

DRAFT

**Amex Corporation Tarneit Property Site
Stormwater Management Report**

Property south of Regional Rail Link

13th June 2013

Prepared by Marcus Cairney



This report has been prepared by the office of Spiire

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1. Introduction

Spiire have been engaged by Amex Corporation to develop a site stormwater management strategy for the Tarneit property located on the corner of Leakes Road and Tarneit Road.

The site is approximately 128 hectares but is split in two by the Regional Rail Link (RRL) corridor.

This document will focus on the section of the property south of the RRL corridor (approximately 24 hectares), as shown in Figure 1.1 below.

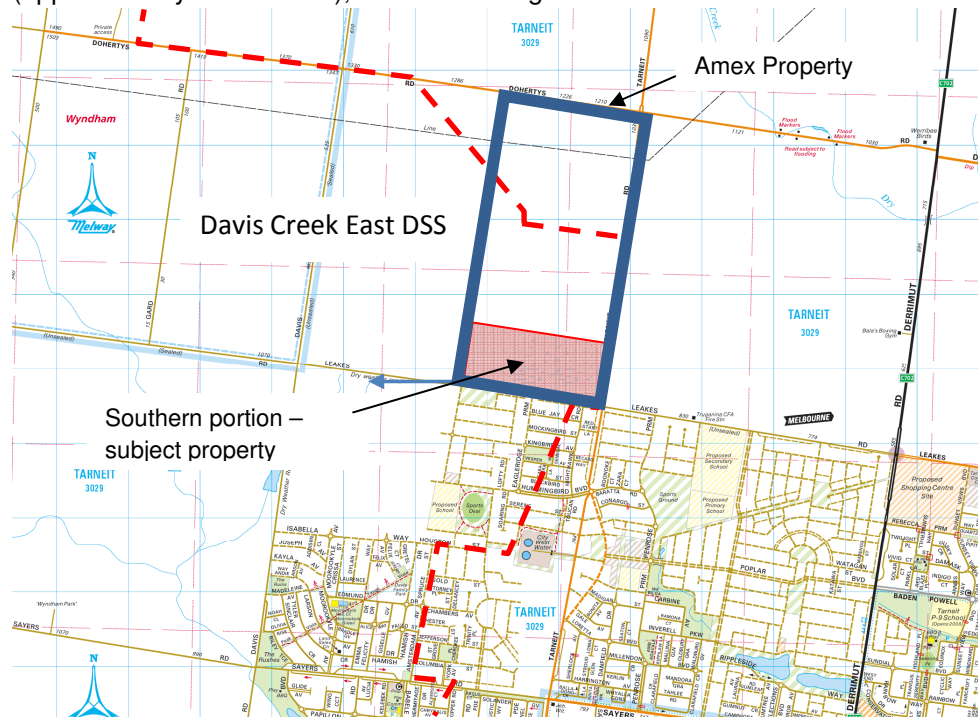


FIGURE 1.1 – Site Location

The land is currently rural grazing land; it is very flat with not more than a metre elevation difference across the site. It falls generally to the south west corner, but has a depression in the middle of the lot.

The study area is located within Melbourne Water's Davis Creek East Drainage Scheme as defined on figure 1.1. Drainage from the study area is directed to Davis Creek.

The purpose of this report is to develop a stormwater management plan for the site, focussed around a single point of discharge in the south west corner of the site discharging into existing drainage in Leakes Road. This involves:

- Investigating the capacity of existing drainage in Leakes Road
- Assessing the flows from the site
- Determining if retardation measures are required and if so their required sizes
- Determining volumes of fill required to grade site appropriately to the south west corner

1.1 Previous Work in the area

Spiire have previously designed the Tarneit Rise estate and associated stormwater infrastructure to the south of Leakes Road. This involved a RORB model that incorporated the site in question.

The Growth Area Authority is also in the process of updating the whole precinct structure plan for the area which will set some critical constraints.

2. Existing Site Conditions

In its current configuration the area under investigation would receive significant flows from the rural land to the north in a storm event. But with the Regional Rail Link corridor bisecting the site and no allowances for flow conveyance through the corridor once the rail line has been constructed, we can consider the site as an isolated catchment. It is approximately 24ha in size and generally falls from the north east corner to the south west. There is a trapped low point in the middle of the site which will require filling in order to outfall the entire site to the south west corner.

3. Melbourne Water Corporation Development Services Scheme

As previously mentioned the site is located within the Melbourne Water Davis Creek East Drainage Scheme. As such, there are no retardation requirements or water quality requirements placed on the site.

Retardation at this site has been investigated and is recommended so that further drainage works downstream of the site are not required. If there was no retardation on the site the existing drainage in Leakes Road, and potentially further downstream, would all need to be upgraded at substantial cost to the developer, and require lengthy negotiations with neighbouring landowners. The existing drainage capacities and retardation requirements are discussed further in section 4 below.

Water quality treatment is not a requirement at this site, but may be implemented as an opportunity as part of the wider the scheme. Given there will be a retarding basin, the land set aside for this could be utilised to incorporate a stormwater quality treatment device such as a wetland or raingardens. See section 5 for further details.

4. Hydrologic/Hydraulic Analysis

4.1 Existing conditions

Existing drainage in Leakes Road has been designed to take the discharge from the Tarneit Rise wetland/RB to the south as well as the rural flows to the north. A 1500mm diameter pipe on the southern side of Leakes Road near the south west corner of the site runs, at a grade of 1 in 500, west to an open outfall channel. The Amex site point of discharge would be pit 5 as per Appendix A which relates to the design drawings of existing drain. The invert of this pit is the control setting the levels of the drainage network within the Amex South site. Refer to section 4.4 for details of the connection from the Amex South Site drainage network into the Leakes Road drain.

A RORB model was setup to depict all the rural catchments discharging to this drainage in Leakes Road, ie Tarneit Rise and the Amex site south of the RRL. (Refer Appendix B for the RORB catchment plan). This model was run and calibrated against rational method calculations. The parameters used were $K_c = 1.47$, $m = 0.80$, $IL = 15\text{mm}$, $CL = 2.5\text{mm}$.

Table 3.1.1: Rural 1 in 100 Year ARI Peak Flows

Location	Peak Flows RORB (m^3/s)	Peak Flows RATIONAL (m^3/s)
Amex site discharge	1.22	1.19
Tarneit Rise discharge	1.80	1.86
Combined discharge in Leakes Road	3.01	3.03

4.2 Developed Conditions

The rural RORB model was updated to reflect the developed conditions within the catchment. Note the basin in Tarneit Rise is contained within the model.

Running this model with the same parameters, showed that the existing pipe in Leakes road did not have capacity to drain the 100 year ARI flows from the Amex site without retardation.

Table 3.2.1: Developed 1 in 100 Year ARI Peak Flows

Location	Peak Flows (m^3/s)
Amex site discharge	4.46
Tarneit Rise retarded discharge	1.81
Combined discharge in Leakes Road	5.23

The capacity of the pipe in Leakes Road is only $3.4\text{m}^3/\text{s}$ and hence the flows coming from the Amex site would need to be retarded back until the combined discharge in Leakes Road is less than this, or a duplicate pipe system would need to be constructed to convey the flows to the Davis Creek Outfall.

4.3 Retardation Requirements

On the basis of conveying all the flows to the south-west corner of the site and the capacity limitations in the existing pipe, a retarding basin was modelled utilising RORB. The model was carried out to determine the retardation volume required. The discharge requirements were based on the existing drainage capacity in Leakes Road with respect to the critical duration and hence not necessarily the pre-developed flow rate.

A retarding basin of approximately 4900m³ is required in the Amex site to retard the 100 year ARI flows back to a discharge flow rate matching the available capacity of the existing drainage infrastructure in Leakes Road. This will require a land take of approximately 6500m².

Table 3.2.2: Developed 1 in 100 Year ARI Peak Flows with 4900m³ retarding basin

Location	Peak Flows (m ³ /s)
Amex site retarded discharge	1.58
Tarneit Rise retarded discharge	1.81
Combined discharge in Leakes Road	3.38

4.4 Flow Conveyance

A concept plan for the site has been provided by Tract (see Appendix C). This was used to derive a catchment plan and drainage network. The critical roads in the development are the three main east west roads which will convey the overland flows to the retarding basin located in the south west corner of the site.

