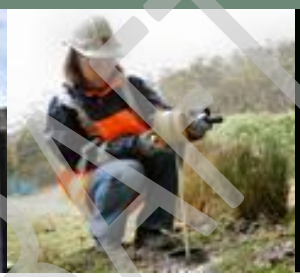
Preliminary Stormwater, Sewerage & Water Supply Design

51 Cranston Parade, Acton

Prepared for:	Danny Noonan
Prepared by:	Robert Casimaty November 2011

transport infrastructure | community infrastructure | industrial infrastructure | climate change



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Robert Casimaty

Date: 25 November 2011

1. Stormwater Drainage

1.1 Description of the Stormwater Catchment

The upstream stormwater catchment for the proposed development is described in drawing HB08115 – P28.

The upper reaches of the catchment are defined by the ridgeline of the Meehan Range, where the catchment is generally steep forested land. At the foothills of the Meehan Range the land is largely developed into 1.0 to 2.0 Ha semi rural allotments. Here the catchment is cut in two by Acton Road and Estate Drive.

To the east of Acton Road and Estate Drive the land is considerably flatter with some limited semi rural development.

The land encompassing the proposed Cranston Parade development is extremely flat and low lying. Inspection suggests that this land acts as a natural retention basin to contain peak stormwater flows from the upstream catchment from entering the downstream Hobart Airport drainage system.

Further to the west the development is characterised by extremely flat low lying undeveloped rural land. This extends to the east to Holyman Drive, which accesses Hobart Airport. There is a large swale drain/retention basin running along the western side of Holyman drive. This drain is part of the Hobart Airport/proposed Direct Factory Outlet development on the eastern side of the Holyman Drive/Tasman Highway intersection.

This swale drain, along with a number of drains from the land proposed for this development discharge into the old Llanherne Golf Club where it spills out into open ground before discharging into the main Hobart Airport drain. This drain discharges under a number of triple 900 mm diameter culverts, including:

- Culverts across Gatty Street
- Culverts across the taxi runway to a minor aircraft hanger
- 300 m long culverts under the Hobart Airport runway.

Downstream of Hobart Airport there is a formed open drain that crosses under Pittwater Road before discharging into Pittwater Bay.

The hydraulic capacity of this outlet drain is 6.5 m^3/s; ensuring a maximum water level upstream of the Gatty Street Culverts of 3.0 m.

The total catchment area upstream of the Hobart Airport culverts inlet is 17.8 sqr km.

An inspection of the catchment on 13 July 2009 indicated that, despite a week of relatively dry weather that proceeded heavy rain; the site was still inundated with water. This suggests that:

- The proposed development is poorly drained
- Infiltration from the site is small to insignificant.

It is considered that any development within this area will need to address the above drainage issues.

1.2 Method of Analysis

1.2.1 Adopted Approach

A preliminary assessment of the stormwater hydraulics of the Cranston Parade site using the rational method outlined in Australian Rainfall and Runoff using a proprietary software package called *drains* was carried out. The following key assumptions were included in our modelling:

- Catchment areas, stream lengths and stream gradients were determined from contours on a 25,000 Tasmap of the area and verified by site inspection
- The storage characteristics of the natural detention basin were calculated from Lidar survey of the site
- The coefficient of runoff from the upstream catchments was assumed to be of the order of C = 0.4
- Levels of the culverts around the Hobart Airport area were obtained from historical ground survey
- The maximum tide level in Pittwater was assumed to be RL 1.85 m. This included a 0.50 m allowance for sea level rise over the next 50 years
- The allowable flow into the Hobart Airport site from the Cranston Parade site and upstream catchment was assumed to be restricted to ensure that the maximum flood level upstream of the Gatty Road culvert was RL 3.0 m. This was to ensure that the risk of flooding of the Hobart Airport terminal, adjacent car parks and runway was minimised
- No allowance was made for retention of flows from any future development within the Hobart Airport precinct. It has been assumed that these additional flows will be managed by that developer.

