



WASTEWATER HYDRAULIC MODEL REPORT

Mt Welcome

DOCUMENT CONTROL RECORD

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1.0 INTRODUCTION

1.1 BACKGROUND

The proposed development is located south of Pukerua Bay, within the Porirua Northern Growth Area. This land was rezoned as part of Council-led Plan Variation 1 to Plan Change 19 (PC19), which was notified in 2022 and is now operative.

This report addresses the wastewater modelling options and staging that could be utilised to service the Mt Welcome development within the Northern Growth Area (NGA). This report should be read together with the infrastructure report (R001v3-1753-02) to understand the proposed development scope.

Sections 2 to 6 report the modelling on the network model provided by WWL in May 2024. In August 2026, Tiaki Wai provided an updated model that includes the engineered overflow at Pump Station 13 (PS13) in Plimmerton, which the earlier model did not represent. This changes how overflows downstream of Mt Welcome are reported.

An initial model run has been completed to allow the first 200 lots to proceed while Tiaki Wai completes its wastewater network model and reports, which are currently in draft. A consent condition is proposed so that, at 200 lots, the full development is re-run on the final model using agreed parameters. It was generally agreed that a solution exists, combining storage with targeted upgrades to the bulk main. Because Tiaki Wai's modelling and report are still in draft, we propose to finalise that solution during engineering approvals once they are finalised. Section 7 sets out the initial development modelling for the first 200 lots.

1.2 LOCATION

The site is located at 422, 422A and 422B State Highway 59, Pukerua Bay, and encompasses a total area of 205.60 hectares. It formally comprises the following land parcels:

- Part Lot 1 DP 89102 (4.38 ha)
- Lot 2 DP 891020 (5.64 ha)
- Lot 1 DP 534864 (55.33 ha)
- Lot 2 DP 534864 (140.25 ha)
- Lot 1 DP 608433, Lot 1000 DP 608433 (34 Muri Road)
- Road Reserve (SH59 Corridor)

References to “the site” within this report refer collectively to all seven allotments, unless stated otherwise.

The site is situated in a rural area south of Pukerua Bay and north of Plimmerton, within the Porirua City boundaries in the Wellington region. It is bounded by State Highway 59 to the west and three adjoining land blocks to the north, east, and south.



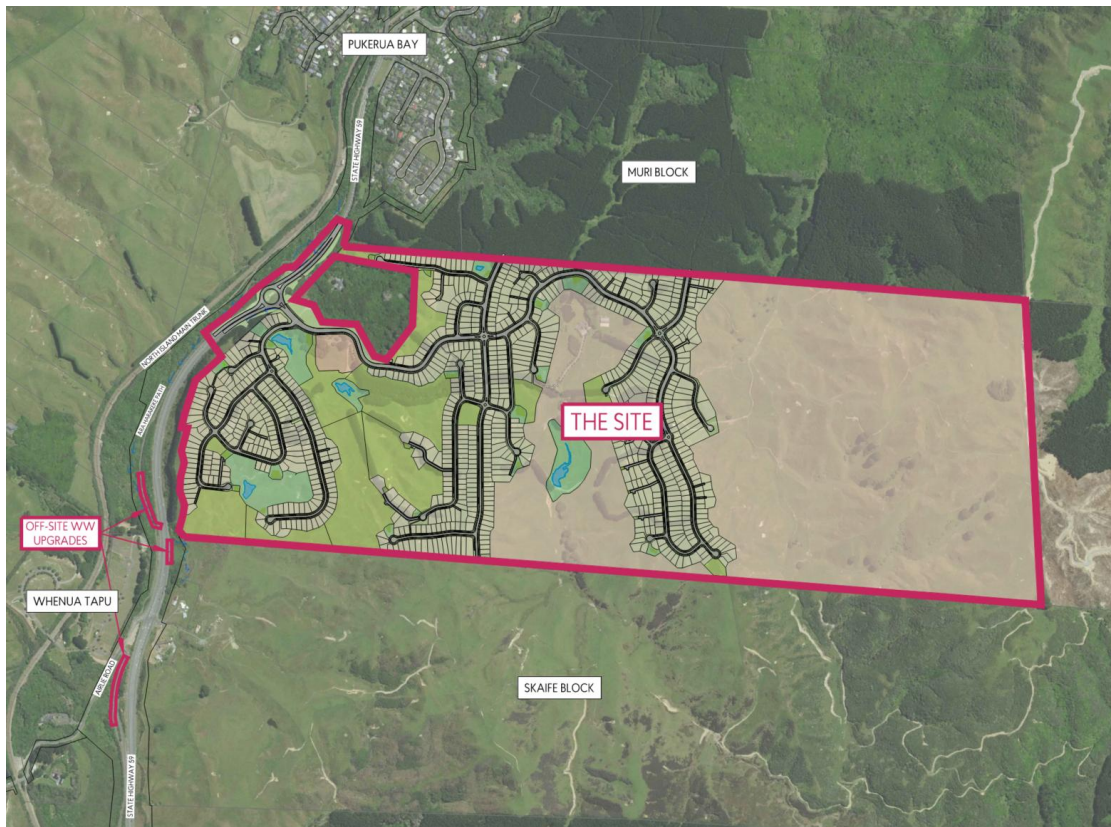


Figure 1. Site Extents Plan – Entire Site.

1.3 PROPOSED DEVELOPMENT

The proposed development comprises 949 residential allotments ranging in size from 316m² to 2,386m², enabling the construction of 949 future dwellings with an average lot size of around 523m². The development also includes a commercial centre to serve the new local community, together with associated three-waters infrastructure (wastewater, including storage facilities; stormwater management systems; and water reticulation), roading, and a connected network of pedestrian and cycling trails.

2.0 METHODOLOGY

2.1 WASTEWATER MODEL

A Porirua City Council (PCC) wastewater hydraulic model has been developed by Wellington Water Limited (WWL), now Tiaki Wai. This calibrated model was provided by WWL in May 2024, and it was used to assess effects of the proposed development on the downstream network, identify constraints and develop mitigation and upgrade options within the network. This allowed us to assess the wastewater network capacity, network performance, and proposed pump station storage requirements for the proposed development. With the model results it is possible to identify system constraints and confirm the upgrades required to service the development.

This model has the following features:

- Software and Version: Infoworks ICM 2024.5
- Extent: The model considered all the catchments associated with the Porirua City wastewater treatment plant (WTP).
- Network scenarios: The following scenarios were included in the System Performance network:
 - Base. Built with 2018 information.
 - Forecasting scenarios for an existing 2033 and 2068 population.
- The model considered long-term rainfall scenarios for the dry (DWF) and wet weather flows (WWF) as follows.



- DWF: Seven days starting the 08 Jan 2006. No rain in this period
- WWF: Three days of rainfall starting the 04 April 2017. Total model simulation 7 days.

For more detailed information about the hydraulic model, refer to the following documents:

- Cannons Creek and Porirua Long-Term Flow Monitoring - Model Calibration Report. By Wellington Water Limited. August 2018.
- System performance assessment – Porirua Wastewater Network. By Stantec for Wellington Water Limited. December 2018.

This model does not represent the engineered overflow at PS13. Tiaki Wai's updated model (Section 7.2).

2.2 CUT-OFF MODEL

For this project assessment, the model was cut off to just consider the network upstream of the existing public pump station 07 (model ID S070000). It was decided to reduce the extent of the model to allow the level of detail to be increased in a defined area, while reducing the simulation computational time for optioneering purposes. The final model extent is seen in Figure 2 below.

