

In the Planning and Environment Court  
Held at: Brisbane

Appeal No. 2916 of 2024

Between: **DAVID MANTEIT**

Appellant

And: **BRISBANE CITY COUNCIL**

Respondent

**AFFIDAVIT**

Filed on: April 2025

I, **ANDREW DENNIS CORRIGAN** of Gould Development Solutions, 67/24 Dunmore Terrace, Auchenflower, Brisbane in the State of Queensland, being under oath say:

1. I am a Registered Professional Engineer in Queensland and Director with Gould Development Solutions. A copy of my Curriculum Vitae appears at **Exhibit ADC-1**, pages 47 to 51.
2. I have prepared a report in accordance with the *Planning and Environment Court Rules (Qld) 2018*. This report accurately states my opinions and conclusions. A copy of the report I prepared for this appeal appears at **Exhibit ADC-1**, pages 4 to 62.
3. The contents of this affidavit are true, except where they are stated on the basis of information and belief, in which case they are true to the best of my knowledge.
4. I have been instructed on an expert's duty in accordance with the *Planning and Environment Court Rules 2018* and I confirm that:
  - (a) I have made all necessary enquiries in the discharge of my professional duty that I consider significant;
  - (b) I have not received or accepted instructions to adopt or reject a particular opinion in relation to an issue in dispute in this proceeding;
  - (c) the opinions held in the report exhibited to this affidavit are genuinely held by me; and
  - (d) I understand and have to the best of my ability discharged that duty.

Deponent:



Solicitor:



**AFFIDAVIT OF ANDREW CORRIGAN**  
Filed on behalf of the Respondent

**CITY LEGAL – BRISBANE CITY COUNCIL**  
Level 20, 266 George Street  
BRISBANE Q 4000  
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5. I understand that a person who provides a false matter in an affidavit commits an offence.

SWORN by **ANDREW DENNIS CORRIGAN**  
at Brisbane  
this 22<sup>nd</sup> day of April 2025 and  
made in the form of an electronic  
document, signed electronically and  
made, signed and witnessed in accordance  
with Part 6A of the *Oaths Act 1867*.



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**Deponent**

before me:



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**Sarah McCabe**

Australian Legal Practitioner, City Legal – Brisbane City Council

special witness under the *Oaths Act 1867*

I understand the requirements for witnessing a  
document by audio visual link and have complied with those  
requirements.

In the Planning and Environment Court  
Held at: Brisbane

Appeal No. 2916 of 2024

Between: **DAVID MANTEIT**

Appellant

And: **BRISBANE CITY COUNCIL**

Respondent

### CERTIFICATE OF EXHIBIT

Exhibit "**ADC-1**" to the Affidavit of **ANDREW DENNIS CORRIGAN** sworn before me on this 22<sup>nd</sup> day of April 2025:

### INDEX OF EXHIBIT

No.	Description	Date	Page No.
'ADC-1'	Civil Engineer Report	22.04.2025	4 - 62



Deponent



Solicitor – Sarah McCabe

**CERTIFICATE OF EXHIBIT**  
Filed on behalf of the Respondent

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# "ADC-1"

Planning & Environment Court of Queensland  
Brisbane  
No. 2916/24

Applicant: David Manteit  
Respondent Brisbane City Council

## **Report for the Court on Provision of Stormwater Infrastructure**

### **For Resubdivision of 128 Ashridge Road, Darra, Queensland**

By  
Andrew Corrigan

22 April 2025

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### Attachments

<b>A</b>	<b>My CV</b>
<b>B</b>	<b>Contours taken from 2019 Brismaps.</b>
<b>C</b>	<b>Stormwater catchments</b>
<b>D</b>	<b>Design Options for Stormwater Infrastructure</b>

## 1. INTRODUCTION AND PURPOSE OF THIS REPORT

- 1.1. The Applicant has submitted an application to subdivide the existing lot into two lots. It is anticipated that the existing house will remain, and, in the future, a new house constructed on the new lot.
- 1.2. A site view with subject and surrounding lots identified is as follows. Contours are taken from 2019 Brismaps. Contours for the wider area are included in **Attachment B**.



- 1.3. I obtained the location of the proposed new dwelling from the Civil Works Engineers plan S01 which is page 10 of the Applicant's Affidavit dated 31 March 2025 (which is Document 6 in the table below of Appeal documents) and added it to the site view as follows.



- 1.4. I note the report of Mr Kieran Ryan, the Respondent's town planner, which states that the most likely development outcome for the newly created lot would be a single dwelling house with a maximum site cover of 60%. Given the location of the driveway crossover and the constraints of the site (size, shape, depression in back corner), the proposed new dwelling location identified on the plans seems the most likely location for a new dwelling.
- 1.5. This application triggers the requirement for consideration of stormwater infrastructure within the subject lot because of the assessment benchmarks identified by Mr Ryan at paragraph 4.4(h)(vi).
- 1.6. The Respondent issued an Approval with conditions. The Applicant has objected to the following conditions.
  - 1.6.1. Condition 7 – grant easements over stormwater pipes in the subject development that service up slope lots.

- 1.6.2. Condition 12 - carry out any earthworks in the subject lot to ensure stormwater discharge to Ashridge Road.
- 1.6.3. Condition 17 – provide stormwater infrastructure within the subject lot generally in accordance with marked up plan SK01. This plan depicted pipe drainage for future development of Lots 98 and 99 to the east, drainage to the low surface area of the lot in the southwest corner, discharge to Ashridge Road.
- 1.6.4. Condition 18 – provide connections to Lots 98 and 99 for future ultimate development
- 1.6.5. Condition 24 – provide a driveway crossover in accordance with Council standard drawings
- 1.7. The Applicant has lodged an appeal.

## **2. MY CV**

- 2.1. My CV is included in **Attachment A**.
- 2.2. I have in excess of 40 years' experience as a civil and structural engineer (RPEQ) and builder (Licensed in Qld). I have investigated, designed and constructed land subdivisions, roads and infrastructure including stormwater infrastructure.

### **3. EXECUTIVE SUMMARY**

- 3.1. The application to subdivide the existing lot into two lots requires a Development Approval. Brisbane City Plan 2014 stipulates that the development must ensure satisfactory stormwater drainage of the subject site as well as provision in the development for drainage of up slope future development.
- 3.2. Lots 97, 98 and 99 discharge stormwaters to the subject lot. The existing topography of the subject lot causes stormwater discharge into the adjacent lot to the west including some discharge from upstream lots. Lot 97 was not listed in the Council Conditions and in my opinion, this is an oversight.
- 3.3. The Council as Respondent issued a DA with Conditions which included a marked-up plan SK01. The Conditions included
  - 3.3.1. earthworks filling of the subject lot if required to achieve stormwater discharge of the subject lot to Ashridge Road (Condition 12)
  - 3.3.2. piped discharge of any dwellings on the two lots to be created and land surrounding the dwellings to Ashridge Rd (Condition 17)
  - 3.3.3. connections to Lots 98 and 99 upstream for the future development of these lots (Condition 18) with easements (Condition 7)
- 3.4. The construction of a dwelling on the subdivided lot on the subject site will create a barrier to stormwater flow across the subject site and hence will change the stormwater discharge characteristics - namely flow will be diverted to the south of the dwelling and, unless stormwater infrastructure is provided, will result in concentration of flow into the adjacent Lot 1. This and the discharge from the upstream sites along with drainage from the existing and any new dwelling should be addressed in a stormwater master plan for the development.
- 3.5. The development application material and the Civil Works Engineers report submitted as part of the appeal incorrectly state the stormwater conditions of the site and surrounding lots.

- 3.6. Detailed upstream stormwater modelling is required and has not been carried out by the Applicant. I have undertaken a rudimentary analysis of upstream catchment boundaries (in **Attachment C**) along with options for stormwater infrastructure that satisfies the objectives (**Attachment D**). This stormwater infrastructure satisfies the intent of the red indicative mark ups on the approved plan SK01.
- 3.7. In my opinion, the proposed development triggers the need for piped stormwater infrastructure within the subject site that will manage flows in accordance with the planning scheme. Hence, in my opinion, as is the usual practice, the Applicant should provide the necessary design with sufficient details to demonstrate a satisfactory solution.

#### **4. CITY PLAN REQUIREMENTS FOR DRAINAGE OF THE SUBJECT LOT AND UPSTREAM LOTS**

##### **On-site drainage**

- 4.1. The requirements for on-site drainage are set out in PO2, PO3 and PO4 of 9.4.9 Stormwater Code of the Planning Scheme as follows.

##### *PO2*

*Development ensures that the stormwater management system and site work does not adversely impact flooding or drainage characteristics of premises which are up slope, down slope or adjacent to the site.*

##### *PO3*

*Development ensures that the stormwater management system does not direct stormwater run-off through existing or proposed lots and property where it is likely to adversely affect the safety of, or cause nuisance to properties.*

##### *PO4*

*Development provides a stormwater management system which has sufficient capacity to safely convey run-off taking into account increased run-off from impervious surfaces and flooding in local catchments.*

- 4.2. The effect of these requirements is that the development does not affect adjacent property, and a stormwater management system is provided with adequate capacity for the property after the proposed development.
- 4.3. The practical effects of these requirements are as follows.
- 4.3.1. the roofs and any impervious surfaces of the existing and proposed dwelling must be discharged to Ashridge Road.
- 4.3.2. There must be no change of stormwater discharge to an adjacent property which causes a nuisance. Lot 1 to the west is the adjacent property to be considered. The rear area of the proposed lot at the southwest corner which is a low point, must be considered.