The level of the retarding basin has been derived from the control point in the Leakes Road drainage pipe. The outlet pipe from the retarding basin is 1200mm dia. graded 1 in 500 to convey the retarded discharge of 1.58m³/s.

Rational method calculations were undertaken to determine approximate 100 year ARI flows (refer Appendix D for calculations).

The three main roads have road reserve widths of 16m (northern), 18m (central), and 12m (southern), and a minimum sawtooth crest grade of 1 in 500. The main roads will therefore have the following capacities:

- Northern main road (16m): 1.75m³/s
- Central main road (18m): 1.67m³/s
- Southern main road (12m): 0.35m³/s

The underground drainage has been sized to convey the 5 year ARI flows with the gap flows (the difference between the 5 year ARI and the 100 year ARI flows) being conveyed along the roads. In instances where the capacity of the road was insufficient to convey this gap flow due to the relatively flat grade on the roads, the underground drainage has been upsized to allow for greater capacity. Figure 4.1 indicates the road reserves that do not have the capacity to convey the gap flows.

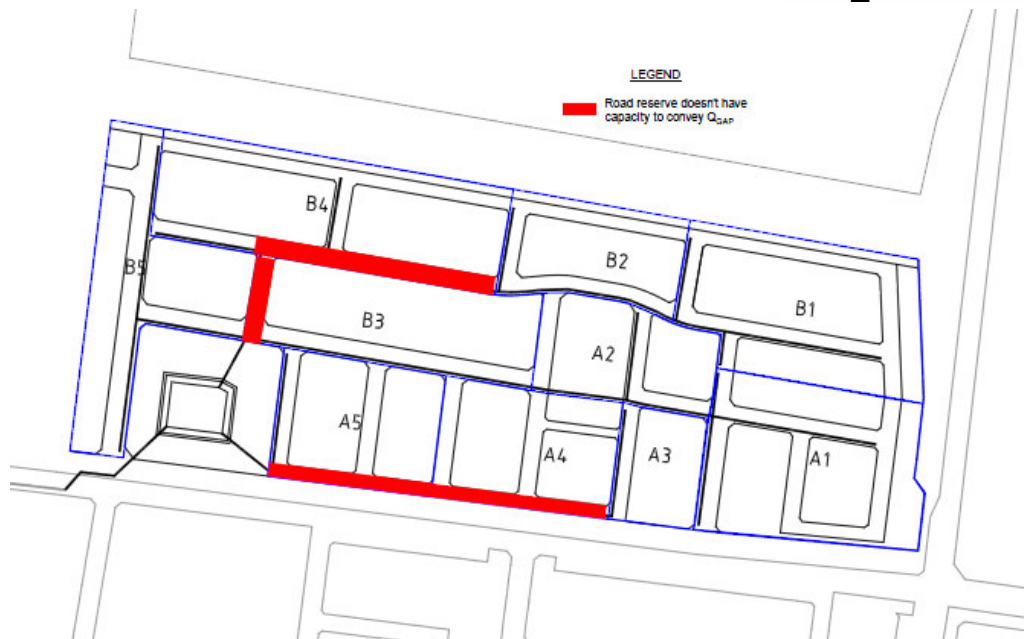


FIGURE 4.1 – Roads without capacity to convey gap flows

Referring to figure 4.1, the underground drainage running through catchment B3 has been sized for 50 year ARI flows, the underground drainage on the southern boundary of catchment A4 has been sized for 50 year ARI flows, and the underground drainage on the southern boundary of catchment A5 has been sized for 90 year ARI flows. The size of the drainage pipes is provided in the calculations page in Appendix D.

Details of proposed drains, retarding basin, wetland, and approximate road grading are presented in the Drainage Concept Plan in Appendix F.

The capacity of the road reserves has been calculated using PC-Convey. This generally proves to be a conservative approach and once the roads have been detail designed and modelled in a more accurate modelling tool such as HEC-RAS, the capacities tend to be higher. Hence it may be possible to reduce the size of some of the underground drainage infrastructure at the detail design stage.

The conveyance capacity of each road reserve has been derived from the Melbourne Water Land Development Manual criteria: Appendix A Section 3.1 'Residential streets used as floodways' states that the depth of flooding over the crest of an undulating street shall be no more than 300mm. The inundated road cross sections from PC-Convey indicating this 300mm water depth are provided in Appendix E.

5. Stormwater Quality

As stated in section 3, water quality treatment is not required as part of this drainage strategy. If the drainage scheme for the area was to incorporate stormwater treatment there is an opportunity for either a wetland or raingardens in the land set aside for the retarding basin.

Based on the retardation volume being 4900m³ we would expect an approximate base area of 3000 – 4000m² with a total land take of approximately 6500m² assuming 1 in 6 batters. Therefore a water quality treatment option would be able to be located within the base of this retarding basin. It is recommended that a wetland be located in the base of the retarding basin as this will provide stormwater treatment as well as provide valuable public space amenity to the development.

6. Site Grading

6.1 Site Cut and Fill

To achieve the grading required to drain the site appropriately, fill will be required. A design surface for the site was created with high points in the north east and south east corners; and a low point matching into the existing surface in the south west corner. This meant there was approximately 2m difference in level between these points.

In order to reduce the fill required a number of measures have been taken:

- The south east boundary corner has been filled to roughly match the existing surface adjacent to Leakes Road (approximately 1.60m fill required)
- The north east boundary corner is at the same level as the south east corner (approximately 1.30m fill required)
- Main roads have relatively flat 1 in 500 saw tooth crest grades and hence some underground drainage is oversized to allow for the minimised flood conveyance capacity of the roads (Refer to section 4.4 for pipe sizing)
- Creating a flow path through the centre of the site graded from the east to the retarding basin in the west

These measures will result in a quantity of cut from the site to aid the cut/fill balance and minimise the amount of imported fill required. The area in cut is the surrounds of the retarding basin and is up to 1.5m deep; approximately 2m lower than the areas of greatest fill on the site.

A further volume of fill, however, has been derived by filling to a predicted lot level. An extra 300mm above the edge of road reserve has been allowed for to establish the estimated volume of fill required for the lot surface level.

Table 5.2.1 below shows the total volumes of cut and fill required, including the volume of fill required up to the estimated lot level.

Table 5.2.1: Site Cut and Fill

Volume of fill (m ³)	Volume of cut (m ³)	Excess fill required (m ³) ⁽¹⁾
137,600	32,000	105,600

Notes:

- (1) Assume that 100% of site derived cut will be used for fill.

See Appendix G for a plan showing depth of fill contours. Note this plan does not incorporate the fill depths required to allow for the 300mm additional fill on lots.

7. Conclusion

This drainage strategy has been carried out for Amex Corporation Pty Ltd to determine hydraulic and hydrological requirements within the subject site.

The precinct concept plan, provided by Tract, created the opportunity to have three main east-west drainage lines grading into the retarding basin. In order to minimise the fill requirements for the site, the roads have a relatively flat grade and the site boundary levels tie in with the existing surface levels where possible. The retarding basin has generated a cut quantity which alleviates the quantity of fill required to be imported. The design also utilises the existing drainage in Leakes Road and hence negates the need for any negotiations with neighbouring landowners.

A summary of our outcomes from this investigation, on the basis of the Tract concept are as follows:

- A 4900m³ retarding basin is required in the south western corner of the property
- The drainage network outlets into the existing drainage pipe on Leakes Road, south west of the site, at flows within the existing capacity of this pipe
- Approximately 105,600m³ of imported fill is required to bring the north eastern corner of the site up to a sufficient level such that the site can be drained to the south west corner

Appendix A

Design Drawings of existing outfall drain

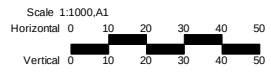
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Standard Drawing RDA1-CPG - Version 20090516



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Checked L. HOLMES
Authorised ---

