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STORMWATER DRAINAGE STRATEGY REPORT

TO

ACCOMPANY DEVELOPMENT APPLICATION

FOR

**PROPOSED SUBDIVISION
OF LOT 1 DP 1144668
ANDROMEDA DRIVE, CRANEBROOK**

Prepared for:

The Trustees of the Roman Catholic Church for the Diocese of Parramatta

March 2013

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1.0 INTRODUCTION

The Diocese of Parramatta proposed to create residential lots at the eastern, vacant portion of the Corpus Christi Primary School site at Andromeda Drive, Cranebrook.

This report summarises the stormwater drainage strategy for the proposed subdivision. The locality of the site is shown on **Figure 1**.



Figure 1 - Site location

Source: GoogleEarth

2.0 PROPOSED DEVELOPMENT

The development is proposed to create 22 residential lots with areas ranging from 555m² to 1303m² and a vegetation translocation area.

A cul-de-sac is to be created to service the lots and is to be extended off Cassar Crescent. It is proposed to have a straight through road entering the site from the northern section of Cassar Crescent and a 'give way' situation for cars turning left out of the site or right into the site. The lots along the northern boundary, lots 1- 2 and 8 – 9, will have access to the proposed road via two concrete driveways extending off Road 1 contained within rights of carriageway.

The vegetation translocation area is to be created as a 'Reserve Area' along the eastern boundary of the site for biodiversity conservation purposes. The area of this reserve is approximately 1395 m². The strip of vegetation along the western boundary of the site, adjacent to the Northern Road is to be preserved within the setback zone of the proposed lots along this boundary.

3.0 THE SITE

The site has an area of 2.05 ha. and adjoins the eastern extent of Corpus Christi Primary School, which has access via Andromeda Drive. There is existing residential development to the north and south of the site and The Northern Road adjoins the site to the east. The site predominantly contains open grassed land, with dense clusters of trees towards the outer edges of the site. The site slopes gently to the west at an average slope of 4%.

4.0 CODES & POLICIES

The stormwater drainage strategy for the proposed development was prepared to comply with the requirements and objectives in the following documents:

- *Penrith Local Environmental Plan 1998 (Urban Land)*
- *Penrith Development Control Plan 2006*
- *Penrith Council's Guidelines for Engineering Works – Part 1 Design*
- *Institution of Engineers Australia Rainfall & Runoff (1987)*

5.0 STORMWATER DRAINAGE STRATEGY

5.1 Existing stormwater drainage and catchment

The site contains a piped depression which drains to the north along the western portion of Cassar Crescent. The catchment area from the south extends to Wagner Place and Hindmarsh Street and consists of approximately 26 hectares as show in the Catchment Plan in *Appendix 1*, sheet 3. The drainage system from the south drains along a Reserve from Goldmark Crescent, through the school site and Cassar Crescent (west) and to the north of Andromeda Drive. The pipe system consists of 1350mm diameter pipes, inlet pits and gully pits.

Current runoff from the development site drains to the west where there is an existing easement for drainage. This easement connects into a raised grated letterbox pit adjacent to the northern boundary of the school on the western bend of Cassar Crescent. Cassar Crescent contains roll kerb and drains at approximately 1% towards the intersections with Andromeda Drive, from a crest located on the eastern bend of Cassar Crescent. The existing street drainage in Cassar Crescent drains from the north side of the crest towards the intersection with Andromeda Drive where it connects into a large GPT located in an overland flow channel adjacent to a public reserve. The overland flow channel flows into Andromeda Drive Reserve downstream of the catchment.

The site is contained within a catchment in the Hawkesbury and Nepean Catchment Authority area.

5.2 Proposed Stormwater Strategy

The proposed strategy for draining and discharging stormwater is:

- To ensure minimal changes to peak flows immediately downstream from the site.
- To provide for flows to drain toward the street drainage system so as not to burden downhill properties during storm events.
- Modelled to achieve the overall pollutant removal efficiencies from the site as required in Council's DCP.
- Designed to be efficient in terms long term management and maintenance.
- To produce a cost effective, aesthetically pleasing design.

5.3 Stormwater Quality

Penrith City Council's DCP states the objective to '*minimise urban runoff pollutants to watercourses*'.

The strategy proposed for this development is applying treatment measures within the development to achieve the required objectives at the point of discharge from the site.

Penrith City Council's DCP requires the following levels of treatments to be achieved in the post-development phase:

| Pollutant | Retention Criteria |
|----------------------------------|--|
| <i>Litter (gross pollutants)</i> | 70 % of material > 5mm |
| <i>Coarse Sediment</i> | 80% for particles <0.5mm |
| <i>Nutrients</i> | 45% retention |
| <i>Fine Particles</i> | 50% for particles <0.1mm |
| <i>Oil & Grease</i> | 90% of load with no visible discharges |

Table 1: Treatment removal efficiencies criteria

The measures proposed are:

- Allowance for provision of rainwater re-use in rainwater tanks on future houses. Rainwater tanks will be required as part of the development consent by Penrith City Council for future dwelling houses on each lot in accordance with the DCP and BASIX requirements. Rainwater re-use tanks will reduce the total runoff from the development site and will reduce the demand for potable water from the street watermain. Water tanks have been specified as having a volume of storage of 6KL per proposed dwelling.
- The 'right of way' access drives are to be constructed of permeable pavers which will provide for treatment of stormwater by filtering through the bedding and base course before discharge to the stormwater system.
- A gross pollutant trap is designed to collect gross pollutants and coarse and fine sediments prior to discharge into the bioretention system
- A shallow bioretention system is proposed to further treat the runoff by removing nutrients and coarse and fine sediments prior to discharge. This shallow bioretention basin is proposed to take low flows, with high flows bypassing the basin. The extended detention depth is proposed to be 0.15m with a total surface area of 142m², a filter area of 107m² and a filter media depth of 0.6m. The bioretention area is to be planted with effective nutrient removing native plants which will compliment the returned trees within the vicinity.

Soil erosion and sediment control works would be implemented during construction to control impacts during this stage.

The proposed stormwater quality treatment measures have been modelled using MUSIC Version 5 computer program by eWater. The proposal has been modelled subdividing the catchments into

contributing areas. The latest advice and recommendations from eWater has been applied in modelling this development.

