

**ADW JOHNSON PTY LIMITED**

ABN 62 129 445 398

Sydney  
Level 35 One International Towers  
100 Barangaroo Avenue  
Sydney NSW 2000  
02 8046 7411  
sydney@adwjohnson.com.au

Central Coast  
5 Pioneer Avenue  
Tuggerah NSW 2259  
02 4305 4300

coast@adwjohnson.com.au

Hunter Region  
7/335 Hillsborough Road,  
Warners Bay NSW 2282  
02 4978 5100

hunter@adwjohnson.com.au

## Water Cycle Management Plan

### Proposed Bulky Goods Development

**Property:**

Lots 102 DP1209157  
11 Bryant Drive, Tuggerah

**Applicant:**

Aventus Tuggerah Pty Ltd

**Date:**

March 2021

Project Management • Town Planning • Engineering • Surveying  
Visualisation • Social Impact • Urban Planning

[www.adwjohnson.com.au](http://www.adwjohnson.com.au)

# Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Initial Issue	March 2019	Ben Myles	Mark Kelly
B	DA Issue	March 2019	Ben Myles	Mark Kelly
C	Layout Amended	April 2019	Ben Myles	Mark Kelly
D	Council Comments	February 2020	Ben Myles	Mark Kelly
E	Council Comments	March 2021	Ben Myles	Ben Myles

## Limitations Statement

This report has been prepared in accordance with and for the purposes outlined in the scope of services agreed between ADW Johnson Pty Ltd and the Client. It has been prepared based on the information supplied by the Client, as well as investigation undertaken by ADW Johnson and the sub-consultants engaged by the Client for the project.

Unless otherwise specified in this report, information and advice received from external parties during the course of this project was not independently verified. However, any such information was, in our opinion, deemed to be current and relevant prior to its use. Whilst all reasonable skill, diligence and care have been taken to provide accurate information and appropriate recommendations, it is not warranted or guaranteed and no responsibility or liability for any information, opinion or commentary contained herein or for any consequences of its use will be accepted by ADW Johnson or by any person involved in the preparation of this assessment and report.

This document is solely for the use of the authorised recipient. It is not to be used or copied (either in whole or in part) for any other purpose other than that for which it has been prepared. ADW Johnson accepts no responsibility to any third party who may use or rely on this document or the information contained herein.

The Client should be aware that this report does not guarantee the approval of any application by any Council, Government agency or any other regulatory authority.

## Executive Summary

---

ADW Johnson was commissioned by Aventus Property Group to prepare a Water Cycle Management Plan (WCMP) for a proposed bulky goods development, located within Lot 102 DP 1209157, 11 Bryant Drive, Tuggerah (the site). The preparation of this management plan has been undertaken to accompany a Development Application required for the proposed development.

Drainage works are currently earmarked for the subject site as part of Council's section 7.11 contributions plan for the Tuggerah area. Whilst not strictly being in accordance with the proposed 7.11 plan, it was shown that a design of a box culvert could provide a similar outcome and meet the intent of the contributions plan. The proposed box culvert is to be utilised as an emergency overland flow route for larger flooding events impacting on Bryant Drive.

DRAINS modelling has been completed to ensure that the post developed flows are adequately attenuated back to pre-developed levels for all outlet locations. It was found that based upon the site grading and redistribution, four (4) out of the five (5) post developed catchments did not require a detention structure as post developed flows were less than or equal to pre developed flows. Modelling indicates that an underground tank with approximately 445m<sup>3</sup> of storage was required to adequately attenuate flows from the main catchment.

MUSIC modelling was completed to show compliance with Council's water quality targets. It is noted that full water quality treatment was not provided on a number of the catchments as they will be catered for in future regional works provided by Central Coast Council.

The main catchment was modelled using MUSIC and it was found that a treatment train of GPT's, litter baskets and a "Jellyfish" filter adequately treated runoff to Council's standards.

Further MUSIC modeling was undertaken to ensure the flow regime entering an existing EEC area was maintained post development. The analysis indicates that the site can be graded to ensure the flow regime is maintained and water quality targets can be met.

Council's regional flooding maps indicate that the site is subject to flooding during the 1% AEP storm event. A review of the site survey indicates that the majority of the existing site is currently above the 1% AEP flood level and the proposed grading of the site will lift the proposed development even higher, ensuring compliance with Council's floodplain management guidelines.

An erosion and sedimentation control plan has been completed for the proposed development to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the site to downstream waterways during the construction period.

# Table of Contents

<b>1.0</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>2.0</b>	<b>SITE DESCRIPTION.....</b>	<b>2</b>
<b>3.0</b>	<b>COUNCIL REQUIREMENTS .....</b>	<b>3</b>
3.1	CCC REGIONAL STORMWATER WORKS .....	3
3.1.1	<i>Regional Flooding / Overland Flow Path.....</i>	<i>3</i>
<b>4.0</b>	<b>OBJECTIVES.....</b>	<b>5</b>
4.1	CONCEPT STORMWATER DESIGN .....	5
4.2	STORMWATER QUANTITY.....	5
4.3	STORMWATER QUALITY / WATER SENSITIVE URBAN DESIGN .....	5
4.4	FLOODPLAIN MANAGMENT .....	5
4.5	EROSION AND SEDIMENTATION CONTROL .....	6
<b>5.0</b>	<b>CONCEPT STORMWATER DESIGN .....</b>	<b>7</b>
5.1	CATCHMENT 1 – BRYANT DRIVE NORTH.....	7
5.2	CATCHMENT 2 – BRYANT DRIVE SOUTH .....	7
5.3	CATCHMENT 3 – LAKE ROAD.....	8
5.4	CATCHMENT 4 – STAGE 2 .....	8
5.5	CATCHMENT 5 – EEC .....	8
<b>6.0</b>	<b>STORMWATER QUANTITY.....</b>	<b>9</b>
6.1	MODELLING.....	9
6.1.1	<i>Catchment Data.....</i>	<i>9</i>
6.1.2	<i>Model Parameters and Rainfall Data.....</i>	<i>10</i>
6.2	RESULTS .....	10
<b>7.0</b>	<b>WATER QUALITY/WATER SENSITIVE URBAN DESIGN.....</b>	<b>12</b>
7.1	TREATMENT DEVICES .....	12
7.2	MODELLING.....	12
7.2.1	<i>Catchment Data.....</i>	<i>12</i>
7.3	RESULTS .....	13
7.4	EEC FLOW REGIME.....	14
<b>8.0</b>	<b>REGIONAL STORMWATER CONVEYANCE.....</b>	<b>15</b>
8.1	CONTRIBUTIONS PLAN .....	15
8.2	REGIONAL FLOODING / OVERLAND FLOW PATH .....	16
8.3	ALTERNATE DESIGN .....	16
8.3.1	<i>Culvert Conveyance .....</i>	<i>17</i>
8.3.2	<i>Culvert Levels and Flows.....</i>	<i>18</i>
8.3.3	<i>Connections to Adjoining Properties.....</i>	<i>18</i>
8.3.4	<i>Council Concerns.....</i>	<i>19</i>
<b>9.0</b>	<b>FLOODPLAIN MANAGEMENT.....</b>	<b>20</b>
<b>10.0</b>	<b>EROSION AND SEDIMENTATION CONTROL .....</b>	<b>21</b>
<b>11.0</b>	<b>CONCLUSION.....</b>	<b>22</b>



## EXHIBITS

<b>Exhibit 001</b>	Existing Site and Catchments
<b>Exhibit 002</b>	Concept Stormwater Design
<b>Exhibit 003</b>	Proposed Catchments
<b>Exhibit 004</b>	EEC Flows
<b>Exhibit 005</b>	Council Proposed Contribution Plan Works
<b>Exhibit 006</b>	Alternate Stormwater Contribution Works
<b>Exhibit 007</b>	Erosion & Sedimentation Control Plan

## APPENDICES

<b>Appendix A</b>	DRAINS Model
<b>Appendix B</b>	MUSIC Details
<b>Appendix C</b>	CPAA Information
<b>Appendix D</b>	Flood Information Application

## 1.0 Introduction

---

ADW Johnson was commissioned by Aventus Property Group to prepare a Water Cycle Management Plan (WCMP) for a proposed Bulky Goods development, located within Lot 102 DP 1209157, 11 Bryant Drive, Tuggerah (the site). The preparation of this management plan has been undertaken to accompany a Development Application required for the proposed development.

It is noted that this report has been prepared to address the requirements of Stage 1 of the development only. Further information will be provided under separate cover when required for Stage 2.

This report documents the means of stormwater detention, treatment and disposal from the proposed development in accordance the Central Coast Council (CCC) requirements current at the time of writing this report.

## 2.0 Site Description

The subject site, as depicted in Figure 1 below, is located within Lot 102 DP 1209157, 11 Bryant Drive, Tuggerah. The site has an area of approximately 5.6ha.



**Figure 1: Site Locality (Nearmaps Image)**

The subject site is bound to the north by Lake Road and existing residential development, to the east by existing mixed use properties, to the south by existing commercial development and to the west by Bryant Drive and the existing Tuggerah Super Centre.

The western portion of the site consists largely of an asphalt overflow carpark associated with the existing Super Centre, whilst the eastern portion is largely undisturbed open grasses and vegetation. A small open grassed area, associated with a previous residential dwelling, exists on the Bryant Drive frontage of the site.

The existing carpark largely grades toward Bryant Drive and slopes in the order of 1-2%. Flows generated within the carpark sheet flow to a series of dish drains located within low points running east west. The flows are then captured by a series of stormwater pits and conveyed to the stormwater network in Bryant Drive before ultimately being discharged into an open channel on the corner of Bryant Drive and Lake Road.

The western portion of the site consists of a series of small open channels before flattening out into open plains with slopes in the order 0.5-0.7%. A relatively large area of Endangered Ecological Community (EEC) is present in the south east corner of the subject site. It is noted that this EEC will not be disturbed by any works associated with Stage 1 of the development.

The existing site and infrastructure can be seen in Exhibit 1.

## 3.0 Council Requirements

The proposed development is to comply with the following CCC documents:

- CCC – Civil Works Specification Design Guideline 2018;
- CCC – Wyong Development Control Plan 2013.

The CCC – Civil Works Design Guideline outlines the requirements for fractions impervious for the various catchments and subcatchments used in the modelling of the proposed subdivision. Additionally, the Civil Works Design Guideline outlines the various requirements for the design of both the stormwater detention and stormwater quality requirements for the development.

### 3.1 CCC REGIONAL STORMWATER WORKS

During a Pre-DA meeting held at Central Coast Council (Wyong Shire) offices, Council indicated that the subject site, and adjacent catchments, are subject to future stormwater conveyance and quality works under a contributions plan.

A review of the relevant contribution plan indicates that Council is proposing to construct an open channel system along the northern and eastern boundaries of the subject site. This open channel will be capable of conveying the 20% AEP storm event and caters for both the subject site and upstream catchments.

The open channels will discharge into a proposed stilling pond which is located within Stage 2 of the subject site. The stilling pond then spills into a wetland located on the adjacent, Council owned property.

It is noted that a portion of the proposed contributions works severely impact on the EEC community in the south east corner of the site and would likely result in the removal of all vegetation associated with this area.

Despite these works being proposed to cater for the subject site, based upon the proposed grading of the development and the likely impact to the EEC, it is considered that it is more appropriate for the majority of Stage 1 of the development to provide its own stormwater detention and water quality treatment and discharge to Bryant Drive.

The proposed development footprint will impact on the land earmarked for drainage infrastructure under the contributions plan, however design works have been undertaken to provide a new system to provide a similar outcome to the contributions plan. The proposed design is discussed further in Section 8. It is noted, that the proposed solution will not involve land acquisition by Council, thereby removing these costs.

Any potential future works undertaken on the subject site as a part of Stage 2 will consider the contributions plan works in further detail. It is noted that as Stage 1 will cater for itself, the contributions works will likely decrease as the contributing catchment has become smaller.

#### 3.1.1 Regional Flooding / Overland Flow Path

The Central Coast Council flood mapping tool outlines that the fringe of the site is impacted by regional flooding, however through additional correspondence with council, it was discovered that in extreme flood events water overtopping Bryant Drive is currently conveyed through the adjoining property, 19-21 Bryant Drive, and onto the subject site.

Council requires that the abovementioned box culvert system is designed to have the capacity to convey these flows in an emergency situation. The conveyance of these flows is discussed further in section 8.



## 4.0 Objectives

### 4.1 CONCEPT STORMWATER DESIGN

A concept stormwater design is required to demonstrate that stormwater runoff can be effectively and efficiently conveyed from the proposed subdivision to the existing downstream infrastructure and receiving waters. The stormwater design is required to consider adjacent properties and ensure no nuisance runoff occurs onto the existing properties.

### 4.2 STORMWATER QUANTITY

The pit and pipe network needs to cater for the minor storm event (5% AEP) without any surcharging within the system and minimising flow widths and ponding. The overland flow paths need to cater for the major storm event (1% AEP) with freeboard to adjacent habitable floor levels.

The purpose of this study is to limit post-development critical peak flows to less than or equal to existing flows all storm events up to and including the 1% AEP.

### 4.3 STORMWATER QUALITY / WATER SENSITIVE URBAN DESIGN

The stormwater drainage system must effectively remove the nutrients and gross pollutants from the site prior to the runoff entering the existing downstream waterways.

The stormwater design for the proposed subdivision is to adopt Water Sensitive Design (WSUD) principles throughout the development to promote sustainable and integrated land and water resource management.

The guidelines for stormwater quality treatment objectives are expressed as mean annual reductions of pollutant loads. The target objectives were obtained from Table 11.1 in the CCC Civil Works Guideline.

