Flovac Systems Pty Ltd
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15th September 2017,

Roche Group Pty Ltd
Wes van der Gardner
General Manager –Development
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Harrington Waters Estate Density Increase North East Catchment

Dear Wes,

Please find enclosed our review of the proposed density increase within the North East Catchment of Harrington Waters Estate.

As such take note that our review is strictly limited this North East Catchment and does not factor capacity at the vacuum pump station, in line with instructions from Midcoast Water.

Should you have any queries please don't hesitate to contact me.

Yours Sincerely,

Rick Wickham,
(Engineering Projects Manager)
Mobile: 61 447 614 632

Background:

Harrington Waters Estate is serviced by a vacuum sewerage system, with its Vacuum Sewerage Pumping Station (VSPS) located at the end of the Faith Court - Midcoast Council asset reference SPS HR09, asset 357. As per Midcoast Water as-constructed GIS mapping system, there are a total of 4 vacuum mains extending out from the VSPS to the Harrington Waters Estate catchment. The North East Catchment of this estate sits immediately to the right of the VSPS to the north of Harrington Rd.

Within this North East Catchment is the proposed density increase (medium density development), constituting some 203 medium density dwellings (2 & 3 bedrooms) and a club house facility. Figure 1 below outlines the location of the proposed medium density development within the North East catchment.

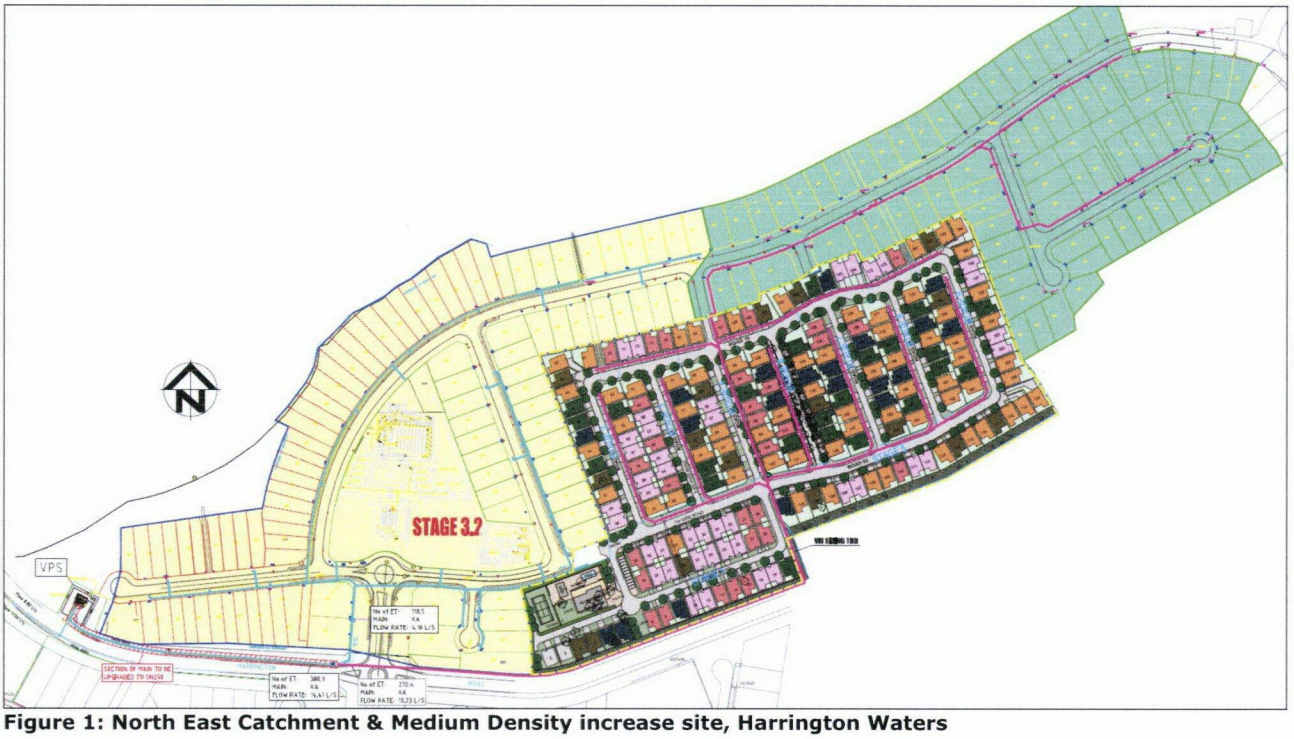

Figure 1: North East Catchment & Medium Density increase site, Harrington Waters

Original North East Catchment's Loadings with No Density Increase:

Design Basis: Pre-density Increase		
	ET	PWWF (r=3), L/s
Currently serviced (residential)	97	3.67
Currently serviced Stage 3.2 (commercial)	13.5	0.51
Serviced in future	88	3.33
Original Development at the proposed density increase site	112	4.24
Total	**310.5**	**11.75**

Table 1: Harrington Waters North East Catchment Pre-density increase

Basis for these pre-density increase loadings calculations are as follows:

ADWF: 240L/day.EP
EP/ET: 3.1
Where ADWF/ET = 240L/day.EP x 3.1 EP/ET = 744L/day or 0.0086l/s

Peaking factor (r): 3 (nominated by Midcoast Water)
PDWF/ET = 3 x ADWF/ET = 3 x 744L/day = 2246.4L/day.ET or 0.026 L/s.ET

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SA/ET = 0.012 L/s.ET
PWWF/ ET = PDWF/ET+ SA/ET = 0.026+0.012=0.038L/s.ET

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Proposed North East Catchments Loadings with Density Increase:

Design Basis: Post Density Increase		
	ET	PWWF (r=3)
Serviced currently	97	3.67
Currently serviced Stage 3.2 (commercial)	13.5	0.51
Serviced in future	88	3.33
Proposed Density Increase (203 Dwellings @ 0.8 ET/Dwelling)	162.4	6.14
Proposed Clubhouse Facility	20	0.76
Total	**376.1**	**14.41**

Table 2: Harrington Waters North East Catchment Post-density increase

Density allocations are as follows:

- Medium density development, consisting of individual 203 dwellings on lots less than 450m^2. Accordingly, in line with Midcoast Water Guidelines an occupancy rate of 0.8ET per dwelling is applied to lots less than 450m^2.

  Breakdown of 203 dwellings is as follows:

  1 Storey / 3 BR Unattached - 128
  1 Storey / 2 BR Duplex - 42
  1 Storey / 2 BR Unattached - 31
  1 Storey / 2BR Custom - 2

- A further 20ET has been allocated to this clubhouse site. Also refer later to commentary with respect to swimming pool infrastructure within this site.

- All other existing and future lots within the overall North Eastern Catchment have been applied with 1ET per dwelling.

Storm Allowance:

Water authorities generally provide concessions for reduced storm allowances for vacuum sewers, when compared to the traditional gravity systems. This is due to less rainfall dependant inflow & infiltration (IIF) and ground water infiltration (GWI) possible within the sealed vacuum mains. Typically, this is based around good design practice where, the vacuum sewers only utilise a single collection chamber shared between 4 dwellings, eliminating the possibility of a myriad of deep gravity networks, as with the traditional gravity sewers. However, from operational audits of vacuum sewers, the vast major points of IIF and GWI within the system are from the concrete collection chambers and incoming and house plumbing.

Due to the nature of the batch process associated with 2 phase transport within the vacuum system, water ingress from wet weather events can cause major operational problems within the system, leading to prolonged vacuum losses and potential high level/overflows at collection chambers. Typically, with vacuum sewers being constructed in poor soil conditions, including water charged ground/acid sulphate soils, the need to address the longevity of vacuum sewer asset may also be a key consideration, including:

- The use of Acid sulphate soil resistant Polyethylene collection chambers, eliminate long term degradation of collection infrastructure and the potential latter water ingress; and

- Water tight lids, encompassing a positive seal arrangement, effectively eliminating the possibility of Inflow into the system during wet weather events.

Swimming Pool Backwash and Wet weather overflows:

We note that the current loadings do not specifically cater for the following scenarios associated with the proposed communal swimming pool at the clubhouse facility:

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1. Rainfall overflows from the pool being sent to the vacuum sewer; and

2. Subject to the nature of the swimming filter system utilised, any potential back wash volumes being sent to the vacuum sewer. Given the potential volumes and uncontrolled time of discharge out of the swimming pool infrastructure, pools can take considerable capacity off trunk vacuum mains and potentially drown localised vacuum mains, changing the nature of 2 phase flow within the whole vacuum main.

Capacity of the VSPS:

For the purposes of this submission, Flovac sought up-to-date operational data pertaining to the VSPS from the Midcoast Water. However, Flovac was advised that Midcoast Water is satisfied that there is adequate capacity at the VSPS, to cater for the proposed density increase and that no additional review was necessary.

Vacuum Mains Profiles:

Static design reviews of existing vacuum mains along the north side of Harrington Road and on Harbour Boulevard were undertaken considering:

- Liquid capacity in the context of 2 phase flow;

- Potential for volume accumulation/stagnation;

- Airflow & mixing;

- Staging of the proposed medium density development in the context of the servicing the remaining sections of the North East Catchment; and

- Risk reduction to ensure there is adequate distribution of vacuum nodes across the North East Catchment, for better vacuum pressure distribution and faster vacuum recovery.

