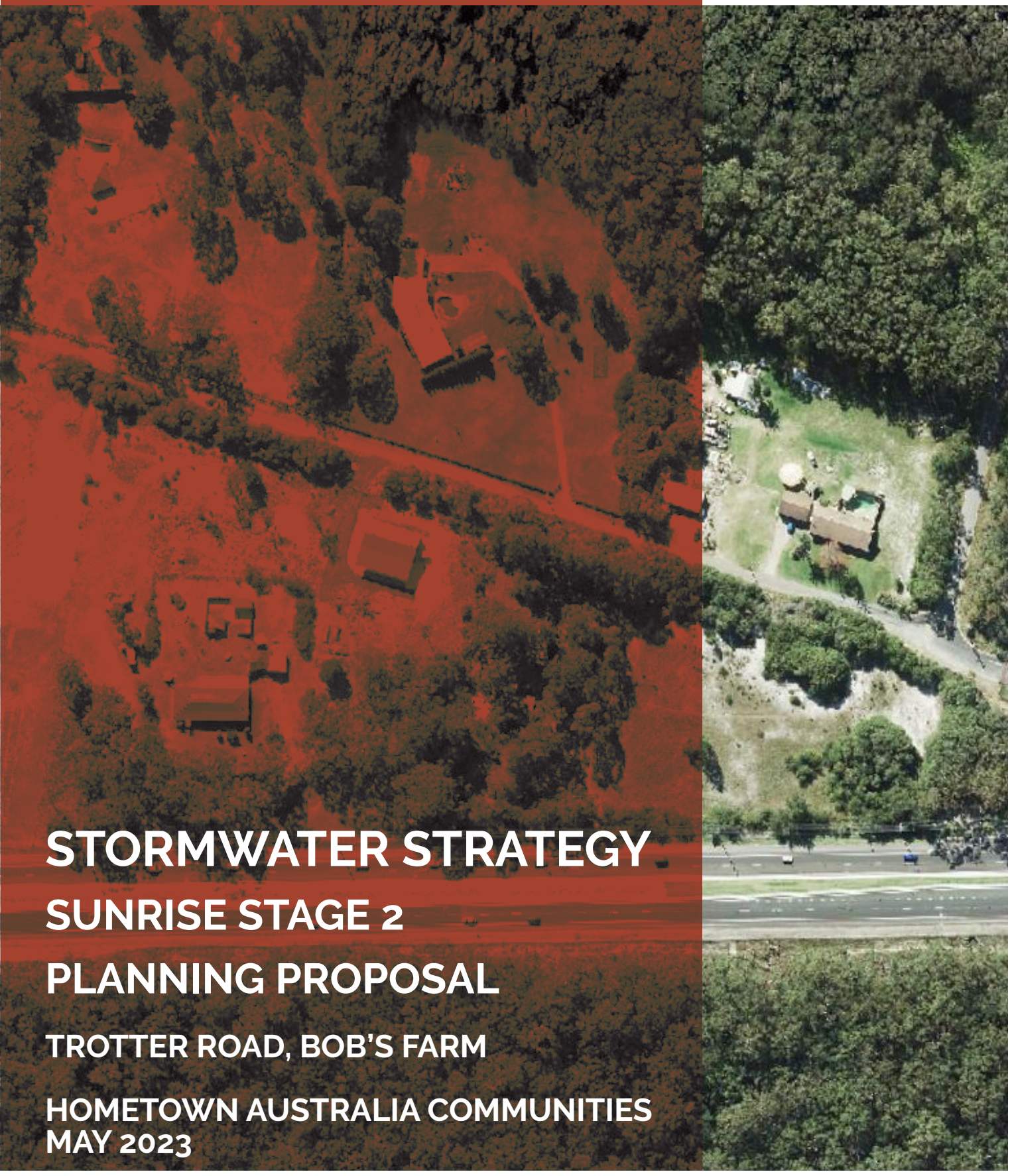


STORMWATER STRATEGY

SUNRISE STAGE 2

PLANNING PROPOSAL

TROTTER ROAD, BOB'S FARM

HOMETOWN AUSTRALIA COMMUNITIES
MAY 2023

adw johnson

HUNTER OFFICE
7/335 Hillsborough Road,
Warners Bay NSW 2282
(02) 4978 5100

CENTRAL COAST OFFICE
5 Pioneer Avenue,
Tuggerah NSW 2259
(02) 4305 4300

SYDNEY OFFICE
Level 35, One International Towers
100 Barangaroo Avenue,
Sydney NSW 2000
(02) 8046 7412

www.adwjohnson.com.au

Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Draft Issue	02/11/22	Mitchell Knox	Robert Champness
B	Address Gateway requirements	04/05/23	Mitchell Knox	Nathan Delaney
C	Council Comments	12/05/23	Mitchell Knox	-

Executive Summary

ADW Johnson has been engaged by Hometown Australia Holdings Pty Ltd to prepare a stormwater strategy for Lots 3622 DP 622485 and 2 DP 622229 at Bobs Farm. The strategy is required to support a Planning Proposal for the extension of an existing lifestyle village located on Lot 51 DP 1175028.

This stormwater strategy specifically addresses both stormwater quantity and quality outcomes. It addresses the conditions and constraints of the existing stormwater drainage regime and identifies appropriate stormwater infrastructure to adequately manage runoff within the site's boundaries.

Based on review of the existing site topography and geotechnical conditions, an infiltration-centric stormwater strategy is recommended. End-of-line infiltration basins are proposed to both attenuate peak flows and improve runoff quality.

DRAINS modelling was undertaken to demonstrate that the proposed stormwater management system can be sized to meet Council's requirements in relation to stormwater detention and peak site discharges.

MUSIC modelling has demonstrated that a proposed treatment train of gross pollutant traps and infiltration basins can satisfy Council's water quality stripping targets within the development footprint.

The existing site is situated above the regional Probable Maximum Flood. The proposed development provides favourable conditions for refuge-in-place subject to extreme flood events.

Commentary is provided herein which confirms that the proposed development will not adversely impact the hydrological integrity of coastal wetlands or the quality of drinking water catchments.

This strategy report has concluded that appropriate stormwater controls can be readily implemented within the proposed site footprint. The stormwater strategy presented herein is considered to be well-suited to existing site conditions and is fully compliant with Council's Development Control Plan.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1.0 Introduction

ADW Johnson has been engaged by Hometown Australia Holdings Pty Ltd to prepare a stormwater strategy for Lot 3622 DP 622485 and Lot 2 DP 622229 at Bobs Farm. The strategy is required to address stormwater management outcomes for a Planning Proposal to permit a caravan park use over the site.

Specifically, the stormwater strategy considers peak flow management, Water Sensitive Urban Design (WSUD), flood impacts and affectation and erosion and sediment control.

The land subject to this proposal is located at Bobs Farm. It is bounded by Trotter Road to the north and Nelson Bay Road to the south. The existing 'Sunrise' lifestyle village adjoins the site's western boundary. The planning proposal will facilitate the extension of the Sunrise Village over this site. An aerial image of the subject lands is shown in ***Figure 1***.

Figure 1 – Existing Site.
Source: SIX Maps.

2.0 Site Description

2.1 EXISTING SITE

The subject site is located within Port Stephens Council LGA at Nelson Bay Road, Bobs Farm. It is situated to the west of the Anna Bay township and lies between Fenninghams Island to the north and the Anna Bay sandbeds to the south. Attention is drawn to ***Figure 2*** which shows the site in its broader context.

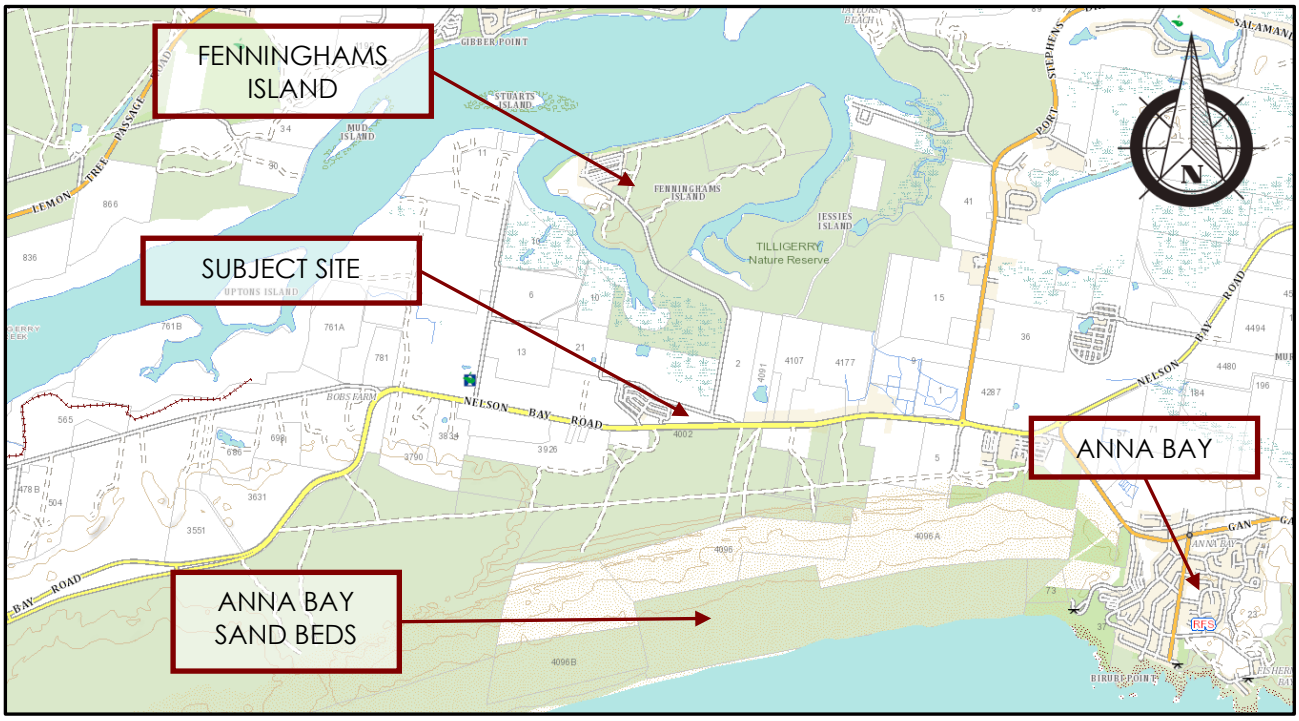


Figure 1 – Site Locality.
Source: SIX Maps.

Site levels vary generally in the order of 5.8m to 9m AHD. Existing topography is typified by gentle slopes of generally less than 3%. The site is bisected by a gentle crest creating two distinct catchments falling north to Trotter Road and south the Nelson Bay Road.

2.2 EXISTING GEOLOGY

The NSW *eSPADE* GIS confirms that the site is situated within the *Shoal Bay* landscape. Port Stephens Council's *hydrologic soil group mapping*, which is based on the NSW soil landscape maps, shows the site as being Group A (sandy/Shoal Bay) soils. An excerpt from Council's soil mapping is shown in ***Figure 3***.

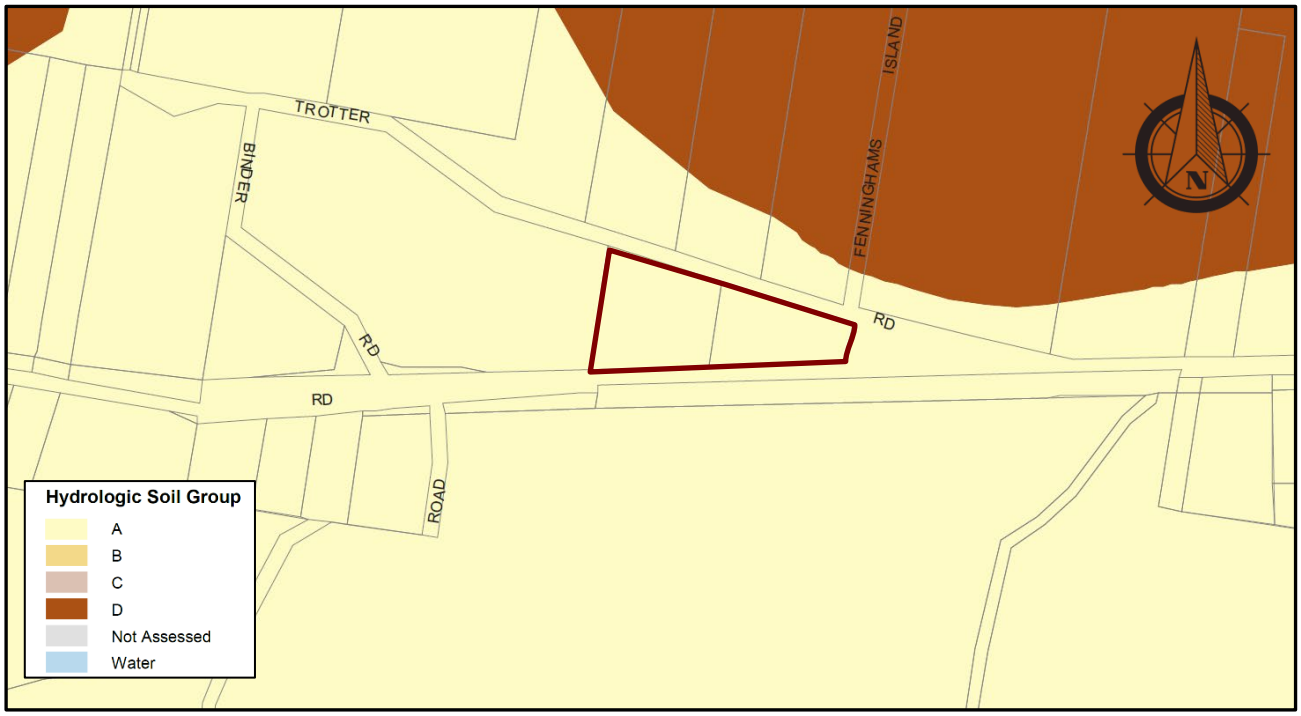


Figure 2 – Hydrologic Soil Groups.
Source: Port Stephens Council.

