

**BEFORE A HEARINGS PANEL OF THE GREATER WELLINGTON REGIONAL
COUNCIL AND MASTERTON DISTRICT COUNCIL**

[GWRC Ref: WAR 070077]

IN THE MATTER of resource consent applications to
Greater Wellington Regional Council
pursuant to section 88 of the
Resource Management Act 1991

AND

IN THE MATTER of a Notice of Requirement to
Masterton District Council pursuant
to section 168, 168A and 181 of the
Resource Management Act 1991

BY Masterton District Council

FOR the proposed upgrade of the
Masterton Wastewater Treatment
Plant

**SUPPLEMENTARY STATEMENT OF EVIDENCE OF
JOHN HARDING
ON BEHALF OF MASTERTON DISTRICT COUNCIL**

**RESPONSES TO OFFICER'S REPLY AND PUBLIC HEALTH SUBMISSION
30 MARCH 2009**

**Subject: MfE/MoH Microbiological Water Quality Guidelines 2003 (the
Guidelines) and their application to an intermittent discharge from the
upgraded Masterton WWTP**

Introduction

1. These notes have been prepared to provide a précis of relevant sections of the Guidelines and how they relate to the discharge of treated effluent to the Ruamahanga River. The Guidelines themselves are a very complete and well referenced piece of work and they should be consulted directly for further

information. They can be downloaded from the Ministry for the Environment website.

2. In New Zealand the Microbiological Water Quality Guidelines published in 2003 by the Ministry for the Environment is the key document for assessing and managing the public health risk from microbiological contamination of recreational waters. This joint Ministry for the Environment/Ministry of Health publication is the result of a wide consultative effort and incorporates the risk based approach to monitoring water quality promoted by the World Health Organization. The Guidelines provide councils with the information needed to monitor the state of their waters.
3. In the past, and dating back to the 1940's in the USA, guidelines for assessing the public health risk of using recreational waters have been largely based on faecal indicator counts. The 2003 Guidelines moved away from the sole use of guideline values of faecal indicator bacteria and instead use a combination of a qualitative *risk grading* of the catchment supported by the *direct measurement of appropriate faecal indicators* to assess the suitability of a site for recreation. In addition, alert and action levels are used for surveillance throughout the bathing season.
4. The two components to providing a grading for a beach (which can be a recreational site in a river) are:
 - 4.1 the *Sanitary Inspection Category* (SIC), which generates a measure of susceptibility of a water body to faecal contamination;
 - 4.2 microbiological monitoring results, which generate a *Microbiological Assessment Category* (MAC), which provides a measurement of the actual water quality over time.
5. These two combined give an overall *Suitability for Recreation Grade* (SFRG) which “....describes the general condition of a site at any given time, based on both risk and indicator bacteria results.” This provides the basis for informing the public whether or not the water is suitable for recreational use, from a public health risk perspective.

Aim of the Guidelines

6. The aim of the Guidelines is to help water managers control the public health risk from microbiological contamination in recreational waters, and to provide for monitoring and reporting on the general health of beaches. The Guidelines were designed to provide guidance to water managers in implementing the Resource Management Act 1991 (RMA), and the Health Act 1956 for shellfish-gathering or contact recreation.

Status of the Guidelines

7. While the Guidelines have been developed over an extensive period of consultation with regional and local councils and health authorities and present a preferred approach to monitoring recreational waters, they are not legislated standards that must be adhered to at all times. In particular, the distinction between the action, alert and surveillance levels needs to be appreciated.
8. The guidelines have not been incorporated into the Regional Fresh Water Plan, but nevertheless provide useful guidance. I understand that the Wellington Regional Fresh Water Plan (WRFP) has a policy that consents not be issued for discharge which renders the river unsuitable for bathing. In my view if a discharge causes "action" levels to be exceeded at bathing beaches (when that would not otherwise be the case) then this policy would not be met. As discussed below, the discharge does not currently cause the Cliffs site to reach action levels and will not do so in the future (the discharge will be removed at flows when most bathing will occur).

