pavement
- KG — Construct kerb and gutter in accordance with Cumberland Council Standard Drawings
- KO — Construct kerb only in accordance with Cumberland Council Standard Drawings
- DD — Construct dish drain in accordance with Cumberland Council Standard Drawings
- VC — Construct vehicle crossing in accordance with Cumberland Council Standard Drawings
- PR — Construct kerb pram ramp in accordance with Cumberland Council Standard Drawings
- Construct batter
- RW — Construct retaining wall (Location and extent indicative only).
- P10.00 — Proposed finished surface level
- 10.0 — Major contour
- 9.9 — Minor contour

Stormwater Drainage Legend

- A1 — Stormwater drainage structure / pit number.
- Surface inlet pit/Juntion pit
- Kerb inlet pit with lintel
- Ø375 SW — Proposed stormwater drainage line with pipe size
- Construct headwall outlet
- Ø375 SW — Proposed temporary stormwater drainage line with pipe size
- Construct temporary headwall outlet
- Temporary surface inlet pit/Juntion pit
- Construct stormwater dentention basin. Details to be confirmed in the detailed design stage.
- Provide outlet scour protection.
- Construct subsoil drainage line
- IR — Construct subsoil intermediate riser
- HER — Construct subsoil high end riser
- esw — Existing stormwater
- Grassed lined swale

Sheet List Table

Drawing Number	Drawing Title
405675-MMD-00-XX-DR-C-0001	Civil Works Cover Sheet
405675-MMD-00-XX-DR-C-0011	Civil Works General Notes Sheet
405675-MMD-00-XX-DR-C-0021	Civil Works Legends Sheet
405675-MMD-00-XX-DR-C-0051	Civil Works General Arrangement Plan
405675-MMD-00-XX-DR-C-0061	Civil Works Demolition Plan
405675-MMD-00-XX-DR-C-0101	Civil Works Soil and Water Management Plan
405675-MMD-00-XX-DR-C-0111	Civil Works Soil and Water Management Notes and Details Sheet
405675-MMD-00-XX-DR-C-0151	Civil Works Earthworks Cut and Fill Plan
405675-MMD-00-XX-DR-C-0161	Civil Works Earthworks Sections Sheet 1
405675-MMD-00-XX-DR-C-0162	Civil Works Earthworks Sections Sheet 2
405675-MMD-00-XX-DR-C-0201	Civil Works Alignment Control Plan
405675-MMD-00-XX-DR-C-0251	Civil Works Typical Road Cross Sections Sheet 1
405675-MMD-00-XX-DR-C-0252	Civil Works Typical Road Cross Sections Sheet 2
405675-MMD-00-XX-DR-C-0301	Civil Works Road Longitudinal Sections
405675-MMD-00-XX-DR-C-0401	Civil Works Siteworks Plan Sheet 1
405675-MMD-00-XX-DR-C-0402	Civil Works Siteworks Plan Sheet 2
405675-MMD-00-XX-DR-C-0403	Civil Works Siteworks Plan Sheet 3
405675-MMD-00-XX-DR-C-0404	Civil Works Siteworks Plan Sheet 4
TOTAL NUMBER OF SHEETS	**18**

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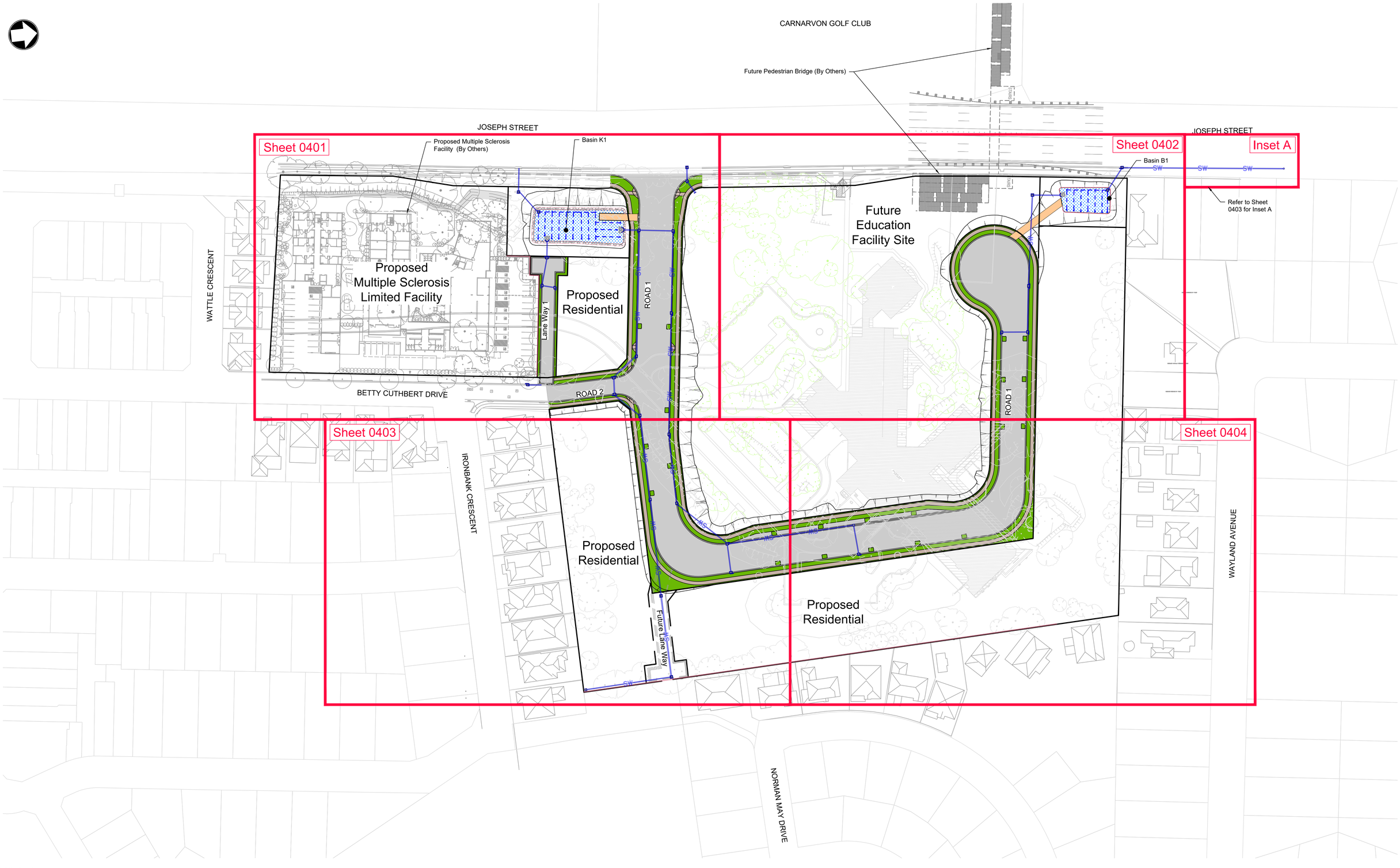
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Legends Sheet

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1: NTS	Status: PRE		Rev: P5	Security: STD	

Drawing Number: 405675-MMD-00-XX-DR-C-0021



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P1	24/01/2020	GAP	Issued for Information	AS	JW

1:750 37.5m 75.0m

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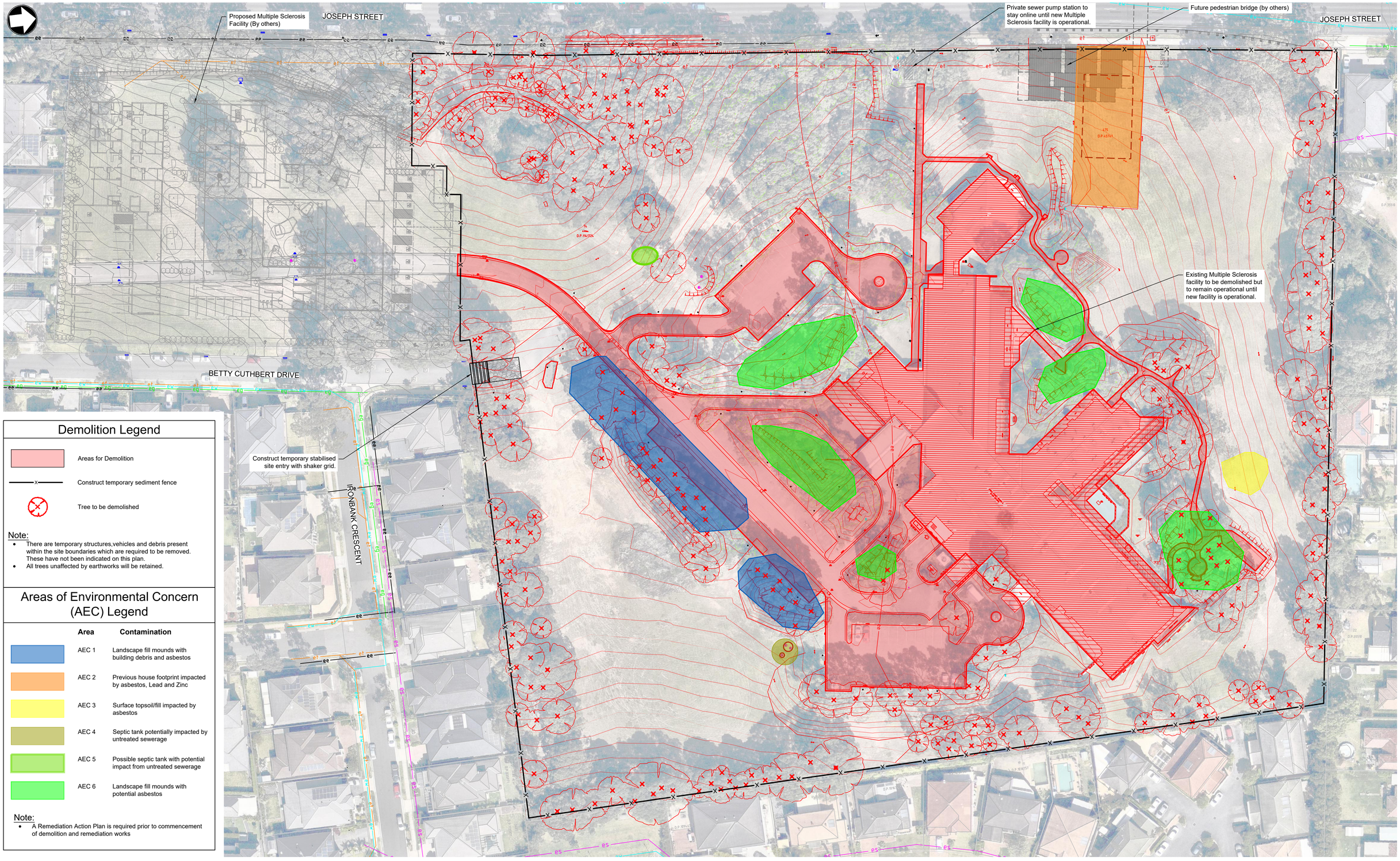
80 Betty Cuthbert Drive, Lidcombe
Civil Works
General Arrangement Plan

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	1:750	Status	PRE	Rev	P5
Security	STD				

Drawing Number: 405675-MMD-00-XX-DR-C-0051



Demolition Legend

- Areas for Demolition
- Construct temporary sediment fence
- Tree to be demolished

Note:

- There are temporary structures,vehicles and debris present within the site boundaries which are required to be removed. These have not been indicated on this plan.
- All trees unaffected by earthworks will be retained.

