WALLACIA GOLF COURSE REDEVELOPMENT - FLOOD ASSESSMENT

REPORT FOR CATHOLIC METROPOLITAN MEMORIAL TRUST

OCTOBER 2017

grc HYDRO

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WALLACIA GOLF COURSE REDEVELOPMENT - FLOOD ASSESSMENT

FINAL REPORT
OCTOBER 2017

Project Wallacia Golf Course Redevelopment - Flood Assessment	Project Number 170038
Client Warren Smith & Partners / Catholic Metropolitan Memorial Trust	Client Representative Nicole Meo
Authors Stephen Gray Beth Marson	Prepared by  Stephen Gray
Date 26 October 2017	Verified by  Zac Richards

Revision	Description	Distribution	Date
1	Draft Report	Warren Smith & Partners	October 2017
2	Final Report	Warren Smith & Partners	October 2017

Table of Contents

Introduction

This report provides a flood assessment for the proposed redevelopment of the Wallacia Golf Course, located at 13 Park Road Wallacia (the subject site).

Figure 1 (see rear of report for figures) presents the location of the subject site which is north of Park Road, east of the Nepean River and south of Penrith CBD.

Site Description

The site is traversed by Jerrys Creek and tributaries of the same. The upstream catchment of Jerrys Creek at the southern boundary of the subject site is 6 km^2. A catchment map for Jerrys Creek is shown in Figure 2.

The 1% AEP flood liability of the site is shown in Figure 3. The flood behaviour on the site can be described as follows:

- 1% AEP flow in Jerrys Creek through the site is 51.3 m^3/s;
- flood levels on Jerrys Creek range from 38.6 mAHD in the upstream (at the southern boundary of the site) to 35.2 mAHD at the northern boundary of the site;
- tributary flood levels vary significantly owing to the rolling terrain found on the subject site; and
- the most significant tributary, situated on the northern boundary of the subject site, flows in a western direction towards Jerrys Creek and is significantly attenuated via a series of basins. The 1% AEP Peak flow in the tributary is 14.2 m^3/s immediately upstream of the confluence.

Proposed Development

The proposed development is defined by the plans presented in Attachment A. All built elements are located outside the flood extent with the one exception being the road layout. The road layout does interact with some of the minor overland flow paths and tributary watercourses that run to Jerrys Creek. Overall however the road network lies approximately flush on ground and so impacts on flood behaviour are relatively minor. Drainage (design by Warren Smith and Partners) has been incorporated into the developed case scenario to alleviate cross flow at those locations were the road does interact with modelled flow paths.

Design Goal

The design goals were to:

- Build an accurate modelling system for the subject site;
- Define site flood liability in the 1% AEP event;
- Ensure that proposed development was compatible with modelled flood liability in accordance with the NSW Floodplain Development Manual (NSW, 2005); and
- Ensure that proposed development did not result in unacceptable flood impacts for areas proximate to the subject site.

Previous Studies

Penrith City Council has carried out the Overland Flow Flood Overview Study in 2006 in order to:

- identify and map all major overland flow paths
- define local flood behaviour in the study area
- assess provisional flood hazard for properties at risk from flooding, and
- rank catchment areas in terms of severity of flooding to help prioritise catchment areas for further studies and risk management plans.

The current study incorporates a higher degree of detail relative to the Council study, particularly in regard to the hydrological model used, with the aim of better defining flood behaviour for the subject site.

No other previous study have been identified for the subject site or the Jerrys Creek catchment.

Model Build

To carry out the assessment GRC Hydro have built a modelling system. This system is based on the use of a hydrological model (WBNM) to convert rainfall into runoff and then a hydraulic model (TUFLOW) to convert applied runoff into depths and levels. TUFLOW is a hydraulic modelling tool that can utilise one and two dimensional model elements. Both WBNM and TUFLOW are commonly used in Australia for flood modelling and can be considered best practice.

