Tweed Valley Hospital Development

Design Report

Civil & Structural

Issued for: State Significant Development Application

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Report Amendment Register

Rev. No.	Section & Page No.	Issue/Amendment	Author/Initials		Reviewer/Initials		Date
A		DA	Aleksandar Vasiloski	AV	Stephen Naughton	SN	31/08/2018
B	Structural Information Added	DA	Aleksandar Vasiloski	AV	Stephen Naughton	SN	6/09/2018
C	Rezoning References deleted	DA	Aleksandar Vasiloski	AV	Stephen Naughton	SN	21/09/2018
D	Updated Masterplan	DA	Aleksandar Vasiloski	AV	Stephen Naughton	SN	2/10/2018
E	Included Piling details	DA	Aleksandar Vasiloski	AV	Stephen Naughton	SN	4/10/2018
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F	Added reference table	DA	Aleksandar Vasiloski	AV	Stephen Naughton	SN	19/10/2018

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1. Overview

On 13 June 2017, the NSW Government announced the allocation of $534 million for the development of a new state-of-the art hospital on a greenfield site in the Tweed, to be known as Tweed Valley Hospital (Project). The Project is located on a portion of 771 Cudgen Road, Cudgen, legally described as Lot 102 DP 870722 (Project Site).

This EIS has been prepared to accompany a State Significant Development Application for the Tweed Valley Hospital which will be assessed under Part 4 of the Environmental Planning and Assessment Act. The project has been established based on the following supporting documentation:

- Tweed Valley Hospital Business Case
- Tweed Valley Hospital Master Plan
- Tweed Valley Hospital Concept Proposal and design.

The Tweed Valley Hospital Project for which a staged approval is sought consists of:

- Delivery of a new Level 5 major referral hospital to provide the health services required to meet the needs of the growing population of the Tweed-Byron region, in conjunction with the other hospitals and community health centres across the region;
- Master planning for additional health, education, training and research facilities to support these health services, which will be developed with service partners over time. These areas will be used initially for construction site/ compound and at-grade car parking;
- Delivery of the supporting infrastructure required for the hospital, including green space and other amenities, campus roads and car parking, external road upgrades and connections, utilities connections, and other supporting infrastructure.

The development application pathway for the Project consists of a staged Significant Development Application under section 4.22 of the Environmental Planning and Assessment Act 1979 (EP&A Act) which will consist of:

- A concept development application and detailed proposal for Stage 1 (early and enabling works); and
- A second development application for Stage 2 works which will include detailed design, construction and operation of the Tweed Valley Hospital.

A detailed description of the proposed staging of the development is provided in the following sections.

1.1. Concept Proposal and Stage 1 Early and Enabling Works

This component (and EIS) seeks approval for a Concept proposal of the Tweed Valley Hospital and Stage 1 early and enabling works.

The Concept Proposal is informed by service planning to 2031/32 and has a gross floor area in the range of 55,000m2 to 65,000m2. The hospital is expected to include (with more detail to be confirmed/provided at Stage 2) the following components/ services:

- A main entry and retail area
- Administration Services
- Ambulatory Services
- Acute and Sub-Acute in-patient units
- Paediatrics
- Intensive Care Unit
- Close Observation Unit
- Mental Health Services
- Maternity Unit
- Renal Dialysis
- Pathology
- Pharmacy
- Cancer Services including Day Oncology and Radiation Oncology
- Emergency Department
- Integrated Interventional Services
- Interventional Cardiology
- Medical Imaging
- Mortuary
- Back of house Services
- Car parking
- Future expansion area

Stage 1 includes:

- Early and enabling works (for site clearance and preparation), generally comprising:
    - Construction Compound for Stage 1 works,
    - Augmentation and connection of permanent services for the new facility (water, sewer, electricity, telecommunications),
    - General clearance of site vegetation within the footprint of construction works, including tree stumps,
    - Chipping of cleared vegetation (excluding weed species) to use on site for ground stabilisation/ erosion control, or off-site disposal (as required),
    - Bulk earthworks to establish the required site levels and create a stable landform by recycling the excavated material in preparation for hospital construction,
    - Piling and associated works,
    - Stormwater and drainage infrastructure for the new facility,
    - Rehabilitation and revegetation of part of the wetland area,
    - Construction of internal roadways for use during construction and in preparation for final road formations in Stage 2, and
    - Retaining walls.

1.2. Stage 2: Hospital Delivery - Main Works and Operation

Stage 2 (which will be subject to a separate application) would include the detailed design, construction and operation of the Tweed Valley Hospital. Stage 2 will be subject to a separate application following Stage 1.

1.3. Subsequent Stages: Potential Future Expansion

Any subsequent stages would be subject to a separate application(s) as required and would be related to works for potential future expansion of the facility. Details of this are unknown at this stage and would be developed as required.

2. Introduction

Bonacci has been commissioned by Health Infrastructure NSW to describe the civil works including the stormwater strategy associated with the State Significant Development Application (DA) for the new Tweed Valley Hospital at Lot 102 in DP870722, 771 Cudgen Road, Cudgen NSW.

The development application pathway for the Tweed Valley Hospital (the Project) will consist of a staged State Significant Development (SSD) Application, which will consist of:

- a concept development application and stage 1 early and enabling works (this stage); and
- a second development application for stage 2, which will include detailed design, main construction and operation of the Tweed Valley Hospital.

Preliminary works have been undertaken including demolition of the existing structures and the setup of temporary site offices and associated infrastructure, the enabling of appropriate site access, security, parking and the enabling of appropriate stormwater management by constructing catch drains and basins for the former agricultural land.

This report describes the concept development, and Stage 1 works being bulk earthworks, haul roads, other relevant structures and stormwater strategy to manage proposed stormwater runoff volumes and stormwater pollution resulting from the works by utilising the with the newly constructed stormwater management basins. This report will demonstrate the application of Water Sensitive Urban Design (WSUD) principles, Australian Rainfall and Runoff (ARR), Environmental Protection Authority (EPA), Tweed valley Council standards and guidelines and relevant Australian Standards.

This report will specifically address the following:

- Flooding impacts and controls,
- Stormwater Runoff volumes and detention strategies (Stormwater Quantity),
- Stormwater Quality treatment measures (Stormwater Quality), and
- Erosion and Sedimentation Control measures.

2.1. Objectives

The objectives of this Civil and Structural Design Report is to demonstrate compliance with all the requirements of Tweed Shire Council Development Control Plans (DCP) including Tweed Urban Stormwater Quality Management Plan (2016), Development Design Specifications – D5: Stormwater Drainage Design, D6: Site Regrading and D7: Stormwater Quality as follows:

- To design a stormwater trunk drainage system for the site to accommodate the stormwater runoff up to and including 100-year ARI storm events without having adverse impact to adjoining properties,
- To maintain the permissible site discharge (peak flows from existing site) for the site due to development from 5-year ARI (minor storm events) up to and including 100-year ARI (major storm events) storm events,

- To provide a functional Water Sensitive Urban Design (WSUD) measures for the site to improve the water quality system overall and achieves the pollutant removal targets set by Council's Water Sensitive Urban Design Technical Guidelines, and

- Site regrading should be sensitive to existing landforms and must not adversely impact on other land.

2.2. Existing Documentation

The following relevant existing documentation has been referenced for the design:

- Masterplan Report by STH and BatesSmart Architects, dated October 2018,

- Preliminary Geotechnical Investigation by Morrison Geotechnic, dated 28th September 2018,

- Level and Detail Survey by B & P Surveys, dated 15 June 2018,

- Tweed Valley Flood Study, 2009 Update by BMT WBM, dated 19th October 2009, and

- Tweed Valley Hospital - Flooding and Costal Hazards Assessment by BMT WBM, dated 28th September 2018.

3. Site Description

3.1. Location

The site is located within the parcel of land that is identified as Lot 102 in DP870722, 771 Cudgen Road, Cudgen NSW. The site is bordered by Cudgen Road to the south, Turnock Street to the east, private property to the west, an environmental area to the north-west and a wetland to the north and north-east. An environmental area traverses the northern parts of the site. The project site is located within Tweed Shire Council Local Government Area (LGA). The locality map of the site is shown in *Figure 3-1* below:

Figure 3-1: Site Locality Map (Source: nearmap)

3.2. Topography

The site is located on a localised crest. The location of the earthworks and associated infrastructure sit on a local crest and generally fall to the north and north-west. There are a number of constructed channels and a bund with openings to the west and north west boundary that direct flows through and off the site. Images of the site and bund are shown below:

View from the crest towards the environmental area (North-West)

View of the crest from the environmental area (south-east view)

View of the existing downstream site bund

3.3. Preliminary Geotechnical Information

A preliminary geotechnical investigation has been undertaken by Morrisons Geotechnical. An initial layout of boreholes for the purpose of concept design has been proposed. Due to access constraints at this stage only a limited number have been completed.

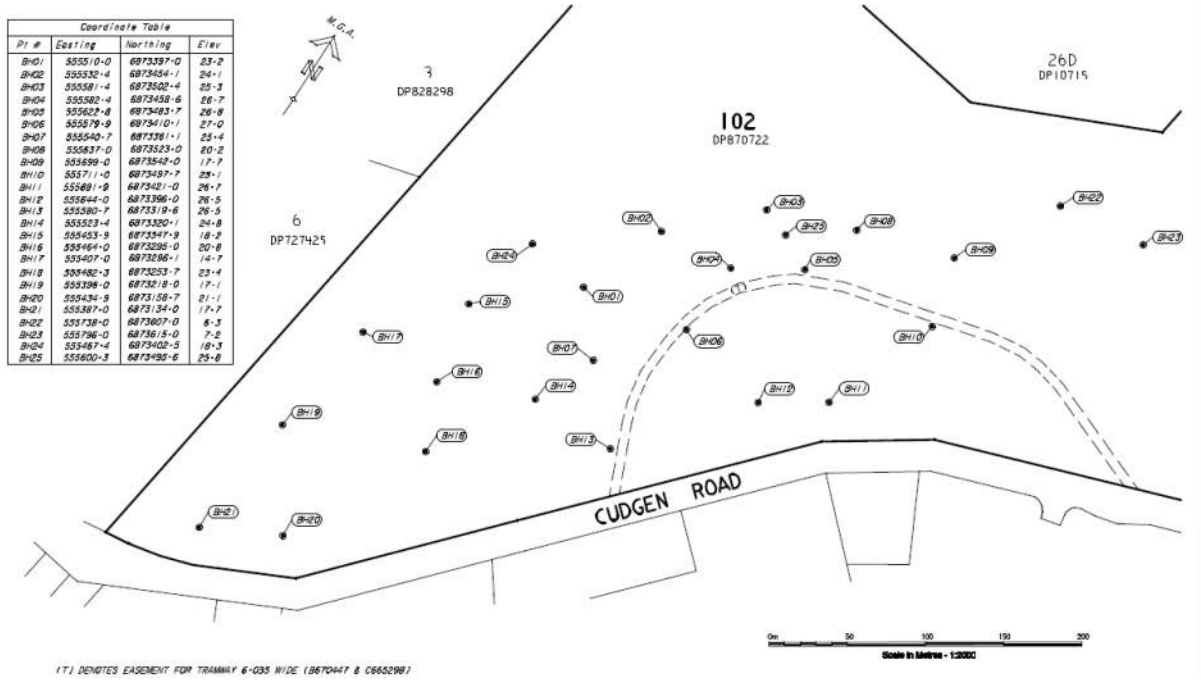


Figure 3-2: Bore hole plan provided by Morrison Geotechnical

Generally, the subsurface conditions comprised 3 different strata. The upper layer varies in thickness from between 0.8m and 3.6m of silty clays. This overlies a layer of material which is highly variable and comprises bands of low strength basalt, high to very high strength basalt and clays. Below this variable layer very high strength fresh basalt was encountered. This profile can be seen in the photographs of bore holes 1 and 7.

Table 3-1: Borehole logs

Bore Hole	RL of surface	Depth to top of layer containing basalt of varying strength and clay layers	Depth to basalt with consistent high strength	Termination depth of bore hole	Depth of ground water encountered	Comment
BH1	**23.2**	**1.2**	**14.2**	**17.4**	**11.2**	
BH2	**24.1**	**2.8**	**Not encountered**	**9.8**	**Not logged**	
BH3	**25.3**	**3.6**	**7.8**	**7.95**	**Not logged**	**Refusal at 7.95**
BH4	**26.7**	**0.8**	**2.8**	**10.1**	**Not logged**	
BH5	**26.8**	**1.1**	**5.25**	**6.95**	**Not logged**	
BH6	**27.0**	**2.7**	**14.4**	**14.5**	**Not logged**	**Bore hole appears not to have encountered fresh basalt**
BH7	**25.4**	**1.5**	**15.4**	**19.05**	**14.0**	**Layer of VH strength basalt clearly evident**
BH25	**25.8**	**1.2**	**20.05**	**21.3**	**11.6**	

Note: Only the boreholes that encountered bedrock are listed in Table 3-1 above. For the full borehole table refer to pages 7 and 8 of the Preliminary Geotechnical Investigation by Morrison Geotechnic, dated 28th September 2018.

Bore Hole 1

Bore Hole 7

4. Proposed Development

The Concept Development is comprised of a new building and four carparks, landscaped gardens, and identifies future supplementary development zones. The Stage 1 proposed works are comprised of general site clearance of vegetation within the footprint of the of the hospital construction works including tree stumps, bulk earthworks to the desired site levels and create a stable landform, stormwater and drainage infrastructure for the new facility, construction of internal roadways for use during construction and in preparation of final road formations in Stage 2, construction of retaining and support structures, installation of services and site compound and associated works. The concept plan for the project for the site is shown in *Figure 4-1* below:

Figure 4-1: The Architectural Site Plan (by STH and Bates Smart Architects)

The Stage 1 works for the site are shown in *Figure 4-2* below; Note the basins were constructed as part of Preliminary works:

Figure 4-2: General Earthworks Plan

4.1. Substructure

4.1.1.Excavation and earthworks

It is anticipated that due to the topography, the lower levels of the building are to be excavated into the northern slope of the site up to approximately 6.0m in depth. It is intended to utilise cut material as filling for building platforms. Due to the presence of bands of very high strength rock, some of the material excavated may need to be crushed before re-use.

4.1.2.Retention systems

It is expected that the clays and weathered basalt will not be self-supporting therefore either retaining walls or permanent batters are to be utilised. To avoid the potential issues with long term performance of waterproofing systems, batters within subfloor spaces will be utilised where possible adjacent clinical areas in preference to retaining walls.

4.1.3.Foundations

It is proposed to found the main building structure on consistent material comprising the high strength basalt. Due to the depth it is therefore anticipated that bore piers will be required generally. Should high strength rock be encountered at the base of the deeper excavations then high-level pad footings could be utilised. In this instance it will be necessary to verify that no low strength rock is present below the footing through coring and spoon testing.

