Attachment 5 – Stormwater and Flooding Response

5001_23_03_03_council rfi response_rev2.docx

3rd March 2023

General Manager
Ballina Shire Council
PO Box 450
BALLINA NSW 2478

ATTN: Noramon Decharat and Patrick Knight

Dear Noramon and Patrick,

RE: EAC MASTERPLAN DA2022/75
EMMANUEL ANGLICAN COLLEGE
LOT 1 DP 1278708, 62 HORIZON DRIVE, WEST BALLINA.

Ardill Payne & Partners (APP) has reviewed Council's Request for Additional information dated 20 September 2022 as well as subsequent meeting (6 October 2022) and email correspondence in relation to this RFI. Please find below a summary of the sites stormwater history as well as responses to items 5-9 of Councils RFI. The RFI items have been copied below in italics for ease of review.

In addition to the below being responses to Councils RFI items it also effectively covers the items raised in various submissions to Council in relation to the proposal. The main items raised within the submissions relate to the loss of storage within the Colleges southern oval due to the construction of the Multipurpose Centre as well as associated filling for the Multipurpose Centre.

Site Stormwater History

Building on the college site was commenced in 1999, since that time the college has continued to expand. The summary below outlines the changes to site stormwater discharge locations as well as changes to the external receiving systems.

The college has effectively had 3 catchments since its inception. There have been minor changes to the catchment boundaries over the College's development. More significantly there have been changes to discharge points of these catchments as discussed below. Plans showing the catchment boundaries and discharge points for major flows at various periods of times have been enclosed as Appendix A. The various time periods are further discussed below.

Pre 1999 – The college site was undeveloped and the surrounding housing estate was in place. Council asset stormwater drainage had been installed with discharge of the drainage line extending north through 54 Horizon Drive (SP 69608) and discharging to open drains within Lot 137 DP 858896 and Lot 2 DP500372. These open drains outfall to Fishery Creek to the north east. To the south of the site an open drain running parallel with the River Street (formally Pacific Highway) flowed west with outfall to

Emigrant Creek adjacent to the Emigrant Creek boat ramp. These two drainage routes would have been the discharge points of the site prior to development.

1999-2000 – the college site commenced development with filling of the northern portion of the site and construction of the first stage of buildings being completed. At this time, the three primary catchments for the site were defined. Catchment 1 consists of the partially filled northern portion of the site which discharged to the north in accordance with Councils directions through the initial development approval process. This catchment discharges via a detention basin constructed in the north eastern corner. This basin was designed to accommodate the completed initial masterplan at the time of its construction. Catchment 2 consists of a small portion in the east of the site. This catchment effectively runs from the eastern boundary across the parking, pickup and set down area. This catchment discharges to Horizon Drive. Catchment 3 is the southern portion of the site, at this period of time this catchment discharged to the south west via the open drain along River Street.

1999-2005 – during this period the College was operational with the catchments and discharge locations effectively unchanged from above. New buildings within Catchment 1 were being constructed and occupied.

2005/2006 – during this period the catchment boundaries were still effectively unchanged. Outside of the site the neighbouring Riverbend development as well as Riverbend Drive and roundabout with River Street (then Pacific Highway) was under construction. During this period a major change to the discharge point of Catchment 3 occurred. As part of the Riverbend Drive construction the open drain which was the primary drainage point for Catchment 3 was filled and no culvert provision below Riverbend Drive to drain the southern portion of the site was provided. Due to this blocking of the natural drainage point of this catchment the school was directed by Council to discharge Catchment 3 to the existing piped network within Horizon Drive. This change to the discharge point of Catchment 3 effectively increased the Colleges catchment discharging to this network over seven fold.

2006-2019/2020 – During this period the Colleges catchments and discharge locations effectively remained constant post Riverbend construction. Additional buildings were constructed within Catchment 1, the later buildings in the far north having onsite detention tanks to attenuate flows from the additional roof area despite the original detention basin being sized to accommodate them.

The drainage solution of the Catchment 3 implemented as directed by Council post Riverbend construction achieved approximately 0.5% longitudinal fall to the invert of the pipe network. This in effect meant that the college oval ponded water during rainfall events as the pipe network filled and back flowed into the oval. The water on the oval was slow draining as the pipe network had to fully discharge prior to drainage of the site. Also during this time the northern portion of the oval was incrementally filled in an attempt to achieve additional grade and improve drainage times of the oval.

2019 – 2022 – During the construction of the recent Multi-Purpose Hall approval was sought and achieved to reinstate a drainage discharge under Riverbend Drive to the then open drain running west along River Street. Subsequently the Council completed the River Street duplication through this portion and piped the open drain further to the west. The construction of the Multi-Purpose Hall and

associated carparking infrastructure increased the size of Catchment 2 with a portion of the Hall and carpark areas now included in this catchment. The Multipurpose Hall was provided with a 30 kL onsite detention tank to mitigate flows from the Multipurpose Hall in addition to the 31 kL of detention storage provided in the bio-retention basin constructed at the same time. Whilst this posed an increase to Catchment 2 in normal rainfall events overflow from the basin and detention tank is directed south west to the newly constructed culvert below Riverbend Drive. The reinstatement of the south western culvert effectively reduced the Colleges discharge toward Horizon Drive network.

2022 – Future – The proposed masterplan will implement onsite detention tanks to mitigate post development flows to current flow rates for events up to and including the Q100 event. The size of the proposed tanks is nominated on '5001-SMP01 Rev B Stormwater Management Plan' which was included within the 'Infrastructure Services Report' prepared by APP for the DA submission.

Further the College is committed to providing an overland flow path from the northern corner of Horizon Drive through the north eastern corner of the site to the open drainage system to the north. Council and the College are collaborating on the optimal arrangement for this overland flow path. The flow path is intended to allow ponded water within Horizon Drive to discharge via overland flow once at this level rather than relying on Councils piped network for discharge of all events up to and including the 1:100 year event. In addition to overland flow this corridor could also be utilised by the Council for pipe duplication if this provides greater stormwater drainage benefit to the surrounding area.

5. Stormwater management

A stormwater conveyance plan is required that clearly specifies the following:

- *Internal catchments, details of internal conveyance infrastructure (plan locations, sizes, grades, invert levels, flow capacities) flow rates in design events in both piped systems and overland flow paths.*
- *The legal points of discharge.*
- *Analysis of external conveyance infrastructure that demonstrates there is sufficient spare capacity available to accommodate runoff from the school; from the school boundary to the ultimate discharge points at Fishery Creek (east of Barlows Road) and Emigrant Creek (south of River Street).*

Further Drains modelling for the three site catchments for the pre-developed (1999), existing case (2022) and final masterplan has been completed. A summary of the discharge rates for the 10, 20 and 100 year ARI events is within the table overleaf.

