Recreational Water Quality:

A practitioner's discussion on the limitations of the 2003 national guidelines

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EXECUTIVE SUMMARY

On 1 November 2012, a small group of unitary and regional council science staff representing the SWIM and Coastal Special Interest Groups (SIGs) met in Wellington to discuss current issues associated with the existing national microbiological water quality guidelines for freshwater and marine recreational areas (MfE/MoH 2003). This report documents the main discussion points from the workshop. The scope of the workshop was determined from issues raised through earlier discussions amongst council scientists within the wider SIGs.

The key items discussed at the workshop were:

1. Current monitoring issues;
2. Current reporting issues;
3. Suitability for Recreation Grade assessments and interpretation;
4. National reporting; and
5. Shellfish gathering waters and other issues.

Overall, there are a number of shortcomings with the existing guidelines, particularly in relation to site selection, the methodology for deriving Suitability for Recreation Grades (SFRGs), and the credibility of the guidelines for shellfish gathering waters. The most contentious issue to resolve concerns the influence of rainfall on monitoring and reporting, in particular, whether it is appropriate to avoid sampling in rain events and/or exclude microbiological data influenced by rainfall-related from generating SFRGs. The number of data points needed to generate SFRGs is also an issue for many councils that have insufficient resources – and in some cases justification on public recreational usage grounds – to monitor microbiological water quality weekly for 20 weeks each year.

It is recommended that the issues documented in this paper are addressed through either a formal review of the existing national guidelines and/or the development of a supporting practitioner's guide. This will provide for improved consistency in regional monitoring and reporting of recreational water quality and, in doing so, improve reporting of recreational water quality at the national level.

TABLE OF CONTENTS

1.0 INTRODUCTION

Most regional and unitary councils throughout New Zealand undertake annual recreational water quality monitoring programmes in collaboration with Territorial Local Authorities (TLAs) and the Public Health Units of District Health Boards (PHUs). Monitoring is carried out over the summer months to assess the microbiological water quality of freshwater and nearshore coastal areas commonly used for contact recreation. The monitoring results are compared to 'trigger levels' in the Ministry for the Environment (MfE) and Ministry of Health (MoH) microbiological water quality guidelines (2003). Monitoring data collated over time are also used to calculate a Suitability for Recreation Grade for each monitoring site.

After almost ten years since the implementation of the guidelines, a small number of regional and unitary council staff responsible for recreational water quality monitoring programmes met at a one day workshop on 1 November 2012 to discuss issues and limitations associated with the current guidelines. The staff present form part of a Recreational Water Quality Working Group, a subgroup of the Coastal Special Interest Group (C-SIG) and the Surface Water Integrated Management (SWIM) Special Interest Group. The November workshop followed initial informal discussion sessions held with council scientists at SWIM in Wellington on 21 May 2012 and C-SIG in Auckland on 26 July 2012.

This paper documents the discussion held by the Recreational Water Quality Working Group on 1 November 2012 and subsequent discussions on recreational shellfish water quality monitoring deferred to the C-SIG scientists meeting the next day. It also incorporates comments made at the May and July SIG meetings and review comments on this paper contributed by individual SIG members following circulation of a draft version of the paper to all council scientists in December 2012.

1.1 BACKGROUND

The Recreational Water Quality Working Group was set up in mid 2011 with the support of the Resource Managers Group (RMG). The primary purpose of the group is to create a dedicated forum to discuss issues relating to recreational water quality, including site selection, microbiological indicators, cyanobacteria blooms, shellfish toxins and beach grading and reporting. The group was established recognising that recreational water quality is a current national reporting indicator and that this group should be seeking regional consistency in monitoring and reporting where possible, with the view to assisting with any refinements to national reporting.

The primary focus of the Recreational Water Quality Working Group since its inception has been on national reporting carried out by the Ministry for the Environment. In 2012, the Ministry shifted from its traditional reporting of seasonal (annual) compliance with the MfE/MoH (2003) microbiological 'trigger levels' to reporting on Suitability for Recreation Grades (SFRGs). Neither the former nor the current reporting approaches have met with universal agreement from councils, largely because of underlying issues with the existing guidelines. The Recreational Water Quality Working Group has stated its support for grading-based national reporting but there are regional gaps and inconsistencies that can only be addressed if the Ministry is willing to revisit the existing guidelines and address their limitations. It is understood that the Ministry will be in a position to do this later in 2012/13 and Ministry staff have welcomed feedback from practitioners on how the guidelines can be improved.

1.2 WORKSHOP SCOPE AND PARTICIPANTS

The primary purpose of the November workshop was to discuss and document the key issues that council users have with the existing MfE/MoH (2003) microbiological water quality

guidelines. Participants were reminded of the broader collective objective that improving consistency in regional recreational water quality monitoring and reporting will, subsequently, facilitate improved reporting of recreational water quality at the national level.