Please note at the time of this assessment, Flovac was not privy to dynamic operational findings from the existing reticulation network or as-constructed vacuum main long sectional profile information.

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Layout of collection infrastructure:

In line with changing OH &S guidelines, water authorities (including Midcoast Water) are now requesting the external location of the vacuum interface valve to the primary collection chamber. The footprint of this dual infrastructure arrangement and potential layout of multiple collection points within the medium density development is outlined within the enclosed Flovac schematics.

With collection chamber infrastructure on both sides of the roads, some branch vacuum mains will naturally need to be laid above storm water. An example of a typical crossing is shown in figure 2 below.

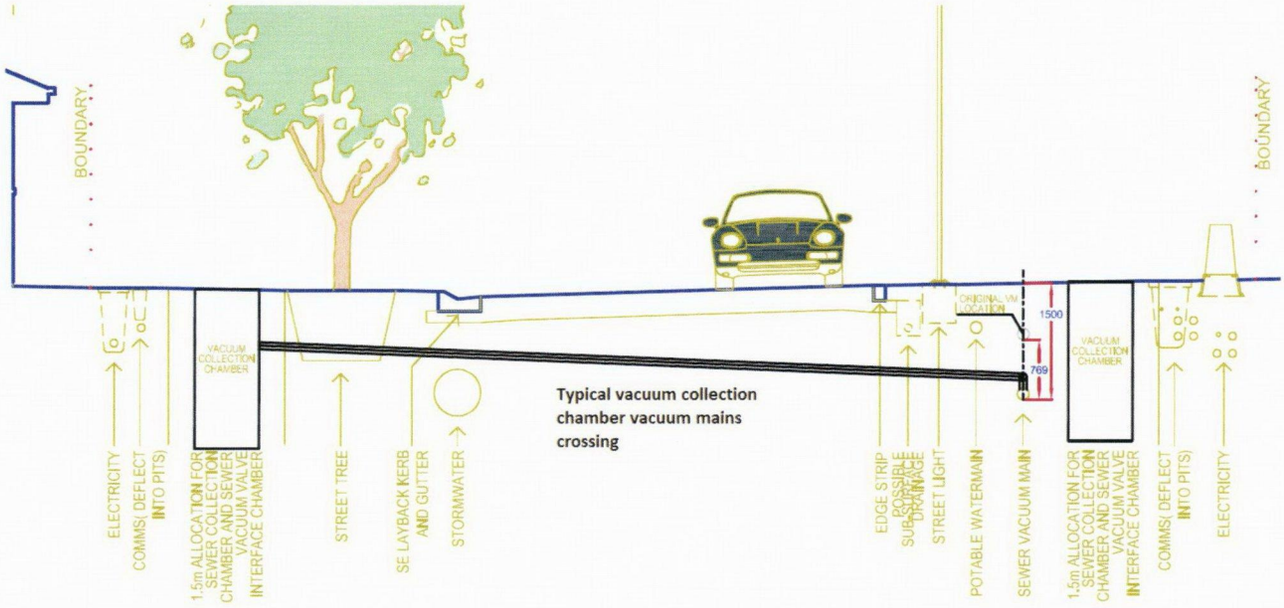

Figure 2: Typical collection chamber vacuum mains crossing

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Summary of Findings & Recommendations:

We find the proposed Harrington Waters Estate density increase to part of the North East Catchment can be adequately serviced using the existing system, incorporating the following recommendations:

- Application of the original peaking factor multiplier of 3 for this catchment;
- With the proposed density increase and the need to service the remainder of the North East Catchment, the total flow within this catchment will now be approximately 14.41L/s (r=3). As such, approximately 250m of the existing DN 160 HDPE vacuum mains will need to be upgraded to DN250 HDPE, from the VSPS to the intersection of Harrington Rd and Harbour Boulevard. We note that the ultimate capacity of DN250 HDPE PE100 (SDR 13.6) to be around 16.1L/s, assuming use of vacuum mains. The existing DN160 vacuum main travelling north on Harbour Boulevard will remain (but without any further extensions), continuing to service the existing development. With the establishment of the DN250 upgrade, this is now proposed to become the trunk mains for the North East Catchment. This main is proposed to extend along Harrington Rd, past the proposed Club house facility, before heading north into the North East Catchment via a potential small easement corridor. Refer enclosed Flovac schematics for more details;
- Vacuum collection chamber infrastructure is constructed to actively reduce the impacts of rainfall dependant IIF and GWI;
- Each collection chamber is ideally serviced by a dedicated DN150 venting system to maximum air intake;
- Design of vacuum mains profiles must support the needs of the staging strategy for this development; and
- No backwash or overflows from the proposed communal Club House facility be sent to the vacuum sewer.

