DNBS
CONSULTING ENGINEERS

SITE BASED STORMWATER MANAGEMENT PLAN

Proposed Multi-Unit Development
Lots 5-7 on RP10094
5-9 Folkestone Street, Bowen Hills

Hutchinson Builders Pty Ltd

March 2016

Document Control

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1 INTRODUCTION

1.1 Background

DNBS Consulting Engineers has been engaged by Hutchinson Builders Pty Ltd to undertake a Site Based Stormwater Management Plan (SBSWMP) in support of a change to the approved Development Application (DA) stormwater philosophy for the proposed Multi-Unit Development at 5-9 Folkestone Street, Bowen Hills (the subject site) Lots 5-7 on RP 10094. This report supersedes the previously approved SBSWMP by WC designs dated 22/5/15 and the approved detailed stormwater design drawings number 10823 sheets c10, c11, c20, c21 and c22 by Intelara Engineering Pty Ltd.

This assessment has been prepared in accordance with the Brisbane City Council (BCC) Planning Scheme Policy – Infrastructure Design Chapter 7 (Stormwater) and the Queensland Urban Drainage Manual (QUDM2).

1.2 Executive Summary

In response to the highlighting of BCC PSP 7.6.3.1 (2) by EDQ regarding Level III drainage (connection to kerb and channel) is only permitted if the total discharge from an MCU development including any external catchment does not exceed 30L/s, we provide the following response:

Refer to Appendix D for evidence of BCC accepting entire discharge of Q10 flows greater than 30l/s, in multiple locations (limited to 30/s per location) to kerb and channel for similar sized developments around the city. Where no piped (minor) stormwater drainage exists in the road frontage, discharge to kerb and channel is considered "stormwater best management practice" by BCC Engineering Assessment.

In response to EDQ's claim that sheet flow in Folkestone Street must be limited to 3mm, we highlight QUDM table 7.04.1 which references a maximum minor flow depth covering the entire road (with zero depth at the road crown) for a minor road. The existing Q2 flow depth in Folkestone Street is 130mm with a 3.5m flow with and this remains unchanged as a result of the development. With the principle of no worsening being applied, road flow with in Folkestone Street continues to be QUDM compliant for both pre and post development scenarios. For further details refer to section 3.4 of this report.

1.3 Objectives

The objective of this SBSMP is to:

- *Minimise the quantity of pollutants such as sediment, litter, nutrients and oil entering Brisbane's waterways and stormwater drains;*
- *Minimise and prevent environmental harm to Brisbane's waterways and associated ecosystems;*
- *Provide an effective stormwater management system that balances environmental, social and economic interests within the Brisbane community and incorporates water quality controls;*
- *Ensure stormwater is managed to minimise the impact of flooding; and*
- *Minimise environmental nuisance or harm from land-disturbing activities.*

These objectives will be achieved through the implementation of:

- *Management strategies designed to minimise water pollution from the development of the subject site;*
- *Management strategies to maintain pre-development peak discharges at the existing legal point of discharge;*
- *Specific construction phase controls to minimise erosion and control sediment loss; and*
- *Specific operational phase controls to minimise sediment and nutrient export from the subject site.*

1.4 Scope

Specifically, this report details the following:

1. *Water Quality issues including:*
   a. *an assessment of stormwater quality treatment required for the subject site;*
2. *Water Quantity issues including:*
   a. *determination of pre and post development discharge rates*
   b. *assessment of the downstream drainage system to indicate capacity for post development flows.*
3. Stormwater Management Controls for the:
   a. *construction; and*
   b. *operational phases.*

To minimise the impact of the proposed development on the external environment the proponent shall implement this SBSMP.

1.5 Description of the Subject Site

1.5.1 Location

The subject site is located 50m east of the intersection of Flokestone Street and Abbotsford Road in Bowen Hills. Refer to Figure 1.1 for site locality details.

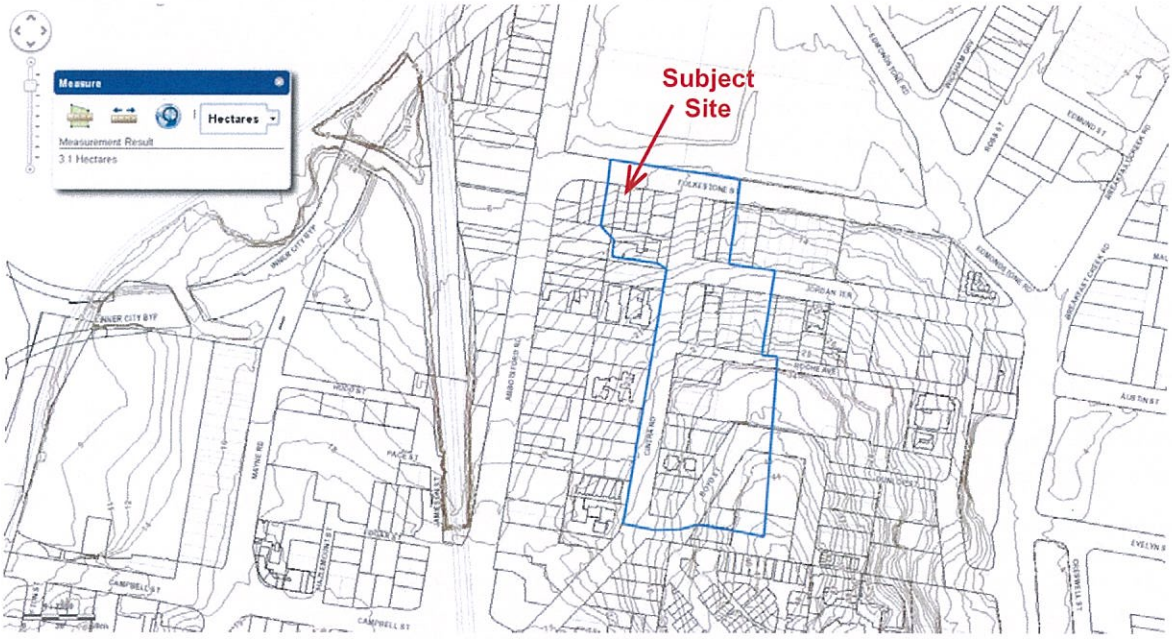


Figure 1.1 Site Locality Plan and External Catchment Plan

1.5.2 Landuse and Vegetation and C10 values

The existing houses have been demolished and site earthworks are underway. The pre-development C10 value has been taken as 0.87 appropriate for an average lot size of 300-450m2. The post development

C10 value has been taken as 0.88 which is appropriate for a high density residential development. These values have been taken from BCC PSP – Infrastructure Design Chapter 7 (Stormwater) Table 7.3.3.1A.

1.5.3 Topography, Stormwater Conveyance, Time of Concentration and External Catchments

The subject site of 0.11ha (Catchment SITE) has time of concentration of 5minutes. The total catchment that contributes to road flow in front of the subject site (EXRD) has been assessed as 3.1ha using the BCC mapping tool and is detailed in Figure 1.1. The time of concentration for this catchment has been taken as 10minutes as per QUDM table 4.06.1 (standard inlet time for catchment between 6% and 10% at top of catchment)

The subject site is broken up into catchments 1/1 (0.01ha) which will consist of a pervious open drain area to cut off external catchment flows at the rear of the proposed building and catchment 3/1 (0.1ha) that will consist of the proposed building area over the subject site.

