Water Sensitive Design Strategy

Bluey's Beach Development

50522033

Prepared for
Addenbrooke Pty Ltd

24 August 2022

Cardno

now

Stantec

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1 Introduction

1.1 Background Information

Addenbrooke Pty Ltd proposes a new subdivision in Lot 23 in DP 537919 Boomerang Drive, Blueys Beach. The site is located approximately 280 kilometres north of Sydney and 60 kilometres southeast of Taree. The township contains a mix of permanent residents and holiday cottages together with various holiday retreats, a function centre and a small shopping precinct on Boomerang Drive. The land has a total area of 34.94 hectares with a readily developable portion of approx. 6.47 hectares based on the current zoning and concept plan by Robert Moore & Associates Pty Ltd Drawing No. 050017 P6.

This report summarises the Water Sensitive Design Strategy (WSDS) for submission to MidCoast Council to support the Development Application for the proposed subdivision development at Lot 23 in DP 537919 Boomerang Drive, Blueys Beach.

1.2 Site Context

Cardno's Civil Engineers, Sara Belgrove and Tarni Penn, inspected the Site on 18 October, 2021. A summary of the existing drainage features and infrastructure is presented in Figure 1-1.

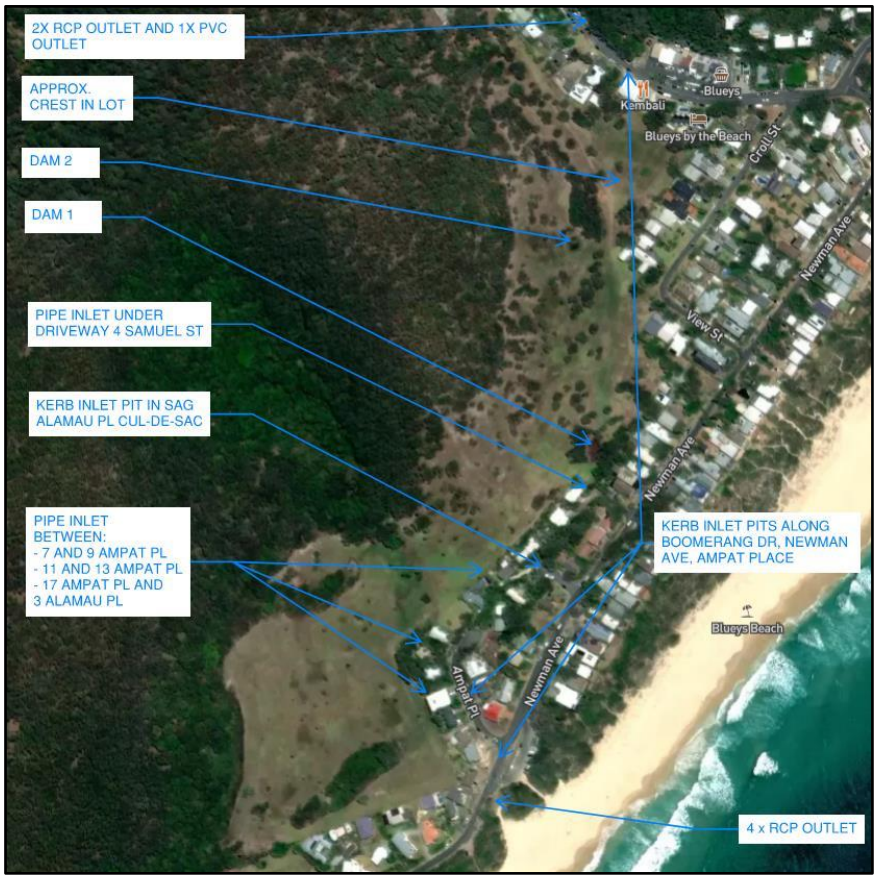


Figure 1-1 Existing Infrastructure

The Site contains three water courses which collect overland flow from the steeply sloped upstream hill catchments. These watercourses are not shown on the LEP 2014 or DCP 2019 water course maps and have therefore not been classified in planning instruments under the Strahler Stream Order system. However, they are shown in the Water Management (General) Regulation 2018 Hydroline Spatial Dataset (Hydroline Dataset 2018) and could be classified through this under the Strahler Stream Order system. An excerpt from the Hydroline Dataset 2018 is provided in Figure 1-2 below.

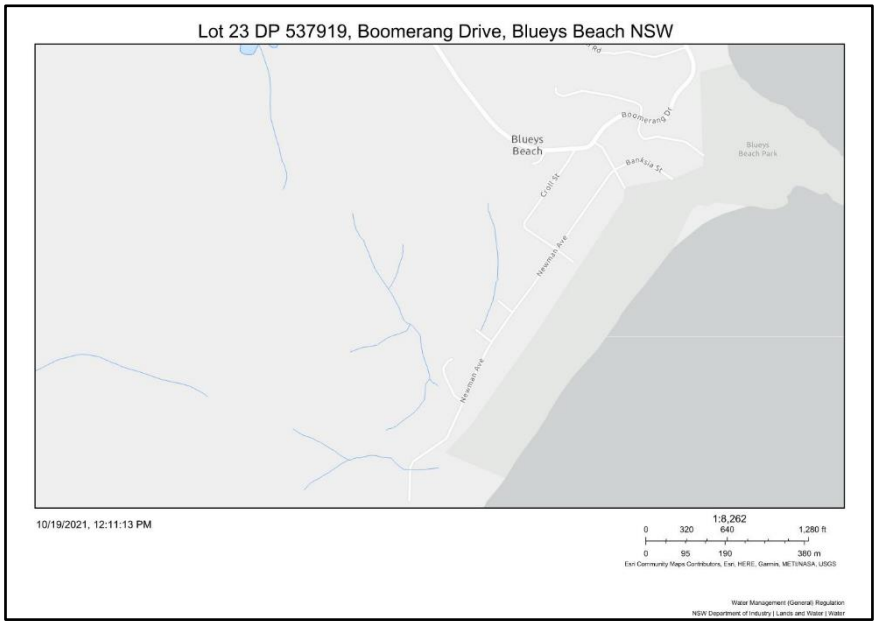


Figure 1-2 Hydroline Dataset 2018

The first water course (northern-most) appears as a first order stream and drains south through the densely vegetated steeply sloped hill catchment to be collected in a dam (Dam No. 2 as identified in Figure 1-1). Dam 2 appeared circular in shape and had no defined spillway. Dam 2 was relatively full and the area directly downstream was wet during the inspection. Dam 2 overflows through a grassed paddock downstream to another dam (Dam No. 1 as identified in Figure 1-1).

Dam 1 was larger in surface area to Dam 2 and it had a defined spillway which was approximately 1-2m wide. Dam 1 was relatively full during the inspection. Stormwater from Dam 1 overflows across the existing accessway from Samuel Street to the site and is collected through a Reinforced Concrete Pipe (RCP) inlet under the driveway of 4 Samuel Street.

Photos of Dam 1 and Dam 2 are presented in Figure 1-3 and Figure 1-4.

This watercourse was not well defined (no clear channel banks) and can likely be removed and managed through the road network of the proposed subdivision. The northern-most water course is presented in Figure 1-5.

Figure 1-3 Dam 1 (Looking downstream towards 4 Samuel Street)

Figure 1-4 Dam 2 (Looking downstream)

Figure 1-5 Northern-most water course (Looking downstream)

The second water course (central as per Figure 1-2) appears to be a second order stream and drains south-west tending to south through the densely vegetated steeply sloped hill catchment. Stormwater from this water course is collected via an RCP inlet/pit between 11 and 13 Ampat Place. This RCP inlet/pit was blocked at the time of inspection and could not be inspected. Overflow from this RCP pit is directed through grassed swales parallel to the rear boundaries of 11 and 9 Ampat Place, then captured by another RCP inlet/pit between 7 and 9 Ampat Place. The second water course is presented in Figure 1-6.