**Off-site drainage – drainage to upstream lots and adjacent lots**

- 4.4. If a site has upstream lots, namely lots where the slope of the land naturally causes discharge of stormwater to the subject lot, then development of the subject lot triggers the requirement to provide drainage for the upstream lots as follows.
- 4.4.1. PO2 of 9.4.9 Stormwater Code of the Planning Scheme states as follows.
- Development ensures that the stormwater management system and site work does not adversely impact flooding or drainage characteristics of premises which are up slope, down slope or adjacent to the site.*
- 4.4.2. This requirement is read in conjunction with City Plan 2014 Schedule 6 PSP – Infrastructure Design, Chapter 7 Stormwater Drainage 7.6.5.

Section 7.6.5 (relevant parts) states as follows.

***Provision of drainage for future upslope development of a neighbouring property***

1. *Provision must be made for the future orderly development of adjacent properties with respect to stormwater drainage where at least part of those upslope properties would drain through the development, or the most feasible location for stormwater drainage infrastructure to service those properties is within the development.*

2. *If a piped drainage connection is provided for up-slope development, the drainage infrastructure must fully extend to the boundary of the up-slope site to ensure that the up-slope property owner does not have to undertake works in the down-slope property to connect to this stormwater infrastructure.*
3. *Where a pipe is used to facilitate an up-slope stormwater connection (now or in future) the minimum pipe size is 225mm nominal diameter for any development. This stormwater pipe must be connected to a lawful point of discharge.*
4. *The development is to design any up-slope stormwater connection for fully developed catchment flows.*

4.5. PO11 of 9.4.9 Stormwater Code of the Planning Scheme states as follows.

**PO11**

*Development provides for the orderly development of stormwater infrastructure within a catchment, having regard to the:*

- (a) existing capacity of stormwater infrastructure within and external to the site, and any planned stormwater infrastructure upgrades;*
- (b) safe management of stormwater discharge from existing and future up-slope development;*
- (c) implication for adjacent and down-slope development.*

4.6. The effect of these above requirements is: -

- 4.6.1. The subject development must not adversely affect an adjacent or upstream lot.
- 4.6.2. The subject development must provide for the drainage characteristics of the upstream lots.
- 4.6.3. The characteristics of the upstream lots must take into account future orderly full development of the upstream lots.

4.7. In my opinion, the practical effect is as follows on the scope of the proposed development.

- 4.7.1. The development must collect and discharge the roofs and impervious areas of the existing and proposed dwelling of the subject lot to Ashridge Road.

- 4.7.2. The earthworks and building for the development on the subject lot must not concentrate or increase the existing stormwater discharge into Lot 1 RP117157. The discharge that is affected by the construction of the new dwelling, should be formally conveyed and not merely left to discharge into Lot 1 RP117157.
- 4.7.3. The future development of the upstream lots must be catered for.
- 4.8. The future upstream development must comply with PO3 of 9.4.9 Stormwater Code of the Planning Scheme and City Plan 2014 Schedule 6 PSP – Infrastructure Design, Chapter 7 Stormwater Drainage 7.6.1. These requirements are stated as follows.

*PO3: Development ensures that the stormwater management system does not direct stormwater run-off through existing or proposed lots and property where it is likely to adversely affect the safety of, or cause nuisance to properties.*

Section 7.6.1 (relevant parts) states as follows.

*2. When land is developed, the roof and surface-water run-off from that land and any external catchment (through the development site) must be discharged to a lawful point of discharge, being:*

- a. where the location of the discharge is under the lawful control of Council, being:
  - i. a Council-owned open space asset such as a [park](#) or drainage reserve provided the concentration of stormwater does not adversely affect the drainage capacity of the asset and/or impact on adjoining properties; or*
  - ii. a road reserve, including the kerb and channel and compliance with the permissible flow width, flow depth and hazard.**
- b. where the location of the discharge is to stormwater drainage infrastructure designed for such purpose, being:*

*(a) a stormwater drainage easement within the downstream property receiving the runoff, where that easement has been designed to incorporate run-off from the development or the additional flow does not adversely affect the drainage capacity of the infrastructure or easement; or*

*ii. an existing enclosed stormwater drainage system (excluding any foul water lines) including a gully pit, stormwater maintenance hole or stormwater pipe or roof water pipe with easement, ensuring that the capacity of that infrastructure is adequate to receive the stormwater run-off; or*

*iii. an existing stormwater drain within the property where that drain has sufficient capacity to receive such run-off without adversely impacting on neighbouring properties.*

- 4.9. The effect of PO3 and Section 7.6.1 b. i. is that the future design of the future upstream development would be required to conform to the design assumptions and the discharge capacity that has been allowed and provided for the subject lot.
- 4.10. Hence, the design assumptions of the size and characteristics of upstream catchments that are made for the subject development, must be adhered to by the upstream development.

## 5. THE DEVELOPMENT APPLICATION

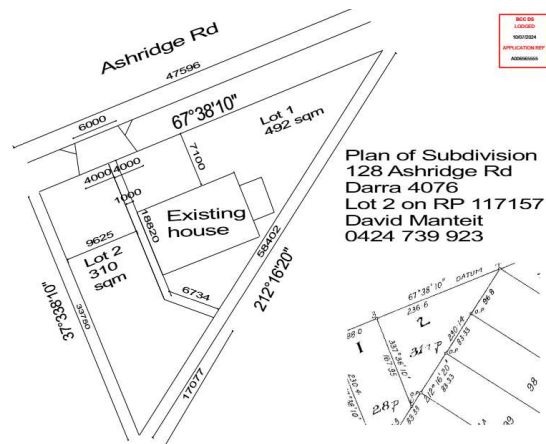
### The Application

5.1. The documents that I considered that are part of the application were as follows.

#	Title	Pages	Date	Comment
1	Assessment Report by Applicant titled "Town Planning Application"	9	14May24	<p>Council stamp dated 10July24</p> <p>Contains plan of subdivided lots (page 9 of the document) and following plans and text that states that</p> <ul style="list-style-type: none"><li>• Two proposed lots will be piped to kerb</li><li>• Earth fill to right side of lot and battered to the rear</li><li>• No piping required to service rear lots</li></ul>

				<p>Page 6 Contains arrows of stormwater flow directions marked up on alleged survey plan. Same plan is Page 27 of affidavit of 19 Nov 24 in the Appeal (see below).</p> <p>Contains ground contours and marked up stormwater flow direction (page 7)</p>
2	DA Form 1	12	19July24	Email to Council updates the Form 1

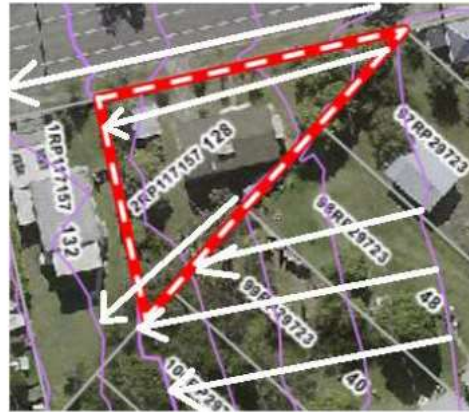
5.2. The subdivision plan submitted was as follows.



- 5.3. The plan of existing ground contours is included in page 6 by the Applicant in the Assessment Report by the Applicant titled "Town Planning Application". This plan refers to Brisbane City Council Contours in 2002<sup>1</sup>. It was marked up by the Applicant to show the flow directions of stormwater as follows.

**Brisbane City Council Contours 2002.**

1) Contours 2002 show flow of rainwater in rear neighbours land falling downstream from on neighbour to the other rear neighbour, left of each other, rather than to the subject property. Therefore there are no "Upstream" neighbours to the subject development.



<sup>1</sup> Page 6 of the document

- 5.4. I note that the Applicant is using contours from 2002. As in paragraph 1 above and **Attachment B** I have used Brismaps 2019.
- 5.5. The Applicant refers<sup>2</sup> to a “recent survey by ONF Surveyors” (which I have not received). The Applicant includes on page 7 of the Assessment Report by the Applicant titled “Town Planning Application” a diagram attributed to this survey. In my opinion, the contours shown on this survey match Brismaps 2019 whereas the contours in the plan on page 6 are different. The Applicants markup on page 7 depicts the natural flow of rainwater from the middle of the subject property to the right and rear of the subject property.
- 5.6. The Applicant goes on to state that the right rear corner of the site is below the proposed dwelling pad and that filling of this area is not proposed because such filling would “interfere with the natural and existing flow of stormwater”. The survey plan has been marked up with red arrows to indicate the direction of stormwater flow.
- 5.7. The marked-up plan is as follows.

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<sup>2</sup> Page 7 of Town Planning Application.

