Proposed Coffs Harbour Campus Health Education Building

Hogbin Drive, Coffs Harbour, NSW 2450

Civil Engineering Report and Site Based Stormwater Management Plan

Meinhardt Project Reference # 117904

Date of Issue: 23.08.2018
Revision: F

Prepared For:

PDT Architects and Coffs Harbour Campus
Attn: Lilian Arli

Meinhardt

Level 2, 135 Wickham Terrace
Brisbane, Qld 4000

P. 07 3018 5000 | F. 07 3108 5099
www.meinhardtgroup.com

Disclaimer

Information in this document is current at the time of writing. While all professional care has been undertaken in preparing the document, Meinhardt accepts no liability for loss or damages incurred as a result of reliance placed upon its content.

The mention of any company, product or process in this report does not constitute or imply endorsement by Meinhardt.

REV	DATE	AUTHOR	QA CHECK	REVIEWER
A	06/04/08	SK	Draft Report	
B	18/04/18	SK (RPEQ 13033)	APPROVAL ISSUE	
C	06/07/18	SK (RPEQ 13033)	APPROVAL ISSUE	
D	23/07/18	SK (RPEQ 13033)	APPROVAL ISSUE	
E	16/08/18	SK (RPEQ 13033)	APPROVAL ISSUE	
F	23/08/18	SK (RPEQ 13033)	APPROVAL ISSUE	

Table of Contents

NOTE: These engineering consultancy notes to be read in conjunction with Architect's Design Report, Drawings and other consultants functional Design Briefs.

1 Introduction

This report is prepared in relation to the construction of the new Campus Health Education Building located within the existing Southern Cross University (SCU) Campus. The development site can be identified as Lot 1 on DP 1030262.

The Detail Survey of the Development Site is attached to this report as Appendix A.

The Proposed Development layout is attached to this report as Appendix B.

The intent of this report is to provide recommendations for civil works and stormwater management strategies for the proposed development in compliance with the Coffs Harbour City Council planning requirements.

This report has further amended to provide responses to the Coffs Harbour City Councils (CHCC) following information requests:

- (RFI) No. 0857/18DA dated 03/07/2018.
- DA 0857/18 - Additional Information- WSUD dated 08/08/2018.

The formal responses to both RFIs are given under Section 11 of this report.

2 Site Location

The proposed development site is located within the Southern Cross University – Coffs Harbour premises. The development site is bounded by the Hogbin Drive to the west and the existing university playground to the east. An existing detention pond is located to the north of the development and the south is bounded by a strip of dense vegetation.

Figure 2.1 – Proposed Development Site locality

3 Current Use

The existing site is vacant at the moment. It is undeveloped and covered with grass.

4 Easements

From the survey plan, no easements affecting the site.

5 Existing Topography

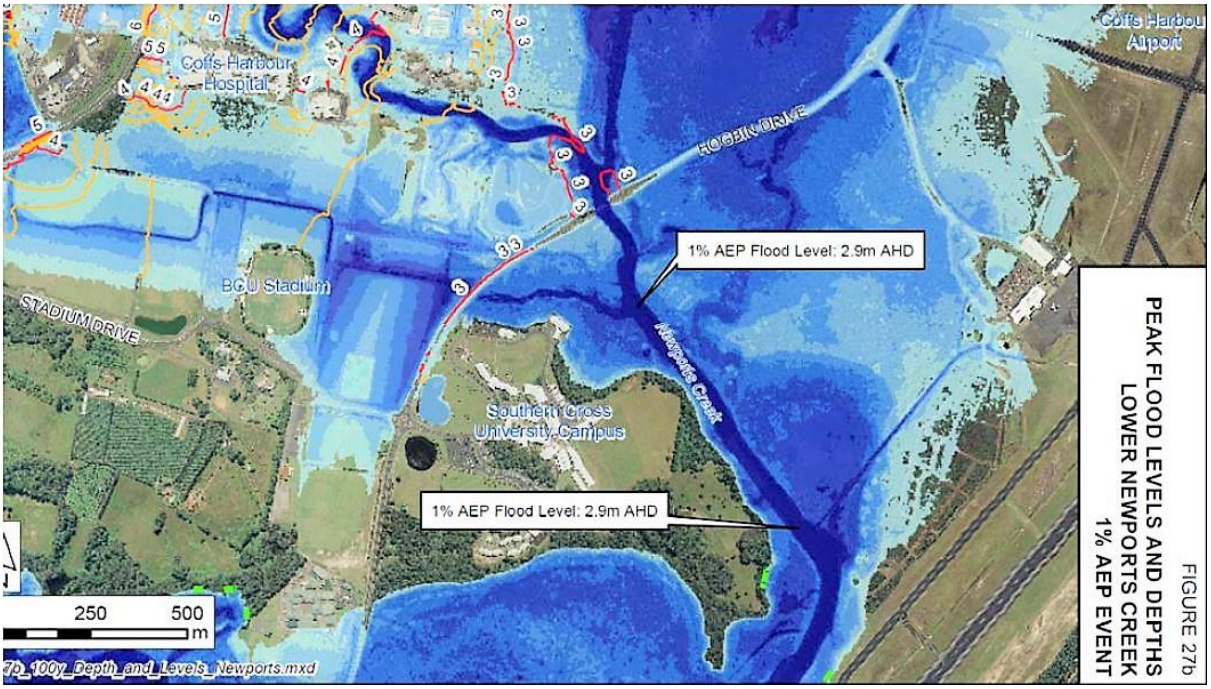
The development site is relatively flat and will be located over the existing valley between existing playground and Hogbin Drive. The existing ground over the proposed development area falls from RL3.5 to RL 2.7 towards the detention pond. The existing valley / overland flow path will be partially obstructed by the proposed development.

6 Flood Search

According to the Preliminary Engineering Report by de Groot & Censon Pty Ltd and the online mapping system of CH City Council:

The Boambee Creek and Newports Creek Flood Study (WMA Water, Jan 2011) is the current reference study. Figure 6.1 shows an extract of that study. The predicted peak 100-year ARI flood level in that location is RL 2.95m AHD. At this level Hogbin Drive is inundated north of the campus entry and shallow inundation of parts of the entry road and Hogbin Drive roundabout will occur. Contrary to the shading in the figure, the flood inundation will extend partway across site 1 as the ground levels here range from approximately RL 2.5 at the edge of the pond in the north to RL 4.5 at the tree line in the south. Council will set the minimum floor level requirement for the development with consideration as to its nature. Regardless, it will not be below RL 3.5m AHD.

Figure 6.1 – Extract from the de Groot & Benson Report



The proposed Building floor level will be located above the flood level (at RL3.85m AHD) and the proposed carpark and other external areas will be located close to the existing surface levels to minimise any impact on the floodplain from the Boambee Creek and Newports Creek catchments.

7 Stormwater Drainage

7.1. Existing Drainage Conditions

The existing topography and overland conditions are outlined in Clause 5 presented above. An overland flow path, where the new building set to be built, convey stormwater from the upstream undeveloped catchments to the detention pond at the North. No underground drainage infrastructure can be found at the development site.

The current drainage system within the CH campus has been developed based on the Infrastructure Strategy Report No. CH9104 (May 1992) by the Public Works NSW (Refer Appendix C).

Accordingly, a stormwater management strategy has been developed with two stormwater retention basins to cater for the increased run-off from the University to Hogbin Drive for a 1% AEP. These basins have been incorporated with the irrigation dam to provide an aesthetic entrance. Sediment and litter traps have been provided for all stormwater outlets.

The maximum water level, according to the Public Works' Report, is 2.75m AHD, which is approx. 750mm below the Main access road to the University.

All upstream catchments have been captured in to the current underground drainage pipes and above ground drainage channels before discharging into the detention ponds.

The detail stormwater modelling or the calculations are not available for review. However, it is assumed that the current detention basins are designed for the fully developed scenario of the University Masterplan.

7.2. Proposed Drainage Strategy

The proposed stormwater strategy is based on the existing drainage conditions / strategy identified under Clause 7.1 above. Accordingly:

- The building downpipes will be connected to the proposed open drain (West) and to the proposed underground drainage system (East). The proposed drainage system will be discharged to the existing detention pond to the north of the development
- The carpark and hardstand areas will be collected in an underground drainage system (via. Treatment) and will be discharged to the proposed swale for further treatment.
- The existing overland flow path will be diverted around the proposed building into a landscaped swale and will be discharged to the existing detention pond.
- Natural landscape channels/ swales will be provided where possible to improve stormwater quality and to slow down runoff.

Refer Appendix D for the Proposed Stormwater Management Plan

7.3. Legal Point of Stormwater Discharge

The legal Point of Discharge for this development will be the southern Detention Pond as show in Appendix D.

Upstream catchments will be collected in a trapezoidal shape landscaped channel, which runs between the proposed building and the carpark. The channel will be designed to carry the surface runoff for up to 1% AEP from upstream catchments.

7.4. Stormwater Quantity Management

The modelling of the stormwater runoff quantity has been considered for the existing case and operational phase of the development. The calculations have been conducted based on the methods specified in the Queensland Urban Drainage Manual (2013) with using a 1d model in XPSWMM.

7.4.1 XP-SWMM Rainfall Parameters

In order to accurately evaluate the natural hydrology of the site, several modelling parameters have been utilised, as follows:

- AR&R temporal patterns; and
- Intensity Frequency Data (IFD) for the Raceview area.

The IFD data used in the hydrologic analysis for a range of storm events is presented in Table 7.1

Table.7.1 – Intensity Frequency Data – Coffs Harbour Area (mm/hr)

Storm Duration (min)	Average Recurrence Interval -Years				
	2	5	10	20	100
10	116	144	160	182	232
15	97	122	136	155	199
30	69	88	99	113	147
45	56	71	80	93	121
60	47	61	69	80	104
90	37	49	55	64	84

To input the IFD information into XP-SWMM, rainfall multipliers are generated to represent the depth of rainfall for the given storm event and storm duration. The rainfall multipliers are then applied to the temporal patterns within XP-SWMM to generate flood hydrographs for use within the hydraulic

analysis. Table 7.2 presents the rainfall multipliers applied to the XP-SWMM model for flood hydrograph generation.

