NORTHROP

TAFE NSW Construction Centre of Excellence

2-44 O'Connell Street, Kingswood NSW 2747

CIVIL ENGINEERING: SSDA DESIGN REPORT

PREPARED FOR:
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Civil Engineering SSDA Design Report

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
18.12.20	1	Draft	J. Gilligan	J. Gilligan
10.02.21	2	Final	J. Gilligan	J. Gilligan
04.03.21	3	Final	A. Carvalhaes	J. Gilligan

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Executive Summary

This report has been prepared to accompany a detailed State Significant Development Application (SSDA) SSD_ 8571481 for the development of an educational facility at the TAFE Nepean Kingswood Campus, located at 2-44 O'Connell Street, Kingswood (the site). The legal description of the site is Lot 1 in DP 866081. The site comprises a rectangular lot with an area of approximately 23 hectares.

The purpose of this report is identify and describe the civil engineering design elements required for the proposed development.

Specifically, the SSDA seeks development consent for the construction and operation of the TAFE NSW Construction Centre of Excellence (TAFE CCoE) a multi-level, integrated educational facility designed to accommodate specialised training and education for construction-related TAFE NSW courses (the project).

The TAFE CCoE will be a new learning environment with an emphasis on flexibility and adaptability, to encourage cross-disciplinary collaboration, industry engagement and educational excellence. On 27 February 2019, the NSW Government announced the delivery and associated funding for the CCoE.

The proposed development is classified as State Significant Development (SSD) on the basis that it falls within the requirements of clause 4, Schedule 19 of the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP), being 'development for the purpose of a tertiary institution that has a capital investment value of more than $30 million'.

The Minister for Planning, or their delegate, is the consent authority for the SSDA and this application is lodged with the NSW Department of Planning, Industry and Environment (NSW DPIE) for assessment.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) issued for the project. Specifically, this report has been prepared to respond to the following SEARs:

SEARs	Report Section
15. Water Quality - Demonstrate that all practical measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented; and - Identify sensitive receiving environments and develop a strategy to avoid or minimise impacts on these environments.	Section 3.1 and 6.2
18. Stormwater Management Detail any steps/measures to be taken to protect existing stormwater assets such as avoiding over and/or adjacent to stormwater assets and building bridges over stormwater assets, if required. Outline measures to minimise or eliminate flooding, degradation of water quality, and avoid adverse impacts on any heritage items, and create pipeline easements where required. - Detail how the design of the proposal would ensure that post-development stormwater flows match pre-development flows. Provide, where applicable, a preliminary stormwater management plan for the development that: - is prepared by a suitably qualified person in consultation with Council and any other relevant drainage authority. - details of proposed drainage design for the site including on-site detention facilities, water quality measures and the nominated discharge point. - demonstrates compliance with Council or other drainage authority requirements; and - stormwater plans detailing the proposed methods of drainage without impacting on the downstream properties.	Section 6.1 and 6.2
20. Drainage Detail measures to minimise operational water quality impacts on surface waters and groundwater.	Section 3.1 and 6.2
24. Water and Soils Provide: - an assessment of potential impacts on surface and groundwater (quality and quantity), soil, related infrastructure and watercourse(s) where relevant; - details of measures and procedures to minimise and manage the generation and off-site transmission of sediment, dust and fine particles; and - an assessment of salinity and acid sulphate soil impacts, including a Salinity Management Plan and/or Acid Sulphate Soils Management Plan, where relevant.	Section 3.1

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1. General

1.1 Introduction

Northrop Consulting Engineers Pty Ltd (Northrop) have been engaged by Gray Puksand to prepare the Civil Engineering design and documentation in support of a SSDA submission to DPIE for the proposed TAFE NSW Construction Centre of Excellence located at the TAFE NSW Kingswood Campus, in the suburb of Kingswood within the Penrith Local Government Area (LGA).

This report covers the works shown as the Northrop Drawing Package required for the development of the site including:

- Sediment and Soil Erosion Control
- Stormwater Management (Quantity and Quality)

In addition, some commentary has also been provided on bulk earthworks and pavements which will be further developed in the following stages of the project.

1.2 Related Reports and Documents

This report is to be read in conjunction with the following reports and documents:

- Design Standards as provided by Penrith City Council regarding On-site Stormwater Detention (OSD) and water quality.
- Detailed site survey plan provided by Surveying & Spatial Information Services dated 7th February 2020.
- Site survey plan provided by Rygate Surveyors dated 6th November 2020
- Geotechnical Investigation Report prepared by PSM dated 8th December 2020 (PSM4240-004L)

2. Existing Site Conditions

2.1 Subject Site

The TAFE NSW Construction Centre of Excellence is to be located at the TAFE NSW Kingswood Campus, in the suburb of Kingswood within the Penrith Local Government Area (LGA). The site is located at 2-44 O'Connell Street, Kingswood and legally described at Lot 1 in Deposited Plan (DP) 866081. It has an area of approximately 22 hectares (ha) and is bound by the Great Western Highway to the north and O'Connell Street to the west. The site directly abuts two residential properties to the south and the Western Sydney University, Werrington Campus to the east.

A proposed building location has been identified by the project Architect in the north eastern portion of the site as shown in Figure 2.

Figure 1 – Existing Site Plan *(SIX Maps, 2020)*

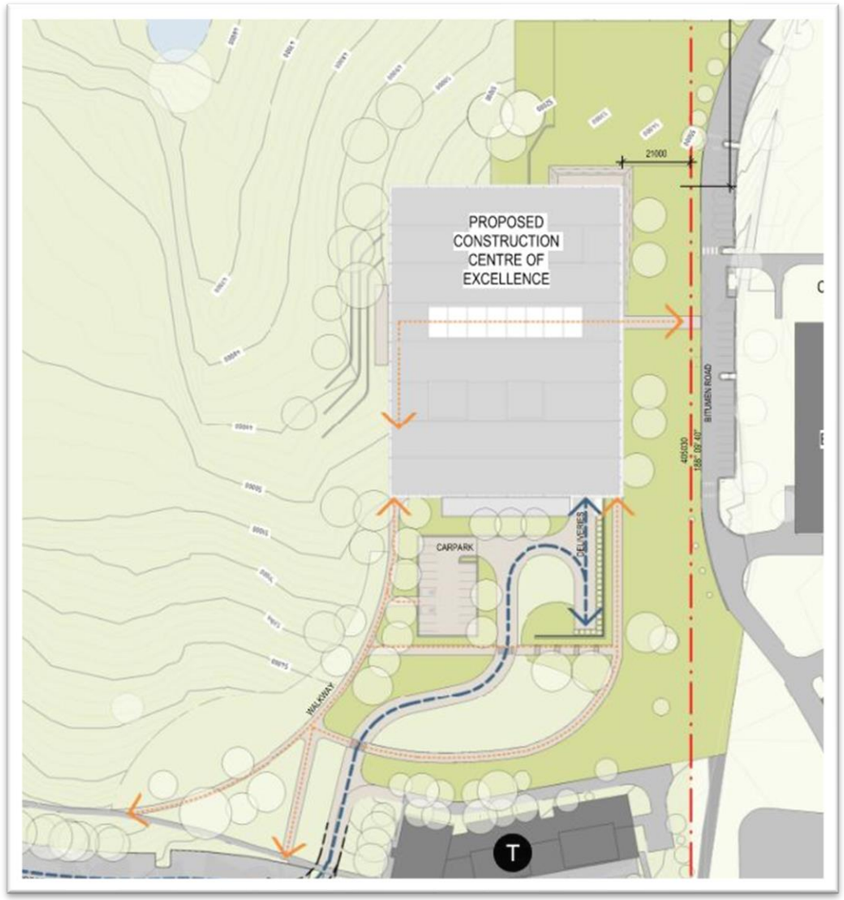


Figure 2 – Proposed Building Layout *(Gray Puksand, 2021)*

2.2 Site Topography

Levels in the north eastern portion of the site fall from approx. RL 56.00 AHD to RL 50.00m AHD at an approximate grade of 5-6% where the proposed building location has been identified. This corresponds to approximately 6.0m difference in elevation. Beyond the potential building locations, the surface falls at a similar grade to north west towards an existing basin with a permanent pond of water at approx. RL 47.00m AHD.

2.3 Contamination and Geotechnical Conditions

2.3.1 Geotechnical

A Geotechnical Investigation Report has been prepared by PSM dated 8th December 2020 (PSM4240-004L). A design CBR 2% has been recommended for the purposes of new pavement design subject to further testing once bulk earthworks operations have been undertaken.

Further Geotechnical Advice has been sought with regards to ground improvement methodologies to achieve CBR 3% or greater to establish new pavement profiles for the proposed development.

For the purposes of bulk earthworks calculations, a nominal 200mm depth of topsoil has been identified in the Geotechnical Investigation Report that will need to be stripped to expose the natural subgrade material. Topsoil may be stockpiled and ameliorated for reuse / spreading in open space grassed areas.

Temporary and permanent batter slope angles have been nominated in the Geotechnical Investigation Report and have been considered as part of the proposed works as summarised below:

Table 1 – Batter Slopes

Unit	Temporary	Permanent
Engineered Fill / Natural Soil	1.5H: 1V	2H: 1V
Bedrock Units	1H: 1V	1.5H: 1V

Investigation Report Engineer that will need to be revised once the project Geotechnical Engineer has reviewed the proposed earthworks design for the development.

2.3.2 Contamination

A preliminary contamination investigation and report has been undertaken by JBS&G dated 8th December 2020 (59831/134229 Rev A). The report indicates that the risk of contamination at the site is low. It further states that as fill is present at the site, given the nature of the investigation that an unexpected finds protocol for the proposed development works is considered if unidentified contamination is encountered.

2.4 Access to Site

The site has street frontages to the Great Western Highway and O'Connell Street, approximately 550m and 440m in length, respectively.

There are two vehicular entrances to the site along O'Connell Street (Gate 1 North and Gate 2 South), which provide access to internal circulation roadways and car parking however these are not connected. A circulation road extends from the Gate 2 access on O'Connell Street through the site adjacent to buildings along the southern boundary leading to an existing carpark near the proposed development area.

The existing road surfaces are made up of an asphaltic concrete wearing course overlaid on a granular road base material. The condition of the road surface wearing course is variable which has degraded over time.

Figure 3 – Gate 2 Existing Site Access

Remnants of an existing road were observed in the green space central to the existing basin / pond and the eastern boundary. It is understood that this road extended from a private road in an adjacent property to the south, through the green space and once connected with the Great Western Highway. The road is slightly elevated above the surrounding natural surface and covered in vegetation.

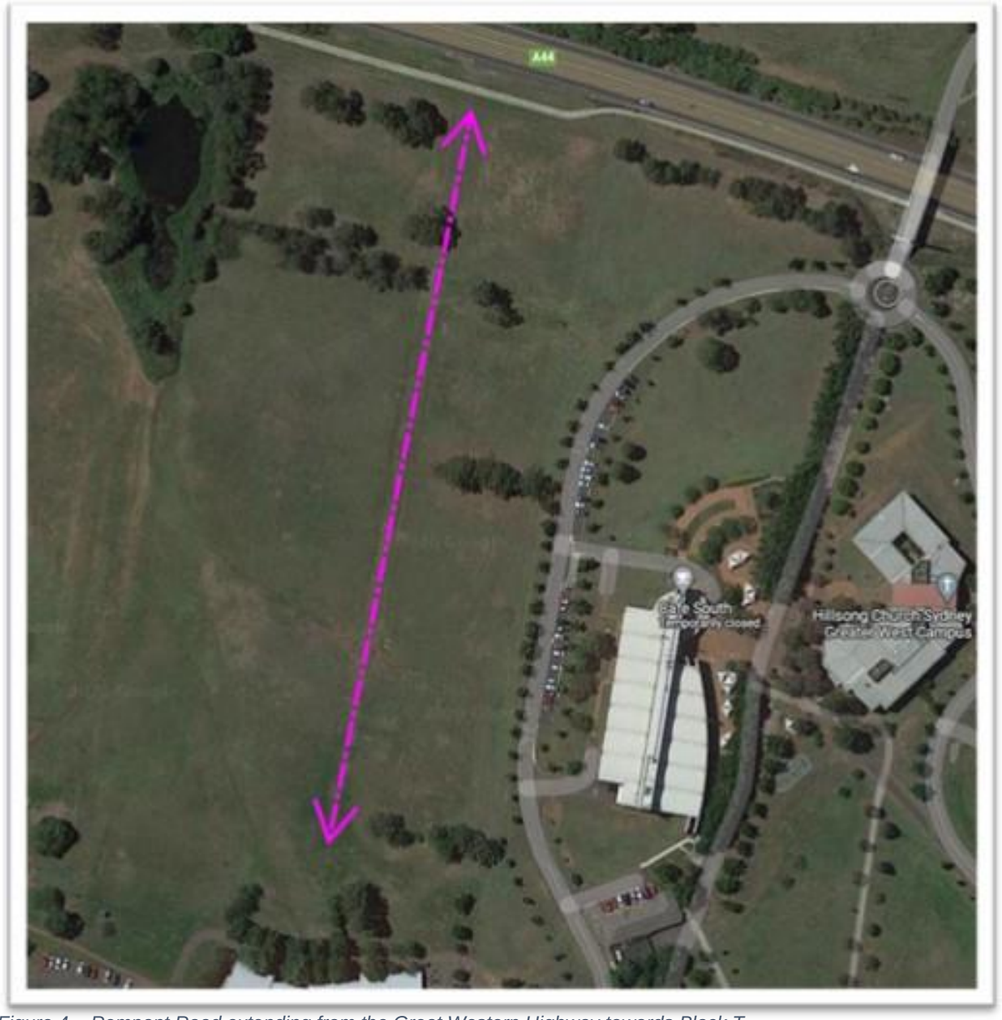


Figure 4 – Remnant Road extending from the Great Western Highway towards Block T

2.5 Existing Infrastructure

Northrop has undertaken a preliminary investigation of existing infrastructure in the vicinity of the proposed development site. Our assessment has been based on limited survey information as well as publicly available information from Penrith City Council, and site inspections undertaken on the 20th September 2020 and 29th October 2020.

2.5.1 Existing stormwater infrastructure

Four headwalls were identified along the northern edge of Building T (3 x 300mm and 1 x 450mm) discharging stormwater to the green space. From here flows are directed north west over land towards the existing basin / pond.

A single headwall was identified in the north east portion of the site discharging flows from Western Sydney University, through the green space. Flows are directed from the headwall in a natural channel west towards the existing basin / pond.

An additional headwall was identified under the remnant road (approx. 450mm diameter) to direct surface flows blocked by the remnant road towards the existing basin / pond

The outlet of the existing pond was not accessible at the time of inspection. Based on limited visibility of the pond, it is understood that water from the pond overflows to another depression outside the property boundary. From here it is piped to a smaller depression before it discharges to the north via a series of headwalls under the Great Western Highway.

On the northern side of the Great Western Highway flows continue north through private property. They are directed under St Charbel Boulevard in a series of box culverts before being conveyed further north.

From review of the Spatial Information Exchange maps data, the depression through the site, the channel extending from Western Sydney University and the basin / pond are plotted as watercourses / tributaries connecting to Werrington Creek. Further consultation with the Office of Water is to be undertaken to determine the constraints associated with these existing features.

