INGHAMS ENTERPRISES (NZ) PTY LTD

PRELIMINARY STORMWATER MANAGEMENT STUDY

BLOXAM BURNETT & OLLIVER

ENGINEERS • PLANNERS • SURVEYORS

APRIL 2013

Inghams Enterprises (NZ) Pty Ltd

Preliminary Stormwater Management Study

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1.0 INTRODUCTION

1.1 As part of the proposed plan change and associated proposed development, Inghams Enterprises (NZ) Pty Ltd ('Inghams') are required to demonstrate that the potential stormwater runoff effects associated with the proposed development can be accommodated in a less than minor manner.

1.2 The Inghams site is located on the corner of Waihekau Road and Seddon Road, near Waitoa. The existing facilities include a number of factory and office buildings, outdoor hardstand areas and onsite car parking facilities. An existing drain is located on the northern border of the site which commences at Seddon Road and drains in a south western direction. A wetland area is located at the southern end of the drain, of which the inlet is controlled by a weir.

1.3 The proposed development will increase the extent of the development north of the existing site boundaries to include additional buildings, work areas and carparks. The proposed development is anticipated to increase the area of hardstand by approximately 2.3 ha, which was previously characterised as farm land. Further details of the proposed expansion plans are illustrated in drawing 140510/P/06 attached as **Annexure 1**.

1.4 The soil assessment for the site indicates that there are three types of soils present on site. Kereone and Te Puninga Soils, which are considered to have good drainage characteristics (although Te Puninga Soils are limited by seasonally high water tables), and Waitoa Soils which have moderate/low drainage characteristics. Based on the site soils map, the site extensions will largely be formed on the better draining Kereone and Te Puniga soils.

2.0 PROPOSED EFFECTS

2.1 The two main effects identified as a result of the proposed development is the impact on the existing drain to the north and the increase in overland flow catchments. Each of these effects will be discussed below.

2.2 The proposed Plan Change proposes to extend the existing 'Building and Plant Management Area' (BPMA) to the north. This will likely require the infilling of the existing drain in this area to accommodate development of a carparking area. Accordingly any existing flows within this channel will require diversion, either by reforming a new perimeter drain (if the gradient allows) or including any such flows into a underground culvert system.

2.3 The site expansion will increase the area of impermeable area by approximately 2.3ha, including new buildings/building extensions, increased hardstand work area and expansion of the carpark area. This change will result in higher surface discharge flows, which will require retention. The retention options are discussed below in section 4 of this report.

2.4 Water quality is dealt with under Regional Council Consents and any required treatment will be addressed via this process.

3.0 SURFACE FLOW CALCULATIONS

3.1 In respect to the existing drain, there is no reliable information to ascertain the extent of the upstream catchment. However based on site observations, it was considered the extent of catchment was limited. Any detailed design process will need to include any upstream catchment, including the damming effect of Seddon Road.

3.2 The pre and post development stormwater flows have been calculated (for zones one to three) in accordance with the Hamilton City Council Development procedure. Rainfall intensity tables have been sourced from the development manual using climate change adjusted figures.

3.3 The existing site flows have been separated into three zones (as shown on drawing 140510/P/06 attached as **Annexure 1**). The first two are currently impermeable (and will remain so) while the third will be modified from farm land to hard stand (impermeable).

3.4 For purposes of the assessment, the existing site flows are calculated using a mixture of impermeable and permeable areas, however the estimated future surface flows will focus on the change in permeable areas. The design will focus on attenuating a 20% AEP storm event (5 year), with consideration for extreme rainfall events (of a 2% AEP storm, 50 year).

Table 1 details the estimated flows for the site for a 20% AEP (5 year) rainfall event.

20% AEP storm event				
Zone	Area	Description	Pre Development flow (l/s)	Post Development flow (l/s)
1	3,980 m^2	Existing carpark to be reformed as building/site development	95	100
2	6,530 m^2	Existing carpark to remain	155	155
3	24,930 m^2	Undeveloped area to be converted to carpark/hardstand	130	580
Totals			380	835

Table 2 details the estimated flows for the site for a 2% AEP (50 year) rainfall event.