The modelling system is comprised of the following elements:

- Lidar data has been used to inform a 2 m finite difference grid. This data has a typical accuracy of +/- 0.15 m (1st confidence interval);
- pipe elements are included in the developed case only at road locations subject to traversing flows;
- Roughness was applied universally as a value of 0.05 (Mannings). In the developed case model the road layer was given a roughness of 0.02;
- A free draining outlet was allowed at the catchment's downstream boundary;
- The proposed development as presented in the plans displayed in Attachment A were incorporated into the model to produce a developed case; and
- proposed basins were implemented into the developed case model via the inclusion of break lines which represented the dam/earth bund.

The 2 and 9 hour durations were run based on our past experience of critical durations for various catchment areas in the Sydney metropolitan area. Of these the 2 hour event produced peak flood levels on the site.

Site Flooding

Flood Model Results

The following figures present the existing and proposed development scenario flood model results:

- Figure 3: Existing Scenario – 1% AEP flood depths and levels;
- Figure 4: Existing Scenario – 1% AEP flood hazard;
- Figure 5: Proposed Development – 1% AEP flood depths and levels; and
- Figure 6: Proposed Development – 1% AEP flood hazard.

As indicated in Figure 3 the subject site is flood prone in the 1% AEP event. Comments in regard to flooding in the 1% AEP event:

- Jerrys Creek traverses the subject site and has a peak flow of 51.3 m^3/s in the 1% AEP event;
- Overall flood liability of the site is limited;
- Besides the road layout and proposed basins, none of the proposed development interacts with flood liable regions of the site; and
- Flood liability of the road layout has been relieved via implemented cross-flow drainage, although element sizes are relatively minor at ~ 300 mm diameter in the majority of cases.

Impacts

The impact that the proposed development has on peak flood levels is examined in Figure 7. This figure indicates that proposed development causes negligible changes to the subject site's flood liability in the 1% AEP event. Additionally, the proposed development causes no impacts on adjoining properties.

Conclusions

Development of the subject site is proposed as per plans attached in Attachment A.

The subject site's flood affectation is mild in the 1% AEP event and it is not substantially altered by the proposed development.

Based on the work presented herein it is our assessment that:

- Site flood liability in the 1% AEP event is defined by Figure 3;
- The proposed development integrates well with subject site flood liability;
- No building floor levels are required to be informed by these results; and
- No impacts off-site occur due to proposed development.