Figure 1-6 Central water course (Looking upstream)

The third water course (southern-most on Figure 1-2) appears to be a first order stream and drains east and is collected via the abovementioned RCP inlet between 7 and 9 Ampat Place. An earth embankment/ levee has been constructed along the rear boundaries of 5 and 7 Ampat Place to ensure the overland flow is directed to this RCP inlet. This levee and the downstream view of the third water course is presented in Figure 1-7.

Figure 1-7 Southern-most watercourse and earthen levee (Looking downstream)

The RCP inlets at 4 Samuel Street, 7-9 and 11-13 Ampat Place and at 3 Alamou Place are connected via a pit and pipe network, which is then collected within the Newman Avenue drainage line and discharged to the four pits adjacent to the Blueys Beach carpark. This information was confirmed with Work As Executed (WAE) drawings provided by Council, which are dated 1972. An excerpt from the drawings is presented in Figure 1-8, noting the four RCP inlets denoted as follows:

- 4 Samuel Street: Node L
- 7-9 Ampat Place: Node P
- 11-13 Ampat Place: Node T
- 3 Alamou Place: Node U

The naming convention shown on the WAE drawings is used for this assessment.

The inlet pits in this network are the four pits mentioned above plus a sag kerb inlet pit at the end of the Alamou Place cul-de-sac (Node V) and an on-grade kerb inlet pit on Ampat Place (Node M). The remaining nodes shown on the WAE drawings are sealed junction pits.

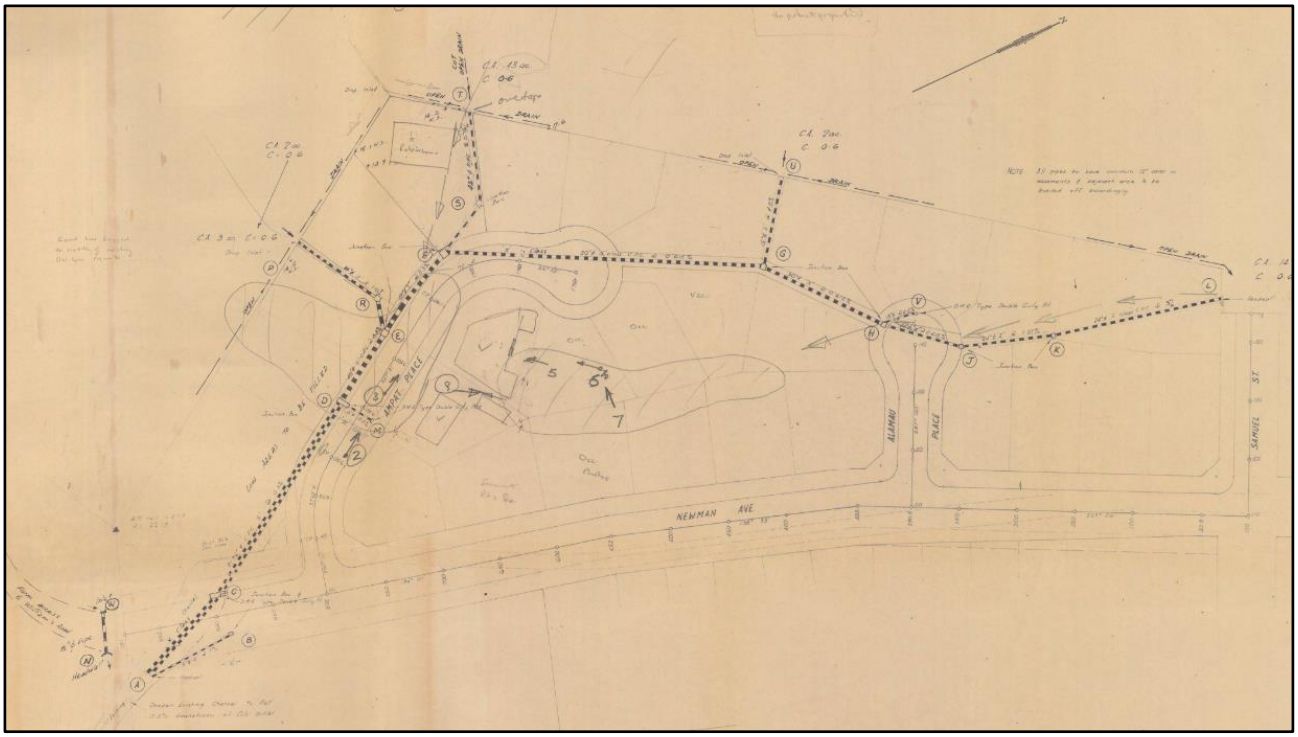


Figure 1-8 Drainage network Ampat Place, Samuel Street and Alamau Place (McGlashan & Crisp, 1972)

Figure 1-9 show the outlet to Blueys Beach off Newman Avenue.

Figure 1-9 Outlet to Blueys Beach (Looking upstream)

There is a crest north of the first water course and a smaller northern catchment of the site drains towards Boomerang Drive. This catchment appears to be collected via several privately-owned stormwater pits and/ or via overland flow through the properties along this southern extent of Boomerang Drive. The private stormwater pits and additional overland flow is then collected through a series of kerb inlet pits along Boomerang Drive. This existing stormwater network under Boomerang Drive north of the site is shown in Figure 1-10. The existing DN675 pipe outlet is presented in Figure 1-11.

Figure 1-10 Existing Stormwater Network Information under Boomerang Drive

Figure 1-11 DN675 Outlet across Boomerang Drive (Looking upstream)

1.3 Proposed Development

The proposed development at Bluey's Beach includes 73 residential lots, 2 commercial buildings and a parkland. A total of two drainage reserves to meet the stormwater management requirements of the site. The existing drainage inlets described in Section 1.2 will be retained to avoid the need for augmentation of the infrastructure located within the private properties. Refer to drawing 50522033-C-1004-OGA for details of the proposed development.

2 Design Criteria and Objectives

2.1 Policy Requirements

2.1.1 Great Lakes Regional Development Control Plan 2019 (DCP 2019)

2.1.1.1 Section 11 – Water Sensitive Design

Section 11.4.2.3 states the requirements of a Water Sensitive Design Strategy for a Major Subdivision i.e. one that results in 3 or more lots which have been adhered to in this report.

2.1.2 Correspondence between MidCoast Council and Cardno, now Stantec

Table 2-1 outlines the consultation undertaken during the preparation of this Flooding and Stormwater Assessment, including how comments and issues were addressed in the master plan. Evidence of the consultation outcomes are provided in Appendix A.

Table 2-1 Summary of consultation outcomes

Response ID	Organisation, Date	Comment	Response
1	MCC, 06/05/22	Section 1.4.2.3 DCP states that "Consideration should be given to quality and quantity across the frequency spectrum from quarterly (0.25 year ARI) treatment flows up to the safe control of 100 year ARI discharges" The question for Council is, have we understood the stormwater criteria correctly or could we potentially reduce the water quantity minor design criteria? For reference the minor structure design criteria (for pit and pipe network etc.) is 20% AEP as per Table 1 Annexure M5 in the 0041 Geometric sealed road design worksection.	For a minor system (i.e. pits and pipes) a 20% AEP capacity is acceptable. A 1% AEP capacity is required for major systems (i.e. trunk mains, basins etc). All overflow above the 1% AEP is to be in defined over land flow paths which needs to be demonstrated in the plan. It is noted that there are houses directly downstream that may be impacted by this overland flow path that needs to be addressed.
2	MCC, 06/05/22	0074 Stormwater drainage AUS-SPEC Section 3.6 states that "No basin spillway located directly upstream of urban areas." This will impact the proposed design of Basin Y1 and Basin Y2 (see sketch below for reference) which are both proposed to be open air and will have high-level weir spillways. Particularly relevant for Basin Y2, where we are maintaining the existing flow regime by controlling the flow in a basin and allowing for high level discharge via a spillway (by replacing an existing dam and spillway). The question for Council is, is the proposed design approach and basin location are agreeable? Particularly for Basin Y2 where the existing scenario is currently non-compliant with Council's specification.	The section 3.6 requirement must be met. An over land flow path to cater for the PMF peak flows with 0.5m freeboard to all dwellings is to be downstream of all basin spillways.
3	MCC, 06/05/22	Results from the pre-development model indicate there is surcharging at pits and also overflow from headwalls during the 10% AEP event up to the 1% AEP event. The questions in this instance, is Council willing to accept our design if we limit flows/ surcharge to the pre-development levels or alternatively would they prefer we improve this post-development to be compliant with their criteria and achieve no surcharge from pits/pipes during minor/ major storm events?	Post development flows must meet the criteria to ensure no surcharge given the intensification caused by the development. Any discrepancies in the model may attribute to further surcharge and possible flooding which needs to be avoided. Given the size and scale of the development we would establish the nexus that all pipes and pits are to be upgraded as

