



**Water Cycle Management Plan
Amended Carpark
Lot 510 DP729020 Brisbane Water Drive
Koolewong**

Gemsted Pty. Ltd.

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FIGURES

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1.0 Introduction

ADW Johnson was commissioned to undertake the design of an amended carpark layout for the Koolewong Marina on Lot 510 in DP 729020, Brisbane Water Drive, Koolewong. As part of the design process a Water Cycle Management Plan has been prepared.

The design of these works has been undertaken to accompany a Development Application for the site.

This report documents the proposed stormwater management measures to be implemented to safely and efficiently capture and transport the stormwater runoff from the site to Brisbane Water minimising impacts on neighbouring properties, infrastructure and the environment.

2.0 Site Description

The site of the proposed marina as shown in Figure 1 is located towards the southern end of Murphys Bay and makes up one of the many inlets of Brisbane Water in the Gosford City Local Government Area. The site is located approximately two kilometres north of Woy Woy, 500 metres south of Koolewong and is situated on the north eastern side of Brisbane Water Drive.

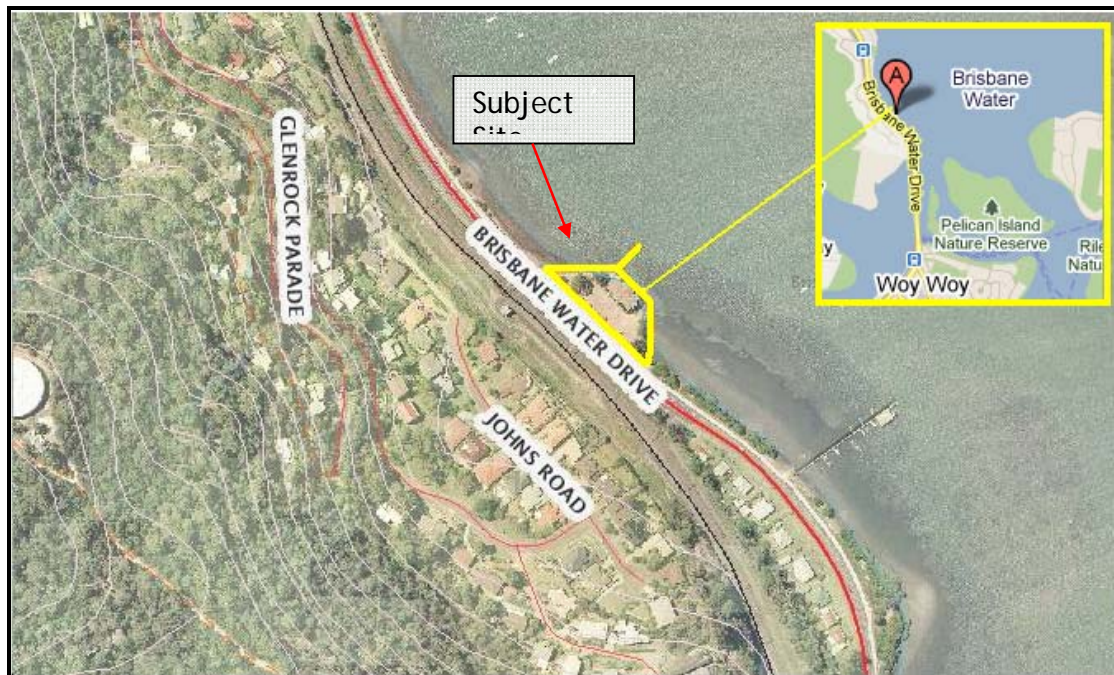


Figure 1: Locality Plan (with broader location insert)

The site is bound by Brisbane Water Drive to the west and Brisbane Water to the north, south and east. The subject site consists of an irregular shaped allotment with a total area of 2533m² above MHWM and contains a two storey building, carparking and associated hardstands and services. These existing features, shown in Figure 2, equate to a predeveloped impervious area of 1,448m², or 57% of the area.

