Appendix B

Engineering Calculations

ENGINEERING CALCULATIONS

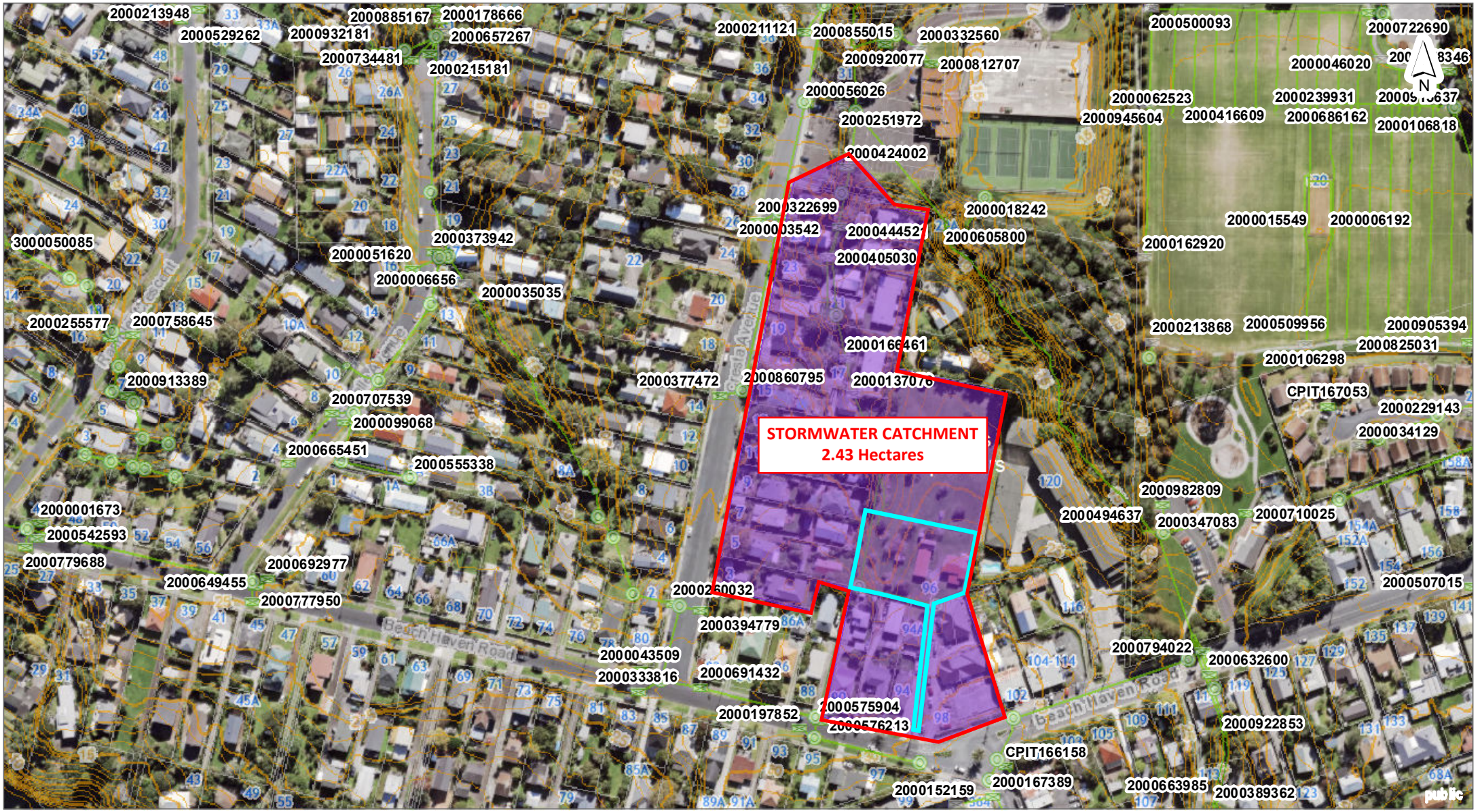
STORMWATER CAPACITY CHECK

Location: 96 Beach Haven Road/13 Cresta Avenue, Beach Haven

Client	**Bentley Studios Ltd.**
Job No	200626/01
Date	15/09/2021
Design Engineer	Natalie Naidoo
Contact Phone	(09) 534 6523
Email	natalien@aireys.co.nz

Job no. 200626/01
96 Beach Haven Road/13 Cresta Avenue
Bentley Studios Ltd.