Areas of Environmental Concern (AEC) Legend

	Area	Contamination
	AEC 1	Landscape fill mounds with building debris and asbestos
	AEC 2	Previous house footprint impacted by asbestos, Lead and Zinc
	AEC 3	Surface topsoil/fill impacted by asbestos
	AEC 4	Septic tank potentially impacted by untreated sewerage
	AEC 5	Possible septic tank with potential impact from untreated sewerage
	AEC 6	Landscape fill mounds with potential asbestos

Note:

- A Remediation Action Plan is required prior to commencement of demolition and remediation works

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P4	18/06/2021	BS	Issued for Information	ADS	JW
P3	13/05/2020	SE	Issued for DA	ADS	JW
P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

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80 Betty Cuthbert Drive, Lidcombe
Civil Works
Demolition Plan

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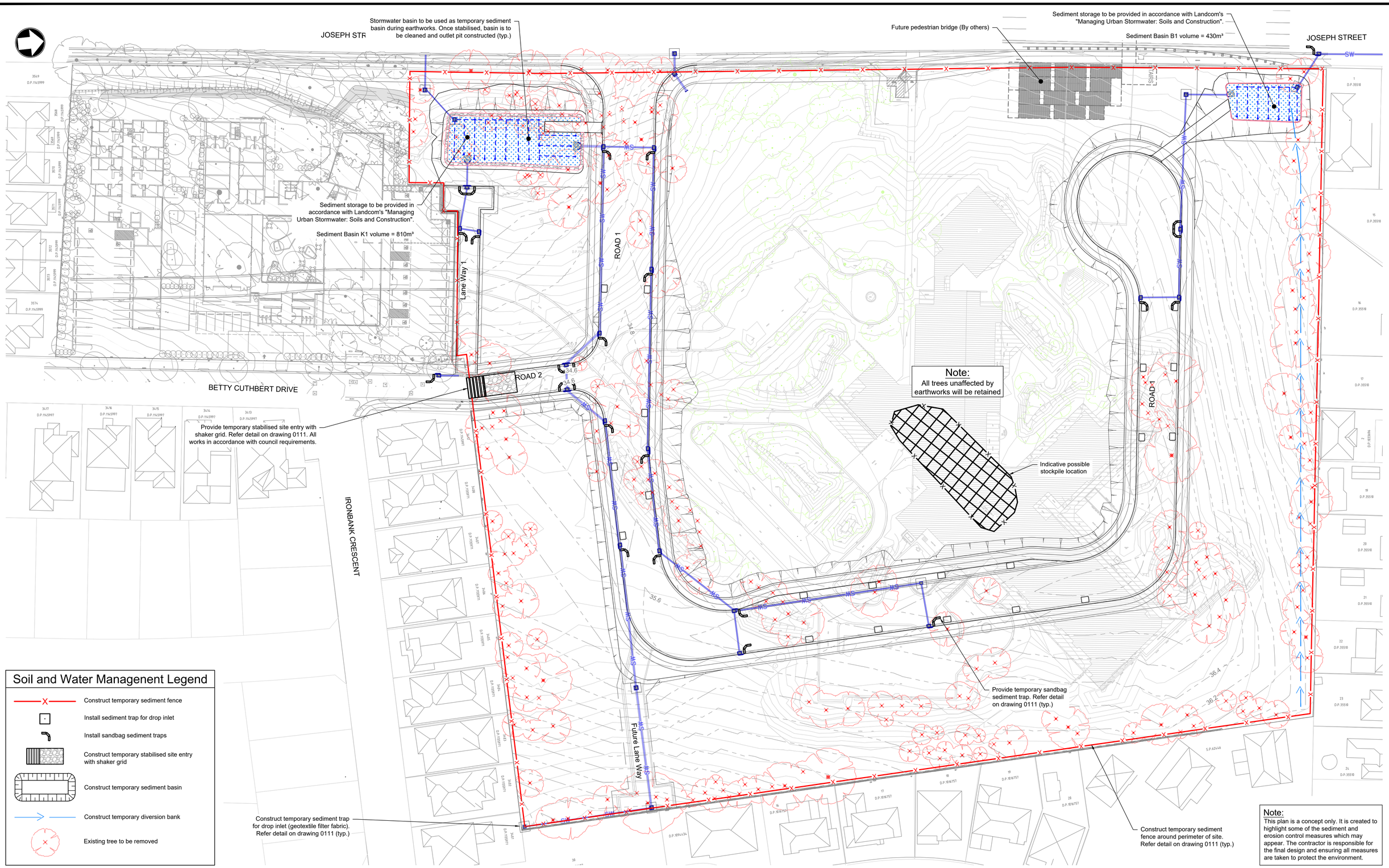
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	Status		Rev	Security	
1:500	PRE		P6	STD	

Drawing Number: 405675-MMD-00-XX-DR-C-0061



Soil and Water Managenent Legend

- Construct temporary sediment fence
- Install sediment trap for drop inlet
- Install sandbag sediment traps
- Construct temporary stabilised site entry with shaker grid
- Construct temporary sediment basin
- Construct temporary diversion bank
- Existing tree to be removed

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1:500 0 25m 50m

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80 Betty Cuthbert Drive, Lidcombe
Civil Works
Soil and Water Management Plan

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	1:500	Status	PRE	Rev	P5	Security	STD

Drawing Number: 405675-MMD-00-XX-DR-C-0101

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Soil and Water Management Notes

General Instructions

SWM01 These plans present an indicative soil and water management plan (SWMP) only and are of a conceptual nature. The contractor shall be responsible for the establishment and management of the site and preparing a detailed plan and obtaining approval from the relevant authority prior to the commencement of any works.

SWM02 This plan is to be read in conjunction with the engineering plans and any other plans, written instructions, specification or documentation that may be issued and relating to development of the subject site.

SWM03 The contractor will ensure that all soil and water management works are consistent with 'Managing Urban Stormwater - Soils and Construction' - also known as 'The Blue Book'.

SWM04 All builders and sub-contractors shall be informed of their responsibilities in minimising the potential for soil erosion and pollution to downslope lands and waterways.

Erosion Control

SWM05 Water shall be prevented from entering the permanent drainage system until sediment concentration is less then or equal to 50mg/L, ie the catchment area has been permanently landscaped and / or any likely sediment has been filtered through an approved structure.

SWM06 Any sand used in the concrete curing process (spread over the surface) will be removed as soon as possible and within 10 working days from placement.

SWM07 Acceptable receptors will be constructed for concrete and mortar slurries, paints, acid washings, light-weight waste materials and litter.

SWM08 'Sediment' fencing will be installed as indicated on the plans and at the direction of site superintendent to ensure containment of sediment. The sediment fencing will outlet or overflow under stabilised conditions into the sediment basin, to safely convey water into a suitable filtering system should the pores in the fabric block.

SWM09 Stockpiles should not be located within 5m of trees and hazard areas, including likely areas of concentrated or high velocity flows such as waterways, drainage lines, paved areas and driveways. Where they are within 5m from such areas, special sediment control measures should be taken to minimise possible pollution to downstream waters. Measures should also be applied to prevent the erosion of the stockpile.

SWM10 All cut and fill batters are to be seeded and mulched within 14 days of completion of formation.

SWM11 Any existing trees which form part of the final landscaping plan will be protected from construction activities by-

a. Protecting them with barrier fencing or similar materials installed outside the drip line,
b. Ensuring that nothing is nailed to them,
c. Prohibiting paving, grading, sediment wash or placing of stockpiles within the drip line except under the following conditions,

(i) Encroachment only occurs on one side and no closer to the trunk than either 1.5 metres or half the distance between the outer edge of the drip line and the trunk, which ever is the greater,

(ii) A drainage system that allows air and water to circulate through the root zone (e.g. a gravel bed) is placed under all fill layers of more than 300 millimetres depth

(iii) Care is taken.

SWM12 During windy weather, large disturbed unprotected areas should be kept moist (not wet) by sprinkling with water to keep dust under control.

SWM13 Temporary protection from erosive forces will be undertaken on lands where final shaping has not been completed but works are unlikely to proceed for periods of two months or more (eg. on topsoil stockpiles). This may be achieved with a vegetative cover. A recommended listing of plant species for temporary cover is -

i) autumn/winter sowing - oats/ryecorn at 20 kg/ha
- japanese millet at 10 kg/ha
ii) spring/summer sowing - japanese millet at 20 kg/ha
- oats/ryecorn at 10 kg/ha

SWM14 Diversion banks / channels will be rehabilitated as soon as possible and within 5 working days from their final shaping. Other than in the winter months, suitable materials include turf grasses such as Couch or Kikuyu. During winter, or at other times when temporary rehabilitation (more than 3 months) is required, it is suggested that hessian cloth is used but only if tacked with appropriate pegs and an anionic bitumen emulsion. Foot and vehicular traffic should be kept away from these areas.

SWM15 Undertake site development works in accordance with the engineering plans. Where possible, phase development so that land disturbance is confined to areas of workable size.

Construction Sequence

SWM16 Where practical, the soil erosion hazard on the site should be kept as low as possible. To this end, works should be undertaken in the FOLLOWING SEQUENCE -

(i) Install inlet sediment traps to all gully pits fronting the site,

(ii) Install a 1.8m chain wire fence around the boundaries and attach hessian cloth or similar to it on the windward side (ties at the top, centre and bottom and at 1m intervals or as instructed by the superintendent),

(iii) Install geofabric sediment fence and sediment traps around all permanent stormwater reticulation structures as shown on the plan,

(iv) Construct stabilised construction entrance as shown on the plan or to location as determined by superintendent,

(v) Install diversion banks along the boundary where required, rehabilitate disturbed lands downslope from the basins within 20 working days,

(vi) Ensure that the sediment basin is directed onto a turfed area and drains to a suitable location. A temporary stormwater line may be necessary to convey the flows to this location. Construct diversion channels at the boundary to drain into the sediment basin as shown on plans,

(vii) At completion stabilise site and decommission sediment basin and all erosion control devices.

SWM17 Temporary soil and water management structures will be removed only after the lands they are protecting are rehabilitated.

SWM18 Final site landscaping will be undertaken as soon as possible and within 20 working days from completion of construction activities.

Site Inspection and Maintenance

SWM19 At least weekly and after every rain fall event, the contractor will inspect the site and ensure that -

(i) Drains and all sediment control devices operate effectively and initiate repair or maintenance as required,

(ii) Receptors for concrete and mortar slurries, paints, acid washings, light-weight waste materials and litter are to be emptied as necessary. Disposal of waste shall be in a manor approved by the superintendent,

(iii) Spilled sand (or other materials) is removed from hazard areas, including likely areas of concentrated or high velocity flows such as waterways, gutters, paved areas and driveways,

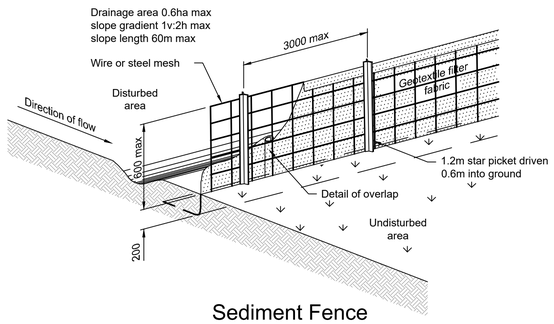
(iv) Sediment is removed from basins and / or traps when less than 20m³ of trapping capacity remain per 1000m² of disturbed lands, and / or less than 500mm depth remains in the settling zone. Any collected sediment will be disposed in areas where further pollution to down slope lands and waterways is unlikely,

(v) Rehabilitated lands have effectively reduced the erosion hazard and initiate upgrading or repair as appropriate.

SWM20 The contractor shall provide all monitoring control and testing.

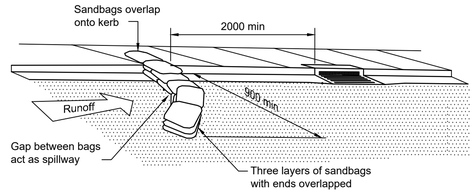
Note:

This plan is a concept only. It is created to highlight some of the sediment and erosion control measures which may appear. The contractor is responsible for the final design and ensuring all measures are taken to protect the environment.



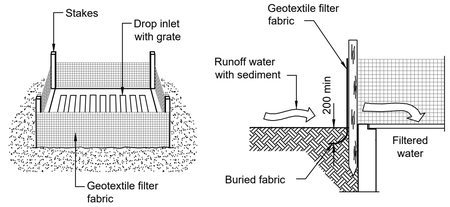
Sediment Fence (Geotextile Filter Fabric)

NTS



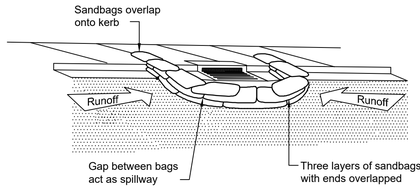
Sediment Trap for Kerb Inlet (On Grade - Sandbag)

NTS



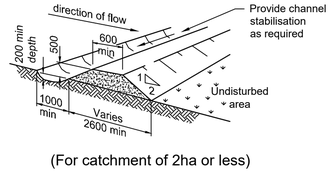
Sediment Trap for Drop Inlet (Geotextile Filter Fabric)

NTS



Sediment Trap for Kerb Inlet (at Low Point - Sandbag)

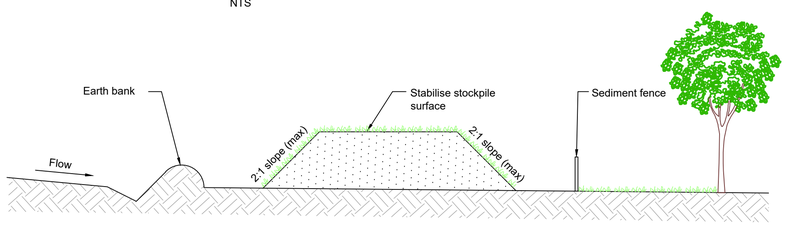
NTS



(For catchment of 2ha or less)

Diversion bank (with channel)

NTS

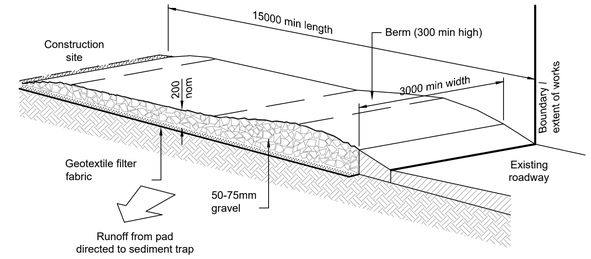


Construction Notes

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 2m in height
4. Where there are to be in place for more than 10 days, stabilise following the approved escp or swmp to reduce the c-factor to less than 0.10
5. Construct earth banks (standard drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (standard drawing 6-8) 1m to 2m downslope

Stockpiles

NTS

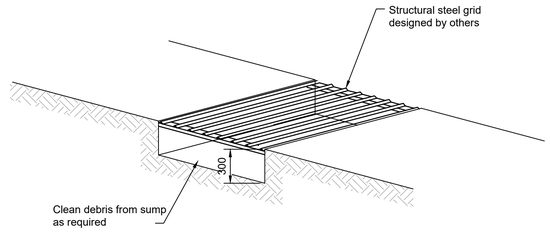


Temporary Site Entrance

NTS

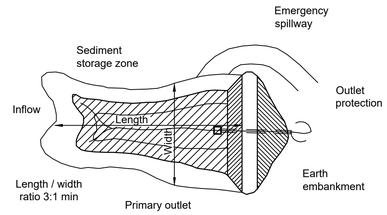
Maintenance

- The temporary access shall be maintained in a condition that prevents tracking or flowing of sediment onto public rights of way,
- This may require periodic top dressing with additional gravel as conditions demand and repair and/or cleanout of any measures used to trap sediment,
- All sediment spilled, dropped, washed or tracked onto public rights of way must be removed immediately.



