

Effluent Quantity and Quality Review

Wastewater flow volumes

The existing discharge consent allows the discharge of up to 465m³ per day (annual mean) and a maximum flow of 1,460m³ per day to the river. Effluent flow volumes are monitored continuously by the operator¹. Flow volumes recorded between December 2011 and June 2013 are presented below².

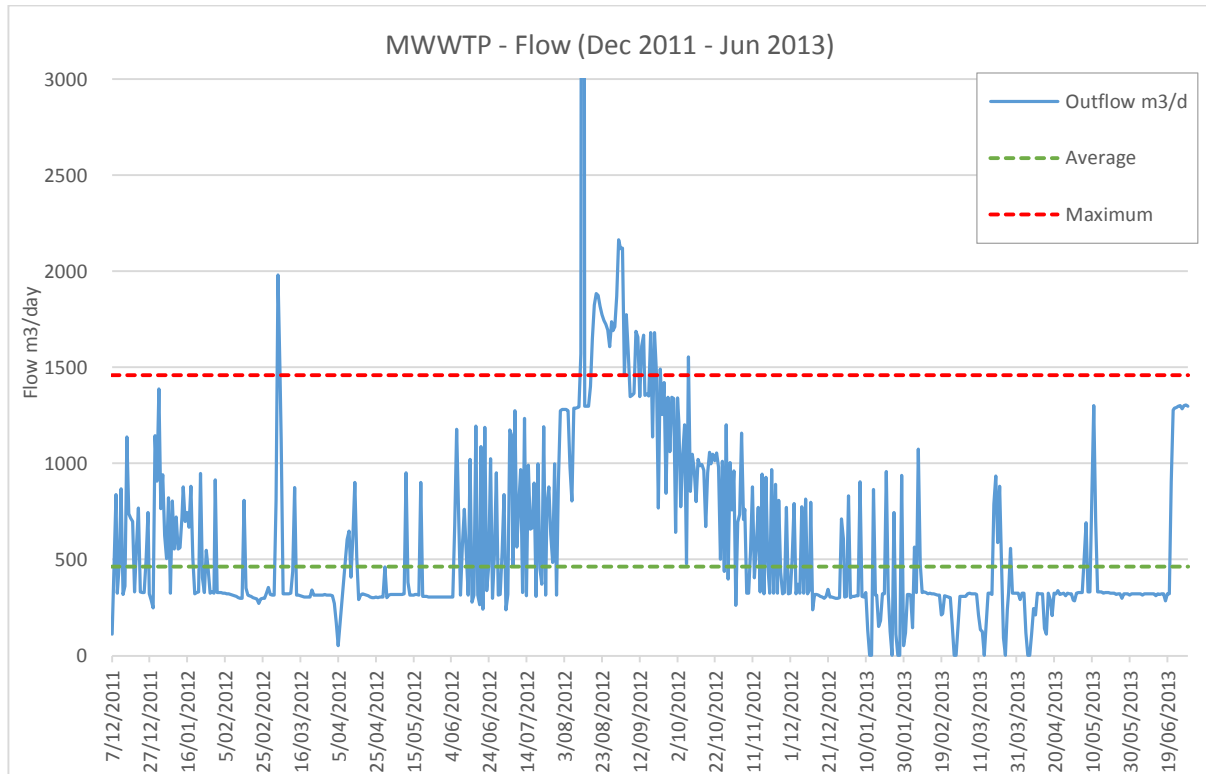


Figure 1 – Treated effluent Flow volumes between Dec 2011 and Jun 2013

The ‘spike’ in August 2012 occurred due to a pump malfunction which caused the level in the maturation cells to rise and overflow into the river. As a result, SWDC have altered their alarm configuration, operational monitoring and inspection process on site to avoid repeat of this issue.

Across the period presented the flow monitoring records indicate the following:

	Actual	Consent limit	Compliance achieved?
Average daily discharge*	608m ³ (589m ³)	465m ³	No
Median Daily Discharge	326 m ³		
Max daily discharge	11,478 m ³ (2,163m ³)	1,460m ³	No

Table 1 – MWWTP Flow monitoring data December 2011-June 2013 (count = 567) (* - average across entire period, not annual average; bracketed values exclude outlier in August 2012)

¹ Effluent inflows were not measured following equipment failure in late 2011 and which has been replaced by outflow monitoring.