Response ID	Organisation, Date	Comment	Response
			required that are being connected into.
4	MCC, 06/05/22	0074 Stormwater drainage AUS-SPEC Section 3.6 regarding freeboards for major structures states that the "Minimum floor levels of dwellings: 0.5 m freeboard above the 100 year ARI flood level in the basin" The question for Council, is are there specific freeboards for basins directly upstream of roadways, is this also 0.5m or is it 0.3m as Section 3.5 regarding freeboards for roadways states "0.3 m freeboard between the 100 year flood level and floor levels on structures and entrances to underground car parks"?	0.5m freeboard must be applied.

2.1.3 MidCoast Council Guidelines for Water Sensitive Design Strategies 2019 (Guidelines for WSDS 2019)

2.1.3.1 Objectives

The objectives of this Water Sensitive Design Strategy align with the purpose of Chapter 3.3 of Council's Guidelines for Water Sensitive Design Strategies, 2019. These objectives and a description of how they are achieved within the design are listed in Table 2-2.

Table 2-2 Water Sensitive Design Objectives (MidCoast Council, 2019)

Objective	How this objective is achieved in the WSDS
To safeguard the environment by maintaining or improving the quality of stormwater run-off.	Gross Pollutant Trap (SPEL Vortceptor and Ecoceptor) and swale are proposed to improve quality of stormwater runoff upstream and within the proposed development site.
To protect and restore aquatic, estuarine or riparian ecosystems and bushland areas.	The existing watercourses upstream and within the proposed development site are retained where possible. The earthwork extent was optimised to minimise impact to the existing reserve area.
To harvest rainwater and urban stormwater runoff for use where appropriate.	A 5kL tank is proposed for each new building to harvest rainwater from the roof. Two basins and an underground detention tank are proposed to harvest stormwater.
To control the hydrological impacts of development on receiving surface and ground water systems by controlling the frequency, magnitude and duration of flows to preserve, as far as practicable, pre-development groundwater and surface water regimes and interactions.	The peak runoff from the proposed development is controlled by the new basins and an underground detention tank to meet the predevelopment condition as per Council's requirements. The proposed drainage system within the development site was designed to have no adverse impact to the downstream private properties. Refer to Flood Study for Lot 23 DP537919 – Blueys Beach Development for details on the peak post development flows.
To control the impacts of development on channel bed and bank erosion by controlling the magnitude, nature and duration of sediment-transporting flows.	Gross Pollutant Trap (SPEL Vortceptor and Ecoceptor) and swales are proposed to improve quality of stormwater runoff upstream and within the proposed development site.
To promote disconnection of impervious areas to the drainage system by introducing appropriate measures to minimise the rate, frequency and volume of urban runoff events in order to improve WSD performance.	The proposed Gross Pollutant Trap (SPEL Vortceptor and Ecoceptor) and swales within the development meets the WSD performance targets required by Council.

2.1.3.2 Targets

2.1.3.2.1 Water Quality

Water quality targets will be set as listed in Table 2-3 in accordance with Section 11.4.2. of the DCP 2019.

Table 2-3 Stormwater Quality Targets (Subdivision) (MidCoast Council, 2019)

Stormwater Quality Targets				
Site Characteristics	**Gross Pollutants**	**Total Suspended Solids**	**Total Phosphorus**	**Total Nitrogen**
Lots over 2,500m^2 in size where the percentage of existing impervious surface is less than 10% of the area.	90%	Neutral or Beneficial Effect on Water Quality - meaning loads of pollutants from future development must be equivalent to or less than that from the existing land use prior to development.		

2.1.3.2.2 Water Quantity

Limit peak post-development flowrates to pre-development levels for the full range of storm events from the 20% up to and including the 1% AEP event for the critical catchment storms. Refer to Flood Study for Lot 23 DP537919 – Blueys Beach Development for details on the peak post development flows.

3 Constraints and opportunities

3.1 Opportunities

The site opportunities are described below.

3.1.1 Flooding

> Lots are not listed as flood affected in statutory mapping.

3.1.2 Drainage

> Potential for integrated solutions for water quality incorporating existing central watercourse within Development as a feature. Potential for constructed wetland feature as part of drainage reserve.

> Potential to incorporate existing dam adjacent Samuel Street in drainage measures

> Existing stormwater connections from development lot to Council system in road network

> Northern-most watercourse is not well defined and conveyance can be managed within subdivision layout with appropriate water quality measures i.e. within a pit and pipe network and overland flow paths.

> Southern-most watercourse conveyance can be managed within the subdivision layout, with appropriate water quality measures i.e. within a pit and pipe network and overland flow paths.

> Retaining the central water course will provide an opportunity to be incorporated as a positive aesthetic, water-quality and community recreational feature of the development.

> Potential for the proposed development to improve the current drainage impacts to properties adjacent to the Site by managing flows from the steep adjacent slopes and maintaining or improving water quality for runoff leaving the Site.

3.2 Constraints

The site constraints include the following:

> Existing watercourses within the development needs to be managed or diverted.

> Due to the extents of the second water course, it is envisaged this will have to be retained and protected within the proposed development layout.

> The existing inlet pits downstream of the development are located within the private properties and needs to be retained / incorporated into the design.

> Condition of the existing downstream drainage network is unknown.

> There is no water quality measures/treatment for the existing development/catchment adjoining the site.

4 Best planning practices

Options for the configuration of the water sensitive design treatment devices have been reviewed with the development team. The locations of the proposed treatment measures have been strategically proposed at the outlet of each existing catchment and where possible non-proprietary devices have been proposed in line with Council's requirements detailed in Section 4.4.5 of Council's 2019 Guidelines for WSDS.

Gross Pollutant Trap (SPEL Vortceptor and Ecoceptor) and swale are proposed to improve quality of stormwater runoff upstream and within the proposed development site. The nominated treatment measures have been designed and coordinated with the project team and meet the objectives and targets detailed in Council's 2019 DCP and outlined in Section 2.

5 Integrated Water Cycle Management

5.1 Reduced Potable Water Demand

In order to reduce the site's overall potable water demand in accordance with Council's Water Cycle Management Guidelines, the following measures are proposed:

1. Toilets, kitchen and bathroom taps shall have a minimum 4-star rating.
2. Provision of rainwater reuse tanks to each dwelling. Retained roof water in rainwater tanks will be used as follows:
    a. Toilet flushing
    b. Laundry washing
    c. Garden irrigation

    Further details on the rainwater tanks and water re-use assumptions are detailed in Section 6.1.2.4.1.

6 Stormwater Management

6.1 Water Quality Assessment (MUSIC)

6.1.1 Water Quality Objectives

Outlined in Section 2.1.3.2.1.