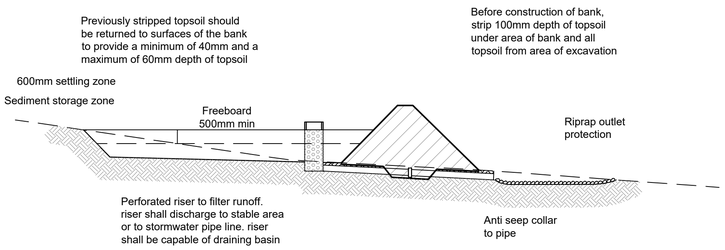
Shaker Pad

NTS



Sediment Basin (Typical) Plan - Type C Soils

NTS



Sediment Basin (Typical) Cross Section - Type C Soils

NTS

Preliminary - Not for Construction

Rev	Date	Drawn	Description	Ch'k'd	App'd
P5	09/07/2021	BS	Issued for Information	ADS	JW
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P3	18/06/2021	BS	Issued for Information	ADS	JW
P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

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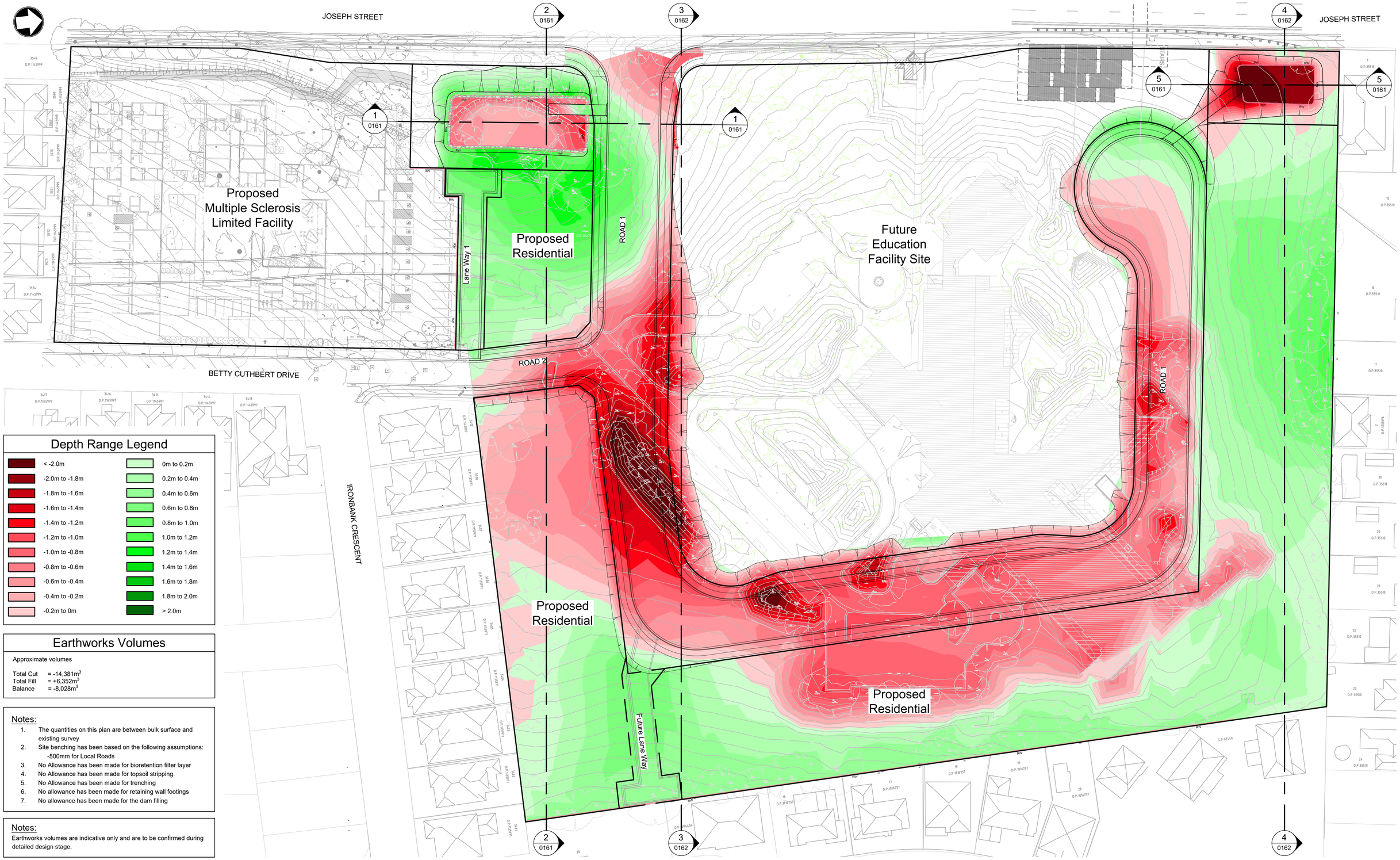
Client: NSW GOVERNMENT Planning, Industry & Environment

Title: Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Soil and Water Management Notes and Details Sheet

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	

Scale at A1	Status	Rev	Security
As Shown	PRE	P5	STD

Drawing Number: 405675-MMD-00-XX-DR-C-0111



Depth Range Legend

< -2.0m	0m to 0.2m
-2.0m to -1.8m	0.2m to 0.4m
-1.8m to -1.6m	0.4m to 0.6m
-1.6m to -1.4m	0.6m to 0.8m
-1.4m to -1.2m	0.8m to 1.0m
-1.2m to -1.0m	1.0m to 1.2m
-1.0m to -0.8m	1.2m to 1.4m
-0.8m to -0.6m	1.4m to 1.6m
-0.6m to -0.4m	1.6m to 1.8m
-0.4m to -0.2m	1.8m to 2.0m
-0.2m to 0m	> 2.0m

Earthworks Volumes

Approximate volumes

Total Cut = -14,381m^3
Total Fill = +6,352m^3
Balance = -8,028m^3

Notes:

1. The quantities on this plan are between bulk surface and existing survey
2. Site benching has been based on the following assumptions:
   -500mm for Local Roads
3. No Allowance has been made for bioretention filter layer
4. No Allowance has been made for topsoil stripping.
5. No Allowance has been made for trenching
6. No allowance has been made for retaining wall footings
7. No allowance has been made for the dam filling

Notes:

Earthworks volumes are indicative only and are to be confirmed during detailed design stage.

Preliminary - Not for Construction

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P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

1:500 0 25m 50m

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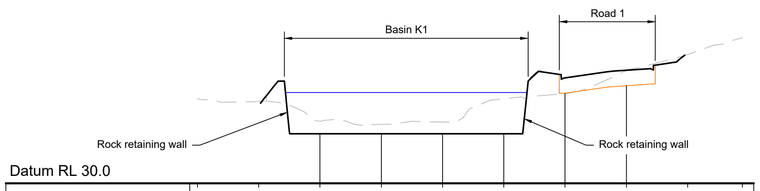
Client
NSW GOVERNMENT
Planning, Industry & Environment

Title
Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Earthworks Cut and Fill Plan

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	Status		Rev	Security	
1:500	PRE		P5	STD	

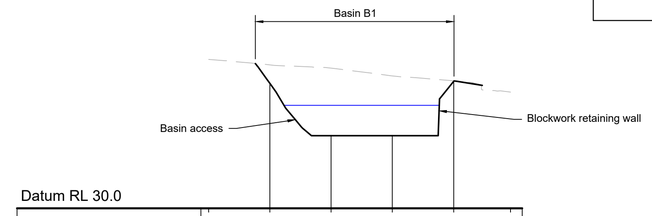
Drawing Number
405675-MMD-00-XX-DR-C-0151



Datum RL 30.0

Design Level			31.620	31.620	31.620	31.620	33.442	33.689		
Bulk Level			31.620	31.620	31.620	31.620	32.942	33.185		
Existing Level	32.77	32.68	32.03	31.92	32.00	32.77	32.92	33.67	34.21	34.75
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	88.928

Section 1
1:500 HORI
1:100 VERT
0151



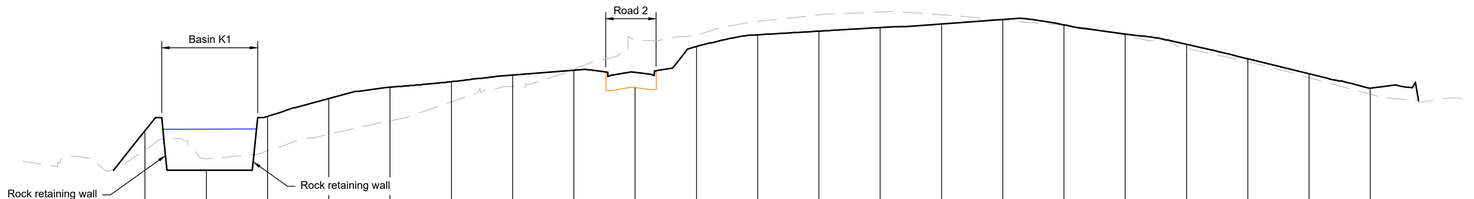
Datum RL 30.0

Design Level		34.076	32.370	32.370	34.149	
Bulk Level		34.076	32.370	32.370	34.149	
Existing Level	34.86	34.68	34.57	34.32	34.16	33.79
Chainage	0.000	10.000	20.000	30.000	40.000	49.304

Section 5
1:500 HORI
1:100 VERT
0151

Legend

- Proposed design surface
- Proposed bulk earthworks surface
- Existing surface profile



Datum RL 30.0

Design Level			32.909	31.620	33.378	33.960	34.329	34.508	34.727	34.882	34.814	35.662	36.040	36.159	36.276	36.394	36.542	36.363	36.067	35.728	35.256	34.766	34.296										
Bulk Level			32.909	31.620	33.378	33.960	34.329	34.508	34.727	34.882	34.314	35.662	36.040	36.159	36.276	36.394	36.542	36.363	36.067	35.728	35.256	34.766	34.296										
Existing Level	31.92	32.04	32.28	31.99	32.25	32.79	33.23	33.85	34.35	34.91	35.88	36.03	36.48	36.70	36.79	36.70	36.52	36.35	36.02	35.59	35.16	34.64	34.10	33.90	33.96								
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	235.016								

Section 2
1:500 HORI
1:100 VERT
0151

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Rev	Date	Drawn	Description	Ch'k'd	App'd
P5	09/07/2021	BS	Issued for Information	ADS	JW
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P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

1:100 0 5m 10m
1:500 0 25m 50m

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Client: NSW GOVERNMENT Planning, Industry & Environment