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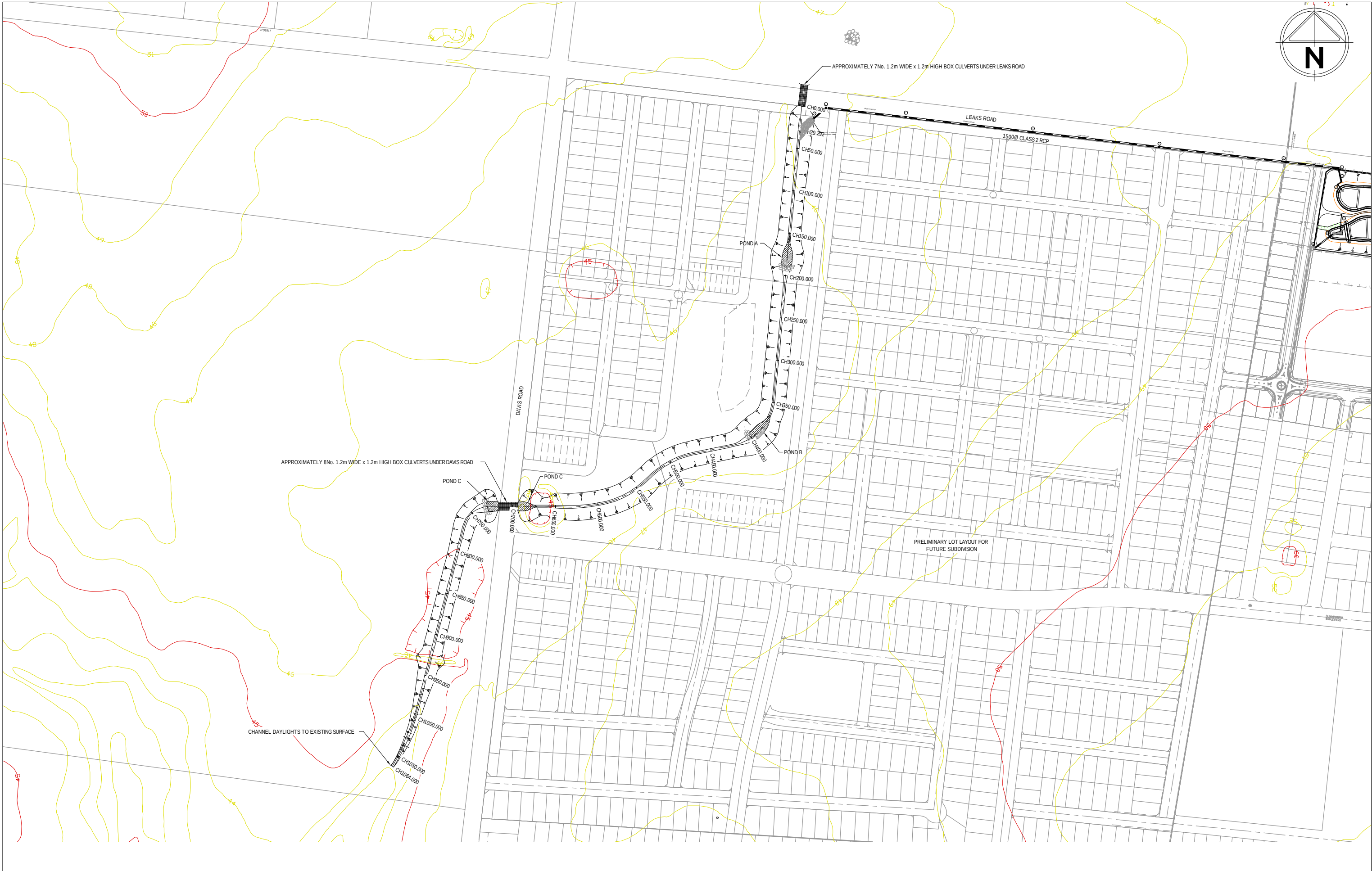
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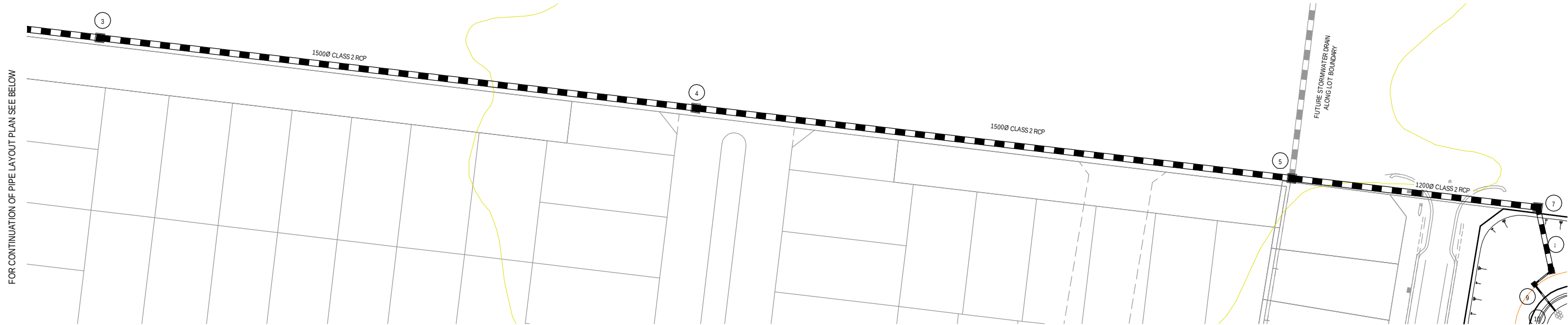
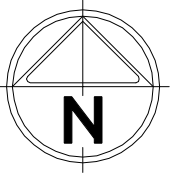


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TEMPORARY CHANNEL
LAYOUT PLAN

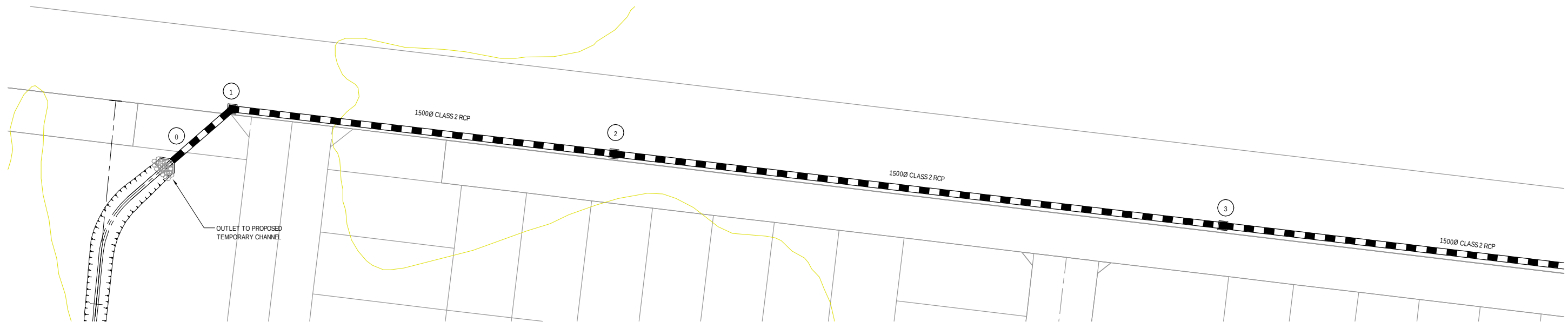
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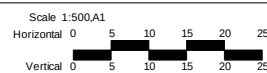
LAYOUT PLAN



LAYOUT PLAN

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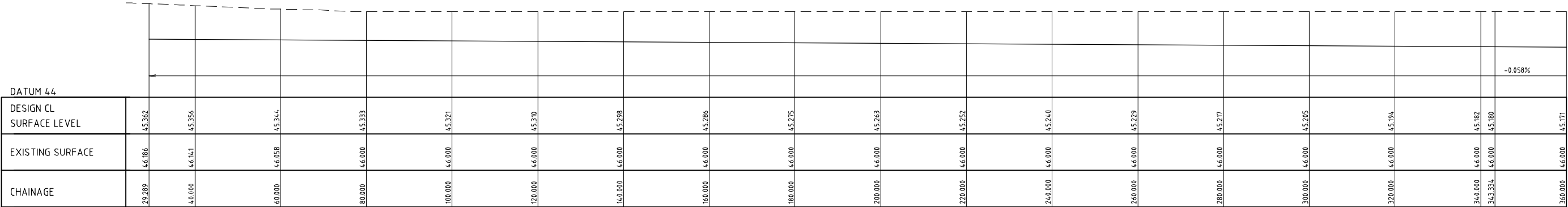
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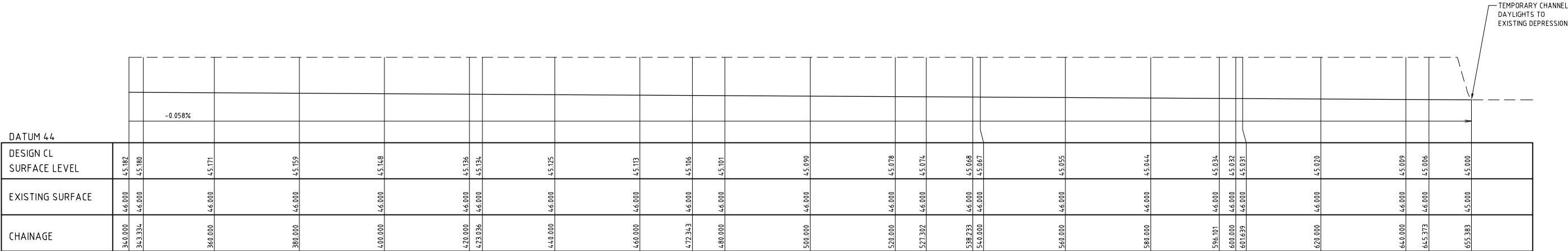


