Barrenjoey Consulting Engineers pty ltd
Stormwater Structural Civil

PROPOSED
SHOP TOP HOUSING DEVELOPMENT
267-269 CONDAMINE ST MANLY VALE
FLOOD & OVERLAND FLOW STUDY

Job No 180803
Feb 2019
Prepared by
Lucas Molloy
BE CPEng NER

Box 672 Avalon NSW 2107
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INTRODUCTION

This report has been prepared in relation to the proposed Development Application for shop top housing at No 267-269 Condamine St Manly Vale in respect to the Councils comments /concerns over overland stormwater flows along Kenneth Rd and flooding from the Burnt Bridge Creek.

The development is as detailed in the architectural plans by *Gartner Trovato Architects* refer Appendix A and includes two below ground parking levels, a ground floor retail level and four upper levels of residential units. The site is located on the south western corner of the Kenneth Rd / Condamine St intersection Manly Vale.

The existing sites topography is as shown in the survey plan 24880 (dated 21-06-18) by *John R Holt Surveyors pty ltd*, refer Appendix B.

Barrenjoey Consulting Engineers p/l inspected the site on 22nd August 2018.

Northern Beaches Council website aerial view of 267-269 Condamine St Manly Vale

BURNT BRIDGE CREEK FLOOD

The site is located approx. 50m north of the Burnt Bridge Creek culvert system that passes below Condamine St Manly Vale. Although effected by the Council established FPL (Flood Planning Level) the site not effected by the flows associated with the creek system. Refer Appendix C.

KENNETH ROAD OVERLAND FLOW

The Kenneth Rd drainage system adjacent to the site contains conventional below ground pipes and above ground kerb / gutters.

Upon site inspection and topographic mapping analysis the area adjacent to the site would have a catchment area of 4.11Ha. Noting the significant piped system that will collect and direct flows down Pitt Rd away from the subject property, with overland flow surcharging this system travelling down Kenneth Rd towards the subject property, refer Appendix D.

Hydrologic Analysis
(1% AEP event)

Catchment area	- 41100m2 (45% impervious, 55% pervious)
Catchment length / slope	- 440m @ 10%
Peak Flowrates	- Rational Method analysis (refer Appendix G) 2512 l /s - DRAINS analysis (refer Appendix F, electronic copy available upon request) 511 l/s Pitt Rd piped system 153 l/s Kenneth Rd piped system 1690 l/s Kenneth Rd kerb and gutter system (100% Pitt Rd overflow + 50% lower Kenneth Rd catchment)

Hydraulic Analysis
HECRAS modelling of site conditions
Review / summary, refer Appendix H for data (electronic copy available upon request)

Max flow in kerb and gutter adjacent to basement entry/driveway - 320mm

Cross section data	Gutter	TWL	Drive Crest
Western edge	13.650	13.970	14.050
Eastern edge	13.250	13.520	13.650

SUMMARY

The site is not subject to the effects of flooding from the Burnt Bridge Creek flows.

It is our opinion that based on this study/HECRAS analysis that the basement entry driveway will crest above the overland flow travelling down Kenneth Rd.

It is to be noted that, due to the many complex factors that can affect a site, the subjective nature of a risk analysis, and the imprecise nature of the science of flood analysis, the risk of persons being injured, to life and property cannot be completely removed. The recommendations within this Report do not remove the risk associated with the predicted flooding event, though lower those risks to an acceptable level reasonably anticipated by the community in everyday life.

Regards
BARRENJOEY CONSULTING ENGINEERS pty ltd

Per
Lucas Molloy (Director)
BE CPEng NER

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Appendix A

Architectural Plans by
Gartner Trovato Architects

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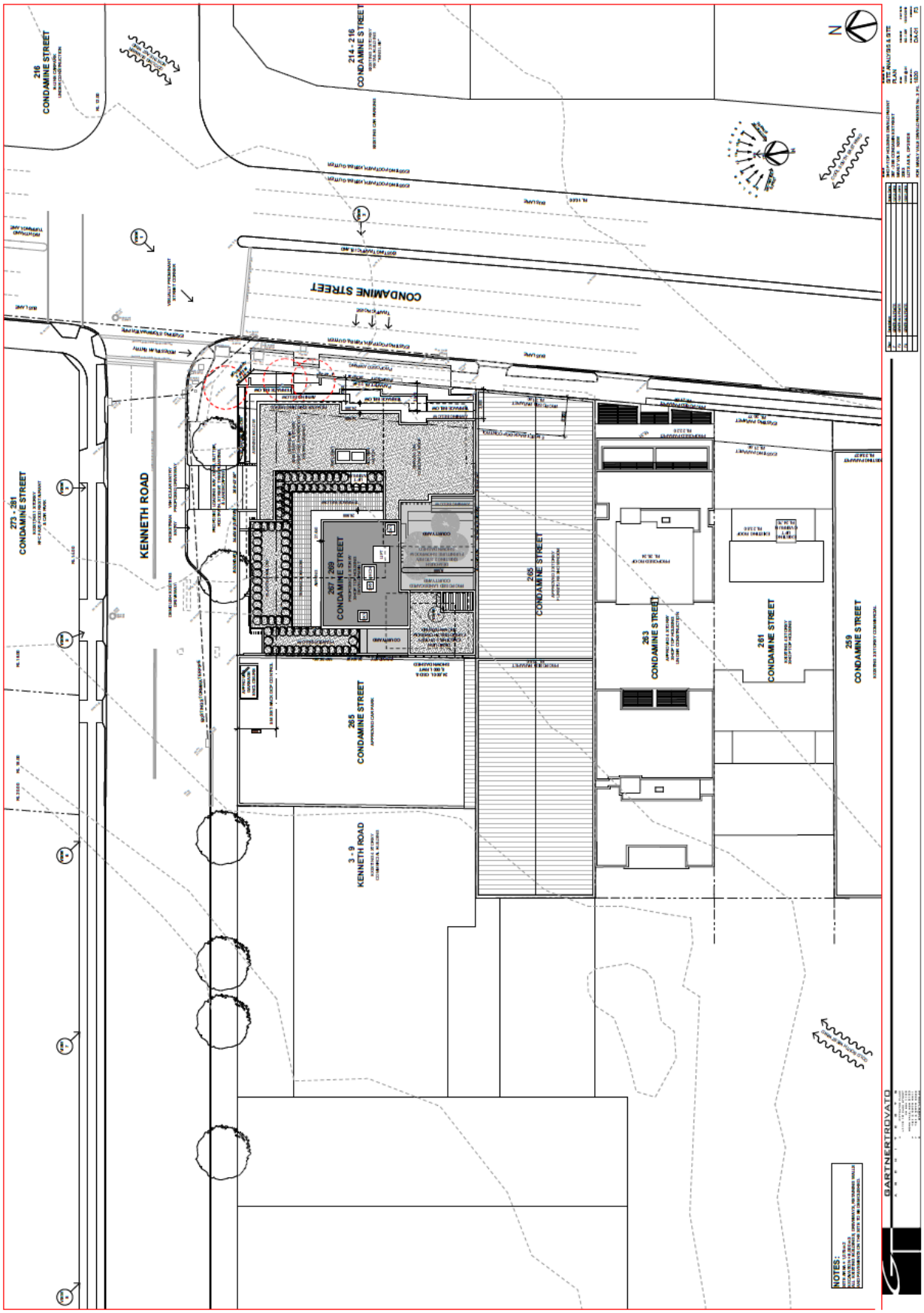

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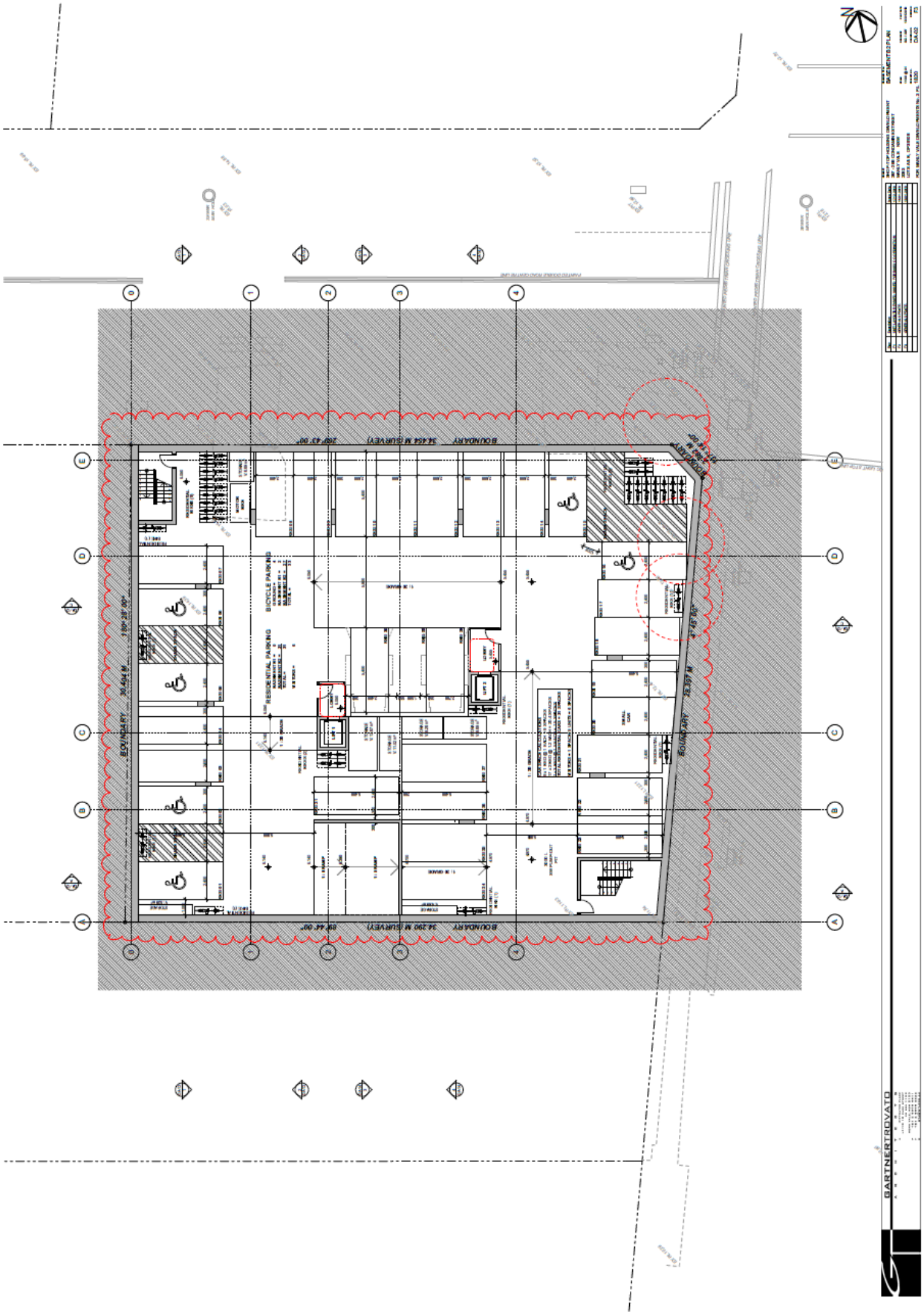