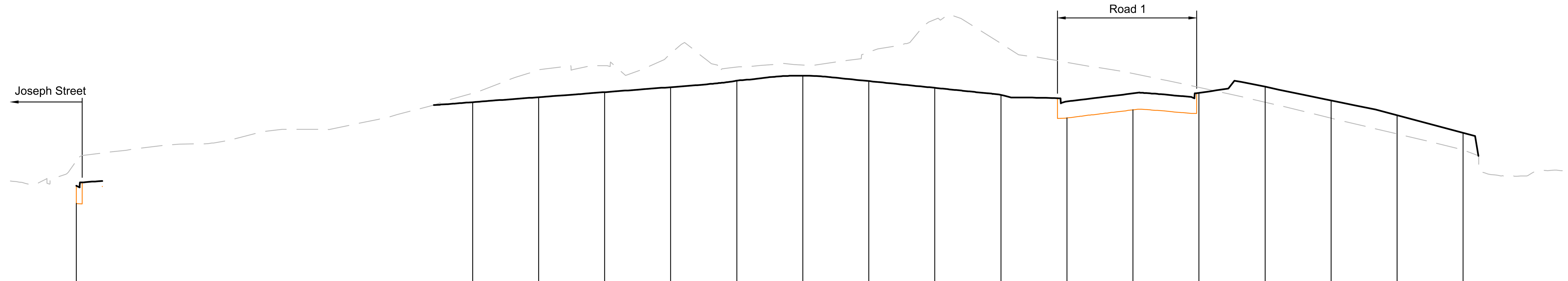
Title
Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Earthworks Sections
Sheet 1

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	Status		Rev	Security	
1:100,500	PRE		P5	STD	

Drawing Number
405675-MMD-00-XX-DR-C-0161

Legend

———	Proposed design surface
——— (orange)	Proposed bulk earthworks surface
— — —	Existing surface profile



Datum RL 30.0

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Bulk Level		32.398						35.465	35.617	35.769	35.921	36.115	36.272	36.105	35.900	35.684	34.987	35.232	35.747	35.939	35.516	35.067	34.537		
Existing Level	33.08	33.69	34.08	34.21	34.62	34.71	35.16	35.74	36.45	36.57	36.93	36.53	36.59	36.98	37.97	37.24	36.67	36.33	35.92	35.47	34.98	34.51	34.02	33.27	33.39
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	235.016

Section 3 / 0151
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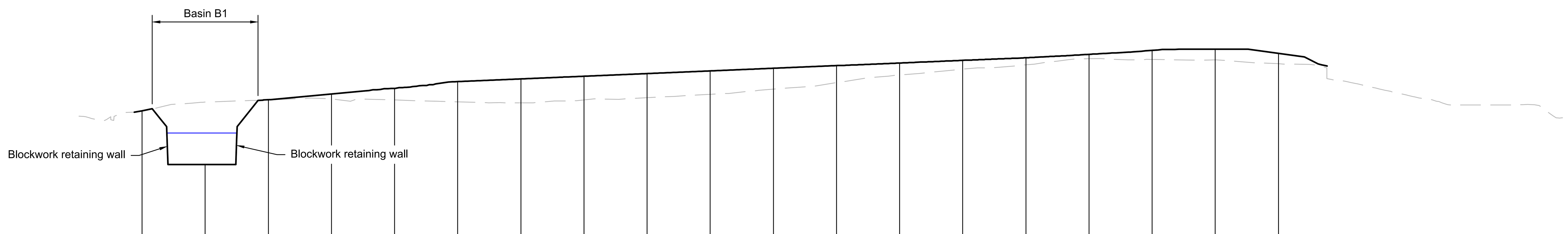
1:100 VERT



Datum RL 30.0

Design Level		34.075	32.370	34.425	34.607	34.784	35.001	35.086	35.170	35.254	35.338	35.421	35.505	35.589	35.673	35.755	35.862	35.990	36.025	35.892					
Bulk Level		34.075	32.370	34.425	34.607	34.784	35.001	35.086	35.170	35.254	35.338	35.421	35.505	35.589	35.673	35.755	35.862	35.990	36.025	35.892					
Existing Level	33.90	34.07	34.35	34.42	34.45	34.42	34.36	34.33	34.42	34.49	34.59	34.76	34.96	35.21	35.39	35.53	35.73	35.70	35.69	35.57	35.02	34.58	34.26	34.27	33.85
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	235.016

Section 4 / 0151
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1:100 VERT

Preliminary - Not for Construction

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1:100 0 5m 10m
1:500 0 25m 50m

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Client
NSW GOVERNMENT | Planning, Industry & Environment

Title
Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Earthworks Sections
Sheet 2

Designed	A.Singh	Eng check	B. Soo	
Drawn	B.Sayasane	Coordination	T.Loder	
Dwg check	A.Singh	Approved	J.Wukowic	

Scale at A1	Status	Rev	Security
1:100,500	PRE	P5	STD

Drawing Number
405675-MMD-00-XX-DR-C-0162

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Preliminary - Not for Construction

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P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

1:500 0 25m 50m

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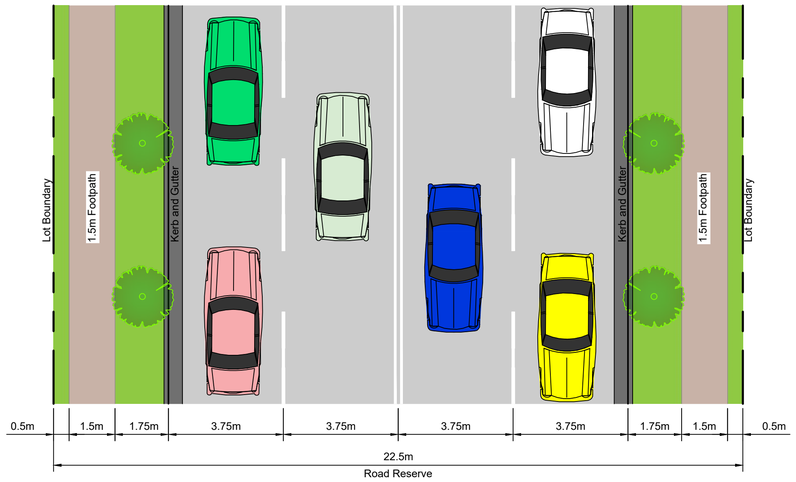
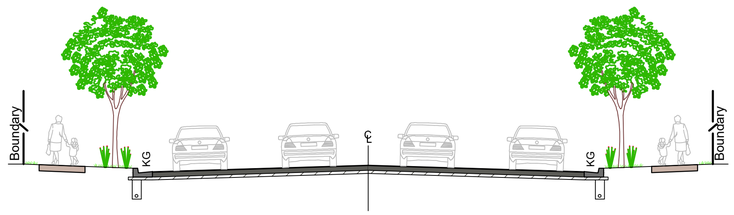
Client
NSW GOVERNMENT
Planning, Industry & Environment

Title
Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Alignment Control Plan

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	1:500	Status	PRE	Rev	P5
Security	STD				

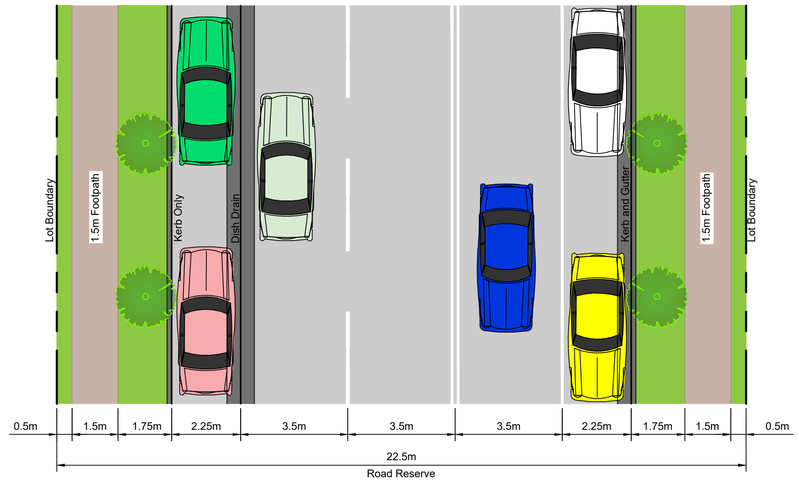
Drawing Number
405675-MMD-00-XX-DR-C-0201

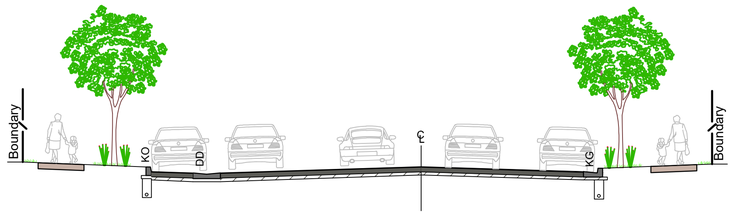




22.5m Collector Road (A)

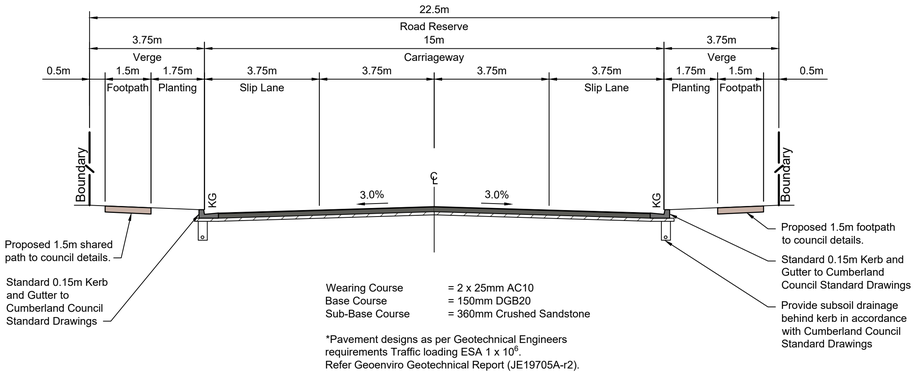
1:100





22.5m Collector Road (B)

1:100



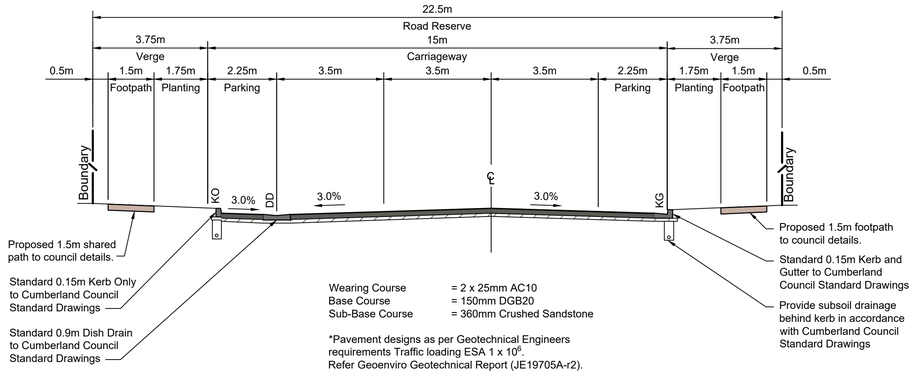
Wearing Course = 2 x 25mm AC10
Base Course = 150mm DGB20
Sub-Base Course = 360mm Crushed Sandstone

*Pavement designs as per Geotechnical Engineers requirements Traffic loading ESA 1 x 10^6.
Refer Geoenviro Geotechnical Report (JE19705A-r2).

22.5m Collector Road (A)

Road 01 (CH320.000 - CH 419.378)

1:100



Wearing Course = 2 x 25mm AC10
Base Course = 150mm DGB20
Sub-Base Course = 360mm Crushed Sandstone

*Pavement designs as per Geotechnical Engineers requirements Traffic loading ESA 1 x 10^6.
Refer Geoenviro Geotechnical Report (JE19705A-r2).