**PEET TARNEIT RISE SYNDICATE
TARNEIT RISE DRAINAGE OUTFALL
DRAINAGE PIPE OUTFALL
LAYOUT PLAN**

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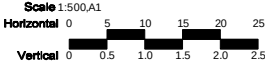
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TEMPORARY CHANNEL LONGITUDINAL SECTION

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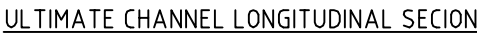
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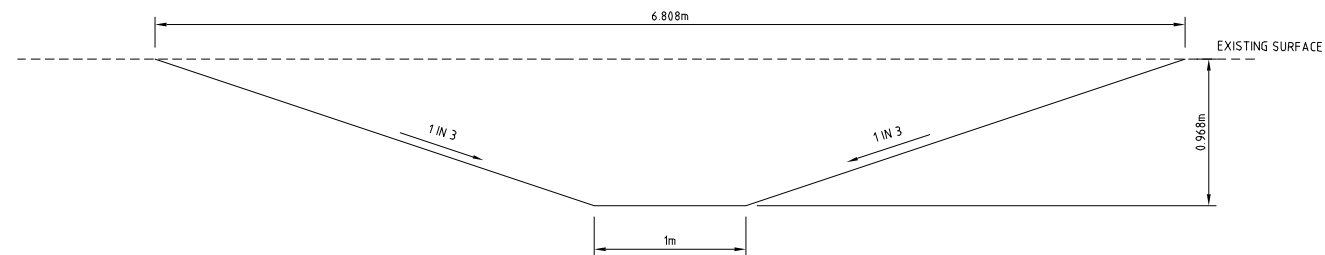
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LONGITUDINAL SECTION

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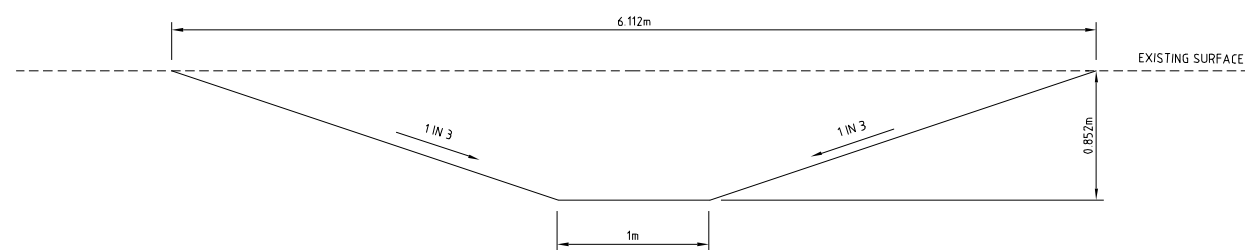



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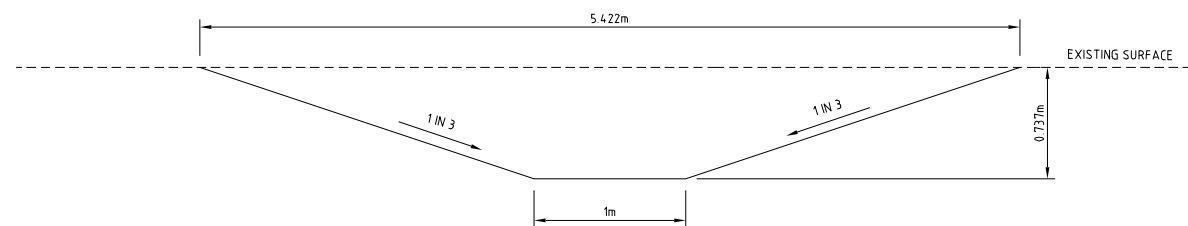
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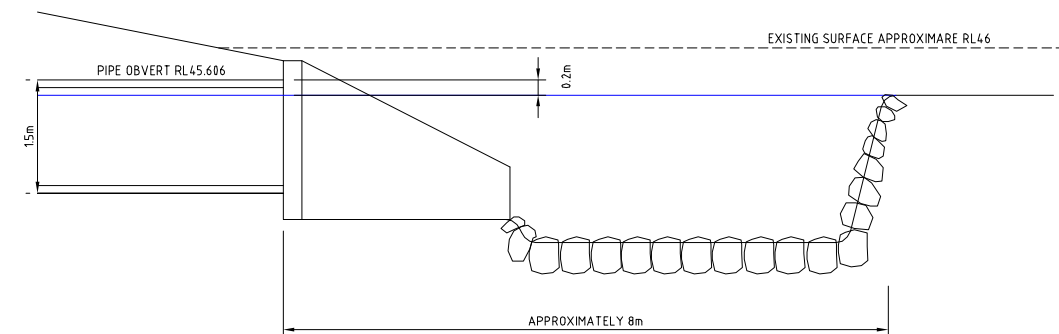