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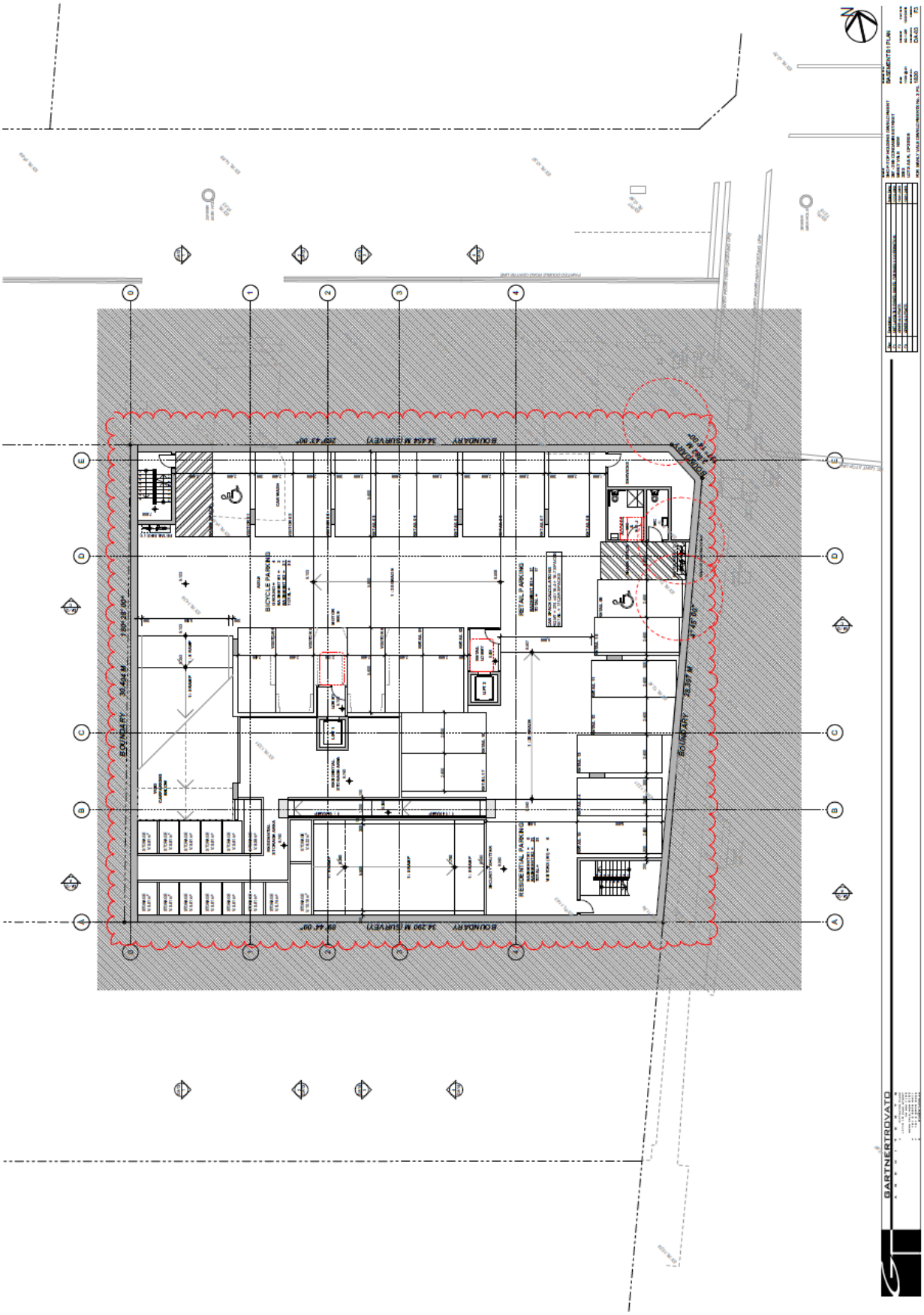

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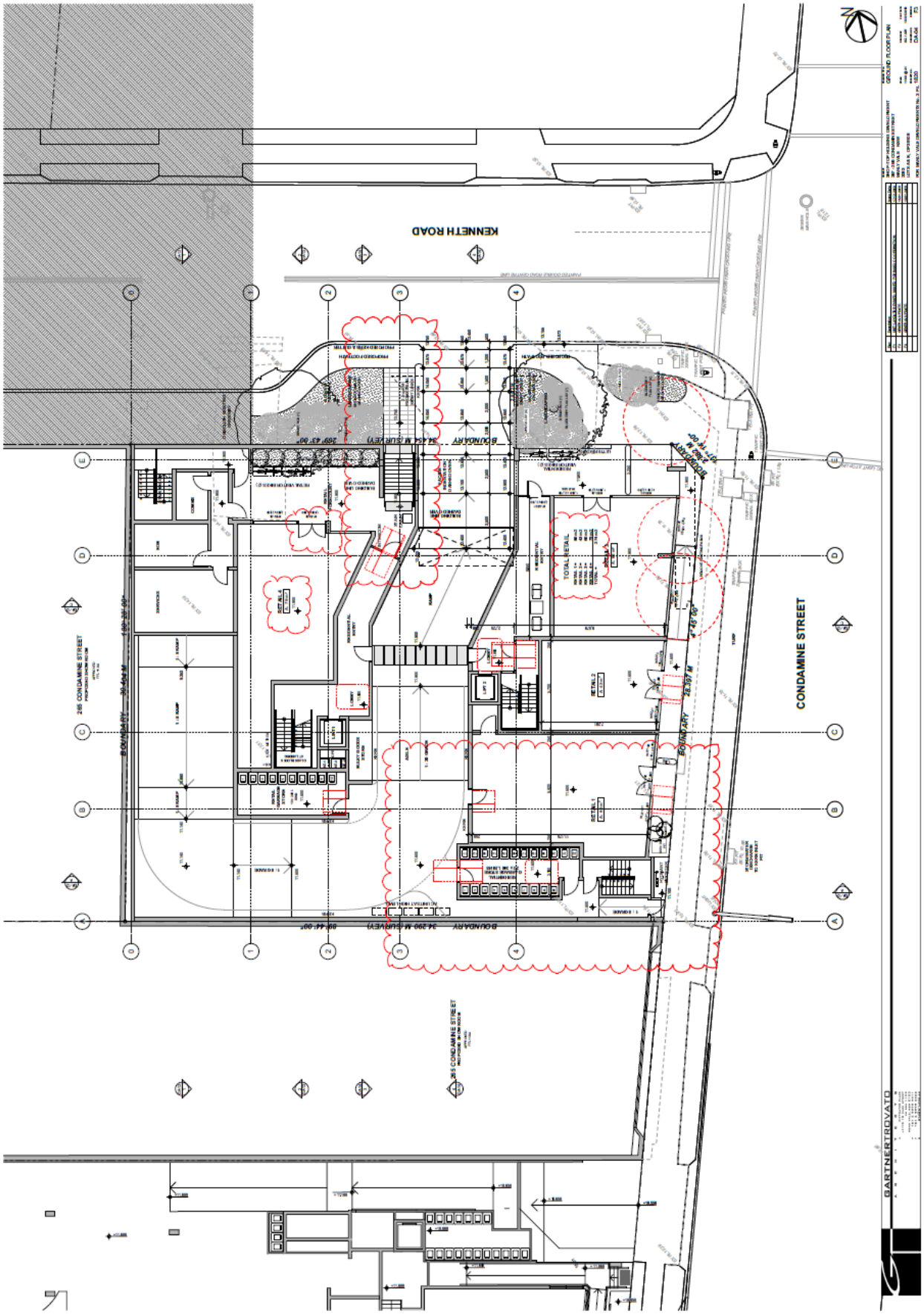

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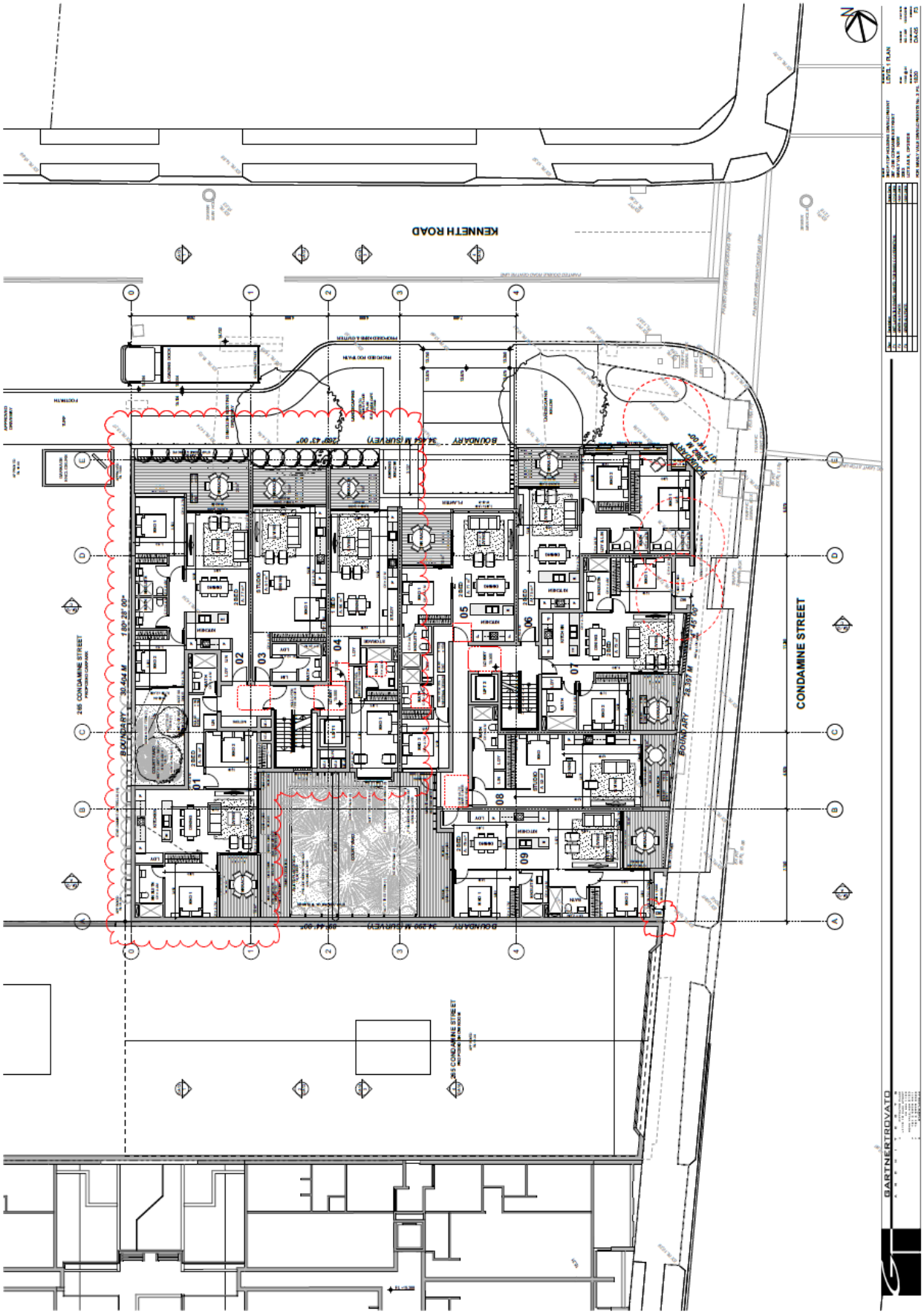