22.5m Collector Road (B)

Road 01 (CH120.000 - CH220.000)

1:100

Preliminary - Not for Construction

Rev	Date	Drawn	Description	Ch'k'd	App'd
P6	09/07/2021	BS	Issued for Information	ADS	JW
P5	02/07/2021	BS	Issued for Information	ADS	JW
P4	18/06/2021	BS	Issued for Information	ADS	JW
P3	13/05/2020	SE	Issued for DA	ADS	JW
P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

1:100 0 5m 10m

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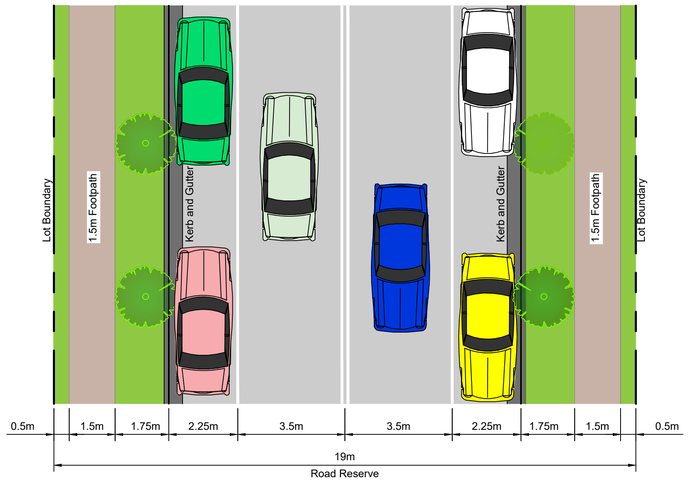
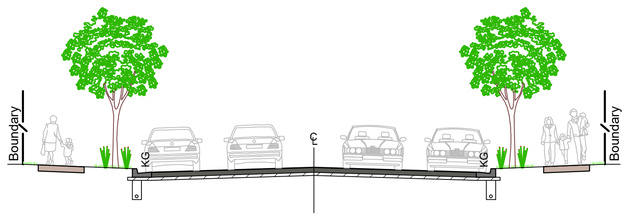
Client: NSW GOVERNMENT Planning, Industry & Environment

Title
Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Typical Road Cross Sections
Sheet 1

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1 1:100	Status PRE		Rev P6	Security STD	

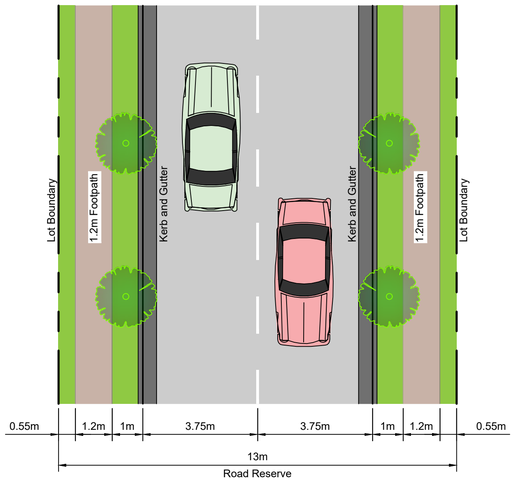
Drawing Number
405675-MMD-00-XX-DR-C-0251

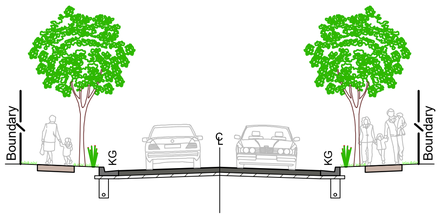




19m Collector Road

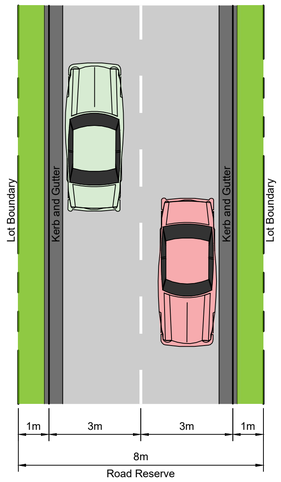
1:100

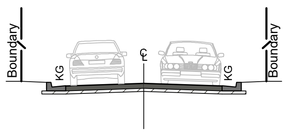




13m Local Road

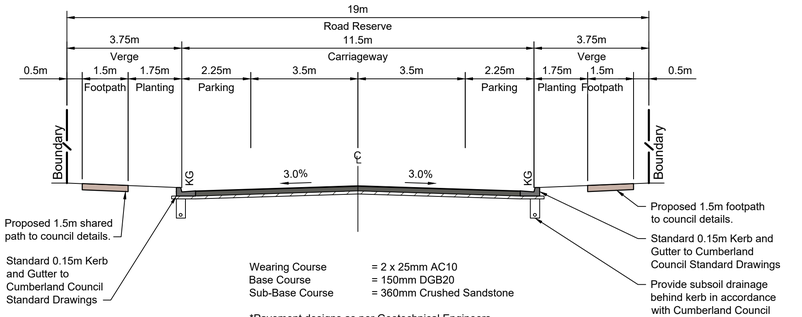
1:100





8.0m Laneway

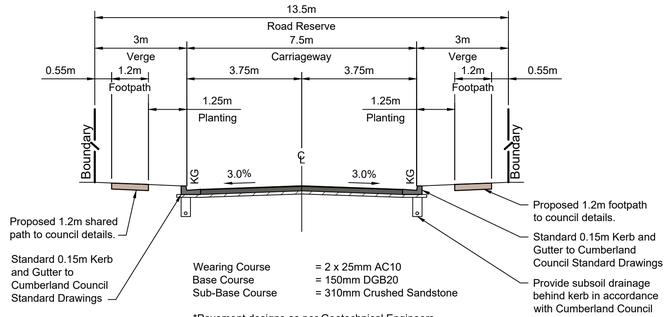
1:100



19m Collector Road

Road 1 (CH0.000 - CH120.000 and CH220.000 - CH320.000)

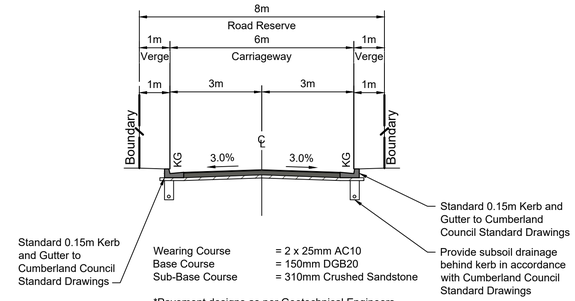
1:100



13.5m Local Road

Road 2

1:100



8.0m Laneway

Laneway 1

1:100

Preliminary - Not for Construction

Rev	Date	Drawn	Description	Ch'k'd	App'd
P6	09/07/2021	BS	Issued for Information	ADS	JW
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P3	13/05/2020	SE	Issued for DA	ADS	JW
P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

1:100 0 5m 10m

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Client

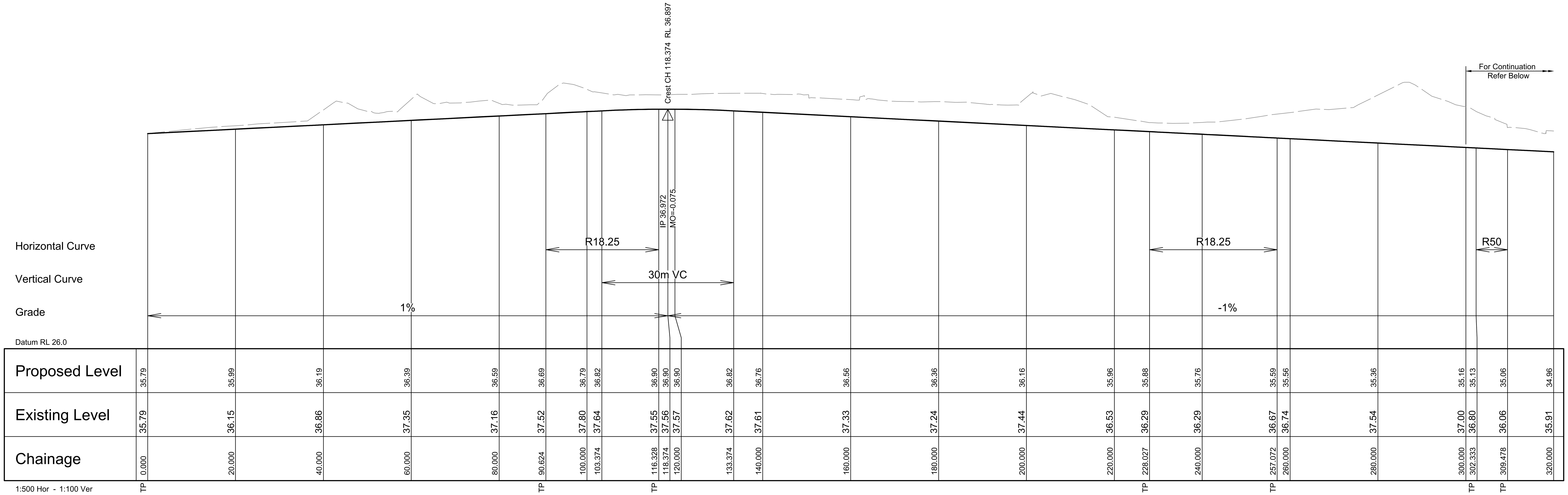
NSW GOVERNMENT | Planning, Industry & Environment

Title

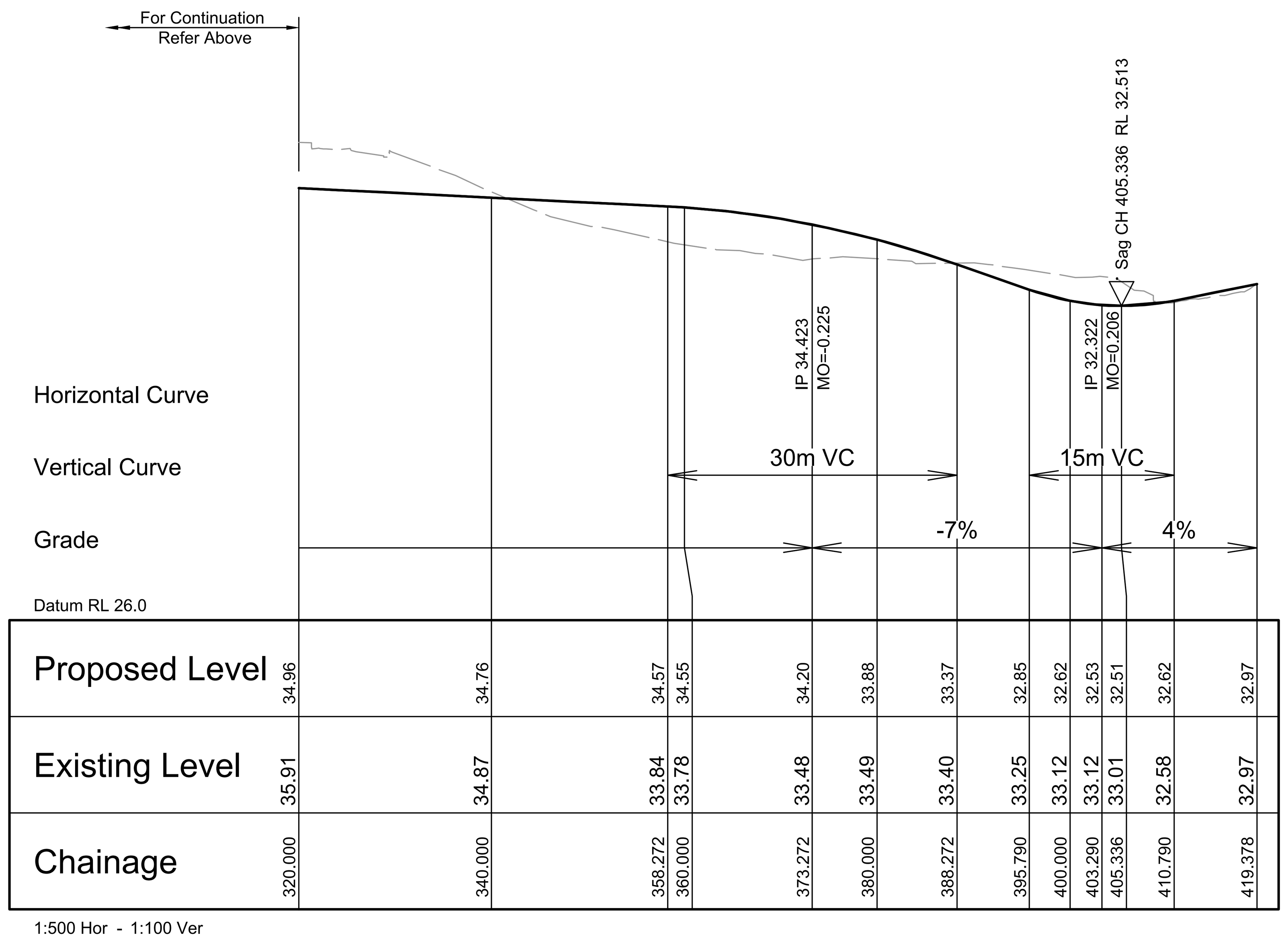
Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Typical Road Cross Sections
Sheet 2

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	Status		Rev	Security	
1:100	PRE		P6	STD	