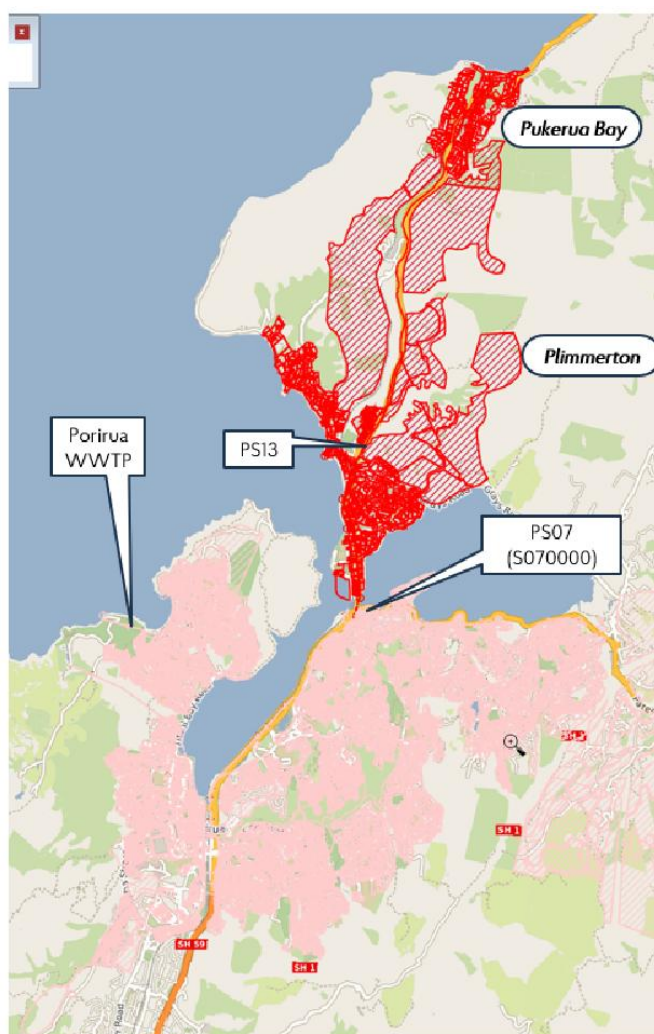


Figure 2. Cut off model extent.



3.0 MODEL DEVELOPMENT

3.1 OPERATION

Table 1 summarises the updates made to several pump stations relevant to the project. These changes reflect refinements to the model inputs and operational settings based on the latest information. Some parameters have been updated following correspondence with WWL, as referenced in Appendix 5.

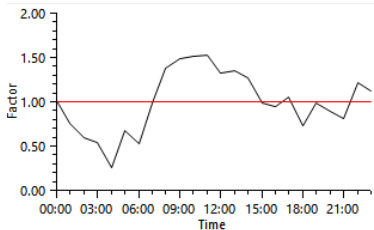
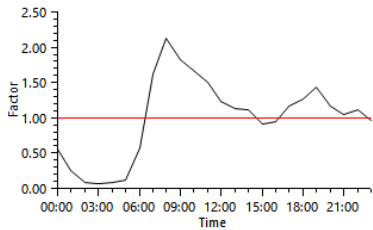
Table 1. Model Update – Operational Updates.

	Provided Model	Updated Model
Muri Road Pump Station PS-30 Asset ID: WWPS230 Location: 12 Muri Road.	P1 – Duty: 3.0l/s On: 73.5mRL Off: 72.96mRL P2: 5.0l/s On: 73.8mRL Off: 72.96mRL Storage: 2.9 m ² 4m height 11.6m ³ volume approx..	P1 – Duty: 3l/s On: 73.5mRL Off: 72.96mRL P2: 5.0l/s On: 73.8mRL Off: 72.96mRL Storage: Supported by future on-site storage (Section 7.4).
Plimmerton Pump Station PS-13 Asset ID: WWPS31436 Location: 212 St Andrews Road	P1 – Duty: 30.0l/s On: -0.746mRL Off: -1.342mRL P2: 71.0l/s On: -0.546mRL Off: -1.342mRL Storage: 14.0 m ² 5m height 70.0m ³ approx..	P1 – Duty: 68.0l/s On: -0.746mRL Off: -1.342mRL Storage: No changes * Changes suggested by WWL (Manu Ward).
Paremata Pump Station PS-08 Asset ID: WWPS31410 Location: 106 St Andrews Road	P1 – Duty: 50.0l/s On: -1.319mRL Off: -1.619mRL P2: 25.0l/s On: -0.919mRL Off: -1.619mRL P3: 37.0l/s On: -0.819mRL Off: -1.619mRL Storage: 8.0m ² 4.5m height 36.0m ³ approx.	P1 – Duty: 62.0l/s On: -1.319mRL Off: -1.619mRL P2: 20.0l/s On: -0.919mRL Off: -1.619mRL Storage: No changes * Changes suggested by WWL (Manu Ward)

3.2 DRY WEATHER PARAMETERS

For the proposed draining areas, the model has been edited with the dry weather parameters shown in Table 2. Some of these values came from correspondence with WWL, see Appendix 5.

Table 2. Dry Weather Parameters.

	Provided Model	Proposed
Flow Per Capita	ID: 364055_S130201A_PLIMMERTON Flow: 177.348l/day	ID: Residential 200 Flow: 200.0l/day
Foul Profile	Peak factor: 1.53 	Peak factor: 2.12 
Population	As provided model for the scenario 2018 (Base scenario). Upstream PS30:	Mu Rd Stage 2 1750 population 500 lots Mount Welcome 3335 population 949 lots / 1 Commercial lot.



Base Flow	As provided model for the scenario 2018 (Base scenario).	Assume 0.1 l/ha for greenfield areas.
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These changes have been shared with WWL through internal correspondence.

3.3

WET WEATHER PARAMETERS

For the proposed draining areas, the model has been edited with the wet weather parameters shown in Table 3. Some of these values came from correspondence with WWL, see Appendix 5.

Table 3. Wet Weather Parameters.

	Provided Model	Proposed
ID	364055_S130201A_PLIMMERTON	RUNOFF NEW DEV
Run Off	Run Off area – Road: 0.5%	Run Off area – Road: 0.2%
	Run Off area – pavement: 0.5%	Run Off area – pavement: 0.2%
	Run Off area – permeable: 3.2%	Run Off area – permeable: 2.0%
	Run Off area – GWI: 32%	Run Off area – GWI: 20%
	<i>Based on correspondence with WWL</i>	
ID	364055_S130201A_PLIMMERTON	RUNOFF NEW DEV
Ground Infiltration	Soil depth (m)	1
	Percolation coefficient (days)	0.8
	Percolation threshold (%)	20
	Percolation percentage infiltrating (%)	5
	Baseflow coefficient (days)	0.01

The model considers an observed rainfall time series database from 00:00 on 04 April 2017 to 24:00 on 10 April 2017 (7 days). During this period, there are nearly three days of rainfall with a peak intensity of 30.54mm/hr, see Figure 3.

The model period was extended to consider some dry weather flow.



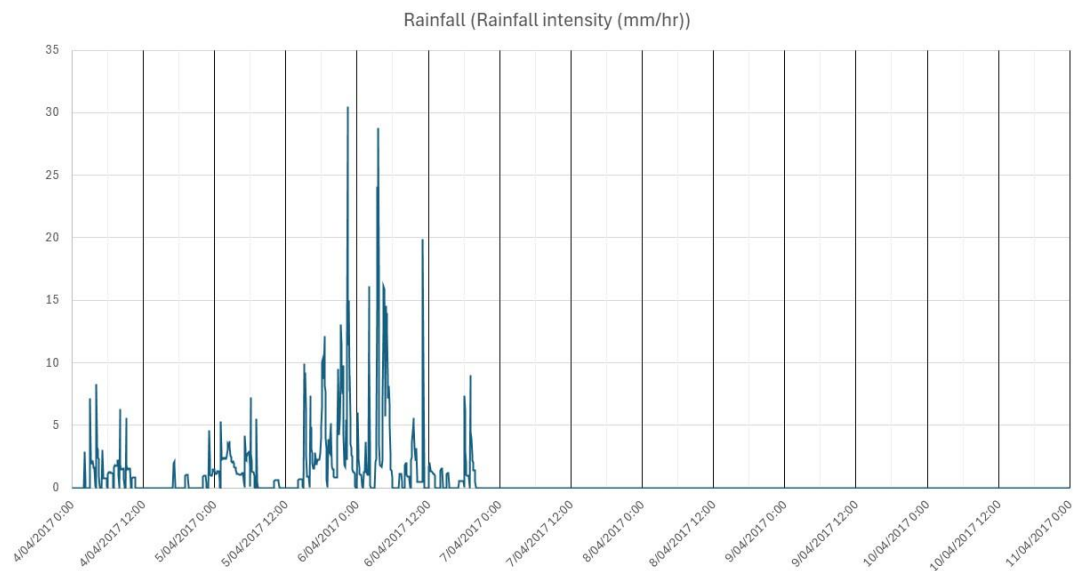


Figure 3. Wet Weather Flow – Rainfall Time Series.

3.4 NGA NETWORK SCHEME

Figure 4 shows the scheme used to evaluate the system performance of the existing public network. The level of service considered for this performance assessment corresponds to the existing scenario, the 2018 population for a WWF.



