



## 1.0 INTRODUCTION

Sydney Water Corporation (SWC) is proposing to subdivide Lot 1 in DP343175 (known as 35 Edna Street, Lilyfield). The site is bordered by Piper Street (north), Edna Street (west) and White Street (east). It occupies a total area of 2178m<sup>2</sup> and slopes in the easterly direction at approximately 7% from west to east.

Northrop Consulting Engineers has been engaged by Sydney Water Corporation to:

- a) Undertake a Flood Impact Assessment for the subject site, and
- b) Prepare a Concept Site Stormwater Management Plan for the proposed subdivision.

The following report has been prepared in response to this – in order to support Development Application for Subdivision of the lot.

The proposed subdivision will provide 5 lots. Lots 1-4 will be residential lots located on the northern side of the site (refer to Appendix 5, drawing number 09447-DA01). The residential lots will occupy a total area of 1270m<sup>2</sup>. The remaining southern portion of the site (910m<sup>2</sup>) will be Lot 5 and remain under SWC ownership (and use).

## 2.0 BACKGROUND DRAINAGE INFORMATION

Northrop has referred to the following information as background to stormwater runoff affecting the subject site:

- ‘Preliminary Stormwater Investigation’, undertaken by Patterson Britton & Partners (dated December 2005) concluded the site was subjected to overland flow through a low point located at Edna Street.
- Orthophoto map (Leichhardt U0945-61) – the contours indicate a local depression that may concentrate flow through the site.
- Detailed site survey plan prepared by Degotardi, Smith and Partners (reference number 30408A01.DWG). This shows detailed levels and a drainage pipe passing through the southern part of the site.

This report has been prepared to support Development Application for Subdivision. In particular the following assessments have been made for stormwater components:

1. Identify and analyse the stormwater drainage system in vicinity of the site.
2. Determine 100-year ARI flows and flow paths affecting the site.
3. Prepare a Concept Site Stormwater Management Plan (incorporating on-site stormwater detention – as required).



### 3.0 FLOOD IMPACT ASSESSMENT

#### 3.1 Hydrological and hydraulic analysis

A localised depression exists on the eastern side of Edna Street – adjacent to the south-west corner of the subject site. The nature of this depression leads to the potential for overland flow to enter the southern portion of the site in times of blockage or overflow of the street drainage system. The “Catchment Plan” (refer to Appendix 1- 09447-SK01) indicates the catchment areas contributing runoff to the Edna Street low point.

The “Catchment Plan” shows two (2) sub-catchments that have been analysed to determine flow to the Edna Street low point in the 100 year Average Recurrence Interval (ARI) storm event.

- Sub-catchment 1 – Catchment contributing flow direct from Edna Street.
- Sub-catchment 2 – Catchment contributing to the Piper Street drainage system. This recognises the potential for overflow from the piped system to contribute to the Edna Street low point.

The Rational Method was used to calculate Sub-catchment flows. The rainfall intensity values used were as stated in Leichhardt Councils Draft Stormwater Requirements – Supplement 3.

The following table summarises the results of the simplified analysis of Sub-catchment flows.

| Sub-catchment           | Area (m <sup>2</sup> ) | % impervious | Flow (m <sup>3</sup> /s) <sup>1</sup> |                   |          |
|-------------------------|------------------------|--------------|---------------------------------------|-------------------|----------|
|                         |                        |              | Total catchment                       | Pipe              | Overland |
| 1 - Piper Street        | 9655                   | 80           | 0.60                                  | 0.14 <sup>2</sup> | 0.46     |
| 2 - Edna Street         | 12130                  | 80           | 0.75                                  | 0.00 <sup>3</sup> | 0.75     |
| Total 100 year ARI flow |                        |              |                                       |                   | 1.21     |

- Note:
1. Flow to Edna Street low point.
  2. Allowance for pipe flow in Piper Street has been made to determine quantity of overflow to Edna Street – based on 50% blockage.
  3. No allowance for pipe inflow has been made for Edna Street catchment – 100% blockage required by Council for overland flow assessment.





### 3.2 Overland flow path analysis

Section 3.1 assesses the local stormwater runoff contributing to the low point in Edna Street. A total 100-year ARI flow of  $1.21\text{m}^3/\text{s}$  has been determined to potentially be conveyed through the site. This is based on full (100%) pipe blockage in Edna Street (in accordance with Council requirements).

This section of the report describes the nature by which overland flow would be managed under (a) pre-developed and (b) post-developed scenarios.

#### *a) Pre-development overland flow*

In the event that the stormwater pipe at the Edna Street low point is blocked, overland flow would build up over the kerb, footpath and then an additional 250mm depth (over an existing retaining wall at the boundary) before entering the site at the western site boundary (refer to Figure 1).



*Figure 1: View from Edna Street along western site boundary showing kerb inlet pit at the depression.*

Upon entering the site, flow is directed along the western side of the building, then across the northern frontage. Site inspection indicates that the overland flow most likely discharges to White Street via a stormwater drainage structure on the corner of Piper and White Street refer to Figure 2.





Figure 2: Left shows ponding of overland flow on the north-east point of site; right shows the stormwater drainage structure on the corner of Piper and White Street.

*b) Post-development overland flow*

Proposed site planning

All buildings on the site are proposed to be demolished to enable four (4) residential lots to be established on the northern portion of the proposed subdivision. As a result, the existing site overland flow path is proposed to be diverted through proposed Lot 5. This will provide a more direct route to the receiving trunk drainage system (in White Street) and address any effect to the proposed residential properties.

In addition it is recommended that the retaining wall along the Edna Street frontage is adjusted. This is in order to direct overflow from Edna Street to the southern portion of the site (only). In this regard it is proposed to lower the top of the existing retaining wall to footpath level for the portion of wall fronting the southern portion of the site (i.e. southern 15m).

### Proposed site levels

The creation of new lots will require the existing site levels to be raised to suit street levels along Edna and Piper Street. This will provide for separate driveway entries for the respective lots. Refer to Appendix 5, drawing number 09447- DA01.

Such site levels could be conditioned as part of a Consent to the Subdivision and activated through subsequent future Development Applications for dwelling houses.

### Proposed overland flow calculations

### Entering off Edna Street

Calculations have been performed using the broad-crested weir equation to determine the height of water at the location planned for overflow from Edna Street. The calculations indicate the depth of water will be approximately 130mm across the 15.0m length under 100-year ARI storm conditions – refer to Appendix 4.

*Conveyed through southern portion (Lot 5)*

A HEC-RAS model was developed to model the proposed southern portion of the site (Lot 5) to determine the level of flow in the 100 year ARI flood event. Detailed survey information provided by Degotardi, Smith & Partners was used to develop cross section information. Existing buildings along the south and proposed buildings along the north were entered in as blockouts.