A schematic of the model is included in *Appendix 3* and a summary of the treatment train effectiveness is shown in *Table 2* below.

The MUSIC model does not specifically model for Faecal coliforms or oils and greases, however based on advice from eWater these pollutants are removed as part of the treatment train. The reason that these pollutants are not included in the model at present is that there is insufficient data on source node generation or pollutant removal efficiencies, especially from the Australian context.

Summary of the Treatment Train Effectiveness

| | Sources | Residual Load | % Reduction |
|---------------------------------------|---------|---------------|-------------|
| Flow (ML/yr) | 21.1 | 17.3 | 18 |
| Peak Flow (m3/s) | 0.09 | 0.41 | -358.5 |
| Total Suspended Solids (kg/yr) | 4170.00 | 1110.00 | 73.3 |
| Total Phosphorus (kg/yr) | 8.55 | 4.71 | 45 |
| Total Nitrogen (kg/yr) | 60.1 | 32.8 | 45.4 |
| Gross Pollutants (kg/yr) | 538 | 89.9 | 83.3 |

Table 2: Summary of treatment train effectiveness of total catchment

The retention criterion for total suspended solids was separated into two components by Penrith City Council, namely coarse and fine sediments. These two components have different removal efficiency criteria of 80% and 50% respectively. As MUSIC does not separate total suspended solids into these two components, the percentage reduction of 73.3% obtained indicates that it is most likely that both these criteria have been met by the proposed treatment measures.

The results shown in the table above indicate that the treatment measures proposed for the development achieve the retention criteria stipulated by Penrith City Council.

5.4 Hydrology

The proposed stormwater drainage system and the existing and post development stormwater catchments for the development are shown in *Appendix 1*, pages 2 and 3 respectively. The proposed strategy is to connect to the current street drainage system in Cassar Crescent, with minimal increase to the peak flowrates immediately downstream of the site.

The proposed strategy includes capturing the majority of the stormwater runoff from the site via street and interallotment drainage systems which will connect into two additional stormwater pits proposed in the road reserve of Cassar Crescent. Low flows will enter the GPT and bioretention basin and then into the proposed new pit, while high flows will bypass directly into this pit. This will then connect into the existing drainage system in Pit 1 shown in *Appendix 2*. The existing pipe exiting this pit and connecting into the 1350mm line will be upgraded from a 375mm pipe to a 525 mm pipe, denoted 'C' in *Appendix 2*.

A portion of the site catchment, approximately 4380m², containing lots 16-22, will drain to an interallotment drainage line along the southern boundary of the site. This interallotment drainage line will connect into an existing letterbox pit adjacent to the southern boundary of the school site located in the public reserve at the end of Goldmark Crescent.

Computer model DRAINS by Watercom has been used to model both the predevelopment and post development conditions of the site, using the catchments shown in *Appendix 1*, page 3. Hydraulic modelling of the 5, 20 and 100 year ARI have been utilised to establish the legitimacy of the

stormwater drainage strategy. Tables 1 summarises the peak outflows calculated downstream of the site marked 'A' in *Appendix 2*. Table 2 summarises peak pipe flows and overland flowrates at the two locations 'B' and 'C' to ascertain whether the existing capacity of the street drainage and the capacity of the upgraded pipe are sufficient to handle post development peak flows.

| Location | ARI | Flow, m ³ /s | |
|----------|----------|-------------------------|-----------------|
| | | Predevelopment | Postdevelopment |
| A | 5 year | 5.47 | 5.82 |
| | 20 year | 6.86 | 7.25 |
| | 100 year | 8.12 | 8.37 |

Table 1: Summary of existing and post development peak flows at 'A'.

| Area | ARI, year | Pipe Flow, m ³ /s | | Overland Flow, m ³ /s | | |
|------|-----------|------------------------------|------|----------------------------------|------|-------|
| | | Pre | Post | Pre | Post | d x V |
| B | 5 | 5.41 | 5.70 | 0.00 | 0.02 | |
| | 20 | 6.00 | 6.10 | 0.81 | 1.10 | |
| | 100 | 6.02 | 6.06 | 1.99 | 2.18 | 0.38 |
| C | 5 | 0.19 | 0.66 | 0.01 | 0.01 | |
| | 20 | 0.25 | 0.70 | 0.03 | 0.22 | |
| | 100 | 0.30 | 0.75 | 0.05 | 0.30 | |

Table 2: Summary of existing and post development peak flows at 'B' and 'C'.

DRAINS results showed there to be a nil or negligible increase to overflows or pit surcharges in the 5 year event under post development conditions which demonstrates that the capacity of the existing drainage system is sufficient for the 5 year event. DRAINS results for area 'C' indicate that the upgrading of the existing 375mm pipe to a 525mm pipe is sufficient to not increase pit surcharging or overland flow for the 5 year event.

While Post Development results by DRAINS show a small increase in total flow in each of the ARI events examined, overland flow volumes are only slightly increased with all depth-velocity products being acceptable according to the AR&R criterion of below 0.4m²/s. Current conditions in the 100 year event already show overland flow down Cassar Crescent to be between 1777 – 2070 L/s. Under the proposed development the overland flow through Cassar Crescent increases slightly to between 1890 – 2180 L/s. The greatest overland flow volume under post development conditions is found at area 'B' and is 2180L/s, with a velocity of approximately 1.89m/s and a depth of 0.2m giving a depth-velocity product of 0.38m²/s. Overland flow volumes experienced in the 100 year ARI event in Cassar Crescent are already present and are therefore not isolated to this development but rather a catchment wide issue. Therefore, on site detention of this site would not be effective to reduce these flows.

Given that the post development flows downstream of the site will have little to no adverse impacts on the capacity of any of Council's stormwater systems and that the area has no formal OSD requirements, it is considered that on site detention of stormwater is not applicable to or required for this development.

6.0 SUMMARY

The proposed stormwater management strategy for the development complies with the requirements of Penrith City Council as set out in the DCP, LEP, Engineering Design Specifications and Australian Rainfall & Runoff.