Roles and Responsibilities

9. The Guidelines spell out in Section B the **recommended** roles and responsibilities of the regional council, the Medical Officer of Health and the local authorities. It is recommended that the regional council be responsible for monitoring and reporting, the Medical Officer of Health reviews the effectiveness of the monitoring and reporting strategy and the territorial authority is required to inform the public if an "*action*" level is exceeded. The Medical Officer of Health will ensure that the public is informed within agreed timeframes.

10. The Guidelines state that: *The Medical Officer of Health has a lead role, given his/her responsibilities under the Health Act, to ensure the proper steps are taken by the territorial local authorities to protect public health.* While neither the Guidelines nor the Health Act define who is the final arbiter of gradings the Guidelines recommend that both the Medical Officer of Health and the Regional Council be involved. (As far as I am aware, The river is not currently graded by either).

Predicted performance of the proposed new oxidation ponds

11. The Guidelines note that when there is a direct discharge of treated effluent there is the potential for the relationship between indicators and pathogens to be altered by the treatment process. While it is correct to infer that water exceeding the guideline values poses an unacceptable health risk, the opposite is not necessarily true.
12. However, in the present case, where there is effective pond treatment, it can be inferred that low *E.coli* levels in the river will correspond with low pathogen levels. In his response Humphrey Archer has addressed pathogen removal in oxidation ponds and provided evidence to demonstrate that ponds followed by a series of maturation cells are very effective at virus removal. Oxidation ponds followed by maturation cells provide a very high level of microbiological treatment, comparable to disinfection. For example, the consented limit for the new Hutt Valley WWTP is a rolling geometric mean of 1000 *E.coli* /100mL, and that for the Moa Point plant is 200 *E.coli*/100mL. This should be compared with the 300 *E.coli* /100mL proposed for the Masterton WWTP.

Determining a Grade

13. In order to grade a recreational water body, the relevant authorities must establish the *Microbiological Assessment Category* (MAC), with an MAC category ranging from A to D being established from existing or collected monitoring data. Definitions of the categories are given in Table E1 from the Guidelines as shown below:

Table E1: Microbiological Assessment Category (MAC) definitions

A	Sample 95 percentile =<130 <i>Escherichia coli</i> per 100 mL
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B	Sample 95 percentile 131–260 <i>Escherichia coli</i> per 100 mL
C	Sample 95 percentile 261–550 <i>Escherichia coli</i> per 100 mL
D	Sample 95 percentile >550 <i>Escherichia coli</i> per 100 mL

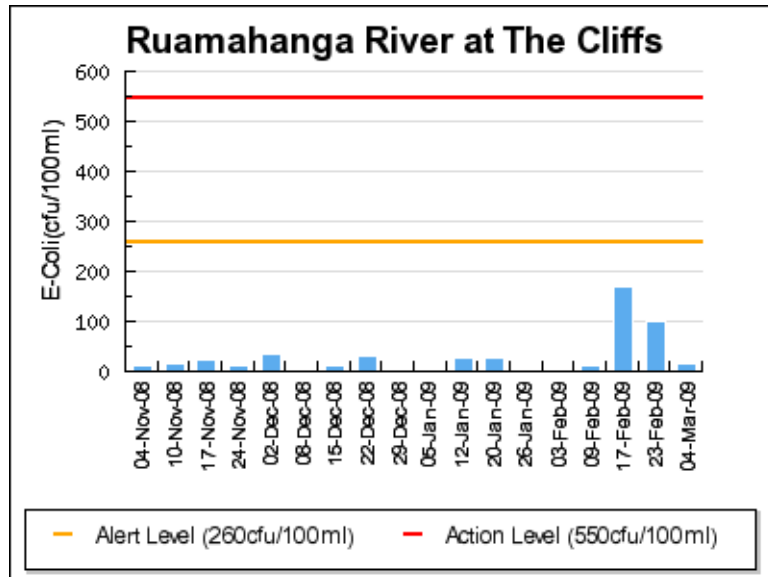
Note: The Hazen method is used for calculating the 95 percentiles (It is important to note there are several ways to calculate percentiles. Each uses a different formula, generating different results. The Hazen method has been chosen for these guidelines, as it tends to be about the 'middle' of all the options.).