A Manning's "n" roughness value of 0.035 was used for the southern portion of the site.

The results of the overflow calculations indicate the maximum depth to be 150mm. Refer to Appendix 2 for HEC-RAS output/results.

Northrop drawing number 09447-DA02, Appendix 6, provides an overview of the scheme for overland flow management through the proposed development site, including general outcomes of the calculations. It also shows 500mm freeboard protection will be to adjoining floor levels from the calculated 100-year ARI flow through the southern portion (Lot 5).



#### 4.0 CONCEPT SITE STORMWATER MANAGEMENT PLAN

A Concept Site Stormwater Management Plan has been prepared to support the Development Application for Subdivision. The plan indicates proposed measures to manage stormwater runoff and discharge from the proposed residential portion of the subject site.

The concept stormwater management scheme incorporates provisions for On-site Stormwater Detention (OSD) in accordance with Council requirements. Preliminary calculation for OSD are summarised as follows:

##### Pre-development conditions:

Area = 312m<sup>2</sup>

Impervious area = 50% (actual 90-95%)

Time of concentration (t<sub>c</sub>) = 5min paved  
= 11min grassed

Note: reduced impervious area reduces actual pre-development runoff.

##### Post-development conditions:

Area = 312m<sup>2</sup>

Impervious area = 80%

(t<sub>c</sub>) = 5min paved  
= 11min grassed

The storage volume for OSD provisions was calculated by comparing the 100 year ARI post-development site discharge with the 5 year ARI pre-development site discharge (in accordance with Council requirements). This was calculated using the DRAINS software program.

The following table provides a summary of the design flows calculated in the model. The post-development flows are based on providing 5m<sup>3</sup> OSD per lot (based on a maximum site area of 312m<sup>2</sup>). Refer to Appendix 4 for DRAINS input and output values.

| ARI | Pre-Development<br>(l/s) | Post-Development<br>(l/s) |
|-----|--------------------------|---------------------------|
| 5   | 13                       | 10                        |
| 10  | 15                       | 10                        |
| 20  | 17                       | 11                        |
| 100 | 20                       | 12                        |



A possible layout for stormwater management measures is shown on the Concept Site Stormwater Drainage Plan (drawing number 09447-DA01, Appendix 5). This indicates the general layout for stormwater drainage to discharge to Piper and White Street (including provision for an inter-allotment drainage network to service the south-western lot (Lot 3)).

Such recommendations for OSD and drainage could be conditioned as part of Consent for the Subdivision, and activated upon future Development Application's for residential housing.



## APPENDIX 1 –CATCHMENT PLAN – 09447 SK01



LEGEND



SITE BOUNDARY



CATCHMENT AREA 1



CATCHMENT 1 OVERLAND FLOW



CATCHMENT AREA 2



CATCHMENT 2 OVERLAND FLOW



TOTAL OVERLAND FLOW



CATCHMENT REFERENCE

| CATCHMENT SUMMARY |                        |                                    |
|-------------------|------------------------|------------------------------------|
| CATCHMENT         | AREA (m <sup>2</sup> ) | 100YR ARI FLOW (m <sup>3</sup> /s) |
| 1                 | 9,655                  | 0.597                              |
| 2                 | 12,130                 | 0.750                              |



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PROJECT  
**35 EDNA STREET,  
LILYFIELD**

DRAWING TITLE  
**CATCHMENT PLAN**

DATE  
**17.07.09**  
REV  
**1**  
JOB No.  
**09447**  
DRAWING No.  
**SK01**



**APPENDIX 2 – WEIR FLOW CALCULATION**

PROJECT:

SWC  
PIPER ST, WILYFIELD

JOB No:

09447

PAGE No:

DESIGNED:

CN

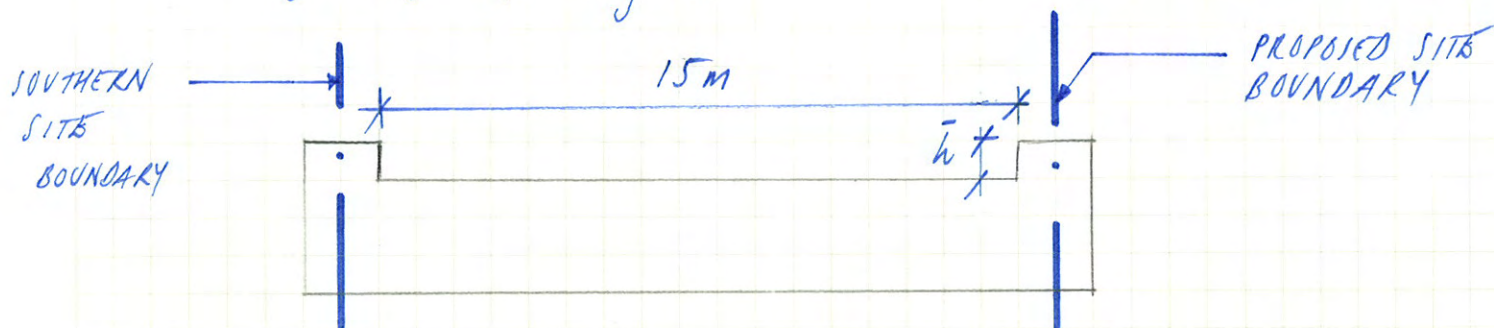
DATE:

09-07-09

• WEIR FLOW CALC. (ALONG EDNA STREET)

$$Q_{TOT} = 1.21 \text{ m}^3/\text{s}$$

$$Q = C_d \cdot A_o \cdot \sqrt{2g \cdot \bar{h}}$$



$$C_d = 0.41$$

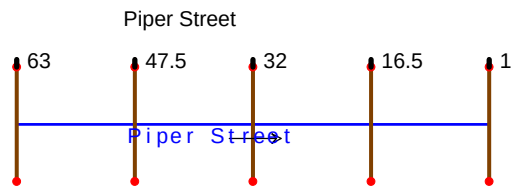
$$A_o = 1.95 \text{ m}^2$$

$$\bar{h} = 0.13 \text{ m}$$

$$Q = 1.28 \text{ m}^3/\text{s} < Q_{TOT} = 1.21 \text{ m}^3/\text{s} \quad \checkmark \text{ OK}$$