PIPE FLOW CALCULATIONS					REFERENCE
Existing 400Ø SW line (2000585602)					
Overland Flow Rate		**Q = 2.78 C i A**			*Rational Formula*
Storm Scenario		**10%**	AEP		
Coefficent of Runoff	C	**0.65**			
Rainfall Intensity	i	**110.0**	mm/hr		
Area of Runoff	A	**2.43180**	ha		
Overland Runoff Rate	**Q**	**483**	**L/s**		
Design Capacity		$V_d = {}^1/n\ R^{2/3}\ S^{1/2}$			*Manning's Formula*
Pipe Material		**PE**			
ID Pipe Size		**400.0**	mm		
Pipe Grade	S	**7.00%**			
Number of Barrels		**1**			
Manning's n	n	0.011			
Pipe Design Flow	**Q_d**	**651.2**	**l/s**	**OK**	
Pipe Flow Charateristics					
Flow Ratio	q/Q	0.74			
Approx Depth Ratio	d/D	0.66			
Approx Velocity Ratio	v/V	1.10			
Approx Pipe Flow Velocity	**V**	**5.70**	**m/s**	**NG**	



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Ø400 SW Drain Catchment

0 10 20 30
Meters

Scale @ A4
= 1:2,500

Date Printed:
15/09/2021

Auckland Council
Te Kaunihera o Tāmaki Makaurau

ENGINEERING CALCULATIONS

WASTEWATER CAPACITY CHECK

Location: 96 Beach Haven Road/13 Cresta Avenue, Beach Haven

Client	**Bentley Studios Ltd.**
Job No	200626/01
Date	15/09/2021
Design Engineer	Natalie Naidoo
Contact Phone	(09) 534 6523
Email	natalien@aireys.co.nz

AIREY CONSULTANTS LTD. Consulting Civil and Structural Engineers Botany Takapuna Queenstown	Client: Da Silva Builders	
	Job: 96 Beach Haven Road Beach Haven	Job No: 200626-01
	Calc's By: NN Phone: Checked: MTW (09)534-6523	Date: 23/03/2021

Watercare Code of Practice Wastewater Flow Calculations

Enter Values

Result Cells

1. Occupany Allowance

EXTG Downstream 150mmØ WW pipe (ID 938052)

Number of dwellings	=	372 *(incl. future development)*
Watercare Design Occupancy (per dwelling)	=	3
Total occupancy for design purposes	=	1116

2. Residential Wastewater Flows

Peak Design Flow (PWWF) (Litres/Person/Day)	=	1206
Self-Cleansing Design Flow (Litres/Person/Day)	=	540
Residential Wastewater Design Flow (Litres/sec)	=	15.58
Self-Cleansing Design Flow (Litres/sec)	=	6.98

3. Commercial, Industrial or CBD Wastewater Design Flows

Design Flow (Litres/day/sqm)	=	Table 5.1 Watercare CoP
Commercial Floor Area (m²)	=	0
Commercial Peak Design Flow (Litres/sec)	=	0.00
Commercial Self-Cleansing Design Flow (Litres/sec)		0.00
Total Wastewater Design Flow (Litres/sec)	=	15.58

PIPE CAPACITY FORMULA

Colebrook-White $V=-2\sqrt{(2gDS)}\log(ks/3.7D+2.51u/(D\sqrt{(2gDS)}))$

u= 1.141 $x10^{6}$ kinematic viscosity of fluid (water at 15 degrees)

k_s= 1.5 mm (effective roughness)

D= diameter

S= hydraulic gradient

R= d/4 (circ. pipes)

Q= VA

Pipe Grade S(%)	Pipe Dia D (mm)	Pipe Vel'y (m/s)	PIPE CAP'Y (l/s)	DESIGN FLOW (l/s)
3.2	150	1.57	**27.7**	**15.58**

0.75m/s self cleansing velocity (gravity system)

Notes: Max velocity PWWF 3.0m/s

1) 150mm diameter pipe has sufficient capacity to cater for the proposed development including future development.