External Catchment EX1a (0.043ha) consists of ground area to the rear of the proposed development from upstream properties. Catchment EX1b (0.054ha) consists building roof area from 54 Cintra Road. This catchment currently discharges roofwater (Q20 flows) to the kerb and channel of Cintra Road with only the Qgap (Q50-Q20) going through the subject site. Refer to Figures 1.2-1.4 for further details.

Figure 1.3 Roofwater from 54 Cintra Road building area routed to Cintra Road.

Figure 1.2 Roofwater outlets from 54 Cintra Road building area to kerb and channel.

Figure 1.2 Pavement Area at front of 54 Cintra Road falling to Cintra Road.

1.6 Description of the Development

The proposed development of 0.11ha is comprised of:

- A Multi Unit building (roof area 0.1ha);
- A pervious open drain area to the rear of the proposed building to cut off and direct the upstream external catchment through the subject site (0.01ha);

Refer to Appendix A for further details on the proposed development layout.

1.7 Water Quality Improvement

As the subject site is less than 2500m2 and deemed low risk under the BCC PSP no formal water quality treatment to remove nutrients (ie bioretetion/ stormwater 360) is required to treat post development flows. Envriopod gully pit inserts will be used to treat basement washdown and all flows from internal site field inlets as per Stormwater Best Management Practice.

2 PRE- & POST-DEVELOPMENT HYDROLOGY

The natural hydrology of the site and surrounding catchments has been assessed in accordance with QUDM2 Section 4. Summaries of the hydrological calculations are contained in Table 2.1 and Table 2.2 for pre- and post-development (un-mitigated) scenarios respectively. The site acts as a single catchment of 0.11ha. Times of concentration for each catchment are detailed in 1.4.3.

Table 2.1 Pre-Development Hydrology

Catch. ID	FI	Tc	Ac (ha)	I_{100} (mm/hr)	C	Q_{100} (m^3/s)	I_{50} (mm/hr)	C	Q_{50} (m^3/s)	I_{20} (mm/hr)	C	Q_{20} (m^3/s)	I_{10} (mm/hr)	C	Q_{10} (m^3/s)	I_2 (mm/hr)	C	Q_2 (m^3/s)	I_1 (mm/hr)	C	$Q_{3\text{-month}}$ (m^3/s)
SITE	0.80	5	0.11	325.00	1.00	**0.099**	291.00	1.00	**0.089**	248.00	0.91	**0.069**	215.00	0.87	**0.057**	151.00	0.74	**0.034**	117.00	0.70	**0.010**

Table 2.2 Post-Development Hydrology

Catch. ID	FI	Tc	Ac (ha)	I_{100} (mm/hr)	C	Q_{100} (m^3/s)	I_{50} (mm/hr)	C	Q_{50} (m^3/s)	I_{20} (mm/hr)	C	Q_{20} (m^3/s)	I_{10} (mm/hr)	C	Q_{10} (m^3/s)	I_2 (mm/hr)	C	Q_2 (m^3/s)	I_1 (mm/hr)	C	$Q_{3\text{-month}}$ (m^3/s)
SITE	0.90	5	0.11	325.00	1.00	**0.099**	291.00	1.00	**0.089**	248.00	0.92	**0.070**	215.00	0.88	**0.058**	151.00	0.75	**0.035**	117.00	0.70	**0.010**
EX1A	0.90	5	0.043	325.00	1.00	**0.039**	291.00	1.00	**0.035**	248.00	0.92	**0.027**	215.00	0.88	**0.023**	151.00	0.75	**0.013**	117.00	0.70	**0.004**
EX1B	0.90	5	0.054	325.00	1.00	**0.049**	291.00	1.00	**0.044**	248.00	0.92	**0.034**	215.00	0.88	**0.028**	151.00	0.75	**0.017**	117.00	0.70	**0.005**
1\1	0.90	5	0.01	325.00	1.00	**0.009**	291.00	1.00	**0.008**	248.00	0.92	**0.006**	215.00	0.88	**0.005**	151.00	0.75	**0.003**	117.00	0.70	**0.001**
3\1	0.90	5	0.1	325.00	1.00	**0.090**	291.00	1.00	**0.081**	248.00	0.92	**0.064**	215.00	0.88	**0.053**	151.00	0.75	**0.031**	117.00	0.70	**0.009**
EXRD	0.80	10	3.1	253.00	1.00	**2.179**	227.00	1.00	**1.955**	192.00	0.91	**1.510**	167.00	0.87	**1.251**	116.00	0.74	**0.739**	90.00	0.70	**0.216**

Comparison of the pre- and post-development, unmitigated hydrology indicates there will be no change to the peak Q50 discharge from the subject site when using the C10 values provided by BCC for the pre and post development land uses.

3 STORMWATER MANAGEMENT – QUANTITY CONTROLS

3.1 Onsite Detention

As there is no change to the pre developed Q50 (major storm) flow rate from the subject site as a result of the development (when using the C10 values provided by BCC for the pre and post development land uses), onsite detention will not be required.

In addition, the site is in the lower 3rd of the catchment of Breakfast Creek and the site is immediately upstream from Breakfast Creek and the Perry Park fields opposite the site are inundated in a major event. It would be undesirable to have detention where it may increase chances of peak flows from the site coinciding with the wider catchment flood peak.

No detention will be required or provided for the subject site.

3.2 Internal Site Catchment 3/1 – Roofwater Flows

The Q10 (53l/s minor flow) from the site roof catchment of 0.1ha will be taken to the kerb and channel in 200x150 RHS roofwater outlets to the kerb and channel in 2 separate locations 15m apart. Flows greater than Q10 will sheet flow to the kerb and channel as per the existing situation, with no worsening of the predevelopment situation.

BCC PSP 6 Chapter 7 specifies that one roofwater outlet discharging up to 30l/s for each 2 redeveloped lots is appropriate and since we have 3 lots, it is considered stormwater best management practice to discharge in two separate locations 15m apart. This philosophy has been approved in numerous locations around the city by Brisbane City Council when there is no existing minor piped drainage in the street to connect to, and it is considered stormwater best management practice for the subject site, to minimise the risk and impact on external stakeholders during the construction phase of the development. For further details of other approved reports refer to Appendix D.

3.3 External Site Catchments EX1A and Ex1B and Internal Catchment 1/1

The total Q10 flow at proposed inlet 1/1 is the Q10 from catchment EX1A and the Q10 flow from catchment 1/1. This gives a total flow of 28l/s which is less than the 30l/s that is allowable for a single outlet to the kerb and channel in a 200x150 RHS roofwater outlet. The flow from catchment EX1B does not contribute in a Q10 (as the roofwater from downpipes is routed towards the kerb and channel of Cintra road). It is considered that this outlet to the kerb and channel is largely for the upstream catchment from 54 Cintra Road and therefore doesn't count and one of the 2 allowable outlets to kerb for the subject site.

The Q50 major flow at inlet 1/1 also includes the QGap (Q50-Q20= 10l/s) from Catchment EX1B. This gives a total Q50 flow of 53l/s and an overland flow of 25l/s that will be taken down the proposed driveway over an 800mm wide weir (at R.L. 5.60) through a gap in the proposed building wall. This gives a maximum overland flow depth of 70mm through the wall opening using the weir equation and a coefficient of 1.7.

3.4 External Catchment EXRD – Total Contributing Catchment to Road Flow Adjacent to the Subject Site, Road Flow Depths and QUDM compliance

The total contributing catchment to road flow adjacent to the subject site is 3.1ha as explained in section 1.4.3.