Table 1 - Peak Catchment Flow Rates

ARI Event	Development Phase	Catchment Flow Rate (L/s)			
		1	2	3	Total Site
10	Pre Development	774	416	571	1761
	Existing Case	724	429	574	1727
	Final Masterplan	736	429	552	1717
20	Pre Development	887	477	655	2019
	Existing Case	845	497	657	1999
	Final Masterplan	860	492	639	1991
100	Pre Development	1140	612	840	2592
	Existing Case	1040	629	840	2509
	Final Masterplan	1060	620	788	2468

The modelling results confirm that the peak flow rates for the existing and final development case as a whole of site are reduced from the predeveloped case.

In addition to the above, following our meeting on the 6 October, it was agreed that review of overland flow routes for runoff which exceeds the capacity of the piped network system intended to convey minor events as this is the portion of stormwater which potentially effects neighbouring properties and the wider community.

This review of the wider area utilised NSW Government Spatial Services Light Detection and Ranging (LiDAR) data, Council infrastructure GIS, available field survey, site inspections and local knowledge. Based on this review three primary overland flow routes have been identified which would discharge excess flows from the site. A summary sketch '5001-SK05 Overland Flow Path on LiDAR Elevations' has been prepared showing coloured elevation bandings between RL1.0m AHD (red) to 2.5m AHD (blue). Areas of elevation above or below this banding extents is displayed as the solid colour.

These overland flow paths are generally summarised as follows:

1. Through the north eastern corner to Fishery Creek via open drainage north of Horizon Drive (northern portion of site)
2. To River Street running east and down Riverview Avenue (southern portion of site)

There exists a high point in Horizon Drive at 55 Horizon Drive which prevents water traveling north or east into Westland Drive up to approximately 1.60-1.65m AHD. This highpoint separates overflow routes 1 and 2. The local high point within River Street is approximately 1.5m AHD which would allow overland flow to preferentially travel east along River Street rather than North along Horizon Drive.

Further the levels of Riverbend Drive and intersection with River Street prevent overland flow to the west.

6. Other stormwater issues

The MUSIC model and MUSIC-link results provided in the Infrastructure Services Report are not identical. Please provide clarification of these figures. In addition, the DRAINS and MUSIC figures are required to be amended to indicate the location of the legal point of discharge.

MUSIC modelling has been reviewed and confirmed MUSIC-Link results are enclosed. The MUSIC model can be provided at Councils request.

7. Overland flow details

Council adopted the Ballina Island and West Ballina Overland Flood Study and Flood Protection Feasibility Study and Plan at the meeting held 26 May 2022. Subsequent investigations have identified a low point in Horizon Drive near the northern school site boundary and SP 69608. The proposal is required to include an unobstructed overland flow path from this low point to discharge to Lot 137 DP 858896.

As discussed within item 5 the College has provided a commitment to Council to investigate and facilitate an overland flow path from the north western corner of Horizon Drive through the site and north to Lot 137 DP 858896. Conceptual plans demonstrating potential gradients for an overland flow path through this area are enclosed within Attachment B.

Additional to overland flow path potential for pipe duplication through this corridor would also be possible if this were to provide a more favourable outcome. Council are currently modelling and reviewing the most effective solution within the available corridor. Formal agreements between the College and Council are being currently prepared.

8. Flooding

Plans are required that clearly show existing levels/contours/building footprints and proposed (to full extent of the Master Plan) levels/contours/building footprints.

Flood modelling is required to identify and quantify existing and proposed flooding impacts (including cumulative impacts) and associated flood impact mitigation measures.

The flood modelling is to consider flooding from riverine (Richmond River), local creek catchments, ocean storm surge and over land flow stormwater sources.

The modelling is also to take into consideration the impacts of the March 2022 flood events and the outcomes of subsequent studies such as the CSIRO Study that will focus on understanding the impact of climate, catchment and hydrological drivers on flooding in the Northern Rivers.

A report is required detailing proposed flood monitoring and flood evacuation plans to ensure all staff and students can be safely evacuated in the event of flooding of the site and access roads in events up to the PMF level.

Council has adopted the 'Ballina Flood Plain Risk Management Study 2012' prepared by BMT. The subject site is located within the riverine flood plain storage area. This report/study reviewed the impact of filling the Ballina Island, East and West Ballina (school site included) as one of the flood risk management measures. The conclusion of this was "the results showed that there was negligible flood impact (less than 5mm). This suggests that the filled areas lay within flood storage portions of the floodplain, and the lost flood storage due to the fill is small relative to the total flood storage available in the floodplain. Filling in existing urban areas is therefore acceptable in terms of flood impact." ('Ballina Flood Plain Risk Management Study 2012', Appendix F, section F4).

The estimated area of filling within the flood modelling associated with the above management measure is in excess of 500 Ha. The school site represents approximately 6 Ha of this. As such modelling the sites existing and future filled states would not yield any meaningful results given the filling of more than 500Ha in the modelling resulted in less than 5mm afflux.

With respect to flood velocities and flow impacts due to the development, below is a summary of 1:100 year flood event metrics from the 2012 BMT flood modelling:

- Current Climate 1.8-2.2m with velocity range of 0-0.2m/s
- 2100 climate change Horizon– 2.6-2.8m with velocity range of 0-0.2m/s

Whilst the modelling results do not provide a directional component, we offer the following around expected direction and potential impacts from the proposed development.

The majority of the northern portion of the site is at or above 2m AHD. The lower south-western oval is approximately 1.2-1.6m AHD. River Street and Horizon Drive vary from approximately 1.3-1.7m AHD within the frontages of the College.

Under general riverine flooding such as the beginning of March 2022 water would be expected to enter the site in the north eastern corner due to the lower elevations around the site discharge location to the north. Also back water flooding from the drainage culvert below Riverbend Drive would cause inundation of the low lying playing field. As the water continued to rise flooding of Horizon Drive and River Street would occur in similar fashion to the oval. As the flood velocities are very low, velocity

increases due to constrictions and the like from the proposed buildings would not be expected to have any measurable increase at or beyond the site boundaries.

For localised flooding events such as the secondary flood in March 2022 Council has commissioned and adopted the 'Ballina Island and West Ballina Overland Flow Flood Study Final Overland Flood Study Report and Mapping November 2020' prepared by GHD. This report reviews rainfall on grid modelling to determine overland flow paths. This modelling utilises the ground topography determined by LIDAR flown in 2017 to identify low spots, directions and magnitudes of overland flows.