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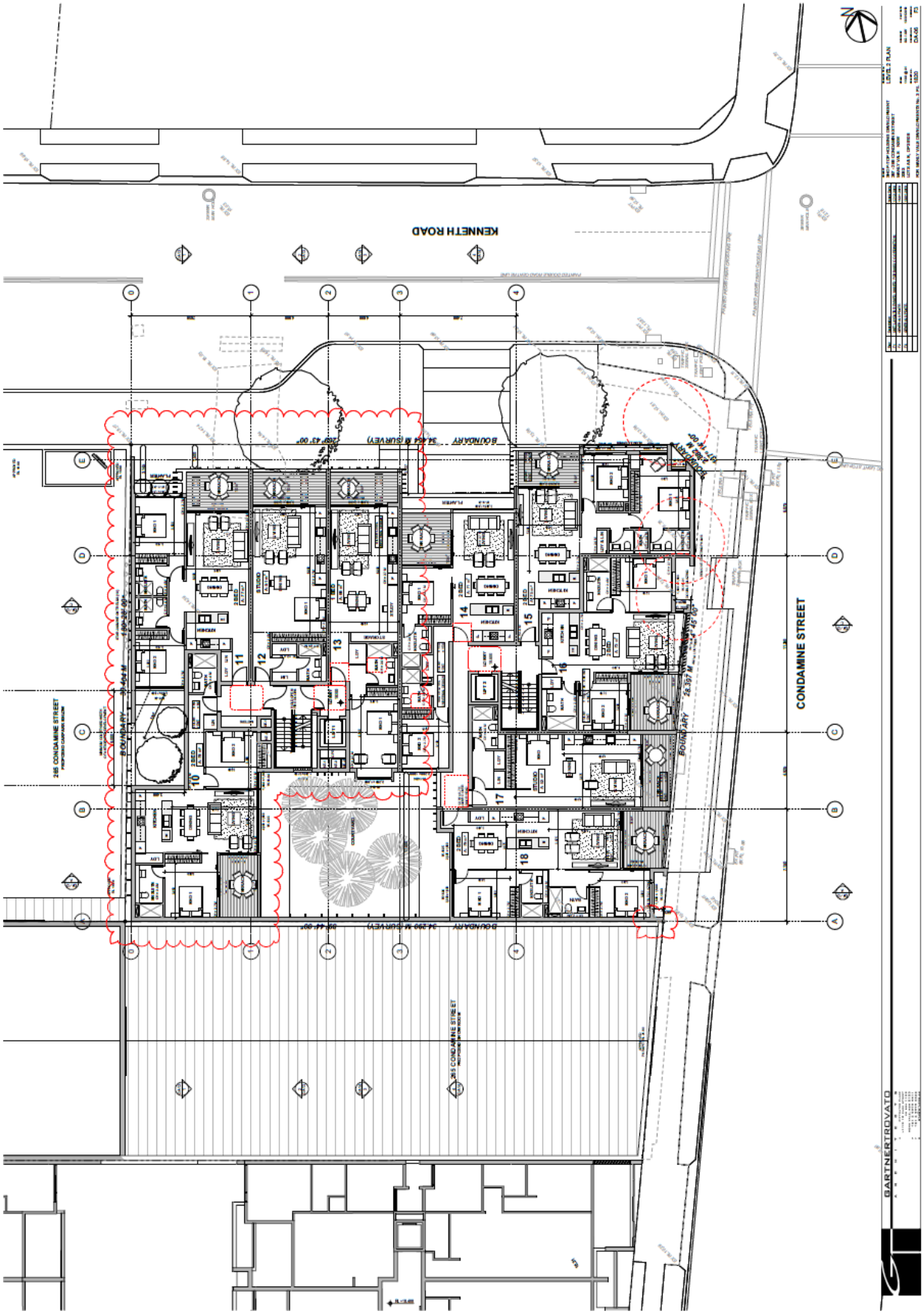

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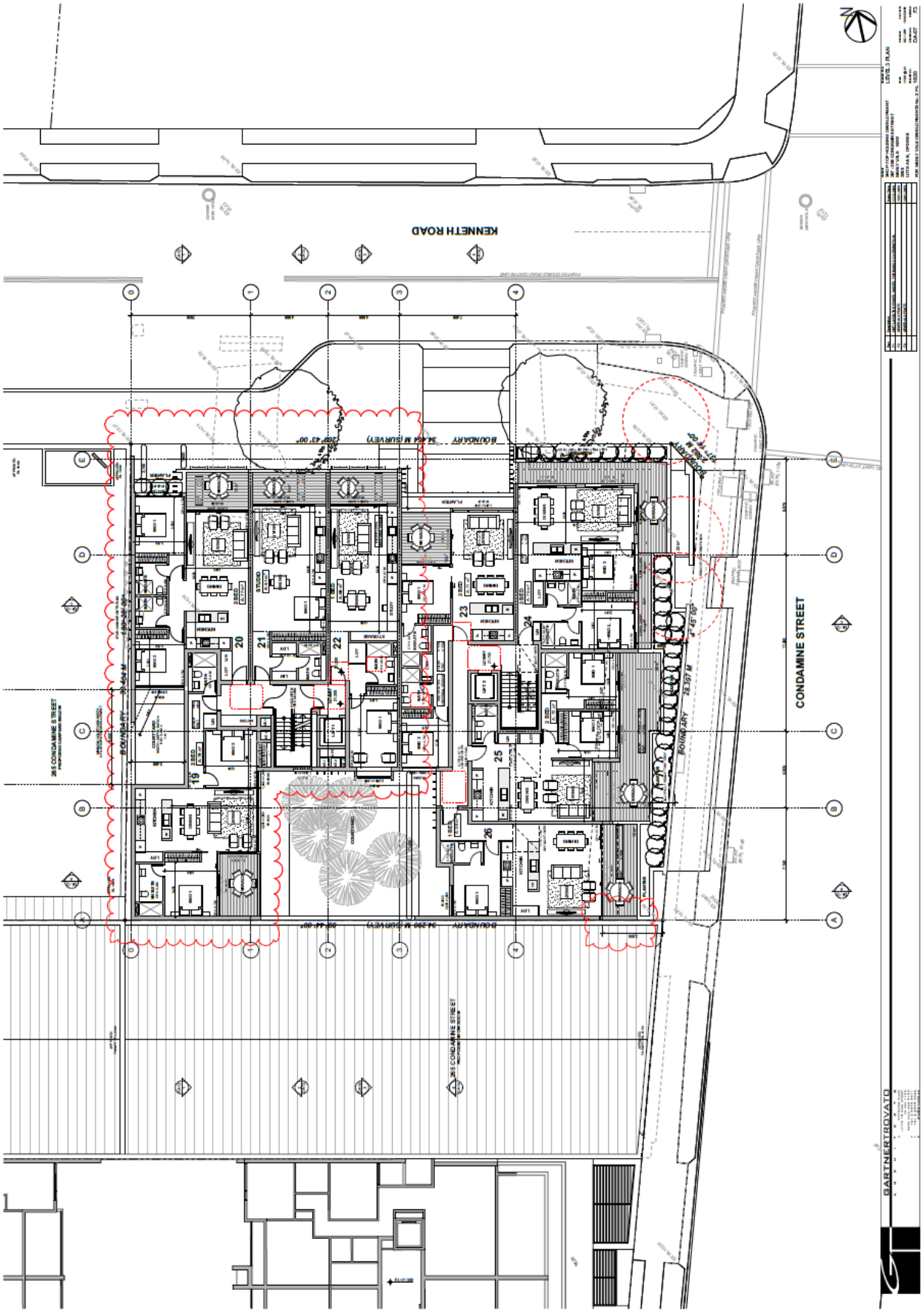

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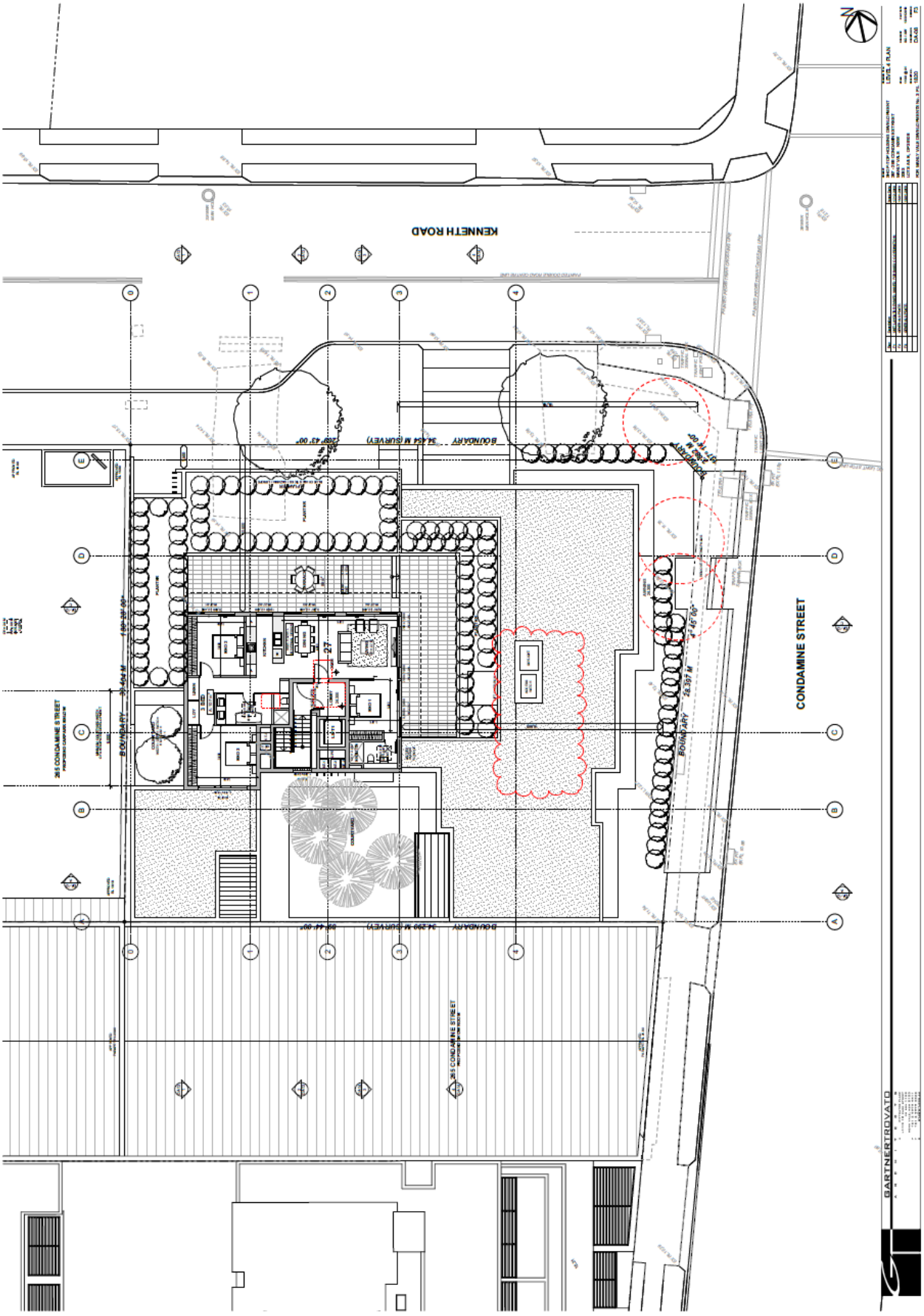