4.2. Super Structure

4.2.1.Structural Grid

The structural is generally to be to be based on a standard 8.4 x 8.4 grid in accordance with HI guidelines. This may be varied in non-clinical spaces.

4.2.2.Floor systems

The floors are to be post tensioned concrete supported on reinforced concrete columns. Floors are to be designed to support the loads specified by AS1170.1. In addition the floors are to be designed to limit accelerations due to vibration as specified by Health Infrastructure.

4.2.3.Structure resisting lateral forces

Seismic forces specified by AS1170.4 and wind forces specified by AS1170.2 are to be resisted by reinforced concrete shear walls. Generally, these are to be incorporated into lift shafts and stair cores.

4.2.4.Importance Level

The building is to be considered as Importance Level 4 as defined by the NCC.

4.2.5.Structural sizes for planning purposes

For the purpose of setting floor levels and allocating space for structure, the following structure is proposed:

Item	Location	Size	Quantities	Notes
Columns	Generally on 8.4x8.4 grid	600mmx600 8.4m centres supporting 8 levels 500mm x500 mm supporting 4 levels	Concrete varies N65 to N40	Avoid transfers
Suspended floors	Clinical Theatres, Imaging	260mm slabs 450mm x 2200mm band	Concrete - S40 Reinforcement - 45 & PT - 24 kg/cum	Design for factor 1
Suspended floors	IPU's	220mm slabs generally (260 bays) 400mm x2200mm band	Concrete - S40 Reinforcement - 45 & PT - 24 kg/cum	Design for factor 2
Stair	Generally	250mm tk. concrete walls	Reinforcement - 200 kg/cum	
Lift shafts	Generally	250mm tk. concrete walls	Reinforcement - 200 kg/cum	
Shear	T.B.C - Allow for 8.4m wall per 500 on plan	250mm tk. average	Reinforcement - 180 kg/cum	
Roof	Over wards/ theatres/IP U's	Post tensioned concrete 220mm slabs generally (260mm end bays) 400mm x 2200mm band beams Provide metal deck roof	Concrete - S40 Reinforcement - 45 kg/cum + SL82 mesh top	
Roof	Over plant	Structural steel Extend 400mm x400mm columns to roof	Allow 28 kg/sqm of steel	
Stairs	Internal	Reinforced concrete Throat thickness – 250mm	Concrete S32 Reinforcement - 120 kg/cum	
Stairs	External	Reinforced Concrete or structural steel depending on purpose		Avoid stair pressurisation if possible by making stairs
Helipad	Roof	Slab – 400 thick flat plate post tensioned to achieve concrete	Concrete - S40 Reinforcement - 80 kg/cum & PT - 30 kg/cum	
Substructure		Bored Piers	Concrete – N65	Found on fresh basalt
Retaining walls	Building undercroft	250 thick reinforced concrete	Concrete – S32 Reinforcement 150 kg/cum	Avoid retaining Where possible
Retaining walls	External	< 2.4m - Blockwork 290mm 2.4m – 4.0m - Reinforced 350 tk.		

4.3. Flood Impact Assessment

A flood study "Tweed Valley Flood Study, 2009 Update, Revision 1 (dated 19 October 2009)," has been produced by BMT WBM on behalf of Tweed Shire Council. This study identifies that the northern portion of the site is flood affected. The flood levels burdening the northern portions of the site are as follows:

- 5% AEP 2.3m AHD
- 1% AEP 3.2m AHD
- PMF 8.0m AHD

The proposed finished floor level for the lowest level of the proposed new hospital building is RL18.75m AHD.

Section A3 – Development of Flood Liable Land of Tweed Shire Council, requires all critical infrastructure and facilities to be located above the PMF level. The NSW Floodplain Development Manual, for the management of flood liable land, recommends that the PMF is set as the FPL (minimum floor level) for emergency response facilities such as hospitals.

The location of the project is intentionally selected to be above the PMF level, making the proposed development lot ideal for critical infrastructure such as a hospital.

4.4. Stormwater Drainage

4.4.1.Catchment Delineation

The project works and associated infrastructure are located generally in the southern portion of the site, along the localised ridgeline. The project lot size is approximately 23.23ha in area and sits at ridge level. The site drains via a number of catch drains to the newly constructed basins.

A stormwater drainage system will be constructed to convey stormwater runoff from the newly constructed, buildings and associated, roads, carparks and landscape areas. It will be designed to mimic natural flows to minimise future impact to the endangered ecological community in the receiving wetland. The details of the discharge characteristics will be determined at detail design stage, guided by advice from a suitably qualified ecologist.

As part of Stage 1 works, a stormwater drainage system will be constructed to convey stormwater runoff from the newly facility, level pads and associated infrastructure. The site catchment will be divided into sub catchments and stormwater runoff from each sub catchment will be directed into one of the stormwater basins. The stormwater network will be designed to mimic natural flows to minimise future impact to the environmental area downstream.

4.4.2.Hydrology and Hydraulics

For the Concept Proposal, the stormwater drainage systems for the project site have been designed to cater for design storms up to and including 100-year ARI (1% AEP) storm events as per Development Design Specification D5 by Tweed Shire Council.

The hydrology and hydraulic analysis for the site was established using a DRAINS (computer program for hydrological and hydraulic assessment) model. The hydrological parameters used in DRAINS are in accordance with Tweed Shire Council's Specifications.

The intensity-frequency-duration (IFD) data for the site was extracted from Australian Rainfall and Runoff Volume 1, 1987 (Also provided in Council's Development Design Specification D5) is provided in **Appendix B**.

The DRAINS model was calibrated to provide the permissible site discharge (PSD) as per Development Design Specification D5, being 200L/s/ha. The DRAINS model was subsequently used to calculate the required on-site detention volumes. The Drains model flows were obtained for 5-year, 20-year and 100-year ARI storm events. The effect of climate change was considered in hydraulic modelling, with effects of an increase in rainfall intensity checked. The increase is accounted for in the calculated detention volumes. An increase in sea level is not likely to have significant impacts on the site.

For Stage 1 works, at the commencement, during and the end of the works, the site will remain close to 100% pervious with the only impervious area being the site compound facilities. Stormwater pit and pipe systems are proposed to convey stormwater runoff to the newly constructed basins to act as sedimentation basins and protect the newly constructed haul roads.

4.4.3.Stormwater Analysis and Design

For the Concept Proposal, the proposed stormwater drainage network was designed using DRAINS software. It is proposed that all stormwater runoff from the new building, roads and carparks and landscape areas are captured and directed into the proposed new stormwater pit and pipe system. DRAINS will be used to model the proposed network and to correctly size the inlet pits and the network pipes. The table below shows the pre-development stormwater discharge rates, the potential post development discharge rates and the permissible discharge rates as per Tweed Shire Council Development Design Specification D7:

Pre Development Discharge Rates		
20% AEP	10% AEP	1% AEP
3.89m3/s	6.06m3/s	8.06m3/s
Post Development Discharge Rates		
20% AEP	10% AEP	1% AEP
5.39m3/s	7.69m3/s	10.0m3/s
Permissible Discharge Rates		
20% AEP	10% AEP	1% AEP
4.65m3/s	4.65m3/s	4.65m3/s

It is important to note, while the permissible discharge rates are conservative, there is an opportunity to alter the discharge rate by conducting detail investigation into the capacity of the receiving stormwater network.

To comply with Council's permissible site discharge requirements, approximately 6000m^3 of on-site detention will be provided.

4.4.4.Water Quality

Tweed Shire Council DCP and Development Design Specifications set targets for the reductions of water borne pollution being conveyed from the site through the stormwater drainage system and ultimately public waterways.

Stormwater pollution originates from a number of sources, atmospheric depositions, erosion, litter and debris, vehicle emissions and weathering of buildings. These pollutants can be categorised in a broadly as follows; gross pollutants (over 5mm in size), total suspended solids (1 to 5mm in size), phosphorous, nitrogen and oils, grease and hydrocarbons. The key pollutants that are generally measured and the pollution reduction targets set are as follows:

- Reduction of Mean Annual Load of Gross Pollutants – 90% (greater than 5mm)
- Reduction of Mean Annual Load of Total Suspended Solids – 80%
- Reduction of Mean Annual Load of Total Phosphorous –60%
- Reduction of Mean Annual Load of Total Nitrogen – 45%

The site's former use was as agricultural land. As preliminary works, catch drains and basins were constructed to direct stormwater runoff into the new basins prior to discharge.
The project will result in a reduction in total stormwater pollution being discharged to public waterways by capturing runoff from hard and soft surfaces within the site and directing the stormwater to water quality devices. A proposed water quality strategy for the site is described in detail below.

4.4.5.Water Quality Strategy

For the Concept Proposal, stormwater quality treatment strategies have been developed for the site to reduce stormwater pollutant discharge resulting from of the project site. The project site has been distributed into the following sub-catchments based on the specific WSUD measures required for the site. A summary of the impervious area was based on the masterplan.

The water quality strategy for the site will incorporate swales, enviropods, bioretention basins and extended detention basins. The roof runoff will be directed into the bioretention basin by a pit and pipe system while hardstand runoff will be first treated by enviropods and then either swales that discharge to the bioretention system or directly into the bioretention systems. Ultimately the bulk of the stormwater will end up in an extended detention basin where it will settle and discharge to the receiving waters in a controlled manner.

Table 4-1: Summary of Sub-catchments and Water Quality Measures for overall Site

Sub-catchments	Area (ha)	Impervious Fraction (%)	WSUD Treatment Measures	Comments
Roads	1.38	100	Enviropods, swales, bioretention	
Carparks	1.55	100	Enviropods, swales, bioretention	
Roof	1.25	100	bioretention	
Grass 1	0.74	0	Enviropods, swales, bioretention	
Grass 5	18.31	0		Bypass
Total	23.23	-		Rounding accounts for the difference in site area.

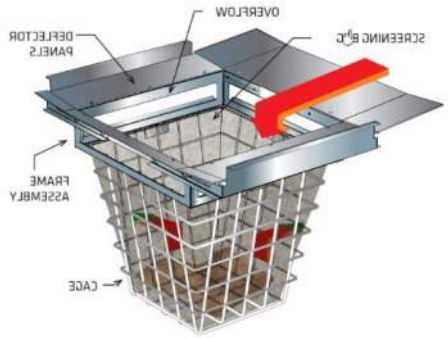
The properties of the individual WSUD measures are provided in **Appendix C**.

4.4.6.Proposed Treatment Devices

Further information on each element of the proposed treatment devices are provided below:

4.4.6.1. EnviroPod Pit Inlet Trap

EnviroPod's (or other similar approved equivalents) provide effective removal of TSS and gross pollutants. EnviroPod's are a filter cage system which are inserted into roadway gully pits to filter and remove pollutants before the water enters the piped drainage system. It is proposed to place EnviroPod filters within every stormwater inlet pit.

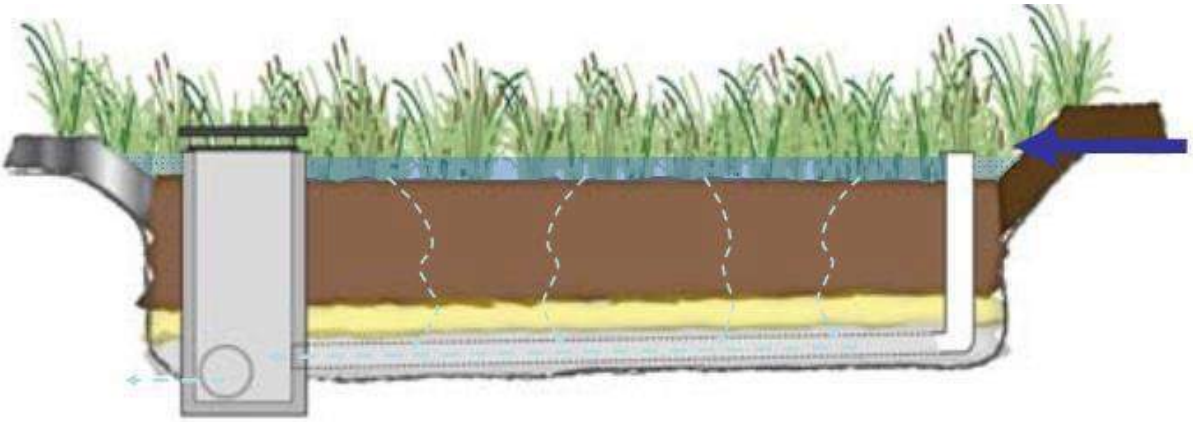


The MUSIC modelling parameters for this device are set by the manufacturer, Stormwater 360.

Parameters	Total Suspended Solids	Total Phosporous	Total Nitrogen	Gross Pollutants
Input (mg/L)	100	10	10	14.8
Output (mg/L)	46	7	8.7	0
Reduction (%)	54	30	13	100

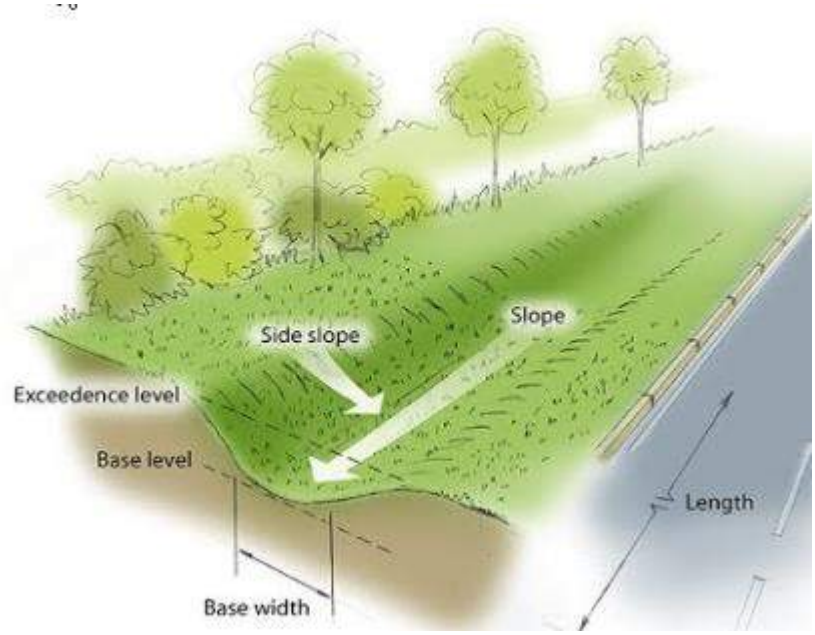
4.4.6.2. Bio-Retention (Bio-Detention)

Bio-Detention systems are vegetated areas where stormwater is passed through densely planted filter media (loamy sand) allowing the plants to absorb the collected and stored nutrients. Bio-retention basins utilise temporary ponding above the vegetated surface to increase the volume of stored water for treatment. Bio-Detention systems can take a number of forms but all have common features including the extended detention depth above the media surface, the filter media and a low level drainage media and subsoil system. These are shown in the figure below. Bio-Detention basin(s) with a total surface area of 2500m2 and a filter area of 2250m2 is adequate for the project.