6.1.2 MUSIC Model

6.1.2.1 Catchments

6.1.2.1.1 Existing Scenario

The stormwater catchment area upstream and within the site was determined using a 1m Digital Elevation Model (DEM) obtained from NSW Government Spatial Service's ELVIS (Elevation Information System) portal and LSW's detailed site survey "3154 LSW BASE DETAIL_270422" (version 1, dated 27/04/2022).

The pre-developed site was modelled as five catchments, which include the four site discharge points plus the external existing developed catchment contributing to Basin 1 (Y2). The four natural catchments were further divided into two different source nodes i.e. the open pastured 'agricultural' land adjacent to the existing houses and the densely vegetated 'forested' areas upstream (see Section 6.1.2.3 for further details on these source nodes).

The catchment areas are presented in Table 6-1.

Table 6-1 MUSIC Pre-Development Catchments

Catchment	Source	Size (Ha)	Fraction Impervious (%)
BASIN 1 (BLOCK Y2)	Forest	2.380	0
	Agricultural	3.760	0
	Urban - Mixed-use	3.228	50
BASIN 2 (BLOCK Y3)	Forest	14.408	0
	Agricultural	1.911	0
BASIN 2 BYPASS (EXISTING CREEK)	Forest	1.174	0
	Agricultural	2.939	0
BASIN 3 (UNDERGROUND OSD)	Forest	0.957	0
	Agricultural	1.442	0

The delineated catchments are presented in Figure 6-1.

Figure 6-1 MUSIC Pre-developed Catchment Delineation

6.1.2.1.2 Proposed Scenario

The post-developed site catchments were delineated based on the proposed development's land uses, which include road reserves, residential and commercial lots and natural undeveloped catchments. The residential and commercial lots were further divided into two different source nodes, which include the roofed areas and landscaped areas (see Section 6.1.2.3 for further details on these source nodes).

The catchment areas are presented in Table 6-2. The proposed treatment units are shown on 50522033-C-1045-CSWP.

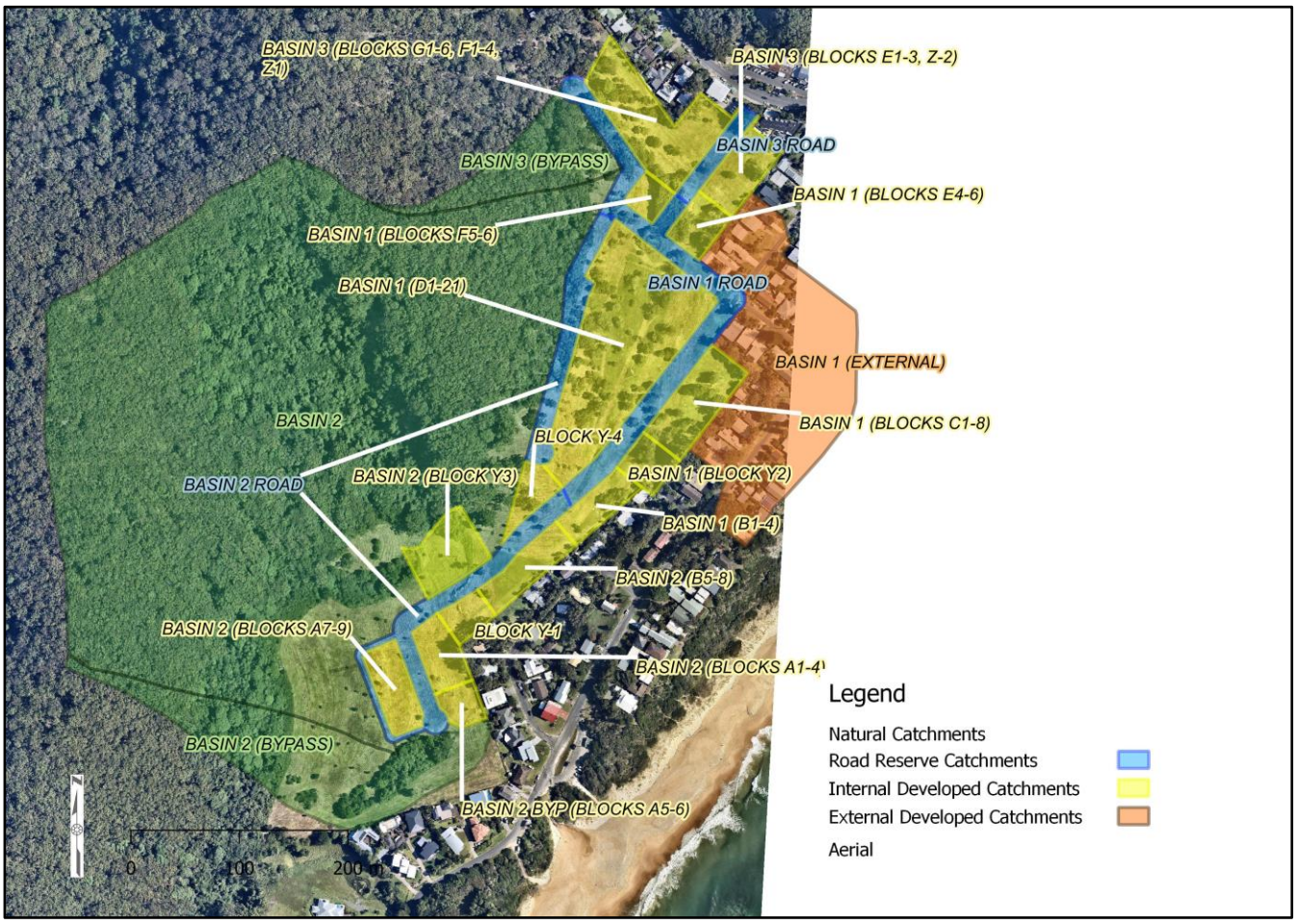
Table 6-2 MUSIC Post-Development Catchments

Catchment	Name	Source	Size (Ha)
BASIN 1 (BLOCK Y2)	B-1 ROAD	Urban - Mixed	1.025
	B-1 ROOF	Roof	1.410
	BLOCKS B1-4	Urban - Residential	0.106
	BLOCKS C1-8	Urban - Residential	0.195
	BLOCKS D1-30, E4-6 AND F5-6	Urban - Residential	1.199
	B-1 (EXTERNAL)	Urban - Mixed-use	3.228
BASIN 2 (BLOCK Y3)	B-2 ROAD	Urban - Mixed	1.031
	B-2 ROOF	Roof	0.330
	BLOCKS A1-4 & A7-9	Urban - Residential	0.300
	BLOCKS B5-8	Urban - Residential	0.157
	BLOCKS Y1 and Y4	Urban - Residential	0.306
	BASIN 2 - NATURAL	Forest	18.726
	B-2 BYPASS ROOF	Roof	0.060

BASIN 2 BYPASS (EXISTING CREEK)	BLOCKS A5-6	Urban - Residential	0.070
	BASIN 2 BYPASS - NATURAL	Forest	2.014
BASIN 3 (UNDERGROUND OSD)	B-2 ROAD	Urban - Mixed	0.164
	B-3 ROOF	Roof	0.390
	BLOCKS G1-6, E1-3, F1-4 AND Z1-2	Urban - Residential	0.687
	BASIN 3 - NATURAL	Forest	0.835

The delineated catchments are presented in Figure 6-2.

Figure 6-2 MUSIC Post-developed Catchment Delineation



6.1.2.2 *Base Data*

MidCoast Council's Rainfall Template was used for this assessment to as per Council's standards.

6.1.2.3 *Source Nodes*

Pollutant loadings for the source nodes were derived from the NSW MUSIC Modelling Guidelines (BMT WBM, 2015). The following land-use source nodes were used to represent the site surface types:

- Roof
- Mixed-use
- Residential
- Agricultural
- Forest

The adopted Base Flow and Storm Flow concentration parameters are documented below in Table 6-3. Stochastic pollutant generation was selected.