² An outlier reading of almost 12,000m³ from August 2011 has been removed for presentation purposes. The result was due to a pump malfunction and skewed results. Refer below for additional detail.

Wastewater Quality

Condition 7 of the consent outlines the effluent quality requirements, prior to discharge to the Ruamahanga River. These standards were amended by the October 2011 variation and took effect from 1 December 2011, when consented *E.Coli* counts were reduced from 10,000cfu/100ml to 200cfu/100ml. This reflected the anticipated performance from the UV disinfection plant required to be installed, which was completed in November 2011.

Condition 7 WAR970079 [30753] – October 2011 Variation															
Parameter	E.coli cfu/ 100 mL	BOD mg/L		SS mg/L		Oil & Grease mg/L		Total N mg/L		Ammonia Nitrogen mg/L		Total P mg/L		pH	
		Geomean	90 th percentile	Geomean	90 th percentile	Geomean	90 th percentile	Geomean	90 th percentile	Geomean	90 th percentile	Geomean	90 th percentile	Geomean	90 th percentile
Post UV treatment system (from 1 December 2011)	200	60	90	100	170	10	15	25	37.5	6.5 (sum) 24 (win)	25 (sum) 36 (win)	10	15	6.5- 8.5	9

Table 2 - Flow monitoring data of discharge quantities from MWWTP December 2007-November 2012 (* - average across entire period, not annual average; ** - excludes outlier in August 2012)

***E. Coli* levels and the effectiveness of UV Filtration**

The 2011 variation to the existing consent required the installation of ultraviolet (UV) disinfection of the effluent prior to treatment. There was also a significant reduction in consented *E.Coli* levels contained within the discharge (from 2000cfu/100ml to 200cfu/100l) at the same time. Monitoring has indicated a substantial drop in the *E.Coli* discharge levels following disinfection, as set out in Figure 2 below:

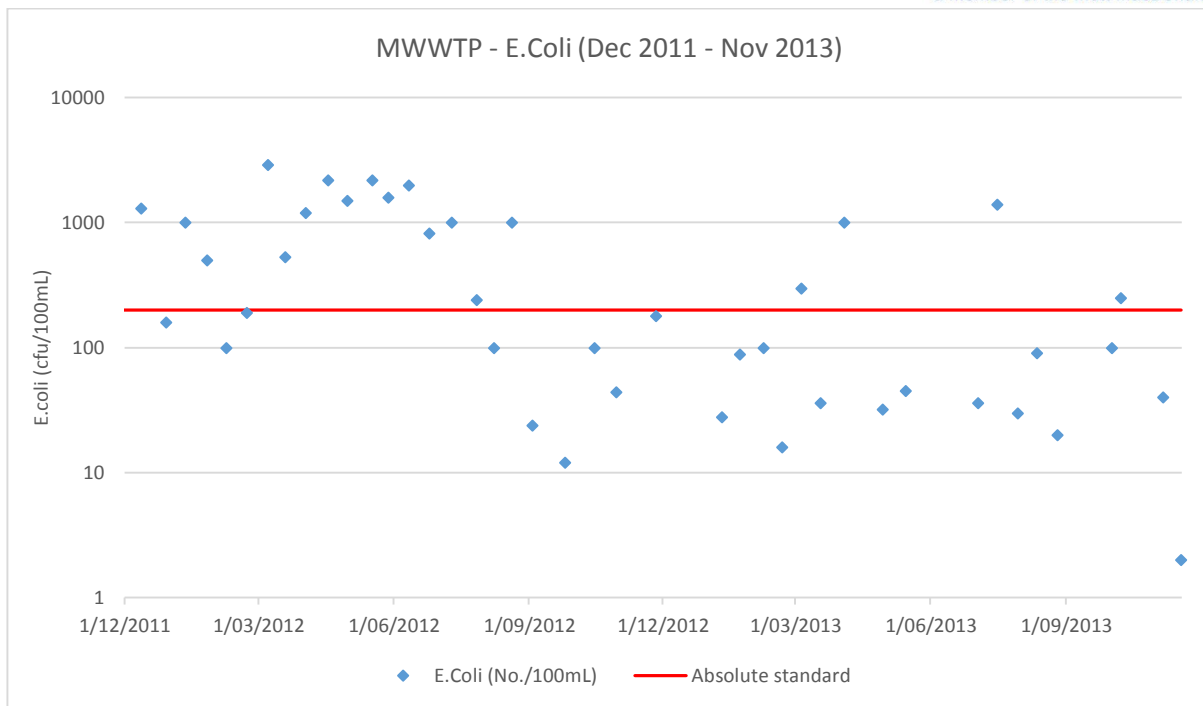


Figure 2 – E.Coli concentrations from MWWTP; December 2011 to November 2013

Since the installation of the UV plant, performance has increased significantly. Monitoring results from 1994-2001 give a geometric mean of 10,900cfu/100ml, which decreased to 4,400cfu./100ml between 2001-2011. As outlined above, more recent monitoring indicates improving performance, however the effluent quality does not technically comply with the consent absolute trigger of 200cfu/100ml. In the last year of monitoring (November 2012 – November 2013) there have been 3 incidences of non-compliance.

The non-compliant *E. coli* readings since UV installation have resulted from a number of plant malfunctions and necessary plant operational changes, including:

- the need for frequent manual cleaning of the UV tubes than initially anticipated
- Infiltration of non UV light treated effluent into the weir discharge chamber contaminating the discharge.
- a small defect in the UV light reactor vector lens and an unaccountable change in the UV light reactors default settings which caused the lamps to remain on without flow, resulting in a build-up of hardened organic matter on the quartz sleeves that encapsulate the lamps, both these factors decreased the effectiveness of the UV light treatment.

These three plant malfunctions have now been remediated. It is anticipated that with the improvements now in place, this will continue to trend toward achieving compliance.

BOD

Recent monitoring results for BOD indicate full compliance with the consent standards both in terms of geomean (36mg/L) and 90th percentile performance (60mg/L). The current consent standard is 60mg/L (geomean) and 90mg/L (90th percentile).