The stormwater treatment strategy has been prepared with the view of ensuring long-term efficiency and sustainability by proposing treatment measures which are easy and cost effective to maintain and provide an aesthetically pleasing solution.

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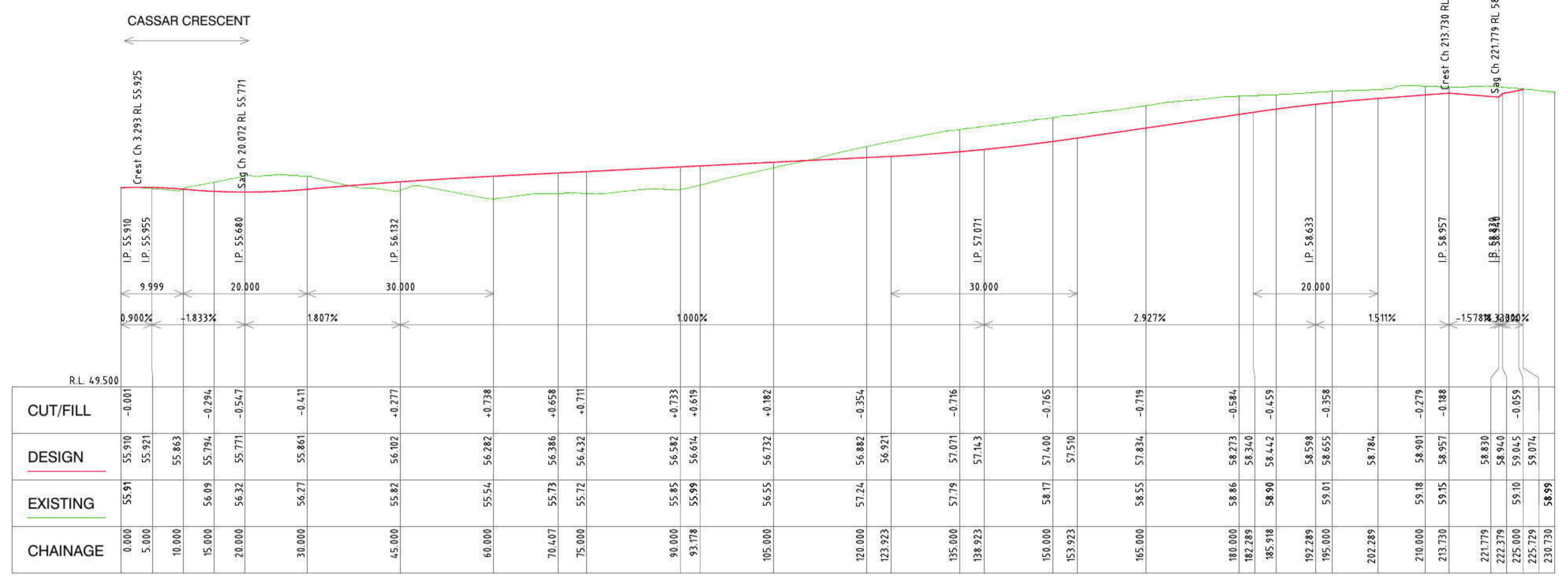
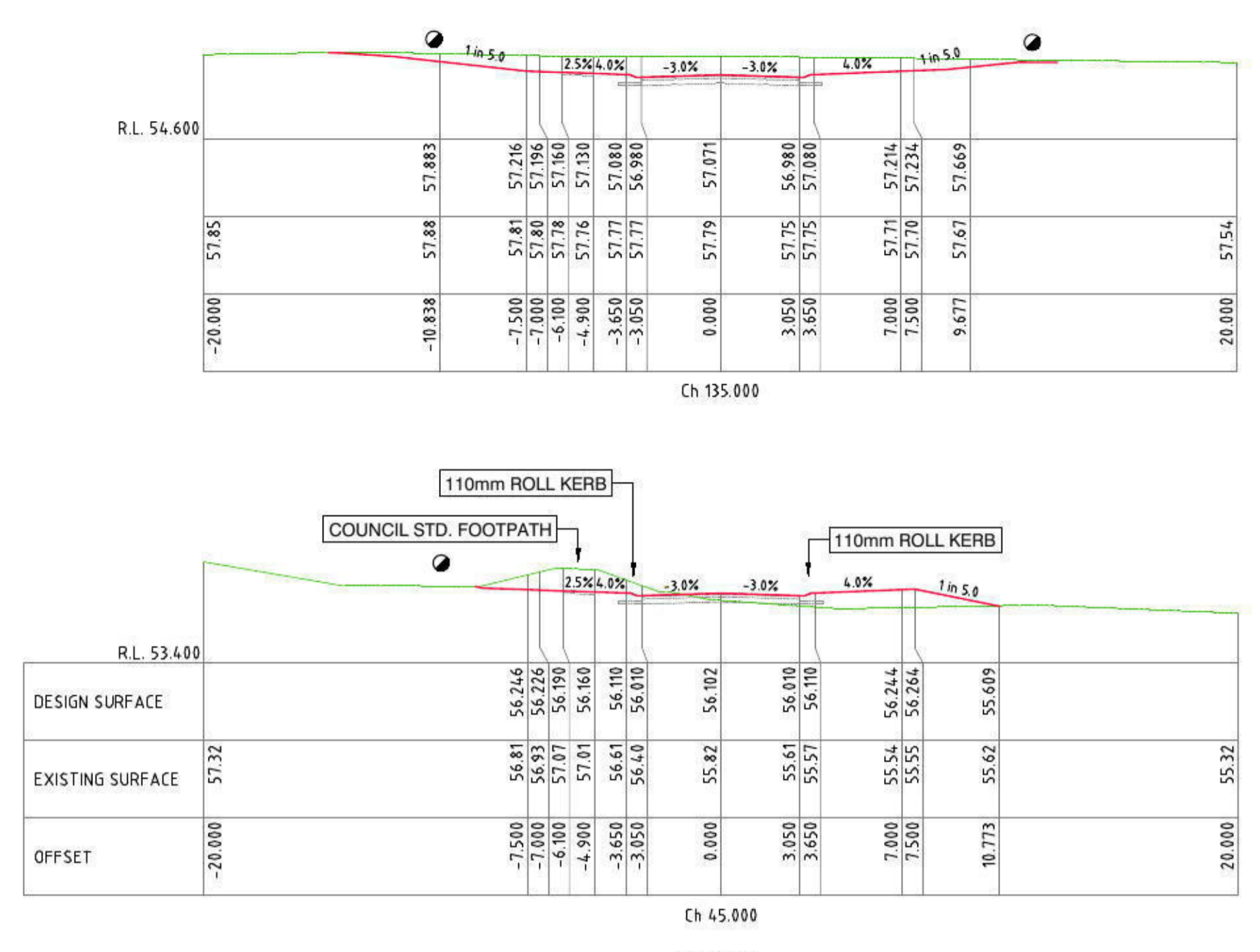
Brian Lapham
CPEng NPER

