2 Cross Street, Brookvale NSW

Stormwater Drainage Concept Design

Leda Holdings Pty Ltd

28 October 2020
Ref: 201224R002RevA

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Document History and Status

Rev	Description	Author	Reviewed	Approved	Date
A	Draft	MZ	KL		28.10.2020

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1 Introduction

1.1 Background

Leda Holdings Pty Ltd is proposing to construct a new multi-storey storage facility at 2 Cross Street, Brookvale. The proposed development will include the construction of a two-storey self-storage building and parking spaces.

Tonkin has been engaged by Leda Holdings Pty Ltd, to develop a preliminary design for stormwater drainage within the site to support the Development Application (DA) to Northern Beaches Council (Council).

1.2 This report

This report forms the basis for the stormwater drainage design. It outlines the design requirements for site drainage and discharge, details the design procedure and presents the proposed stormwater drainage plan for the management of site runoff.

This report shall be read in conjunction with the preliminary drawings. A copy of the drawings has been provided in Appendix A.

1.3 Design inputs

The stormwater design draws on a number of inputs which are summarised in Table 1-1.

Table 1-1 List of design inputs

Data	Source	Reference	Date	Note
Architectural Plans	PACE ARCHITECTS	*200826*	02.10.20	Sheets
Detail Survey	LandPartners	*SY075018.000.1.1*	Survey: 25/08/2020 Drawing: 03/09/2020	
Dial Before You Dig	Dial Before You Dig	*Job No. 2012224*	08.10.20	Data received from: AusGrid, Council, Jemena, NBN, Optus, Sydney Water, Roads and Traffic Authority NSW and Telstra

1.4 Relevant standards and guidelines

The preliminary stormwater drainage design has been carried out in accordance with the relevant local, state and national design guidelines and Australian Standards. These include, but are not limited to:

- Australian Rainfall and Runoff (ARR) guidelines
- AS 3500.3 – Plumbing and drainage – Stormwater drainage
- AS 3725 – Design for installation of buried concrete pipes
- Northern Beaches Council (Former Warringah) - Development Control Plan (2011)
- Northern Beaches Council (Former Warringah) – On-site Stormwater Detention Technical Specification
- Northern Beaches Council WSUD & MUSIC Modelling Guidelines (Revision 3: June 2016)
- WaterNSW - Using MUSIC in Sydney Drinking Water Catchment (2nd Edition: June 2019)
- NSW MUSIC Modelling Guidelines.

1.5 Council requirements

The stormwater drainage system must comply with a number of Council requirements and policies including, but not limited to:

- site flood information must be assessed to determine whether additional stormwater management measures are required to protect the development from external floodwaters in all events up to and including 1% annual exceedance probability (AEP) storm events.
- on-site detention (OSD) requirements must be established so as to ensure that the site includes measures to minimise its impact on downstream flooding where possible.
- site drainage systems must be designed to the major/minor system design principles in the Australian Rainfall and Runoff guidelines, allowing for overflows of the piped system and flows in excess of the capacity of the piped system to be discharged in a controlled manner.
- Water Sensitive Urban Design (WSUD) principles are to be implemented into the development through the design of stormwater drainage, on-site detention and landscaping in order to improve the quality of site discharge so that natural drainage systems downstream of the development are protected.

2 Site description and conditions

2.1 General

The proposed development is located at 2 Cross Street, Brookvale, and occupies approximately 4,852 m^2 of land. The site can be accessed Cross Street.

Detailed survey indicates that the main portion of the site generally falls in a south-easterly direction at an approximate grade of 1.25% (LandPartners, 2020).

2.2 Existing conditions

The existing site comprised a two-storey warehouse & office building and onsite parking. It was almost completely impervious (98.5% of total area), with only a small portion (approximately 72 m^2, 1.5% of total area) of pervious surface within a garden bed at the front of the allotment.

Figure 2-1 Site Locality Plan (Six map, 2020)

There is an existing 825 mm diameter pipe within the site that runs along the western boundary of the allotment then changes direction at Cross Street. This pipe runs eventually discharging to Brookvale

Creek. There is an existing kerb inlet pit (KIP) located at the south-eastern corner of the site (i.e. the lowest point of the site).

