Stellen
Civil and Structural Engineering

30 November 2021

Glenn Piper
Harbord Hotel Holdings Pty Ltd
29 Moore Rd
Freshwater NSW 2096

c/o Wade@hothousestudio.com

Stormwater and Overland Flow Control for Proposed Change of Use at 29 Moore Road Freshwater

Introduction

For the proposed Harbord Beach Hotel change of use, Stellen Consulting was engaged to:

- Assess the existing stormwater and overland flow conditions
- Review options for addressing the existing stormwater pipe and overland flow to make the site suitable for the Change of Use

This report outlines the existing situation and the results of our investigation into two proposed options to remove the stormwater pipe and overland flow from the subject site for the change of use.

We recommend an option for a stormwater diversion to relocate the pipe into the public domain for better maintenance access, and to upgrade the pipe and pits to carry the 1%AEP flow, allowing for an appropriate blockage factor.

Information Relied Upon

- Architectural drawings by Hot House Architects dated 21 September 2021, Appendix A
- Survey by Total Surveying Solutions TSS dated 19/11/2018, Appendix A
- BoM rainfall data obtained from Design Rainfall Data System (2016)
- Northern Beaches Council Stormwater Mapping, Stormwater pipe system, Appendix B
- Australian Rainfall and Runoff (ARR) 2019-chapter 5 flood routing principle and chapter 6 a guide to flood estimation 6.4. Assessment of Design Blockage Levels.

Inputs and Assumptions

The following assumptions were used or the modelling of the diversion and overland flow:

- Council pipe system including pit and pipe sizes was relied based on Northern Beaches Council map.
- A 150mm kerb high measured from the road gutter invert level.
- For conservative modelling, the invert level of the council pipe system is taken as max 1m deep from the pit surface level.
- Digital Elevation Model (DEM) with a resolution of 1m obtained from ELVIS by Geoscience Australia.

— Pits on grade modelled assuming 25% blockage factor, and 50% for every sag pit.

Catchment Delineation and Georeferencing Council Pipeline.

The contributing catchments upstream of the development site were calculated using a DEM. The predicted catchments contributing to the overland flow through the site are shown below in Figure 1.

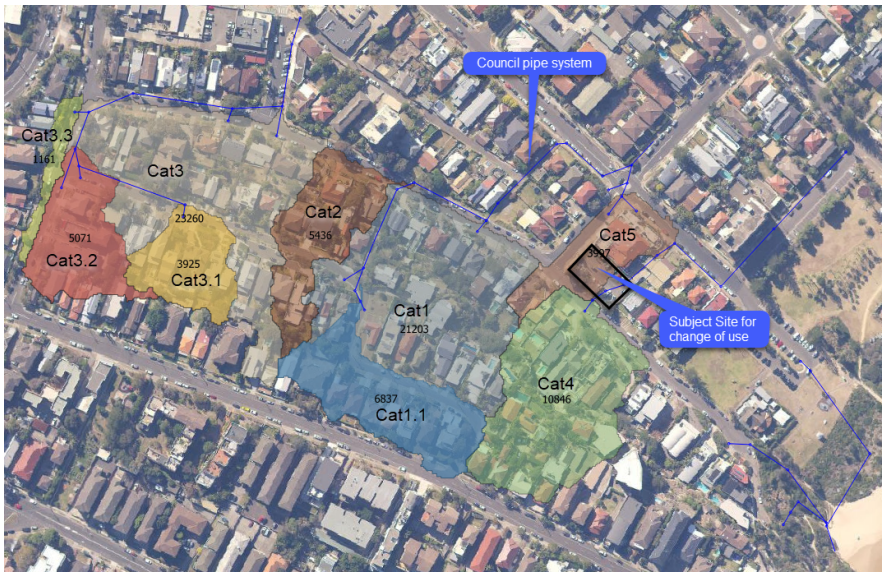

Figure 1: Effective catchment upstream of the subject site

The total catchment flows contributing to the site are categorised based on the catchment plan and council pipeline system to directly contributing flows, indirectly contributing flows and no effecting flows as shown in Table 1:

Table 1: Catchment contributing to 29 Moore Road

Direct		Indirect		No effect	
Catchment ID	Area (m^2)	Catchment ID	Area (m^2)	Catchment ID	Area (m^2)
Cat 4	10846	Cat 1	21203	Cat 5 (downstream)	2997
Cat 5 (upstream)	1000	Cat 2	5436		
		Cat 3	24421		

After defining the catchment, the contributing flow from catchments was estimated from the DRAINS model and the total areas was defined as follow:

— Total catchment flows directly contributing to the site are estimated to be 1.1846ha.