14. The Guidelines state that: “If microbiological data is required (ie monitoring data is not available) the sampling programme should obtain at least 20 data points **over the period of greatest recreational use.** (my emphasis) This will normally be the summer bathing season, but may vary with the types of recreational activity most common in the area.” This advice is relevant to the proposed intermittent discharge to the Ruamahanga River in that samples taken when the river is in flood do not reflect bathing risk. The guidelines were not developed with intermittent discharge in mind. Nevertheless in my opinion the reference to the period of greatest recreational use implies that monitoring should be focussed on flows when swimming is likely. In the present case I consider that the focus should be on data from the summer bathing season at flows below median or perhaps up to around 20 cumecs above which bathing is extremely unlikely.
15. As an indication of the variability of Ruamahanga water quality upstream of the existing ponds, the Rua 1 sampling site has a 95%ile value for summer/below median flow of 127 *E.coli* /100mL, whereas the all flows 95%ile value is 1825/100mL. These values should be compared to those in Table E1 from the Guidelines, as shown above.

Summer 2008/2009 Monitoring Results at The Cliffs

16. Greater Wellington Regional Council monitors bathing sites throughout the region on a weekly basis from 1 November to 31 March, including some 7 sites along the length of the Ruamahanga River. The *E.coli* results for The Cliffs show that all results this summer since the first on the 4th November have been less than the alert level of 260/100mL, and 17 out of the 19 results are less than

50/100mL. There was 1 result of 100/100mL and 1 of 170/100mL. These monitoring results are interesting given that discharge of treated effluent is currently continuous. Clearly, after the upgrade has been commissioned the results will be considerably better.



The Sanitary Inspection Category

17. The authority must also establish the *Sanitary Inspection Category* (SIC). This category can be Very High, High, Moderate, Low or Very Low, and is found for a specific water body by the use of the SIC flow chart, Figure H3, in the Guidelines.

The Suitability for Recreation Grade (SFRG)

18. SFRG’s are obtained through a combination of the SIC and MAC gradings, as shown below in Table E2 from the Guidelines. The possible SFRG’s are Very Good, Good, Fair, Poor and Very Poor.

Table E2: Suitability for Recreation Grade (SFRG) for freshwater sites

Susceptibility to faecal influence	Microbiological Assessment				Exceptional circumstances ***
	Category Indicator counts (as percentiles – refer Table E1)				
	A =< 130 <i>E. coli</i> / 100	B 131–260 <i>E. coli</i>	C 261–550 <i>E. coli</i>	D >550 <i>E. coli</i> / 100	

	mL	100 mL	100 mL	mL	
Sanitary Inspection Category: Very Low	Very Good	Very Good	Follow Up**	Follow Up**	
Sanitary Inspection Category: Low	Very Good	Good	Fair	Follow Up**	
Sanitary Inspection Category: Moderate	Follow Up*	Good	Fair	Poor	
Sanitary Inspection Category: High	Follow Up*	Follow Up*	Poor	Very Poor	
Sanitary Inspection Category: Very High	Follow Up*	Follow Up*	Follow Up*	Very Poor	
Exceptional circumstances***					

Notes

- * Indicates unexpected results requiring investigation (reassess SIC and MAC).
- ** Implies non-sewage sources of indicators, and this should be verified.
- *** Exceptional circumstances: relate to known periods of higher risk for a graded beach, such as during a sewer rupture or an outbreak of a potentially waterborne pathogen in the community of the recreational area catchment. Under such circumstances a grading would not apply until the episode has abated.
(For example: if MAC = C and SIC = Moderate, then Suitability for Recreation Grade = Fair.)