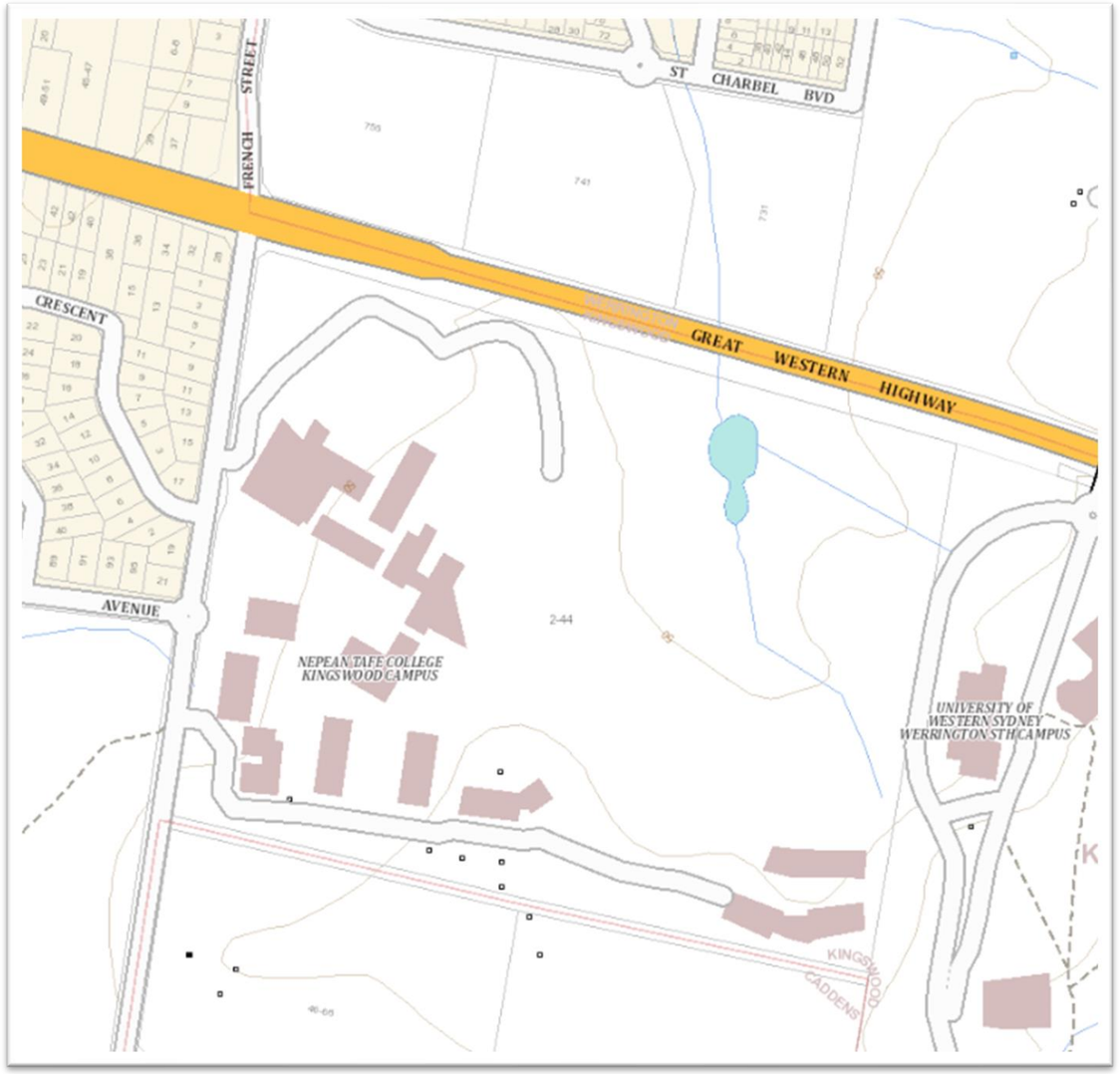


Figure 5 – Existing Site Plan nominating watercourses (SIX Maps, 2020)





Figures 6-10 (Clockwise from top left) - Headwalls near Block T, Flow path from Block T to Basin, Headwall and channel discharging flows from Western Sydney University, Outlet configuration from Basin / Pond in the verge of Great Western Highway, Culvert Crossing under Great Western Highway

2.6 Flooding

From review of the College, Orth and Werrington Creeks Catchment and Overland Flow Study commissioned by Penrith City Council, the site is flood affected to the north in the location of the existing basin / pond up to RL 47.00m AHD for the 1% AEP Flood. The project team have commissioned a Flood Consultant to provide further advice with respect to the existing conditions and the proposed development.

Figure 11 – Peak Design Flood Level for the 1% AEP Flood (College, Orth and Werrington Creeks Catchment Overland Flow Flood Study, June 2017).

3. Sediment and Soil Erosion Control

3.1 Sediment and Erosion Control

The objectives of the erosion and sediment control for the development site will be to ensure:

- Adequate erosion and sediment control measures are applied prior to the commencement of construction and are maintained throughout construction; and
- Construction site runoff is appropriately treated in accordance with Penrith City Council requirements prior to discharge.

As part of the works, the erosion and sedimentation control will need to be provided during the construction phase of the development in accordance with Penrith City Councils requirements and the NSW Department of Housing Manual, “Managing Urban Stormwater Soil & Construction” 2004 (Blue Book) - prior to any earthworks commencing on site.

3.1.1 Sediment Basin

A temporary sediment basin has been designed to capture site runoff during construction and has been located towards the north eastern side of the site, in the lowest point. The construction of the basin will be undertaken in stages to enable maximum runoff capture assisted by diversion swales and direct runoff to the basin.

Calculations to determine the concept design basin size have been based on available geotechnical information regarding soil types and through the use of the Soils and Construction Volume 1 Manual.

To ensure the sediment basin is working effectively it will be maintained throughout the construction works. Maintenance includes ensuring adequate settlement times or flocculation and pumping of clean water to reach the minimum storage volume at the lower level of the settling zone. The settling zone will be identified by pegs to clearly show the level at which design storage capacity is available.

The pumped water from the sediment basin can be reused for dust control during construction.

Overflow weirs are to be provided to control overflows for rainfall events in excess of the design criteria which caters for a storm event up to and including the 1% AEP storm event.

The concept sediment basin sizing is summarised in the table below. Detailed sediment basin sizing, configuration and location shall form part of the Construction Certificate application.

The sediment basin has been located for future conversion into the permanent water quality basin.

Table 2 – Sediment Basin Volumes

Total Disturbed Area	2.5	Settling zone volume	288m^3
Soil Texture Group	F	Sediment storage volume	144 m^3
Design rainfall depth (days)	5	Total Basin Volume	432m^3
Design rainfall depth (percentile)	80		
x-day, y-percentile rainfall event	27.4		
CV	0.42		

3.1.2 Sediment and Erosion Control Measures

Prior to any earthworks commencing on site, sediment and erosion control measure shall be implemented generally in accordance with the engineering drawings and the “Blue Book”. The measures are intended to be a minimum treatment only as the contractor will be required to modify and stage the erosion and sedimentation control measures to suit the construction program, sequencing, and techniques. These measures may include:

- A temporary site security/safety fence is to be constructed around the site, the site office area, and the proposed sediment basin.
- Sediment fencing provided downstream of disturbed areas, including any topsoil stockpiles.
- Dust control measures including covering stockpiles, installing fence hessian and watering exposed areas.
- Placement of hay bales or mesh and gravel inlet filters around and along proposed catch drains and around stormwater inlets pits; and
- The construction of a temporary sediment basin as noted above.
- Stabilised site access at the construction vehicle entry/exits.

Any stockpiled material, including topsoil, shall be located as far away as possible from any associated natural watercourses or temporary overland flow paths. Sediment fences shall be installed to the downstream side of stockpiles and any embankment formation. All stockpiles and embankment formations shall be stabilised by hydroseeding or hydro mulching on formation.

Figure 12 – Sediment Fence

4. Bulk Earthworks

The proposed works will generally consist of earthworks cut and fill operations to establish working platform levels consistent and reflective of the design of the proposed TAFE NSW Construction Centre of Excellence. The levels are to be designed to optimise and balance cut to fill material across the site where possible. Due to the sloping nature of the site and the layout of the proposed development, the site will predominantly be in cut to cater for the proposed development. Surplus material generated from the proposed development is to be spread over existing open areas.

4.1 Construction Sequencing

The sequence of work for the bulk earthworks will generally include:

- Provision of site establishment erosion and sediment control measures typically outlined in this report's section Erosion & Sediment Control.
- Clearing of vegetation from the proposed development site and either removal or mulching.
- Demolition of existing structures and pavements (as required).
- Stripping and stockpiling of topsoil suitable for reuse.
- Inspection of exposed natural material to ensure conformity with design assumptions and requirements.
- Placement of cut to fill layers not greater than 200mm in thickness and compacted to not less than 98% Standard Maximum Dry Density (SMDD) in accordance with the geotechnical report; and
- Spread topsoil to a maximum depth of 200mm and hydroseed or hydro mulch disturbed areas.

5. Pavements

Based on the Geotechnical Investigation Report prepared by PSM dated 8th December 2020 (PSM4240-004L) a design CBR 2% has been recommended for the purposes of new pavement design subject to further testing once bulk earthworks operations have been undertaken.

Further Geotechnical Advice has been sought with regards to ground improvement methodologies to achieve CBR 3% or greater to determine new pavement profiles for the proposed development.

With consideration to traffic loading specified in the Austroads (5.5×10^5 ESAs – 40 Year Design Life), a proposed flexible pavement profile may be as follows:

- 50mm AC10 Wearing Course (Polymer Modified)
- 150mm DGB20 Base Course Material compacted to 98% MMDD
- 350mm DGS40 Subbase Material compacted to 98% MMDD
- Ground Improvement to achieve minimum CBR 3%.

Based on discussion with the broader project team it is understood that the existing road pavements may be utilised during the construction and operational phase of the development within the TAFE site and the adjacent Western Sydney University site.

Further Geotechnical Investigation of existing road pavement profiles will need to be undertaken to assess whether they are suitable for ongoing use during construction and operation of the facility or if upgrades are required.

6. Stormwater Management Strategy

6.1 Stormwater Quantity Management

6.1.1 Stormwater Policy and Guidelines

The stormwater drainage for the proposed TAFE NSW Construction Centre of Excellence has been designed to comply with the following guidelines:

- Australian Rainfall and Runoff
- Penrith City Council's Water Sensitive Urban Design (WSUD) Policy (2013)
- Penrith City Council's WSUD Technical Guidelines (2015)
- Managing Urban Stormwater: Soils and Construction Volume 1, 4th Edition, March 2004

6.1.2 Stormwater Drainage

6.1.2.1 On-Site Stormwater Detention (OSD)

According to Penrith City Council's Stormwater Drainage Guidelines for Building Developments, On-site Stormwater Detention (OSD) is generally required for all types of developments in the Penrith City Council Local Government area to limit post development flows to predevelopment rates. This is typically provided on most developments to avoid nuisance flooding of downstream properties.

To control flows generated during storm events, water is stored and released at controlled rate on the development site. Storage is typically provided either of the following:

- below ground in a purpose made holding tanks; or
- above ground in landscaped basins or on the surface of hardstand areas such as car parks.

Recent discussion with Penrith City Council has indicated that the proposed development is not required to provide On-site Stormwater Detention. As such it has not been included as a feature of the proposed design. Formal correspondence from Council regarding this matter has been requested.

6.1.2.2 Major / Minor Drainage System

The major/minor approach to stormwater drainage is the recognised drainage concept for urban catchments within the Penrith City Council Local Government Area

The minor drainage system is comprised of below ground pit and pipe network and is designed to control nuisance flooding and enable effective stormwater management for the site. Council requires the minor drainage system to be designed for the critical 5% Annual Exceedance Probability (AEP) with overland flow safely catering for the 1% AEP.

The major drainage system will be designed to control and convey flows from the critical 1% AEP event. This incorporates suitably designed overland flow paths and drainage to direct flows into the OSD, system for all events up to the critical 1% AEP storm event.

In accordance with Council's requirements, overland flow paths are to be designed to contain a 1% AEP storm flow are to be provided over all pipelines that are not designed to cater for this flow. The design of the overland flowpath must consider the velocity-depth hazard.

Modelling has been undertaken to establish a proposed stormwater pit and pipe network. The proposed stormwater network has been documented on civil engineering drawings presented in Appendix B.

6.1.2.3 Connection to Councils Drainage System

Typically outflow pipes from stormwater drainage systems connect either directly to Council's stormwater infrastructure or utilise existing site stormwater connections within the site.

In the vicinity of the proposed development area, both Council's drainage system and any existing pipes appear to be a significant distance away. Flows generated on the site are proposed to discharge via a headwall and be conveyed overland towards the existing basin / pond.

Detailed survey will be required to determine the location and size of existing infrastructure, and where the current pond discharges to the Council stormwater network. Any existing private stormwater infrastructure will have to have condition assessment and capacity modelled before being used as part of the development.

Existing stormwater lines may need to be decommissioned, replaced or extended, and/or rerouted to a suitable connection point within the site.

Ultimately, connection points (in this case analysis of the pond and its overflow / connection) will be subject to Council review and approval following verification of additional survey information.

6.1.3 Proposed System

The 12d drainage Model for the proposed site was developed based upon the following methodology

- The site pit and pipe network are proposed to discharge freely to a headwall and convey flows overland towards the existing basin.
- An indicative pit and pipe network was developed for the proposed siteworks (refer civil engineering plans for details).
- No tailwater conditions have been considered (discharge free to atmosphere).
- 70% of the roof catchment from the new building is to drain directly to rainwater harvesting tank for the 1:100-year storm event which then overflows to the piped network.
- Designs for roof drainage shall be undertaken as either conventional or siphonic drainage by a certified Hydraulic Engineer during the detail design stage of the works.
- For the purposes of modelling, the rainwater tanks are considered full during simulation.
- All paved areas are collected within grated pits and drains.
- 20yr and 100yr ARI events were considered for all standard durations; and
- For the major system (100yr ARI storm event), a conservative blockage factor of 30% has been applied to all stormwater pits within the development area in accordance with Penrith City Council's requirements.
- As part of the proposed stormwater system for the site, connections to the existing headwalls on the northern side of Block T have been proposed to drain the flows to the west of the site and discharge in direction to the pond.
- The pit DIV01\01 has been included in the design to cater for overflows of the upstream catchment on the eastern side of the site. This pit has been designed as a sag pit, with 100% blockage and the piped system convey the flows away from the building entrance, to the northern side of the site, where it discharges to.

6.1.4 Results

Iterations were performed in the 12d Drainage model to determine the size of the proposed piped network in order to satisfy major / minor system requirements in accordance with Penrith City Council standards.

The proposed piped drainage system has been designed to cater for the 1 in 20-year ARI event leading to the outlet headwall. A provision for overland flows for events greater that the 1 in 20-year ARI event has also been considered on surface not conveying the 1 in 100-year ARI event below ground.

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.

6.2 Stormwater Quality Management

The stormwater management system for the site shall comply with section 3.2 of Penrith City Council's Water Sensitive Urban Design Policy. Council's policy requires improved water quality of the stormwater flow from the developed site prior to discharge into the authority's drainage system.

Council also requires the removal of target pollutants from the site during the construction phase as vehicles that may enter of exit could generate various pollutants such as silt, oil and grease. These target pollutants can be identified into five major groups of stormwater pollutants:

- Gross Pollutants
- Coarse, medium, and fine sediments
- Oil and grease
- Heavy Metals and
- Nutrients

6.2.1 Water Quality Objectives

In accordance with section 3.2 of Penrith City Council's Water Sensitive Urban Design Policy, we note the following targets have been set in relation to stormwater quality

Table 3 – Pollutant Reduction Targets

Reduction in annual average suspended solids (SS) export load	85%
Reduction in annual average total phosphorus (TP) export load	60%
Reduction in annual average total nitrogen (TN) export load	45%
Reduction in annual average gross pollutants (GP) export load	90%

To demonstrate compliance with Penrith City Council's Water Sensitive Urban Design (WSUD) Policy (2013), treatment removal loads will be analysed from pre-to post development scenarios using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) for the main building works. It should be noted that there are some smaller areas of footpaths being provided to replace existing paths through the development site which are considered periphery works not included as part of the model.