Currently there is no piped minor flow drainage system in Folkestone Street, so all flow (both major and minor) is currently conveyed as sheet flow towards the sag at the intersection of Folkestone Street and Abbotsford Road.

The minor flow capacity of Folkestone Street has been assessed in accordance with QUDM table 7.04.1. The maximum allowable flow depth for a minor storm in Folkestone Street (which is considered) a minor road is zero depth at the road crow or 220mm. As a conservative estimate to ensure no overtopping of the kerb and channel this has been taken as 150mm.

The half road capacity has been assessed as $0.63m^3/s$ or $1.26m^3/s$ for the both sides of the road as overtopping of the road crown will occur at the intersection of Folkestone Street and Cintra Road. The minor drainage system drainage design standard is Q2 for a minor road with a flow depth of 130mm and a maximum flow width of 3.5m which is QUDM compliant. In addition the Q10 for catchment EXRD will be contained below the top of the kerb and channel with a maximum flow of $1.25m^3/s$ for both pre and post development scenarios. With the principle of no worsening applied there is no issue with the drainage from the subject site being discharged to the kerb and channel.

The Q50 major flow capacity for Flokestone Street has been assessed as $6.42m^3/s$ adjacent to the subject site which is well in excess $1.955m^3/s$ of Q50 Flow.

For further details road flow depth calculations completed using FlowMaster software refer to Appendix E.

4 STORMWATER MANAGEMENT – QUALITY CONSTRUCTION CONTROLS

Personnel with appropriate qualifications in soil and water quality management must supervise implementation of the approved works during construction. Soil and water management practices must be constantly monitored, reviewed and modified in order to correct any deficiencies. Any amendments to the approved documents during construction are to be discussed and approved the superintendent prior to implementation of the amended practices.

4.1 Construction Controls

During the construction phase of the development the following sediment and erosion control devices and stormwater management controls will be implemented on the site. Developed in accordance with IEAust Guidelines and Gold Coast City Council Land Development Guidelines the location of control devices is presented in Appendix B. Due to the nature of the development and topography of the site, the necessary erosion and sediment control measures will be minor.

4.1.1 Sediment Basin Requirements

Sedimentation basins are generally required where:

- The disturbed area is greater than 1 hectare;
- The disturbed solids are dispersive; and/or
- Where there is a need to control runoff suspended solids/turbidity.

Since the disturbed area on the subject site is less than a hectare, the subject site does not meet any of the above criteria and therefore a fully designed sediment basin will not be required during the construction phase of the development. However, a token sediment basin may be constructed on site at adjacent to the legal point of discharge/ kerb and channel of Flokestone Street (if required).

4.1.2 Pre-Construction

Sediment erosion controls will be developed as construction progresses through each development stage. Sediment and Erosion controls are illustrated in Appendix B.

Before construction activities begin, the following sediment and erosion control measures will be implemented to minimise disturbance and ensure that the performance criteria for water quality are met:

- Designation and marking of transport routes across undisturbed portions of the site to ensure minimal disturbance;
- Maintain open space areas in a vegetated state to reduce soil disturbance and provide filter strip treatment of runoff;
- Install sediment fence around the boundary of the proposed open space areas and as indicated in Appendix B;
- Install shake down grids and construction exits to remove sediment from vehicles prior to exiting the site; and
- Site personnel informed of the erosion and sediment controls.

4.1.3 During Construction

Measures to mitigate water quality impacts during the construction will include:

- Sediment fences to be erected at the base of all batters to prevent sediment laden stormwater from flowing onto road surfaces;
- Grass filter strips to be placed along all road verges;
- Sediment fences to be erected around soil stockpiles;
- Regular inspections as soon as practicable after storm events to check and maintain controls; and
- Sediment to be removed from fences and basins when controls are 40% full and at the completion of construction. All material to be re-used or stored on-site in a controlled manner or taken off-site for re-use or disposal at a licensed waste disposal facility.

5 CONCLUSIONS

This study has reviewed the hydrology and hydraulics of the site for pre- and post-development scenarios and investigated the impact of the proposed development on downstream properties and receiving waters.

Based on this study the following conclusions have been drawn:

- Peak discharges for all storms up to and including the critical Q50 ARI critical storm are maintained from the site. The proposed development and its stormwater pipe system will not adversely impact the existing stormwater drainage network adjacent to the subject site or adjacent/downstream properties.
- Onsite detention will not be required as part of the proposal;
- Discharge to the kerb and channel from the proposed site is limited to 2 roofwater outlets at least 15m appart;
- A third roofwater outlet is utilised for the external catchment that is not part of the subject site;
- Discharge to the kerb and channel where no minor pipe flow street drainage existing complies with stormwater best management practice for the subject site and is consistent with various other stormwater solutions for projects around Brisbane.
- Existing Road flow depths for both major and minor storms in Folkestone Street are compliant with QUDM and remain unchanged from the predevelopment scenario;
- The proposal of roofwater outlets to the kerb and channel is acceptable since the principal of no worsening should be applied.

In summary, flooding of downstream properties and the integrity of receiving water bodies will not be adversely impacted as a result of this development provided the mitigation measures described herein are implemented.