Appendix 1

Stormwater Drainage Strategy Plan

I117G P6 – Sheets 2 & 3

● LOT REGRADING/FILLING - Min. 1% TO VERGE



ROAD No. 1
H:1:500 V:1:100

LEGEND

- PROPOSED PAVEMENT
- PROPOSED 1.2 WIDE FOOTPATH
- PERMEABLE PAVERS WITH PERMEABLE SUB-BASE DRAINING TO SUBSOIL TRENCHES
- PROPOSES LOT REGRADING/FILLING (Min. 1% TO KERB)
- DENOTES BIORETENTION BASIN
- PROPOSED STACKED ROCK RETAINING WALL (Max. 600 HIGH)
- PROPOSED STORMWATER INFRASTRUCTURE
- SUBSOIL DRAINAGE LINE (TO PIT)
- G.P.T. UNIT (GROSS POLLUTANT TRAP)
- DENOTES EXISTING STORMWATER
- DENOTES APPROX. BUILDING FOOTPRINT



| REVISIONS | DATE | REVISION DETAILS | BY |
|-----------|----------|-----------------------|------|
| C | 02.04.13 | LONG. SECTION AMENDED | K.G. |
| B | 28.03.13 | ISSUE FOR D.A. | K.G. |
| A | 07.03.13 | DRAFT ISSUE | S.W. |

NOTES:
1. EXISTING SURFACE - 0.5m INTERVAL

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SCALE: 1:500
LONG SECTION: H: 1:500 V: 1:100
CROSS SECTION: H: 1:500 V: 1:100

SCALE IN METRES AT ORIGINAL REDUCTION RATIO

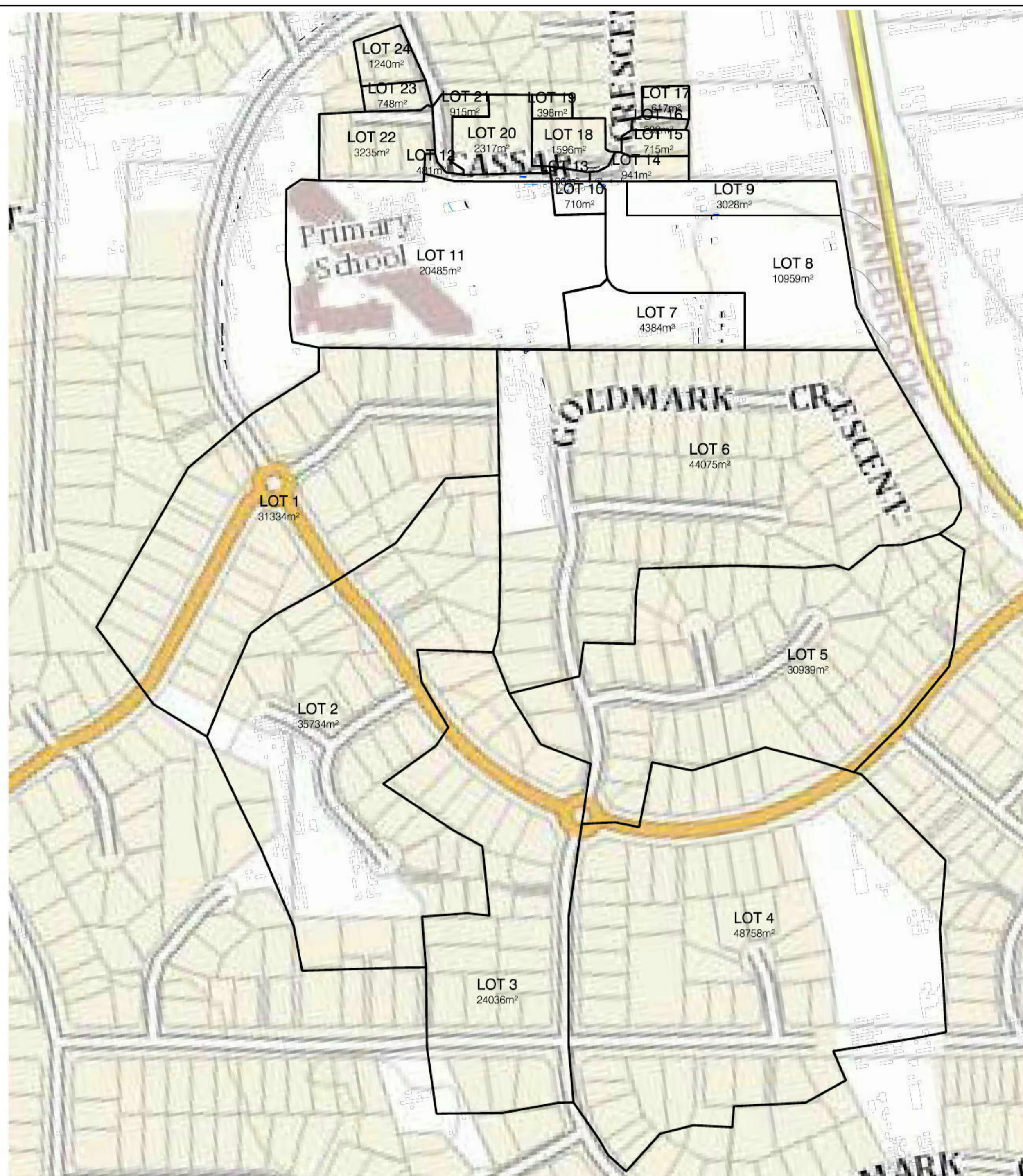
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CLIENT: THE TRUSTEES OF THE CATHOLIC CHURCH FOR THE DIOCESE OF PARRAMATTA
SURVEY: C.L.
DRAWN: S.W./K.G.
DESIGNED: -
APPROVED: B.L.