ASHRIDGE

Approx. 100m

1 RP117157

2 RP117157

3 RP117157

4 RP117157

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#	Title	Pages	Date	Comment
1	Notice of Appeal	21		<p>Seeks: -</p> <p>Amend Condition 12 to delete the requirement for earthworks to achieve stormwater discharge to Ashridge Rd.</p>

				<p>Amend Condition 17 (stormwater connection for subject allotment as per marked up SK01) to delete reference to SK01.</p> <p>Delete Condition 18 (upstream drainage provision)</p> <p>Delete Condition 24 (driveway crossover)</p>
2	Affidavit by Applicant	49 Cover page plus 48 pages	19Nov24	<p>Commentary by Applicant on the Lawful Point of Discharge and issues of provision of stormwater infrastructure.</p> <p>Page 12 includes a design of the pad for the proposed dwelling with levels and arrows denoting stormwater runoff.</p> <p>Page 27 depicts existing ground contours. This diagram is a portion of the survey plan included above in paragraph 4.5.</p>
3	Affidavit by Applicant	21	19Nov24	Includes: -

		Cover page plus 20 pages		Tables of design levels for various options that show that a piped solution as marked up by the Council does not achieve a solution.  Plans of other projects as examples.
4	Affidavit by Applicant	31  Cover page plus 30 pages	20Nov24	Describes alleged issues with pipework marked on SK01; presents comparisons to other properties
5	Submissions for Trial	50	28March25	Repeat of Document 3 above plus more pages
6	Affidavit by Applicant	19  2 cover pages plus 17 page report	31March25	Report (17 pages) by Civil Works Engineers date 28 March 2025

### **The Proposed Stormwater Works in the Application**

- 5.9. From the documents above that have been submitted, it is my opinion that the application proposes the following.
- 5.9.1. Subdivide the existing lot.
  - 5.9.2. Provide piped connections to Ashridge Road for the two dwellings (one existing, one future)<sup>3</sup>.
  - 5.9.3. Do not provide any earth filling to the rear southwest corner of the lot (where there is a low point). Hence, maintain the existing discharge location from the subject lot into the adjacent lot to the west (Lot 1).
  - 5.9.4. Do not provide any pipe connections to adjacent lots to the south.
  - 5.9.5. Provide a wider than usual driveway crossover.
- 5.10. I understand the text in the Assessment Report<sup>4</sup> that states “fill the right side of Lot 2 to achieve 36.75 AHD” means that the intention is to provide an earthworks pad for a dwelling on the subdivided lot.
- 5.11. I defer to the opinion of Mr Ryan that no further operational works permit will be required for the Applicant to install a stormwater solution required by the conditions of development approval. In my experience, the further approval that will be needed is a building permit from a private certifier. There is no later opportunity for Council to review detailed design of the stormwater system. Hence, in my experience, an appropriately detailed stormwater master plan is submitted at the DA stage which has sufficient design detail to demonstrate compliance of the stormwater drainage for the proposed development. At the time of the later assessment, the private certifier will check compliance of plans for the building permit with the scope of stormwater defined in the DA.

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<sup>3</sup> Page 2 of above report, response to AO4.2; first paragraph under heading “Stormwater Code” page 3

<sup>4</sup> Report titled “Town Planning Application” dated 14 May 2024, page 1 response to AO2.1, 3<sup>rd</sup> paragraph 7<sup>th</sup> page under diagram and heading “2) Surveyor’s contours”; 2<sup>nd</sup> paragraph under heading “Stormwater Code” page 3

- 5.12. The Applicant provided an Affidavit dated 31 March 2025 which contains the Report (17 pages) by Civil Works Engineers dated 28 March 2025. This report is part of the Appeal and not part of the Application. It was prepared in response to the Conditions of DA Approval that were issued to the Applicant by the Council. The Report is not the usual civil engineering report that sets out the stormwater master plan for the site as described in the previous paragraph. Rather, the Report is a further statement that:
- 5.12.1. there is no need for provision of piped stormwater infrastructure to adjacent lots to the southeast; and
  - 5.12.2. stormwater discharges towards the adjacent lot to the west and not to Ashridge Road.
  - 5.12.3. the Report also examined levels for a design that would comply in detail with the marked-up SK01 and concluded that the levels cannot be designed to provide a solution.
- 5.13. In my experience, an engineer's report that was submitted as part of a DA application would include a stormwater masterplan with appropriate details to demonstrate a solution. These details would include an analysis of upstream catchments including possible future development along with high level design of stormwater infrastructure. However, the applicant and Civil Works Engineers have stated that upstream drainage is not required; and the only stormwater infrastructure required is pipework to discharge the roofs of the two dwellings to Ashridge Road. Hence, the engineering report submitted does not address a stormwater master plan.

## **6. CONDITIONS IMPOSED WHICH ARE APPEALED**

- 6.1. The Conditions that are appealed in relation to stormwater are as follows. I have included my understanding of Mr Manteit's opposition to each condition based on the material I have read.

### **Condition 7 – provide easements**

- 6.2. Condition 7 stipulated easements through the subject development for the stormwater system. The Applicant submits that piped infrastructure for adjacent lots is not required and therefore there is no requirement for easements.

### **Condition 12 - Carry out Earthworks on the Proposed Lot**

- 6.3. Condition 12(a) requires earthworks to achieve discharge of the proposed lot to Ashridge Road. The Applicant disagrees with this Condition on the basis that existing flow is towards Lot 1 and this existing flow direction can be maintained after the proposed development, as set out in paragraph 4.5 above.

### **Condition 17 - Provide Stormwater Connections to Ashridge Road for the Subject Site**

- 6.4. Approval Condition 17 stipulated that connections to roof and developed areas of the existing and proposed lot should provide discharge to Ashridge Road. Condition 17 stated that stormwater drainage should be "generally as shown on the Approved Plan SK01".
- 6.5. In my opinion the wording of Approval Condition 17 stating that stormwater drainage should be "generally as shown on the Approved Plan SK01" means an indicative arrangement and amendment to it is readily possible provided that the objectives of master plan drainage are achieved. I have previous experience where a mark-up by the Council occurred and subsequently the Applicant submitted design details which varied from the Council markup.
- 6.6. The Approved Plan SK01 depicts pipework and field gully pits that indicate the following.

- 6.6.1. Drainage to the Ashridge Road kerb of the dwellings within the subject lot. This requirement is acknowledged by the application - see above in paragraph 5.9.2.
- 6.6.2. Drainage connections to adjacent upstream Lots 98 and 99. I note that Lot 97 should also be serviced.
- 6.6.3. Drainage to the southwestern corner area of the subject lot (to the rear of the proposed new dwelling). This area is a low point and the proposed new dwelling on the subject lot will cause concentration of stormwater at this location. Unless captured and conveyed, this stormwater will cause concentration of flow onto Lot 1 RP117157.
- 6.6.4. The mark-up of SK01 by the Respondent depicted two piped discharges to the kerb of Ashridge Road.

**Condition 18 - Provide Stormwater Connections to Upstream Lots**

- 6.7. Approval condition 18 stipulated provision of stormwater drainage connections to Lots 98 and 99.

**Condition 24 - Driveway Crossover**

- 6.8. The Condition requires provision of a driveway crossover in accordance with Council standard drawings rather than the non-standard and wider crossover proposed.

## **7. ON-SITE DRAINAGE REQUIREMENTS**

7.1. As stated above in paragraph 4.3, the requirements of City Plan are as follows.

- 7.1.1. the roofs and any impervious surfaces of the existing and proposed dwelling must be discharged satisfactorily and in practice this means discharge by pipes to Ashridge Road (Benchmarks PO2, PO3 and PO4 of 9.4.9 of the Stormwater Code; particularly Schedule 6 PSP – Infrastructure Design, Chapter 7 Stormwater Drainage 7.6.1, 2a)).
- 7.1.2. There must be no change of stormwater discharge to an adjacent property due to the development which causes a nuisance. The rear area of the proposed lot at the southwest corner, which is a low point, must be considered along with discharge generally from the existing and proposed lots so that there is no change of flow into Lot 1 along with nuisance (Benchmarks PO2, PO3 and PO4 of 9.4.9 of the Stormwater Code; and generally Schedule 6 PSP – Infrastructure Design, Chapter 7 Stormwater Drainage 7.6.1, 2).

### **My Comments on the Conditions**

- 7.2. Condition 17 relates to on-site drainage. Condition 12(a) is relevant because a possible option is to provide earthworks that help achieve on-site drainage. However, in my opinion, earthworks may not be required if satisfactory drainage is achieved by pipe infrastructure.
- 7.3. My view is that Condition 17 is an appropriate response to the development in the context of the planning scheme provisions identified above, and my reasons are as follows.
  - 7.3.1. There is a low point in the southwest corner of the subject land and unless stormwater drainage is provided at this location, the existing stormwater discharge into the adjacent Lot 1 will be concentrated by the proposed development. Hence earthworks and/or a drainage point via a pipe should be provided to ensure compliance with PO2, PO3 and PO4 of 9.4.9 Stormwater Code of the Planning Scheme.

- 7.3.2. The proposed dwelling and building pad will alter the existing characteristics of the stormwater drainage through the subject lot. I have depicted the proposed dwelling on the diagram in paragraph 1.3 above and repeated as follows. The discharge is affected by the proposed dwelling and pad which will act as a barrier to flow. Flow will have to traverse to the left of the proposed dwelling. This will concentrate the flow that discharges into Lot 1 RP117157 which is not permitted to ensure compliance with PO2, PO3 and PO4.



- 7.3.3. The adjoining lots 97, 98 and 99 slope towards the northwest and hence the relevant upstream portions of these lots discharge into the subject lot. This discharge is considered in the following section of this report on off-site drainage.

### My Comments and Disagreement with the Application

- 7.4. I disagree with aspects of the development application material as follows.
- 7.5. The text on page 7 below the Surveyors Contours states that it is proposed not to “interfere with the natural and existing flow of stormwater”. However, as I have explained, the proposed dwelling and building pad will alter the existing characteristics of the stormwater drainage through the subject lot.