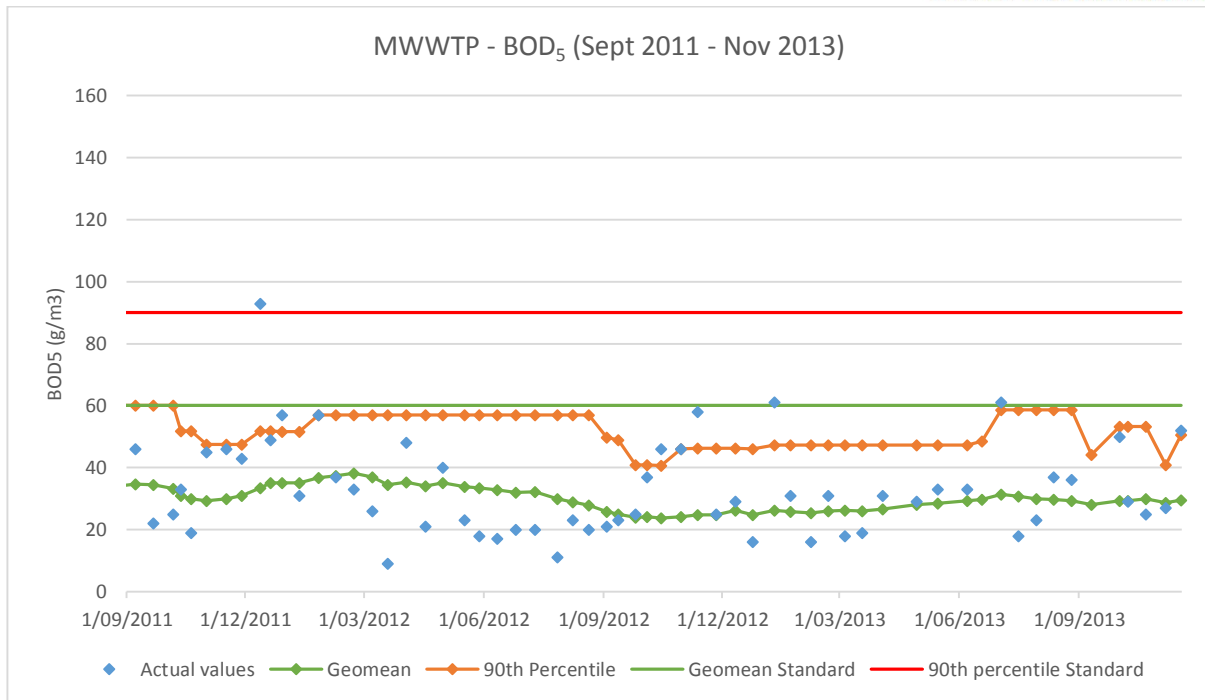


Figure 3 – BOD levels (mg/L) from MWWTP; September 2011 to November 2013

The BOD₅ results show a quite steady geomean and a regular reduction of the 90th percentile results over the last two years. No difference between winter and summer can be noted.

Suspended solids (SS)

Recent monitoring results for TSS indicate full compliance with the consent standards both in terms of geomean (52.9mg/L) and 90th percentile performance (97.5mg/L). The current consent standard is 100mg/L (geomean) and 170mg/L (90th percentile). There does appear to have been a trend of increasing TSS in the discharge during 2013, and this will require further investigation and should be mitigated through the proposed optimisation works.

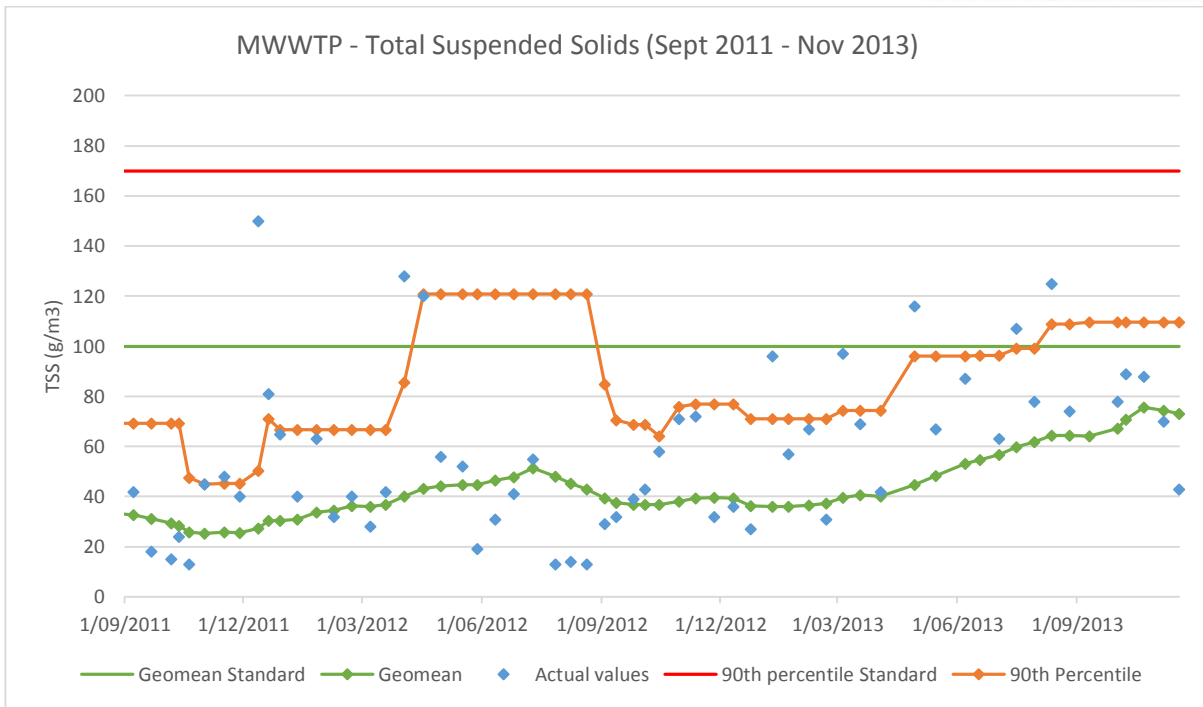


Figure 4 – Suspended sediment levels (mg/L) from MWWTP; September 2011 to November 2013

Total Nitrogen

Recent monitoring results for effluent Total Nitrogen as presented below (geomean 25mg/L, against a current standard of 25mg/L and 90th percentile 37mg/L, against a current standard 37.5mg/L). Current performance as shown in Figure 5 does not comply with Total Nitrogen geomean standards, or 90th percentile standards, although improvement in compliance with the 90th percentile standard is noted.

