SOUTH WAIRARAPA DISTRICT COUNCIL

20 FEBRUARY 2019

AGENDA ITEM D5

MARTINBOROUGH WATER SUPPLY CONTAMINATION INCIDENT

Purpose of Report

The purpose of this paper is to summarise the Martinborough water supply contamination incident, immediate actions taken, remedial works required, the proposed plan for restoration of normal water supply to residents of Martinborough (to allow lifting of the boil water notice), and longer term improvements required to avoid a recurrence of the contamination incident.

Recommendations

Officers recommend that the Council:

1. Receive the Water Supply Contamination Incident Report.

1. Executive Summary

On the 30th of January a positive E.coli result was received from the Martinborough School after a second positive result at a different location a boil water notice was put in place on the 1st of February. Twenty days later (February the 20th) the notice is still in effect with an anticipated lifting of the notice date of the 21st.

The past 20 days on the boil water notice has caused disruption and frustration within the community across residents and business alike. Council staff worked with its contractors CityCare Ltd and with Wellington Water through the event to ensure all that could be done to ensure the community safety and the speediest return to normal water supply as possible.

Through the event working with Regional Public Health ensured that all steps were taken to minimise any public risk.
There were delays and changes required through the process of rectification, this combined with continual communication at times resulted in increased questions from the community. Throughout the process to speed up the response the process was iterative. That is it was amended continually as new or more information was discovered.

An example was the chlorination of the eastern section before the results from samples taken were received and the works done on replacing the failed backflow protection before the probable issue of the pumps was known.

All best efforts were made to keep the community informed of the actions and the impacts. In most cases this worked well, however as in the first flushing program, somethings did not go to plan and in this case council took a stop-amend and continue approach, to maintain progress. This is often difficult to communicate as works can be fluid. The success of this approach is seen in the second flushing program, when there was no impact and the community was oblivious to the works undertaken.

Post all remedial works having been completed and the network fully flushed with three times the network volume, council now awaits 3 consecutive days of clear samples to have the boil water notice lifted.

2. Background

2.1 Incident details

On 30 January 2019, SWDC received a positive E.coli test result for water sampled from the Martinborough School on 29 January 2019 (14 Dublin Street, see attachment A for location). Other samples taken from the network that day returned negative for E.coli. Regional Public Health was contacted by SWDC to discuss the course of action, and the school was subsequently advised to use an alternative source as a precaution. Further samples were taken from the system on 30 January 2019 and sent for testing, and the results received on 31 January all returned negative for E.coli.

A further positive E.coli result was received on 1 February for water sampled from the reservoir sample tap on 31 January 2019 (see Attachment A). A boil water notice was issued by SWDC on 1 February 2019.

Further positive E.coli results were received in the following few days from water sampled from the reservoirs. Initial investigation work initiated by SWDC focused on a backflow prevention device that had caused water quality issues in the past, located on a private line adjacent the reservoirs. SWDC elected to chlorinate a limited area of the reticulation network adjacent the reservoirs to mitigate this perceived risk, with the extent of chlorination carried out being based on the known fluctuation in operational levels in the reservoir at about that time (total volume of pipework equal to operational volume change in the reservoirs).

Prior to chlorinating this area, SWDC took additional samples from several locations in the area. Two of samples taken prior to chlorination of this area returned positive for E.coli (15 Fairway Drive and Martinborough Golf Course), with the results being received on Monday 4 February 2019. Results taken from these locations following completion of the chlorination all returned negative for E.coli.

2.2 Wellington Water support

Wellington Water began providing operational assistance to SWDC on 3 February 2019 through provision of alternative water supply bladders (procured as part of our Community Infrastructure Resilience project), and providing technical support from 4 February 2019.

3. Discussion

3.1 System overview

The Martinborough water supply is an unchlorinated water supply sourced from bores adjacent the Ruamahanga River to the north west of the town. The water is pumped by the bores through the UV plant and directly in the reticulation. Four supply reservoirs are located at the far (south eastern) end of the network, with each reservoir providing for around 1,000m3 storage.

Chlorine is not currently added to the water supply due to the manganese content of the water, which reacts with chlorine resulting in significant customer issues and complaints, and operational issues.

However, a manganese water treatment plant is included in SWDC's Long Term Plan. This plant would remove the manganese content from the water, and allow chlorination of the supply without the associated water quality issues.

The water is treated using UV to achieve a target dose of 40 mj/cm2, thereby providing a treatment barrier to contamination for both protozoa and microbiological contaminants.

3.2 Preliminary Investigations

A joint workshop was held between Wellington Water and SWDC staff on 5 February 2019, to commence developing a plan for lifting the boil water notice.

It was agreed that given the multiple positive E.coli results received in multiple locations, we should assume all areas of the reticulation could potentially be contaminated.