Table 7.2 – XP-STORM Rainfall Multipliers Applied to the Temporal Patterns (mm)

Storm Duration (min)	Average Recurrence Interval -Years				
	2	5	10	20	100
10	19.29	24.05	26.72	30.40	35.14
15	24.27	30.47	33.98	38.77	44.99
30	34.60	43.98	49.40	56.65	66.15
45	41.75	53.47	60.31	69.39	81.34
60	47.36	61.01	69.02	79.61	93.56
90	56.14	72.92	82.87	95.93	113.20

The initial and continuing losses have been applied to the hydrologic model. In this case, the values applied to model are summarised in Table 7.3.

Table 7.3 – Rainfall Losses

Rainfall Loss Type	Event <30yr ARI	Event >30Yr ARI
Pervious Initial Loss (mm)	5	2.5
Pervious Continuing Loss (mm/hr.)	2.5	0
Impervious Initial Loss (mm)	2.5	0
Impervious Continuing Loss (mm/hr.)	0	0

7.4.2 Pre-Development Model

An XP-SWMM model was developed for the existing scenario based on the natural topography, survey data and existing flow paths through the subject site. A summary of the catchment parameters applied to the XP-SWMM model is illustrated in Table 7.4. A brief description of how they were derived is described below:

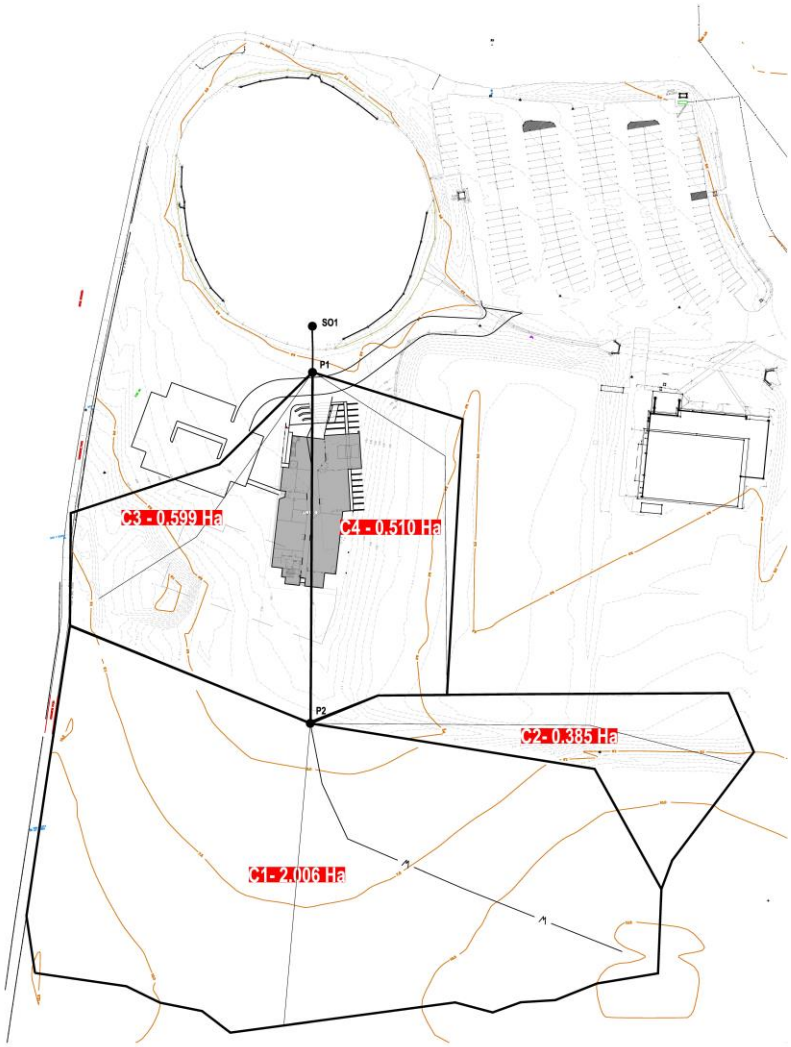
The fraction impervious has been determined by calculating the impervious area in the pre-developed land parcel. When applying the "Runoff' routing mode of XP-SWMM, a catchment width is required. The model assumes a rectangular catchment, and therefore the width represents the catchment area divided by the length of the flow path. An analysis of the catchments has been undertaken to determine the average slope, with the results being applied to the model

Table 7.4 – Pre-development Catchment Parameters

Catchment ID	Catchment Area(Ha)	Flow path Length(m)	Catchment Width(m)	Catchment Slope	Percentage of Impervious (%)
C1	2.006	103	195	0.0437	0
C2	0.385	148	26	0.0270	0
C3	0.599	108	55	0.0440	0
C4	0.510	134	38	0.0243	0

Pre-development XP-SWMM nodes and the corresponding catchment plan are shown below in Figure 7.1.

Figure 7.1 – Pre-development XP-SWMM Nodes and catchment plan



7.4.3 Post-Development Model

A post development XP-SWMM model was established based on the development layout with the adoption of relevant impervious factors and channel discharges.

7.4.4 Post-Development Catchment Definition

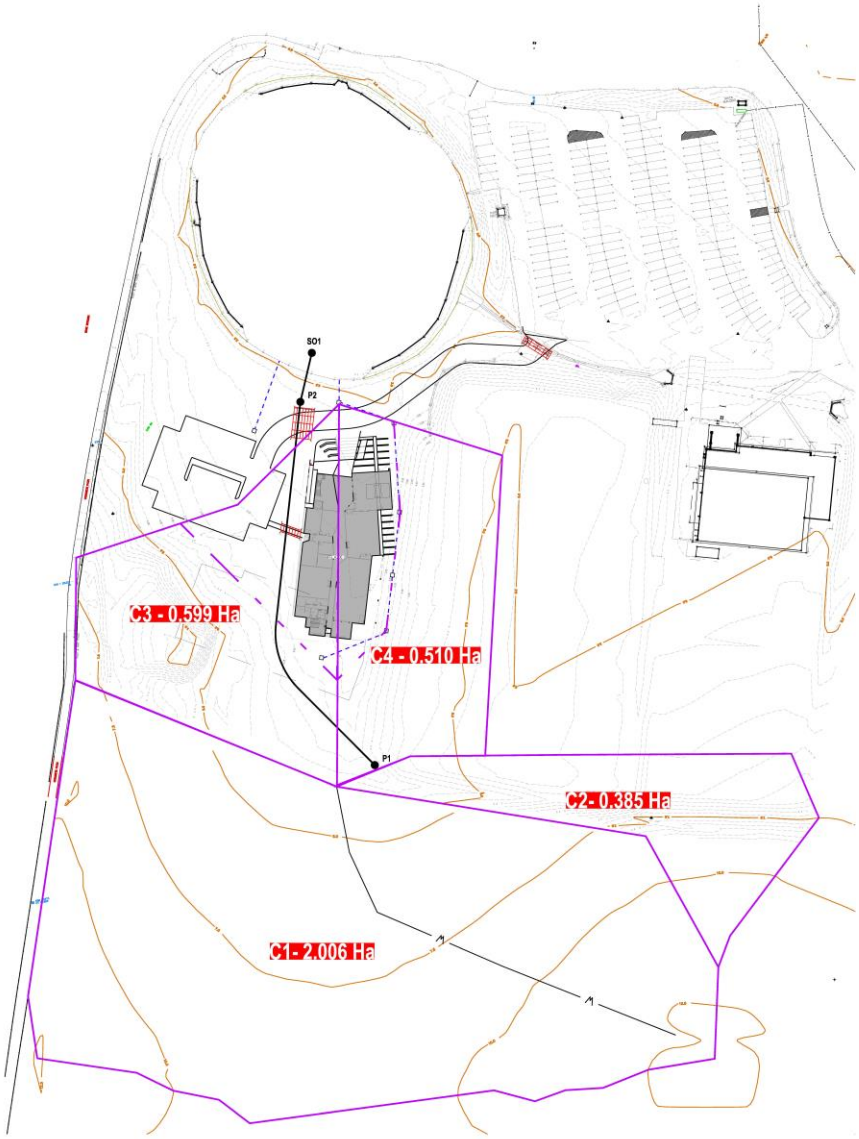
A summary of the post development catchment parameters applied to the XP-SWMM model is contained in Table 7.5 below.

Table 7.5 – Post-development Catchment Parameters

Catchment ID	Catchment Area(Ha)	Flow path Length(m)	Catchment Width(m)	Catchment Slope	Percentage of Impervious (%)
C1	2.006	103	195	0.008	0%
C2	0.385	148	26	0.009	0%
C3	0.599	108	55	0.007	33%
C4	0.510	134	38	0.004	26%

Post development XP-SWMM nodes and the corresponding catchment plan are shown below in Figure 7.2.

Figure 7.2 – Post-development XP-SWMM Nodes and catchment plan



7.4.5 Model Results (Stormwater Quantity)

A comparison between the peak discharge values obtained using XP-SWMM model for the pre-and post-development scenarios are presented in Table 7.6.

Table 7.6 –XP-SWMM Vs Rational Method Peak discharge rates

Outlet	Return Period	XP-SWMM Existing condition - Peak Discharge (m3/s)	XP-SWMM (Un-mitigated) Peak Discharge (m3/s)	Increase of Discharge (m3/s)
SO1 (Detention Pond)	2 Yr.	0.617	0.695	0.078
	5 Yr.	0.797	0.969	0.172
	10 Yr.	0.949	1.142	0.193
	20 Yr.	1.169	1.370	0.201
	100 Yr.	1.662	1.800	0.138

It is anticipated that the current detention ponds are designed for the fully developed scenario of the Campus and the above increase of discharge rates have been accommodated for.