2% AEP storm event			
Zone	Area	Description	Post Development flow (l/s)
1	3,980 m^2	Existing carpark to be reformed as building/site development	150
2	6,530 m^2	Existing carpark to remain	230
3	26,510 m^2	Undeveloped area to be converted to carpark/hardstand	870
Totals			1,250

3.5 Based on the values presented in **Tables 1 and 2** above (for zones 1 to 3), the greenfields flow for the site is 380 l/s and is estimated to increase an additional 455 l/s for a 20% AEP event. With respect to a 2% AEP storm event an estimated 415 l/s of water will flow over the surface of the site.

4.0 STORMWATER OPTIONS

4.1 In respect to the existing drain, two options are considered. The first option includes forming a piped reticulation system under the proposed car park while a second option will be to reform the drain around the perimeter of the site. Both of these options will require detailed design, including consideration of downstream levels, gradients and capacity of the appropriate channel or culverts.

4.2 In respect to attenuation for the increased surface runoff from the proposed development (for zones one to three), three options are presented in this report. Each option is based on a 20% AEP event and is assumed to have surface runoff collected by strategically placed catchpits (or similar) with appropriate discharge points. All of the options are considered preliminary and require specific investigations prior to any construction including geotechnical analysis, ground water levels and outlet drain invert levels.

4.3 The first attenuation option is to accommodate the increased flows in the existing wetland area west of the site. It is likely the existing wetland will require an increase in capacity to accommodate the additional flows, however this is subject to detailed design.

4.4 The second attenuation option is to store the increased surface runoff in a suitably sized rain tank, with an orifice outlet restricting the flow to no more than greenfields. This treatment is subject to confirmation of any ground water levels and drain outlet levels. The water stored may be reused by Inhams for washing down or similar.

4.5 The third attenuation option is to store the surface runoff in a suitably sized soakage chambers, including an overflow outlet limited to no more than greenfields flow. This treatment is subject to geotechnical analysis including soil type, soakage rate, ground water level as well as verification of outlet levels. For the purpose of the report a indicative idea of a soakage system is included in **Annexure 2**. A conservative soakage rate of $1e^{-7}$ m/s, results in a minimum storage volume of $204m^3$ with a corresponding ground contact area of $416m^2$.

4.6 The site will require a suitably located secondary overland flow path to accommodate runoff generated during an extreme rainfall event (2% AEP). This will need to allow for surface runoff from zones one to three as well as any upstream catchment north of Seddon Road. As Seddon Road is acting as a dam, the likely upstream overflow is considered to be minimal, however this will need to be verified during detailed design. Given the size of the carpark, it is considered an overland flow path can easily be formed.