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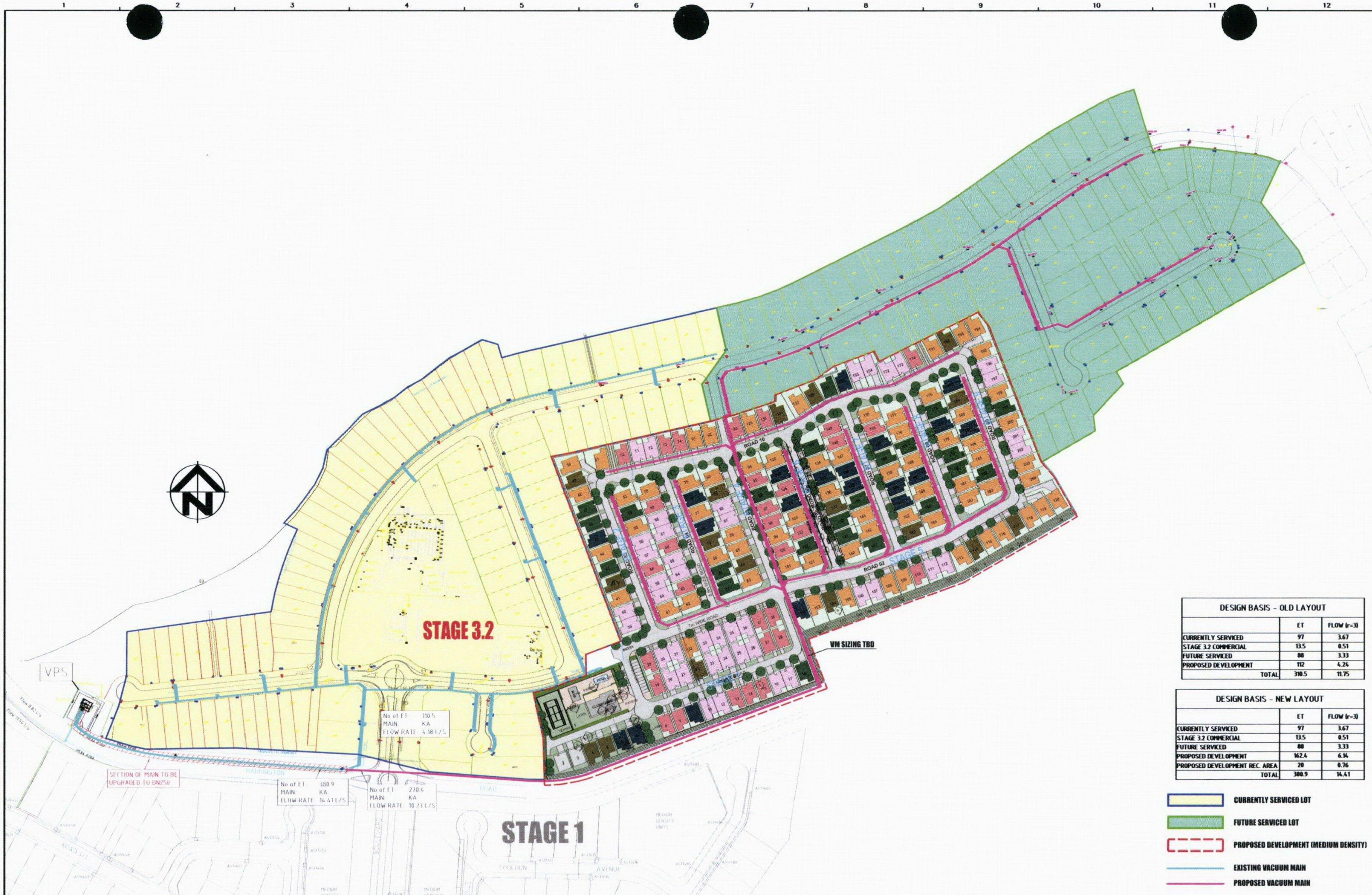
Flovac Schematics



DESIGN BASIS - OLD LAYOUT		
	ET	FLOW (r=3)
CURRENTLY SERVICED	97	3.67
STAGE 3.2 COMMERCIAL	13.5	0.51
FUTURE SERVICED	88	3.33
PROPOSED DEVELOPMENT	112	4.24
TOTAL	310.5	11.75