The modelling indicates that a number of overland flow paths are located within the College site. These flow paths appear more dramatic than they would be in reality as formal pit and pipe drainage present within the College is not modelled which would cause all rainfall to be overland flow onsite. The identified overland flows remains within the site boundary and discharge to the main outlet locations identified for the 2006-2019 time period rather than to Horizon Drive.

Subsequent to the GHD modelling the Multi-Purpose Hall has been constructed within the south eastern corner of the site. The Multi-Purpose Hall and Riverbend Culvert construction will alter the discharge point of the identified overland flow from the eastern site of the oval area to the south-western corner. The remainder of the northern overland flow locations onsite will continue to operate as per current arrangement.

It was agreed with Council to determine expected fill volumes from present to final masterplan. The summary of estimated filling volumes associated with the various proposed masterplan elements is as follows:

Performing Arts Centre – approximately 1,100m^3 of fill over 1,550m^2 footprint. Existing ground level approximately 2.2m being raised to 2.9m AHD.

STEM and Digital Technology Centre – approximately 1,100m^3 of fill over 1,400m^2 footprint. Existing ground level approximately 2.15m being raised to 2.9m AHD.

Playing Field – Up to 10,000m^3 allowance for up to 0.5m of fill across entire field. The field currently varies between around 1.2-1.8m AHD. Additional filling is expected to facilitate faster drainage of the field between events however the final level is not resolved at this point in time.

The remaining buildings being the Collaboration Centre, Extension to the Discovery Centre and Early Learning extension are expected to be constructed utilising lightweight elevated floors similar to the existing Discovery Centre buildings to minimise settlement and differential movement of adjacent buildings. In this respect minimal filling works is expected beyond trimming and shaping to achieve stormwater falls.

Based on this the total estimated fill to be imported to complete the proposed masterplan is approximately 12,000-13,000m^3

9. Wastewater

Section 3.1 of the Infrastructure Services Report (Attachment 3) contains calculations for future sewer loads and notes on how the total EP and total load was derived. Please provide further justification of the peaking factor used to derive the peak wet weather flow (PWWF).

Peaking rates provided in Attachment 3 have not been calculated/derived by APP. Rather these have been provided by Council based on internal pump station telemetry data. Relevant correspondence in relation to this has been previously provided to Council.

We trust this clarifies the above items. Should you require any further clarification please contact this office on 02-6686 3280.

Yours faithfully

Ryan Beavis
BE (Hons) MIEAust 3199502
ARDILL PAYNE & PARTNERS

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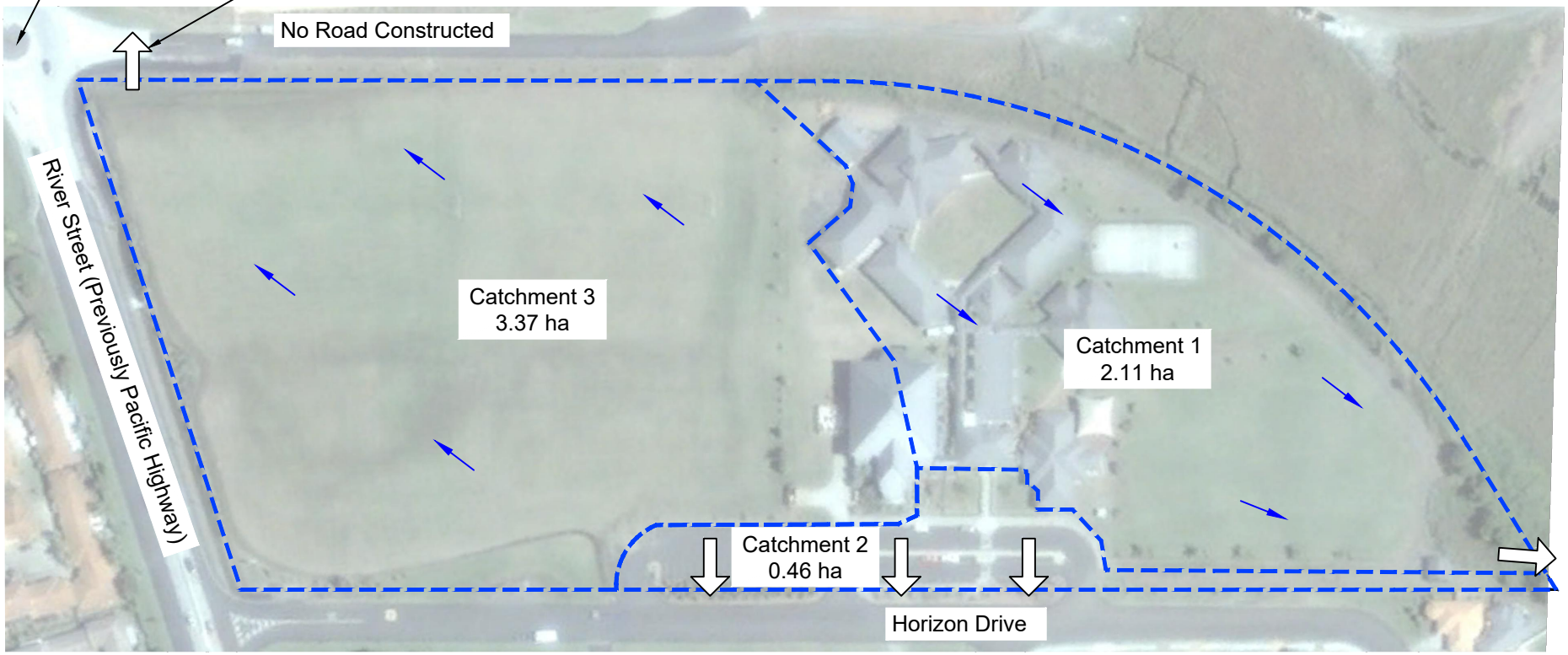
Appendix A

Historical site catchments and Wider Area Elevation Sketch



Catchment Boundary

Flow Arrow

Catchment Discharge

This plan is NOT to be used for construction purposes unless it carries the approval stamp of the local authority.

