Stormwater Report

Lot 12 Bayshore Drive, Byron Bay: Proposed Lot 2

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Prepared for: Byron Shire Council

UPR	Description	Date Issued	Issued By
3544-1018	1st draft	23/03/2021	Damian Hyde
3544-1026	2nd draft – updated following changes to proposed TAFE site layout	27/08/2021	Duncan Thomson

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1. Introduction

1.1 Background

Byron Shire Council engaged GeoLINK to provide stormwater advice for Lot 12 Bayshore Drive, located in the Byron Industrial Estate (refer to **Figure 1.1**). This report will aid Council's investigation into servicing requirements for future commercial development of the site. As required by Council, two stormwater options have been investigated; one that will cater for the TAFE development in the short term, and the other long term option that considers the full future development of Lot 2. The proposed subdivision of Lot 12 into three lots is shown in **Figure 1.2**.

1.2 Previous Studies

In April of 2016, a Review of Environmental Factors (REF) was submitted by BMACK Project Management Services for the clean-up of Lot 12. This clean-up was for the developable portion of Lot 12 and did not include works in the existing wetland. These works included the creation of a temporary sediment basin to capture silt and sediment runoff from the site during the proposed clean-up. On page 20 of the Blackwood Ecological Services Ecological Assessment included with BMACK's DA submission it states, *"erosion and sedimentation control measures would not be removed until disturbed areas have established."*

In February of 2021, GeoLINK was engaged to determine the suitability of the wetland in Lot 12 for Acid Frog habitat. This investigation found that the wetland is suitable habitat for Acid Frogs and that Acid Frogs were present in the wetland. This investigation also covered the existing sediment pond and the small area of trees in the north eastern corner of the site, which were both found to be unsuitable for Acid Frogs. The outcome of this investigation is that any water discharging into the wetland must be pre-treated to an acceptable level and the pH level of the existing wetland cannot be substantially altered from the stormwater discharged from any proposed development.

1.3 Existing Site

Lot 12 DP 1189646 located along Bayshore Drive is a 5.8 ha site. The proposal is to develop the 2.6 ha of cleared area adjacent to Bayshore Drive, with the remainder of the site being left as undeveloped wetland. The northern boundary is shared with the Habitat development and the southern boundary is shared with industrial/commercial buildings that are accessed off Centennial Circuit. The portion of the site to be developed is generally flat with a gradual slope from the north eastern corner to the south western corner. A small portion of the north eastern corner falls toward Bayshore Drive.

The south western corner of the site to be developed has an existing sediment basin that was constructed during on-site works that occurred in 2016.