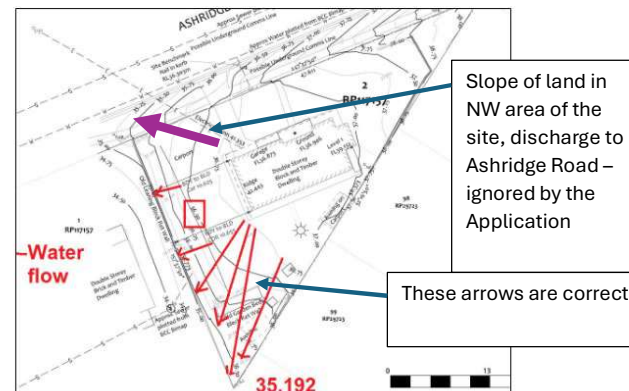


- 7.6. The stormwater flow characteristics of the subject site will be altered by the a new dwelling and cause a concentration of flow into the adjacent Lot 1 to the west. The application states that the current flow will not be interfered with, but this is incorrect.
- 7.7. The conclusions stated in page 6 by the Applicant in the Assessment Report by the Applicant titled “Town Planning Application” are incorrect as follows.
- 7.7.1.1. The arrows depict that all stormwater from the subject lot discharges into the adjacent lot to the south (Lot 1) including flow from the northern side of the subject lot. This is incorrect as follows.

7.7.1.1.1. The contours on the plan in paragraph 1.2 above show that the ground in the northwest part of the subject site falls to Ashridge Road and hence stormwater on this part of the subject lot will discharge to the road reserve.

7.7.1.1.2. The survey plan titled "2) Surveyor's contours" by the Applicant on Page 7 of the Assessment Report by the Applicant titled "Town Planning Application" shows the contours (that agree with the contours in Brismaps 2019 that I have used) and the fall of the land towards Ashridge Road. I have marked this plan as follows.

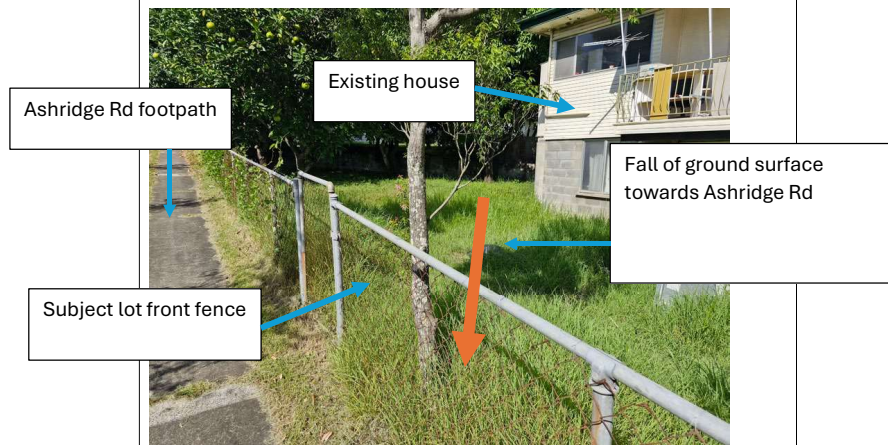
2) Surveyor's contours.



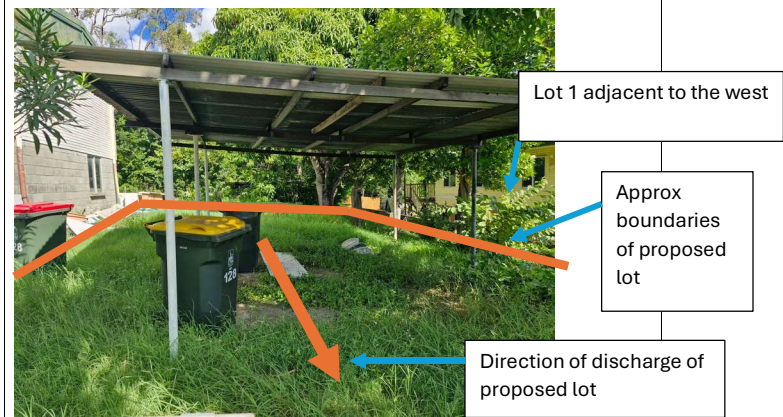
7.7.1.1.3. The fall of the land in the northwest corner of the subject site towards Ashridge Road, shown on this plan, has been ignored by these red arrows on this diagram.

7.7.1.1.4. I took the photos below which shows the existing lot surface falling towards Ashridge Road in the northwest area of the subject lot including a substantial portion of the proposed new lot.

View of northwest corner of the site



View from Ashridge Road of the location of the proposed new lot



7.7.1.2. Even if the existing discharge from all of Lot 2 was into Lot 1 as shown on the Applicants above two plans (with which I disagree), then the development would trigger the requirement to prevent worsening or change of flow into Lot 1 in accordance with PO2, PO3 and PO4 of 9.4.9 Stormwater Code of the Planning Scheme.

**My Comments and Disagreement with the Report of Civil Works Engineers**

7.8. The relevant conclusions of the Civil Works Engineers report were as follows.

7.8.1. All of Lot 2 (the subject lot) naturally drains towards Lot 1<sup>5</sup>.

7.8.2. The topography of the subject lot prevents stormwater being able to naturally flow towards Ashridge Road<sup>6</sup>.

7.9. I disagree with both of these conclusions by Civil Works Engineers.

7.10. My reasons are set out below.

7.10.1. Whilst I agree that the existing topography allows some discharge from the subject lot to Lot 1, the proposed development will change this flow and cause concentration of discharge. As stated above, the new dwelling will act as a barrier across a substantial existing width of the flow path towards Lot 1.

7.10.2. This result would not comply with PO2 of 9.4.9 Stormwater Code of the Planning Scheme.

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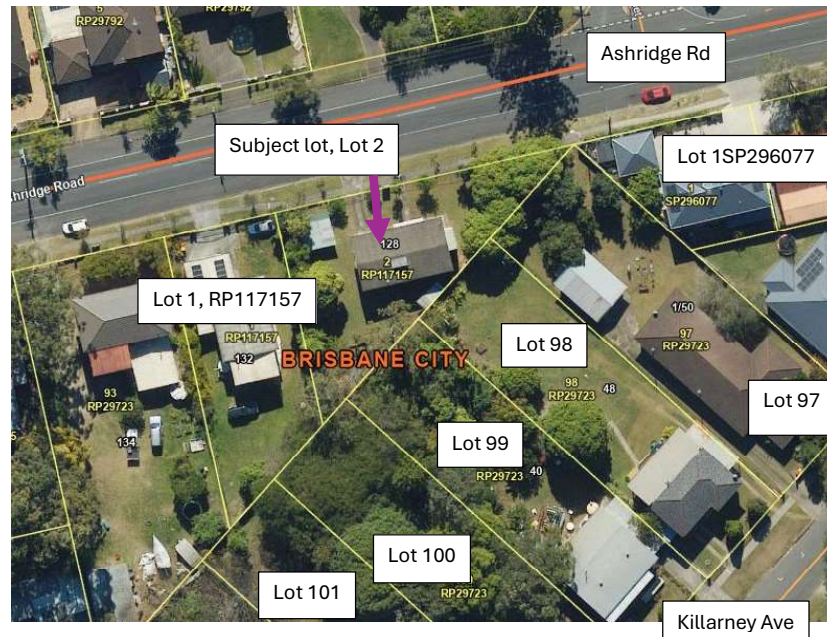
<sup>5</sup> First paragraph page 2

<sup>6</sup> First paragraph, Section 3, page 2

- 7.10.3. I disagree with the statement that the topography along the western side of Lot 2 prevents stormwater runoff to be conveyed naturally and freely to Ashridge Road. The contour plan (paragraph 1.2 above) shows that the northern part of the western boundary of Lot 2 does have topography that causes stormwater to flow into the Lot and away from Ashridge Road. However, the southern part of the western boundary has topography that allows natural stormwater flow from Lot 2 towards Ashridge Road. I also observed this topography when I walked past the site and took photos. The contours show topography that allows a substantial portion of Lot 2 to drain naturally to Ashridge Road. Where Civil Works Engineers states that "all of Lot 2" discharges to Lot 1, this is incorrect.
- 7.10.4. Even if the existing discharge from all of Lot 2 was into Lot 1 (with which I disagree), then the development would trigger the requirement to prevent worsening or change of flow into Lot 1 to ensure compliance with PO2, PO3 and PO4 of 9.4.9 Stormwater Code of the Planning Scheme. The solution would be to create discharge to Ashridge Road.

## 8. UPSLOPE DRAINAGE REQUIREMENTS

- 8.1. In my experience, a stormwater master plan which includes an assessment of upstream and on-site catchments along with calculations and design is carried out (by the Applicant) and submitted as part of the DA application.
- 8.2. An approved DA is then on the record and can be addressed at the time of detailed design as part of the building works permit. An approved DA is placed on the file for the subject property and is accessible to a future developer of the upstream lots.
- 8.3. The development triggers the requirement under City Plan 2014 to consider and cater for discharge from upstream lots. The application material states that there is no discharge from upstream lots to the subject land. This is incorrect.
- 8.4. I have set out an approximate analysis of the upstream catchments and assumptions for stormwater flow in **Attachment C**. I note that the planning zone is Low Medium Density Residential (Up to 3 Storeys) and I have adopted the report on town planning by Keiran Ryan of Reel Planning for potential upstream development.
- 8.5. The view below depicts the relevant lots upstream.



- 8.6. I obtained the current land surface contours from the 2019 Brismaps and I denoted the stormwater catchments that are upstream of the subject lot, as follows. I labelled the catchments A, B, C (which partly discharge towards the subject lot) and D and E which do not. Details of the catchments are set out in **Attachment C**.