However, the distribution of the above flow increases over the current detention ponds have been reviewed and the increase of water depths in the ponds due to additional discharge has been considered in Table 7.7 below.

Table 7.7 – Change of catchment pond water level

OUTFLOW VOLUME AT DETENTION (100YR EVENT)				
Storm Duration (min)	Volume at Outlet - Proposed conditions(m3)	Volume at Outlet - Existing conditions(m3)	Volume Increase(m3)	Increase of water level(mm)
10	1205	1159	45	3
15	1567	1517	51	3.4
30	2271	2178	93	6.2
45	2758	2645	113	7.5
60	3039	2896	143	9.5
90	2979	2807	172	11.5

Given the above results, the increase of runoff due to the development (if not considered in the initial master plan design) can still be accommodated in the ponds with a negligible increase of the water level.

7.5. Stormwater Quality management

According to the Infrastructure Strategy Report No. CH9104 (May 1992) by the Public Works NSW (Refer Appendix C) for the current drainage system, a range of stormwater quality management measures across the current drainage system within the CH campus have been developed. Some of these measures include:

- Two stormwater retention/ detention basins with the incorporation of irrigation dams for water re-use.
- Two stormwater retention/ detention basins to manage and restrict sediment and erosion discharge into the external drainage system
- Stormwater flow attenuation by accommodating the peak flows in detention ponds and restricting the discharge into the council system.
- Sediment and litter traps for all stormwater outlets
- Integrating stormwater management into the landscape by the existing dams that incorporate multiple uses providing a variety of benefits, including water quality protection, stormwater detention and retention, public open space, and recreational and visual amenity of the community.

The core principles of WSUD with regard to stormwater management have been achieved by the masterplan design of the Coffs Harbour Campus.

Additionally, the following best management practices as per Coffs Harbour City Council's Water Sensitive Urban Design (WSUD) Guideline will be implemented for the proposed development:

- Cut and fill has been minimized follow the existing terrain excluding for the building platform, which needs to be raised above the designated flood level.
- The current overland flow path will be diverted into a landscaped swale with rock pitching to the outlet to provide scour protection.

- Building downpipes will be connected to the landscaped swale for initial treatment before discharging into the existing dams. The design is to minimise roofwater runoff by avoiding the channelling and concentration of flow to maintain natural drainage patterns of catchments.
- Car park drainage will be captured and directed to a GPT as end of pipe solutions to improve stormwater discharge.
- landscaped areas will be provided for filtering runoff, swale drains, and infiltration.
- An effective sediment and erosion control measures will be provided during the construction stage.

Above measures are conceptually precented on the Proposed Stormwater Management plan, which is attached to this report as Appendix D.

The above infrastructure Strategy Report by Public Works NSW does not consider water quality modelling and doesn't demonstrate the compliance of water quality to the current standards. Therefore, the above WSUD strategy has been compiled and modelled in MUSIC software to ascertain the compliance with the current Healthy Waterways Guidelines.

7.5.1 Water Quality Objectives (WQO)

The relevant water quality objectives as outlined under the Technical Design Guidelines for South East Queensland are as follows:

- 80% reduction in coarse sediment (TSS)
- 60% reduction in total phosphorous (TP)
- 45% reduction in total nitrogen (TN)

7.5.2 Modelling Approach

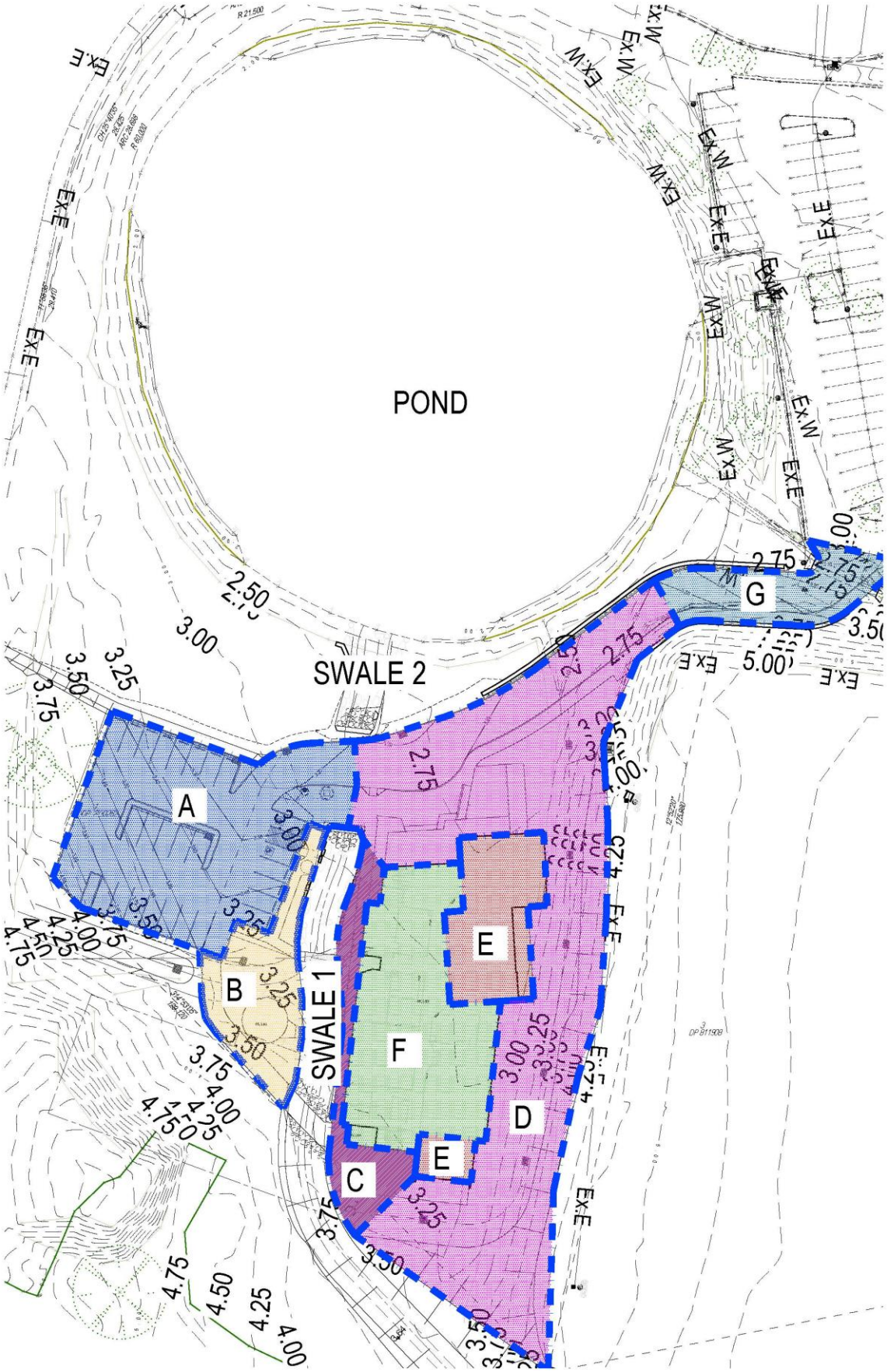
Conceptual stormwater quality modelling was undertaken using MUSIC Version 6.3, which is a widely accepted approach to assess the treatment train effectiveness within the land development industry. A combined MUSIC model was established for the sub catchments of the proposed development and the existing site to ascertain the pollutant reduction targets at the discharge point from the Campus.

7.5.3 Proposed Development Model

A treatment train has been established in accordance with the proposed design for the various catchments based on surface types as identified under "Water by Design – MUSIC Modelling Guidelines V1.0-2010". Each sub catchment has been separately inserted into the model with proposed treatment measures and relevant impervious / pervious percentages calculated from the proposed design.

The sub catchments of the proposed development as utilized in the modelling are shown below in Figure 7.3

Figure 7.3 - The catchment plan modelled in MUSIC for the proposed development


POND
SWALE 2
SWALE 1
A
B
C
D
E
F
G
Ex.E
Ex.W

7.5.4 Existing Site Model

In addition to the above, the existing site catchments have also been included in the model to identify the predicted pollutant concentrations at the outlet from the campus as requested by Coffs Harbour City Council (CHCC).