## APPENDIX 3 – HEC-RAS





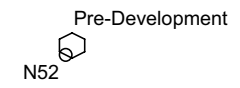
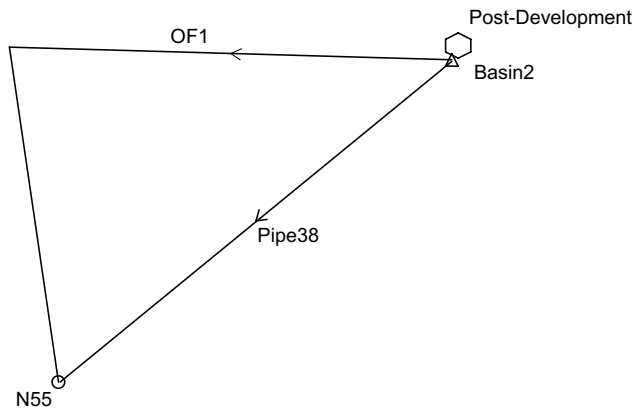
None of the XS's are Geo-Referenced (• Geo-Ref user entered XS • Geo-Ref interpolated XS • Non Geo-Ref user entered XS • Non Geo-Ref interpolated XS)

HEC-RAS Plan: Plan 01 River: Piper Street Reach: Piper Street Profile: PF 1

| Reach        | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|--------------|-----------|---------|---------|-----------|-----------|-----------|-----------|------------|----------|-----------|-----------|--------------|
|              |           |         | (m3/s)  | (m)       | (m)       | (m)       | (m)       | (m/m)      | (m/s)    | (m2)      | (m)       |              |
| Piper Street | 63        | PF 1    | 1.21    | 13.39     | 13.64     | 13.64     | 13.70     | 0.025230   | 1.11     | 1.09      | 8.71      | 1.00         |
| Piper Street | 47.5      | PF 1    | 1.21    | 13.00     | 13.14     | 13.14     | 13.18     | 0.028273   | 0.93     | 1.30      | 15.00     | 1.01         |
| Piper Street | 32        | PF 1    | 1.21    | 12.29     | 12.38     | 12.38     | 12.43     | 0.027690   | 0.93     | 1.30      | 14.99     | 1.01         |
| Piper Street | 16.5      | PF 1    | 1.21    | 11.25     | 11.36     | 11.36     | 11.40     | 0.028119   | 0.93     | 1.30      | 15.00     | 1.01         |
| Piper Street | 1         | PF 1    | 1.21    | 10.62     | 10.71     | 10.71     | 10.75     | 0.027907   | 0.93     | 1.30      | 14.91     | 1.01         |

## APPENDIX 4 – DRAINS INPUT AND OUTPUT DATA





09447 53 Edna Street, Lilyfield

OSD Calculations

Input Data

PIT / NODE DETAILS

| Name | Type | Family | Size | Ponding Volume (cu.m) | Pressure Change Coeff. Ku | Surface Elev (m) | Max Pond Depth (m) | Base Inflow (cu.m/s) | Blocking Factor | x       | y        | Bolt-down lid | Part Full Shock Loss |
|------|------|--------|------|-----------------------|---------------------------|------------------|--------------------|----------------------|-----------------|---------|----------|---------------|----------------------|
| N52  | Node |        |      |                       |                           | 11.41            |                    | 0                    |                 | 1673.68 | -1257.52 |               | 128                  |
| N55  | Node |        |      |                       |                           | 11.41            |                    | 0                    |                 | 1464.88 | -1313.68 |               | 132                  |

DETENTION BASIN DETAILS

| Name   | Elev  | Surf. Area | Init Vol. (cu.m) | Outlet Type | K | Dia(mm) | Centre RL | Pit Family | Pit Type | x        | y        | HED | Crest RL | Crest Leng | id  |
|--------|-------|------------|------------------|-------------|---|---------|-----------|------------|----------|----------|----------|-----|----------|------------|-----|
| Basin2 | 11.2  | 0.36       |                  | 0 Orifice   |   | 100     | 11.28     |            |          | 1534.166 | -1256.91 | No  |          |            | 130 |
|        | 11.5  | 0.36       |                  |             |   |         |           |            |          |          |          |     |          |            |     |
|        | 11.51 | 27         |                  |             |   |         |           |            |          |          |          |     |          |            |     |
|        | 11.7  | 27         |                  |             |   |         |           |            |          |          |          |     |          |            |     |

SUB-CATCHMENT DETAILS

| Name       | Pit or Node | Total Area (ha) | Paved Area % | Grass Area % | Supp Area % | Paved Time (min) | Grass Time (min) | Supp Time (min) | Paved Length (m) | Grass Length (m) | Supp Length (m) | Paved Slope(%) | Grass Slope % | Supp Slope % | Paved Rough | Grass Rough | Supp Rough | Lag Time or Factor | Gutter Length (m) | Gutter Slope % | Gutter FlowFactor |
|------------|-------------|-----------------|--------------|--------------|-------------|------------------|------------------|-----------------|------------------|------------------|-----------------|----------------|---------------|--------------|-------------|-------------|------------|--------------------|-------------------|----------------|-------------------|
| Pre-Develo | N52         | 0.0312          |              | 50           | 50          | 0                | 5                | 11              | 0                |                  |                 |                |               |              |             |             |            |                    | 0                 |                |                   |
| Post-Devel | Basin2      | 0.0312          |              | 80           | 20          | 0                | 5                | 11              | 0                |                  |                 |                |               |              |             |             |            |                    | 0                 |                |                   |

PIPE DETAILS

| Name   | From   | To  | Length (m) | U/S IL (m) | D/S IL (m) | Slope (%) | Type         | Dia (mm) | I.D. (mm) | Rough | Pipe Is  | No. Pipes | Chg From | At Chg | Chg (m) | RI (m) | Chg (m) | RL (m) | etc (m) |
|--------|--------|-----|------------|------------|------------|-----------|--------------|----------|-----------|-------|----------|-----------|----------|--------|---------|--------|---------|--------|---------|
| Pipe38 | Basin2 | N55 |            | 2          | 11.23      | 11.21     | 1 uPVC, unde | 100      | 105       | 0.03  | NewFixed |           | 1        | Basin2 | 0       |        |         |        |         |

DETAILS of SERVICES CROSSING PIPES

| Pipe | Chg (m) | Bottom Elev (m) | Height of Service (m) | Chg (m) | Bottom Elev (m) | Height of S (m) | Chg (m) | Bottom Elev (m) | Height of S etc (m) |
|------|---------|-----------------|-----------------------|---------|-----------------|-----------------|---------|-----------------|---------------------|
|------|---------|-----------------|-----------------------|---------|-----------------|-----------------|---------|-----------------|---------------------|