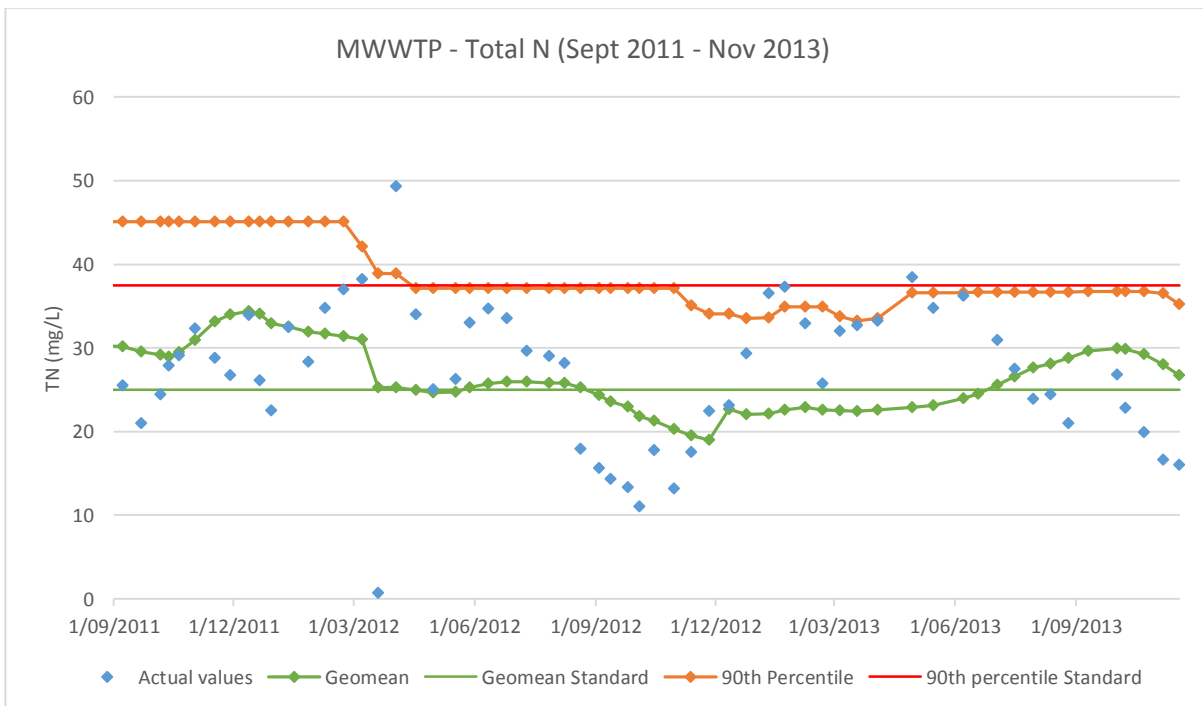


Figure 5 – Total Nitrogen concentrations (mg/L) from MWWTP; September 2011 to November 2013

Ammoniacal Nitrogen

The consent contains different Standards for Summer and Winter in terms of Ammoniacal Nitrogen Monitoring results are combined and illustrated in Figure 6 below.

	Ammoniacal Nitrogen (mg/L)			
	Geomean		90 th percentile	
	Winter	Summer	Winter	Summer
Current Consent Standard	24	6.5	36	25
Sept 2011 – Nov 2013	13.8	15.3	30	29.9

Table 3 – Ammoniacal Nitrogen concentrations (mg/L) from MWWTP, September 2011 – November 2013.