The analysis involved undertaking a hydraulic profile of the Hobart Airport drain from Pittwater back to the Gatty Road Culvert. This was used to determine the maximum flow through this section of the drainage network that would prevent flooding of the Gatty Road culvert.

Upstream of the Gatty Road Culvert the storm flows were diverted through a retention basin in order to limit the downstream flows (and the resultant flood levels) to prevent flooding of the Gatty Road culvert.

1.2.2 Limitations of the Analysis

The analysis was undertaken without consultation with other adjacent landowners, particularly Hobart Airport. As a consequence a number of assumptions were required:

- The analysis has assumed that any development within the Hobart Airport precinct will adopt the same 1 in 20 year and 1 in 100 year flood levels
- The analysis assumes that a 1 in 100 year flood level of RL 3.0 will be adopted by Hobart Airport for protection of the runway
- No allowance has been made for retaining storm flows from the Hobart Airport land. This has meant that the calculated retention volumes for the development of the Cranston Parade site may be too conservative. It is considered that, if development occurs on the Hobart Airport site then the proponents would be expected to also provide some form of retention

- It has been assumed that the drainage system between the downstream end of the Holyman Drive swale and the Gatty Road culvert (through the old Llanherne golf course) will be upgraded to a suitably sized open drain or swale drain system
- No condition assessment was made of the condition of the culverts and open drains downstream of the Cranston Parade site.

It is expected that the above will be addressed by any developers of the Hobart Airport land.