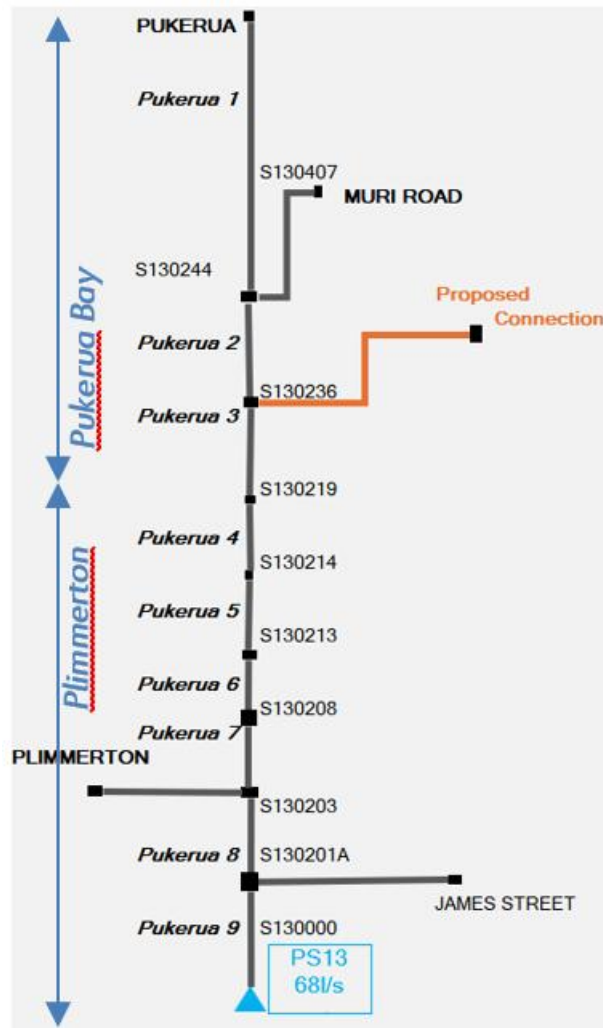


Figure 4. NGA Schema of The Provided Wastewater Model.

4.0 EXISTING SYSTEM PERFORMANCE

Model results show that in the WWF, there are no overflows, see Appendix 2 for a base stage scenario. There were branches with a lack of capacity (surcharge state = 2), and they are located mainly from Pukerua 3 to Pukerua 8. Critical branches present a surcharge state larger than 1 at the branches Pukerua 3, 4, 9 and Plimmerton. It is evident that upstream of Pump Station 13 (PS13), the network has limited spare capacity. Other critical reach is located to the east of the pump station (along James Street), outside the main trunk line conveying flows toward Pukerua Bay. Overall, the existing network performs adequately under current (2018 baseline) conditions but has very limited available capacity to accommodate additional flows from the NGA without bulk upgrades. The following items represent key constraints within the network that limit upstream flows and future development capacity:

- Reduction of pipe diameters between the branch Pukerua 4, from 315mm to 250mm, between manholes S130231 (PCC_W00792) and S130233 (PCC_WW007936).
- Low gradient values. Pukerua 4 with 0.42% and 8 with 0.325%.
- Pipe capacity reduction. See branches Muri Rd3, Pukerua 3, 4, 7 and 8.

Table 4 shows the following constraints in the existing network (highlighted in red):



Table 4. Network properties and model results for a WWF 2018 scenario.

Network Properties							Model Results – WWF 2018 (April 04 to April 10, 2017)			
BRANCH	Min Diam (mm)	Max Diam (mm)	Min Gradient %	Max Gradient %	Min Full Capacity (L/s)	Max Full Capacity (L/s)	Max. Flow (l/s)	Acum Vol (m³)	Volume lost (m³)	Max SS*
Pukerua 2	250	250	1.40	5.38	71	140	46.8	8314	0	0.6
Pukerua 3	250	315	0.429	8.22	39	208	46.0	8320	0	1
Pukerua 4	250	375	0.423	1.02	39	179	44.0	8321	0	2
Pukerua 5	375	375	0.53	0.53	129	129	43.5	8313	0	0.4
Pukerua 6	375	375	0.52	1.00	128	177	43.5	8313	0	0.4
Pukerua 7	375	375	0.45	0.51	119	127	43.4	8316	0	0.49
Pukerua 8	375	375	0.325	0.425	101	115	55.2	9575	0	0.53
Pukerua 9	375	375	0.72	15.81	151	706	60.6	10258	0	1
Plimmerton	150	150	0.33	5.20	9	35	12.0	1258	0	2
James St	150	150	0.32	31.76	9	88	7.3	683	0	0.74

(*) *Surcharge State. 1 = Surcharge by depth (by backflow). 2 = surcharge by flow (by capacity)*

The model used for this assessment did not represent the PS13 engineered overflow, so no spill was reported there. On Tiaki Wai's updated model, the PS13 engineered overflow spills under the 2016 base scenario in the 2-year ARI design storm (Section 7.6). The existing network therefore has less spare capacity at PS13 than this section indicates.

5.0 PROPOSED NETWORK DESIGN

5.1 PROPOSED NETWORK

Given the undulating topography, the wastewater network has been designed as a predominantly gravity-based system, supported by six pump stations and several localised low-pressure areas. The catchments contributing to each pump station are illustrated in Figure 5. A detailed description of the proposed network layout is provided in the Civil Infrastructure Report (R001v3-1753-02).

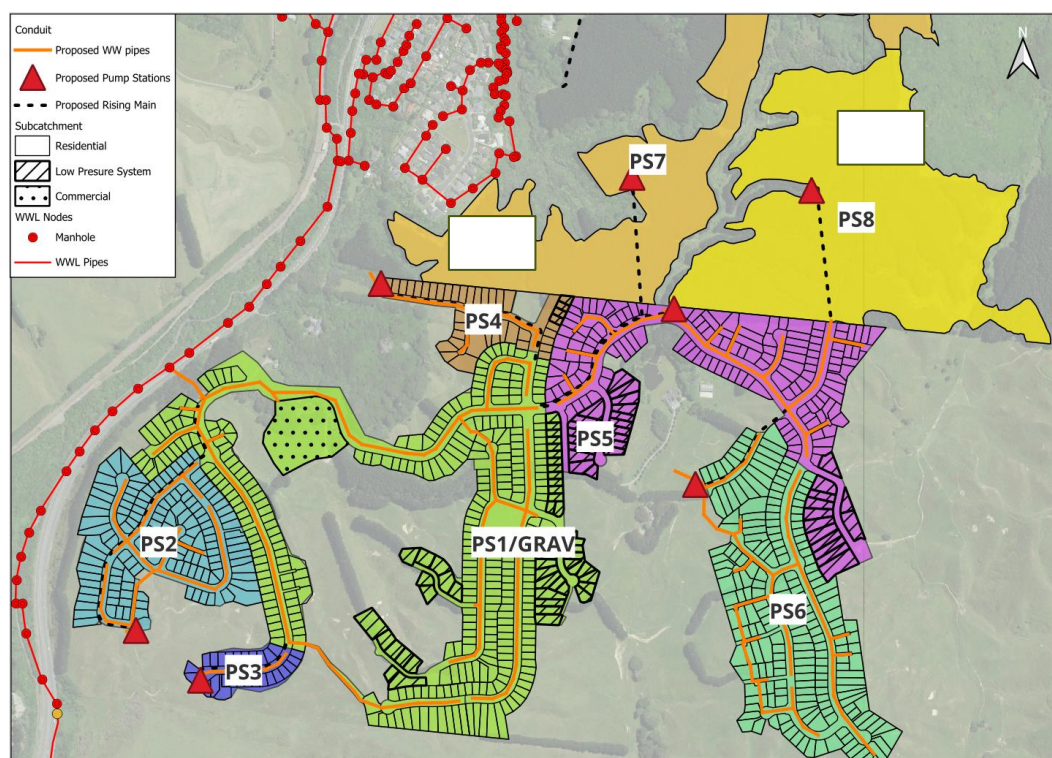


Figure 5. Model catchments.



The piped network is also designed to incorporate flows from the Muri Road development and convey them through this site to the SH59 bulk main. Collaborative discussions with the Muri Road project team are progressing to establish an integrated catchment solution.

Table 5 shows the main catchment descriptions for the wastewater design.

Table 5. Wastewater Catchment Description.