DESIGN BASIS - NEW LAYOUT		
	ET	FLOW (r=3)
CURRENTLY SERVICED	97	3.67
STAGE 3.2 COMMERCIAL	13.5	0.51
FUTURE SERVICED	88	3.33
PROPOSED DEVELOPMENT	162.4	6.14
PROPOSED DEVELOPMENT REC. AREA	20	0.76
TOTAL	380.9	14.41

CURRENTLY SERVICED LOT
FUTURE SERVICED LOT
PROPOSED DEVELOPMENT (MEDIUM DENSITY)
EXISTING VACUUM MAIN
PROPOSED VACUUM MAIN

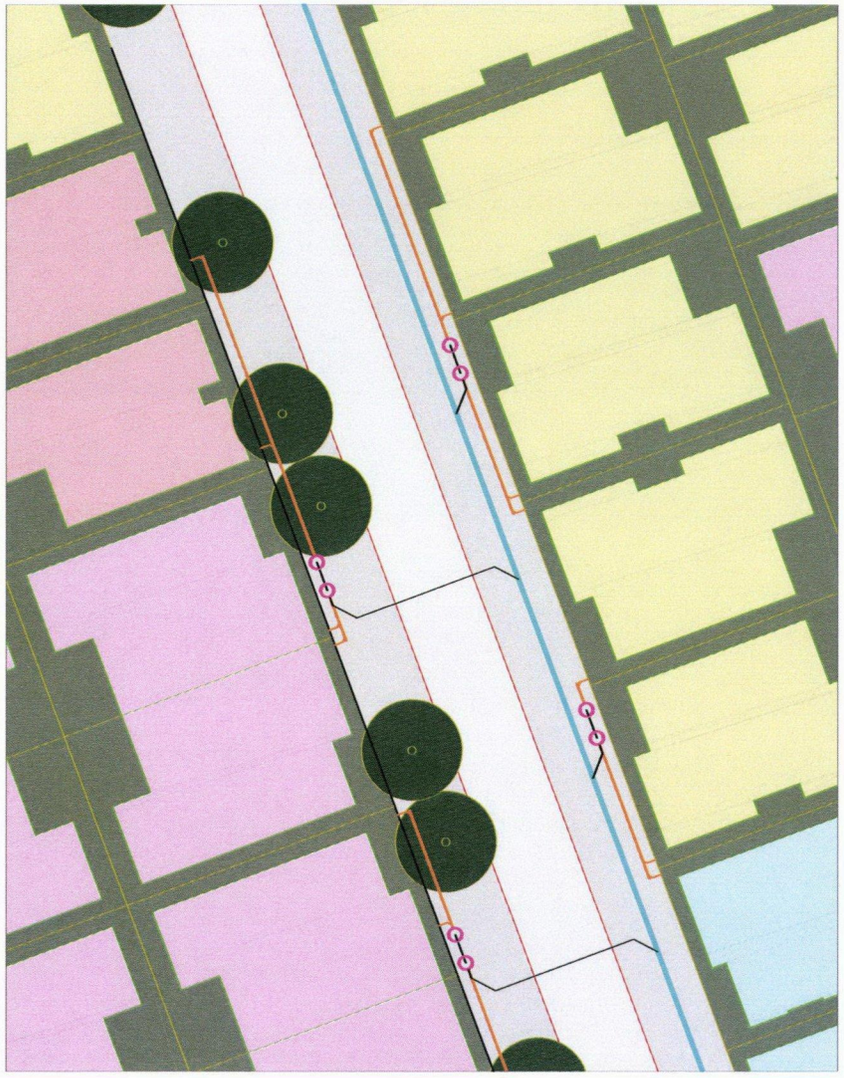
ISSUE	DATE	GRID	REVISION	DRN	REC	APPD

DESIGN SURVEY: NONE
VERTICAL DATUM: NONE
COORDINATE SYS: NONE
ASCON SURVEY: NONE
DES REF
DES CALC
DES CHD
DRN
Q.C. CHD
NORTH POINT
CLIENT: ROCHE GROUP