CHANNEL DETAILS

| Name | From | To | Type | Length (m) | U/S IL (m) | D/S IL (m) | Slope (%) | Base Width (m) | L.B. Slope (1:?) | R.B. Slope (1:?) | Manning n | Depth (m) | Roofed |
|------|------|----|------|------------|------------|------------|-----------|----------------|------------------|------------------|-----------|-----------|--------|
|------|------|----|------|------------|------------|------------|-----------|----------------|------------------|------------------|-----------|-----------|--------|

OVERFLOW ROUTE DETAILS

| Name | From   | To  | Travel<br>Time<br>(min) | Spill<br>Level<br>(m) | Crest<br>Length<br>(m) | Weir<br>Coeff. C | Cross<br>Section | Safe Depth<br>Major Stor<br>(m) | SafeDepth<br>Minor Stor<br>(m) | Safe<br>DxV<br>(sq.m/sec) | Bed<br>Slope<br>(%) | D/S Area<br>Contributing<br>% | id  |
|------|--------|-----|-------------------------|-----------------------|------------------------|------------------|------------------|---------------------------------|--------------------------------|---------------------------|---------------------|-------------------------------|-----|
| OF1  | Basin2 | N55 |                         | 1                     | 11.71                  | 1                | 1.67 Dummy1      | 0.3                             | 0.3                            | 0.4                       |                     | 1 0                           | 137 |

09447 53 Edna Street, Lilyfield

OSD Calculations

100yr ARI Output Data

PIT / NODE DETAILS

| Name | Max HGL | Max Pond<br>HGL | Max Surface<br>Flow Arriving<br>(cu.m/s) | Version 8<br>Max Pond<br>Volume<br>(cu.m) | Min<br>Freeboard<br>(m) | Overflow<br>(cu.m/s) | Constraint |
|------|---------|-----------------|------------------------------------------|-------------------------------------------|-------------------------|----------------------|------------|
| N55  | 11.31   |                 |                                          | 0                                         |                         |                      |            |

SUB-CATCHMENT DETAILS

| Name       | Max<br>Flow Q<br>(cu.m/s) | Paved<br>Max Q<br>(cu.m/s) | Grassed<br>Max Q<br>(cu.m/s) | Paved<br>Tc<br>(min) | Grassed<br>Tc<br>(min) | Supp.<br>Tc<br>(min) | Due to Storm                                                  |
|------------|---------------------------|----------------------------|------------------------------|----------------------|------------------------|----------------------|---------------------------------------------------------------|
| Pre-Develo | 0.02                      | 0.011                      | 0.009                        | 5                    | 11                     |                      | 0 AR&R 100 year, 25 minutes storm, average 145.1 mm/h, Zone 1 |
| Post-Devel | 0.021                     | 0.018                      | 0.004                        | 5                    | 11                     |                      | 0 AR&R 100 year, 25 minutes storm, average 145.1 mm/h, Zone 1 |

Outflow Volumes for Total Catchment (0.04 impervious + 0.02 pervious = 0.06 total ha)

| Storm    | Total Rainfall<br>cu.m | Total Runoff<br>cu.m (Runoff %) | Impervious Runoff<br>cu.m (Runoff %) | Pervious Runoff<br>cu.m (Runoff %) |
|----------|------------------------|---------------------------------|--------------------------------------|------------------------------------|
| AR&R 100 | 13.85                  | 12.10 (87.4%)                   | 8.60 (95.5%)                         | 3.51 (72.4%)                       |
| AR&R 100 | 21.96                  | 20.11 (91.5%)                   | 13.87 (97.2%)                        | 6.23 (81.1%)                       |
| AR&R 100 | 28.16                  | 26.19 (93.0%)                   | 17.90 (97.8%)                        | 8.29 (84.1%)                       |
| AR&R 100 | 33.3                   | 31.22 (93.8%)                   | 21.24 (98.1%)                        | 9.98 (85.6%)                       |
| AR&R 100 | 37.73                  | 35.53 (94.2%)                   | 24.12 (98.3%)                        | 11.41 (86.4%)                      |
| AR&R 100 | 41.65                  | 39.34 (94.5%)                   | 26.67 (98.5%)                        | 12.68 (87.0%)                      |
| AR&R 100 | 59.59                  | 56.63 (95.0%)                   | 38.33 (99.0%)                        | 18.30 (87.8%)                      |
| AR&R 100 | 68.42                  | 64.81 (94.7%)                   | 44.07 (99.1%)                        | 20.74 (86.6%)                      |
| AR&R 100 | 75.25                  | 70.99 (94.3%)                   | 48.51 (99.2%)                        | 22.48 (85.3%)                      |
| AR&R 100 | 85.74                  | 80.19 (93.5%)                   | 55.32 (99.3%)                        | 24.87 (82.9%)                      |
| AR&R 100 | 97.44                  | 89.93 (92.3%)                   | 62.93 (99.4%)                        | 27.00 (79.2%)                      |

PIPE DETAILS

| Name   | Max Q<br>(cu.m/s) | Max V<br>(m/s) | Max U/S<br>HGL (m) | Max D/S<br>HGL (m) | Due to Storm                                                 |
|--------|-------------------|----------------|--------------------|--------------------|--------------------------------------------------------------|
| Pipe38 | 0.012             |                | 1.4                | 11.342             | 11.31 AR&R 100 year, 1 hour storm, average 95.5 mm/h, Zone 1 |

CHANNEL DETAILS

| Name | Max Q<br>(cu.m/s) | Max V<br>(m/s) | Chainage<br>(m) | Max<br>HGL (m) | Due to Storm |
|------|-------------------|----------------|-----------------|----------------|--------------|
|------|-------------------|----------------|-----------------|----------------|--------------|

OVERFLOW ROUTE DETAILS

| Name | Max Q U/S | Max Q D/S | Safe Q | Max D | Max DxV | Max Width | Max V | Due to Storm |
|------|-----------|-----------|--------|-------|---------|-----------|-------|--------------|
| OF1  | 0         |           | 0      | 2.969 | 0       | 0         | 0     | 0            |

DETENTION BASIN DETAILS

| Name   | Max WL | MaxVol | Max Q<br>Total | Max Q<br>Low Level | Max Q<br>High Level |
|--------|--------|--------|----------------|--------------------|---------------------|
| Basin2 | 11.67  |        | 4.5            | 0.012              | 0.012               |
|        |        |        |                |                    | 0                   |

CONTINUITY CHECK for AR&R 100 year, 25 minutes storm, average 145.1 mm/h, Zone 1

| Node   | Inflow<br>(cu.m) | Outflow<br>(cu.m) | Storage Change<br>(cu.m) | Difference<br>% |
|--------|------------------|-------------------|--------------------------|-----------------|
| N52    | 17.43            | 17.43             | 0                        | 0               |
| Basin2 | 18.1             | 18.08             | 0.01                     | 0.1             |
| N55    | 18.08            | 18.08             | 0                        | 0               |