Asset ID	Gravity Area (ha)	Pressure Area (ha)	Gravity Lots	Pressure Lots	Yield (lots)	Population	Gravity Area (ha)
WWPS - 1	22.55	3.43	324	50	374	1309	22.55
WWPS - 2	8.90	0	136	0	136	476	8.90
WWPS - 3	1.71	0	27	0	27	94.5	1.71
WWPS - 4	3.03	0.15	38	4	42	147	3.03
WWPS - 5	10.83	3.16	139	32	171	598.5	10.83
WWPS - 6	13.83	0	203	0	203	710.5	13.83
WWPS - 7 Muri Rd West	15.25	0	250.0	0	250	875	15.25

5.2 MODELLED NETWORK

Table 6 summarises the wastewater network configuration adopted for the simulation. The proposed development ultimately discharges to the existing manhole PCC_WW007923 (model ID S130236), as shown in Figure 6.

In the model, low-pressure lots are assumed to discharge directly into the final gravity manhole, and no infiltration flow has been applied to these catchments.

Table 6. Modelled Network.

Nodes Total	232
Manholes	217
Storage	7
Outfall	8
Pipes	222
Orifice Fixed	2
Pump Fixed	8
Pipe Length (m)	9000
Pipe Size (mm)	150 - 300
Length 300mm	74m
Length 225mm	1565m
Length 150mm	7361m
Catchments	956
Catchments Contributing Area (ha)	82.76
Catchments Population Count	5086



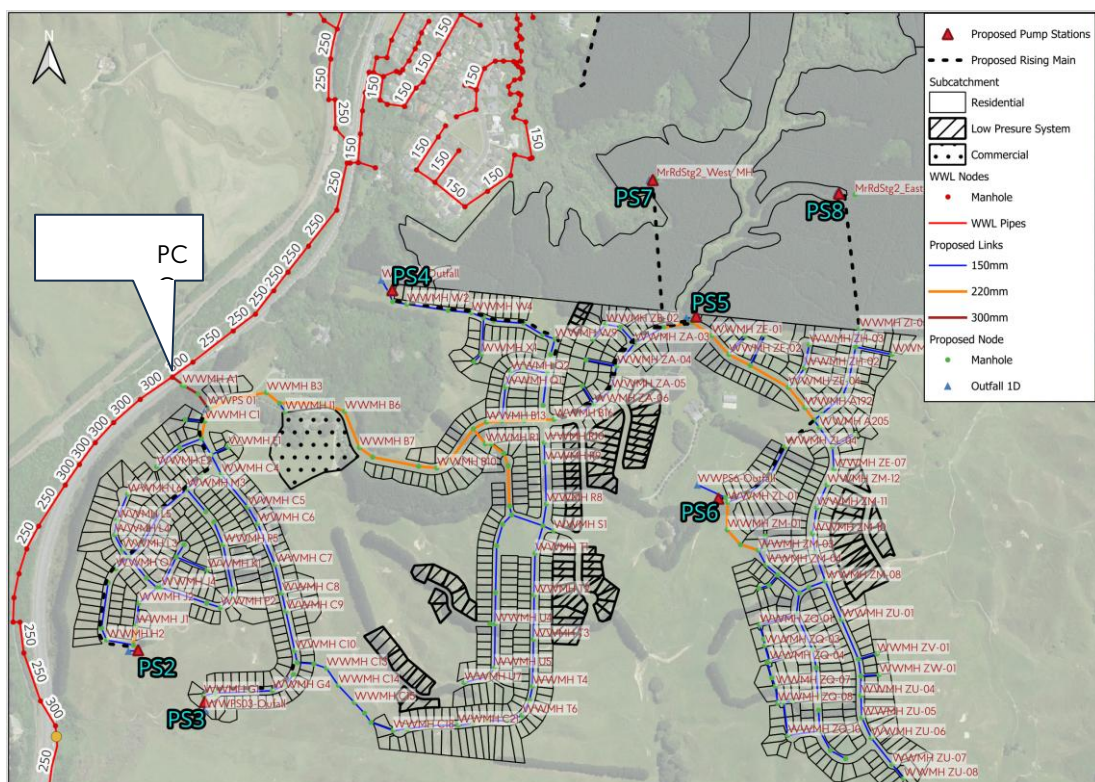


Figure 6. Proposed Wastewater Network.

5.3

PUMP AND STORAGE

Six wastewater pump stations are proposed across the Mt Welcome site. Five pump stations (PS2 to PS6) are designed solely to convey wastewater from local low points where gravity discharge is not achievable. Two pump stations (PS7 and PS8) were designed for the Muri East and West development, respectively. PS5 receives accumulated volume from other pump stations; from this, an accumulated ADWF has been included at the moment of the storage capacity. Pump Station 1 / attenuation tank (PS1) will serve as the primary peak wet-weather storage facility, providing the main attenuation function for the development prior to discharging to the existing bulk main. PS1 discharge rate will be controlled and rate-limited to align with the capacity of the downstream trunk network and the proposed bulk-main upgrades. PS1 is located within reserve Lot 1300, which can accommodate up to 1,789m³ of storage (Section 7.8). Table 7 shows the proposed pump rates and wet well storage volumes. Appendix 1 includes the design calculation tables.

Table 7. Designed Pump Stations and Storage

Asset ID	Catchment	ADWF (l/s)	Acum. ADWF (l/s)	Design Storage [8hr] (m ³)	Design Storage [12hr] (m ³)	Design Storage [20hr] (m ³)	No Pumps	Pump Rates (l/s)
WWPS - 1	Full Development	3.01	11.70	336.9	505.3	842.2	-	-
WWPS - 2	136 lots	1.09	=	31.5	47.3	78.8	1	6
WWPS - 3	27 lots	0.22	=	6.3	9.4	15.6	1	2
WWPS - 4	42 lots	0.34	=	9.7	14.6	24.3	1	2
WWPS - 5	171 lots	1.38	7.04	202.6	303.9	506.6	2	11 and 25
WWPS - 6	203 lots	1.63	=	47.1	70.6	117.7	1	7
(WWPS-7) Muri West*	250 lots	2.01	=	58.0	86.9	144.9	1	8.5
(WWPS-8) Muri East*	250 lots	2.01	=	58.0	86.9	144.9	1	8.5



5.4 MOUNT WELCOME WWF MODEL RESULTS

Appendix 2 shows a graph with the Mount Welcome model results for a level of service of WWF 2018. The model result shows that there is no overflow in the system, and the proposed network complies with the WWL specifications criteria in terms of velocity and capacity. The proposed development provides a peak discharge of approximately 56.24 L/s (14355m³ during the simulation period), servicing 1449 residential lots and a commercial area.

Table 8. Mount Welcome - WWF Model Results.

Asset ID	Max WWF (l/s)	Max. Vol (m ³)	[8hrs] Max Storage (m ³)	[12hrs] Max Storage (m ³)	[20hrs] Max Storage (m ³)
WWPS - 1	51.39	14363	-	-	-
WWPS - 2	4.2	1200	33	82	79
WWPS - 3	1.06	229	7	16	16
WWPS - 4	1.43	395	20	25	24
WWPS - 5	29.25	8991	92	322	546
WWPS - 6	6.54	1885	49	123	118
(WWPS-7) Muri West	15.6	2745	84	159	145
(WWPS-8) Muri East	16.03	2795	89	168	145

5.5 MODEL - STAGING

The proposed Mount Welcome development was divided into 25 stages of approximately 30 to 50 lots, as seen in Figure 7 and these were grouped by the addition of a new proposed pump station. Table 9 summarise the accumulated number of lots.

Table 9. Mt Welcome Staging description.