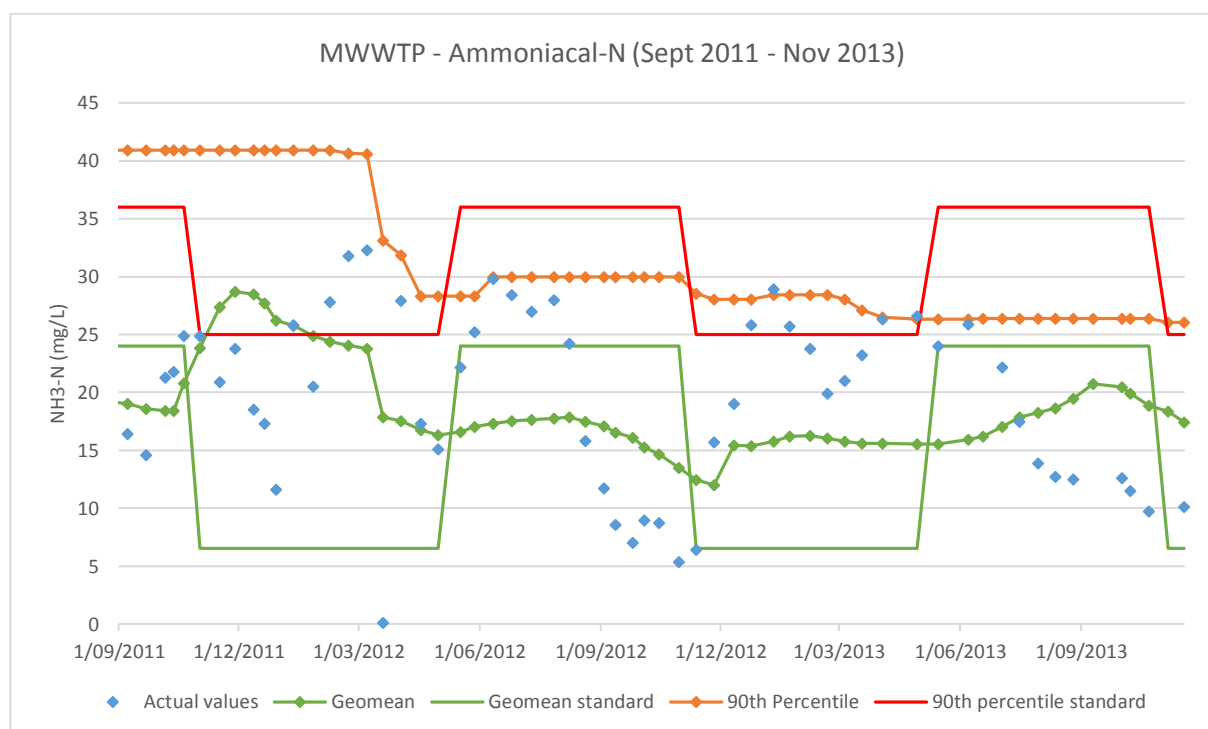


Figure 6 – Ammoniacal Nitrogen concentrations (mg/L) from MWWTP; September 2011 to November 2013

These monitoring results indicate non-compliance with standards for Ammoniacal Nitrogen during summer periods. The data shows some seasonal trends with reduced ammoniacal-N during summer months, however this is not significant enough to have a reasonable impact on the rolling geomean.

Total Phosphorus

Recent monitoring of TP indicates full compliance with the consent compliance standards. The geomean and 90th percentile obtained from the recent monitoring period is 5.6mg/L (the current standard is 10mg/L) and 8.4mg/L respectively (current standard 15mg/L).