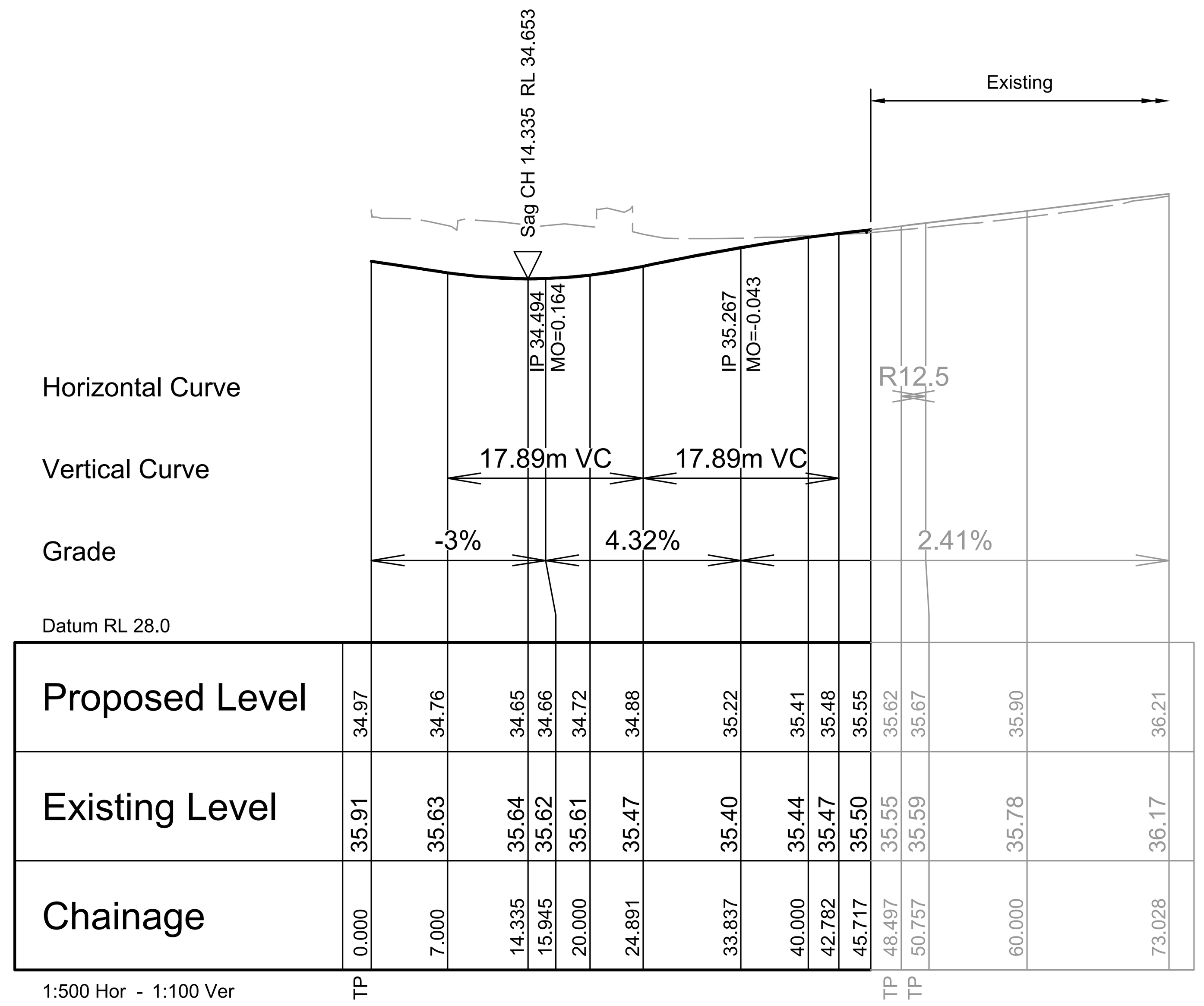
Drawing Number
405675-MMD-00-XX-DR-C-0252



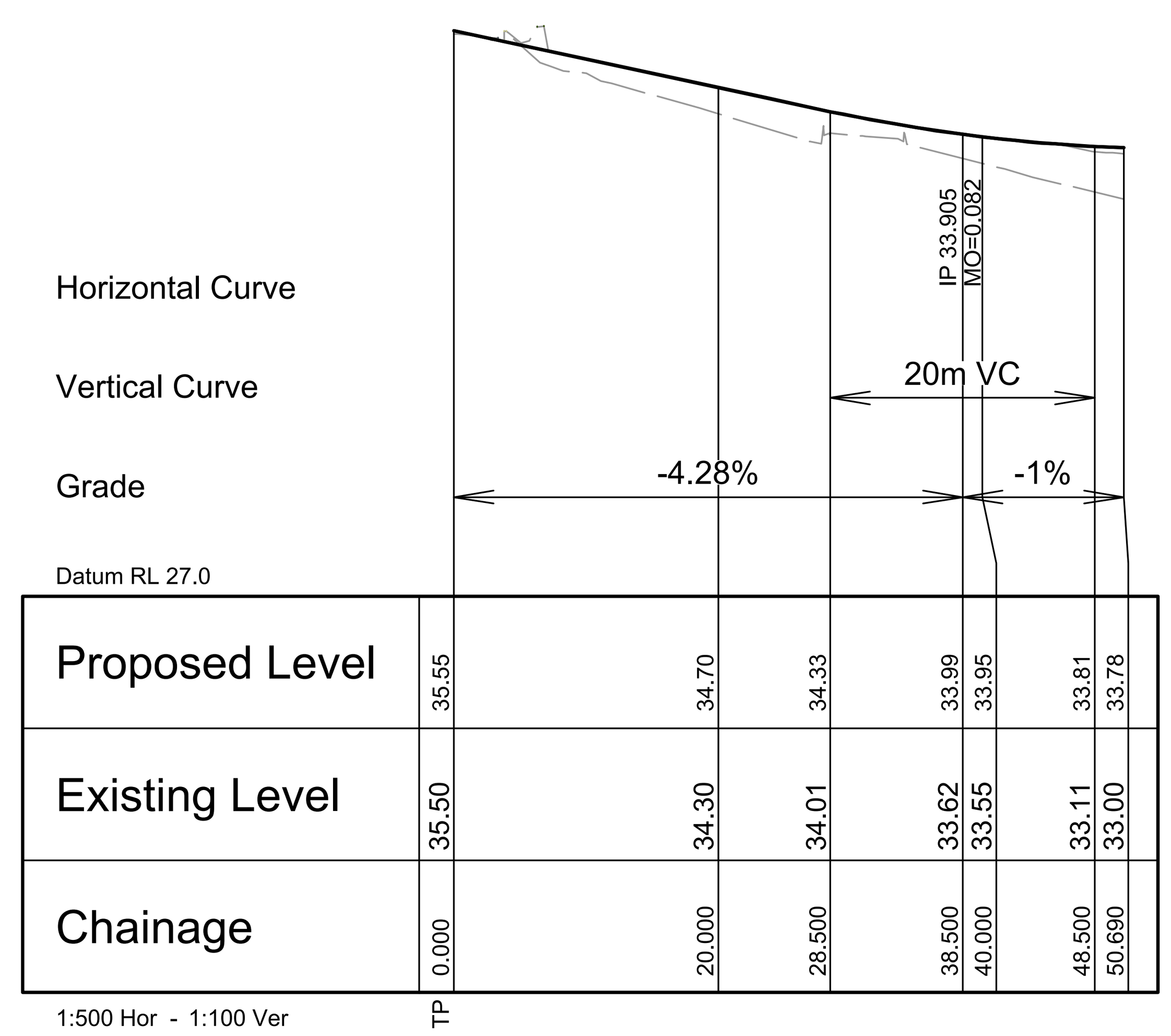
Longitudinal Section Along Road 1



Longitudinal Section Along Road 1



Longitudinal Section Along Road 2



Longitudinal Section Along Lane Way 1

Preliminary - Not for Construction

Rev	Date	Drawn	Description	Ch'k'd	App'd
P5	09/07/2021	BS	Issued for Information	ADS	JW
P4	02/07/2021	BS	Issued for Information	ADS	JW
P3	18/06/2021	BS	Issued for Information	ADS	JW
P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

1:100 0 5m 10m
1:500 0 25m 50m

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NSW GOVERNMENT
Planning, Industry & Environment

Title
Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Road Longitudinal Sections

Designed	A.Singh	Eng check	B. Soo
Drawn	B.Sayasane	Coordination	T.Loder
Dwg check	A.Singh	Approved	J.Wukowic

Scale at A1	Status	Rev	Security
1:100,500	PRE	P5	STD

Drawing Number
405675-MMD-00-XX-DR-C-0301

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Joseph Street

Proposed drainage to connect to existing drainage in Joseph Street. New pit to be installed (if required)

Future road widening

Future footpath

1.8m high perimeter fence

Match to future kerb and footpath (Joseph Street Road Widening)

Construct pram ramp in accordance with Cumberland Council Standard Drawings (typ.)

Match to existing road levels in Joseph Street and make smooth connection(typ.

Proposed drainage to connect to existing drainage in Joseph Street. New pit to be installed (if required)

Match to existing levels along property boundary (typ.)

Batter 1 in 4

Proposed Stormwater Basin K1
- Basin K1 Storage Volume: 767.5m³
- 100 Year TWL = RL 32.871
- Bio Retention Area = 500m²

Provide end cap for future drainage connection

Proposed Multiple Sclerosis Limited

Proposed Residential

Proposed Education Facility Site

Proposed Residential

Retaining wall constructed as part of future MSL site, prior to laneway works in current DA. All proposed works along Lane Way 1 to match MSL bottom of wall retaining levels and make smooth connection.

Existing drainage pit to be modified to a junction pit

Match to existing road levels in Betty Cuthbert Drive and make smooth connection(typ.)

Construct new kerb inlet pit to connect to existing pipe to suit existing kerb alignment

Road 1

Road 2

Lane Way 1

CH 419.378
CH 405.34 Sag
CH 400.000
CH 380.000
CH 360.000
CH 340.000
CH 320.000
CH 300.000
CH 280.000
CH 260.000
CH 240.000
CH 220.000
CH 200.000
CH 180.000
CH 160.000
CH 140.000
CH 120.000
CH 100.000
CH 80.000
CH 60.000
CH 50.690
CH 40.000
CH 20.000
CH 0.000

TP 309.478
TP 302.333

K1 K2 K3 F2 F3 M1 E6 E7 G3 G4 G5 G6 G7 H1 H2 H3 H4 J1

For continuation refer to Dwg No 0402

For continuation refer to Dwg No 0403

Preliminary - Not for Construction

Rev	Date	Drawn	Description	Ch'k'd	App'd
P5	09/07/2021	BS	Issued for Information	ADS	JW
P4	02/07/2021	BS	Issued for Information	ADS	JW
P3	18/06/2021	BS	Issued for Information	ADS	JW
P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

1:250 0 12.5m 25m

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Client: NSW GOVERNMENT Planning, Industry & Environment

Title
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80 Betty Cuthbert Drive, Lidcombe
Civil Works
Siteworks Plan
Sheet 1

Designed	A.Singh		Eng check	B. Soo
Drawn	B.Sayasane		Coordination	T.Loder
Dwg check	A.Singh		Approved	J.Wukowic

Scale at A1	Status	Rev	Security
1:250	PRE	P5	STD

Drawing Number
405675-MMD-00-XX-DR-C-0401

For continuation refer to Dwg No 0401

For continuation refer to Dwg No 0403 - Inset 'A'

Joseph Street

Proposed Education Facility Site to discharge to proposed pit M1

Future kerb (Joseph Street Road Widening)

Match to existing levels along property boundary (typ.)

Future pedestrian bridge (By others)

Match to existing road levels in Joseph Street and make smooth connection(typ.)

1.8m high perimeter fence

Proposed drainage line to be constructed under existing Joseph Street verge

STAIRS

Batter 1 in 4

A1 A2 A3 A4 A5 B1 B2

ø375 SW

RW IR HER

Proposed Stormwater Basin B1
- Basin B1 Storage Volume: 373.6m³
- 100 Year TWL = RL 33.7
- Bio Retention Area = 180m²

Road 1

CH 0.000 CH 20.000 CH 40.000 CH 60.000

KG

Proposed Education Facility Site

Proposed Residential

Match to existing levels along property boundary (typ.)

Proposed grassed lined swale to convey stormwater flows from proposed residential land to Basin B1

1 D.P.35510 2 D.P.3551 15 D.P.35510 16 D.P.35510 17 D.P.35510

RESIDENCE PARTIALLY OBSCURED BY TREES

RESIDENCE OBSCURED BY TREES

For continuation refer to Dwg No 0404

Preliminary - Not for Construction

Rev	Date	Drawn	Description	Ch'k'd	App'd
P5	09/07/2021	BS	Issued for Information	ADS	JW
P4	02/07/2021	BS	Issued for Information	ADS	JW
P3	18/06/2021	BS	Issued for Information	ADS	JW
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P1	24/01/2020	GAP	Issued for Information	AS	JW

1:250 0 12.5m 25m

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80 Betty Cuthbert Drive, Lidcombe
Civil Works
Siteworks Plan
Sheet 2

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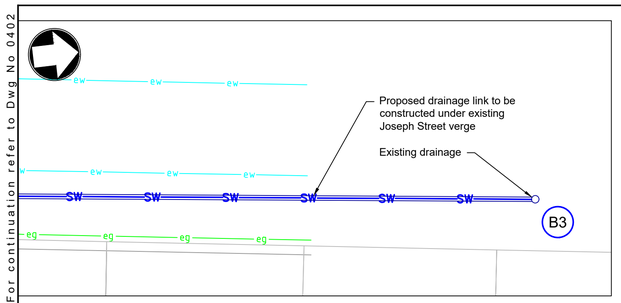
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	1:250	Status	PRE	Rev	P5	Security	STD

Drawing Number: 405675-MMD-00-XX-DR-C-0402

For continuation refer to Dwg No 0401

For continuation refer to Dwg No 0402



Inset 'A'
1:250

Match to existing levels along property boundary (typ.)