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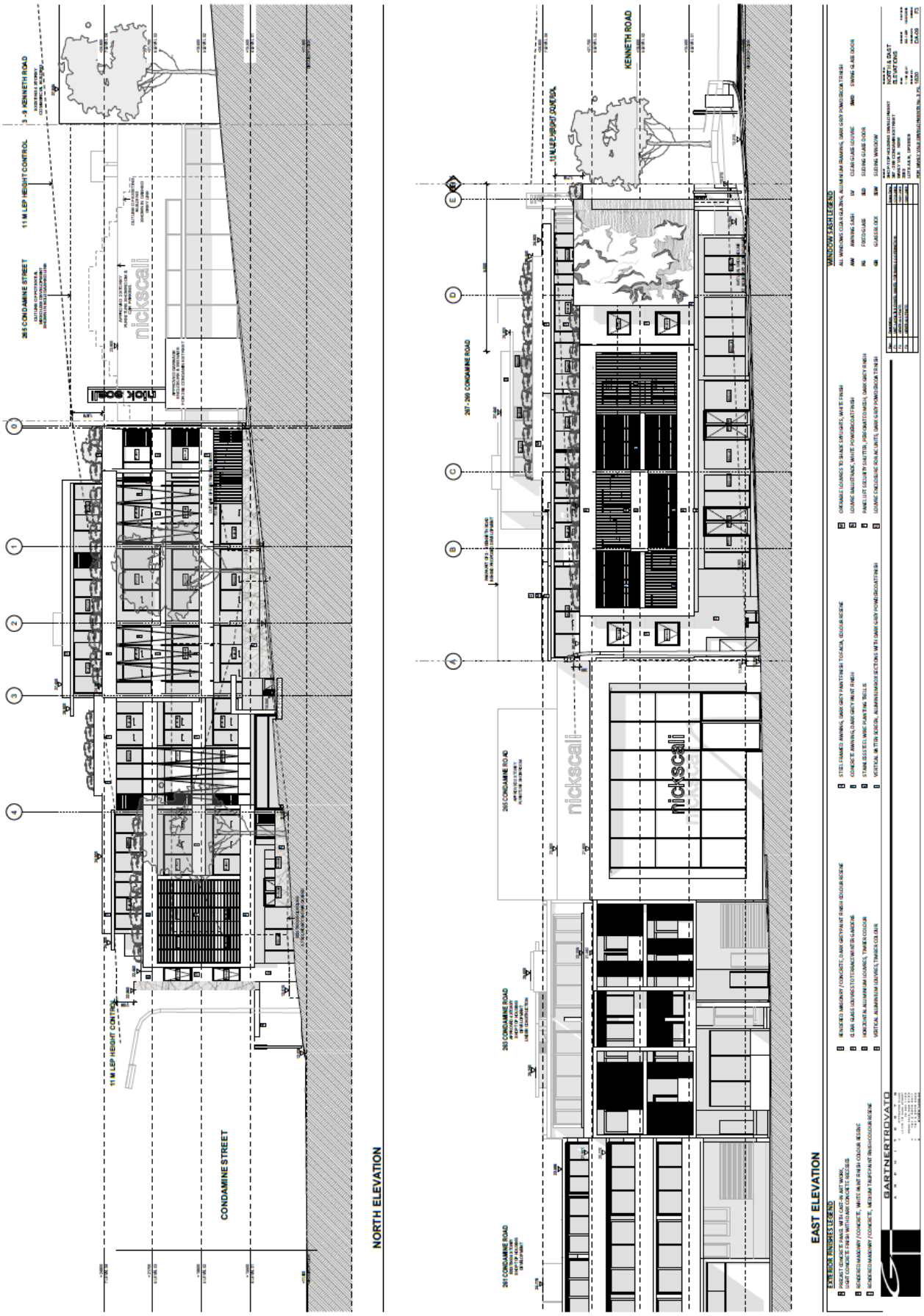

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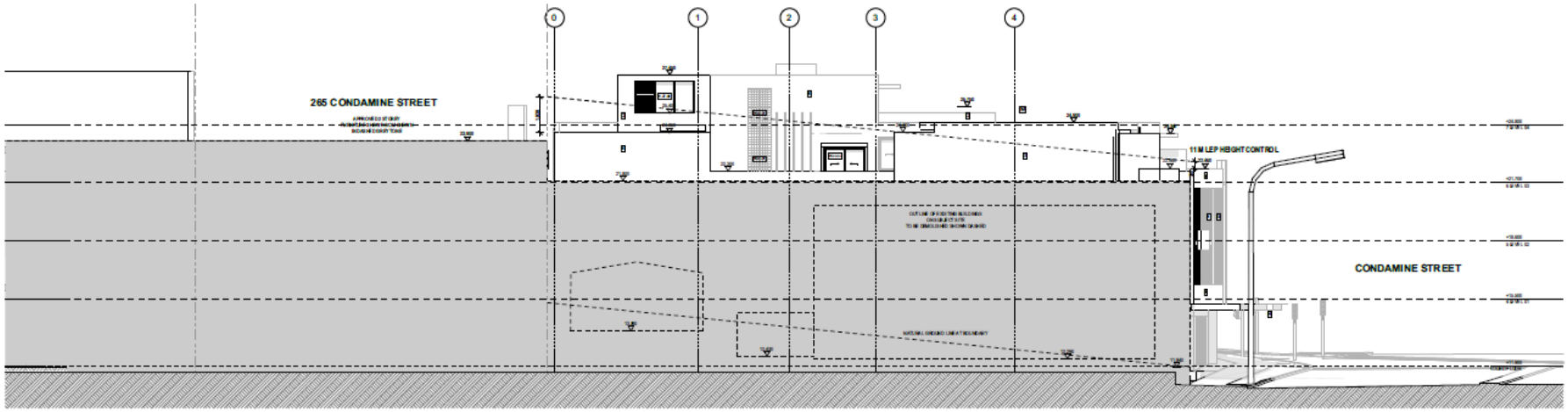
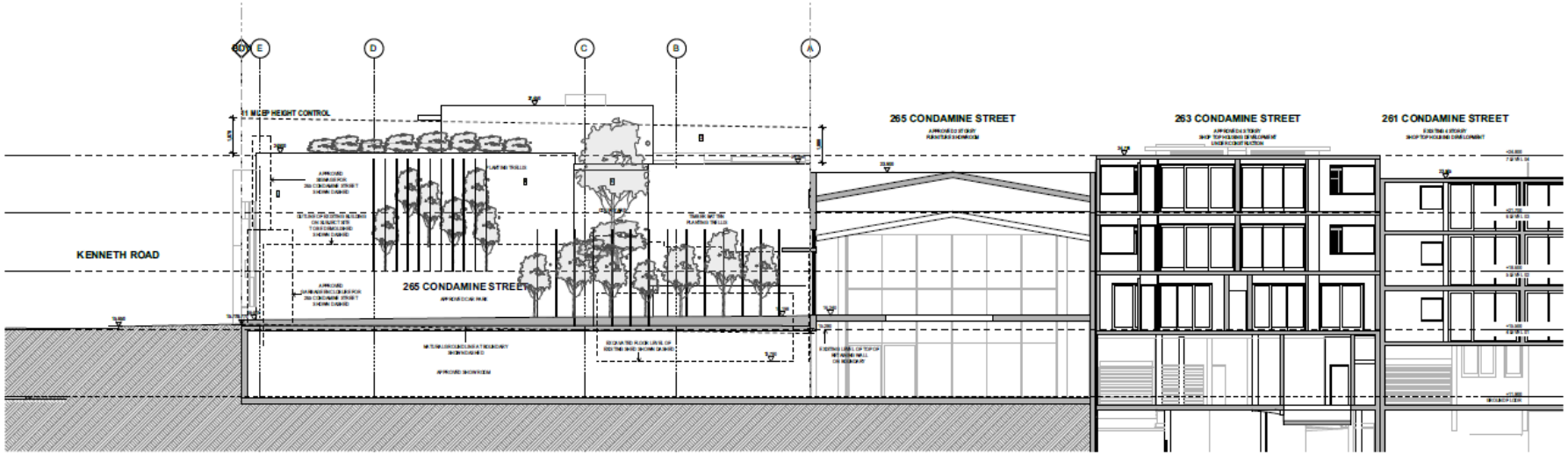


SOUTH ELEVATION



WEST ELEVATION

EXTERIOR FINISHES LEGEND

- PRECAST CONCRETE PANEL WITH CAST-IN ART WORK, LIGHT CONCRETE FINISH WITH DARK CONCRETE RECESS
- RENDERED MASONRY / CONCRETE, WHITE PAINT FINISH COLOUR RESENE
- RENDERED MASONRY / CONCRETE, MEDIUM TAUPE PAINT FINISH COLOUR RESENE
- RENDERED MASONRY / CONCRETE, DARK GREY PAINT FINISH COLOUR RESENE
- CLEAR GLASS LOUVRES TO TERRACE/WINTER GARDENS
- HORIZONTAL ALUMINIUM LOUVRES, TIMBER COLOUR
- VERTICAL ALUMINIUM LOUVRES, TIMBER COLOUR
- STEEL FRAMED AWNING, DARK GREY PAINT FINISH TO FACIA, COLOUR RESENE
- CONCRETE AWNING, DARK GREY PAINT FINISH
- STAINLESS STEEL WIRE PLANTING TRELLIS
- VERTICAL MITTEN SCREEN, ALUMINIUM BOX SECTIONS WITH DARK GREY POWDERCOAT FINISH
- OPERABLE LOUVRES TO SHADE SKYLIGHTS, WHITE FINISH
- LOUVRE BALUSTRADE, WHITE POWDERCOAT FINISH
- PANEL LIFT SECURITY SHUTTER, PERFORATED MESH, DARK GREY FINISH
- LOUVRE ENCLOSURE FOR AC UNITS, DARK GREY POWDERCOAT FINISH

WINDOW SASH LEGEND

ALL WINDOWS CLEAR GLAZING, ALUMINIUM FRAMING, DARK GREY POWDERCOAT FINISH

AW	AWNING SASH	LV	CLEAR GLASS LOUVRE
FG	FIXED GLASS	SLD	SLIDING GLASS DOOR
GB	GLASS BLOCK	SLW	SLIDING WINDOW
SWD	SWING GLASS DOOR		

GARTNERTROVATO ARCHITECTS

Rev	Description	Date
P1	DRAFT ISSUE TO COUNCIL WITH DA LODGEMENT	17.01.2020
P2	AMENDED PLANS	19.02.2020
P3	AMENDED PLANS	23.03.2020

SHOP TOP HOUSING DEVELOPMENT
267 - 269 CONDAMINE STREET
MANLY VALE NSW
2093
LOTS A & B, DP329918

SOUTH & WEST ELEVATIONS

DRAWING NO. DA-10 REVISION P3

FOR MANLY VALE DEVELOPMENTS No. 3 Pty. Ltd.

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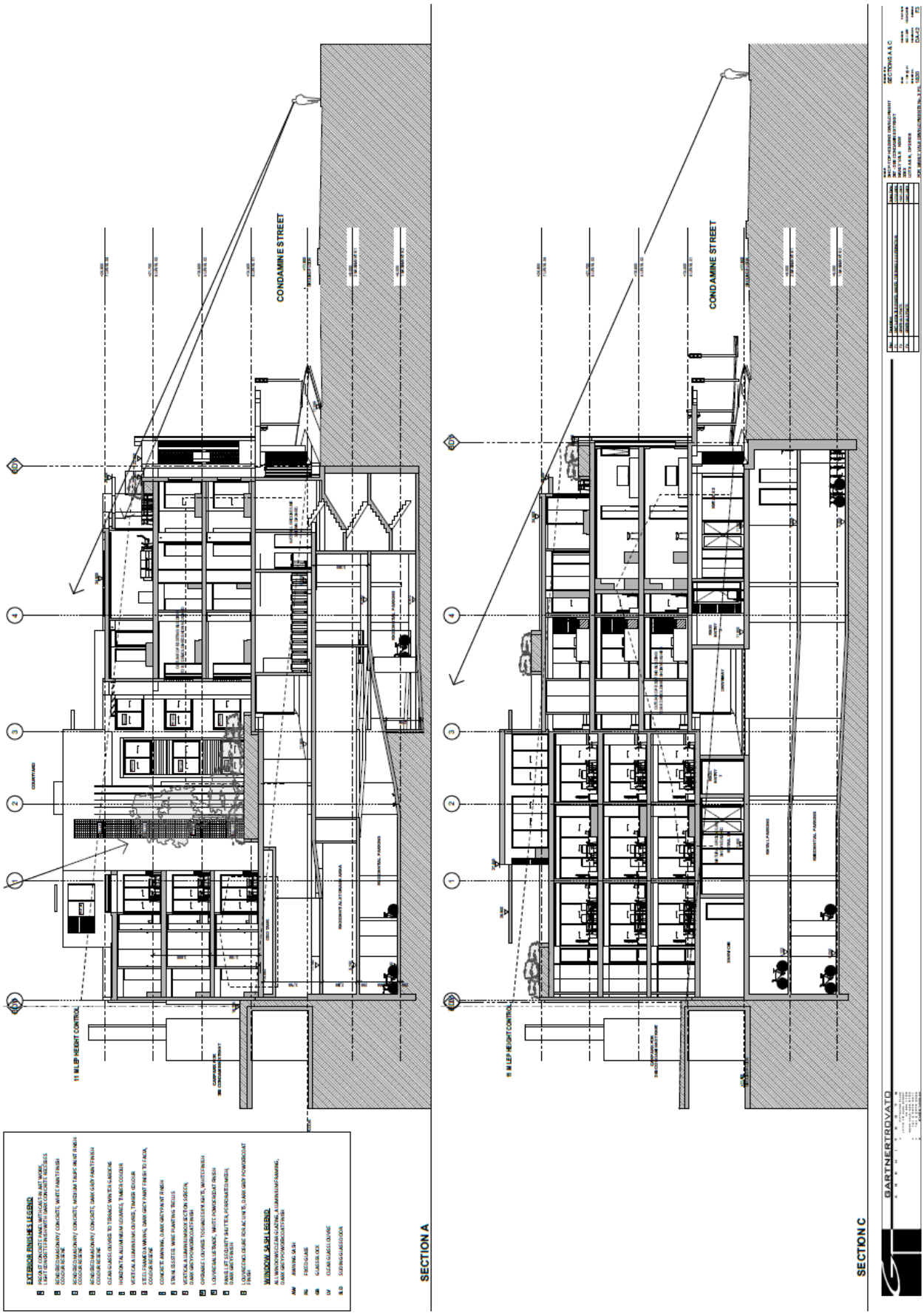