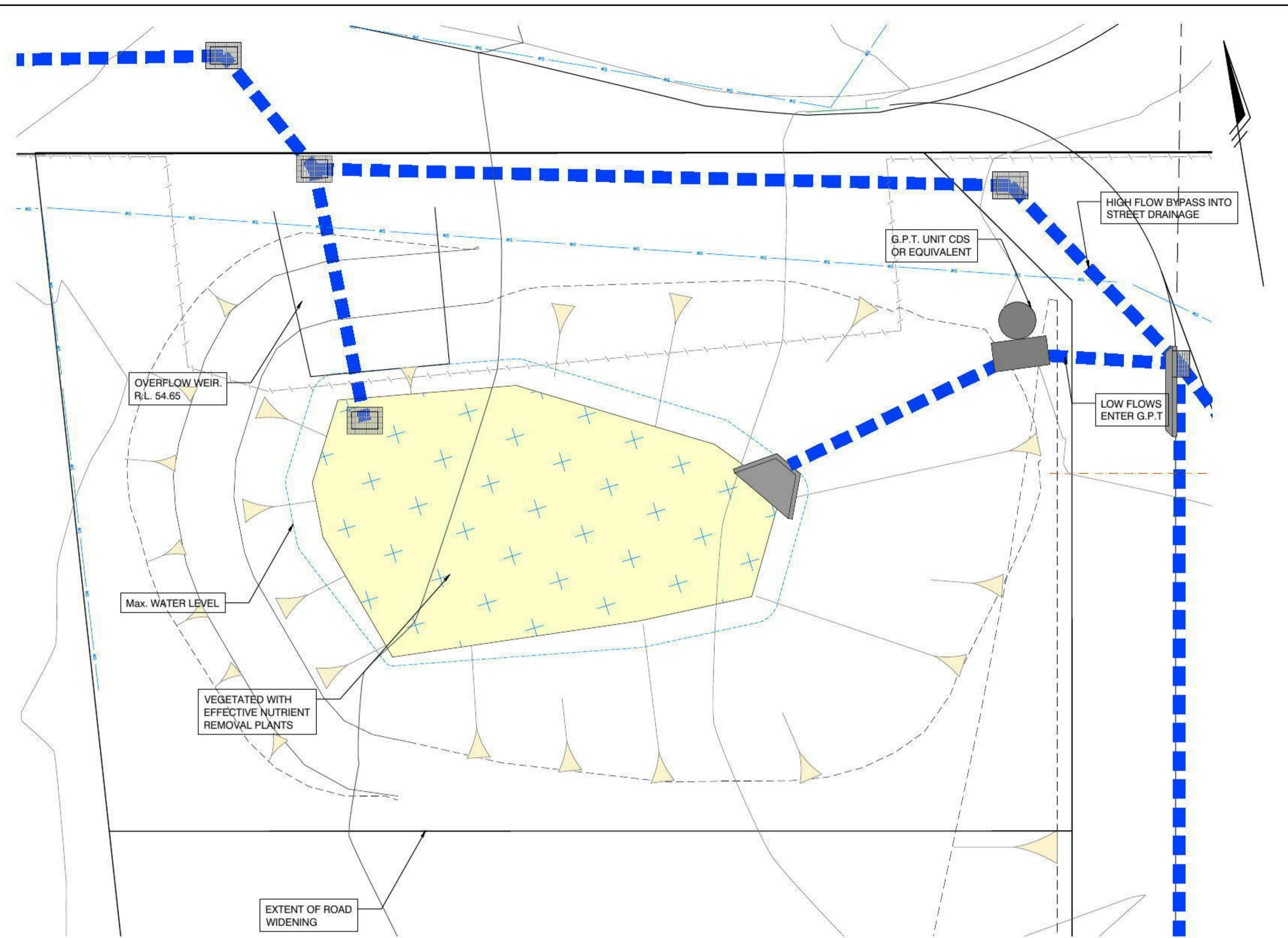
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JOB No: 1117EG
DWG No: P6-2
SHEET 2 OF 3 SHEETS
SIZE A1

ISSUE FOR D.A.



CATCHMENT PLAN
1:2000



BIORETENTION DETAIL
1:100



BIORETENTION TYPICAL SECTION
H:1:500 V:1:100

| REVISIONS | DATE | REVISION DETAILS | BY |
|-----------|----------|------------------|------|
| A | 28.03.13 | ISSUE FOR D.A. | K.G. |



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|-----------------------------|----------------------------------|
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|---|---|
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| SURVEY: C.L. | DATE OF SURVEY: 18.01.13 |
| DRAWN: S.W.K.G. | DATE OF PLAN: 07.03.13 |
| DESIGNED: - | DATE LAST SAVED: 28.03.13 |
| APPROVED: B.L. | DATE APPROVED: - |