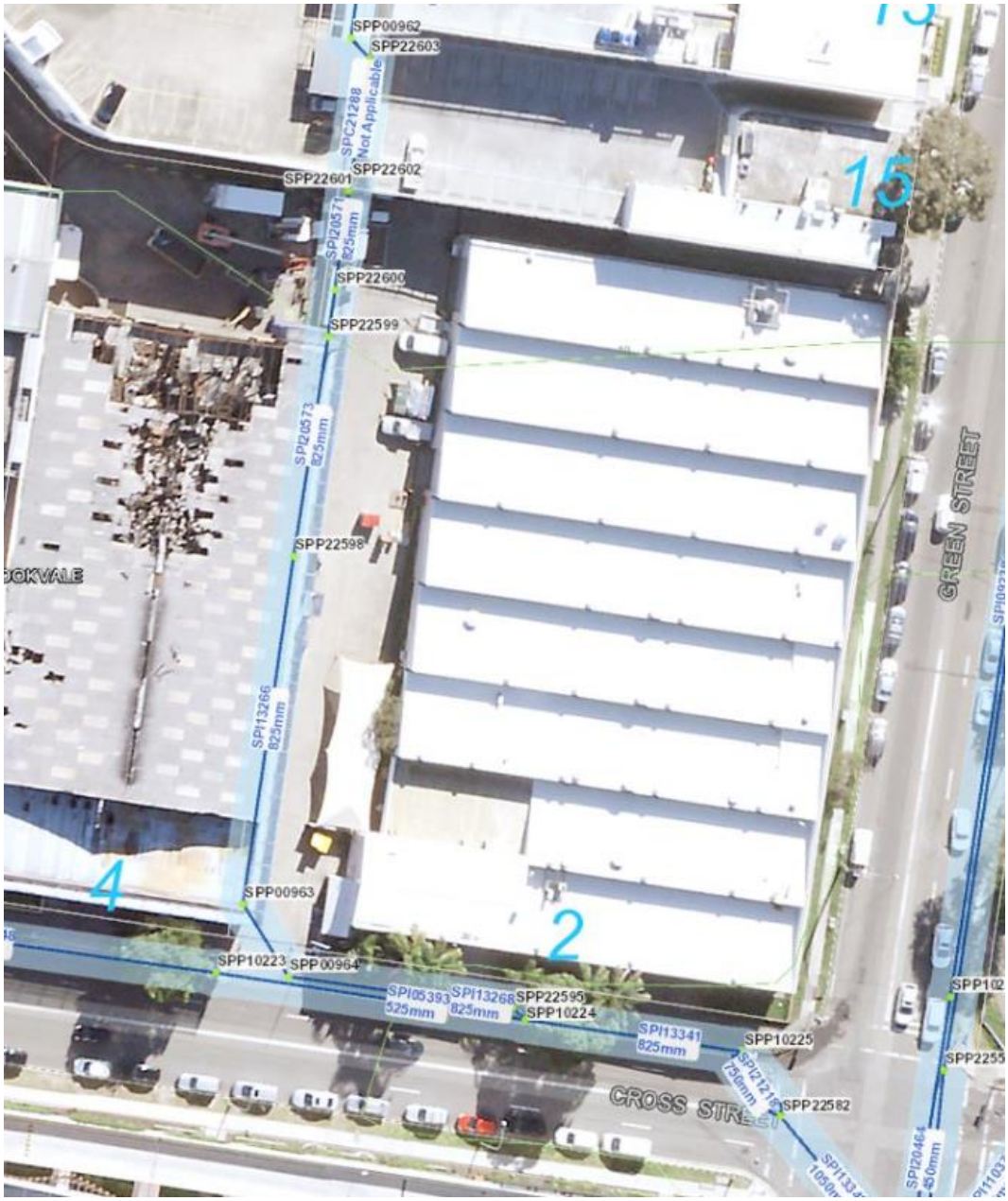


Figure 2-2 Stormwater Pipe Network (Northern Beaches Council)

2.3 Proposed development works

The proposed site works will not increase the current level of imperviousness. The post development has reduced the portion of impervious area from 98.5% to 92.3%. Therefore, the proposed development is not likely to increase site discharge.

As exposed surfaces across the proposed development will almost entirely comprise roof areas, runoff from the entire site will be collected and conveyed via the underground drainage network. The site's underground drainage network can then be connected into the existing KIP within Cross Street.