— Total catchment flows indirectly contributing to the site are estimated to be 5.1060ha.

— Total catchment flow that has no effect to the site are estimated to be 0.2997ha.

The council pipeline from the council map was modelled and georeferenced. To achieve more manageable areas, the catchments were subdivided to sub catchment as shown in the catchment plan Figure 1.

Stormwater Model Construction

The pipe and overland flows were estimated using DRAINS hydraulic modelling software by Watercom assuming that 70% of the area is paved and 30% as grassed.

The model adopted ILSAX methodology which is built into DRAINS. The total flow path length and average slope was determined for each catchment. The model uses retardance coefficient n of 0.01 and 0.33 for paved and grassed areas respectively. Based on the catchment contour lines, road geometry, and council system the model in DRAINS was built as shown in Figure 2.

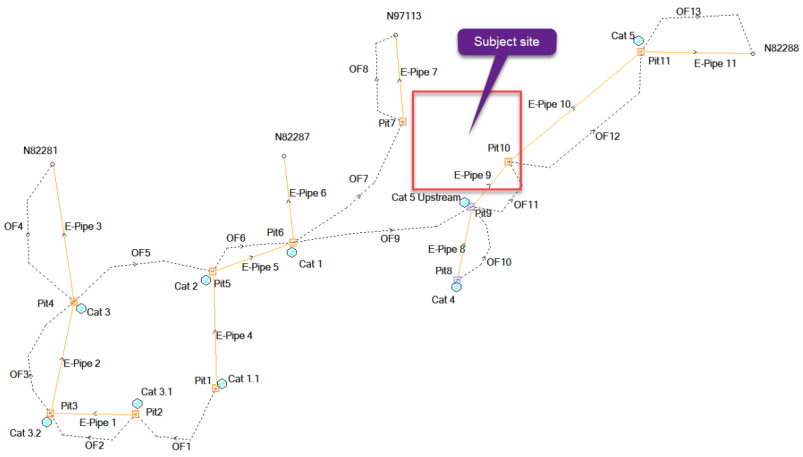

Figure 2: DRAINS model

Assessment of Existing Stormwater and Overland Flow

The existing system was assessed to evaluate the captured flows from the catchments during the 5%AEP and 1%AEP rain events.

During the rain event, rainfall is converted to runoff and is transferred through a network of flow paths to the catchment outlet. The model predicts that the system experiences an overland flow during the 5%AEP and 1%AEP rain events as shown in Figure 3 and Figure 4 respectively. This overland flow is confined within the road kerbs (overland flow segments) and passes from sub catchment 1.1 to sub catchment 3.1, and from catchment 3 to catchment 2, and from catchment 1 to catchment 5 as shown in the DRAINS model Figure 2.

Conservatively the system was modelled to assume 50% of the overland flow- during the 1%AEP rain event from catchments 1, 1.1, 2, 3, 3.1 and 3.2 flow into the sag pit on Undercliff Road, and the following flows obtained:

- Total indirect overland flow was estimated to be 96 l/s and 165 l/s during the 5%AEP and 1%AEP rain events respectively.
- Total direct flow contributing to the site was 482 l/s and 629 l/s during the 5%AEP and 1%AEP rain events respectively.

— The total overland flow affecting the is 253 l/s and 393 l/s overland flow during the 5% AEP and 1% AEP rain events respectively.