Table 6-3 Adopted Base Flow and Storm Flow Concentration Parameters (mg/L – log10) (NSW MUSIC Modelling Guidelines, 2015)

Land-use Zone		TSS		TP		TN	
		Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Roof	Base Flow	1.10*	0.17*	-0.82*	0.19*	0.32*	0.12*
	Storm Flow	1.30	0.32	-0.89	0.25	0.30	0.19
Mixed-use	Base Flow	1.10*	0.17*	-0.85*	0.19*	0.11*	0.12*
	Storm Flow	2.15*	0.32*	-0.60*	0.25*	0.3*	0.19*
Residential	Base Flow	1.20	0.17	-0.85	0.19	0.11	0.12
	Storm Flow	2.15	0.32	-0.60	0.25	0.30	0.19
Agricultural	Base Flow	1.40	0.13	-0.88	0.13	0.074	0.13
	Storm Flow	2.30	0.31	-0.27	0.30	0.59	0.26
Forest	Base Flow	0.9#	0.13	-1.50#	0.13	-0.14#	0.13
	Storm Flow	1.90#	0.20	-1.10	0.22	-0.075#	0.24

* Not listed in NSW MUSIC Modelling Guidelines, 2015

Differs from Guidelines

The percentage effective impervious area for each surface type was adopted in accordance with Section 4.6.4 of Council's Guidelines for WSDS 2019 and are presented in Table 6-4.

Table 6-4 MUSIC Adopted Developed Imperviousness

Source Node	Fraction Impervious (%)	Comment
Road Reserve	62.5	Footway (half the area of road catchment) = 25% Carriageway (half the area of road catchment) = 100%
Lot Landscaping	20	
Lot Roof	100	

6.1.2.4 Treatment Nodes

A stormwater treatment train with three (3) treatment nodes are proposed as part of the water cycle treatment train. Treatment measures include:

- Rainwater Tank
- Swale
- Ponds
- SPEL Ecoceptor Gross Pollutant Trap (GPT)
- SPEL Vortceptor GPT

6.1.2.4.1 Rainwater Tank

A 5kL rainwater tank is proposed for each lot in the development and the roof area draining to each tank was adopted to be 300m^2/lot in accordance with Section 4.6.4-7 of Council's Guidelines for WSDS 2019. A breakdown of the rainwater tanks proposed in each catchment is presented in Table 6-5.

Table 6-5 Rainwater Tank Schedule

Catchment	Lots	Individual Roof Area (m^2/ lot)	Total Roof Area (m^2)	Individual Tank Volume (kL/ lot)	Total Tank Volume (kL)
BASIN 1 (BLOCK Y2)	47	300	14100	5	**235**
BASIN 2 (BLOCK Y3)	11	300	3300	5	**55**

BASIN 2 BYPASS (EXISTING CREEK)	2	300	600	5	**10**
BASIN 3 (UNDERGROUND OSD)	13	300	3900	5	**65**

The water re-use for each catchment's rainwater tanks has been calculated in accordance with Section 4.6.7 of Council's Guidelines for WSDS 2019. A breakdown of the adopted annual re-use values is presented in Table 6-6.

Table 6-6 Rainwater Tank Reuse Schedule

Catchment	Toilet (55L/day/dwelling)	Washing (95L/day/dwelling)	Outdoor (36L/year/dwelling)	Total Annual (kL/year)
Basin 1	2585	4465	1692	**2575**
Basin 2	605	1045	396	**603**
Basin 2 (Bypass)	110	190	72	**110**
Basin 3	715	1235	468	**712**

6.1.2.4.2 Swale

Swales are designed along the outer edges of the proposed road reserves around the development. The swales are design to collect stormwater runoff from the upstream natural catchments and discharge it to the proposed water quality and/ or quantity devices. The swales will also capture sediment and remove nutrients from the upstream catchment.

Five (5) swales adding to a length of approximately 1630 m were modelled in the post development scenario.

6.1.2.4.3 Ponds

Two (2) ponds, located on the Y2 and Y3 blocks, were included in the post development model. The ponds help to remove sediment from the upstream catchment and the proposed development. The ponds were modelled with the parameters presented in Table 6-7.

Table 6-7 Pond Parameters

Parameter	Pond 1 (Y2 Block)	Pond 2 (Y3 Block)
Surface Area (m^2)	700	1980
Extended Detention Depth (m)	1.7	2.6
Permanent Pool Volume (m^3)	0	50
Notional Detention Time (hours)	0.302	0.470
Re-Use Drawdown (kL/yr)	0	0

6.1.2.4.4 Gross Pollutant Traps

SPEL GPT's are proposed as primary treatment measures to remove gross pollutants and coarser sediment from the stormwater runoff. SPEL MUSIC treatment nodes were downloaded from the SPEL website and included in the model as detailed below.

SPEL Ecoceptor

There are six (6) Ecoceptor GPT's proposed throughout the proposed development. These are dispersed throughout the development to treat the various catchments prior to discharge from the site. The Ecoceptor models proposed are the 8000 and 10000 which are a hydrodynamic in-line proprietary GPT manufactured by SPEL.

SPEL Vortceptor

There is one (1) Vortceptor GPT proposed downstream of the Basin 2 Natural Catchment and directly upstream of Basin 2. The Vortceptor model proposed is the SVO.1200, which is an offline non-blocking vortex type separator GPT.

6.1.3 Results

The MUSIC model prepared for the predevelopment and post development scenario is shown in Figure 6-3 and Figure 6-4.