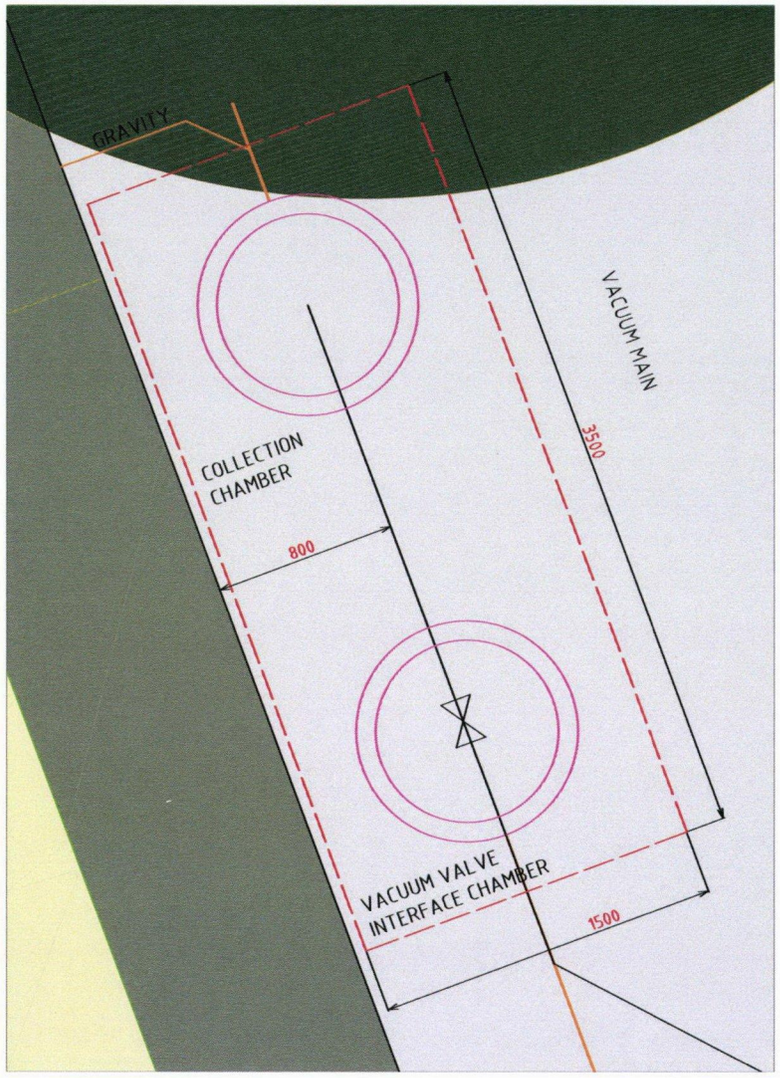
VACUUM SEWERAGE SPECIALIST: FLOVAC SYSTEMS
FLOVAC VACUUM SEWERAGE SYSTEMS PTY LTD

HARRINGTON WATERS
NORTH-EAST CATCHMENT
PROPOSED LAYOUT

FILE
PROJECT
DRAWING NO.: HAR-DES-100-001
ISSUE: D
ORIGINAL SHEET SIZE: A1
SCALE



VACUUM COLLECTION
CHAMBER TYPICAL LAYOUT



VACUUM COLLECTION
CHAMBER ALIGNMENT

ISSUE	DATE	GRD	REVISION	DRN	REC	APPD

DESIGN SURVEY NONE | VERTICAL DATUM NONE | DES CALC
COORDINATE SYS NONE | DES CHD
ASCON SURVEY NONE | DES REF | DRN | Q.C. CHD

NORTH POINT

CLIENT: ROCHE

VACUUM SEWERAGE SPECIALIST: FLOVAC SYSTEMS
FLOVAC VACUUM SEWERAGE SYSTEMS PTY LTD

HARRINGTON WATERS
NORTH-EAST CATCHMENT
VACUUM SEWERAGE ALIGNMENT DETAILS

FILE
PROJECT
DRAWING NO.: HAR-DES-C[illegible]02
ISSUE: C
SCALE
ORIGINAL SHEET SIZE: A1

566
810

Density Increase Site

LEGEND

HOUSING LEGEND

TYPE	No.	
A - SINGLE STOREY 3 BEDROOM	66	63%
B - SINGLE STOREY 3 BEDROOM	23	
C - SINGLE STOREY 3 BEDROOM	17	
D - SINGLE STOREY 3 BEDROOM	20	
E - SINGLE STOREY 2 BEDROOM DUPLEX	42	21%
F - SINGLE STOREY 2 BEDROOM	31	15%
CUSTOM - SINGLE STOREY 2 BEDROOM	2	1%
TOTAL	203	

PROPOSED STREET TREE/ CLUBHOUSE TREES

BOTANICAL NAME	COMMON NAME
Elaeocarpas eumundi	Quondong
Trisaniopsis 'luscious'	Water Gum
Cupaniopsis anarcardioides	Tuckeroo
Syzygium australe	Brush Cherry

- GENERAL GARDEN BED PLANTING
- WATER QUALITY CONTROL VEGETATION
- TURF
- PAVED AREA
- HEDGE PLANTING
- RETAINING WALL
- FEATURE WALL
- MAIN PEDESTRIAN PATH CONNECTION
- EXISTING SEWER
- EXISTING STORMWATER
- SITE BOUNDARY