FIGURES

FIGURE 1
WALLACIA GOLF COURSE REDEVELOPMENT
SUBJECT SITE LOCATION

MULGOA ROAD

PARK ROAD

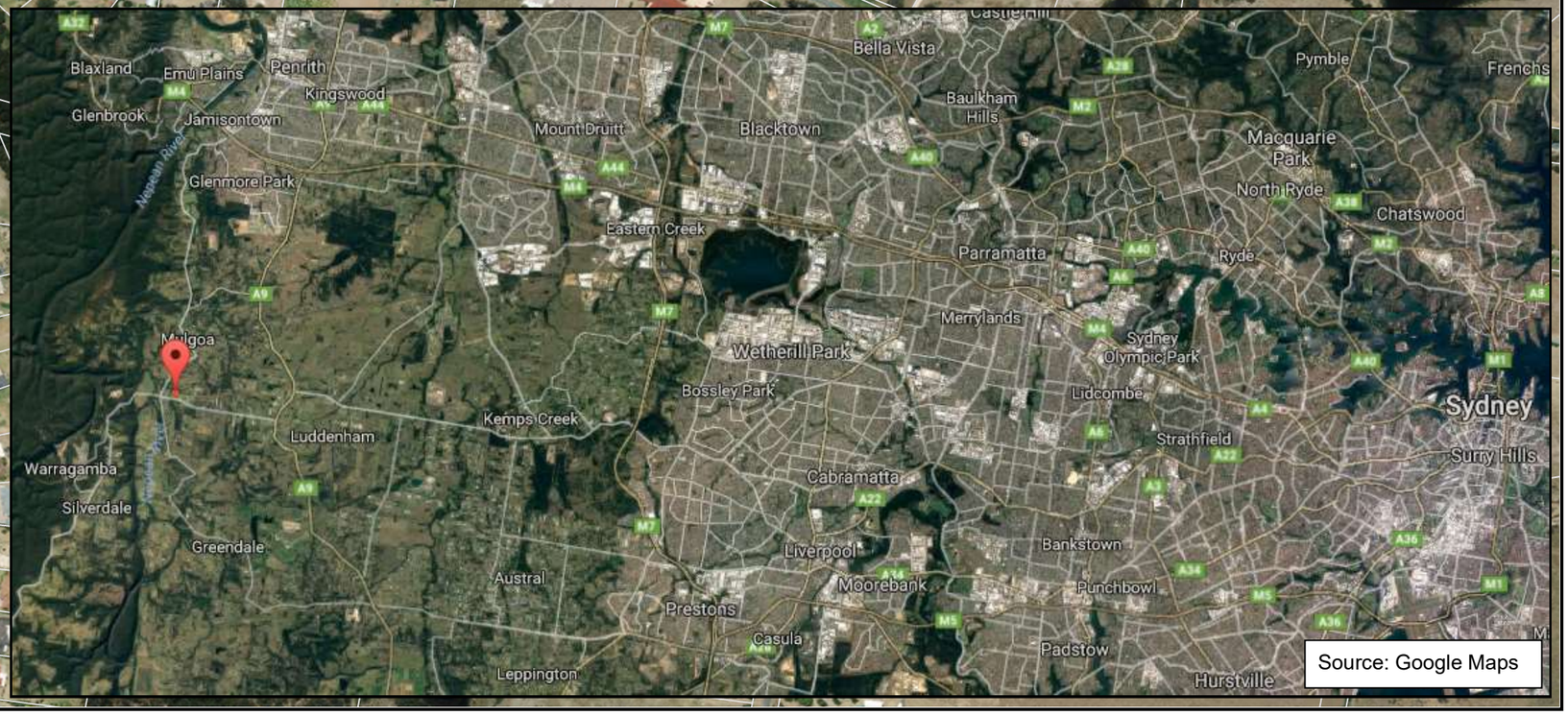
GREENDALE ROAD

N

0 150
meters

Subject Site

Cadastral Boundaries



Source: Google Maps

FIGURE 2
WALLACIA GOLF COURSE REDEVELOPMENT
UPSTREAM CATCHMENT & GROUND LEVEL

Ground Level (m AHD)
- 40 to 45
- 45 to 50
- 50 to 55
- 55 to 60
- 60 to 65
- 65 to 70
- 70 to 75
- 75 to 80
- 80 to 85
- 85 to 90

Wallacia Subcatchments

Subject Site

Cadastral Boundaries

N

0 435
meters

FIGURE 3
WALLACIA GOLF COURSE REDEVELOPMENT
1% AEP DESIGN EVENT
EXISTING PEAK FLOOD DEPTHS

Flood Depth (m)
- 0.05 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- 0.5 to 1
- > 1

Major Flood Level Contours (2 m Spacing)

Minor Flood Level Contours (1 m Spacing)

Subject Site

Cadastral Boundaries

N

0 110
meters

FIGURE 4
WALLACIA GOLF COURSE REDEVELOPMENT
1% AEP DESIGN EVENT
EXISTING FLOOD HAZARD

Low Hazard
High Hazard
Subject Site
Cadastral Boundaries

N

0 110
meters

FIGURE 5
WALLACIA GOLF COURSE REDEVELOPMENT
1% AEP DESIGN EVENT
PROPOSED PEAK FLOOD DEPTHS

Flood Depth (m)
- 0.05 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- 0.5 to 1
- > 1

Major Flood Level Contours (2 m Spacing)
Minor Flood Level Contours (1 m Spacing)

Proposed Stormwater Network
- Proposed Pipes
- Proposed Pits
- Proposed Basins
- Proposed Road Outline
- Subject Site
- Cadastral Boundaries

N

0 110
meters

FIGURE 6
WALLACIA GOLF COURSE REDEVELOPMENT
1% AEP DESIGN EVENT
PROPOSED FLOOD HAZARD

Low Hazard
High Hazard

Proposed Stormwater Network
Proposed Pipes
Proposed Pits
Proposed Basins
Proposed Road Outline
Subject Site
Cadastral Boundaries