A source to tap approach was agreed to review and resolve all potential sources of contamination, while concurrently developing a system flushing and/or disinfection plan, a sampling and testing plan, and a communications plan that collectively could form the plan for removal of the boil water notice. Possible sources identified by the group included:

- Source water
- UV plant
- Reservoirs
- Backflow, due to existing backflow prevention device malfunction, properties with no backflow prevention, private mains, or irrigators.
- System air valves
- Loss of pressure due to system shutdowns, either planned or unplanned (for example bursts)

Work immediately commenced on progressive isolation, cleanout, and super chlorination of the water reservoirs, together with investigation of the other possible sources of contamination.

3.3 Findings (as of Tuesday 12 February)

3.3.1. UV Plant Performance

Analysis of the UV plant performance and operator correspondence indicates that a power cut occurred on 23 January 2019.
UV plant data for this period is shown below:

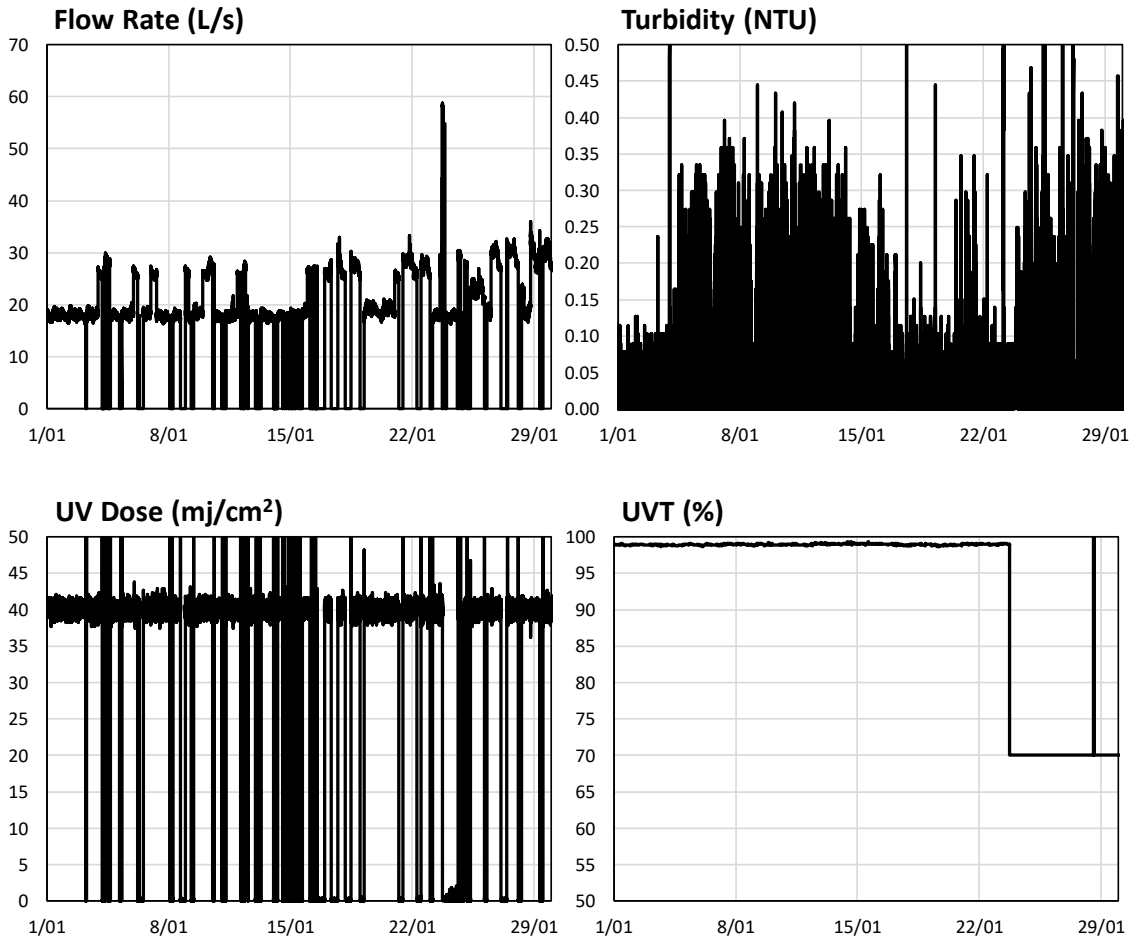

Figure 1: UV Plant Operation January 2019

As can be seen above, the UVT step-changed from 99 to 70%. This was an instrument fault and not deteriorated raw water quality (as indicated by the instantaneous transition). This fault was present for the remainder of the month. Operations staff are reported to have entered a manual UVT of 95% into the UV controller during this time.

The plant ran without UV treatment from 23:07 on the 23rd to 14:18 on the 24th (15h 11m).

Analysis of plant performance in February indicates the UV plant running at around half dose on the 2nd and 3rd of February 2019, possibly due to lamp failure, though no alarm was recorded (see following charts).