Previous investigations, historic use records and ground-truthing indicate that the entire site is typified by the sandy, well-drained soils of the Shoal Bay landscape.

2.3 EXISTING DRAINAGE

With reference to shallow natural grades and sandy soil profiles, it is evident that the site's hydrology is dominated by groundwater recharge. It is expected that frequent rainfall events are disposed of via infiltration to the catchment's soils, with less-frequent rainfall events generating runoff once the groundwater storage has been exhausted.

In relation to surface water runoff, the site's northern catchment drains to Trotter Road. Under existing conditions, two low points in Trotter Road report to private properties with no legal points of discharge.

It is understood that Trotter Road will be upgraded in support of DA16/2007/15/5, being a long-term caravan park located at 16 Trotter Road. The proposed roadworks will formalise the existing drainage regime by redirecting overflows to Fenninghams Island Road. From Fenninghams Island Road, flows will be conveyed northwards into an upstream tributary of Fenninghams Island Creek.

The proposed upgrades of Trotter Road have been subject to detailed hydrologic modelling and reporting (Reference 240060(1) by ADW Johnson dated 2022). Peak flows into Fenninghams Island Road following the Trotter Road upgrades are provided in ***Table 1***.

Table 1 - Peak Flows Received by Fenninghams Island Road

Recurrence	Peak Catchment Flows (m3/s)		
	1EY	10% AEP	1% AEP
Post upgrades	0.039	0.219	0.469

Source: ADW Johnson 2022

The site's southern catchment falls towards a low point in its southwestern corner. Overflows are subsequently disposed into an existing table drain in Nelson Bay Road which is shown in ***Figure 4***. The capacity of the existing table drain is not known.

Figure 3 – Nelson Bay Road Table Drain.
Image: Google.

Figure 5 presents a broad plan of the existing drainage network.

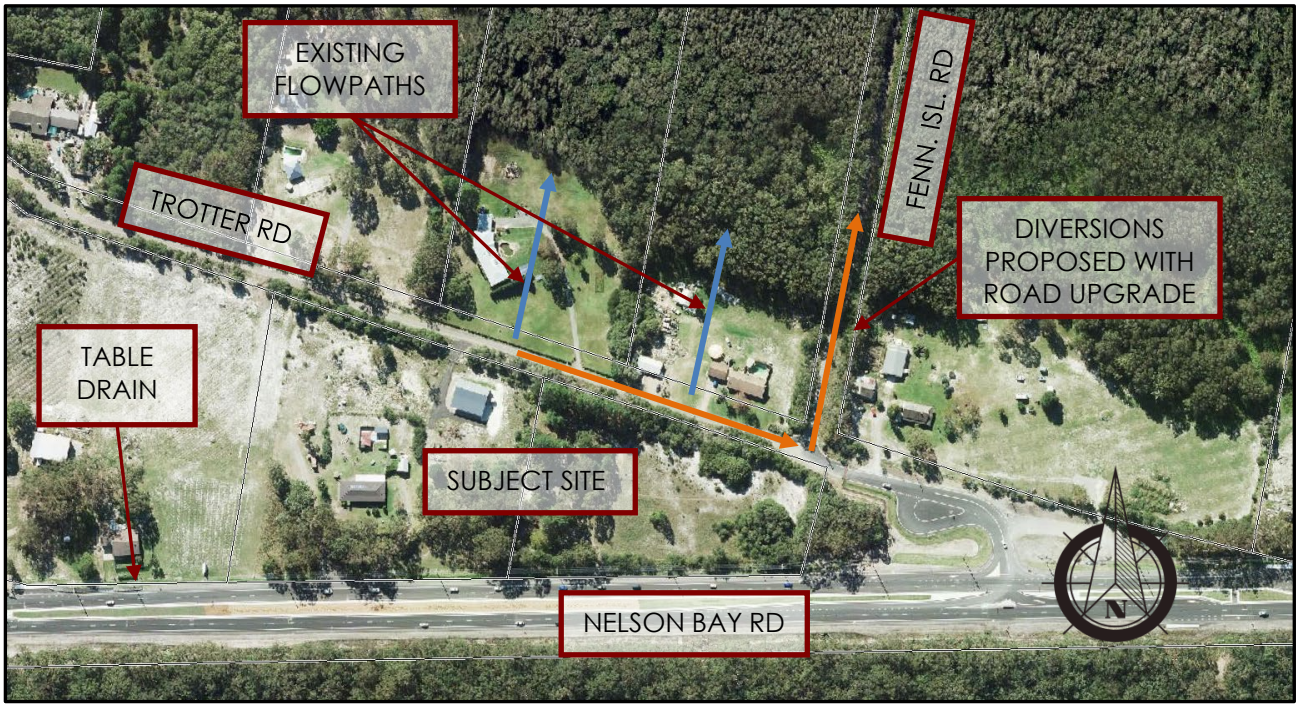


Figure 4 – Existing Drainage Regime.
Source: Six Maps.

2.4 EXISTING HYDROGEOLOGY

As noted in Qualtest's *Preliminary Contamination* Assessment (2022), groundwater is anticipated in an unconfined aquifer beneath the site at depths greater than 2m below ground surface. The proposed development is unlikely to intercept groundwater at such depths.

Groundwater is expected to flow northwards to either Bobs Farm Creek or Tilligerry Creek. Qualtest 2022 notes that groundwater conditions and flows may vary subject to climatic influences.

2.5 PREVIOUS REPORTING

The existing Sunrise Stage 1 Development has been the subject of previous stormwater reporting. MM Hyndes Baily & Co. prepared a *Drainage Strategy Report* for 4011 Nelson Bay Road in August 2017. The report updated a previous strategy assessment prepared by Northrop Engineers in 2013.

A fundamental principal of the approved drainage strategy was that infiltration basins were to wholly accommodate the 100-year ARI design storm. A network of infiltration basins was sized to ensure no discharge from the site up to the 100-year ARI design storm.

The proposed infiltration basins were central to the strategy's water quality treatment train. Though not modelled in MUSIC, online "silt traps," comprising of a perforated pipe and permeable pit sumps, were proposed to mitigate sedimentation of the proposed basins.

The Sunrise Stage 1 stormwater strategy accounted for highly infiltrative soils. Whilst the 2013 assessment adopted an exfiltration rate of 10m/day, MM Hyndes Bailey & Co. applied a factor of safety, adopting a rate of 2m/day (83.6mm/hr). Field infiltration testing indicated a much higher degree of ground permeability in the order of 15m/day (627mm/hr).

2.6 PROPOSED DEVELOPMENT

The Planning Proposal seeks to allow for the extension of an existing lifestyle village that is located on Lot 51 DP 1175028 into adjacent land described as Lots 3622 DP 622485 and 2 DP 622229. The proposed development would create:

- Approximately 62 long-term dwelling sites in addition to the existing Sunrise stage one development;
- Community facilities;
- A network of communal driveways; and
- Caravan and boat storage facilities.

A potential site layout is presented in ***Figure 6***. It is noted that ***Figure 6*** is conceptual in nature, being indicative of the site's developable capability. It is expected that the masterplan will evolve until it is confirmed by a future Development Application.

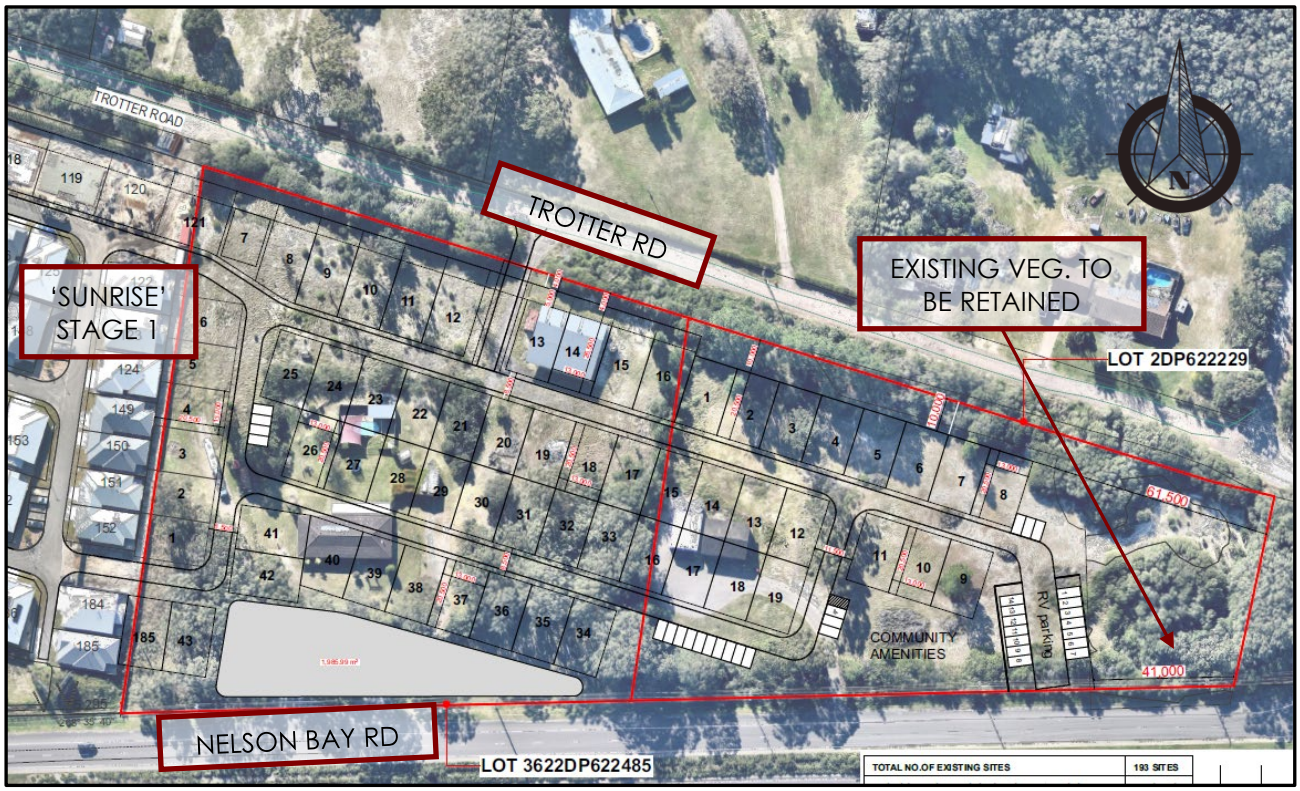


Figure 5 – Indicative Masterplan.
Source: Hometown Communities.

3.0 Council Requirements

Port Stephens City Council provides objectives and controls for developments within "Port Stephens Development Control Plan 2014" (DCP). *Part B* "General Provisions" of the DCP outline relevant controls for development.

Part B4 – *Drainage and Water Quality* of the DCP defines objectives in relation to stormwater as follows in ***Sections 3.1*** to ***3.2***.

3.1 STORMWATER DRAINAGE PLAN

The objectives of **B4.A – Stormwater Drainage Plan** are:

- To ensure a stormwater drainage plan is submitted when *development increases non-permeable surfaces* and will place significant additional flows into *public drainage;*
- To ensure the stormwater drainage plan details a legal and physical point of discharge to minimise impacts on *water balance*, *surface water* and *groundwater* flow regimes and flooding; and
- To implement sustainable mitigation systems that can be maintained using resources available to the maintainer.

A stormwater drainage plan would be provided as part of a stormwater management plan in support of any future development application over the subject lots.

3.2 ON-SITE DETENTION

The objective of **B4.B – On Site Detention** is to regulate the impacts on the capacity of the public drainage system.

Control **B4.2** states that on-site detention/on-site infiltration is required where the post-development flow rate/volume exceeds the pre-development flow rate/volume. Control **B4.3** states that the infiltration/detention system is to be:

- Sized so that the post-development flow rate and volume equals the pre-development flow rate and volume for all storm events up to and including the 1% annual exceedance probability (AEP) storm event; and
- Provided by either underground chambers, surface storage or a combination of both.

3.3 STORMWATER QUALITY

The objectives of **B4.C – Water Quality** are:

- To ensure development does not impact on water quality through use of water quality modelling, such as MUSIC Modelling and subsequent WSUD measures;
- To safeguard the environment by improving the quality of stormwater run-off; and
- To ensure water quality is protected and maintained during the construction phase through the conditioning of appropriate measures.