09447 53 Edna Street, Lilyfield

OSD Calculations

20yr ARI Output Data

PIT / NODE DETAILS

| Name | Max HGL | Max Pond HGL | Max Surface Flow Arriving (cu.m/s) | Max Pond Volume (cu.m) | Min Freeboard (m) | Overflow (cu.m/s) | Constraint |
|------|---------|--------------|------------------------------------|------------------------|-------------------|-------------------|------------|
| N55  | 11.31   |              |                                    | 0                      |                   |                   |            |

SUB-CATCHMENT DETAILS

| Name       | Max Flow Q (cu.m/s) | Paved Max Q (cu.m/s) | Grassed Max Q (cu.m/s) | Paved Tc (min) | Grassed Tc (min) | Supp. Tc (min) | Due to Storm                                                 |
|------------|---------------------|----------------------|------------------------|----------------|------------------|----------------|--------------------------------------------------------------|
| Pre-Develo | 0.017               |                      | 0.009                  | 0.007          | 5                | 11             | 0 AR&R 20 year, 25 minutes storm, average 110.2 mm/h, Zone 1 |
| Post-Devel | 0.018               |                      | 0.015                  | 0.003          | 5                | 11             | 0 AR&R 20 year, 25 minutes storm, average 110.2 mm/h, Zone 1 |

Outflow Volumes for Total Catchment (0.04 impervious + 0.02 pervious = 0.06 total ha)

| Storm      | Total Rainfall cu.m | Total Runoff cu.m (Runoff %) | Impervious Runoff cu.m (Runoff %) | Pervious Runoff cu.m (Runoff %) |
|------------|---------------------|------------------------------|-----------------------------------|---------------------------------|
| AR&R 20 yr | 10.74               | 9.00 (83.8%)                 | 6.58 (94.2%)                      | 2.42 (64.4%)                    |
| AR&R 20 yr | 16.9                | 15.04 (89.0%)                | 10.58 (96.3%)                     | 4.46 (75.5%)                    |
| AR&R 20 yr | 21.54               | 19.58 (90.9%)                | 13.60 (97.1%)                     | 5.98 (79.3%)                    |
| AR&R 20 yr | 25.36               | 23.28 (91.8%)                | 16.08 (97.5%)                     | 7.21 (81.2%)                    |
| AR&R 20 yr | 28.65               | 26.47 (92.4%)                | 18.22 (97.8%)                     | 8.25 (82.2%)                    |
| AR&R 20 yr | 31.54               | 29.25 (92.7%)                | 20.10 (98.0%)                     | 9.15 (82.9%)                    |
| AR&R 20 yr | 44.55               | 41.61 (93.4%)                | 28.55 (98.6%)                     | 13.06 (83.7%)                   |
| AR&R 20 yr | 51.39               | 47.80 (93.0%)                | 33.00 (98.8%)                     | 14.80 (82.3%)                   |

PIPE DETAILS

| Name   | Max Q (cu.m/s) | Max V (m/s) | Max U/S HGL (m) | Max D/S HGL (m) | Due to Storm                                                      |
|--------|----------------|-------------|-----------------|-----------------|-------------------------------------------------------------------|
| Pipe38 | 0.011          |             | 1.3             | 11.337          | 11.307 AR&R 20 year, 25 minutes storm, average 110.2 mm/h, Zone 1 |

CHANNEL DETAILS

| Name | Max Q (cu.m/s) | Max V (m/s) | Chainage (m) | Max HGL (m) | Due to Storm |
|------|----------------|-------------|--------------|-------------|--------------|
|------|----------------|-------------|--------------|-------------|--------------|

OVERFLOW ROUTE DETAILS

| Name | Max Q U/S | Max Q D/S | Safe Q | Max D | Max DxV | Max Width | Max V | Due to Storm |
|------|-----------|-----------|--------|-------|---------|-----------|-------|--------------|
| OF1  |           | 0         | 0      | 2.969 | 0       | 0         | 0     | 0            |

DETENTION BASIN DETAILS

| Name   | Max WL | MaxVol | Max Q<br>Total | Max Q<br>Low Level | Max Q<br>High Level |
|--------|--------|--------|----------------|--------------------|---------------------|
| Basin2 | 11.6   |        | 2.6            | 0.011              | 0.011               |
|        |        |        |                |                    | 0                   |

CONTINUITY CHECK for AR&R 20 year, 25 minutes storm, average 110.2 mm/h, Zone 1

| Node   | Inflow<br>(cu.m) | Outflow<br>(cu.m) | Storage Change<br>(cu.m) | Difference<br>% |
|--------|------------------|-------------------|--------------------------|-----------------|
| N52    | 12.9             | 12.9              |                          | 0               |
| Basin2 | 13.57            | 13.54             |                          | 0.01            |
| N55    | 13.54            | 13.54             |                          | 0               |



09447 53 Edna Street, Lilyfield

OSD Calculations

10yr ARI Output Data

PIT / NODE DETAILS

| Name | Max HGL | Max Pond HGL | Max Surface Flow Arriving (cu.m/s) | Max Pond Volume (cu.m) | Min Freeboard (m) | Overflow (cu.m/s) | Constraint |
|------|---------|--------------|------------------------------------|------------------------|-------------------|-------------------|------------|
| N55  | 11.3    |              |                                    | 0                      |                   |                   |            |

SUB-CATCHMENT DETAILS

| Name       | Max Flow Q (cu.m/s) | Paved Max Q (cu.m/s) | Grassed Max Q (cu.m/s) | Paved Tc (min) | Grassed Tc (min) | Supp. Tc (min) | Due to Storm                                                |
|------------|---------------------|----------------------|------------------------|----------------|------------------|----------------|-------------------------------------------------------------|
| Pre-Develo | 0.014               | 0.008                | 0.006                  | 5              | 11               |                | 0 AR&R 10 year, 25 minutes storm, average 95.1 mm/h, Zone 1 |
| Post-Devel | 0.015               | 0.013                | 0.003                  | 5              | 11               |                | 0 AR&R 10 year, 25 minutes storm, average 95.1 mm/h, Zone 1 |

