Amato Slapp Engineering Pty Ltd
ABN: 43 625 850 973
www.asengineering.com.au

27th August 2021

The Owners

9 Gaudrons Road

Sapphire Beach, NSW 2450

Stormwater Assessment to Support Planning Proposal

9 Gaudrons Road Sapphire Beach, Lot 11 DP1141269

Background

Lot 11 DP1141269 is proposed to be rezoned to facilitate future subdivision to three lots. There are currently two existing dwellings on the site which are proposed to remain on separate future lots, with a proposed future lot located on the southern portion of the site. A pre-lodgement meeting was held with Coffs Harbour City Council (CHCC) on 17 June 2020 and comments were raised in regard to how stormwater will be managed. The objective of this assessment is to undertake a preliminary Hydrological analysis to determine peak flows under existing and future land uses and identify suitable measures to address stormwater runoff for future development of the site.

Figure 1 – Site locality (Source CHCC Tech one)

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Site Description

The site is located on the Southern border of Gaudrons Road. The approximate site area is 5.29 hectares, and occupies a low ridgeline with gentle slopes on the northern extent of the site with moderate to steep slopes at the southern extent of the site. The Pacific Highway road corridor is immediately to the east of the site. There is a natural drainage gully to the Southern end of the site discharging East under the Pacific Highway. To the West there is an additional natural drainage line that runs North along the property boundary, before heading North-West through the adjoining lot 10 DP 1141269 (19 and 19A Gaudrons Road). The site and surrounding areas are shown in figure 1.

Methodology

A site analysis has been prepared identifying existing flow patterns and discharge locations, and is included in **Appendix A**. A conceptual hydrological model has been developed for the existing and proposed future landuse to quantify potential impacts. The site analysis, and assumptions used to develop the hydrological model are discussed below.

Site Analysis

The site is currently used as an agricultural operation and contains two dwellings, sheds, four covered growing areas (greenhouses) and associated hardstand areas. The existing impervious site areas are summarised in Table 1 below.

Description	Area (m2)
Dwelling 1	285
Dwelling 2	170
Roof/Shed 1	80
Roof/Shed 2	420
Hardstand Access Area	1580
Greenhouse 1, 2, 3	900
Greenhouse 4	2535
TOTAL	5970

Table 1 – Existing Impervious Site Areas

Existing catchments were defined from aerial imagery and topographic mapping (2018 LIDAR) and reviewed through a site walkover. There are three defined catchments. The North-Eastern part of the site flows to an existing concrete catch drain located on Lot 18 DP 1141269. The Western part of the site flows on to adjoining Lot 10 DP 1141269. The Southern part of the site drains to an existing farm dam and natural drainage gully to the South.

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North-Eastern catchment – Greenhouses 1, 2, 3 and half of 4 are contained in this catchment, along with a small portion of the existing hardstand area. The outlet is located along the concrete catchdrain on the adjoining lot. The outlet consists of a multi-pipe headwall, with a small amount of storage at the inlet. Additional information on the Pacific Highway drainage network is required to confirm the discharge location, however it is likely that an outlet is located on the Eastern side of the highway, discharging to the trunk drainage system that runs east between Gumtree Glen and Crystal Drive.

Western catchment – The existing dwellings, sheds, and a majority of the existing hardstand area are contained within this catchment. No defined outlets were identified from a site walkover. Existing stormwater discharges as non-concentrated flows to the adjoining lot. Downstream of the adjoining lot the existing natural watercourse flows North, under Gaudrons Road, traversing several rural properties prior to discharging under the Pacific Highway adjacent Sugarmill Road.

Southern catchment – The largest of the greenhouses is located on the boundary between the Southern and North-Eastern catchments. The greenhouse has a roof water collection system connected to a storage tank, with an overflow outlet located in the Southern catchment. It has been assumed that in a major event the roof water system would overflow and part of the flows would discharge to the North-Eastern catchment. The catchment includes a farm dam, and small pump shed. The outlet adjacent the South-Eastern corner of the site consists of a box culvert. It is likely that this system discharges to the trunk drainage system on the eastern side of the Pacific Highway, between Gumtree Glen and Crystal Drive.