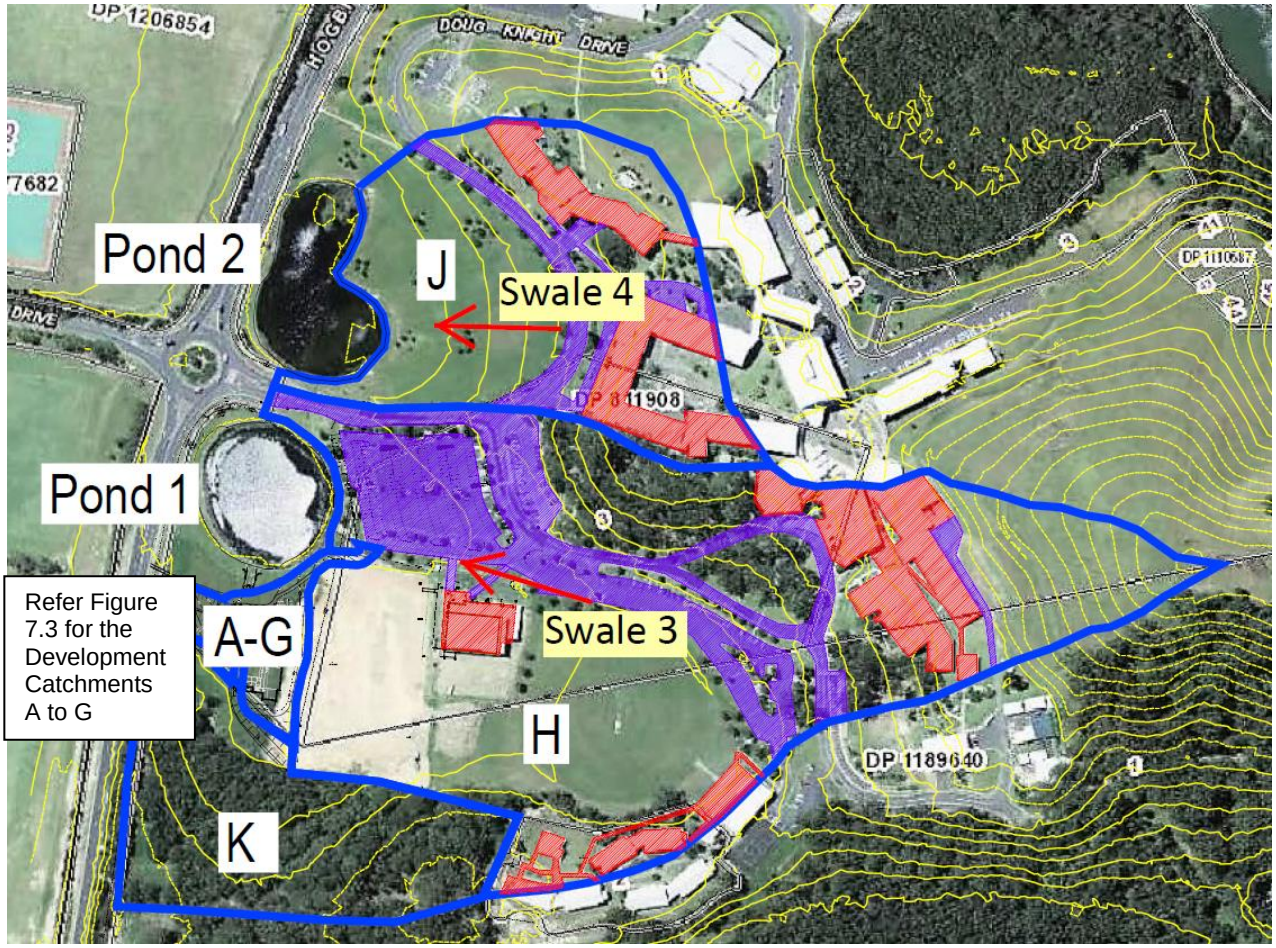
The existing site catchments, impervious parameters and land use have been identified based on the following assumptions:

1. The DTM (contours) provided by CHCC has been used to identify sub-catchments of the existing site into the existing lagoons/ ponds.
2. This Six Map by NSW Government has been used to identify the land use and impervious/ pervious parameters.
3. The existing inground drains, open channels, swales and stormwater quality improvement devices within the existing campus have been excluded from the model due to insufficient survey information.
4. The existing two ponds/ lagoons and overland flow paths (considered as 2 sperate swales over catchments J and H) have been modelled as the only treatment devices for the existing campus (verse case scenario).

The above approach has been discussed and agreed with the Urban Engineer | Sustainable Places Group at CHCC.

Based on the above, the sub catchments of the existing site as utilized in the modelling are shown below in Figure 7.4

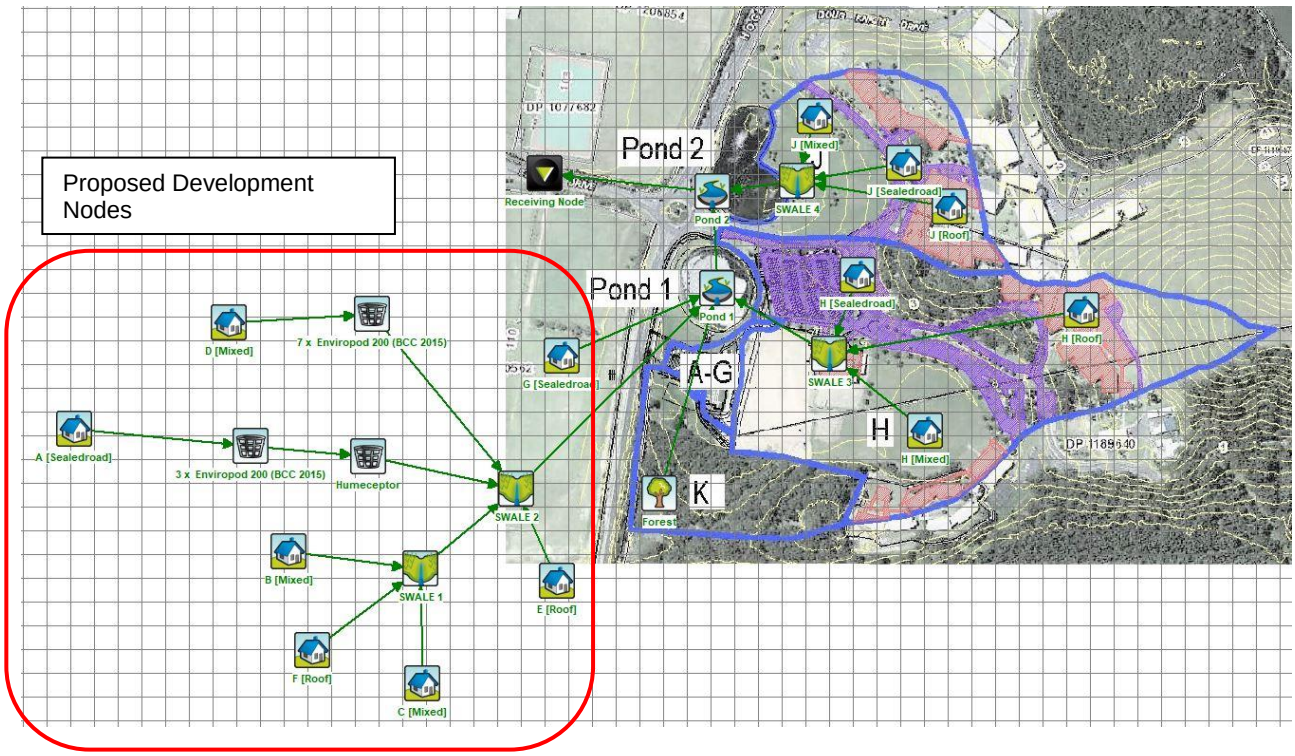
Figure 7.4 - The catchment plan modelled in MUSIC for the existing campus.



7.5.5 MUSIC Nodes

The combination of proposed development and existing catchment nodes in MUSIC are presented below in Figure 7.5.

Figure 7.5 - The treatment system layout modelled in MUSIC



The existing sub catchment 'K' towards the Pond 1 has been considered as a forest catchment with Default MUSIC Parameters.

7.5.6 MUSIC Node Input Parameters

The MUSIC model for the commercial land use has been established with the soil characteristics and water quality parameters as recommended in Table 7.8 and 7.9 below. These parameters are specified under the Water by Design Music Modelling Guidelines.

Table 7.8 - Soil Characteristics for Commercial Land Use

Parameter	Commercial
Rainfall Threshold (mm)	1
Soil capacity (mm)	18
Initial Storage (%)	10
Field Capacity (mm)	80
Infiltration Capacity Coefficient a	243
Infiltration Capacity coefficient b	0.6
Initial Depth (mm)	50
Daily Recharge Rate (%)	0
Daily Base Flow Rate (%)	31

Table 7.9 - Water Quality Parameters for Commercial Land Use

Pollutant	Flow conditions	Roof		Roads		Ground Level	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
TSS	Base Flow	N/A	N/A	0.78	0.39	0.78	0.39
	Storm Flow	1.30	0.38	2.43	0.38	2.16	0.38
TP	Base Flow	N/A	N/A	-0.60	0.50	-0.60	0.50
	Storm Flow	-0.89	0.34	-0.30	0.34	-0.39	0.34
TN	Base Flow	N/A	N/A	0.32	0.30	0.32	0.30
	Storm Flow	0.37	0.34	0.37	0.34	0.37	0.34

7.5.7 Meteorological Data

Six-minute rainfall data for Coffs Harbour area – plv058189 (6 Minute Time Step) was used in the MUSIC modelling.

7.5.8 Development Model Scenario Description

- Catchment A – Carpark and associated hardstand area will be captured and discharged through 3 Filter Baskets and a Gross Pollutant Trap (GPT) before discharging into the Swale 2
- Catchment B and C – Paths and landscaped area directly discharges into Swale 1
- Catchment D – Paths, landscaped areas and part access driveway captured and discharged through 7 Filter Baskets into the Swale 2
- Catchment E – Roof areas discharged into the Swale 2
- Catchment F – Roof areas discharged into the Swale 1
- Catchment G – Access crossover discharged into the Detention Pond

7.5.9 Treatment Devices

Swale 1 and 2 – Parameters were used from the detail design of the civil works
Enviropod Series 200 Filter Baskets - MUSIC nodes for the treatment device was provided by Stormwater 360
GPT – Standard nodes for 'Humeceptor GPT' have adopted
PONDS – Parameters of the existing detention ponds have been adopted based on the survey information and previous Infrastructure Strategy Report for the University. Some parameters such as Outlet Properties and Permanent Pool Volume have been estimated based on the available information.
SWALE 3 & 4 – Parameters adopted based on assumptions of the flow path over catchments J & H.

The MUSIC software file will be provided as a part of this Report submission and the detail inputs of the above devices can be viewed on actual MUSIC Nodes.

7.5.10 Water Quality Results

The water quality results based on the MUSIC model are summarized in the Table 7.10 below.

Table 7.10: Predicted Pollutant Export Concentrations (Standard Deviations)

Pollutant	Predicted Reduction (%)	Objective (%)
Total Nitrogen - TN	40.3	45
Total Phosphorus – TP	74.3	60
Total Suspended Solids - TSS	88.4	80

Compliance is achieved against the objectives for TP and TSS. Compliance is not achieved for TN, however, total predicted reduction is very close to the target reductions. Given the conservative approach of the model and exclusion of number of existing treatment opportunities within the campus due to insufficient information, we believe the above results are satisfactory and can be considered as in compliance against the target reductions.

8 Earthworks

No Significant earthworks are proposed for the development of the land. The earthworks associated with the development would be the fill platform for the building, excavation for the new carpark, services, driveway crossovers and the overland flow channels/ swales.