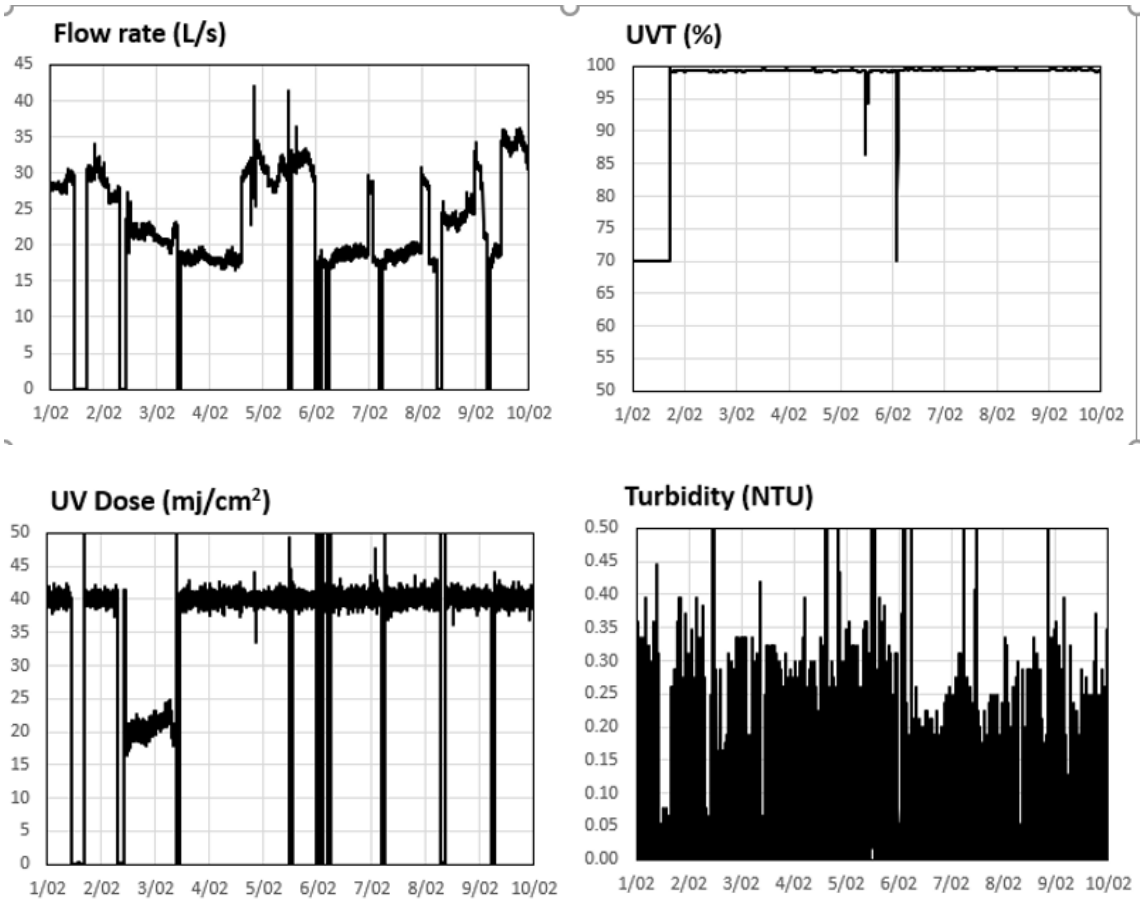

Figure 2: UV Plant Operation February 2019

Given the performance of the UV plant indicated above, this is considered highly likely to be the source of the contamination.

3.4 Reservoirs

Refer to attachment B for reservoir cleanout and inspection details received so far. Reservoir #1 contained spots of moss on the floor and a mild build-up of silt, the floor seals were generally in good condition. The hatch seal requires replacement. Reservoir #4 contained a build-up of silt and manganese, the tank was low pressure cleaned, the reservoir bladder was in good condition once cleaned. The hatch on Reservoir #4 is warped, breaking the liner, and will be replaced. Reservoir #2 hatch is heavily corroded and will also be replaced.

Cleanout of the remaining reservoirs is ongoing and will be completed this week.

A loose wooden slat on the roof of one of the timber tanks has been identified and will be repaired, though inspection shows the inner liner was not broken. Generally the reservoirs are in reasonable condition and are not considered a likely source of the contamination.

3.5 Backflow Prevention

One faulty backflow preventer has been identified and was replaced.

Investigation of other properties considered of risk and confirmation of adequacy of backflow prevention measures for those properties is ongoing. Backflow is a possible source of contamination. However there was no known significant pressure loss within the system during this time considered likely to cause the contamination.

3.6 Other risk sources

Work to check status of the other possible sources of contamination and complete any remedial works identified is ongoing.

3.7 Action Plan and System Improvements - Key Considerations

Key considerations for development of an action plan for removal of the boil water notice, and for system improvements generally, include:

1. Identification and elimination of possible sources of contamination prior to restoration of supply.
2. Methodology for restoring the network to the pre-event level of service (single treatment barrier to contamination), while appropriately managing the risk to public health (ongoing provision of safe and healthy water)
3. Considering the logistics of, and implications for, chlorination of a water supply with significant manganese content.
4. Improvements to short-term approach to risk management.
5. Improvements to longer (medium) term approach to risk management.