AIREY CONSULTANTS LTD. Consulting Civil and Structural Engineers Botany Takapuna Queenstown	Client: Bentley Studios Limited	
	Job: 96 Beach Haven Road/13 Cresta Avenue Beach Haven	Job No: 200626-01
	Calc's By: NN Phone: Checked: MTW (09)534-6523	Date: 23/03/2021

Watercare Code of Practice Wastewater Flow Calculations

Enter Values

Result Cells

1. Occupany Allowance

EXTG Downstream 300mmØ WW pipe (ID 938052)

Number of dwellings	=	2600 *(incl. future development)*
Watercare Design Occupancy (per dwelling)	=	3
Total occupancy for design purposes	=	7800

2. Residential Wastewater Flows

Peak Design Flow (PWWF) (Litres/Person/Day)	=	1206
Self-Cleansing Design Flow (Litres/Person/Day)	=	540
Residential Wastewater Design Flow (Litres/sec)	=	108.88
Self-Cleansing Design Flow (Litres/sec)	=	48.75

3. Commercial, Industrial or CBD Wastewater Design Flows

Design Flow (Litres/day/sqm)	=	Table 5.1 Watercare CoP
Commercial Floor Area (m²)	=	0
Commercial Peak Design Flow (Litres/sec)	=	0.00
Commercial Self-Cleansing Design Flow (Litres/sec)		0.00
Total Wastewater Design Flow (Litres/sec)	=	108.88

PIPE CAPACITY FORMULA

Colebrook-White $V=-2\sqrt{(2gDS)}\log(k_s/3.7D+2.51u/(D\sqrt{(2gDS)}))$

u= 1.141 x10^6 kinematic viscosity of fluid (water at 15 degrees)

k_s= 0.6 mm (effective roughness)

D= diameter

S= hydraulic gradient

R= d/4 (circ. pipes)

Q= VA

Pipe Grade S(%)	Pipe Dia D (mm)	Pipe Vel'y (m/s)	PIPE CAP'Y (l/s)	DESIGN FLOW (l/s)
1	300	1.57	111.0	108.88

0.75m/s self cleansing velocity (gravity system)

Max velocity PWWF 3.0m/s

Notes:

1) 300mm diameter pipe has sufficient capacity to cater for the proposed development including future development.

AIREY CONSULTANTS LTD. Consulting Civil and Structural Engineers Botany Takapuna Queenstown	Client: Bentley Studios Limited		
	Job: 96 Beach Haven Road/13 Cresta Avenue Beach Haven		Job No: 200626-01
	Calc's By: NN Checked: MTW	Phone: (09)534-6523	Date: 23/03/2021

Watercare Code of Practice Wastewater Flow Calculations

Enter Values

Result Cells

1. Occupany Allowance

EXTG Downstream 300mmØ WW pipe (ID 938052)

Number of dwellings	=	272	*(existing development)*
Watercare Design Occupancy (per dwelling)	=	3	
Total occupancy for design purposes	=	816	

2. Residential Wastewater Flows

Peak Design Flow (PWWF) (Litres/Person/Day)	=	1206	
Self-Cleansing Design Flow (Litres/Person/Day)	=	540	
Residential Wastewater Design Flow (Litres/sec)	=	11.39	
Self-Cleansing Design Flow (Litres/sec)	=	5.10	

3. Commercial, Industrial or CBD Wastewater Design Flows

Design Flow (Litres/day/sqm)	=		Table 5.1 Watercare CoP
Commercial Floor Area (m²)	=	0	
Commercial Peak Design Flow (Litres/sec)	=	0.00	
Commercial Self-Cleansing Design Flow (Litres/sec)		0.00	
Total Wastewater Design Flow (Litres/sec)	=	11.39	

PIPE CAPACITY FORMULA

Colebrook-White $V=-2\sqrt{(2gDS)}\log(k_s/3.7D+2.51u/(D\sqrt{(2gDS)}))$

u= 1.141 $x10^6$ kinematic viscosity of fluid (water at 15 degrees)

k_s= 1.5 mm (effective roughness)

D= diameter

S= hydraulic gradient

R= d/4 (circ. pipes)