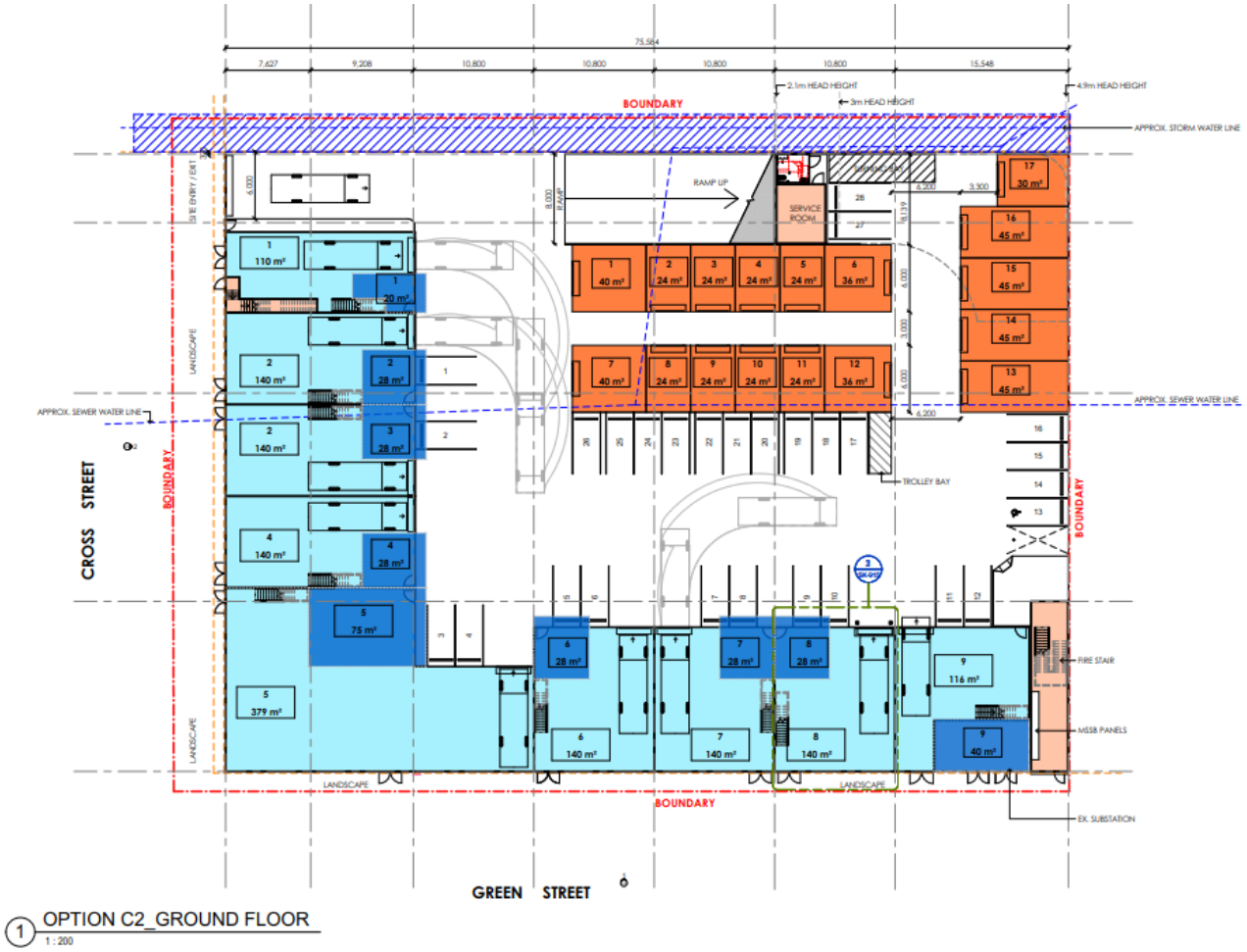


Figure 2-3 Proposed Architectural Layout (Pace Architects)

3 Flood management

Design of stormwater drainage systems must give consideration to the management of flows from external catchments in addition to the management of flows generated within the site, so as to ensure that the development is protected in all events up to and including 1% AEP storm events.

Flood information provided by Council has identified the site as flood-affected in a 1% AEP storm event (Northern Beaches Council, 2020b). A Flood Management Report is therefore required as part of the Development Application to assess the flood risk and any impact the proposed development may have on existing flood levels, storage and flow paths.