The proposed alterations to the existing carpark as shown in Figure 3 to gain an additional 11 spaces will result in an impervious area of 1,613m², or 64% of the area.

3.0 Objectives

The water cycle management plan for the development need to be assessed in accordance with Gosford City Council's "*DCP 165 - Water Cycle Management*" to ensure that the stormwater runoff from the development is conveyed to the receiving waters safely and efficiently without adversely impacting downstream properties and infrastructure whilst minimising the impacts on the environment.

3.1 STORMWATER QUANTITY

The stormwater runoff as a result of the development must not adversely affect downstream properties or infrastructure for all storm events up to and including the 1 in100yr ARI design storm event.

3.2 STORMWATER QUALITY

The stormwater drainage system must effectively reduce the nutrients and gross pollutants leaving the site prior to the runoff entering the receiving waters to ensure impacts of development are minimised.

The guidelines for stormwater quality treatment objectives are expressed as mean annual reductions of pollutant loads. The target objectives were obtained from Gosford City Council's DCP 165 – Water Cycle Management and are shown in Table 1.

Table 1: Stormwater treatment objectives

Pollutant	Stormwater Treatment Objectives
Suspended Solids	80% Retention of the AAL
Total Phosphorus	45% Retention of the AAL
Total Nitrogen	45% Retention of the AAL
Litter	Retention of litter greater than 40mm for flows up to 25% of the 1 year ARI peak flow
Oil and Grease	No oil or grease to be visible downstream of development for flows up 25% of the 1 year ARI peak flow

3.2.1 Controls for Building Development

As the proposed alterations are minor in nature and only constitute an increase in impervious area of 165m² DCP165 states that the development is deemed to satisfy the water quality requirements of Table 1 through the installation of one or more of the following elements for roof and surface water quality.

Roof Treatment

The following devices must be installed:

- First Flush Disposal
- Overflow from the rainwater tank directed to:
 - an infiltration trench
 - A pervious soft landscaped area of not less than 20m²
 - Street drainage

Hardstand Areas

One or more of the following elements must be used:

- Grading to soft landscaping or vegetated swales
- Pit and pipe drainage to an infiltration trench or soft landscaping area
- A proprietary treatment device
- Porous Paving
- Alternative devices

3.3 TOTAL WATER MANAGEMENT

The stormwater management for the site must also make provisions for total water management including water harvesting.

It is proposed to utilise a 10,000L rainwater tank to capture roof runoff for reuse for landscaping and external uses.

3.4 EROSION AND SEDIMENTATION CONTROL

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

4.0 Stormwater Quantity

The stormwater runoff as a result of the development must not adversely affect downstream properties or infrastructure for all storm events up to and including the 100yr ARI event.

As the subject site and contributing catchment drain directly to Brisbane Water and there are no downstream properties between the development and the receiving waters there are no requirements for detaining runoff from this development.

As the development will not have any adverse impacts on downstream properties or infrastructure locally or regionally there will be no further assessment of stormwater quantity required in this report.

5.0 Water Quality

The proposed stormwater drainage system as detailed in Figure 3 consists of a pit and pipe network draining the hardstand areas and discharging to Brisbane Water.

The roof runoff from the existing building will be collected by a rainwater tank for reuse in landscaping and external uses. Overflow from the rainwater tank will connect into the internal pit and pipe network.

It is intended to use a combination of treatment devices within the drainage system to remove nutrients, sediments, and oils and greases from the catchment prior to the runoff leaving the site.

5.1 WATER QUALITY CONTROLS

First Flush

The runoff from the roof areas will be treated by at source controls. The roof runoff will pass through a first flush device prior to entering the rainwater tank.

Gross Pollutant Traps

To remove litter and coarse sediments from the carpark and hardstand areas it is intended to provide at source gross pollutant treatment for the runoff. This treatment will consist of a 200 micron Enviropod pit insert in each of the pits.

The 'Enviropod' pit insert consists of a galvanized mild steel filter box with plastic flaps to seal against pit walls, a galvanized mild steel cage to support filter cartridge, an adjustable filter base support, and a removable GPT filter cartridge.