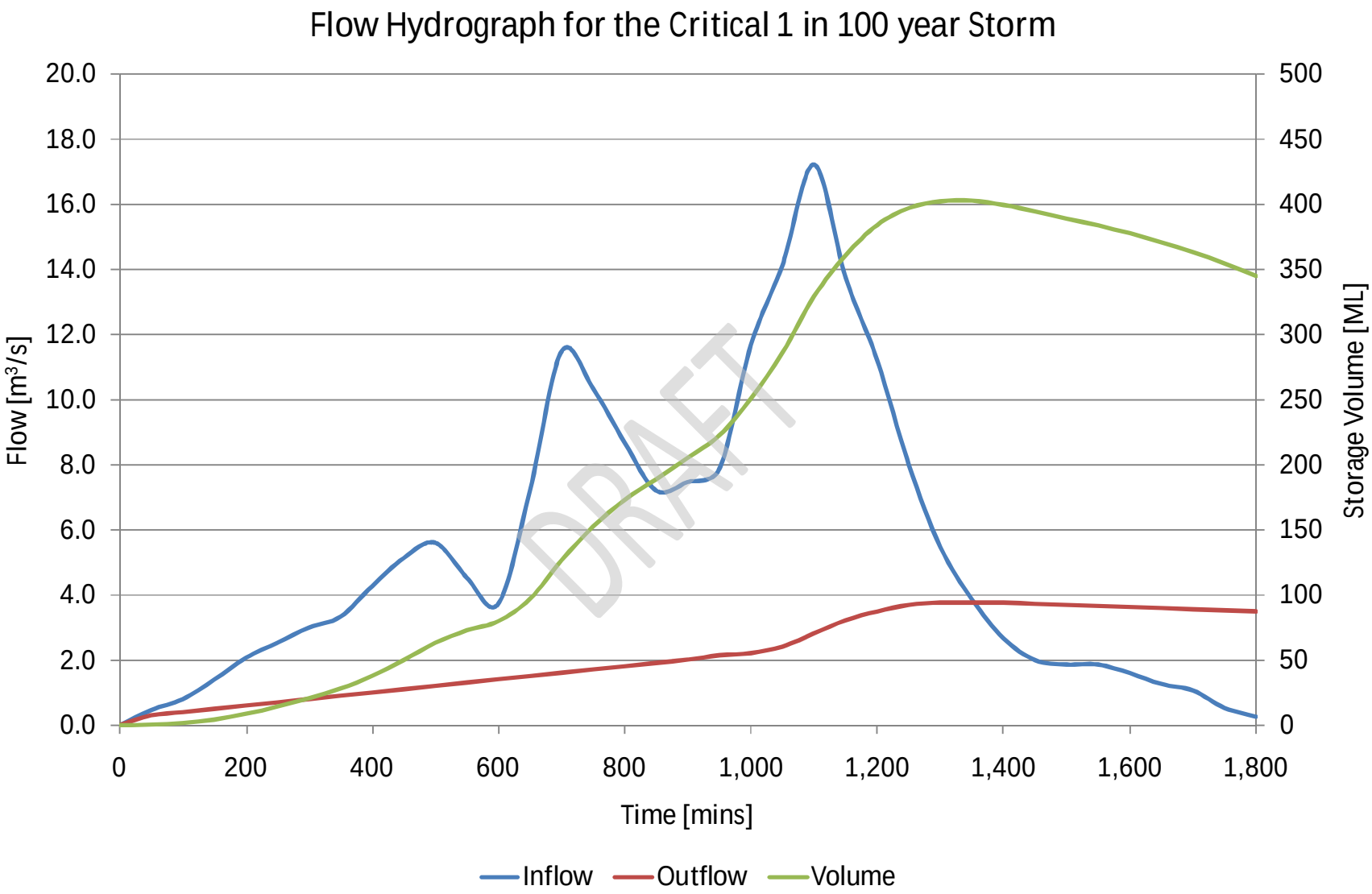
1.3 Outcomes of the Analysis

The hydraulic model was run for both a 1 in 20 and a 1 in 100 storm event scenario. The results of the analysis are as follows:

	1 in 20 year storm	1 in 100 year storm
Critical storm duration	30 hours	30 hours
Maximum flow onto site	11.5 m^3/s	17.2 m^3/s
Maximum flow from site	2.63 m^3/s	3.84 m^3/s
Maximum flood level on site	2.80 m	3.25 m
Stormwater Retention Volume	300,000 kL	410,000 kL

The following figure depicts the inflow and outflow hydrographs for the 1 in 100 year storm for the proposed development.

To cater for a 1 in 100 year storm it is considered that a 410,000kl storage will be required.


Flow Hydrograph for the Critical 1 in 100 year Storm
Flow [m³/s]
Storage Volume [ML]
Time [mins]
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
500
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
Inflow
Outflow
Volume
DRAFT

Preliminary discussions with Clarence City Council regarding their stormwater design requirements for this development have suggested that the following minimum levels may need to be adopted for the development:

Parameter	Minimum Level
Minimum building pad levels	300 mm above maximum 1 in 100 year storm
Road levels	above the 1 in 20 year storm level

This will not only require substantial filling over the Cranston Parade site but will reduce the holding capacity of the natural detention basin.

A minimum building level of 3.6m has been adopted for the development.

1.4 Proposed Detention Storage

The proposed development of the site will reduce the holding capacity of the existing low lying land. To overcome this it is proposed to construct a deeper retention basin within the undeveloped land. This is depicted in drawing HB08115 – P27.

The new detention basin will have footprint of 15 Ha and a floor level of around RL 1.5 m to match in with the levels of the surrounding drainage system. Once the pond fills to RL 2.25 m, stormwater will start to spill into the vegetation conservation area. This will replicate the existing drainage conditions encountered on this land. The total flooded area at top water level, including inundation into the conservation land would be 55 Ha.

The outlet of the detention basin will be connected to the existing Hobart Airport drainage system via an open drain. The drain will have a nominal slope of 1 in 5,000 and will have a cross sectional width of around 6 m to cater for the hydraulic capacity of the outlet to Pittwater.