**Table 1 – Stormwater Treatment Objectives**

Pollutant	Stormwater Treatment Objectives
Suspended Solids	80% retention of the average annual load
Total Phosphorus	45% retention of the average annual load
Total Nitrogen	45% retention of the average annual load
Litter	90% reduction in the post development average annual load for pollutants greater than 5mm in diameter

### 4.4 FLOODPLAIN MANAGEMENT

Floodplain management requirements are outlined in Chapter 3.3 of the Wyong Development Control Plan 2013. Chapter 3.3 documents the minimum requirements for a development to ensure that any issues relating to flooding are adequately addressed. The aim of this report is to show that the proposed development complies with all floodplain management requirements.

#### 4.5 EROSION AND SEDIMENTATION CONTROL

Erosion and sedimentation control measures need to be implemented during any construction activities on the proposed subdivision to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the construction site to downstream drainage.

## 5.0 Concept Stormwater Design

The proposed stormwater system contains a combination of conventional pit and pipe networks and WSUD elements to effectively convey stormwater runoff to the existing downstream infrastructure.

Flows generated within the carpark areas are proposed to be captured by a series of pits located within the carpark areas and conveyed by an underground pipe system to the existing infrastructure in Bryant Drive. Flows generated on the roofs of the proposed buildings are to be captured by downpipes which will be connected directly to the carpark network.

Based upon the conceptual grading, there will be a number of different discharge locations for the development, each of which is discussed in further detail below.

The concept stormwater design can be seen in Exhibit 2 whilst the proposed catchments can be seen in Exhibit 3.

### 5.1 CATCHMENT 1 – BRYANT DRIVE NORTH

The largest proposed catchment discharges to the existing stormwater system within Bryant Drive at the northern edge of the subject site.

The Bryant Drive North catchment is approximately 1.9ha in area and drains the vast majority of the proposed development. The catchment generally grades in a westerly direction towards Bryant Drive with flows being captured by a series of stormwater pits.

For the purposes of the modelling, Catchment 1 is required to be split into two (2) subcatchments, being Catchment 1A and 1B. All flows generated in Catchment 1A will be conveyed to an underground detention tank before discharging to the existing network in Bryant Drive. Flows generated within Catchment 1B will not be conveyed to the detention tank, with Catchment 1A being over detained to cater for this area.

Flows generated within Catchment 1A will be conveyed through a GPT prior to entering the detention tank, with flows then entering a Jellyfish filter system after leaving the tank. Flows captured in Catchment 1B will be treated by a series of litter baskets contained within the surface inlet pits.

Modelling details can be seen in Sections 6 and 7.

### 5.2 CATCHMENT 2 – BRYANT DRIVE SOUTH

The existing Catchment 2 is much larger than the proposed catchment and therefore the peak post developed flows are less than the peak pre developed flows. Accordingly, it is not required to provide stormwater detention within this catchment.

Stormwater quality within Catchment 2 will be achieved through the use of litter baskets within the surface inlet pits, with catchment 1 being over treated to ensure Council targets are met for Catchment 1 and 2 combined.



### 5.3 CATCHMENT 3 – LAKE ROAD

Based upon the existing surface levels and the proposed grading surface, a portion of the proposed carpark located within the 'finger' adjoining Lake Road will drain to the existing network within Lake Road.

Similar to Catchment 2, the existing Catchment 3 is much larger than the proposed catchment and therefore stormwater detention is not required.

Given the size of this catchment, and the fact it will sheet flow to Lake Road, it is considered that water quality treatment is not required.

### 5.4 CATCHMENT 4 – STAGE 2

Catchment 4 includes a portion of the proposed development as well as a portion of the Stage 2 land. Two (2) outlets will be provided into the stage 2 land, where the flows will be conveyed to existing flow paths.

The first outlet will be located on the alignment of the contributions plan drainage channel and will convey flows from a small portion of the development, along with flows from upstream properties. The design of this system is discussed further in section 8.

The second outlet discharging into Stage 2 will be provided in a similar location to an existing headwall, with all discharge being directed to the existing open channel. Similar to Catchments 2 and 3, the existing catchment is much larger than the post developed catchment and therefore stormwater detention is not required.

As per Catchment 3, this outlet will be catered for in the future regional works and therefore it is considered that the catchment does not need to meet Council's water quality targets. Despite this, in order to ensure gross pollutants are captured prior to entering the downstream waterways, it is proposed to provide litter baskets within all surface inlet pits.

### 5.5 CATCHMENT 5 – EEC

As mentioned in Section 2.0, a cluster of EEC exists in the south eastern corner of the subject site. Whilst no works within Stage 1 of the development will have a direct impact on the EEC, the development will alter the existing flow regime draining to this area.

In order to ensure the existing flow regime is followed as closely as possible, the site has been graded to direct a similar volume of flows to the EEC in developed conditions. Flows will be discharged via a stabilised headwall before being trapped by a large level spreader which will spread the flows out to mimic the existing flow conditions.

A gravel base will be provided on the level spreader to allow for infiltration of flows to ensure groundwater flows are recharged. It is noted that the existing site soils are clay and that infiltration is unlikely to occur in meaningful amounts during both existing and developed conditions.

A Jellyfish filter system will be provided prior to this outlet to ensure that water quality targets are met for any stormwater being conveyed to the EEC.

Modelling of the EEC flows can be seen in Section 7.4 whilst the proposed outlet configuration can be seen in Exhibit 4.

## 6.0 Stormwater Quantity

The proposed development is required to limit post-development critical peak flows to less than or equal to existing flows for all design storms for all storm events up to and including the 1% AEP.

### 6.1 MODELLING

The quantity of required storage to reduce the post developed discharge from the site to less than or equal to the existing discharge for various storm events was analysed using the 'DRAINS' software, which uses the runoff routing method.

#### 6.1.1 Catchment Data

Catchment data for the existing site was based upon the detail survey and current site conditions, whilst the data for the developed site was based upon council's guidelines and the proposed development layout.

The pre development catchment boundaries can be seen in Exhibit 1, whilst the catchment parameters can be seen in Table 2 below.

**Table 2 – Pre Development Catchments**

Catchment	Total Area (ha)	% Impervious	Impervious Area (ha)	Pervious Area (ha)
Catchment 1	1.05	80	0.84	0.21
Catchment 2	0.44	90	0.40	0.04
Catchment 3	0.11	10	0.01	0.1
Catchment 4	2.16	25	0.54	1.62
Catchment 5	1.69	10	0.17	1.52
<b>Total</b>	<b>5.45</b>	<b>-</b>	<b>1.96</b>	<b>3.49</b>

The post development catchment boundaries can be seen in Exhibit 2, whilst the catchment parameters can be seen in Table 3 below.

**Table 3 – Post Development Catchment and Subcatchment Areas**

Catchment	Total Area (ha)	% Impervious	Impervious Area (ha)	Pervious Area (ha)
Catchment 1A	1.57	90	1.41	0.16
Catchment 1B*	0.09	90	0.08	0.01
Catchment 2	0.43	95	0.41	0.02
Catchment 3	0.06	90	0.05	0.01
Catchment 4	2.08	50	1.04	1.04
Catchment 5	1.22	45	0.55	0.67
<b>Total</b>	<b>5.59</b>	<b>-</b>	<b>3.47</b>	<b>2.12</b>

\* Catchment 1B outlets to the same location as 1A, however does not enter the OSD tank.

### 6.1.2 Model Parameters and Rainfall Data

As per the new CCC civil design guideline, model parameters were based upon AR&R and experience on similar sites. The following parameters were adopted for the DRAINS model:

- Pervious depression storage = 5mm;
- Impervious depression storage = 1mm;
- Soil Type = 3;
- Antecedent Moisture Condition = 3.

Rainfall data for the site was sourced from the Bureau of Meteorology whilst times of concentration for each catchment were based upon the kinematic wave equation. A screenshot of the DRAINS model can be seen in **Appendix A**.

## 6.2 RESULTS

In accordance with Council's requirements, modelling was undertaken to demonstrate compliance of post development flows being less than or equal to the pre development flows.

The results of the DRAINS modelling can be seen in Table 4 below.

**Table 4 – DRAINS Results**

ARI Event (Year)	Pre Development Flow (m <sup>3</sup> /s)	Post Development Flow Without Detention (m <sup>3</sup> /s)	Post Development Flow With Detention (m <sup>3</sup> /s)
<b>Catchment 1</b>			
20%	0.42	0.67	0.41
10%	0.47	0.76	0.46
5%	0.54	0.87	0.51
2%	0.59	0.94	0.56
1%	0.66	1.04	0.65
<b>Catchment 2</b>			
20%	0.18	0.17	n/a
10%	0.20	0.20	n/a
5%	0.23	0.23	n/a
2%	0.25	0.25	n/a
1%	0.28	0.28	n/a
<b>Catchment 3</b>			
20%	0.04	0.02	n/a
10%	0.05	0.03	n/a
5%	0.05	0.03	n/a
2%	0.06	0.03	n/a
1%	0.07	0.04	n/a
<b>Catchment 4</b>			
20%	0.78	0.78	n/a
10%	0.89	0.89	n/a
5%	1.04	1.04	n/a
2%	1.15	1.13	n/a
1%	1.29	1.27	n/a

Catchment 5			
20%	0.56	0.44	n/a
10%	0.64	0.50	n/a
5%	0.76	0.58	n/a
2%	0.82	0.62	n/a
1%	0.92	0.70	n/a

As it can be seen from Table 4 above, the peak post developed flows are less than or equal to the peak pre developed flows without the provision of stormwater detention for Catchments 2-5. Catchment 1 however, requires a stormwater detention tank in order adequately attenuate the peak flows. The tank parameters can be seen in Table 5 below.

**Table 5 - Tank Parameters**

Tank Parameter	Detail
Outlet Controls	0.15m H x 1.40m W cut out – IL RL 0m*
	Weir (top of control pit wall) – 0.5m length - IL RL 0.85m
Tank Surface Area	305m <sup>2</sup>
Tank Depth	1.0m
Max Water Depth (1% AEP Event)	1.0m
Total Storage at 1% AEP Stage	305m <sup>3</sup>

\* Levels are relative to the bottom of the tank. R.L's to AHD to be provided at CC stage.

It is anticipated that the proposed tank will be constructed as a concrete structure, however this is to be confirmed at the CC stage of the project.

## 7.0 Water Quality/Water Sensitive Urban Design

The proposed stormwater system, as detailed in Section 5.0, uses a combination of pit and pipe networks and water sensitive urban design elements to convey stormwater runoff from the site. It is intended to use a combination of treatment devices within the drainage system to remove nutrients and sediments from the stormwater prior to the runoff leaving the site.

### 7.1 TREATMENT DEVICES

The stormwater design for the proposed subdivision proposes to use a combination of conveyance, and end of line controls to treat the stormwater runoff from the site. The treatment train will be modelled for demonstration of compliance with CCC's key objectives.

#### Conveyance

The low flows will be conveyed through a GPT which will be the conveyance control used to treat the stormwater. The GPT is the primary pollution control device in the treatment train after the stormwater is conveyed via the pit and pipe network. The GPT will primarily remove litter, large debris and the nutrients attached to particles. The GPT will be in the form of a Humegard (or approved equivalent) and litter baskets.

#### End of Line

It is proposed to provide a stormwater 360 "Jellyfish" filter device at the end of the treatment train to provide tertiary treatment to flows prior to them leaving the site.

### 7.2 MODELLING

The software used for the water quality modelling is MUSIC. This program is well regarded as industry best practice for analysis of the effectiveness of treatment mechanisms on the quality of stormwater runoff from a development site of this size.

The MUSIC model parameters were adopted using the MUSIC-LINK feature, whilst treatment node parameters were based upon a combination of Council's guidelines and information provided by individual device providers.

The MUSIC-LINK report can be found in **Appendix B**.

#### 7.2.1 Catchment Data

The MUSIC catchments were based upon the proposed architectural layout and grading. A summary of the catchment parameters can be seen in Table 6 overleaf.

**Table 6 – Post Development Catchment and Subcatchment Areas**

Catchment	Sub Catchment	Total Area (ha)	% Impervious	Impervious Area (ha)	Pervious Area (ha)
Catchment 1	1A Roof	0.26	100	0.26	0.00
	1A Road	1.31	90	1.18	0.13
	1B Road	0.09	90	0.08	0.01
Catchment 2	Roof	0.17	100	0.17	0.00
	Road	0.26	95	0.25	0.01
Catchment 3	Roof	-	-	-	-
	Road	-	-	-	-
Catchment 4	Roof	0.58	100	0.58	0.00
	Road	0.39	85	0.39	0.06
Catchment 5	Roof	0.18	100	0.18	0.00
	Road	0.18	85	0.15	0.03

### 7.3 RESULTS

In accordance with Council requirements, modelling has been undertaken to demonstrate compliance with water quality objectives for stormwater runoff from the proposed development prior to discharge of stormwater into the downstream waterways.

As discussed in Section 5.0, Catchments 3, 4 and 5 are to be catered for in the future regional Council works and therefore they are not required to meet Council's water quality targets. Litter baskets will be provided within all pits within these catchments to ensure no gross pollutants enter the downstream waterways.

Catchment 1 has been over treated to cater for Catchment 2 which will be provided with litter baskets only.

The results of the modelling for the combined Catchments 1 and 2 are shown in Table 7 below.

**Table 7 – Pollutant Loads and Reductions**

Catchments 1 & 2				
Pollutant	Without Treatment (kg/yr)	With Treatment (kg/yr)	Modelled Reduction (%)	Target Reduction (%)
TSS	6660	1060	84.1	80
TP	11.8	5.15	56.4	45
TN	56.2	30.3	46.1	45
GP	589	6.12	99	90

From Table 7, it can be seen that the MUSIC modelling indicates that the proposed treatment train complies with council's water quality targets. A screenshot of the MUSIC model can be seen in **Appendix B**.