- 8.7. Part of 1SP296017, part of 1RP230117, part of 97RP29723, part of 98 RP29723, part of 99 RP29723 and a small part of 100 RP29723 discharge towards the subject lot.
- 8.7.1. The stormwater discharge connection to Lot 99 will service a catchment which consists of a small part of Lot 99, a larger portion of Lot 98, a large part of Lot 97 and a small part of Lot 1 RP230117.
- 8.7.2. The stormwater discharge connection to Lot 98 will service a catchment which consists of a small part of Lot 98 and a very small part of Lot 97.
- 8.7.3. In my opinion, a drainage point to Lot 97 is also required. It was omitted by the Council Conditions, and in my opinion, this was an oversight by the Respondent. The stormwater discharge connection to Lot 97 will discharge a catchment which consists of part of Lots 97 and 1 SP296077.

- 8.7.4. Catchments D and E discharge to Lot 100 RP29723 and do not affect the subject lot.
- 8.8. To ensure compliance with PO2, PO4 and 7.6.5 of PSP Infrastructure Design, upstream connections to Lots 97, 98 and 99 must be provided.
- 8.9. The proposed development anticipates a new earthworks pad, and a new dwelling located on the pad. This dwelling and pad will alter the existing characteristics of the stormwater drainage through the subject lot. I have depicted the proposed dwelling on the diagram above and the discharge of Catchment B is affected by the proposed dwelling. Namely, discharge flow will have to traverse to the south of the proposed dwelling. Unless re-directed, this will concentrate the flow that discharges into Lot 1 RP117157.
- 8.10. I consider that condition 18 is an appropriate response to the City Plan provisions above in paragraph 8.8 because it provides for the connection required for the future development of the upstream lots.
- 8.11. I consider that condition 7 is an appropriate response to these City Plan provisions because it registers the infrastructure and enables access to the pipes that service the upstream stormwater connections.

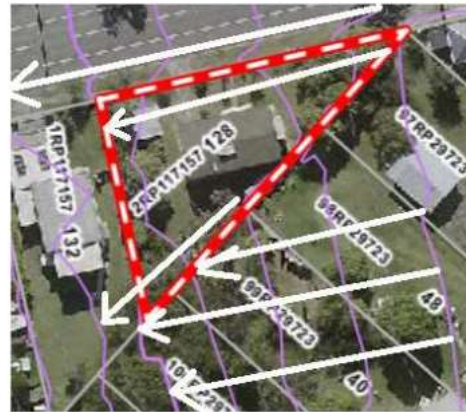
**My Comments and Disagreement with the Application**

- 8.12. I disagree with aspects of the application material as follows. These comments should be read with my comments in paragraph 8.9 above in relation to the flow toward Lot 1.
- 8.12.1. The existing slope of the adjacent lots to the southeast causes their discharge of stormwater to the subject lot. The stormwater flow characteristics of the subject site will be altered by the proposed development and cause a concentration of flow into the adjacent Lot 1 to the west. The application states that the current flow will not be interfered with, but this is incorrect.
- 8.12.2. The conclusions stated in page 6 by the Applicant in the Assessment Report by the Applicant titled "Town Planning Application" (also included above in paragraph 5.3) are incorrect as follows.

8.12.2.1. The plan on page 6 (excerpt below) shows stormwater from Lots 98 and 99 discharging towards the subject lot. However, the stated conclusion by the Applicant (in the text above the plan) is that the contours show flow to the “left” of the subject property and concludes that “there are no “Upstream” neighbours to the subject development”. This is incorrect as follows.

**Brisbane City Council Contours 2002.**

1) Contours 2002 show flow of rainwater in rear neighbours land falling downstream from on neighbour to the other rear neighbour, left of each other, rather than to the subject property. Therefore there are no “Upstream” neighbours to the subject development.



8.12.2.1.1. The discharge from Lot 97 has been ignored (the contours show that Lot 97 slopes towards the subject lot).

8.12.2.1.2. Discharge from the western triangular areas of Lots 98,99 and 100 flows into the subject lot and not south of it. The arrows on Lots 98, 99 and 100 are correct but the text above the plan contradicts these arrows.

8.12.3. The text on page 7 below the Surveyors Contours states that it is proposed not to "interfere with the natural and existing flow of stormwater". However, the proposed dwelling and building pad will alter the existing characteristics of the stormwater drainage through the subject lot thus causing interference with the natural and existing flow of stormwater. I have depicted the proposed dwelling on the diagram in paragraph 1.2 above and repeated as follows. The discharge is affected by the proposed dwelling and pad which will act as a barrier to flow. Flow will have to traverse to the left of the proposed dwelling. This will concentrate the flow that discharges into Lot 1 RP117157 which is not permitted.



### **My Comments and Disagreement with the Report of Civil Works Engineers**

- 8.13. I disagree with the conclusion by Civil Works Engineers (set out in paragraph 5.11 above), that pipes to convey the discharge from Lots 98 and 99 are not necessary and an “upstream stormwater connection would serve no practical function”.
- 8.14. My reasons are set out below.
- 8.14.1. As I set out above in paragraph 8.12.3, whilst I agree that the existing topography allows discharge from the subject lot, as well as discharge from Lot 98 and 99, to flow into Lot 1 RP117157 (“Lot 1”), the proposed development will change this flow and cause concentration of discharge.. The development in the future of Lots 98 and 99 will cause increased flows into the subject lot and unless conveyed in pipework, will cause an increased discharge to Lot 1. That approach is consistent with City Plan 2014 Schedule 6 PSP – Infrastructure Design, Chapter 7 Stormwater Drainage 7.6.5
- 8.14.2. Where Civil Works Engineers states that “stormwater runoff does not accumulate on the subject site and readily flows onto Lot 1 RP117157” and this is an apparent criterion for it being acceptable for no pipework, I disagree. Whether water accumulates or flows readily to an adjacent site is not a criterion for eliminating pipework. The opposite is true – where stormwater readily flows to an adjacent site and a development itself or an upstream development will cause a change of flow, then it is imperative that there is infrastructure provided to cater for the change of flow.
- 8.14.3. Civil Works Engineers has not included the discharge from Lot 97 – for both the existing situation and after future development. I note that Council Conditions did not include Lot 97, and, in my opinion, this is an oversight. In any event, a RPEQ who was considering stormwater management of the subject site would be professionally required to consider Lot 97.

## 9. CONCEPT DESIGN FOR UPSTREAM DRAINAGE

### Usual Design Process for a DA

- 9.1. In my experience, at the time of applying for a Development Approval, it is expected that an Applicant will provide sufficient design detail for the proposed stormwater system to demonstrate that there is a satisfactory solution but not necessarily depict details that will be designed later at the time of a building permit (for a building project) or at operational works approval (for a civil engineering project). In my experience, stormwater modelling, usually using software computer models, is common as part of the DA application along with plans that demonstrate levels.

### Objectives of the Stormwater Design

- 9.2. The objectives to be achieved by the design are as follows.
- 9.2.1. Drainage of the development within the subject lot with discharge to the Ashridge Road kerb. This requirement is discussed above in paragraph 6.7.1.
  - 9.2.2. Drainage connections to upstream lots 97, 98 and 99 that will cater for future development of these upstream lots. This requirement is discussed above in paragraphs 4.7.3.
  - 9.2.3. Drainage to the southwestern corner area of the subject lot (to the rear of the proposed new dwelling). This area is a low point and as discussed above in paragraph 4.7.2, the proposed new dwelling on the subject lot will cause concentration of stormwater at this location. Unless captured and conveyed, this stormwater will cause concentration of flow onto Lot 1 RP117157.
- 9.3. Two possible options to achieve the above are set out in **Attachment D**. Other options are possible. Each of my two options can be fine-tuned. The two options shown by me in **Attachment D** are both possible. The purpose of my calculations and diagrams in **Attachment D** is to demonstrate these possible options that satisfy the objectives.

### Stormwater catchments

- 9.4. In the absence of analysis of upstream catchments by the Applicant, I devised indicative catchments for the subject lot and upstream lots as set out in paragraph 8.6 above. I considered potential upstream development and adopted the town planning report of Keiran Ryan of Reel Planning at sections 5.9 – 5.11.
- 9.5. The existing lots upstream have a size of 1,012m<sup>2</sup> and it is likely that a rear lot is created with a townhouse located on the new lot. Hence, a development upstream would consist of each existing lot (relevantly Lots 97,98 and 99) containing two townhouses or the existing house plus a townhouse.
- 9.6. Noting PO2 above, the conveyance of stormwater through the subject lot would follow the drainage characteristics of the upstream catchment. In my experience, this means that there cannot be a redirection of rainwater from an upstream development where the existing catchment shapes and areas are substantially altered. Hence the roof drainage downpipes should generally comply with the existing catchment boundaries. In practice, this is generally what occurs when the roof is designed. The effect of this is that a part area only of the roof of a future townhouse is assumed to be located in each catchment. Namely, the portion of the roof that is located in the current undeveloped catchment discharges to that same catchment because the future design locates the downpipes accordingly.

Hence Catchment A will include one future townhouse roof (on Lot 97) plus land surrounding the townhouse. Catchment B will include half a townhouse roof and a small amount of surrounding land on Lot 98. Catchment C will include the existing house on Lot 97, a townhouse on Lot 98 and half a townhouse on Lot 99.

Catchments D and E do not affect the subject lot if the existing drainage characteristics of the upstream catchment are generally maintained.

### Two Options for Stormwater Drainage

- 9.7. I used the Rational Method to estimate stormwater flows. I set out stormwater design principles and assumptions for the calculations in this method in **Attachment C**. I note that my assumptions for parameters for stormwater calculations are the same as set out in the report by Civil Works Engineers. I provide a table of calculations of catchment size and pipe flows in **Attachment D**.