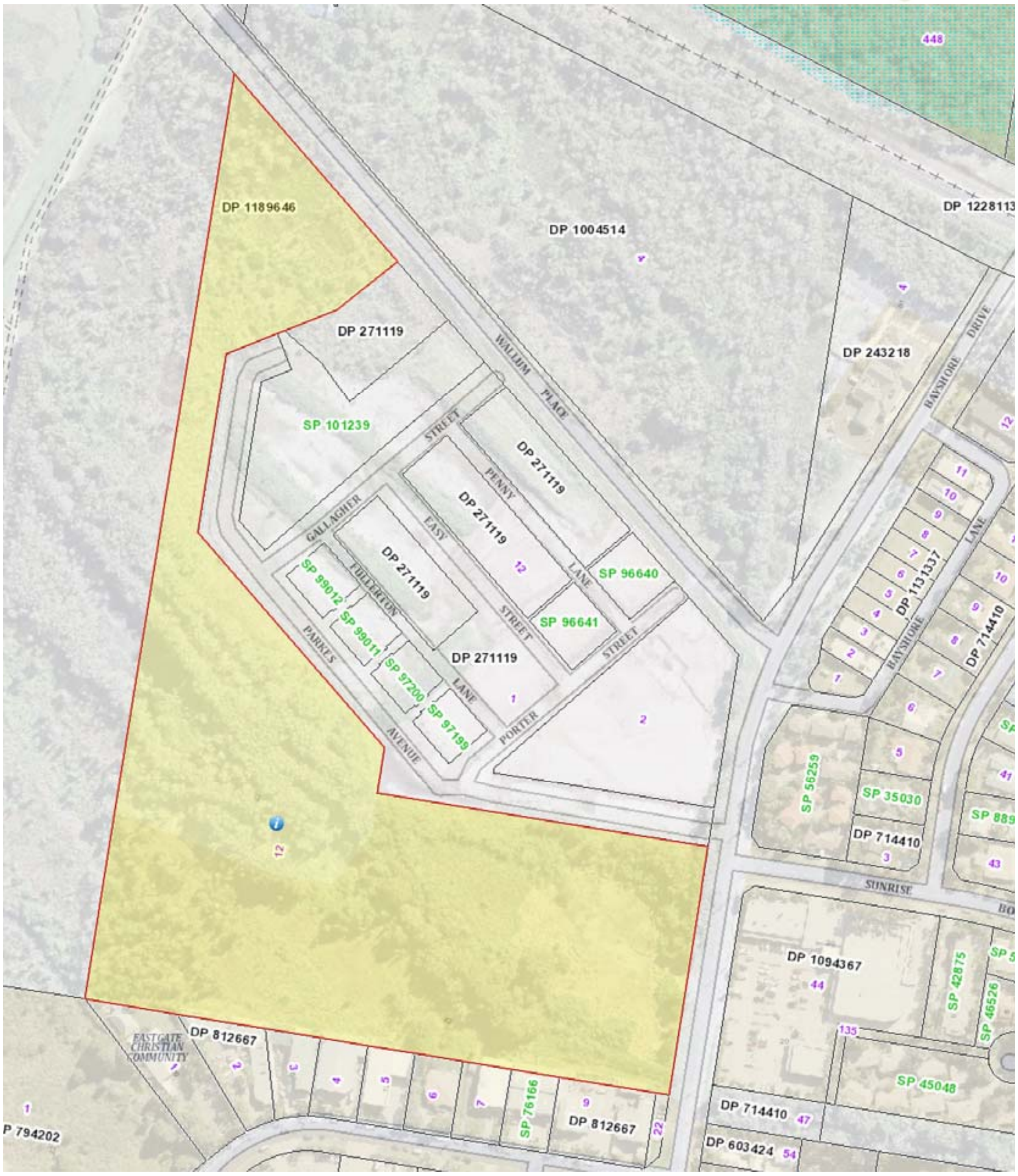

Figure 1.1 Extent of Lot 12 (shown in yellow)

Figure 1.2 Proposed Subdivision of Lot 12

1.4 Overview of Proposed Stormwater Management Strategy

The proposed stormwater management strategy for Lot 2 includes management of flows from the site incorporating the minor/ major drainage system approach, as well as incorporating stormwater quality treatment prior to discharge. It is proposed that the drainage system will comprise a pit and pipe network for minor flows and overland flow paths for major flows. The stormwater drainage system will discharge into a bioretention basin located at the western end of the lot, which will both treat and detain stormwater before discharging to the existing wetland.

As the existing sediment basin was to be decommissioned after vegetation had established in disturbed areas, this basin has been excluded from the design.

2. Preliminary Stormwater Detention Design

2.1 Design Criteria

Design criteria for stormwater management are specified in the *Byron Shire Development Control Plan 2014 – Chapter B3 – Services* (DCP Chapter B3). With regard to stormwater detention, the DCP Chapter B3 references the Northern Rivers Local Government Development Design and Construction Manuals. The relevant criterion from this manual is that:

> *Basins shall be designed so that the peak flow from the proposed development for the 5, 10, 20, 50 and 100 year ARI events, for durations from 5 minutes to 3 hours, does not exceed the existing peak flow from the site i.e. post-development flows must not exceed pre-development flows*

2.2 DRAINS Modelling

The development of the site will result in an increase in the impervious area, which will lead to increases in the peak flow of stormwater emanating from the site. To ensure that the proposed stormwater system meets the peak flow attenuation target, hydrologic and hydraulic calculations have been undertaken using a model developed with the DRAINS software.

The key inputs to the model are:

- Pre-development impervious area percentage = 0%
- Post-development (TAFE only) impervious area percentage = 25%
- Post-development (fully developed Lot 2) impervious area percentage = 54%

The basin geometries used in the DRAINS model are presented below. The piped network can be connected into the basin at any location and more than one connection would be beneficial to keep pipe diameters smaller and maintain sufficient pipe cover.

2.2.1 TAFE Development Only

- Surface area at base level of 4.00 mAHD = 270 m²
- Surface area at top water level of 4.60 mAHD = 460 m²
- Low level outlet: 6 x 225 mm diameter PVC pipes; U/S IL = 4.20 mAHD
- High level outlet: 2.9 m long weir with crest level = 4.51 mAHD
- Top of bund level = 4.70 mAHD

2.2.2 Fully Developed Lot 2

- Surface area at base level of 4.00mAHD = 360m²
- Surface area at top water level of 4.60mAHD = 600m²
- Outlets and bund level as per 'TAFE development only' scenario

The peak flows for the pre-development and post-development situations are presented in the following table. It is evident from the results that the basins provide an adequate level of stormwater peak flow attenuation for all of the design storm events for each of the design scenarios.