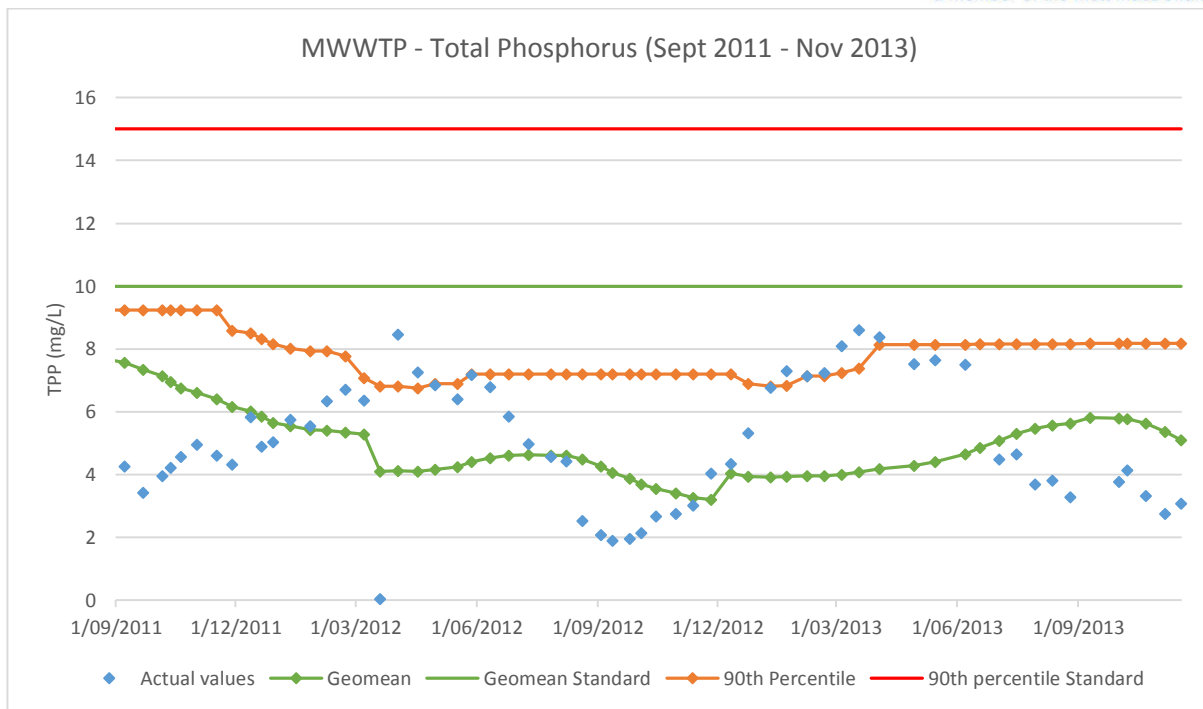


Figure 7 – Total Phosphorus concentrations (mg/L) from MWWTP; September 2011 to November 2013.

A seasonal trend is evident from the absolute values with increasing TP during winter months.

Oil and Grease

Monitoring results for Oil and Grease indicate that a geomean of approximately 3.9mg/L was achieved in the period 2011-2013 (current standard 10mg/L) and a 90th percentile 6.4mg/L (current standard 15mg/L).

Compliance with current Oil and Grease standards is achieved.

pH

Monitoring results for pH indicate that a geomean of 8 was achieved between 2011-2013 (current compliance standard between 6.5 – 8.5) and 90th percentile 8.4 respectively (current compliance standard of 9.0).

The activity has therefore consistently achieved a performance within the current standard for pH.

Summary

The following tables present a summary of the effluent quantity and quality data that has been reviewed including a calculation of mass loads.

MARTINBOROUGH WWTP CONSENT COMPLIANCE

	E.coli (cfu/100ml)		SS (mg/L)		BOD (mg/L)		Total N (mg/L)		Ammonia N (mg/L)				Total P (mg/L)		Oil & Grease		pH		Outflow	
	# Non-compliances	Standard	Actual Values	Standard	Actual Values	Standard	Actual Values	Standard	Summer Values	Standard	Winter Values	Standard	Actual Values	Standard	Actual Values	Standard	Actual Values	Standard	Actual Values	Standard
Geomean Range			25.2 75.5		23.8 38.1		19.0 34.4		12.0 28.7		13.5 20.8		3.2 7.6		2.8 3.5		7.8 8.1			
Geomean Avg			43.3	100	30.0	60	26.5	25	19.7	6.5	17.6	24	4.9	10	3.1	10	8.0	6.5-8.5		
90th Percentile Avg			85.6	170	51.8	90	38.6	37.5	33.0	25	30.2	36	7.8	15	5.1	15	8.4	9		
Absolute value	18	200																		
Average																			589	465
Maximum																			2163	1460

Compliance Period Notes

- F.C and E.Coli data set from December 2011 - November 2013. UV disinfection unit installed end of November 2011.
- Outflow data from Dec 2011 to June 2013, excluding the 13 August 2012 outlier value of 11,478m3/d
- All other data taken from September 2011 - November 2013. Variation consent commenced September 2011.