3.8 Discussion

3.8.1. Item 1 - Identification and elimination of possible sources of contamination

Progressive identification and elimination of possible sources of contamination is ongoing. Any issues identified will be addressed. However, the most likely source of contamination has been identified, due to the inadequate performance of the UV plant during January and early February 2019.

Work is currently underway to address issues identified with plant performance and control, with Lutra currently working on validation checks, checks to controls, and alarms, preparing a re-commissioning plan, reviewing operating processes and protocols, and ensuring adequacy of operator training.

3.8.2. Items 2 & 3 – Methodology for restoring supply

The two options considered for restoration of the network supply (after addressing possible sources of contamination) are:

1. flushing with chlorine with sufficient concentration and contact time to achieve disinfection, or
2. flushing with unchlorinated water with sufficient volume to displace the entire network volume inclusive of ‘dead-end’ pipes several times.

Ideally, disinfection of the network using chlorine could be used to eliminate any residual contamination within the network. Chlorine provides an additional barrier to contamination, however its use is significantly complicated by the manganese content of the water.

Based on expert advice from Lutra, the expected impact of chlorinating the water to achieve disinfection of the network includes:

1. A very large logistical exercise.
2. Potentially a month or more of disruption to customers through discoloured water and associated complaints.
3. Significant disruption to customer level of service, due to flushing and ongoing system operational issues.
4. Removal of the biofilm that has built up in the network
5. The need of air scouring or high velocity flushing of the entire network (or both)
6. Reaction of the chlorine with the biofilms causing disinfection by-products.
7. A significant increase in opposition to chlorination as a potential longer term additional barrier to contamination.
8. Issues with water availability in the current period of high demand while this work is carried out.

Extensive public communications prior to completing this exercise would also be required.

It is considered that the logistics indicated above may take several weeks to arrange and coordinate to achieve the desired outcome.

As an alternative, thoroughly flushing the network three times (so as to achieve not less than two times displacement of the total volume within the full network) is considered a viable option in the circumstances and given the manganese constraints of the system.

The flushing plan must be completed with careful oversight of UV plant operation and be completed within the operating constraints of the bores and UV plant, including drawdown limitations for bore operation.

Refer to Appendix 3 for an overview of the proposed flushing plan.
The adequacy of the flushing plan will be verified through check of flow rates (Appendix D) and a sampling program at extremities of the network (Appendix E).

3.8.3. Item 4 – Improvements to short-term approach to risk management (0-6 months)

Proposed improvements to manage short-term water supply risks include:

1. A full review of the water safety plan inclusive of critical control points.
2. Education and engagement with critical customers, vineyards etc.
3. Risk assessment, check of adequacy, and ensuring ongoing testing and management of backflow prevention devices.
4. Development of basic process guides, ongoing training and competency for operational staff including escalation procedures.
5. Public communications and education, including around the need for a multi-barrier approach.
6. Implementation of system interlocks to ensure pumps cannot run if the UV plant runs off specification.
7. Developing a network model and use of the model to develop detailed flushing plans.

3.8.4. Item 5 – Improvements to medium-term approach to risk management (6 month – 1 year)

Proposed improvements to manage water supply risks in the medium term include:

1. Ongoing communications and education programs with the community.
2. Installation of a manganese treatment plant.
3. Network cleaning program following UV plant installation.
4. Improvements to system operation, valving, hydrant locations for flushing etc.
1. Implementing an additional barrier to contamination (chlorination is recommended following manganese plant commissioning.

3.9 Proposed Action Plan for Lifting of Boil Water Notice

The proposed action plan for lifting of the boil water notice is:

1. Review validation, functionality and operational performance of the UV plant (Lutra).
2. Complete cleaning and disinfection of reservoirs (Citycare).
3. Carry out comprehensive flushing plan (SWDC, Wellington Water, and Citycare).
4. Complete comprehensive sampling plan at extremities of the network (SWDC and Wellington Water, using Eurofins ELS).

3.9.1. Risks

Key risks include:

- Ensuring UV plant operation and controls are satisfactory prior to lifting the boil water notice (as the only current treatment barrier to contamination)
- Minimising risk to public health through ensuring adequacy of the flushing program completed
- Monitoring UV plant operation during flushing operation
- Management of the manganese/chlorine reaction risk.
- Longer term system management risks, including operator training and competency.

3.10 Communications plan

A communications plan is required and will be developed between SWDC and Wellington Water, for agreement with Regional Public Health.

3.11 Health and Safety implications

Implementing the action plan will require significant resourcing over an extended period of time. Careful management of logistics and monitoring of personnel welfare will be required during this period.