Outflow Volumes for Total Catchment (0.04 impervious + 0.02 pervious = 0.06 total ha)

| Storm      | Total Rainf cu.m | Total Runoff cu.m (Runoff %) | Impervious Runoff cu.m (Runoff %) | Pervious Runoff cu.m (Runoff %) |
|------------|------------------|------------------------------|-----------------------------------|---------------------------------|
| AR&R 10 yr | 9.38             | 7.64 (81.4%)                 | 5.69 (93.3%)                      | 1.95 (59.3%)                    |
| AR&R 10 yr | 14.7             | 12.84 (87.4%)                | 9.15 (95.8%)                      | 3.69 (71.8%)                    |
| AR&R 10 yr | 18.67            | 16.71 (89.5%)                | 11.73 (96.7%)                     | 4.98 (76.1%)                    |
| AR&R 10 yr | 21.94            | 19.87 (90.6%)                | 13.86 (97.2%)                     | 6.02 (78.3%)                    |
| AR&R 10 yr | 24.73            | 22.54 (91.2%)                | 15.67 (97.5%)                     | 6.88 (79.5%)                    |
| AR&R 10 yr | 27.18            | 24.88 (91.6%)                | 17.26 (97.7%)                     | 7.62 (80.1%)                    |
| AR&R 10 yr | 38.13            | 35.19 (92.3%)                | 24.38 (98.4%)                     | 10.82 (81.0%)                   |
| AR&R 10 yr | 44.09            | 40.50 (91.9%)                | 28.25 (98.6%)                     | 12.25 (79.4%)                   |

PIPE DETAILS

| Name   | Max Q (cu.m/s) | Max V (m/s) | Max U/S HGL (m) | Max D/S HGL (m) | Due to Storm                                                     |
|--------|----------------|-------------|-----------------|-----------------|------------------------------------------------------------------|
| Pipe38 | 0.01           |             | 1.2             | 11.335          | 11.305 AR&R 10 year, 25 minutes storm, average 95.1 mm/h, Zone 1 |

CHANNEL DETAILS

| Name | Max Q (cu.m/s) | Max V (m/s) | Chainage (m) | Max HGL (m) | Due to Storm |
|------|----------------|-------------|--------------|-------------|--------------|
|------|----------------|-------------|--------------|-------------|--------------|

OVERFLOW ROUTE DETAILS

| Name | Max Q U/S | Max Q D/S | Safe Q | Max D | Max DxV | Max Width | Max V | Due to Storm |
|------|-----------|-----------|--------|-------|---------|-----------|-------|--------------|
| OF1  | 0         | 0         | 2.969  | 0     | 0       | 0         | 0     | 0            |

DETENTION BASIN DETAILS

| Name   | Max WL | MaxVol | Max Q Total | Max Q Low Level | Max Q High Level |
|--------|--------|--------|-------------|-----------------|------------------|
| Basin2 | 11.56  | 1.7    | 0.01        | 0.01            | 0                |

CONTINUITY CHECK for AR&R 10 year, 25 minutes storm, average 95.1 mm/h, Zone 1

| Node   | Inflow (cu.m) | Outflow (cu.m) | Storage Change (cu.m) | Difference % |
|--------|---------------|----------------|-----------------------|--------------|
| N52    | 10.94         | 10.94          | 0                     | 0            |
| Basin2 | 11.61         | 11.57          | 0.01                  | 0.2          |
| N55    | 11.57         | 11.57          | 0                     | 0            |

09447 53 Edna Street, Lilyfield

OSD Calculations

5yr ARI Output Data

PIT / NODE DETAILS

| Name | Max HGL | Max Pond HGL | Max Surface Flow Arriving (cu.m/s) | Max Pond Volume (cu.m) | Min Freeboard (m) | Overflow (cu.m/s) | Constraint |
|------|---------|--------------|------------------------------------|------------------------|-------------------|-------------------|------------|
| N55  | 11.3    |              |                                    | 0                      |                   |                   |            |

Version 8

SUB-CATCHMENT DETAILS

| Name       | Max Flow Q (cu.m/s) | Paved Max Q (cu.m/s) | Grassed Max Q (cu.m/s) | Paved Tc (min) | Grassed Tc (min) | Supp. Tc (min) | Due to Storm                                               |
|------------|---------------------|----------------------|------------------------|----------------|------------------|----------------|------------------------------------------------------------|
| Pre-Develo | 0.012               | 0.007                | 0.005                  | 5              | 11               |                | 0 AR&R 5 year, 25 minutes storm, average 83.6 mm/h, Zone 1 |
| Post-Devel | 0.013               | 0.011                | 0.002                  | 5              | 11               |                | 0 AR&R 5 year, 25 minutes storm, average 83.6 mm/h, Zone 1 |

Outflow Volumes for Total Catchment (0.04 impervious + 0.02 pervious = 0.06 total ha)

| Storm      | Total Rainf cu.m | Total Runoff cu.m (Runoff %) | Impervious Runoff cu.m (Runoff %) | Pervious Runoff cu.m (Runoff %) |
|------------|------------------|------------------------------|-----------------------------------|---------------------------------|
| AR&R 5 yei | 8.36             | 6.62 (79.2%)                 | 5.03 (92.5%)                      | 1.59 (54.4%)                    |
| AR&R 5 yei | 13.02            | 11.17 (85.8%)                | 8.06 (95.2%)                      | 3.11 (68.2%)                    |
| AR&R 5 yei | 16.5             | 14.54 (88.1%)                | 10.32 (96.2%)                     | 4.22 (73.0%)                    |
| AR&R 5 yei | 19.32            | 17.26 (89.3%)                | 12.15 (96.8%)                     | 5.10 (75.4%)                    |
| AR&R 5 yei | 21.74            | 19.56 (90.0%)                | 13.72 (97.1%)                     | 5.83 (76.7%)                    |
| AR&R 5 yei | 23.84            | 21.55 (90.4%)                | 15.09 (97.4%)                     | 6.46 (77.4%)                    |
| AR&R 5 yei | 33.2             | 30.27 (91.2%)                | 21.17 (98.1%)                     | 9.10 (78.3%)                    |
| AR&R 5 yei | 38.38            | 34.80 (90.7%)                | 24.54 (98.4%)                     | 10.26 (76.4%)                   |
| AR&R 5 yei | 42.43            | 38.19 (90.0%)                | 27.18 (98.5%)                     | 11.02 (74.2%)                   |
| AR&R 5 yei | 48.67            | 43.23 (88.8%)                | 31.23 (98.7%)                     | 12.00 (70.5%)                   |
| AR&R 5 yei | 55.88            | 48.55 (86.9%)                | 35.92 (98.9%)                     | 12.64 (64.6%)                   |

PIPE DETAILS

| Name   | Max Q (cu.m/s) | Max V (m/s) | Max U/S HGL (m) | Max D/S HGL (m) | Due to Storm                                                    |
|--------|----------------|-------------|-----------------|-----------------|-----------------------------------------------------------------|
| Pipe38 | 0.01           |             | 1.2             | 11.332          | 11.304 AR&R 5 year, 25 minutes storm, average 83.6 mm/h, Zone 1 |

