Hargrave Apartments
1-5 Hargrave St & 38-40 Orth St
KINGSWOOD
Residential Apartments

Stormwater Concept DA Submission Report

www.jhaservices.com Ph: (02) 9437 1000
Sydney | Brisbane
Level 23, 101 Miller St, North Sydney NSW 2060

CONTENTS

Document Control Sheet

Title	Hargrave Apartments Kingswood – Stormwater Concept DA Submission Report
Project	Hargrave Apartments
Description	Stormwater Concept DA Submission Report
Key Contact	Chris Harpley

Prepared By

Company	JHA
Address	Level 23, 101 Miller Street, North Sydney NSW 2060
Phone	61-2-9437 1000
Email	Chris.Harpley@jhaengineers.com.au
Website	www.jhaservices.com
Author	Chris Harpley
Checked	Paul Catley
Authorised	Paul Catley

Revision History

Issued To	Revision and Date								
	REV	A							
	DATE	12/09/2016							
	REV								
	DATE								
	REV								
	DATE								

1. EXECUTIVE SUMMARY

JHA Consulting Engineers have been engaged to provide details of the proposed stormwater methodology for the development site.

The proposed residential development will connect to the existing Council stormwater main in Orth Street as outlined within this report. The stormwater runoff from the roof areas will discharge to a pollution control treatment plant via a 120 m^3 rainwater reuse tank. Generally, rainfall runoff from all other paved and landscaped areas will be collected via a system of surface inlet pits and discharge to Council main via a treatment plant. Storms in excess of the piped drainage system will travel overland to both Hargraves and Orth Streets.

The system will drain to the existing Council stormwater drainage system in Orth Street approximately 70 m east of the development site.

The development site is not within a zone requiring On Site Detention for the stormwater system.

The proposed treatment plant will reduce the pollution loads from the site in accordance with Council's draft policy for Water Management.

2. PROPOSED DEVELOPMENT AND DRAINAGE SYSTEM OVERVIEW

The new development comprises of 3 basement levels of car parking and 7 levels of residential apartments with a total of approximately 121 apartments.

The drainage from the roof areas will be directed to a rainwater reuse storage tank of 120m^3 effective capacity. This tank will overflow to the stormwater treatment plant. This system will incorporate a syphonic drainage system to minimise the depth of the reuse storage tank installation.

The runoff from all ground level hardstand and landscaped areas will generally be directed to the stormwater treatment plant located adjacent to the car park exit to Orth Street on the northern side of the development. The runoff from the Level 6 open communal area will also be directed to the treatment plant.

The roof system will be designed to have drainage capacity for the 5 minute duration 100 year ARI storm to discharge to the reuse storage tank. The reuse inlet system will have capacity for a first flush diversion system for 20 litre per 100 m^2 of roof area with the discharge draining to a pump out system located in basement 3 car park.

The overflow capacity for the reuse storage tank will be capable of the 5 minute duration 100 year ARI storm with the overflow directed to a junction pit prior to the treatment plant to enable excess rainfall to bypass the capacity of the treatment plant as necessary. The treatment plant will discharge via a new piping system extended from Council's existing piped stormwater system in Orth Street.

The ground level drainage system will have the capacity for a 5 minute duration 20 year ARI storm with the runoff from greater storms directed via overland flow paths to either Hargrave or Orth Streets.

The treatment plant will be of SPEL manufacture, as detailed in the Water Quality section, which will discharge from the site to a new 375 diameter stormwater drainage piping system connecting to the existing Council drainage system in Orth Street. The new drainage system will include a new inlet pit adjacent to the discharge point from the site and connect to the existing Council stormwater inlet pit approximately 70 m east of the site in Orth Street.

3. RAINWATER REUSE SYSTEM

The Rainwater Reuse System has been designed to provide maximum reuse from the stormwater collected from the roof area.

The storage capacity has been determined from actual rainfall data from the Bureau of Meteorology's closest rainfall data site and the inflow averaged from the average monthly rainfalls from 1971 to 2015.

The calculations and assumption for the volume of reuse water required are set out in Tables 3.1 & 3.2 below.

It is noted that the estimated volume of usage exceeds the actual storage volume but given that the average rainfall is approximately 61 mm per month it is not considered good practice to oversize the storage volume for minimal return on the volume that can be utilised.

POPULATION ESTIMATION			
STYLE OF APARTMENT	Total Development	No. of Occupants	Total Population
STUDIO	0	1	0
1 BEDROOM	66	2	132
2 BEDROOM	54	3	162
3 BEDROOM	1	4	4
TOTAL APARTMENTS	121		
COMMERCIAL & RETAIL	0	m^2	
TOTAL POPULATION			298
IRRIGATION AREA		500	m2

Table 3.1

WATER USAGE ESTIMATION			
ACTIVITY	**USAGE**	**WEEKLY USAGE**	**MONTHLY USAGE**
TOILET FLUSH (AAA Rated dual flush)	18	37548	150192
Irrigation	25mm / m^2	12500	50000
TOTAL LITRES		**50,048**	**200,192**
Average litres per Apartment		**414**	**1654**

Assumptions: Only WC's and irrigation are fed from rainwater reuse

Table 3.2

The storage volume of 120,000 litres of reuse water will be able to provide approximately 40% of the expected usage demand annually. Our assessment is that even an increase of storage volume to approximately 500,000 litres, the usage return would only increase to approximately 43%.

The capacity for the storage volume for the first flush diversion is noted in Table 3.4 below. It has been assumed that the pollution load in regards to the roof water runoff would be medium to heavy thus 20 litre per 100m^2 of roof area has been used. The first flush system will incorporate a system of diverters and 300 diameter piping to store the required volume. The first flush system will drain to a pump out pit located in the basement 3 car park which discharges to the stormwater system for the external ground level runoff.

The proposed volume of first flush will assist in maintaining the cleanest reuse water and also eliminate constant cleansing of the reuse storage tanks even for small intensity and duration of minor storm events.

First Flush Capacity		
Light Pollution	5	litres per 100 m2
Heavy Pollution	20	litres per 100 m2
Roof Area	1590	m2
Proposed First Flush	20	litres per 100 m2
Storage Required	318	litres
Proposed 300mm pipe to store first flush		
Capacity =	70.686	litres per meter
Length Required	4.498769205	m
Length to be provided	5	m min

Table 3.4

The stored reuse rainwater, will be pumped via a set of dual pumps and filters to distribute the reuse rainwater to all water closet cisterns and the landscaping irrigation system. The water supply to the cisterns will be supplemented with a potable water supply in accordance with Sydney Water requirements.

4. WATER QUALITY

Generally, the discharge from the site roof and ground level will be directed through a SPEL treatment system as defined and detailed below.

Council's policy requirements are as noted below together with the MUSIC Model results for the reductions to be achieved with the proposed treatment system.

Pollutant	Description	Council Retention Criteria	Reduction Achieved
Litter	All anthropogenic material (cans, bottles, wrappings etc.)	70% of material >= 5 mm diameter	100%
Coarse Sediment	Coarse Sand (>=0.5mm)	80% of the load for particles <+0.5mm diameter	80%
Nutrients	Total Phosphorus & Total Nitrogen	45% retention of the load for each	Phosphorus – 64% Nitrogen – 53.8%
Fine Particles	Fine Sand (>=0.05mm)	50% of the load for particles <=0.1um diameter	50%
Free Oil and Grease	Free floating viscous liquids >= 150um that do not emulsify in aqueous solutions	90% of the load with no visible discharge	90%

Table 4.1 – Penrith Council Pollution Retention Criteria – Table 2 of Section C3 Water Management with Reduction Achieved as modelled noted

We have undertaken a MUSIC model to determine the reduction in pollutants utilising the nominated SPEL treatment plant. The results of this model are as per the below.