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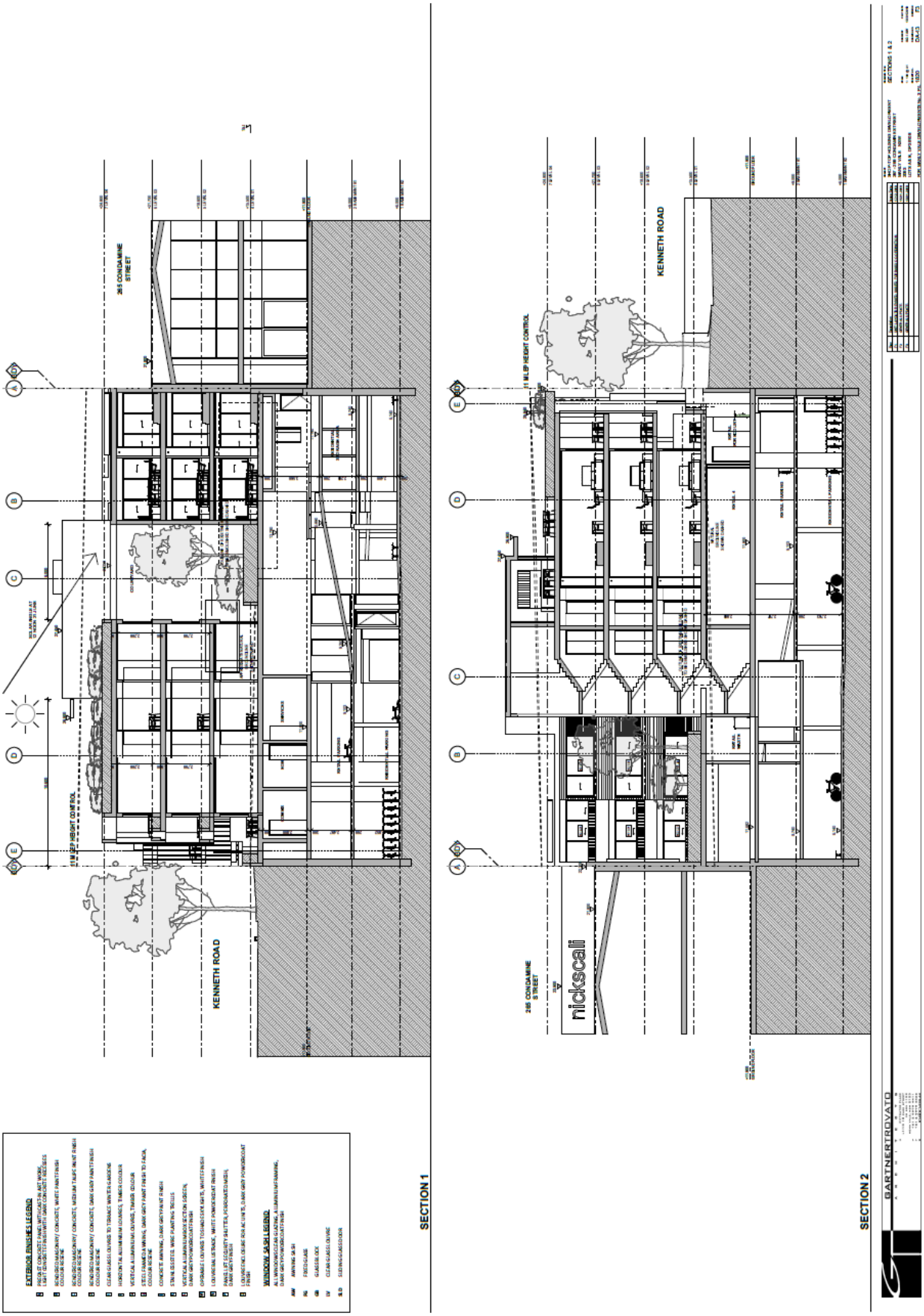

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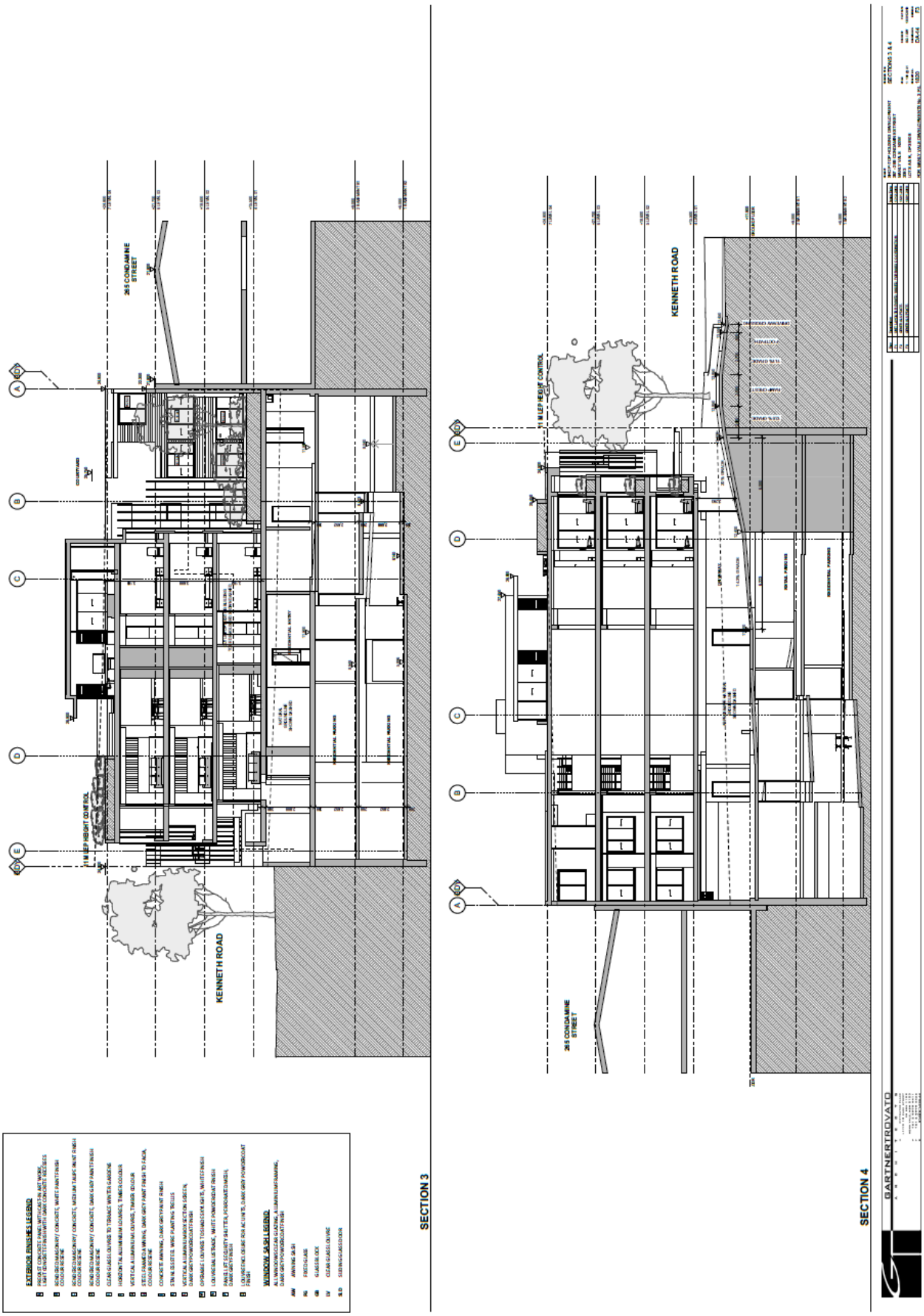

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Appendix B

Survey Plan by
John R Holt Surveyors pty ltd

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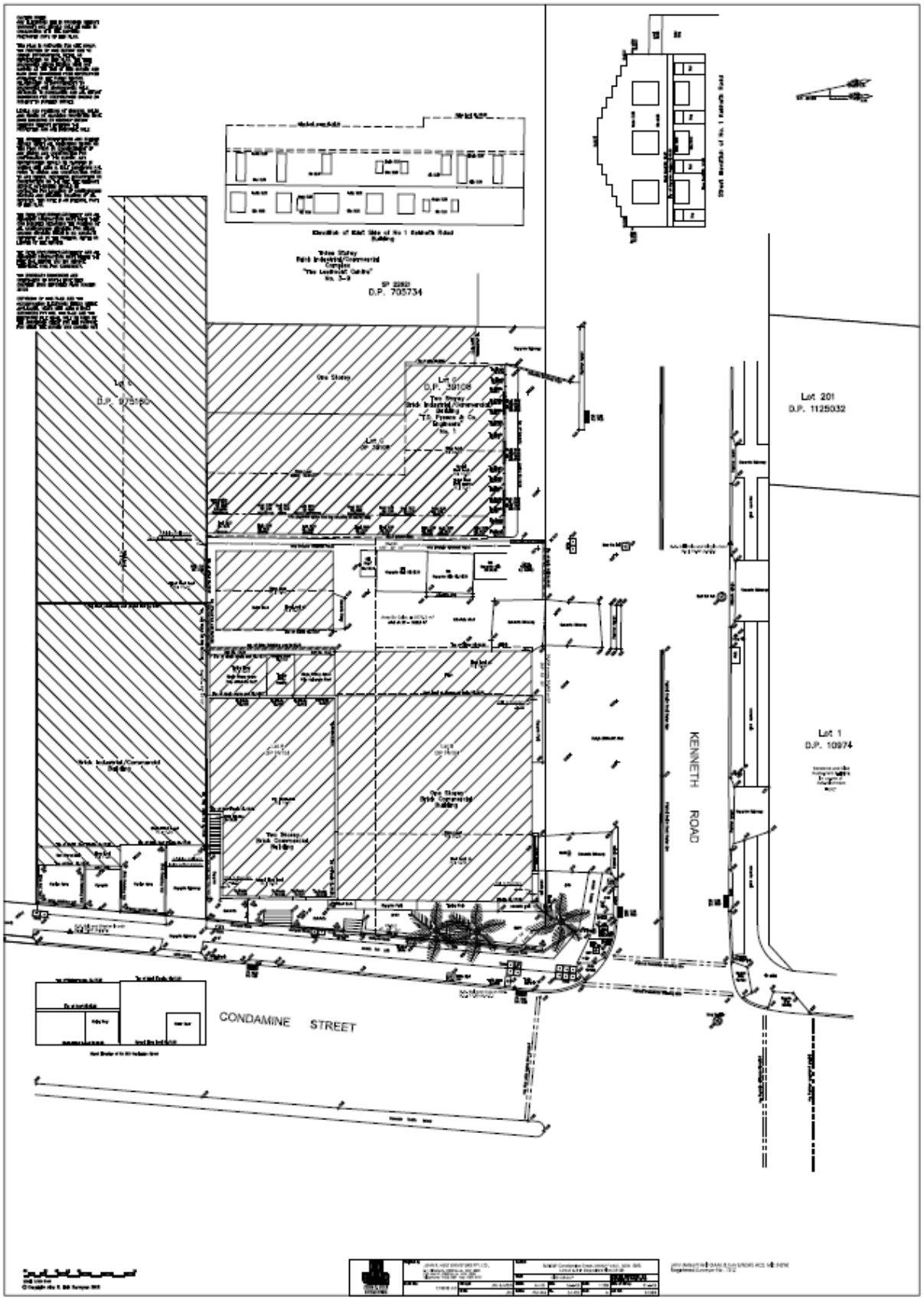