Details on the management of flood flows moving through the site and how the preliminary stormwater drainage design complies with Council requirements and design standards for developing on flood prone land are discussed in the Flood Management Report (Tonkin, 2020).

4 On-site detention storage

On-site detention (OSD) is a common requirement for industrial and commercial developments to control the rate of discharge and help minimise flooding in downstream drainage systems. OSD is not however required where the development site is located within the 1% AEP floodplain (Warringah Council, n.d.).

Flood information provided by Council indicates that the development site is located within the 1% AEP floodplain (Northern Beaches Council, 2020b). On this basis – in accordance with the Section 2.7 On-Site Stormwater Detention Technical Specification (Warringah Council, n.d.) – and based on phone discussions with Council, the site does not require OSD storage.

5 Internal drainage system

5.1 Design standard

External flows and runoff generated by the site will be managed via an underground drainage system comprising pits and pipes. The internal drainage system will collect and convey flows towards Council's existing drainage network in Cross Street.

As per Section 6.4 in Water Management for Development Policy (Northern Beaches Council). the underground drainage system shall have sufficient capacity to convey 5% AEP flows, at a minimum. Overland flow paths shall convey flows exceeding the capacity of the underground drainage system in all events up to and including a 1% AEP design event.

5.2 Hydrologic and hydraulic modelling

DRAINS modelling was used to design the internal drainage system. The modelling approach is consistent with Council's guidelines and the latest (2016) Australian Rainfall and Runoff guidelines.

5.2.1 Rainfall data

Consistent with the Australian Rainfall and Runoff guidelines, the model was run for an ensemble of storm events (i.e. varied temporal patterns and storm durations) and the median peak flows generated by the catchments were adopted. The latest rainfall intensities and temporal patterns within the region were obtained from the Bureau of Meteorology (BoM) and Australian Rainfall and Runoff Data Hub, respectively.

5.2.2 Hydrological loss parameters

Council guidelines specify a set of parameter values that must be adopted for hydrological modelling (Section 4.4 On-Site Stormwater Detention Technical Specification, Warringah Council, n.d.). The adopted loss parameters are summarised in Table 5-1.

Table 5-1 Hydrological loss parameters

Parameter	
Impervious area depression storage	1 mm
Pervious area depression storage	5 mm
Soil type for antecedent conditions and infiltration rates	2.5

5.2.3 Assumptions

Downstream conditions

It is proposed that the site drainage system connects into the existing KIP in Cross Street. In the absence of hydraulic grade levels at this pit, it has been assumed that water levels at the pit will be at cover of the pit (9.01 mAHD) in the 5% AEP storm event and at top of kerb (9.16 mAHD) in the 1% AEP storm event. These levels were obtained from the most recent site survey (LandPartners, 2020).

5.2.4 Results

The DRAINS modelling results are provided in Appendix B.

The modelling results indicate that the proposed drainage system is capable of conveying the 5% AEP flows generated by the site, such that a minimum freeboard of 150 mm can be achieved at all pits. Based on the results of the DRAINS model, the post-development peak flows are estimated to be:

- $Q_{5\%\ AEP}$ =215L/s
- $Q_{1\%AEP}$ =323L/s

The overland flow paths have also been provided that have the capacity to safely convey the 1% year ARI flows that exceed the capacity of the minor system around the proposed buildings in such a manner that does not encroach on adjacent properties.

6 Water Sensitive Urban Design

6.1 Pollutant reduction targets

As per Section 2 in WSUD & MUSIC Modelling Guidelines (Northern Beaches Council), council requires that all developments implement the principles of Water Sensitive Urban Design (WSUD) in order to meet the water quality improvement targets presented in Table 6-1.

Table 6-1 Pollutant reduction targets

Pollutant	Performance target reduction loads
Gross pollutants	90% reduction in the mean annual load of gross pollutants
Total suspended solids (TSS)	85% reduction in the mean annual load of TSS
Total phosphorus (TP)	65% reduction in the mean annual load of TP
Total nitrogen (TN)	45% reduction in the mean annual load of TN

6.2 Water quality modelling

In order to assess and determine the required measures to achieve the above pollutant reduction targets, water quality modelling of the proposed development was undertaken using the eWater Model for Urban Stormwater Improvement Conceptualisation (MUSIC). The modelling approach complies with the NSW MUSIC Modelling Guidelines (BMT WBM, 2015).