Appendix A

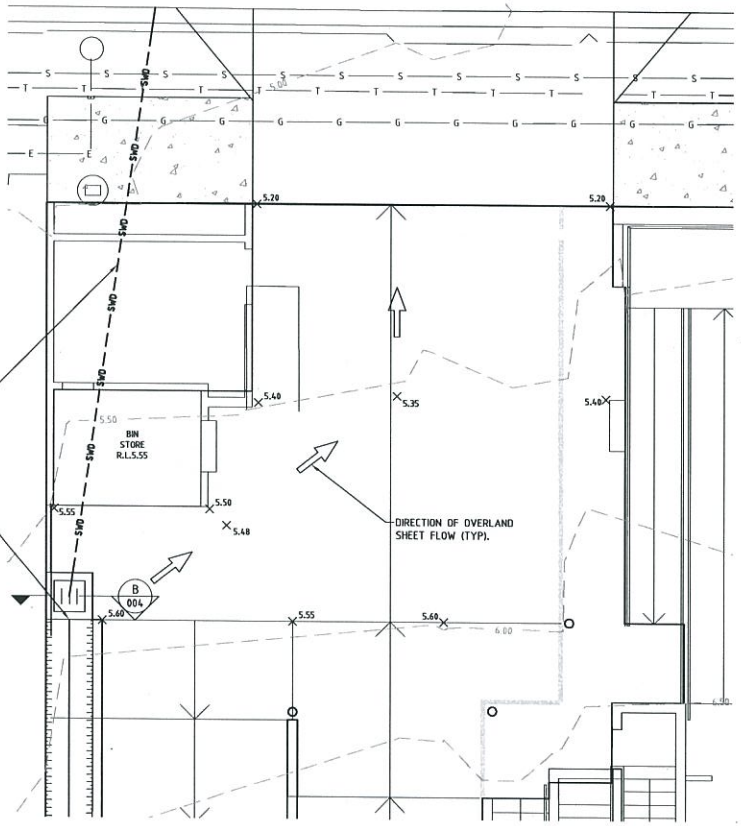
Operational Control Plan

LEGEND

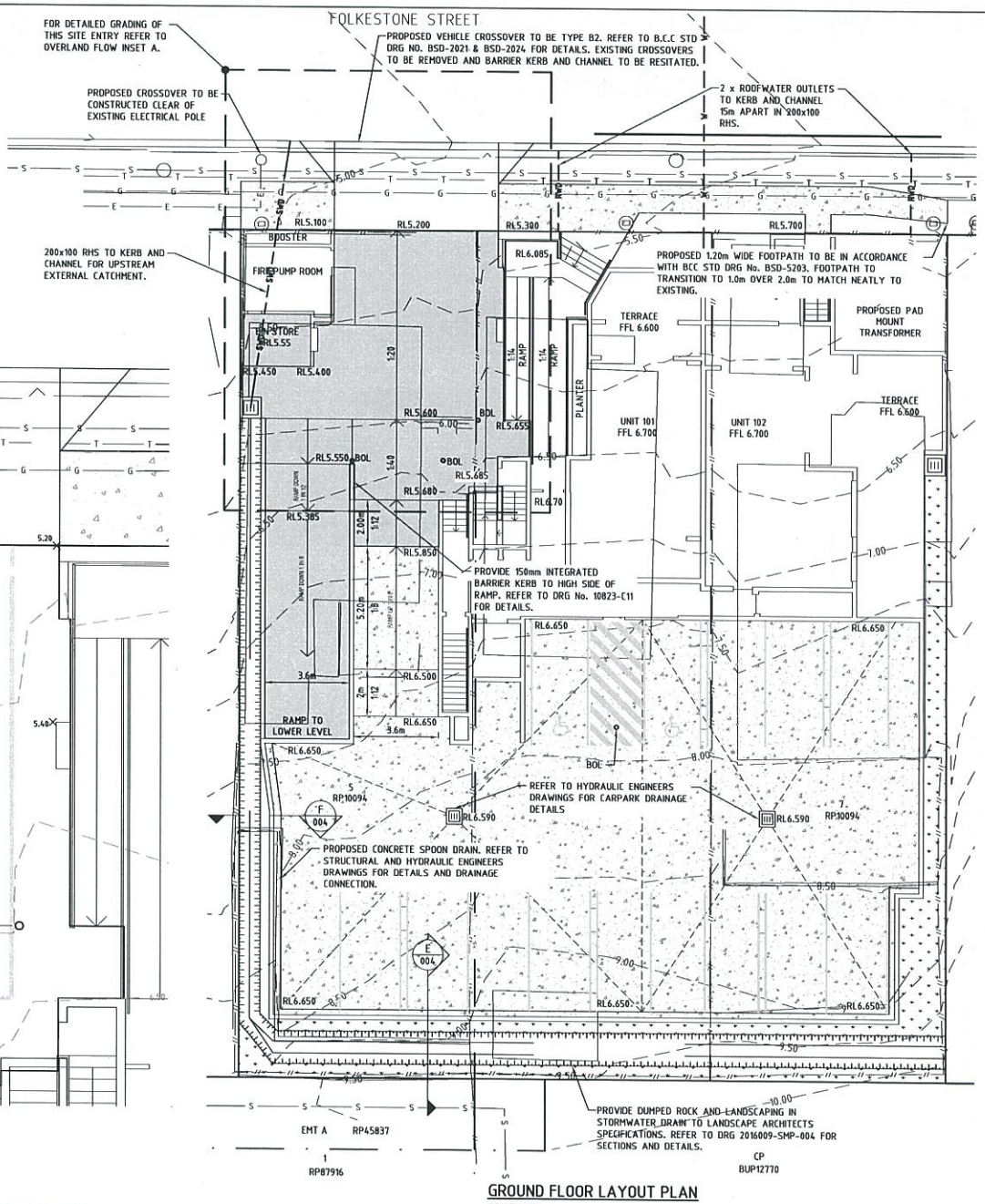
- EXISTING KERB AND CHANNEL
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER DRAINAGE
- EXISTING SURFACE CONTOURS
- EXISTING ELECTRICAL RETICULATION
- EXISTING GAS
- EXISTING TELSTRA
- EXISTING FENCE
- PROPOSED WATER SERVICE
- PROPOSED SEWERAGE RETICULATION
- PROPOSED STORMWATER
- EXISTING FIRE HYDRANT
- EXISTING WATER METER
- EXISTING POWER POLE
- EXISTING SEWER MANHOLE
- EXISTING ELECTRICITY PIT
- EXISTING TELSTRA PIT
- EXISTING SURFACE LEVEL
- PROPOSED TOP OF BANK

DRAWING NOTES

- CONTRACTOR TO MATCH ALL PROPOSED WORKS NEATLY TO EXISTING.
- PROPOSED VEHICLE CROSSOVER TO BE TYPE B2. REFER TO B.C.C STD DRGs BSD-2021 & BSD-2024 FOR DETAILS.
- ALL PROPOSED SERVICES ARE TO HYDRAULIC ENGINEERS DESIGN AND SPECIFICATIONS. REFER TO HYDRAULIC DRAWINGS FOR ALL SERVICE DETAILS.
- FOR STORMWATER DISCHARGE TO THE KERB REFER TO B.C.C STD DRG No. BSD-8114 FOR KERB ADAPTOR DETAILS AND INSTALLATION REQUIREMENTS.
- CONTRACTOR TO TAKE CARE DURING ANY VERGE CONSTRUCTION WORKS TO AVOID ANY DAMAGE TO EXISTING SERVICES.
- STRUCTURAL ENGINEER IS TO ENSURE THAT THE FOOTINGS ARE LOCATED SO AS NOT TO IMPACT THE INTEGRITY OF THE STORMWATER PIPES
- REFER TO ARCHITECTS DRAWINGS FOR DEMOLITION DETAILS
- REFER TO ARCHITECTS DRAWINGS FOR LINEMARKING DETAILS
- REFER TO BCC STD DRG No. BSD-8011 FOR STORMWATER BEDDING DETAILS.



OVERLAND FLOW INSET A
SCALE 1:50



GROUND FLOOR LAYOUT PLAN
SCALE 1:100

REV	DATE	AMENDMENT DESCRIPTION
A	11.02.16	OPERATIONAL WORKS

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1:100 0 2 4 6 8 10m — 2 1 — FULL SIZE ON A1

CLIENT: HUTCHINSON BUILDERS PTY LTD

PROJECT: MULITDWELLING UNITS - CIVIL WORKS
LOTS 5-7 ON RP10094
5-9 FOLKESTONE STREET, BOWEN HILLS

HORIZONTAL DATUM: MGA '94
VERTICAL DATUM: AHD (m)

DRAFTER: HW
DESIGNED: DS
REVIEWED: DS

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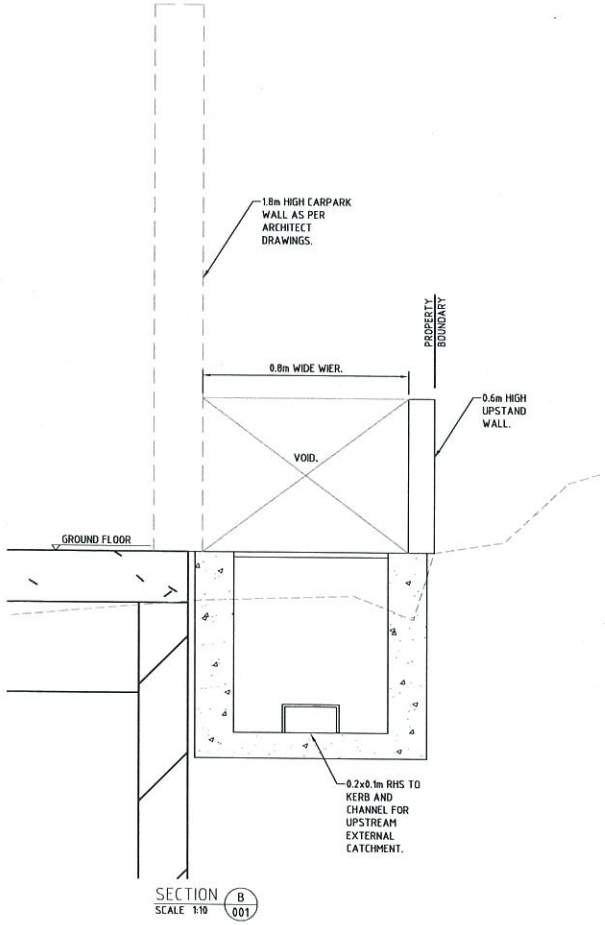
TITLE: OPERATION CONTROL PLAN