Table 2.1 Peak Flows

Design Storm Event (ARI)	*Peak Flows (m^3/s) – TAFE development only*		*Peak Flows (m^3/s) – Fully developed Lot 2*	
	Pre-Development	*Post-Development*	*Pre-Development*	*Post-Development*
5	0.26	0.26	0.26	0.26
10	0.29	0.28	0.29	0.28
20	0.35	0.32	0.35	0.32
50	0.40	0.39	0.40	0.38
100	0.45	0.45	0.45	0.44

3. Preliminary Stormwater Treatment Design

3.1 Design Criteria

Table B3.2 of DCP Chapter B3 outlines the requirements for treatment of stormwater and the water quality targets are reproduced below as **Table 3.1**.

Table 3.1 DCP Stormwater Treatment Targets

Pollutant / Issue	*Retention Criteria*
Litter	70% of average annual load greater than 5mm
Coarse Sediment	80% of average annual load for particles 0.5mm or less
Fine Particles	50% of average annual load for particles 0.1mm or less
Total Phosphorus	45% of average annual load
Total Nitrogen	45% of average annual load
Hydrocarbons, motor fuels, oils & grease	90% of average annual load

3.2 MUSIC Modelling

The proposed land use changes and associated increase in impervious areas will also result in higher loads of water-borne contaminants. Compliance with the stormwater quality targets will, by default, require the vast majority of stormwater runoff from the site to be routed through treatment devices (such as bioretention systems) before discharging to the receiving wetland. This will ensure the hydraulic 'disconnection' of runoff from impervious surfaces, thus significantly attenuating the impact of frequent flows on the ecological health of the wetland. A conceptual stormwater treatment model was developed using the MUSIC software and this model was used to ensure that the stormwater system meets the stormwater quality targets.

The pollutants modelled using the MUSIC software do not exactly match the pollutants listed in the DCP. Therefore, the stormwater treatment targets adopted for the MUSIC modelling for this assessment are presented in **Table 3.2**.

Table 3.2 Adopted Stormwater Treatment Targets

Contaminant	*Target*
Total Suspended Solids (TSS)	80% of average annual load retained
Total Phosphorus (TP)	45% of average annual load retained
Total Nitrogen (TN)	45% of average annual load retained

In the bioretention basin, stormwater runoff will be retained within a defined extended detention depth (200 mm) and then infiltrate down through the filter layer (sandy loam soil) and into the underlying soils. The surface of the bioretention basin will be densely planted with locally occurring native ground cover species.

Treatment of the stormwater occurs both on the surface of the bioretention system and within the filter layer. When storm inflows cause temporary ponding on the surface of the system, pollutants are removed from the stormwater through sedimentation and particulate adhesion onto the stems and leaves of the vegetation. The agitation of the surface layer of the soil caused by movement of the vegetation and the root systems prevents the accreted sediments clogging the filter layer. As stormwater percolates through the filter layer, fine particulates and some soluble pollutants are removed through processes such as adhesion onto the surface of the soil particles, biological transformation of pollutants by biofilms growing on the surface of the soil particles, and biomass uptake of nutrients and metals through the root systems of the vegetation.

The MUSIC model was used to quantify the pollutant removal provided by the bioretention basin. The results are summarised in **Table 3.3** for the 'TAFE development only' scenario and in **Table 3.4** for the 'Fully developed Lot 2' scenario. The results indicate that the predicted pollutant load reductions meet the adopted targets.

Table 3.3 Stormwater Pollutant Load Reductions – TAFE development only

Pollutant	*Post-Development Load – without treatment (kg/yr)*	*Post-Development Load – with treatment (kg/yr)*	*Load Reduction (%)*
Total suspended solids	1560	43	97
Total phosphorus	3.27	0.75	77
Total nitrogen	19.8	4.7	76

Table 3.4 Stormwater Pollutant Load Reductions – Fully developed Lot 2

Pollutant	*Post-Development Load – without treatment (kg/yr)*	*Post-Development Load – with treatment (kg/yr)*	*Load Reduction (%)*
Total suspended solids	3060	273	91
Total phosphorus	7.84	2.47	69
Total nitrogen	56	18	67

4. Management of Flooding Impacts

4.1 Flood Impact Management

Lot 2 generally falls from the north eastern corner to the south western corner. The proposal is to maintain the existing overland flow path in this direction with some measures put in place to protect the proposed development and the existing buildings over the southern boundary from the site.