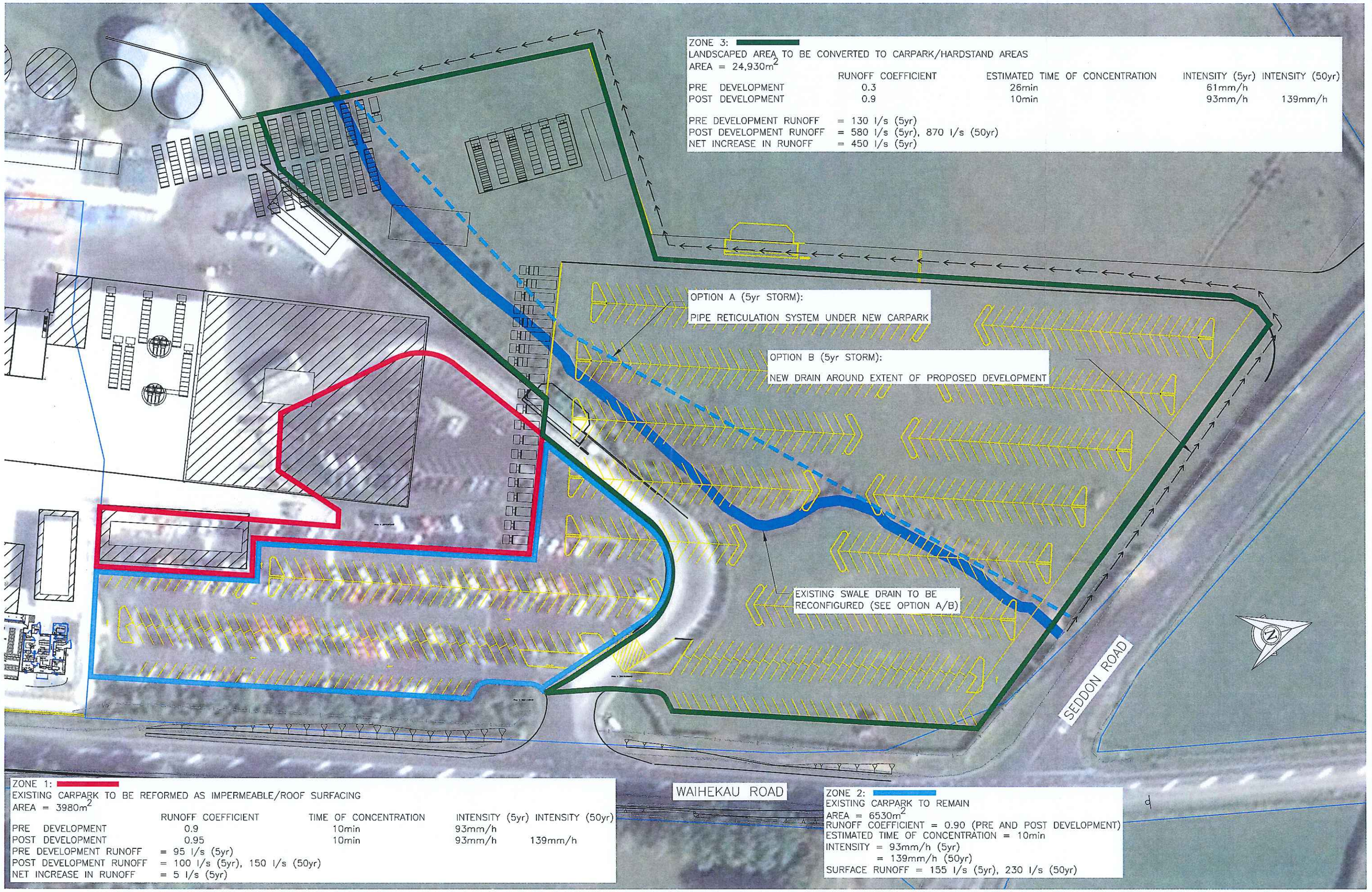
5.0 SUMMARY

5.1 In summary, the potential stormwater runoff effects associated with the proposed development are assessed as:

- The proposed development will increase the surface water flow by an estimated 455 l/s.
- An existing drain will be requiring consideration as part of the site development.
- Three options are considered reasonable for attenuation of a 20% AEP event, including rain tank, detention pond and soakage chambers.
- Each attenuation option will require further investigation prior to construction.
- Given the size of the carpark, it is likely an overland flow path can easily be formed to accommodate an extreme rainfall event (2% AEP) with minimal impact to the site facilities.

ANNEXURE 1:

SURFACE FLOW AND CATCHMENT AND ASSESSMENT DRAWING



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Waihekau Road
Waitoa

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ANNEXURE 2:

SOAKAGE PIT CALCULATIONS

Project :	**Ingham Site - Waihekau Road - Waitoa**
Client :	**Ingam Enterprises Ltd**
Description :	**Carpark Expansion**