Stages	Accumulated No of Lots	Proposed Infrastructure
1-7	301	Gravity Network (GN)
8-12	472	GN + PS2
13	501	GN + PS2 + PS3
14	542	GN + PS2 + PS3 + PS4
15-18	738	GN + PS2 + PS3 + PS4 + PS5
19-23	949	GN + PS2 + PS3 + PS4 + PS5 + PS6
24	949 + Muri 1 (1199)	GN + PS1 + PS2 + PS3 + PS4 + PS5 + PS6 + PS7
25	949 + Muri 2 (1449)	GN + PS1 + PS2 + PS3 + PS4 + PS5 + PS6 + PS7 + PS8



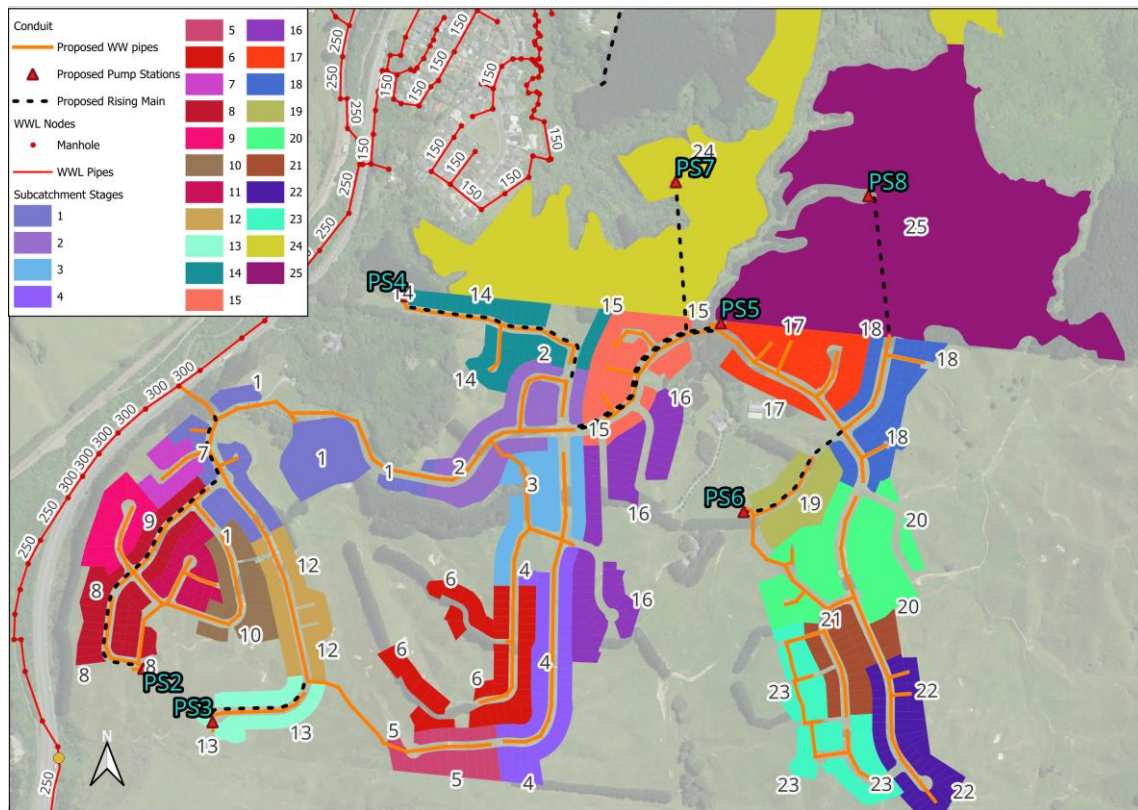


Figure 7. Mount Welcome – Stage locations

5.6 BASE STAGE - ASSUMPTIONS

The following are the main modelling assumptions for the assessment of wastewater impact:

- Population: 2018 population for all the stage scenarios around the catchment. These values were given in the provided model.
- Muri Road Development Stage 1: The development located at 34 Muri Road is not included in any of the stages. This development would discharge upstream pump station PS30, at a fixed rate of 8 L/s.
- Plimmerton Farm development: This proposed development was not included into the assessment of the bulk main, due to the unknown development programme and the development discharging lower into the catchment. Development programmes are further detailed in the Infrastructure Report,

Appendix 3 and Appendix 4. shows the model results for the base stage scenario.

5.7 STAGING MODEL RESULTS

Table 10 shows the peak flows and the accumulated volume discharged into the existing network for the 8-, 12- and 20-hours storage duration together with the overflows in Pukerua Bay (between bulk manholes S130236 and S130218) and Plimmerton (manholes between S130218 and PS13). From the model results it is possible to confirm that just with the Mount Welcome development (stages 1 to 23) there is no overflows in the existing network, as soon as Muri Road development is included, both on-site storage and bulk network upgrades become essential to accommodate additional flows.

Under the full NGA development, total overflow volumes are approximately 360m³, 562m³, and 578 m³ for the 8-, 12-, and 20-hour storage scenarios respectively, assuming no PSI attenuation or bulk upgrades. These differences arise from the way the internal pump stations at Mount Welcome discharge to the network—shorter storage durations result in more frequent pump activation, which reduces the peak load on the downstream system over time, as illustrated in Figure 8.



Table 10. Model Results WWF-2018 – Bulk network overflows.

Stage	Acum. No Lots	Proposed Infrastructure	Storage Vol. Duration	Mount Welcome Max Flow/Vol	Pukerua Bay Overflow	Plimmerton Overflow
1-12	472	Gravity network +PS2	8 hrs	15.7 l/s 4455 m ³	None	None
			12 hrs	16.0 l/s 4475 m ³		
			20 hrs	17.2 l/s 4420 m ³		
1-14	542	Gravity network +PS2 +PS3+PS4	8 hrs	19.59 l/s 5093 m ³	None	None
			12 hrs	19.3 l/s 5120 m ³		
			20 hrs	20.6 l/s 5033 m ³		
1-18	738	Gravity network +PS2+PS3+PS4+PS5	8 hrs	30.7 l/s 6854 m ³	None	None
			12 hrs	28.1 l/s 6835 m ³		
			20 hrs	27.3 l/s 6662 m ³		
1-23	949	Gravity network +PS2+PS3+PS4+PS5+PS6 <i>See Appendix 3.</i>	8 hrs	31.26 l/s 8855 m ³	None	None
			12 hrs	31.2 l/s 8831 m ³		
			20 hrs	32.0 l/s 8778 m ³		
1-24	1199	Gravity network +PS2+PS3+PS4+PS5 +PS6+PS7	8 hrs	55.9 l/s 11586 m ³	[1] S130219 (96 m ³)	None
			12 hrs	56.2 l/s 11535 m ³	[1] S130219 (74 m ³)	[3] S133404 (92 m ³), S130207 (61 m ³) and S130204 (47 m ³)
			20 hrs	54.1 l/s 11382 m ³	[1] S130219 (66 m ³)	[3] S133404 (57 m ³), S130207 (33 m ³) and S130204 (10 m ³)
1-25 FULL	1449	Gravity network +PS2+PS3+PS4+PS5 +PS6+PS7+PS8. <i>See Appendix 3 and Appendix 4 for the full development scenario.</i>	8 hrs	56.3 l/s 14355 m ³	[1] S130219 (193 m ³)	[3] S133404 (84 m ³), S130207 (49 m ³) and S130204 (34 m ³)
			12 hrs	54.4 l/s 14250 m ³	[1] S130219 (189 m ³)	[3] S133404 (192 m ³), S130207 (108 m ³) and S130204 (74 m ³)
			20 hrs	56.2 l/s 14127 m ³	[1] S130219 (187 m ³)	[3] S133404 (204 m ³), S130207 (118 m ³) and S130204 (69 m ³)



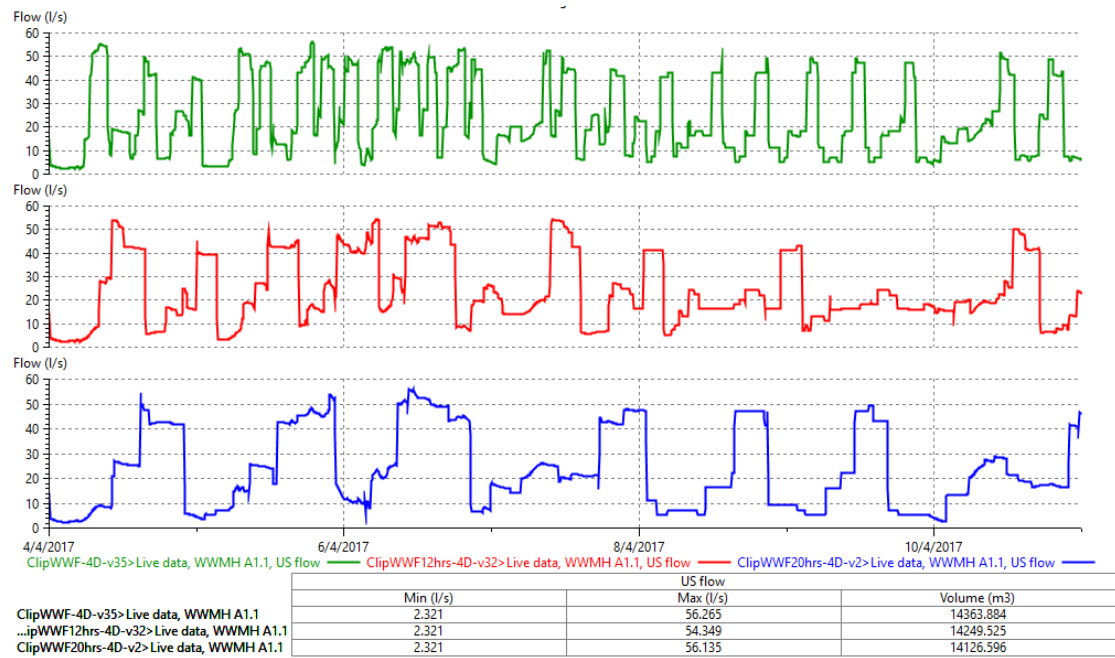


Figure 8. Mt Welcome full development discharge for different storage duration

Figure 8 illustrates the discharge profiles for each storage scenario—8 hours (green), 12 hours (red), and 20 hours (blue). While the total discharged volume is the same across all scenarios, the 8-hour storage option distributes flows more evenly, resulting in improved flow management from the site and preventing overflows within the bulk network.