The Proposed Intermittent Discharge

19. For the upgraded Masterton WWTP the question is: how do we determine an SFRG for an intermittent discharge? At summer flows less than median the 95 percentile at Rua 1 (ie upstream of the discharge) is 127 *E.coli*/100mL and this is not expected to change downstream of the WWTP when there is no discharge. If we inspect Table E2 we can see that for flows below median in the summer we are in the “A” MAC column, therefore with a SIC of Low or possibly Moderate we are looking at an SFRG of either “Very Good” or “Follow Up”. (In this case the Follow Up would be a result of an unexpectedly high “A” MAC for a moderate SIC, which all sounds a little confusing and illustrates the difficulty of using the guidelines to measure intermittent discharges).
20. Following the upgrade, when flows are above median in the summer and tertiary treated effluent is discharged to the river the MAC grading will be D,

because the 95 percentile *E.coli* value at Rua 1 (ie upstream) is currently 1825/100mL, which well exceeds the 550/100mL value for an MAC of D. The addition of tertiary treated effluent will in fact reduce this 1825 value, however combining the “High” SIC for a tertiary treated discharge of effluent with an MAC of “D” and the SFRG will be Very Poor.

21. Finally, Box 2 from the guidelines provides the green/amber/red “traffic light” *E.Coli* concentrations corresponding to the surveillance, alert and action levels for freshwater. These concentrations should be compared to the Rua 1 (upstream) 95 percentile values of 127/100mL for flows of < median and 1825/100mL for all flows. In other words, in the absence of any discharge of effluent, the microbiological quality of the Ruamahanga River is Very Good at low flows, and Very Poor at high flows.

Box 2: Surveillance, alert and action levels for freshwater

(i)1.1. Acceptable/Green Mode: No single sample greater than 260 *E. coli*/100 mL.

- Continue routine (e.g. weekly) monitoring.

(i)1.2.

(i)1.3. Alert/Amber Mode: Single sample greater than 260 *E. coli*/100 mL.

- Increase sampling to daily (initial samples will be used to confirm if a problem exists).
- Consult the Catchment Assessment Checklist (CAC) to assist in identifying possible location of sources of faecal contamination.

- Undertake a sanitary survey, and report on sources of contamination.

(i)1.4.

(i)1.5. Action/Red Mode: Single sample greater than 550 *E. coli*/100 mL.

- Increase sampling to daily (initial samples will be used to confirm if a problem exists).
- Consult the CAC to assist in identifying possible location of sources of faecal contamination.

- Undertake a sanitary survey, and report on sources of contamination.
- Erect warning signs.
- Inform public through the media that a public health problem exists.

The Councils approach to health risk assessment

22. I am not an expert in health risk assessment let alone health impact assessment. However, as technical peer reviewer I have been closely involved with the approach that Masterton District Council has taken in relation to the assessing the improvements which the upgrade will bring in terms of bathing quality and the residual risks which will remain.
23. I fully accept that Mr Ball's study was not a Health Impact Assessment and with the wisdom of hindsight should not have been titled as such. However I do believe it is an appropriate and useful approach which serves as a support to the Guidelines which, (I quote) "**...cannot be directly used to determine water quality criteria for wastewater discharges because there is a potential for the relationship between indicators and pathogens to be altered by treatment.**"
24. While the Guidelines are based on *E. coli* and as noted by Dr Palmer these cannot reliably predict pathogen levels, Mr Archer has demonstrated there is a good correlation in terms of reduction on *E. coli* and other pathogens. Mr Ball's study was based on predicted levels of adenovirus and therefore is more human risk based than the guidelines on their own.
25. The other difficulty with the guidelines and their reliance on 95 percentiles for *E. coli* is that they are not well suited to intermittent discharges. That is the reason that Dr Hickey has adopted the Monte Carlo simulation method which has then been fed into the Mr Ball's study. Notwithstanding Dr Palmer's reservations I consider that to be an appropriate approach.
26. None of the other waste water discharge applications I am familiar with have carried out the same level of analysis as in the present case. In my role as peer reviewer I remain of the view that the combined approach to health risk assessment in the present case has been "fit for purpose" and you can have a high degree of confidence in the overall conclusions.