Recommendation

That SWDC and 3WDMC:

- provide any further feedback for improvement of the proposed action plan,
- endorse the proposed action plan for agreement with Regional Public Health,
- prepare for the implementation of the action plan as proposed.

4. Appendices

Appendix 1 – Action Plan for Martinborough Water Supply
Appendix 2 – Martinborough Water Supply
Martinborough Flushing Calculations
Appendix 3 – Martinborough Water Supply
Flushing Plan & Map

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Appendix 1 –

Action Plan for Martinborough Water Supply

ACTION PLAN FOR MARTINBOROUGH WATER SUPPLY

Purpose of Report

Outline Flushing plan to work in conjunction with UV disinfection commissioning.

1. Executive Summary

Staged approach to ensure clean water is distributed throughout the network displacing any stagnant or contaminated water.

2. Martinborough Water System – Flushing Plan

The flushing plan is designed to flush the whole network systematically, while still providing town with sufficient water for normal activities.

Additional flushing points have been installed at dead-end lines for:

1. Shooting butts Road – 50mm
2. Cromarty Drive – 50mm
3. Puratanga Road – 50mm
4. Omarere Road – 50mm
5. Ponatahi Road – 50mm
6. Lake Ferry Road – 50mm

In order to ensure the water network is clean it is planned to turn the water over 3 times. This shall be achieved using the flowmeters out of the treatment plant and out of the reservoirs.

The volume for the sections of the network in each stage is calculated and a hydrant or scour valve (see above) will be opened to turn the system over. The flow rate from the two bores will be increased to ensure 40-45L/s is flushing through the system.

In conjunction property owner will be requested to open an outdoor tap to exchange the water in their laterals and internal pipes.

Summary

The overall plan will run through each stage with the disruption to town minimised:

- Water supply will be maintained through the town,
- The pump rate will be increased to maintain pressure within the system,
- 1 of the reservoirs filled to ensure turnover of the water,
- Hydrants and scour valves will be open at end of lines to fully circulate the water through section; these sections are detailed for each stage.

Table of Stages

If needed, each section can be isolated

Stage	Section of town	Approximate volume	Time at 20L/s flush three times volume
1	Lower part of town, NE of Cambridge and Jellicoe	205	7h
2	Mid section between Stage 1 (including Lake Ferry Road) up to Regent St and Hawkins Drive	135	4h
3	Regent to Todds Road	62	2h
4	Todds Road to Reservoir, (excluding Shooting Butts)	214	7h
5	Shooting Butts pumped main	3.8	0.25h
		620 Total	19 hours

Following the completion of the flushing in each stage, the contractors will co-ordinate with the council to take samples at identified dead-ends that are being flushed. These are identified at each point as part of the hydrant/scour shut-down.

Rural connections

The council will organise visits to rural connections to ensure their tanks have been chlorinated or emptied and refilled. Also some of the connections have long laterals which will be run during the flushing period to clear them out.

Stage 1 Flushing points (may be carried out concurrently with Stages 4 and 5)

Stage 1 Flushing points – operating for 7 hours once all hydrants are opened			
Flushing Point	Time when opened – Signature required	Time when closed – Signature required	Sample needed just prior to closure
Hydrant end of Nelson Road			Yes
Scour on Ponatahi Road			Yes
Hydrant on Huangarua Road			Yes
Hydrant on New York Street West			Yes
Hydrant on Kitchener St/SH53			Yes
Taps in Kansas St			
Hydrant in Kitchener St at square			
Hydrant on Dublin St West			
Hydrant on Greenaway Place			
Hydrant on Grey Street			Yes
Hydrant on Weld Street			Yes
Taps in Waka Lane			
Scour on Ferry Road			Yes

Equalise the flows from each of the hydrant, monitor the flow rate for 7 hours.
Close and move to Stage 2

Stage 2 Flushing points

Stage 2 Flushing points – operating for 4 hours once all hydrants are opened			
Flushing Point	Time when opened – Signature required	Time when closed – Signature required	Sample needed just prior to closure
Scour on Omarere Road			Yes
Scour on Regent St by rugby club			Yes, take from Marae sample point
Scour on Texas Street			
Hydrant in Kitchener St at square			
Scour on Kansas Street			
Hydrant on Radium St			
Hydrant on Jellicoe St near Malcolm			
Hydrant on Regent St near Dublin			
Hydrant on Hawkins Drive			Yes
Hydrant on Tuscan Lane			
Hydrant on Cherry Lane			
Hydrant on Maple Lane			
Hydrant on Campbell Drive			Yes
Scour on Lake Ferry Road			Yes

Equalise the flows from each of the hydrant, monitor the flow rate for 4 hours. Close and move to Stage 3

Stage 3 Flushing points

Stage 3 Flushing points – operating for 2 hours once all hydrants are opened			
Flushing Point	Time when opened – Signature required	Time when closed – Signature required	Sample needed just prior to closure
Scour on Purutanga Road			Yes
Scour on Todds Road			Yes
Hydrant on Oxford St			
Hydrant on New York St			
Scour on Dublin St			Yes