Model development and results will be provided in subsequent reports and documentation for further review incorporating a combination of various treatment devices as described below.

6.2.2 Proposed Treatments

Possible stormwater quality treatment devices such as StormFilter Cartridges, Ocean guard Pit Inserts and Rainwater Tanks are discussed below

6.2.2.1 Rainwater Tank

A 60 kL Rainwater Tank is proposed for this development in accordance with the Penrith's Council WSUD policy. The rainwater tank should be able to cater for at least 80% of the non-potable demand of the development.

The rainwater should provide water for flushing for the 34 toilets in the building. The adopted reuse rate is 0.1kL/day per toilet. As the site will only be occupied 5 days of the week, the daily reuse rate has been proportioned by 5/7, resulting in a reuse rate of 2.428kL/day.

Node Water Balance - Rainwater Tank - 60 kL

	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	GP (kg/yr)
Flow In	2.99	77.25	0.46	6.65	83.83
ET Loss	0.00	0.00	0.00	0.00	0.00
Infiltration Loss	0.00	0.00	0.00	0.00	0.00
Low Flow Bypass Out	0.00	0.00	0.00	0.00	0.00
High Flow Bypass Out	0.00	0.00	0.00	0.00	0.00
Pipe Out	1.03	21.82	0.15	2.20	0.00
Weir Out	1.25	27.26	0.19	2.70	0.00
Transfer Function Out	0.00	0.00	0.00	0.00	0.00
Reuse Supplied	0.71	9.85	0.10	1.33	0.00
Reuse Requested	0.88	0.00	0.00	0.00	0.00
% Reuse Demand Met	80.23	0.00	0.00	0.00	0.00
% Load Reduction	23.90	36.47	26.73	26.35	100.00

Decimal Places 2

Figure 13: Node Water Balance Results

6.2.2.2 Stormfilter Cartridges

Filtration cartridges in the form of Stormfilters are to be provided as an end of line treatment device to treat stormwater runoff from the proposed development. The Stormfilter system targets a full range of pollutants including total suspended solids, soluble heavy metals, oil and grease and total nutrients. Each cartridge has a treatable flow rate of 1~1.6L/s and is designed to capture and treat the first flush volume of a rainfall event.

In developing the MUSIC model for the proposed works, an offline 12 x 690mm cartridge system by Ocean Protect has been proposed as an end of line treatment prior to discharge. The position of the Stormfilter units have been proposed to maximise flows and allow easy access for maintenance.

6.2.2.3 Ocean Guard Pit Inserts

Surface Inlet Pits within the development area have been designed to be provided with Ocean Guard Pit Inserts including oil absorbent media. The pit inserts will sit beneath the stormwater pit grates and will collect gross pollutants and larger sediments prior to treatment by the Stormfilter cartridges.

Figure 14 (Left) – Stormfilter Cartridge System, Figure 14 (Right) – Stormwater Pit Litter Basket Insert

6.2.3 Water Quality Modelling – MUSIC Model, Parameters and Methodology

A water quality modelling tool, MUSIC was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales. MUSIC Models the total amount of gross pollutants and nutrients produced within various types of catchments. It allows the user to simulate the removal rates expected with implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

The following methodology and parameters were incorporated in the MUSIC Modelling

- The MUSIC model was created to assess the effectiveness of water quality nodes which are to be constructed as part of the proposed development
- In accordance with Council's requirements Penrith MUSIC link and standard nodes have been used in the model.
- A Music Model was established to represent the post-developed site. From architectural plans, the site was then categorized into the following areas
    - Roof
    - Road
    - Hardstand
    - Landscape

A treatment train was designed to incorporate a series of treatment nodes including a Rainwater Tank, Stormfilter Cartridges, Ocean Guard Pit Inserts The effectiveness of the proposed treatments is summarised below.

6.2.4 Results

The following results were achieved in the model

Table 4 – Ocean Guard MUSIC Input Parameters (upstream of Stormfilter)

Pollutant	Post-Development with no WSUD measures (kg/yr.)	Post-Development with WSUD measures (kg/yr.)	Removal Rate (%)	Target Removal Rate (%)
Suspended Solids (mg/L)	907	126	85.6	85
Phosphorus (mg/L)	1.91	0.702	61.9	60
Nitrogen (mg/L)	16.7	9.12	45	45
Gross Pollutants (kg/ML)	183	0	100	90

Results of the MUSIC analysis indicate that the proposed treatment train consisting of a 60kL Rainwater Tank, 12 x Stormfilter Cartridges and 16 x Ocean Guard Pit Inserts generally satisfies Council's statutory requirements for target pollutant removal rates.

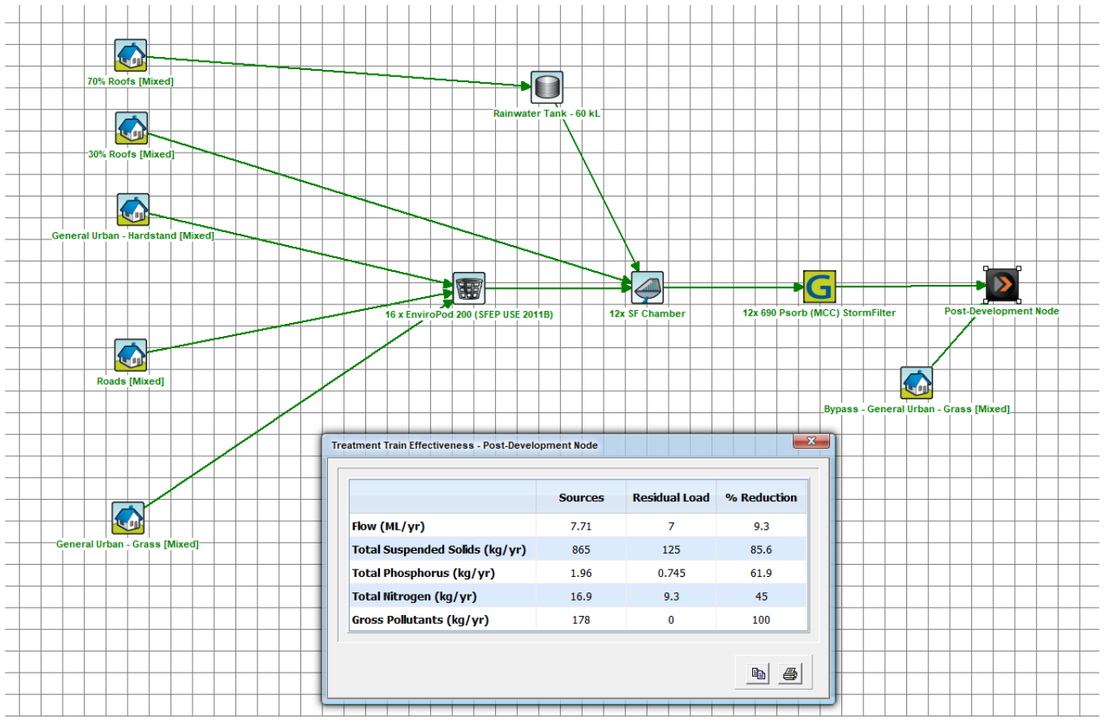


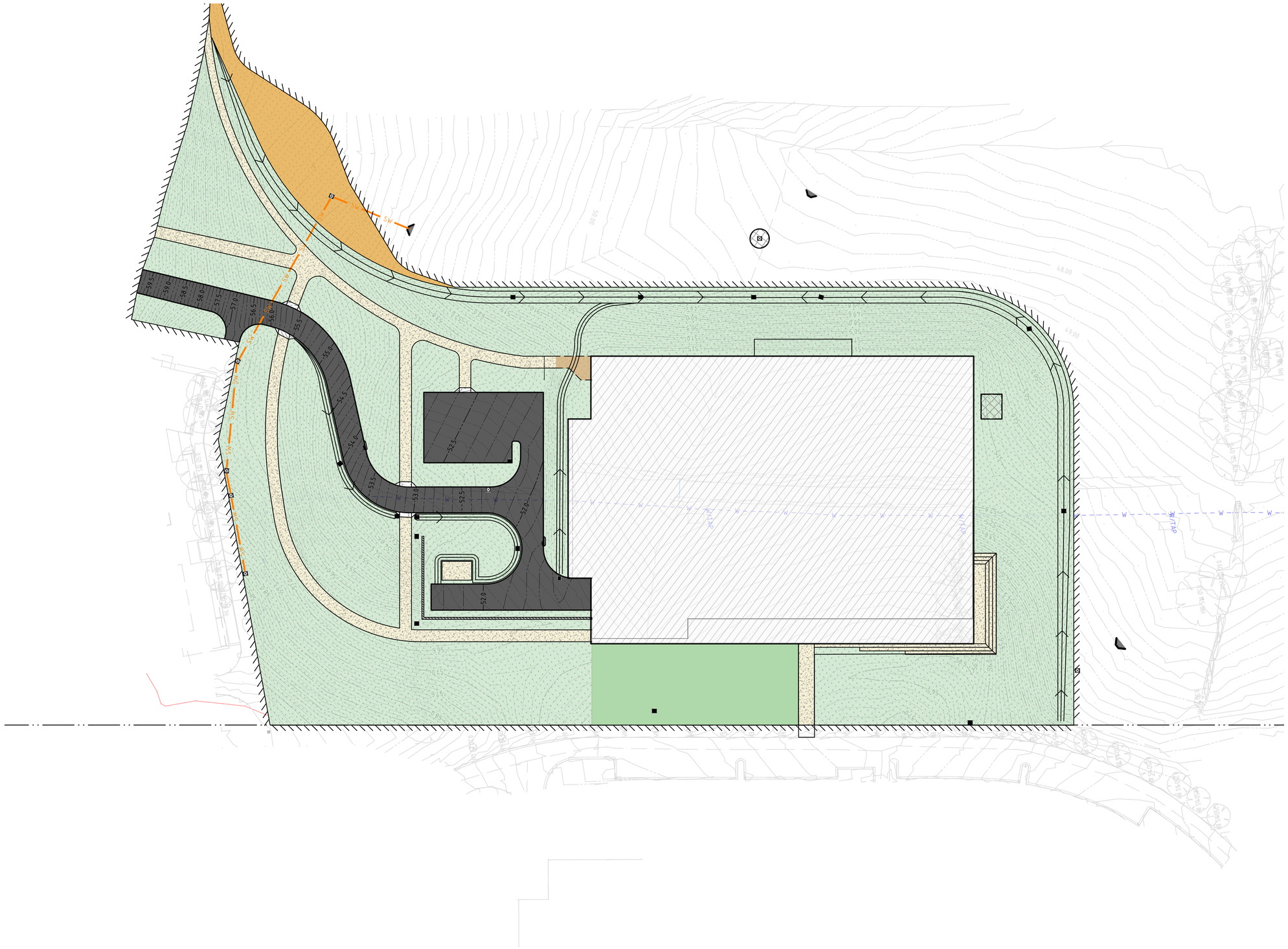
Figure 15 – MUSIC Model and Results

7. Conclusion

In summary, the requirements for the proposed development are as follows:

- Stormwater Infrastructure – OSD storage is not required based on discussion with Penrith City Council. Water Quality measures will be required for the proposed development. Water quality treatment is achieved using a rainwater tank, propriety filter cartridge devices and pit insert baskets.
- On-going maintenance of water quality and quantity systems will be required for the development. As the design for the proposed development is progressed, information regarding on-going maintenance costs will be considered by the Project Team to ensure systems are financially feasible for the operational life of the development.
- Development runoff is generally distributed to suit the drainage direction of existing catchment areas. On this basis, stormwater from the proposed development is proposed to drain towards the existing pond / basin to the north west before discharge to the creek in direction to the Great Western Highway.

Appendix A – MUSIC Catchment Plan



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JOB MANAGER: J. GILLIGAN
VERIFIER:

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR INFORMATION	AC	SH	JG	04.03.21

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PROJECT
TAFE NSW CONSTRUCTION CENTRE OF EXCELLENCE

DRAWING TITLE
CIVIL ENGINEERING PACKAGE

CATCHMENT PLAN

JOB NUMBER **202025**

DRAWING NUMBER **DAC04.51**

REVISION **1**

DRAWING SHEET SIZE = A1

Appendix B – Engineering Plans

TAFE NSW CONSTRUCTION CENTRE OF EXCELLENCE

SCHEMATIC DESIGN
CIVIL ENGINEERING PACKAGE

SOURCE : NEARMAP.COM.AU (©2021)

LOCALITY PLAN

CIVIL DRAWING SCHEDULE

DWG No.	DRAWING TITLE
DAC01.01	COVER SHEET, DRAWING SCHEDULE AND LOCALITY PLAN
DAC01.11	SPECIFICATION NOTES
DAC02.01	SEDIMENT AND SOIL EROSION CONTROL PLAN
DAC02.11	SEDIMENT AND SOIL EROSION CONTROL DETAILS
DAC03.01	BULK EARTHWORKS CUT TO FILL PLAN
DAC04.01	SITEWORKS AND STORMWATER MANAGEMENT PLAN
DAC04.21	STORMWATER LONGITUDINAL SECTIONS - SHEET 01
DAC04.22	STORMWATER LONGITUDINAL SECTIONS - SHEET 02
DAC04.23	STORMWATER LONGITUDINAL SECTIONS - SHEET 03
DAC04.24	STORMWATER LONGITUDINAL SECTIONS - SHEET 04
DAC04.25	STORMWATER LONGITUDINAL SECTIONS - SHEET 05
DAC04.51	STORMWATER CATCHMENT PLAN
DAC04.61	STORMWATER MANAGEMENT DEVICES

DRAWN: C.PASKE DESIGNED: J.GRINSELL JOB MANAGER: J.GILLIGAN VERIFIER:

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
01	ISSUED FOR INFORMATION - 50%	CP		JG	29.01.21
2	ISSUED FOR INFORMATION	TB		JG	04.03.21

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SCALE 1:2500@ A1 0 20 40 60 80 100 120m

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PROJECT
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DRAWING TITLE
CIVIL ENGINEERING PACKAGE
COVER SHEET, DRAWING SCHEDULE AND LOCALITY PLAN

JOB NUMBER 202025
DRAWING NUMBER DAC01.01
REVISION 2
DRAWING SHEET SIZE = A1

NOTE: ALL CIVIL ENGINEERING CONSTRUCTION WORKS TO BE CARRIED OUT IN ACCORDANCE WITH PENRITH CITY COUNCIL DEVELOPMENT GUIDELINES .THE AFOREMENTIONED GUIDELINES INCLUSIVE OF ALL SPECIFICATIONS TAKE PRECEDENCE OVER NOTES PROVIDED BELOW.