The workshop focused on the following areas:

1. Current monitoring issues;
2. Current reporting issues;
3. Suitability for Recreation Grade assessments and interpretation;
4. National reporting; and
5. Other issues – principally further research needs and shellfish gathering waters

The workshop attendees were:

- Anna Madarasz-Smith (Hawke's Bay RC)
- Jarrod Walker (Auckland Council)
- Juliet Milne (Greater Wellington RC)
- Lesley-Bolton Ritchie (Environment Canterbury)
- Michele Stevenson (Environment Canterbury)
- Summer Greenfield (Greater Wellington RC)

The session on issues relating to shellfish monitoring was carried over to a meeting of the Coastal SIG scientists held in Wellington on 2 November 2012. Additional council staff present at that meeting included:

- Emily Roberts (Taranaki RC)
- Hilke Giles (Waikato RC)
- Megan Oliver (Greater Wellington RC)
- Nick Ward (Environment Southland)

2.0 CURRENT MONITORING ISSUES (REGIONAL)

2.1 SITE SELECTION

Rationale for site selection was discussed. Some examples:

- Environment Canterbury bases site selection on general knowledge of popular recreational sites which include not only those used for swimming but also those used primarily for boating and/or fishing (this raises the issue of primary *vs* secondary contact guidelines). Sites are discussed each year at pre-season meetings with territorial authorities and Public Health agencies.
- Auckland Council has recently selected sites based on a risk matrix which includes site usage (high, medium or low), type of recreation (partial, ie 'secondary' vs full, ie, 'primary'), beach grading (contamination risk of high, medium or low), cultural significance (some identified or none identified), confidence level (based on data quality) and a weighting system (sites with primary recreation have a higher weighting) to derive the final selection of sites.
- Greater Wellington RC has selected sites based on knowledge of popular recreational sites (primarily swimming) in consultation with territorial authorities and Regional Public Health.

The general consensus was that different regions will select sites in different ways but site selection should be heavily based on **public usage**. There may be no standard protocol for assessing public usage across the country but councils should be able to demonstrate that there is a robust process for site selection (and ongoing inclusion of sites in monitoring programmes). Currently there would be few regions that have data on the number of users, with most relying on anecdotal information. The number of bathers is recorded in many regions at the time of sampling but sampling times may not be a good reflection of peak usage (particularly given highest use is likely to occur on weekends). Two councils that have collected robust site usage data in recent years are Tasman DC (James 2011)[1] and Marlborough DC (Tiernan 2012)[2], which made use of a combination of traffic counts, on-site counts and aerial counts during peak usage days (eg, MDC used on-site questionnaires over a period of six weekends). In both cases, the surveys found that existing site selections based on anecdotal information were inadequate (estimated usage based on mid-week sampling and anecdotal evidence over-estimated usage for some sites and under-estimated it for others).

Guidance needed:
What are the best options for evaluating site usage and popularity, what consideration should be given to usage type (eg, swimming vs watersport use) and what factors, other than public usage, should be taken into account in selecting monitoring sites? For example, should the 'risk of contamination' be taken into account (eg, if resources are limited and you can only monitor one of two moderately used sites, do you opt to monitor the site that has a higher risk of contamination?) Similarly, should a site be located near or further away from potential contamination sources such as stream mouths and stormwater outfalls (people, particularly young children, often recreate near these areas)? Also, how many sites are needed on a long beach (eg, 5 km) that has multiple access points – is one site enough?

2.2 SAMPLING FREQUENCY AND DURATION

Most sites are sampled weekly but the monitoring season varies between regions (eg, Auckland at 21–22 weeks (1 November to 31 March inclusive) vs Northland at 17 weeks

[1] James, T. 2011. *Tasman's natural swimming holes and beaches: Popularity and effects on the recreational experience.* Tasman District Council Report #11002.
[2] Tiernan, F. 2012. *Recreational water quality report 2011–12.* Marlborough District Council, Technical Publication 12-013.

(typically) and Canterbury at 15 weeks). The monitoring season may legitimately vary from region to region based on climate and usage. For example, Southland has a relatively short bathing season due to climate[3]. In the Tasman District, on-site opinion surveys found that site usage was strongly related to water temperature, with most people avoiding swimming at water temperatures <18^{o}C (James (2011) – in Tasman this would suggest that sampling should generally occur from December to March. Budget constraints also have a major influence on sampling capacity (resulting in some councils monitoring only a subset of sites for the full 20 weeks) and the availability of tertiary students to assist with sampling over the full summer period is another issue for many regions/districts[4].

At sites graded 'very good' or 'very poor' for recreation the sampling frequency is often reduced or sampling ceases altogether (in the case of 'very poor' sites, if sampling is to cease, permanent health warning signage is required indicating that the site is not suitable for contact recreation). The problem then is that over a 5-year period 100 data points will not be available for calculation of the Microbiological Assessment Category (MAC) value. Under the current guidelines, this means that the Suitability for Recreation Grade (SFRG) will always be considered an *interim* grade. Interim grades may not be acceptable to the public or specific water users. It is also unclear what an interim grade implies – what is the statistical relevance of the 100 data points requirement and is a grade based on less than 100 data points much less reliable?

Guidance needed:
What is the minimum number of data points needed to identify an SFRG (ie, is there a robust alternative to the current 100?) – and if not all councils can achieve the minimum over a five-year period can allowance be made for a longer time period to be used to calculated the MAC? At 'very good' or 'very poor' sites (which are presumably more stable from a water quality perspective), is it possible for a grade to be based on fewer data points given that most sites with these grades are not sampled weekly or have been dropped from regular monitoring? What should the protocol be for reporting (including annual council reporting, website reporting and MfE national reporting) and for assessing whether grades assigned to 'very good' and 'very poor' sites are still appropriate?