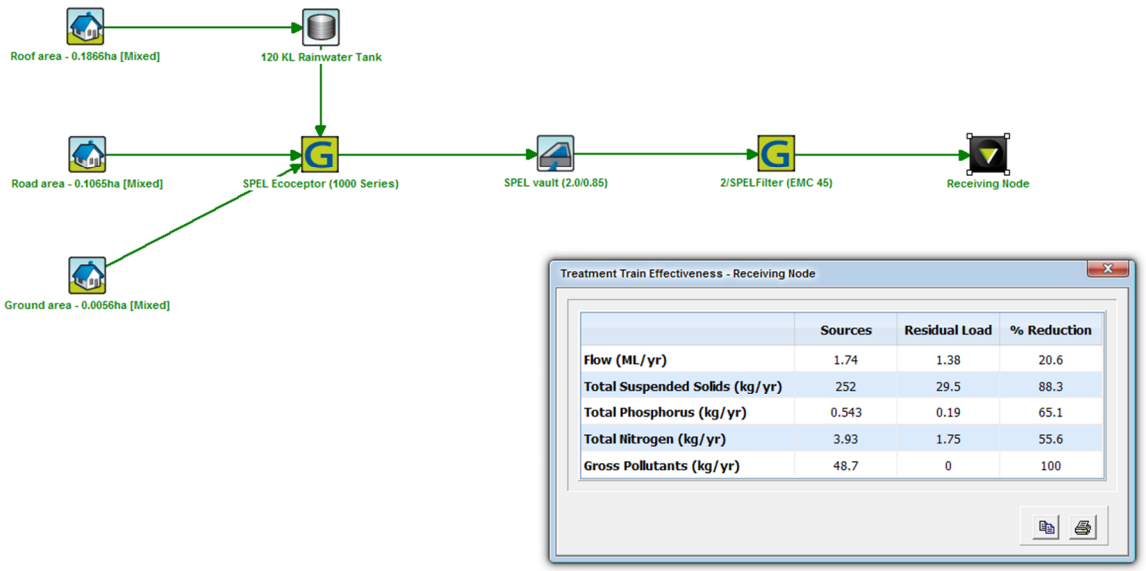
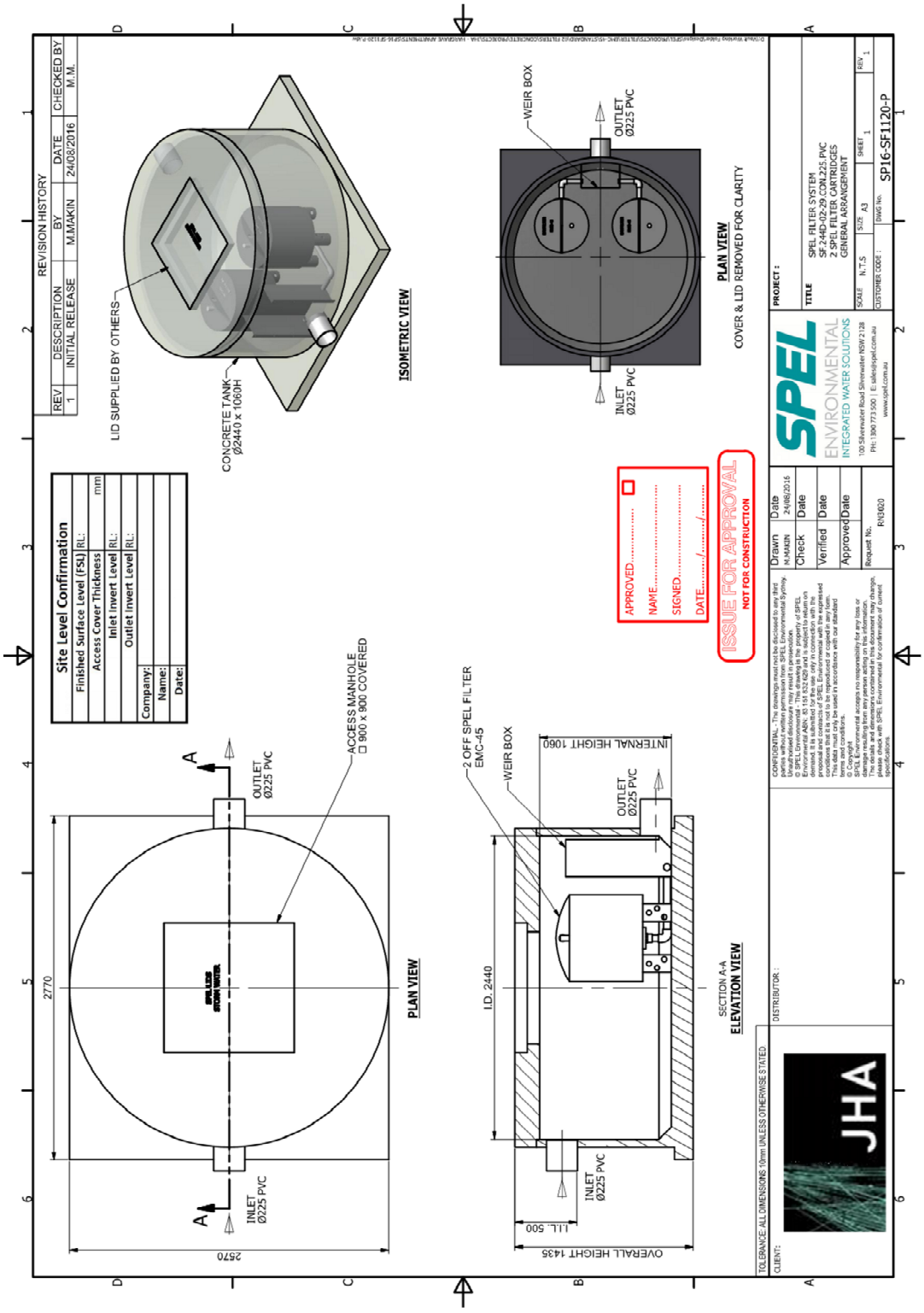


Figure 1 – MUSIC Results Screen Snapshot

The SPEL treat System will have all surface runoff directed to a SPEL Ecoceptor (E.240/103737). This includes the overflow from the rainwater reuse storage tank which is fitted with a first flush system which will remove gross pollutants and organic load from the reuse storage tank.

The Ecoceptor then drains to two SPEL Filter (EMC 45) units installed in series vial a SPEL Vault. This will ensure that all runoff is treated prior to any discharge from the site. The details of the proposed system parts are included below.



5. APPENDIX A – PIPING CALCULATIONS

The piping calculations presented below are preliminary but indicate that the concept is able to be achieved. The design basis is for a 20 yr ARI 5 minute storm with the pipe capacity determined as a pipe flowing full.

PIPE FLOWING FULL CALCULATIONS

JHA
Level 23, 101 Miller Street, North Sydney, NSW 2060
PO Box 3, North Sydney, NSW 2059

Project: **HARGRAVES APARTMENT**	Job No: **160181**	Designed: CFH	Design Frequenc **20 year**
			Rainfall Intensity: **213**
Address: **1-5 Hargrave Street and 38-40 Orth Street KINGSWOOD**	Date: **8-Sep-16**	Sheet: **1** of: **2**	Material: **PVC**
			Mannings "n": **0.013**

SECTION	SUB-AREA A	SUB-AREA C	SUB-AREA A x C	TOTAL A x C	Max Time Con. min	Intensity mm/hr	Flow Q l/s	PIPE DIAM. mm	GRADE 1 in X	PIPE CAPACITY l/s
Reuse Water Drainage										
FIRST FLUSH-STORAGE	1648.0	0.9	1483.2	1483.2	5.0	272.00	112.06	By Syphonic System		
Storage Overflow to Junction Pit				1483.2		272.00	112.06	375	100	182.98
Ground Level Drainage										
SIP2	54.0	0.8	43.2	43.2		213.00	2.56	100	200	3.70
SIP2-SIP3				62.4	5.0	213.00	3.69	100	200	3.70
SIP3	70.0	0.8	56.0	56.0		213.00	3.31	100	200	3.70
SIP3-SIP4				118.4	5.0	213.00	7.01	150	200	11.66
SIP4	60.0	0.8	48.0	48.0		213.00	2.84	100	200	3.70
SIP4-SIP5				166.4	5.0	213.00	9.85	150	200	11.66
SIP5	19.0	0.8	15.2	15.2		213.00	0.90	100	200	3.70
SIP5-SIP6				181.6	5.0	213.00	10.74	150	200	11.66
SIP6 & DP1 & DP3	88.5	0.8	70.8	70.8		213.00	4.19	100	200	3.70
SIP6-SIP7				252.4	5.0	213.00	14.93	150	200	11.66
SIP7	104.0	0.8	83.2	83.2		213.00	4.92	100	200	3.70
SIP7-SIP8				335.6	5.0	213.00	19.86	225	45	71.83
SIP8 & DP2	51.3	0.8	41.0	41.0		213.00	2.43	100	200	3.70
SIP8-SIP36				376.6	5.0	213.00	22.28	225	45	71.83
SIP36	57.0	0.8	45.6	45.6		213.00	2.70	100	200	3.70
SIP36-SIP9				422.2	5.0	213.00	24.98	225	45	71.83
SIP9	17.0	0.8	13.6	13.6		213.00	0.80	100	200	3.70
SIP9-SIP10				435.8	5.0	213.00	25.78	225	200	34.07
SIP10	49.0	0.8	39.2	39.2		213.00	2.32	100	200	3.70
SIP10-SIP11				475.0	5.0	213.00	28.10	225	200	34.07
SIP11	10.5	0.8	8.4	8.4		213.00	0.50	100	200	3.70
SIP11-SIP12				483.4	5.0	213.00	28.60	225	200	34.07
SIP12	9.0	0.8	7.2	7.2		213.00	0.43	100	200	3.70
SIP12-SIP13				490.6	5.0	213.00	29.03	225	200	34.07
SIP13	70.0	0.8	56.0	56.0		213.00	3.31	100	200	3.70
SIP13-SIP14				546.6	5.0	213.00	32.34	225	200	34.07
SIP14	28.0	0.8	22.4	22.4		213.00	1.33	100	200	3.70
SIP14-SIP15				569.0	5.0	213.00	33.67	225	48	69.55
SIP15	14.0	0.8	11.2	11.2		213.00	0.66	100	200	3.70
SIP15-SIP16				580.2	5.0	213.00	34.33	225	48	69.55
SIP16	12.0	0.8	9.6	9.6		213.00	0.57	100	200	3.70
SIP16-SIP17				589.8	5.0	213.00	34.90	225	48	69.55
SIP17	16.0	0.8	12.8	12.8		213.00	0.76	100	200	3.70
SIP17-GTD1				602.6	5.0	213.00	35.65	225	48	69.55
GTD1	20.5	0.8	16.4	16.4		213.00	0.97	100	200	3.70
GTD1-SIP18				619.0	5.0	213.00	36.62	225	48	69.55
SIP18	9.0	0.8	7.2	7.2		213.00	0.43	100	200	3.70
SIP18-SIP19				626.2	5.0	213.00	37.05	225	48	69.55
SIP19	6.5	0.8	5.2	5.2		213.00	0.31	100	200	3.70
SIP19-Junction Pit				631.4	5.0	213.00	37.36	225	48	69.55