4.4.6.3. Swale

Swales systems are vegetated channels where stormwater is conveyed from one location to another. Swales also provide water quality improvements by capturing total suspended soils and gross pollutants.



4.4.7.Water Quality Model

For the Concept Proposal, the water quality strategy for the project site was established using *MUSIC* [Version 6.2] model. The *MUSIC* model was established using Gold Coast Council's *MUSIC link*. The Catchment summary along with WSUD measures for the site are summarised in Table 3.1 above. A screen shot of *Music* [version 6.2] model representing the site is provided below.

The Pollutant generation parameters for the site are as per Tweed Shire Council's Development Design Specification D7. The *MUSIC Model Source Parameters* for the site are attached in **Appendix C**.

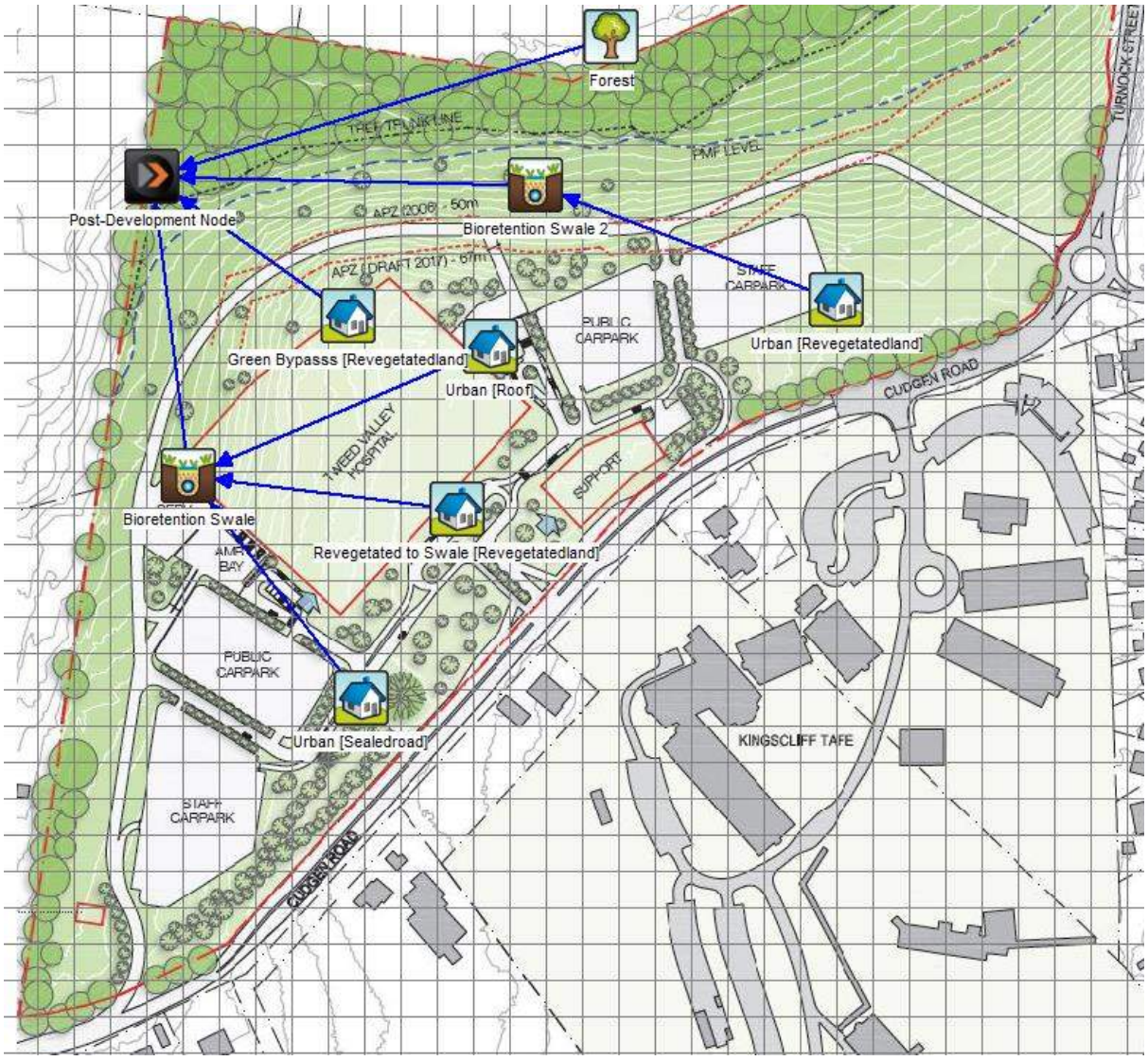
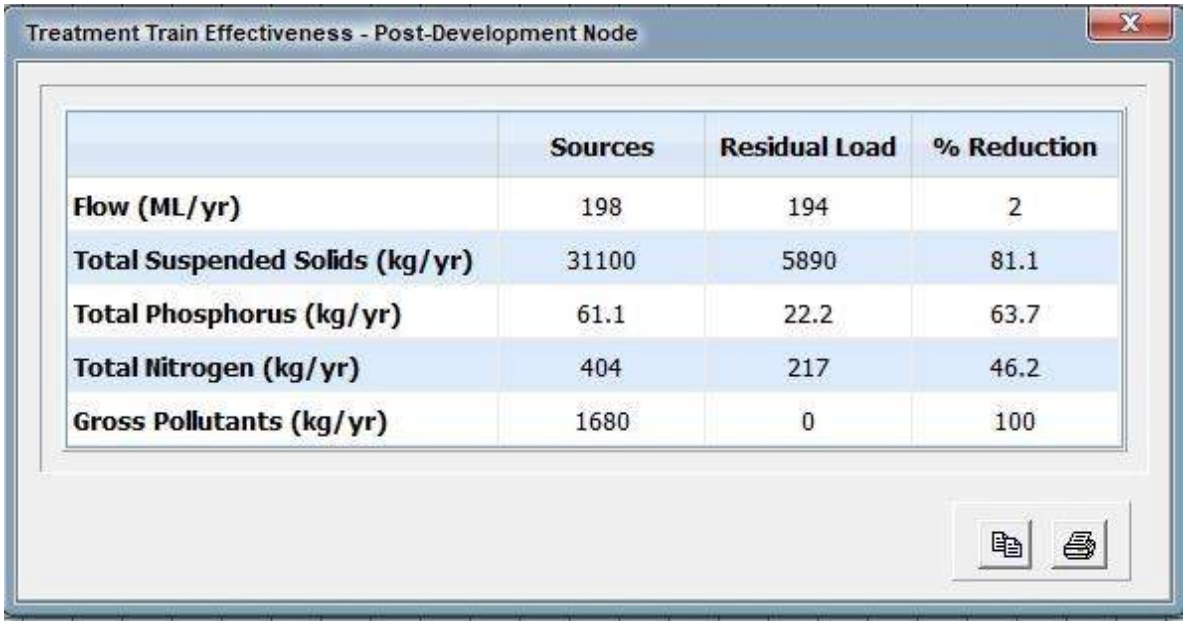


Figure 4-3: A Schematic Diagram of the Music Model Showing Existing and Proposed Scenario

4.4.8.Water Quality Results

The results of MUSIC modelling show that the pollutant removal rate achieves pollutant reduction targets provided in *Section 3*. The results from the MUSIC model are shown below as a screen shot.



	Sources	Residual Load	% Reduction
Flow (ML/yr)	198	194	2
Total Suspended Solids (kg/yr)	31100	5890	81.1
Total Phosphorus (kg/yr)	61.1	22.2	63.7
Total Nitrogen (kg/yr)	404	217	46.2
Gross Pollutants (kg/yr)	1680	0	100

Figure 4-4: Music model Results

As part of preliminary works basins were constructed at the northern portion of the site without disturbing the existing environmental area. During Stage 1 works, the newly constructed basins will be utilised as sedimentation basins as part of the soil and water management systems (See Section 3.3 below). At the completion of Stage 1 works, the resulting pollution runoff will result in the decrease agricultural pollutant runoff as there is no proposed activity at the completion of Stage 1 works.

4.5. Bulk Earthworks / Excavation

The bulk earthworks for the Stage 1 works of the project and associated infrastructure are detailed on Drawing No. C0005, C0006, C0007, C00011 and C00013. The finished floor level for the main building is RL18.75m AHD.

Approximate volumes of cut and fill are 118,653m^3 and 139,812m^3 cubic metres respectively, resulting in excess cut volume of 21,159m^3. Excavated rock is to be crushed to appropriate grade and reused on site as road base where suitable and general fill where appropriate.

Soil and water management for the project will be implemented during construction. The design of these measures is in accordance with the Landcom "Blue Book". Refer to drawings C0005, C0006 and C0007 for the Soil and Water Management plan, Typical Detailing and sediment basin volume calculation sheets.

For soil and water management of the site, the following measures are provided to minimise the risk of sediments being washed into neighbouring properties, receiving environmental areas and erosion of the site.

- *As preliminary works, basins were constructed along the northern portions of the site. Utilise the new basins as sedimentation basins by providing a minimum of 7126 cubic metres to the overall disturbed site assuming that any upstream catchment is excluded by providing diversion stormwater drainage lines (which bypasses the site during the construction stage) to control stormwater quality overall as per Soil and Construction Volume 1, March 2004 by Landcom*
- *Catch drains and similar infrastructure to manage the runoff within the site and direct it to the appropriate basin*
- *A sediment fence/catch drain (or diversion bund) around the site*
- *Temporary access to site with shaker pad*
- *Indicative stockpile areas with sediment fence around it during construction. The stockpile must be located out of water flow paths (and be protected by earth banks/drains as required).*

5. Summary

The Civil and Structural concept proposal for the site including stormwater management strategy described in this report identifies that the site is suitable for the proposed use and development and demonstrates compliance with all the requirements of Tweed Shire Council Development Control Plans (DCP) including Tweed Urban Stormwater Quality Management Plan (2016), Development Design Specifications – D5: Stormwater Drainage Design, D6: Site Regrading and D7: Stormwater Quality, Australian Rainfall and Runoff (2016), Landcom Managing Urban Stormwater: Soils and Construction, NSW Floodplain Development Manual (2005), Guidelines for Development Adjoining Land and Water Managed by DECCW (OEH, 2013), AS 3500: Plumbing and Drainage, AS 2890: Parking Facilities, and AS 1428: Design for Access and Mobility.

The Stage 1 component of the project including the stormwater management strategy described in this report demonstrates compliance with all the requirements of Tweed Shire Council Development Control Plans (DCP) including Tweed Urban Stormwater Quality Management Plan (2016), Development Design Specifications – D5: Stormwater Drainage Design, D6: Site Regrading and Landcom Managing Urban Stormwater: Soils and Construction.

Appendix A – Civil, Stormwater and Piling Drawings

TWEED VALLEY HOSPITAL DEVELOPMENT
STAGE 1 - EARLY AND ENABLING WORKS

DRAWING No.	DESCRIPTION
20 10748 C001	DRAWING REGISTER AND CONSTRUCTION NOTES
20 10748 C005	SOIL AND WATER MANAGEMENT PLAN
20 10748 C006	SOIL AND WATER MANAGEMENT DETAILS
20 10748 C007	SOIL AND WATER MANAGEMENT CALCULATIONS
20 10748 C011	GENERAL EARTHWORKS PLAN
20 10748 C030	CONCEPT STORMWATER MANAGEMENT PLAN
20 10748 C055	RETAINING WALL DETAILS
20 10748 C056	RETAINING WALL DETAILS

GENERAL NOTES

G1 THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ARCHITECTURAL AND OTHER CONSULTANTS DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS OR SKETCHES AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE SUPERINTENDENT BEFORE PROCEEDING WITH WORK.

G2 MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE SPECIFICATION, CURRENT SAA CODES, BUILDING REGULATIONS AND THE REQUIREMENTS OF ANY OTHER RELEVANT STATUTORY AUTHORITIES.

G3 THESE DRAWINGS MUST NOT BE SCALED. ALL DIMENSIONS ARE IN METERS. ALL SET OUT DIMENSIONS AND LEVELS, INCLUDING THOSE SHOWN ON THESE DRAWINGS SHALL BE IN ACCORDANCE WITH THE ARCHITECT'S DRAWINGS AND VERIFIED ON SITE.

G4 ALL SETOUT AND DIMENSIONS OF THE STRUCTURE INCLUDING KERBS AND RETAINING WALLS, AND BULK EARTHWORKS MUST BE TAKEN FROM THE ARCHITECT'S DRAWINGS. SETOUT OF THE STORMWATER PITS BY OTHERS. CONTRACTOR TO CONFIRM SETOUT OF SERVICE TRENCHING INCLUDING SUBSOIL ON SITE.

G5 THE CONTRACTOR SHALL COMPLY WITH ALL REGULATIONS OF AUTHORITIES HAVING JURISDICTON OVER THE WORKS. REFER TO GEOTECHNICAL REPORT BY MORRISON GEOTECHNIC PTY LTD, REFERENCE: GE18/144, DATED AUGUST 2018.

G6 ALL DIMENSIONS AND REDUCED LEVELS MUST BE VERIFIED ON SITE BEFORE THE COMMENCEMENT OF ANY WORK.

G7 THE APPROVAL OF A SUBSTITUTION SHALL BE SOUGHT FROM THE SUPERINTENDENT BUT IS NOT AN AUTHORISATION OF A COST VARIATION. THE SUPERINTENDENT MUST APPROVE ANY COST VARIATION INVOLVED BEFORE ANY WORK STARTS.

G8 ALL LEVELS SHOWN ARE TO THE AUSTRALIAN HEIGHT DATUM.

G9 SERVICE INFORMATION SHOWN IS APPROXIMATE ONLY. PRIOR TO COMMENCEMENT OF ANY WORKS, THE CONTRACTOR SHALL LOCATE ALL UNDERGROUND SERVICES AND COMPLY WITH ALL REQUIREMENTS OF THOSE AUTHORITIES.

G10 EXISTING SURFACE CONTOURS, WHERE SHOWN, ARE INTERPOLATED AND MAY NOT BE ACCURATE.

G11 UNLESS NOTED OTHERWISE, ALL VEGETATION SHALL BE STRIPPED TO A MINIMUM DEPTH OF 150mm UNDER ALL PROPOSED PAVEMENT AND BUILDING AREAS.

G12 MAKE SMOOTH CONNECTION WITH ALL EXISTING WORKS.