The estimated storage capacity of the detention storage is as follows:

	Pond Water Level			
	1.50 m	2.25 m	2.70 m	3.00 m
Surface area of pond	148,740 m^2	151,775 m^2 333,890 m^2	535,698 m^2	538,410 m^2
Capacity of Pond	-	110,000 kL	180,000 kL	220,000 kL
Capacity of Conservation Area	-	-	90,000 kL	200,000 kL
Capacity of Drain	-	10,000 kL	20,000 kL	20,000 kL
Total Capacity		120,000 kL	290,000 kL	440,000 kL

The pond top water level of 3.00m will provide approximately 250mm hydraulic fall from the development into the pond.

2. Water Services

2.1 Estimated Water Demand

The estimated water supply demand from the development has been calculated from the following three flow streams:

- General consumption by users within the development – such as washing, drinking and toilet flushing
- Estimated fire hydrant demands
- Estimated fire sprinkler demands.

The following outlines the methodologies used to estimate the above flows.

2.1.1 General Water Consumption

General water consumption has been estimated using typical data contained in Water Services Association of Australia (WSAA), Water Supply Code of Australia, Second Edition, Version 2.3. This has been compared with Southern Water's current water headworks policy for the Clarence Municipality, which was prepared by the Clarence City Council prior to the water and sewerage reform.

The water headworks plan for the Clarence Municipal area for a light industrial development uses 25 per Litres gross floor area as an average daily water demand for general consumption.

This equates to a peak flow of 0.50 L/s where the floor area equals half the total development and the peak to average flow ratio is 3.2.

WSAA recommend the following peak water demands for light industrial developments:

- Melbourne 0.40 L/s
- Canberra 0.54 L/s
- Adelaide 0.65 L/s
- Ballarat/Bendigo 0.50 L/s.

This suggests that 0.50 L/s is appropriate.

For a 60 Ha development this equates to 30 L/s peak water consumption demand.

2.1.2 Sprinklers

Sprinkler system water supply demands have been estimated using AS 2118.1 for normal industrial applications, excluding foam and paper storage. For a sprinkler design flow of 10 mm per minute and 200 square metre fire compartments this equates to a peak design flow of 53 L/s.

2.1.3 Hydrants

Fire hydrant water supply demands have been estimated using AS 2419.1 and assuming the following design scenarios:

- 1 to 2 storey developments with < 5,000 square meter compartments and – requiring 2 hydrants each at 10 L/s (or 20 L/s total) acting in conjunction with sprinklers
- Areas greater than 27,000 m^2 without sprinklers requiring a total of 4 hydrants each at 10 L/s (or 40L/s total) acting without sprinklers.

2.1.4 Total Water Demand

The total water demand has been estimated as 95 L/s from the following scenarios:

Case	Peak Flow
General consumption: 100%	30 L/s
General consumption: 75% Sprinklers: 100% Hydrants: 100%	95 L/s
General consumption: 75% No Sprinklers Hydrants: 100%	63 L/s

2.2 Proposed Connection to Southern Water Infrastructure

At this stage Southern Water has not been contacted regarding connection of the development to their water reticulation.

3. Sewage Services

3.1 Sewage Discharges

The estimated sewage discharge from the proposed development has been estimated using typical data from a number of sources, including:

- Data contained in Water Services Association of Australia (WSAA), Sewerage Code of Australia, Second Edition, Version 2.3
- Southern Water's current sewer headworks policy for the Clarence Municipality, which was prepared by the Clarence City Council prior to the water and sewerage reform
- Typical data contained in Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse.

The following summaries this information:

Case	Basis	Flow
WSAA Sewerage Code of Australia	150 equivalent persons per gross Ha 180 L per equivalent person per day	27 kL per day per gross Ha
Headworks Policy	20 equivalent persons per gross floor area in Ha 225 L per equivalent person per day Gross floor area to total area equals 50%	9.0 kL per day per gross Ha
Metcalf and Eddy	75 L per person per day 100 persons per gross Ha	7.5 kL per day per gross Ha

The data obtained from WSAA appears unreasonably conservative so the adopted average dry weather flow from the development has been assumed to be 9.0 kL per gross Ha per day or 540 kL per day total.