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- 9.9.1. Pipe drainage with connections to the upstream lots, connections to the existing and proposed dwelling on the subject lot and field gully inlets to allow drainage of the low point in the southwest corner of the existing lot. This option assumes detention tanks for each roof of the subject lot as well as future roofs on upstream lots. This assumption of detention tanks reduces the total discharge at the kerb to below 30L/s to comply with 7.6.3.1 of City Plan 2014 Schedule 6 PSP – Infrastructure Design, Chapter 7 Stormwater Drainage.
- 9.9.2. A second option is to not make use of detention tanks and provide two separate pipe systems and two discharges to the kerb, as also shown in **Attachment D**. Each discharge would be less than the 30L/s requirement.

#### **Comments on Pipe Drainage by Civil Works Engineers**

- 9.10. Civil Works Engineers appear to have concluded that the marked-up plan SK01 was not feasible and then did not consider any amendments to the markup that would allow a workable design solution. It appears to me that Civil Works Engineers and the Applicant have adopted a literal response to the markup by the Respondent on SK01. In my experience, a literal interpretation is not necessarily required to satisfy Council conditions. I disagree with the latter approach by Civil Works Engineers.
- 9.11. My design option in **Attachment D** does vary from SK01 that was supplied by the Respondent. And the amendments I suggest to the marked-up plan that should have been considered by Civil Works Engineers, are as follows.
- 9.11.1. In Section 4 of the report by Civil Works Engineers, a long section of the suggested Respondent pipe route is depicted as Diagram 2. I do not disagree with the levels shown by Civil Works Engineers. However, the route of the pipe is the long way around the perimeter of the site and this route suffers two problems: -
- 9.11.1.1. A longer pipe has a greater fall and greater depth than a shorter route. In the case of the long route, the depth of the pipe becomes too deep to discharge to the Ashridge Road kerb (as correctly identified by Civil Works Engineers).

9.11.1.2. The southwest corner of the subject site is a particularly low area of ground surface level, and the perimeter pipe route traverses this low area – resulting in the need for a particularly low pipe invert level and/or insufficient ground cover to the pipe.

9.11.2. I have adopted a shorter pipe route (as shown in **Attachment D**) where the pipe that conveys discharge from Lots 97,98 and 99 is located between the existing house and the proposed dwelling. I depict a stub pipe to drain the southwest corner of the site where the design includes some earth filling to achieve the necessary pipe cover (to Pits 6 and 7). This stub pipe is optional and could be deleted if the ground surface level in the southwest corner was raised and a satisfactory overland flow to Ashridge Road was provided (a surface drain along a footpath for example).

The design assumptions that I made, described in the previous paragraph, are common solutions to stormwater design – namely to choose as short a pipe route as possible in order to minimise pipe depth; and if necessary where a pipe traverses a low area of surface level, to place earth fill to locally increase the surface level and achieve the necessary pipe cover. In my experience, a civil engineer that is considering stormwater design, encounters these design issues frequently.


9.11.3. Civil Works Engineers then depicted Diagram 3 where correct ground cover was assumed and the conclusion made that the discharge level of the pipe accordingly would be lower than the kerb level in Ashridge Road. As stated above, I don't disagree with the levels shown by Civil Works Engineers. However, in my experience, a stormwater designing civil engineer would move to a design such as in my **Attachment D** which does achieve the necessary levels.

- 9.11.4. Civil Works Engineers goes on in the report to calculate storm discharge flows from Lots 98 and 99. I do not disagree with the input parameters of the calculation (set out by Civil Works Engineers below Table 1 on page 4 of the Civil Works Report). I do not disagree with the requirement that each kerb outlet must be limited to 30L/s discharge. However, Civil Works Engineers has not included Lot 97 (as discussed above). Also, it appears that Civil Works Engineers has assumed the whole of a lot and has not considered the portion of each upstream lot and roof that will discharge into a drainage stub from Lot 2, according to upstream catchment boundaries. I have undertaken a rudimentary analysis of upstream catchment boundaries (in **Attachment C**) but as stated above, in my experience, it is usual for a DA application to include sufficient modelling of catchments and analysis of future development to demonstrate a suitable design.
- 9.11.5. Civil Works Engineers states in Section 7 the difficulty of imposing stormwater detention requirements onto future upstream developments. I disagree and, in my experience, as described by me in paragraph 6.8 above, the design assumptions for a downstream development become part of the Development Approval for that downstream site. Subsequently, the developer of an upstream site can obtain those design assumptions and design the upstream site stormwater system accordingly. The planning scheme outlines this (as described in paragraph 6.8) and in my experience, it is a common procedure.
- 9.11.6. Where Civil Works Engineers states that Council guidelines for ROL applications are not required to provide on site detention, in my opinion this applies to underground detention tanks and detention devices that are more elaborate than single lot above ground detention tanks. My suggested solution assumes the latter only.

## 10. EXPERTS STATEMENT

- 10.1. I, the undersigned, hereby acknowledge that I have been instructed on an expert's duty in accordance with Rule 428 of the *Uniform Civil Procedure Rules 1999* (Qld).
- 10.2. I confirm that:
- 10.2.1. I have read, and agree to be bound by, the code of conduct; and
  - 10.2.2. the factual matters stated in my report are, to the best of my knowledge, true and correct; and
  - 10.2.3. I have completed all inquiries I consider appropriate in formulating my conclusions; and
  - 10.2.4. the opinions stated in my report are genuinely held by me; and
  - 10.2.5. my report contains reference to all matters that I consider significant with respect to engineering and construction issues that I have been requested to consider; and
  - 10.2.6. I understand my duty to the Court, and I have complied with that duty.

Signed


<b>Andrew Corrigan</b> BE, CPEng, MIEAust, RPEQ 1897, MICE, MASCE, MIPWEA, Licensed Builder Qld (QBCC), MW

**Attachment**

<b>A</b>	<b>My CV</b>
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I am a Director of Gould Development Solutions Pty Ltd and a part time sessional Tribunal Member of the Queensland Civil and Administrative Tribunal (QCAT). My previous roles were: -

- January 2014 to June 2015 – engineering and building expert at Everything Infrastructure Services, a consultancy for projects and transactions
- 2003 – 2015 - Executive Director and Commercial Manager at Northbuild Construction Pty Ltd, a Qld based "second tier" commercial building contractor
- 1998 – 2003 - managing director of my own commercial building contracting company until merging with Northbuild
- 1985 - 1998 - Project Manager and Construction Manager in Brisbane and Cairns with a national commercial construction company (both building and civil engineering) and a regional commercial building and civil engineering construction contractor.
- 1982 – 1985 – Project Manager and Site Engineer – national civil engineering contractor
- 1976 – 1982 - design civil and structural engineer with an Australian/international consulting engineering firms in Canberra, PNG, Indonesia, Saudi Arabia, UK and Hong Kong.

I am a professionally qualified engineer and hold a Bachelor of Engineering. I am a Registered Professional Engineer in Queensland (#1897). I am a chartered engineer with the Institution of Civil Engineers (UK) and the American Society of Civil Engineers. I am a member of the Institute of Public Works Engineering. I hold both a Contractor License and a Supervisor License in the class "Builder – Open" with the Qld Building and Construction Commission. I have experience in civil engineering, structural engineering and commercial building construction in both design and construction management.

#### **Qualifications**

- Bachelor of Engineering, Sydney University 1977

#### **Professional Affiliations**

- Member, Institution of Engineers, Australia
- Registered Professional Engineer, Queensland (RPEQ 01897)
- Member, Institute of Public Works Engineering Australasia, Queensland (IPWEAQ)
- Member, Institute of Civil Engineers, UK
- Member, American Society of Civil Engineers
- Master of Wine, Institute of Masters of Wine, UK
- Licensed Building Contractor, QBCC

#### **Professional Address**

My experience in Australia extends across the design and construction of civil engineering, structures and building projects of small, medium and major size. I have more than 15 years' experience as a director of construction contracting companies. I have experience at managing the delivery and stakeholders in complex projects particularly infrastructure, hospital, education, airports and emergency services, with Local, State and Federal Government Authorities and Agencies. I have been involved in the construction of major projects for the Queensland State Government. These projects have required the co-ordination and management of a large number of stakeholders and subcontractors across a broad range of disciplines. I have experience at design and also construction of roads and bridges to Qld TMR standards along with subdivisions for both residential and industrial development. My project experience includes civil engineering construction of roads and bridges, drainage, subdivisions, bridges and infrastructure; city high-rise buildings, large industrial buildings,

multi-residential, aged care, retail, educational, hospital and tourism developments such as airport terminals, hotels and food/drink outlets.

I have acted as an expert witness for a number of construction disputes before QCAT, The P&E Court, the Land Court and the Supreme Court of Queensland as well as arbitrations and alternative dispute resolution processes. I am now a part time sessional Tribunal member of QCAT. I have experience in expert witness reports across a range of projects including land resumptions, planning and development approval disputes, heritage buildings and structures, land subdivision planning, design and construction disputes and building disputes. I act regularly as an expert for Queensland local authorities including Brisbane City, Gold Coast, Moreton Bay, Sunshine Coast, Noosa, Toowoomba, Somerset and other Councils for planning, civil engineering and building disputes. I have acted as a mediator and arbitrator on building disputes for the QBSA (forerunner of the QBCC).

In both commercial and government agencies I have held board and advisory positions, such as the Advisory Board for the Master of Business Administration at the Business Faculty at QUT.