Table 11 shows the maximum storage capacity per pump station and the pump activation count within the modelling period. Notice that the PS5 wet weather pump is needed when the Muri development is in place. Under this combined, fully developed NGA scenario, substantial storage capacity is required to manage peak wet-weather discharges as seen in the 20-hour duration for PS-5.

Table 11. Model Results WWF-2018 – Maximum Storage and Pump Station activation count.

	Storage Vol. Duration	Stage 1-12	Stage 1-14	Stage 1-18	Stage 1-23	Stage 1-24	Stage 1-25 [Full]
PS-2	8 hrs	33 m ³ [24]	33 m ³ [24]	33 m ³ [24]	33 m ³ [24]	33 m ³ [24]	32 m ³ [24]
	12 hrs	49 m ³ [17]	49 m ³ [17]	49 m ³ [17]	49 m ³ [17]	49 m ³ [17]	49 m ³ [17]
	20 hrs	82 m ³ [11]	82 m ³ [11]	82 m ³ [11]	82 m ³ [11]	82 m ³ [11]	82 m ³ [11]
PS-3	8 hrs	-	7 m ³ [25]	7 m ³ [25]	7 m ³ [25]	7 m ³ [25]	7 m ³ [25]
	12 hrs	-	10 m ³ [18]	10 m ³ [18]	10 m ³ [18]	10 m ³ [18]	10 m ³ [18]
	20 hrs	-	36 m ³ [6]	36 m ³ [6]	36 m ³ [6]	36 m ³ [6]	36 m ³ [6]
PS-4	8 hrs	-	10 m ³ [25]	10 m ³ [25]	10 m ³ [25]	10 m ³ [25]	10 m ³ [25]
	12 hrs	-	15 m ³ [17]	15 m ³ [17]	15 m ³ [17]	15 m ³ [17]	15 m ³ [17]
	20 hrs	-	24 m ³ [11]	24 m ³ [11]	24 m ³ [11]	24 m ³ [11]	24 m ³ [11]
PS-5	8 hrs	-	-	61 m ³ [20] and [0]	61 m ³ [16] and [0]	91 m ³ [18] and [14]	92 m ³ [16] and [25]
	12 hrs	-	-	196 m ³ [7] and [0]	196 m ³ [10] and [0]	321 m ³ [6] and [3]	321 m ³ [11] and [10]
	20 hrs	-	-	282 m ³ [5] and [0]	282 m ³ [8] and [0]	545 m ³ [5] and [2]	545 m ³ [8] and [8]
PS-6	8 hrs	-	-	-	49 m ³ [21]	49 m ³ [21]	49 m ³ [21]
	12 hrs	-	-	-	74 m ³ [15]	74 m ³ [15]	74 m ³ [15]
	20 hrs	-	-	-	123 m ³ [21]	123 m ³ [21]	123 m ³ [21]
PS-7	8 hrs	-	-	-	--	83 m ³ [19]	83 m ³ [19]
	12 hrs	-	-	-	--	90 m ³ [14]	90 m ³ [14]
	20 hrs	-	-	-	--	160 m ³ [9]	160 m ³ [9]
PS-8	8 hrs	-	-	-	-	-	89 m ³ [19]



12 hrs	-	-	-	-	-	102 m ³ [13]
20 hrs	-	-	-	-	-	170 m ³ [9]

Hydraulic modelling indicates that Mt Welcome can discharge via gravity without on-site attenuation at PS1 or bulk network upgrades if developed solely. This provides a peak discharge of approximately 31.26 L/s, servicing 949 residential lots and a commercial area. This scenario assumes no concurrent NGA development and demonstrates the feasibility of gravity servicing while deferring the need for large-scale storage infrastructure.

These staging results are from the earlier model, which do not represent the PS13 engineered overflow, and have not been re-run.

6.0 ALTERNATIVE OPTIONS

To address the constraints identified in Section 5, three mitigation approaches have been assessed:

- Bulk network upgrades only,
- On-site attenuation/storage only, and
- A combined approach using both bulk upgrades and storage at PS1.

Each option is summarised below, including the various internal pump-rate settings and storage configurations assessed.

The options were assessed on the earlier model, which did not represent the PS13 engineered overflow. They remain valid for comparing approaches and selecting the long-term solution. The required storage volumes and upgrade extents will be confirmed on Tiaki Wai's final model at detailed design (Section 7.8).

6.1 BULK NETWORK UPGRADES ONLY

Under this option, development flows are mitigated solely by increasing the downstream conveyance capacity of the existing wastewater trunk main. No on-site attenuation is provided.

The following upgrades along the bulk network are considered:

- **Upgrade 1.** 210m of the existing DN225 wastewater main to DN375. This section follows the Ara Harakeke Pathway alignment, avoiding the trafficable off-ramp from SH59 to Airlie Road.
- **Upgrade 2.** 22m section of the existing DN225 wastewater main to DN375. Two approaches are being considered: either replacing the existing main in its current alignment or installing a new section within the SH59 berm
- **Upgrade 3.** The final stage of works involves upgrading approximately 163m of the existing DN225 main to DN375. This may be achieved either by replacing the existing pipe or by constructing a new bypass.

These upgrades will increase trunk-main capacity from 66 L/s to 93 L/s, providing an additional 27 L/s of conveyance and resulting in approximately 47 L/s of available capacity near Mt Welcome.

Table 12 shows some of the results after upgrades 1 to 3 and 1 to 4.

Table 12. Model Results WWF 2018 – Option with bulk network upgrade.

Stage	Proposed Solution	Mount Welcome Max Flow	Pukerua Bay Overflow	Plimmerton Overflow
1-24	v-2 Replace trunk pipe S130221.1, S130219.1, S130224, S130225 and S130226	55.6 [14355m ³]	None	[3] S133404 (14 m ³), S130207 (26 m ³) and S130204 (5 m ³)
	v 30 Replace trunk pipe S130221.1, S130219.1, S130224, S130225 and S130226. Sealing S130207	55.6 [14355m ³]	None	[3] S133404 (28 m ³), and S130204 (16 m ³)



1-25	v-2 Replace trunk pipe S130221.1, S130219.1, S130224, S130225 and S130226	55.6 [14355m ³]	None	[3] S133404 (126 m ³), S130207 (174 m ³) and S130204 (61 m ³)
	v-31 Replace trunk pipe S130221.1, S130219.1, S130224, S130225 and S130226. <i>See Appendix 3.</i>	55.6 [14355m ³].	None	[3] S133404 (226 m ³), and S130204 (135 m ³)

Residual overflows remain under full development scenarios. The approximate lost volume (spill) during the simulation period, with a development until stage 24 is 45 m³, and after the full development is 361 m³.

6.2 ATTENUATION TANK ONLY

This option manages development flows by throttling discharge at PS1 and providing on-site attenuation storage before connection to the trunk network. No downstream bulk upgrades are undertaken.

A number of configurations have been simulated to optimise the volume of the tanks, and at the same time reduce the spill volume downstream and ensure the tank is emptied. These simulations are shown in Table 13. The use of this attenuation device is more effective in order to reduce overflows downstream.

Table 13. Model Results WWF 2018 – Option with PS1 / attenuation tank.

Stage	Proposed Solution	Mount Welcome Max Flow	Pukerua Bay Overflow	Plimmerton Overflow
1-24	v-2 PS1-20l/s Grav: 15l/s Storage: 605 m ³ 360m ²	35 l/s [11100m ³]	[1] S130219 (23 m ³)	[3] S133404 (91 m ³), S130207 (80 m ³) and S130204 (20 m ³)
	v-32 Grav: 27l/s +1 Storage: 697 m ³ 400 m ²	28.l/s [10950m ³]	None	None
1-25	v-2 PS1-15l/s Grav: 12.1l/s Storage: 1936 m ³ . 400m ²	27.1 l/s [14349m ³]	None	None
	v-32 Grav: 27l/s +1 Storage: 1584 m ³ 400 m ² <i>See Appendix 3.</i>	28 l/s [13398m ³]	None	None

The use of this attenuation device is more effective than an upgrade only option in order to reduce overflows downstream.