## 7.4 EEC FLOW REGIME

As mentioned in Sections 2.0 and 5.5, a cluster of EEC exists in the south eastern corner of the subject site. Whilst no works within Stage 1 of the development will have a direct impact on the EEC, the development will alter the existing flow regime draining to this area.

To ensure the development does not have an adverse impact on the area of EEC, MUSIC modelling was undertaken to determine the total flows draining to the EEC area in both the pre developed and post developed scenarios. The results of the modelling can be seen in **Table 8** below.

**Table 8 - EEC Flows**

Catchment	Total Area (ha)	% Impervious	Flow (ML/yr)
Predeveloped	1.2	10	5.22
Post Developed	0.71	50	5.40

It can be seen from Table 8 above that the post developed flows discharging to the EEC area closely mimic the pre developed flows.

In addition to maintaining flows to the EEC, further MUSIC modelling has been undertaken to ensure that flows discharging to this area also meet Council's water quality targets. As mentioned in section 5.5 it is proposed to provide a Jellyfish filter system prior to flows discharging. The results of the MUSIC modelling can be seen in **Table 9** below.

**Table 9 – Pollutant Loads and Reductions**

Pollutant	Catchments 5			
	Without Treatment (kg/yr)	With Treatment (kg/yr)	Modelled Reduction (%)	Target Reduction (%)
TSS	637	42.9	93.3	80
TP	1.31	0.52	60.2	45
TN	8.75	4.49	48.7	45
GP	96.3	2.97	96.9	90

A catchment plan showing the proposed catchments to the EEC area can be seen in **Exhibit 3** along with the MUSIC modelling results.

Further information surrounding the ECC area is contained within the Ecology report, prepared by AEP.

## 8.0 Regional Stormwater Conveyance

As mentioned in Section 3.1, the subject site and adjacent catchments are subject to future stormwater conveyance and quality works under Wyong district Contributions Plan No.1. Whilst the water quality control measures proposed under the contributions plan are not impacted by the development, the stormwater conveyance channel along the northern boundary of the subject site, proposed under the plan, is proposed to be varied as part of the development layout.

### 8.1 CONTRIBUTIONS PLAN

A review of the contribution plan No.1 indicates that Council is proposing to construct an open channel system along the northern and eastern boundaries of the subject site. This open channel will be capable of conveying the 20% AEP storm event and caters for both the subject site and upstream catchments.

To further understand the intent of the proposed conveyance channels, a review of the underlying stormwater report used to inform the contributions plan was undertaken. The report, prepared by Webb McKeown in 2000, outlines a number of constraints, and subsequent options for the conveyance and treatment of stormwater in the Tuggerah industrial area.

In regards to the channel proposed along the northern boundary, the Webb McKeown report outlines the provision of a concrete based channel with grass lined batters capable of conveying the 20% AEP flows. The channel is to be within a 10m – 20m strip of land to be dedicated to Council. The catchment for the proposed channel is notated as "Building Pad 2" which encompasses part of the subject site and a number of adjoining properties.

It is noted that the channel is proposed to be provided in between future building pads 1 & 2, both of which are to be filled up to approximately 1.5m above the invert of the channel. Whilst the report outlines that the channel has been designed to convey the 20% AEP flows (with the provision of 300mm freeboard) it is noted that the report does not indicate how flows in excess of the 20% AEP event are conveyed. Despite this, considering the channel is cut in between the proposed building pads, it is expected that flows in excess of the 20% AEP will be conveyed between the building pads until the capacity of this cross section is breached and flows spill on to the building pads themselves. The contributing catchments and channel design can be seen in **Exhibit 5**.

An important item that is not considered within the existing report, is how to deal with the complications of staged construction of the future building pads. It is noted that should the channel be constructed as part of this development, but prior to the filling of the properties fronting Lake Road, the channel will be unable to convey the flows generated by these properties in the interim.

To enable the safe conveyance of flows up to, and including, the 1% AEP event without impacting on the building pads and to enable the construction of a system capable of meeting the intent of the contributions plan whilst also being sympathetic to both the proposed and future development, an alternate design has been prepared.



## 8.2 REGIONAL FLOODING / OVERLAND FLOW PATH

As mentioned in section 3.1.1, council requires that the alternate box culvert design has the capacity to convey overland flow overtopping Bryant Drive in extreme flood events. Council requires that the culvert inlet lines up with the existing overland flow path along the southern boundary of 19 – 21 Bryant Drive and that the inlet is subject to a 25% blockage factor.

A review of the Flood Impact Assessment Report, prepared by SKM for the Pacific Highway and Wyong Road intersection upgrade, indicates that the overland flow path currently conveys water through the carpark on the southern edge of 19 - 21 Bryant Drive in the 1 in 100 year and greater flood events. An extract of the report, showing the 1 in 100-year flood impacts can be seen in **Figure 2** below.

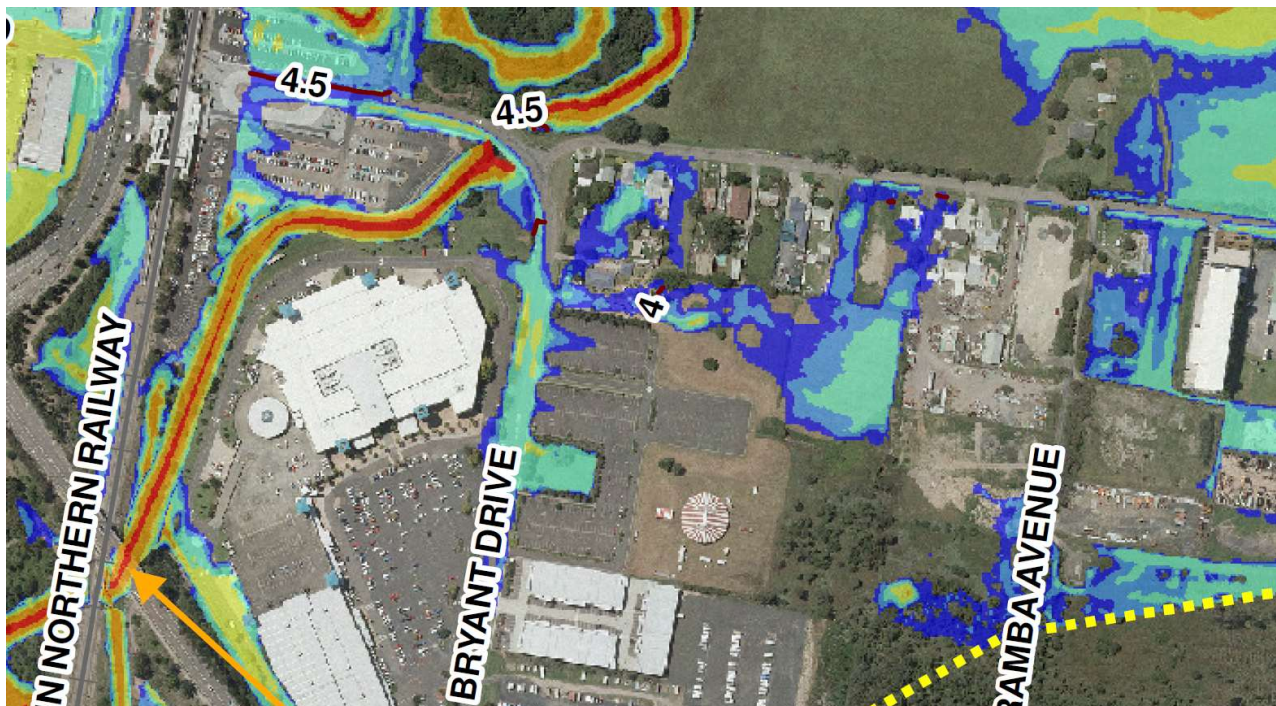


Figure 2. Extract of RMS Flood Study

The proposed culvert design outlined within section 8.3 will ensure that the abovementioned council requirements are complied with.

## 8.3 ALTERNATE DESIGN

The alternate design, proposed to be constructed with this development, aims to not only meet the intent of the contributions plan, but provide a safe and efficient stormwater system capable of conveying flows up to the 1% AEP whilst also being sympathetic to both the proposed development and existing adjoining properties.

As can be seen in **Exhibit 6**, it is proposed to provide a box culvert system, underneath the proposed access road, in lieu of the open channel proposed in the contributions plan. The culvert will be designed to convey the 1% AEP, including a 50% blockage on all pits and pipes and provide connections to the adjoining properties. The culvert will also be designed to ensure it has capacity to take any flows that enter the site from 19 – 21 Bryant Drive in an extreme flood event. The following sections of the report outline the design of the proposed box culvert.

### 8.3.1 Culvert Conveyance

To determine the peak discharge required to be conveyed by the culvert, the contributing catchment to the culvert based upon both the ultimate scenario (Lake Road and 19 – 21 Bryant Drive developed) and interim scenario (subject site developed and water overtopping Bryant Drive) were compared.

The contributing catchments can be seen in **Exhibit 6** & **Exhibit 8** whilst the catchment parameters can be seen in **Tables 9 & 10** below.

**Table 9. Contributing Catchment Parameters – Ultimate Scenario**

Catchment	Total Area (ha)	% Impervious	Time of Concentration (min)
Development	0.21	90	5
Bryant Drive	0.80	90	5
Lake Road	0.46	90	5

**Table 10. Contributing Catchment Parameters – Interim Scenario**

Catchment	Total Area (ha)	% Impervious	Time of Concentration (min)
Catchment 1A	1.57	90	5
Catchment 1B	0.09	90	5
Catchment 2	0.43	95	5
Bryant Drive	1.82	90	8

Using the abovementioned parameters, a rational method calculation was undertaken to determine the 1% AEP flow required to be conveyed by the proposed box culvert in the ultimate scenario.

To account for the size of the Bryant Drive catchment, the proposed OSD tank and associated differences in hydrograph peaks a DRAINS model was prepared to determine the peak flow in interim scenario.

The results of both analyses' can be seen in **Table 11** below.

**Table 11. Rational Method Calculation**

Catchment	Flow (m <sup>3</sup> /s)
Ultimate Scenario	1.03
Interim Scenario	1.84

It can be seen from **Table 11** above that the critical peak flow occurs during the interim scenario when flows overtop Bryant Drive. It is noted that the interim peak flow calculated is the flow approaching the pit in the low point of Bryant Drive. This pit has a 450mm diameter pipe outlet at 0.5% which will be capable of conveying a portion of the flow. Based upon the Colebrook White pipe capacity charts, it has been adopted that this pipe will convey approximately 0.23 m<sup>3</sup>/s. The design flow adopted for the culvert sizing is therefore 1.61 m<sup>3</sup>/s. A copy of the Colebrook White Chart can be seen in **Appendix C**.

As required by council, a blockage factor of 25% was applied to the culvert inlet. The culvert sizing was undertaken using the Concrete Pipe Association of Australia (CPAA) sizing charts assuming an inlet control with 0.5m ponding at the inlet. A summary of the sizing can be seen in **Table 12** below, whilst a copy of the CPAA chart can be seen in **Appendix C**.

**Table 12. Culvert Sizing**

Ponding Depth (m)	Culvert Width (m)	Culvert Depth (m)	Capacity (m <sup>3</sup> /s)
0.5	2.7	0.6	1.61
0.38	2.1 (x2)	0.6	1.61

It can be seen from **Table 12** above that a 2.7m x 0.6m box culvert would be required to convey the flows without the provision of the blockage, whilst including the 20% blockage twin 2.1m x 0.6m box culverts would be required. Accordingly, it is proposed to provide twin 2.1m x 0.6m box culverts.

It is noted that the CPAA sizing was checked against an orifice calculation and the size was confirmed as being adequate.

### 8.3.2 Culvert Levels and Flows

To ensure that 19 – 21 Bryant Drive can drain in the interim scenario, the culvert inlet is to be provided at the base of the proposed retaining wall. Given the existing levels on site, this results in a maximum achievable longitudinal grade of 0.3% for the proposed box culvert.

To ensure the culvert capacity, a Manning's calculation as undertaken adopting a 4.2m wide x 0.6m high box culvert with a Manning's 'n' of 0.013 and longitudinal grade of 0.3%. this calculation resulted in a flow conveyance of approximately 6.9 m<sup>3</sup>/s, well in excess of the required flow.

A review of the catchments draining to the culvert in the interim scenario (excluding overflow from Bryant Drive) reveals that a peak flow of 0.7 m<sup>3</sup>/s flow velocity of 1m/s would be conveyed within the culvert in the minor design storm event (20-year ARI). A Manning's calculation, adopting an 'N' of 0.012 and a longitudinal grade of 0.3%, reveals that the water level within the culvert would be 140mm deep which results in a velocity of over 1 m/s. This is important as a flow velocity of 1m/s will ensure that the build-up of sediment and other debris is minimised, lowering the risk of blockages and minimising maintenance of the system.

It is noted that the design flows entering the culvert will only increase in the ultimate scenario resulting in the self-cleansing velocity being achieved more frequently.

### 8.3.3 Connections to Adjoining Properties

As mentioned in Section 8.1, consideration is needed to be given to the staged construction of the proposed building pads and how this will impact on the proposed stormwater conveyance. It is noted that this was not considered in the Webb McKeown report and, based upon the channel design, it is considered that the adjoining properties would not be able to drain to the channel without first being filled.

Based upon the Central Coast Council upgrade of Lake Road, the majority of the lots fronting Lake Road currently drain to Lake Road, with only a small portion at the rear of the lots currently draining via sheet flow into the subject site. Given the small size of the catchments, and their largely pervious nature, it is considered that the flow generated

would be minimal and would likely pond in the backyards of these properties in the current situation. As such, it is considered that a stormwater connection to these properties, in the interim scenario, is not required.