CHANNEL DETAILS

| Name | Max Q (cu.m/s) | Max V (m/s) | Chainage (m) | Max HGL (m) | Due to Storm |
|------|----------------|-------------|--------------|-------------|--------------|
|------|----------------|-------------|--------------|-------------|--------------|

OVERFLOW ROUTE DETAILS

| Name | Max Q U/S | Max Q D/S | Safe Q | Max D | Max DxV | Max Width | Max V | Due to Storm |
|------|-----------|-----------|--------|-------|---------|-----------|-------|--------------|
| OF1  | 0         |           | 0      | 2.969 | 0       | 0         | 0     | 0            |

DETENTION BASIN DETAILS

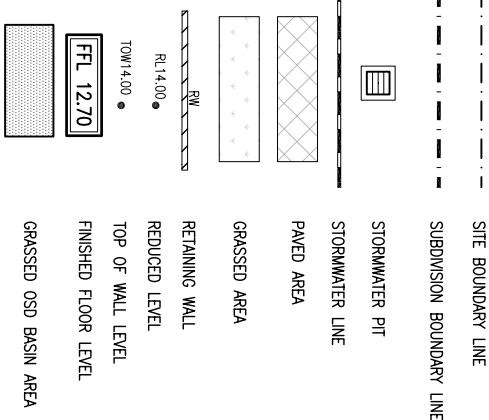
| Name   | Max WL | MaxVol | Max Q<br>Total | Max Q<br>Low Level | Max Q<br>High Level |
|--------|--------|--------|----------------|--------------------|---------------------|
| Basin2 | 11.54  |        | 1              | 0.01               | 0.01                |
|        |        |        |                |                    | 0                   |

CONTINUITY CHECK for AR&R 5 year, 25 minutes storm, average 83.6 mm/h, Zone 1

| Node   | Inflow (cu.m) | Outflow (cu.m) | Storage Change (cu.m) | Difference % |
|--------|---------------|----------------|-----------------------|--------------|
| N52    | 9.44          | 9.44           | 0                     | 0            |
| Basin2 | 10.11         | 10.08          | 0.01                  | 0.2          |
| N55    | 10.08         | 10.08          | 0                     | 0            |

## APPENDIX 5 – CONCEPT STORMWATER PLAN– 09447 DA01

LEGEND



GENERAL NOTES

THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH OTHER SUCH WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DIMENSIONS ARE IN MILLIMETRES & ALL LEVELS ARE IN METRES, UNO (UNLESS NOTED OTHERWISE).

NO DIMENSION SHALL BE OBTAINED BY SCALING THE DRAWINGS.

ALL LEVELS AND SETTING OUT DIMENSIONS SHOWN ON THE DRAWINGS SHALL BE CHECKED ON SITE PRIOR TO THE COMMENCEMENT OF THE WORK.

DURING EXCAVATION WORK THE STRUCTURE SHALL BE MAINTAINED IN A STABLE AND NO PART SHALL BE OVERSTRESSED.

DETAILED SURVEY DATA WAS OBTAINED FROM AWT SURVEY SURVEYORS, DRAWING NO. 050419 DATED 12 MAY 2005.

ALL WORK IS TO BE UNDERTAKEN IN ACCORDANCE WITH THE DETAILS SHOWN ON THE DRAWINGS, THE SPECIFICATIONS AND THE SUPERINTENDENT.

EXISTING SERVICES WHERE SHOWN HAVE BEEN PLOTTED FROM SUPPLIED DATA AND SUCH THEIR ACCURACY CAN NOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH THE LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF WORK.

ALL SERVICE TRENCHES UNDER VEHICULAR PAVEMENTS SHALL BE BACK FILLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LEICHAHART MUNICIPAL COUNCIL.

ALL TRENCH BACKFILL MATERIAL SHALL BE COMPACTED TO THE SAME DENSITY AS THE ADJACENT MATERIAL.

ON COMPLETION OF STORMWATER INSTALLATION, ALL DISTURBED AREAS MUST BE RESTORED TO ORIGINAL CONDITION, INCLUDING KERBS, FOOTPATHS, CONCRETE AREAS, GRAVEL AND GRASSED AREAS AND ROAD PAVEMENTS, UNLESS DIRECTED OTHERWISE.

CONTRACTOR TO OBTAIN ALL AUTHORITY APPROVALS UNLESS DIRECTED OTHERWISE.

STORMWATER DRAINAGE

- ALL DRAINAGE LINES SHALL BE UPVC (CLASS SN4) SEWER GRADE DRAINAGE PIPE, UNO.
- ALL DRAINAGE LINES SHALL BE LAID AT 1% MIN. FALL, UNO.
- ALL LEVELS ARE AUSTRALIAN HEIGHT DATUM (AHD).
- MINIMUM EAVES GUTTER CROSS-SECTIONAL AREA = 9600mm<sup>2</sup>
- ALL DOWNPIPES TO EAVES GUTTERS TO BE 100 x 75 COLORBOND STEEL OR ø100 PVC MIN. UNO.
- THE STORMWATER DRAINAGE DESIGN HAS BEEN CARRIED OUT IN ACCORDANCE WITH AS/NZS 3500.3.2-2003 "STORMWATER DRAINAGE: ANY VARIATIONS TO THE NOMINATED LEVELS SHALL BE REFERRED TO ENGINEER IMMEDIATELY.
- ANY VARIATIONS TO SPECIFIED PRODUCTS OR DETAILS SHALL BE REFERRED TO THE ENGINEER FOR APPROVAL.
- SUBSOIL DRAINAGE SHALL BE PROVIDED TO ALL RETAINING WALLS & EMBANKMENTS, WITH THE LINES FEEDING INTO THE STORMWATER DRAINAGE SYSTEM.
- THE STORMWATER DRAINAGE REQUIREMENTS HAVE BEEN CALCULATED IN ACCORDANCE WITH LEICHAHART COUNCIL'S DEVELOPMENT CONTROL PLAN 2006.
- ALL PIT COVERS AND GRATES TO BE CLASS 'A'.
- ALL GRATES TO BE GALVANISED STEEL WITH HINGES AND CHILD PROOF LOCK.
- ALL PIT COVERS TO BE CONCRETE, UNO.