STORMWATER DRAINAGE

1. ALL DRAINAGE LINES SHALL BE UPVC (CLASS SN4) SEWER GRADE DRAINAGE PIPE, U.N.O.
2. ALL DRAINAGE LINES SHALL BE LAID AT 1% MIN. FALL, UNO.
3. ALL LEVELS ARE AUSTRALIAN HEIGHT DATUM (AHD).
4. ALL DOWNPIPES GUTTERS TO BE DESIGNED IN ACCORDANCE WITH AS/NZS 3500.3.2 – 2003 'STORMWATER' DRAINAGE.
5. THE STORMWATER DRAINAGE DESIGN HAS BEEN CARRIED OUT IN ACCORDANCE WITH AS/NZS 3500.3.2-2003 'STORMWATER' DRAINAGE.
6. ANY VARIATIONS TO THE NOMINATED LEVELS SHALL BE REFERRED TO ENGINEER IMMEDIATELY.
7. SUBSOIL DRAINAGE SHALL BE PROVIDED TO ALL RETAINING WALLS & EMBANKMENTS, WITH THE LINES FEEDING INTO THE STORMWATER DRAINAGE SYSTEM.
8. ALL GRATES TO BE GALVANISED STEEL WITH HINGES AND CHILD PROOF LOCK.
9. ALL GRATES TO BE HEEL SAFE WITHIN AGED CARE DEVELOPMENTS.
10. THE STORMWATER DRAINAGE IS DESIGNED IN ACCORDANCE WITH PENRITH CITY COUNCIL DEVELOPMENT GUIDELINES.

RAINWATER RE-USE

1. PROVIDE RAINWATER RE-USE SYSTEM TO SUPPLY WATER FOR TOILET FLUSHING.
2. GUTTER GUARD TO BE INSTALLED ON ALL EAVES GUTTERS.
3. A PERMANENT SIGN IS TO BE LOCATED IN THE VICINITY OF THE TANK STATING THE WATER IS "NON POTABLE WATER" WITH APPROPRIATE HAZARD IDENTIFICATION.
4. PIPEWORK USED FOR RAINWATER SERVICES SHALL BE COLOURED LILAC IN ACCORDANCE WITH AS1345.
5. ALL VALVES AND APERTURES SHALL BE CLEARLY AND PERMANENTLY LABELLED WITH SAFETY SIGNS TO COMPLY WITH AS1319.
6. RAINWATER TANK RETICULATION SYSTEM AND MAINS WATER BYPASS ARRANGEMENT TO BE INSTALLED IN ACCORDANCE WITH AS/NZS 3500.1.2-2003 AND THE NSW CODE OF PRACTICE : PLUMBING AND DRAINING.
7. A FIRST FLUSH FILTRATION DEVICE IS TO BE PROVIDED AT RAINWATER TANK.

GENERAL NOTES

THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH OTHER SUCH WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DIMENSIONS ARE IN MILLIMETRES & ALL LEVELS ARE IN METRES, UNO (UNLESS NOTED OTHERWISE).

NO DIMENSION SHALL BE OBTAINED BY SCALING THE DRAWINGS.

ALL LEVELS AND SETTING OUT DIMENSIONS SHOWN ON THE DRAWINGS SHALL BE CHECKED ON SITE PRIOR TO THE COMMENCEMENT OF THE WORK.

DETAIL SURVEY DATA WAS SUPPLIED BY RYGATE & COMPANY PTY LIMITED, DRAWING DATED 17/12/20.

EXISTING SERVICES WHERE SHOWN HAVE BEEN PLOTTED FROM SUPPLIED DATA AND SUCH THEIR ACCURACY CAN NOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH THE LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF WORK.

ON COMPLETION OF STORMWATER INSTALLATION, ALL DISTURBED AREAS MUST BE RESTORED TO ORIGINAL CONDITION, INCLUDING KERBS, FOOTPATHS, CONCRETE AREAS, GRAVEL AND GRASSED AREAS AND ROAD PAVEMENTS, UNLESS DIRECTED OTHERWISE.

ALL STORMWATER MANAGEMENT MEASURES SHOWN ON THIS DRAWING HAVE BEEN PREPARED FOR DEVELOPMENT APPLICATION PURPOSES TO DEMONSTRATE FEASIBILITY. ALL MEASURES WILL BE SUBJECT TO DETAIL DESIGN AT THE CONSTRUCTION CERTIFICATE STAGE AND MAY BE SUBJECT TO VARIATION PROVIDED THAT THE DESIGN INTENT IS MAINTAINED.

SEDIMENT AND SOIL EROSION

1. THE SEDIMENT & EROSION CONTROL PLAN PRESENTS CONCEPTS ONLY. THE CONTRACTOR SHALL AT ALL TIMES BE RESPONSIBLE FOR THE ESTABLISHMENT & MANAGEMENT OF A DETAILED SCHEME MEETING COUNCILS AND OTHER REGULATORY AUTHORITY REQUIREMENTS AND MAKE PAYMENT OF ALL FEES.
2. THE CONTRACTOR SHALL INSTIGATE ALL SEDIMENT AND EROSION CONTROL MEASURES IN ACCORDANCE WITH STATUTORY REQUIREMENTS AND IN PARTICULAR THE 'BLUE BOOK' (MANAGING URBAN STORMWATER SOILS AND CONSTRUCTION), PRODUCED BY THE DEPARTMENT OF HOUSING AND COUNCILS POLICIES. THESE MEASURES ARE TO BE INSPECTED AND MAINTAINED ON A DAILY BASIS.
3. THE CONTRACTOR SHALL ENSURE THAT ALL SOIL AND WATER MANAGEMENT WORKS ARE LOCATED AS INSTRUCTED IN THE DRAWINGS AND ADHERE TO ALL REGULATORY AUTHORITY REQUIREMENTS.
4. THE CONTRACTOR SHALL INFORM ALL SUB CONTRACTORS OF THEIR RESPONSIBILITIES IN MINIMISING THE POTENTIAL FOR SOIL EROSION AND POLLUTION TO DOWNSTREAM LANDS AND WATERWAYS.
5. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE SHALL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE;
   5.1. CONSTRUCT TEMPORARY STABILISED SITE ACCESS INCLUSIVE OF SHAKE DOWN / WASH PAD.
   5.2. INSTALL ALL TEMPORARY SEDIMENT FENCES AND BARRIER FENCES. WHERE FENCES ADJACENT EACH OTHER, THE SEDIMENT FENCE CAN BE INCORPORATED INTO THE BARRIER FENCE.
   5.3. INSTALL SEDIMENT CONTROL MEASURES AS OUTLINED ON THE APPROVED PLANS.
6. UNDERTAKE SITE DEVELOPMENT WORKS SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF MINIMUM WORKABLE SIZE.
7. AT ALL TIMES AND IN PARTICULAR DURING WINDY AND DRY WEATHER, LARGE UNPROTECTED AREAS WILL BE STABILISED / KEPT MOIST (NOT WET) TO KEEP DUST UNDER CONTROL ENSURING CONFORMITY TO REGULATORY AUTHORITY REQUIREMENTS.
8. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) SHALL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.
9. WATER SHALL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS THE CATCHMENT AREA HAS BEEN STABILISED AND/OR ANY LIKELY SEDIMENT BEEN FILTERED OUT.
10. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES SHALL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE STABILISED / REHABILITATED.
11. ALLOW FOR GRASS STABILISATION OF EXPOSED AREAS, OPEN CHANNELS AND ROCK BATTERS DURING ALL PHASES OF CONSTRUCTION.
12. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED TO ENSURE THAT THEY OPERATE EFFECTIVELY. REPAIRS AND/OR MAINTENANCE SHALL BE UNDERTAKEN REGULARLY AND AS REQUIRED, PARTICULARLY FOLLOWING RAIN EVENTS.
13. RECEPTORS FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHINGS, LIGHT-WEIGHT WASTE MATERIALS AND LITTER SHALL BE DISPOSED OF IN ACCORDANCE WITH REGULATORY AUTHORITY REQUIREMENTS. CONTRACTOR TO PAY ALL FEES AND PROVIDE EVIDENCE OF SAFE DISPOSAL.
14. IF A TEMPORARY SEDIMENT BASIN IS REQUIRED, ENSURE SAFE BATTER SLOPES IN ACCORDANCE WITH THE GEOTECHNICAL REPORT. MAINTAIN ADEQUATE STORAGE VOLUME IN ACCORDANCE WITH PLANS. TEMPORARY PUMP 'CLEAN FLOCCULATED' WATER TO AUTHORITIES STORMWATER SYSTEM. ENSURE WHOLE DISTURBED SITE RUN-OFF IS DIRECTED TO TEMPORARY SEDIMENT BASIN.

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JOB MANAGER: J. GILLIGAN
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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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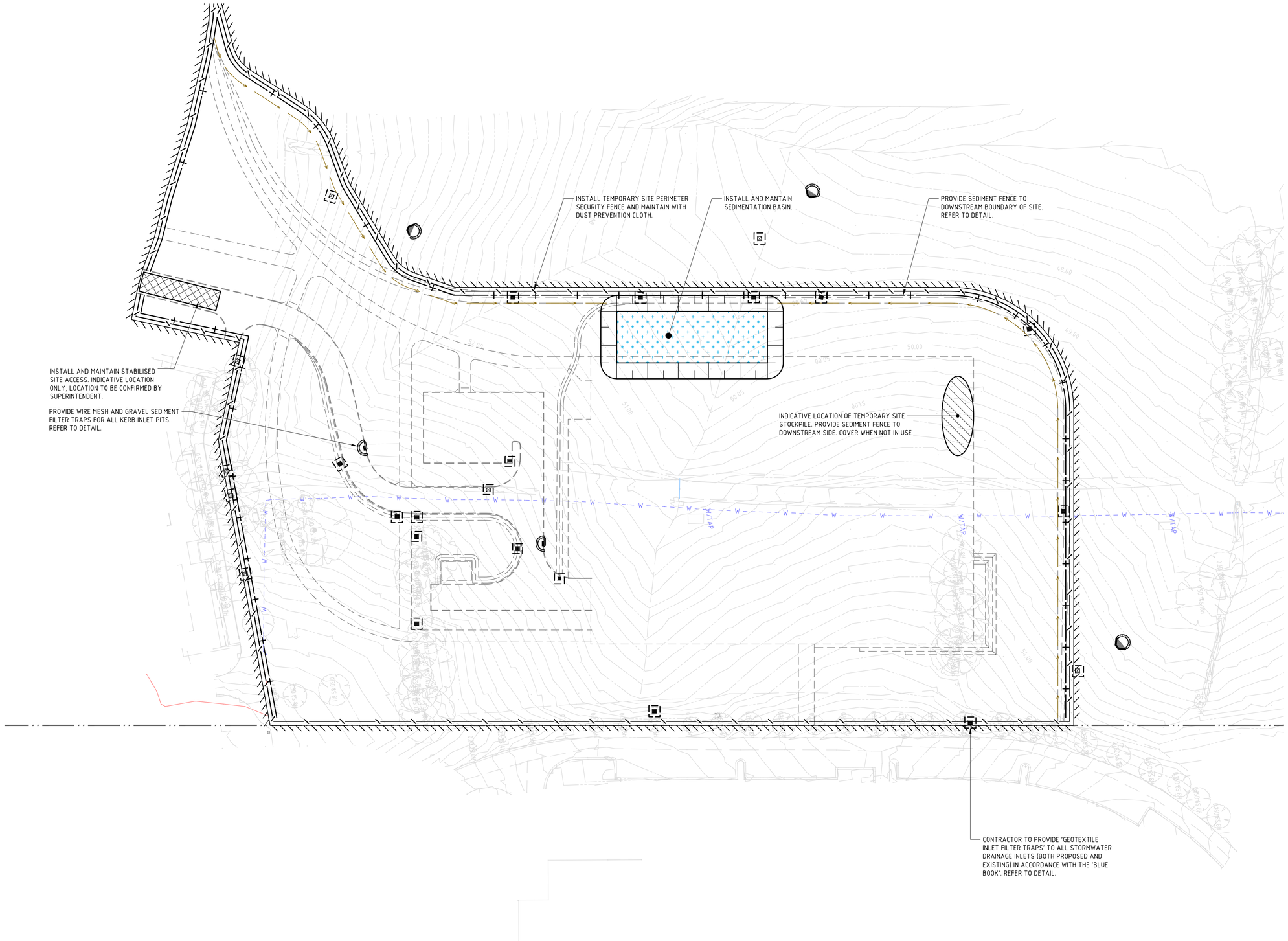
PROJECT: TAFE NSW CONSTRUCTION CENTRE OF EXCELLENCE

DRAWING TITLE: CIVIL ENGINEERING PACKAGE
SPECIFICATION NOTES

JOB NUMBER: 202025
DRAWING NUMBER: DAC01.11
REVISION: 01
DRAWING SHEET SIZE = A1



LEGEND

- PROPOSED BOUNDARY LINE
- EXISTING BOUNDARY LINE
- EXISTING CONTOURS
- SEDIMENT FENCE
- SECURITY FENCE
- MESH AND GRAVEL INLET FILTER
- GEOTEXTILE INLET FILTER
- STABILISED SITE ACCESS
- STOCKPILE
- SEDIMENT BASIN
- TEMPORARY SWALE

SITE PARAMETERS

CONSTRAINT	VALUE
TOTAL DISTURBED AREA (Ha)	2.5
SOIL TEXTURE GROUP	F
DESIGN RAINFALL DEPTH (DAYS)	5.0
DESIGN RAINFALL DEPTH (PERCENTILE)	80.0
X-DAY,Y-PERCENTILE RAINFALL EVENT	27.4
Cv	0.4
SETTLING ZONE VOLUME (m^3)	288
SEDIMENT STORAGE VOLUME (m^3)	144
TOTAL BASIN VOLUME (m^3)	432

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NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
01	ISSUED FOR INFORMATION – 50%	CP		JG	29.01.21
2	ISSUED FOR INFORMATION	TB		JG	04.03.21

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SCALE 1:500@A1
0 5 10 15 20 25m

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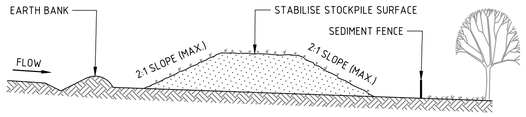
DRAWING TITLE
CIVIL ENGINEERING PACKAGE
SEDIMENT AND SOIL EROSION CONTROL PLAN

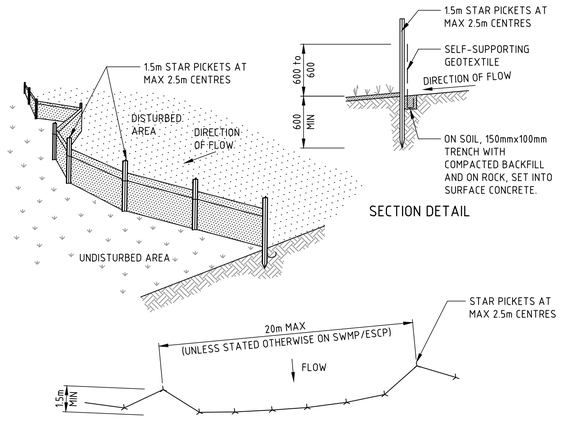
JOB NUMBER 202025
DRAWING NUMBER DAC02.01
REVISION 2
DRAWING SHEET SIZE = A1



CONSTRUCTION NOTES

1. PLACE STOCKPILES MORE THAN 2m (PREFERABLY 5m) 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 THEY 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) 1 TO 2m DOWNSLOPE.