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Date	28/03/2013
Revision	A

Time of Concentration Calculations						Rainfall Intensity Calculations			Stormwater Runoff Calculations				
Catchment Label	*Drainage Length(m)*	*Grade (%)*	*Surface Description of catchment*	*Horton value(n)*	*Individual catchment Tc (min)*	ARI	Chart Source	Intensity (mm/hr)	*Surface Type*	*Plan Area (sq.m)*	Coefficient of runoff (C)	*Discharge (l/sec)*	*Notes*
Zone 1	70	1	Paved	0.015	10	5	Ruakura with climate change	93	Asphalt, Concrete	3,980	0.9	95	
	70	1	Paved	0.015	10	5	Ruakura with climate change	93	Roof	3,980	0.95	100	
	70	1	Paved	0.015	10	50	Ruakura with climate change	139	Asphalt, Concrete	3,980	0.9	140	
	70	1	Paved	0.015	10	50	Ruakura with climate change	139	Roof	3,980	0.95	150	
Zone 2	130	1	Paved	0.015	10	5	Ruakura with climate change	93	Asphalt, Concrete	6,530	0.9	155	
	130	1	Paved	0.015	10	50	Ruakura with climate change	139	Asphalt, Concrete	6,530	0.9	230	
Zone 3	160	1	Average Grass	0.045	26	5	Ruakura with climate change	61	Landscaped grass	24,930	0.3	130	
	160	1	Paved	0.015	10	5	Ruakura with climate change	93	Asphalt, Concrete	24,930	0.9	580	
	160	1	Paved	0.015	10	50	Ruakura with climate change	139	Asphalt, Concrete	24,930	0.9	870	

#REF!

Project :	**Ingham Site - Waihekau Road - Waitoa**	**Client :**	Ingam Enterprises Ltd	BLOXAM BURNETT & OLLIVER
Description :	**Carpark Expansion**	**Date :**	28/03/2013	
		Rev :	A	

Soakage Calcuation Sheet - Page 1

Base Input Values		
Rainfall Intensity Chart:	Ruakura with climate change	
Return Period :	5	*yr*
Time of Concentration (Tc)	10	*mins*
Discharge for given Tc	835	(l/s)

Q17 Surface runoff for storm duration of 17 mins

I Rainfall intensity for corresponding storm duration of 17 mins (mm/h)

Qa Allowable rate of discharge by soakage and/or outlet devices, calculated on Page 2

Storage Requirements for the Peak Demand Period

Critical Storm Duration = 17 (mins)

Duration (min)	I (mm/h)	Q17 (l/s)	Qa (l/s)	Volume of water to store during storm event (m^3)	Volume of water soaked or discharged during storm event (m^3)	Total volume of water generated by site during storm event (m^3)
17	76	678	380	204	488	691

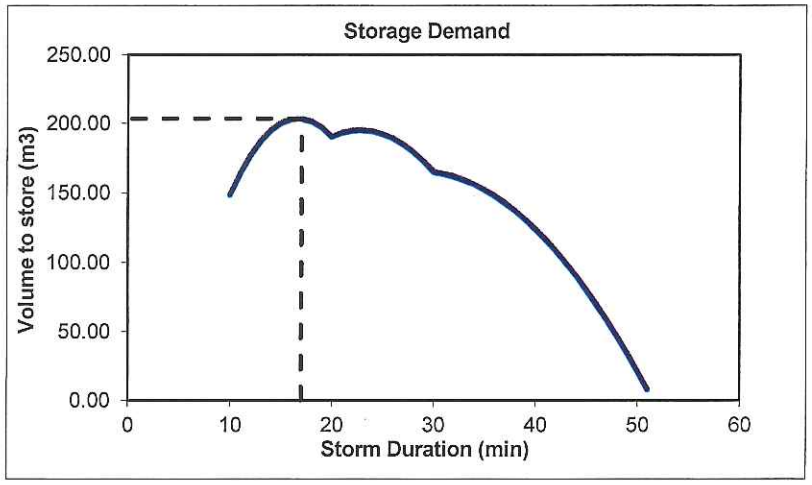

Diagram 1

This diagram represents the volume of water to be stored for any given storm duration. The dashed line indicates the peak event. If the allowable discharge (Qa) meets or exceeds the critical site runoff (Q17) there is no storage requirement.