9 Sewer and Water Reticulation

The proposed sewer and water connections to and from the development will be provided from the existing infrastructure within the Campus and no external connections are proposed. The detail designs will be provided by the Hydraulic Consultant during Building Approval Stage.

10 Erosion and Sediment Control

Erosion and settlement control will comply with the best practice including the use of buffer strips, sediment fencing and silt control. These will be maintained until post construction stabilization has been completed. Detail erosion and sediment control plans will be prepared during the operational works design stage.

The outlet from the development to the Legal Point of Discharge will be provided with rock embedded on concrete as a scour/ erosion control measure.

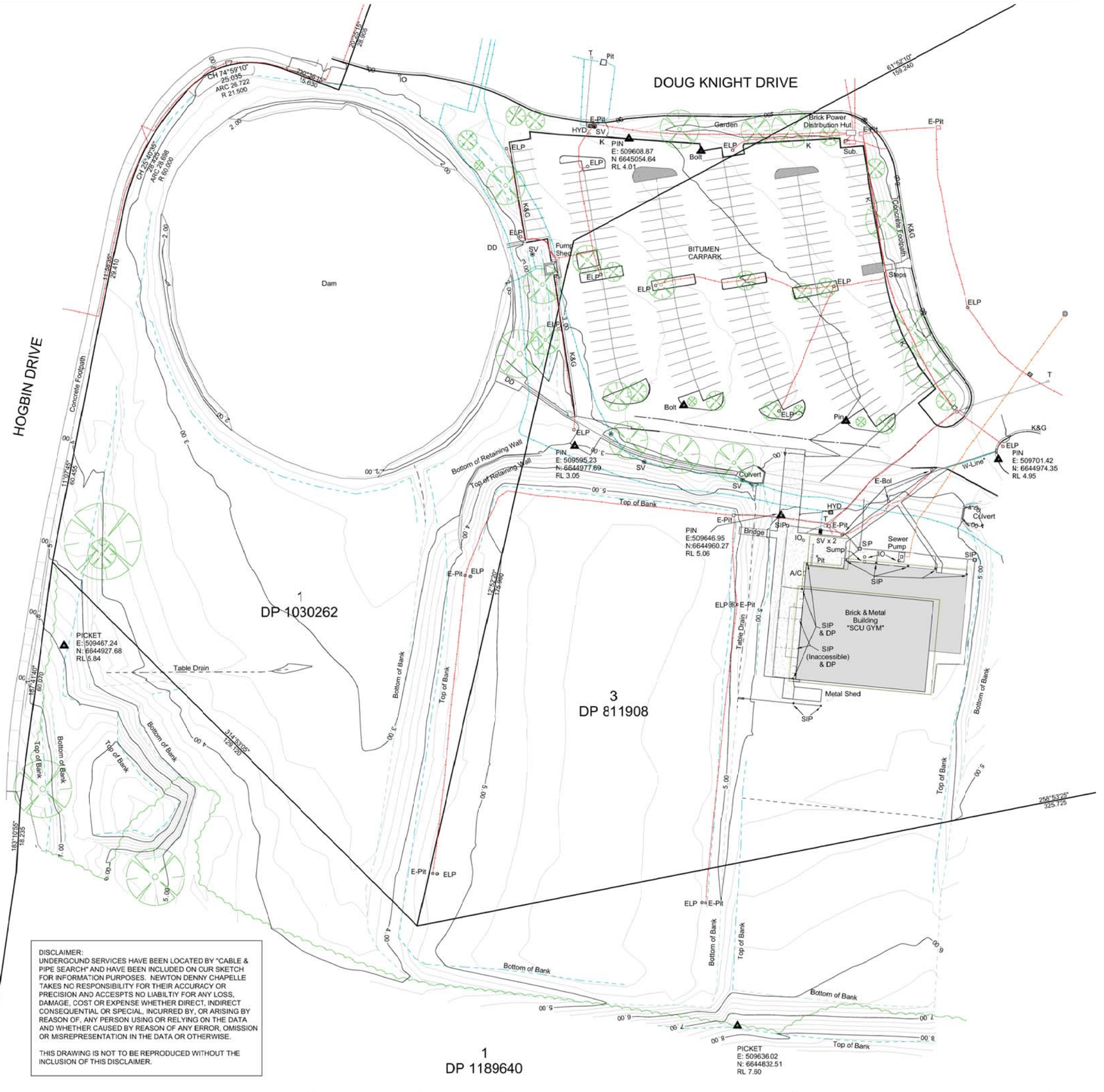
The sediment and erosion control will be addressed in the future operational works application.

11 Civil Response to Coffs Harbour City Council's Information Request

The civil related responses to the Coffs Harbour City Council's information request dated 03rd July 2018 are summarized below:

Council RFI	Response
Council considers that the proposed development needs to meet current water sensitive urban design (WSUD) principals rather than rely on principals established under the original University Masterplan. Please provide an amended concept stormwater management plan and accompanying details demonstrating that compliance with current WSUD criteria can be achieved (e.g. MUSIC modelling or compliance with South East Queensland Deemed to comply scenarios)	MUSIC modelling has been conducted for the proposed design and treatment train. The details including predicted pollutant reduction targets are now included in the revised concept stormwater management plan.
The revised plan models the proposed treatment systems as well as the existing pond. The modelling indicates Council's WSUD criteria are achieved if the treatment impact of the pond is considered (without the pond, the criteria are not achieved in respect to nitrogen reductions). The MUSIC model does not consider other existing development draining to the pond. Therefore, it does not provide an accurate assessment of the performance of the pond and the overall treatment performance.	The entire catchment has been modelled based on the assumptions and methodology as discussed with the CHCC Urban Engineer.
In summary, the additional information is inadequate and the applicant needs to either: • Revise the stormwater concept to achieve Council's WSUD criteria for the development before it discharges into the pond; or • Model the entire catchment of the pond to assess if Council's WSUD criteria are achieved when other existing inputs to the pond are considered.	

Appendix A: Detail Survey Plan



NOTES:

IO	- Denotes inspection outlet
SV	- Denotes stop valve
SIP	- Denotes surface inlet pit
E-Pit	- Denotes electricity pit
HYD	- Denotes hydrant
T	- Denotes communications pit
ELP	- Denotes electric light pole
K&G	- Denotes 150mm upright kerb & gutter
K	- Denotes upright kerb only
DP	- Denotes down pipe
DD	- Denotes dish drain
▲	- Denotes Survey Control Point
⊗	- Denotes tree
	- Denotes electricity line
	- Denotes storm water line
	- Denotes water line
	- Denotes sewer line
	- Denotes telecommunications line
	- Denotes tree Line
	- Denotes top of bank
	- Denotes bottom of bank
W-Line*	- Origin and destination of water line could not be determined using asset detection methods. Physical excavation will be required in order to determine location.
Flood Info.	- According to a report prepared by de Groot & Benscnn Pty Ltd "Geotechnical and Engineering Issues for Proposed Clinical Sciences Hub Southern Cross University – Coffs Harbour", the predicted 1 in 100 year flood level for the site is 2.95m AHD.

DISCLAIMER:
UNDERGCUND SERVICES HAVE BEEN LOCATED BY "CABLE & PIPE SEARCH" AND HAVE BEEN INCLUDED ON OUR SKETCH FOR INFORMATION PURPOSES. NEWTON DENNY CHAPELLE TAKES NO RESPONSIBILITY FOR THEIR ACCURACY OR PRECISION AND ACCESPTS NO LIABILTIY FOR ANY LOSS, DAMAGE, COST OR EXPENSE WHETHER DIRECT, INDIRECT CONSEQUENTIAL OR SPECIAL, INCURRED BY, OR ARISING BY REASON OF, ANY PERSON USING OR RELYING ON THE DATA AND WHETHER CAUSED BY REASON OF ANY ERROR, OMISSION OR MISREPRESENTATION IN THE DATA OR OTHERWISE.

0 5 10 15 20 25
1cm = 5m
1:500

Rev	Date	Amendment
A	30/11/2017	1 in 100 yr Flood Level nominated
B		
C		
D		
E		
F		
G		

Notes :

Design :
Survey : NDC
Drawn : DO'S
Approved:
Datum : AHD

Scale: 1:500@A1

Newton Denny Chapelle
Surveyors Planners Engineers
Email: office@newtondennychapelle.com.au

Lismore
Suite 1
31 Carrington St. Lismore 2480
T: 66 221011 F: 66 224088

Casino
100 Barker St. Casino 2470
T & F : 66 625000

Client:
Southern Cross University

Project :
Partial Detail Survey
SCU Coffs Harbour Campus
Doug Knight Drive
Coffs Harbour

Date 30 November 2017

Ref No. 16/408 REV A

Sheet 1 of 1

Dwg File: K:\Jobs\2016\16408 - SCU\Surveying\AutoCAD\16408 MASTER DETAIL.dwg - A1 Engineering

Appendix B: Proposed Site Plan

HOGBIN DRIVE

EXISTING DAM

15000 SETBACK

STORMWATER DRAINAGE

EXISTING TREES TO REMAIN

NEW FOOTPATH

63893

SWALE

CULVERT UNDER ROAD

STORMWATER DRAINAGE

PROPOSED ACCESS ROAD

NEW RETAINING WALL

EXISTING CARPARK

CULVERT UNDER ROAD

NEW RETAINING WALL

NEW 2m WIDE FOOTPATH

SEATING

FREE STANDING BUILDING SIGN

PROPERTY BOUNDARY

19

26

BICYCLE RACKS

DROP OFF

1

18

BINS

CARPARK
26 CARS

14

13

LP

16000 SETBACK

15000 SETBACK

7

6

SWALE

BRIDGE

PROPOSED BUILDING

EXTERNAL LEARNING SPACE

BRIDGE

MAINTENANCE PATH

21000 APZ

EXISTING SPORT FIELD
(SHOWN INDICATIVE ONLY)