PIPE FLOWING FULL CALCULATIONS

Level 23, 101 Miller Street, North Sydney, NSW 2060
PO Box 3, North Sydney, NSW 2059

Project: **HARGRAVES APARTMENT**	Job No: **160181**	Designed: CFH	Design Frequenc: **20 year**
			Rainfall Intensity: **213**
Address: **1-5 Hargrave Street and 38-40 Orth Street KINGSWOOD**	Date: **8-Sep-16**	Sheet: 2 of: **2**	Material: **PVC**
			Mannings "n": **0.013**

SECTION	SUB-AREA			TOTAL	Max Time	Intensity	Flow	PIPE	GRADE	PIPE
	A	C	A x C	A x C	Con. min	mm/hr	Q l/s	DIAM. mm	1 in X	CAPACITY l/s
SIP1	24.0	0.8	19.2	19.2		213.00	1.14	100	200	3.70
SIP1-GTD2				19.2	5.0	213.00	1.14	100	200	3.70
GTD2	55.0	0.8	44.0	44.0		213.00	2.60	100	200	3.70
GTD2-SIP20				63.2	5.0	213.00	3.74	100	20	11.71
SIP20	23.0	0.8	18.4	18.4		213.00	1.09	100	200	3.70
SIP20-SIP21				81.6	5.0	213.00	4.83	100	20	11.71
SIP21	24.0	0.8	19.2	19.2		213.00	1.14	100	200	3.70
SIP21-SIP23				100.8	5.0	213.00	5.96	150	27	31.73
SIP22 & SIP23	53.0	0.8	42.4	42.4		213.00	2.51	100	200	3.70
SIP23-SIP24				143.2	5.0	213.00	8.47	150	40	26.07
SIP24	49.0	0.8	39.2	39.2		213.00	2.32	100	200	3.70
SIP24-SIP34				182.4	5.0	213.00	10.79	150	40	26.07
SIP34	17.5	0.8	14.0	14.0		213.00	0.83	100	200	3.70
SIP34-SIP25				196.4	5.0	213.00	11.62	150	40	26.07
SIP25	20.0	0.8	16.0	16.0		213.00	0.95	100	200	3.70
SIP25-SIP26				212.4	5.0	213.00	12.57	150	40	26.07
SIP26	127.0	0.8	101.6	101.6		213.00	6.01	150	200	11.66
SIP26-SIP27				314.0	5.0	213.00	18.58	225	200	34.07
SIP27	71.0	0.8	56.8	56.8		213.00	3.36	100	200	3.70
Ramps to Pumpout	112.0	0.8	89.6	89.6	5.0	213.00	5.30	150	200	11.66
SIP27-SIP28				460.4	5.0	213.00	27.24	225	200	34.07
SIP28	26.0	0.8	20.8	20.8		213.00	1.23	100	200	3.70
SIP28-SIP29				481.2	5.0	213.00	28.47	225	200	34.07
SIP29 & DP4	65.3	0.8	52.2	52.2		213.00	3.09	100	200	3.70
SIP29-SIP30				533.4	5.0	213.00	31.56	225	200	34.07
SIP30	5.0	0.8	4.0	4.0		213.00	0.24	100	200	3.70
SIP30-SIP31				537.4	5.0	213.00	31.80	225	200	34.07
SIP31	43.0	0.8	34.4	34.4		213.00	2.04	100	200	3.70
SIP31-SIP32				571.8	5.0	213.00	33.83	225	200	34.07
SIP32	7.0	0.8	5.6	5.6		213.00	0.33	100	200	3.70
SIP32-SIP33				577.4	5.0	213.00	34.16	225	200	34.07
SIP33	50.0	0.8	40.0	40.0		213.00	2.37	100	200	3.70
SIP33-Junction Pit				617.4	5.0	213.00	36.53	225	200	34.07
Total to Treatment Plant				2732.0						
TREATMENT PLANT - COUNCIL PIT				2732.0	5.0	213.00	161.64	375	100	182.98

6. APPENDIX B - DRAWINGS

Project	Drawing No	Revision	Title
160181	H000	A	Cover Sheet
160181	H100	A	Site Plan & Roof Plan
160181	H101	A	Basements 1, 2 & 3 and Stormwater Concept Plan Schematic
160181	H102	A	Ground Level
160181	H-ESCP-01	A	Erosion and Sediment Control Plan

HARGRAVE APARTMENTS

HYDRAULIC SERVICES

STORMWATER DRAINAGE CONCEPT PLAN AND EROSION AND SEDIMENT CONTROL PLAN

HYDRAULIC LEGEND

- STORMWATER DRAINAGE
- RW — RAINWATER DRAINAGE
- DOWNPIPE
- / — SUB-SOIL DRAINAGE
- SWRM — STORMWATER RISING MAIN
- OF — OVERFLOW PIPE
- SEDIMENT FENCE
- EXISTING STORMWATER DRAINAGE

SYSTEM ACCESSORIES LEGEND

- PUMP
- KIP — KERB INLET PIT WITH GRATES
- SWP — STORMWATER PIT WITH GRATE
- EX SWP — EXISTING STORMWATER PIT
- GD — GRATED DRAIN
- O/FLOW — OVERLAND FLOW PATH

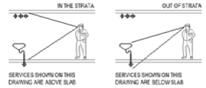
SYSTEM ACCESSORIES LEGEND

- (F) WATER FILTER
- FLOW DIRECTION ARROW
- (A) AMENDMENT SYMBOL
- FS / 100 — INDICATES PIPE RISERS; INDICATES SERVICE TYPE; INDICATES SERVICE SIZE
- FS / 100 — INDICATES SERVICE TYPE; INDICATES SERVICE SIZE; INDICATES PIPE DROPPERS
- exFS / 100 — EXISTING SERVICES IDENTIFICATION. DROPPER / RISER / SIZE
- H-001 — FOR CONTINUATION REFER DRAWING No. H-...

GENERAL ABBREVIATIONS

BG	- BOX GUTTER	LL	- LOW LEVEL
CO	- CLEAROUT	OF	- OVERFLOW
D	- DRAINAGE	RL	- REDUCED LEVEL
DP	- DOWNPIPE	RPZD	- REDUCED PRESSURE ZONE DEVICE
DWG No.	- DRAWING NUMBER	RWO	- RAINWATER OUTLET
EX	- EXISTING	SW	- STORM WATER
FFL	- FINISHED FLOOR LEVEL	SWMH	- STORMWATER MANHOLE
FGL	- FINISHED GROUND LEVEL	SWP	- STORM WATER PIT
GD	- GRATED DRAIN	SWRM	- STORMWATER RISING MAIN
GL	- GROUND LEVEL	TK	- TOP OF KERB
HP	- HIGH POINT	TTG	- TRENCH GRATE
HL	- HIGH LEVEL	TWL	- TOP WATER LEVEL
IRR	- IRRIGATION	UNO	- UNLESS NOTED OTHERWISE
IL	- INVERT LEVEL	U/S	- UNDERSIDE
IO	- INSPECTION OPENING	WL	- WATER LEVEL
KIP	- KERB INLET PIPE	Ø	- DIAMETER

DESIGN ZONES



DRAWING LIST

H000	- COVER SHEET, LEGEND, GENERAL NOTES & DRAWING LIST.
H100	- SITE & ROOF PLAN - STORMWATER CONCEPT PLAN
H101	- BASEMENT LEVEL 1, 2 & 3 PLANS - STORMWATER CONCEPT PLAN AND SCHEMATIC
H102	- GROUND FLOOR PLAN - STORMWATER DRAINAGE LAYOUT
H-ESCP-01	- SITE PLAN - EROSION AND SEDIMENT CONTROL PLAN

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified
A	13.09.16	COUNCIL SUBMISSION	C.H.