The GPT filter cartridge recommended for this application is a monofilament 200 micron pore sized filter bag.

6.0 Erosion and Sedimentation Control

An erosion and sedimentation control plan has been prepared to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the development site to the receiving waters during construction. The proposed erosion and sedimentation control measures can be seen in Figure 4.

The plan utilises silt fencing and gravel bag groynes to capture sediments prior to the runoff leaving the site.

All of the erosion and sedimentation controls are to be maintained for the duration of construction and only removed once the site is stabilised.

7.0 Operation and Maintenance

7.1 ENVIROPOD PIT INSERTS

The Enviropod filter treatment system is configured so that its respective pollutant storage area drains dry. Previous studies undertaken by the Cooperative Research Centre for Catchment Hydrology have shown that wet sump (storage) treatment systems under certain situations can act as a source of nutrients to receiving environments.

The Enviropod system is effective at removing 70% of suspended solids, 100% of litter and coarse sediments, and 75% - 100% of oils and greases. The system removes small amounts of nitrogen and phosphorus attached to suspended solids but does not remove a large percentage of these nutrients.

The distributor of the product can provide a package with the purchase of their system including instillation, monitoring, and maintenance plan.

Monitoring – This component includes 3 months monitoring of each individual filter and contaminate generation factors.

Maintenance plan – this component includes a plan that identifies hotspots and recommends maintenance frequency of each individual filter.

Maintenance - Inspect pits at recommended interval or after large storm events.

8.0 Summary

The stormwater management and pollution control measures proposed for the development will safely convey the minor and major flows from within the development to the receiving waters without adversely impacting downstream properties and infrastructure.

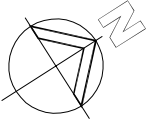
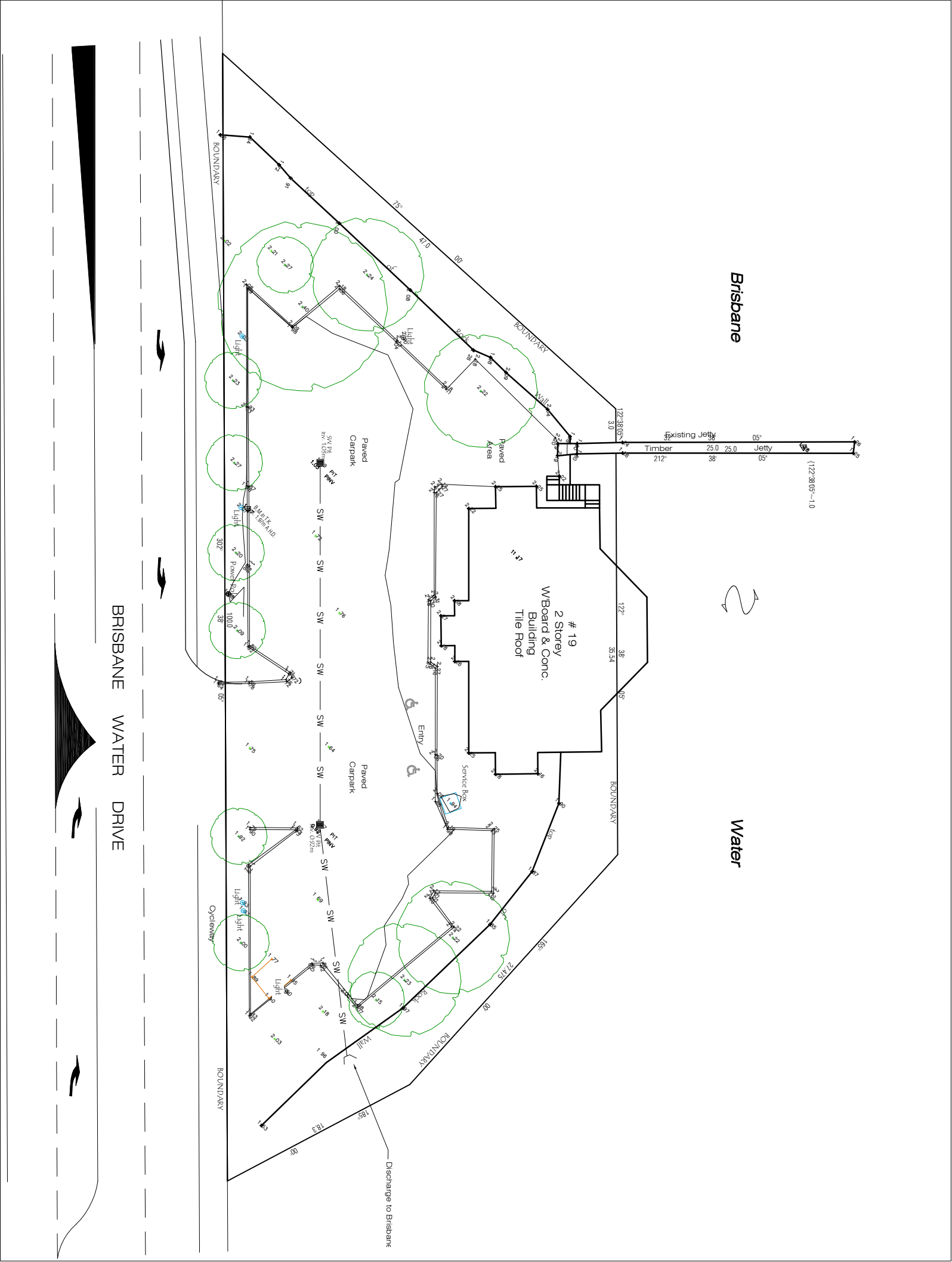
The pollution control measures proposed for the development will effectively remove nutrients and gross pollutants from the stormwater prior to the runoff entering the receiving waters to ensure the impacts on the environment as a result of the development are minimised.