Proposed Residential

Batter 1 4

Proposed Education Facility Site

Road 1

Proposed grass lined swale to convey stormwater flows from proposed residential land to "L" Line

Proposed Residential

Proposed grass lined swale to convey stormwater flows from proposed residential land to "L" Line

RW01 Max height: 0.6m
Length: 202m

For continuation refer to Dwg No 0404

Preliminary - Not for Construction

Rev	Date	Drawn	Description	Ch'k'd	App'd
P5	09/07/2021	BS	Issued for Information	ADS	JW
P4	02/07/2021	BS	Issued for Information	ADS	JW
P3	18/06/2021	BS	Issued for Information	ADS	JW
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P1	24/01/2020	GAP	Issued for Information	AS	JW

1:250 0 12.5m 25m

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Title
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80 Betty Cuthbert Drive, Lidcombe
Civil Works
Siteworks Plan
Sheet 3

Designed	A.Singh		Eng check	B. Soo	
Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	Status		Rev	Security	
1:250	PRE		P5	STD	

Drawing Number
405675-MMD-00-XX-DR-C-0403

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For continuation refer to Dwg No 0402

For continuation refer to Dwg No 0403

Proposed Education Facility Site

Proposed Residential

Proposed Residential

Road 1

Road 1

Batter 1 in 4

Batter 1 in 4

E1

E2

CH 80.000

CH 100.000

CH 120.000

CH 140.000

CH 160.000

CH 160.000

CH 118.37 Crest

TP 16.328

TP 90.624

R 18.29

Proposed grass lined swale to convey stormwater flows from proposed residential land to Basin B1

Proposed grass lined swale to convey stormwater flows from residential land to 'L' Line

Match to existing levels along property boundary (typ.)

RW01 Max height: 0.6m
Length: 202m

RW

RW

RW

KG

KO

DD

MS

SW

ee

D.P.1033696

D.P.35510

D.P.1016757

S.P.62446

Preliminary - Not for Construction

Rev	Date	Drawn	Description	Ch'k'd	App'd
P5	09/07/2021	BS	Issued for Information	ADS	JW
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P3	18/06/2021	BS	Issued for Information	ADS	JW
P2	03/04/2020	ADS	ISSUED FOR DA SUBMISSION	ADS	JW
P1	24/01/2020	GAP	Issued for Information	AS	JW

1:250 0 12.5m 25m

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Title: Proposed Subdivision
80 Betty Cuthbert Drive, Lidcombe
Civil Works
Siteworks Plan
Sheet 4

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Drawn	B.Sayasane		Coordination	T.Loder	
Dwg check	A.Singh		Approved	J.Wukowic	
Scale at A1	1:250	Status	PRE	Rev	P5	Security	STD

Drawing Number: 405675-MMD-00-XX-DR-C-0404

Appendix B – DRAINS Modelling Data

ILSAX CALCULATION SUMMARY SHEET

DRAINS results prepared from Version 2020.061

Soil Type		(25.3%} (0%}
AMC		(74.6%}

LOCATION AND LAND-USE | **TIME AND RUNOFF** | **PIPE SYSTEM DESIGN**

1	2	3	4	5	6	7	10	11	13	14	15	16	17	18	20	21	22	23	24	25
									Overflows Approaching Pit											
AEP	**Pit, Node or Basin Name**	**Sub-Catchment Area**	**Land-Use Type**	**Percent-age**	**Constant Flow Time**	**Length**	**Total Entry Time, t_c**	**Peak Sub-Catchment Flowrate**	**Peak Flowrate(s**	**Flow Width**	**Depth x Velocity**	**Inlet Family**	**Inlet Size**	**Peak Approach Flow**	**Peak Flow in Pipe**	**Reach Length**	**Pipe Slope**	**Pipe Diameter**	**U/S Pipe Invert Level**	**D/S Pipe Invert Level**
		(ha)	(ILSAX)	(%)	(minutes)	(m)	(minutes)	(m^3/s) *worst storm	(m^3/s)	(m)	(m^2/s)			(m^3/s)	(m^3/s)	(m)	(%)	(mm)	(m)	(m)
	A1	0.1737	Paved	95	5		5	0.071				NSW Dep	RM10 1.8n	0.071	0.063	11.505	1	375	34.769	34.654
			Supp.	0	0															
			Grassed	5	10		10													
1%	**A1**	0.1737	Paved	< - - - - - - - - - -		as above	5	0.091				< - - - as above - - - >		0.091	0.074	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10													
	A2	0.1038	Paved	95	5		5	0.042				NSW Dep	RM10 1.8n	0.042	0.105	19.547	1	375	34.634	34.438
			Supp.	0	0															
			Grassed	5	10		10													
1%	**A2**	0.1038	Paved	< - - - - - - - - - -		as above	5	0.054				< - - - as above - - - >		0.054	0.125	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10													
	A3	0.094	Paved	95	5		5	0.038	0.025	4.94	0.01	NSW Dep	RM10 2.4n	0.045	0.148	30.566	3.07	375	34.328	33.391
			Supp.	0	0				0	0	0									
			Grassed	5	10		10													
1%	**A3**	0.094	Paved	< - - - - - - - - - -		as above	5	0.049	0.039	5.84	0.01	< - - - as above - - - >		0.067	0.187	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10		0.002	0.27	0.01									
	A4		Paved									Junction I	Junction P	0	0.152	15.65	5.25	375	33.371	32.549
			Supp.																	
			Grassed																	
1%	**A4**		Paved									< - - - as above - - - >		0	0.201	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed																	
	B2		Paved									Junction I	Junction P	0	0.067	68.776	1.45	375	31.299	30.3
			Supp.																	
			Grassed																	
1%	**B2**		Paved									< - - - as above - - - >		0	0.074	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed																	
	D1	0.0524	Paved	95	5		5	0.021	0.161	12.35	0.02	NSW Dep	RM10 1.8n	0.021	0.021	12.751	1.95	375	34.649	34.4
			Supp.	0	0															
			Grassed	5	10		10													
1%	**D1**	0.0524	Paved	< - - - - - - - - - -		as above	5	0.027	0.259	13.97	0.03	< - - - as above - - - >		0.071	0.028	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10													
	E3	0.0932	Paved	95	5		5	0.038	0	0	0	NSW Dep	RM10 1.8n	0.038	0.104	27.214	1	375	34.36	34.088

			Supp.	0	0														
			Grassed	5	10		10												
1%	**E3**	0.0932	Paved	< - - - - - - - - - -		as above	5	0.049	0.044	8.53	0.01	< - - - as above - - - >	0.093	0.128	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	E4	0.0508	Paved	95	5		5	0.021	0.039	8.53	0.01	NSW Dep	RM10 1.8n	0.021	0.123	29.501	1	375	34.068	33.772
			Supp.	0	0														
			Grassed	5	10		10												
1%	**E4**	0.0508	Paved	< - - - - - - - - - -		as above	5	0.027	0.05	9.13	0.01	< - - - as above - - - >	0.027	0.15	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	E5	0.0462	Paved	95	5		5	0.019	0.019	0.74	0.07	NSW Dep	RM10 1.8n	0.019	0.144	51.546	1	375	33.752	33.237
			Supp.	0	0														
			Grassed	5	10		10												
1%	**E5**	0.0462	Paved	< - - - - - - - - - -		as above	5	0.024	0.025	0.89	0.07	< - - - as above - - - >	0.025	0.169	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	E6	0.0956	Paved	95	5		5	0.039	0.028	1.43	0.05	NSW Dep	RM10 1.8n	0.039	0.174	34.929	2.51	375	33.217	32.342
			Supp.	0	0														
			Grassed	5	10		10												
1%	**E6**	0.0956	Paved	< - - - - - - - - - -		as above	5	0.05	0.036	1.64	0.06	< - - - as above - - - >	0.052	0.208	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	E7	0.0475	Paved	95	5		5	0.019	0.047	1.88	0.07	NSW Dep	RM10 1.8n	0.019	0.19	15	2.99	375	32.321	31.872
			Supp.	0	0														
			Grassed	5	10		10												
1%	**E7**	0.0475	Paved	< - - - - - - - - - -		as above	5	0.025	0.06	2.11	0.07	< - - - as above - - - >	0.025	0.232	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	G6	0.0606	Paved	95	5		5	0.025	0.094	0.95	0.2	NSW Dep	RM10 1.8n	0.092	0.445	6.774	1.05	600	31.781	31.71
			Supp.	0	0														
			Grassed	5	10		10												
1%	**G6**	0.0606	Paved	< - - - - - - - - - -		as above	5	0.032	0.119	1.04	0.23	< - - - as above - - - >	0.116	0.608	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	K2		Paved									Junction I	Junction P	0	0.156	8.23	1	375	30.722	30.64
			Supp.																
			Grassed																
1%	**K2**		Paved									< - - - as above - - - >		0	0.168	< - - - - - - - - - - - - as above - - - - - - - - - - - - >			
			Grassed																
	E1	0.0454	Paved	95	5		5	0.019				NSW Dep	RM10 1.8n	0.019	0.018	12.756	2	375	35.198	34.943
			Supp.	0	0														
			Grassed	5	10		10												
1%	**E1**	0.0454	Paved	< - - - - - - - - - -		as above	5	0.024				< - - - as above - - - >		0.024	0.023	< - - - - - - - - - - - - as above - - - - - - - - - - - - >			
			Grassed				10												
	E2	0.0787	Paved	95	5		5	0.032				NSW Dep	RM10 1.8n	0.032	0.049	54.343	1	375	34.923	34.379
			Supp.	0	0														
			Grassed	5	10		10												
1%	**E2**	0.0787	Paved	< - - - - - - - - - -		as above	5	0.041				< - - - as above - - - >		0.041	0.063	< - - - - - - - - - - - - as above - - - - - - - - - - - - >			
			Grassed				10												
	L1	0.2266	Paved	0	5		5	0.055				Dummy F	Dummy	0.055	0.055	36.828	0.5	300	33.342	33.158
			Supp.	0	0														

			Grassed	100	10		10												
1%	L1	0.2266	Paved	< - - - - - - - - - -	as above		5	0.075				< - - - as above - - - >	0.075	0.065	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	L2	0.6573	Paved	0	5		5	0.161	0.027	1.81	0.04	Interallotr	Interallotm	0.161	0.213	34.744	0.5	525	33.138	32.964
			Supp.	0	0														
			Grassed	100	10		10												
1%	L2	0.6573	Paved	< - - - - - - - - - -	as above		5	0.217	0.036	2.09	0.05	< - - - as above - - - >		0.217	0.258	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	L3		Paved									Junction I	Junction P	0	0.203	41.278	0.5	525	32.944	32.738
			Supp.																
			Grassed																
1%	L3		Paved									< - - - as above - - - >		0	0.257	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed																
	G1	0.1101	Paved	47	5		5	0.032	0.019	1.17	0.04	NSW Dep	RM10 1.8n	0.032	0.227	35.998	0.5	525	32.718	32.538
			Supp.	0	0														
			Grassed	53	10		10												
1%	G1	0.1101	Paved	< - - - - - - - - - -	as above		5	0.042	0.024	1.36	0.05	< - - - as above - - - >		0.042	0.294	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	G2	0.1055	Paved	24	5		5	0.027	0.004	0.39	0.02	NSW Dep	RM10 2.4n	0.027	0.249	13.725	0.5	525	32.518	32.449
			Supp.	0	0														
			Grassed	76	10		10												
1%	G2	0.1055	Paved	< - - - - - - - - - -	as above		5	0.036	0.004	0.43	0.02	< - - - as above - - - >		0.036	0.327	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	G3	0.0971	Paved	34	5		5	0.026	0.025	0.98	0.07	NSW Dep	RM10 2.4n	0.026	0.271	7.522	0.51	525	32.429	32.391
			Supp.	0	0														
			Grassed	66	10		10												
1%	G3	0.0971	Paved	< - - - - - - - - - -	as above		5	0.035	0.032	1.15	0.07	< - - - as above - - - >		0.035	0.358	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	G4	0.0302	Paved	95	5		5	0.012	0.047	7.63	0.01	NSW Dep	RM10 2.4n	0.059	0.277	12.965	0.5	600	32.371	32.306
			Supp.	0	0														
			Grassed	5	10		10												
1%	G4	0.0302	Paved	< - - - - - - - - - -	as above		5	0.016	0.06	8.53	0.01	< - - - as above - - - >		0.076	0.368	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	G5	0.0086	Paved	95	5		5	0.004	0.713	2.03	0.7	NSW Dep	RM10 2.4n	0.717	0.275	53.595	0.9	600	32.286	31.801
			Supp.	0	0														
			Grassed	5	10		10												
1%	G5	0.0086	Paved	< - - - - - - - - - -	as above		5	0.004	0.949	2.26	0.84	< - - - as above - - - >		0.953	0.371	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	Bypass 1	0.0525	Paved	95	5		5	0.021	0	0	0			0.021						
			Supp.	0	0														
			Grassed	5	10		10												
1%	Bypass 1	0.0525	Paved	< - - - - - - - - - -	as above		5	0.027	0	0	0			0.027						
			Grassed				10												
	Bypass 2	0.1145	Paved	95	5		5	0.047	0	0	0			0.203						
			Supp.	0	0				0.156	11.27	0.03									
			Grassed	5	10		10													