The peak flow from the development will depend on the quality of the connections, quality of the sewer network, the amount of rain and the level of the water table within the catchment. As almost all the sewer catchment will be pumped it has been assumed that the peak wet weather flow will be six times the average dry weather flow or 3,240 kL per day.

3.2 Proposed Connection to Southern Water's Sewer Infrastructure

3.2.1 Treatment

The proposed development is located in close proximity to the Cambridge WWTP. This plant was built in 2008 and has a licence capacity of 0.80 ML/day average dry weather flow. In May 2010 the actual average dry weather flow was 0.50 ML per day. The Cambridge WWTP will need to be augmented to receive and treat the proposed average dry weather flows of 0.55 ML per day from this development.

3.2.2 Reticulation

The proposed development lies on very flat land with a high water table. While such land can be reticulated with sewer infrastructure using conventional gravity mains and pump stations this can be expensive. Subject to detailed design and costing, it is proposed to use either the conventional gravity reticulation or pressure sewage system that has been designed and installed to Southern Water's satisfaction.

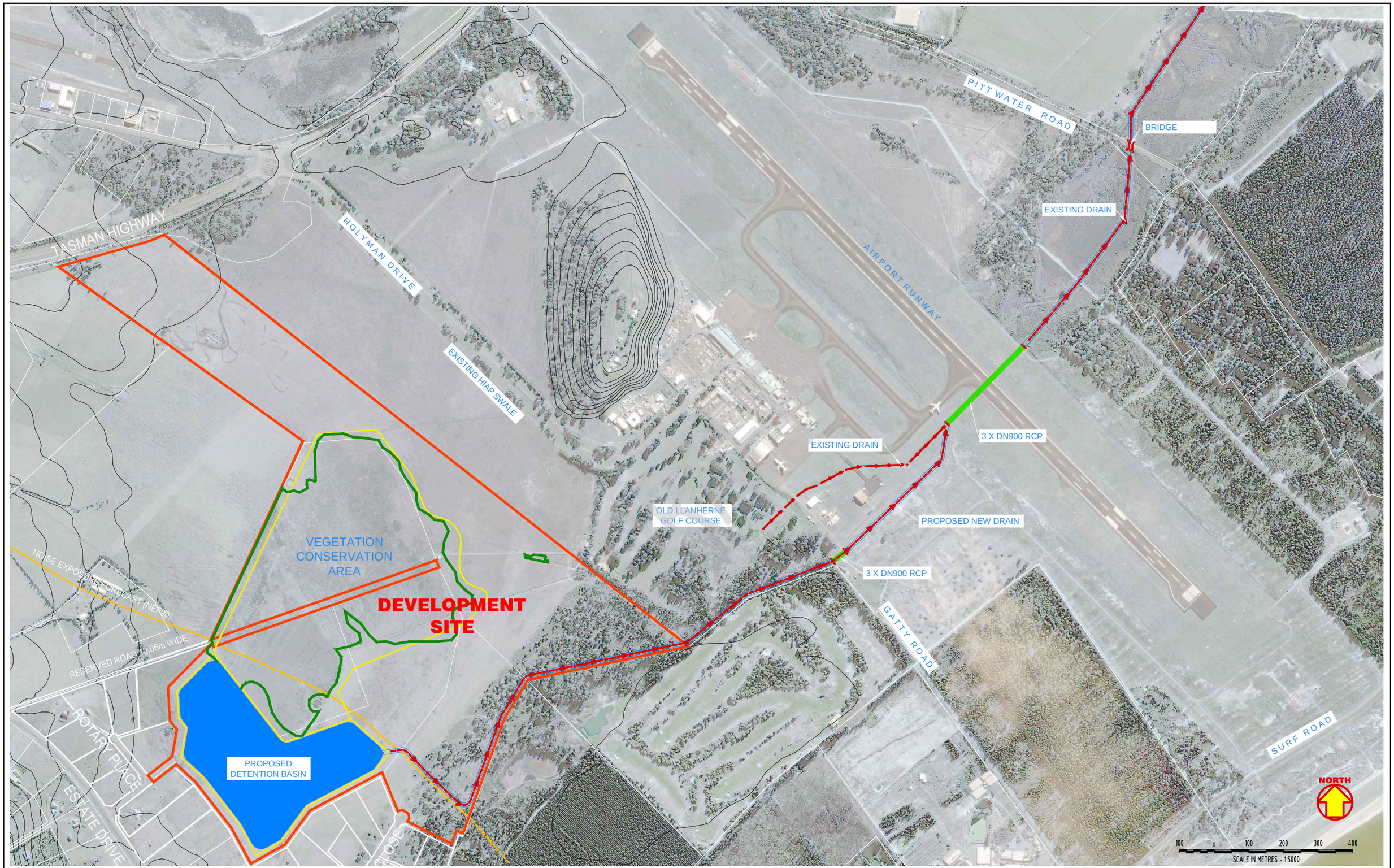
3.2.3 Trunk Mains

There is an existing trunk sewer from Cambridge that runs near the proposed development before connecting into the Cambridge WWTP. This trunk main is a pressure pipe that has flows from Cambridge and the Airport Hotel injected into it. Injecting further flows from this proposed development into the existing pressure main is considered to be extremely complicated and will not be adopted. Accordingly, a new main pump station and rising main will be provided from the proposed development to the Cambridge WWTP. Subject to detailed design and to the extent that other adjacent developments will use this rising main, it is expected that the pipe will need to be around 200 – 300 mm in diameter.

Appendix A

Drawing HB08115 - P27
Site Master Plan, Site Stormwater Drainage Plan

Drawing HB08115 - P28
Master Plan, Development Site Total Stormwater Catchment Plan



SITE STORMWATER DRAINAGE PLAN

REFERENCE FILES ATTACHED: HB08115-X3_C3D; HB08115-X5; HB08115-X6; HB08115-X1

P&S FORM DRG-A1 REV 25

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	DATE	APPROVED
					SIGNED
		R. GIBSON	R. CASIMATY	9-5-2011	DATE

SCALE (PLOTTED FULL SIZE) 1:5000 (A1)