2.3 SAMPLE COLLECTION AND RAINFALL

This was the subject of considerable discussion at both the May 2012 SWIM meeting and the November workshop (particularly in relation to SFRG derivation – see Section 4) and remains the principal area of difference in practice between some councils. There was initially agreement that routine sampling should not be biased to exclude rainfall events (except for health and safety reasons), which recognises the logistical difficulties of organising sampling around rainfall events and, more importantly, the reality that in many regions people do often recreate after summer cloudbursts/storms. This is particularly the case at coastal sites where surfers and kite boarders will undertake their respective activities irrespective of rainfall and storm conditions. In terms of fresh waters, kayakers often use rivers during or after rainfall because there is insufficient water to paddle them at other times and so water sampling by some councils (eg, Marlborough and Tasman DCs) is undertaken in all flows/weather conditions between November and March. This possibly raises the primary vs secondary contact recreation issue and associated level of health risk, although in the case of whitewater kayaking, like swimming and water-skiing, it is considered a form of primary contact recreation (learners or less-experienced practitioners probably (involuntarily) consume more water than most swimmers).

[3] Environment Southland science staff teleconference meeting (2011).

[4] Laboratory availability has also been raised as a problem (some labs are closed over the Christmas period when usage can be the busiest and courier deliveries can also been problematic during holiday periods).

In contrast, Taranaki RC does not routinely monitor in wet weather because all but seven sites also couple as State of the Environment (SoE) sites that need to be sampled following three days of dry weather for more rigorous temporal trend assessment purposes. Also, Taranaki RC has stated that in their region contact recreation in rivers during wet weather is more unlikely because the nature of runoff from Mt Taranaki leads to a rapid rise in river levels (ie, too dangerous and aesthetically unpleasant for recreation). Northland RC science staff have noted that Northland can experience some very intense rainfall events which mean even their 'pristine' sites can exceed the MfE/MoH (2003) guidelines. Overall, the high frequency of rainfall in Northland means that indicator bacteria levels in the region's rivers regularly exceed the guideline trigger values.

It was noted that in some instances follow up sampling is delayed until rainfall has ceased. This can affect the warning status assigned to a site. Also, what constitutes a rainfall event? Auckland uses 20 mm in 24 hours while Hawke's Bay uses 10 mm. The Stormwater Monitoring Handbook might provide some useful guidance (for runoff from urban areas at least)?

Both Environment Canterbury and Auckland Council have permanent signage at sites that are known to be affected by rainfall and (in the case of Auckland) sewer network overflows. Perhaps if councils had a practice in place – such as signage at specific sites – that could be proven to deter the public from swimming in wet weather[5] – then this could be a legitimate reason not to conduct sampling in wet weather at these sites. Overall, though, there are probably few councils that could demonstrate no contact recreation occurred during or after at least *some* rainfall, particularly at coastal beaches. This raises a question posed by a Bay of Plenty RC scientist at the May SWIM meeting: *How much are you protecting public health if you don't monitor in all weather conditions?* In the Wellington region, monitoring in all weather conditions has enabled a very good characterisation of the general amount of rainfall required to affect freshwater sites (as well as the time taken for sites to 'recover' following a guideline exceedance); analysis has shown that some freshwater sites will exceed the guidelines with as little as 5 mm of rainfall, highlighting the risk that even light rainfall can have on some recreational waters. Further, this amount of rainfall is unlikely to deter many river users.

For river sites, flow is another factor that should be considered alongside – or as an alternative 'indicator' to – rainfall, particularly in large catchments where there can be a time lag in the effects of rainfall being observed on water quality in the lower river reaches. The use of flow data is discussed further in Sections 2.7 and 4.2.

Overall, it comes back to **usage** – do people swim/recreate at particular sites in wet weather/high flows? There needs to be a way to demonstrate whether or not sites are used during or following rainfall for recreation. This issue is revisited in Section 4 in relation to SFRG derivation.

Guidance needed:
Improved guidance around sample collection and rainfall is desirable. In particular, what is the correct procedure for follow up sampling after heavy rain? What, if any, permanent or temporary signage should be put in place at sites that exceed guidelines as a result of rainfall (giving consideration to both actual monitoring results and communicating a site's SFRG which may be 'poor' primarily due to the influence of rain-related results)? In addition, how should councils define 'significant' or 'heavy' rainfall (ie, if sampling is avoided in rainfall, how much rainfall has to have fallen and over what time period)? While this will be both site and

[5] It is recognised that some people will still undertake contact recreation at sites that have health warning and signage in place. Councils can't aim to completely protect public health by 'stopping' recreation at sites with risk – we can only make information available for the public to make an informed choice. One of the key questions is *how much* information do we need to make available?

region-specific (and the relevant catchment considerations should be identified) some general overall guidance would be useful.