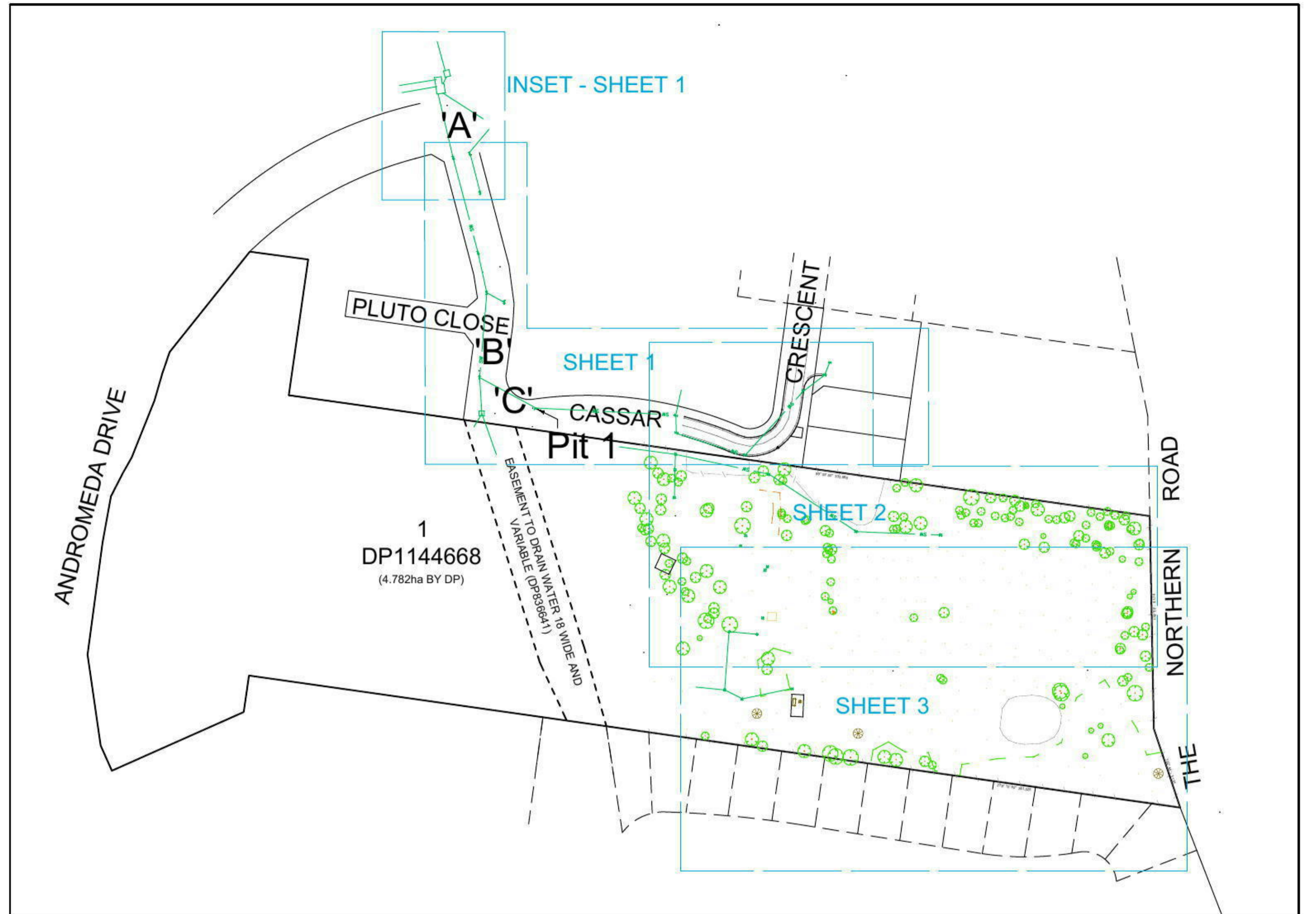
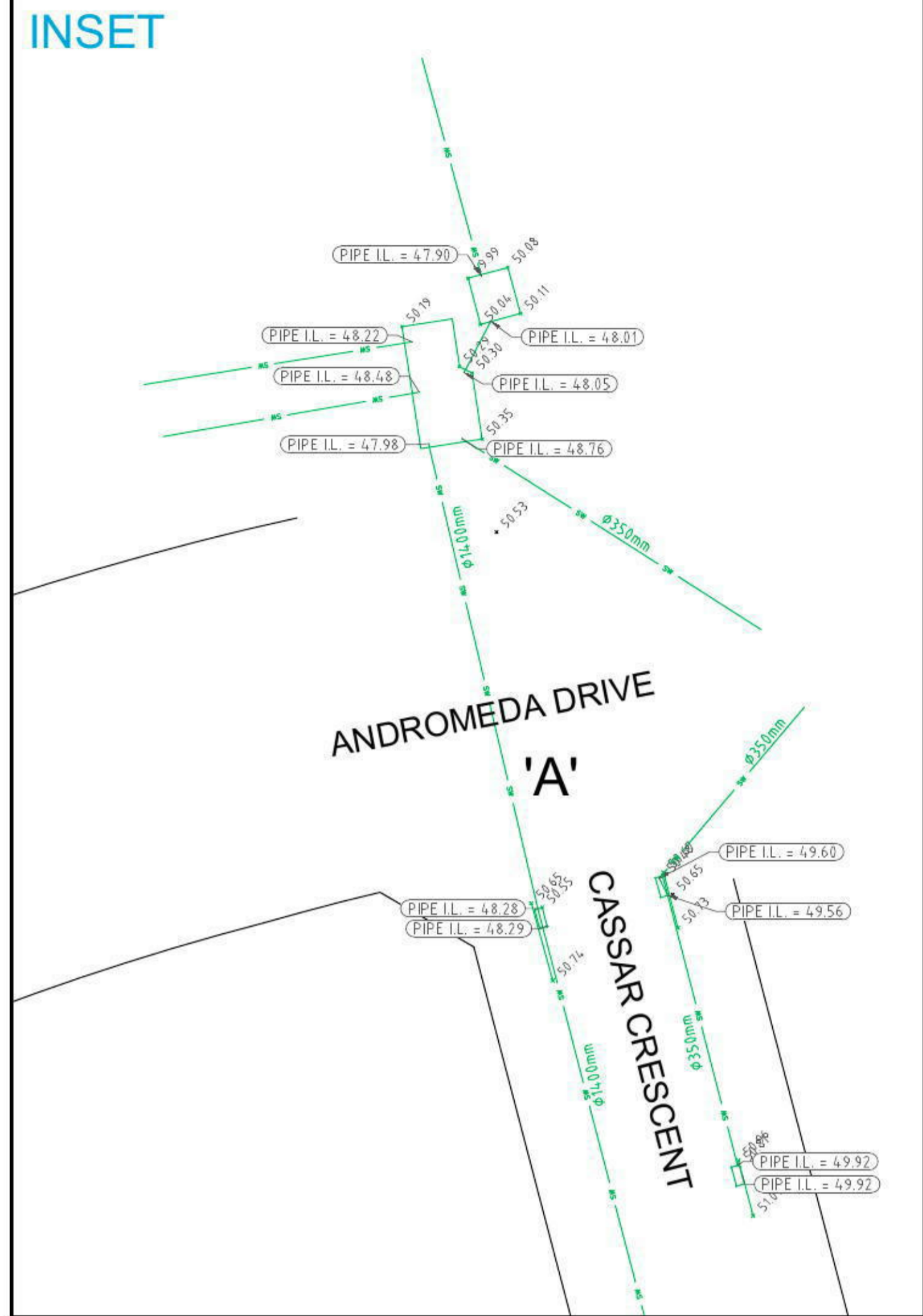
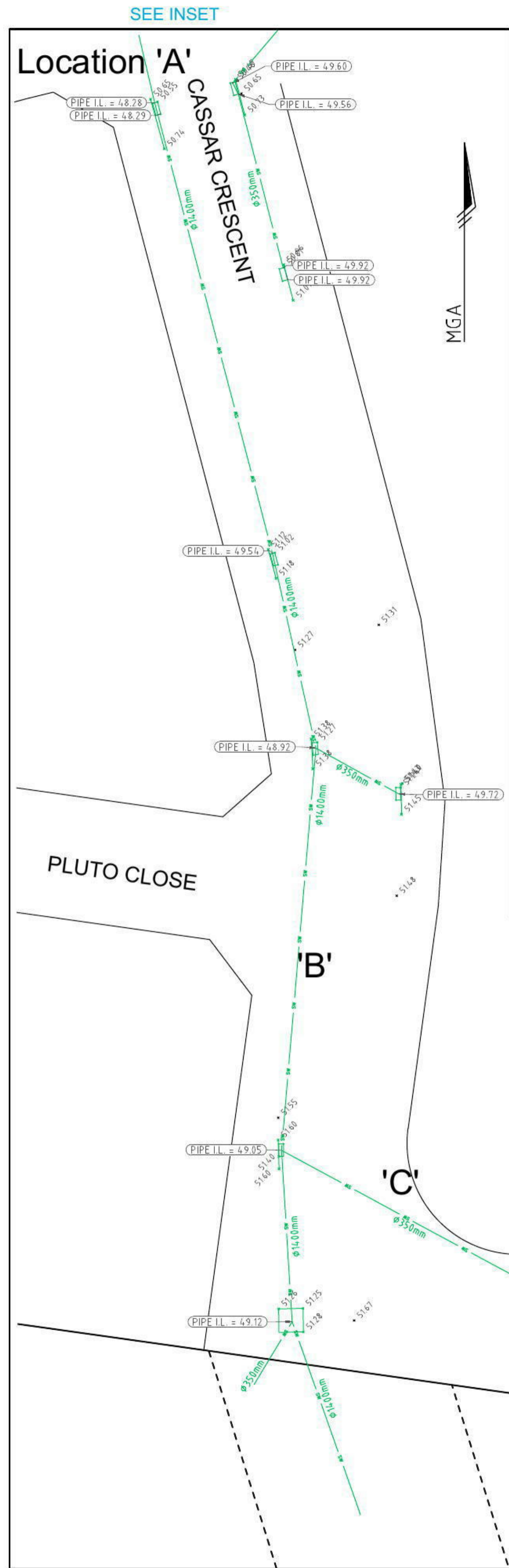
ISSUE FOR D.A.