Equalise the flows from each of the hydrant, monitor the flow rate for 2 hours.
Close and move to Stage 4

Stage 4 could be carried out to ensure reservoir change, in conjunction with Stage 1 and 5

Stage 4 Flushing points – operating for 7 hours once all hydrants are opened			
Flushing Point	Time when opened – Signature required	Time when closed – Signature required	Sample needed just prior to closure
Hydrant in Golf Course			Yes
Hydrant on Barlow Place			
Hydrant on Eagle Place			Yes
Hydrant on Birdie Way			
Scour on Cromarty Drive			Yes

Equalise the flows from each of the hydrant, monitor the flow rate for 7 hours.
Carry out for Stage 5

Stage 5 could be carried out to ensure reservoir change, in conjunction with Stage 1 and 4

Stage 5 Flushing points – operating for 7 hours once all hydrants are opened			
Flushing Point	Time when opened – Signature required	Time when closed – Signature required	Sample needed just prior to closure
Scour on Shooting Butts Private Main			Yes – existing sample point at 101A Shooting Butts
Record meter reading on pumped line			
Shut-off when 4m³ recorded through pumped line – record final reading			

Chain of Custody for Flushing sampling attached.

Appendix 2 –

Martinborough Water Supply

Martinborough Flushing Calculations

Flushing Plan for Martinborough

Road	Dia (mm)		Area (m2)	length (m)	Vol (m3)	Flow (L/s)	Velocity (m/s)	time to turnover x 3 (hr)	time to turnover x 3 (mins)	
Stage 1				**11640**	**205.96**			**6.58**		
Stage 2				**15280**	**134.8**			**4.2**		
Stage 3				**3665**	**61.7**			**1.96**		
Stage 4				**7181**	**213.68**			**6.80**		
Stage 5				**1955**	**3.84**			**0.16**		
								19.70		