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Appendix C

Northern Beaches Council
Burnt Bridge Creek Flood Data

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Appendix D

Northern Beaches Council
Email correspondence re flood analysis requirements

Box 672 Avalon NSW 2107
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Re - Burnt Bridge Creek Flood extents –

From: Robert Barbuto [mailto:Robert.Barbuto@northernbeaches.nsw.gov.au]
Sent: Tuesday, 21 August 2018 12:06 PM
To: Lucasbce <lucasbce@bigpond.com>
Subject: RE: 267 – 269 Condamine Street Manly Vale
Hi Lucas the lowest point of the site is actually RL 10.97 taken at the boundary which is approximately 200mm higher then the 1 in 100 year AEP flood level. Property not flood affected however OSD will be required ,
Kind regards,

Rob Barbuto
Principal Engineer - Major Developments

Development Engineering & Certification
t 02 9942 2339 **m** 0418 620 052
robert.barbuto@northernbeaches.nsw.gov.au
northernbeaches.nsw.gov.au

Re - Flood Analysis requirements –

From: Robert Barbuto [mailto:Robert.Barbuto@northernbeaches.nsw.gov.au]
Sent: Monday, 20 August 2018 10:58 AM
To: lucasbce@bigpond.com
Cc: Patrick Stuart <Patrick.Stuart@northernbeaches.nsw.gov.au>
Subject: FW: 267 – 269 Condamine Street Manly Vale
Importance: High
Hi Lucas,
I think there is some confusion here, I attended the prelodgement meeting and gave the advice the property may not be flood affected but check with or flooding engineers and Patrick has confirmed the 1 in 100 year ARI flood level etc.
If your property is impacted by the 1 in 100 then no OSD will be required.
However also I did want the top water level in Kenneth road determined to make sure that there was sufficient freeboard to the proposed basement entry point/ramp. Council would require a freeboard of 300mm plus for the basement entry point.
I would expect you to use drains or the rational method to determine the quantum of flows and HEC ras or hand calc to determine the top water surface level in the road cross section(s)
Kind regards

Rob Barbuto
Principal Engineer - Major Developments
Development Engineering & Certification
t 02 9942 2339 **m** 0418 620 052
robert.barbuto@northernbeaches.nsw.gov.au
northernbeaches.nsw.gov.au

Appendix E

Northern Beaches Council
Topographical and drainage infrastructure

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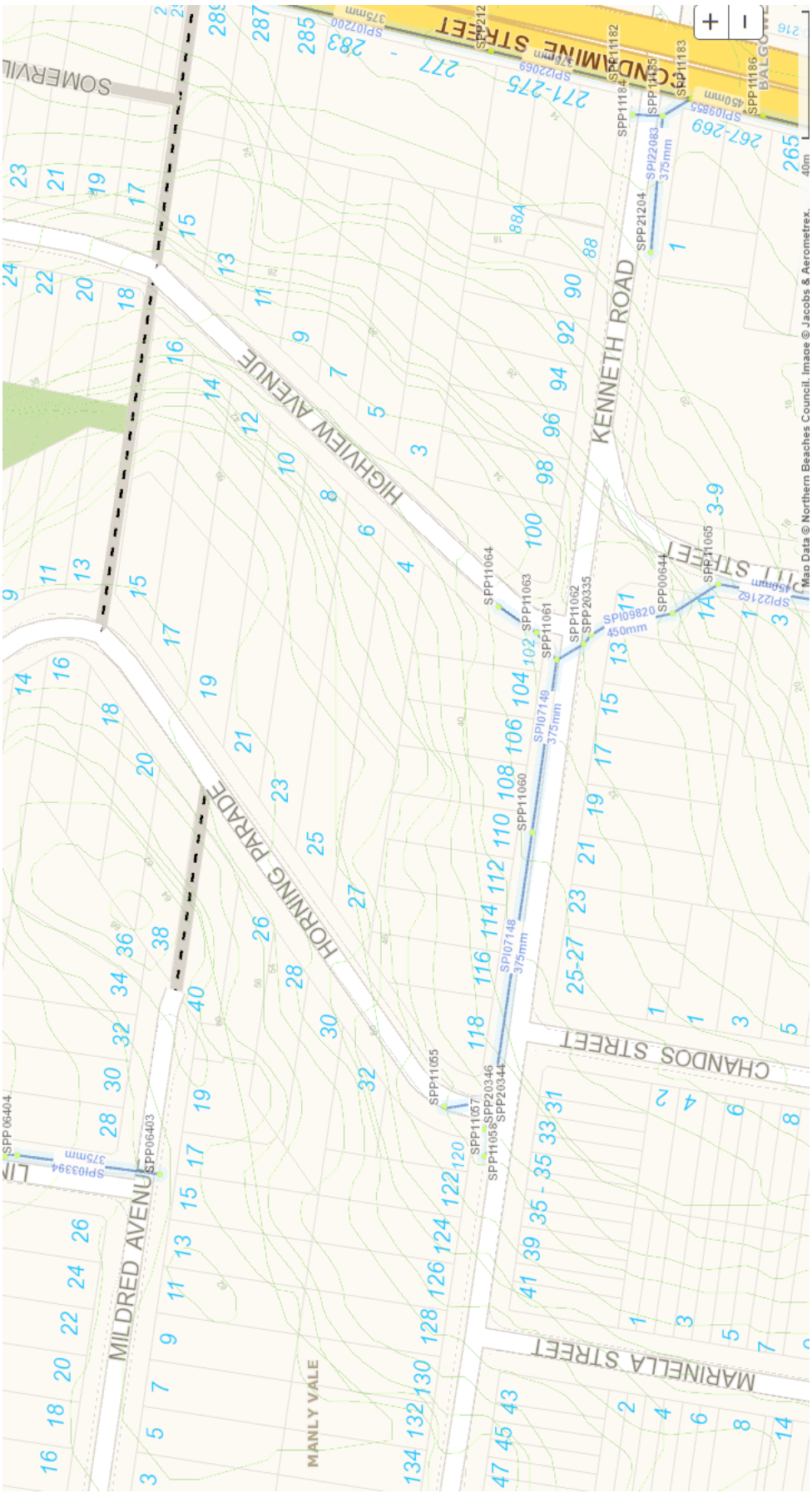

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Appendix F

DRAINS analysis summary output tables
Barrenjoey Consulting Engineers pty ltd

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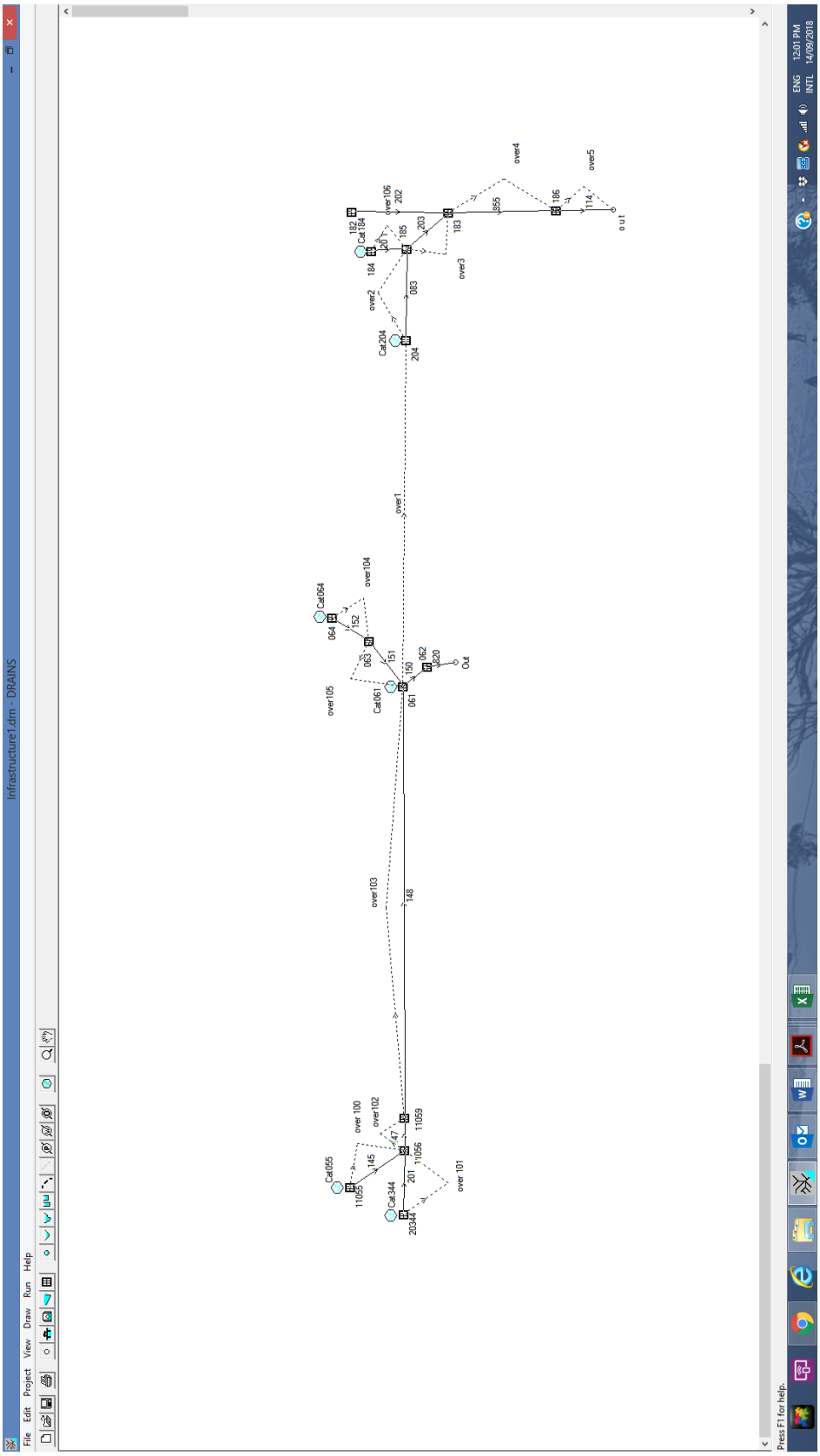