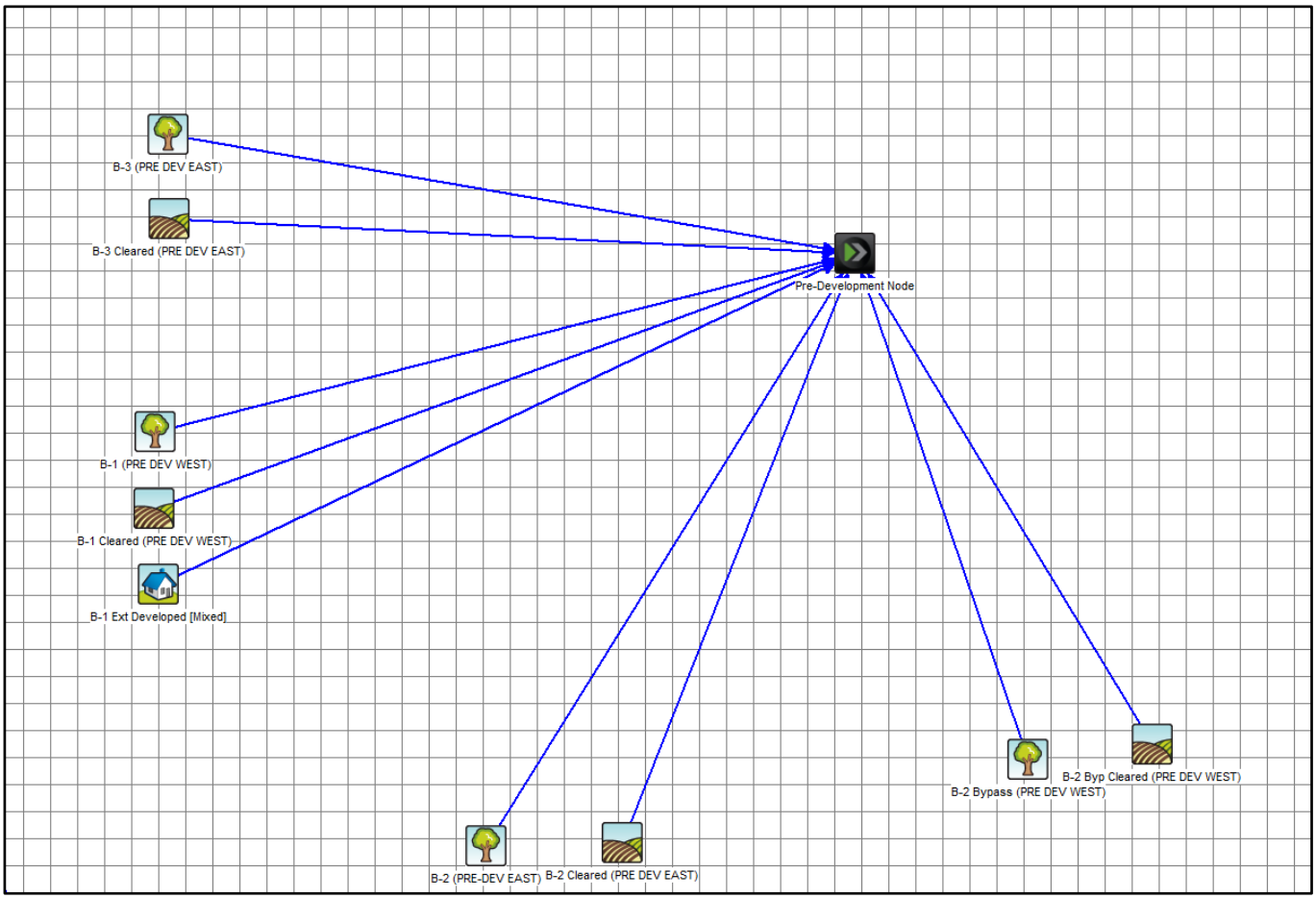


Figure 6-3 Predevelopment Scenario MUSIC Model

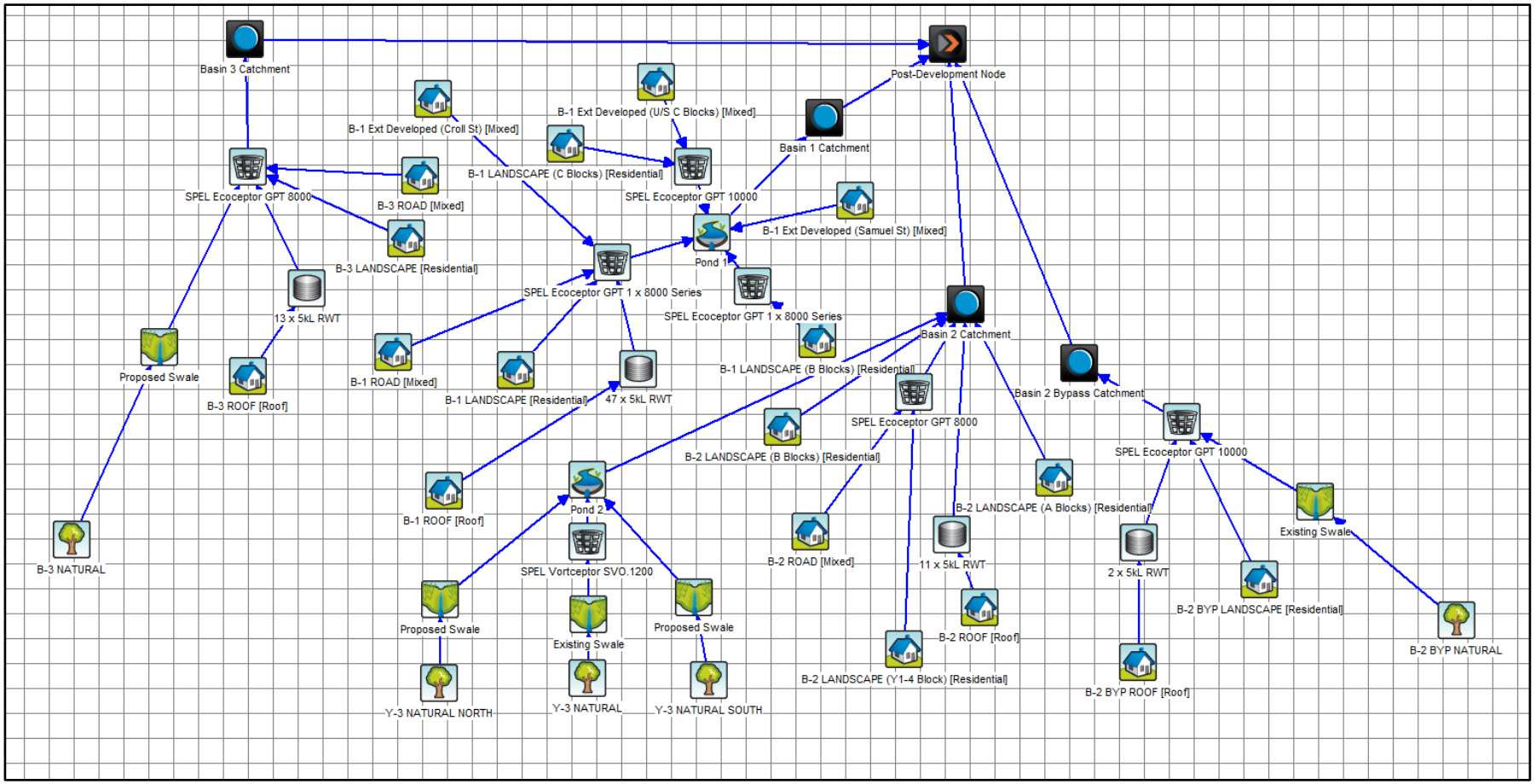


Figure 6-4 Post Development Scenario MUSIC Model

A summary of the results from the MUSIC model is presented in Table 6-8.

Table 6-8 Water Quality Modelling Results for Lot Size Greater Than 2,500m^2 - MUSIC

Objective	Pre-Developed (kg/yr)	Post-Developed (kg/yr)	Improvement (%)	Target Compliance (Y/N)
Total Suspended Solids (TSS)	14500	4560	69%	Y NorBE 10% Improvement on the mean annual nutrient loads
Total Phosphorus (TP)	31.5	17.5	44%	Y NorBE 10% Improvement on the mean annual nutrient loads
Total Nitrogen (TN)	257	219	15%	Y NorBE 10% Improvement on the mean annual nutrient loads
Objective	Source (kg/yr)	Residual (kg/yr)	Reduction (%)	Target (%)
Gross Pollutants	2490	63.9	97%	90% (Y)

The results from the MUSIC model show the nominated treatment train exceeds the pollutant removal targets stipulated in Section 2.1.3.1.

7 Operation and Maintenance Plan

It is recommended that maintenance of stormwater management features be undertaken in accordance with the procedures outlined in the Guidelines for Maintenance of Stormwater Treatment Measures (Stormwater NSW, 2020) and manufacturer guidelines for proprietary devices.

At a minimum, maintenance inspections should be undertaken every 6 months and following significant rainfall events. Following DA stage of the project, an operation and maintenance plan will be prepared in conjunction with the detailed design for the water cycle management elements.

The costs associated with procurement and maintenance over a 5-year period of the SPEL proprietary products is stipulated in Table 7-1.

Table 7-1 SPEL Procurement Maintenance Costs

Model	Costs
Vortceptor SVO.1200 (1)	$ 170,410
Ecoceptor 8000 (4)	$ 144,600
Ecocepter 10000 (2)	$ 209,000
Total	**$ 524,010**

8 Conclusion

The water quality assessment for the proposed subdivision at Lot 23 in DP 537919 Boomerang Drive, Blueys Beach has been undertaken using the MUSIC software model. The following treatment measures are proposed to be integrated in the development:

- 5kL Rainwater Tank for each lot (73)
- Swales (5)
- Ponds (2)
- Gross Pollutant Traps (7)

The modelling results show that the proposed water quality treatment measures proposed meet the performance targets outlined by MidCoast Council in the 2019 Guidelines for Water Sensitive Design Strategies.