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified

ENGINEER
DESIGNER
CHRIS HARPLEY
QUALIFICATIONS
B.E. (CIVIL & ENVIRONMENTAL)(HONS)
CONTACT
CHRIS.HARPLEY@JHAENGINEERS.COM.AU
(02) 9437 1000

CLIENT
pamada

ARCHITECT
Beta Solutions Pty Ltd
ARCHITECTS

CONSULTANT
JHA
Level 23, 101 Miller Street, North Sydney NSW 2060 Australia
+61 (02) 9437 1000
general@jhaengineers.com.au
www.jhaservices.com

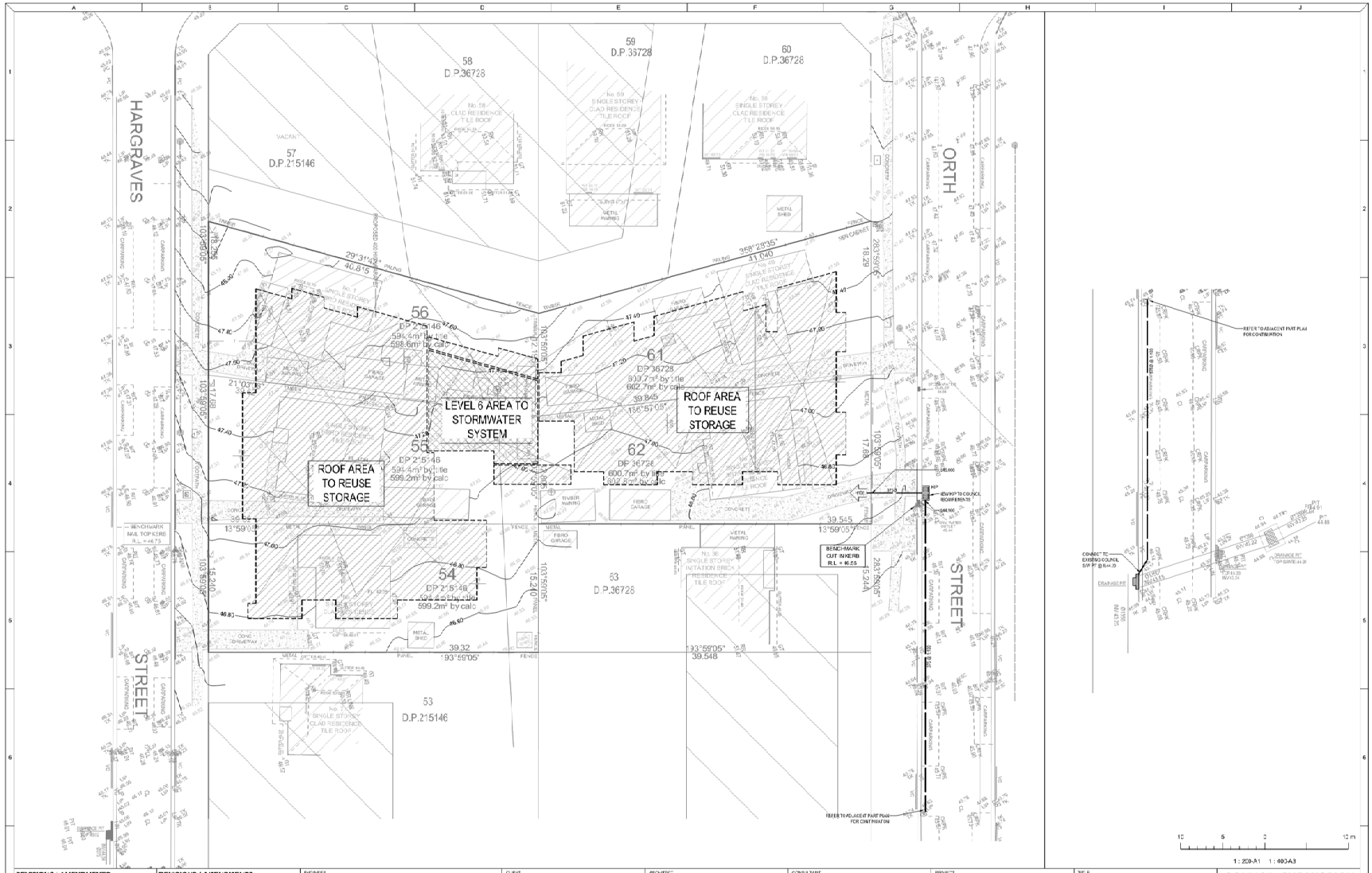
PROJECT
HARGRAVE APARTMENTS
1-5 HARGRAVE STRET AND
38-40 ORTH STREET
KINGSWOOD

TITLE
HYDRAULIC SERVICES
COVER SHEET, LEGEND, GENERAL NOTES & DRAWING LIST

COUNCIL SUBMISSION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	L.K.	SCALE @ A1
CHECKED	C.H.	N.T.S.
APPROVED	D.M.	
CREATED	AUG 2016	
JOB No. 160181	DRAWING No. H000	REV A

Sep 13, 2016 – 2:28pm S:\JOB No\Job No 20160100-20160199\160181 Orth & Hargrave St, Penrith\Drawings\Hydraulics\160181-H000.dwg



REVISIONS / AMENDMENTS					REVISIONS / AMENDMENTS				
Rev.	Date	Description	Verified	D.H.	Rev	Date	Description	Verified
A	13.09.16	COUNCIL SUBMISSION						

All dimensions to be verified on site prior to commencement of ex-site work and/or off-site prefabrication. Figured dimensions to be used in preference to scaled dimensions. This drawing is copyright and remains the property of JHA Consulting Engineers. Reproduction in whole or part of these drawings without written consent constitutes an infringement of copyright.

ENGINEER
DESIGNER
CHRIS HARPLEY
QUALIFICATIONS
B.E. (CIVIL & ENVIRONMENTAL) (HONS)
CONTACT
CHRIS.HARPLEY@JHAENGINEERS.COM.AU
(02) 9437 1000