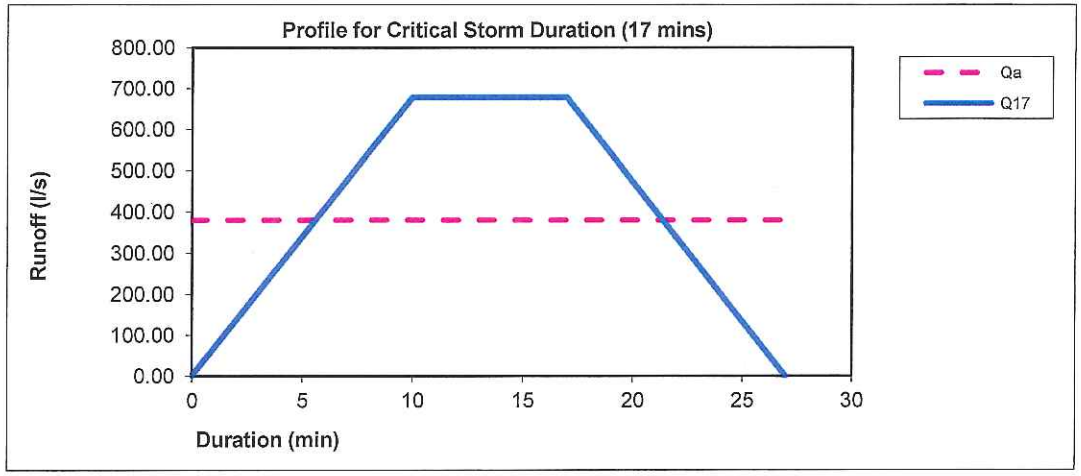

Diagram 2

This diagram represents the flow properties for the critical storm duration (17 mins). The dashed line indicates the discharge by soakage and/or outlet devices (based on calculations in Page 2). The solid line indicates the site discharge during the peak event. The area above the dashed line (within the solid line) is the volume of water to be stored during the critical storm duration, while the area below the dashed line (within the solid line) is the volume of water treated by soakage/outlet.

Project :	Ingham Site - Waihekau Road - Waitoa	Client :	Ingam Enterprises Ltd
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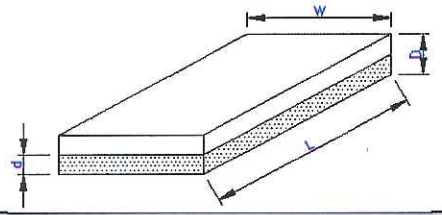
Soakage Calcuation Sheet - Page 2

Soakage Rate (m/s)	1.00E-07

Trench Configuration	
Trench Depth, D (m)	3
Permeable Depth, d (m)	3
Trench Width, W (m)	15.5
Trench Length, L (m)	15
Voids ratio	0.3
Surface Area (m^2)	416
Soakage Discharge (l/s)	0.042
Trench Storage Volume (m^3)	209

Discharge Table 1: Trench

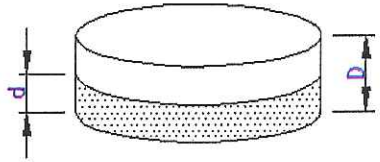


Soak Discharge Devices

Soakage Rate (m/s)	

Circular Hole Configuration	
Total Number of Holes	
Depth of Hole, D (m)	
Permeable Depth, d (m)	
Hole Diameter (m)	
Voids ratio	
Surface Area (m^2)	
Soakage Discharge (l/s)	
Circular Hole Volume (m^3)	

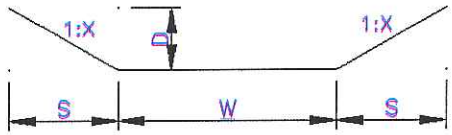
Discharge Table 2: Circular Hole



Soakage Rate (m/s)	

Swale Drain configuration	
Side Grade, 1:	
Swale Depth, D (m)	
Base Width, W (m)	
Swale Length (m)	
Slope Width, S (m)	0
Surface Area (m^2)	
Soakage Discharge (l/s)	
Swale Drain Volume (m^3)	

Discharge Table 3: Swale Drain



Allowable Discharge (Greenfield flow) l/s	380

Summary of Discharge and Storage:

Storage volume available (m^3)	209
Demand volume required (m^3)	204

Summary Table 1: Storage Volume Results

Discharge due to soakage (l/s)	0.042
Allowable Discharge (Greenfield flow) l/s	380