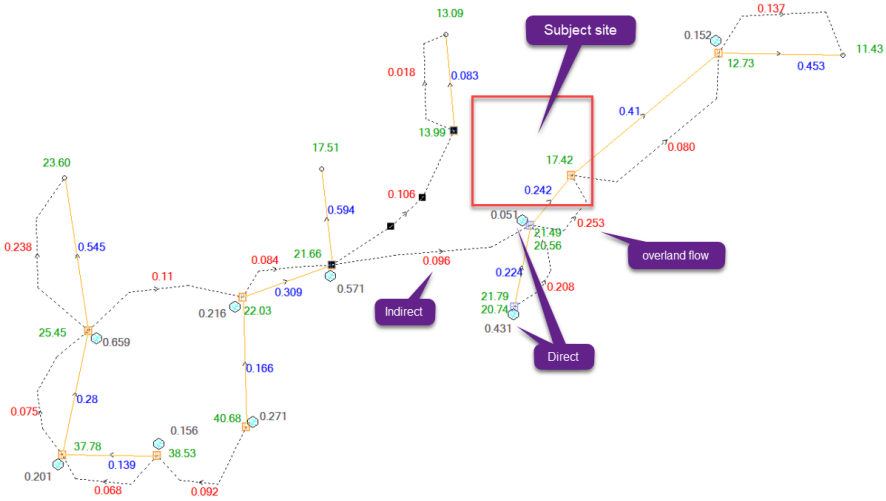

Figure 3: Existing stormwater and overland flow (5% AEP)

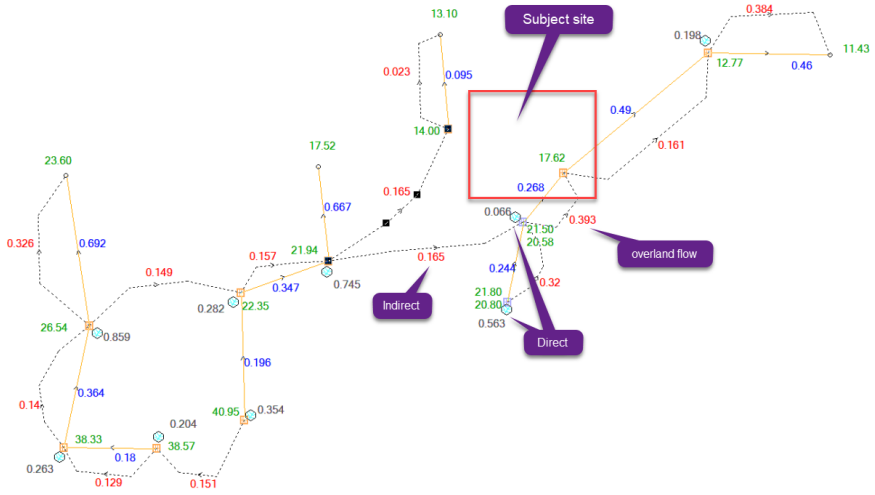

Figure 4: Existing stormwater and overland flow (1% AEP)

Proposed Diversion Options

We considered two diversion options as follow. In both cases a new system of pits and pipes is proposed that carries all flows up to and including the 1%AEP events, even with blockage factors, thereby removing overland flow through the property.

Option 1

Undercliff Road Pipeline. This option is a straight and simple pipe run eastward along Undercliff Road as shown in Figure 5. The total length of this route is approximately 150m and connects to the existing pit at the end of Undercliff Road.

Figure 5: Option 1. Pipe connected through Undercliff Road to downstream council and discharge to the Freshwater Beach

The pipeline is designed to carry the 1%AEP rain event, removing overland flow from 29 Moore Road as shown in Figure 6 and Figure 7. The hydraulic grade line at the 5% AEP of this route is shown in Figure 8, and the system consists of:

- New sag pit located right beside the existing sag pit.
- New on grade pit at Undercliff Road approximately 74 m from the existing sag pit.
- 525mm diameter concrete pipe under the road connected to an existing pit.