Monitoring and risk communication strategy

27. I have referred to the responsibilities of the Medical Officer of Health, the Regional Council and the TLA's under the guidelines.
28. There is currently a risk communication strategy in place as a requirement of the interim consent. I am not sure of what wider communication strategy is in place

for the rest of the river. Section B3 of the Guidelines recommends the development of Regional Protocols for the management of recreational waters, however I understand that there is no such protocol for the management of the Ruamahanga River and I am aware that there is currently no signage at The Cliffs, notwithstanding the full time discharge.

29. Whist the upgrade will significantly improve bathing quality in the river, a risk communication strategy is appropriate. That should be a strategy which involves all of the TLA's, the Regional Council and the Medical Officer of Health. Last week I assisted the Council with the drafting of a proposed Risk Communication Protocol. This protocol has been discussed with the Medical Officer of Health. I attach the proposed protocol as appendix A.
30. I suggest that there would be merit in the District Council monitoring *E. coli* at Wardells Bridge during summer threshold flows and during the period following cessation of the discharge at flows below median. This will allow verification of water quality during the recession of freshes and will allow an appropriate stand-down period to be assessed.
31. The bathing sites on the river should be graded by the Medical Officer of Health and the Regional Council one or two years after the full upgrade is in place. (ideally a provisional grading would be put in place for at least The Cliffs and Wardells Bridge as soon as the full upgrade is in place.)

Conclusions

32. My conclusions as set out in my initial evidence remain the same. In light of the discussion above I add the following:
33. Monitoring data posted on the GW website suggests that the current discharge does not cause action levels to be reached at The Cliffs site during bathing flows and therefore the waters are not rendered unsuitable for bathing. (WRFPP policy).
34. The discharge does however increase health risks and therefore the removal of the discharge from the river during bathing flows will be an improvement.

35. Currently at summer flows below median with a continuous discharge the *E. coli* 95 percentile at Wardells Bridge is 389 and the MAC is a "C". If graded, the SFRG grading for Wardells Bridge (which is within the current mixing zone) would be "Poor". The grading at The Cliffs, which is downstream of full mixing and where there is greater dilution, would either be "Poor" or "Follow Up". (neither site is currently graded). However this grading needs to be considered in the context of actual monitoring results at the Cliffs which confirm that the Cliff site is currently safe for bathing even with a continuous discharge. In particular the monitoring results do not suggest that the current discharge is causing contact recreation guidelines to be breached.

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36. Post upgrade at summer flows below median (no discharge) the predicted 95 percentile at Wardells will be around 127 *E.coli* /100mL, for which the MAC will be an "A" and the SFRG grading is likely to be "Good" or "Very Good". While initially the grading could be changed from "Poor" to "Fair" as a conservative measure, it should be reviewed following a good period of post commissioning monitoring.

37. This prediction is for Wardells Bridge. However it can be confidently predicted that 95 percentiles at the Cliffs will be even lower because of the additional die-off together with dilution with Waingawa River flow. Again, adopting a conservative approach the initial grading can be "Fair" but after monitoring it should be a regraded to "Good" or "Very Good". (A grading of fair is suitable for bathing.)

38. After the upgrade, whenever a discharge occurs a high quality effluent treated to a tertiary level will be diluted at least 30 times by a river experiencing degraded water quality due to rural runoff. The Guidelines are not aimed at these circumstances where swimming is unlikely. They do provide a mechanism for modifying the grading of a recreational site to recognise intermittent and predictable pollution caused by rainfall (see Box 5 in the Guidelines, page H23)

39. In my view the guidelines are not particularly relevant to flows at which swimming does not take place.

40. The applicant's proposal is to at most times achieve a dilution of at least 50:1 at summer flows between 12.3 and 15 cumecs and at least 40:1 at flows between 15 and 20 cumecs. Given the good level of treatment of the wastewater and a

dilution rate of 50:1, with further dilution upstream of the Cliffs, there will not be a high health risk at the Cliffs at these threshold flows. Swimming at flows above 15 cumecs may occur, but in my opinion is unlikely owing to the water velocity, turbidity and temperature.