Future Development

The proposed future development of the site includes 3 rural residential lots. The proposed concept lot layout is included in **Appendix B**. For assessment of potential stormwater impacts it was assumed that existing development on the site will remain with the addition of new access to Lots 2 and 3, and a 400m2 building envelope on Lot 3.

Future access to lots is based on RFS requirements from Planning for Bushfire protection, requiring a 4m sealed carriageway. The additional developed impervious site areas are summarised in Table 2 below.

	Area (m2)
Access Road (212m long),	848
Lot 2 Driveway (68m long)	272
Lot 3 Building Envelope	400
Lot 3 Driveway (175m long)	700
TOTAL	2220

Table 2 – Future Additional Developed Impervious Site Areas

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Hydrological Analysis

Hydrological analysis has been undertaken in accordance with the Australian Rainfall Runoff (ARR) 2019 procedure for peak flow estimation. The 100yr ARI (1% AEP) event has been adopted for analysis. ARR2019 specifies that an ensemble of 10 patterns be run for every duration, with the design peak flow taken as the average of the 10 patterns.

To determine peak flows under existing and future land uses DRAINS software was used to prepare a conceptual hydrological simulation for each catchment with an Initial Loss (IL) Continuing Loss (CL) Model. ARR2019 data was accessed from the associated Datahub website including ARR2019 Storms, Rainfall Ensembles, and Preburst Rainfall. A summary of the adopted modelling parameters is provided in **Appendix C**.

Subject to the final configuration of the future development the drainage patterns and associated impacts may differ from the conceptual hydrological model developed. The analysis provides an indication of the magnitude of impacts, based on the proposed concept layout. Results are presented in the table below.

Catchment	Existing Peak Flows (m3/s)	Future Peak Flows (m3/s)	% Increase
North-Eastern	0.649	0.688	6.0
Western	1.121	1.121	0
Southern	1.254	1.353	7.9

Table 3 – DRAINS results 1% AEP Existing vs Future Peak Flows

Mitigation Options

Mitigation strategies to address increases in stormwater runoff due to development are addressed in CHCC current policy framework. CHCC Water Sensitive Urban Design Guideline 2018 (WSUD 2018) outlines acceptable approaches to mitigating impacts on stormwater for Rural and large lot residential development. It notes that pollution reduction targets do not apply, however design and implementation of the following measures is generally considered acceptable,

"Road reserves may comprise turfed or planted swale drainage subject to Council approval…On-lot measures may comprise rainwater tanks and dispersal of runoff (sheet flow) from impervious areas over grassed/planted areas."

In addition to the above requirements WSUD 2018 notes that discharges should generally be maintained at pre-development levels and refers to Clause 12 (retardation / detention basins) in the Northern Rivers Local Government Handbook of Stormwater Drainage Design. Cl 12.2.10 notes that, *"Design and installation of stormwater detention / retention is required on*

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development sites in all areas where under-capacity drainage systems exist downstream of the site or where the proposed development will result in the existing infrastructure surcharging."

There are two alternative approaches to addressing detention if required, being at the lot-scale, or through construction of centralised basins. The proposed future development provides adequate space for each lot to address detention requirements at the lot-scale. This would allow mitigation measures to be tailored to the future development of each lot and remove the burden on council of maintenance of centralised basins in dedicated drainage reserves.

The proposed approach is to impose a Permissible Site Discharge (PSD) on each lot to match the existing site discharge. A future land-owner might wish to address the PSD requirements through adopting water sensitive design by limiting impervious areas and providing detention or retention through small landscaped storages, or alternatively address the requirement through a more traditional approach by providing a lot-scale on site detention system. This could be controlled through a Stormwater Management Plan for the site, outlining objectives, acceptable solutions, and assumptions to be used for demonstrating compliance of alternative designs.

The proposed concept lot layout sites the shared property access in the North-Eastern catchment. Future grades over the site will be suitable for incorporating a vegetated swale/buffer along the road corridor. Swale systems operate best in the range of 1-4% grade, however can incorporate check dams on steeper grades. This is consistent with the approach proposed in the WSUD 2018 guideline.

The North-Eastern and Southern catchments discharge directly to existing drainage systems that are part of the Pacific Highway Corridor under the control of Transport for New South Wales (TfNSW). The outlet systems passing under the Pacific Highway would be cost prohibitive to upgrade to cater for any increased flows. It is proposed that consultation be undertaken with TfNSW to determine objectives for each catchment, and a preferred solution be developed in consultation with CHCC and TfNSW.