SHEET SIZE A1

REDUCED SCALE PLOT

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CONTRACT TITLE: SITE MASTER PLAN
51 CRANSTON PARADE CAMBRIDGE

STATUS: **PRELIMINARY**

DRAWING TITLE: SITE MASTER PLAN
SITE STORMWATER DRAINAGE PLAN

DATUMS: AHD / GDA PLANE

CLIENT No. –

DRAWING No. HB08115-P27

SHEET 1

REVISION –

VERSION

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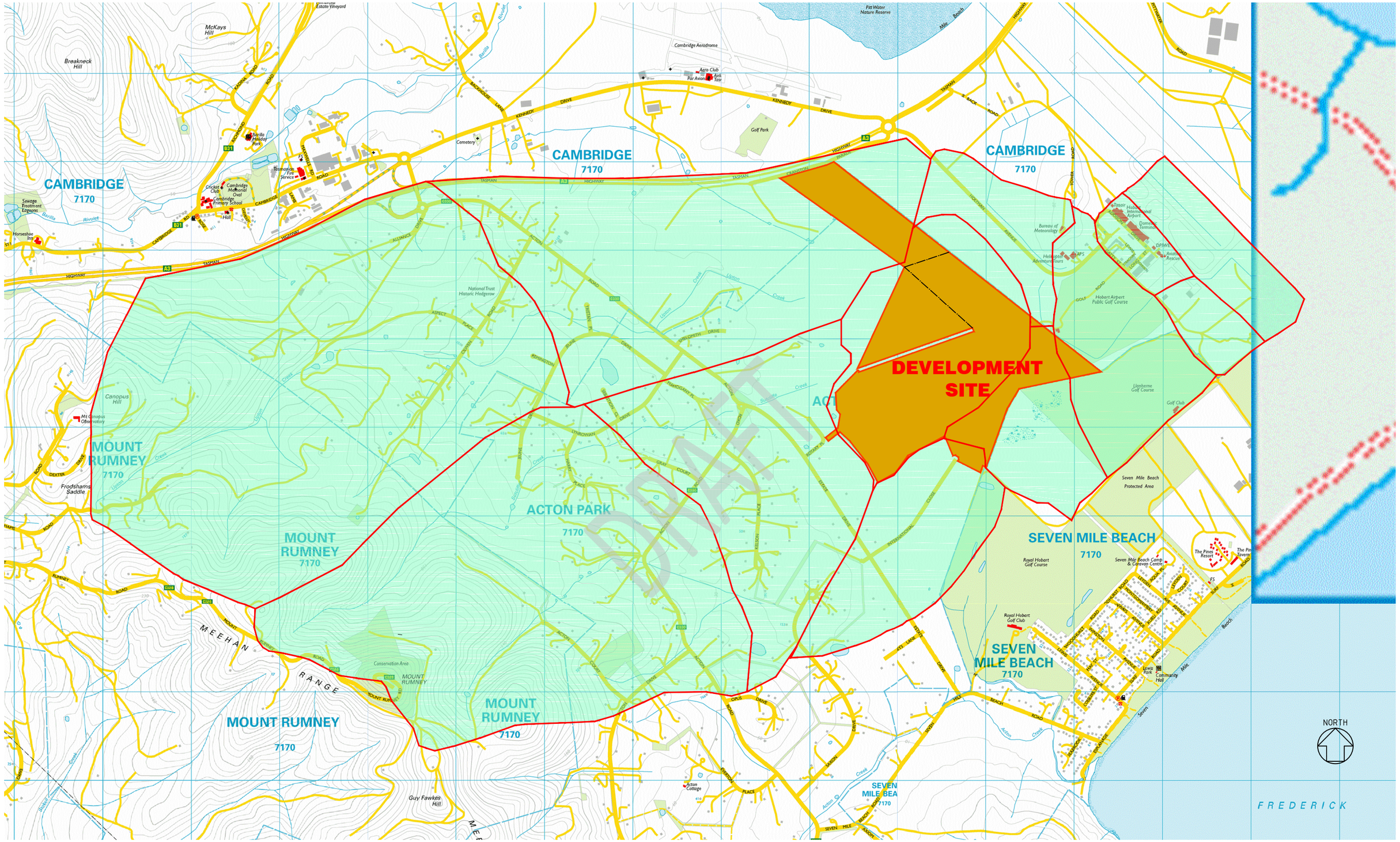

DEVELOPMENT SITE PLAN

200 0 200 400 600 800

SCALE IN METRES - 1:10000

REFERENCE FILES ATTACHED: HB08115-X5; HB08115-X6; HB08115-X7; HB08115-X1

P&S FORM DRG-A1 REV 21

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	DATE	APPROVED
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SHEET SIZE A1

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CLIENT: G. J. CASIMATY

CONTRACT TITLE: SITE MASTER PLAN
51 CRANSTON PARADE CAMBRIDGE

STATUS: PRELIMINARY

DRAWING TITLE: MASTER PLAN
DEVELOPMENT SITE
TOTAL STORMWATER CATCHMENT PLAN

REF. DRGs.

DRAWING No. HB08115-P28

REV. -

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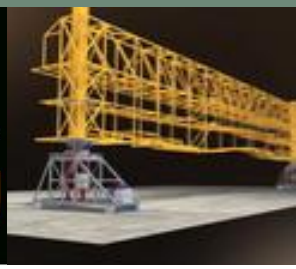

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