Control **B4.5** Requires all developments to include Stormwater Quality Improvement Devices (SQIDs). Before water is released into public drainage it must meet Council's water quality stripping targets shown in ***Table 2***.

Table 2 - Water Quality Stripping Targets

Pollutant	Targets
Total Suspended Solids (TSS)	90% post-development load
Total Phosphorus (TP)	60% retention post-development
Total Nitrogen (TN)	45% retention post-development
Gross Pollutants (GP)	90% post-development load

Source: PSC DCP Schedule E1.,

Given the site is not within a drinking water catchment (refer ***Section 9***), 'Neutral or Beneficial Effect' (NorBE) water quality assessment is not applicable.

3.4 RIPARIAN CORRIDORS

The objective of **B4.B – Riparian Corridors** is to protect and retain riparian corridors as localities of environmental important. The proposed development does not propose any works on waterfront land.

3.5 FLOODING

Part B5 – Flooding of the DCP contains compliance requirements for flood compliance for a proposed development which is situated within the flood planning area or at or below the Flood Planning Level (FPL).

Control **B5.2** requires developments to meet Council's minimum Finished Floor Levels (FFLs). For residential accommodation, Council's required FFL is the FPL. For open car parking spaces, Council's required FFL is the current day, 1% AEP flood level.

Control **B5.8** provides triggers for Flood Impact Risk Assessments, relating to the placement of fill in floodway and flood storage areas.

Control **B5.14** states that a flood refuge is required for all developments which cannot achieve flood-free access to flood-free areas.

Noting that the subject site is not flood liable, Council has advised that the proposed development should address Ministerial Direction 4.1 (Flooding), which includes consideration of the Probable Maximum Flood (PMF) and any potential affectation.

3.6 COASTAL MANAGEMENT

It is noted that a portion of the site is located within a "Coastal Environment Zone" as recognised in the State Environment Planning Policy (Resilience and Hazards) (formerly Coastal Management) 2021. Therefore, Port Stephens Council must be satisfied that the development will not significantly impact on:

a. The biophysical, hydrological, or ecological integrity of the adjacent coastal wetland; and
b. The quantity and quality of surface and ground water flows to and from the adjacent coastal wetland.

3.7 DRINKING WATER CATCHMENTS

Control **B4.10** specifies that any development which (in the opinion of Council) has the potential to significantly and adversely affect the quality of a drinking water catchment will be referred to Hunter Water under Section 51 of the *Hunter Water Act 1991*. Additionally, Figure **BE** of Council's DCP provides unique water quality targets for sites within a drinking water catchment.

3.8 GATEWAY DETERMINATION

Planning Proposal PP-2022-3959 received a Gateway Determination on May 3rd 2023. The determination is subject to the following condition relevant to this stormwater strategy:

1(a). demonstrate there are appropriate arrangements for shelter-in-place and evacuation in a probable maximum flood event in consideration of the draft shelter-in-place guideline.

The NSW *Draft Shelter-in-Place Guideline* was exhibited in January 2023. Emergency response outcomes are detailed in ***Section 7*** with specific reference to the draft guideline.

4.0 Stormwater Strategy

The Planning Proposal and concept masterplan has been planned and designed to achieve drainage, water quality and flooding objectives. A focal point of this stormwater strategy was to disconnect impervious areas from existing table drains using methods which are sympathetic to the existing geomorphic conditions.

A conventional piped drainage network will be provided throughout the site's communal driveway network. Pits and pipes shall be sized according to Council's objectives subject to detailed design. A Gross Pollutant Trap (GPT) is recommended at all piped outlets which may be proprietary (such as a screened separator) or site-specific (such as the in-road sediment traps utilised in the existing Sunrise estate).

The development will imitate the existing site's infiltration-centric drainage regime. The piped stormwater drainage network is to report to an end-of-line infiltration basin. One infiltration basin shall be provided for each of the site's catchments to infiltrate runoff from routine rainfall events, and attenuate runoff from less frequent events up to the 1% AEP design storm. Moreover, the infiltration basin will serve as end-of-line water quality improvement facility.

As noted in ***Section 2.3***, Trotter Road has no capacity to accept stormwater flows in excess of predeveloped magnitudes. Similarly, the capacity of the Nelson Bay Road table drain is not known, and intensification of flows into the table drain is not likely to be supported. Consistent with the approved Sunrise Stage 1, it is recommended that infiltration systems are sized to ensure no site discharge for design storms up to and including the 1% AEP.

Strategy modelling has assumed a single basin reporting to Nelson Bay Road, however a split catchment with multiple basins should not be precluded. Two (2) suitable Legal Points of Discharge have been identified:

1. The swale being proposed by others in conjunction with Trotter Road upgrade works; and
2. The existing table drain in Nelson Bay Road.

Though not engaged by the 1% AEP design storm, it is recommended that a spillway weir is provided on the infiltration basin to account for rare and extreme rainfall events.

Strategy outcomes in relation to peak flow management, runoff quality, flooding and erosion and sediment control are provided from ***Sections 5*** to ***11***.

5.0 Stormwater Discharge

The hydrologic routing package DRAINS was used to estimate peak discharges from the site under vacant and developed conditions. On-site detention facilities were sized to achieve the attenuation requirements of Part B4.B of Council's DCP. Whilst the concept masterplan provided a framework for this assessment, results are scalable for revised footprints and yields.

5.1 MODELLING PARAMETERS

5.1.1 Rainfall Intensity

The Rainfall Intensity Frequency Duration (IFD) data adopted was sourced from the Bureau of Meteorology website (IFD ARR19 application).

5.1.2 Loss Parameters

For stormwater strategy purposes, an ILSAX loss model was adopted within DRAINS. An ILSAX model is well suited to local conditions as it accounts for infiltration decay due to wetting of the catchment. Loss parameters were adopted from Council's *hydrologic soil maps* for a 'rather wet' Group A soil and are shown in ***Table 3***.

Table 3 - DRAINS Modelling Parameters

Parameter	Value
Pervious area depression storage	10 mm
Impervious area depression storage	1.5 mm
Horton Initial Infiltration Rate f_0	83.6 mm/hour
Horton Final Infiltration Rate f_c	25.0 mm/hour
Shape Factor k	2/hour

5.1.3 Boundary Conditions

As described in ***Section 4***, the stormwater strategy proposes a spillway weir from the proposed stormwater basin. Given that the site is not liable to regional flooding (refer ***Section 7***), no tailwater conditions were assigned to the weir.

5.2 CATCHMENTS

Catchment plans are provided as ***Appendix A*** to this report and are detailed in ***Sections 5.2.1*** and ***5.2.2***. A DRAINS network diagram, showing the connectivity of catchments is supplied as ***Appendix B***.

5.2.1 Predeveloped Catchment

Predeveloped catchments were mapped using LiDAR survey imagery and confirmed by ground-truthing. Existing site improvements such as maintenance sheds and compacted vehicle accesses were discounted. ***Table 4*** describes the predeveloped catchment parameters.

Table 4 - Predeveloped Catchment Parameters

Catchment Name	Total area (Ha)	% Impervious
PRE N	1.855	0%
PRE S	1.378	0%
TOTAL	**3.233**	**0%**

It is noted that catchment boundaries are consistent with catchment mapping undertaken in support of the adjoining Trotter Road upgrades. It is additionally noted that a small eastern portion of the subject site (being an area of retained vegetation) has been excluded from catchment mapping.

5.2.2 Developed Catchment

As noted in ***Section 4***, modelling assumed that the entire site would be regraded to a single basin; however, subject to development of the site masterplan, a split catchment should not be precluded.

Consistent with the approved Sunrise Stage 1 stormwater strategy, modelling assumed a developed catchment imperviousness of 70%.

Table 5 describes the predeveloped catchment parameters.

Table 5 - Developed Catchment Parameters

Catchment Name	Total area (Ha)	% Impervious
DEV N	0.178	0%
DEV S	3.055	70%
TOTAL	**3.233**	**66%**

From ***Table 5*** it is evident that modelling has assumed a redirection of developed catchment to the south. A small catchment, being an unimproved or landscaped buffer, would drain north to Trotter Road.

5.3 STORMWATER DISCHARGE CONTROLS

This stormwater strategy proposes a precinct-scale infiltration basin. Infiltration basins are unlined, above-ground facilities designed to return runoff to groundwater and attenuate less frequent rainfall events. They have been effectively implemented in the existing Sunrise Stage 1 development.

Modelling has assumed a single basin servicing the entire developed catchment. Overflows from the basin will be controlled by a spillway weir. Modelled parameters are provided in ***Table 6***.

Table 6 - Infiltration Basin Parameters

Parameter	MB01
Depth	1.5m
Volume to top of bank	2,000 m^3
Exfiltration rate	83.6 mm/hour
Outlet	Spillway @ 1.2m

Given a developed catchment of approximately 3.06 Ha, it follows that approximately 655m^3 of detention storage is proposed for each developable hectare of the proposed development. Whilst modelling has assumed a single basin, it is recommended that split catchments feeding multiple basins are not precluded, provided that an equivalent detention volume is met.

5.4 STORMWATER RESULTS

Peak stormwater flows were monitored from the site's northern and southern points of discharge. Hydrographs for the developed site were prepared with and without stormwater discharge controls to evaluate their effectiveness.

5.4.1 Northern Catchment (Trotter Road)

Peak site flows into Trotter Road under existing and developed conditions are presented in ***Figure 7***.

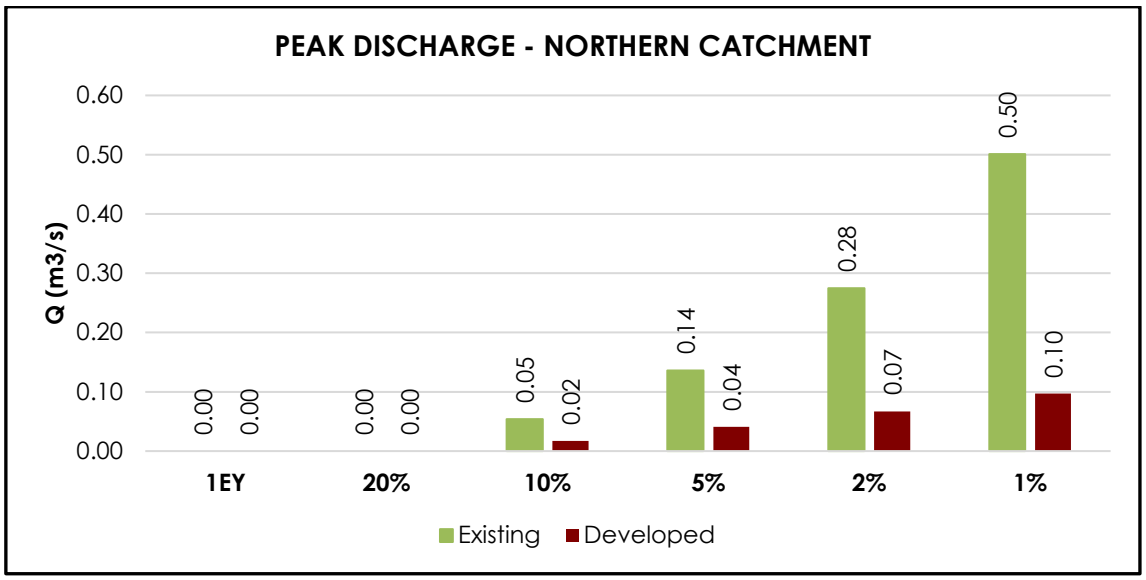


Figure 6 – Peak Site Discharges into Trotter Road.

From ***Figure 7*** it is evident that peak flowrates into Trotter Road are substantially reduced for all design storms under existing conditions. This is an expected result owing to redirection of catchment southwards to the proposed infiltration basin.

From ***Figure 7*** it is also seen that no site runoff occurs under existing conditions up to the 20% AEP design storm. This is an expected result given high permeability of existing soils.

Peak flows into Trotter Road under developed conditions are significantly lower than those allowed for in design of Trotter Road's future upgrade (refer ***Section 2.3***).

5.4.2 Southern Catchment (Nelson Bay Road)

Peak stormwater flows reporting to Nelson Bay Road are shown in ***Figure 8***.