An erosion and sedimentation control plan will be implemented to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the development site to the receiving waters during construction.

The design complies with Gosford City Council's water management and stormwater design requirements, while providing an economical and safe stormwater disposal system that meets the stormwater quality treatment objectives.

Figures

Fig 2



LEGEND
— SW — EXISTING STORMWATER PIPE

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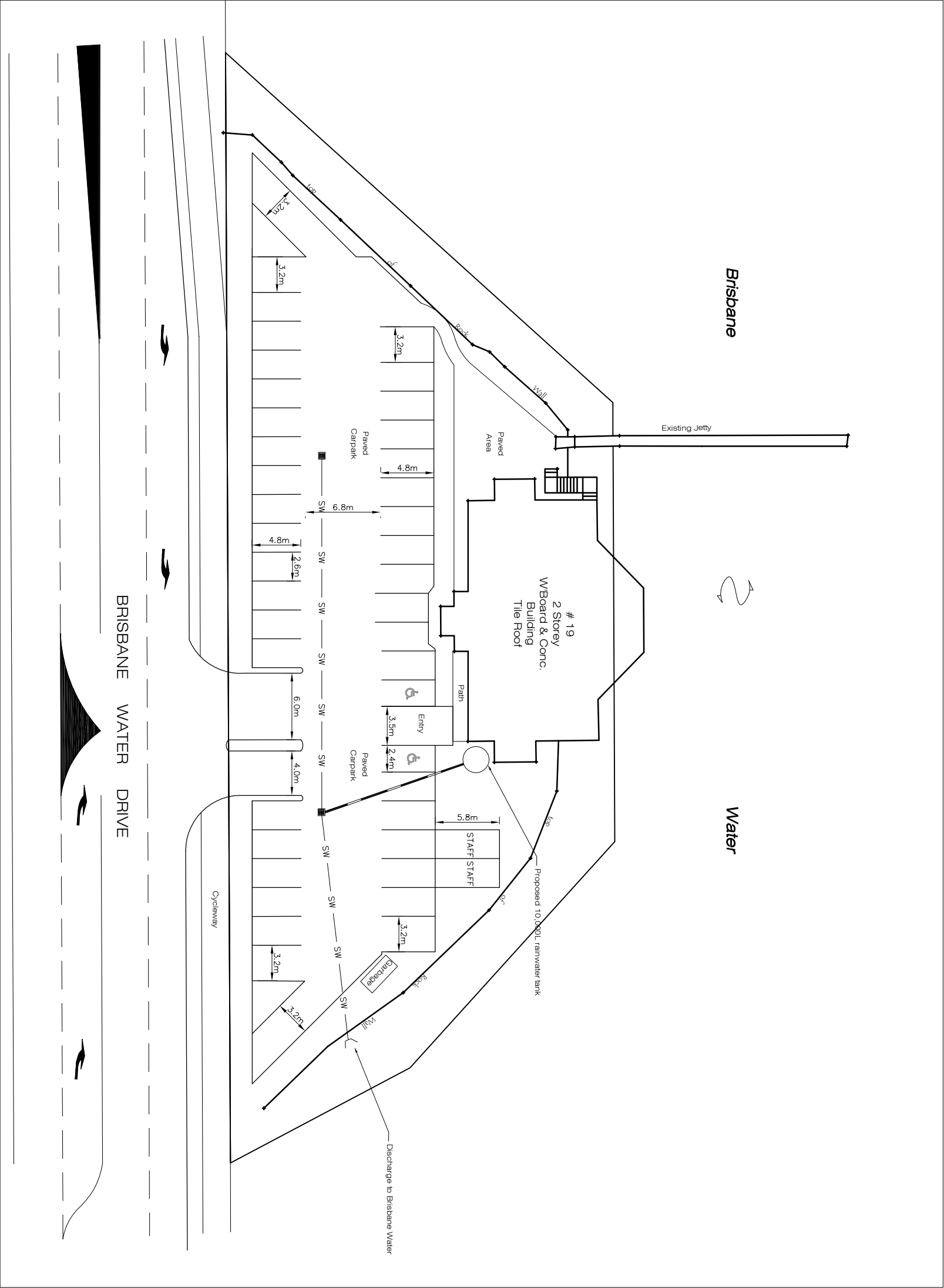
REV.		DATE	AMENDMENT		DRAWN		CHECK	DESIGN	VERIFY	SCALES				Central Coast 2 Bounty Close, P.O. Box 3717, Tuggeroh N.S.W. 2259 Phone: (02) 4305 4300 Fax: (02) 4305 4399 email: coast@adwjohnson.com.au www.adwjohnson.com.au ABN 62 129 445 398	CLIENT GEMSTED PTY LTD	PROPERTY DESCRIPTION			PROJECT					
A		13.07.11	Preliminary Issue		N.D.		A.C.	N.D.	A.C.	LOT 510 D.P. 729020 BRISBANE WATER DRIVE KOOLEWONG						PLAN TITLE FIGURE 2: EXISTING DEVELOPMENT								
DESIGN FILE: S:\												ALL DIMENSIONS ARE IN METRES. DO NOT SCALE		SURVEYED			PROJECT No. 150134		DISCIPLINE SWMP		NUMBER 02		REV. A	