CLIENT
pamada

ARCHITECT
Beta Solutions Pty Ltd
ARCHITECTS

CONSULTANT
JHA

PROJECT
HARGRAVE APARTMENTS
1-5 HARGRAVE STRET AND
33-40 ORTH STREET
KINGSWOOD

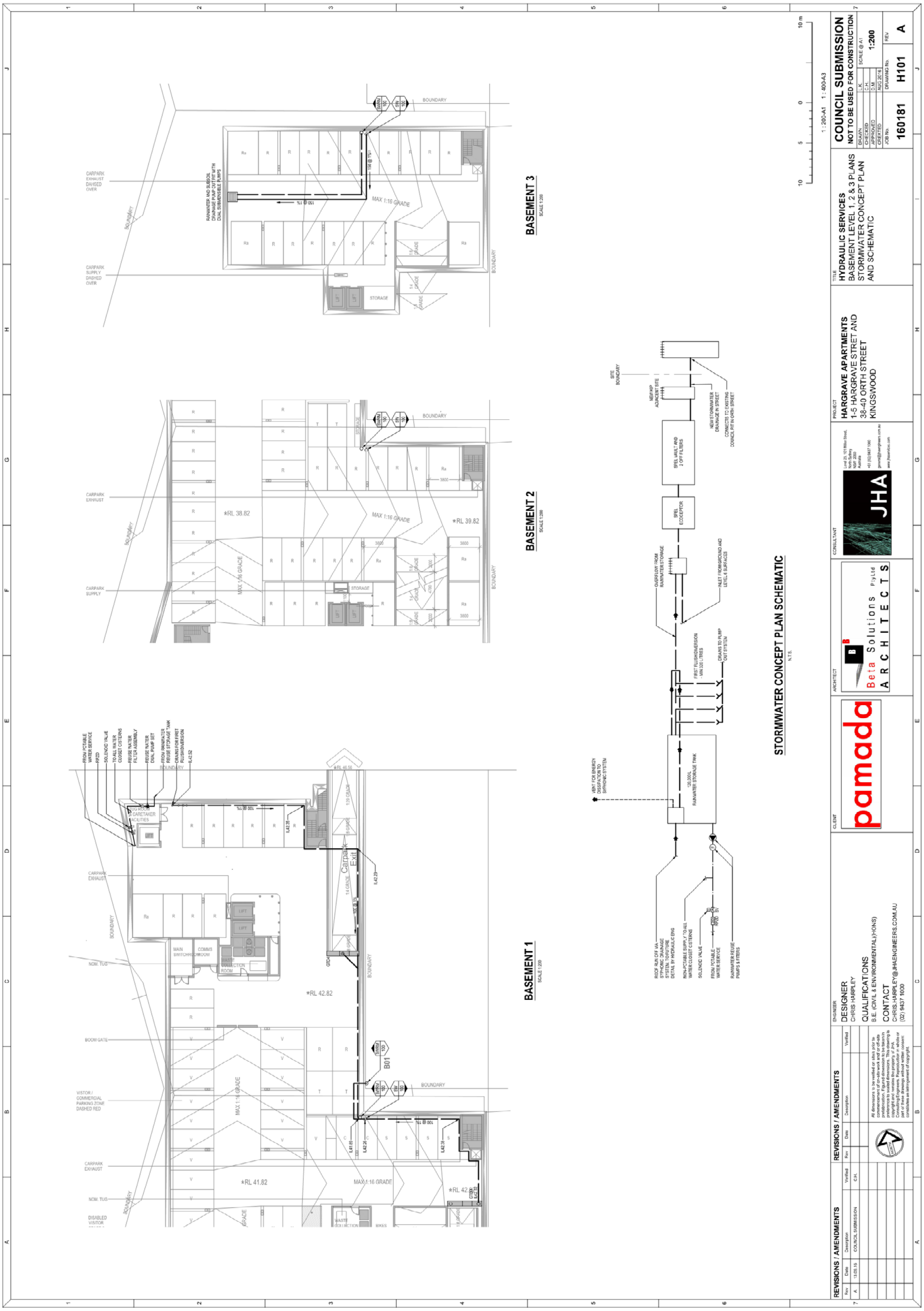
TITLE
HYDRAULIC SERVICES
SITE PLAN & ROOF PLAN
STORMWATER CONCEPT PLAN

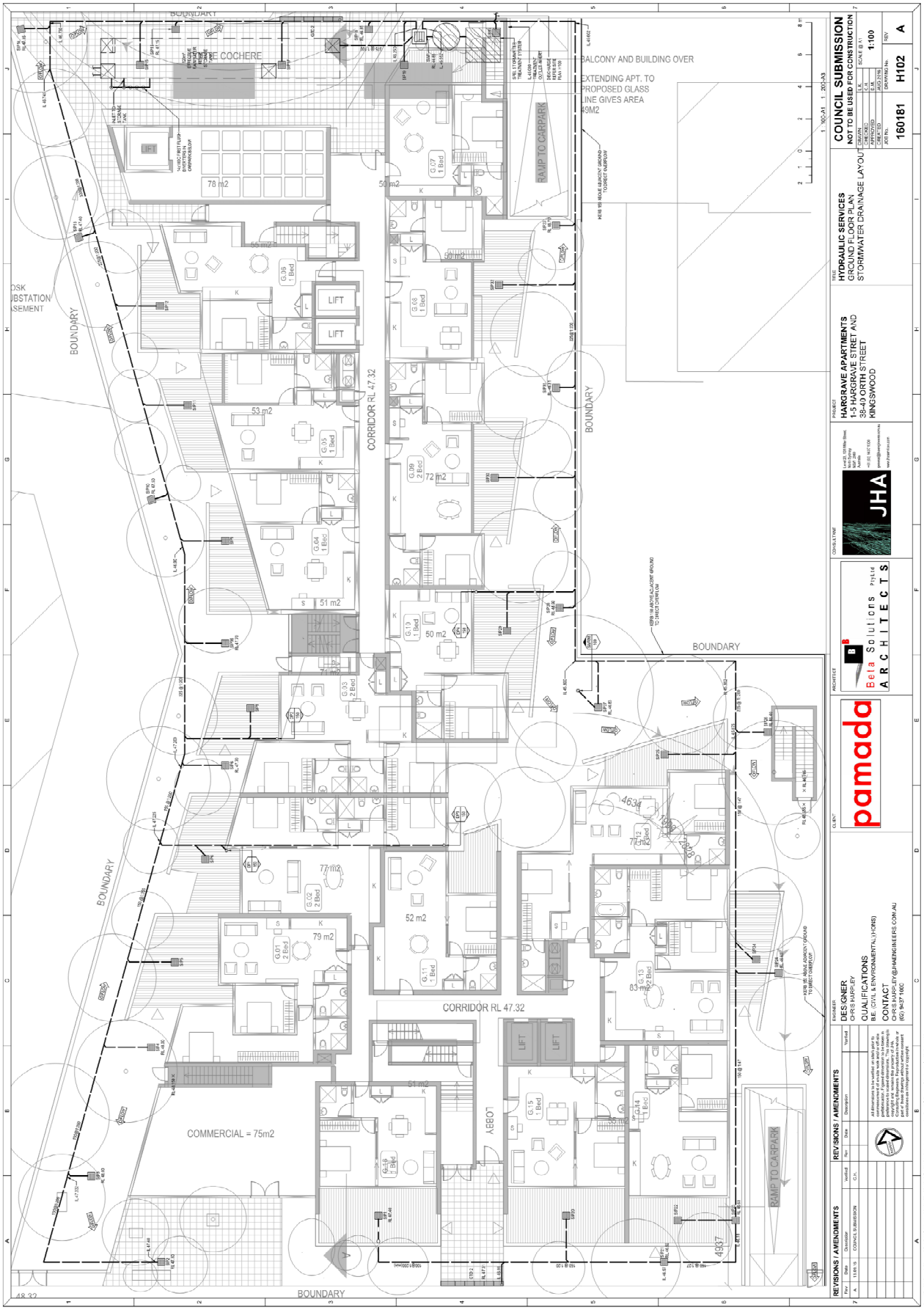
COUNCIL SUBMISSION
NOT TO BE USED FOR CONSTRUCTION

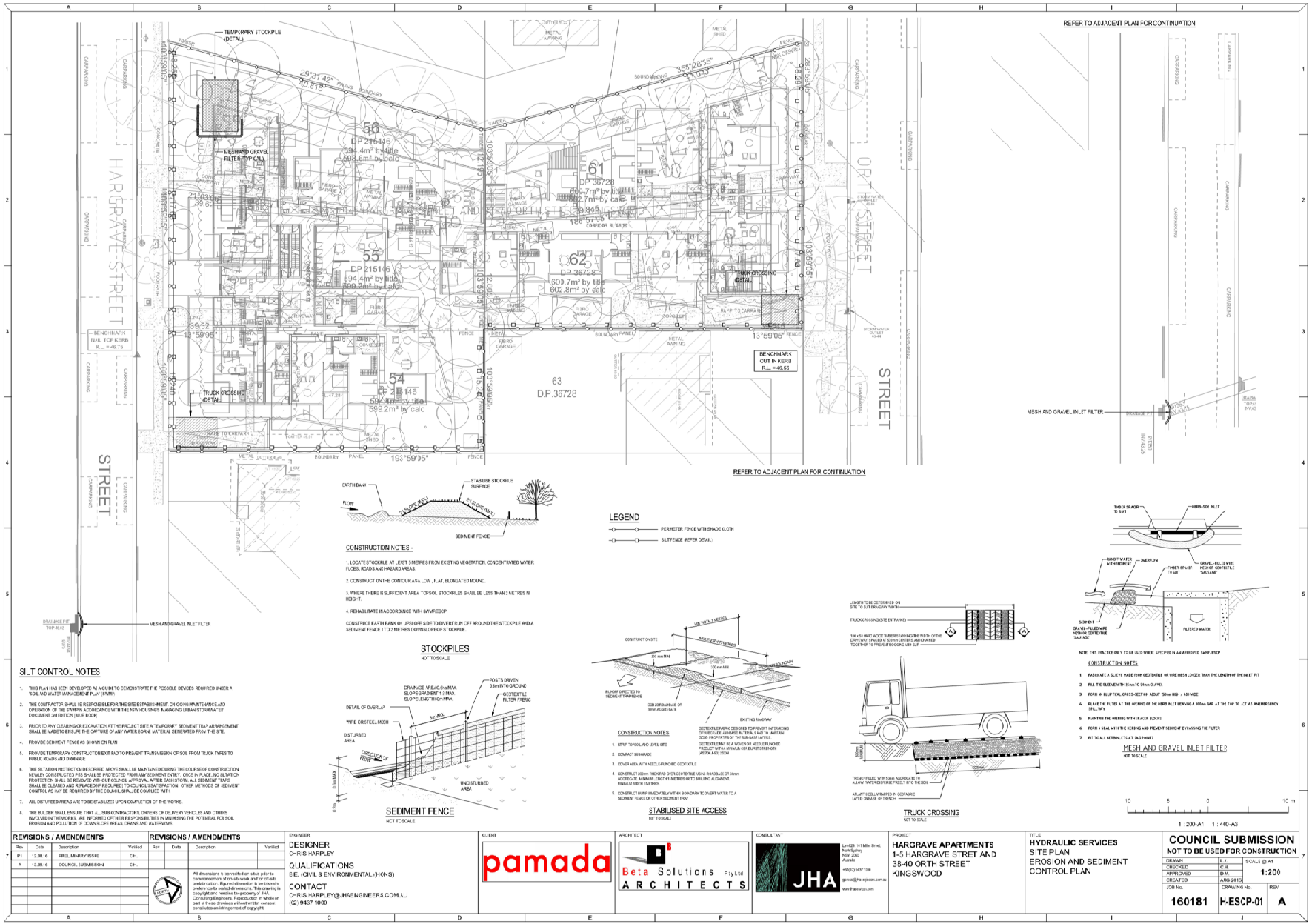
DRAWN	L.K.	SCALE @ A1
CHECKED	D.H.	1:200
APPROVED	D.M.	
CREATED	AUG 2016	