CH 400



CH 200

TEMPORARY CHANNEL CROSS SECTIONS
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TYPICAL OUTFALL TO CHANNEL DETAIL
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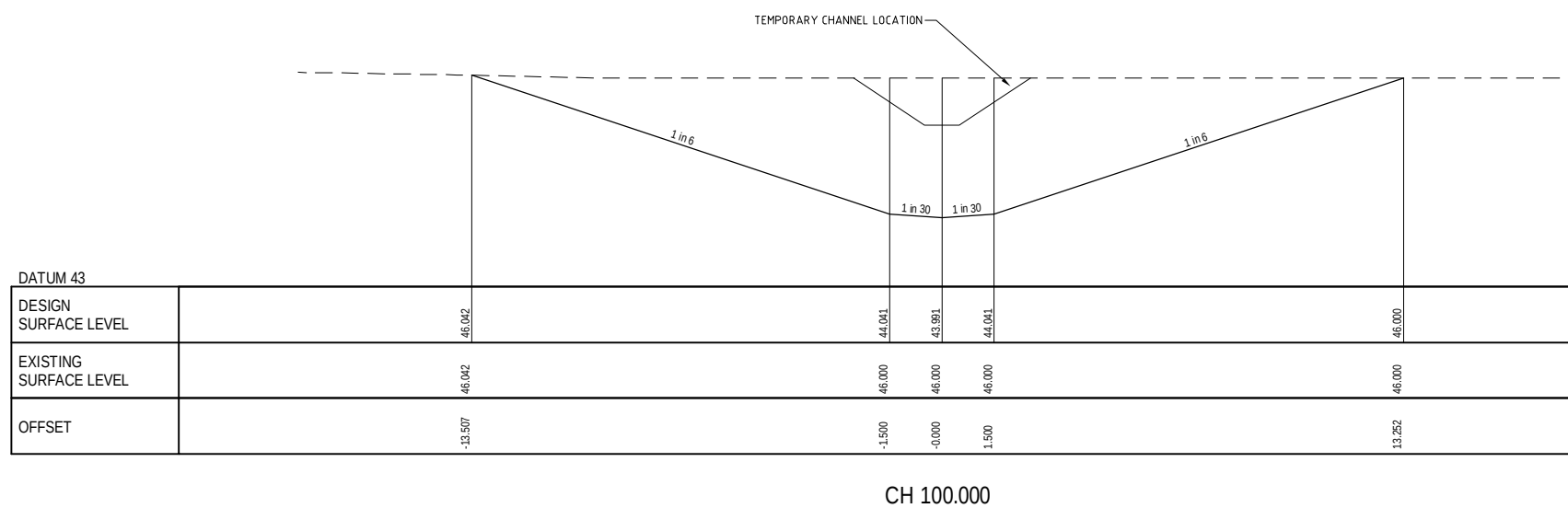
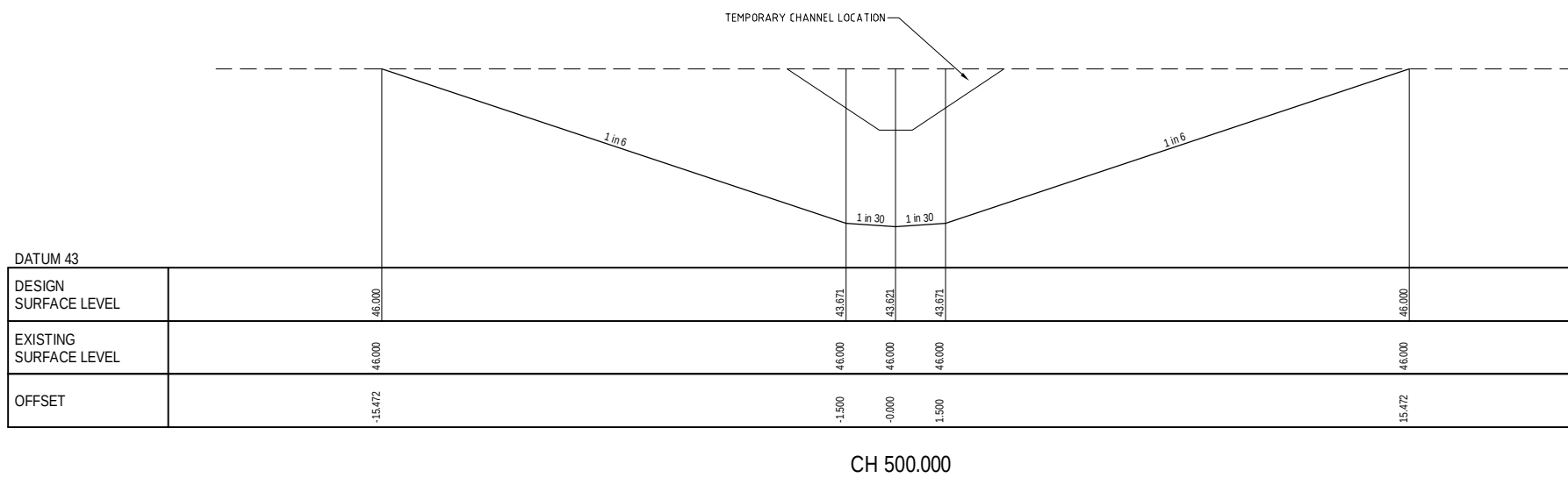
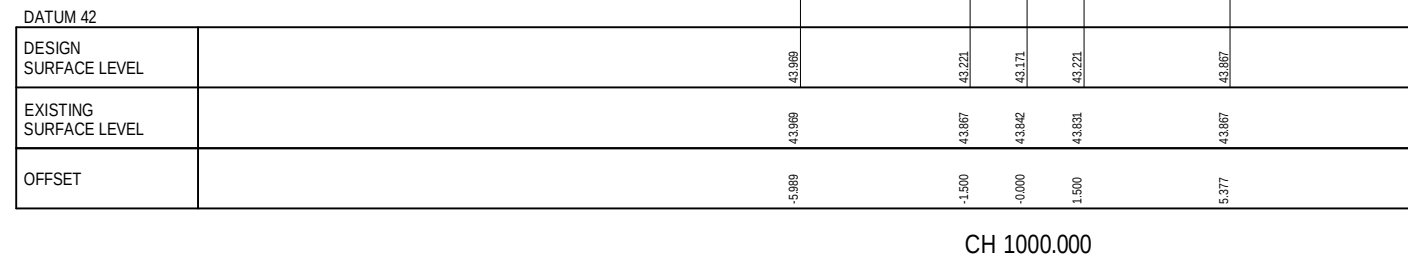
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TEMPORARY CHANNEL
TYPICAL SECTIONS

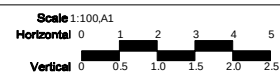
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 ULTIMATE CHANNEL
 TYPICAL SECTIONS

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Appendix B

RORB Catchment Plan

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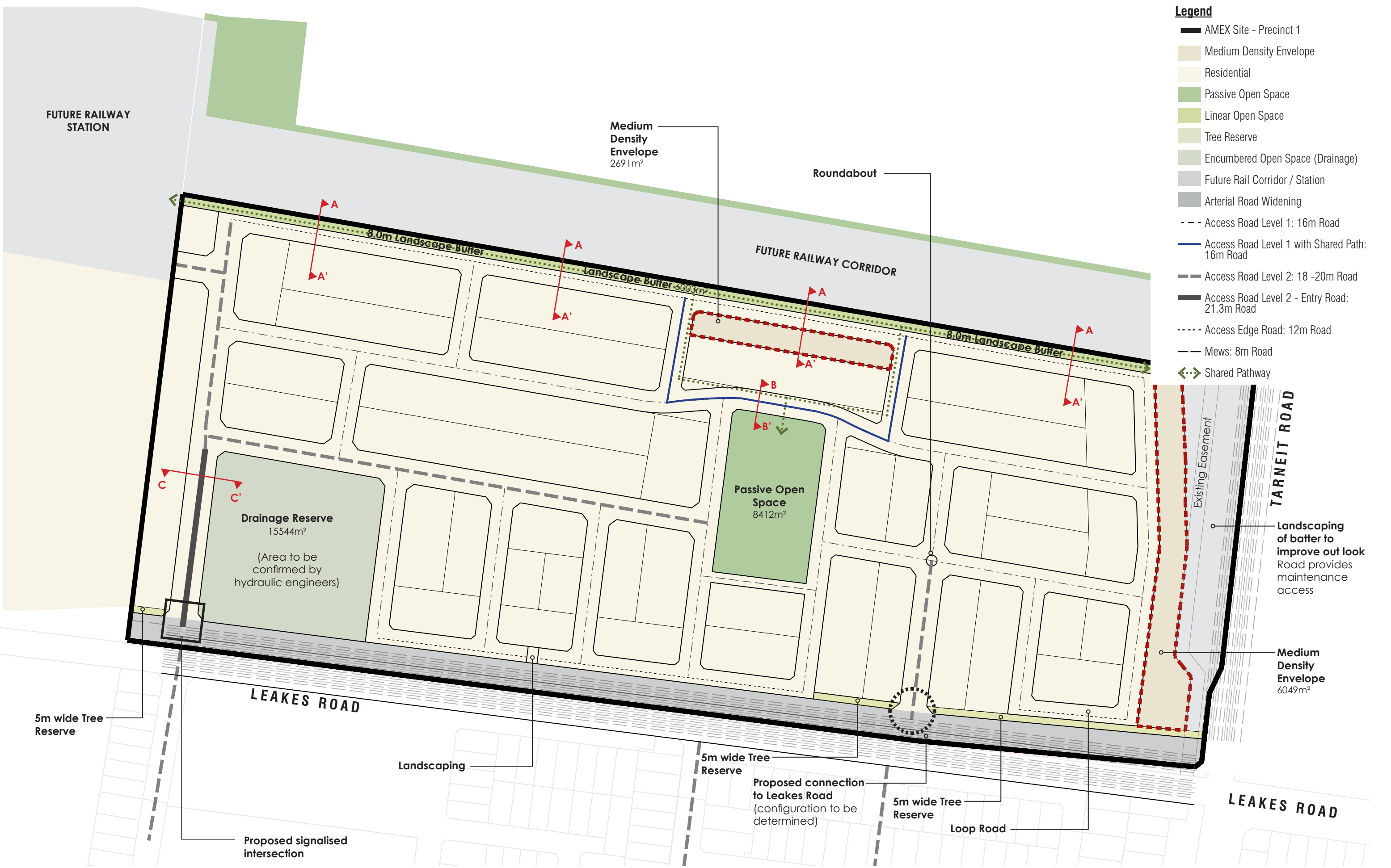