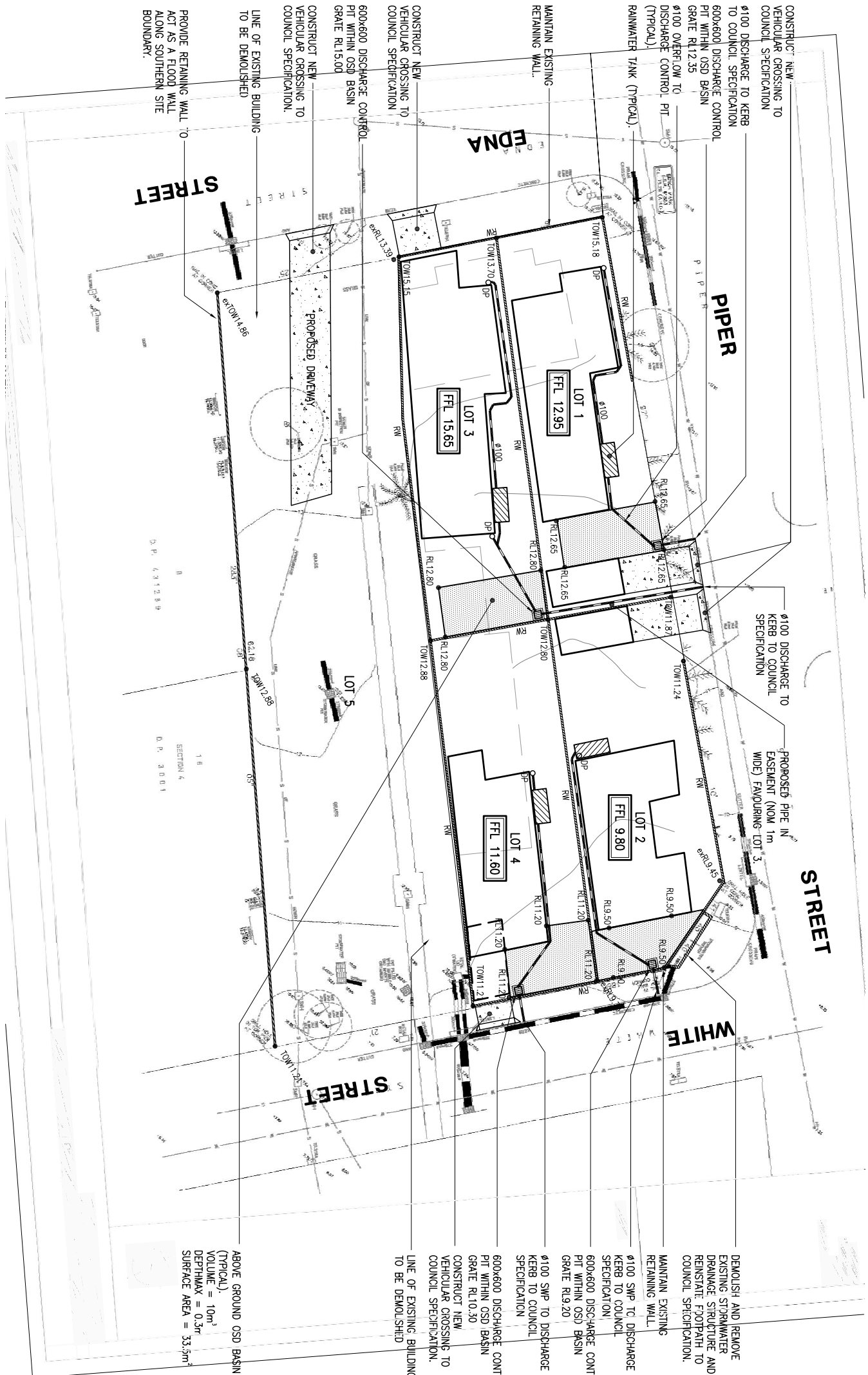
DESIGN SUMMARY:

SUBDIVISION SITE AREA = 312m<sup>2</sup> (MAX)  
PRE DEVELOPED IMPERVIOUS AREA = 50%  
POST DEVELOPED IMPERVIOUS AREA = 80%  
MAX OSD = 5m<sup>3</sup>  
(CALCULATED FROM DRAINS' MODEL)  
WATER DEPTH ABOVE ORIFICE CENTRELINE = 0.45m  
ORIFICE Ø = 100mm  
OSD STORAGE & DISCHARGE BASED ON 100 YR POST - DEVELOPMENT FLOW SHALL NOT EXCEED 5 YR PRE - DEVELOPMENT FLOW

PSD = 13L/s

| ARI     | PRE DEV DISCHARGE (L/s) | POST DEV DISCHARGE (L/s) |
|---------|-------------------------|--------------------------|
| 5 YRS   | 13                      | 10                       |
| 10 YRS  | 15                      | 10                       |
| 20 YRS  | 17                      | 11                       |
| 100 YRS | 20                      | 12                       |

ALL STORMWATER MANAGEMENT MEASURES SHOWN ON THIS DRAWING HAVE BEEN PREPARED FOR DEVELOPMENT APPLICATION PURPOSES TO DEMONSTRATE FEASIBILITY FOR SUBDIVISION ONLY. ALL MEASURES WILL BE SUBJECT TO DETAIL DESIGN AT THE DEVELOPMENT APPLICATION FOR GUIDELINES AND CONSTRUCTION CERTIFICATE STAGES AND MAY BE SUBJECT TO VARIATION PROVIDED THAT THE DESIGN INTENT IS MAINTAINED.



STREET

PIPER

EDNA

WHITE

STREET

ABOVE GROUND OSD BASIN (TYPICAL).  
VOLUME = 10m<sup>3</sup>  
DEPTH MAX = 0.3m  
SURFACE AREA = 33.5m<sup>2</sup>

| ISSUE | DESCRIPTION       | VERIFIED | APPROVED | DATE     |
|-------|-------------------|----------|----------|----------|
| 1     | ISSUED FOR REVIEW | C.N.     |          | -- 08 09 |
| 2     | ISSUED FOR REVIEW | C.N.     |          | 30 09 09 |

CLIENT

**Sydney WATER**

SYDNEY WATER CORPORATION

ARCHITECT

**ARCHITECTUS**

ALL DIMENSIONS TO BE VERIFIED ON DRAWING OR CORRECTING ANY WORK

SCALE 1:200 @ A1

SCALE 1:400 @ A2

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P.O. Box H171  
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Adm & Inv 633 100

PROJECT

**35 EDNA STREET**

**LILYFIELD**

DRAWING TITLE

**CONCEPT SITE STORMWATER**

**MANAGEMENT PLAN**

JOB NUMBER

**09447**

DRAWING NUMBER

**DA01**

ISSUE

**2**

DRAWING SHEET SIZE = A1

NOT FOR CONSTRUCTION

## APPENDIX 6 – CONCEPT OVERLAND FLOW – 09447 DA02