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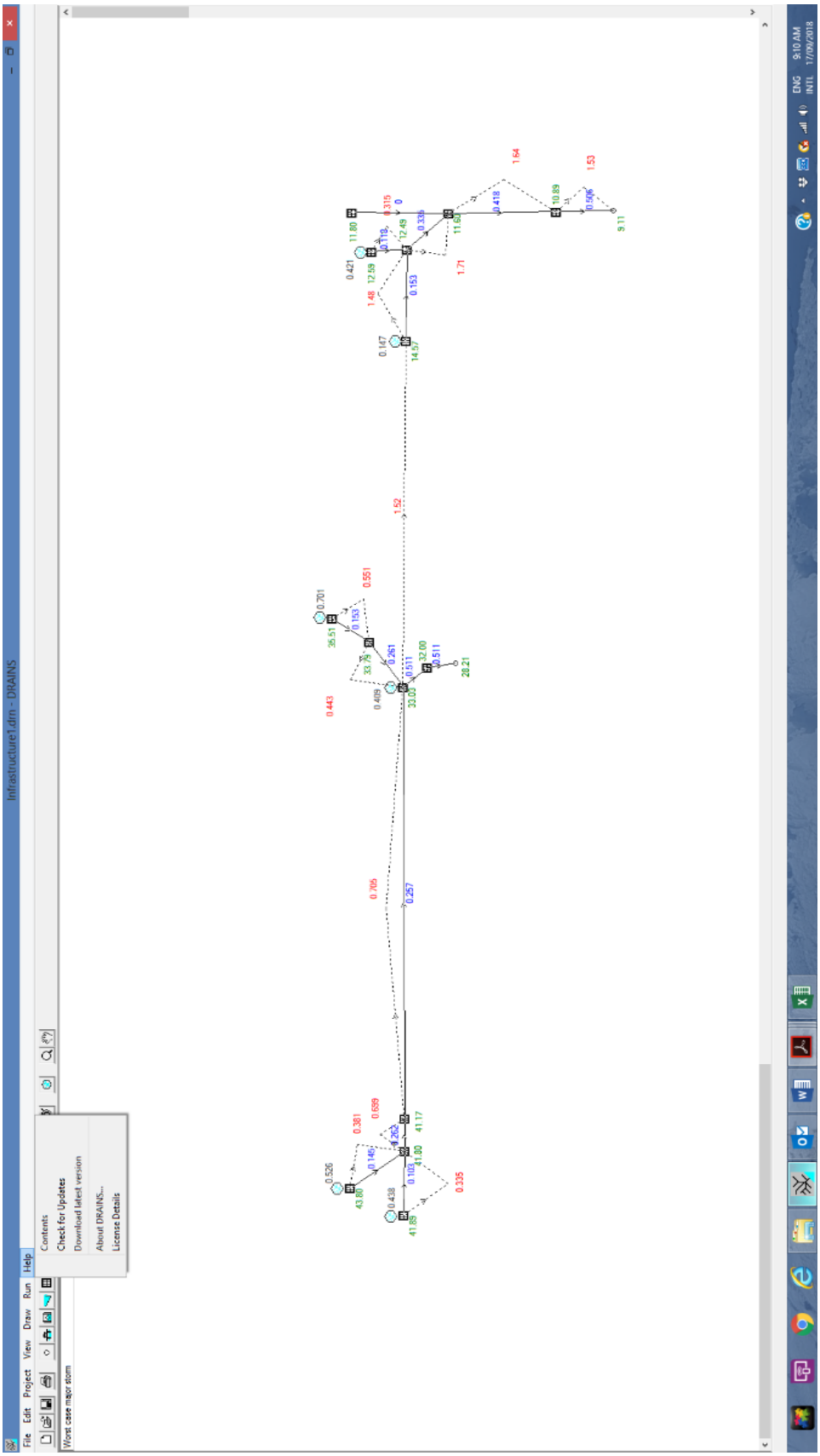

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DRAINS results prepared from Version 2018.01

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Surface Volume (cu.m)	Max Pond Freeboard (m)	Min Overflow Constraint (cu.m/s)
20344	41.89		0.438	0.01	0.335	Inlet Capacity
11056	41.80		0.716	0.00	0.699	Outlet System
11059	41.17		0.699	0.00	0.705	Outlet System
061	33.03		1.542	0.00	1.524	Outlet System
062	32.00		0.000	0.00		None
Out	28.21		0.000			
11055	43.80		0.526	0.30	0.381	Inlet Capacity
064	35.51		0.701	0.29	0.551	Inlet Capacity
063	33.79		0.551	0.01	0.443	Inlet Capacity
204	14.57		1.670	1.43	1.475	Inlet Capacity
185	12.49		1.790	0.01	1.707	Inlet Capacity
183	11.60		1.707	0.00	1.641	Inlet Capacity
186	10.89		1.641	0.01	1.530	Inlet Capacity
o u t	9.11		1.530			
184	12.59		0.421	0.01	0.315	Inlet Capacity
182	11.80		0.000	1.00		None

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
Cat344	0.438	0.247	0.192	2.00	20.00	0.00	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
Cat061	0.409	0.230	0.179	2.00	20.00	0.00	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
Cat055	0.526	0.296	0.230	2.00	20.00	0.00	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
Cat064	0.701	0.395	0.306	2.00	20.00	0.00	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
Cat204	0.147	0.147	0.000	2.00	0.00	0.00	AR&R 100 year, 5 minutes storm, average 265 mm/h, Zone 1
Cat184	0.421	0.237	0.184	2.00	20.00	0.00	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1

Outflow Volumes for Total Catchment (2.12 impervious + 2.35 pervious = 4.47 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)	
AR&R 100 year, 5 minutes storm, average 265 mm/h, Zone 1	987.13	811.11 (82.2%)	447.28 (95.5%)	363.83 (70.2%)	
AR&R 100 year, 10 minutes storm, average 210 mm/h, Zone 1	1564.50	1376.27 (88.0%)	721.31 (97.1%)	654.96 (79.7%)	
AR&R 100 year, 20 minutes storm, average 159 mm/h, Zone 1	2369.10	2157.90 (91.1%)	1103.18 (98.1%)	1054.72 (84.7%)	
AR&R 100 year, 30 minutes storm, average 132 mm/h, Zone 1	2950.20	2714.71 (92.0%)	1378.98 (98.5%)	1335.73 (86.2%)	
AR&R 100 year, 45 minutes storm, average 109 mm/h, Zone 1	3654.23	3384.21 (92.6%)	1713.11 (98.8%)	1671.09 (87.0%)	
AR&R 100 year, 1 hour storm, average 94 mm/h, Zone 1	4201.80	3897.82 (92.8%)	1972.99 (98.9%)	1924.84 (87.2%)	
AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1	5028.75	4655.33 (92.6%)	2365.46 (99.1%)	2289.87 (86.7%)	
AR&R 100 year, 2 hours storm, average 64 mm/h, Zone 1	5721.60	5277.10 (92.2%)	2694.27 (99.2%)	2582.83 (85.9%)	
AR&R 100 year, 3 hours storm, average 50 mm/h, Zone 1	6705.00	6125.24 (91.4%)	3161.00 (99.3%)	2964.24 (84.1%)	

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
201	0.103	0.93	41.822	41.800	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
147	0.262	5.36	41.370	41.166	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
148	0.257	4.58	40.590	33.029	AR&R 100 year, 3 hours storm, average 50 mm/h, Zone 1
150	0.511	5.39	32.259	31.997	AR&R 100 year, 5 minutes storm, average 265 mm/h, Zone 1
820	0.511	6.86	31.216	28.214	AR&R 100 year, 5 minutes storm, average 265 mm/h, Zone 1
145	0.145	4.95	43.617	41.800	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
152	0.153	5.03	35.320	33.786	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
151	0.261	5.82	33.360	33.029	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1
083	0.153	4.39	14.392	12.495	AR&R 100 year, 10 minutes storm, average 210 mm/h, Zone 1
203	0.335	3.38	11.815	11.596	AR&R 100 year, 5 minutes storm, average 265 mm/h, Zone 1
855	0.418	2.68	11.128	10.887	AR&R 100 year, 2 hours storm, average 64 mm/h, Zone 1
114	0.506	6.84	10.114	9.113	AR&R 100 year, 1 hour storm, average 94 mm/h, Zone 1
20 1	0.118	1.06	12.517	12.495	AR&R 100 year, 5 minutes storm, average 265 mm/h, Zone 1
202	0.000	0.00	11.800	11.596	AR&R 100 year, 5 minutes storm, average 265 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

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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
over 101	0.335	0.335	0.000	0.051	0.05	7.41	0.90	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over102	0.699	0.699	0.000	0.078	0.09	7.41	1.20	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over103	0.705	0.705	0.000	0.078	0.10	7.41	1.21	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over1	1.524	1.524	0.000	0.126	0.21	7.41	1.64	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over 100	0.381	0.381	0.000	0.054	0.05	7.41	0.95	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over104	0.551	0.551	0.000	0.068	0.07	7.41	1.09	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over105	0.443	0.443	0.000	0.060	0.06	7.41	1.00	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over2	1.475	1.475	0.000	0.123	0.20	7.41	1.62	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over3	1.707	1.707	0.000	0.135	0.23	7.41	1.71	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over4	1.641	1.641	0.000	0.131	0.22	7.41	1.69	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over5	1.530	1.530	0.000	0.126	0.21	7.41	1.64	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		
over106	0.315	0.315	0.000	0.049	0.04	7.41	0.87	AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1		

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 100 year, 1.5 hours storm, average 75 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
20344	778.51	778.58	0.00	-0.0
11056	1712.85	1713.20	0.00	-0.0
11059	1713.20	1714.38	0.00	-0.1
061	3686.79	3669.64	0.00	0.5
062	2166.88	2167.19	0.00	-0.0
Out	2167.19	2167.19	0.00	0.0
11055	934.22	934.27	0.00	-0.0
064	1245.62	1245.67	0.00	-0.0
063	1245.67	1245.80	0.00	-0.0
204	1725.76	1725.90	0.00	-0.0
185	2473.36	2473.94	0.00	-0.0
183	2473.94	2474.41	0.00	-0.0
186	2474.41	2474.85	0.00	-0.0
o u t	2474.85	2474.85	0.00	0.0
184	747.37	747.47	0.00	-0.0
182	0.00	0.00	0.00	0.0

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Appendix G

Rational Method Analysis
Barrenjoey Consulting Engineers pty ltd

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Barrenjoey Consulting Engineers pty ltd
Stormwater Structural Civil

Job No	180803
Address	Manly Vale
Engineer	LM
Date	17/07/2285
Catchment Location	ManlyVale

TIME OF CONCENTRATION

ARI Storm Event		100	
Flow Path Length	L (m)	440	
Surface Roughness	n	0.02	See Table 3.4 ILSAX Manual
Rainfall Intensity	I (mm/hr)	265	
Slope	S (m/m)	0.1	
Area	A (m2)	41100	
Time of Concentration	tc (min)	5	In accordance with Eqn 3.8 Ilsax Manual
Time of Concentration	tc (min)	14	In accordance with Formula 5.4 AR&R
Time of Concentration	tc (min)	14	In accordance with Formula 5.3 AR&R

FLOWRATE

Area	A (m2)	41100	
Percentage Pervious	%	50	
Rainfall Intensity	I (mm/hr)	265	See Council Supplied data
Run-Off Coefficient (Pervi Area)	C	0.6	
Flowrate	Q m3/s	2.422	In accordance with Formula 5.1 AR&R
	Q l/s	2422	

MANNINGS CROSS-SECTION - HALF ROAD CAPACITY

Floodpath slope	m/m	0.1
Mannings No	n	0.015
Breadth	m	0.2
Increments	m	0.005
s'	m/m	1000
s"	m/m	0.0375

Depth	b'	z'	b"	z"	Area	Perimeter	Radius	Flowrate
0.12	0.00012	0.120	3.200	3.202	0.216	3.522	0.061	0.708
0.125	0.000125	0.125	3.333	3.336	0.233	3.661	0.064	0.785
0.13	0.00013	0.130	3.467	3.469	0.251	3.799	0.066	0.867