6.2.1 Meteorological data

Rainfall

Daily rainfall data recorded at the Castle Cove weather station (Station No. 066080) was obtained from the Bureau of Meteorology (BoM) as this station is relatively close to the development site (approximately 6 km) and has a long record of continuously recorded rainfall data from 1959 to present.

Water quality modelling requires a five-year period representative of typical climate in the region to be modelled. It is important that rainfall patterns over the selected five-year period are representative of long-term averages. Rainfall records from 2010 to 2014 were selected for modelling as the annual average rainfall across this period (1369 mm) is comparative to the long-term average, over a 61-year period (1311 mm).

The average annual distribution of rainfall across the five-year period is also comparative to the long-term averages. Figure 6-1 compares average annual rainfall distributions for the five- and 61-year periods.

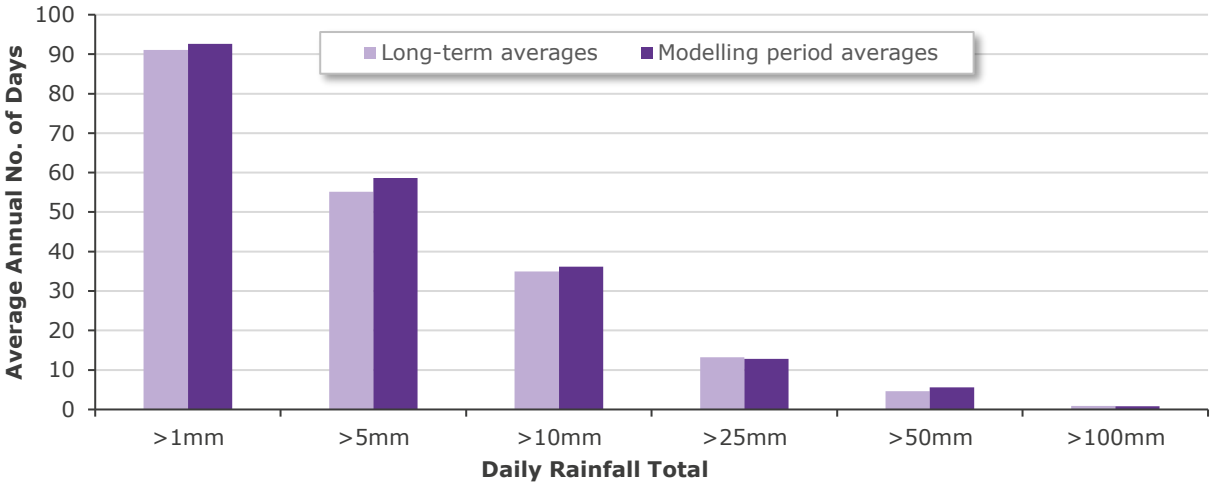


Figure 6-1 Daily rainfall total comparison

Evapotranspiration

The monthly averages for aerial Potential Evapotranspiration (PET) were obtained from BoM's gridded database. The total average annual evapotranspiration within the region is 1239 mm.

6.2.2 Water Quality Improvement Measures

The site will consist of the following water quality improvement measures in order to meet the aforementioned performance objectives:

6.2.2.1 Grass buffer

To minimise the amount of direct runoff from impervious areas, runoff from impervious areas will be directed through a grassed buffer where possible. The purpose of the buffer strip is to slow down runoff, allowing the grass to trap sediment and enhance the removal of nutrients.

It is assumed that all grass buffer strips will be mowed and maintained regularly; therefore, a grass thickness of 50 mm was adopted. As flow is likely to sheet across the buffer strip relatively quickly, it was not reasonable to assume that any exfiltration would occur.

6.2.2.2 Filtration system

A filtration system, Spel Hydrosystem or approved equivalent, has been nominated to remove suspended and dissolved pollutants, including total suspended solids, phosphorus and nitrogen. It is therefore proposed that a filtration system at the downstream is used to absorb and retain these pollutants in the drainage system.

The treatment efficiency data and model parameters for the filtration system were provided by the manufacturer.

6.2.3 Modelling results

The MUSIC modelling results are provided in Appendix C.

Error! Reference source not found. shows the treatment effectiveness of the above measures and demonstrates how the pollutant reduction targets can be met.