Appendix C

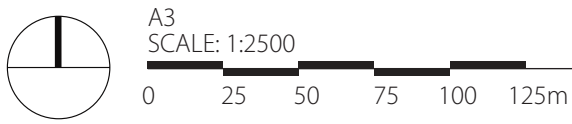
Tract Concept Plan

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- Legend**
- AMEX Site - Precinct 1
 - Medium Density Envelope
 - Residential
 - Passive Open Space
 - Linear Open Space
 - Tree Reserve
 - Encumbered Open Space (Drainage)
 - Future Rail Corridor / Station
 - Arterial Road Widening
 - Access Road Level 1: 16m Road
 - Access Road Level 1 with Shared Path: 16m Road
 - Access Road Level 2: 18 -20m Road
 - Access Road Level 2 - Entry Road: 21.3m Road
 - Access Edge Road: 12m Road
 - Mews: 8m Road
 - Shared Pathway



PRECINCT 1 - CONCEPT PLAN

Appendix D

Rational method calculations

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12/04/13

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Map Reference
Sheet Number
Drg Status

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AMEX CORPORATION
DRAINAGE INVESTIAGTION
RATIONAL CATCHMENT PLAN

DELFIRE INVESTMENTS PTY LTD
WYNDHAM CITY COUNCIL

Rev
Drg No

A
137869D04

100 Year ARI Calculations



Project:	Amex Drainage Strategy
Reference No:	137869

Polynomial Coefficients

ARI	a	b	c	d	e	f	g
5	3.168822	-0.63608	-3.58E-02	9.47E-03	2.70E-04	-4.23E-04	2.11E-05
100	3.910359	-6.63E-01	-3.74E-02	9.44E-03	5.19E-04	-3.59E-04	2.12E-06

BOM IFD information used

100yr URBAN ARI Drainage Calculations

DEVELOPED CATCHMENT

Catchment	Area (ha)	C	Ae (ha)	Σ Ae (ha)	Flow Length (m)	Velocity (m/s)	Tc (mins)	Int (mm/hr)	Q ₁₀₀ m ³ /s	Q ₅ (pipe) m ³ /s	Q _{gap} (road) m ³ /s	Comments
Full Area												
A1	2.91	0.77	2.23	2.23	307	2	7.56	158.07	0.980	0.370	0.684	900dia RCP
A2	1.49	0.63	0.94	3.17	255	2	7.13	162.19	1.430	0.539	0.998	1050dia RCP
A3	0.65	0.76	0.49	0.49	178	2	6.48	168.88	0.231	0.087	0.161	1050dia RCP
A4	1.84	0.77	1.41	1.90	268	2	7.23	161.13	0.850	0.083	0.784	900dia RCP designed to 50 year ARI
A5	1.78	0.78	1.38	3.28	262	2	7.18	161.61	1.473	0.312	1.223	1200dia RCP designed to 100 year ARI
B1	2.87	0.76	2.17	2.17	329	2	7.74	156.41	0.945	0.357	0.659	900dia RCP
B2	1.51	0.74	1.12	3.29	264	2	7.20	161.45	1.477	0.557	1.031	1050dia RCP
B3	2.23	0.77	1.72	4.89	355	2	7.96	154.51	2.100	0.794	1.465	1200dia RCP
B4	3.26	0.75	2.45	5.74	310	2	7.58	157.84	2.517	0.951	1.757	1350dia RCP designed to 50 year ARI
B5	2.36	0.77	1.82	1.82	322	2	7.68	156.93	0.794	0.300	0.554	825dia RCP
												Red indicates that road doesn't
												have capacity to convey Q _{gap}

Appendix E

PC-Convey 12m wide road reserve cross section

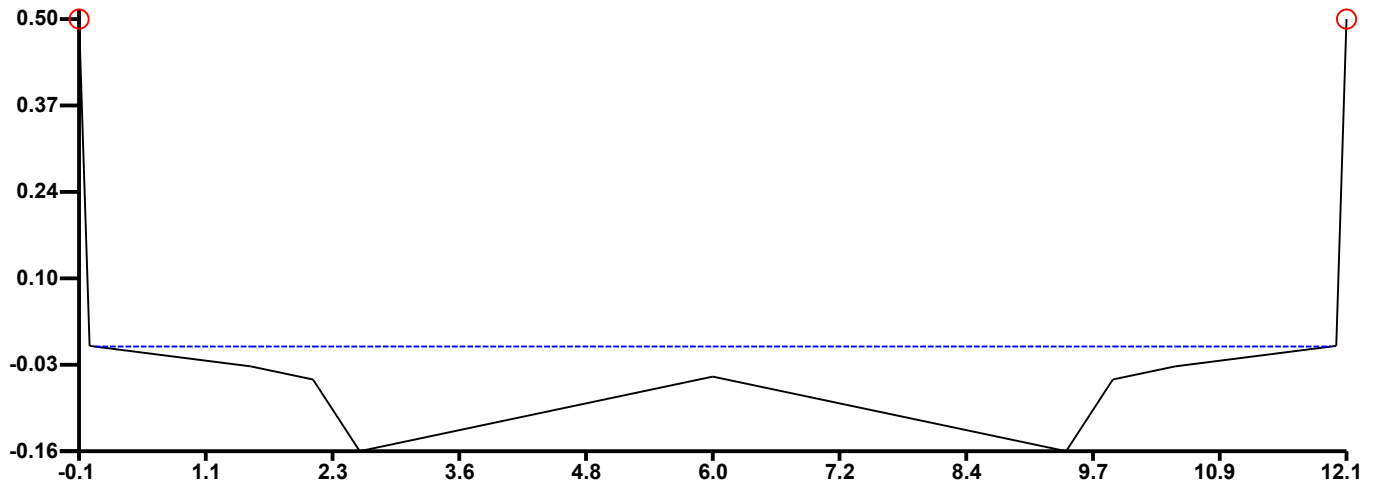
spire



PROJECT: 12m Road reserve - grade 1 in 500**Comment**

Print-out date: 09/04/2013 - Time: 14:13

Data File: G:\13\137869\Water Resources\PC convey\12m Road Reserve - grade 1 in 500.dat

1. CROSS-SECTION:**2. DISCHARGE INFORMATION:**

100 year (1%) storm event

Total discharge = 1.0 cumec

There is no pipe discharge

Overland/channel/watercourse discharge = 1.0 cumec

3. RESULTS: Water surface elevation = -0.001m

Current Grade = 1 in 500

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.00	0.35	0.00	0.35
D(Max) = Max. Depth (m):	0.00	0.16	0.00	0.16
D(Ave) = Ave. Depth (m):	0.00	0.07	0.00	0.07
V = Ave. Velocity (m/s):	0.00	0.40	0.00	0.40
D(Max) x V (cumecs/m):	0.00	0.06	0.00	0.06
D(Ave) x V (cumecs/m):	0.00	0.03	0.00	0.03
Froude Number:	0.00	0.46	0.00	0.46
Area (m ²):	0.00	0.89	0.00	0.89
Wetted Perimeter (m):	0.00	11.93	0.00	11.93
Flow Width (m):	0.00	11.90	0.00	11.90
Hydraulic Radius (m):	0.00	0.07	0.00	0.07
Composite Manning's n:	0.000	0.020	0.000	0.020
Split Flow?	-	-	-	No

4. CROSS-SECTION DATA:

SEGMENT NO.	LEFT HAND POINT		RIGHT HAND POINT		MANNING'S N
	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	
1	-0.100	0.500	0.000	0.000	0.020
2	0.000	0.000	1.550	-0.031	0.020
3	1.550	-0.031	2.150	-0.051	0.020
4	2.150	-0.051	2.600	-0.161	0.020
5	2.600	-0.161	6.000	-0.047	0.020
6	6.000	-0.047	9.400	-0.161	0.020
7	9.400	-0.161	9.850	-0.051	0.020
8	9.850	-0.051	10.450	-0.031	0.020
9	10.450	-0.031	12.000	0.000	0.020
10	12.000	0.000	12.100	0.500	0.020