Upon completion of the TAFE development, a catch drain just north of the TAFE site (refer to drawing 3544-C002 in **Appendix A**) will intercept runoff from the north eastern portion of Lot 12. This catch drain will discharge to the wetland in the south western corner of the site in a controlled manner.

The southern boundary of the site will have a swale constructed to prevent overland flow from Lot 2 crossing the boundary into neighbouring properties. When the remainder of Lot 2 is developed, this swale will be replaced with a carriageway with a single crossfall and constructed in a way which will also provide an overland flow path route to protect neighbouring properties. The overland flow path will discharge water into the proposed bioretention basin in the south western corner of Lot 2. Typical cross sections of the overland flow path route are shown on drawing 3544-C010 in **Appendix A**.

4.2 Floor Levels for TAFE Buildings

The following minimum floor levels are proposed for the TAFE buildings:

- MTU / Maker Space building: 5.55 mAHD
- Connected Learning Centre building: 5.70 mAHD

The background to these proposed floor levels is:

- A flood study for the Belongil Creek Catchment was completed by SMEC in November of 2009. Within this report, flood levels for the industrial estate at Bayshore Drive were provided for 5, 10, 20 and 100 year storm events. The study included minimum freeboard requirements, which for a commercial development is 0.5m. The Bayshore Drive 100 year flood level is 3.9 mAHD and when combined with the required freeboard of 0.5 m equates to a level of 4.4 mAHD.
- The ground levels along the southern boundary are approximately 4.8 mAHD, with the buildings over the southern boundary likely to have floor levels above 4.8 mAHD.
- By adopting the proposed minimum floor levels, it will be possible to fall surface water away from the TAFE buildings, which will help with overland flow paths. This will also help to achieve adequate pipe cover over the stormwater system. It would not be possible to achieve adequate pipe cover and minimum falls away from the building if the floor levels were set at 4.4 mAHD. Based on preliminary design, it is expected that the finished surface levels immediately to the east of the bioretention basin will need to be approximately 5.0 mAHD to provide sufficient cover for stormwater pipes. From this point, the finished surface would be expected to grade upwards towards the east at an average gradient of approximately 0.5%.
- The stormwater pipe network that will be required for the future development of Lot 2 also needs to be considered. It is assumed that a portion of this will discharge to Bayshore Drive with the remainder discharging to the south western corner of Lot 2. To ensure adequate pipe cover can be achieved, while also considering building heights, neighbouring properties and the cost of filling the site, it is possible that concrete box culverts may need to be used rather than concrete pipes.

References

Byron Shire Council, (2019). *Byron Shire Development Control Plan 2014 – Chapter B3 – Services.*

Water by Design, (2010). *MUSIC Modelling Guidelines (Version 1.0).* SEQ Healthy Waterways Partnership.

Copyright and Usage

Appendix A

Preliminary Stormwater Design Plans

LEGEND (Existing)

- Vegetation line
- W — Water
- SRM — Sewer Rising Main
- S — Sewer Gravity
- SW — Stormwater
- Road signs
- Fence
- Sealed road
- Major overland flow path

Existing surface contours shown at 0.2m intervals

Note:
1. All existing services to be located and inverts confirmed prior to works commencing.
2. All existing services are approximate only.

DRAFT

Rev.	Description	Date	Des.	App.	Chk.