3000 SETBACK

EXISTING CLUMP OF TREES TO REMAIN

SWALE

EXISTING BOUNDARY LINE

EXISTING BOUNDARY LINE

LP

PROPERTY BOUNDARY

EXTENT OF TREE LINE

EXISTING BOUNDARY LINE

DESIGN DEVELOPMENT
NOT TO BE USED DURING CONSTRUCTION

Issue	Description	Date	Chk	Auth
B	DA SUBMISSION	13.04.18	GH	LA
A	DRAFT DA SUBMISSION	06.04.18	GH	LA

Architect/ Designer
dwp
www.dwp.com

Client
SOUTHERN CROSS UNIVERSITY

Project
ALLIED HEALTH BUILDING

Location
HOGBIN DR, COFFS HARBOUR
NSW 2450

Project Number
AUBNE-16-0353

Drawing
SITE PLAN

Scale (A3)
1 : 500

Date Printed
17/04/18 8:43:05 AM

Drawing Number
DA102

Issue
B

File Name: BIM 360://dwp_16-0353_SCU_CH Campus_ Health Education Building/AUBNE-16-0353_SCUCHEB_R2017.rvt

Appendix C: Infrastructure Strategy Report – Existing Stormwater

PUBLIC WORKS

COFFS HARBOUR JOINT EDUCATION FACILITY

INFRASTRUCTURE STRATEGY REPORT

REPORT No. CH9104

Prepared for:

N.S.W. TECHNICAL AND FURTHER EDUCATION

DEPARTMENT OF SCHOOLS EDUCATION

MAY 1992

COFFS HARBOUR JOINT EDUCATIONAL FACILITY

INFRASTRUCTURE STRATEGY STUDY

Report No.CH9104

Prepared for :

N.S.W. TECHNICAL and FURTHER EDUCATION
DEPARTMENT of SCHOOLS EDUCATION

MAY 1992

COFFS HARBOUR JOINT EDUCATIONAL FACILITY

INFRASTRUCTURE STRATEGY REPORT

LIST OF TABLES

LIST OF EXHIBITS

APPENDICES

EXECUTIVE SUMMARY

GENERAL

This report establishes and assesses the options for the provision of infrastructure to the new Coffs Harbour Joint Educational Facility. It examines the following infrastructure :

* On-Site Sewerage Reticulation
* Sewage Treatment and Effluent Disposal
* On-Site Irrigation
* Off-Site Water Supply Services
* Stormwater Management
* Off-Site Roadworks
* Power Services to the Site
* Telecommunications Services to the Site.

The infrastructure has been examined for the following population projections and stagings :

POPULATION PROJECTIONS AND STAGING

Stage	1	2	Ultimate
Year	1995	2000	2010
Persons in Attendance : School	1,000	1,200	1,200
: TAFE	600	1,190	2,100
: UNE	700	1,900	2,600
Persons in Residence	Nil	100	400
TOTAL	2,300	4,300	6,300

ON-SITE SEWERAGE RETICULATION

An on-site sewerage reticulation system has been developed for both on-site and off-site sewage treatment. These two systems are shown at Exhibits 5A and 5B. In both cases, the Facility can be serviced by a full gravity system to one pump station or treatment plant. This is provided minimum floor levels are maintained on some buildings.

SEWAGE TREATMENT

Three sewage treatment options were considered as follows :

(1) Connection to the Coffs Harbour City Council's system via an on-site pumping station.

(2) Provision of an on-site treatment plant and sand filtration. Effluent disposal would be via effluent re-use and creek discharge.

(3) Provision of on-site treatment plant and membrane (Memtec) filtration. Effluent disposal would be via effluent re-use and creek discharge.

The options were examined on the basis of capital cost, operational costs, and ease of operation. Each option was subjected to a present worth cost analysis.

Connection to the Coffs Harbour City Council system is recommended, as it has the cheapest capital and operational cost. It has the least complex operation, only consisting of an on-site pump station pumping to Council's system. The works are shown at Exhibit 6, whilst the capital costs are as shown below :

STAGE	HEADWORKS CHARGES	PUMP STATION	TOTAL
1	$142,700	$105,000	$247,700
2	$116,800	NIL	$116,800
Ultimate	$116,800	$10,000	$126,000

The headworks charges are as expected by Coffs Harbour City Council. If these contributions are to be paid, they are reasonable when compared with on-site treatment plants.

ON-SITE IRRIGATION

Four options were examined to irrigate the site. They were as follows :

(a) Supply from town water reticulation

(b) Supply from on-site storage of run-off

(c) Re-use of effluent from Coffs Harbour Sewage Treatment Works

(d) Re-use of effluent from an on-site sewage treatment plant.

Supply from an on-site storage dam is recommended. It is the most economical option. Construction of the dam adjacent to Hogbin Drive, as shown on Exhibit 7, will also provide an aesthetic entrance to the Facility. Water will be pumped from this dam to high pressure sprinklers for grassed areas, and low pressure sprinklers for garden and horticultural areas.

The capital costs for the storage dam and irrigation distribution system are as follows :

STAGE	STORAGE DAM	DISTRIBUTION SYSTEM	TOTAL
1	$72,000	$130,000	$202,000
2	-	$30,000	$30,000
Ultimate	-	$40,000	$40,000

WATER SUPPLY

The current water service main to the site is inadequate for the Facility's demands and needs to be augmented with construction of a ring main link to Coffs Harbour or Sawtell. A computer analysis by Coffs Harbour City Council identified that Council would need to construct any one of the following :

(1) A 200 mm main from Coffs Harbour, at a cost of $300,000

(2) A 200 mm main from Sawtell, at a cost of $240,000

(3) A 150 mm main from Coffs Harbour, at a cost of $240,000.

Each option is shown at Exhibit 10. Supply from Sawtell will not give adequate pressure to all levels of the site. The 200 mm and 150 mm mains from Coffs Harbour give acceptable pressures. The 150 mm main is recommended on the basis of cost.

Council advised that it expected that the facility should pay for installation of the ring main and a headworks contribution. These charges are as follows :

STAGE	SERVICE MAIN	HEADWORKS CHARGES	TOTAL
1	$240,000	$43,400	$273,400
2	-	$66,000	$66,000
Ultimate	-	$115,900	$115,900

If contributions are to be paid, then the headworks charges are reasonable. However, the Facility should not pay the full cost of the service main augmentation. Council's system will benefit via increased security of supply and higher pressures to areas along Hogbin Drive.

Use of rainwater tanks to supplement supply is not recommended. Any savings in capital and operating costs for the reticulation system would most likely be exceeded by the cost of providing a secondary rainwater supply system.

STORMWATER

The Facility's development will generate increased stormwater run-off as a result of the impervious surfaces created.

A stormwater management strategy has been developed and is shown at Exhibit 10. It consists of a stormwater retention basin to cater for the increased run-off to Hogbin Drive. This basin has been incorporated with the irrigation dam to provide an aesthetic entrance. Sediment and litter traps will be required for all stormwater outlets.

Coffs Harbour City Council agrees with the management strategy.

The estimated cost for the basin is $35,300. Surplus spoil from the construction of the dam and basin is estimated at 12,000 cubic metres. This can be utilised on site for construction of playing fields.

ROADWORKS

Existing access to the site is via Hogbin Drive. The Facility will ultimately double the existing peak hour load along Hogbin Drive. Access to the site will need to be via a roundabout and possibly additional left turning slip-lanes.

Council has advised that the cost of the roundabout is expected to be met by the Facility. It also expects the Facility to contribute to upgrading of Hogbin Drive. That level of contribution has not been determined by Council. Council also advised that access to the playing fields opposite the site via pedestrian crossings would not be permitted. It suggested an overhead pedestrian bridge.

If Council charges are to be paid, the cost of the roundabout should be met by the Facility. This cost is estimated by the P.W.D. at $350,000. A pedestrian bridge to the playing fields is estimated to cost $300,000, and is not recommended. The money would be better spent on constructing on-site playing facilities.

If any contribution is sought for upgrading Hogbin Drive, Council will need to clearly establish on what basis it has been formulated considering the benefit to which the general public will benefit and the Facility's staged development.

POWER SUPPLY

The local power supply authority has an established supply grid in the vicinity of the site. Northern Rivers Electricity have advised that the adjacent mains will need to be augmented at full cost to the Facility. A system augmentation (headworks) charge will also apply. The provision of on-site high voltage power mains will also have to be paid for by the Facility. All these costs are summarised below.

STAGE	SERVICE MAIN	HEADWORKS CHARGES	ON-SITE CABLES	TOTAL
1 & 2	$33,000	$43,337	$200,128	$276,465
Ultimate	-	$31,807	$129,000	$160,807

TELECOMMUNICATION

Telecom advised that it will provide an optical fibre service to a central distribution point within the site. The costs invlvolved will not be required to be met by the Facility. The cost of the distribution system within the site would have to be met by the Facility and be subject to open tender.

INFRASTRUCTURE COST ESTIMATE

The estimated capital costs for the off-site infrastructure and some on-site infrastructure are shown at the Summary Table. They will need to be confirmed when development proposals are finalised. Coffs Harbour City Council has advised that it "is anxious to assist to ensure that development may commence at the earliest possible date...". Negotiations should be held with Council, and to a lesser extent Northern Rivers Electricity, to either reduce or verify the infrastructure charges they wish to apply to the Facility.

1.0 INTRODUCTION

This Strategy Study establishes and assesses the options for the provision of infrastructure to the new Coffs Harbour Joint Educational Facility. It has been undertaken by the Public Works Department on behalf of the Technical and Further Education Commission and the Department of Schools Education, New South Wales.

The Facility will be located at a site on Hogbin Drive, a secondary road distributor linking Sawtell to Coffs Harbour. The site location is shown at Exhibit Two.

The site will be developed to accommodate the combined educational needs of a University of New England Campus, a T.A.F.E. College and a Senior High School. Development will occur over three stages with Stage 1 reached in Year 1995, Stage 2 in Year 2000 and the ultimate Stage in Year 2010.