To enable future connection, for these same properties once they are filled during development, it is proposed to provide piped connections from the box culvert to the boundary. These pipes will be capped and only used once the adjoining sites have been filled. It is noted that, as it is unknown if the adjoining properties will be developed individually, a pipe connection will be provided to each individual lot and these connections will be designed to convey the 1% AEP.

Similar to the above, a piped connection will be provided to Lot 141 DP1007716 to ensure it can continue to drain during both the interim and future scenarios. In this case, the pipe connection will be used during both scenarios. It is noted that Lot 13 DP 5536 also adjoins the site, however this lot is provided with a drainage connection to Bryant Drive and therefore no connection is required.

A typical detail of the proposed connections can be seen in **Exhibit 6**.

#### 8.3.4 Council Concerns

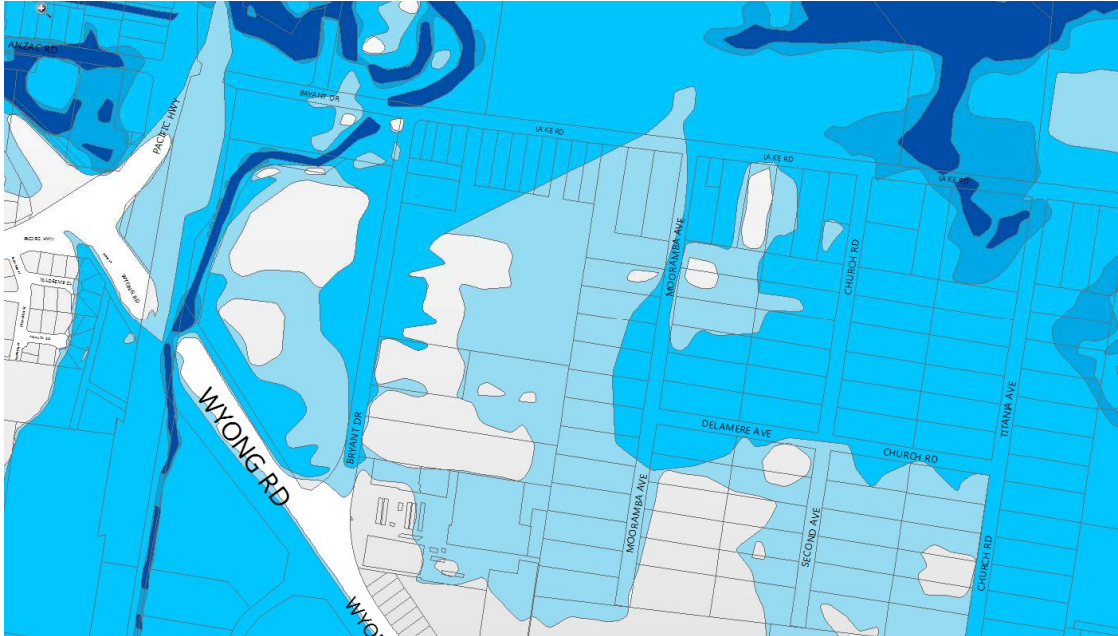
Previous correspondence has been had with Central Coast Council regarding the proposed solution and a number of concerns were raised. These concerns included:

- Flow conveyance – Council is concerned that the channel system was designed to convey the 20% AEP with the proposed solution being able to convey the 1% AEP
  - As mentioned earlier in the report, based upon the channel and building pad design, flows larger than the 20% AEP would be conveyed between the building pads until the capacity of the cross section is exceeded and the flows spill onto the building pad. As such it is considered that ultimately the 1% AEP flows would find their way to the same location and the proposed solution is preferred due to the fact it would not allow flows to spill onto the building pads, which has the potential to cause damage to private property;
- Maintenance – Council is concerned that maintenance of the system would be difficult;
  - The culvert system could be kept as private system to be maintained by the owner of the site;
  - Maintenance access pits would be provided to the system in accordance with Council standards;
- Blockages / Surcharge / Larger Storm events – Council is concerned about what may happen in larger events and if the system is to block;
  - As mentioned in the report, despite the extremely low risk of blockage due to the size and nature of the upstream catchment, a 25% blockage factor has been taken into account for the design inlet;
  - Blockage factors of 50% will be applied to all internal pits as requested by council;
  - Given the limited capacity of the channel system it is considered that the proposed box culverts provide a much better outcome during larger storm events.
- Location of culvert inlet;
  - The culvert inlet has been located to coincide with the overland flow path through the adjoining property.



## 9.0 Floodplain Management

A review of Council's flooding maps indicate that portions of the site are flood affected in both the 1% AEP and PMF events. A copy of Council's flooding map can be seen in Figure 2 below.



**Figure 2: Site Flooding (CCC's Flooding Maps)**

As the site is flood affected, a flood information application was submitted to Central Coast Council. The response indicates that the 1% AEP flood level within the site is R.L 3.8m with the minimum habitable floor level being R.L 4.3m. A copy of the flood information application response can be seen in **Appendix D**.

A review of the site survey indicates that the majority of the existing site is currently well above the 1% AEP flood level with the exception of the small open area associated with the previous residential dwelling. Council indicated the following at the pre-da meeting:

- Council has no objection to filling within the site to bring the low-lying area above the 1% AEP flood level;
- The proposed carpark level could be a maximum of 300mm below the 1% AEP level if required.

At the time of writing this report, the formal Pre-DA meeting minutes were not available.

Given the majority of the site is currently above the 1% AEP flood level and the proposed grading is to lift the site further, it is considered that the proposed development will not be impacted by the regional flood levels and therefore complies with Council's floodplain management guideline.

## 10.0 Erosion and Sedimentation Control

---

Erosion and sedimentation control measures need to be implemented during any construction on the proposed subdivision to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the construction site to downstream waterways.

An Erosion and Sedimentation Control Plan can be seen in **Exhibit 7**. The attached Erosion and Sedimentation Control Plan is only an indicative plan as another Erosion and Sedimentation Control Plan will be provided as part of the Construction Certificate drawings and a further plan will be provided by the contractor before construction takes place.

It is expected that particular care will need to be taken when preparing the erosion and sediment control plan to ensure no adverse effects on the EEC.

## 11.0 Conclusion

---

To comply with Central Coast Council stormwater management guidelines, the stormwater system for the proposed development will consist of a series of stormwater pits and pipes, an underground detention tank, gross pollutant traps and a Jellyfish filter system.

Consideration has been given to an existing area of EEC, with the site being graded to ensure the existing flow regime to the area is followed as closely as possible.

Consideration was given to the provision of Council's channelized stormwater conveyance system outlined in the contributions plan. An alternate design of a box culvert system was proposed in lieu of the channel to provide a design that was sympathetic to both the intent of the contributions plan and the proposed development.

It has been determined that the proposed development will not be adversely affected by regional flooding.

Water conservation has been considered during the design and modelling of the proposed development so as to incorporate water retention or reuse measures to reduce the demand on potable water. Furthermore, the incorporation of water retention devices has reduced the volume of stormwater runoff from the developed site.

An Erosion and Sedimentation Control Plan has also been prepared for construction of the proposed development also complying with Council's requirements.

## Exhibits

---

EXHIBIT 001	EXISTING SITE AND CATCHMENTS
EXHIBIT 002	CONCEPT STORMWATER DESIGN
EXHIBIT 003	PROPOSED CATCHMENTS
EXHIBIT 004	EEC FLOWS
EXHIBIT 005	COUNCIL PROPOSED CONTRIBUTION PLAN WORKS
EXHIBIT 006	ALTERNATE STORMWATER CONTRIBUION WORKS
EXHIBIT 007	EROSION & SEDIMENTATION CONTROL PLAN
EXHIBIT 008	PROPOSED CULVERT CATCHMENT PLAN





PREDEVELOPMENT CATCHMENTS

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
E	26.02.2021	GENERAL AMENDMENTS	JJ	BM	DATUM: N/A CONTOUR INTERVAL: 0.5m	0 25 50m SCALE: 1:1000 (FULL)	NOTE : PLANS ARE PREPARED IN COLOUR

- project management
- civil engineering
- infrastructure
- superintendency
- economic analysis
- social impact
- town planning
- surveying
- development feasibility
- visualisation
- urban design

LEGEND

SITE BOUNDARY

EXISTING LOT BOUNDARY

EXISTING STORMWATER

EXISTING MAJOR CONTOURS

EXISTING MINOR CONTOURS

PRE DEVELOPMENT CATCHMENT 1

PRE DEVELOPMENT CATCHMENT 2

PRE DEVELOPMENT CATCHMENT 3

PRE DEVELOPMENT CATCHMENT 4

PRE DEVELOPMENT CATCHMENT 5



drawing title:  
EXHIBIT 001 -  
EXISTING SITE AND  
CATCHMENTS

location: 11 BRYANT DRIVE  
TUGGERAH, NSW

council: CENTRAL COAST COUNCIL

dwg ref: 190557-EX-001

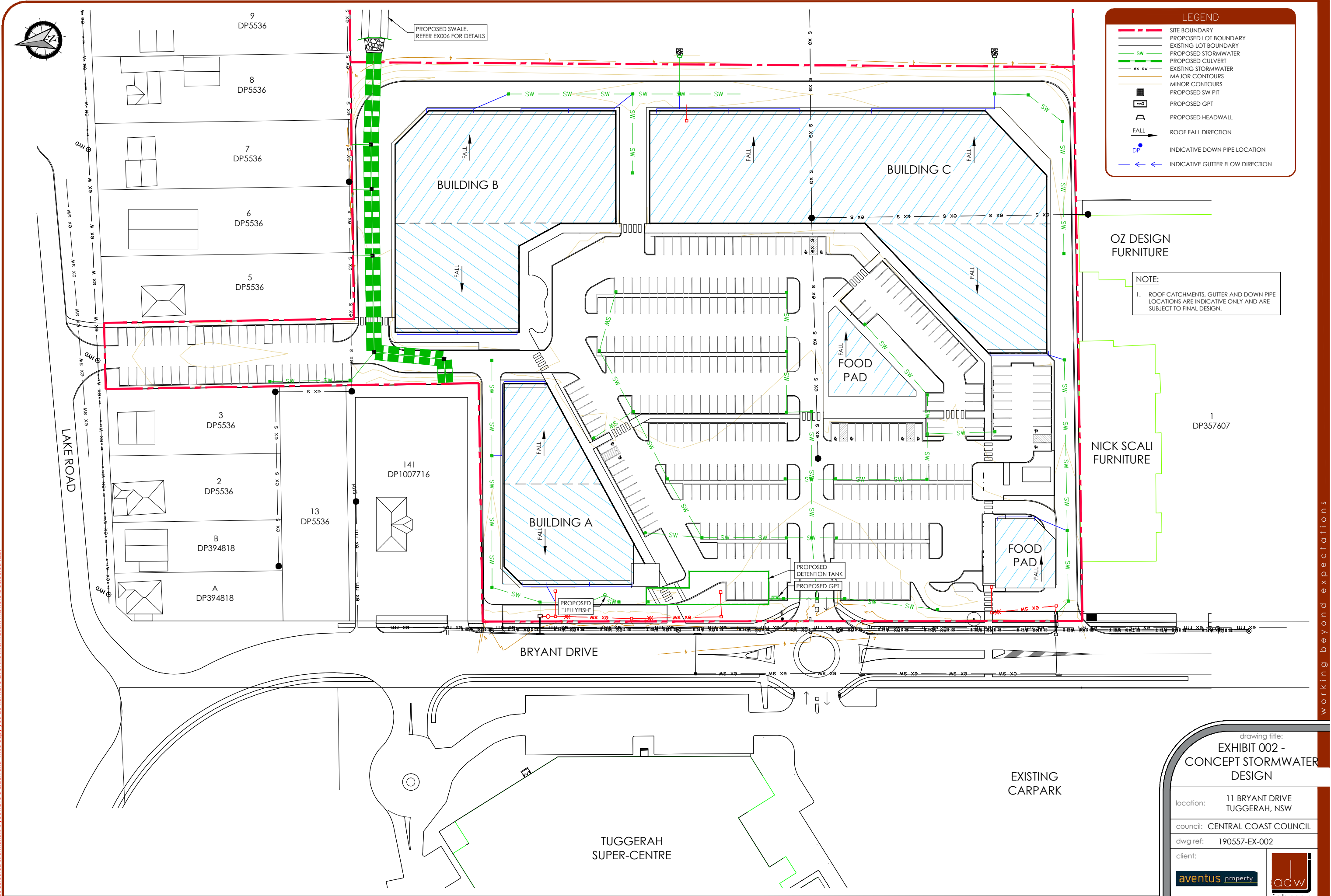
client:

adventus property

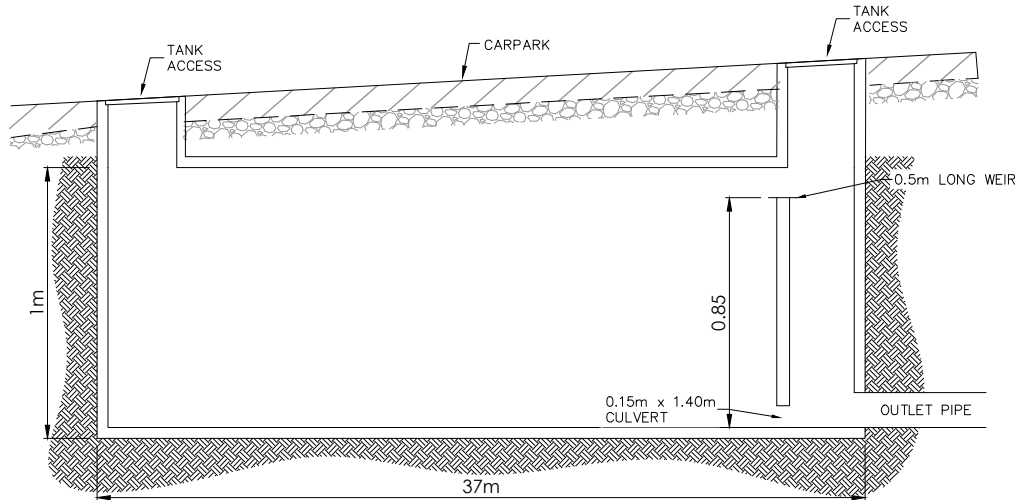
adw  
johnson

central coast office ph: (02) 4305 4300  
hunter office ph: (02) 4978 5100  
sydney office ph: (02) 8046 7411