Project: EAC Masterplan Amdendments

Client: Emmanuel Anglican College

Title: Pre 2006 Site Stormwater Catchments & Discharge

Do not scale drawing. Use written dimensions only

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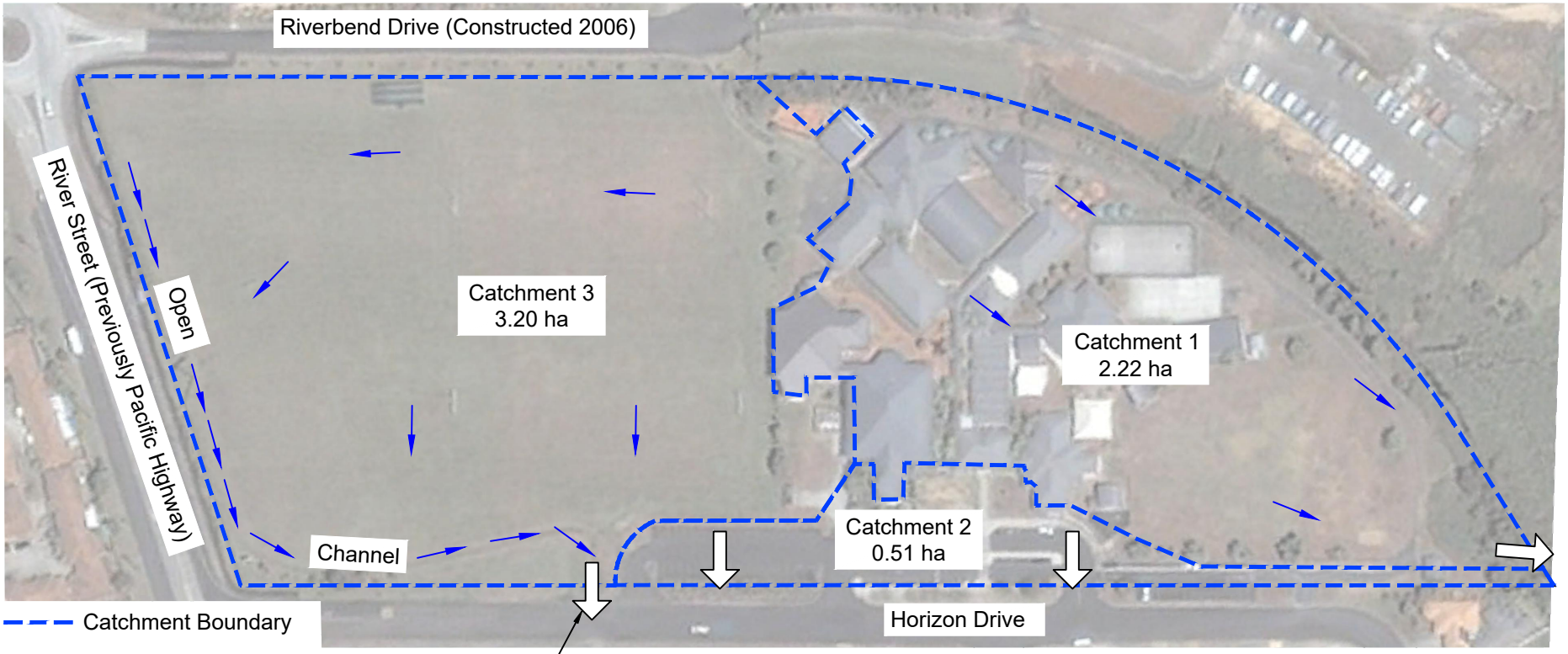

This plan is NOT to be used for construction purposes unless it carries the approval stamp of the local authority.

Project: EAC Masterplan Amdendments

Client: Emmanuel Anglican College

Title: 2006 -2012 Stormwater Catchments & Discharge

Do not scale drawing. Use written dimensions only

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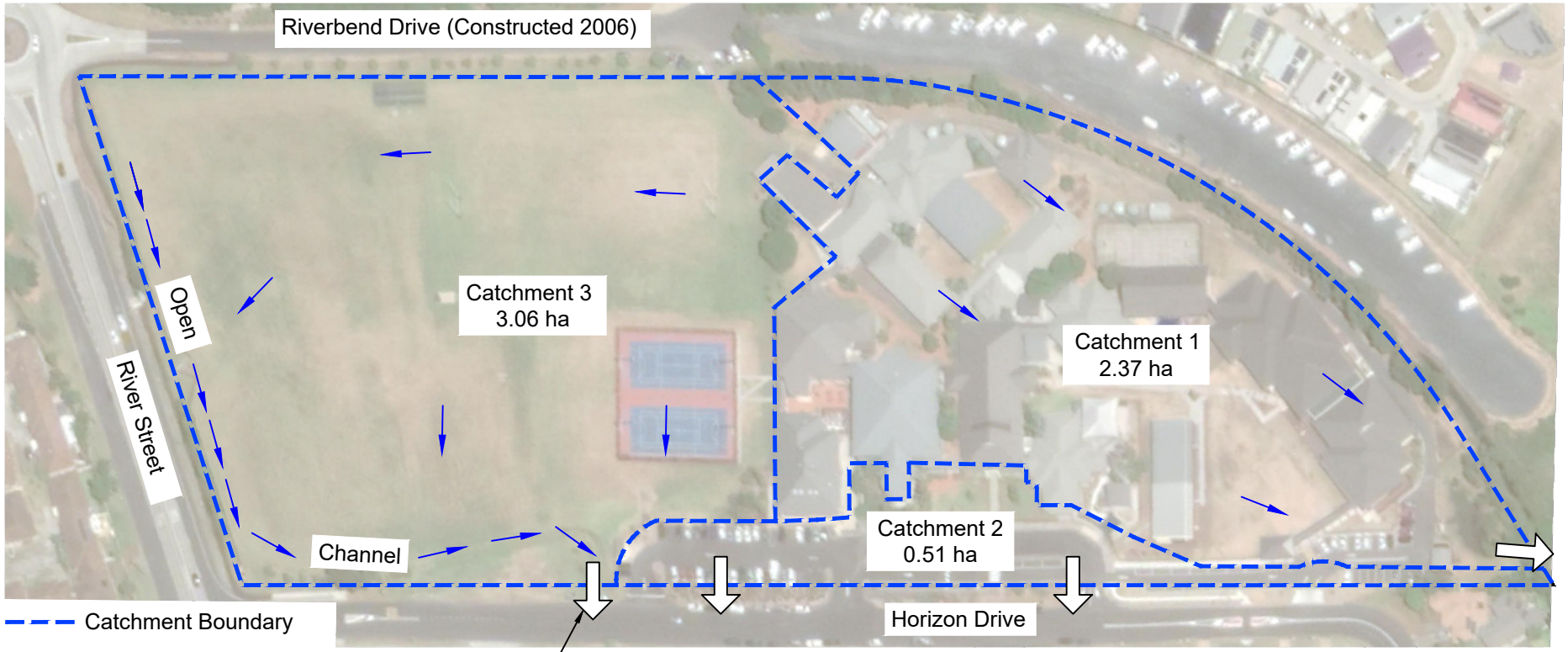

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Project: EAC Masterplan Amdendments