SITEWORKS NOTES

S1 PRIOR TO THE PLACEMENT OF ANY PAVEMENTS, BUILDINGS OR DRAINS THE EXPOSED SUBGRADE SHALL BE COMPACTED TO A MINIMUM OF 98% STANDARD COMPACTION IN ACCORDANCE WITH TEST 'E1.1' OF A.S. 1289 FOR THE TOP 300mm. ANY SOFT SPOTS SHALL BE REMOVED AND REPLACED WITH GRANULAR FILL TO THE ENGINEERS APPROVAL AND COMPACTED IN ACCORDANCE WITH THE COMPACTION REQUIREMENTS SET OUT BELOW. ON HIGHLY REACTIVE CLAY AREAS SITE EXCAVATED MATERIAL MAY BE USED WITH THE PRIOR AUTHORISATION OF THE ENGINEER.

S2 ALL FILL AND PAVEMENT MATERIALS SHALL BE COMPACTED IN ACCORDANCE WITH GEOTECHNICAL REPORT BY MORRISON GEOTECHNIC PTY LTD REFERENCE: GE18/144 DATED AUGUST 2018 MOISTURE CONTENT TO BE MAINTAINED AT +/- 2% OMC. MINIMUM COMPACTION REQUIREMENTS ARE DETAILED BELOW FOR (ALL REQUIREMENTS ARE TO VERIFIED BY A SUITABLY QUALIFIED GEOTECHNICAL ENGINEER):

- LANDSCAPED AREAS 95% STD.
- FILL UNDER ANY FOOTINGS AND FLOOR SLABS FOR ANY STRUCTURE TO SUBGRADE LEVEL;
  - FINE CRUSHED ROCK 98% STD.
  - SELECTED FILL WITHOUT CONSPICUOUS CLAY CONTENT 98% STD.
- BUILDING BASECOURSE 98% MOD
- FILL UNDER ROAD PAVEMENTS;
  - TO WITHIN 500mm OF FINISHED SUBGRADE LEVEL 98% STD.
  - UP TO FINISHED SUBGRADE LEVEL 98% STD.
- ROAD PAVEMENT MATERIALS;
  - SUB BASE 98% MOD.
  - BASE COURSE 98% MOD.

THE MAXIMUM COMPACTION IS TO BE NO GREAT THAN 4% ON TOP OF THE ABOVE MENTION VALUES.

S3 GRADE EVENLY BETWEEN FINISHED SURFACE SPOT LEVELS. FINISHED SURFACE CONTOURS ARE SHOWN FOR CLARITY. WHERE FINISHED SURFACE LEVELS ARE NOT SHOWN, THE SURFACE SHALL BE GRADED SMOOTHLY SO THAT IT WILL DRAIN AND MATCH ADJACENT SURFACES OR STRUCTURES.

S4 ALL DIMENSIONS GIVEN ARE TO FACE OF KERB, CENTER OF PIPE OR EXTERIOR FACE OF BUILDING UNLESS NOTED OTHERWISE.

S5 ANY STRUCTURES, PAVEMENTS OR SURFACES DAMAGED, DIRTIED OR MADE UNSERVICABLE DUE TO CONSTRUCTION WORK SHALL BE REINSTATED TO THE SATISFACTION OF THE ENGINEER.

S6 ANY FILL REQUIRED SHALL BE APPROVED BY THE ENGINEER / GEOTECHNICAL CONSULTANT

S7 CONTRACTOR IS TO ENSURE THAT ALL EXCAVATIONS ARE MAINTAINED IN A DRY CONDITION WITH NO WATER ALLOWED TO REMAIN IN THE EXCAVATIONS.

S8 ALL FINISHES AND COLOURS TO BE IN ACCORDANCE WITH ARCHITECTURAL SPECIFICATIONS.

S9 REFER TO STRUCTURAL DRAWINGS FOR CONCRETE, REINFORCEMENT AND RETAINING WALL DETAILS.

S10 GENERALLY FOR TRENCHING WORKS THE CONTRACTOR MUST:
A) COMPLY WITH THE GENERAL PROVISIONS OF PART 3.1 "MANAGING RISKS TO HEALTH AND SAFETY" OF NSW WORK AND HEALTH AND SAFETY REGULATION 2011

B) COMPLY PART 6.3 DIVISION 3 "EXCAVATION WORK" OF NSW WORK HEALTH AND SAFETY REGULATION NSW 2011

S11 PRIOR TO THE EXCAVATION OF ANY TRENCH DEEPER THAN 1.5 METRES THE CONTRACTOR MUST:
A) NOTIFY THE OCCUPATIONAL HEALTH AND SAFETY AUTHORITY ON THE APPROPRIATE FORM.

STORMWATER DRAINAGE NOTES

SW1 UNLESS NOTED OTHERWISE BY HYDRAULIC ENGINEERS DRAWINGS, ALL DOWNPIPES & GRATED INLETS SHALL BE CONNECTED TO PITS OR MAIN STORMWATER DRAINS WITH 150 DIA. UPVC PIPES LAID AT A MINIMUM GRADE OF 1 IN 100. FOR SYPHONIC ROOF DRAINAGE SYSTEMS ALL DOWNPIPES CONNECTION DRAIN SIZES TO BE CONNECTED INTO MAIN STORMWATER DRAINS SHALL BE IN ACCORDANCE WITH HYDRAULIC ENGINEERS DRAWINGS.

SW2 ALL MAIN STORMWATER DRAINS SHALL BE CONSTRUCTED USING MATERIALS AS SPECIFIED ON THE DRAWINGS IN ACCORDANCE WITH THE APPROPRIATE A.S. IF NOT SPECIFIED THEN CLASS 2 RRJ RCP SHALL BE USED FOR DIAMETERS > 225mm. SEWER CLASS SEH UPVC IN ACCORDANCE WITH AS1260 SHALL BE USED FOR Φ225mm OR SMALLER.

SW3 ALL PIPEWORK TO BE INSTALLED IN ACCORDANCE WITH AS3725 FOR RCP AND AS2032 FOR PVC. ALL BEDDING TO BE TYPE H2 UNLESS NOTED OTHERWISE.

SW4 FOR ALL PITS > 1.2m DEEP, STEP IRONS SHALL BE INSTALLED.

SW5 PRECAST PITS MAY BE USED EXTERNAL TO THE BUILDING SUBJECT TO APPROVAL BY BONACCI GROUP.

SW6 ENLARGERS, CONNECTIONS AND JUNCTIONS TO BE PREFABRICATED FITTINGS WHERE PIPES ARE LESS THAN 300 DIA.

SW7 WHERE SUBSOIL DRAINS PASS UNDER FLOOR SLABS AND VEHICULAR PAVEMENTS, UNSLOTTED uPVC SEWER GRADE PIPE IS TO BE USED.

SW8 GRATES AND COVERS SHALL CONFORM WITH AS 3996 AND AS 1428.1 FOR ACCESS REQUIREMENTS.

SW9 CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES ARE NOT TO BE REDUCED WITHOUT APPROVAL.

SW10 AT ALL TIMES DURING CONSTRUCTION OF STORMWATER PITS, ADEQUATE SAFETY PROCEDURES SHALL BE TAKEN TO ENSURE AGAINST THE POSSIBILITY OF PERSONNEL FALLING DOWN PITS.

SW11 ALL EXISTING STORMWATER DRAINAGE LINES AND PITS THAT ARE TO REMAIN ARE TO BE INSPECTED AND CLEANED. DURING THIS PROCESS ANY PART OF THE STORMWATER DRAINAGE SYSTEM THAT WARRANTS REPAIR SHALL BE REPORTED TO THE SUPERINTENDENT/ENGINEER FOR FURTHER DIRECTIONS.

KERBING NOTES

K1 ALL CONCRETE TO HAVE A MINIMUM COMPRESSIVE STRENGTH OF 32 MPa U.N.O.

K2 ALL KERBS, GUTTERS, DISH DRAINS AND CROSSINGS TO BE CONSTRUCTED ON 75mm GRANULAR BASECOURSE COMPACTED TO A MINIMUM 98% MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS1289 5.2.1.

K3 EXPANSION JOINTS (EJ) TO BE FORMED FROM 10mm COMPRESSIBLE CORK FILLER BOARD FOR THE FULL DEPTH OF THE SECTION AND CUT TO PROFILE. EXPANSION JOINTS TO BE LOCATED AT DRAINAGE PITS, ON TANGENT POINTS OF CURVES AND ELSEWHERE AT MAX 12m CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE EXPANSION JOINTS ARE TO MATCH THE JOINT LOCATIONS IN THE SLAB.

K4 WEAKENED PLANE JOINTS TO BE MIN 3mm WIDE AND LOCATED AT 3m CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE WEAKENED PLANE JOINTS ARE TO MATCH THE JOINT LOCATIONS IN THE SLAB.

K5 BROOMED FINISH TO ALL RAMPED AND VEHICULAR CROSSINGS. ALL OTHER KERBING OR DISH DRAINS TO BE STEEL FLOAT FINISHED.

K6 IN THE REPLACEMENT OF KERBS:-
- EXISTING ROAD PAVEMENT IS TO BE SAWCUT 900mm U.N.O. FROM THE LIP OF GUTTER. UPON COMPLETION OF THE NEW KERB AND GUTTER, NEW BASECOURSE AND SURFACE TO BE LAID 600mm WIDE U.N.O.
- EXISTING KERBS ARE TO BE COMPLETELY REMOVED WHERE NEW KERBS ARE SHOWN.

JOINTING NOTES

PEDESTRIAN FOOTPATH JOINTS

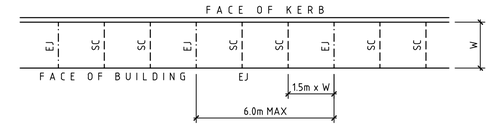
J1 EXPANSION JOINTS (EJ) ARE TO BE LOCATED WHERE POSSIBLE AT TANGENT POINTS OF CURVES AND ELSEWHERE AT 6m CENTRES.

J2 SAWCUT JOINTS (SC) ARE TO BE LOCATED AT A MAX 1.5m x WIDTH OF PAVEMENT. THE TIMING OF THE SAWCUT IS TO BE CONFIRMED BY THE CONTRACTOR ON SITE. SITE CONDITIONS WILL DETERMINE HOW MANY HOURS AFTER THE CONCRETE POUR BEFORE THE SAW CUTS ARE COMMENCED.

J3 WHERE POSSIBLE JOINTS SHOULD BE LOCATED TO MATCH KERBING AND / OR ADJACENT PAVEMENT JOINTS.

J4 PROVIDE 10mm WIDE FULL DEPTH EXPANSION JOINTS (EJ) BETWEEN BUILDINGS AND ALL CONCRETE OR UNIT PAVERS

J5 ALL PEDESTRIAN FOOTPATH JOINTINGS AS FOLLOWS (U.N.O.).



VEHICULAR PAVEMENT JOINTS

J6 ALL VEHICULAR PAVEMENTS TO BE JOINTED AS SHOWN ON DRAWINGS.

J7 LONGITUDINAL WARPING JOINTS (LWJ) SHOULD GENERALLY BE LOCATED AT A MAXIMUM OF 3m TO 4.5m MAX CENTERS. ALL LWJ's SHOULD BE TIED UP TO A MAXIMUM TOTAL WIDTH OF 30m.

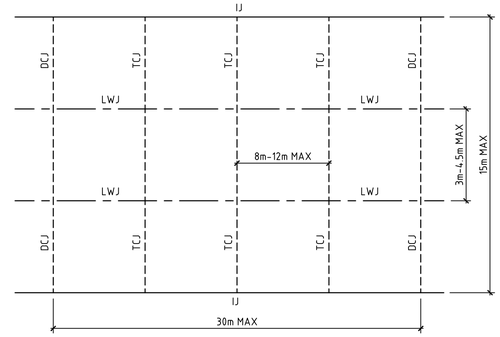
J8 TRANSVERSE CONTRACTION JOINTS (TCJ) SHOULD GENERALLY BE LOCATED AT A MAXIMUM OF 8m TO 12m MAX CENTERS. TCJ's CAN BE SPACED AT SUITABLE INTERVALS UP TO A RECOMMENDED MAXIMUM LENGTH OF 15m.

J9 TRANSVERSE DOWELLED CONSTRUCTION JOINTS (DCJ) TO BE PROVIDED FOR PLANNED INTERRUPTIONS SUCH AS AT THE END OF EACH DAY'S OPERATIONS (POUR BREAK), AT BLOCK OUTS FOR BRIDGES AND INTERSECTIONS OR FOR UNEXPECTED DELAYS WHEN THE SUSPENSION OF OPERATIONS IS LIKELY TO CREATE A JOINT.

J10 ISOLATION JOINTS WITH SUB-GRADE BEAM (IJ) TO BE PROVIDED AT INTERSECTIONS OR AT THE JUNCTION OF A POUR BREAK.

J11 ALL VEHICULAR PAVEMENTS TO BE JOINTED IN ACCORDANCE WITH AUSTROADS AGPT02-12 GUIDE TO PAVEMENT TECHNOLOGY PART 2 STRUCTURAL PAVEMENT DESIGN AND SUPPLEMENT AP-T36-06 PAVEMENT DESIGN FOR LIGHT TRAFFIC

J12 VEHICULAR PAVEMENT JOINTING AS FOLLOWS (U.N.O.)