Fig 3



DETAIL PLAN

SCALE 1:200

NOTE: EXISTING CARPARK LAYOUT AND SERVICES ARE NOT SHOWN IN THIS DRAWING

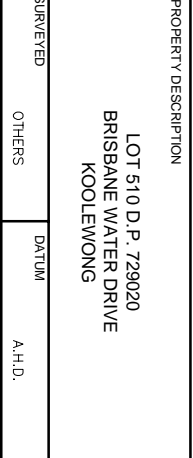
REV.		DATE	AMENDMENT		DRAWN	CHECK	DESIGN	VERIFY	SCALES		 <div>Central Coast 2 Bounty Close, P.O. Box 3717, Tuggerah N.S.W. 2259 Phone: (02) 4305 4300 Fax: (02) 4305 4399 email: coast@dwjohnson.com.au www.dwjjohnson.com.au ABN 62 129 445 398</div>	CLIENT GEMSTED PTY LTD	PROPERTY DESCRIPTION		PROJECT	PROPOSED CARPARK				
										PLAN TITLE			FIGURE 3: PROPOSED CARPARK LAYOUT							
A		13.07.11	Preliminary Issue		N.D.	A.C.	N.D.	A.C.					SURVEYED		PROJECT No.	DISCIPLINE	NUMBER	REV.		
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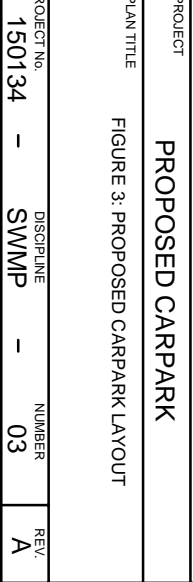
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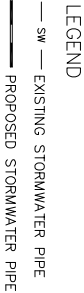