6.3 COMBINED NETWORK UPGRADES AND ATTENUATION

This hybrid option utilises both upstream attenuation and targeted downstream upgrades to optimise performance and reduce reliance on very large tank volumes.

Table 14 summarises the assessment of various combinations of gravity discharge, pump discharge, and attenuation storage, along with the resulting overflows at key locations in the network.

Table 14. Model Results WWF 2018 – Option with bulk upgrade and PS1.

Stage	Proposed Solution	Mount Welcome Max Flow	Pukerua Bay Overflow	Plimmerton Overflow
1-24	v-2 PS1-20l/s Grav: 15l/s Storage: 605 m ³ Replacing bulk pipes (1 to 3).	35 l/s [11100m ³]	[1] S130219 (23 m ³)	[3] S133404 (91 m ³), S130207 (80 m ³) and S130204 (20 m ³)



Stage	Proposed Solution	Mount Welcome Max Flow	Pukerua Bay Overflow	Plimmerton Overflow
1-25	v34 Grav: 27l/s +1 Storage: 688 m ³ Replacing bulk pipes (1 to 4).	28.L/S 10960m ³	None	None
	v-10 PS1-0l/s Grav: 40+2 l/s Storage: 377 m ³ Replacing bulk pipes (1 to 3). <i>See Appendix 3.</i>	42.2 l/s [14435m ³]	None	S133404 (79 m ³) S130207 (42 m ³) and S130204 (33 m ³)
	v-17 PS1-0l/s Grav: 40+1 l/s Storage: 457 m ³ Replacing bulk pipes (1 to 3).	41.3 l/s [14081m ³]	None	S133404 (91 m ³) S130207 (33 m ³) and S130204 (30 m ³)
	v-19 Grav: 30+5 l/s Storage: 635 m ³ Replacing bulk pipes (1 to 4). <i>See Appendix 3.</i>	36/14296m ³	None	S133404 (61 m ³) and S130204 (3 m ³)
	v-23 Grav: 30l/s +1 Storage: 826 m ³ Replacing bulk pipes (1 to 4).	31l/s/11871 [P1-SPILL]	None	S133404 (37 m ³) and S130204 (20 m ³)
	v-25 Grav: 25l/s +0.5 Storage: 1033 m ³ Replacing bulk pipes (1 to 4).	25.5L/S 12986m ³ [P1-SPILL]	None	None
	v-28 Grav: 27l/s +1 Storage: 1241 m ³ Replacing bulk pipes (1 to 4).	28.55L/S 13304m ³ [P1-SPILL]	None	None /S133404 (3 m ³)
	v30 Grav: 27l/s +1 Storage: 1587 m ³ Replacing bulk pipes (1 to 4). <i>See Appendix 3. and Appendix 4.</i>	28.L/S 13398m ³	None	None

7.0 INITIAL DEVELOPMENT MODELLING – FIRST 200 LOTS

7.1 PURPOSE

This section sets out the modelling undertaken after R004v1 was issued (21 November 2025) to enable the first 200 Mt Welcome lots to be serviced by gravity, ahead of PS1 detention and bulk network upgrades.

We have proposed a staged assessment could confirm that the initial stages have no effect on the network. A model and parameters have therefore been developed to confirm that the initial stages can be delivered without mitigation.

The work comprised:

- A review of the Porirua System Performance Assessment (SPA), prepared by Hydraulic Analysis Limited (HAL) for Wellington Water (Revision 1, May 2026, draft for client comment)
- Modelling of 100 and 200 Mt Welcome lots on the updated network model issued by Tiaki Wai on 19 August 2026, with the other developments the SPA schedules for the same horizon
- A review of Tiaki Wai's own modelling of the first 200 lots (September 2026)
- An enlargement of reserve Lot 1300, so provide further confidence in future storage requirements

The full-development design and mitigation options in Sections 5 and 6 are unchanged, and remain the basis for the long-term solution.



7.2 UPDATED TIAKI WAI MODEL

Tiaki Wai issued the updated model to Envelope on 19 August 2026. It is a simplified version of the Porirua Strategic Wastewater Model used for the SPA. It differs from the model used in Sections 2 to 6 as follows:

- It uses the SPA growth scenarios, including the 2016 base and the 2027 current (CUR) scenarios used in this section, in place of the 2018 base population.
- It uses the SPA climate-adjusted design storms (SPA Table 10-1): the 6-month ARI (64.0 mm), 1-year ARI (93.4 mm) and 2-year ARI (122.5 mm) events.
- It represents the engineered overflow at PS13

Tiaki Wai has advised that a fully calibrated model is expected in the coming months.

7.3 PS13 ENGINEERED OVERFLOW

PS13 is the Plimmerton pump station at 212 St Andrews Road. It receives all flows from the Pukerua Bay catchment, including Mt Welcome, and pumps them to the downstream network. When inflow exceeds the pump capacity, the excess spills through an engineered overflow pipe.

The model used in Sections 2 to 6 did not represent this overflow, so it could not report spills at PS13. The updated model does. The PS13 engineered overflow is therefore the control point for assessing the effect of the initial stages.

7.4 MURI ROAD AND PLIMMERTON FARMS DEVELOPMENTS

Muri Road and Plimmerton Farms also discharge to the Pukerua Bay trunk main and PS13. Table 15 shows how the SPA schedules the three greenfield developments (Appendix B, Table B-1), and how each was represented in this assessment.

Table 15. Greenfield developments draining to PS13.

Development	SPA 2027 (CUR)	SPA 2036 (MED)	This assessment
Mt Welcome	Nil	Nil	100 and 200 lots added to CUR (950 lots from 2046 in the SPA)
Plimmerton Farms Stage 1	220 lots	600 lots	220 lots, as in CUR
Muri Road Stage 1	Nil	83 lots	Not included (outside the CUR horizon)
Muri Road Stage 2	Nil	Nil	Not included (not consented)

Plimmerton Farms Stage 1 (220 lots) is in the SPA's 2027 scenario and is included in this assessment. It was not included in the assessment in Sections 5 and 6.

Muri Road Stage 1 (83 lots) discharges to the network through PS30, with on-site storage and a fixed pumped rate of 8 L/s, so its wet-weather contribution at PS13 is much smaller than a gravity connection would be. Muri Road Stage 2 is not consented. The Mt Welcome network retains an allowance for up to 500 Stage 2 lots, as assessed in Sections 5 and 6.

The first 200 Mt Welcome lots were therefore tested together with the other development the SPA schedules for the same horizon.

7.5 SCENARIOS AND PARAMETERS

Table 16 sets out the model basis for the initial development modelling.



Table 16. Initial development modelling – model basis.

Parameter	Adopted basis
Model	Simplified Porirua model issued by Tiaki Wai on 19 August 2026, including the PS13 engineered overflow.
Design storms	SPA Table 10-1: 6-month ARI (64.0 mm), 1-year ARI (93.4 mm) and 2-year ARI (122.5 mm).
Base scenario	2016 base scenario supplied with the model.
Adjusted current scenario (CUR)	SPA 2027 current scenario, including 220 Plimmerton Farms lots, with 100 or 200 Mt Welcome lots added.
Greenfield wet-weather parameters	SPA Table 5-5, 2027–2036 (CUR–MED) horizon: runoff areas 0.1 / 0.1 / 1.0 / 10 %.
Mt Welcome discharge	Gravity discharge, with no PS1 detention.
PS13 discharge	Limited to the adopted pump capacity of 68 L/s.
Assessment extent	Network between the Mt Welcome discharge point and PS13.

The SPA assigns greenfield wet-weather parameters by growth horizon. The 2027–2036 (CUR–MED) values are for newly constructed networks and were adopted as it would cover the period in which the first 200 lots would be built and connected, so they have been adopted here. The higher 2046–2056 (M2L–LNG) values apply to the fully developed scenario.

7.6 RESULTS

Table 17 and Table 18 show the peak flow and accumulated volume at the PS13 engineered overflow for each design storm, with 100 and 200 Mt Welcome lots.

Table 17. PS13 engineered overflow – peak flow and volume, 100 Mt Welcome lots.