2.4 INDICATORS FOR BRACKISH WATERS

There is some uncertainty and difference in application of the microbiological indicator used in brackish and estuarine waters. For example, Environment Canterbury monitors both *E. coli* and enterococci in estuarine waters and base the beach grade or indicator result on the worst result while Northland RC monitors both enterococci and faecal coliforms and Auckland Council uses enterococci in tidal creeks but *E. coli* in coastal lagoons. It was considered that enterococci is a more conservative indicator to use (can be affected by false positives) but it is not clear how much scientific evidence actually exists to support this view.

Guidance needed:
Clarification is needed over which indicator is to be used in estuarine waters – what salinity/conductivity range defines an estuary (eg, >10 ppt=brackish or saline and so use enterococci)? Also, should sampling of estuarine sites be standardised to tidal conditions in any way (recognising that water quality will likely vary with tidal state yet recreational usage might be primarily limited to mid-high tide)?

2.5 ANALYTICAL METHODS – MPN VS CFU

The MfE/MoH (2003) guidelines specify several 'approved' analytical methods for fresh and coastal waters. There are some differences in what councils use – eg, Environment Canterbury, Nelson CC, Tasman DC and Auckland Council use enterolert/colilert (Most Probably Number (MPN) tests) because these are faster tests, while Greater Wellington RC uses membrane filtration (CFU). It was unclear whether or not – 10 years on from the guideline release – one method is now considered more appropriate. If so, and a council changes methods, is the historic data set able to be correlated and combined with data obtained under the new method?

Guidance needed:
The existing guidelines need to be updated with the most appropriate microbiological analytical methods as well as guidance on whether data sets using the two methods (CFU and MPN) can be treated as one. A microbiological specialist(s) should be consulted to provide this advice.

2.6 APPLICATION OF GUIDELINES DOWNSTREAM OF WWTP DISCHARGES

The MfE/MoH (2003) guidelines clearly state that they are not to be used in the instance where a site is affected by discharge from a wastewater treatment plant (WWTP) as pathogen/indicator bacteria ratios can be altered as a result of the treatment process. As a result Greater Wellington RC has conservatively graded freshwater sites potentially influenced by WWTP discharges as 'poor' or 'very poor' despite indicator bacteria counts being low (ie, the actual monitoring data suggest that the sites should have a SFRG of 'fair' or even 'good'). It appears that few other councils do this.

Guidance needed:
Specialist advice is needed on what investigations need to be undertaken at sites affected by WWTPs to identify whether or not it is appropriate to apply indicator bacteria guidelines. If indicator organisms can be used, which one should it be? If norovirus testing is recommended, what are the monitoring requirements, frequency, location, etc.?

Another question: What is the risk to human health from different faecal sources (eg, birds vs human effluent vs livestock. A review of the latest research is needed and this should feed into informing the SIC assessments (see Section 4.1).

2.7 HEALTH WARNING SIGNAGE

The principal issue discussed was how long to wait before erecting warning signage at a site, recognising that public health should be the primary driver. The MfE/MoH (2003) guidelines indicate two consecutive action-level results are required to for health warnings at a coastal site but only one is required for freshwater sites. It was agreed that it is not practical to erect warning signs after a single action-level guideline exceedance and two consecutive action level results should be the trigger at both coastal and freshwater sites. However, should any exceptions to this be considered – such as in the case of a very high indicator count from the routine sample result? For example, Auckland Council will consider erecting health warning signs at coastal sites when an enterococci test result is greater than 1,000 MPN/100mL (additional factors – catchment type and risk – are taken into account before erecting signage).

The use of permanent signage at consistently 'poor' rainfall-affected sites was also recommended, including sites assigned modified SFRGs on the basis that these sites are not used for recreation in wet weather (see Section 4.2).

In terms of warnings to avoid swimming/recreation following rainfall – is 48 hours relevant for both coastal and freshwater sites? In Hawke's Bay a general warning is issued if there is 8–10 mm of rain over three days (which does not constitute 'significant' rainfall in some other regions). General warnings are less likely to be effective than site-specific health warning signs but are understandable for practical reasons. River flows are starting to be used in some regions (instead of rainfall), such as in Manawatu-Wanganui[6] and Otago, and could be particularly useful in large catchments where rainfall in the headwaters can take a number of days to impact on water quality in lowland river reaches. While establishing relationships between river flows and *E. coli* concentrations shows good potential as a water quality 'forecasting' measure, monitoring of river water quality is still required given the potential for contamination events un-related to rainfall/river flow, such from stock access to the water.

Guidance needed:
The requirements and advice for health warning signage in the existing MfE/MoH (2003) guidelines should be revisited and clarified, including consideration of including a new 'exceptionally high' indicator result threshold which, if exceeded on any occasion, requires an immediate health warning to be issued.

[6] For some of the river sites in the Manawatu-Wanganui region, the public can ring Horizons RC and get the stage flow and the Horizon's website has information about whether it is mostly likely safe or not, based on river flow.

3.0 CURRENT MONITORING ISSUES (REGIONAL)

Reporting both compliance with the MfE/MoH (2003) microbiological trigger values and updated SFRGs is important.