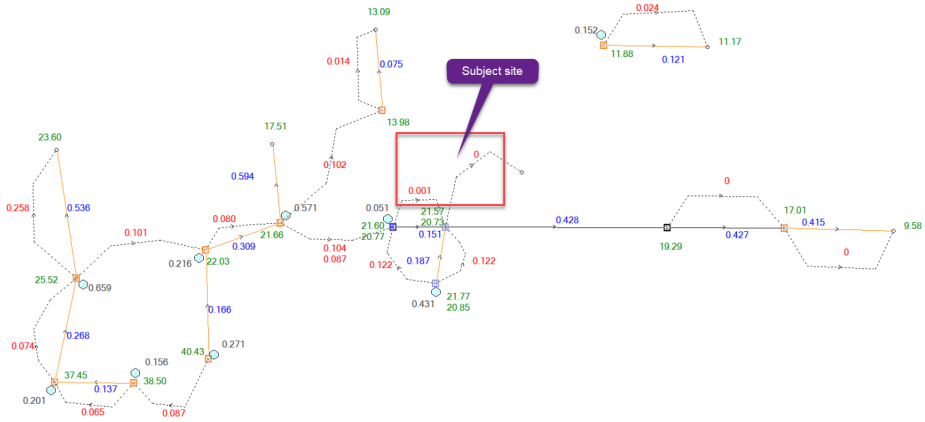

Figure 6: Option 1. Stormwater and overland flow (5% AEP)

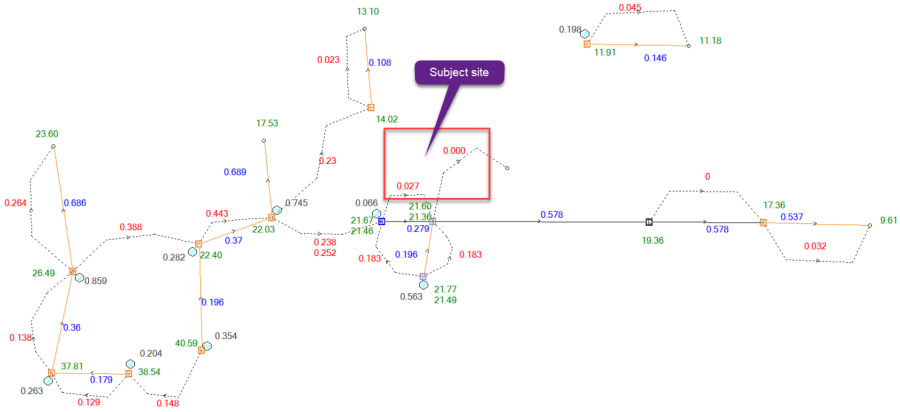

Figure 7: Option 1. Stormwater and overland flow (1% AEP)

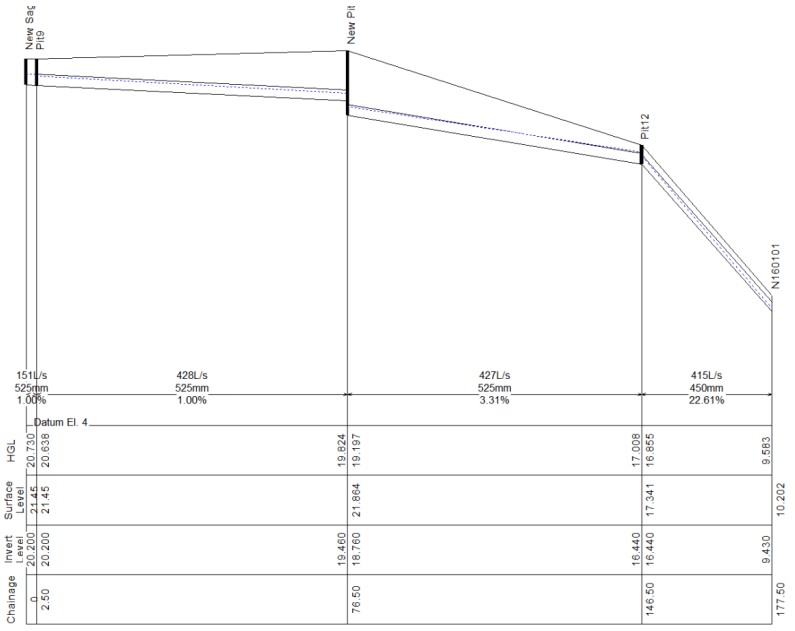

Figure 8: Option 1. HGL (5% AEP)

Option 2

This route runs via Charles Street to Moore Road. This option does not divert water to another discharge point, merely re-routes the pipe around the site. The pipe connects the sag pit in the Undercliff Road to the downstream pit at Moore Road by running the pipeline along Charles Street as shown in Figure 9. The total length of the route in option 2 is approximately 140m.