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Appendix H

HECRAS analysis summary output tables
Barrenjoey Consulting Engineers pty ltd

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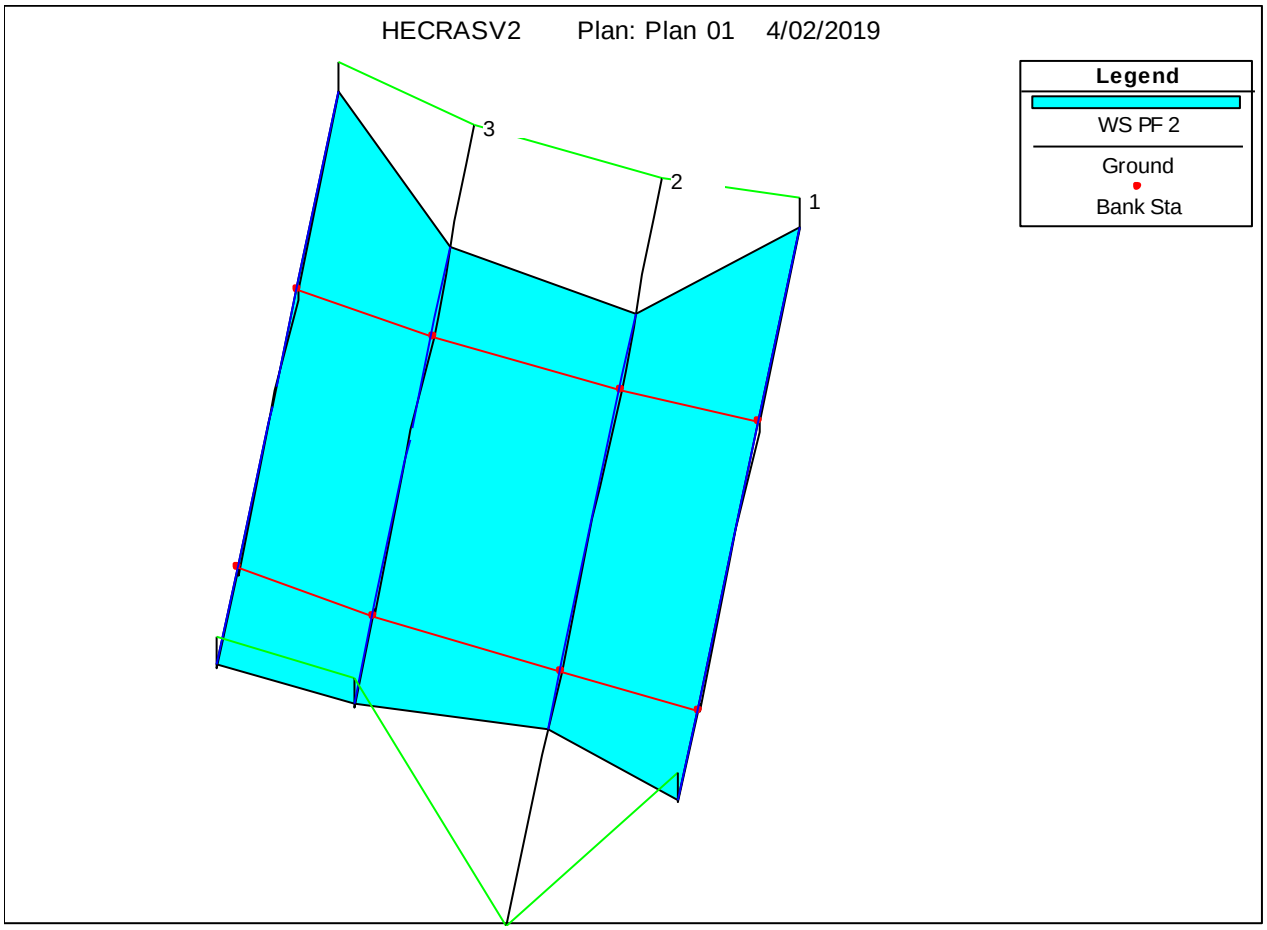
Barrenjoey Consulting Engineers pty ltd
Stormwater Structural Civil

PROFILE OUTPUT TABLE

Reach	Stat	Profile	Q	Ch El	W.S.	Crit	E.G.	Slope	Vel	Area	Width	Froude
1	4	PF 2	1.69	13.95	14.27	14.27	14.32	0.002865	1.00	1.95	19.35	0.91
1	3	PF 2	1.69	13.65	13.97	13.97	14.02	0.002687	1.00	1.83	15.51	0.90
1	2	PF 2	1.69	13.25	13.52	13.52	13.58	0.004826	1.09	1.62	14.45	1.03
1	1	PF 2	1.69	12.92	13.20	13.20	13.25	0.004745	1.13	1.92	19.99	1.03



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HEC-RAS HEC-RAS 5.0.3 September 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X    X  XXXXXX   XXXX      XXXX     XX    XXXX
X    X  X      X   X     X  X    X X   X
X    X  X      X         X  X    X   X  X
XXXXXXX  XXXX    X     XXX  XXXX    XXXXXX   XXXX
X    X  X      X         X  X    X   X      X
X    X  X      X    X     X  X   X   X      X
X    X  XXXXXX   XXXX      X   X  X   X  XXXXX
```

PROJECT DATA
Project Title: HECRASV2
Project File : HECRASV2.prj
Run Date and Time: 4/02/2019 2:36:58 PM

Project in SI units

PLAN DATA

Plan Title: Plan 01
Plan File : C:\Users\lucasbce\Documents\BCE Files\Job Files\180803\HECRASV2.p01

Geometry Title: Stream1
Geometry File : C:\Users\lucasbce\Documents\BCE Files\Job Files\180803\HECRASV2.g01

Flow Title : 100
Flow File : C:\Users\lucasbce\Documents\BCE Files\Job Files\180803\HECRASV2.f01

Plan Summary Information:
Number of: Cross Sections = 4 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 100
Flow File : C:\Users\lucasbce\Documents\BCE Files\Job Files\180803\HECRASV2.f01

Flow Data (m3/s)

River	Reach	RS	PF 2
Stream	1	4	1.69
Stream	1	1	1.69

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Stream	1	PF 2	Normal S = 1	Normal S = 1

GEOMETRY DATA

Geometry Title: Stream1
Geometry File : C:\Users\lucasbce\Documents\BCE Files\Job Files\180803\HECRASV2.g01

CROSS SECTION

RIVER: Stream
REACH: 1 RS: 4

INPUT
Description: UpHill
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
99	14.75	99.01	14.25	105.55	14.1	105.56	13.95	109.5	14.29
115.5	14.08	115.51	14.23	119	14.23	119.01	14.73		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
99	.015	105.55	.013	115.51	.02

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
105.55	115.51	4	4	.1	.3

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (m)	14.32	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.015	0.013	0.020
W.S. Elev (m)	14.27	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	14.27	Flow Area (m2)	0.65	1.15	0.15
E.G. Slope (m/m)	0.002865	Area (m2)	0.65	1.15	0.15
Q Total (m3/s)	1.69	Flow (m3/s)	0.49	1.15	0.05
Top Width (m)	19.35	Top Width (m)	6.54	9.31	3.49
Vel Total (m/s)	0.87	Avg. Vel. (m/s)	0.76	1.00	0.33
Max Chl Dpth (m)	0.32	Hydr. Depth (m)	0.10	0.12	0.04
Conv. Total (m3/s)	31.6	Conv. (m3/s)	9.2	21.4	0.9
Length Wtd. (m)	4.00	Wetted Per. (m)	6.57	9.61	3.53
Min Ch El (m)	13.95	Shear (N/m2)	2.77	3.36	1.22
Alpha	1.13	Stream Power (N/m s)	2.10	3.35	0.40
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	0.01	0.02	0.00
C & E Loss (m)	0.00	Cum SA (1000 m2)	0.05	0.13	0.04

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Stream
REACH: 1 RS: 3

INPUT
Description: UpHill Drive 1
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
99	14.05	100.35	14.05	102.35	14.05	103.85	13.875	105.05	13.75
105.55	13.65	109.5	13.98	115.5	13.75	115.51	13.9	119	13.9
119.01	14.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
99	.015	105.55	.013	115.5	.02

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
105.55	115.5	5.5	5.5	.1	.3

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (m)	14.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.015	0.013	0.020
W.S. Elev (m)	13.97	Reach Len. (m)	5.50	5.50	5.50
Crit W.S. (m)	13.97	Flow Area (m2)	0.36	1.23	0.24
E.G. Slope (m/m)	0.002687	Area (m2)	0.36	1.23	0.24
Q Total (m3/s)	1.69	Flow (m3/s)	0.34	1.25	0.10
Top Width (m)	15.51	Top Width (m)	2.50	9.51	3.50
Vel Total (m/s)	0.92	Avg. Vel. (m/s)	0.94	1.02	0.42
Max Chl Dpth (m)	0.32	Hydr. Depth (m)	0.14	0.13	0.07
Conv. Total (m3/s)	32.6	Conv. (m3/s)	6.5	24.2	1.9
Length Wtd. (m)	5.50	Wetted Per. (m)	2.52	9.53	3.71
Min Ch El (m)	13.65	Shear (N/m2)	3.75	3.40	1.71
Alpha	1.12	Stream Power (N/m s)	3.53	3.46	0.71
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	0.00	0.01	0.00
C & E Loss (m)	0.00	Cum SA (1000 m2)	0.03	0.09	0.03

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Stream
REACH: 1 RS: 2

INPUT
Description: Downhill Drive 1
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
99	13.65	100.35	13.65	102.35	13.65	103.85	13.475	105.05	13.35
105.55	13.25	109.5	13.52	115.5	13.32	119	13.61	125	13.61

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
99	.015	105.55	.015	115.5	.02

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
105.55	115.5	4	4	.1	.3

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (m)	13.58	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.015	0.015	0.020
W.S. Elev (m)	13.52	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	13.52	Flow Area (m2)	0.25	1.13	0.24
E.G. Slope (m/m)	0.004826	Area (m2)	0.25	1.13	0.24
Q Total (m3/s)	1.69	Flow (m3/s)	0.28	1.23	0.18
Top Width (m)	14.45	Top Width (m)	2.09	9.95	2.42
Vel Total (m/s)	1.04	Avg. Vel. (m/s)	1.11	1.09	0.75
Max Chl Dpth (m)	0.27	Hydr. Depth (m)	0.12	0.11	0.10
Conv. Total (m3/s)	24.3	Conv. (m3/s)	4.0	17.8	2.6
Length Wtd. (m)	4.00	Wetted Per. (m)	2.11	9.96	2.42
Min Ch El (m)	13.25	Shear (N/m2)	5.57	5.39	4.72
Alpha	1.04	Stream Power (N/m s)	6.20	5.86	3.52
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	0.00	0.00	0.00
C & E Loss (m)	0.00	Cum SA (1000 m2)	0.02	0.04	0.01

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Stream
REACH: 1 RS: 1

INPUT
Description: DownHill
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
99	13.67	99.01	13.17	105.55	13.07	105.56	12.92	109.5	13.18
115.5	13	115.51	13.15	119	13.15	119.01	13.65		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
99	.03	105.55	.015	115.5	.02

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
105.55	115.5	10	10	.1	.3

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (m)	13.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.030	0.015	0.020
W.S. Elev (m)	13.20	Reach Len. (m)			
Crit W.S. (m)	13.20	Flow Area (m2)	0.51	1.24	0.17
E.G. Slope (m/m)	0.004745	Area (m2)	0.51	1.24	0.17
Q Total (m3/s)	1.69	Flow (m3/s)	0.21	1.40	0.08
Top Width (m)	19.99	Top Width (m)	6.54	9.95	3.50
Vel Total (m/s)	0.88	Avg. Vel. (m/s)	0.42	1.13	0.44
Max Chl Dpth (m)	0.28	Hydr. Depth (m)	0.08	0.12	0.05
Conv. Total (m3/s)	24.5	Conv. (m3/s)	3.1	20.3	1.1
Length Wtd. (m)		Wetted Per. (m)	6.57	10.10	3.69
Min Ch El (m)	12.92	Shear (N/m2)	3.62	5.70	2.14
Alpha	1.41	Stream Power (N/m s)	1.52	6.45	0.95

Frctn Loss (m) Cum Volume (1000 m3)
C & E Loss (m) Cum SA (1000 m2)

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

SUMMARY OF MANNING'S N VALUES

River:Stream

Reach	River Sta.	n1	n2	n3
1	4	.015	.013	.02
1	3	.015	.013	.02
1	2	.015	.015	.02
1	1	.03	.015	.02

SUMMARY OF REACH LENGTHS

River: Stream

Reach	River Sta.	Left	Channel	Right
1	4	4	4	4
1	3	5.5	5.5	5.5
1	2	4	4	4
1	1	10	10	10

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Stream

Reach	River Sta.	Contr.	Expan.
1	4	.1	.3
1	3	.1	.3
1	2	.1	.3
1	1	.1	.3

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End

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