2.0 OBJECTIVES

The objective of the study is to determine the necessary works to provide infrastructure for for the following categories:

- On-site Sewerage Reticulation
- Sewage Treatment and Effluent Disposal
- On-site Irrigation
- Off-site Water Supply Services
- Stormwater Management
- Off-site Roadworks
- Power Supply Services to Site
- Telecommunication Services to Site

In each category the objectives are to:

- Determine the Facility's demands for the services at each development stage.
- For those demands, examine the options to provide the required infrastructure.
- For each option, evaluate the costs involved in constructing the infrastructure, with consideration of staging works to suit development and to be cost effective.
- Establish, where appropriate, the most economical and viable option of infrastructure provision.
- Comment, where appropriate, on the costs imposed by local authorities for their supply of infrastructure works.

3.0 PLANNING DATA

3.1 LOCATION

The site chosen for the Joint Education Facility is shown at Exhibit One. It is approximately 3 kilometres south of Coffs Harbour City and 3 kilometres north of the town of Sawtell. It occupies 141.2 hectares and is land dedicated to the Facility by Coffs Harbour City Council, identified as Lots 2, 3 and 4, Deposited Plan 811908. Lot 2 is the T.A.F.E. site, Lot 3 is the High School Site and Lot 4 is the University of New England, Northern Rivers site. The site is currently zoned 1(5) Rural but that zoning is currently being amended to zone 5, Special Uses Education.

3.2 PLANNING PROJECTIONS

Each education authority has provided its projection for development of the site. These projections are shown at Table 3.1 for the three stages adopted.

Table 3.1
POPULATION PROJECTIONS

Stage	1	2	Ultimate
Year	1995	2000	2010
Persons in Attendance			
- School	1000	1200	1200
- TAFE	600	1190	2100
- UNE	700	1900	2600
Persons in Residence	Nil	100	400
TOTAL	2300	4300	6300

3.3 SITE DEVELOPMENT CONSTRAINTS

The provision of infrastructure to the site is affected by planning constraints which control development. These are shown at Exhibit Two and are commented on as follows :

(a) The waters of Newports Creek are classified a Class P - Protected Waters under the Clear Waters Act, 1970. Class P waters are waters into which:

- Untreated wastes are not to be discharged.
- No sewage overflows are permitted
- Effluent from treated waste must be diluted by material wastes to a minimum of 19 times
- Only strict minimum amounts of suspended solids, grease, oil and nutrient are allowed to be discharged.

Those requirements will affect the consideration of on-site sewage treatment and stormwater management.

(b) Portions of the site are zoned 7 (w), Environmental Protection (Wetlands), 7(b) Environmental Protection (Buffer), and 6(b) Open Space (Proposed). Zone 7(b) aims to preserve the ecological or scenic value of the land and provide a buffer to wetlands and watercourses. Zone 7 (w) aims to protect coastal wetlands. Zone 6 (b) aims to preserve open space around an osprey nesting site.

So the type and location of sewage treatment facilities, sewage reticulation, irrigation storage, roads, stormwater management structures and underground conduits will not be allowed if they conflict with the aims of any of the above zones.

(c) Parts of the land are below the 1 in 100 year flood level. Any structures in those flood affected areas should be protected from flooding and not significantly affect the flood levels of Newports Creek. Structures likely to be affected will be sewage pumping stations, treatment plants, irrigation dams, electrical transformers, and roadworks.

3.4 BUILDING LAYOUTS

Based on advice from Public Works Department's State Projects - Schools Education and the UNE's consulting architect, the concept building layout for the total facility is as shown on Exhibit Three. The position and size of the buildings is conceptual only and subject to final design.

3.5 AUTHORITIES CONTROLLING INFRASTRUCTURE DEVELOPMENT

Exhibit Four shows schematically the authorities who have input into infrastructure development for the site and what type of infrastructure they are concerned with. Coffs Harbour City Council, Northern Rivers Electricity and Telecom expect cash contributions for the provision of off-site and, in some cases, on-site infrastructure. These authorities, along with the Environmental Protection authority, have control over some technical standards applicable to infrastructure works.

7.0 STORMWATER

7.1 STORMWATER MANAGEMENT REQUIREMENTS

Development of the site will necessitate stormwater drainage works to cater for increased runoff concentration. Drainage basins have been identified as shown on Exhibit 11. Only one of these basins has an affect on an existing drainage system i.e. the basin draining to Hogbin Drive and Marshall's Estate Playing Fields.

Council was requested to provide their requirements for stormwater management. Council's reply was as follows :

1. A retention basin would be required on the facility site, to retard the increased run-off. The cost of that basin would be at full cost to the facility.

2. Trash screens would be required at all stormwater outlets to the creek.

3. No headworks contributions for downstream drainage works will be applicable.

7.2 STORMWATER MANAGEMENT STRATEGY

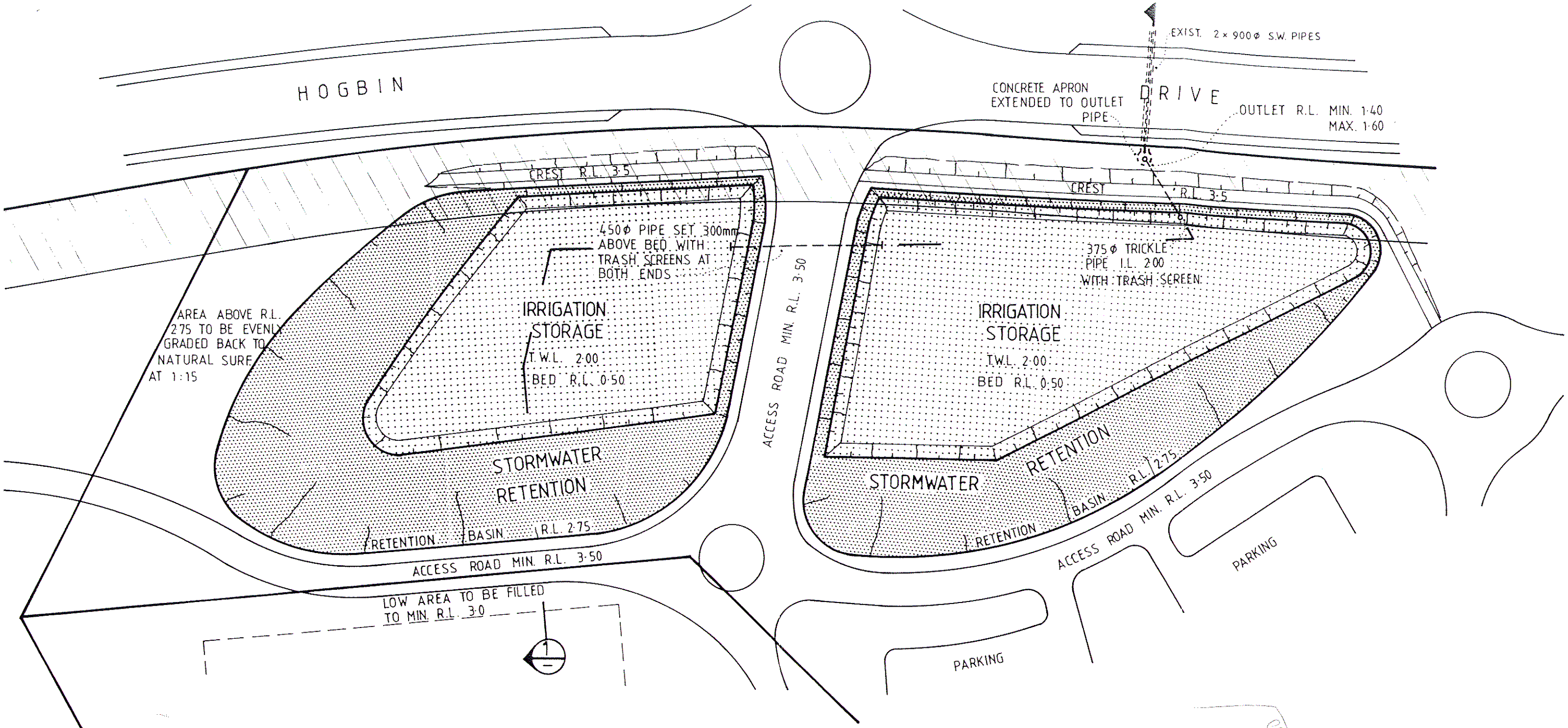
The stormwater management strategy is shown at Exhibit 11. It consists of a retention basin incorporated with the irrigation storage and trash screens located at every outlet to the creek. The retention basin will be required at Stage 1, with trash screens incorporated as design policy.

The Irrigation Management Service, N.S.W. Agriculture & Fisheries, was engaged to cost and design the combined retention/irrigation storage. The I.M.S. Study is shown at Appendix C. The detailed design is shown at Exhibit 8 and Appendices 3 and 4 of Appendix C.

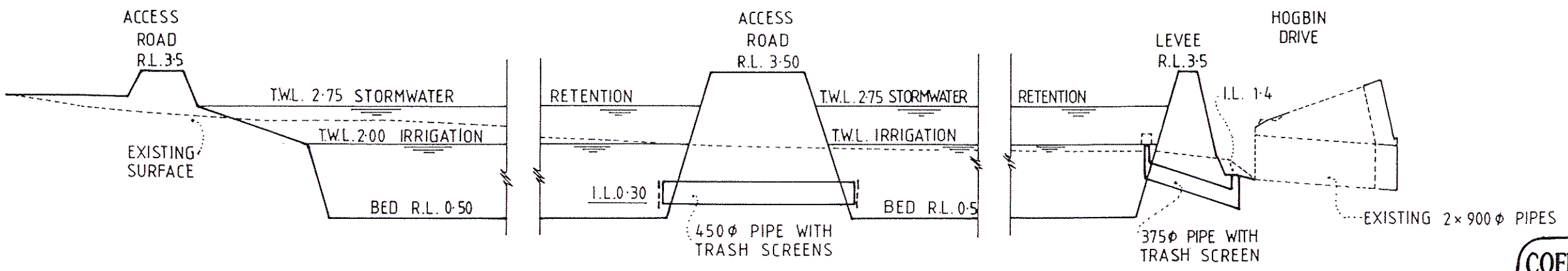
The retention basin is designed to cater for a 1 in 100 year storm event. Normal practice for retention basins is to drain the design storm in less than 12 hours. So I.M.S. have designed a 12 Ml capacity basin with a restricted pipe outlet to drain the design storm event in 9.7 hours.