RPEQ CERTIFICATION: DS RPEQ# 11028

DRAWING No: 2015009-SMP-001

AMDT: A



SECTION B / 001
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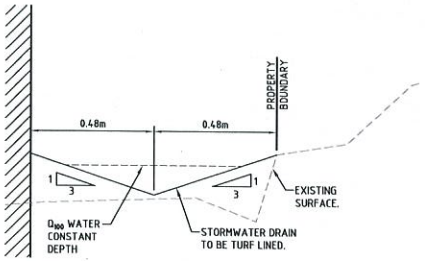
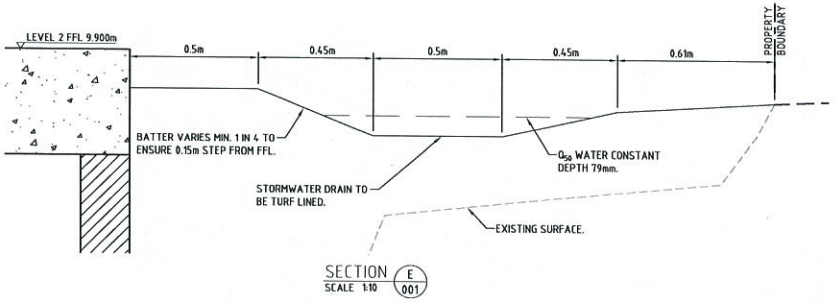


SECTION F / 001
SCALE 1:10



SECTION E / 001
SCALE 1:10

A	11.02.16	OPERATIONAL WORKS
AMDT	DATE	AMENDMENT DESCRIPTION

1:10 0 0.2 0.4 0.6 0.8 1.0m
0.2 FULL SIZE ON A1

CLIENT: HUTCHINSON BUILDERS PTY LTD

PROJECT: MULITDWELLING UNITS - CIVIL WORKS
LOTS 5-7 ON RP10094
5-9 FOLKESTONE STREET, BOWEN HILLS

HORIZONTAL DATUM: MGA '94
VERTICAL DATUM: AHD (m)
DRAFTER: HW
DESIGNED: DS

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REVIEWED: DS
RPEQ CERTIFICATION: DS RPEQ № 11028

TITLE: OPERATION CONTROL SECTIONS AND DETAILS SHEET

DRAWING No: 2015009-SMP-004
AMDT: A

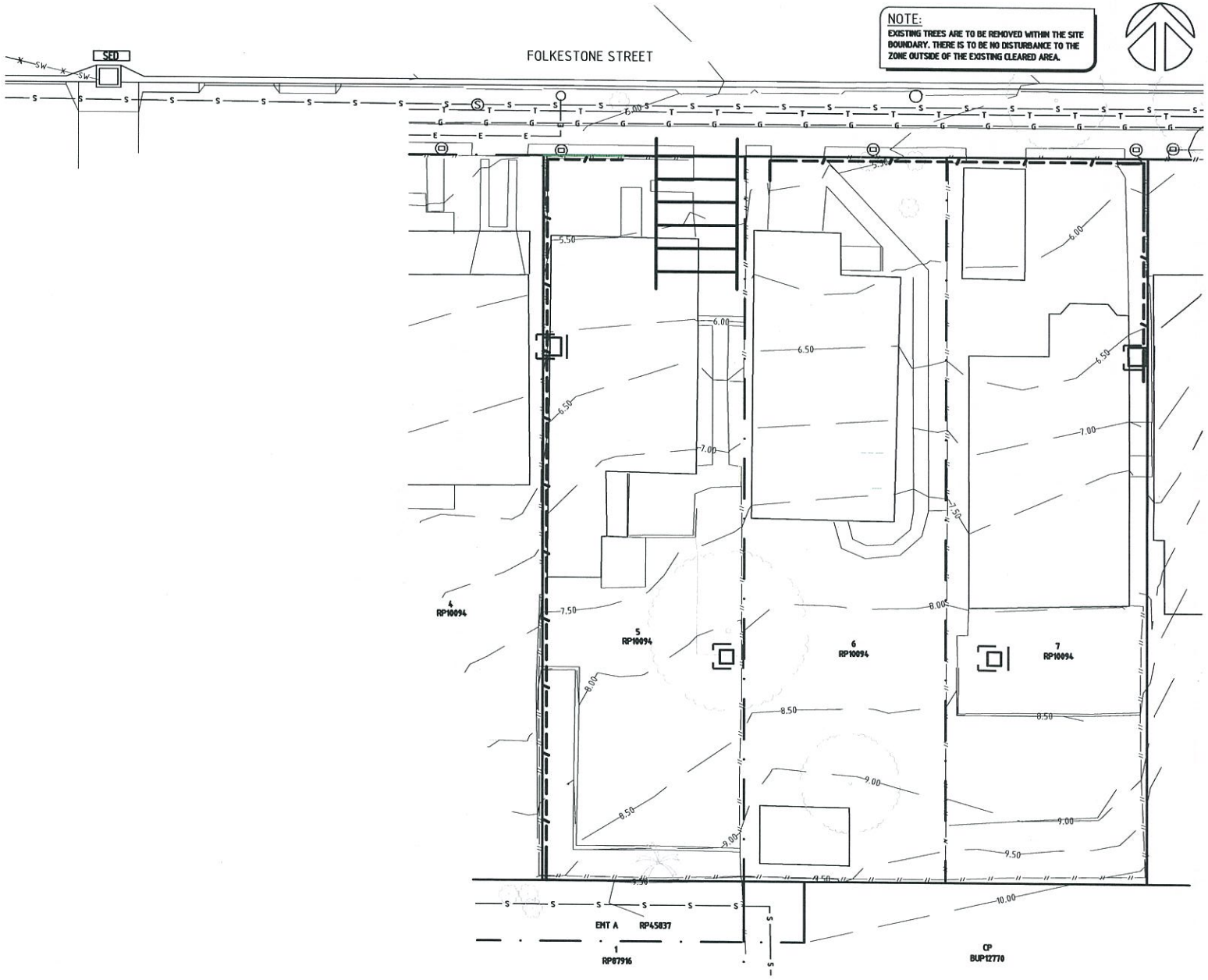
Appendix B

Sediment and Erosion Control Plan

LEGEND

- EXISTING KERB AND CHANNEL
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER DRAINAGE
- EXISTING SURFACE CONTOURS
- EXISTING ELECTRICAL RETICULATION
- EXISTING GAS
- EXISTING TELSTRA
- EXISTING FENCE
- PROPOSED WATER SERVICE
- PROPOSED SEWERAGE RETICULATION
- PROPOSED STORMWATER
- EXISTING FIRE HYDRANT
- EXISTING WATER METER
- EXISTING POWER POLE
- EXISTING SEWER MANHOLE
- EXISTING ELECTRICITY PIT
- EXISTING TELSTRA PIT
- EXISTING SURFACE LEVEL
- SILT FENCE
- VEHICLE SHAKE DOWN
- GULLY PIT SEDIMENT BARRIER
- FIELD INLET TREATMENT

NOTE:
EXISTING TREES ARE TO BE REMOVED WITHIN THE SITE BOUNDARY. THERE IS TO BE NO DISTURBANCE TO THE ZONE OUTSIDE OF THE EXISTING CLEARED AREA.