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P3	ISSUED FOR EARLY WORKS DA	04.10.18	PN	-
P2	ISSUED FOR EARLY WORKS DA	06.09.18	PA	-
P1	ISSUED FOR EARLY WORKS DA	03.09.18	PA	-

Rev Description Date By App

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Project Name: TWEED VALLEY HOSPITAL DEVELOPMENT, KINGSCLIFF, NSW

Drawing Title: DRAWING REGISTER AND CONSTRUCTION NOTES

DEVELOPMENT APPLICATION

Designed	CS	Project Director Approved	Date
Drawn	PA		
Scale	-		North
Date	03.09.18		
Sheet	A1		

Project Ref: 20 10748 01 Drawing No: C001 Rev: P4

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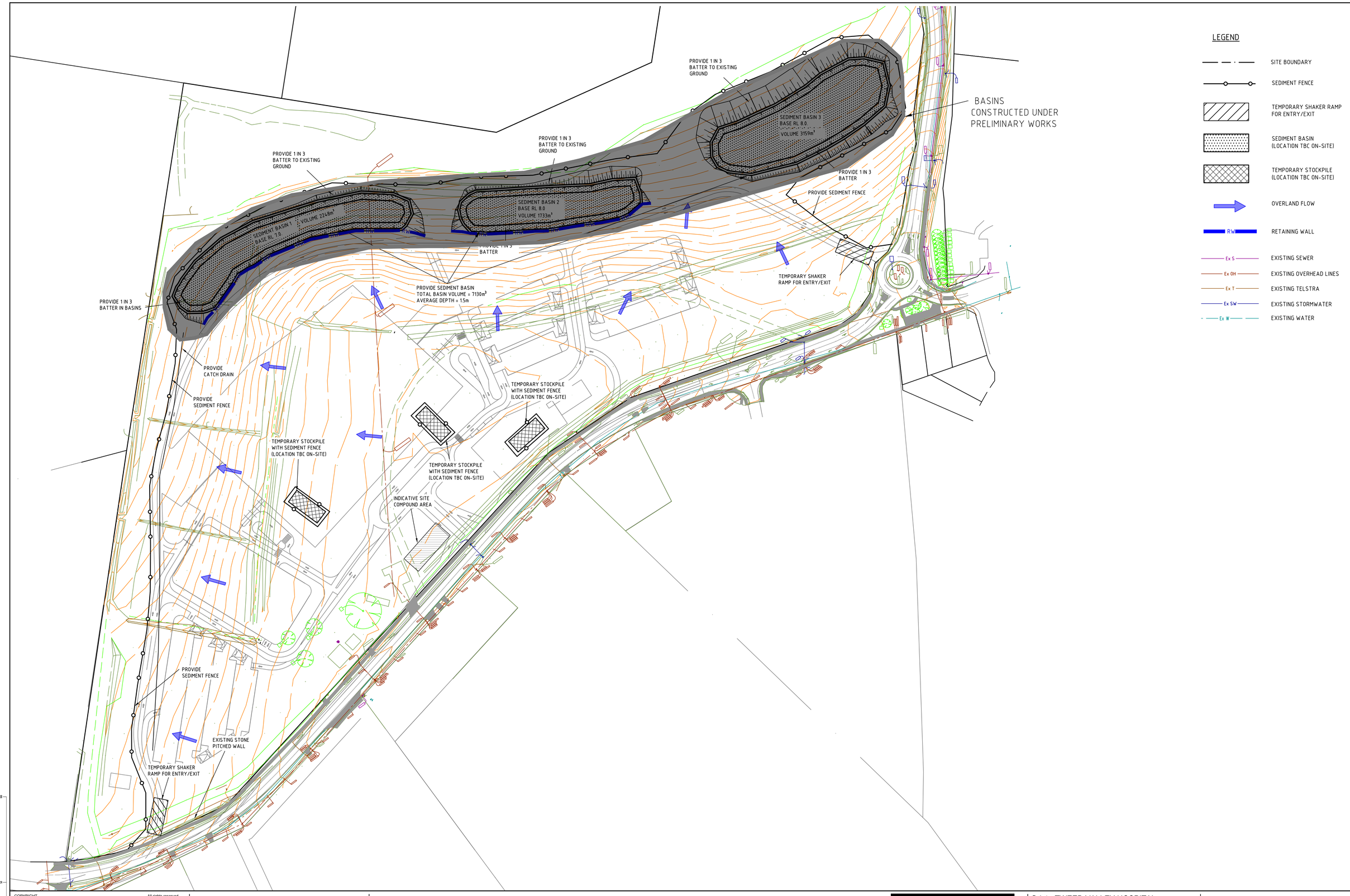

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P1	ISSUED FOR EARLY WORKS DA	03.09.18	PA	-

Rev Description Date By App

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Project Name: TWEED VALLEY HOSPITAL DEVELOPMENT, KINGSCLIFF, NSW

Drawing Title: SOIL AND WATER MANAGEMENT PLAN

DEVELOPMENT APPLICATION

Designed	P.A
Drawn	P.A
Scale	1:1250
Date	03.09.18
Sheet	A1

Project Director Approved Date North

Project Ref: 20 10748 01 Drawing No: C005 Rev: P4

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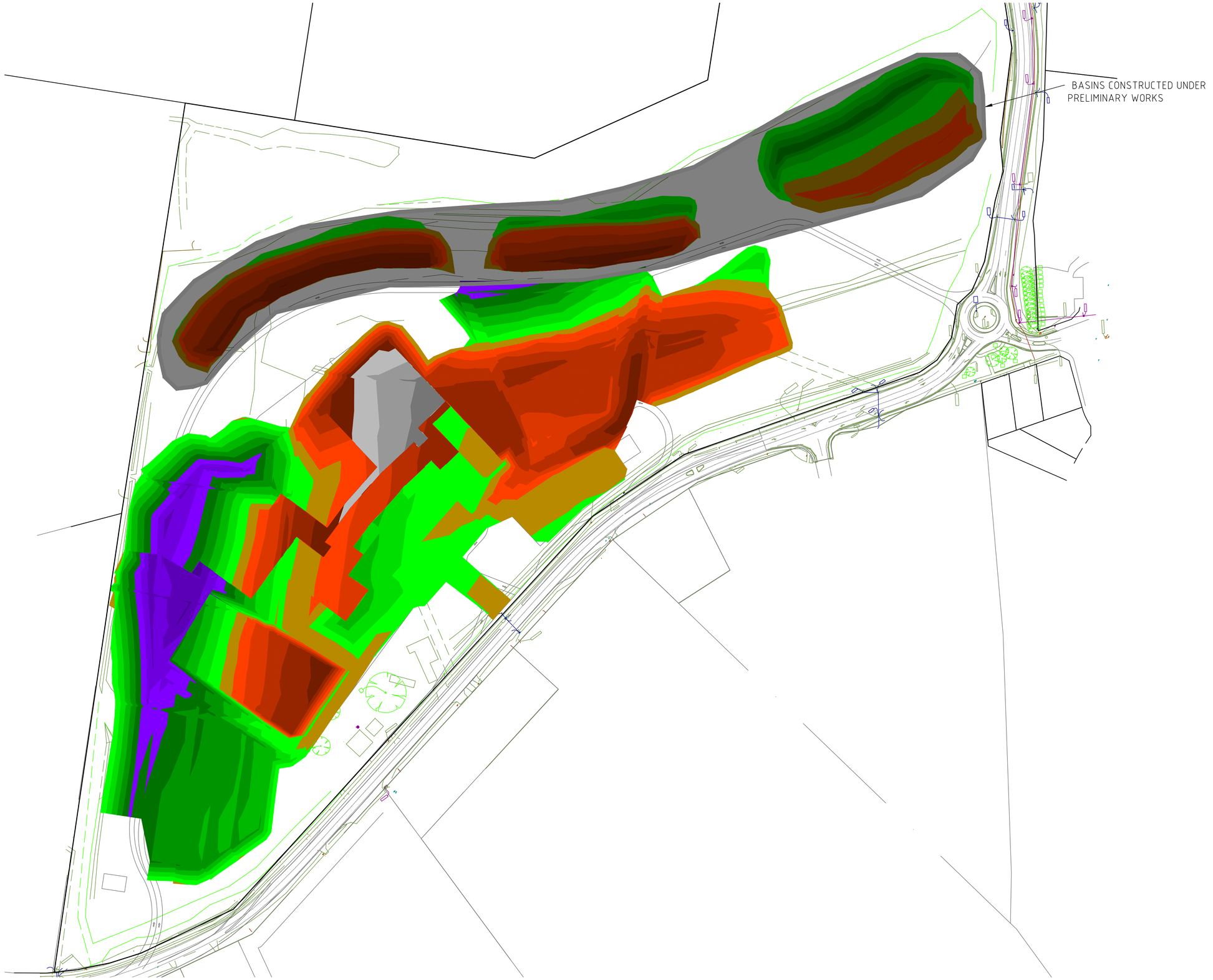

NOTE
1. VOLUMES ARE APPROXIMATE ONLY, WHICH ARE IN PLACE AND DO NOT INCORPORATE BULKING FACTORS AND OVER EXCAVATION
2. LEVELS PROVIDED ARE PRELIMINARY AND MIGHT CHANGE AS DESIGN PROGRESSES.
3. GROUND WATER SEEPAGE MAY OCCUR IN EXCAVATED AREAS. DE-WATERING MAY BE REQUIRED IN THIS INSTANCE.
4. RE USE OF THE EXCAVATED ROCK FOR ROAD BASE AND OTHER PURPOSES

EARTHWORKS QUANTITIES
BASINS
CUT VOLUME = 28,451m^3
FILL VOLUME = 8,450m^3

NET (CUT) = 20,001m^3

EARTHWORKS QUANTITIES
REMAINDER OF WORKS
CUT VOLUME = 111,361m^3
FILL VOLUME = 110,203m^3

NET (CUT) = 1,158m^3

EARTHWORKS QUANTITIES
TOTAL
CUT VOLUME = 139,812m^3
FILL VOLUME = 118,653m^3

NET (CUT) = 21,159m^3

Rev	Description	Date	By	App
P4	ISSUED FOR EARLY AND ENABLING WORKS	16.10.18	PN	-
P3	ISSUED FOR EARLY WORKS DA	04.10.18	PN	-
P2	ISSUED FOR EARLY WORKS DA	06.09.18	PA	-
P1	ISSUED FOR EARLY WORKS DA	03.09.18	PA	-

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PLAN SCALE 1:1250 A1 SHEET

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Project Name: TWEED VALLEY HOSPITAL DEVELOPMENT, KINGSCLIFF, NSW
Drawing Title: GENERAL EARTHWORKS PLAN

DEVELOPMENT APPLICATION

Designed	P A	Project Director Approved	Date
Drawn	P A		
Scale	1:1250		
Date	03.09.18		
Sheet	A1		

North

Project Ref: 20 10748 01 | Drawing No: C011 | Rev: P4

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P2	ISSUED FOR EARLY WORKS DA	06.09.18	PA	-
P1	ISSUED FOR EARLY WORKS DA	03.09.18	PA	-

Rev Description Date By App

PLAN SCALE 1:1250 A1 SHEET

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Project Name: TWEED VALLEY HOSPITAL DEVELOPMENT, KINGSCLIFF, NSW

Drawing Title: CONCEPT STORMWATER MANAGEMENT PLAN

DEVELOPMENT APPLICATION

Designed	P A
Drawn	P A
Scale	1:1250
Date	03.09.18
Sheet	A1

Project Director Approved Date North

Project Ref 20 10748 01 Drawing No C030 Rev P4

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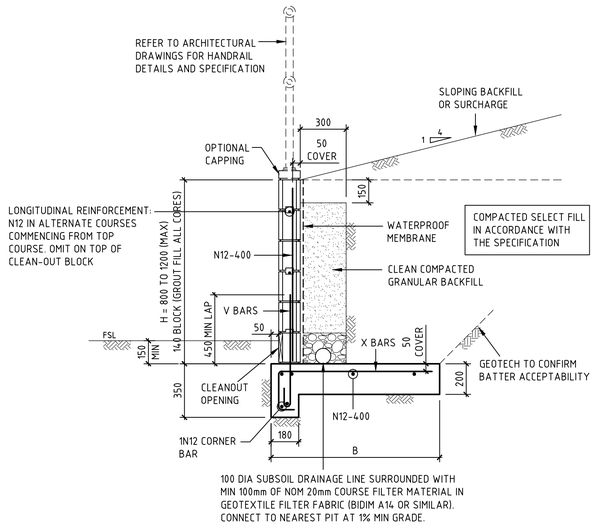
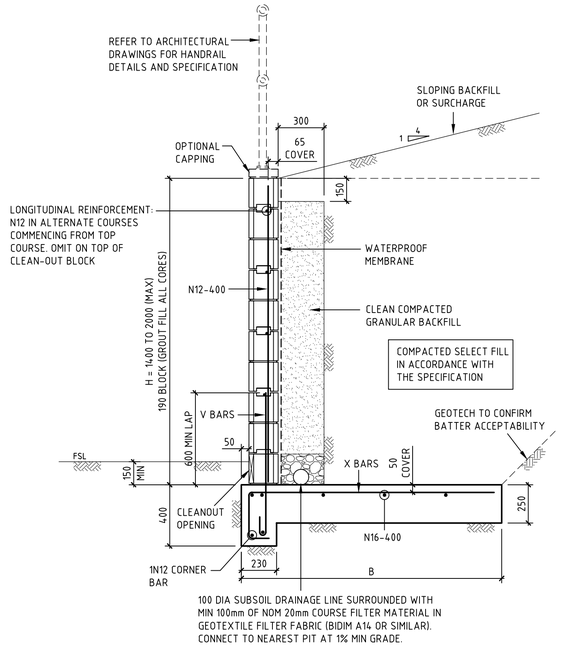


BLOCK RETAINING WALL (MAX 1200 HIGH)

SCALE 1:20

NOTE: DESIGNER TO CHECK THE NEED FOR SHEAR KEY



BLOCK RETAINING WALL (MAX 2000 HIGH)

SCALE 1:20

BLOCK RETAINING WALL BASE TYPE 1

WALL HEIGHT				REINFORCEMENT		BASE DIMENSIONS	
TOTAL HEIGHT (mm) H	HEIGHT OF BLOCKWORK			X-BARS AND V-BARS	K-BARS	WIDTH, B (mm) WITH FOLLOWING BACKFILL CONDITIONS	
	150 SERIES	200 SERIES	300 SERIES			LEVEL	MAX 1:4 SLOPE
800	800	-	-	N12-400	-	800	1000
1000	1000	-	-	N12-400	-	1000	1200
1200	1200	-	-	N12-400	-	1100	1500
1400	-	1400	-	N12-400	-	1300	1700
1600	-	1600	-	N16-400	-	1400	2000
1800	-	1800	-	N16-400	-	1600	2200
2000	-	2000	-	N16-200	-	1700	2500
2200	-	1400	800	N16-400	N16-400	1900	2800
2400	-	1600	800	N16-400	N16-400	2000	3100
2600	-	1600	1000	N20-400	N20-400	2200	3300
2800	-	1800	1000	N20-400	N20-400	2400	3600
3000	-	2000	1000	N16-200	N16-200	2600	3900
3200	-	2000	1200	N20-200	N16-200	2800	4200
3400	-	2000	1400	N20-200	N16-200	2900	4500

Rev	Description	Date	By	App
P1	ISSUED FOR EARLY WORKS DA	16.10.18	PN	-

Rev	Description	Date	By	App

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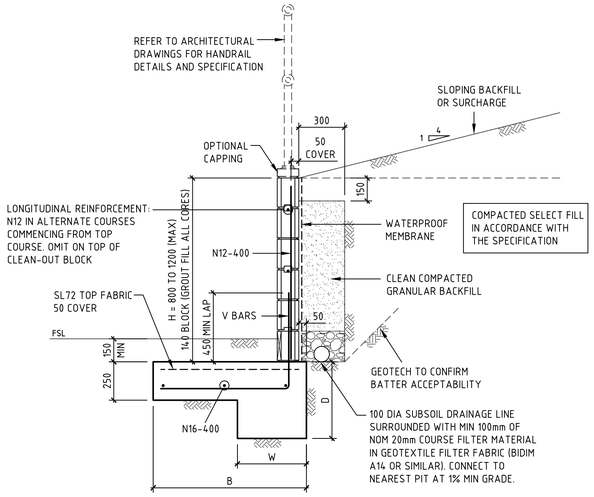
Project Name: TWEED VALLEY HOSPITAL DEVELOPMENT, KINGSCLIFF, NSW