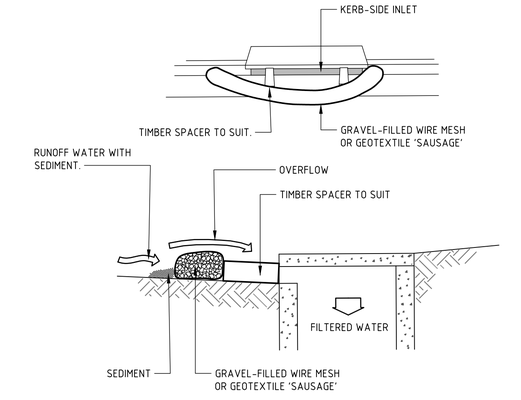
STOCKPILES (SD 4-1)



CONSTRUCTION NOTES

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

SEDIMENT FENCE (SD 6-8)

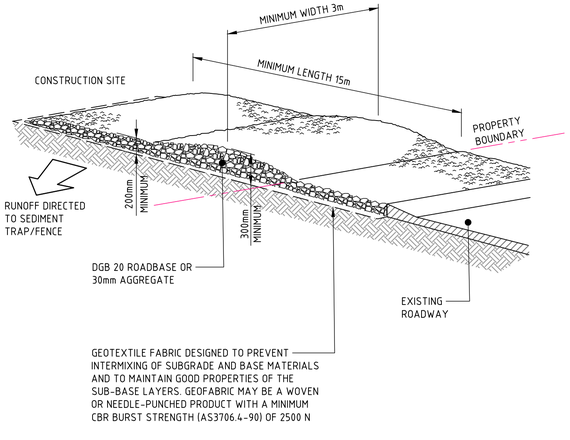


NOTE:THIS PRACTICE ONLY TO BE USED WHERE SPECIFIED IN APPROVED SWMP/ESCP.

CONSTRUCTION NOTES

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

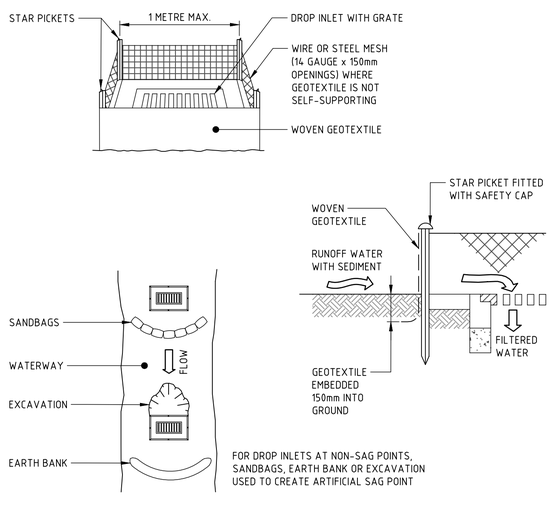
MESH AND GRAVEL INLET FILTER (SD 6-11)



CONSTRUCTION NOTES

1. STRIP THE TOPSOIL, LEVEL THE SITE AND COMPACT THE SUBGRADE.
2. COVER THE AREA WITH NEEDLE-PUNCHED GEOTEXTILE.
3. CONSTRUCT A 200mm THICK PAD OVER THE GEOTEXTILE USING ROAD BASE OR 30mm AGGREGATE.
4. ENSURE THE STRUCTURE IS AT LEAST 15 METRES LONG OR TO BUILDING ALIGNMENT AND AT LEAST 3 METRES WIDE.
5. WHERE A SEDIMENT FENCE JOINS ONTO THE STABILISED ACCESS, CONSTRUCT A HUMP IN THE STABILISED ACCESS TO DIVERT WATER TO THE SEDIMENT FENCE.

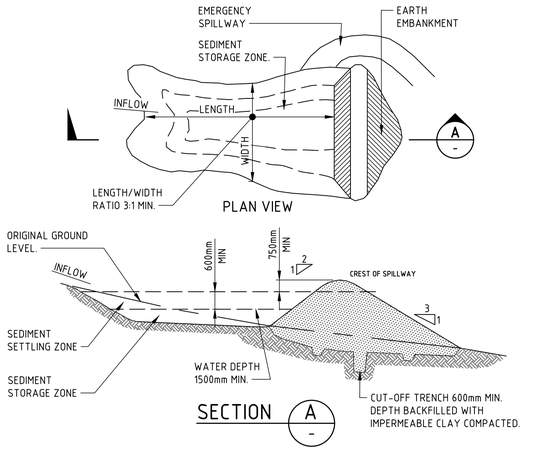
STABILISED SITE ACCESS (SD 6-14)



CONSTRUCTION NOTES

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES.
2. FOLLOW STANDARD DRAWING 6-7 AND STANDARD DRAWING 6-8 FOR INSTALLATION PROCEDURES FOR THE STRAW BALES OR GEOFABRIC. REDUCE THE PICKET SPACING TO 1 METRE CENTRES.
3. IN WATERWAYS, ARTIFICIAL SAG POINTS CAN BE CREATED WITH SANDBAGS OR EARTH BANKS AS SHOWN IN THE DRAWING.
4. DO NOT COVER THE INLET WITH GEOTEXTILE UNLESS THE DESIGN IS ADEQUATE TO ALLOW FOR ALL WATERS TO BYPASS IT.

GEOTEXTILE INLET FILTER (SD 6-12)



CONSTRUCTION NOTES

1. REMOVE ALL VEGETATION AND TOPSOIL FROM UNDER THE DAM WALL AND FROM WITHIN THE STORAGE AREA.
2. CONSTRUCT A CUT-OFF TRENCH 500mm DEEP AND 1200mm WIDE ALONG THE CENTRELINE OF THE EMBANKMENT EXTENDING TO A POINT ON THE GULLY WALL LEVEL WITH THE RISER CREST.
3. MAINTAIN THE TRENCH FREE OF WATER AND RECOMPACT THE MATERIALS WITH EQUIPMENT AS SPECIFIED IN THE SWMP TO 95 PER CENT STANDARD PROCTOR DENSITY.
4. SELECT FILL FOLLOWING THE SWMP THAT IS FREE OF ROOTS, WOOD, ROCK, LARGE STONE OR FOREIGN MATERIAL.
5. PREPARE THE SITE UNDER THE EMBANKMENT BY RIPPING TO AT LEAST 100mm TO HELP BOND COMPACTED FILL TO THE EXISTING SUBSTRATE.
6. SPREAD THE FILL IN 100mm TO 150mm LAYERS AND COMPACT IT AT OPTIMUM MOISTURE CONTENT FOLLOWING THE SWMP.
7. CONSTRUCT THE EMERGENCY SPILLWAY.
8. REHABILITATE THE STRUCTURE FOLLOWING THE SWMP.

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

EARTH BASIN - WET

DESIGNED: J. GRINSELL
DRAWN: C. PASKE
JOB MANAGER: J. GILLIGAN
VERIFIER:

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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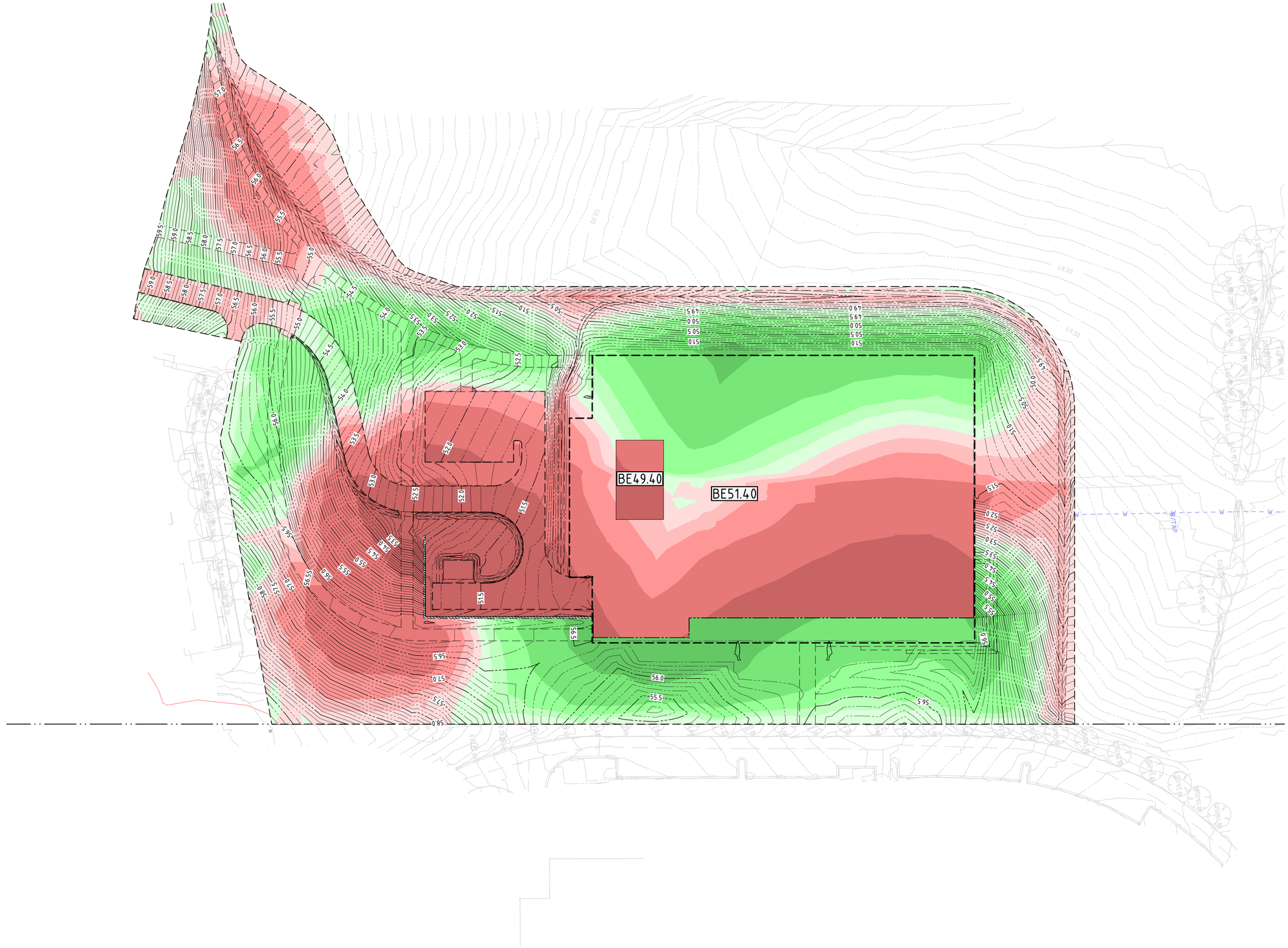
PROJECT
TAFE NSW CONSTRUCTION CENTRE OF EXCELLENCE

DRAWING TITLE
CIVIL ENGINEERING PACKAGE
SEDIMENT AND SOIL EROSION CONTROL DETAILS

JOB NUMBER 202025
DRAWING NUMBER DAC02.11
REVISION 2
DRAWING SHEET SIZE = A1



LEGEND

- PROPOSED BOUNDARY LINE
- EXISTING BOUNDARY LINE
- BEXX.XX — BULK EARTWORKS SPOT HEIGHT
- + eRLXX.XX — EXISTING SPOT HEIGHT
- BEXX.XX — BULK EARTHWORKS PAD LEVEL
- X.X — DIRECTION OF GRADE
- BATTERS
- XX.XX — CONTOURS

DEPTH OF CUT

- - 99m TO - 15m
- - 15m TO - 10m
- - 10m TO - 5m
- - 5m TO - 2m
- - 2m TO - 1m
- - 1m TO - 0.5m
- - 0.5m TO - 0.25m
- - 0.25m TO - 0.0m

DEPTH OF FILL

- 0.0m TO 0.25m
- 0.25m TO 0.5m
- 0.5m TO 1m
- 1m TO 2m
- 2m TO 5m
- 5m TO 10m
- 10m TO 15m
- 15m TO 99m

GENERAL NOTES:

1. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH COUNCIL / RELEVANT AUTHORITY SPECIFICATIONS AND DETAILS.
2. CAD FILES / DTM FILES TO BE SUPPLIED IN AUTOCAD FORMAT FOR SETOUT PURPOSES (UPON REQUEST).
3. NO ALLOWANCE HAS BEEN MADE FOR BULKING FACTORS. NOTE ALL VOLUMES DEPICTED ARE SOLID VOLUMES ONLY AND MAY NOT REFLECT DETAILED EARTHWORKS.
4. NO ALLOWANCE HAS BEEN MADE FOR DETAILED EARTHWORKS; ie SERVICE TRENCHING, DETAILED EXCAVATION, FOOTINGS, RETAINING WALLS AND THE LIKE. CONTRACTOR IS TO ALLOW FOR REMOVAL OF ALL EXCESS MATERIAL GENERATED BY THE WORKS.
5. THE CONTRACTOR SHALL USE FINAL SURFACE LEVELS AND TYPICAL PAVEMENT DETAILS FOR ACTUAL EARTHWORKS LEVELS.
6. BULK EARTHWORKS ARE BASED ON THE FOLLOWING DEPTHS FROM FINISHED SURFACE LEVELS;
   - 6.1. LANDSCAPE AREA 200mm
   - 6.2. BUILDING SLAB 300mm (REFER STRUCTURAL DWGS)
   - 6.3. FOOTPATH PAVEMENT 150mm
   - 6.4. ROAD PAVEMENT 520mm
   - 6.5. SAND PIT 2300mm
7. APPROXIMATE BULK EARTHWORK VALUES AS FOLLOWS;
   - 7.1. CUT 15,916 cu.m
   - 7.2. FILL 9,569 cu.m
   - 7.3. BALANCE 6,347 cu.m (EXCESS CUT OVER FILL)
   - 7.4. NOTE: A SITE STRIP OF 200mm HAS BEEN CONSIDERED. APPROX VOLUME 5,174cu.m.