Summary Table 2: Discharge Results

Project :	Ingham Site - Waihekau Road - Waitoa	**Client :**	Ingam Enterprises Ltd
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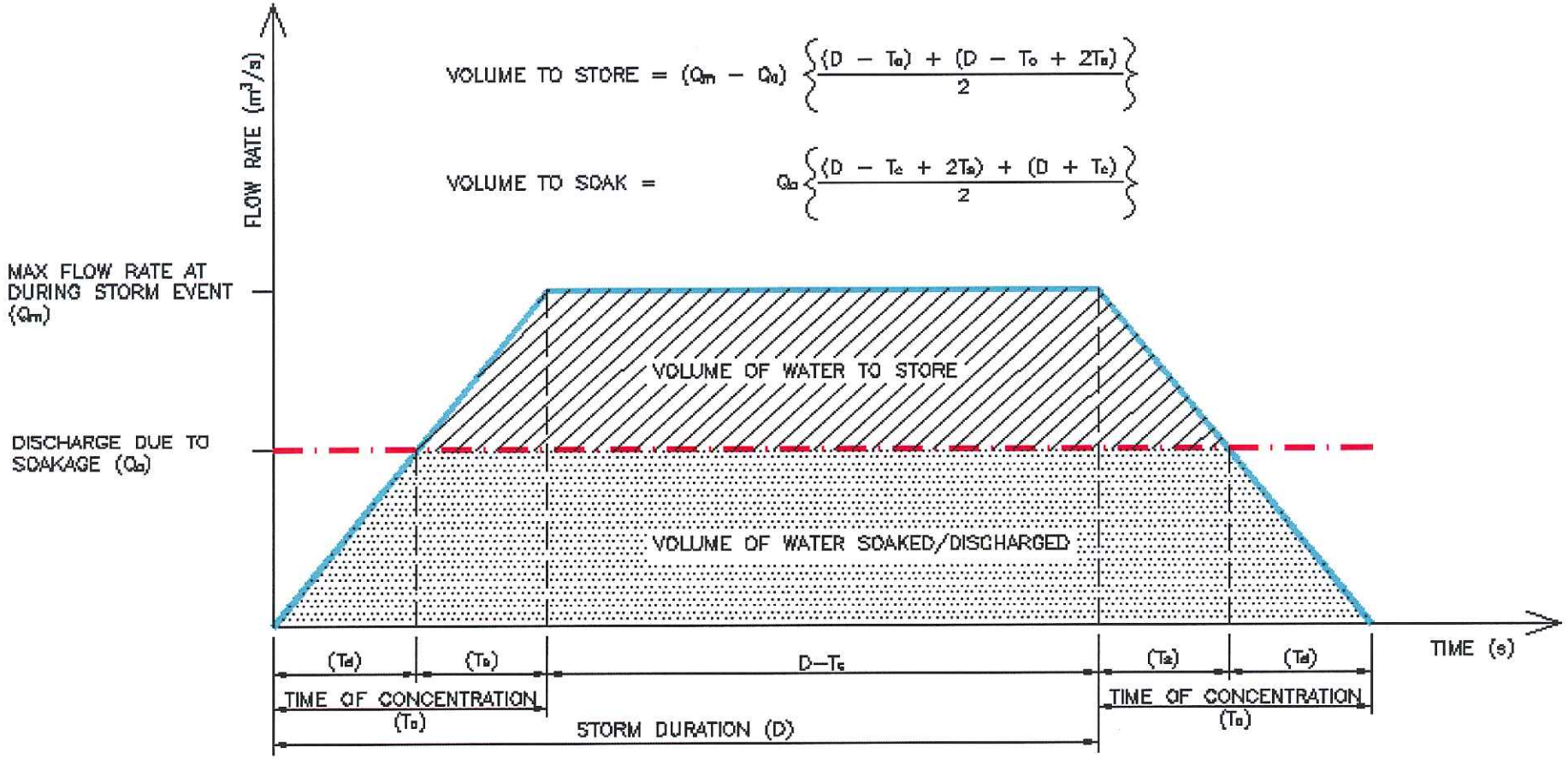
Soakage Calcuation Sheet - Page 3

Forumula Sheet

$$\text{VOLUME TO STORE} = (Q_m - Q_s)\left\{\frac{(D - T_s) + (D - T_c + 2T_s)}{2}\right\}$$

$$\text{VOLUME TO SOAK} = Q_s\left\{\frac{(D - T_c + 2T_s) + (D + T_c)}{2}\right\}$$



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