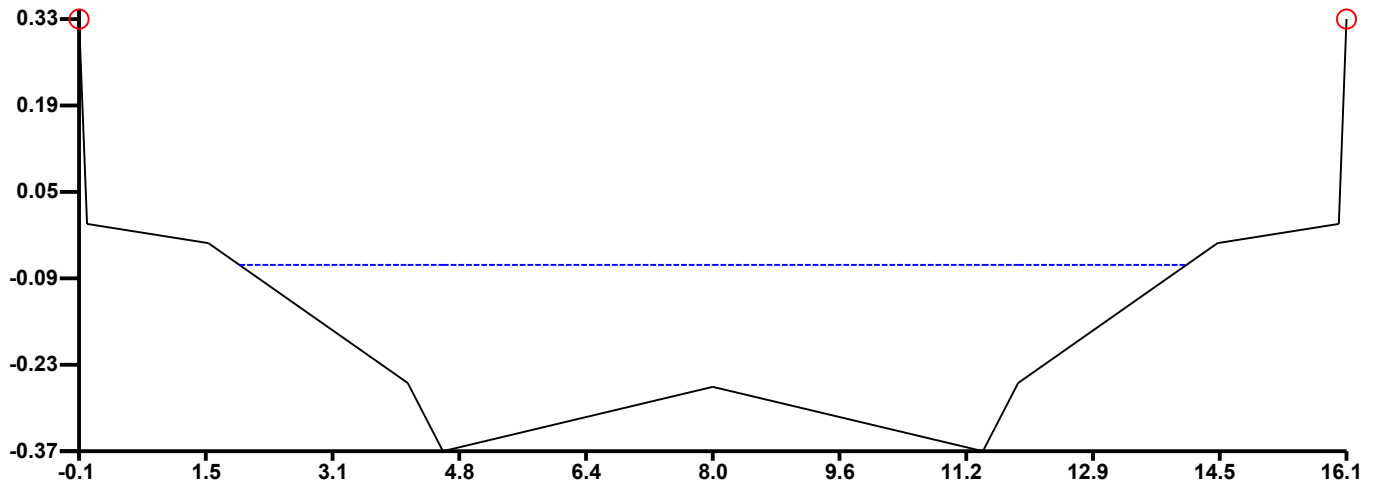
PC-Convey 16m wide road reserve cross section



PROJECT: 16m Road Reserve grad 1in500**Comment**

Print-out date: 09/04/2013 - Time: 14:18

Data File: G:\13\137869\Water Resources\PC convey\16m Road Reserve - grade 1in500.dat

1. CROSS-SECTION:**2. DISCHARGE INFORMATION:**

Non-standard storm event

Total discharge = 1.0 cumec

There is no pipe discharge

Overland/channel/watercourse discharge = 1.0 cumec

3. RESULTS: Water surface elevation = -0.066m

Current Grade = 1 in 500

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.00	1.75	0.00	1.75
D(Max) = Max. Depth (m):	0.00	0.30	0.00	0.30
D(Ave) = Ave. Depth (m):	0.00	0.19	0.00	0.19
V = Ave. Velocity (m/s):	0.00	0.75	0.00	0.75
D(Max) x V (cumecs/m):	0.00	0.22	0.00	0.22
D(Ave) x V (cumecs/m):	0.00	0.14	0.00	0.14
Froude Number:	0.00	0.54	0.00	0.54
Area (m ²):	0.00	2.34	0.00	2.34
Wetted Perimeter (m):	0.00	12.15	0.00	12.15
Flow Width (m):	0.00	12.11	0.00	12.11
Hydraulic Radius (m):	0.00	0.19	0.00	0.19
Composite Manning's n:	0.000	0.020	0.000	0.020
Split Flow?	-	-	-	No

4. CROSS-SECTION DATA:

SEGMENT NO.	LEFT HAND POINT		RIGHT HAND POINT		MANNING'S N
	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	
1	-0.100	0.330	0.000	0.000	0.020
2	0.000	0.000	1.550	-0.031	0.020
3	1.550	-0.031	4.100	-0.256	0.020
4	4.100	-0.256	4.550	-0.366	0.020
5	4.550	-0.366	8.000	-0.262	0.020
6	8.000	-0.262	11.450	-0.366	0.020
7	11.450	-0.366	11.900	-0.256	0.020
8	11.900	-0.256	14.450	-0.031	0.020
9	14.450	-0.031	16.000	0.000	0.020
10	16.000	0.000	16.100	0.330	0.020

PC-Convey 18m wide road reserve cross section



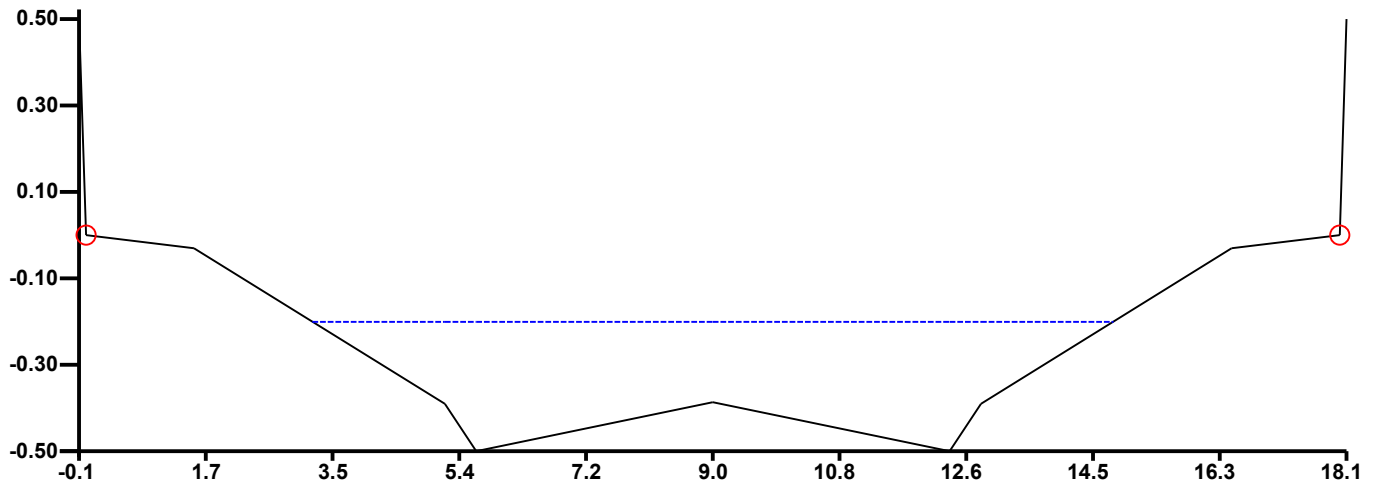
PROJECT: 18m Road Reserve 1in 500

Comment

Print-out date: 10/04/2013 - Time: 8:36

Data File: G:\13\137869\Water Resources\PC convey\18m Road Reserve - grade 1in500.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

Non-standard storm event

Total discharge = 1.0 cumec

There is no pipe discharge

Overland/channel/watercourse discharge = 1.0 cumec

3. RESULTS: Water surface elevation = -0.201m

Current Grade = 1 in 500

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.00	1.67	0.00	1.67
D(Max) = Max. Depth (m):	0.00	0.30	0.00	0.30
D(Ave) = Ave. Depth (m):	0.00	0.19	0.00	0.19
V = Ave. Velocity (m/s):	0.00	0.75	0.00	0.75
D(Max) x V (cumecs/m):	0.00	0.22	0.00	0.22
D(Ave) x V (cumecs/m):	0.00	0.15	0.00	0.15
Froude Number:	0.00	0.54	0.00	0.54
Area (m^2):	0.00	2.23	0.00	2.23
Wetted Perimeter (m):	0.00	11.55	0.00	11.55
Flow Width (m):	0.00	11.50	0.00	11.50
Hydraulic Radius (m):	0.00	0.19	0.00	0.19
Composite Manning's n:	0.000	0.020	0.000	0.020
Split Flow?	-	-	-	No