DRAWN: C. PASKE
DESIGNED: J. GRINSELL
JOB MANAGER: J. GILLIGAN
VERIFIER:

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
01	ISSUED FOR INFORMATION - 50%	CP		JG	29.01.21
2	ISSUED FOR INFORMATION	TB		JG	04.03.21

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ARCHITECT
GRAY PUKSAND

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SCALE 1:500@A1 0 5 10 15 20 25m

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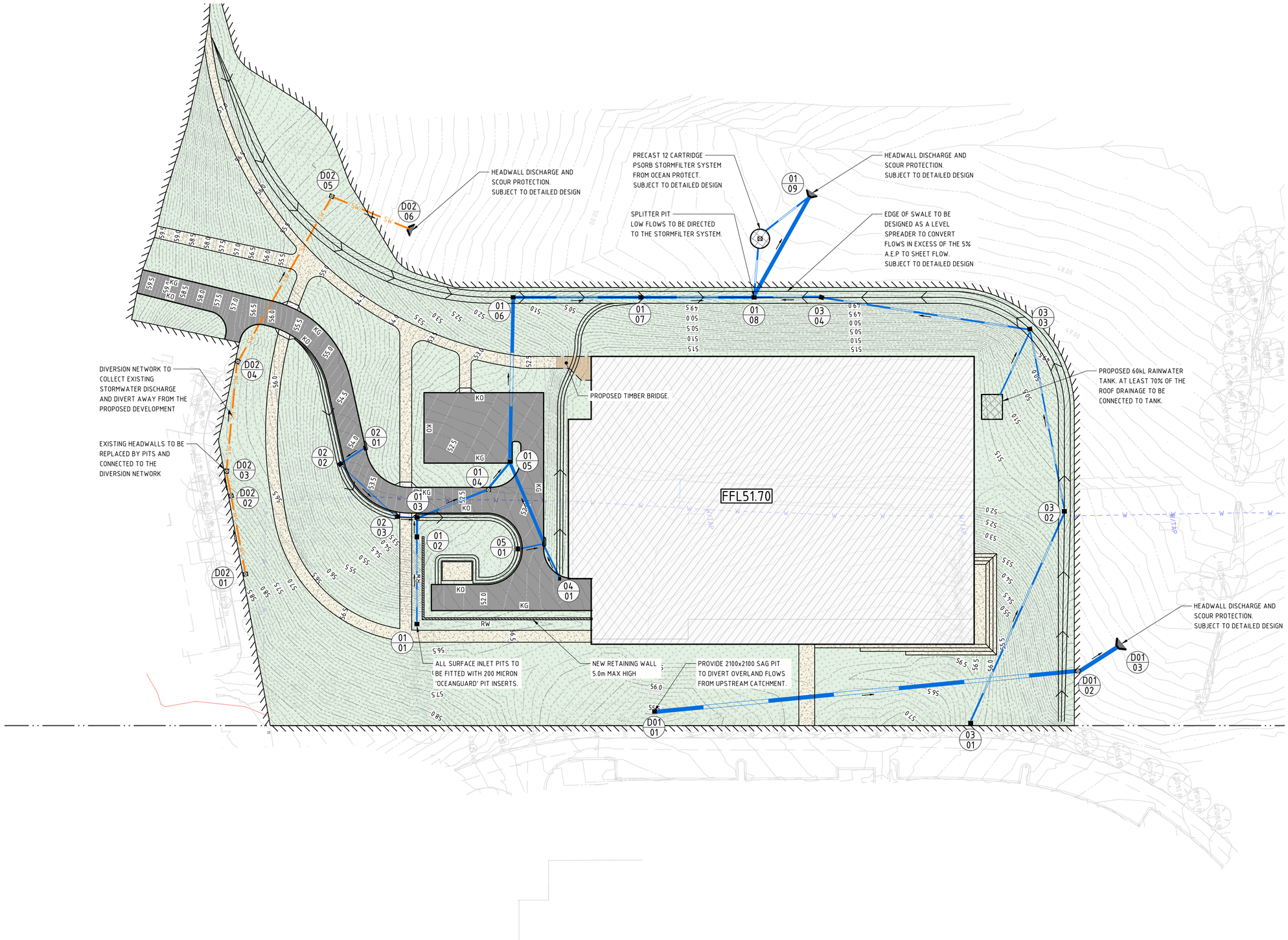
PROJECT
TAFE NSW CONSTRUCTION CENTRE OF EXCELLENCE

DRAWING TITLE
CIVIL ENGINEERING PACKAGE
BULK EARTHWORKS CUT TO FILL PLAN

JOB NUMBER 202025
DRAWING NUMBER DAC03.01
REVISION 2
DRAWING SHEET SIZE = A1



LEGEND

- PROPOSED BOUNDARY LINE
- EXISTING BOUNDARY LINE
- PROPOSED KERB
- EXISTING KERB
- SAWCUT AND PAVEMENT INFILL
- KO — KERB ONLY
- KG — KERB AND GUTTER
- IK — INTEGRAL KERB
- DD — DISH DRAIN
- VC — VEHICULAR CROSSING
- KR — KERB RAMP
- WS — WHEEL STOP
- MTE — MATCH TO EXISTING
- • RLXX.XX — PROPOSED SPOT HEIGHT
- × eRLXX.XX — EXISTING SPOT HEIGHT
- FFLXX.XX — PROPOSED FINISHED FLOOR LEVEL
- BATTERS
- XX.XX — CONTOURS
- EXISTING CONTOURS
- DRAINAGE SWALE
- DRAINAGE STRUCTURE WITH EXTENDED CHAMBER (NEW / EXTG)
- GRATED INLET PIT (NEW / EXTG)
- KERB INLET PIT (NEW / EXTG)
- JUNCTION PIT (NEW / EXTG)
- 1 / A — STORMWATER PIT TAG STRUCTURE No / LINE ID
- ROCK HEADWALL

DRAWN: C. PASKE
DESIGNED: J. GRINSELL
JOB MANAGER: J. GILLIGAN
VERIFIER:

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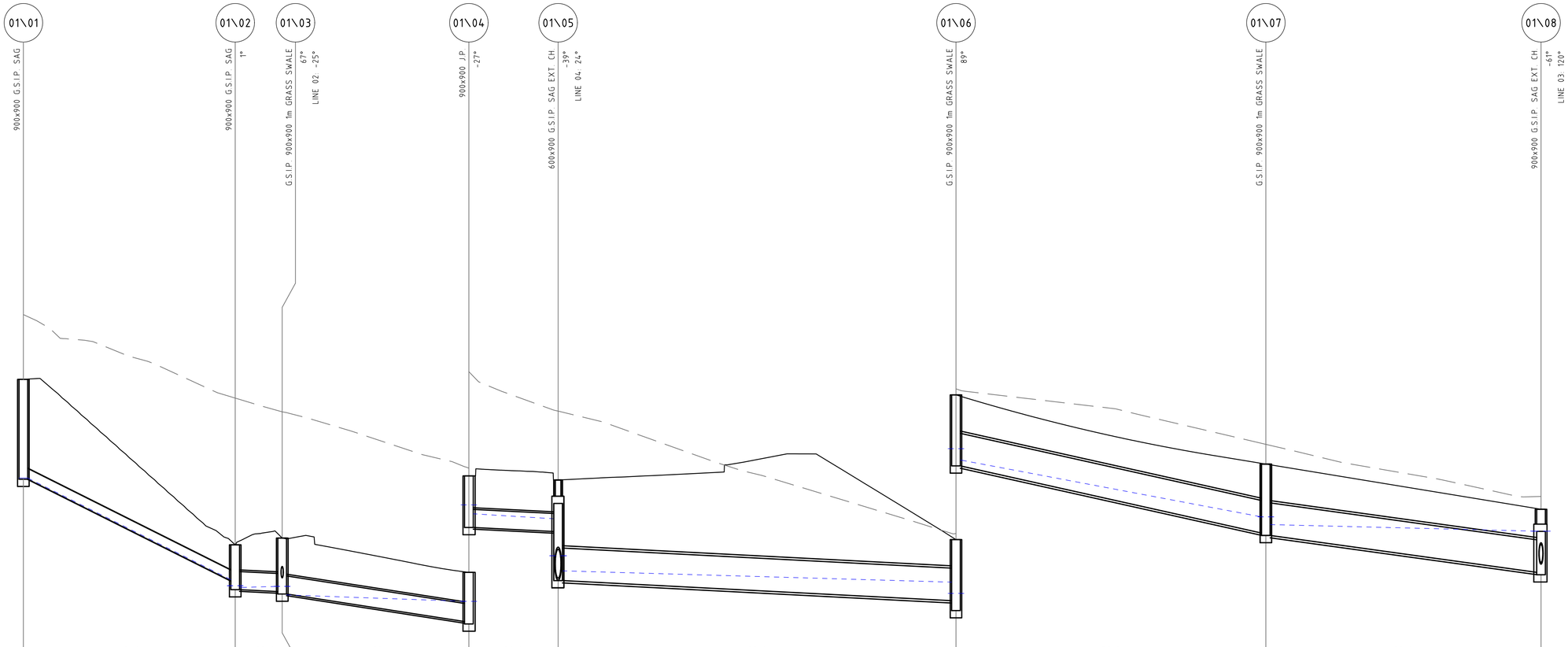
DRAWING TITLE
CIVIL ENGINEERING PACKAGE

SITEWORKS AND STORMWATER MANAGEMENT PLAN

JOB NUMBER **202025**

DRAWING NUMBER **DAC04.01** | REVISION **02**

DRAWING SHEET SIZE = A1



PIPE CLASS	UPVC	RRJ2	RRJ2	RRJ2	RRJ2	RRJ2	RRJ2	RRJ2
PIPE GRADE (%)	10.0%	1.0%	3.1%	1.0%	1.0%	4.5%	2.8%	
PIPE SIZE (mm)	225	375	375	375	675	675	675	
MINIMUM COVER (m)	0.60	0.60	0.61	0.65	0.60	0.60	0.60	
Vf - FULL PIPE VELOCITY (m/s)	Vf=2.08	Vf=1.79	Vf=1.34	Vf=1.47	Vf=2.09	Vf=3.41	Vf=1.98	
Q - PIPE FLOW (L/s)	Q=27	Q=108	Q=146	Q=147	Q=529	Q=564	Q=597	
DATUM RL	47.0			45.0		42.0		
H.G.L. (5% AEP)	54.204	51.978 51.978	51.941	51.964 51.964	51.787	51.454 51.454	51.469	51.347 50.599
FINISHED SURFACE	56.256	52.826		52.966	52.255		52.170	
NATURAL SURFACE	57.599	55.868		55.583	54.416		53.598	
PIPE INVERT LEVEL	54.186	52.078	51.896	51.856	51.806	51.235	51.185	51.101
DEPTH TO INVERT	2.071	0.748	0.930	1.109	1.159	1.020	1.070	1.068
CO-ORDINATED SETOUT	E290704.269 N6261488.224	E290682.512 N6261491.341		E290677.696 N6261492.076		E290673.382 N6261510.894		E290666.970 N6261517.293
CHAINAGE	0.000	21.979		26.851	46.220		55.475	

PIPE CLASS	RRJ2	RRJ2	RRJ2	RRJ2	RRJ2	RRJ2	RRJ2	
PIPE GRADE (%)	1.0%	1.0%	1.0%	4.5%	2.8%			
PIPE SIZE (mm)	675	675	675	675	675			
MINIMUM COVER (m)	0.60	0.60	0.60	0.60	0.60			
Vf - FULL PIPE VELOCITY (m/s)	Vf=2.09	Vf=3.41	Vf=1.98					
Q - PIPE FLOW (L/s)	Q=529	Q=564	Q=597					
DATUM RL		42.0						
H.G.L. (5% AEP)	50.652 49.989	49.585	48.405 48.405	48.245	48.109 48.109			
FINISHED SURFACE	50.935	49.500		48.563				
NATURAL SURFACE	51.060	49.909		48.828				
PIPE INVERT LEVEL	49.667	49.462	48.070	48.020	47.255			
DEPTH TO INVERT	1.267	1.472	1.430	1.480	1.308			
CO-ORDINATED SETOUT	E290626.232 N6261523.932		E290630.795 N6261555.752		E290634.847 N6261584.008			
CHAINAGE	96.751	128.897		157.442				

LINE 01

DRAWN: C.PASKE
DESIGNED: J.GRINSELL
JOB MANAGER: J.GILLIGAN
VERIFIER:

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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ARCHITECT
GRAY PUKSAND

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SCALE 1:100@A1 0 1 2 3 4 5m

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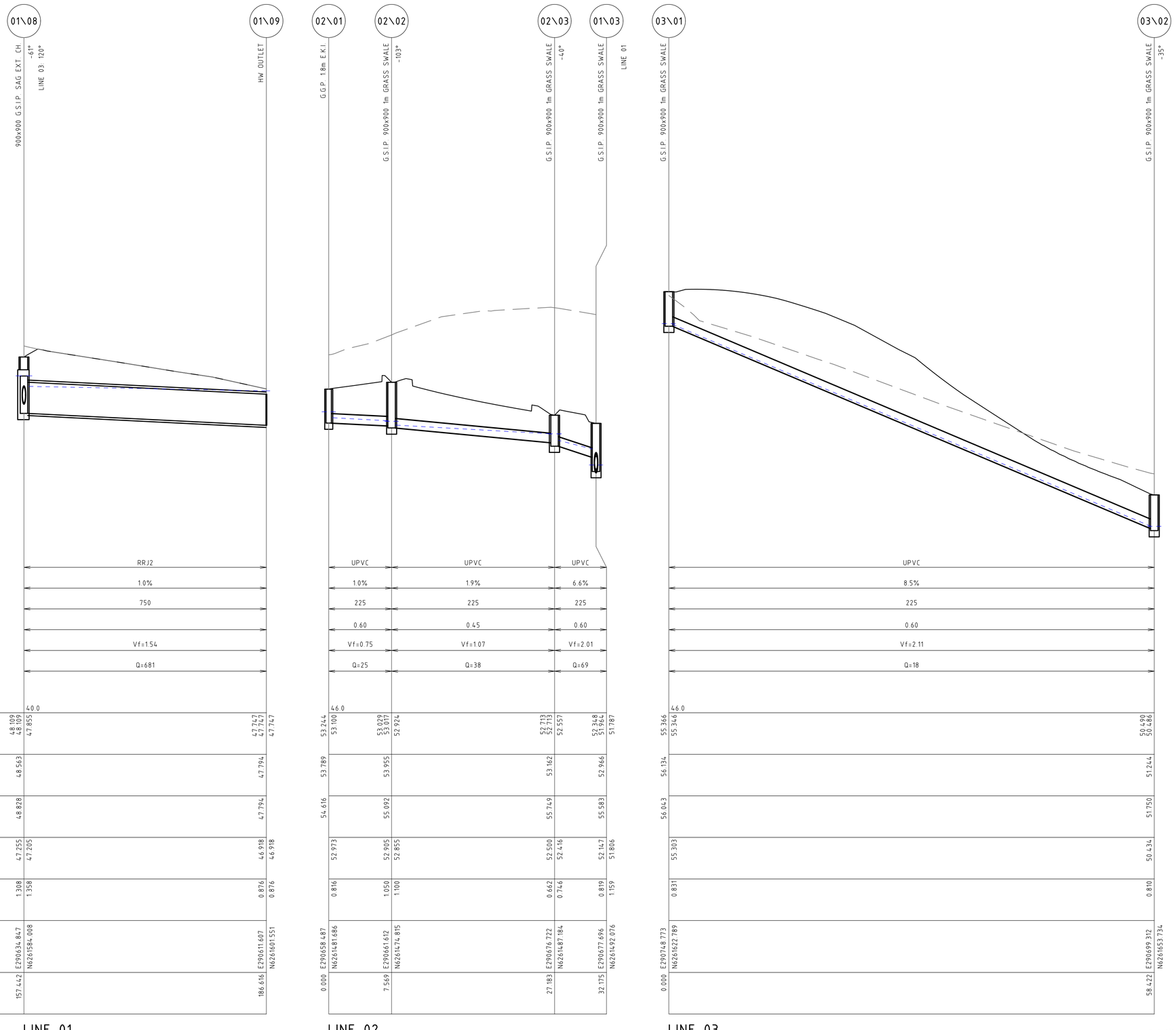
DRAWING TITLE
CIVIL ENGINEERING PACKAGE
STORMWATER LONGITUDINAL SECTIONS - SHEET 01

JOB NUMBER 202025
DRAWING NUMBER DAC04.21
REVISION 2
DRAWING SHEET SIZE = A1



	LINE 01			LINE 02			LINE 03	
PIPE CLASS	RRJ2		UPVC	UPVC	UPVC	UPVC		
PIPE GRADE (%)	1.0%		1.0%	1.9%	6.6%	8.5%		
PIPE SIZE (mm)	750		225	225	225	225		
MINIMUM COVER (m)			0.60	0.45	0.60	0.60		
Vf - FULL PIPE VELOCITY (m/s)	Vf=1.54		Vf=0.75	Vf=1.07	Vf=2.01	Vf=2.11		
Q - PIPE FLOW (L/s)	Q=681		Q=25	Q=38	Q=69	Q=18		
DATUM RL	40.0		46.0			46.0		
H.G.L. (5% AEP)	48.109 48.109	47.855	53.244 53.100	53.079 53.077	52.924	52.713 52.713	52.557	52.368 51.966	51.787	55.366 55.346	50.490 50.486	47.747 47.747	47.747
FINISHED SURFACE	48.563		47.794	53.789	53.955	53.162	52.966	56.134	51.244
NATURAL SURFACE	48.828		47.794	54.616	55.092	55.749	55.583	56.043	51.750
PIPE INVERT LEVEL	47.255	47.205	46.918	46.918	52.973	52.905 52.855	52.500	52.416	52.147	51.806	55.303	50.434
DEPTH TO INVERT	1.308	1.358	0.876	0.876	0.816	1.050 1.100	0.662	0.746	0.819	1.159	0.831	0.810
CO-ORDINATED SETOUT	E290634.847 N6261584.008		E290611.607 N6261601.551	E290658.487 N6261481.686	E290661.612 N6261474.815	E290676.722 N6261487.184	E290677.696 N6261492.076	E290748.773 N6261622.789	E290699.312 N6261653.734
CHAINAGE	157.442	186.616	0.000	7.569	27.183	32.175	0.000	58.422