Conclusion

The preliminary hydrological analysis indicates that future development of the site at the proposed density will result in minor increases to peak flows from the site. To counteract the effects of increased runoff a combination of strategies could be used adopting water sensitive design approaches and/or more traditional detention basins. It is proposed to address requirements at the lot-scale where acceptable to CHCC and TfNSW. The proposed measures would be developed in consultation with CHCC and incorporated in a site-specific Stormwater Management Plan to accompany a future Development Application for Subdvision.

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For any further information please do not hesitate to contact AS Engineering directly.

Yours faithfully

AS Engineering

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Attachments

Appendix A – SK001 Site Analysis Sheet 1 of 2, SK002 Site Analysis Sheet 2 of 2

Appendix B – SK003 Concept Lot Layout

Appendix C – Hydrological Modelling Parameters Summary

APPENDIX 7 - STORMWATER ASSESSMENT

A1

LEGEND

- Site boundary
- Catchment boundary
- LIDAR Contours 2018 (0.5m)
- Structures
- Hardstand access area
- Concrete catch drain
- Stormwater flow arrow
- Inlet to piped system
- Natural water course

PRELIMINARY

Rev.	Date	Revision Details	By	Ver	App.

ENGINEERING
CIVIL ENGINEERING & PROJECT MANAGEMENT
COFFS HARBOUR

Antonio Sapp Engineering Pty Ltd
ABN 43 625 650 975
0434 404 699
info@aseng.com.au

Client: CHRIS & CHRIS BOWEN

Project: LOT 11 DP1141269
9 GAUDRONS ROAD
SAPPHIRE BEACH

Drawn	Signed	Date
RWN	RWN	14/04/23
Designed	Signed	Date
Verified	Signed	Date
Approved	Signed	Date

Drawing Title: PLANNING PROPOSAL
SITE ANALYSIS PLAN
SHEET 1 OF 2

Project No.: 205102
Scale: 1 in 500 (A1)
Drawing No.: SK001 Rev.

APPENDIX 7 - STORMWATER ASSESSMENT

PRELIMINARY

Rev.	Date	Revision Details	By	Ver	Appd

AS ENGINEERING
CIVIL ENGINEERING & PROJECT MANAGEMENT
COFFS HARBOUR

Amato Sippi Engineering Pty Ltd
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Client: CHRIS & CHRIS BOWEN

Project: LOT 11 DP1141269
9 GAUDRONS ROAD
SAPPHIRE BEACH

Drawn	Signed	Date
RWN	RWN	14/04/23
Designed	Signed	Date
Verified	Signed	Date
Approved	Signed	Date

Drawing Title: PLANNING PROPOSAL
SITE ANALYSIS PLAN
SHEET 2 OF 2

Project No: 205102
Scale: 1 in 500 (A1)
Drawing No: SK002 Rev:

Redistributed 0 5 10 15 20 25 30m

APPENDIX 7 - STORMWATER ASSESSMENT

A1

PRELIMINARY

Rev	Date	Revision Details	By	Ver	App

Ansaris Sapp Engineering Pty Ltd
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CIVIL ENGINEERING & PROJECT MANAGEMENT
COFFS HARBOUR

Client: CHRIS & CHRIS BOWEN

Project: LOT 11 DP1141269
9 GAUDRONS ROAD
SAPPHIRE BEACH

Drawn: BRS	Signed: BRS	Date: 21/08/21
Designed:	Signed:	Date:
Verified:	Signed:	Date:
Approved:	Signed:	Date:

Drawing Title: PLANNING PROPOSAL
CONCEPT LOT LAYOUT

Project No: 205102
Scale: 1 in 800 (A1)
Drawing No: SK003 Rev:

APPENDIX 7 - STORMWATER ASSESSMENT

9 Gaudrons Road Stormwater Assessment

DRAINS MODEL INPUTS

	Area (m2)	%	Flow Path (m)	Roughness (n)	Slope (%)	t (minutes)
Western Catchment - Existing						
Total Area (m2)	19745					
Indirectly Connected Impervious Areas (RIA)	2377	12.0				2
(Dwelling 1 and 2 Shed 1 and 2, 90% Hardstand Access Area)						
Pervious Areas (PA)	17368	88.0	100	0.06	11.5	18.3
Western Catchment - Developed						
Indirectly Connected Impervious Areas	2577	13.1				2.0
Existing areas plus 50% Building Envelope Lot 3						
Pervious Areas (PA)	17168	86.9	100	0.06	11.5	18.3

	Area (m2)	%	Flow Path (m)	Roughness (n)	Slope (%)	t (minutes)
North Eastern Catchment - Existing						
Total Area (m2)	11585					
Indirectly Connected Impervious Areas	2246.5	19.4				2
(Greenhouse 1,2,3 and 50% of 4, 5% Hardstand)						
Pervious Areas	9338.5	80.6	74	0.06	5.5	19.1
North Eastern Catchment - Developed						
Indirectly Connected Impervious Areas	3366.5	29.1				2
Existing plus Shared Access and Driveway Lot 2						
Pervious Areas	8218.5	70.9	40	0.06	5.5	15.6

	Area (m2)	%	Flow Path (m)	Roughness (n)	Slope (%)	t (minutes)
Southern Catchment - Existing						
Total Area	21647					
Indirectly Connected Impervious Areas	1346.5	6.2				2
(Greenhouse 50% of 4, 5% Hardstand)						
Pervious Areas	20300.5	93.8	98	0.06	18.5	16.5
Southern Catchment - Developed						
Indirectly Connected Impervious Areas	2246.5	10.4				2
Existing plus 50% Building Envelope Lot 3 and Driveway Lot 3						
Pervious Areas	19400.5	89.6	68	0.06	18.5	14.6

TOTALS

Exist IMP Area TOTAL	5970
Dev IMP Area TOTAL	8190
TOTAL AREA	52977

ASSUMPTIONS

Flow times for pervious areas estimated using modified Friends Equation as outlined in NRLG Handbook
Roughness n=0.06 densely grassed - as per NRLG Handbook
Impervious Areas IL 0.4mm, CL 0mm (ARR2019 Table 9.6.8)
Pervious Areas IL 50mm, CL 3.3mm (Review of ARR Design Inputs for NSW Final Report (OEH), Site 20507

ARR DATAHUB INPUTS

Results - ARR Data Hub
[STARTTXT]

Input Data Information
[INPUTDATA]
Latitude,-30.229022
Longitude,153.145794
[END_INPUTDATA]

River Region
[RIVREG]
Division,South East Coast (NSW)
River Number,5
River Name,Bellinger River
[RIVREG_META]

Time Accessed,13 April 2021 01:25PM
Version,2016_v1
[END_RIVREG]

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9th April 2021

The Owners

148 Gaudrons Road

Sapphire Beach NSW 2450

C/O Mr Stephen Sawtell

Factor X Solutions Pty Ltd

Stormwater Assessment to Support Planning Proposal

148 Gaudrons Road Sapphire Beach, Lot 7 DP555490

Background

Lot 7 DP555490 is proposed to be rezoned to facilitate future subdivision to minimum 1 hectare lots. A pre-lodgement meeting was held with Coffs Harbour City Council on 17 June 2020 and comments were raised in regards to Flooding and Overland Flow. The objective of this assessment is to undertake a preliminary Hydrological and Hydraulic analysis to assess the potential restriction imposed on the future lots by the natural drainage gully that traverses the site.

Site Description

The site is located on the Northern side of Gaudrons road. The approximate site area is 2.05 hectares and is traversed by a natural drainage gully running in a North-East direction. The natural drainage gully continues through the adjoining property (Lot 218 DP812014) for approximately 180m before joining another natural watercourse. The drainage line is steeply graded and falls approximately 60m in level over 310m of length. Side slopes are in the order of 30% to 35%. The subject site and downstream lot are shown in figure 1.

Methodology

To determine the potential restriction imposed on future subdivision of lot 7 DP 555490 a preliminary desktop Hydrological and Hydraulic analysis has been undertaken. Catchment definition has been based on aerial imagery, and topographic mapping. Hydrological analysis has been undertaken in accordance with the Australian Rainfall Runoff (ARR) 2019 procedure for peak flow estimation. The 100yr ARI (1% AEP) event has been adopted for analysis. Hydraulic analysis has been undertaken using Mannings equation to estimate the natural drainage line capacity at a depth of flow of 0.3m.