- 41.** I appreciate that my view about risk at threshold flows is not based on a quantitative risk assessment. Nevertheless in my opinion it reflects a common sense approach to the issue. I would like to remind the Hearings Committee of the evidence provided by Dr Hickey showing the results of his Monte Carlo predictions of water quality at Wardells Bridge for a 30 times dilution of effluent in the 10 to 20 cumecs range. The proposal is for greater dilution in that range.
- 42.** Monitoring over the first few summers of intermittent discharge will should readily verify the improvements in water quality and will allow for grading of the river. Monitoring will also allow an assessment of whether post discharge stand down periods are required and if so for how long. In my view the MDC assessment and the current monitoring results suggest that the river will be fit for swimming at The Cliffs soon after a discharge ceases.

John Harding 27 March 2009-03-26

ATTACHMENT 1

Masterton Wastewater Treatment Upgrade Draft Guidelines Assessment and Risk Communication Protocol - 26 March 2009

1. Principles - Wairarapa Regional Risk Communication Protocol

- MDC supports a whole of river approach to managing water quality in accordance with the MfE/MoH Microbiological Water Quality Guidelines
- Currently the Cliffs 'beach' is not graded. Once the MWWT upgrade is fully commissioned the discharge will be removed from the river at flows normally used for swimming.
- Grading of the Cliffs "beach" will occur after the MWWTP discharge has been removed from the river during summer below median flow. The provisional grading will be "fair"
- The grading of the Cliffs site will be reviewed after the first full summer of monitoring.
- It is expected that the grading of the Cliffs site will rise from "Fair" to "Good" or "Very good"
- Sampling of E.coli will be carried out by MDC at Wardells Bridge. Such sampling will be carried out as required by the conditions of the consent.
- In addition, MDC will sample at Wardells Bridge following the recession of a fresh. Such samples will so far as practicable be taken at flows between 12.3 cumecs and 20 cumecs. and during the period 12 hours after the cessation of the discharge. (*The purpose of this sampling program is to gather a range of representative samples over a summer period to provide information to assist in developing the risk assessment and communications protocol*)
- Greater Wellington Regional Council will be requested to extend current sampling at the Cliffs to include the 24 hour period following a fresh.
- MDC recognises that risk communication to recreational users of the river is important. There is a current risk communication strategy in place but that is based on a full time discharge to the river.
- It is appropriate that the strategy be reviewed prior to the commencement of the intermittent discharge.
- Development of a Wairarapa Regional Risk Communication Protocol (WRRCP) will be promoted by MDC. The WRRCP should be developed by the three territorial local authorities Wellington Regional Council and Public Health.
- The aim of the WRRCP will be to ensure that the public are informed of microbiological health risks in time for them to make informed decisions about whether or not to enter the water

- The WRRCP should address risks from all sources of microbiological contamination.
- Responsibilities are outlined in general terms within the MfE/MoH Guidelines. MDC supports the inclusion of detailed responsibilities within the Protocol
- A public education strategy will form part of the Protocol
- MDC favours consistent permanent signage at all recognised swimming locations (“beaches”) on the Ruamahanga River, supported by temporary signage for specific incidents
- Signage wording would be determined jointly by the 3 TLA’s, GW and RPH, supported by an agreed level of consultation with the public and Iwi
- Status of river flows, beaches and incidents would be advised on District Council and GW websites
- MDC notes that the Cliffs are within Carterton District and for this reason supports linking of the Council websites
- It is recommended that a report on progress with implementing the Protocol be provided to the Medical Officer of Health and GW every 5 years

2. Signage

Suggestions for consistent permanent signage include simple statements such as:

- At low flows when the river appears clean the water quality is likely to be safe for swimming at this location
- At high flows (which usually coincide with lesser water clarity) microbiological contamination can be expected and swimming is not advisable
- Swimming is not recommended for at least 24 hours after such higher flows

(a different approach may be required for the sites further downstream that are affected by Carterton/Greytown/Martinborough effluent discharges)