A	11.02.16	OPERATIONAL WORKS	
AMDT	DATE	AMENDMENT DESCRIPTION	

CLIENT: HUTCHINSON BUILDERS PTY LTD

PROJECT: MULITDWELLING UNITS - CIVIL WORKS
LOTS 5-7 ON RP10094
5-9 FOLKESTONE STREET, BOWEN HILLS

HORIZONTAL DATUM: MGA '94
VERTICAL DATUM: AHD (m)

DRAFTER: HW
DESIGNED: DS

DNBS CONSULTING ENGINEERS
PO BOX 641 MERMAID BEACH QLD 4218
M:0422573524 PH:0755728703
E:danes@dnbsconeng.com.au WEB:www.dnbsconeng.com.au

REVIEWED: DS
RPEQ CERTIFICATION: DS RPEQ# 11028

TITLE: SEDIMENT AND EROSION PLAN

DRAWING No: 2015009-OPW-002
AMDT: A

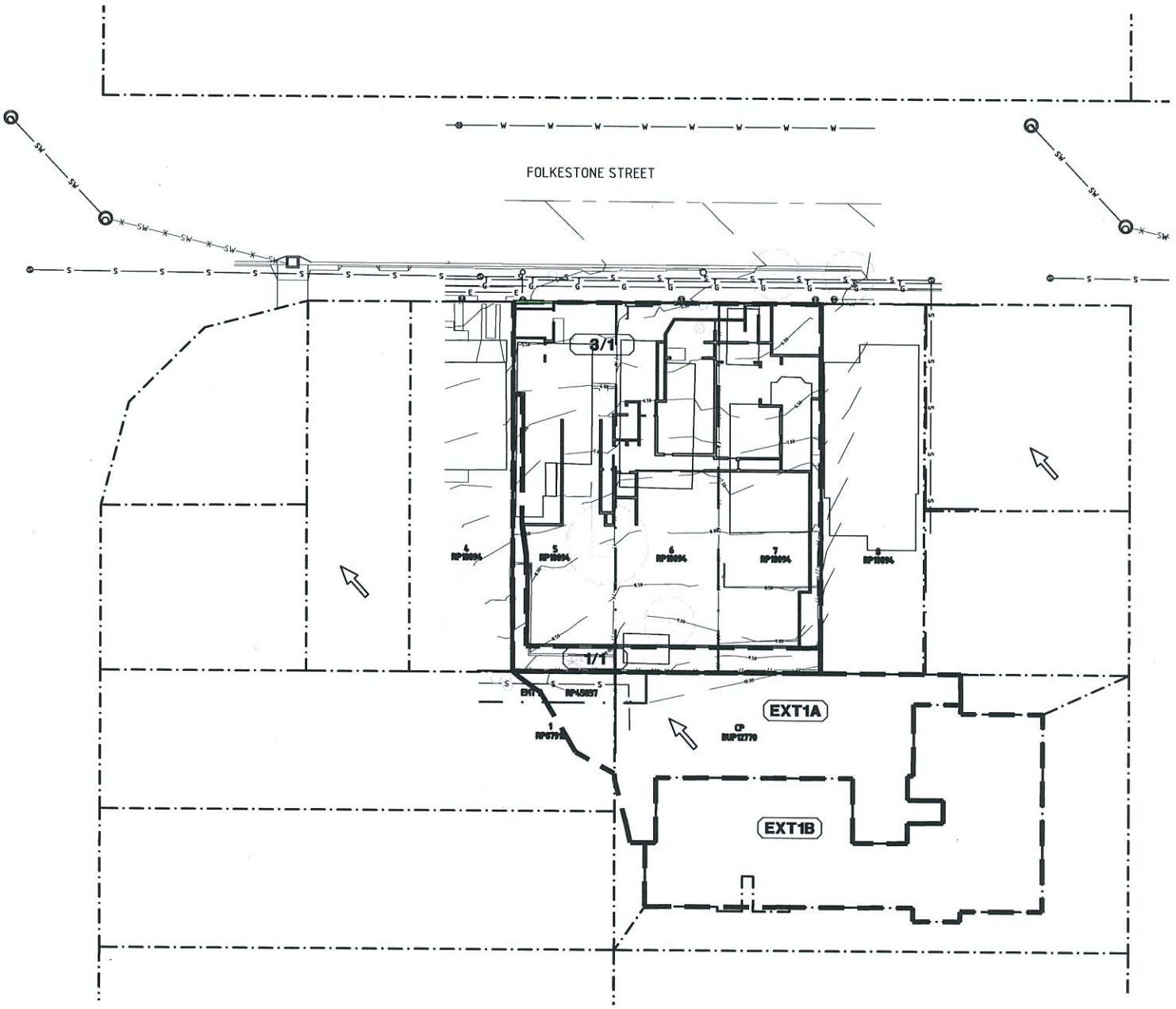
Appendix C

Site Catchment Plan

LEGEND

- EXISTING KERB AND CHANNEL
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER DRAINAGE
- EXISTING SURFACE CONTOURS
- EXISTING ELECTRICAL RETICULATION
- EXISTING GAS
- EXISTING TELSTRA
- EXISTING FENCE
- PROPOSED WATER SERVICE
- PROPOSED SEWERAGE RETICULATION
- PROPOSED STORMWATER
- EXISTING FIRE HYDRANT
- EXISTING WATER METER
- EXISTING POWER POLE
- EXISTING SEWER MANHOLE
- EXISTING ELECTRICITY PIT
- EXISTING TELSTRA PIT
- EXISTING SURFACE LEVEL
- DENOTES CATCHMENT BOUNDARY
- 3/1 DENOTES CATCHMENT NAME
- DENOTES STORMWATER FLOW DIRECTION

STORMWATER CATCHMENT TABLE	
CATCHMENT No.	AREA (ha)
EXT1A	0.043
EXT1B	0.054
1/1	0.010
3/1	0.100



A	11.02.16	OPERATIONAL WORKS
AMDT	DATE	AMENDMENT DESCRIPTION

CLIENT: HUTCHINSON BUILDERS PTY LTD

PROJECT: MULITDWELLING UNITS - CIVIL WORKS
LOTS 5-7 ON RP10094
5-9 FOLKESTONE STREET, BOWEN HILLS

HORIZONTAL DATUM: MGA '94
VERTICAL DATUM: AHD (m)
DRAFTER: HW
DESIGNED: DS
REVIEWED: DS

DNBS CONSULTING ENGINEERS
PO BOX 641 MERMAID BEACH QLD 4218
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RPEQ CERTIFICATION: DS RPEQ# 11028

TITLE: SITE CATCHMENT PLAN

DRAWING No: 2015009-OPW-003

AMDT: A

Appendix D

BCC Approved Reports with Kerb and Channel Discharge

9-11a Chelmsford Avenue Lutwyche A004166453

Table 3.5 ~ Post-development Peak Flow Rates

ARI (Years)	XP Rafts Value (m3/s)	Increase compared to Pre Development XP Rafts Values
Q10	0.071	0.0%
Q50	0.087	1.4 %

Comparison of the pre and post development flows shows a small increase in discharge for the Q50 storm event only therefore it has been deemed unnecessary to detain stormwater within the site before discharging to the external drainage network.