N
1

0 110
meters

FIGURE 7
WALLACIA GOLF COURSE REDEVELOPMENT
1% AEP DESIGN EVENT
PROPOSED PEAK FLOOD IMPACTS

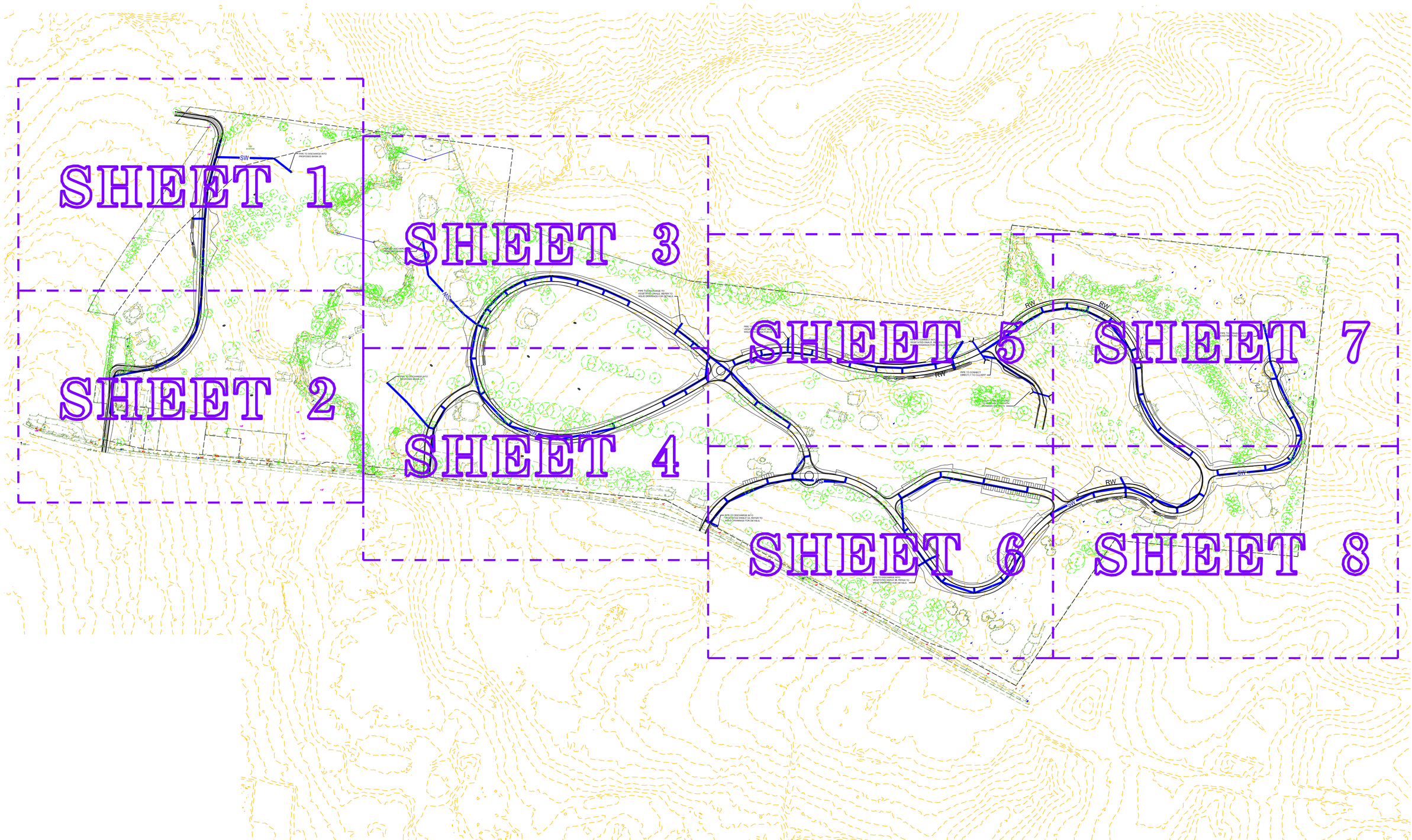
Change in Flood Level (m)
- < -0.3
- -0.3 to -0.2
- -0.2 to -0.1
- -0.1 to -0.01
- No Impact
- 0.01 to 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- > 0.3
- Newly Flooded
- No Longer Flooded