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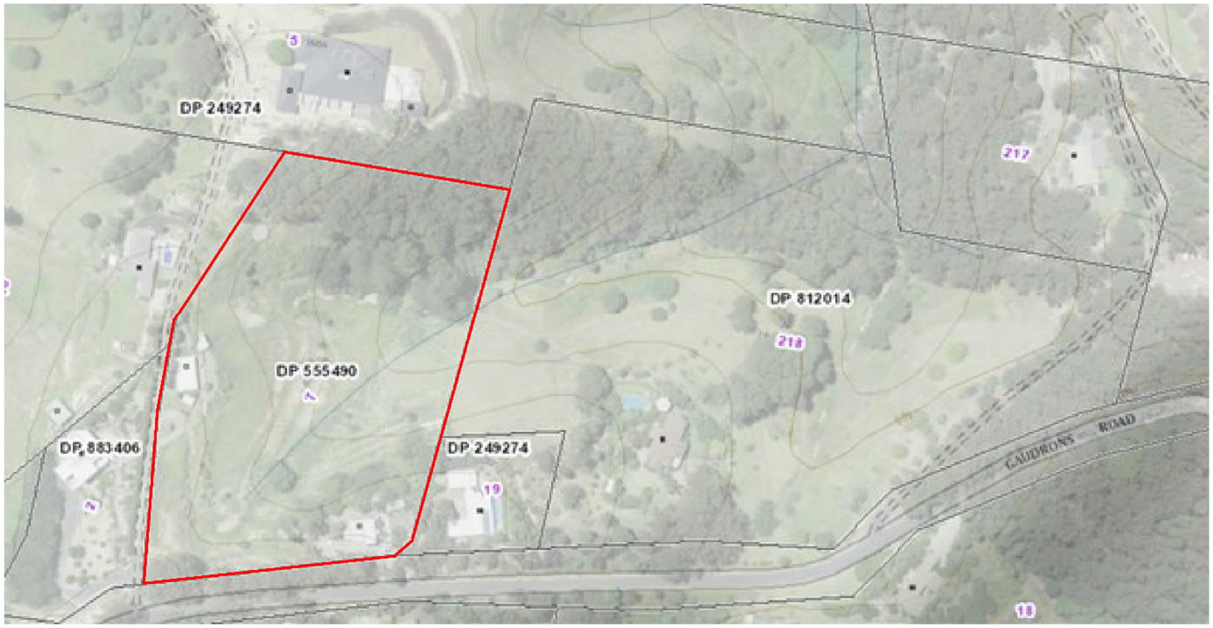

Figure 1 – Subject site and adjoining lots (source Six Maps)

Catchment Definition

The catchment is primarily small lot Rural Residential landuse, and extends to Gaudrons Road to the South, and is confined by a ridge to the west on adjoining Lots. The catchment area was estimated using topographic maps, resulting in a measured approximate catchment area of 2 hectares. The catchment is shown below in figure 2.

Figure 2 – Estimated Catchment Area (source Six Maps)

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Hydrological Analysis

ARR2019 specifies that an ensemble of 10 patterns are to be calculated for every duration, with the design peak flow taken as the average of the 10 patterns. ARR2019 data was accessed from the associated Datahub website including ARR2019 Storms, Rainfall Ensembles, and Preburst Rainfall. DRAINS software was used to simulate the catchment with an Initial Loss (IL) Continuing Loss (CL) Model. A summary of the adopted modelling parameters is provided below:

- ARR Data Hub Latitude,-30.226231 Longitude,153.132447
- Impervious Areas IL 0.4mm, CL 0mm (ARR2019 Table 9.6.8)
- Pervious Areas IL 50mm, CL 3.3mm (Review of ARR Design Inputs for NSW Final Report (OEH), Site 205007 Woolgoolga)
- Catchment Area 2 hectares
- Indirectly connected impervious area 0.12 hectares (6%), 2min flow time
- Pervious Area 94%, 11 min flow time (Friends equation - 110m flow length, n = 0.035, Slope 35%)

The peak mean flow of 1.369m3/s for the 1% AEP event at the catchment outlet occurs during the 15 minute storm burst. Results for the full ensemble of storms modelled is included in Figure 3.