LOT 510 D.P. 729020
BRISBANE WATER DRIVE
KOOLEWONG



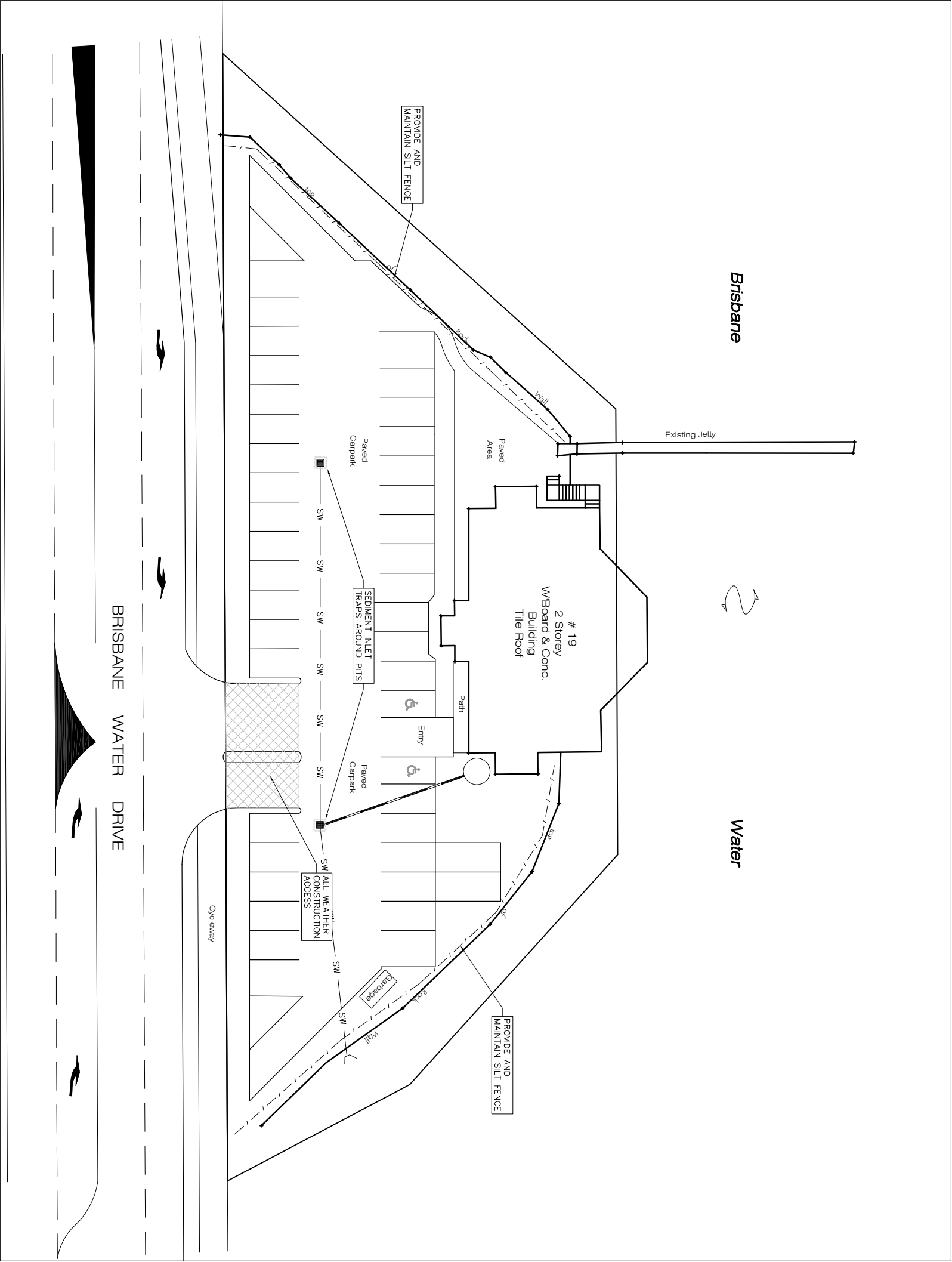
PROPOSED CARPARK

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LEGEND
— SW — EXISTING STORMWATER PIPE
— PROPOSED STORMWATER PIPE

Fig 4



DETAIL PLAN

SCALE 1:200

NOTE: EXISTING CARPARK LAYOUT AND SERVICES ARE NOT SHOWN IN THIS DRAWING

REV.	DATE	AMENDMENT	DRAWN	CHECK	DESIGN	VERIFY	SCALES
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CLIENT
GEMSTED PTY LTD

PROPERTY DESCRIPTION
LOT 510 D.P. 729020 BRISBANE WATER DRIVE KOOLEWONG

PROJECT	PROPOSED CARPARK
PLAN TITLE	FIGURE 4: EROSION AND SEDIMENTATION CONTROL PLAN
PROJECT No.	150134 - SWMP
DISCIPLINE	-
NUMBER	04
REV.	A

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- LEGEND
- SW — EXISTING STORMWATER PIPE
 - PROPOSED STORMWATER PIPE
 - \ — SILT FENCE
 - PIT INLET CONTROLS

- EROSION AND SEDIMENT CONTROL NOTES
1. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE CONSISTENT WITH THE "MANAGING URBAN STORMWATER" - 3RD EDITION (1998) PREPARED BY THE NSW DEPARTMENT OF HOUSING AND GOSFORD CITY COUNCIL REQUIREMENTS.