Client: Emmanuel Anglican College

Title: 2012-2019 Stormwater Catchments & Discharge

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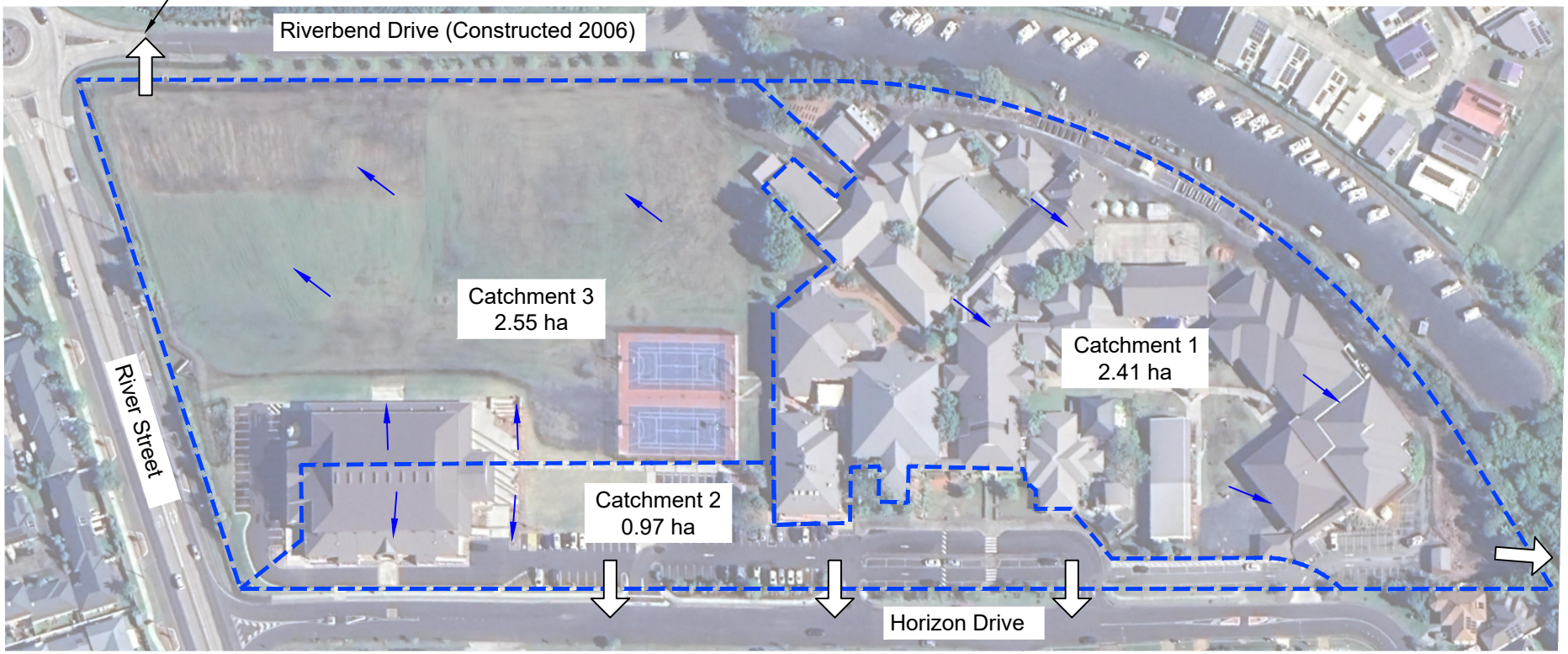

Catchment Boundary

Flow Arrow

Catchment Discharge

This plan is NOT to be used for construction purposes unless it carries the approval stamp of the local authority.

Project: EAC Masterplan Amdendments

Client: Emmanuel Anglican College

Title: 2019-2022 Site Catchments & Discharge

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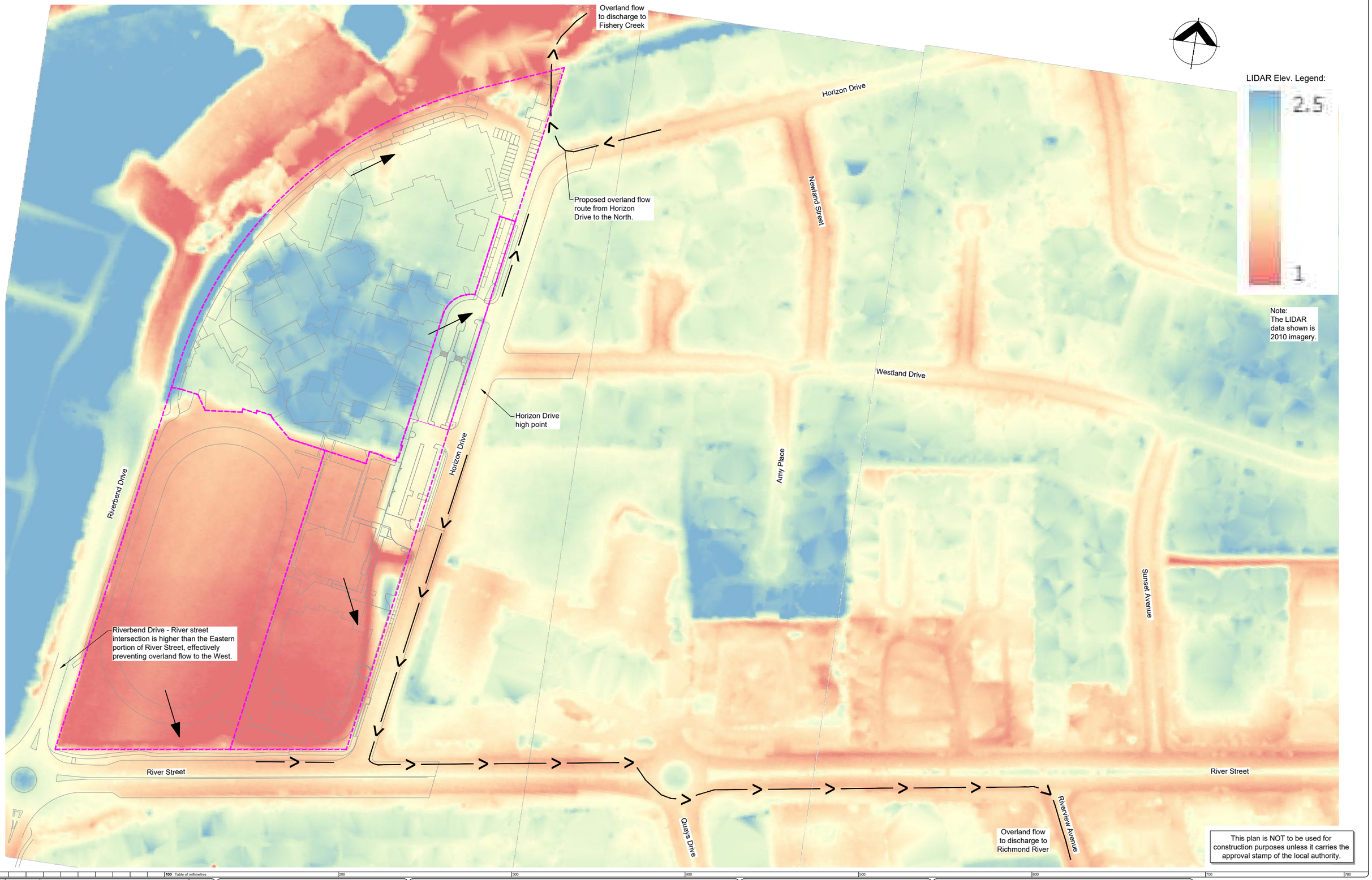