JOB No.	DRAWING No	REV
160181	H100	A

Sep 12, 2016 - 3:26pm S:\Job No 2016\160100-160199\160181 Orth & Hargrave St, Penrith\Drawings\Hydraulics\160181-H100.dwg







7. APPENDIX C - CHECKLIST

APPENDICES

Appendix A

Checklist for Stormwater Concept Plan

Survey Information	Yes	No	NA
1. Site boundaries are clearly indicated	x	☐	☐
2. North point shown	x	☐	☐
3. Services within the public footway	☐	☐	x
4. Site features including tree, structures, depressions	x	☐	☐
5. Contours at 0.1m for flat sites ranging to 0.5m for steep sites and extending 10m into adjoining properties	x	☐	☐
6. Top of kerb levels	x	☐	☐
7. Boundary levels	x	☐	☐
8. Levels to AHD where site is affected by overland flow, flooding or where works on Council's drainage network are required.	x	☐	☐
9. Benchmarks indicated	x	☐	☐
General	**Yes**	**No**	**NA**
1. Plans to scale of 1:100 or 1:200	x	☐	☐
2. Designers name, qualifications and contact details are included on the plans	x	☐	☐
3. Design report submitted including details of any variations	x	☐	☐
4. Plans are consistent with architectural and landscape plans	x	☐	☐
5. 100 year ARI overland flow extents provided	x	☐	☐
6. Development layout and proposed driveway locations are clearly indicated	x	☐	☐
7. Drainage layout with preliminary pipe sizing and levels	x	☐	☐
8. Preliminary calculations to indicate that the proposed design is achievable, as required	x	☐	☐
9. Proposed finished floor, garage and ground surface levels	x	☐	☐
10. Freeboard to finished levels has been achieved	x	☐	☐
11. Location and level of any proposed retaining walls	☐	☐	x
12. Proposed connection point to Council's stormwater system	x	☐	☐
13. Appropriate tail water selected	☐	☐	x
14. The proposal will not have adverse impact on other properties or the stormwater network	x	☐	☐

HARGRAVE APARTMENTS

HYDRAULIC SERVICES
STORMWATER DRAINAGE CONCEPT PLAN AND
EROSION AND SEDIMENT CONTROL PLAN

HYDRAULIC LEGEND

- STORMWATER DRAINAGE
- RW — RAINWATER DRAINAGE
- DOWNPIPE
- / — SUB-SOIL DRAINAGE
- SWRM — STORMWATER RISING MAIN
- OF — OVERFLOW PIPE
- SEDIMENT FENCE
- EXISTING STORMWATER DRAINAGE

SYSTEM ACCESSORIES LEGEND

- PUMP
- KIP — KERB INLET PIT WITH GRATES
- SWP — STORMWATER PIT WITH GRATE
- EX SWP — EXISTING STORMWATER PIT
- GD — GRATED DRAIN
- O/FLOW — OVERLAND FLOW PATH

SYSTEM ACCESSORIES LEGEND

- (F) — WATER FILTER
- FLOW DIRECTION ARROW
- A — AMENDMENT SYMBOL
- INDICATES PIPE RISERS
- FS / 100 — INDICATES SERVICE TYPE, INDICATES SERVICE SIZE
- FS / 100 — INDICATES SERVICE TYPE, INDICATES SERVICE SIZE, INDICATES PIPE DROPPERS
- exFS / 100 — EXISTING SERVICES IDENTIFICATION. DROPPER / RISER / SIZE
- H-001 — FOR CONTINUATION REFER DRAWING No. H-...

GENERAL ABBREVIATIONS

BG	- BOX GUTTER	LL	- LOW LEVEL
CO	- CLEAROUT	OF	- OVERFLOW
D	- DRAINAGE	RL	- REDUCED LEVEL
DP	- DOWNPIPE	RPZD	- REDUCED PRESSURE ZONE DEVICE
DWG No.	- DRAWING NUMBER	RWO	- RAINWATER OUTLET
EX	- EXISTING	SW	- STORM WATER
FFL	- FINISHED FLOOR LEVEL	SWMH	- STORMWATER MANHOLE
FGL	- FINISHED GROUND LEVEL	SWP	- STORM WATER PIT
GD	- GRATED DRAIN	SWRM	- STORMWATER RISING MAIN
GL	- GROUND LEVEL	TK	- TOP OF KERB
HP	- HIGH POINT	TTG	- TRENCH GRATE
HL	- HIGH LEVEL	TWL	- TOP WATER LEVEL
IRR	- IRRIGATION	UNO	- UNLESS NOTED OTHERWISE
IL	- INVERT LEVEL	U/S	- UNDERSIDE
IO	- INSPECTION OPENING	WL	- WATER LEVEL
KIP	- KERB INLET PIPE	Ø	- DIAMETER

DESIGN ZONES

SERVICES SHOWN ON THIS DRAWING ARE ABOVE SLAB

SERVICES SHOWN ON THIS DRAWING ARE BELOW SLAB

DRAWING LIST

H000	- COVER SHEET, LEGEND, GENERAL NOTES & DRAWING LIST.
H100	- SITE & ROOF PLAN - STORMWATER CONCEPT PLAN
H101	- BASEMENT LEVEL 1, 2 & 3 PLANS - STORMWATER CONCEPT PLAN AND SCHEMATIC
H102	- GROUND FLOOR PLAN - STORMWATER DRAINAGE LAYOUT
H-ESCP-01	- SITE PLAN - EROSION AND SEDIMENT CONTROL PLAN

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified
A	13.09.16	COUNCIL SUBMISSION	C.H.

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified

ENGINEER
DESIGNER
CHRIS HARPLEY
QUALIFICATIONS
B.E. (CIVIL & ENVIRONMENTAL)(HONS)
CONTACT
CHRIS.HARPLEY@JHAENGINEERS.COM.AU
(02) 9437 1000

CLIENT
pamada

ARCHITECT
Beta Solutions PtyLtd
ARCHITECTS

CONSULTANT
JHA
Level 23, 101 Miller Street,
North Sydney
NSW 2060
Australia
+61 (02) 9437 1000
general@jhaengineers.com.au
www.jhaservices.com