Drawing Title: RETAINING WALL DETAIL

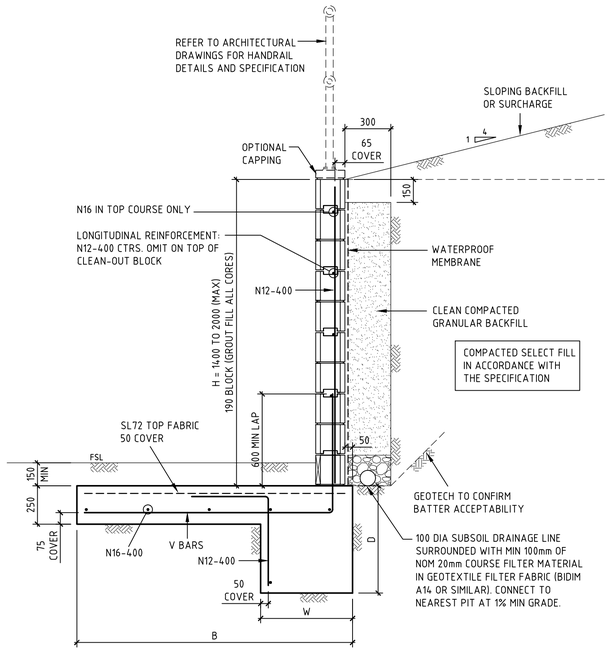
DEVELOPMENT APPLICATION

Designed	PA	Project Director Approved	Date
Drawn	PA		
Scale	-		North
Date	03.09.18	Project Ref	Drawing No / Rev
Sheet	A1	20 10748 01	C055 P1



BLOCK RETAINING WALL (MAX 1200 HIGH)

SCALE 1:20



BLOCK RETAINING WALL (MAX 2000 HIGH)

SCALE 1:20

BLOCK RETAINING WALL BASE TYPE 2

WALL HEIGHT				REINFORCEMENT		BASE DIMENSIONS				
TOTAL HEIGHT (mm) H	HEIGHT OF BLOCKWORK			X-BARS AND V-BARS	K-BARS	HEEL WIDTH (mm) W	LEVEL BACKFILL		MAX 1:4 SLOPING BACKFILL	
	150 SERIES	200 SERIES	300 SERIES				BASE WIDTH (mm) B	HEEL DEPTH (mm) D	BASE WIDTH (mm) B	HEEL DEPTH (mm) D
800	800	-	-	N12-400	-	450	600	500	800	500
1000	1000	-	-	N12-400	-	450	800	500	1000	500
1200	1200	-	-	N12-400	-	450	1000	500	1200	600
1400	-	1400	-	N16-400	-	450	1200	500	1400	600
1600	-	1600	-	N16-400	-	450	1400	600	1600	700
1800	-	1800	-	N16-400	-	450	1600	700	1800	800
2000	-	2000	-	N16-200	-	600	1800	700	2000	800
2200	-	1400	800	N16-400	N16-400	600	2000	800	2200	900
2400	-	1600	800	N16-400	N16-400	600	2200	900	2400	1000
2600	-	1600	1000	N20-400	N20-400	900	2400	900	2600	1000
2800	-	1800	1000	N20-400	N20-400	900	2600	900	2800	1100
3000	-	2000	1000	N16-200	N16-200	900	2800	1000	3000	1200
3200	-	2000	1200	N20-200	N16-200	900	3000	1100	3200	1300
3400	-	2000	1400	N20-200	N16-200	900	3200	1200	3400	1500

Rev	Description	Date	By	App
P1	ISSUED FOR EARLY WORKS DA	16.10.18	PN	-

Rev	Description	Date	By	App

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Project Name: TWEED VALLEY HOSPITAL DEVELOPMENT, KINGSCLIFF, NSW

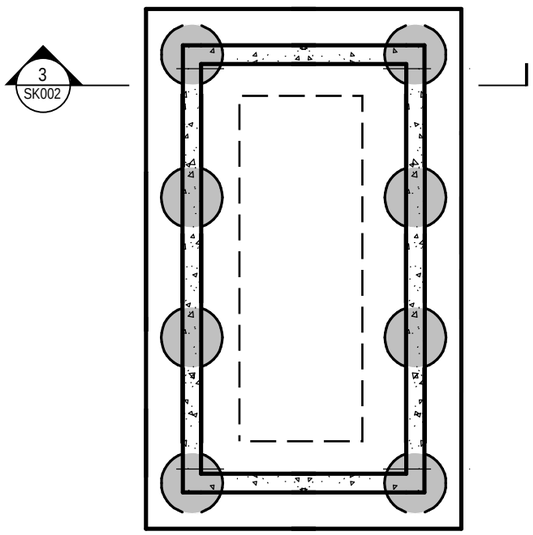
Drawing Title: RETAINING WALL DETAIL

DEVELOPMENT APPLICATION

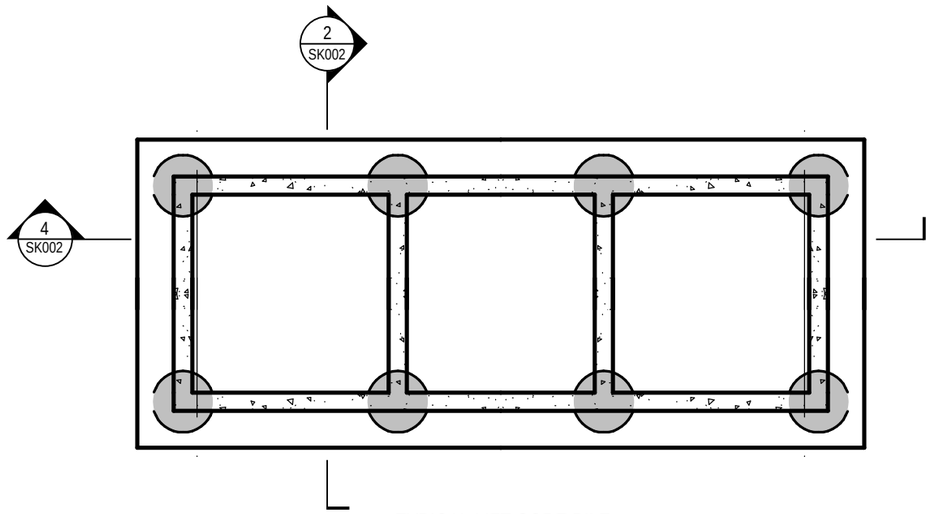
Designed	P.A
Drawn	P.N
Scale	-
Date	03.09.18
Sheet	A1

Project Director Approved | Date | North

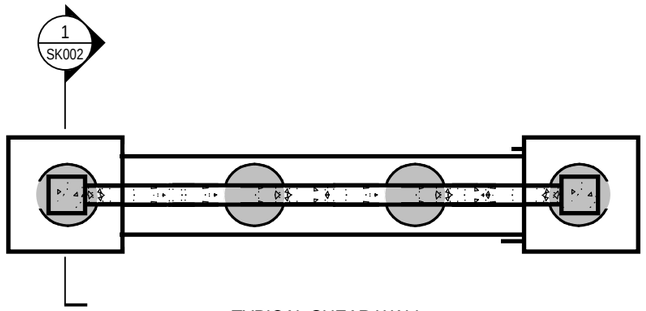
Project Ref: 20 10748 01 | Drawing No: C056 | Rev: P1



TYPICAL STAIR CORE PILE
ARRANGEMENT



TYPICAL LIFT CORE PILE
ARRANGEMENT



TYPICAL SHEAR WALL
PILE ARRANGEMENT

BORED PILE SCHEDULE			
PILE	NO OF SUSPENDED SLABS SUPPORTED	ULTIMATE LIMIT STATE VERTICAL LOAD (kN)	NOMINAL DIAMETER (mm)
P1	3	3600	1000
P2	4	4800	1000
P3	5	6000	1000
P4	6	7200	1000
P5	7	8400	1000
P6	8	9600	1000
P7	9	10800	1000

NOTES
1. PILES TO BE DESIGNED BY D&C PILING SUBCONTRACTOR IN ACCORDANCE WITH AS2159
2. SUBJECT TO FINAL DESIGN, PILE DIAMETERS MAY VARY FROM 600MM TO 1200MM
3. PILES UNDER CORES, LIFT SHAFTS AND SHEAR WALLS TO BE DESIGNED TO RESIST THE LATERAL LOADS NOMINATED ON THE STRUCTURAL DRAWINGS

BORED PILES

BP1 REFER TO THE GEOTECHNICAL REPORT FOR A DESCRIPTION OF THE ANTICIPATED SITE CONDITIONS. THE PILING CONTRACTOR IS TO STUDY THE REPORT AND MAKE HIS OWN EVALUATION OF THE SITE CONDITIONS. ANY ADDITIONAL COSTS INCURRED SHALL BE BORNE BY THE PILING CONTRACTOR.

BP2 THE BORED PILES ARE PROPORTIONED FOR THE SCHEDULED LOADS WITH ALLOWABLE SOCKET SKIN FRICTION AND END BEARING CAPACITY AS INDICATED IN THE REPORT. THE DEPTHS AND LENGTHS NOMINATED IN THE SCHEDULE ARE INDICATIVE ONLY. THEY MAY NEED TO BE VARIED DEPENDING ON THE SITE CONDITIONS ENCOUNTERED. THE PILING CONTRACTOR NEEDS TO INCORPORATE ANY DESIGN CHANGES REQUIRED.

BP3 THE BORED PILES SHALL BE INSTALLED TO A MAXIMUM TOLERANCE OF ±75mm FROM THAT REQUIRED IN PLAN AND INCLINED AT NOT MORE THAN 1 IN 75 FROM THE VERTICAL OR SPECIFIED RAKE.

BP4 ALL WORKMANSHIP AND MATERIAL SHALL BE IN ACCORDANCE WITH AS 2159.

BP5 THE BORED PILES SHALL BE LOCATED CONCENTRIC WITH THE COLUMNS AND WALLS UNLESS NOTED OTHERWISE.

BP6 DRILL AND INSTALL THE BORED PILES IN THE LOCATIONS SHOWN ON THE DRAWINGS AND THE ABOVE REQUIREMENTS.

BP7 BEFORE ANY CONCRETE IS POURED, ALL ROCK SOCKETS SHALL BE DEWATERED AND INSPECTED BY THE GEOTECHNICAL ENGINEER , WHO SHALL BE EMPLOYED BY THE BUILDER, TO VERIFY THE SOIL PARAMETERS. THE SOCKET BASE AND WALLS MUST BE CLEAN AND FREE FROM CLAY.

BP8 IF THE CONCRETE NEEDS TO BE TREMIED, SUPER PLASTICIZER MUST BE ADDED TO THE MIX AND THE CONCRETE GRADE INCREASED BY 30% . REFER TO THE SPECIFICATIONS FOR THE INSPECTION OF THE HOLE PRIOR TO CONCRETING.

BP9 THE PILING CONTRACTOR SHALL ALLOW FOR THE COST INTEGRITY TESTING OF ALL BORED PILES.

BP10 ANY ALTERNATIVE DESIGN SHALL MEET THE ABOVE REQUIREMENTS AND THE SCHEDULED LOADS. THE PILING CONTRACTOR SHALL OBTAIN CERTIFICATION FOR THE CALCULATIONS OF THE ALTERNATIVE SYSTEM. THE DETAILS AND CALCULATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE PERFORMANCE OF THE ALTERNATIVE BORED PILES.

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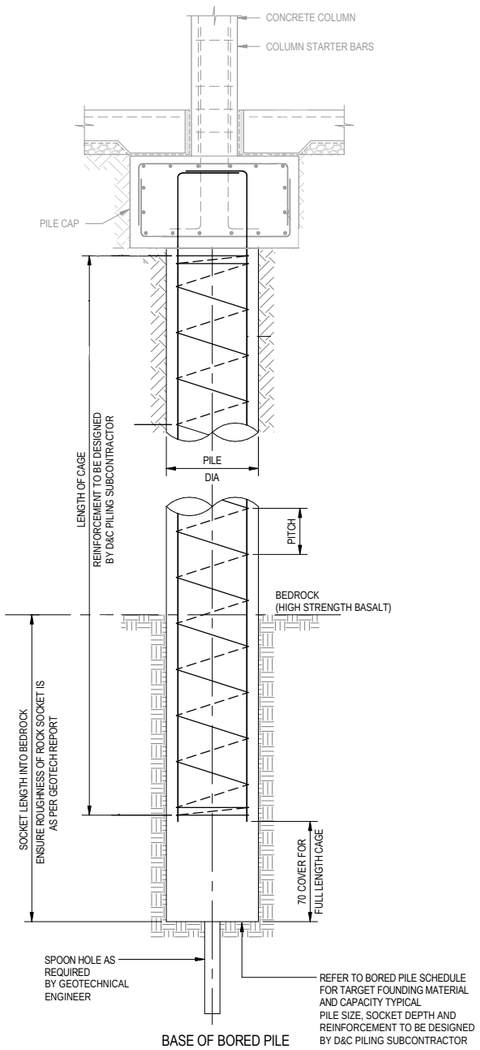
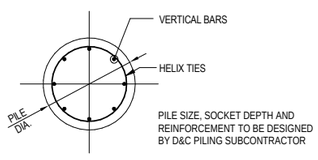
Project Name	Drawn	Date
TWEED VALLEY HOSPITAL	TU	08/08/2018
Drawing Title	**Project Ref**	**Sketch No** / **REV**
PILING DETAILS SHEET 1	10748	SK001 / 1