 2. DISTURBED AREAS TO BE KEPT TO A MINIMUM.
 3. CONTROL CLEAN WATER FROM ABOVE THE SITE AND THROUGH THE SITE.
 4. ERECT AND MAINTAIN SILT FENCES AT THE DOWNSLOPE SIDE OF DISTURBED AREA DURING CONSTRUCTION.
 5. CONSERVE ALL TOPSOIL, STOCKPILE AND PROTECT FOR REUSE ON SITE.
 6. STOCKPILES OF MATERIAL TO BE PLACED AWAY FROM DRAINAGE LOW POINTS AND HEAVILY TRAFFICABLE AREAS AND TO BE SURROUNDED BY SILT FENCING AT ALL TIMES.
 7. PROTECT ALL DISTURBED AREAS FROM EROSION.
 8. MINIMISE SEDIMENTATION.
 9. PLACE SEDIMENT INLET TRAPS AROUND ALL PITS WITHIN AND DOWNSTREAM OF THE DEVELOPMENT.
 10. CONSTRUCT AN ALL WEATHER CONSTRUCTION ACCESS TO THE SITE.
 11. AREAS OUTSIDE THE BOUNDARIES OF THE PROPOSED DEVELOPMENT WILL BE FENCED WITH NO DO REBAND TO KEEP THE AREAS FREE FROM DISTURBANCE OF MACHINERY, PARKED VEHICLES AND WASTE MATERIAL.
 12. ALL DISTURBED AREAS ARE TO BE REVEGETATED OR OTHERWISE PROTECTED AS SOON AS PRACTICAL.
 13. MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES UNTIL COMPLETE REHABILITATION IS ACHIEVED.