DA SUBMISSION

KING + CAMPBELL

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REV	DATE	DESCRIPTION	BY
A	27.04.17	ISSUE FOR INFORMATION	AS
B	16.05.17	MASTERPLAN HOUSE TYPES UPDATED	AS
C	29.05.17	MASTERPLAN UPDATED	AS
D	09.06.17	MASTERPLAN & HOUSE TYPES UPDATED	AS
E	26.06.17	CLUBHOUSE UPDATED	AS
F	13.07.17	MASTERPLAN UPDATED - LOTS ADDED	AS
G	24.07.17	TYPICAL SERVICES PLAN & SECTION ADDED	AS
H	25.07.17	SEWER NOTES AMENDED	AS
J	26.07.17	ISSUE FOR INFORMATION	AS
K	01.08.17	DA SUBMISSION	AS
L	12.09.17	AMENDED LOT NUMBERS	AS

DATUM: AHD
SCALE: 1:1000@A1 (1:2000@A3)
0 10 20 30 40 50m
SCALE: 1:1000 @ A1

NOMINATED ARCHITECT: NSW ARB No 7525 QLD ARB No 3497

PROJECT NO:	5801
DA NO:	TBA
DESIGNED BY:	NS/AS
DRAWN BY:	NS/AS
CHECKED BY:	NS
DATE CREATED:	03/17

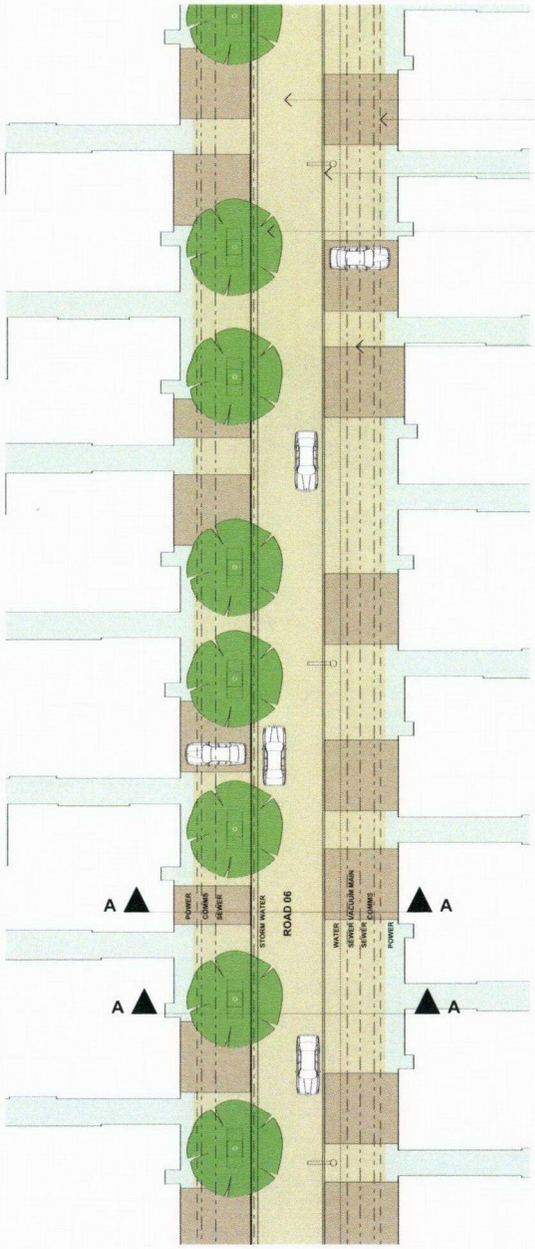
DRAWING TITLE: SITE MASTERPLAN — A1

PROJECT: PT LOT 3115 DP 1233800
HARRINGTON WATERS ESTATE, BOAMBEE STREET, HARRINGTON NSW

CLIENT: ROCHE GROUP PTY LTD

DRAWING NO:	SHEET	REVISION
5801 _DA0.1_ L	2	L

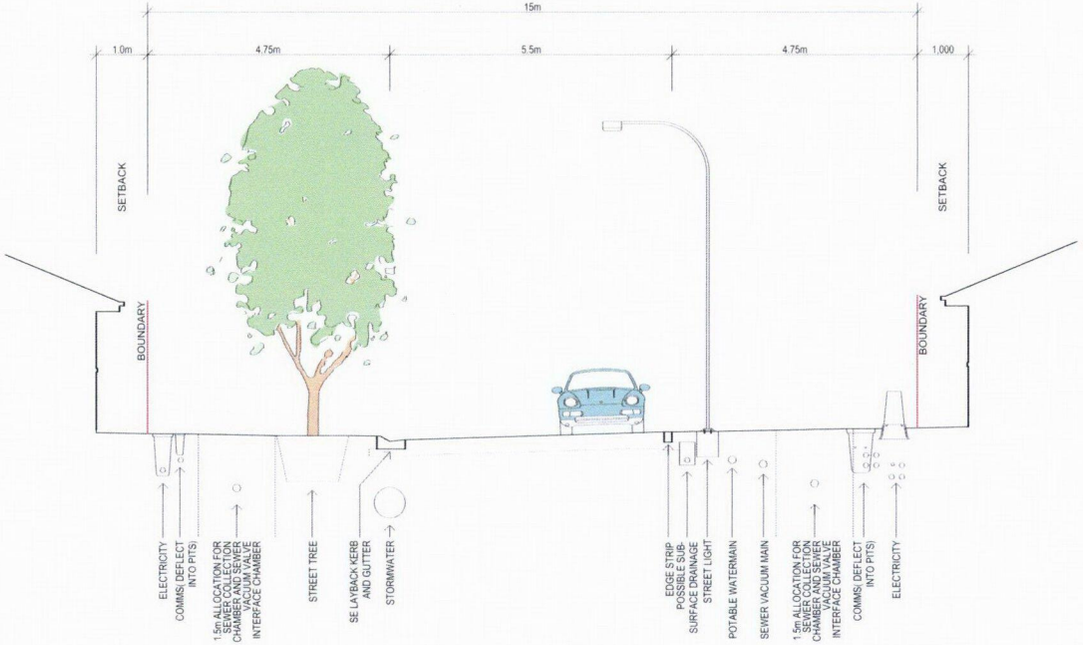
Service Corridors



BOTANICAL NAME	COMMON NAME
Elaeocarpas eumundii	Quondong
Trisaniopsis 'luscious'	Water Gum
Cupaniopsis anarcardioides	Tuckeroo
Syzygium australe	Brush Cherry

TYPICAL SERVICES STREET PLAN

SCALE 1:200 @ A1



TYPICAL SERVICES STREET SECTION AA

SCALE 1:50 @ A1

DA SUBMISSION

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E: info@kingcampbell.com.au