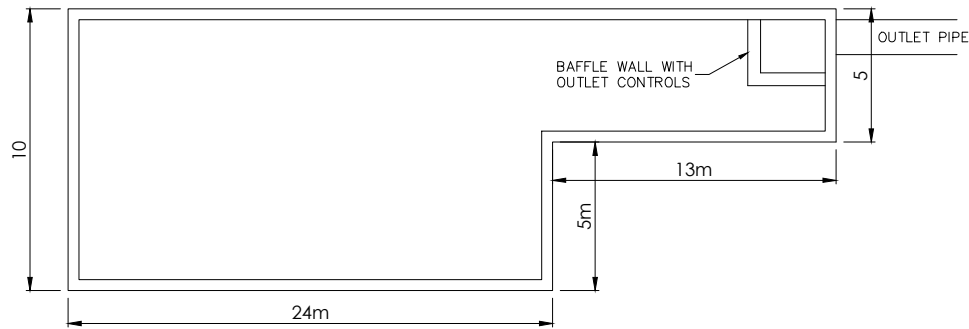
www.adwjohnson.com.au



ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
E	26.02.2021	GENERAL AMENDMENTS	JJ	BM	DATUM: N/A CONTOUR INTERVAL: 0.5m	0 12.5 25.0m SCALE: 1:500 (FULL)	NOTE: PLANS ARE PREPARED IN COLOUR
• project management • civil engineering • infrastructure • superintendency • economic analysis • social impact • town planning • surveying • development feasibility • visualisation • urban design							

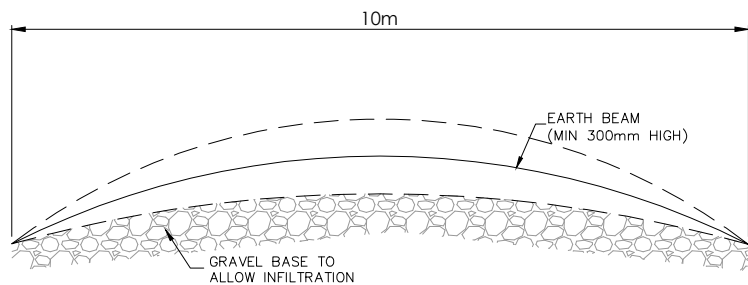


TYPICAL OSD TANK SECTION  
N.T.S.

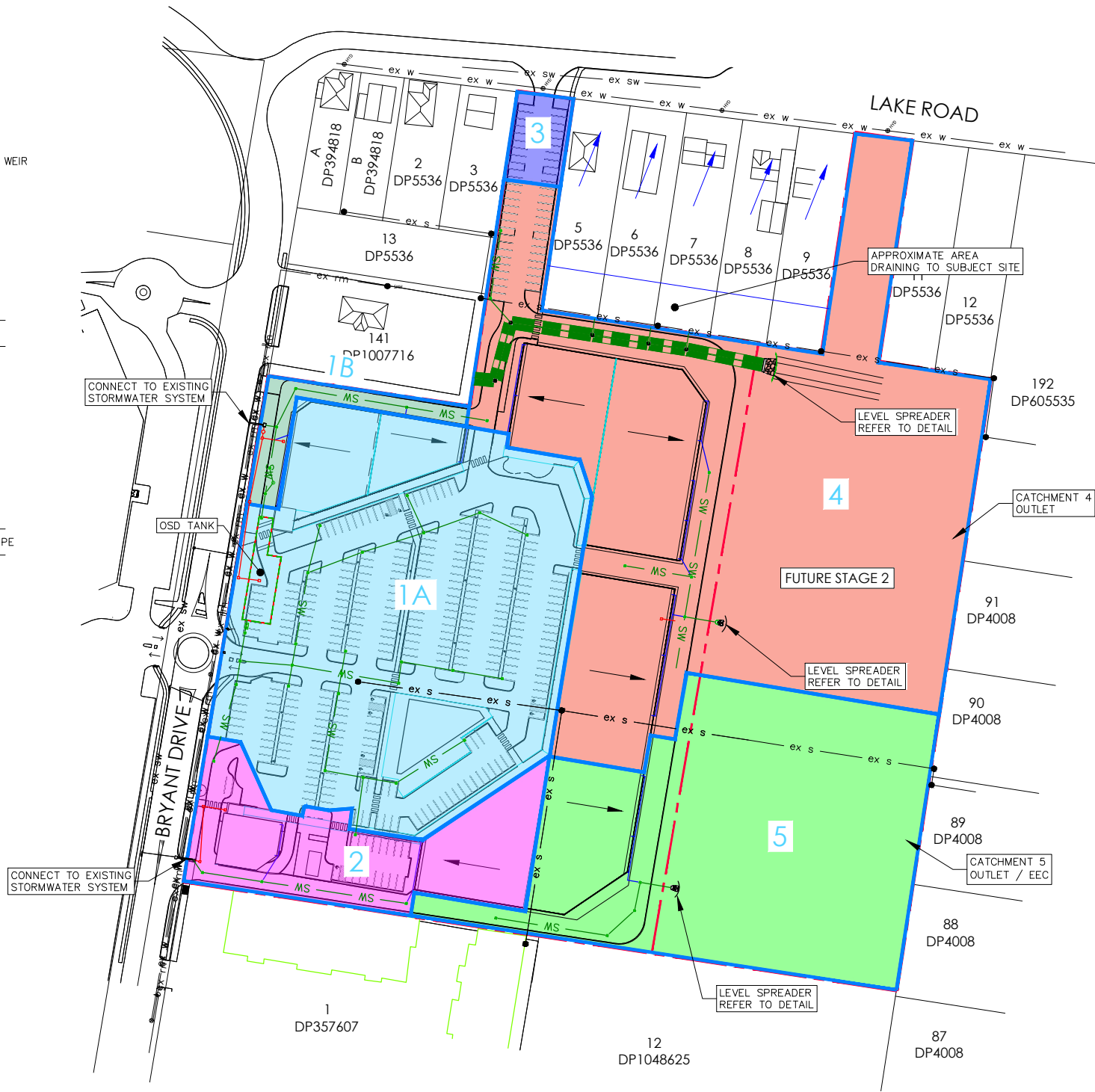


TYPICAL OSD TANK PLAN  
N.T.S.

- CONSTRUCTION NOTES:
1. TANK DIMENSIONS INDICATIVE ONLY. FINAL DIMENSIONS TO BE DETERMINED AT CC STAGE.
  2. TANK TO HAVE STEP IRONS LOCATED AT CC DESIGN STAGE.



LEVEL SPREADER DETAIL  
N.T.S.



POST DEVELOPMENT CATCHMENT



**LEGEND**

- SITE BOUNDARY
- PROPOSED LOT BOUNDARY
- EXISTING LOT BOUNDARY
- SW PROPOSED STORMWATER
- PROPOSED CULVERT
- ex SW EXISTING STORMWATER
- ex SW EXISTING STORMWATER TO BE REMOVED
- MAJOR CONTOURS
- MINOR CONTOURS
- POST DEVELOPMENT CATCHMENT 1A
- POST DEVELOPMENT CATCHMENT 1B
- POST DEVELOPMENT CATCHMENT 2
- POST DEVELOPMENT CATCHMENT 3
- POST DEVELOPMENT CATCHMENT 4
- POST DEVELOPMENT CATCHMENT 5
- PROPOSED GSIP
- PROPOSED HEADWALL

- GENERAL NOTES:—**
1. REFER TO DA DRAWINGS REFERENCE 190557E-DA PREPARED BY ADW JOHNSON FOR DETAILS SURROUNDING INFRASTRUCTURE TO BE REMOVED
  2. REFER TO DA PLANS FOR DETAIL SURROUNDING ROOT DRAINAGE.

drawing title:  
**EXHIBIT 003 -  
PROPOSED  
CATCHMENTS**

location: 11 BRYANT DRIVE  
TUGGERAH, NSW

council: CENTRAL COAST COUNCIL

dwg ref: 190557-EX-003

client:



central coast office ph: (02) 4305 4300  
hunter office ph: (02) 4978 5100  
sydney office ph: (02) 8046 7411

www.adwjohanson.com.au

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
E	26.02.2021	GENERAL AMENDMENTS	JJ	BM	DATUM: N/A CONTOUR INTERVAL: 0.5m	0 25 50m SCALE: 1:1000 (FULL)	NOTE : PLANS ARE PREPARED IN COLOUR
• project management • civil engineering • infrastructure • superintendency • economic analysis • social impact • town planning • surveying • development feasibility • visualisation • urban design							





PRE EEC CATCHMENT

Flow (ML/yr)	Outflow
	5.27

PRE-DEVELOPED FLOWS FROM MUSIC



POST EEC CATCHMENT

Flow (ML/yr)	Inflow
	5.40

POST-DEVELOPED FLOWS FROM MUSIC

**LEGEND**

- SITE BOUNDARY
- PROPOSED LOT BOUNDARY
- EXISTING LOT BOUNDARY
- PROPOSED STORMWATER
- PROPOSED CULVERT
- EX SW --- EXISTING STORMWATER
- EX SW --- EXISTING STORMWATER TO BE REMOVED
- MAJOR CONTOURS
- MINOR CONTOURS
- EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- PRE EEC CATCHMENT
- POST EEC CATCHMENT
- APPROXIMATE AREA OF EEC

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
E	26.02.2021	GENERAL AMENDMENTS	JJ	BM	DATUM: N/A CONTOUR INTERVAL: 0.5m	0 25 50m SCALE: 1:1000 (FULL)	NOTE: PLANS ARE PREPARED IN COLOUR

drawing title:  
**EXHIBIT 004 - ECC FLOWS**

location: 11 BRYANT DRIVE  
TUGGERAH, NSW

council: CENTRAL COAST COUNCIL

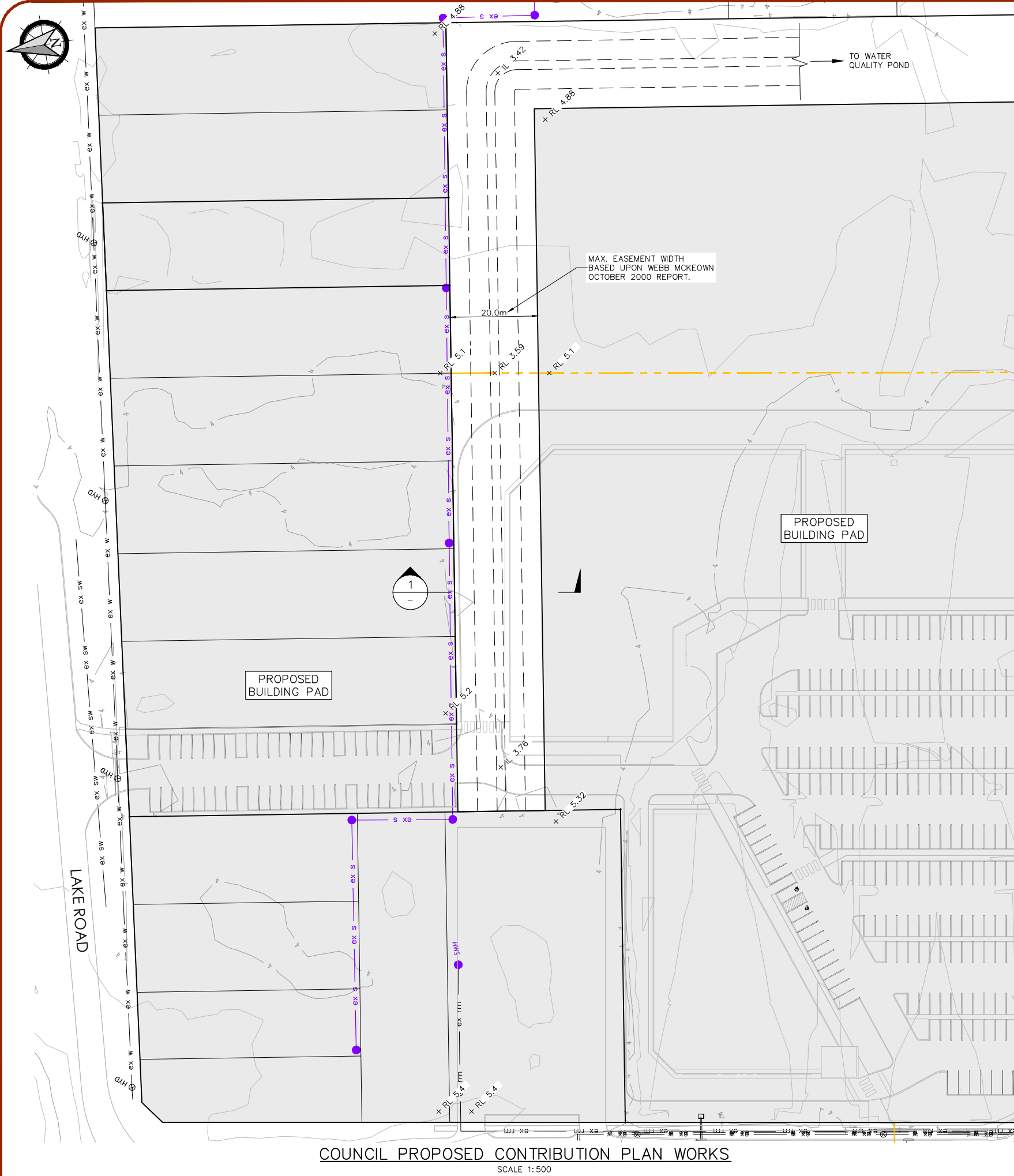
dwg ref: 190557-EX-004

client:

**adw johnson**

central coast office ph: (02) 4305 4300  
hunter office ph: (02) 4978 5100  
sydney office ph: (02) 8046 7411

www.adwjohanson.com.au



COUNCIL PROPOSED CONTRIBUTION PLAN WORKS

SCALE 1: 500

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
E	26.02.2021	GENERAL AMENDMENTS	JJ	BM	DATUM: AHD CONTOUR INTERVAL: 0.5m	A1 1:500 0 12.5 25.0m A3 1:1000	A1 1:100 0 2.5 5.0m A3 1:200

- project management
- civil engineering
- infrastructure
- superintendency
- economic analysis
- social impact
- town planning
- surveying
- development feasibility
- visualisation
- urban design

LEGEND

SITE BOUNDARY

EXTENT OF WORKS

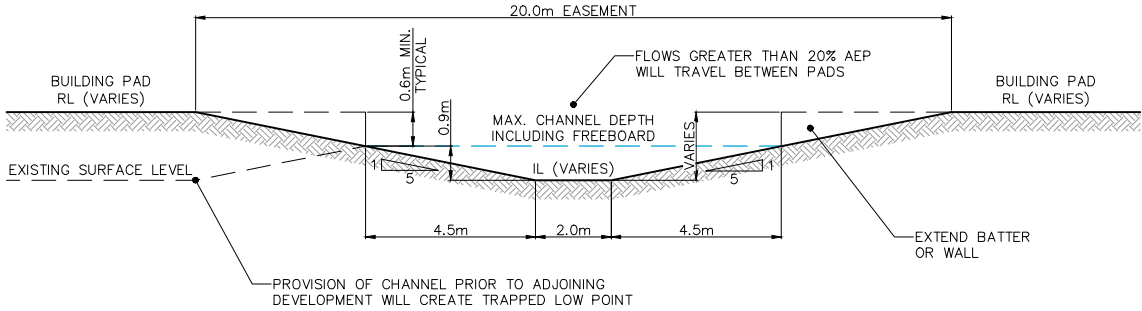
ex sw

ex s

ex rm

ex w

- GENERAL NOTES: –
- BUILDING PAD SHAPES & LEVELS TAKEN FROM WEBB MCKEOWN REPORT.



SECTION 1  
SCALE 1:100

NOTE: CHANNEL SECTION BASED UPON WEBB MCKEOWN OCTOBER 2000 REPORT. ASSUMING 20.0m EASEMENT

NOTE: BASED UPON PROPOSED CHANNEL WORKS, FLOWS GREATER THAN 20% AEP WILL BE CONVEYED BETWEEN BUILDING PADS

drawing title:  
COUNCIL PROPOSED  
CONTRIBUTION PLAN  
WORKS

location: 11 BRYANT DRIVE  
TUGGERAH, NSW

council: CENTRAL COAST COUNCIL

dwg ref: 190557-EX-005

client:

aventus property

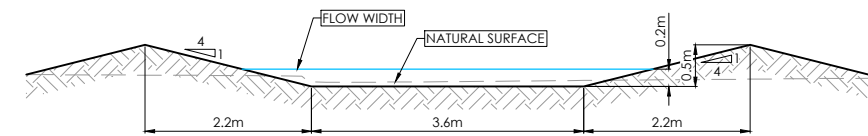


central coast office ph: (02) 4305 4300  
hunter office ph: (02) 4978 5100  
sydney office ph: (02) 8046 7411

www.adwjohanson.com.au



- | Station | Proposed Surface Level (m) | Natural Surface Level (m) | Structure / Feature | Width (m) | Depth (m) | Flow Area (m²) | Velocity (m/s) | Time (s) |
|---------|----------------------------|---------------------------|---------------------|-----------|-----------|----------------|----------------|----------|
| 0+00    | 4.50                       | 3.90                      | HEADWALL INLET      | 0.6       | 0.6       | 0.36           | 1.3            | 0.00     |
| 0+30    | 4.85                       | 3.88                      | ACCESS PIT          | 0.98      | 0.98      | 0.96           | 1.3            | 7.70     |
| 0+60    | 4.87                       | 3.79                      | ACCESS PIT          | 1.08      | 1.08      | 1.17           | 1.3            | 21.29    |
| 0+90    | 5.02                       | 3.71                      | ACCESS PIT          | 1.31      | 1.31      | 1.71           | 1.3            | 29.00    |
| 1+20    | 5.12                       | 3.64                      | ACCESS PIT          | 1.47      | 1.47      | 2.16           | 1.3            | 29.23    |
| 1+50    | 5.18                       | 3.60                      | ACCESS PIT          | 1.58      | 1.58      | 2.50           | 1.3            | 56.22    |
| 1+80    | 4.13                       | 3.53                      | HEADWALL OUTLET     | 0.6       | 0.6       | 0.36           | 1.3            | 20.12    |
| 2+00    | 4.13                       | 3.53                      | TAILOUT SWALE       | 0.6       | 0.6       | 0.36           | 1.3            | 78.34    |
| 2+30    | 4.13                       | 3.53                      | TAILOUT SWALE       | 0.6       | 0.6       | 0.36           | 1.3            | 13.52    |
| 2+60    | 4.13                       | 3.53                      | TAILOUT SWALE       | 0.6       | 0.6       | 0.36           | 1.3            | 91.86    |
| 2+90    | 4.13                       | 3.53                      | TAILOUT SWALE       | 0.6       | 0.6       | 0.36           | 1.3            | 23.75    |
| 3+00    | 4.13                       | 3.53                      | TAILOUT SWALE       | 0.6       | 0.6       | 0.36           | 1.3            | 115.61   |
| 3+30    | 4.13                       | 3.53                      | TAILOUT SWALE       | 0.6       | 0.6       | 0.36           | 1.3            | 46.58    |
| 3+60    | 4.13                       | 3.53                      | TAILOUT SWALE       | 0.6       | 0.6       | 0.36           | 1.3            | 162.19   |



SECTION 3  
SCALE 1:50

[www.adwjohnson.com.au](http://www.adwjohnson.com.au)

notes	
<p>A1 1:100</p>	<p>A3 1:200</p>

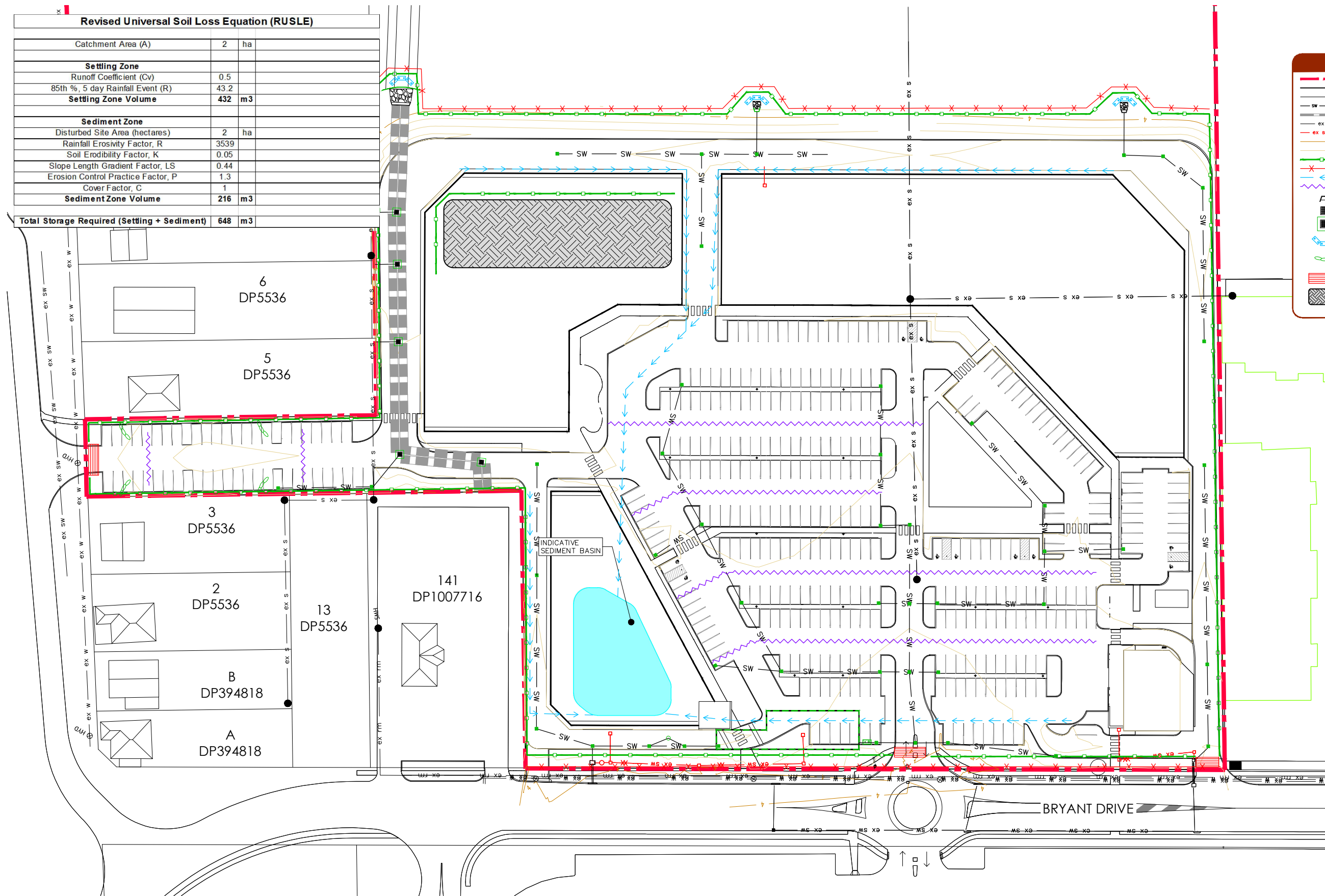
- project management
- civil engineering
- infrastructure
- superintendency
- economic analysis
- social impact
- town planning
- surveying
- development feasibility
- visualisation
- urban design

working beyond expectations





Revised Universal Soil Loss Equation (RUSLE)		
Catchment Area (A)	2	ha
<b>Settling Zone</b>		
Runoff Coefficient (Cv)	0.5	
85th %, 5 day Rainfall Event (R)	43.2	
<b>Settling Zone Volume</b>	<b>432</b>	<b>m3</b>
<b>Sediment Zone</b>		
Disturbed Site Area (hectares)	2	ha
Rainfall Erosivity Factor, R	3539	
Soil Erodibility Factor, K	0.05	
Slope Length Gradient Factor, LS	0.44	
Erosion Control Practice Factor, P	1.3	
Cover Factor, C	1	
<b>Sediment Zone Volume</b>	<b>216</b>	<b>m3</b>
<b>Total Storage Required (Settling + Sediment)</b>	<b>648</b>	<b>m3</b>




- ### LEGEND
- |  |                                   |
|--|-----------------------------------|
|  | SITE BOUNDARY                     |
|  | PROPOSED LOT BOUNDARY             |
|  | EXISTING LOT BOUNDARY             |
|  | PROPOSED STORMWATER               |
|  | PROPOSED CULVERT                  |
|  | EXISTING STORMWATER               |
|  | EXISTING STORMWATER TO BE REMOVED |
|  | MAJOR CONTOURS                    |
|  | MINOR CONTOURS                    |
|  | SEDIMENT/SILT FENCING             |
|  | NO-GO FENCING                     |
|  | DIVERSION DRAIN                   |
|  | MULCH MOUND                       |
|  | PROPOSED HEADWALL                 |
|  | PROPOSED SW PIT                   |
|  | PROPOSED PIT INLET FILTER         |
|  | STRAWBALES                        |
|  | GRAVEL/SAND BAGS                  |
|  | SITE ACCESS/SHAKER RAMP           |
|  | STOCKPILE LOCATION                |

**NOTE:**

1. EROSION AND SEDIMENT PLAN INDICATIVE ONLY. CONTRACTOR TO PROVIDE DETAILED PLAN PRIOR TO CONSTRUCTION.
2. CONTRACTOR TO ENSURE DISTURBED SITE AREA IS NO MORE THAN 2ha AT ANY GIVEN TIME.