1%	**Bypass 2**	0.1145	Paved	< - - - - - - - - - -		as above	5	0.06	0	0	0			0.228					
			Grassed				10		0.168	11.45	0.03								
	Existing 1	1.028	Paved	0	0	146	4.52	0.283						0.283					
			Supp.	0	0	-1													
			Grassed	100	0	146	7.46												
1%	**Existing 1**	1.028	Paved	< - - - - - - - - - -		as above	4.12	0.403						0.403					
			Grassed				6.8												
	Existing 2	2.41	Paved	0	0	135	3.92	0.713						0.713					
			Supp.	0	0	-1													
			Grassed	100	0	135	6.48												
1%	**Existing 2**	2.41	Paved	< - - - - - - - - - -		as above	3.58	0.949						0.949					
			Grassed				5.91												
	M1	1.6509	Paved	30	0	164	4.61	0.496						0.496	6.412	5.01	525	32.391	32.07
			Supp.	0	0	164													
			Grassed	70	0	164	7.61												
1%	**M1**	1.6509	Paved	< - - - - - - - - - -		as above	4.2	0.687						0.687	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				6.94												
	F2		Paved									Dummy	F Dummy	0	5.896	1	525	32.059	32
			Supp.																
			Grassed																
1%	**F2**		Paved									< - - - as above - - - >		0	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed																
	MSL Facilit	0.162	Paved	95	5		5	0.066						0.066					
			Supp.	0	0														
			Grassed	5	10		10												
1%	**ISL Facilit**	0.162	Paved	< - - - - - - - - - -		as above	5	0.085						0.085					
			Grassed				10												
	H1	0.1103	Paved	13	5		5	0.027				NSW Dep	RM10 2.4n	0.027	6.053	0.99	375	32.135	32.075
			Supp.	0	0														
			Grassed	87	10		10												
1%	**H1**	0.1103	Paved	< - - - - - - - - - -		as above	5	0.037				< - - - as above - - - >		0.037	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	H2	0.0164	Paved	95	5		5	0.007				NSW Dep	RM10 2.4n	0.007	12.259	1.08	375	32.055	31.923
			Supp.	0	0														
			Grassed	5	10		10												
1%	**H2**	0.0164	Paved	< - - - - - - - - - -		as above	5	0.009				< - - - as above - - - >		0.009	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	H3	0.1435	Paved	95	5		5	0.059				NSW Dep	RM10 2.4n	0.059	3.726	1.02	375	31.903	31.865
			Supp.	0	0														
			Grassed	5	10		10												
1%	**H3**	0.1435	Paved	< - - - - - - - - - -		as above	5	0.075				< - - - as above - - - >		0.075	< - - - - - - - - - - - - as above - - - - - - - - - - - - >				
			Grassed				10												
	Existing MS	0.256	Paved	95	5		5	0.105						0.105					
			Supp.	0	0														
			Grassed	5	10		10												
1%	**xisting MS**	0.256	Paved	< - - - - - - - - - -		as above	5	0.134						0.134					

			Grassed				10									
	B1	0.6313	Paved	0	5		5	0.154		0.154	9.481	2.65	375	31.6	31.349	
			Supp.	0	0											
			Grassed	100	10		10									
1%	**B1**	0.6313	Paved	< - - - - - - - - - -		as above	5	0.208		0.208	< - - - - - - - - - -		as above		- - - - - - - - - - >	
			Grassed				10									
	K1	0.1478	Paved	0	5		5	0.036		0.036	13.607	1.49	375	30.945	30.742	
			Supp.	0	0											
			Grassed	100	10		10									
1%	**K1**	0.1478	Paved	< - - - - - - - - - -		as above	5	0.049		0.049	< - - - - - - - - - -		as above		- - - - - - - - - - >	
			Grassed				10									

NOTES

This sheet presents results from a pipe system model using ILSAX, the rational method, extended rational method (ERM), or the ARR 2016 initial loss - continuing loss (IL-CL) model implemented in the DRAINS program,(www.watercom.com.au) involving considerable calculations with multiple rainfall patterns, and complex hydraulic computations. Therefore, unlike older rational method calculation sheets, this sheet does not portray hand calculations.
It presents the key model inputs and outputs of interest to reviewers.

Depending on inputs, the table may show results for a minor storm, a major storm, or both.
There may be multiple rows for up to three overflow routes coming to a pit.
You can edit headings or delete columns or rows.

The contents of each column are explained below:

Column 1: Design annual exceedance probability (AEP); values for minor storms, major storms or both may be displayed. Numerical values are not available for the rational method, but users can enter these.
Column 2: Pit Name from DRAINS (The connecting sub-catchment, downstream pipe and overflow route are assumed to have similar names, so they do not need to be entered in the table.)
As well as pits, headwalls, detention basins and nodes connected to sub-catchments are included.
Column 3: Sub-Catchment Area (ha)
Column 4: Land-Use Type: paved, supplementary and grassed areas (in different rows) for ILSAX, impervious and pervious areas for the rational method and ERM, or effective impervious areas (EIAs),remaining impervious areas (RIAs)
Column 5: Percentages of paved, supplementary and grassed areas for ILSAX, or impervious and pervious areas for the rational method and ERM, or effective impervious areas (EIAs),remaining impervious areas (RIAs) and pervious areas (PAs) for the IL-CL model.
Column 6: Constant flow times for the paved, supplementary and grassed areas (minutes) for ILSAX, or impervious and impervious areas for the rational method and ERM, or effective impervious areas (EIAs),remaining impervious areas (RIAs) and pervious areas (PAs) for the IL-CL model.
Column 7: Lengths of paved, supplementary and grassed area flow path segments (m) for ILSAX, or impervious and impervious areas for the rational method and ERM, or effective impervious areas (EIAs),remaining impervious areas (RIAs) and pervious areas (PAs) for the IL-CL model.
Column 8: Slopes of paved, supplementary and grassed area flow path segments (%) for ILSAX, or impervious and impervious areas for the rational method and ERM, or effective impervious areas (EIAs),remaining impervious areas (RIAs) and pervious areas (PAs) for the IL-CL model.
Column 9: Roughnesses of paved, supplementary and grassed area flow path segments (Manning's values) for ILSAX, or impervious and impervious areas for the rational method and ERM, or effective impervious areas (EIAs),remaining impervious areas (RIAs) and pervious areas (PAs) for the IL-CL model."
Column 10: Total flow times for the paved, supplementary and grassed areas (minutes) for ILSAX, or impervious and pervious areas for the rational method and ERM, or effective impervious areas (EIAs),remaining impervious areas (RIAs) and pervious areas (PAs) for the IL-CL model.
For the rational methoid, it is the total catchment time of concentration.
Column 11: Peak Sub-Catchment Flowrate (m^3/s). For the rational method, the output indicates whether this is a full catchment or partial area estimate.
Column 12: Origin of Overflows, the names of any pits or nodes from which overflows come to the pit.
Column 13: Peak Overflows from upstream pits or nodes(m3/s), which may include flows from the sub-catchment through which they flow.
- not outputted for the rational method.)
Column 14: Approach Flow Width (m) - not outputted for the rational method.
Column 15: Approach Flow Depth x Velocity (m^2/s) - not outputted for the rational method.
Column 16: Inlet Family, in the DRAINS classification.
Column 17: Inlet Size, in the DRAINS classification.
Column 18: Total Approach Flow (m^3/s), sum of peaks of local sub-catchment runoff hydrograph plus overflow hydrographs directed to the pit.
(This will probably overestimate the true peak coming from additi0on of hydrographs.)

Column 19: Bypass Flow (m^3/s), the overflow occurring because of lack of inlet capacity or overflowing of the pipe system
Column 19a: Baseflow or Direct Inflow Peak (m^3/s), if present in the model; otherwise this column does not appear.
Column 20: Flow in Pipe (m^3/s).
Column 21: Pipe Length (mm).
Column 22: Pipe Slope (%).
Column 23: Pipe Diameter (mm) or Box Dimensions (m).
Column 24: Upstream Pipe Invert Level (m AHD).
Column 25: Downstream Pipe Invert Level (m AHD).
Column 26: Upstream Pipe Hydraulic Grade Line Level (inside the pipe) (m AHD).
Column 27: Downstream Pipe Hydraulic Grade Line Level (m AHD).
Column 28: Pipe Flow Velocity (m/s), for full or part-full flow.
Column 29: Pit Pressure Change Coefficient, the Ku value applying to the main line through the pit.
Column 29a: Chart Structure Number. If the QUDM method for determining Ku is applied, the number of the Chart in QUDM (2008) that is used to determine pit pressure change K factors is displayed.
If this is given as 'H-O'L' the equations in a paper by Hare and O'Loughlin are used.
Column 29b: Ratios used to define a K value from the appropriate QUDM chart, if teh QUDM method is applied.
Column 30: Water Surface Elevation (m AHD).
Column 31: Surface or Kerb and Channel (Kerb and Gutter) Obvert Level (m AHD).
Column 32: Freeboard (m), the difference between the levels in the two previous columns.
Column 33: Pit Name (repeated).

Appendix C – Bioretention Basin Maintenance Schedule

Bioretention Basin Maintenance Schedule

The procedures as listed below are set out as a guide and to be read in conjunction with UPRCT's Water Sensitive Urban Design, Technical Guidelines for Western Sydney.

Maintenance Item	Frequency	Description of activity and requirements	Comment
Visual inspection - driveway surface	6 monthly (frequency to be adapted as required)	Visual inspection of maintenance access surface for deformation, cracking, potholing and surface distress.	Visual inspection to identify cracking over 3mm and potholes/deformation greater than 25mm require immediate repair works, to be identified by inspector. Where issues identified, specific repair works to be nominated by inspector, along with appropriate timeframe for works.
Visual inspection - drainage assets		Visual inspection of drainage assets including pit entries, grates, screens and gutters. Inspection of bioretention basin surface for debris, rubbish etc.	Where issues identified, specific repair works to be nominated. Where identified, debris and other items to be removed and disposed of appropriately.
Visual inspection - concrete items		Visual inspection of kerbing, pits, headwalls and other concrete assets for cracking, deformation, spalling and exposed reinforcement.	Where issues identified, specific repair works to be nominated by inspector.
Visual inspection - guardrails and signage		Visual inspection for guardrails and signage for any damage. Inspection to include post footings, as well deformation to posts such as bending, loose fixtures, corrosion and missing items.	Where issues identified, specific repair/replacement works to be nominated by inspector.
Vegetation - Batters and basin surface	Quarterly (frequency to be adapted as required)	Strimming and mowing of grass within the basin area to be completed, as required. Weed species to be removed, if identified.	Seasonal changes to vegetation growth rates will impact the required frequency, to be adjusted as appropriate. Waste materials to be appropriately disposed.
Debris removal	6 monthly (frequency to be adapted as required)	Where identified during visual inspection, debris and other items to be removed and disposed of appropriately.	Seasonal changes to sediment entrainment rates, due to changes in rainfall, will impact the required frequency, to be adjusted as appropriate via visual inspections. Waste materials to be appropriately disposed.
Dewatering and de-sludge	Every 2 years (if required)	Remove concentrated sediment deposits. Inspect filter media to identify whether basin function is impaired and cannot be rectified by normal maintenance procedures. Inspect vegetation to identify whether replacement of plantings are required	Waste materials to be appropriately disposed.
Replacement of bioretention media (including water tolerant plantings)	Every 10 years (frequency to be adapted as required)	Removal and replacement of bioretention media, including associated items (subsoil drainage, landscaping).	Requirement for this maintenance activity to be confirmed during visual inspection.
Resurfacing of basin maintenance access	Every 10 years (if required)	Trim and resurface of basin access (assuming AC or gravel surface - if concrete no resurfacing required)	Requirement for this maintenance activity to be confirmed during visual inspection.
Pipe jetting	Every 2 years (if required)	Where potential drainage issues are identified in the visual inspection, pipe jetting and CCTV survey may be required.	Appropriate traffic management to be installed during works (if required) and waste materials to be appropriately disposed.
Emergency maintenance	After spills	Outlet to be protected with bunding and contact Council/ Environmental Authorities immediately for further instruction on remedial works.	Non-standard maintenance, bunding and K-sorb to be used as necessary to treat affected area.

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