JOB No: I117EG
DWG No: P6-3
SHEET 3 OF 3 SHEETS
SIZE A1

Appendix 2

Partial Detail Survey Plan

I117SW D01- Sheet 1



Survey Notes:

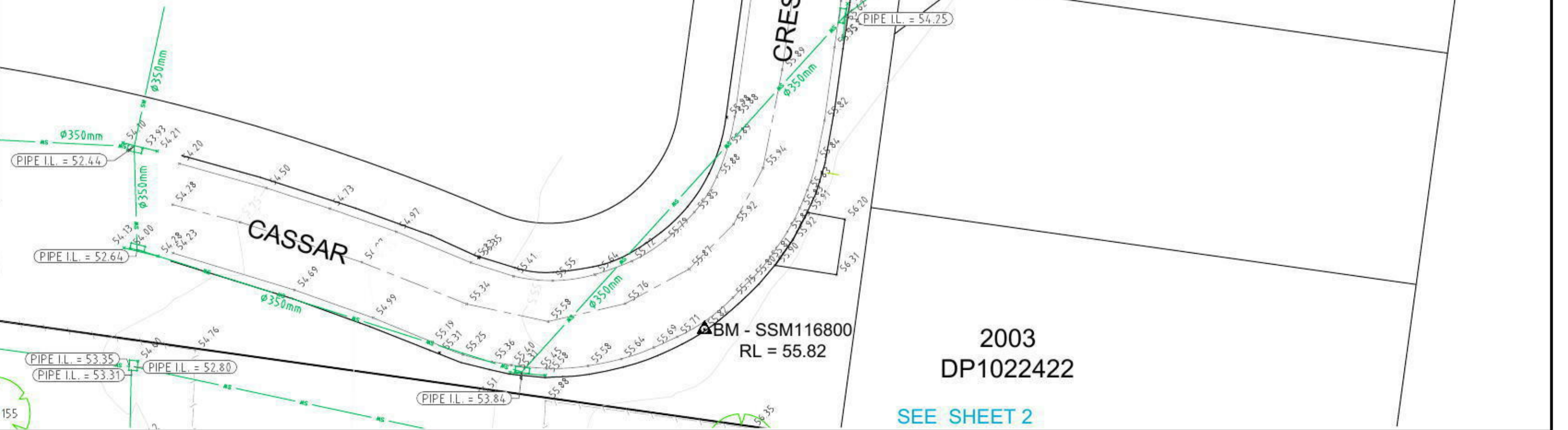
1. This plan does not define boundaries. No formal boundary definition has been undertaken & as such all boundary dimensions are subject to final survey.
2. The position of features shown is subject to a boundary survey.
3. Any Services shown are indicative only. Positions are based on surface indicator/s located during field survey. Other services may exist which are not shown.
4. No investigation of underground services has been undertaken as part of this survey. Lines shown joining pits are a best estimate based on surface indicators.
5. Prior to any demolition, excavation or construction on the site, the relevant service authority MUST be contacted for possible location of further underground services and detailed locations of all services.
6. All dimensions are based on Australian Height Datum (AHD) - Origin of levels is SSM97355 on Andromeda Drive (RL = 50.53).
7. Origin of coordinates: SSM97355.
8. Azimuth - D.P.: MGA North
9. Contours are indicative of ground form only. Spot levels should be used, with caution, for calculations of quantities.
10. Contour interval: 0.5m.
11. All adjoining building information is indicative only and is subject to further survey