VERIFIER:
JOB MANAGER: J GILLIGAN
DESIGNED: J GRINSELL
DRAWN: C PASKE

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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02	ISSUED FOR INFORMATION	AC		JG	04.03.21

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ARCHITECT
GRAY PUKSAND

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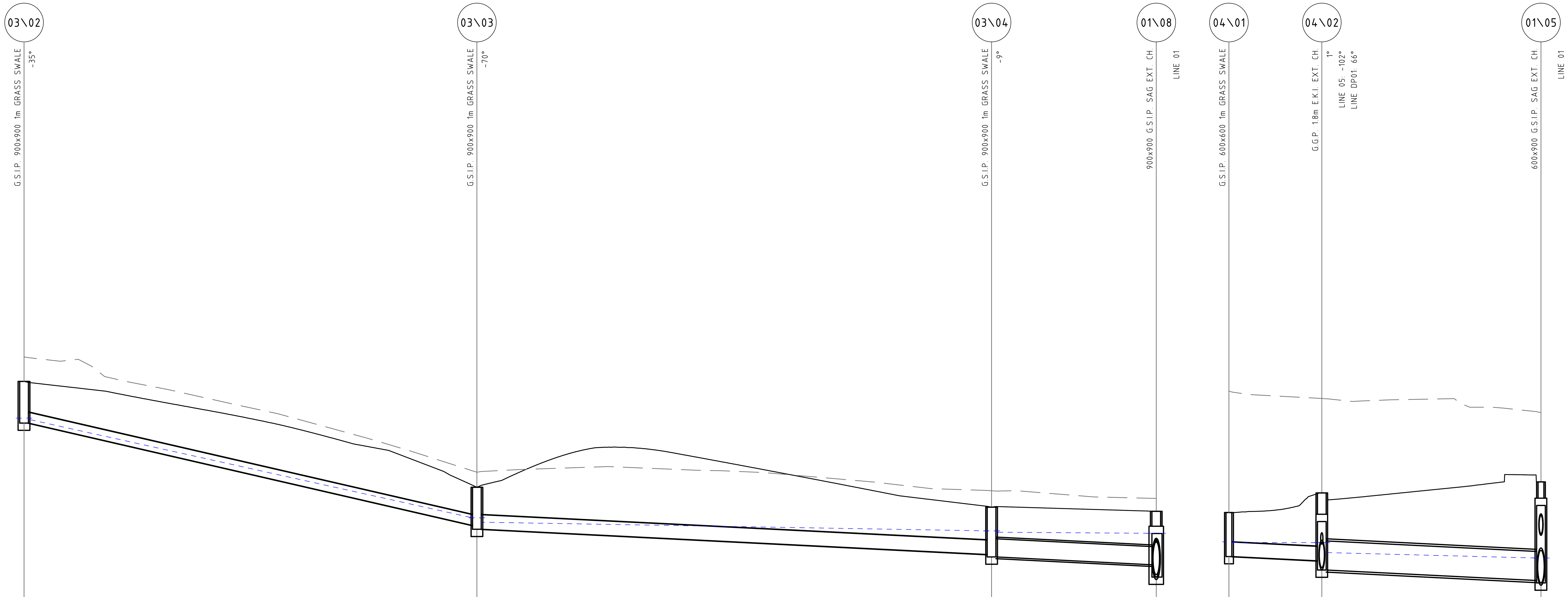
DRAWING TITLE
CIVIL ENGINEERING PACKAGE
STORMWATER LONGITUDINAL SECTIONS - SHEET 02

JOB NUMBER 202025
DRAWING NUMBER DAC04.22
REVISION 02
DRAWING SHEET SIZE = A1



LINE 03

	03\02 – 03\03	03\03 – 03\04	03\04 – 01\08
PIPE CLASS	UPVC	UPVC	RRJ2
PIPE GRADE (%)	4.6%	1.0%	1.0%
PIPE SIZE (mm)	225	300	375
MINIMUM COVER (m)	0.60	0.60	0.63
Vf - FULL PIPE VELOCITY (m/s)	Vf=2.08	Vf=1.11	Vf=0.76
Q - PIPE FLOW (L/s)	Q=38	Q=63	Q=84

DATUM RL 42.0

	03\02	03\03	03\04	01\08
H.G.L. (5% AEP)	50.490 50.486 50.462	48.429 48.429 48.338	48.159 48.159 48.131	48.109 48.109 47.855
FINISHED SURFACE	51.244	49.059	48.648	48.563
NATURAL SURFACE	51.750	49.369	48.986	48.828
PIPE INVERT LEVEL	50.434 50.384	48.270 48.193	47.670 47.620	47.460 47.205
DEPTH TO INVERT	0.810 0.860	0.789 0.867	0.978 1.028	1.104 1.358
CO-ORDINATED SETOUT	E290699.312 N6261653.734	E290652.626 N6261651.638	E290637.258 N6261600.817	E290634.847 N6261584.008
CHAINAGE	58.422	105.163	158.285	175.283

LINE 04

	04\01 – 04\02	04\02 – 01\05
PIPE CLASS	UPVC	RRJ2
PIPE GRADE (%)	1.0%	1.0%
PIPE SIZE (mm)	300	600
MINIMUM COVER (m)	0.60	0.80
Vf - FULL PIPE VELOCITY (m/s)	Vf=0.58	Vf=1.47
Q - PIPE FLOW (L/s)	Q=14	Q=369

DATUM RL 45.0

	04\01	04\02	01\05
H.G.L. (5% AEP)	50.932 50.920	50.916 50.916 50.711	50.599 50.599 50.286
FINISHED SURFACE	51.538	51.942	52.170
NATURAL SURFACE	54.045	53.891	53.598
PIPE INVERT LEVEL	50.629	50.540 50.351	50.134 50.084
DEPTH TO INVERT	0.909	1.402 1.591	2.036 2.086
CO-ORDINATED SETOUT	E290698.065 N6261525.443	E290688.841 N6261522.928	E290666.970 N6261517.293
CHAINAGE	0.000	9.587	32.208

DRAWN: C.PASKE DESIGNED: J.GRINSELL JOB MANAGER: J.GILLIGAN VERIFIER:

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01	ISSUED FOR INFORMATION - 50%	CP		JG	29.01.21
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ARCHITECT: GRAY PUKSAND

SCALE 1:250@ A1 (0 2 4 6 8 10 12m)
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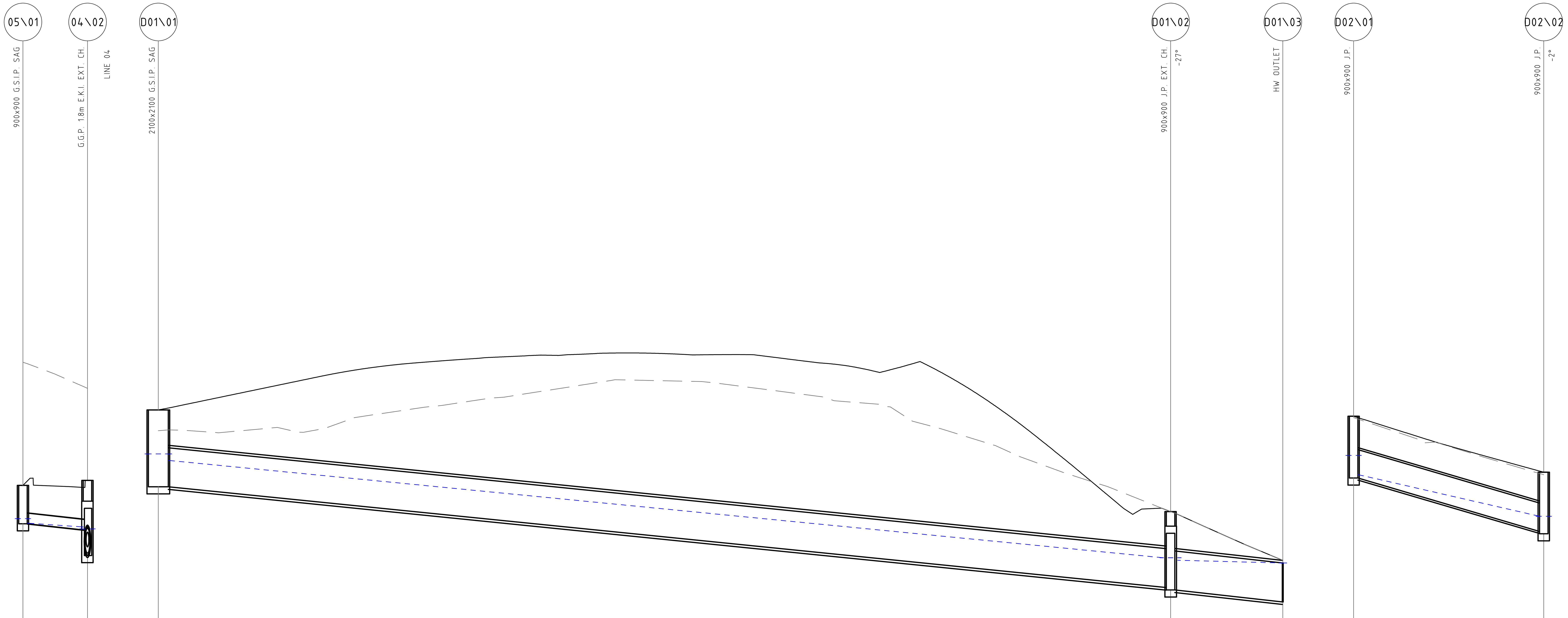
DRAWING TITLE: CIVIL ENGINEERING PACKAGE

STORMWATER LONGITUDINAL SECTIONS - SHEET 03

JOB NUMBER: 202025

DRAWING NUMBER: DAC04.23 REVISION: 02

DRAWING SHEET SIZE = A1



LINE 05

PIPE CLASS		UPVC		
PIPE GRADE (%)		2.2%		
PIPE SIZE (mm)		225		
MINIMUM COVER (m)		0.60		
Vf - FULL PIPE VELOCITY (m/s)		Vf=0.80		
Q - PIPE FLOW (L/s)		Q=11		
DATUM RL		45.0		
H.G.L. (5% AEP)	51.132	51.038	50.956 50.916	50.711
FINISHED SURFACE	51.837		51.942	
NATURAL SURFACE	54.445		53.891	
PIPE INVERT LEVEL		51.024	50.890	50.351
DEPTH TO INVERT		0.813	1.052	1.591
CO-ORDINATED SETOUT	E290689.125	N6261516.118	E290688.841	N6261522.928
CHAINAGE	0.000		6.830	

LINE DIV01

PIPE CLASS		RRJ2			RRJ2	
PIPE GRADE (%)		2.0%			2.2%	
PIPE SIZE (mm)		825			825	
MINIMUM COVER (m)		0.60				
Vf - FULL PIPE VELOCITY (m/s)		Vf=2.41			Vf=1.89	
Q - PIPE FLOW (L/s)		Q=465			Q=462	
DATUM RL		47.0				
H.G.L. (5% AEP)	54.504	54.366	52.303 52.303	52.251	52.194 52.194	52.194
FINISHED SURFACE	55.436		53.283		52.250	
NATURAL SURFACE	54.993		53.283		52.250	
PIPE INVERT LEVEL		53.807	51.672	51.622	51.369	51.369
DEPTH TO INVERT		1.629	1.611	1.661	0.881	0.881
CO-ORDINATED SETOUT	E290734.586	N6261544.401	E290739.624	N6261651.419	E290734.979	N6261662.273
CHAINAGE	0.000		107.143		119.017	

LINE DIV02

PIPE CLASS		RRJ2		
PIPE GRADE (%)		5.9%		
PIPE SIZE (mm)		600		
MINIMUM COVER (m)		0.60		
Vf - FULL PIPE VELOCITY (m/s)		Vf=2.76		
Q - PIPE FLOW (L/s)		Q=550		
DATUM RL		50.0		
H.G.L. (5% AEP)	57.471	57.066	56.182 56.182	
FINISHED SURFACE	58.301		57.116	
NATURAL SURFACE	58.271		57.063	
PIPE INVERT LEVEL		56.993	55.861	
DEPTH TO INVERT		1.307	1.255	
CO-ORDINATED SETOUT	E290685.798	N6261446.849	E290665.673	N6261446.471
CHAINAGE	0.000		20.128	

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DRAWN: C.PASKE DESIGNED: J.GRINSELL JOB MANAGER: J.GILLIGAN VERIFIER:

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01	ISSUED FOR INFORMATION - 50%	CP		JG	29.01.21
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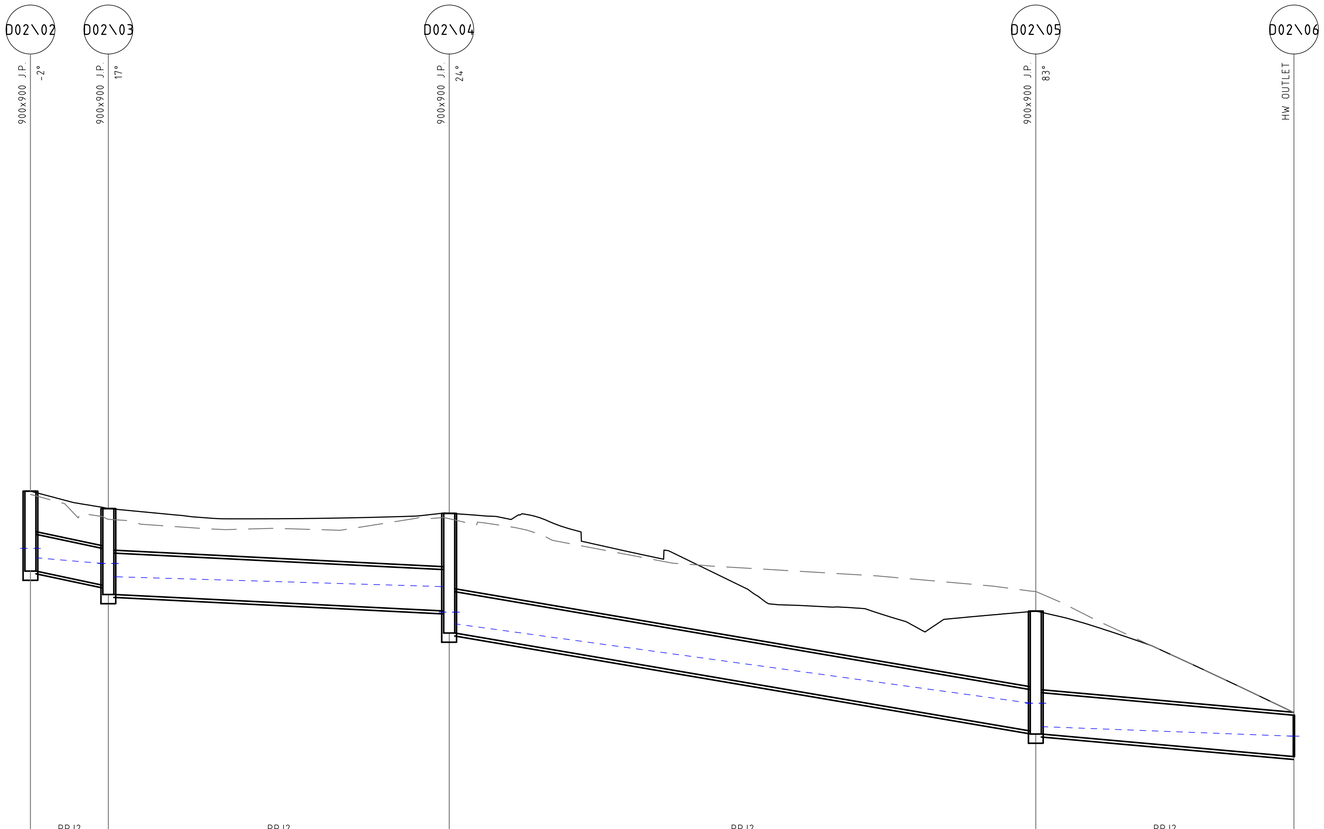
DRAWING TITLE: CIVIL ENGINEERING PACKAGE — STORMWATER LONGITUDINAL SECTIONS - SHEET 04