Amendments

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Project Title

Lot 12 Bayshore Drive Subdivision

Client

Byron Shire Council

Designed	DH	Drawn	DH	Checked
Approved		Date		

XREFs

Scale

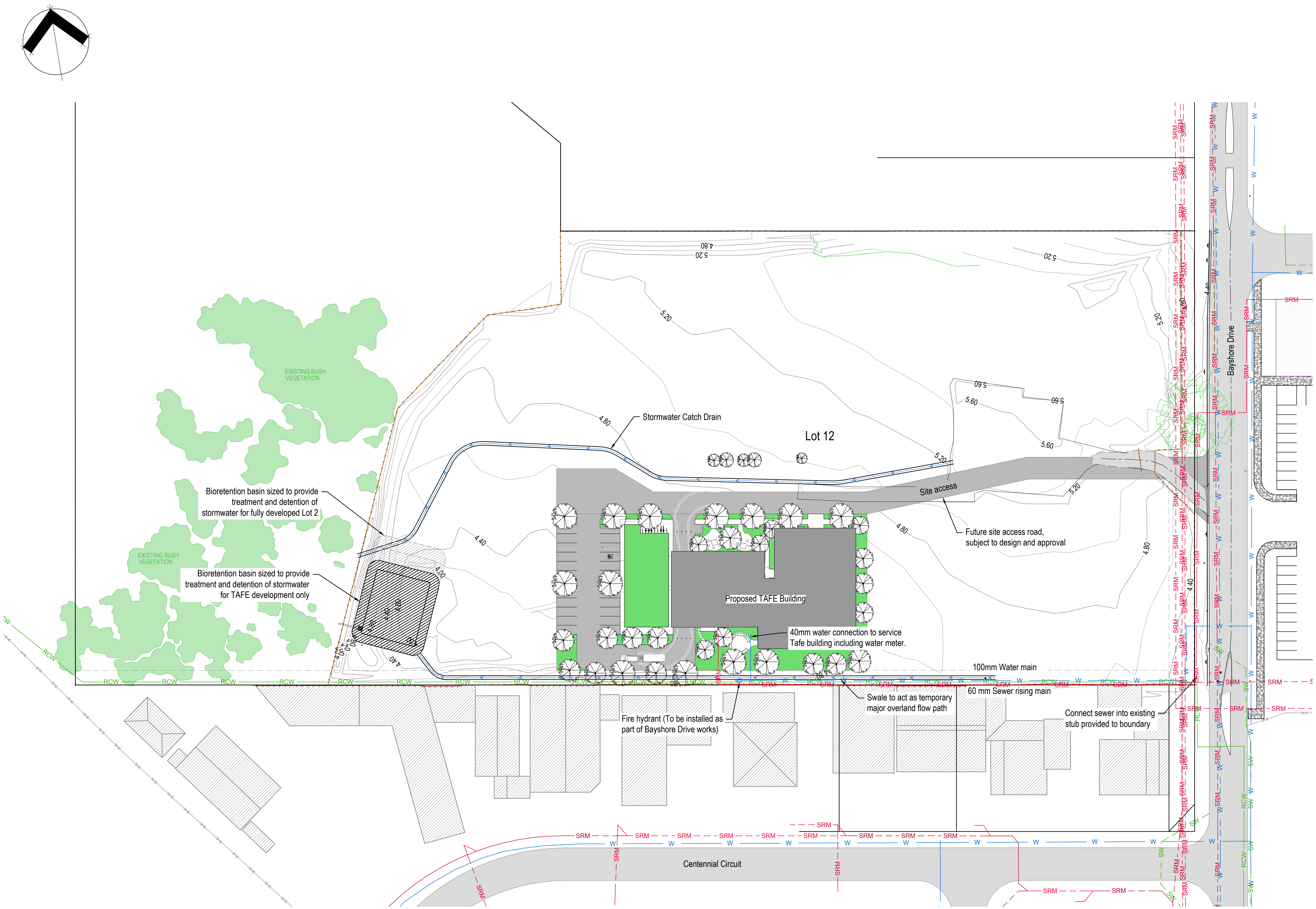
metres 0 5 10 15 20 25

Drawing Title

Existing Site Plan

3544-1015

Drawing Number	*Revision*
3544/C001	A



LEGEND (Proposed)

- Boundary
- W — Water
- SRM — Sewer Rising Main
- Easement

LEGEND (Existing)

- Vegetation line
- W — Water
- SRM — Sewer Rising Main
- S — Sewer Gravity
- SW — Stormwater
- Road signs

Existing surface contours shown at 0.2m intervals

Note:

1. All existing services to be located and inverts confirmed prior to works commencing.
2. All existing services are approximate only.
3. TAFE building, car park, access roads and services all subject to detailed design and approval.

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Approved	Date	

XREFs

Scale

metres 0 5 10 15 20 25

Drawing Title

General Arrangement Plan

3544-1016

Drawing Number 3544/C002

Revision

LEGEND (Proposed)

Boundary
W Water
SRM Sewer Rising Main
Easement

LEGEND (Existing)

Vegetation line
W Water
SRM Sewer Rising Main
S Sewer Gravity
SW Stormwater
Road signs

Existing surface contours shown at 0.2m intervals

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XREFs				

Scale

A	metres	0	2	4	6	8	10
B		0	0.5	1.0	1.5	2.0	2.5

Drawing Title
Stormwater Plan and Sections

3544-1017

Drawing Number: 3544/C010
Revision