3.1 GUIDELINE EXCEEDANCES IN COASTAL WATERS

The primary issue in relation to reporting against the MfE/MoH (2003) microbiological 'trigger values' concerned marine (coastal) waters. The action trigger value states there must be two consecutive results above 280 enterococci/100mL but not all councils collect a second water sample (certainly not the next day) if the first (routine) sampling event coincided with a heavy rain event. The Ministry for the Environment attempted to address this problem in national reporting some years ago by only using the first sample result for compliance assessments. Councils such as Hawke's Bay, Environment Canterbury and Greater Wellington follow this practice, using the first action level result in regional reporting and the second consecutive action level result to invoke the management response (ie, erection of health warning signage). However, some councils still take the coastal guideline text as it stands and, consequently, report a considerably lower number of exceedances of the MfE/MoH (2003) guidelines.

The concept of site 'closure' was also discussed. The reality is that beaches or rivers are not officially closed to recreation, rather site warnings are issued. Reporting and media communication should reflect this.

Guidance needed:
The amendment to interpretation of coastal water guideline exceedances proposed by MfE (2005)[7] should be clarified and incorporated into a revision of the existing MfE/MoH (2003) guidelines.

3.2 THE INFLUENCE OF WET WEATHER

The influence of exceptionally wet years on annual reporting was discussed. Hawke's Bay RC include 30-year monthly rainfall averages in their reporting which provides context for the water quality results. Some councils also report the percentage of guideline non-compliance that is related to rainfall events. Adding a map of rainfall across the region for the summer season or providing weekly rainfall values in reporting can be useful to contextualise results. However, it is noted that, particularly for some coastal sites, there is not always a direct relationship between rainfall and elevated enterococci counts.

Guidance needed:
Advice on reporting indicator guideline exceedances related to wet weather would be useful.

3.3 REPORTING SFRGs

As noted in Section 2.2, there is uncertainty about how to appropriately report sites graded 'very good' or 'very poor' where little/no recent microbiological water quality data are being collected to 'validate' the original grades. Not reporting SFRGs for these sites would bias the reporting of SRFGs to the 'middle' range of grades (ie, 'good', 'fair, 'poor') and would not truly reflect the full range of beach grades.

SFRGs utilise potentially 'emotive' words (ie, 'good', 'fair', 'very poor') and the October 2012 national recreational water quality report card release generated a number of enquiries of

[7] Ministry for the Environment. 2005. *Follow-up (consecutive) sampling of marine waters – proposed amendments to guidelines. Draft discussion paper*. Ministry for the Environment, Wellington.

specific councils as to what the grades actually mean. For example, in the Wellington region, concern was raised that a coastal site in Eastbourne was graded 'poor' but water quality at the site had only exceeded the action trigger value once over the last summer bathing season. Does the 'poor' grade in this context overstate the potential health risk?

Some sites may rise or fall by one grade on a yearly basis (as the latest summer's worth of indicator bacteria results are used to upgrade the MAC) without any real change in microbiological risk. It would be useful to explore whether there is a process for determining a meaningful shift in MAC for a site (eg, a 'fuzzy' boundary approach as applied with macroinvertebrate community index grades for New Zealand's rivers). This would have to be examined very carefully because MACs and SFRGs are tools for communicating health risk to the public; hard boundaries are easier in practice.

Guidance needed:
Advice on how best to communicate SFRGs to the public would be useful, particularly if this undertaken alongside reporting of actual indicator counts or where there has been a change in SFRG for a site that may not represent a 'meaningful' shift in terms of its general suitability for recreation. Also see Section 4.

4.0 SUITABILITY FOR RECREATION GRADE ASSESSMENTS & INTERPRETATION

This was the main focus of the workshop, reflecting the recent adoption of SFRGs in national level reporting of recreational water quality. The discussion addressed the individual components of the SFRG as well as related monitoring and reporting considerations associated with SFRGs.

4.1 SANITARY INSPECTION CATEGORY (SIC) DERIVATION

There is a lot of concern about the SIC assessment process. Present assessments are subjective and not as transparent as they should be. The present guidelines are difficult to use because they do not provide enough supporting information to assist with a robust assessment process.

What is the best way to undertake the sanitary risk assessment for a site? Is a desktop exercise suitable or is a more structured process involving territorial authorities, public health agencies and community groups required? How much information is required for a catchment – do we have to know everything about the catchment? For example, the area of each type of land use within both rural and urban catchments, stocking densities, discharge locations, bird densities, etc.

All of the SICs in the guidelines need to be revisited and updated. Some new categories are also required. For example, in their 2012 grading review report, Greater Wellington RC had to 'estimate' some new SIC values to address gaps such as stock access or waterfowl impacts in tributaries. Also, no category exists for dense bird populations in marine waters.

Improved definition/guidance for categories is required to make decisions more transparent. For example:

- How many birds constitute a 'dense" population'? Also does the risk vary with species (eg, black back gulls *vs* red billed gulls *vs* ducks *vs* geese)?
- What is the boundary between 'low' and 'high' intensity landuse in the upstream catchment? Does 'intensive agricultural land use' equate to 10% dairying, or 20%? Or 50%? Or XX stock per hectare?
- How close, to a recreation site, does a potential contaminant source need to be to be considered (some regions have some very large river catchments) and how likely does the 'potential' have to be to be considered (the location of stormwater outfalls and effects of runoff are good examples)?