Issue	Date	Description	App'd
A	10/11/2022	Original Issue - Overland Flow	RB

Client: Emmanuel Anglican College

Project: Emmanuel Anglican College, Ballina, NSW 2473

Title: Overland Flow Path on LIDAR Elevations

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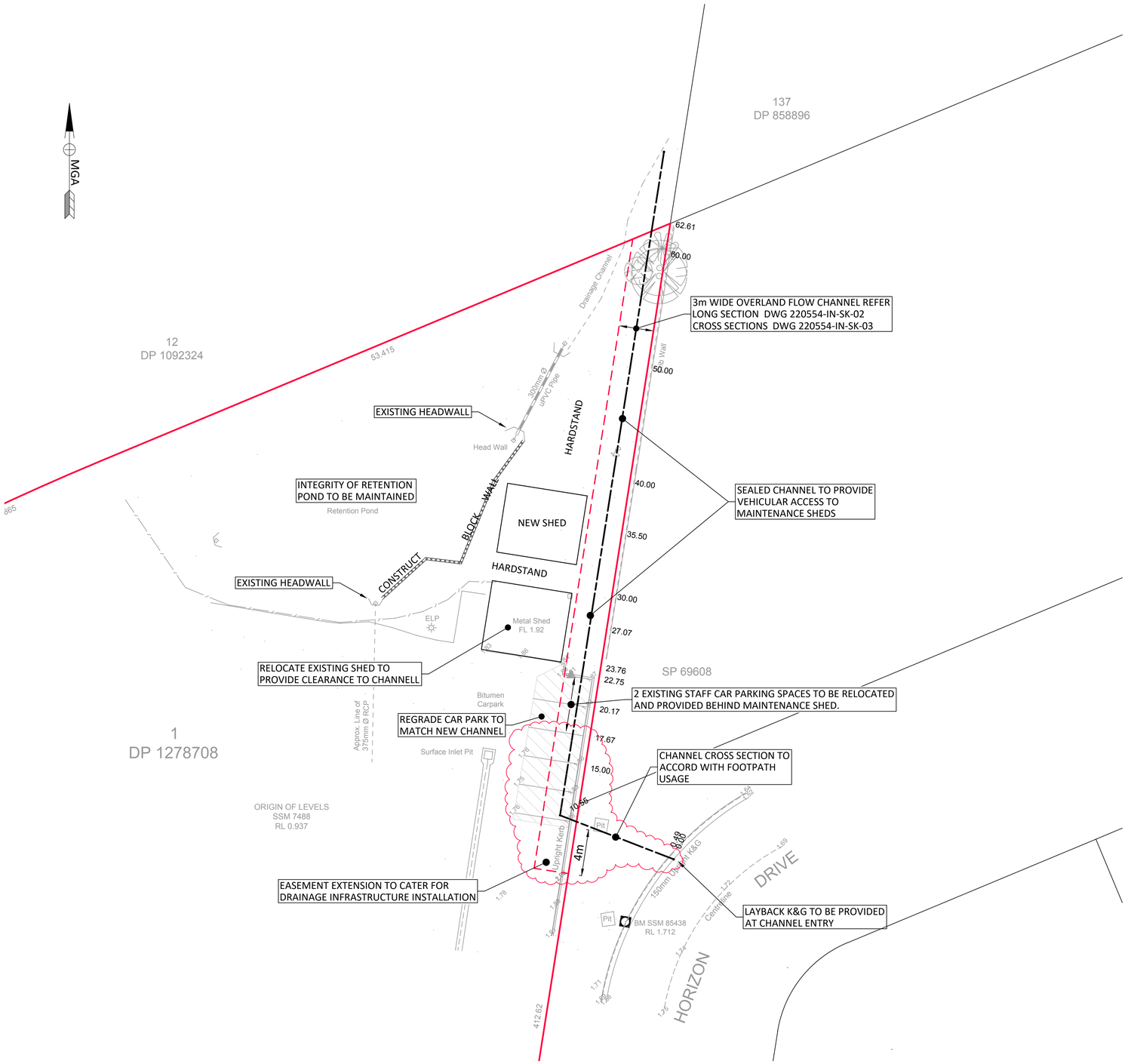
Date	10/11/2022		
Job No.	5001	Dwg No.	SK05
		Issue	A

Appendix B

Conceptual Overland Flow Path drawings



SITE PLAN

RR 1:200@A1

NOTES:

1. Overland Flow Channel to provide storm water pathway from Horizon Drive to the north. Grades as shown on Long Section (DWG 220554-01-IN-SK-02) Final design to be completed following the issue of consent by Ballina Shire Council.
2. Channel to be sealed through Emmanuel Anglican College so as to provide all weather acces to the College maintenance area.
3. Emmanuel Anglican College car park to be regraded to accord with designed channel levels and wheel stops removed from the three northern most car parks shown on the plan.
4. Channel cross section to be blended into footpath formation and to be grassed where it crosses public property.
5. Both the existing and new (approved) maintenance sheds to be 3.5 metres from the eastern boundary of Emmanuel Anglican College (Lot 1 DP 1278708) so as to provide clearance from the proposed channel.
6. Channel to have the benefit of a Memorandum of Understanding between Emmanuel Anglican College and Ballina Shire Council following the issue of consent for the the proposed amendments.