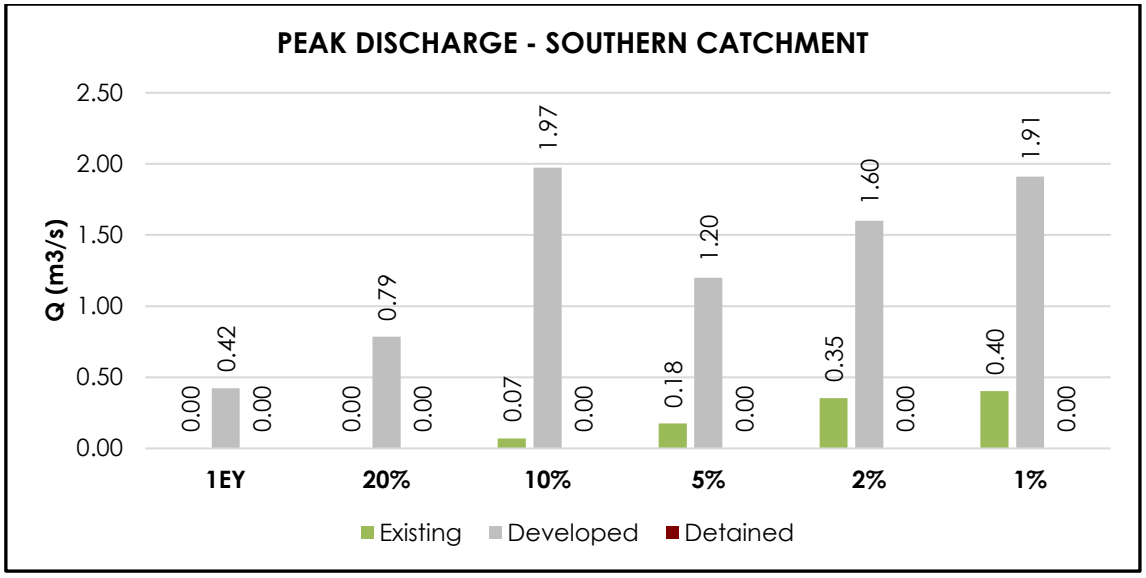


Figure 7 – Site Contribution to Existing Gully.

From ***Figure 8*** it is evident that on-site stormwater controls are required to suppress peak discharges to below their predeveloped magnitudes. It is also seen from ***Figure 8*** that the infiltration basin's volume is sufficient to ensure no site runoff for all design storms up to the 1% AEP.

Consistent with ***Figure 7*** the existing catchment yielded no site runoff up to the 20% AEP design storm.

5.5 SUMMARY OF STORMWATER DETENTION OUTCOMES

With reference to ***Section 5***, the following outcomes are demonstrated by this stormwater strategy:

1. The proposed development is to incorporate on-site infiltration systems in accordance with DCP Control **B4.2**;
2. End-of-line detention storage is to be provided at approximately 655 m^3 per developable hectare, (subject to future design);
3. Modelling has demonstrated a significant reduction in peak flows reporting to Trotter Road for all design storms up and including the 1% AEP, complying with DCP Control **B4.3**;
4. Modelling has confirmed no intensification of flows into Nelson Bay Road, complying with DCP Control **B4.3**; and
5. The proposed detention volume is sufficient to ensure no site runoff from developed catchments up to and including the 1% AEP design storm.

6.0 Stormwater Quality

The Stormwater Management Strategy for the site focuses on minimising impact of the development on the receiving waters adjacent to the site. The quality of the stormwater discharging from the development was determined using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). The MUSIC model was used to simulate pollutant source elements for the proposed development and the treatment of the pollutant loading using treatment devices.

6.1 MUSIC MODELLING

Source node inputs were obtained from the *NSW MUSIC Modelling Guidelines'* (BMT WBM, 2015) and adjusted as required to satisfy PSC's desired rainfall-runoff parameters. The model utilised version 6.3.4 of Council's MUSIC-Link data and was configured to the Williamtown catchment with sensitive sandy soils.

Catchment boundaries were consistent with those used for detention modelling outlined within **Section 5**. The northern developed catchment, being an unimproved buffer between Trotter Road and the development, was excluded from water quality modelling. The developed catchment was delineated into specific surface types being consistent with similar developments. ***Table 7*** presents the modelled catchment composition.

Table 7 - Catchment Composition

Surface Type	% Of Developable Area	Area (Ha)	Fraction Impervious
Lot (residential)	20%	0.61	40%
Roof	40%	1.22	100%
Driveway (sealed road)	30%	0.92	70%
Open Space (residential)	10%	0.31	10%
Total	**100%**	**3.06**	**-**

Summating impervious lot, roof, driveway and open space areas gives an overall impervious fraction of 70%. This is consistent with assumptions made for peak flow modelling (***Section 5***) and the Sunrise Stage 1 stormwater strategy.

6.2 TREATMENT TRAIN

The MUSIC model implemented a treatment train comprising of Gross Pollutant Traps (GPTs) and infiltration basins. These are detailed in ***Sections 6.2.1*** to ***6.2.2***.

It is noted that the above treatment train devices have been adopted for the purpose of determining the appropriate land take required to facilitate the appropriate treatment of stormwater. Alternate devices such as swales, buffer strips or bioretention facilities could be used, subject to compliance with PSC's stripping targets.

6.2.1 Gross Pollutant Traps

Gross Pollutant Traps (GPTs) are utilised as conveyance controls. It is proposed that a single GPT is positioned at the low point of each developed catchment to intercept a majority of its stormwater discharge (subject to detailed design).

Modelling was based on the SPEL 'Ecoceptor' which has been implemented successfully on similar developments in Bobs Farm. Pollutant removal efficiencies were obtained from SPEL's website and are presented in ***Table 8***.

Table 8 - GPT Pollutant Removal Efficiencies

Pollutant	% Removal Efficiency
Total Suspended Solids	71%
Total Phosphorus	69%
Total Nitrogen	47%
Gross Pollutants(>2000µm)	95%

Source: SPEL 2022.

It is noted that other proprietary GPTs should not be precluded from future stormwater management reporting for the site. Additionally, non-proprietary devices such as Sunrise Stage 1's 'Silt Traps' may also be considered in substitution of a proprietary GPT.

6.2.2 Infiltration Basins

As described in ***Section 5.3.2***, infiltration basins are proposed as end-of-line controls. They provide essential pollutant reduction through the physical settling of suspended particles and via percolation through well-drained surrounding soils.

Basins were modelled in MUSIC as 'Media Filtration' devices with media parameters matching surrounding soils. Volumetric parameters were modelled consistently with the stormwater detention analysis (***Section 5***). ***Table 9*** describes the key parameters implemented within MUSIC.

Table 9 - Infiltration Basin Parameters

Parameter	Value
Extended Detention Depth	1.20m
Filter Area	864m
Exfiltration Rate	0mm/hour
Saturated Hydraulic Conductivity	83.6mm/hour[1]
Filter Depth	0.5m
Median Particle Diameter	2mm

1. *Group A soil under 'rather wet' conditions (PSC 2021).*

6.3 WATER RESULTS

The average annual pollutant loads were assessed at-source and under residual conditions. Pollutant reductions are presented in ***Table 10***.

Table 10 - Treatment Train Effectiveness

Pollutant	Source Load	Residual Load	Reduction (%)
TSS (kg/yr)	2890	74.2	97.4
TP (kg/yr)	6.31	0.8	87.3
TN (kg/yr)	47.2	17.4	63.2
GP (kg/yr)	571	0	100

From ***Table 15*** it is seen that the proposed treatment train, sized for stormwater detention, surpasses Council's minimum requirements for pollutant stripping. With respect to total nitrogen and total phosphorus, high removal efficiencies were observed. This is a direct function of the infiltration-centric stormwater strategy, which limits opportunities for pollutants to discharge from the site via stormwater runoff.

A MUSIC-Link report is provided in ***Appendix D*** and confirms that the results were achieved with conforming parameters.

These results indicate that there is sufficient available land within the site to cater for the proposed development, with detention requirements governing the size of end-of-line stormwater facilities.

6.4 SUMMARY OF WATER QUALITY OUTCOMES

With reference to ***Section 6***, the following outcomes are demonstrated by this stormwater strategy:

1. The proposed development is to incorporate a stormwater treatment train including Gross Pollutant Traps (GPTs) and end-of-line infiltration basins;
2. Modelling confirmed that the treatment train surpassed Council's water quality stripping targets (DCP control **B4.5**);
3. Sizing of end-of-line controls is likely to be governed by stormwater infiltration criteria, rather than water quality criteria; and
4. Alternate water quality treatment trains should not be precluded provided Council's water quality stripping targets are met.

7.0 Flooding

Council's Flood Prone Land Mapping (PMF) is shown in ***Figure 9***.

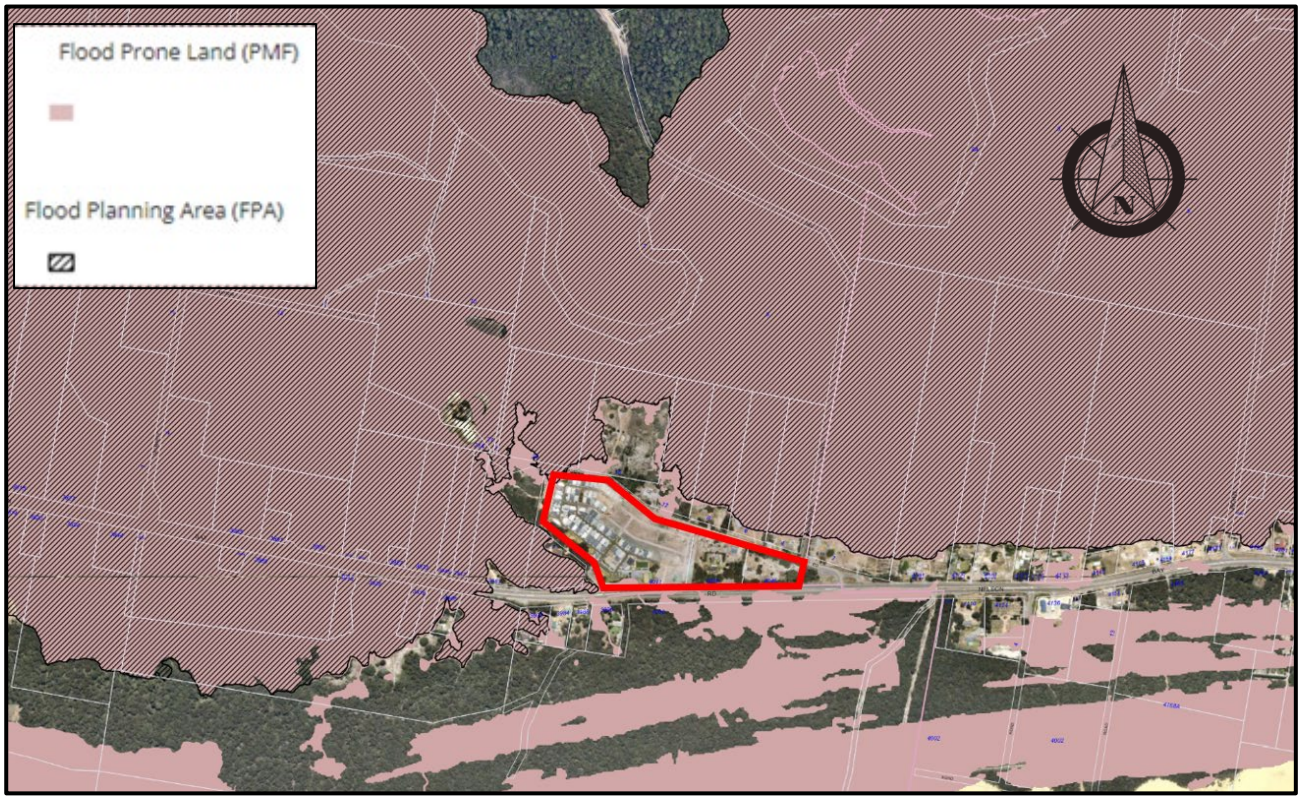


Figure 8 – Flood Prone Land Mapping (PMF).
Source: PSC.

From ***Figure 9*** it is evident that the subject site is not located within Council's Flood Prone Land (PMF) Mapping as shown in ***Figure 9***. A small portion of the existing Sunrise 'Stage 1' development is within the Flood Prone Land mapping.

It is noted that PSC's flood prone land mapping differs slightly to PMF flood extents mapped within the *Anna Bay and Tilligerry Creek Flood Study* prepared by Jacobs Group dated December 2017. Visual inspection confirms a high degree of correlation between sources at major points of inundation. It is subsequently considered that the general flood behaviours and outcomes detailed in Jacobs 2017 remain an appropriate basis for this report.

Both Port Stephens Council and the State Emergency Service websites identify Jacobs 2017 as the current regional flood study for Anna Bay.

7.1 PROBABLE MAXIMUM FLOOD

Noting that the subject site is not flood liable, Council has advised that the proposed development should address Ministerial Direction 4.1 (Flooding), which includes consideration of the Probable Maximum Flood (PMF) and any potential affectation. The *Anna Bay and Tilligerry Creek Flood Study* prepared by Jacobs Group in 2017 maps the site as being above the PMF envelope. An excerpt from Jacobs' flood mapping is provided in ***Figure 10***.