REV	DATE	DESCRIPTION	BY
A	27.04.17	ISSUE FOR INFORMATION	AS
B	16.05.17	MASTERPLAN HOUSE TYPES UPDATED	AS
C	29.05.17	MASTERPLAN UPDATED	AS
D	09.06.17	MASTERPLAN & HOUSE TYPES UPDATED	AS
E	26.06.17	CLUBHOUSE UPDATED	
F	13.07.17	MASTERPLAN UPDATED - LOTS ADDED	
G	24.07.17	TYPICAL SERVICES PLAN & SECTION ADDED	
H	25.07.17	SEWER NOTES AMENDED	
J	26.07.17	ISSUE FOR INFORMATION	
K	01.08.17	DA SUBMISSION	

DATUM AHD SCALE @A1

NOMINATED ARCHITECT: NIGEL SWIFT - NSW ARB No 7925 QLD ARB No 3997

PROJECT NO:	5801
DA NO:	TBA
DESIGNED BY:	NS/AS
DRAWN BY:	NS/AS
CHECKED BY:	NS
DATE CREATED:	03/17

DRAWING TITLE: TYPICAL SERVICES LAYOUT

A1

PROJECT: PT LOT 2 DP1230485
HARRINGTON RD, HARRINGTON WATERS ESTATE, HARRINGTON NSW

CLIENT: ROCHE GROUP PTY LTD

DRAWING NO:	SHEET	REVISION
5801 _DA0.3_ J	4	J

Site Staging

DA SUBMISSION

KING + CAMPBELL

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REV	DATE	DESCRIPTION	BY
A	09.06.17	ISSUE FOR INFORMATION	KD
B	13.09.17	ISSUE FOR DA	AS

DATUM: AHD SCALE: 1:1000@A1

SCALE 1:1000 @ A1

NOMINATED ARCHITECT: NEALL SHAFT - NSW REG No 7025 QLD ARB No. 3457

PROJECT NO:	5801
DA NO:	TBA
DESIGNED BY:	KD
DRAWN BY:	KD
CHECKED BY:	TS
DATE CREATED:	09/08

DRAWING TITLE: EXHIBIT 5 - STAGING PLAN

A1

PROJECT: PT LOT 3115 DP 1233800
HARRINGTON WATERS ESTATE, BOAMBEE STREET, HARRINGTON N

CLIENT: ROCHE GROUP PTY LTD

DRAWING NO	SHEET	REVISION
5801 _DA8.5_ B	22	B