### **Engineering and Construction Experience**

Expert Witness and Report Services: -

- Disputes amongst apartment owners, the body corporate and in some cases the QBCC, developer, builder and designers for building defects and repairs, alterations and additions to multi-residential properties; experience at body corporate legal matters.
- Investigations and reporting on alleged non-conformance of engineering design, superintending and construction as-delivered for land subdivisions – Roma, Brisbane, Ipswich and Cooroy; and buildings and structures
- Reviews of development approval conditions for building projects in several local authorities; including matters in dispute. Projects in Douglas Shire, Mackay, Townsville, Brisbane, Lockyer Valley, Gold Coast, Moreton Bay Regional, Redland City Council, Sunshine Coast, Longreach, Biloela, Rockhampton
- Specialist advice about Lawful Point of Discharge of stormwater and proposed developments
- Dispute over development approvals for quarry developments – Sunshine Coast Regional Council, Brisbane City Council, Gold Coast City Council
- Investigations into major road design including pavement and subgrade assessments for Sunshine Coast and other regions including a dispute over compensation for major haulage of mining ore on a State Highway near Mt Isa involving highway pavement modelling.
- Dispute over planning approvals, Local Govt Infrastructure Plans, Priority Infrastructure Plans and Infrastructure Contributions and the cost of infrastructure for developments in Brisbane, Sunshine Coast, Moreton Bay. Townsville and others.
- Disputes over illegal land filling Brisbane, Gold Coast that affected flooding
- Compensation for land resumption for major state-controlled road; Townsville, Gin Gin, Rockhampton, Ipswich Motorway, Bli Bli
- Review of construction effect on existing sewer infrastructure, including sewer rehabilitation, Gold Coast
- Dispute over structural failure of existing buildings – heritage buildings Ipswich, new industrial buildings in Brisbane, multi-level apartment developments at Kangaroo Point and Greenslopes, Rockhampton, Coolangatta, New Farm
- Examination of comparisons of construction methods and costs for high rise buildings in Brisbane for several disputes by owners with Valuer-General valuations

- Examination of development application where development affects existing heritage buildings and infrastructure (historic houses, warehouses and ex-public buildings, Cairncross Drydock, Bulimba)– structural assessments and cost estimation to make structurally sound.
- Review of disciplinary complaints against registered engineers for the BPEQ
- Assessment of damage and cost of repair of collisions of heavy vehicles and highway bridges and truck explosions and various forms of damage to highway bridges
- Specialised advice on complex delay effects on projects underway in construction including effects of latent conditions; delay cost advice to insurers

Construction Management: -

- Consultancy to a second-tier building contractor on completion of several high-rise residential projects in West End, Brisbane and Gladstone
- Consultancy to contractors on defects and satisfying QBCC directions
- Cost Estimator and Tender Bid Manager on civil engineering and building projects including PPP and Managing Contractor projects
- Consultancy to a major civil engineering contractor on contract management of large Qld main roads contracts including contract finalisation

Project Director/Manager for construction contracting delivery: -

- Thursday Island Hospital Chronic Disease Centre 2013 (\$26 M)
- Helensvale Community Centre Library and Performing Arts 2013 (\$14 M)
- "Chelsea" Apartments for Metro, Bowen Hills, Design+Construct 2012 (\$55 M)
- Redevelopment of Bundaberg Hospital, 2007 – 2013 (\$45 M), Design+Construct Managing Contractor
- Bid manager – building works – SEQld Schools PPP 2009 (\$200 M)
- Several D+C contracts for Education Qld high school delivery incl Meridan State College, Mango Hill SHS, Burpengary SHS
- "Harmony" Apartments, Runaway Bay 2009 (\$50 M)
- Defence contracts – building and civil engineering works at Shoalwater Bay, Wide Bay (training facilities NTARIP Package 6), Amberley hangar extension, Canungra buildings
- QR Station Redevelopments – Park Rd Annerley, Kingston, Virginia, Geebung, Bald Hills 1999 – 2003 including new bridges, passenger lifts and facilities.
- Woodridge Shopping and Medical Centre 2002, Farrington Grove Aged Care, Mitchelton, Brisbane, Development
- D&C Radisson Royal Palms Resort (now "QT Resort"), Port Douglas
- Radisson Plaza Hotel, Cairns (now Shangri-La)
- Cairns International Airport Terminal (including air side services and air bridges) as well as extensive building services, and tasks such as liaison with authorities
- Cairns Railway Workshop building.
- Dept of Forestry Technical Services Building, Indooroopilly
- McDonalds Restaurant George St
- QUT Law School
- Central Plaza II.
- Representative of Concrete Constructions Pty Ltd on board of Henry and Walker Contracting, Northern Territory. Provided management advice and training in area of project cost control and reporting to Henry and Walker

- Esk-Kilcoy Main Road including Somerset Dam Bridge, part of Wivenhoe Dam project; Curragh Qld Mines Road-Rail Access, Blackwater including road/rail bridges; various Bruce Highway augmentations as part of Bicentennial Roads Programme including bridges for TMR at Tully, Mackay and Babinda; Jackson-Moonie Oil Pipeline – section from St George to Moonie

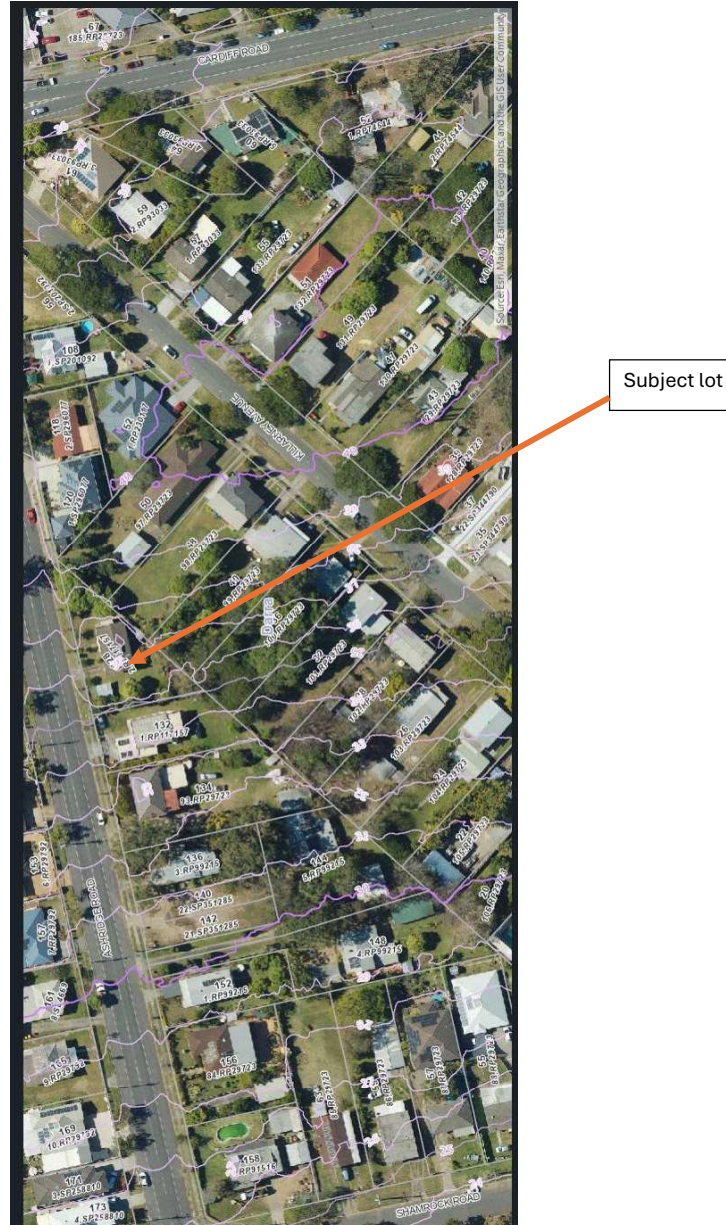
Civil and Structural Engineering design: -

- Design Civil Engineer, Design Team Leader – Jubail City - Riyadh, Saudi Arabia; London, UK
- Canberra – design of neighbourhood subdivisions in Tuggeranong, drainage works Belconnen and Canberra City, new design Wentworth Avenue Kingston, new post tensioned dual carriageway bridge Kingsford-Smith Drive, Melba over Ginninderra Creek, new long span pedestrian and cycle bridge Ginninderra Town Centre.
- Port Moresby – design of augmentations to Port Moresby Water Treatment Plant at Mt Eriama, Port Moresby Water Reticulation Study; design of Goroka Sewerage Reticulation, various small water supply and sewerage projects in regional villages including Maprik, Vanimo, Tufi, Kavieng and others
- Commercial Manager, Northbuild – oversaw design management as part of Design+Construct contracts

**Attachment**

<b>B</b>	<b>Brismap 2019 Contours</b>
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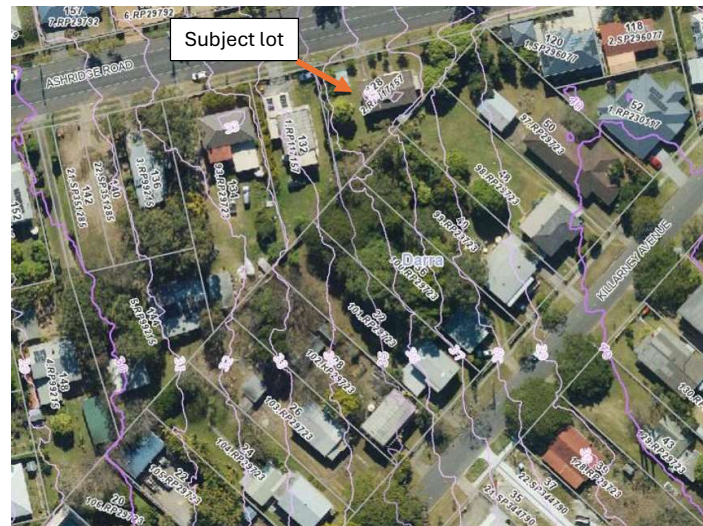
Attachment B Contours from Contours taken from 2019 Brismaps.