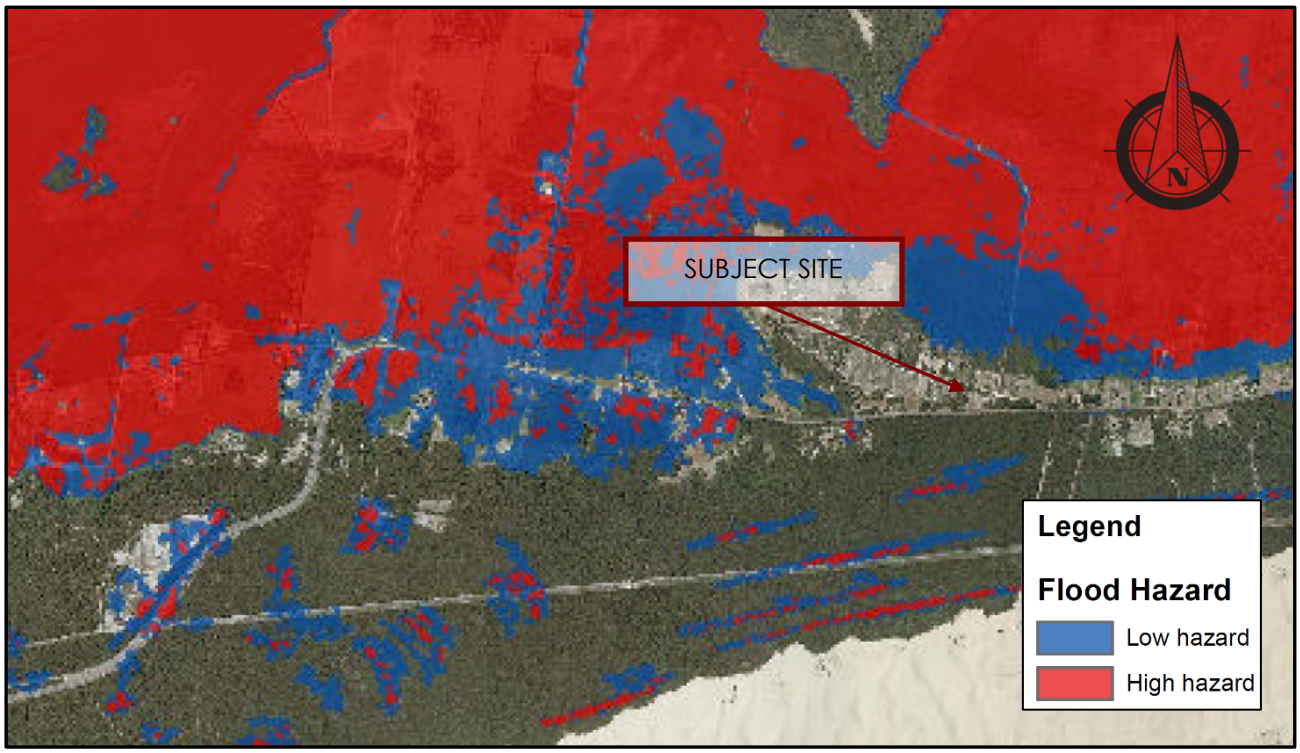


Figure 9 – PMF Flood Extents and Hazard.
Image: Jacobs 2017.

7.2 EMERGENCY RESPONSE PLANNING

NSW Floodplain Development Manual observes the PMF as the appropriate tool for emergency and response planning. As the proposed development is not liable to the PMF, opportunity exists for residents to shelter safely and comfortably in their own homes. Importantly, a shelter-in-place strategy for the proposed development would not confine residents to upper floors. Connectivity between residents and to communal facilities would be preserved by the internal road network which is also flood-free.

Rare and extreme regional floods are likely to be the product of extratropical cyclones (East Coast Lows), cyclones with storm surges or similar. Such meteorological events are likely to provide long warning tames, enabling residents to obtain extra supplies, seek medical treatments or renew medication prescriptions. The presence of a site manager will assist with informing residents of upcoming risk and mobilising response efforts.

The Anna Bay commercial precinct, located approximately 4km east of the proposed development, is a logical destination for off-site evacuation if required. Anna Bay provides groceries, pharmaceuticals and pathology services. Access would be eastward along Nelson Bay Road, then southeast via Gan Gan Road. PMF extents are shown against the proposed evacuation route in ***Figure 11*** below.

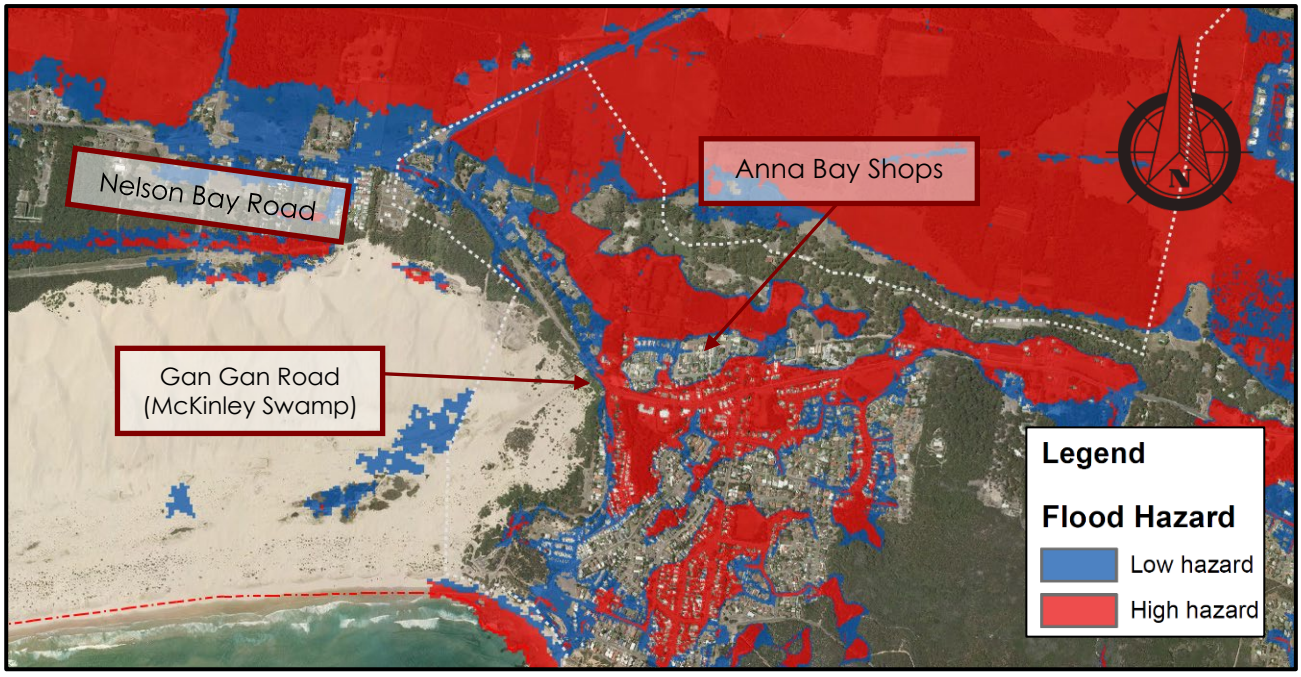


Figure 10 – PMF Site Connectivity.
Image: Jacobs 2017.

From ***Figure 11*** it is noted that Nelson Bay Road and Gan Gan Road are inundated by low-hazard floodwaters at multiple locations during a PMF event. There is one high-hazard point of inundation between the proposed development and the Anna Bay shopping commercial centre, being Gan Gan Road at McKinley Swamp.

The *NSW Flood Risk Management Guide FB03 (Flood Hazard)* defines hazard thresholds for vehicle stability in floods. At low velocities, the guide observes that large cars are considered unstable in flood depths above 0.4m (0.3m for small cars). Jacobs 2017 provides flood level hydrographs at McKinley Swamp for critical design storms up to and including the PMF which is replicated in ***Figure 12***.

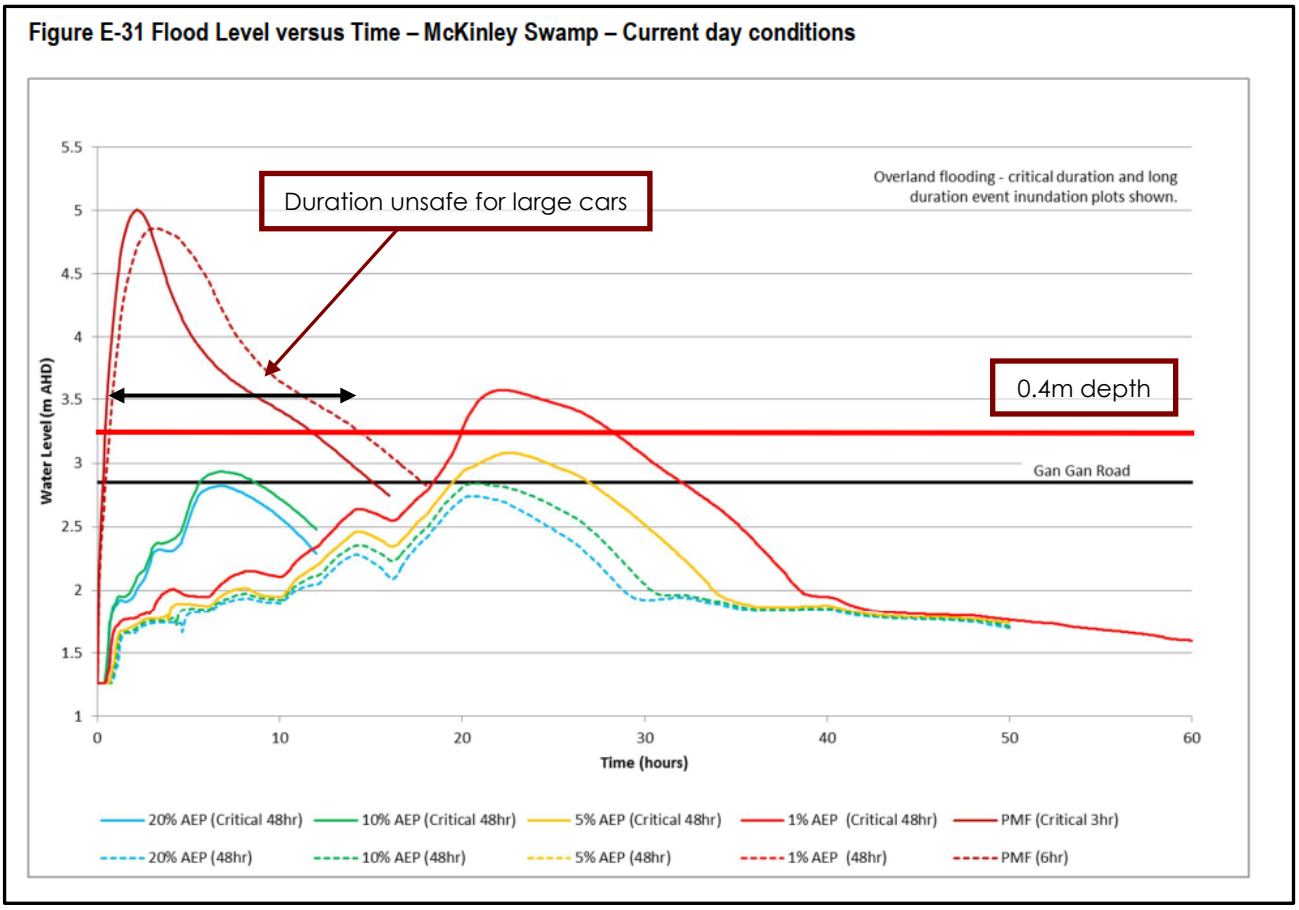


Figure 11 – Flood Level Hydrographs at McKinley Swamp.
Image: Jacobs 2017.

From ***Figure 12*** it is evident that Gan Gan Road is subject to flash flooding behaviour, becoming inundated within 1 hour of the start of the PMF event. Access to Anna Bay for large cars is restored within approximately 14 hours (approximately 18 hours for small cars). This report cannot provide comment on duration of disruption at other points of inundation along Gan Gan Road as flood level hydrographs are not provided. However, owing to shallower reported depths and hazard levels, it is likely that floodwaters would recede at these minor crossings before McKinley Swamp.

7.2.1 NSW Draft Shelter-in-Place Guidelines

The NSW *State Flood Plan* (2021) identifies the ability for people to move themselves from flood-affected areas to a safe location, preferably with access to community services, as the best flood response. Effective emergency response planning must therefore be cognisant of the duration in which access to food and health services may be interrupted. The New South Wales Flood *Draft Shelter-in-Place Guideline (2023)* advises that shelter-in-place is especially appropriate when flood warning time and flood duration are less than six hours.

From ***Section 7.2*** it is noted that the proposed development would be isolated from Anna Bay for approximately fourteen hours. Whilst longer than the duration recommended for Shelter-in-Place, the proposed development benefits from the following mitigation measures:

- The entire Sunrise community, including internal roads and community facilities, is situated above the PMF level;
- Residents sheltering in their homes are likely to have sufficient stores of food and living essentials in the order of several days;
- Connectivity between residents is retained at all times, including residents within the existing Sunrise Stage 1 community;
- Access to an existing service station at 4136 Nelson Bay Road is uninterrupted, providing continuous access to fuel, food and basic amenities;
- Travel between the site and Anna Bay would be gained by specialist vehicles or four-wheel-drives in less than 14 hours should it be warranted by a medical emergency; and
- A community bus is retained on-site which could assist with evacuation of non-driving residents once access to Anna Bay is restored.

It is subsequently considered that the proposed development is uniquely suited for sheltering-in-place for more than six hours.

The Draft Shelter-in-Place Guideline provides a list of considerations for shelter-in-place (SIP) to be successful. ***Table 11*** responds to the guideline's requirements.