Figure 9: Option 2. Pipe diverted around the subject area from Undercliff Road to Moore Road

The pipeline is designed for all events up to the 1% AEP as shown in Figure 10 and Figure 11. The section of this route is also shown in Figure 12 showing the hydraulic grade line at the 5% AEP, and it consists of:

- New sag pit located right beside the existing sag pit.
- New on grade pit at the Undercliff Road and Charles Street intersection 26 m from the existing sag pit.
- A 26m long, 525mm diameter concrete pipe in Undercliff Road.
- Concrete pipe under road minimum diameter of 450 mm along Charles Street and Moore Road connected to existing on grade pit at Moore Road, for a total length of 110m.

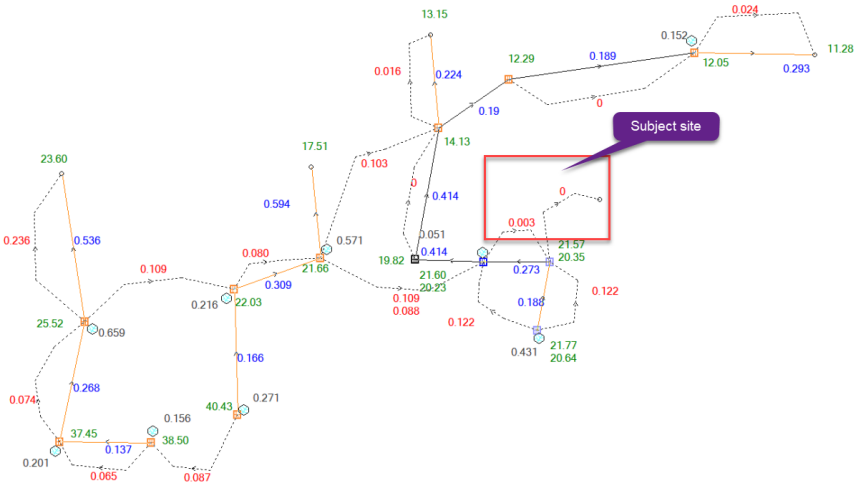

Figure 10: Option 2. Stormwater and overland flow (5% AEP)

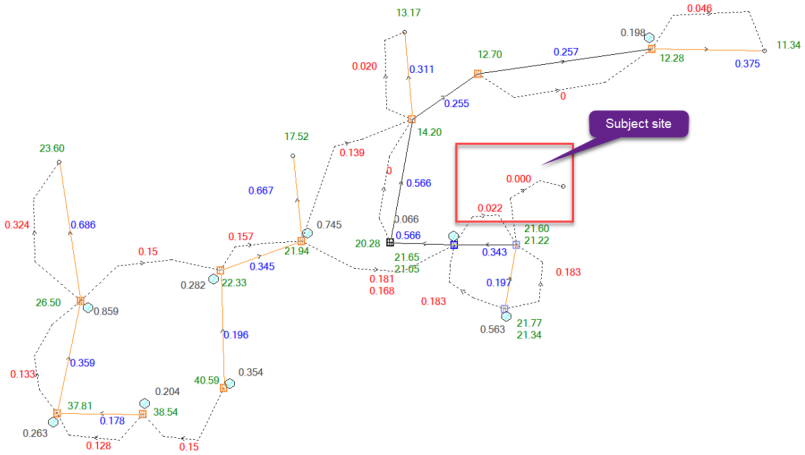

Figure 11: Option 2. Stormwater and overland flow (1% AEP)