Proposed Stormwater Network
- Proposed Pipes
- Proposed Pits
- Proposed Basins
- Proposed Road Outline
- Subject Site
- Cadastral Boundaries

N

0 110
meters

ATTACHMENT A



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NORTH

20 0 20 40 60 80 100m

PLAN SCALE 1:2000 A1 SHEET

REVISION	AMENDMENT	DATE	REVISION	AMENDMENT	DATE
01	ISSUE FOR DEVELOPMENT APPLICATION	19/10/17			

CLIENT

Catholic Cemeteries & Crematoria
Care, Compassion, Choice

PROJECT

WALLACIA GOLF COURSE

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TITLE

STORMWATER KEY PLAN

SCALE	DRAWN	DESIGNED	CHECKED	APPROVED
AS SHOWN	M.CZ.	N.M.	N.M.	M.C.

JOB No.	DRAWING No.	ISSUE
5936000	C6.01	1

DATE	STATUS
SEP 2017	DEVELOPMENT APPLICATION

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

LEGEND

- ▭ 600 x 900 GRATED INLET PIT
- Ø450 STORMWATER PIPE DIAMETER AND FLOW
- SW STORMWATER PIPE
- SWALE
- PIT STRUCTURE NUMBER
- STORMWATER LINE NUMBER
- ⇨ INDICATIVE OVERLAND FLOW ROUTE
- CONCRETE HEADWALL

Xrefs: X-5936000-TB_A1H; X-5936000-SU_Contours; X-5936000-SW_Layout; X-5936000-DE_Design; X-5936000-ARCH_Landscape; X-5936000-SU_Ground; X-5936000-TB
Plot Date: 19.10.2017@16:08:31 Login Name: nmeo Cad File: T:\5936000\Drawings\AutoCAD\Civil\Design\Civil 2D\C6.02 Stormwater Layout Plan Sheet 1.dwg

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PLAN SCALE 1:500 A1 SHEET

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TITLE
STORMWATER LAYOUT PLAN SHEET 1 OF 8

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JOB No.	DRAWING No.	ISSUE
5936000	C6.02	1

DATE	STATUS
SEP 2017	DEVELOPMENT APPLICATION

LEGEND

- 600 x 900 GRATED INLET PIT
- Ø450 — STORMWATER PIPE DIAMETER AND FLOW
- SW — STORMWATER PIPE
- SWALE
- PIT STRUCTURE NUMBER
- STORMWATER LINE NUMBER
- INDICATIVE OVERLAND FLOW ROUTE
- CONCRETE HEADWALL

A D J O I N S S H E E T 1

A D J O I N S S H E E T 4

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TITLE: **STORMWATER LAYOUT PLAN SHEET 2 OF 8**

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JOB No.	DRAWING No.	ISSUE
5936000	C6.03	1

DATE: SEP 2017 STATUS: DEVELOPMENT APPLICATION

LEGEND

- 600 x 900 GRATED INLET PIT
- Ø450 — STORMWATER PIPE DIAMETER AND FLOW
- SW — STORMWATER PIPE
- SWALE
- PIT STRUCTURE NUMBER
- STORMWATER LINE NUMBER
- INDICATIVE OVERLAND FLOW ROUTE
- CONCRETE HEADWALL

PIPE TO DISCHARGE INTO PROPOSED BASIN 2B

PIPE TO DISCHARGE TO VEGETATED SWALE. REFER TO WSUD DRAWINGS FOR DETAILS.