The basin will be located either side of the main entrance road, and will store 12 Ml at a depth of 0.75 metres. The retention bed of the basin will, under normal conditions, be empty and grassed to allow ease of maintenance.

I.M.S. advise that the estimated cost of the basin is $28,000 for the embankment earthworks, and $7,500 for the oulet pipework, giving a total cost of $35,300. Construction of the basin and irrigation storage will result in a spoil surplus of 12,000 cubic metres. This spoil can be used in constructing playing fields on the High School site.



PLAN
1 : 1000



SECTION 1/-
HORIZ 1 : 1000
VERT. 1 : 100

COFFS HARBOUR JOINT EDUCATION FACILITY
IRRIGATION STORAGE/STORMWATER RETENTION PONDS DETAIL
EXHIBIT 8

EXISTING DRAINAGE 2 × 1500 ϕ CULVERT WITH FLOOD FLAPS

EXISTING DRAINAGE 2 × 900 ϕ CULVERT

SEDIMENT AND LITTER TRAPS AT ALL OUTLET TO NEWPORT CREEK SHOWN THUS

ESTATE

FIELDS

MARSHALL

SPORTING

DRIVE

HOGBIN

BOUNDARY

PARKING

HOSPITALITY

BUSINESS CENTRE

ROAD

COMPUTERS & GENERAL LEARNING

T.A.F.E.

ADMINISTRATION

IRRIGATION STORAGE

STORMWATER RETENTION

GYMNASIUM SPACE

PERFORMANCE

GENERAL LEARNING SPACE

HIGH SCHOOL

LIBRARY

SCIENCE

MUSIC & ART

CANTEEN

P.E. COURT

PLAYING FIELD

TECHNOLOGY & APPLIED SCIENCE

DRAINAGE

PATH

BASIN

NEWPORTS CREEK (TIDAL)

CONVENTION CENTRE

ENVIRONMENT PROTECTION ZONE

THEATRES

LIBRARY

UNION

SERVICE ROAD

ENTRANCE & ADMINISTRATION

FACULTY BUILDINGS

UNIVERSITY

OSPREY NEST & RESERVE

RL 20

RESIDENTIAL

WETLANDS

APPROX. BOUNDARY ONLY

40 20 0 40 80 120 160 200m

SCALE

COFFS HARBOUR JOINT EDUCATION FACILITY

STORMWATER DRAINAGE MANAGEMENT STRATEGY

EXHIBIT 11

Appendix D: Proposed Stormwater Management Plan

900mm MAX. HIGH GABION BASKET STONE WALL. DESIGN, CONSTRUCTION AND CERTIFICATION BY THE CONTRACTOR/ INSTALLER (REFER GEOTECNICAL REPORT NO. RGS31440.1-AC BY REGIONAL GEOTECHNICAL SOLUTIONS FOR DESIGN REQUIREMENTS)

OVERLAND FLOW PATH. REFER LANDSCAPE DRAWINGS FOR SURFACE TREATMENT

GROUTED ROCK BEACHING/ CHECK DAM TO THE OUTLET (15m² APPROX.)

HUMECEPTOR STC3 GROSS POLLUTANT TRAP

ASPHALT CARPARK

CONCRETE DRIVEWAY

100Ø uPVC (SN8) @ 1:100 MIN.

GROUTED ROCK BEACHING TO THE OUTLET (15m² APPROX.)

400mm MAX. HIGH ROCK RETAINING WHERE REQUIRED. REFER LANDSCAPE DRAWINGS

DOWNPIPE CONNECTIONS (WEST) TO OPEN DRAIN

DOWNPIPE CONNECTIONS (EAST) TO INGROUND DRAIN

FFL 3.850

FFL 3.800

OVERLAND FLOW PATH. REFER LANDSCAPE DRAWINGS FOR SURFACE TREATMENT

CUT OFF DRAIN

GROUTED ROCK BEACHING TO THE OUTLET (15m² APPROX. FOR EACH SIDE)

800mm MAX. HIGH GABION BASKET STONE WALL. DESIGN, CONSTRUCTION AND CERTIFICATION BY THE CONTRACTOR/ INSTALLER (REFER GEOTECNICAL REPORT NO. RGS31440.1-AC BY REGIONAL GEOTECHNICAL SOLUTIONS FOR DESIGN REQUIREMENTS)

REMOVE AND DISPOSE EXISTING GABION WALL. CONTRACTOR MAY USE STONE TO CONSTRUCT NEW GABION WALLS

INVERT LINE (TYP)

TOE OF BATTER (TYP)

FIELD INLET PIT (TYPICAL)

GRADE LINE (TYP)

1 DP 1030262

3 DP 811908

REFER DRAWING CSK2 FOR CONTINUATION

LEGEND

SYMBOL	DESCRIPTION
PROPOSED	
	PROPOSED BUILDING FOOTPRINT
43.3	PROPOSED CONTOURS
FS43.520	PROPOSED FINISHED SURFACE LEVEL
TW43.520	PROPOSED FINISHED WALL LEVEL (TOP OF WALL)
	DIRECTION OF FALL (PROPOSED SURFACE)
	PROPOSED STORMWATER PIT, LINE AND FLOW DIRECTION
4/1	PROPOSED STORMWATER PIT NUMBER (STRUCTURE NUMBER OF LINE NUMBER)
FP SSD	FLUSH POINT AND SUB SOIL DRAIN
	CHANGE OF GRADE LINE (RIDGE OR VALLEY)
EXISTING	
12.8	EXISTING (PRE-DEVELOPMENT) SURFACE LEVEL
13	EXISTING CONTOURS
Ex.D	EXISTING STORMWATER
Ex.S	EXISTING SEWER
Ex.W	EXISTING WATER
Ex.E	EXISTING ELECTRICITY
Ex.T	EXISTING COMMUNICATION LINE
S SW	EXISTING SEWER AND STORMWATER MANHOLES

ABBREVIATIONS

CHCC	COFFS HARBOUR CITY COUNCIL
FFL	FINISHED FLOOR LEVEL
UNO	UNLESS NOTED OTHERWISE

REV	DESCRIPTION	BY	DATE
P1	PRELIMINARY ISSUE	SK	06-04-18
P2	DA ISSUE	SK	18-04-18

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PROJECT NORTH

ARCHITECT LOGO: dwp

CLIENT LOGO: Southern Cross University

MEINHARDT
Meinhardt Australia Pty Ltd
A.C.N. 010 014 776
Level 2, 135 Wickham Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3018 5000
F: +61 7 3018 5099
info@meinhardtgroup.com
http://www.meinhardtgroup.com

CLIENT
SOUTHERN CROSS UNIVERSITY

PROJECT
CH CAMPUS HEALTH EDUCATION BUILDING
HOGBIN DRIVE, COFFS HARBOUR, NSW

TITLE
STORMWATER MANAGEMENT PLAN SHEET 1

STATUS
PRELIMINARY NOT FOR CONSTRUCTION

DESIGNED	DRAWN	APPROVED	DATE	SCALE @ A1	SHEET
SK	SK	PD	MAR 2018		1 OF 2

PROJECT No	DRAWING No	REV
117904	CSK1	P2

REFER DRAWING CSK1 FOR CONTINUATION

GROUTED ROCK BEACHING TO THE OUTLET (15m² APPROX.)

400mm MAX. HIGH ROCK RETAINING WHERE REQUIRED. REFER LANDSCAPE DRAWINGS

DOWNPIPE CONNECTIONS (WEST) TO OPEN DRAIN

DOWNPIPE CONNECTIONS (EAST) TO INGROUND DRAIN

OVERLAND FLOW PATH. REFER LANDSCAPE DRAWINGS FOR SURFACE TREATMENT

FFL 3.850

FFL 3.800

CUT OFF DRAIN

GRADE LINE (TYP)

INVERT LINE (TYP)

TOE OF BATTER (TYP)

TOP OF BATTER (TYP)

FIELD INLET PIT (TYPICAL)

GROUTED ROCK BEACHING TO THE OUTLET (15m² APPROX. FOR EACH SIDE)

EXISTING OVERLAND FLOW PATH

EXISTING OVERLAND FLOW PATH

3
DP 811908

Ex.E

IL2.716
IL2.836
IL2.950
IL3.000
IL3.100
IL3.150
IL3.250
IL3.270
IL3.700
IL4.000

3+64

314°55'05"
129.420

REV	DESCRIPTION	BY	DATE
P1	PRELIMINARY ISSUE	SK	06-04-18
P2	PRELIMINARY ISSUE	SK	13-04-18

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PROJECT NORTH

N

ARCHITECT LOGO

dwp

CLIENT LOGO

Southern Cross University

MEINHARDT

Meinhardt Australia Pty Ltd

A.C.N. 010 014 776

Level 2, 135 Wickham Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3018 5000
F: +61 7 3018 5099
info@meinhardtgroup.com
http://www.meinhardtgroup.com

CLIENT
SOUTHERN CROSS UNIVERSITY

PROJECT
CH CAMPUS HEALTH EDUCATION BUILDING
HOGBIN DRIVE, COFFS HARBOUR, NSW

TITLE
STORMWATER MANAGEMENT PLAN
SHEET 2

STATUS
PRELIMINARY
NOT FOR CONSTRUCTION

DESIGNED	DRAWN	APPROVED	DATE	SCALE @ A1	SHEET
SK	SK	PD	MAR 2018		2 OF 2

PROJECT No	DRAWING No	REV
117904	CSK2	P2