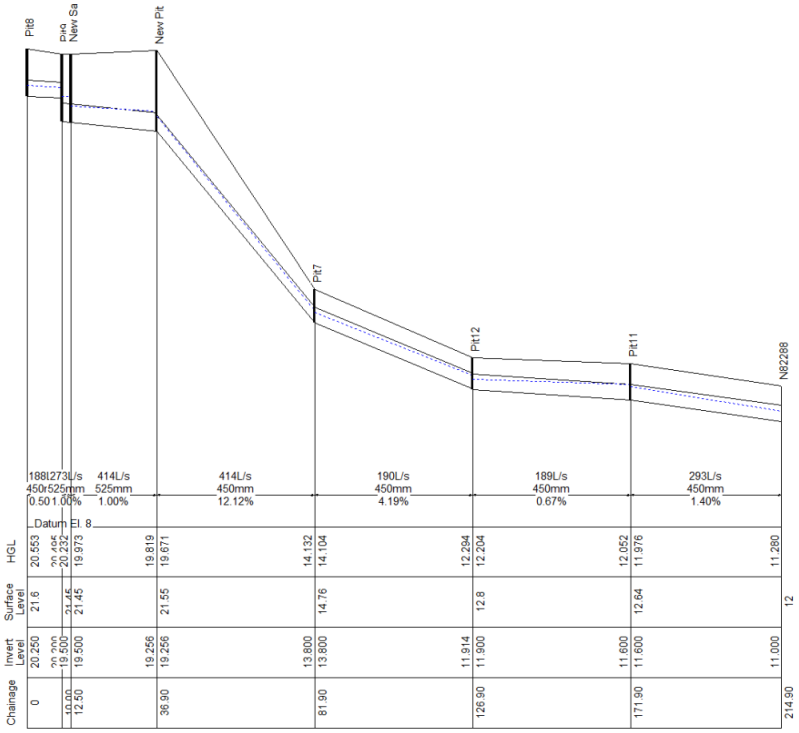

Figure 12: Option 2. HGL (1% AEP)

Conclusion

The existing site is traversed by a council pipeline and associated overland flow, governed principally by pit inlet capacity at Undercliff Road.

Two options for diversion were considered:

- Option 1 directing stormwater east along Undercliff Road to an existing discharge to Freshwater Beach. This option reduces the amount of stormwater entering Freshwater Basin—especially Kooloora Ave—which is known to have capacity and flooding issues.
- Option 2 rerouting the pipe around the property in the streets and reconnecting to the same discharge pit as the existing situation.

Both options are designed to remove overland flow at for all rainfall events up to the 1%AEP with appropriate blockage factors.

However, we recommend Option 2 for the following reasons:

- The proposed design does not have any significant impact to the upstream or downstream properties. It merely reroutes the pipe around the property in the streets.
- Water is not directed into any new catchment or catchment outlet.
- Early indication from council development engineers was that it would provide better maintenance access.

Stellen
Civil and Structural
Engineering

In both cases, we can conclude that it is feasible to remove the overland flow, allowing the site to be developed for a different use.

Please contact me with any questions regarding this report.

Kind regards,

yasser

Civil Engineer
Stellen Consulting
Level 1, 27 Belgrave Street, Manly, NSW 2095
T. +61 2 8317 1392
E. Yasser.alashmori@stellenconsulting.com.au

Stellen

Revision History

Revision	Prepared by	Date	Details	Reviewed by	Approved by
A	YYA	12.11.2021	Draft statement for overland flow control	IRW	IRW

Stellen
Civil and Structural
Engineering

Appendix A

Architectural Plans by Hot House Architects dated 21 September 2021

PP SHEET LIST

PP_001	COVER SHEET
PP_020	SITE ANALYSIS
PP_100	LEVEL B02 BASEMENT
PP_101	LEVEL B01 BASEMENT
PP_104	LEVEL 00 PLAN
PP_110	ROOF PLAN
PP_200	EAST & WEST ELEVATION
PP_201	NORTH & SOUTH ELEVATION
PP_600	SHADOWS - 9 AM - WINTER 21 JUNE
PP_601	SHADOWS - 12 PM - WINTER 21 JUNE
PP_602	SHADOWS - 3 PM - WINTER 21 JUNE

Survey by Total Surveying Solutions TSS dated 19/11/2018

JOB No.:	182375
PLAN No.:	182375_A
DATE:	19/11/2018
DRAWN:	DF
CHK:	GS

Stellen
Civil and Structural
Engineering

Appendix B

https://services.northernbeaches.nsw.gov.au/icongis/index.html