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| LEGEND | |
|--------|-----------------------|
| BB | BOTTOM OF EMBANKMENT |
| BK | BACK OF KERB |
| EG | EDGE OF GARDEN |
| FE | FENCE (CONSTRUCTED) |
| P | GULLY PIT OUTLINE* |
| JM | TIMBER / SCRUB MEDIUM |
| LP | LIP LINE OF KERB |
| PEJB | ELEC.CABLE JUNCT. BOX |
| PSMH | SEWER MANHOLE CNTR. |
| PWMR | WATER METER |
| PWTP | WATER TAP |
| RC | CENTRE OF ROAD |
| TC | TOP OF BANK |
| TREE | (TAG NUMBER SHOWN) |



| REVISIONS | | | |
|-----------|------------|------------------|-----|
| No. | DATE | REVISION DETAILS | BY |
| A | 24.01.2013 | Original Issue | OGL |

| NOTES | |
|-------------------|--|
| See Flyout Page 1 | |

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| SCALE: 1:250 @A1 | DATUM: AHD |
| LONG SECTION: H: N/A, V: N/A | CROSS SECTION: H: N/A, V: N/A |

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 DATE OF PLAN: 25.01.13
 DATE LAST SAVED: 30.01.13
 DATE APPROVED: 25.01.13

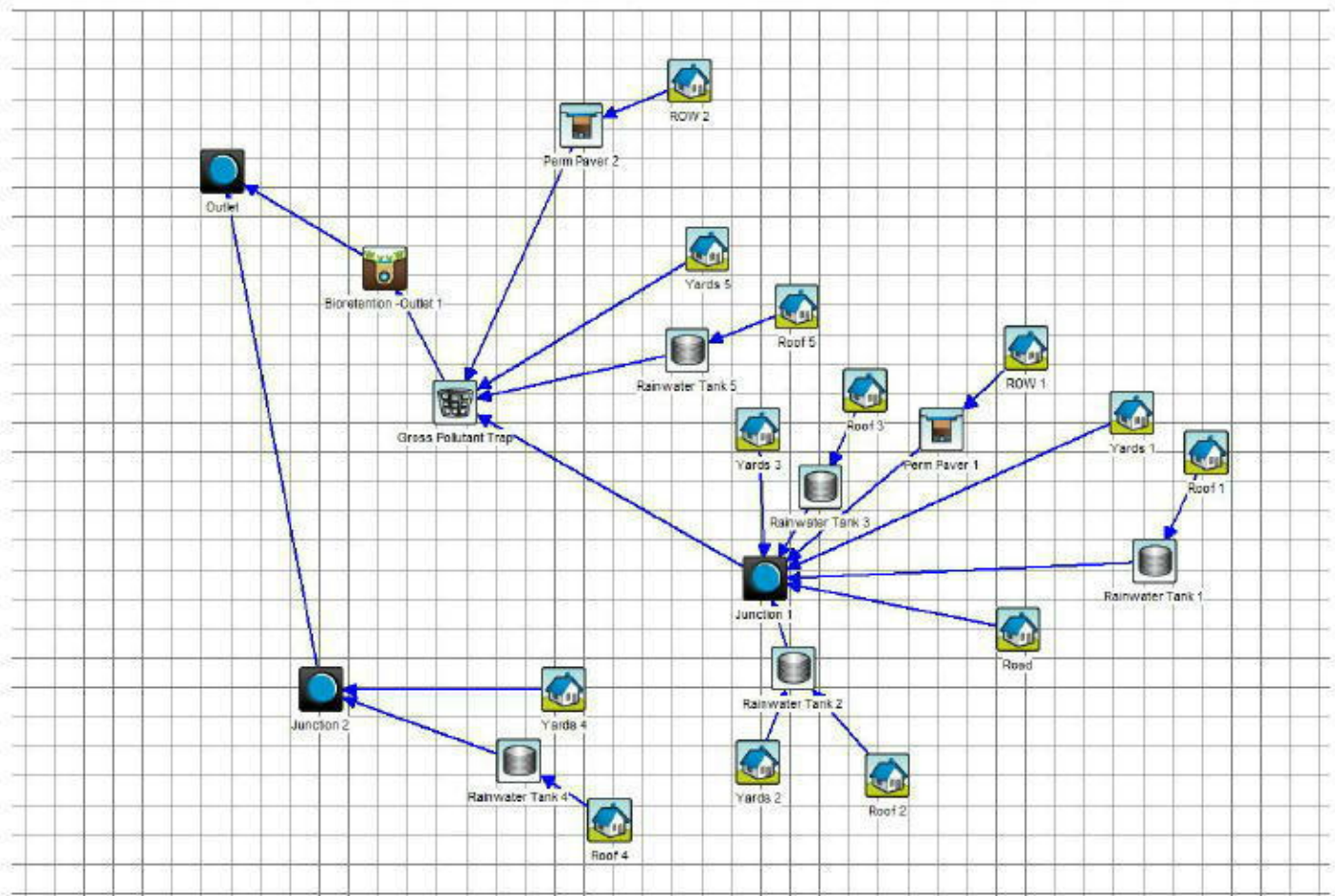
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| DESIGNED: | DATE LAST SAVED: 30.01.13 |
| APPROVED: B.J.F. | DATE APPROVED: 25.01.13 |

TITLE: PARTIAL DETAIL SURVEY OVER XAVIER COLLEGE
 PART LOT 1, DP1144668
 86-94 ANDROMEDA DRIVE
 CRANE BROOK

| | |
|---------------------|----------|
| JOB No: 117SW | ISSUE: A |
| DWG No: D01 | |
| SHEET 1 OF 3 SHEETS | SIZE: A1 |

Appendix 2

Schematic of MUSIC model layout



MUSIC Model Schematic