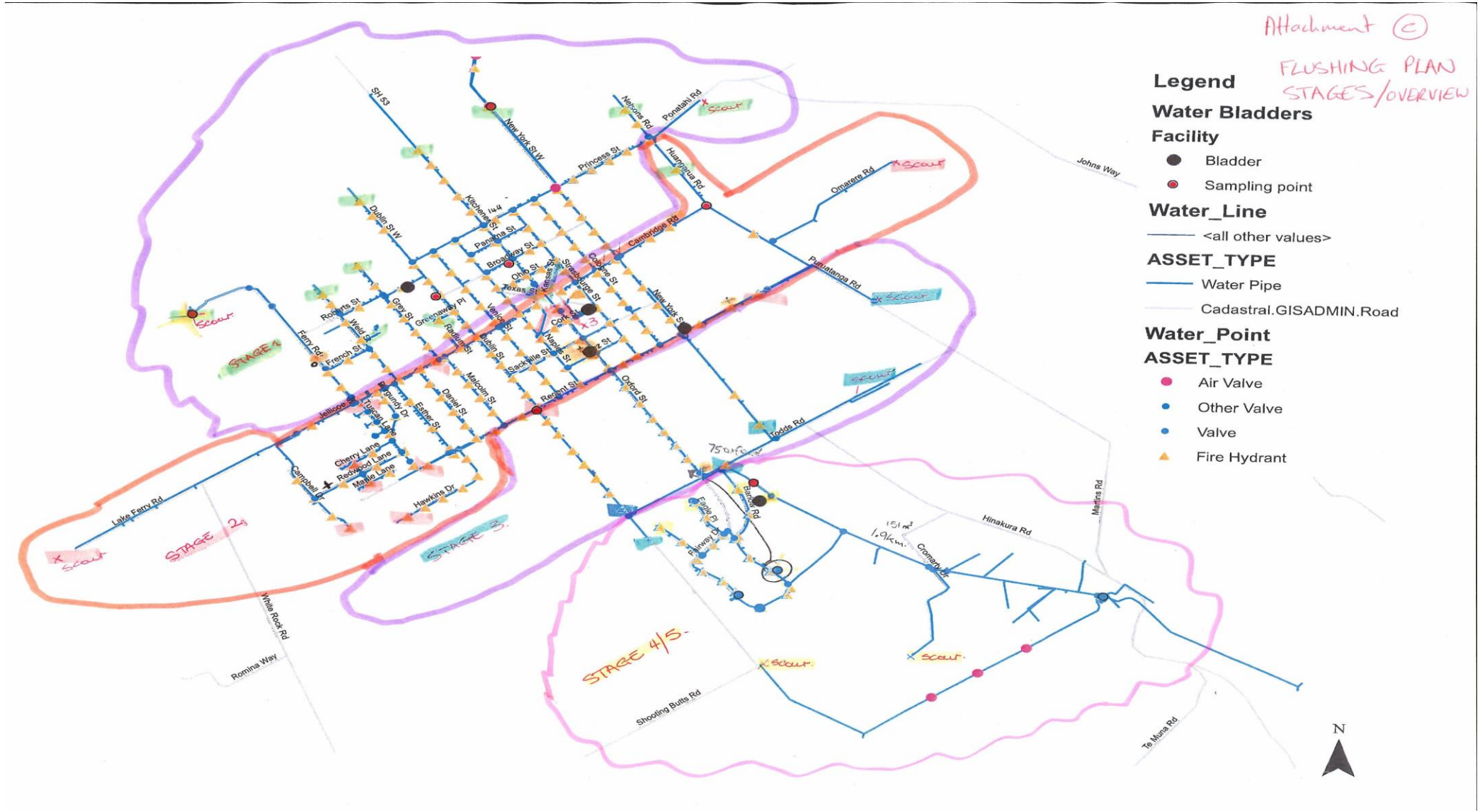
Road	Dia (mm)		Area (m2)	length (m)	Vol (m3)	Flow (L/s)	Velocity (m/s)	time to turnover x 3 (hr)	time to turnover x 3 (mins)	
Stage 1										
Ponatahi	50		0.001963	310	0.61	5	2.546	0.101	6.087	
Nelson	100		0.007854	270	2.12	20	2.546	0.088	5.301	
Princess 1	100		0.007854	470	3.69	40	5.093	0.077	4.614	Feed to Ponatahi 30min then open hydrant and Nelson
New York West to Cambr	150		0.017671	460	8.13	20	1.132	0.339	20.322	
Princess 2	150		0.017671	330	5.83	40	2.264	0.121	7.289	Feed to Cologne, Strasbourge, and Kitchener
New York West Rising	300		0.070686	1340	94.72	40	0.566	1.973	118.399	Supply to town
New York West Main	200		0.031416	620	19.48	20	0.637	0.812	48.695	
Strasbourge	100		0.007854	470	3.69	20	2.546	0.154	9.228	
Cologne	100		0.007854	470	3.69	20	2.546	0.154	9.228	
Ohio N	100		0.007854	140	1.10	20	2.546	0.046	2.749	
Kansas N	25		0.000491	95	0.05	5	10.186	0.008	0.466	
Kitchener Princess to Squa	150		0.017671	330	5.83	40	2.264	0.121	7.289	Feed to Ohio, Broadway, Panama
Broadway	100		0.007854	140	1.10	20	2.546	0.046	2.749	
Panama	100		0.007854	140	1.10	20	2.546	0.046	2.749	
Kitchener Princess to Squa	150		0.017671	85	1.50	20	1.132	0.063	3.755	
Kitchener Princess to Nor	100		0.007854	500	3.93	20	2.546	0.164	9.817	
Princess 3	150		0.017671	360	6.36	20	1.132	0.265	15.904	Feed to Venice, Naples, Dublin
Naples including 190m Jel	100		0.007854	660	5.18	20	2.546	0.216	12.959	
Venice	100		0.007854	470	3.69	20	2.546	0.154	9.228	
Dublin to Roberts	150		0.017671	80	1.41	20	1.132	0.059	3.534	
Dublin	100		0.007854	390	3.06	20	2.546	0.128	7.658	
Greenaway	100		0.007854	80	0.63	20	2.546	0.026	1.571	
Dublin West	80		0.005027	420	2.11	20	3.979	0.088	5.278	
Roberts 1	150		0.017671	200	3.53	20	1.132	0.147	8.836	
Grey	100		0.007854	420	3.30	20	2.546	0.137	8.247	
Grey	150		0.017671	10	0.18	20	1.132	0.007	0.442	
Grey N	100		0.007854	200	1.57	20	2.546	0.065	3.927	
Roberts 2	150		0.017671	210	3.71	20	1.132	0.155	9.278	
Weld	150		0.017671	420	7.42	20	1.132	0.309	18.555	
Weld N	100		0.007854	200	1.57	20	2.546	0.065	3.927	
Waka	50		0.001963	70	0.14	5	2.546	0.023	1.374	
French	100		0.007854	210	1.65	20	2.546	0.069	4.123	
Ferry Road	100		0.007854	300	2.36	20	2.546	0.098	5.890	
Ferry Road	50		0.001963	770	1.51	5	2.546	0.252	15.119	
				11640.00	**205.96**			6.576		
Stage 2										
Omarere	50		0.001963	700	1.37	20	10.186	0.057	3.436	
Huangarua	100		0.007854	430	3.38	20	2.546	0.141	8.443	
Puruatanga to Regent	100		0.007854	550	4.32	20	2.546	0.180	10.799	
Puruatanga dead end	25		0.000491	340	0.17	20	40.744	0.007	0.417	
Regent 1	100		0.007854	660	5.18	20	2.546	0.216	12.959	
New York Cambridge to R	150		0.017671	500	8.84	40	2.264	0.184	11.045	
Cambridge	100		0.007854	295	2.32	40	5.093	0.048	2.896	Feed to Cologne, Strasbourge
Cologne	100		0.007854	490	3.85	20	2.546	0.160	9.621	
Strasbourge	100		0.007854	480	3.77	20	2.546	0.157	9.425	
Cork N	100		0.007854	140	1.10	20	2.546	0.046	2.749	
Texas E	80		0.005027	85	0.43	20	3.979	0.018	1.068	
Kansas S	25		0.000491	140	0.07	5	10.186	0.011	0.687	
Oxford Regent to Square	150		0.017671	330	5.83	40	2.264	0.121	7.289	Feed to Cork, Kansas, Texas, Sackville and Suez
Sackville	100		0.007854	420	3.30	20	2.546	0.137	8.247	
Suez	100		0.007854	295	2.32	20	2.546	0.097	5.792	
Regent 2	150		0.017671	150	2.65	40	2.264	0.055	3.313	Feed to Naples, Strasbourge
Naples	100		0.007854	470	3.69	20	2.546	0.154	9.228	
Regent 3	150		0.017671	360	6.36	20	1.132	0.265	15.904	
Venice	100		0.007854	470	3.69	20	2.546	0.154	9.228	
Dublin to Regent	100		0.007854	460	3.61	20	2.546	0.151	9.032	
Jellicoe Dublin to Naples	100		0.007854	210	1.65	20	2.546	0.069	4.123	
Jellicoe Dublin to Malcoln	80		0.005027	180	0.90	20	3.979	0.038	2.262	
Radium	100		0.007854	200	1.57	20	2.546	0.065	3.927	
Malcolm	100		0.007854	460	3.61	20	2.546	0.151	9.032	
Regent 4	150		0.017671	300	5.30	40	2.264	0.110	6.627	
Jellicoe Malcolm to Grey	100		0.007854	80	0.63	20	2.546	0.026	1.571	
Daniel	150		0.017671	460	8.13	20	1.132	0.339	20.322	
Esther	100		0.007854	460	3.61	20	2.546	0.151	9.032	
Regent 5	200		0.031416	330	10.37	40	1.273	0.216	12.959	
Hawkins	100		0.007854	540	4.24	20	2.546	0.177	10.603	
Tuscan	50		0.001963	270	0.53	5	2.546	0.088	5.301	
Burgundy	150		0.017671	200	3.53	20	1.132	0.147	8.836	
Jellicoe Malcolm Cambpe	100		0.007854	500	3.93	20	2.546	0.164	9.817	