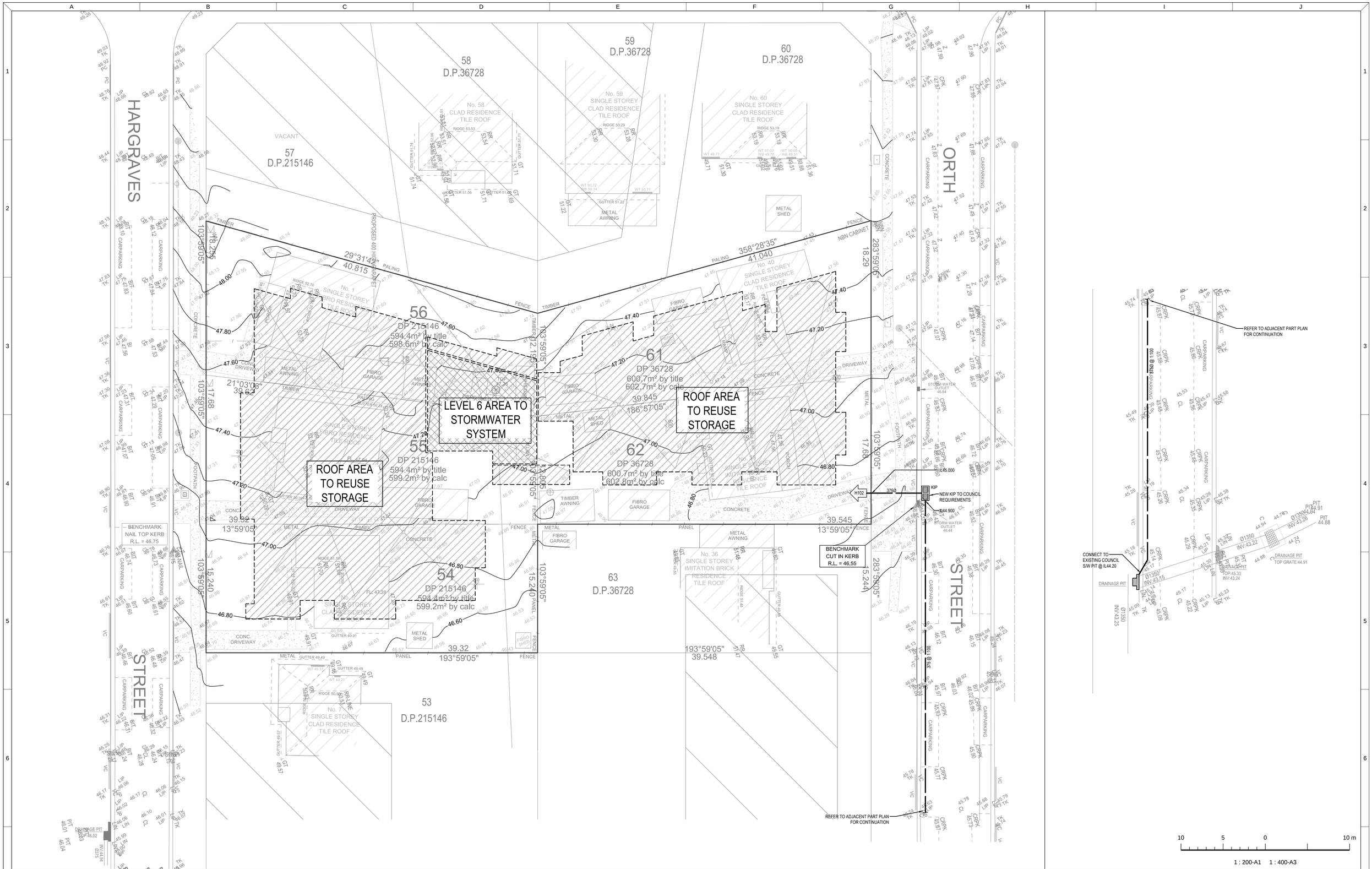
PROJECT
HARGRAVE APARTMENTS
1-5 HARGRAVE STRET AND
38-40 ORTH STREET
KINGSWOOD

TITLE
HYDRAULIC SERVICES
COVER SHEET, LEGEND,
GENERAL NOTES &
DRAWING LIST

COUNCIL SUBMISSION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	L.K.	SCALE @ A1	
CHECKED	C.H.	**N.T.S.**	
APPROVED	D.M.		
CREATED	AUG 2016		
JOB No.	DRAWING No.	REV	
160181	**H000**	**A**	

Sep 13, 2016 – 2:28pm S:\JOB No\Job No 20160100–20160199\160181 Orth & Hargrave St, Penrith\Drawings\Hydraulics\160181–H000.dwg



10 5 0 10 m

1 : 200-A1 1 : 400-A3

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified
A	13.09.16	COUNCIL SUBMISSION	C.H.

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified

NORTH

ENGINEER
DESIGNER
CHRIS HARPLEY
QUALIFICATIONS
B.E. (CIVIL & ENVIRONMENTAL)(HONS)
CONTACT
CHRIS.HARPLEY@JHAENGINEERS.COM.AU
(02) 9437 1000

CLIENT
pamada

ARCHITECT
Beta Solutions PtyLtd
ARCHITECTS

CONSULTANT
JHA
Level 23, 101 Miller Street, North Sydney NSW 2060 Australia
+61 (02) 9437 1000
general@jhaengineers.com.au
www.jhaservices.com

PROJECT
HARGRAVE APARTMENTS
1-5 HARGRAVE STRET AND
38-40 ORTH STREET
KINGSWOOD

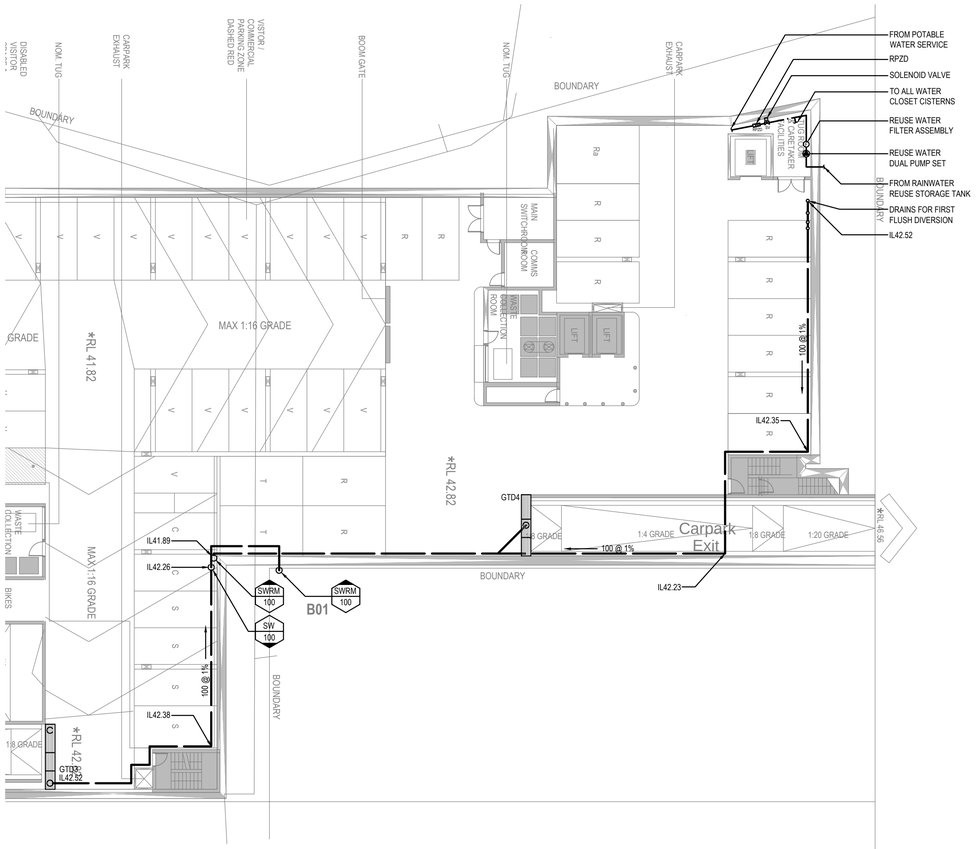
TITLE
HYDRAULIC SERVICES
SITE PLAN & ROOF PLAN
STORMWATER CONCEPT PLAN

COUNCIL SUBMISSION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	L.K.	SCALE @ A1
CHECKED	C.H.	1:200
APPROVED	D.M.	
CREATED	AUG 2016	