Table 6-2 Mean annual pollutant loads

	Source	Residual load	Reduction
Flow (ML/yr)	5.55	5.55	0
Total Suspended Solids (kg/yr)	166	24.8	85.1%
Total Phosphorus (kg/yr)	0.884	0.166	81.3%
Total Nitrogen (kg/yr)	12.6	6.64	47.2%
Gross Pollutants (kg/yr)	134	0	100%

7 Summary

This design report has been prepared to support the Development Application for the proposed new storage facility at 2 Cross Street, Brookvale. The preliminary stormwater drainage design has been carried out in accordance with the relevant local, state and national design guidelines and Australian Standards.

The key stormwater design elements include:

- an underground drainage system with sufficient capacity to convey the 5% AEP flows
- overland flow paths capable of safely conveying flows that exceed the capacity of the underground drainage system in all events up to and including a 1% AEP storm event
- water quality improvement measures that meet the principles of Water Sensitive Urban Design (WSUD) and provide the level of treatment required by Northern Beaches Council. The adopted measures include:
  - grassed buffer where possible; and
  - a filtration system at the downstream end of the stormwater drainage system.

On-site detention (OSD) is not required as part of this development has it has been identified that the proposed development is located within the 1% AEP floodplain.

8 References

BMT WBM (2015). *NSW MUSIC Modelling Guidelines.* Prepared for Greater Sydney Local Land Services. Rev 0.

Harding Architects (2020). *The Lock Up – 2 Cross Street, Brookvale NSW*. Ref no. 200826.

LandPartners (2019). *Detail Survey of Lot 100 in DP817162 – 2 Cross Street, Brookvale.* Ref no. SY075018.000.1. Rev 1.

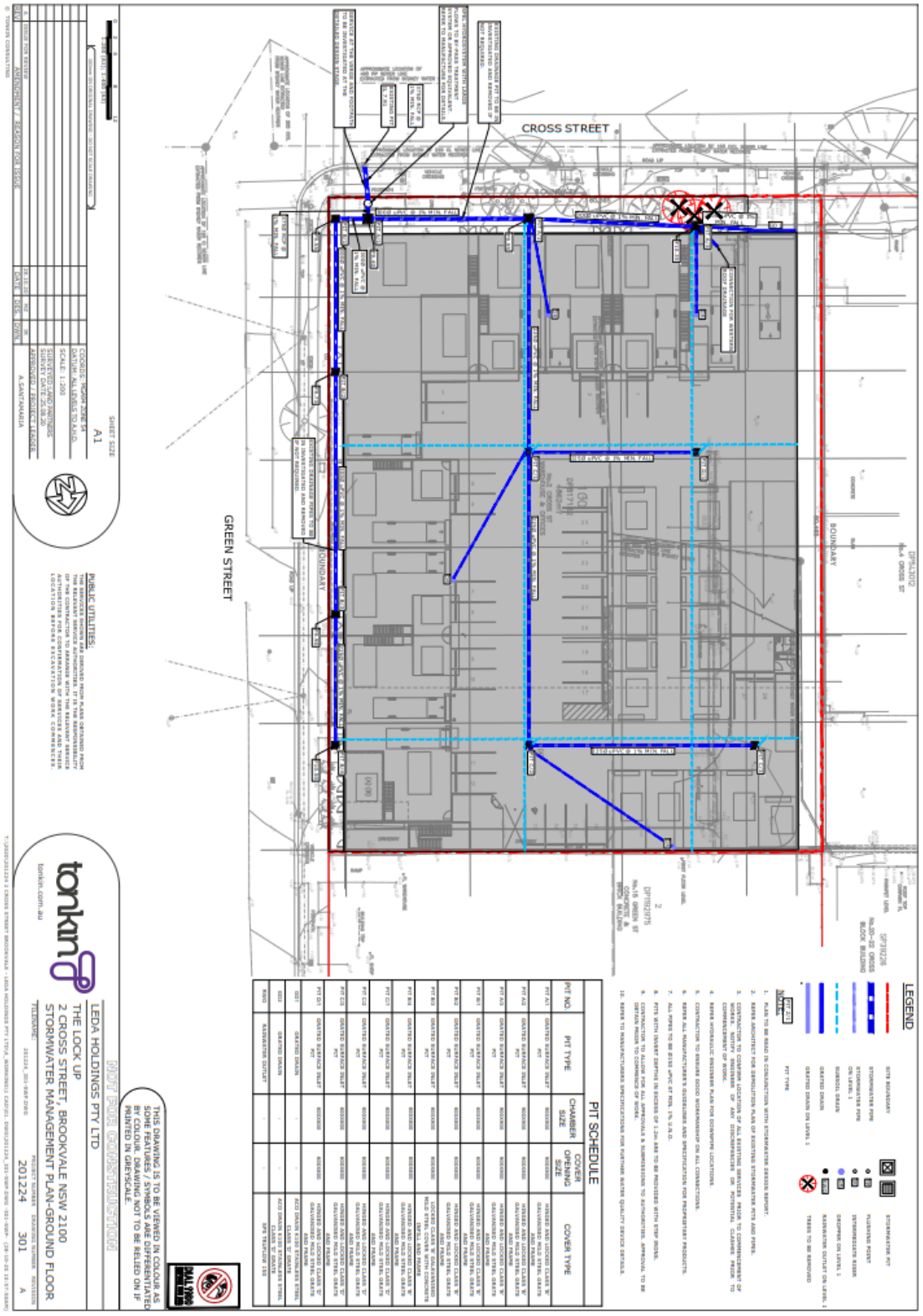
Northern Beaches Council (2020a). *Northern Beaches Mapping.* Accessed 13/03/2020. https://services.northernbeaches.nsw.gov.au/icongis/index.html