In terms of the land use question, Greater Wellington RC has used existing River Environment Classification (REC) definitions to assist with categorising the dominant upstream land use. There may be better approaches?

Is there evidence that the different microbiological risk factors with the same SIC value pose the same risk to recreational users? For example, do the following microbiological hazards that generate a 'moderate' SIC for freshwater sites actually pose the same pathogen risk?

- Direct discharge to recreational waters of urban stormwater not contaminated by sewage
- *vs* low intensity agriculture
- *vs* marina or boat moorings
- *vs* sewer overflows to a tributary upstream
- *vs* unrestricted stock access to a tributary upstream

In other words, are the relative risks implied by the 'very high' to 'very low' categories supported by scientific evidence (eg, dense bird populations may contribute to high indicator bacteria levels but do the pathogens carried by birds pose a high risk to human health compared to stock or municipal wastewater discharges)? In addition, should there be different SIC values for recreational sites used for secondary (as opposed to primary) contact recreation?

One critical question requiring more guidance is what constitutes an *effect* of a microbiological risk factor? Microbiological water quality data often don't support the assigned SIC. If this occurs further evaluation of the catchment and monitoring data (eg, for patterns related to weather/flow conditions) are required. Can the SIC then be modified? For those regions that currently avoid sampling in wet weather, it may not be surprising that the assigned SIC doesn't reflect the monitoring data (eg, if the primary microbiological risk factor that generated the SIC is identified as urban stormwater or runoff from intensive agriculture). This raises the question of whether it is appropriate to modify the SIC if the MAC is modified for rainfall (ie, remove the risk factors that are not relevant during the conditions monitored)? Greater Wellington RC has followed this process for freshwater sites – generating both 'all weather' and 'dry weather' SICs (eg, some sites with a 'high' SIC associated with a primary microbiological risk factor of 'direct runoff from high intensity agricultural land use' in all weather conditions received a 'moderate' SIC for dry weather conditions as a result of the reduced level of risk of direct runoff in dry weather – and in some cases the primary risk factor shifted from runoff in all weather conditions to stock access in tributaries in dry weather conditions).

If a SIC has not been assigned or there is insufficient information to confidently carry out a SIC assessment can a site's SFRG be based solely on the MAC (100 data points or five years of data)? If so, there might need to be a caveat that the MAC is generated from water sample results that were taken in 'all weather' conditions (ie, during rainfall also), to ensure a good categorisation of microbiological water quality at the site.

In terms of SIC reassessment, it was generally agreed that this should occur at five-yearly intervals – except where there was a notable change in the catchment likely to influence the primary microbiological risk factors (eg, upgrade of wastewater or stormwater infrastructure).

Guidance needed:
The SIC assessment process in the MfE/MoH (2003) guidelines needs revisiting to address the above issues, in particular the engagement of appropriate microbiological experts to update the assessment so that it reflects current scientific understanding of the microbiological risks posed by different factors (eg, different bird species and animals vs human waste, etc.)[8]. Clarification is also needed of what skills/expertise are required to determine the SIC (ie, should this responsibility sit with heath protection officers/public health units?) Consideration could also be given to noting tools available to improve the rigour of SIC assessments (eg, PCR markers), as well provision of cost-effective and 'user-friendly' sanitary assessment options where resourcing constraints prevent detailed assessments from being carried out.

4.2 MICROBIOLOCAL ASSESSMENT CATEGORY (MAC) DERIVATION

The principal issues with deriving the MAC centre around:

- What to do if there are insufficient data points (ie, n<100 over the 5-year period); and

[8] For example, in August 2011 Graham McBride (NIWA) advised that the USEPA had revised its recreational water quality criteria/guidelines (the existing MfE/MoH (2003) guidelines followed the USEPA criteria quite closely) and these revisions would include findings from a number of new epidemiological studies, including alternative faecal indicators and more rapid laboratory procedures. The USEPA is also developing quantitative microbial risk assessment guidelines.

- How to treat rainfall-related data (where available).

The first issue is addressed in Section 2.2. The second issue links in with comments made in Section 2.3 and requires more discussion to define a way forward. Some councils (eg, Taranaki RC) have effectively excluded the influence of rainfall on the MAC for a site because sampling is conducted in dry weather conditions. Other councils, including Environment Canterbury and Greater Wellington RC, have developed their own processes to enable a 'dry weather' MAC to be derived alongside the 'all weather' MAC which enable the public to understand the risks of recreation in both dry and wet weather.

Greater Wellington RC's process only applies to freshwater sites and involves generating the dry weather MAC from *E. coli* data that was collected during river conditions at or below median flow (on the basis that such river conditions constitute the majority use of rivers for recreational purposes in the Wellington region). The Canterbury process is more selective (and potentially subjective), where science staff assess individual *E. coli* counts against peak flows and water clarity (median flows are not a suitable method for the alpine rivers of Canterbury and water clarity has proven to be a very useful guide for those rivers that typically have clear water). Should actual rainfall values be used rather than flows? The Canterbury experience – supported from observations in the Manawatu-Wanganui and Otago regions – shows that, in some cases, it is the flow conditions rather than the local rainfall conditions that will (a) result in increased *E. coli* concentrations and (b) deter people from swimming. This is particularly the case for the large catchments where, as outlined in Section 2.7, high rainfall in the headwaters can take some days to impact on lowland river reaches. However, it is also noted that in some cases where rivers flows are high it may be warm and sunny near the coast so people may still want to swim despite the flow conditions.