Appendix 3 –

Martinborough Water Supply Flushing Plan and maps

Attachment (c)

FLUSHING PLAN STAGES/OVERVIEW



South Wairarapa District Council Potable Water Sampling - Chain of Custody

Your on-site pH, FAC, Turbidity results will be included on your report and WINZ transfer if recorded on this sheet FAC Equivalent will be reported where samples are measured for pH and FAC. Samples will be tested for Total Coliforms (MPN), E.CoIi (MPN) unless SWDC advises otherwise

Sample Number	Sample Point	WINZ Code	Sample Time	pH	FAC	Turbidity	Temp	ELS Lab Number
	Misc – Nelson Road	MAR003MA						
	Misc – Ponatachi Road	MAR003MA						
	Misc – Huangarua Road	MAR003MA						
	Misc – New York Street West	MAR003MA						
	Misc – Grey St	MAR003MA						
	Misc – Weld St	MAR003MA						
	Misc – Ferry Road end	MAR003MA						
	Misc – Omarere Rd	MAR003MA						
	Marae Regent St MTB	MAR003MA						
	Misc – Hawkins Dr	MAR003MA						
	Misc – Campbell Drive	MAR003MA						
	Misc – Lake Ferry Road	MAR003MA						
	Misc – Puiruatanga Rd	MAR003MA						
	Misc – Todds Rd	MAR003MA						
	Misc – Dublin St	MAR003MA						
	Misc – Eagle Pl	MAR003MA						
	Golf Course MTB	MAR003MA						
	101A Shooting Butts	MAR003MA						
	Misc – Radium Street	MAR003MA						
	End Fairway Drive (dead leg)	MAR003MA						

Sample Date: Sampler:

2. Martinborough Water System – Flushing Plan

The flushing plan is designed to flush the whole network systematically, while still providing town with sufficient water for normal activities.

Additional flushing points have been installed at dead-end lines for:

1. Shooting butts Road – 50mm
2. Cromarty Drive – 50mm
3. Puratanga Road – 50mm
4. Omarere Road – 50mm
5. Ponatahi Road – 50mm
6. Lake Ferry Road – 50mm

In order to ensure the water network is clean it is planned to turn the water over 3 times. This shall be achieved using the flowmeters out of the treatment plant and out of the reservoirs.

The volume for the sections of the network in each stage is calculated and a hydrant or scour valve (see above) will be opened to turn the system over. The flow rate from the two bores will be increased to ensure 40-45L/s is flushing through the system.

In conjunction property owner will be requested to open an outdoor tap to exchange the water in their laterals and internal pipes.