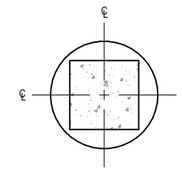


BORED PILE DETAIL

SECTION 1 / SK001

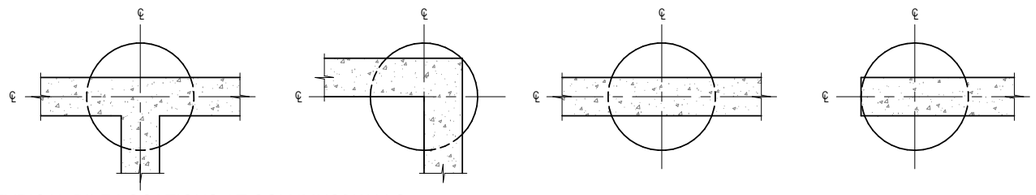


BORED PILE SECTION



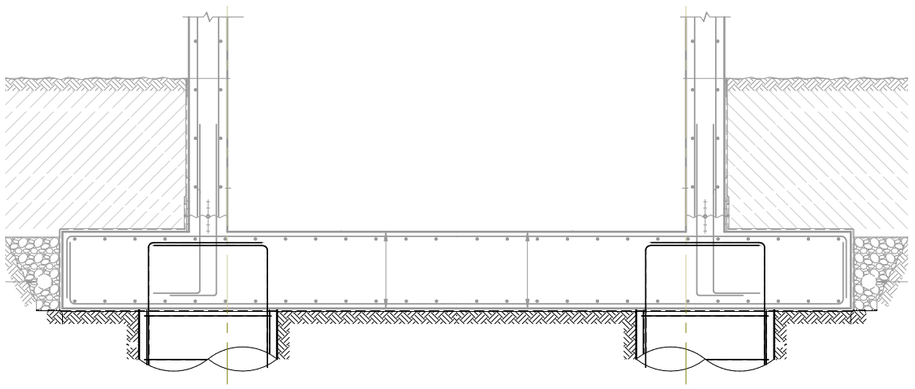
TYPICAL PILE LOCATIONS AT COLUMNS

ALL PILES TO BE CENTRED ON COLUMN/WALLS OVER UNLESS OTHERWISE DENOTED ON PLAN



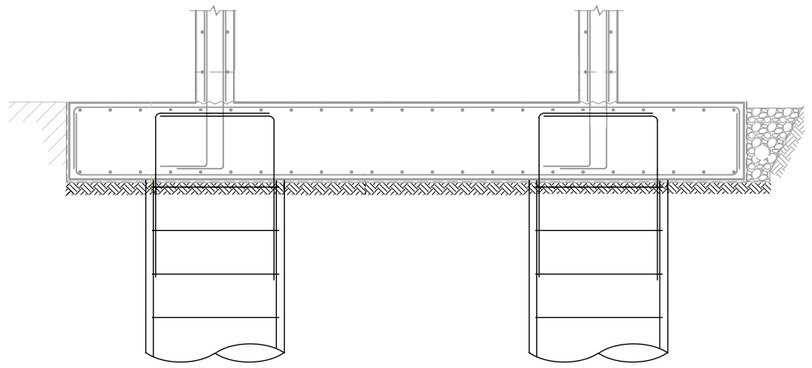
TYPICAL PILE LOCATIONS AT COLUMNS/WALLS

ALL PILES TO BE CENTRED ON COLUMN/WALLS OVER UNLESS OTHERWISE DENOTED ON PLAN



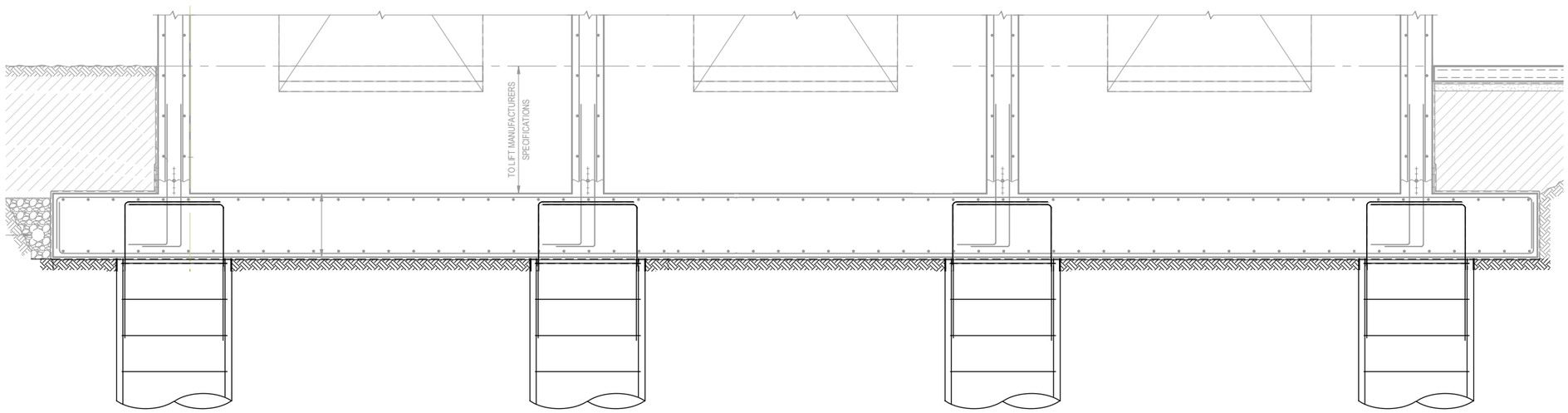
TYPICAL SECTION THROUGH LIFT PIT BASE

SECTION 2 / SK001



TYPICAL SECTION THROUGH STAIR CORE BASE

SECTION 3 / SK001



TYPICAL LONG SECTION THROUGH LIFT PIT BASE

SECTION 4 / SK001

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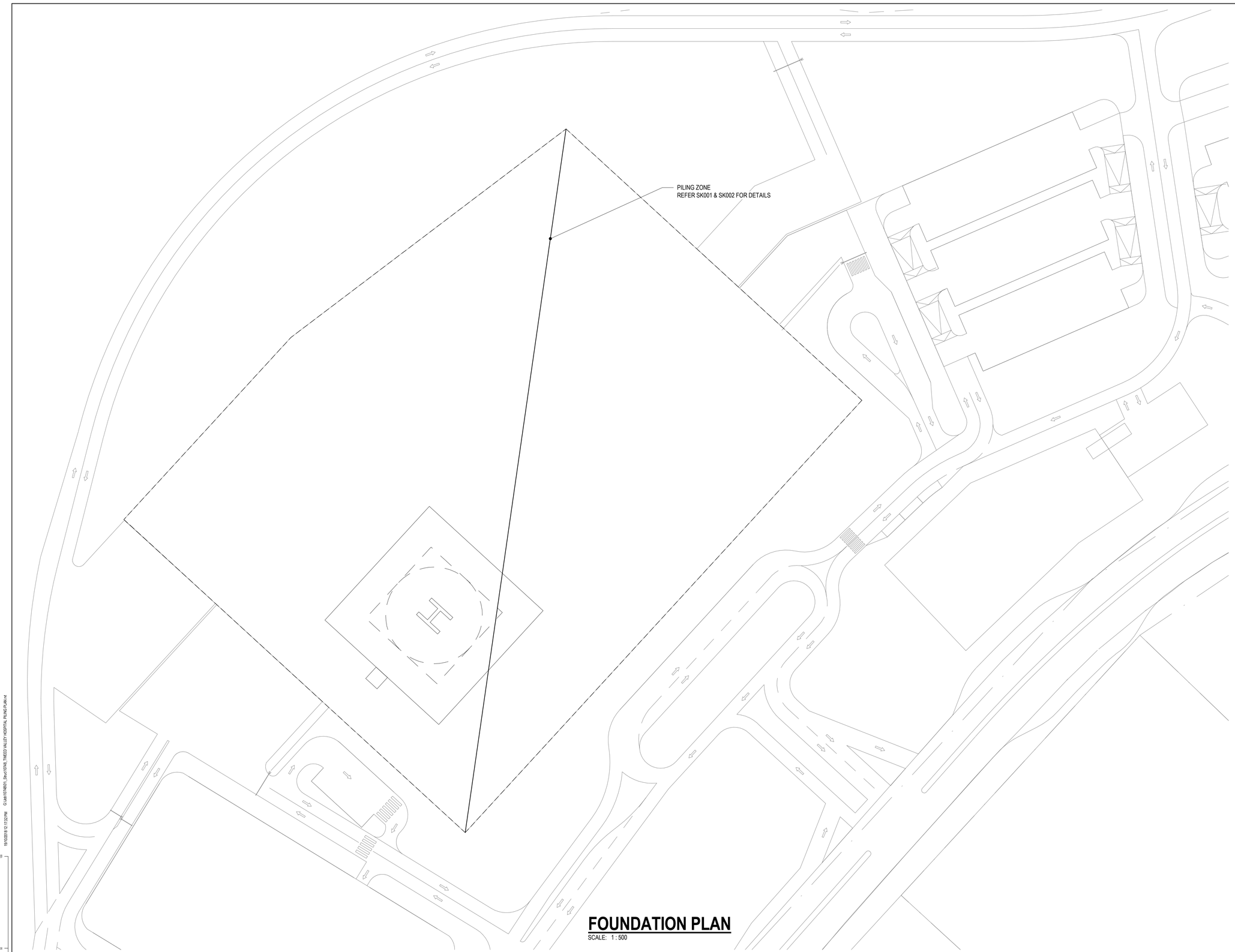
Project Name	Drawn	Date
TWEED VALLEY HOSPITAL	TU	08/08/2018
Drawing Title	**Project Ref**	**Sketch No** / **REV**
PILING DETAILS SHEET 2	10748	SK002 / 1



FOUNDATION PLAN

SCALE: 1 : 500

Rev	Description	Date	By	App

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Project Name: TWEED VALLEY HOSPITAL

Drawing Title: FOUNDATION PLAN

PRELIMINARY

Designed		Project Director Approved	Date 03/08/2018
Drawn	DG		
Scale	1 : 500		
Date	08/30/17		
Sheet	A1		

Project Ref. 10748 | Drawing No. SK003 | Rev 01

North

A1

Appendix B – IFD Data and DRAINS Results

IFD DATA

DURATION OF STORM													
ARI years	5 minutes	6 minutes	10 minutes	20 minutes	30 minutes	1 hour	2 hours	3 hours	6 hours	12 hours	24 hours	48 hours	72 hours
1	130	122	100	73	60	40.9	26.0	19.8	12.4	7.8	5.3	3.5	2.67
2	164	154	126	93	76	51.9	33.1	25.3	16.0	10.1	6.8	4.5	3.49
5	198	186	154	113	93	64.4	41.6	32.0	20.4	13.0	9.0	6.0	4.67
10	217	204	169	125	103	71.4	46.4	35.8	23.0	14.8	10.2	6.9	5.38
20	243	229	190	141	116	81.0	52.9	41.0	26.4	17.1	11.9	8.1	6.31
50	277	261	216	161	133	93.4	61.3	47.7	30.9	20.1	14.1	9.6	7.54
100	301	284	236	177	146	102.7	67.7	52.7	34.3	22.4	15.7	10.8	8.50

Table D5.1
RAINFALL INTENSITY
(millimetres / hour)
for coastal areas

ARI (years)	Frequency Factor Fy
1	0.67
2	0.81
5	0.92
10	1.00
20	1.07
50	1.17
100	1.28

Table D5.2
Frequency Factor
for coastal areas below 500 m AHD

DRAINS RESULTS

DRAINS results prepared from Version 2018.05										
1 in 100 YRS ARI										
PIT / NODE DETAILS				Version 8						
Name	Max HGL	Max Pond	Max Surfa	Max Pond	Min	Overflow	Constraint			
		HGL	Flow Arriv	Volume	Freeboarc	(cu.m/s)				
			(cu.m/s)	(cu.m)	(m)					
Pit1	100.08		13.496		0	10.099	Outlet System			
N742	98.08		8.72							
SUB-CATCHMENT DETAILS										
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm			
	Flow Q	Max Q	Max Q	Tc	Tc	Tc				
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)				
Pre-Devel	8.058	0	8.058	0	26	0	1% AEP, 30 min burst, Storm 9			
Post-Deve	10.027	2.384	7.73	6	18	0	1% AEP, 1 hour burst, Storm 6			
Post	10.027	2.384	7.73	6	18	0	1% AEP, 1 hour burst, Storm 6			
PIPE DETAILS										
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm					
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)						
Pipe2	0.277	0.63	100.767	100.8	1% AEP, 10 min burst, Storm 10					
Pipe113	1.166	8.92	98.682	98.082	1% AEP, 2 hour burst, Storm 10					
CHANNEL DETAILS										
Name	Max Q	Max V			Due to Storm					
	(cu.m/s)	(m/s)								
OVERFLOW ROUTE DETAILS										
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Widtl	Max V	Due to Storm		
OF131	10.099	10.099	1.479	0.637	2.59	4	4.06	1% AEP, 1 hour burst, Storm 5		
OF67	6.653	6.653	1.479	0.488	1.72	4	3.52	1% AEP, 2 hour burst, Storm 10		
DETENTION BASIN DETAILS										
Name	Max WL	MaxVol	Max Q	Max Q	Max Q					
			Total	Low Level	High Level					
Basin757	101.01	10530	7.819	1.166	6.653					
Run Log for Tweed_BASIC run at 17:02:28 on 25/7/2018										

DRAINS results prepared from Version 2018.05												
1 in 5 YEARS ARI												
PIT / NODE DETAILS				Version 8								
Name	Max HGL	Max Pond	Max Surfa	Max Pond	Min	Overflow	Constraint					
		HGL	Flow Arriv	Volume	Freeboarc	(cu.m/s)						
			(cu.m/s)	(cu.m)	(m)							
Pit1	100.02		6.745		0	5.318	Outlet System					
N742	98.05		2.485									
SUB-CATCHMENT DETAILS												
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm					
	Flow Q	Max Q	Max Q	Tc	Tc	Tc						
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)						
Pre-Devel	3.894	0	3.894	0	26	0	0.2EY AEP, 30 min burst, Storm 6					
Post-Deve	5.393	2.305	3.574	6	18	0	0.2EY AEP, 30 min burst, Storm 4					
Post	5.393	2.305	3.574	6	18	0	0.2EY AEP, 30 min burst, Storm 4					
PIPE DETAILS												
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm							
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)								
Pipe2	0.297	0.67	100.167	100.311	0.2EY AEP, 6 hour burst, Storm 1							
Pipe113	0.968	8.5	98.654	98.054	0.2EY AEP, 2 hour burst, Storm 6							
CHANNEL DETAILS												
Name	Max Q	Max V			Due to Storm							
	(cu.m/s)	(m/s)										
OVERFLOW ROUTE DETAILS												
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Widtl	Max V	Due to Storm				
OF131	5.318	5.318	0.908	0.425	1.38	4	3.25	0.2EY AEP, 30 min burst, Storm 4				
OF67	1.55	1.55	0.908	0.203	0.42	4	2.07	0.2EY AEP, 2 hour burst, Storm 6				
DETENTION BASIN DETAILS												
Name	Max WL	MaxVol	Max Q	Max Q	Max Q							
			Total	Low Level	High Level							
Basin757	100.25	7703	2.518	0.968	1.55							
Run Log for Tweed_BASIC run at 17:02:59 on 25/7/2018												