There needs to be a description of the process and grounds to remove rainfall-affected microbiological data (for both freshwater and marine sites) – especially given that recreation can generally occur in all weather conditions in most regions. It was agreed that the **use** of a site for recreational activities should be the driver for which data to use (eg, throughout New Zealand some whitewater kayakers go out during and immediately after a rainfall event when the river levels are high and microbiological risks and indicator bacteria levels high, and similar situations probably occur at coastal surfing sites in stormy conditions). This raised the question whether the number of users should be considered when it comes to reporting? For example, a few kayakers might go out in high river flows but for most of the public, such sites are largely only used in dry weather. Perhaps secondary contact recreation indicator bacteria guideline thresholds need to be developed and included in the generation of MAC grades, along with the types of recreation activities these MAC grades apply to? This would mean that SIC and SFRGs would also need to be generated for secondary contact recreation activities. If such a 'two-tiered' system is to be used, it would require very clear guidance so that it could remain simple for both council staff to use and the public (eg, swimmers vs recreational fishers) to understand.

For sites that are affected by rainfall there needs to be more work undertaken to assess high microbiological indicator values against rainfall. If rainfall data are excluded there will be less data points – is it valid to use a low number of data points (eg, 60 compared to the normal 100, for calculating a 95th percentile/MAC value? – or, as noted in Section 2.2, should results over more bathing seasons be used to make n=100?). Alternatively, is there another robust way of calculating the MAC – eg, could the 95th percentile threshold for deriving the MAC be legitimately adjusted for rain-affected sites? Furthermore, is the 95th percentile the appropriate value to use? The use of this percentile threshold effectively means that a MAC grade for a recreation site can be 'downgraded' due to only one elevated routine test result per summer bathing season.

As noted in Section 2.2, a critical question is what constitutes a rainfall event? The rainfall volume for a rainfall event will vary between catchments and sites. Rainfall intensity is also important – as are other factors such as the length of the preceding dry period.

Guidance needed:
The MAC assessment process in the MfE/MoH (2003) guidelines needs revisiting to provide guidance on how to address both microbiological water quality data-sets that lack 100 data points and the treatment of rainfall-related indicator bacteria data. Additional variable(s) and alternative methods to calculate the MAC should also be considered, along with the merits of and a possible process to distinguish between primary and secondary contact recreation (ie, whether the boundaries for MAC grades should be different and/or a different percentile threshold applied to the current 95th percentile threshold).

4.3 SUITABILITY FOR RECREATION GRADE (SFRG) DERIVATION

Given that the SFRG is derived from both the SIC and MAC, addressing the issues raised in Sections 4.1 and 4.2 should resolve the existing issues with the derivation and reporting of SFRGs. The critical question remains around recreational use in wet weather. A matrix of use could be generated for each monitoring site. From this it will be possible to determine the recreational activities carried out at a site and if the site is used during wet weather. If used during/immediately following wet weather both a 'dry weather' and a wet weather (ie, 'all weather') SFRG could be generated. Just relying on the 'standard' grade could misrepresent the recreational water quality for typical users of a site.

The MfE/MoH (2003) guidelines state that sites graded 'very good' or 'very poor' do not require routine sampling. As a result, most councils either no longer monitor these sites, or do so infrequently (eg, monthly sampling, or weekly sampling for one season once every five years). As noted in Section 2.2, this means that future re-assessments will be based on fewer than 100 data points, resulting in an interim SFRG. National guidance is needed on how often such sites should be sampled to confirm the MAC (and therefore SFRG) is still applicable (eg, should councils sample weekly over one summer season once every five years, or monitor fortnightly or monthly every summer, etc.?). It may be difficult for some councils to justify regular sampling at 'low risk' sites along the open coast. Guidance is also needed on how SFRGs for sites not sampled routinely should be reported both regionally and nationally. 'Very good' and 'very poor' sites need to be reported (at least at the regional level) to truly reflect the full range of beach grades.

Guidance needed:
The MfE/MoH (2003) guidelines need revisiting to provide more detailed guidance on how to reassess sites graded 'very good' or 'very poor' and how best to report grading information.

5.0 NATIONAL REPORTING

The focus of this paper has been to address regional monitoring and reporting issues, recognising that doing so will facilitate improved reporting at the national level. The merits of the Ministry for the Environment's decision to shift to SFRG-based national reporting were not revisited. The Recreational Water Quality Working Group had previously agreed during teleconferences and email exchanges over 2011/12 that SFRGs probably have more potential for national reporting – as well as the advantage of being indicative of general health risks at any time. However, the Working Group has also communicated to the Ministry some of the key issues with the current SFRG process and, because of these issues, some councils would also like to see national reporting of seasonal compliance with the MfE/MoH (2003) microbiological 'trigger levels'.