LEGEND

- PROPOSED MEMORANDUM OF UNDERSTANDING
- PROPERTY BOUNDARY
- PROPOSED CAR PARK REGRADING
- PROPOSED BLOCK WALL

FOR APPROVAL

REV	DESCRIPTION	BY	APP.	DATE
B	CHANNEL RELOCATED TO CLEAR ADJOINING PROPERTY (BSC DIRECTION)			30.11.22
A	FIRST ISSUE			17.11.22

REVISIONS

SCALES SHOWN ARE FOR AN A1 SIZE ORIGINAL DRAWING

0 2 4 6 8 10

1cm = 2m
1:200

SCALES

HORIZ. DATUM	MGA
VERT. DATUM	AHD
SURVEY	NDC
DRAWN	PS
DESIGN	LW
APPROVED DATE	

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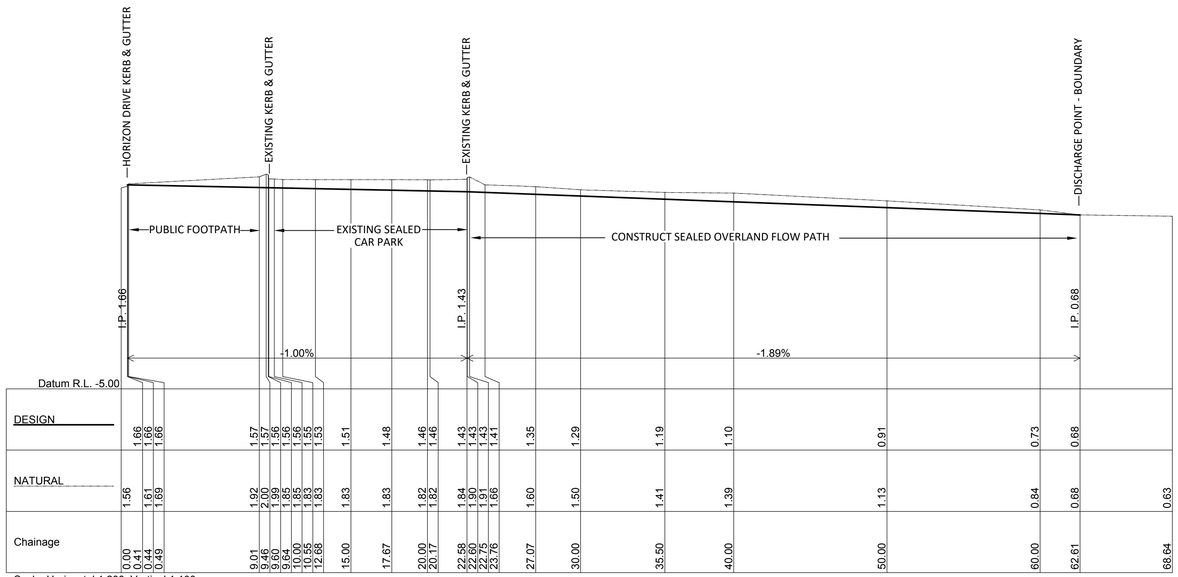
HORIZON DRIVE OVERLAND FLOW PROPOSAL PLAN SHOWING PROPOSED OVERLAND FLOW CHANNEL FROM HORIZON DRIVE THROUGH EMMANUEL ANGLICAN COLLEGE

Client	Reference No.	DRAWING No.	REVISION
EMMANUEL ANGLICAN COLLEGE	220554	220554-01-IN-SK-01	B

Plot Date: 30 Nov, 2022 CAD File Name: K:\Jobs\2022\220554 - Emmanuel Anglican College\Engineering\Drawings\220554-01-IN-SK-01.dwg



Scale Horizontal 1:200 Vertical 1:100

FOR APPROVAL

REV	DESCRIPTION	BY	APP.	DATE
B	FLOW PATH RELOCATION (BSC DIRECTION)			30.11.22
A	FIRST ISSUE			17.11.22

REVISIONS

SCALES SHOWN ARE FOR AN A1 SIZE ORIGINAL DRAWING

SCALES

HORIZ. DATUM	MGA
VERT. DATUM	AHD
SURVEY	NDC
DRAWN	PS
DESIGN	LW
APPROVED DATE	

APPROVALS

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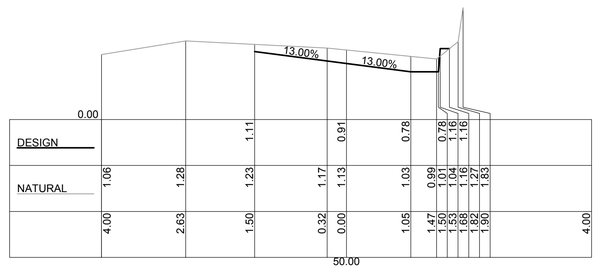
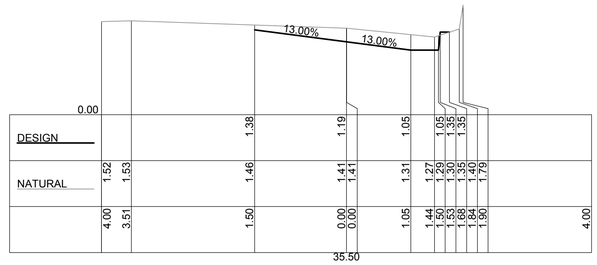
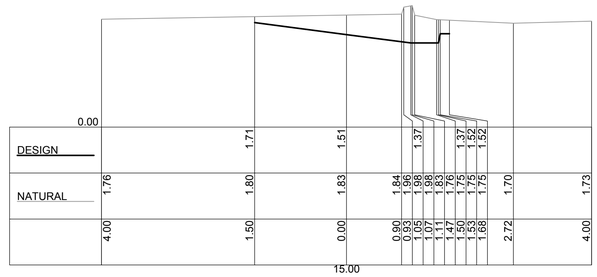
HORIZON DRIVE OVERLAND FLOW PROPOSAL
LONG SECTION
PRELIMINARY DESIGN

Client	Reference No.	DRAWING No.	REVISION
EMMANUEL ANGLICAN COLLEGE	220554	220554-01-IN-SK-02	B

Plot Date: 30 Nov, 2022 CAD File Name: K:\Jobs\2022\220554 - Emmanuel Anglican College\Engineering\Drawings\220554-01-IN-SK-02-B.dwg







FOR APPROVAL

REV	DESCRIPTION	BY	APP.	DATE
B	FLOW PATH RELOCATION (BSC DIRECTION)			30.11.22
A	FIRST ISSUE			17.11.22

REVISIONS

SCALES SHOWN ARE FOR AN A1 SIZE ORIGINAL DRAWING

SCALES

HORIZ. DATUM	MGA
VERT. DATUM	AHD
SURVEY	NDC
DRAWN	PS
DESIGN	LW
APPROVED	
DATE	

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HORIZON DRIVE OVERLAND FLOW PROPOSAL
TYPICAL CROSS SECTIONS
PRELIMINARY DESIGN

Client	Reference No.	DRAWING No.	REVISION
EMMANUEL ANGLICAN COLLEGE	220554	220554-01-IN-SK-03	B