Table 11 - Draft Shelter-in-Place Considerations

Consideration	Response	Complies
The duration for flood inundation is less than six hours.	Duration of flood isolation during is in the order of 14 hours (6-hour PMF event). Mitigation factors exist which enable residents to shelter safely for longer than 6 hours. No dwellings or structures are inundated.	No
The development is not located in an area of high-risk (e.g., floodways and H5 or H6 flood hazard areas).	The development is not located in an area of high-risk (e.g., floodways and H5 or H6 flood hazard areas).	Yes
Access to on-site systems to provide power, water and sewerage services during and beyond the event for the full range of flooding.	The proposed development is connected to public utilities. Electricity, sewer and water supplies would be no more vulnerable than at off-site evacuation centres.	Yes
The location of storage of food, water and medical emergency for SIP purposes should be above the PMF level and available during and beyond the event for the full range of flooding.	Residential food, water and emergency stores would be available during and beyond a PMF event. Connectivity between residents would be retained at times allowing for sharing of goods if required.	Yes
SIP floor level is above PMF.	All proposed floor levels are above peak PMF level (Jacobs 2017).	Yes
SIP provides a minimum floor space per person.	The entire Sunrise community is flood free. Residents are not isolated to individual floor areas.	Yes
SIP must be structurally safe and accessible during floods up to the PMF.	No structures are liable to flooding up to and including the PMF.	Yes

7.2.2 Limitations

This section identifies preliminary outcomes in relation to flood evacuation response for extension of an existing lifestyle living development. We note this letter is based on third-party flood information and third-party advice made available at the time of writing. This advice should not be interpreted as a Flood Emergency Response Plan in and of itself.

We acknowledge that flood risk management policy has been the subject of rapid reforms since the 2022 NSW flood enquiry. We recommend that all relevant authorities are consulted prior to the preparation of a formal Flood Emergency Response Plan for the site. It would be appropriate for this plan to be developed in support of a future Development Application.

7.3 SUMMARY OF FLOODING OUTCOMES

With reference to ***Section 7***, the following outcomes are demonstrated by this stormwater strategy:

1. The proposed development is not located within Council's Flood Planning Area;
2. The site is not liable to the Probable Maximum Flood;
3. Site access to Anna Bay is impeded by the Probable Maximum Flood. The proposed development is well-suited for shelter-in-place until safe vehicular access is restored;
4. Whilst the duration of shelter-in-place would exceed the draft guideline's recommended maximum of six hours, unique circumstances exist which enable residents to shelter in comfort and safety for longer periods;
5. The proposed development satisfies all other considerations of the NSW Draft Shelter-in-Place Guideline (2023);
6. Shelter-in-Place is an appropriate strategy to investigate for this site given it is above the PMF level and likely long warning times for the flood type (East Coast Lows or similar);
7. Opportunity exists for off-site evacuation to Anna Bay within approximately 14 hours of a PMF event. Food, shelter and health services are readily available in Anna Bay.

8.0 Coastal Wetlands

The State Environmental Planning Policy (SEPP) (Resilience and Hazards) includes provisions for development within mapped 'Proximity Areas' to coastal wetlands, as well as coastal environment areas. ***Figure 13*** presents an extract from the SEPP Coastal Wetlands Area Map.

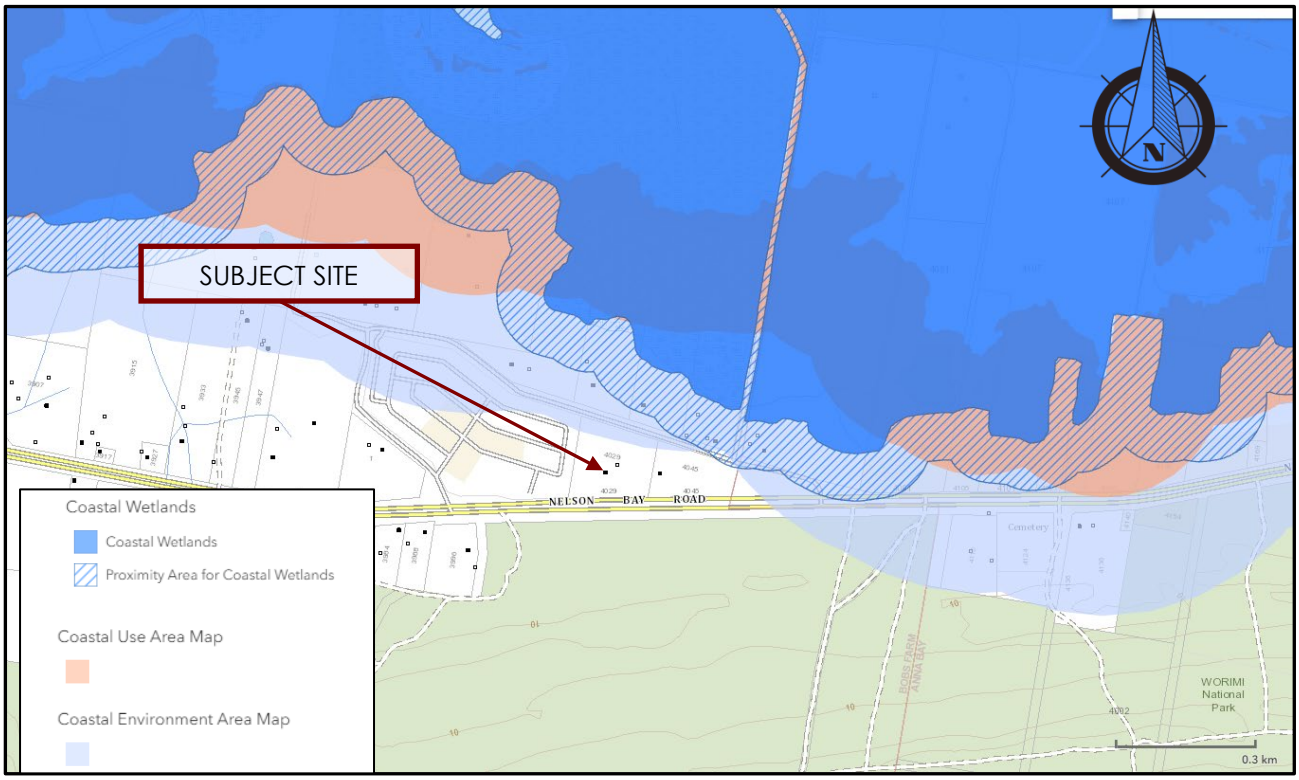


Figure 12 – Coastal Wetlands and Proximity Areas.
Source: NSW ePlanning 2022.

From ***Figure 13*** it is seen that the site's northern frontage (approximately 30m) is within the mapped Coastal Environment Area. The Bobs Farm creek estuary, positioned to the site's north, is mapped as coastal wetlands.

In relation to surface water impacts, controls are proposed to ensure no site runoff up to and including the 1% AEP design storm (refer ***Section 5***). It follows that flooding hydrology and flow volumes within the coastal wetlands complex will not be intensified by the subject development. Noting that the proposed development accounts for less than 1% of the Bobs Farm Creek catchment, the provision of on-site infiltration controls will have negligible impact on wetland drying hydrology.

As the proposed stormwater controls will ensure no site runoff from developed catchments, it follows that no runoff-borne pollutants will discharge from the development. It follows that the proposed development will have no impact on nutrification and sedimentation of downstream coastal wetlands.

Furthermore, owing to flat topography and highly permeable soils, the geomorphic regime of low intensity rainfall events is dominated by groundwater recharge. Subsequently, changes to the subject site's land use will not adversely impact the downstream environments' hydrologic integrity.

9.0 Drinking Water Catchments

Port Stephens Council has noted that the site is located adjacent to a mapped drinking water catchment. ***Figure 14*** presents an excerpt from Council's LEP mapping.

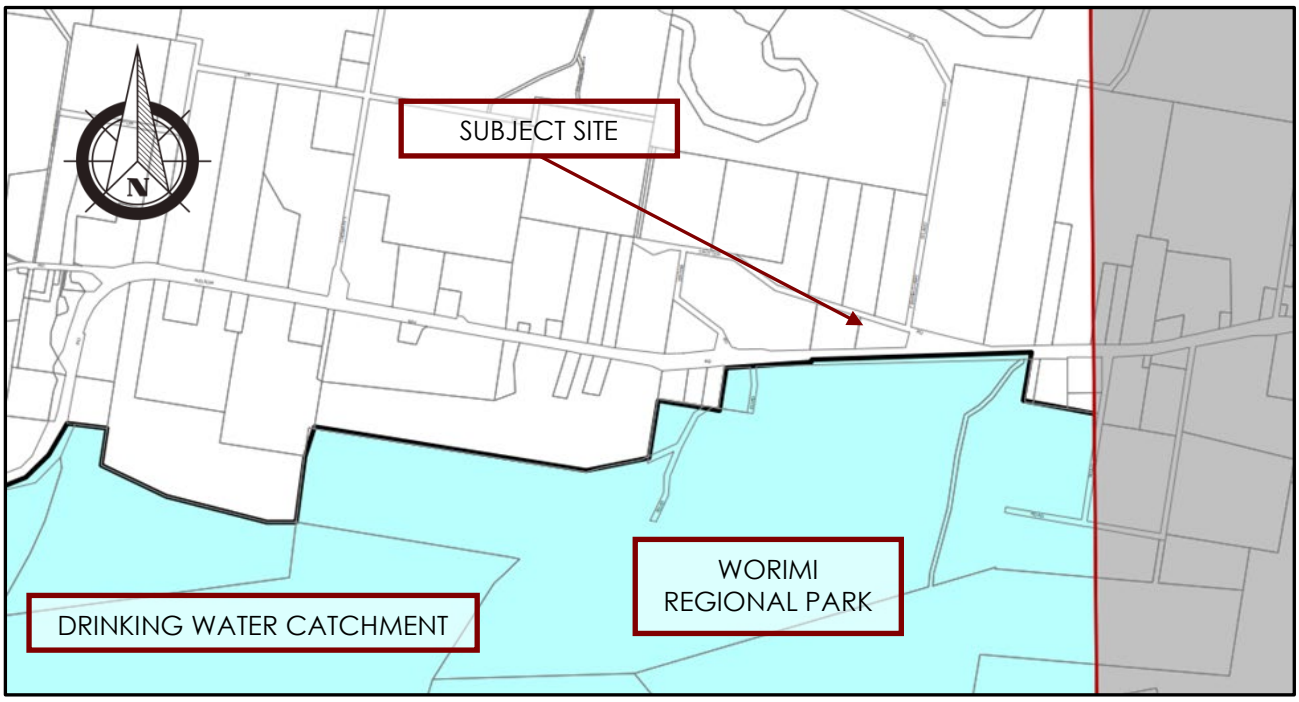


Figure 13 – Drinking Water Catchment.
Source: PSC LEP 2013.

The site is located to the north of the Stockton Sandbeds drinking water catchment, being an unconfined sand aquifer. The site is separated from the Stockton Sandbeds by a ridgeline through Worimi Regional Park peaking at approximately RL 20m AHD. Subsequently, the site drains north to Bobs Farm Creek rather than south to the sandbeds.

If follows that the proposed development will have no impact on drinking water catchments.

10.0 Erosion and Sediment Control

Port Stephens Council requires the use of erosion and sediment controls to manage and contain pollutant runoff, both during construction and as long-term permanent treatments thus ensuring the minimisation of impact on the environment. All erosion and sediment controls and practices are to be in accordance with PSC's DCP and *'Managing Urban Stormwater'* by Landcom/NSW Department of Housing.

Treatment devices will be utilised to contain the generated pollutants from the site during construction. These include but are not limited to:

- Sediment Basins;
- Silt Fencing;
- Strawbale and Geotextile Fencing;
- Kerb Inlet Controls;
- Sandbag Kerb Inlet Sediment traps;
- Shaker Ramp; and
- Diversion Drains.

Any clean water entering the site from upstream catchments is to be diverted around the construction site where possible hence remaining clean. Runoff generated from within the site is to be treated and managed using a combination of the above stated treatment devices.

Due to the extents of disturbed areas, the use of sediment basins will be required (Landcom, 2004). During construction, the proposed infiltration basin would be utilised as a temporary sediment basin.

11.0 Water Sensitive Urban Design

Port Stephens Council requires stormwater drainage plans to minimise impacts on water balance, and to incorporate mitigation measures which are effective and maintainable.

A fundamental objective of Water Sensitive Urban Design (WSUD) is to 'disconnect' impervious catchments from public drainage systems. An end-of-line infiltration system is proposed to disconnect the site from downstream drainage infrastructure.

WSUD additionally aims to reduce a development's demand on potable, mains-supplied water. Consistent with the Sunrise lifestyle village, the proposed development will create premium dwellings supplied with AAA+ appliances and fixtures. Measures such as dual-flush cisterns, efficient appliances and water-conscious gardens shall be provided to reduce each dwelling's potable water demand.

At a precinct scale, measures to reduce mains water consumption shall be revisited at the Development Application stage. Specifically, there may opportunity to utilise the site's groundwater as an alternate water source for irrigation of landscaped areas. Access to groundwater by spear point contingent on appropriate licensing. The suitability of groundwater interception would be subject to further investigations and conceptual design.