JOB NUMBER: 202025

DRAWING NUMBER: DAC04.24 REVISION: 02

DRAWING SHEET SIZE = A1



PIPE CLASS		RRJ2	RRJ2	RRJ2	RRJ2
PIPE GRADE (%)		4.2%	1.0%	3.4%	1.8%
PIPE SIZE (mm)		600	675	675	675
MINIMUM COVER (m)		0.60	0.60	0.60	0.45
Vf - FULL PIPE VELOCITY (m/s)		Vf=3.33	Vf=2.17	Vf=2.53	Vf=2.35
Q - PIPE FLOW (L/s)		Q=550	Q=549	Q=549	Q=546
DATUM RL		48.0			
H.G.L. (5% AEP)	56.182 56.182	56.029	55.936 55.936	55.720	55.558 55.141	54.951	53.656 53.656	53.273	53.117 53.117	53.117
FINISHED SURFACE	57.116		56.832		56.754		55.159		53.503	
NATURAL SURFACE	57.063		56.658		56.666		55.479		53.503	
PIPE INVERT LEVEL	55.861	55.811	55.580	55.430	55.160	54.801	53.202	53.152	52.785	52.785
DEPTH TO INVERT	1.255	1.305	1.252	1.402	1.593	1.953	1.957	2.007	0.718	0.718
CO-ORDINATED SETOUT	E290665.673 N6261446.471		E290659.335 N6261446.267		E290632.373 N6261452.969		E290594.534 N6261482.291		E290605.393 N6261500.343	
CHAINAGE	20.128		26.488		54.309		102.182		123.249	

LINE DIV02

DRAWN: C PASKE
DESIGNED: J GRINSELL
JOB MANAGER: J GILLIGAN
VERIFIER:

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
01	ISSUED FOR INFORMATION	AC		JG	04.03.21

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ARCHITECT
GRAY PUKSAND

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SCALE 1:250@A1 0 2 4 6 8 10 12m
SCALE 1:100@A1 0 1 2 3 4 5m

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Level 11 345 George Street, Sydney NSW 2000
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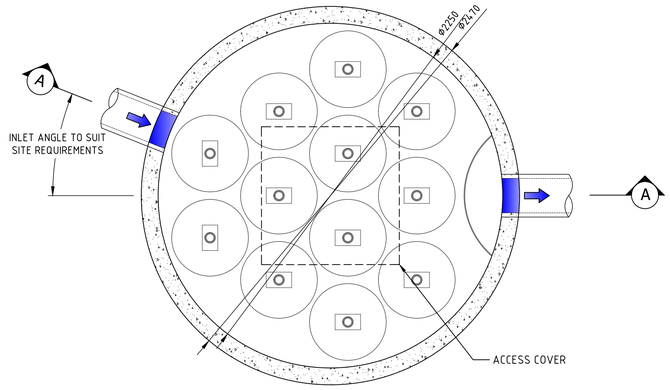
Email sydney@northrop.com.au ABN 81 094 433 100

PROJECT
TAFE NSW CONSTRUCTION CENTRE OF EXCELLENCE

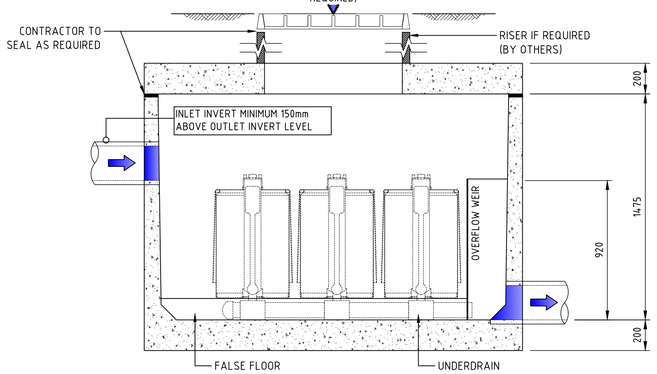
DRAWING TITLE
CIVIL ENGINEERING PACKAGE
MINOR STORMWATER LONGITUDINAL SECTIONS - SHEET 04

JOB NUMBER 202025
DRAWING NUMBER DAC04.25
REVISION 01
DRAWING SHEET SIZE = A1



PLAN

900 SQUARE CAST-IRON SOLID
TOP ACCESS COVER SUPPLIED
LOOSE
(OR CAST INTO LID IF
REQUIRED)



SECTION A-A

DRAWN: C. PASKE
DESIGNED: J. GRINSELL
JOB MANAGER: J. GILLIGAN
VERIFIER:

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DRAWING TITLE
CIVIL ENGINEERING PACKAGE

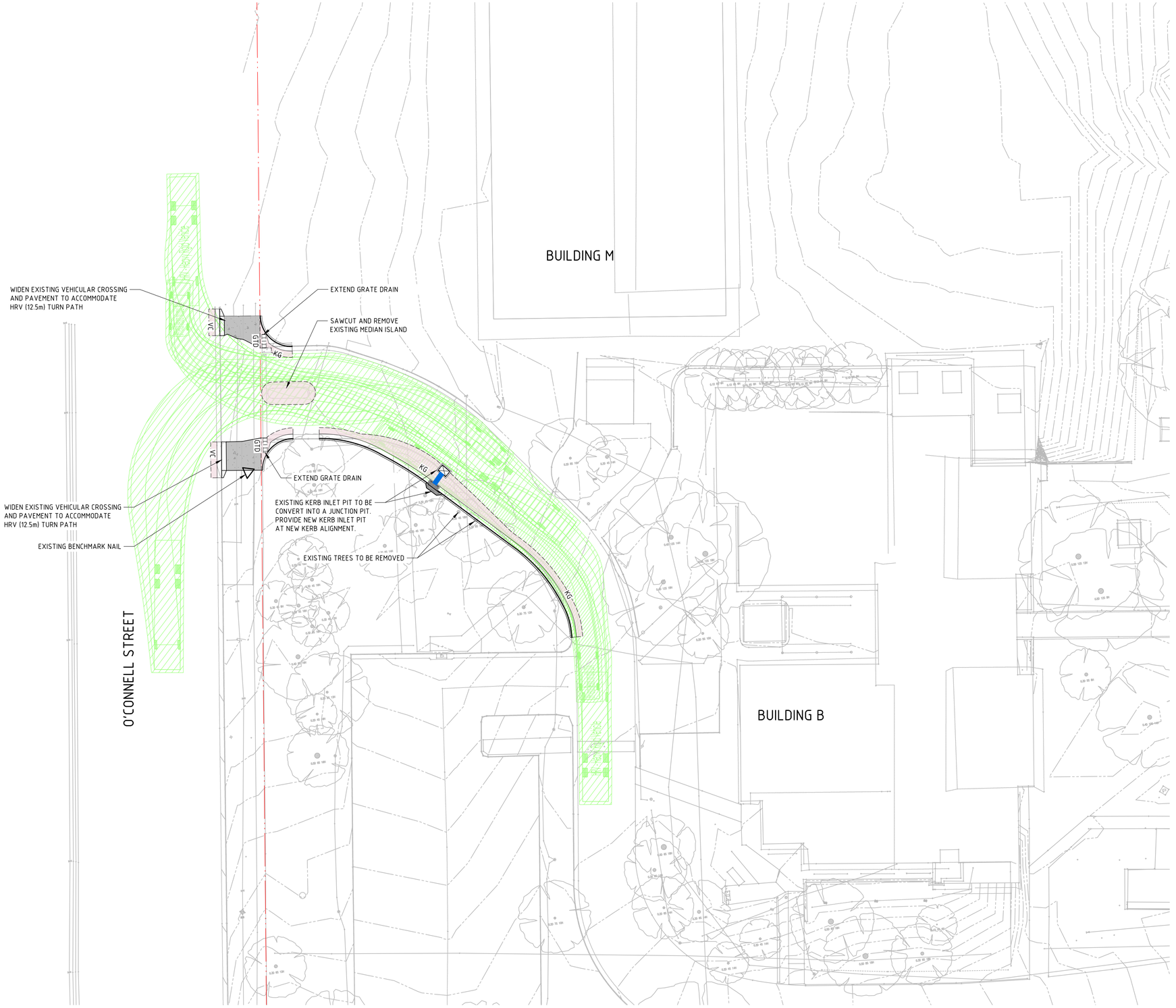
STORMWATER MANAGEMENT DEVICES

JOB NUMBER **202025**

DRAWING NUMBER **DAC04.61**

REVISION **01**

DRAWING SHEET SIZE = A1



LEGEND

- EXISTING BOUNDARY LINE
- PROPOSED KERB
- EXISTING KERB
- FUTURE KERB
- SAWCUT AND PAVEMENT INFILL
- KG — KERB AND GUTTER
- VC — VEHICULAR CROSSING
- EXISTING CONTOURS
- STORMWATER PIPE
- GRATED INLET PIT (NEW / EXTG)
- KERB INLET PIT (NEW / EXTG)
- JUNCTION PIT (NEW / EXTG)
- GTD — GRATED TRENCH DRAIN
- PROPOSED FLEXIBLE PAVEMENT
- PROPOSED DRIVEWAY PAVEMENT

01	ISSUED FOR INFORMATION	TB		JG	02.03.20
02	ISSUED FOR INFORMATION	TB		JG	03.03.20

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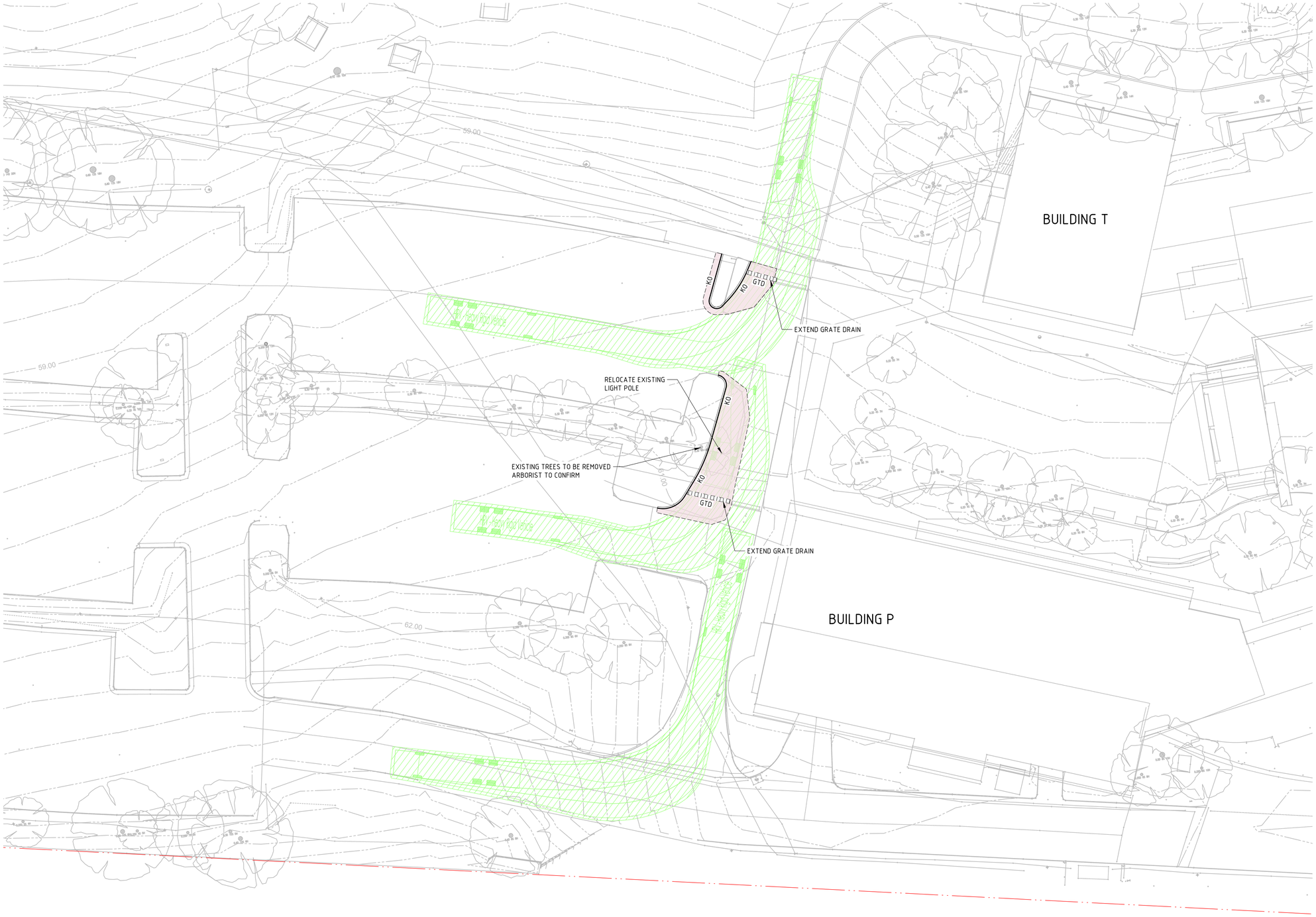
CIVIL ENGINEERING PACKAGE

PROPOSED ACCESS WAY

202025

SKC01.21 | 02



LEGEND

- EXISTING BOUNDARY LINE
- PROPOSED KERB
- EXISTING KERB
- FUTURE KERB
- SAWCUT AND PAVEMENT INFILL
- KG — KERB AND GUTTER
- VC — VEHICULAR CROSSING
- XX.XX — EXISTING CONTOURS
- STORMWATER PIPE
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- KERB INLET PIT (NEW / EXTG)
- JUNCTION PIT (NEW / EXTG)
- GTD — GRATED TRENCH DRAIN
- PROPOSED FLEXIBLE PAVEMENT
- PROPOSED DRIVEWAY PAVEMENT

DRAWN: M. MAI
DESIGNED: J. GILLIGAN
JOB MANAGER: J. GILLIGAN
VERIFIER:

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
01	ISSUED FOR INFORMATION	TB		JG	02.03.20

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0 2 4 6 8 10m

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CIVIL ENGINEERING PACKAGE
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JOB NUMBER 202025
DRAWING NUMBER SKC01.22
REVISION 01
DRAWING SHEET SIZE = A1

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