APPENDIX

A

COUNCIL CORRESPONDANCE

Cardno

now

Stantec

Tarni Penn

From: John Sutcliffe
Sent: Friday, 6 May 2022 2:18 PM
To: Kieran Woodall; Tarni Penn
Cc: Fran Liao; David Laing; Jack Joseph; Jake O'Neil; Terry Maher; Bruce Moore; Belinda Kennewell; Evan Vale
Subject: RE: 50522033 - Blueys Beach Subdivision WSUD Requirements

Afternoon Kieran,

Thanks for the prompt response. To save going back and forth in one hundred emails, is it possible to get a meeting with you and your team early next week so that we can run through the existing model and develop a methodology for how to resolve the issue?

Monday between 9 and 1 and Tuesday between 12 and 3 are clear at the moment.

Regards,

John Sutcliffe
SENIOR PROJECT MANAGER
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CONNECT WITH CARDNO

From: Kieran Woodall <Kieran.Woodall@midcoast.nsw.gov.au>
Sent: Friday, 6 May 2022 12:53 PM
To: John Sutcliffe <john.sutcliffe@cardno.com.au>; Tarni Penn <tarni.penn@cardno.com.au>
Cc: Fran Liao <fran.liao@cardno.com.au>; David Laing <david.laing@cardno.com.au>; Jack Joseph <jack@wtmalouf.com.au>; Jake O'Neil <jake@oneil.net.au>; Terry Maher <terry.maher@cardno.com.au>; Bruce Moore <Bruce.Moore@MidCoast.nsw.gov.au>; Belinda Kennewell <Belinda.Kennewell@midcoast.nsw.gov.au>; Evan Vale <evan.vale@midcoast.nsw.gov.au>
Subject: RE: 50522033 - Blueys Beach Subdivision WSUD Requirements

Good afternoon John,

For clarification, Council notes existing overland flow within private property is made up of sheet flow when approaching downstream boundaries. Uplift associated with the development affords an opportunity for this to be dealt with through a Development Application in which we have a duty of care to ensure that it occurs in accordance with current policies including Section 3.6. For a small scale development what you are proposing may be appropriate under certain circumstances, but not for a subdivision of this size given that the sheet flow of the subject lot is proposed to be captured and concentrated through single points of discharge which poses an elevated risk.

Whether this is done through acquisition, creation of easements or through redesign of the stormwater system that will be at the applicant's discretion. We would note that preliminary advice has been provided through the DAP meetings to assist with preparation of plans and given a Development Application has not been lodged, a full engineering assessment is yet to be completed. Council has attempted to provide advice based on the information presented at each DAP meeting and through follow up correspondence, however this has been subject to change and has been limited in detail to date. We provide this commentary based on the latest request for information and to again assist with preparation of plans before the lodgement of the Development Application.

With regard to the advice that *there is no opportunity to divert these paths*, Section 88K of the conveyancing act affords this opportunity in the event that negotiations with landowners is not successful. From what has been proposed and commentary in the previous email I can only gather that negotiations to secure such overland flow paths has not taken place. We would highly recommend that this is considered before DA lodgement as this may prove to be something that holds up assessment and approval once it is formally referred to engineering as part of that process. Stormwater has been highlighted as a community concern throughout the consultation process and will be required to be addressed as part of our assessment.

Regards,

From: John Sutcliffe <john.sutcliffe@cardno.com.au>
Sent: Friday, 6 May 2022 11:36 AM
To: Kieran Woodall <Kieran.Woodall@midcoast.nsw.gov.au>; Tarni Penn <tarni.penn@cardno.com.au>; Belinda Kennewell <Belinda.Kennewell@midcoast.nsw.gov.au>
Cc: Fran Liao <fran.liao@cardno.com.au>; David Laing <david.laing@cardno.com.au>; Jack Joseph <jack@wtmalouf.com.au>; Jake O'Neil <jake@oneil.net.au>; Terry Maher <terry.maher@cardno.com.au>
Subject: RE: 50522033 - Blueys Beach Subdivision WSUD Requirements

Good morning Kieran,

Just want to seek clarification on the statement below from your response:

The section 3.6 requirement must be met. An over land flow path to cater for the PMF peak flows with 0.5m freeboard to all dwellings is to be downstream of all basin spillways which is also clarified in the previous comment above.

The existing overland flows paths from the natural catchment drain over private property, namely 13 Ampat Place and 1 Samuel Street. As per our previous discussions with council, we are not seeking to change the existing overland flow paths and in real terms, there is no opportunity to divert these paths to meet the requirements stated above.

Our design intent is to reduce post-developed overland flows impacting these existing properties where possible, but overland flow in the post developed scenario will follow the pre-developed flow paths through existing residential blocks.

Are you able to confirm that council is happy with this methodology, as without agreement on this point, development within the catchment cannot proceed.

Regards,

John Sutcliffe
SENIOR PROJECT MANAGER
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CONNECT WITH CARDNO

From: Kieran Woodall <Kieran.Woodall@midcoast.nsw.gov.au>
Sent: Friday, 6 May 2022 10:18 AM
To: Tarni Penn <tarni.penn@cardno.com.au>; Belinda Kennewell <Belinda.Kennewell@midcoast.nsw.gov.au>
Cc: John Sutcliffe <john.sutcliffe@cardno.com.au>; Fran Liao <fran.liao@cardno.com.au>
Subject: RE: 50522033 - Blueys Beach Subdivision WSUD Requirements

Good morning Tarni,

On behalf of Council's Water Quality and Stormwater officers we can provide the following commentary in response to the request for information.