ADJOINS SHEET 1

ADJOINS SHEET 5

ADJOINS SHEET 4

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TITLE: **STORMWATER LAYOUT PLAN SHEET 3 OF 8**

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JOB No.	DRAWING No.	ISSUE
5936000	C6.04	1

DATE	STATUS
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A D J O I N S S H E E T 3

PIPE TO DISCHARGE INTO PROPOSED BASIN 2A

A D J O I N S S H E E T 5 & 6

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LEGEND

- 600 x 900 GRATED INLET PIT
- Ø450 STORMWATER PIPE DIAMETER AND FLOW
- SW STORMWATER PIPE
- SWALE
- PIT STRUCTURE NUMBER
- STORMWATER LINE NUMBER
- INDICATIVE OVERLAND FLOW ROUTE
- CONCRETE HEADWALL

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TITLE **STORMWATER LAYOUT PLAN SHEET 4 OF 8**

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JOB No.	DRAWING No.	ISSUE
5936000	C6.05	1

DATE SEP 2017 STATUS DEVELOPMENT APPLICATION

LEGEND

- 600 x 900 GRATED INLET PIT
- Ø450 — STORMWATER PIPE DIAMETER AND FLOW
- SW — STORMWATER PIPE
- SWALE
- PIT STRUCTURE NUMBER
- STORMWATER LINE NUMBER
- INDICATIVE OVERLAND FLOW ROUTE
- CONCRETE HEADWALL

ADJOINS SHEET 3 & 4

ADJOINS SHEET 7

PIPE TO CONNECT INTO VEGETATED SWALE. REFER TO WSUD DRAWINGS FOR DETAILS.

PIPE TO CONNECT INTO VEGETATED SWALE. REFER TO WSUD DRAWINGS FOR DETAILS.

PIPE TO CONNECT DIRECTLY TO CULVERT

GULLY TO BE REGRADED TO MAINTAIN FLOW PATH BETWEEN CULVERTS

ADJOINS SHEET 6

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TITLE: **STORMWATER LAYOUT PLAN SHEET 5 OF 8**

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JOB No.	DRAWING No.	ISSUE
5936000	C6.06	1

DATE	STATUS
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A D J O I N S S H E E T 5

A D J O I N S S H E E T S 3 & 4

A D J O I N S S H E E T 8

PIPE TO DISCHARGE INTO VEGETATED SWALE 3A. REFER TO WSUD DRAWINGS FOR DETAILS.

PIPE TO DISCHARGE INTO VEGETATED SWALE 3B. REFER TO WSUD DRAWINGS FOR DETAILS.

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LEGEND

- 600 x 900 GRATED INLET PIT
- Ø450 — STORMWATER PIPE DIAMETER AND FLOW
- SW — STORMWATER PIPE
- SWALE
- PIT STRUCTURE NUMBER
- STORMWATER LINE NUMBER
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TITLE: **STORMWATER LAYOUT PLAN SHEET 6 OF 8**

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TITLE

STORMWATER LAYOUT PLAN SHEET 7 OF 8

SCALE	DRAWN	DESIGNED	CHECKED	APPROVED
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JOB No.	DRAWING No.	ISSUE
5936000	C6.08	1

DATE	STATUS
SEP 2017	DEVELOPMENT APPLICATION

ADJOINS SHEET 7

LEGEND

▤	600 x 900 GRATED INLET PIT
Ø450	STORMWATER PIPE DIAMETER AND FLOW
—SW—	STORMWATER PIPE
←	SWALE
⊖	PIT STRUCTURE NUMBER STORMWATER LINE NUMBER
⇨	INDICATIVE OVERLAND FLOW ROUTE
≻▬	CONCRETE HEADWALL

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NORTH

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PLAN SCALE 1:500 A1 SHEET

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TITLE
STORMWATER LAYOUT PLAN
SHEET 8 OF 8

SCALE	DRAWN	DESIGNED	CHECKED	APPROVED
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DATE	STATUS
SEP 2017	DEVELOPMENT APPLICATION

Xrefs: X-5936000-TB_A1H; X-5936000-SU_Contours; X-5936000-SW_Layout; X-5936000-DE_Design; X-5936000-ARCH_Landscape; X-5936000-SU_Ground; X-5936000-TB_
Plot Date: 19.10.2017@16:09:43 Login Name: nmeo Cad File: T:\5936000\Drawings\AutoCAD\Civil\Design\Civil 2D\C6.02 Stormwater Layout Plan Sheet 1.dwg

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150