MARTINBOROUGH WWTP EFFLUENT DATA SUMMARY

All Year	S.S.	Total Solids	BOD5 Total	BOD Soluble	NH3-N	TP	DRP	TN	F.C.	E.Coli	pH	Temp	Conductivity	DO	FOG	Outflow
	mg/L								No./100mL					mg/L	mg/L	m3/d
Average	62.1	431.1	40.6	7.8	18.9	6.1	4.8	27.1	844.4	490.8	8.0	14.8	628.9	8.5	3.8	608
25%ile	37.0	335.5	24.4	3.0	11.4	4.3	2.9	18.7	91.0	25.0	7.8	11.0	462.8	7.1	2.5	314
Median	55.0	453.0	35.0	5.0	19.9	6.5	5.0	28.2	225.0	100.0	7.9	15.1	656.0	8.2	2.5	326
75%ile	81.0	519.0	53.6	8.8	25.8	8.0	6.8	33.0	1515.0	955.0	8.1	18.6	750.0	10.0	4.0	841
90%ile	117.8	554.0	68.1	19.5	29.6	8.9	7.5	38.2	2390.0	1510.0	8.5	20.5	864.8	11.0	6.9	1293
Max									3800.0	2900.0						11478
Count	125	71	125	66	123	125	125	121	42	50	92	92	85	90	83	567

Summer (Nov - Apr)	S.S.	Total Solids	BOD5 Total	BOD Soluble	NH3-N	TP	DRP	TN	F.C.	E.Coli	pH	Temp	Conductivity	DO	FOG	Outflow
	mg/L								No./100mL					mg/L	mg/L	m3/d
Average	72.1	493.3	46.5	8.0	16.0	6.7	5.1	25.2	957.5	515.8	8.0	19.0	728.0	7.3	3.5	417
25%ile	42.0	454.5	29.0	4.0	8.7	5.4	3.6	17.3	100.0	29.0	7.8	18.0	654.5	6.3	2.5	306
Median	64.5	498.5	42.5	6.0	17.9	7.1	5.5	26.7	285.0	130.0	7.9	19.0	741.0	7.3	2.5	323
75%ile	95.3	548.0	58.8	8.0	24.0	8.5	6.8	32.4	2000.0	882.5	8.2	20.4	831.5	8.8	4.3	474
90%ile	127.6	577.3	78.9	16.0	26.8	9.3	7.5	35.3	2390.0	1400.0	8.5	21.8	928.6	9.9	6.1	815
Count	62	32	62	29	60	62	62	58	22	26	40	40	39	40	40	323

Winter (May - Oct)	S.S.	Total Solids	BOD5 Total	BOD Soluble	NH3-N	TP	DRP	TN	F.C.	E.Coli	pH	Temp	Conductivity	DO	FOG	Outflow
	mg/L								No./100mL					mg/L	mg/L	m3/d
Average	56.9	380.0	34.8	7.7	21.7	5.7	4.5	28.8	720.0	13150.5	12.7	11.5	544.9	9.4	4.0	861
25%ile	28.5	317.0	22.5	3.0	13.3	3.7	2.5	22.9	78.5	23.0	7.8	9.1	415.9	7.8	2.5	320
Median	44.0	374.0	31.0	5.0	21.8	5.8	4.4	28.6	165.0	95.5	7.9	11.2	523.0	9.5	2.5	759
75%ile	72.5	488.0	45.9	9.0	27.1	7.4	6.6	34.8	1327.5	865.0	8.1	13.9	666.3	10.4	4.0	1282
90%ile	86.2	520.0	59.4	19.4	39.8	8.3	7.5	41.8	1837.0	1540.0	8.5	15.9	736.0	11.5	9.4	1599
Count	67	39	63	37	63	65	63	63	20	31	55	52	46	50	43	244

MARTINBOROUGH MASS LOADS

		SS	BOD	TN	NH4-N	TP	DRP
Annual Mass Load	kg/yr	13785	9012	6009	4193	1359	1069
Daily Mass Load	kg/d	37.8	24.7	16.5	11.5	3.7	2.9
Summer Mass Load	kg/summer	7076	7076	3842	2434	1027	777
Summer Daily Load	kg/d	19.4	19.4	10.5	6.7	2.8	2.1
Winter Mass Load	kg/winter	17867	10942	9040	6807	1803	1424
Winter Daily Load	kg/d	49.0	30.0	24.8	18.6	4.9	3.9

The above mass load information has been based on average effluent concentrations and average flow rather than a detailed analysis of daily loads.