Regards,

Kieran Woodall
Coordinator Development Engineering

Direct (02) 7955 7219 Mobile 0448 594 069
Kieran.Woodall@midcoast.nsw.gov.au

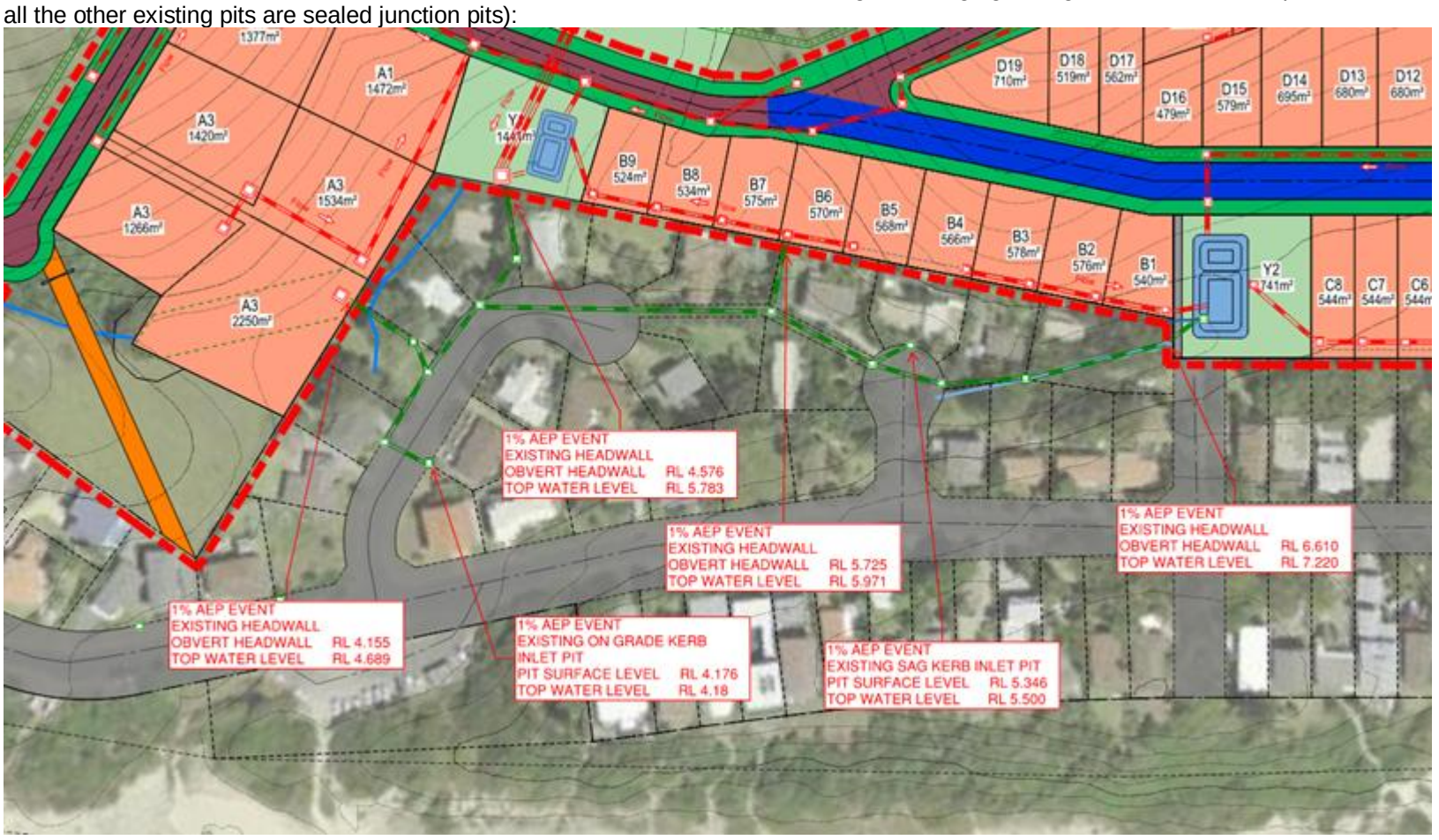
www.midcoast.nsw.gov.au or follow us

From: Tarni Penn <tarni.penn@cardno.com.au>
Sent: Friday, 29 April 2022 8:48 AM
To: Belinda Kennewell <Belinda.Kennewell@midcoast.nsw.gov.au>
Cc: John Sutcliffe <john.sutcliffe@cardno.com.au>; Fran Liao <fran.liao@cardno.com.au>
Subject: 50522033 - Blueys Beach Subdivision WSUD Requirements

Hi Belinda,

My name is Tarni, I'm a Civil Engineer at Cardno, now Stantec assisting in the stormwater design for the proposed subdivision development at Blueys Beach for our Client Malouf Property. I've received your contact details from John who's indicated you might be able to confirm a few things for me regarding Council's WSUD requirements for subdivision developments in the MidCoast LGA. Please see a summary of the questions below, I have also left room for you to provide responses if that suits.

No.	Item	Question	Response
1	Minor event criteria	Section 1.4.2.3 DCP states that "Consideration should be given to quality and quantity across the frequency spectrum from quarterly (0.25 year ARI) treatment flows up to the safe control of 100 year ARI discharges" Typically, quality refers to stormwater treatment and quantity refers to stormwater storage. From this, I inferred the major design event is 1% AEP and the minor design event is 4EY for both water quality and quantity modelling criteria. This is a particularly stringent quantity target. In order to achieve this, the basins have to be oversized to limit the discharge during these less frequent events. The question for Council is, have we understood the stormwater criteria correctly or could we potentially reduce the water quantity minor design criteria? For reference the minor structure design criteria (for pit and pipe network etc.) is 20% AEP as per Table 1 Annexure M5 in the 0041 Geometric sealed road design worksection.	For a minor system (i.e. pits and pipes) a 20% AEP capacity is acceptable. A 1% AEP capacity is required for major systems (i.e. trunk mains, basins etc). All overflow above the 1% AEP is to be in defined over land flow paths which needs to be demonstrated in the plan. It is noted that there are houses directly downstream that may be impacted by this overland flow path that

			needs to be addressed.
2	Basin structure approach	0074 Stormwater drainage AUS-SPEC Section 3.6 states that “No basin spillway located directly upstream of urban areas.” This will impact the proposed design of Basin Y1 and Basin Y2 (see sketch below for reference) which are both proposed to be open air and will have high-level weir spillways. Particularly relevant for Basin Y2, where we are maintaining the existing flow regime by controlling the flow in a basin and allowing for high level discharge via a spillway (by replacing an existing dam and spillway). The question for Council is, is the proposed design approach and basin location are agreeable? Particularly for Basin Y2 where the existing scenario is currently non-compliant with Council’s specification.	The section 3.6 requirement must be met. An over land flow path to cater for the PMF peak flows with 0.5m freeboard to all dwellings is to be downstream of all basin spillways which is also clarified in the previous comment above.
3	Existing system performance	I’ve modelled the existing network along Alamau Pl and Ampat Pl based on the best available information (noting WAE provided was dated 1972). Results from this model indicate there is surcharging at pits and also overflow from headwalls during the 10% AEP event up to the 1% AEP event. See a sketch below of the locations and levels of overflowing/ surcharging during the 1% AEP event (for reference all the other existing pits are sealed junction pits):  The questions in this instance, is Council willing to accept our design if we limit flows/ surcharge to the pre-development levels or alternatively would they prefer we improve this post-development to be compliant with their criteria and achieve no surcharge from pits/pipes during minor/ major storm events?	Post development flows must meet the criteria to ensure no surcharge given the intensification caused by the development. Any discrepancies in the model may attribute to further surcharge and possible flooding which needs to be avoided. Given the size and scale of the development we would establish the nexus that all pipes and pits are to be upgraded as required that are being connected into.
4	Freeboard	0074 Stormwater drainage AUS-SPEC Section 3.6 regarding freeboards for major structures states that the “Minimum floor levels of dwellings: 0.5 m freeboard above the 100 year ARI flood level in the basin” The question for Council, is are there specific freeboards for basins directly upstream of roadways, is this also 0.5m or is it 0.3m as Section 3.5 regarding freeboards for roadways states “0.3 m freeboard between the 100 year flood level and floor levels on structures and entrances to underground car parks”?	0.5m freeboard must be applied.

Apologies that’s a lot of information to digest. If anything isn’t clear, if you have any questions or would prefer to discuss over the phone, please don’t hesitate to contact me via the contact details below.

Kind regards,

Tarni Penn *She/Her*
CIVIL ENGINEER
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Fran Liao

From: John Sutcliffe
Sent: Thursday, 21 July 2022 9:51 AM
To: Kieran Woodall
Cc: Fran Liao
Subject: RE: Meeting - Post Pre-DA - Lot 23 Boomerang Drive

Excellent, thanks for the prompt reply.

We will assume minimum cover and adopt 1.3m to invert, subject to survey confirmation.

Cheers,

John Sutcliffe
Senior Project Manager

Cardno now Stantec

From: Kieran Woodall <Kieran.Woodall@midcoast.nsw.gov.au>
Sent: Thursday, 21 July 2022 9:37 AM
To: John Sutcliffe <john.sutcliffe@cardno.com.au>
Cc: Fran Liao <fran.liao@cardno.com.au>
Subject: RE: Meeting - Post Pre-DA - Lot 23 Boomerang Drive

Hi John,

The information relating to pit invert levels is limited however our system does indicate the following pipe sizes:

Please note that this is indicative only and may not be completely accurate. Site validation may be required for the purpose of finalising the model.

Regards,

Kieran Woodall
Coordinator Development Engineering

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From: John Sutcliffe <john.sutcliffe@cardno.com.au>
Sent: Wednesday, 20 July 2022 5:02 PM
To: Kieran Woodall <Kieran.Woodall@midcoast.nsw.gov.au>
Cc: Fran Liao <fran.liao@cardno.com.au>
Subject: Meeting - Post Pre-DA - Lot 23 Boomerang Drive

Afternoon Kieran,

We are finalising the Tuflow model and we are seeking some additional data on the existing infrastructure on Boomerang Drive. Do you have any stormwater pipe sizes or inverts in the area shown below?

Cheers,

John Sutcliffe
Senior Project Manager

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