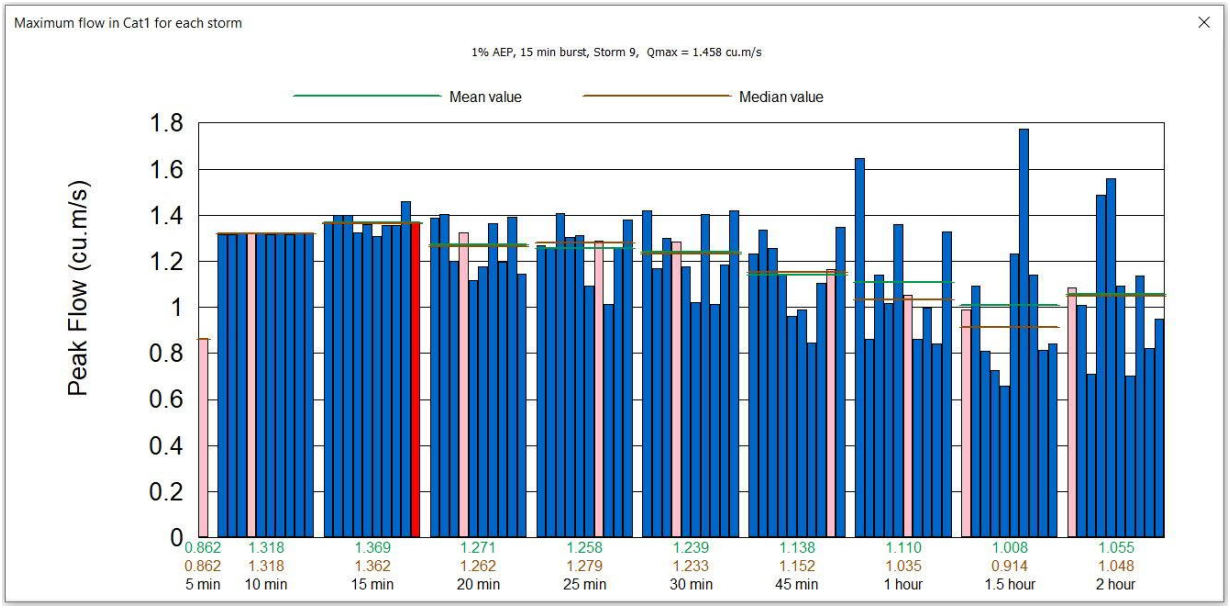

Figure 3 – DRAINS results

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Preliminary Hydraulic Analysis

A check of the potential depth of flow in the gully was approximated using Mannings equation with the following assumptions;

- Grade 15%
- Mannings n Roughness Coefficient 0.043
- Base Width 2m
- Side Slope 1 in 3 metres
- Normal Depth 0.3m

The capacity of the estimated drainage gully cross section at 0.3m is 1.548m3/s. Due to the steepness of the site and the drainage channel any floodplain storage or tailwater effects are likely to be minimal.

Potential Site Restrictions

The site was inspected on 9th April 2021. A photo looking up the existing gully from the eastern side of the property is included in figure 3 below. The channel is well defined and widens as the gully flattens out towards the eastern boundary of the site. Any restrictions on future development due to flooding potential would be limited to the defined channel and banks.

Figure 3 – Existing Gully (looking South-West from Eastern boundary)

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Conclusion

The natural drainage line that traverses the site does not significantly constrain the site for the proposed density of minimum 1 hectare lots.

The steep nature of the site and its location at the top of the catchment will generally result in any overland flows generated on the site being quickly conveyed to the existing natural drainage line, to discharge from the site.

Future development on the site should:

- take into consideration the location of the existing drainage gully
- site any structures clear of the defined channel and banks
- be designed to limit the consequences for downstream properties.

To address overland sheet flows, adoption of general building controls requiring a minimum difference between finished floor levels and finished ground levels, and adequate site drainage would provide sufficient protection to cope with shallow water depths.

For any further information please do not hesitate to contact AS Engineering directly.

Yours faithfully

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