DRAINS results prepared from Version 2018.05										
1 in 20 YEARS ARI										
PIT / NODE DETAILS				Version 8						
Name	Max HGL	Max Pond	Max Surfa	Max Pond	Min	Overflow	Constraint			
		HGL	Flow Arriv	Volume	Freeboarc	(cu.m/s)				
			(cu.m/s)	(cu.m)	(m)					
Pit1	100.04		9.427		0	7.704	Outlet System			
N742	98.07		5.547							
SUB-CATCHMENT DETAILS										
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm			
	Flow Q	Max Q	Max Q	Tc	Tc	Tc				
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)				
Pre-Devel	6.063	0	6.063	0	26	0	5% AEP, 1 hour burst, Storm 9			
Post-Deve	7.689	2.511	5.957	6	18	0	5% AEP, 30 min burst, Storm 5			
Post	7.689	2.511	5.957	6	18	0	5% AEP, 30 min burst, Storm 5			
PIPE DETAILS										
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm					
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)						
Pipe2	0.294	0.67	100.496	100.503	5% AEP, 2 hour burst, Storm 7					
Pipe113	1.051	8.68	98.666	98.066	5% AEP, 1 hour burst, Storm 3					
CHANNEL DETAILS										
Name	Max Q	Max V			Due to Storm					
	(cu.m/s)	(m/s)								
OVERFLOW ROUTE DETAILS										
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Widtl	Max V	Due to Storm		
OF131	7.704	7.704	1.479	0.535	1.98	4	3.7	5% AEP, 1 hour burst, Storm 3		
OF67	3.307	3.307	1.479	0.317	0.87	4	2.74	5% AEP, 1 hour burst, Storm 3		
DETENTION BASIN DETAILS										
Name	Max WL	MaxVol	Max Q	Max Q	Max Q					
			Total	Low Level	High Level					
Basin757	100.56	8837.2	4.359	1.051	3.307					
Run Log for Tweed_BASIC run at 17:03:26 on 25/7/2018										

Appendix C – MUSIC Model Source Parameters

MUSIC Rainfall – Runoff Parameters for Gold Coast

Parameter	Forest	Rural Residential	Urban Residential	Commercial	Industrial
Rainfall Threshold (mm)	1	1	1	1	1
Soil Capacity (mm)	120	120	400	120	120
Initial Storage (%)	25	25	10	25	25
Field Capacity	80	80	200	80	80
Infiltration Capacity Coefficient a	200	200	50	200	200
Infiltration Capacity Coefficient b	1	1	1	1	1
Initial Depth (mm)	50	50	50	50	50
Daily Recharge Rate (%)	25	25	25	25	25
Daily Drainage Rate (%)	5	5	5	5	5
Daily Deep Seepage Rate (%)	0	0	0	0	0

Stormwater Quality Parameters for Source Nodes

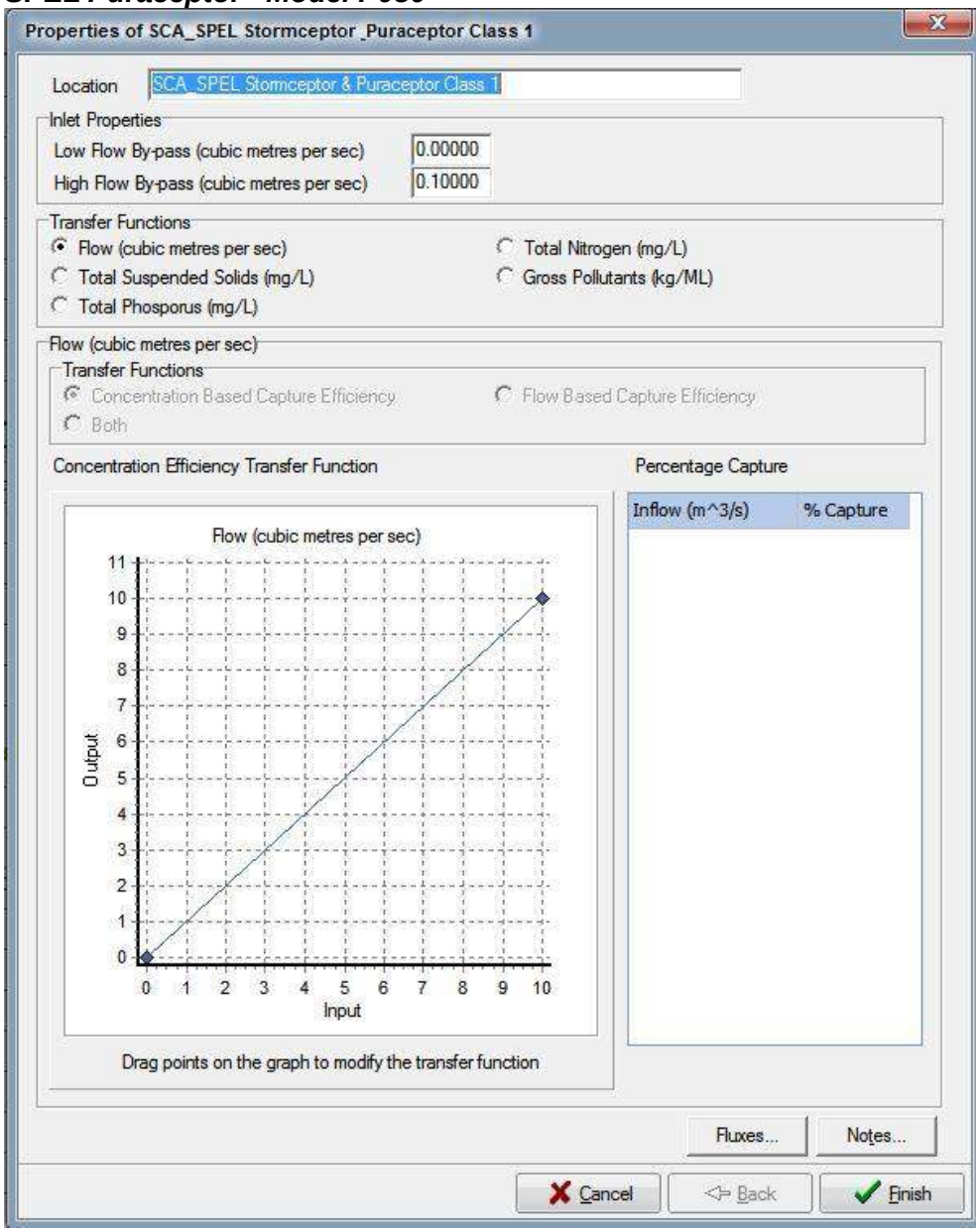
Land-use category		Log_{10} TSS (mg/L)		Log_{10} TP (mg/L)		Log_{10} TN(mg/L)	
		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Forest[1]	Mean	1.90	0.51	-1.10	-1.79	-0.075	-0.59
	Std Dev	0.20	0.28	0.22	0.28	0.24	0.22
Agriculture[2]	Mean	2.30	1.40	-0.27	-0.88	0.59	0.074
	Std Dev	0.31	0.13	0.30	0.13	0.26	0.13
Rural Res[1]	Mean	2.26	0.53	-0.56	-1.54	0.32	-0.52
	Std Dev	0.51	0.24	0.28	0.38	0.30	0.39
Urban[1]	Mean	2.18	1.0	-0.47	-0.97	0.26	0.20
	Std Dev	0.39	0.34	0.31	0.31	0.23	0.20
Commercial[1]	Mean	2.16	0.78	-0.39	-0.60	0.37	0.32
	Std Dev	0.38	0.39	0.34	0.50	0.34	0.30
Industrial[1]	Mean	1.92	0.78	-0.59	-1.11	0.25	0.14
	Std Dev	0.44	0.45	0.36	0.48	0.32	0.20

1 - *Guidelines for Pollutant Export Modelling in Brisbane Version 7)*

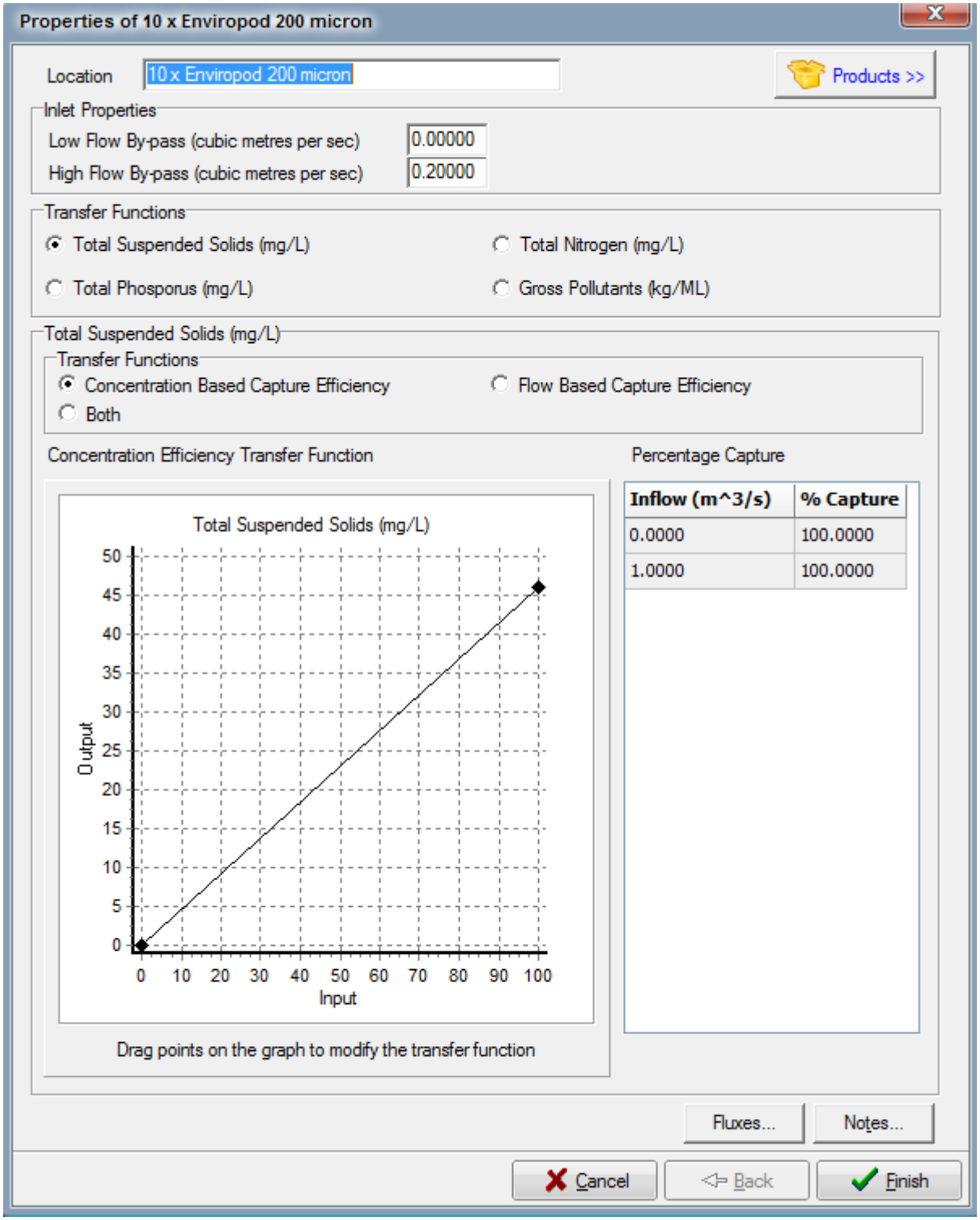
2 - *MUSIC User Guide*

Characteristics of WSUD Measures for the Site:

SPEL *Puraceptor –Model P050*



Enviropod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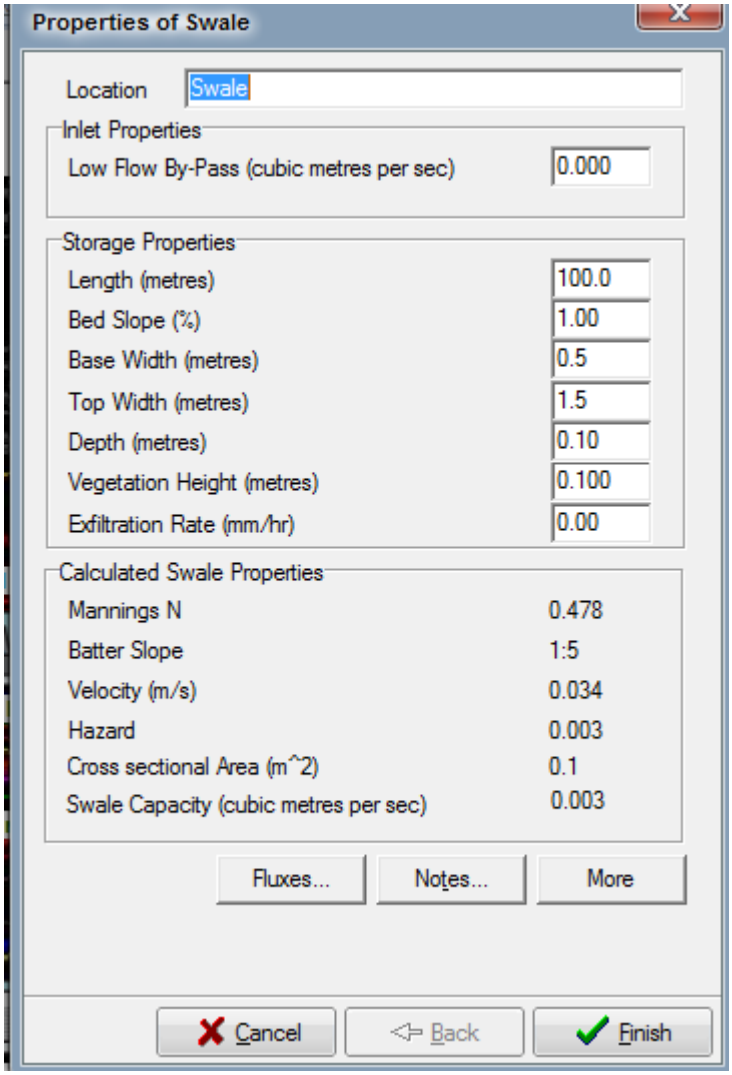
Location
10 x Enviropod 200 micron
Products >>
Inlet Properties
Low Flow By-pass (cubic metres per sec)
0.00000
High Flow By-pass (cubic metres per sec)
0.20000
Transfer Functions
Total Suspended Solids (mg/L)
Total Nitrogen (mg/L)
Total Phosporus (mg/L)
Gross Pollutants (kg/ML)
Total Suspended Solids (mg/L)
Transfer Functions
Concentration Based Capture Efficiency
Flow Based Capture Efficiency
Both
Concentration Efficiency Transfer Function
Total Suspended Solids (mg/L)
Output
Input
0 10 20 30 40 50 60 70 80 90 100
0 5 10 15 20 25 30 35 40 45 50
Drag points on the graph to modify the transfer function
Percentage Capture
Inflow (m^3/s)
% Capture
0.0000
100.0000
1.0000
100.0000
Fluxes...
Notes...
Cancel
Back
Finish

Swale


Properties of Swale
Location
Swale
Inlet Properties
Low Flow By-Pass (cubic metres per sec)
0.000
Storage Properties
Length (metres)
100.0
Bed Slope (%)
1.00
Base Width (metres)
0.5
Top Width (metres)
1.5
Depth (metres)
0.10
Vegetation Height (metres)
0.100
Exfiltration Rate (mm/hr)
0.00
Calculated Swale Properties
Mannings N
0.478
Batter Slope
1:5
Velocity (m/s)
0.034
Hazard
0.003
Cross sectional Area (m^2)
0.1
Swale Capacity (cubic metres per sec)
0.003
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