Plot Date: 30 Nov, 2022 CAD File Name: K:\Jobs\2022\220554 - Emmanuel Anglican College\Engineering\Drawings\220554-01-IN-SK-03-B.dwg

Appendix C

Music Link Report

Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Swale	Swale	Bed slope	0.01	0.04	0.001

Only certain parameters are reported when they pass validation

MUSIC-*link* Report

Project Details		Company Details	
Project:	EAC Masterplan	**Company:**	Ardill Payne and Partners
Report Export Date:	14/11/2022	**Contact:**	Chris Mulder
Catchment Name:	MUSIC - EMR_Copy_cm	**Address:**	45 River St, Ballina, NSW
Catchment Area:	0.476ha	**Phone:**	02 6686 3280
Impervious Area*:	88.44%	**Email:**	chrism@ardillpayne.com.au
Rainfall Station:	58131 ALSTONVILLE		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1985 - 1/01/1995 11:54:00 PM		
Mean Annual Rainfall:	1772mm		
Evapotranspiration:	1444mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Ballina Shire Council		
Scenario:	BSC Development		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness

Node: Receiving Node	Reduction
Flow	8.4%
TSS	87.9%
TP	74.1%
TN	46.7%
GP	97.7%

Treatment Nodes

Node Type	Number
Bio Retention Node	4
Swale Node	1
Rain Water Tank Node	2

Source Nodes

Node Type	Number
Urban Source Node	9

Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Garden	Exfiltration Rate (mm/hr)	None	None	0.2
Bio	Garden	Exfiltration Rate (mm/hr)	None	None	0.2
Bio	Garden	Exfiltration Rate (mm/hr)	None	None	0.2
Bio	Garden	Exfiltration Rate (mm/hr)	None	None	0.2
Bio	Garden	Extended detention depth (m)	None	1	0.2
Bio	Garden	Extended detention depth (m)	None	1	0.2
Bio	Garden	Extended detention depth (m)	None	1	0.2
Bio	Garden	Extended detention depth (m)	None	1	0.2
Bio	Garden	Filter depth (m)	0.3	0.7	0.5
Bio	Garden	Filter depth (m)	0.3	0.7	0.5
Bio	Garden	Filter depth (m)	0.3	0.7	0.5
Bio	Garden	Filter depth (m)	0.3	0.7	0.5
Bio	Garden	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Garden	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Garden	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Garden	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Garden	Orthophosphate Content in Filter (mg/kg)	None	None	50
Bio	Garden	Orthophosphate Content in Filter (mg/kg)	None	None	50
Bio	Garden	Orthophosphate Content in Filter (mg/kg)	None	None	50
Bio	Garden	Orthophosphate Content in Filter (mg/kg)	None	None	50
Bio	Garden	PET Scaling Factor	2.1	2.1	2.1
Bio	Garden	PET Scaling Factor	2.1	2.1	2.1
Bio	Garden	PET Scaling Factor	2.1	2.1	2.1
Bio	Garden	PET Scaling Factor	2.1	2.1	2.1
Bio	Garden	Saturated Hydraulic Conductivity (mm/hr)	50	200	200
Bio	Garden	Saturated Hydraulic Conductivity (mm/hr)	50	200	200
Bio	Garden	Saturated Hydraulic Conductivity (mm/hr)	50	200	200
Bio	Garden	Saturated Hydraulic Conductivity (mm/hr)	50	200	200
Bio	Garden	Total Nitrogen Content in Filter (mg/kg)	None	None	800
Bio	Garden	Total Nitrogen Content in Filter (mg/kg)	None	None	800
Bio	Garden	Total Nitrogen Content in Filter (mg/kg)	None	None	800
Bio	Garden	Total Nitrogen Content in Filter (mg/kg)	None	None	800
Rain	26 kL Detention RT	% Reuse Demand Met	None	None	0
Rain	30kL Detention RT	% Reuse Demand Met	None	None	0
Receiving	Receiving Node	% Load Reduction	None	None	8.4
Receiving	Receiving Node	GP % Load Reduction	90	None	97.7
Receiving	Receiving Node	TN % Load Reduction	45	None	46.7
Receiving	Receiving Node	TP % Load Reduction	60	None	74.1
Receiving	Receiving Node	TSS % Load Reduction	80	None	87.9
Swale	Swale	Base Width (m)	1	None	1

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	Collaboration Center-Ground	Area Impervious (ha)	None	None	0.049
Urban	Collaboration Center-Ground	Area Pervious (ha)	None	None	0.002
Urban	Collaboration Center-Ground	Total Area (ha)	None	None	0.052
Urban	Collaboration Center-Roof	Area Impervious (ha)	None	None	0.052
Urban	Collaboration Center-Roof	Area Pervious (ha)	None	None	0
Urban	Collaboration Center-Roof	Total Area (ha)	None	None	0.052
Urban	Early Learning Centre Extention-Roof	Area Impervious (ha)	None	None	0.01
Urban	Early Learning Centre Extention-Roof	Area Pervious (ha)	None	None	0
Urban	Early Learning Centre Extention-Roof	Total Area (ha)	None	None	0.01
Urban	Endeavour Hub-Ground	Area Impervious (ha)	None	None	0.009
Urban	Endeavour Hub-Ground	Area Pervious (ha)	None	None	0.002
Urban	Endeavour Hub-Ground	Total Area (ha)	None	None	0.012
Urban	Endeavour Hub-Roof	Area Impervious (ha)	None	None	0.028
Urban	Endeavour Hub-Roof	Area Pervious (ha)	None	None	0
Urban	Endeavour Hub-Roof	Total Area (ha)	None	None	0.028
Urban	Performing Art Center-Ground	Area Impervious (ha)	None	None	0.020
Urban	Performing Art Center-Ground	Area Pervious (ha)	None	None	0.047
Urban	Performing Art Center-Ground	Total Area (ha)	None	None	0.068
Urban	Performing Art Center-Roof	Area Impervious (ha)	None	None	0.109
Urban	Performing Art Center-Roof	Area Pervious (ha)	None	None	0
Urban	Performing Art Center-Roof	Total Area (ha)	None	None	0.109
Urban	Technology Center-Ground	Area Impervious (ha)	None	None	0.052
Urban	Technology Center-Ground	Area Pervious (ha)	None	None	0.002
Urban	Technology Center-Ground	Total Area (ha)	None	None	0.055
Urban	Technology Center-Roof	Area Impervious (ha)	None	None	0.09
Urban	Technology Center-Roof	Area Pervious (ha)	None	None	0
Urban	Technology Center-Roof	Total Area (ha)	None	None	0.09

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