**Attachment**

<b>C</b>	<b>Stormwater Catchments</b>
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Area contour plan Contours taken from 2019 Brismaps.



## Upstream Catchments



Catchment Boundaries



Direction of Discharge



Catchment	Lots included in catchment	Natural/undeveloped land discharge direction of catchment	Area of Total Catchment (ha)	Area within subject lot (ha)	Area of catchment Upstream of Subject Lot (ha)
A	1SP296077(part), Lot 2 Subject Lot(part), Lot 98(small part), Lot 97(part)	Across corner of Lot 1RP117157 to Ashridge Rd and directly to Ashridge Road	0.092	0.034	0.058

Catchment	Lots included in catchment	Natural/undeveloped land discharge direction of catchment	Area of Total Catchment (ha)	Area within subject lot (ha)	Area of catchment Upstream of Subject Lot (ha)
B	Lot 2 Subject Lot(part), Lots 97, 98 (part)	Into Lot 1RP117157	0.046	0.030	0.016
C	Lot 2 Subject Lot(part), Lots 97, 98, 99 (part), 1RP230117	Into Lot 1RP117157	0.110	0.008	0.102
D	Lots 97, 98, 99 (part)	Into Lot 100	0.074	Nil	Nil
E	Lots 98, 99 (part)	Into Lot 100	0.056	Nil	Nil

### Stormwater design assumptions

- Level II drainage as per QUDM Section 7.13.2, namely pipe system to convey the greater of 5% AEP (1/20) roof discharge or 39% AEP (1/2) discharge of the roof plus allotment.
- Worst case upstream development assumed to be two townhouses per lot, each 180m<sup>2</sup>, the townhouse towards Killarney Ave to discharge to Killarney Ave, the rear townhouse to discharge towards the subject lot.
- Discharge from upstream lot to be the worst of 5% AEP 180m<sup>2</sup> roof or 39% AEP of 180m<sup>2</sup> roof plus 440m<sup>2</sup> of allotment (namely the portion of the allotment from the rear of the Killarney townhouse to the rear of the lot, 620m<sup>2</sup> less the townhouse itself)
- Coefficient of discharge  $f_i=0.7$  (worst case = town house development upstream), as per QUDM Section 4.5
- Time of Concentration 5 minutes (as per QUDM Section 4.6.2)
- Rainfall intensity 248mm/hr (5% AEP) or 151mm/hr (39% AEP) – from BCC City Plan 2014 Schedule 6 PSP – Infrastructure Design, Chapter 7 Stormwater Drainage, Table &.2.2.2.A
- Minimum pipe size 225mm (Table 7.2.3A)
- Roof drainage detention systems adopted as per QUDM Table 7.13.6, for first option in Attachment D (to limit discharge to the kerb to below 30 L/s in accordance with,

Calculation of storm discharge for various options

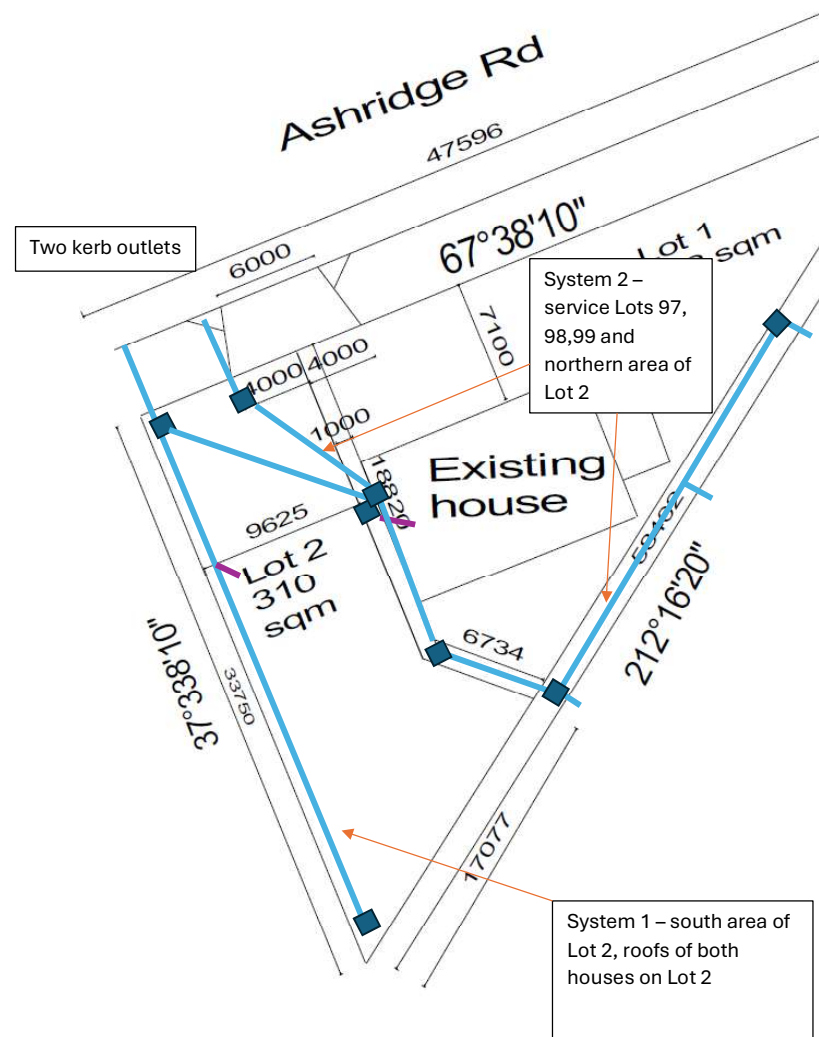
Storm discharge (m3/s) for catchment options			
Catchment Description	A	B	C
Upstream catchment AEP 5% discharge from townhouse roof 180m2	180m2 one townhouse (0.018ha), assume house roof on 1SP296077 discharges to Ashridge Rd via pipes	180m2 half of townhouse (0.009ha)	1.5 x 180m2 (0.027ha)+Main house (part) and shed Lot 97 = 166m2 Total roof 0.044ha
Upstream catchment AEP 39% discharge	0.056ha	0.016ha	0.102ha
Total Catchment AEP 5% discharge from upstream townhouse roof 180m2 plus roofs on subject lot namely 115m2 proposed roof and 143m2 existing house	One townhouse plus half existing house on subject lot 180m2+71m2=251m2	Half a townhouse, half existing house, all of proposed house on subject lot 90m2+71m2+115m2 = 276m2	Same as above 0.044ha
Total Catchment AEP 39% discharge from upstream townhouse roof 180m2 plus proposed roof on subject lot 115m2 plus 143m2 existing house plus 440m2 upstream allotment plus area of subject lot	0.090ha	0.045ha	0.110

**Attachment**

<b>D</b>	<b>Options for Stormwater Infrastructure</b>
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Option for less detention (and two kerb discharge locations to limit kerb discharge as per Chapter 7, 7.6.3.1(1)))



Ashridge Road Darra - Stormwater Discharge

Worst Case	Catchment													
	Coefficient	Rainfall intensity (mm/hr)	Roof area	Lot area	Q(m3/s)	Q(L/s)	Roof area	Lot area	Q(m3/s)	Q(L/s)	Roof area	Lot area	Q(m3/s)	Q(L/s)
AEP5% from roof upstream	0.7	248	0.018		0.0087	9	0.009		0.004	4.3	0.044		0.02	21
AEP39% from roof and allotment upstream	0.7	151		0.056	0.016	16		0.016	0.005	4.7		0.102	0.03	30
AEP 5% from upstream and subject lot roofs	0.7	248	0.0251		0.012	12	0.0276		0.013	13.3	0.044		0.02	21
AEP39% from roof and allotment upstream plus subject lot	0.7	151		0.09	0.026	26		0.045	0.013	13.2		0.11	0.03	32
Lot area within Lot 2	0.7	151		0.034	0.010	10		0.03	0.009	8.8		0.008	0.002	2
Roof area within Lot 2	0.7	248	0.0071		0.003	3	0.0186		0.009	9.0	0		0.000	

Pipes Design

Upstream pit				Downstream pit				Length	Grade	Pipe capacity (L/s)	Inflow (L/s)	Pipe flow (l/s)	Inflow (L/s)	Pipe flow (l/s)
Pit	IL	SL	Depth	Pit	IL	SL	Depth		%	225mm	No roof detention		With roof detention	
Stub Lot 97	36.625	37.3	0.675	Stub Lot 98	36.3	37.0	0.675	20	1.5	65	16	16	7	7
Stub Lot 98	36.325	37.0	0.675	Stub Lot 99	35.39	36.0	0.61	20	4.7	110	4.7	21	0.4	7
Stub Lot 99	35.39	36.0	0.6	4	35.36	36.0	0.64	6	0.5	38	30	51	9	16
4	35.36	36.0	0.6	5	35.31	36.5	1.20	11	0.5	38	8.8	60	8.8	25
5	35.305	36.5	1.195	6	35.1	35.8	0.67	12	1.5	65	12.4	72	0	25
6	35.125	35.8	0.675	Kerb	35.05			6	1.3	59	10	75	10	28
7	35.475	36.15	0.675	6	35.1	35.8	0.675	32	1.1	55	2	2	2	2