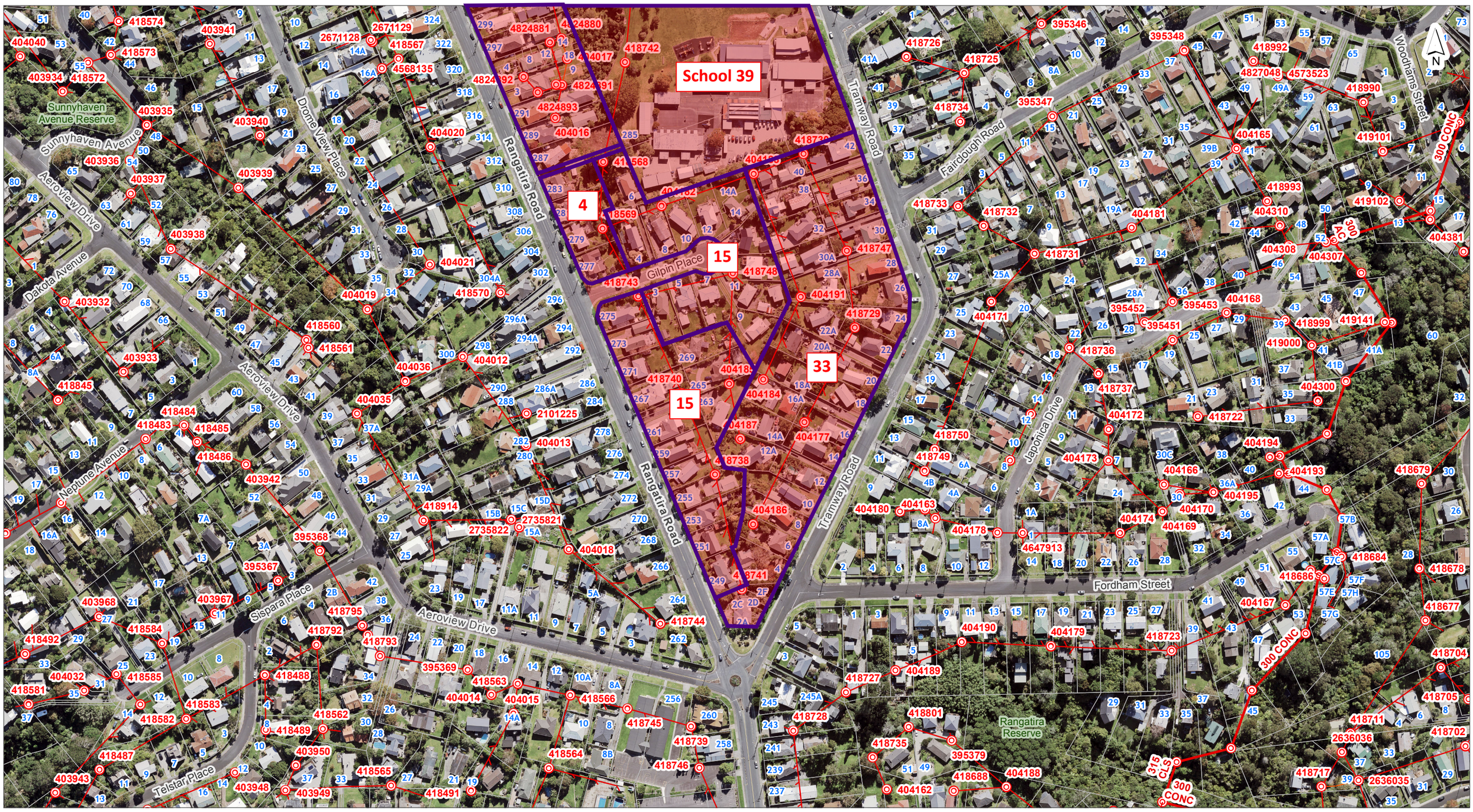
Q= VA

Pipe Grade S(%)	Pipe Dia D (mm)	Pipe Vel'y (m/s)	PIPE CAP'Y (l/s)	DESIGN FLOW (l/s)
3.2	150	1.57	**27.7**	**11.39**

0.75m/s self cleansing velocity (gravity system)

Notes: Max velocity PWWF 3.0m/s

1) 150mm diameter pipe has sufficient capacity to cater for the proposed development including future development.



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Height datum: Auckland 1946.

96 Beach Haven Road

Catchment Analysis - 150mm diameter line

0 25 50 75
Meters

Scale @ A3
= 1:2,500

Date Printed:
4/02/2021

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