12.0 Conclusion

ADW Johnson has been engaged by Hometown Australia Holdings Pty Ltd to prepare a stormwater strategy for Lots 3622 DP 622485 and 2 DP 622229 at Bobs Farm. The strategy is required to support a Planning Proposal for the extension of an existing lifestyle village located on Lot 51 DP 1175028.

The site's existing drainage regime is characterised by flat topography and well-drained sandy soils. Subsequently, an infiltration-centric stormwater strategy has been devised. The capacity of downstream legal points of discharge, being a swale in Trotter Road (proposed by others) and an existing Table Drain in Nelson Bay Road, have been respected by the strategy.

The hydraulic routing package *DRAINS* was used to evaluate peak site discharges under existing and developed conditions. An infiltration basin was assessed providing approximately 655 m^3 of detention storage per developable hectare. Modelling confirmed that the basin indicated on the Concept Plan was sufficiently sized to ensure no site runoff from developed catchments up to and including the 1% AEP design storm, thus ensuring no increase in peak flowrates at the site's points of discharge. Whilst the size and configuration of detention storage is subject to further design, this strategy confirms that Council's requirements can be readily met within the site's footprint.

The proposed development shall be supported by a water quality treatment train comprising of a gross pollutant trap and end-of-line infiltration basin. MUSIC modelling has confirmed that the treatment train satisfied Council's water quality stripping targets.

The 2017 *Anna Bay and Tilligerry Creek Flood Study* indicates that the subject site is flood-free for all regional design floods including the Probable Maximum Flood. In relation to emergency response planning, there are safe and viable arrangements for shelter-in-place and evacuation subject to extreme flood events.

Owing to the existing geomorphic regime, and with consideration given to proposed on-site controls, the hydrological integrity of downstream environments will be materially upheld by the proposed development. It follows that Council's requirements under SEPP (Hazards and Resilience) (coastal wetlands) are met.

LEP mapping indicates that the site adjoins a drinking water catchment, being the Stockton Sandbeds. However, mapping and ground-truthing have confirmed that the site does not report to the drinking water catchment.

Appropriate erosion and sediment controls implemented to the requirements of Port Stephens Council are required for the construction period to protect downstream receiving waters.

This strategy report has concluded that appropriate stormwater controls can be readily implemented within the proposed site footprint. It is considered that the stormwater strategy presented herein is well-suited to existing site conditions and is fully compliant with Council's Development Control Plan.

13.0 References

ADW Johnson. (2022). *Trotter Road Upgrade – DA16-2007-15-5 – Stormwater Improvements (Revision D)*.

Geoscience Australia. (2019). *Australian Rainfall and Runoff: A guide to Flood Estimation*.

Jacobs Group. (2017). *Anna Bay and Tilligerry Creek Flood Study*. Retrieved from <https://flooddata.ses.nsw.gov.au/flood-projects/>.

MM Hyndes Bailey & Co. (2017). *Drainage Strategy Report for Section 96 Application of DA 16-2013-790-1*.

New South Wales Department of Primary Industries. (2008). *Acid Sulfate Soil Assessments in the Anna Bay Catchment*.

New South Wales Government. (2023). *Draft Shelter-in-Place Guideline*.

New South Wales Government. (2021). *NSW State Flood Plan*.

Landcom. (2010). *Water Sensitive Urban Design Book 1: Policy*. Retrieved from <http://www.landcom.com.au/>.

Port Stephens Council. (2014). *Development Control Plan Section B – General Controls*.

Port Stephens Council. (2017). *Hydrologic Soil Mapping*.

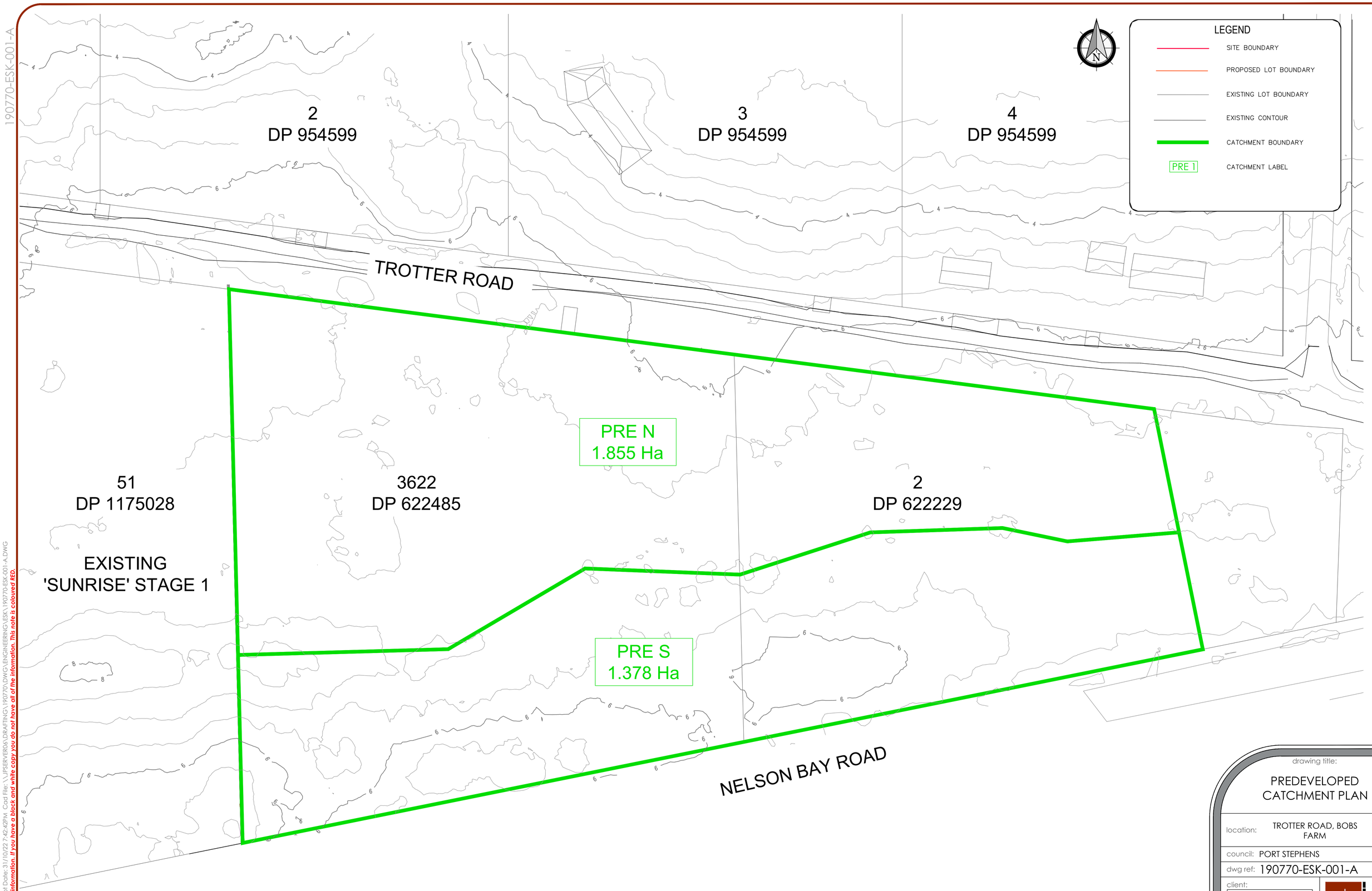
Spel Stormwater. (2022). *Ecoceptor Product Brochure*. Retrieved 26th October 2022 from < https://spel.com.au/ecoceptor/>.

WBM BMT. (2015). *NSW MUSIC Modelling Guidelines*.

Appendix A

STORMWATER STRATEGY PLANS

FIGURE A-1 – PREDEVELOPED CATCHMENT PLAN
FIGURE A-2 – DEVELOPED CATCHMENT PLAN



ver.	date	comment	surveyed	drawn	checked	pm
A	29/10/22	FIRST ISSUE	N/A	MK	MK	SVD

co-ordinate information
CO-ORDINATE SYSTEM: GDA 20
ORIGIN OF CO-ORDINATES: N/A
DATE OF SURVEY N/A

level information
DATUM: A.H.D.
ORIGIN OF LEVELS: N/A
CONTOUR INTERVAL: 0.5m

scale (A1 original size)
0 5 10
A1 / A3
1:200 / 1:400

page
1 OF 1

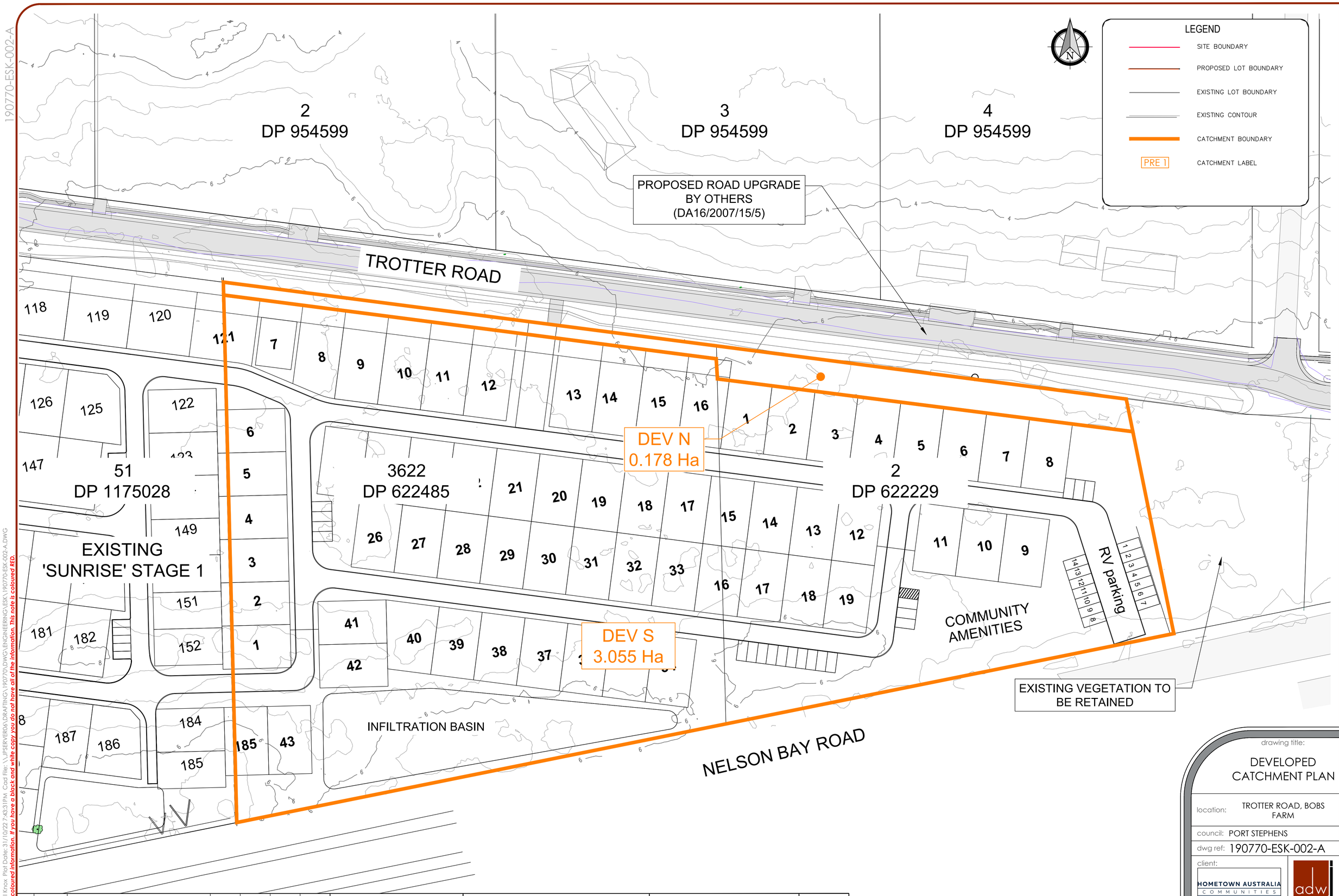
drawing title:
PREDEVELOPED CATCHMENT PLAN

location: TROTTER ROAD, BOBS FARM
council: PORT STEPHENS
dwg ref: 190770-ESK-001-A
client: HOMETOWN AUSTRALIA COMMUNITIES

central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
sydney office ph: (02) 8046 7411
www.adwjohnson.com.au

working beyond expectations

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



ver.	date	comment	surveyed	drawn	checked	pm	co-ordinate information	level information	scale (A1 original size)	page
A	29/10/22	FIRST ISSUE	N/A	MK	MK	SVD	CO-ORDINATE SYSTEM: GDA 20 ORIGIN OF CO-ORDINATES: N/A DATE OF SURVEY N/A	DATUM: A.H.D. ORIGIN OF LEVELS: N/A CONTOUR INTERVAL: 0.5m	0 5 10 A1 / A3 1:200 / 1:400	1 OF 1

drawing title:

DEVELOPED CATCHMENT PLAN

location: TROTTER ROAD, BOBS FARM

council: PORT STEPHENS

dwg ref: 190770-ESK-002-A

client: HOMETOWN AUSTRALIA COMMUNITIES

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

working beyond expectations

Appendix B

DRAINS MODEL

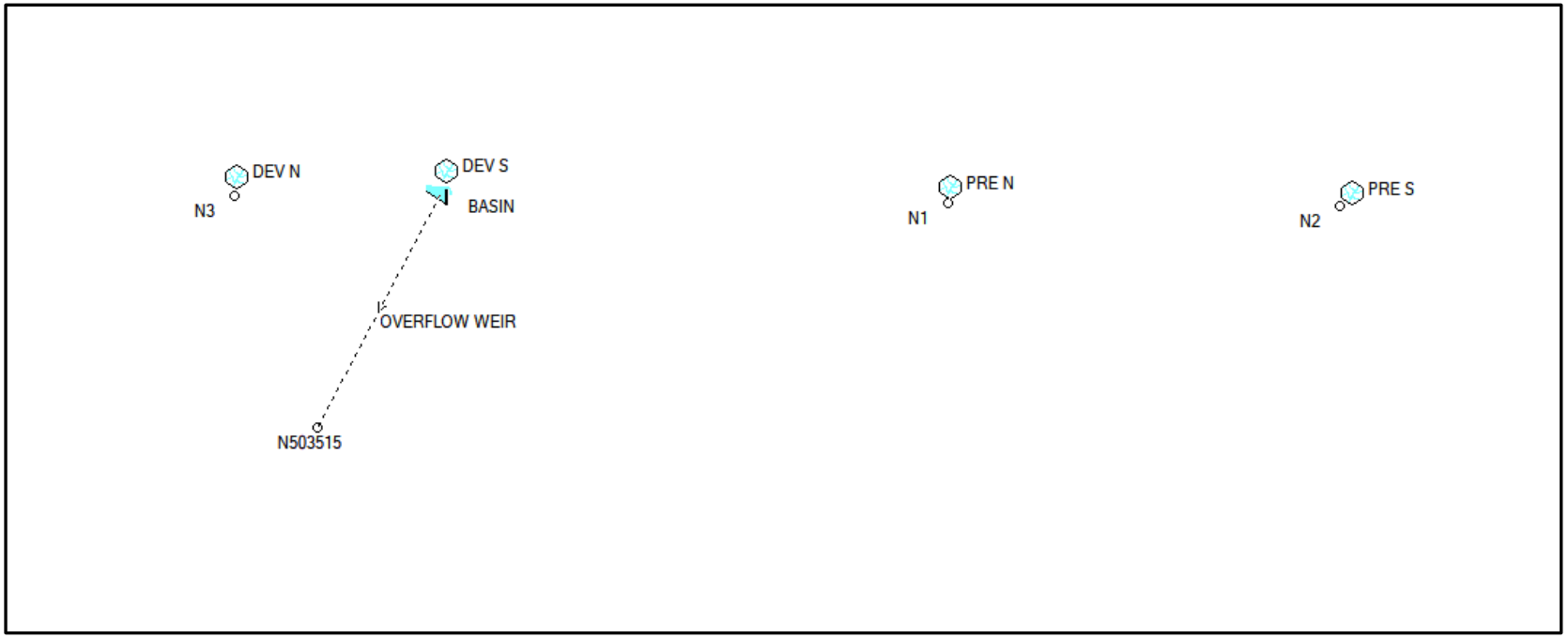


FIGURE B-1 – DRAINS NETWORK DIAGRAM

Table B-1 – Drains Data

PIT / NODE DETAILS			Version 15																		
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full	Inflow	Pit is	Internal	Inflow is	Minor Safe	Major Safe	
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor			lid		Shock Loss	Hydrograph		Width	Misaligned	Pond Depth	Pond Depth	
				(cu.m)	Coeff. Ku			(cu.m/s)									(mm)		(m)	(m)	
N1	Node							0		1125.803	-405.91		1154915		No						
N2	Node							0		1137.409	-406.02		1154922		No						
N3	Node							0		1104.667	-405.709		1154939		No						
N503515	Node							0		1107.102	-412.548		1154946		No						
DETENTION BASIN DETAILS																					
Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m)	id						
BASIN	0	864		None						1110.729	-405.709	No			1154932						
	0.1	917.4																			
	0.2	972.2																			
	0.3	1028.2																			
	0.4	1085.4																			
	0.5	1144																			
	0.6	1203.8																			
	0.7	1265																			
	0.8	1327.4																			
	0.9	1391																			
	1	1456																			
	1.1	1522.2																			
	1.2	1589.8																			
	1.3	1658.6																			
	1.4	1728.6																			
	1.5	1800																			
SUB-CATCHMENT DETAILS																					
Name	Pit or Node	Total Area	Paved Area	Grass Area	Supp Area	Paved Time	Grass Time	Supp Time	Paved Length	Grass Length	Supp Length	Paved Slope(%)	Grass Slope	Supp Slope	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length	Gutter Slope	Gutter FlowFactor	Rainfall Multiplier
		(ha)	%	%	%	(min)	(min)	(min)	(m)	(m)	(m)	%	%	%					(m)	%		
PRE N	N1	1.855	0	100	0	0	0	0	1	150	-1	1	1	-1	0.015	0.2	-1	0				1
PRE S	N2	1.378	0	100	0	0	0	0	1	60	-1	1	1	-1	0.015	0.2	-1	0				1
DEV S	BASIN	3.055	70	30	0	0	0	0	150	150	150	1	1	1	0.02	0.2	0.02	0				1
DEV N	N3	0.178	0	100	0	0	0	0	20	20	0	1	1	0	0.015	0.2	0	0				1

PIPE DETAILS																						
Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	Rl	Chg	RL	etc			
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)	(m)	(m)			
DETAILS of SERVICES CROSSING PIPES																						
Pipe	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	etc												
	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	etc												
CHANNEL DETAILS																						
Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Roofed									
				(m)	(m)	(m)	(%)	(m)	(1:?)	(1:?)	n	(m)										
OVERFLOW ROUTE DETAILS																						
Name	From	To	Travel	Spill	Crest	Weir	Cross	Safe Depth	SafeDepth	Safe	Bed	D/S Area		id	U/S IL	D/S IL	Length (m)					
			Time	Level	Length	Coeff. C	Section	Major Storms	Minor Storms	DxV	Slope	Contributing										
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%										
OVERFLOW WEIR	BASIN	N503515	0.1	1.2	5	2	WEIR 3	0.15	0.15	0.6	1	0		1154945	1.2	1	5					
PIPE COVER DETAILS																						
Name	Type	Dia (mm)	Safe Cover (m)	Cover (m)																		
This model has no pipes with non-return valves																						

Appendix C

MUSIC MODEL

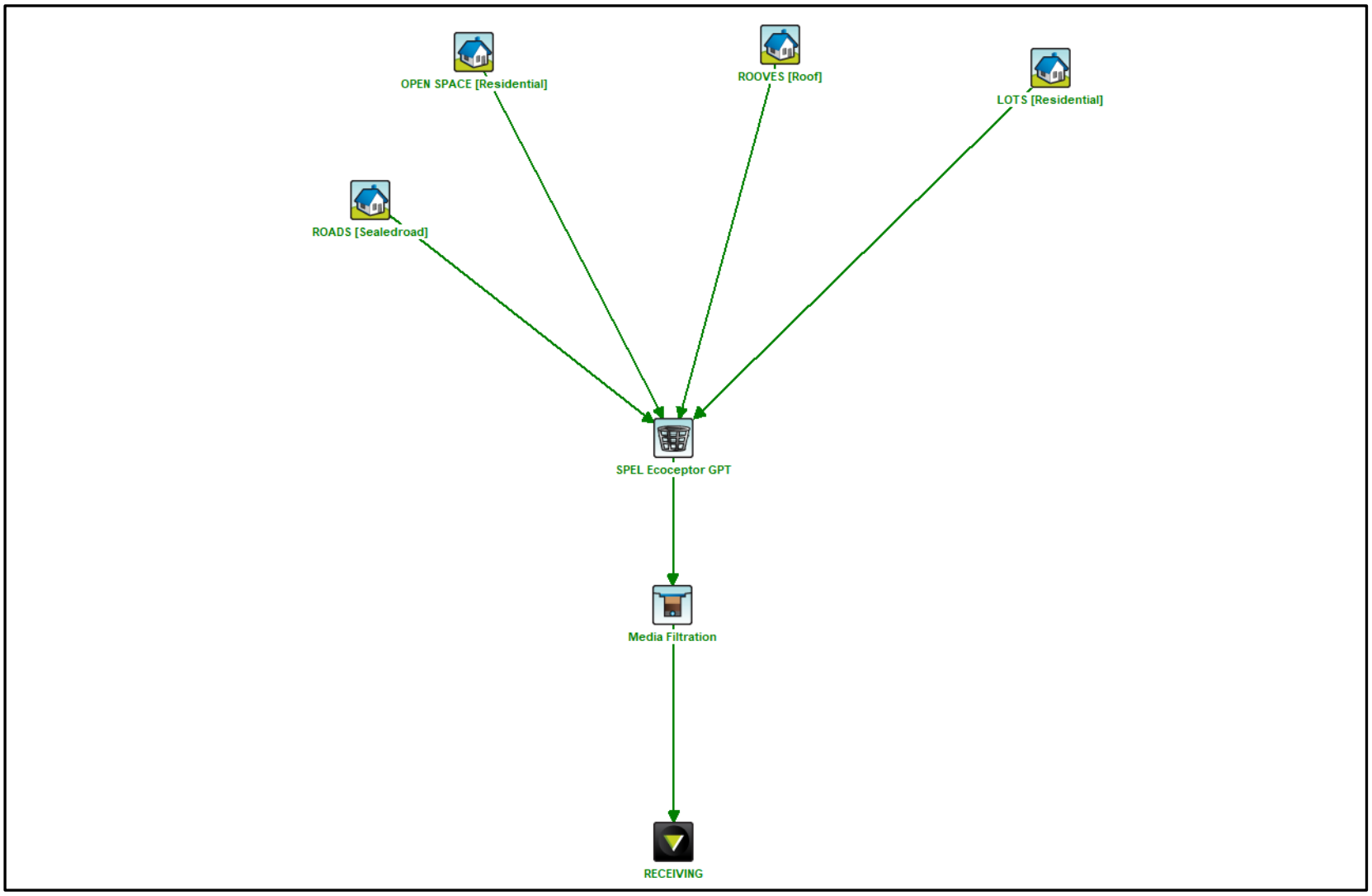


FIGURE C-1 – MUSIC NETWORK DIAGRAM.

Appendix D

MUSIC-LINK REPORT

MUSIC-*link* Report

Project Details		Company Details	
Project:	190770 Sunrise Stage 2	**Company:**	ADW Johnson
Report Export Date:	31/10/2022	**Contact:**	Mitchell Knox
Catchment Name:	190770 MUSIC_A	**Address:**	7/335 Hillsborough Road
Catchment Area:	3.06ha	**Phone:**	4978 5100
Impervious Area*:	69.93%	**Email:**	mitchellk@adwjohnson.com.au
Rainfall Station:	WILLIAMTOWN RAAF - Station 061078 - Zone A		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1998 - 31/12/2007 11:54:00 PM		
Mean Annual Rainfall:	1013mm		
Evapotranspiration:	1394mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Anna Bay and Nelson Bay		
Scenario:	Default Catchment - Sandy soils		

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

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: RECEIVING	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	-0.0571%	Media Filtration Node	1	Urban Source Node	4
TSS	97.4%	GPT Node	1		
TP	87.3%				
TN	63.2%				
GP	100%				

Comments

Please refer to associated stormwater strategy report.

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
GPT	SPEL Ecoceptor GPT	Hi-flow bypass rate (cum/sec)	None	99	0.024
Receiving	RECEIVING	% Load Reduction	None	None	-0.05
Receiving	RECEIVING	GP % Load Reduction	90	None	100
Receiving	RECEIVING	TN % Load Reduction	45	None	63.2
Receiving	RECEIVING	TP % Load Reduction	60	None	87.3
Receiving	RECEIVING	TSS % Load Reduction	90	None	97.4
Urban	LOTS	Area Impervious (ha)	None	None	0.242
Urban	LOTS	Area Pervious (ha)	None	None	0.367
Urban	LOTS	Total Area (ha)	None	None	0.61
Urban	OPEN SPACE	Area Impervious (ha)	None	None	0.029
Urban	OPEN SPACE	Area Pervious (ha)	None	None	0.280
Urban	OPEN SPACE	Total Area (ha)	None	None	0.31
Urban	ROADS	Area Impervious (ha)	None	None	0.647
Urban	ROADS	Area Pervious (ha)	None	None	0.272
Urban	ROADS	Total Area (ha)	None	None	0.92
Urban	ROOVES	Area Impervious (ha)	None	None	1.22
Urban	ROOVES	Area Pervious (ha)	None	None	0
Urban	ROOVES	Total Area (ha)	None	None	1.22

Only certain parameters are reported when they pass validation

adw johnson

APPROVED COMPANY ISO 9001 Quality Management Systems
QMS Certification Services

APPROVED COMPANY ISO 14001 Environmental Management Systems
QMS Certification Services

APPROVED COMPANY AS/NZS 4801 Occupational Health & Safety Management Systems
QMS Certification Services

JAS-ANZ

www.adwjohnson.com.au