3.5 Proposed Development (Legal Point of Discharge)

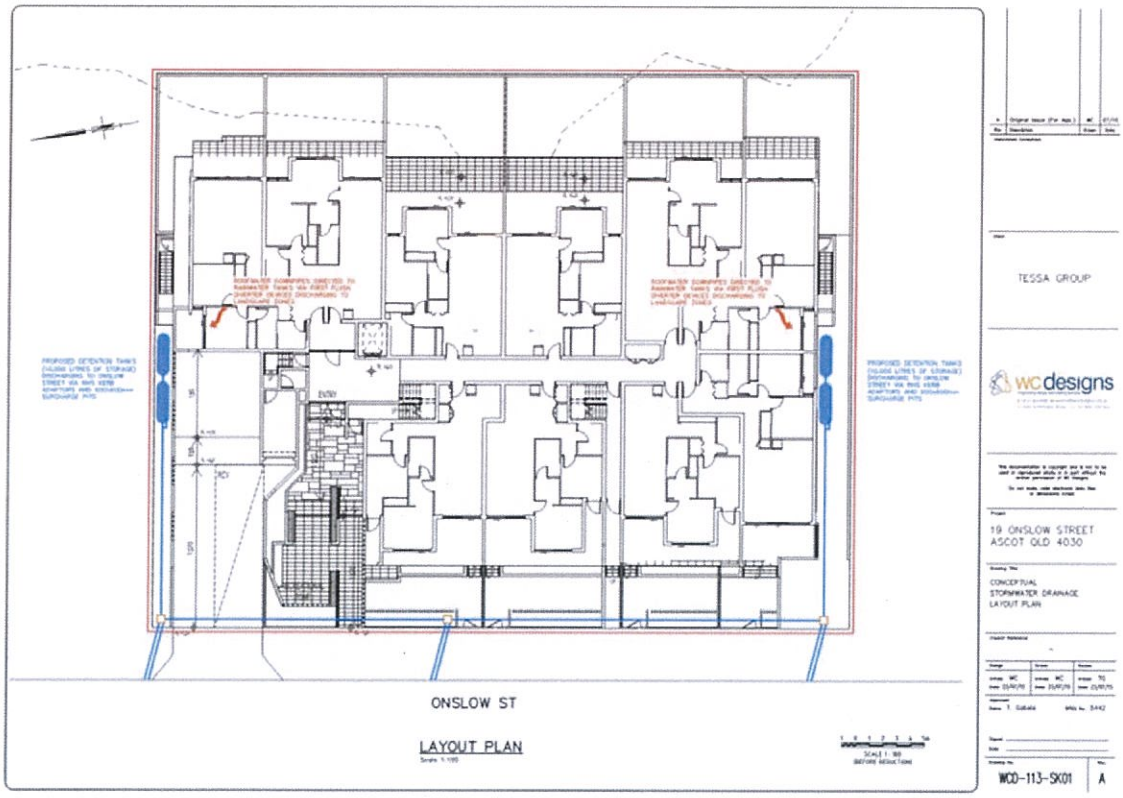
Currently the three lots discharge to the kerb and channel in Chelmsford Avenue via kerb adaptors. It is proposed to maintain the existing discharge regime post development and discharge all minor events to the Chelmsford Avenue kerb and channel and the major events via overland flow, as currently occurs.

Discharge to the kerb and channel will be split into three separate locations similar to the three existing allotments. Internal catchments determined by the hydraulics consultant must apportion the internal catchments equally thereby maintaining discharge at a maximum of 30l/s to each kerb adaptor. Kerb adaptors must also be positioned a minimum of 15m apart.

19-27 Onslow Street Ascot A004196505

36) On Site Drainage - Minor

Provide a stormwater connection to all new or existing allotments and provide drainage infrastructure to ensure stormwater run-off from all roof and developed surface areas will be collected internally and piped in accordance with the relevant Brisbane Planning Scheme Codes and generally in accordance with the approved Conceptual Stormwater Drainage Plan WCD-113-SK01A by WC Design, to a lawful point of discharge.



Appendix E

Flowmaster Road Depth Calculations

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\docume~1\user\desktop\flowmast\bccres.fm2
Worksheet	gccc res street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.045000	m/m
Water Surface Elevation	0.15	m

Elevation range: 0.00 m to 0.32 m.

Station (m)	Elevation (m)	Start Station	End Station	Roughness
0.00	0.22	0.00	6.05	0.015
6.05	0.04	6.05	6.65	0.013
6.50	0.00	6.65	11.00	0.032
6.54	0.15			
6.65	0.15			
11.00	0.32			

Results		
Wtd. Mannings Coefficient	0.014	
Discharge	0.63	m^3/s
Flow Area	0.26	m^2
Wetted Perimeter	4.31	m
Top Width	4.19	m
Depth	0.15	m
Critical Water Elev.	0.22	m
Critical Slope	0.004441	m/m
Velocity	2.39	m/s
Velocity Head	0.29	m
Specific Energy	0.44	m
Froude Number	3.04	
Full Flow Capacity	6.78	m^3/s
Flow is supercritical.		

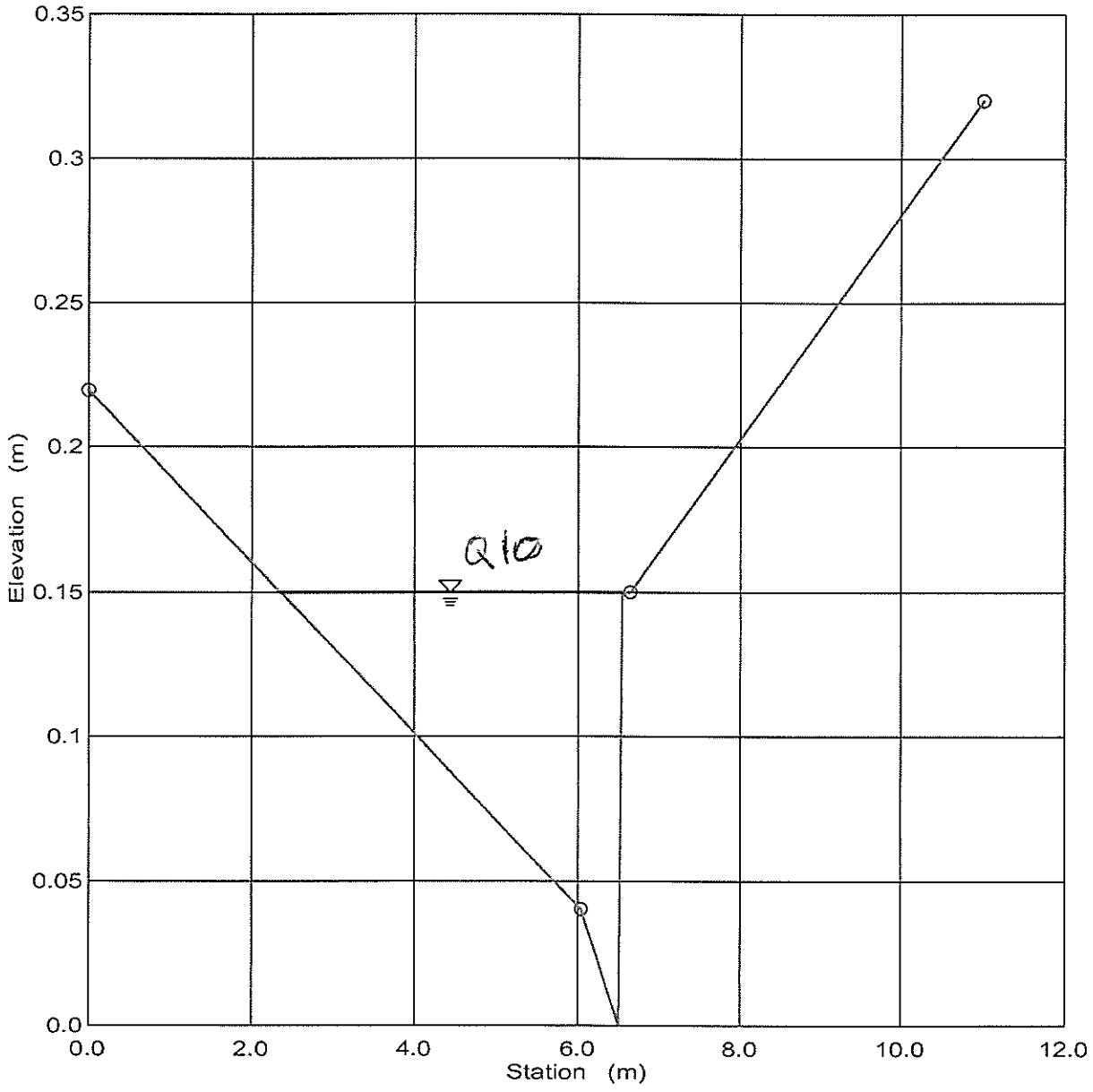
DV product = 0.358 < 0.4 ∴ OK.