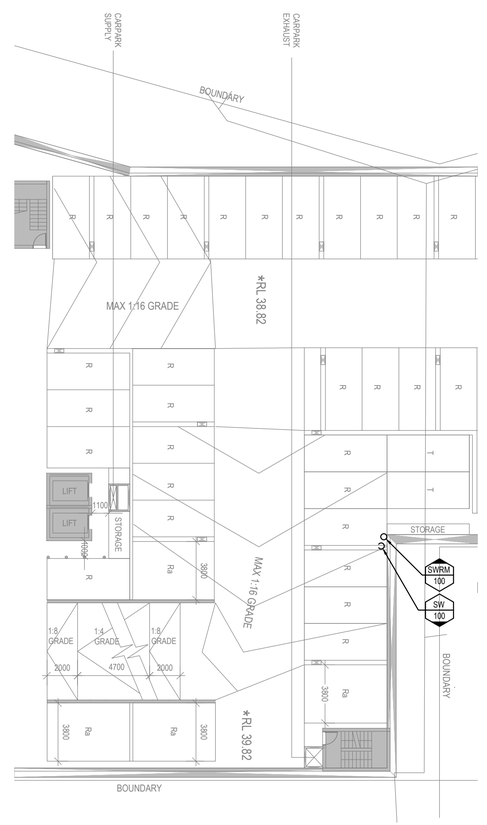
JOB No.	DRAWING No.	REV
160181	H100	A

Document Set ID: 7343784
Version: 1, Version Date: 22/09/2016



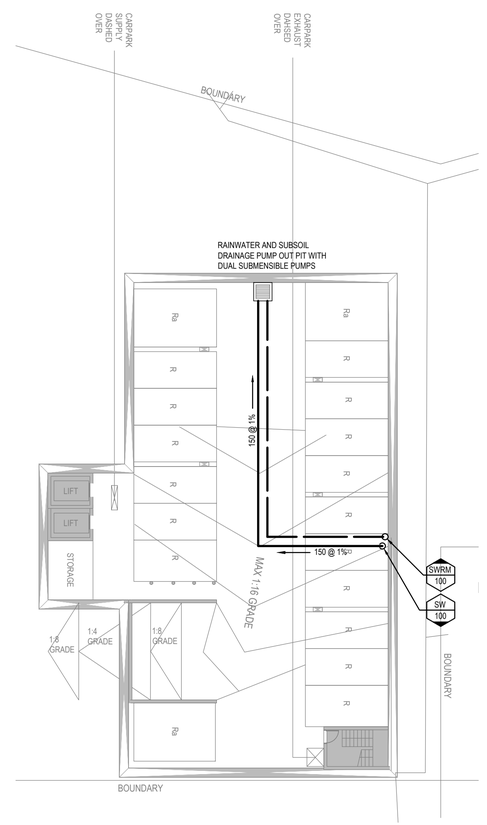
BASEMENT 1

SCALE 1:200



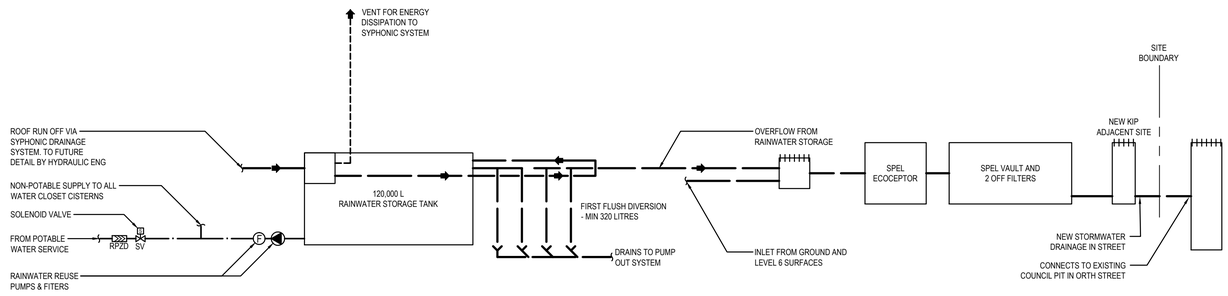
BASEMENT 2

SCALE 1:200



BASEMENT 3

SCALE 1:200



STORMWATER CONCEPT PLAN SCHEMATIC

N.T.S.

10 5 0 10 m

1 : 200-A1 1 : 400-A3

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified
A	13.09.16	COUNCIL SUBMISSION	C.H.

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified

NORTH

ENGINEER
DESIGNER
CHRIS HARPLEY
QUALIFICATIONS
B.E. (CIVIL & ENVIRONMENTAL)(HONS)
CONTACT
CHRIS.HARPLEY@JHAENGINEERS.COM.AU
(02) 9437 1000

CLIENT
pamada

ARCHITECT
Beta Solutions PtyLtd
ARCHITECTS

CONSULTANT
JHA
Level 23, 101 Miller Street, North Sydney NSW 2060 Australia
+61 (02) 9437 1000
general@jhaengineers.com.au
www.jhaservices.com

PROJECT
HARGRAVE APARTMENTS
1-5 HARGRAVE STRET AND
38-40 ORTH STREET
KINGSWOOD

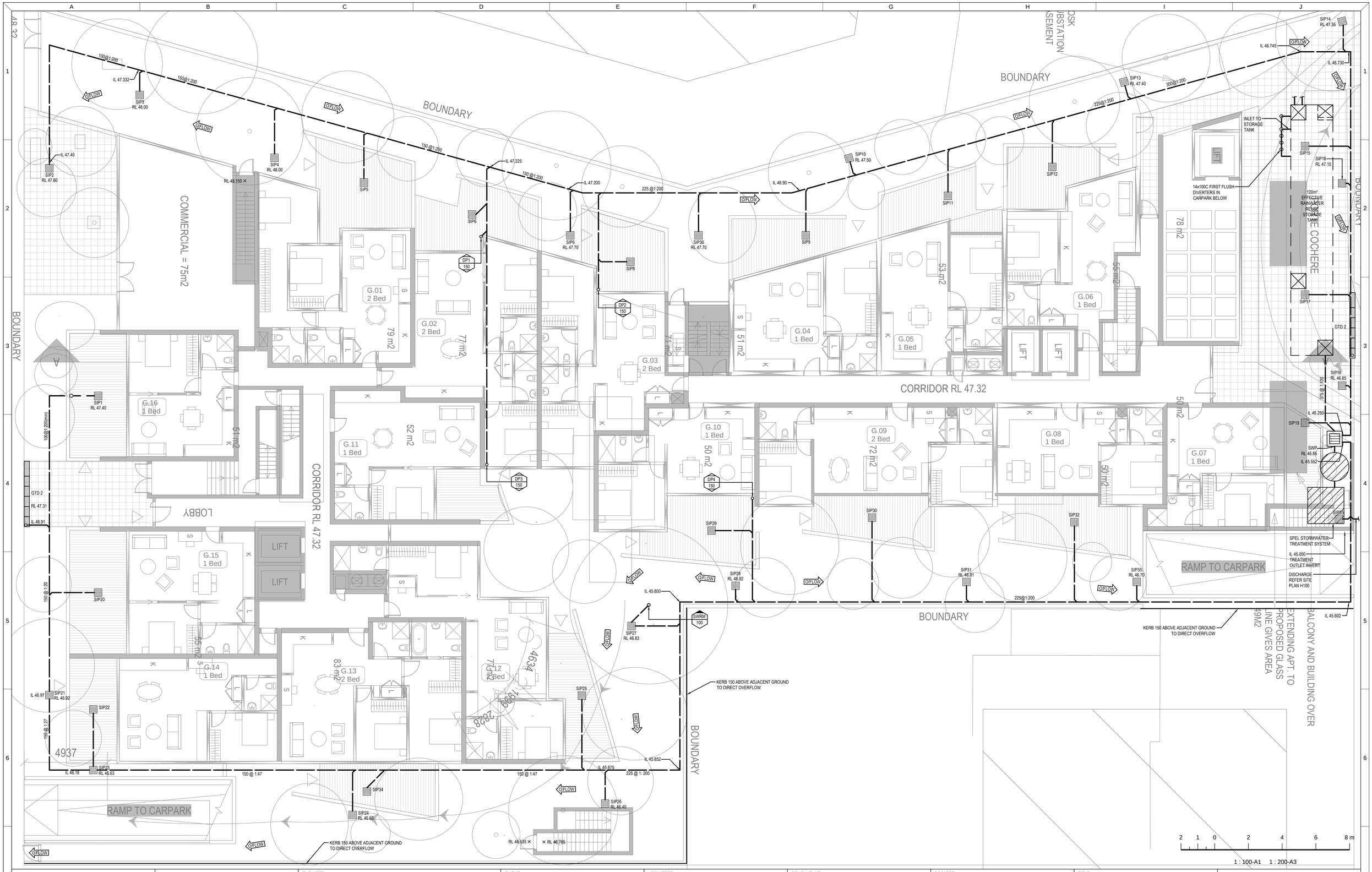
TITLE
HYDRAULIC SERVICES
BASEMENT LEVEL 1, 2 & 3 PLANS
STORMWATER CONCEPT PLAN
AND SCHEMATIC

COUNCIL SUBMISSION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	L.K.	SCALE @ A1
CHECKED	C.H.	1:200
APPROVED	D.M.	
CREATED	AUG 2016	

JOB No.	DRAWING No.	REV
160181	H101	A

Sep 13, 2016 – 2:28pm S:\JOB No\Job No 20160100–20160199\160181 Orth & Hargrave St, Penrith\Drawings\Hydraulics\160181–H101.dwg
Document Set ID: 7343784
Version: 1, Version Date: 22/09/2016



REVISIONS / AMENDMENTS

Rev	Date	Description	Verified
A	13.09.16	COUNCIL SUBMISSION	C.H.

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified

NORTH

ENGINEER
DESIGNER
CHRIS HARPLEY
QUALIFICATIONS
B.E. (CIVIL & ENVIRONMENTAL)(HONS)
CONTACT
CHRIS.HARPLEY@JHAENGINEERS.COM.AU
(02) 9437 1000

CLIENT
pamada

ARCHITECT
Beta Solutions PtyLtd
ARCHITECTS

CONSULTANT
JHA
Level 23, 101 Miller Street,
North Sydney
NSW 2060
Australia
+61 (02) 9437 1000
general@jhaengineers.com.au
www.jhaservices.com

PROJECT
HARGRAVE APARTMENTS
1-5 HARGRAVE STRET AND
38-40 ORTH STREET
KINGSWOOD

TITLE
HYDRAULIC SERVICES
GROUND FLOOR PLAN
STORMWATER DRAINAGE LAYOUT

COUNCIL SUBMISSION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	L.K.	SCALE @ A1
CHECKED	C.H.	1:100
APPROVED	D.M.	
CREATED	AUG 2016	

JOB No.	DRAWING No.	REV
160181	H102	A