Design storm	Base peak (L/s)	CUR peak (L/s)	Base volume (m³)	CUR volume (m³)	Change in volume (m³)
6-month ARI	0.0	0.0	0.0	0.0	Nil
1-year ARI	0.0	4.6	0.0	15.6	+15.6
2-year ARI	12.0	15.3	109.9	197.4	+87.5 (+80%)

Table 18. PS13 engineered overflow – peak flow and volume, 200 Mt Welcome lots.

Design storm	Base peak (L/s)	CUR peak (L/s)	Base volume (m³)	CUR volume (m³)	Change in volume (m³)
6-month ARI	0.0	0.0	0.0	0.0	Nil
1-year ARI	0.0	8.9	0.0	66.6	+66.6
2-year ARI	12.0	17.5	109.9	271.4	+161.4 (+147%)

The results show:

- No spill occurs at the PS13 engineered overflow in the 6-month ARI containment event, with either 100 or 200 lots.
- In the 1-year ARI event, the overflow volume increases from nil to 15.6 m³ with 100 lots, and to 66.6 m³ with 200 lots.
- In the 2-year ARI event, the existing overflow of 109.9 m³ increases by 87.5 m³ with 100 lots, and by 161.4 m³ with 200 lots.
- No new overflow locations occur between Mt Welcome and PS13.

Downstream of PS13, flows are limited by its 68L/s pump capacity. The SPA identifies existing capacity and containment issues further downstream. These are wider network matters being addressed by Tiaki Wai as the network operator.

7.7 TIAKI WAI MODELLING

Tiaki Wai has also modelled the first 200 lots (Version 2, 15 September 2026). It applied the SPA's 2046–2056 wet-weather parameters to the 2027 network loads. Its runs also included Muri Road Stage



1 as an unrestricted gravity discharge and, in some runs, 880 Plimmerton Farms lots. It reports larger overflow increases at PS13.

Envelope does not consider that basis representative of the first 200 lots, which will connect within the 2027–2036 horizon, while Muri Road discharges through PS30 at a fixed 8L/s.

Both assessments use the same design storms, the same PS13 pump capacity of 68 L/s and the PS13 engineered overflow as the control point. Dry-weather capacity at PS13 is not in dispute.

7.8 STAGING, DETENTION AND MODEL REVIEW

Our modelling and parameters supports gravity servicing of the first 200 Mt Welcome lots without detention at PS1.

Before development proceeds beyond 200 lots, the the finalised Tiaki Wai model should be re-run. If that assessment shows a material worsening of overflow performance at PS13 or elsewhere in the assessed network, the necessary bulk network upgrades and/or PS1 detention should be in place before further stages proceed. This is proposed to be secured through consent conditions.

PS1 is located within reserve Lot 1300. The lot has been enlarged so it can accommodate potentially larger storage requirements if required. A modular, progressive tank arrangement allows storage to be built in stages as development proceeds. If extended detention is needed, septicity will be managed by dosing, which is standard mitigation at wastewater pump stations and detention systems.

There has been a general agreement with Tiaki Wai that reserving additional, flexible land and adopting a modular, progressive tank arrangement is an appropriate interim design response while the wastewater modelling is completed.

7.9 LIMITATIONS

The modelling uses a simplified model derived from the SPA. The SPA is a Revision 1 draft, and the model is not yet finalised or fully calibrated. HAL notes that uncontrolled spill results are indicative until confirmed against reported incidents. The SPA assesses normal operating conditions only and does not include blockage or pump-failure scenarios. The network downstream of PS13 was not assessed.

7.10 SUMMARY

- On Tiaki Wai's updated model, which includes the PS13 engineered overflow, the first 200 Mt Welcome lots can connect by gravity without PS1 detention. There is no spill in the 6-month ARI containment event, and no new overflow location upstream of PS13.
- The assessment includes the 220 Plimmerton Farms lots scheduled for the same horizon. Muri Road Stage 1 is limited to discharges through PS30 at a fixed 8L/s.
- The calibrated and final Tiaki Wai model should be re-run before development proceeds beyond 200 lots. If it shows a material worsening, bulk upgrades and/or PS1 detention should be in place before further stages proceed.
- Reserve Lot 1300 has been enlarged to accommodate potential increases in PS1 storage.

8.0 CONCLUSIONS

General Conclusions:

- Unsteady-flow modelling provides a more accurate representation of the existing network's performance under the assumptions outlined in Sections 2 and 3.
- The wet weather flows with historic rainfall data reflect a better representation of the inflows and infiltration within the wastewater network.
- The modelling outputs have been used to develop a compliant wet-weather network design, incorporating six pump stations that meet the following standards:
 - Regional Standard for Water Services, RSWS, Version 3.0.
 - Regional Wastewater Model Specification: Modelling Specifications – Draft 2020
 - Wellington Water's Pressure Sewer Design Guide and Water Services Association of Australia WSA 0716.



Fully Developed Conclusions:

- These staging and option results are from the earlier model, which did not represent the PS13 engineered overflow. They have not been re-run on the updated model, and will be confirmed on Tiaki Wai's final model at detailed design.
- The full development discharges a peak flow of 56.2 l/s servicing 1449 residential lots and a commercial area (1.7 ha). The final discharged manhole is PCC_WW007923 (model ID S130236). This peak flow considers the fully developed Mount Welcome internal design, where pump rates and storage volumes are critical to end up with this value.
- Including the Muri Road development, both on-site storage and bulk network upgrades become essential to accommodate fully developed flows.
- An assessment of different pump storage duration designs was undertaken, providing more confidence in the proposed wastewater design. The 8-hour storage duration for the proposed pump stations results in a lower impact on the downstream network, as seen in Figure 8 and Table 10.
- The bulk upgrade option increases the capacity in the Pukerua Bay reaches (near to Mt Welcome); however, this allows more flow going down where the network near PS13 turns more critical. The bulk upgrades essentially move the overflows from Pukerua Bay to Plimmerton.
- Using PS1, or an attenuation device upstream of the discharge point, is the most effective option for reducing downstream overflows. This approach can reduce peak flows, keeping the system within critical capacity without further upgrades to the existing network and without causing downstream spills. However, the required storage volume for this device is significant, and at larger sizes it becomes impractical as a standalone solution.
- A combination of bulk upgrades and on-site storage within PS1 can limit the site discharge and prevent overtopping in the bulk network upstream of PS13. For the fully developed site, this approach would require approximately 1,590m³ of storage.
- Alternatively, combining bulk upgrades with on-site storage to limit discharge and reduces the required PS1 storage volume. However, this scenario results in some overtopping in the downstream network near Plimmerton. These effects could be mitigated through additional downstream upgrades or network sealing, which should be considered when it becomes critical in later development stages.

Initial Development Conclusions:

- On Tiaki Wai's updated model, and the parameters used by Envelope, the first 200 Mt Welcome lots can connect by gravity without PS1 detention, alongside the 220 Plimmerton Farms lots scheduled for the same horizon. There is no spill at the PS13 engineered overflow in the 6-month ARI containment event.
- The final Tiaki Wai model should be re-run before development proceeds beyond 200 lots. If it shows a material worsening, bulk upgrades and/or PS1 detention should be in place before further stages proceed.
- Reserve Lot 1300 has been enlarged to accommodate up to 1,789 m³ of PS1 storage, in a modular, progressive arrangement.

9.0 ADHERENCE TO THE EXPERT CONDUCT CODE

While this is not a matter before the Environment Court, the author of this report has read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023 ('Code'). The author has complied with the Code in the preparation of this report.

The data, information, facts and assumptions the author has considered as part of this report are set out in this report. The reasons for the conclusions of the report are also set out in this report. Unless stated otherwise, this report is within the author's expertise, and the author has not omitted to consider material facts known to him that might alter or detract from the opinions expressed.



10.0 LIMITATIONS

This report has been prepared for the project described to us and its extent is limited to the scope of work agreed between the client and Envelope Engineering Limited. No responsibility is accepted by Envelope Engineering Limited or its directors, servants, agents, staff or employees for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.



APPENDICES

APPENDIX 1

WASTEWATER DESIGN TABLES

APPENDIX 2

MT WELCOME NETWORK – MODEL RESULTS

APPENDIX 3

BULK NETWORK – MODEL RESULTS

APPENDIX 4

BULK NETWORK – MODEL RESULTS PROFILES

APPENDIX 5
WWL CORRESPONDENCE

APPENDIX 6

INITIAL DEVELOPMENT MODELLING RESULTS