## EROSION & SEDIMENT CONTROL PLAN

ver.	date	comment	drawn	pm	level information	scale (A1 original size)
E	26.02.2021	GENERAL AMENDMENTS	JJ	BM	DATUM: N/A CONTOUR INTERVAL: 0.5m	

NOTE : PLANS ARE PREPARED IN COLOUR

0 10.0 20.0m  
SCALE: 1:400 (FULL)

ic analysis • social impact • town planning • surveying • development feasibility • visualisation • urban design

drawing title:

EXHIBIT 007 -  
EROSION AND SEDIMENT  
CONTROL PLAN

location: 11 BRYANT DRIVE  
TUGGERAH, NSW

council: CENTRAL COAST COUNCIL

dwg ref: 190557-EX-007

client:

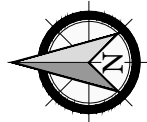
aventus property



central coast office ph: (02) 4305 4300  
hunter office ph: (02) 4978 5100  
sydney office ph: (02) 8046 7411

[www.adwjohnson.com.au](http://www.adwjohnson.com.au)





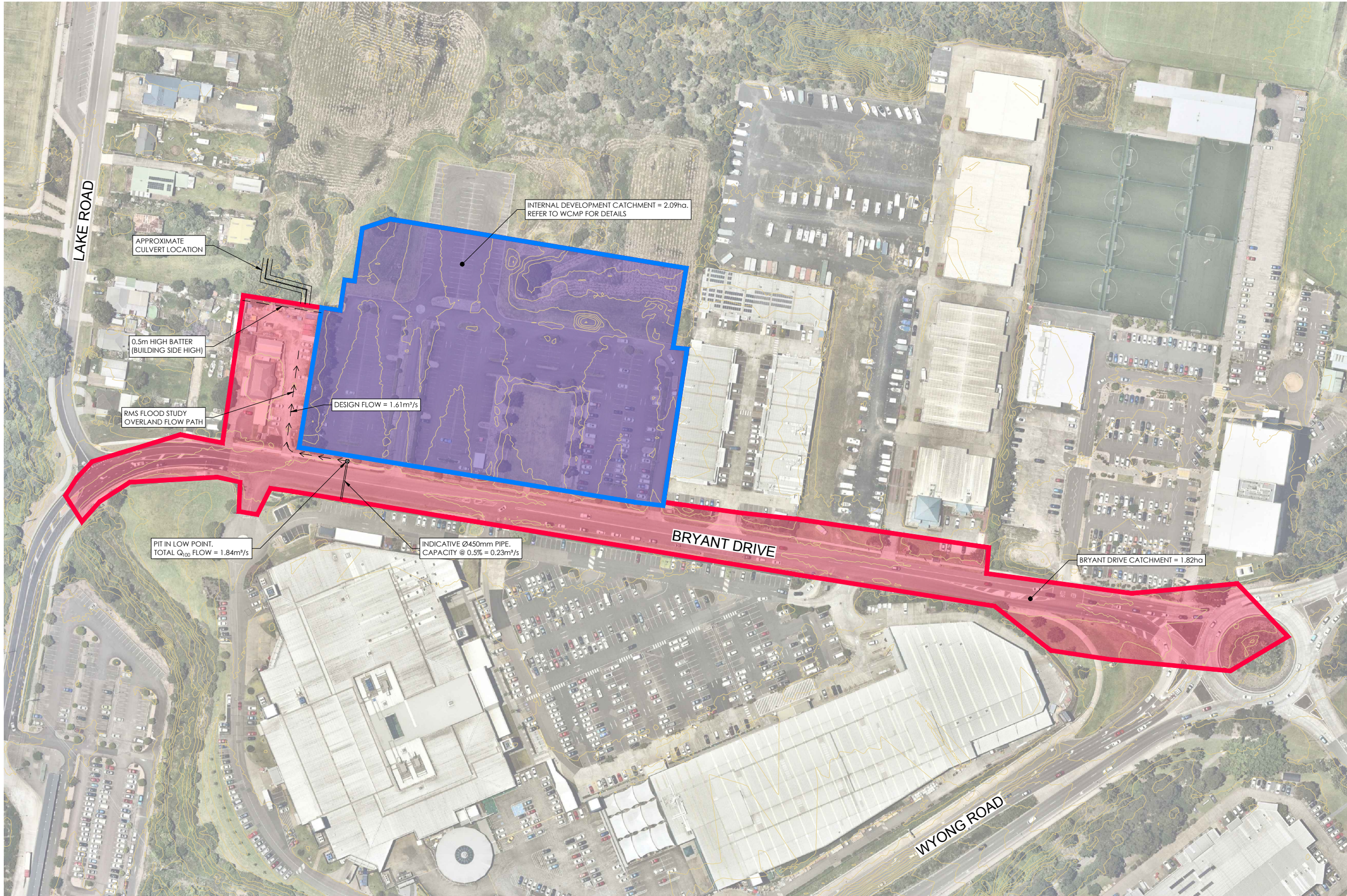
LEGEND

CONTOURS

BRYANT DRIVE CATCHMENT

INTERNAL DEVELOPMENT CATCHMENT

- GENERAL NOTES:-
1. FLOWS CALCULATED USING DRAINS MODEL.
  2. FLOWS INCLUDE DETAINED INTERNAL FLOWS.
  3. Ø450mm PIPE GRADE INDICATIVE ONLY.
  4. CONTOURS SHOWN ARE EXISTING ONLY.



PROPOSED CULVERT CATCHMENT PLAN  
SCALE 1:1000

drawing title:  
PROPOSED CULVERT  
CATCHMENT PLAN

location: 11 BRYANT DRIVE  
TUGGERAH, NSW

council: CENTRAL COAST COUNCIL

dwg ref: 190557-EX-008

client:

adventus property

adwjohnson

central coast office  
hunter office  
sydney office

ph: (02) 4305 4300  
ph: (02) 4978 5100  
ph: (02) 8046 7411

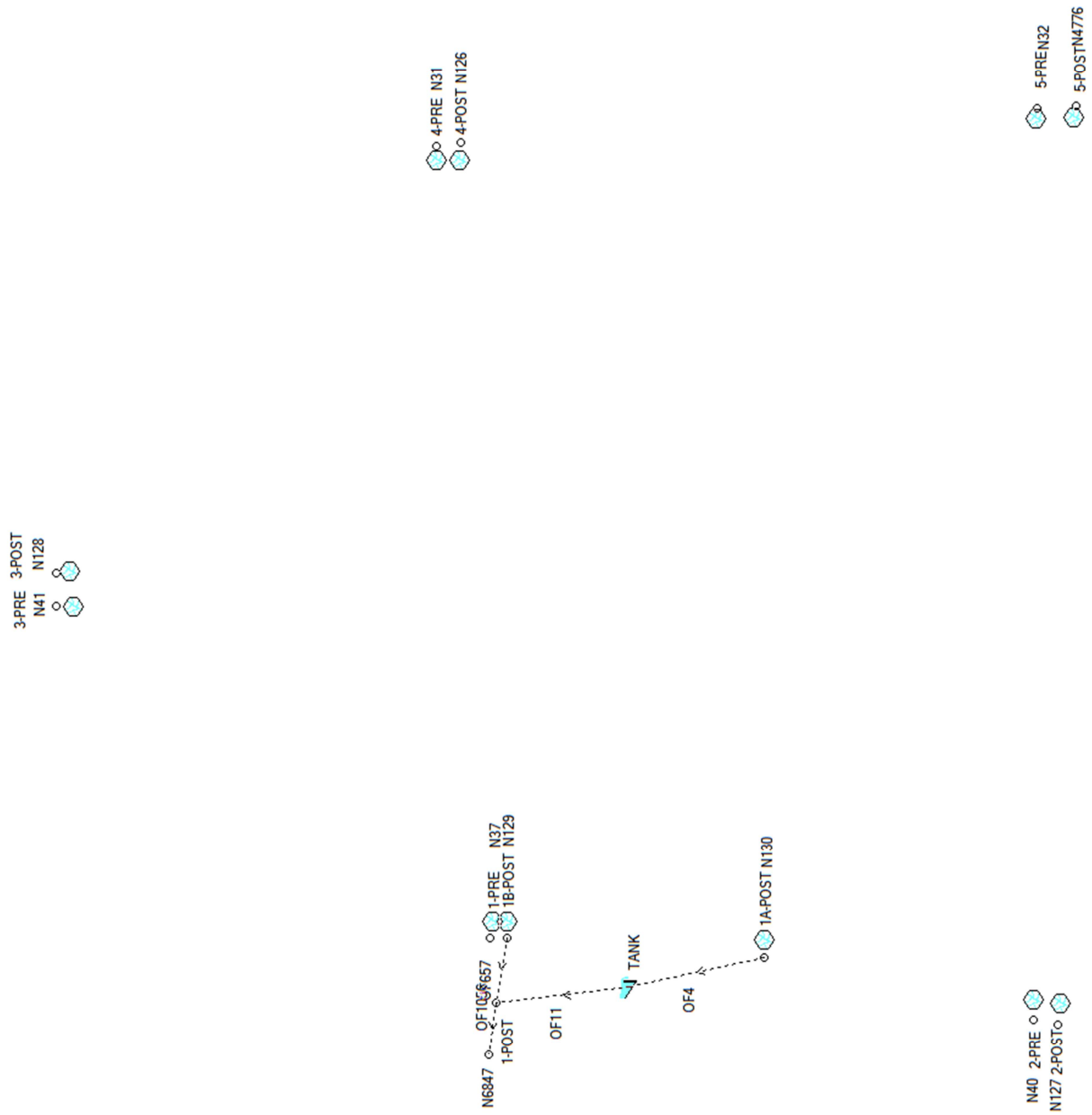
www.adwjohnson.com.au

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
E	26.02.2021	GENERAL AMENDMENTS	JJ	BM	DATUM: MVD CONTOUR INTERVAL: 0.5m	A1 0 25 50m 1:1000 1:2000	NOTE : PLANS ARE PREPARED IN COLOUR
• project management • civil engineering • infrastructure • superintendency • economic analysis • social impact • town planning • surveying • development feasibility • visualisation • urban design							