MAX FLOW DEPTH = 0.15m (TOP OF KERB).

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\docume~1\user\desktop\flowmast\bccres.fm2
Worksheet	gccc res street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

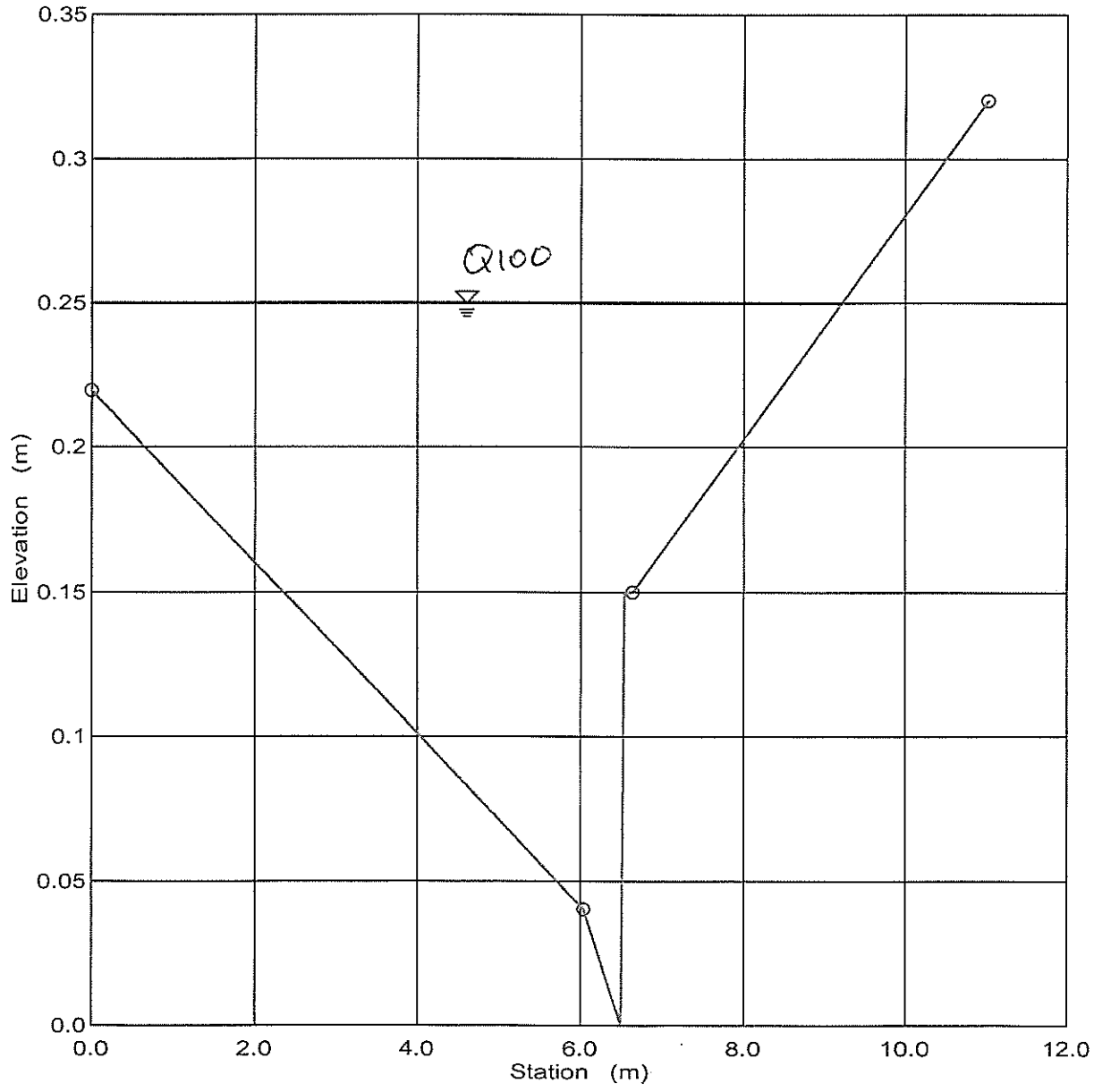
Section Data		
Wtd. Mannings Coefficient	0.014	
Channel Slope	0.045000	m/m
Water Surface Elevation	0.15	m
Discharge	0.63	m^3/s



Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\docume~1\user\desktop\flowmast\bccres.fm2
Worksheet	gccc res street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.014	
Channel Slope	0.045000	m/m
Water Surface Elevation	0.25	m
Discharge	3.21	m^3/s



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\docume~1\user\desktop\flowmast\bccres.fm2
Worksheet	gccc res street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.045000	m/m
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Elevation range: 0.00 m to 0.32 m.

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0.00	0.22	0.00	6.05	0.015
6.05	0.04	6.05	6.65	0.013
6.50	0.00	6.65	11.00	0.032
6.54	0.15			
6.65	0.15			
11.00	0.32			

Results		
Wtd. Mannings Coefficient	0.014	
Discharge	3.21	m^3/s
Flow Area	0.98	m^2
Wetted Perimeter	9.36	m
Top Width	9.21	m
Depth	0.25	m
Critical Water Elev.	0.37	m
Critical Slope	0.004353	m/m
Velocity	3.29	m/s
Velocity Head	0.55	m
Specific Energy	0.80	m
Froude Number	3.23	
Full Flow Capacity	6.78	m^3/s

Flow is supercritical.

Water elevation exceeds lowest end station by 0.03 m.

MAX FLOW DEPTH = 0.25m in accordance with QUDM Table 7.03.1a)