Northern Beaches Council (2020b). *Flood Information Request – Comprehensive.* Property: 2 Cross Street, Brookvale. Issue Date: 26/04/2020. Flood Study Reference: Manly Lagoon Flood Study 2013, BMT WBM.

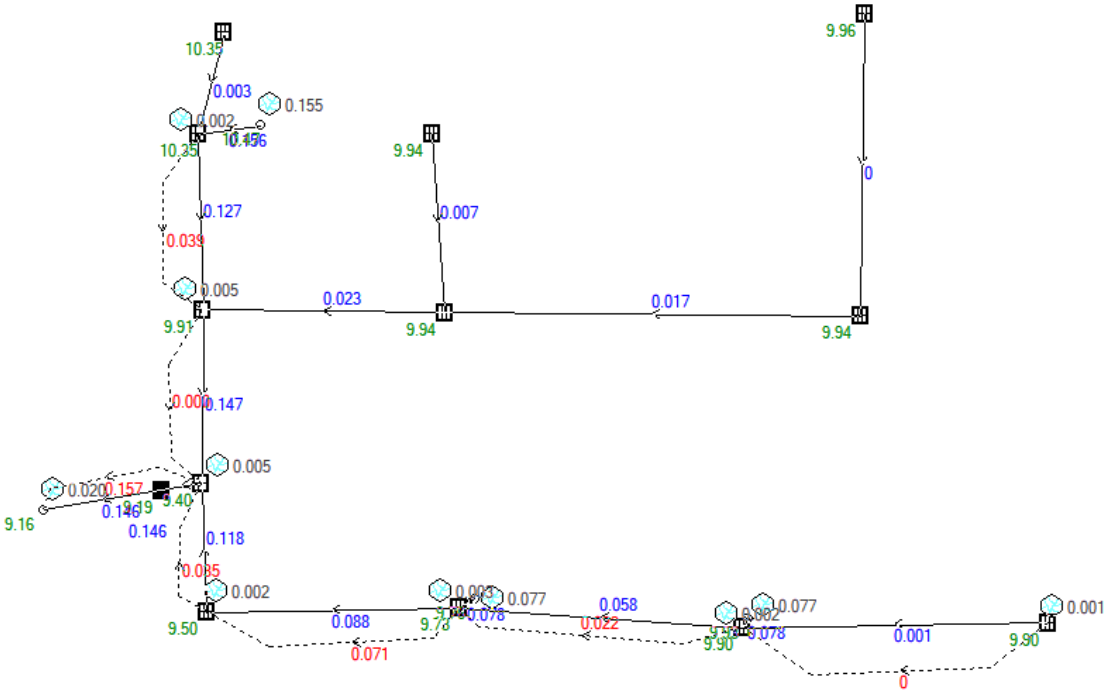
Tonkin (2020).– *Flood Management Report.* Ref no. 201224R001RevA.

Warringah Council (n.d.). *On-site Stormwater Detention Technical Specification.*

Appendix A – Preliminary design drawings



Appendix B – DRAINS modelling results



Appendix C – MUSIC modelling results