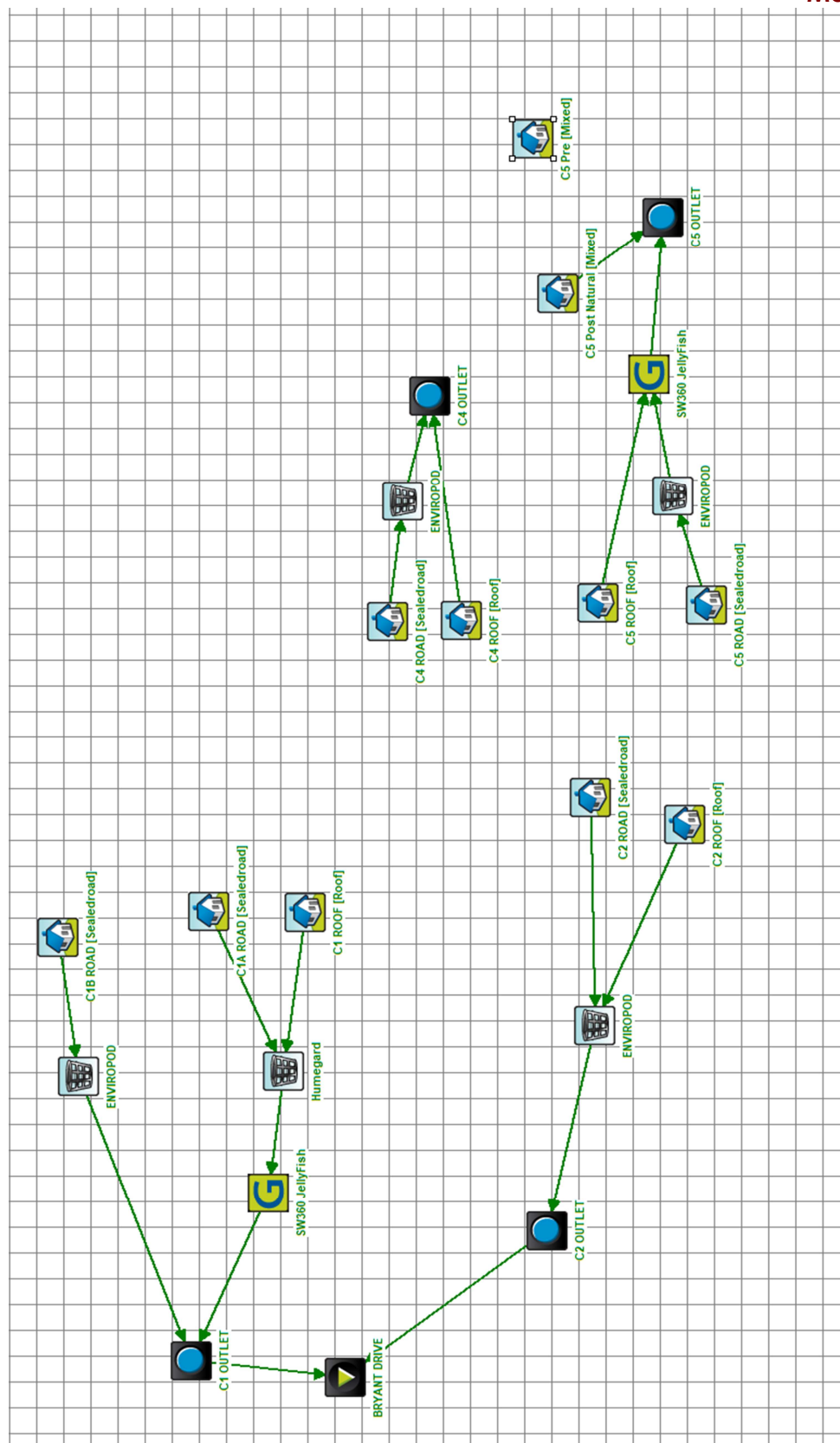
# Appendix A

## DRAINS MODEL



# Appendix B

## MUSIC DETAILS

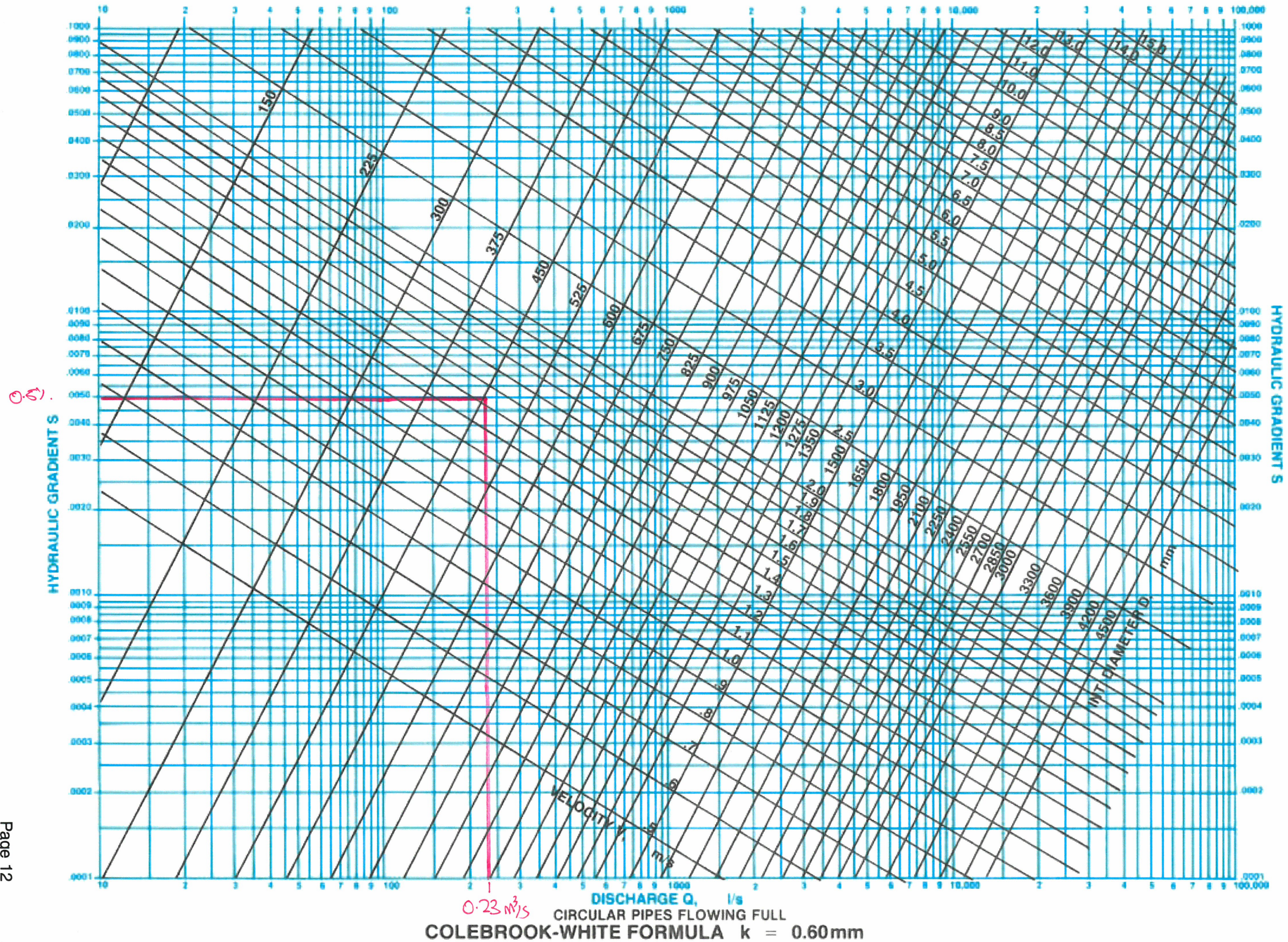


## Appendix C

---

### CPAA INFORMATION

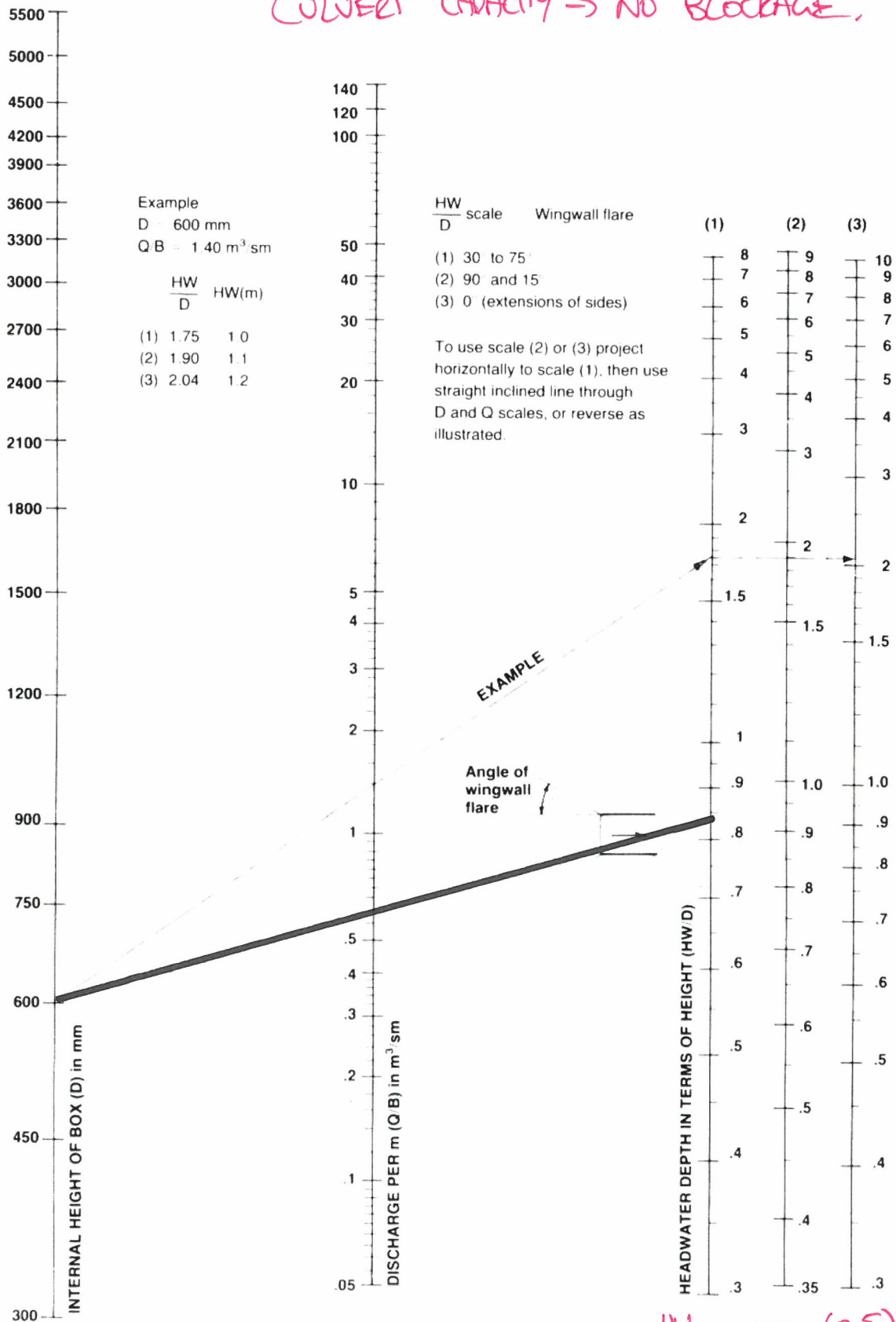








CULVERT CAPACITY → NO BLOCKAGE.



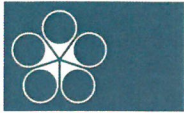
HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

FIGURE 3.4  
ADAPTED FROM [3.4]

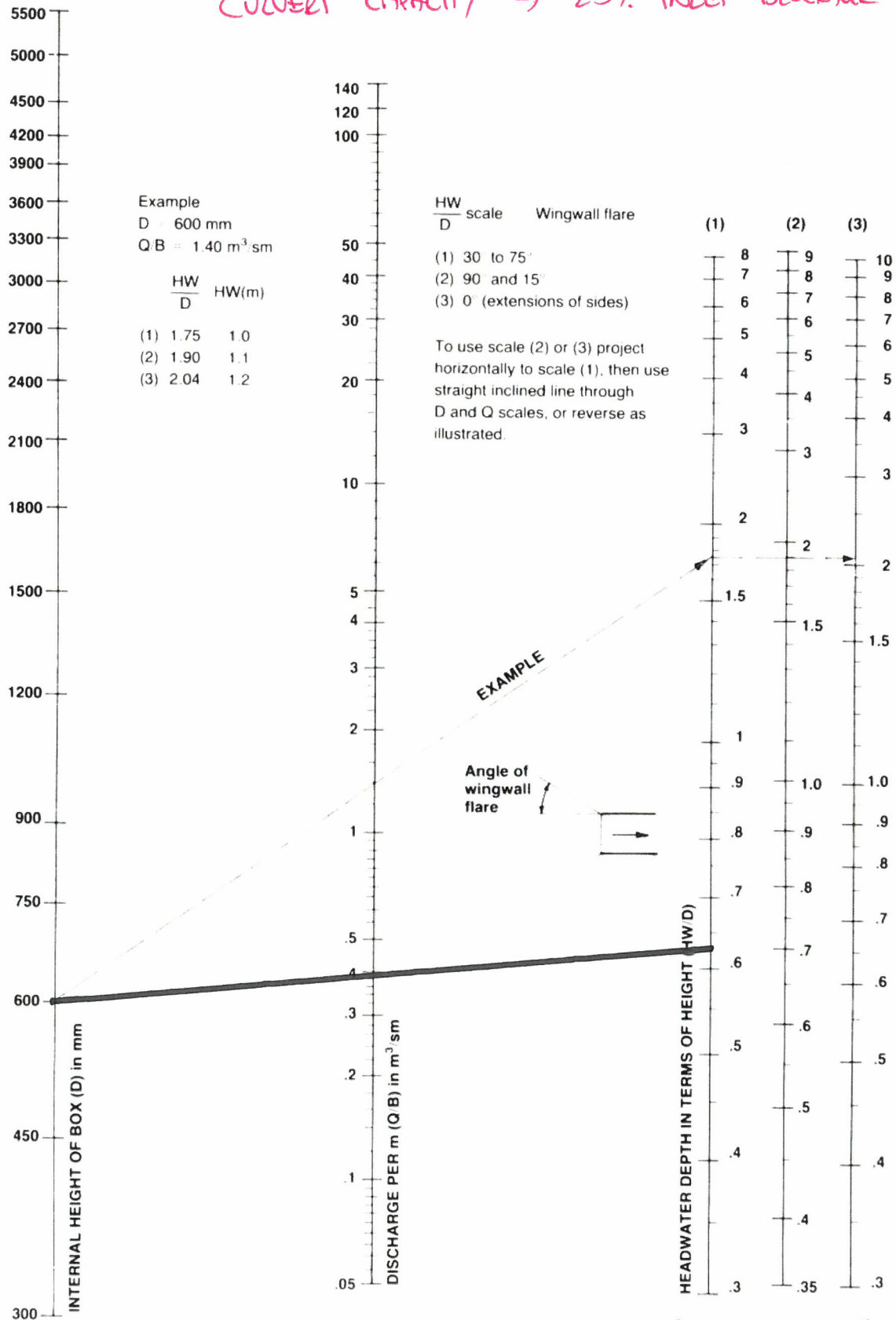
$$\frac{HW}{D} = 0.83 \left( \frac{0.5}{0.6} \right)$$

$$\frac{Q}{B} = 0.6$$

$$\rightarrow B = \frac{Q}{0.6} = \frac{1.61}{0.6} = 2.68 \text{ m} \quad \therefore 2.7 \text{ m} \times 0.6 \text{ m Box CULVERT}$$



CULVERT CAPACITY  $\rightarrow$  25% INLET BLOCKAGE



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

FIGURE 3.4  
ADAPTED FROM [3.4]

$$\frac{HW}{D} = 0.625 \left( \frac{0.375}{0.6} \right)$$

$$\frac{Q}{B} = 0.4$$

$$\rightarrow B = \frac{Q}{0.4} = \frac{1.61}{0.4} = 4 \text{ m} \rightarrow \therefore \text{ADAPT } 2 \times 2.1 \text{ m} \times 0.6 \text{ m BOX CULVERTS}$$

## Appendix D

---

### FLOOD INFORMATION APPLICATION



ADW Johnson  
5 Pioneer Ave  
TUGGERAH NSW 2259

## FLOOD LEVEL CERTIFICATE

**Property:** Lot 102 DP 1209157, 11 Bryant Dr, TUGGERAH NSW 2259

Council refers to your flood enquiry application for the above property, and provides the following information in response:

<b>Design Flood Level</b>	<b>RL 3.8m AHD</b>
<b>Freeboard</b>	<b>0.5m</b>
<b>Minimum Habitable Floor Level</b>	<b>RL 4.3m AHD</b>

\*AHD (Australian Height Datum)

DISCLAIMER: Council provides you with the above information as general advice only, and you should not rely upon that information when making decisions relating to the purchase or development of the above property. Council **strongly recommends** that you seek site specific flooding advice from a suitably experienced expert prior to making any decisions relating to the purchase or development of above property. That disclaimer and recommendation is provided for the following reasons:

1. The information in the above table is based on Council's records. Those records do not include a recent flood study or a recent detailed survey of the above property. For example, a recent detailed survey would provide precise ground levels for the subject property as well as identify, with precision, the location of any watercourses, drainage structures and systems, overland flowpaths and built structures that might impact on the extent and degree to which the subject property might flood. Council does not have sufficient information to provide you with accurate prediction of the likelihood and extent to which the above property might flood, and so cannot provide you with accurate design levels for potential development of that property.

2. Council does not, and cannot, warrant that it will, in its capacity as a consent authority under the *Environmental Planning and Assessment Act 1979*, grant consent to a development application that seeks to erect or use dwellings or other structures on the above property that conform with the levels set out in the above information. As a consent authority, Council is required to consider the suitability of the above property for the specific development proposed as well as consider the requirements of Council's Development Control Plan 2013 – Chapter 3.3 Floodplain Management (this is available on Council's website). Council may also have to consider the requirements of other statutory bodies, such as the Mine Subsidence Board.

The information provided in this letter is provided only to you, and is not intended to be provided to any third party.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Mark Dowdell', written in a cursive style.

Mark Dowdell

**PRINCIPAL DEVELOPMENT DESIGN ENGINEER**