4. CROSS-SECTION DATA:

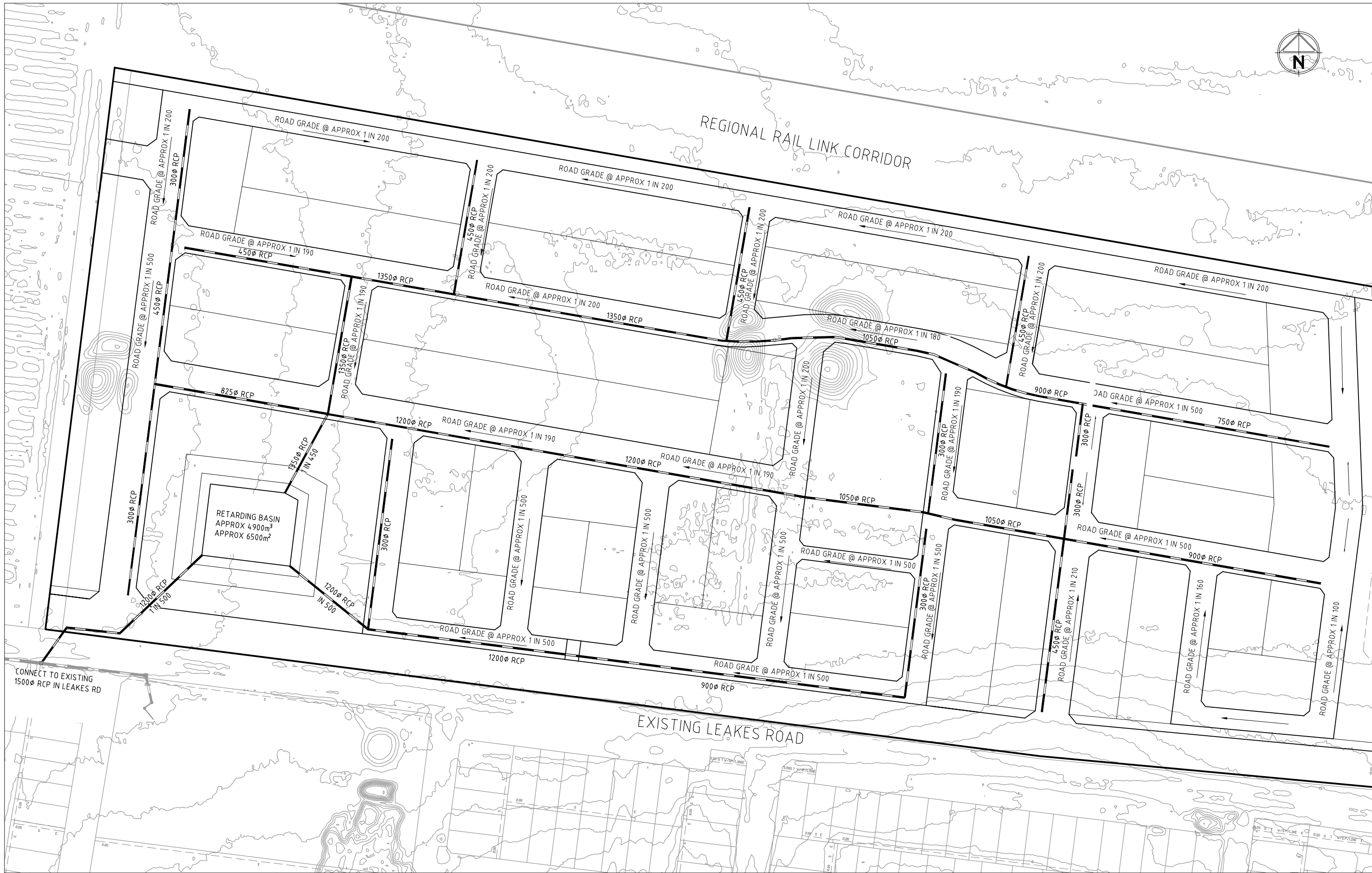
SEGMENT NO.	LEFT HAND POINT		RIGHT HAND POINT		MANNING'S N
	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	
1	-0.100	0.500	0.000	0.000	0.020
2	0.000	0.000	1.550	-0.031	0.020
3	1.550	-0.031	5.150	-0.391	0.020
4	5.150	-0.391	5.600	-0.501	0.020
5	5.600	-0.501	9.000	-0.387	0.020
6	9.000	-0.387	12.400	-0.501	0.020
7	12.400	-0.501	12.850	-0.391	0.020
8	12.850	-0.391	16.450	-0.031	0.020
9	16.450	-0.031	18.000	0.000	0.020
10	18.000	0.000	18.100	0.500	0.020

Appendix F

Drainage concept plan

spire





A	ISSUED FOR INFORMATION	L.H.
Rev	Amendments	Date

file name 137869D00.dwg layout name 137869D02
file location \\melfs\data\13\137869\ACAD
plotted by Marcus Cairney plot date 13/6/2013 4:52 PM
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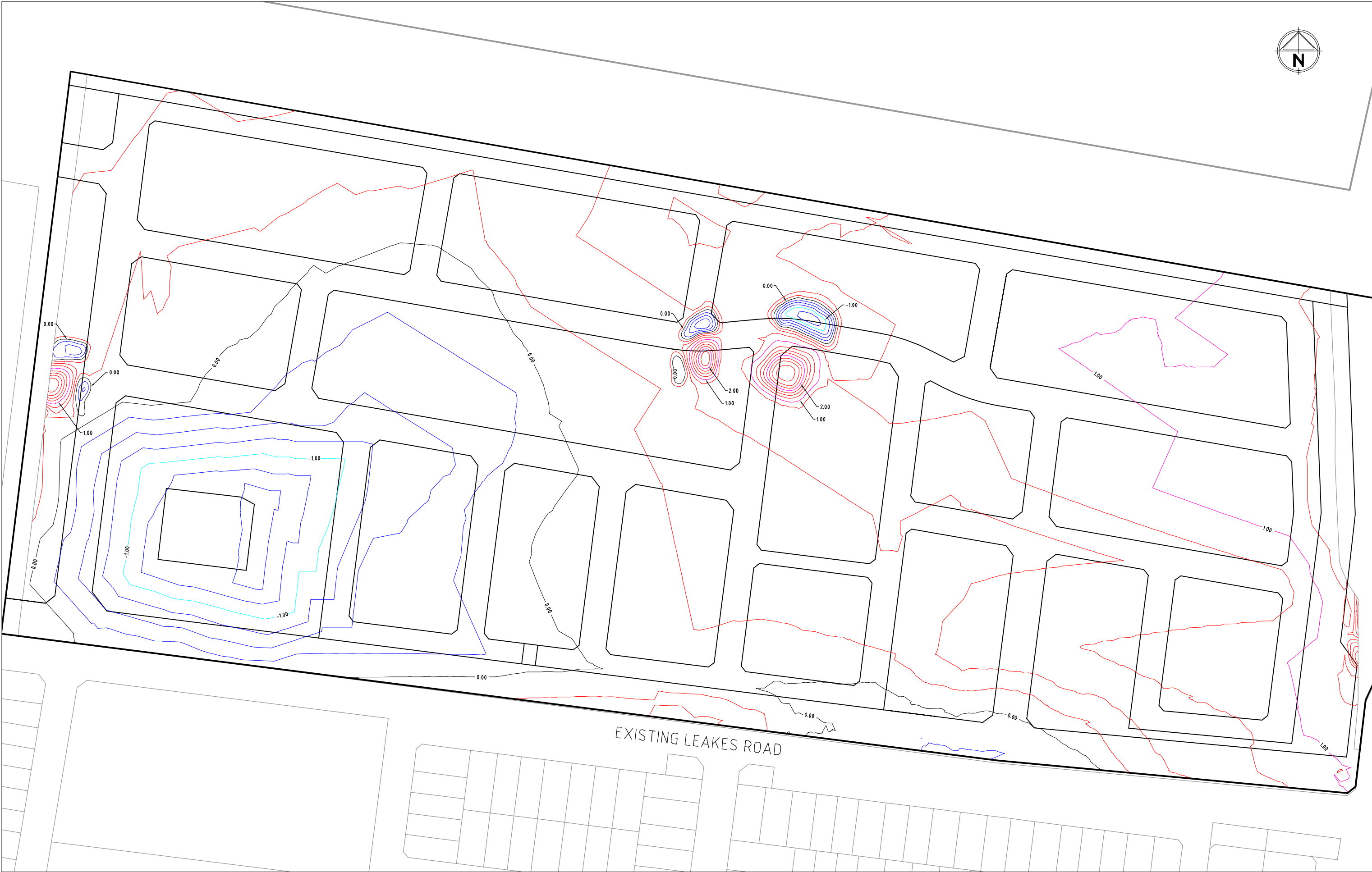
Drg No 137869D02

Appendix G

Fill plan

spire





A	ISSUED FOR INFORMATION	L.H.	10/04/13
Rev	Amendments	App'd	Date

file name 137869D00.dwg layout name 137869D03
file location G:\13\137869\ACAD
plotted by Alexandra Brown plot date 13/6/2013 3:55 PM
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Standard Drawing RDA1 - Version 20120811

Designed 09/04/13
M. CAIRNEY
Checked 10/04/13
L. HOLMES
Authorised PENDING
PENDING

Map Reference MELWAY
Sheet Number 01
Drg Status PRELIMINARY

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