Some of the other challenges and considerations for national reporting of SFRGs include site and data collection, and the treatment of sites graded 'very good' or 'very poor'. These matters are briefly outlined below.

5.1 SITE AND DATA SELECTION

Consideration needs to be given to establishing a core set of monitoring sites that can be used in national reporting. These sites must reflect recreational usage for each region (ie, not State of the Environment or reference sites unless these are used for recreation) and should have biogeographic coverage that is not biased towards region(s) that have a disproportionately higher number of sites.

A process needs to be established to determine an appropriate subset of sites – regions should not 'cherry pick' sites. Consideration also needs to be given to:

- the number of data points used in the SFRG derivation process (eg, managing the differences arising from varying summer sampling periods between regions);
- whether there is any separation of 'primary' versus 'secondary' contact recreation sites (eg, is it simpler to only report sites that are known to be used for primary recreation);
- whether the SFRGs reported include both 'all weather' and 'dry weather' grades (where such grades are available for a site and have been demonstrated as being appropriate for the site); and
- how to obtain data from those regions that do not currently monitor recreational water quality (eg, Otago and Waikato regional councils do not have any formal programmes to monitor recreational waters in coastal waters in their region, although beaches in Dunedin City are monitored by the Dunedin City Council through resource consent conditions).

5.2 'VERY GOOD' AND 'VERY POOR' SITES

As noted in Section 4.3, sites graded 'very good' or 'very poor' for recreation tend to be monitored less frequently (if at all) by councils. Regions and central government may want these sites included in national reporting but a process needs to be determined by which it can be demonstrated that the grades are still valid/current. If such sites are ruled out of national reporting, the continuum of site grades will range from 'good' to 'poor' and it will be necessary for national reporting to still explain that other sites/grades also exist.

6.0 OTHER ISSUES

In addition to recreational shellfish monitoring (summarised in Section 6.1 below following a discussion with the Coastal SIG scientists on 2 November), other issues briefly discussed in relation to revising the MfE/MoH (2003) guidelines included:

- Whether or not consideration should be given to including microbiological 'trigger values' for secondary contact recreation – especially in freshwaters given that there is currently work in this space at the national level associated with the National Policy Statement for Freshwater and limit setting recommendations from the Land and Water Forum;
- The need to cross-reference other relevant guidelines (eg, MfE/MoH (2009) interim cyanobacteria guidelines)[9] and recreational water quality issues (eg, marine biotoxins);
- Possible inclusion of guidance for other contaminants, such as salmonella, campylobacter and cryptosporidium;
- Possible inclusion of a brief note or updated decision-support flowcharts on some key tools available to assist with microbiological risk assessments and investigating 'problem sites', including faecal sterol and microbial source tracking techniques; and
- Clarification of the responsibilities for different organisations under the existing guidelines would be useful, particularly in relation to monitoring and reporting of shellfish gathering waters.

The last issue, the unclear sharing of responsibilities between councils and district health boards/public health units is particularly problematic. Notes G(vii) to G(ix) of the MfE/MoH (2003) guidelines should be revisited to more explicitly define responsibilities for recreational water quality monitoring and reporting. Without more certainty of the roles and responsibilities of regional councils, district/city councils and public health agencies, there is a risk that some recreational waters may not be monitored (eg, as is presently the case for coastal waters in the Waikato region).

6.1 SHELLFISH MONITORING

Many regional and unitary councils monitor waters overlaying popular coastal shellfish gathering sites in order to provide the public with advice on the risks associated with microbial contamination that may render shellfish unsuitable for human consumption. Current monitoring guidance for shellfish gathering waters is detailed in Section F of the MfE/MoH (2003) guidelines. This guidance is based on the 1995 Ministry of Agriculture and Forestry 'Shellfish Quality Assurance Circular' and the 1992 Department of Health 'Provisional microbiological water quality guidelines for recreational and shellfish-gathering waters in New Zealand'.

The main objective of monitoring shellfish gathering waters for microbial indicators is to provide timely, robust advice to the public outlining the risks of shellfish consumption. Shellfish gathering is a popular recreational activity and an important aspect of tikanga maori; as such, providing accurate information on when shellfish consumption may be considered appropriate is important to the public.

In general there is considerable concern over the use of the current guidelines to fulfil this objective. This concern is based on:

- Compliance being based only on seasonal results, and with no clear definition in the guidelines of what constitutes a season;

[9] Ministry for the Environment, Ministry of Health. 2009. *New Zealand guidelines for cyanobacteria in recreational fresh waters – Interim guidelines*. Prepared for the Ministry for the Environment and the Ministry of Health by SA Wood, DP Hamilton, KA Safi and WM Williamson. Ministry for the Environment, Wellington.

- A relatively low median MPN level constituting 'non-compliance', meaning that many sites are easily rendered unsafe;
- Observing sites alternating between compliance and non-compliance between years; and
- A lack of technical explanation between the correlation between indicator bacteria in surrounding waters and public health risk; and
- A number of monitoring studies (eg, Environment Bay of Plenty 2009)[10] having demonstrated that there is no clear relationship between indicator bacteria levels in the water column and indicator or pathogen/virus content (eg, norovirus) in shellfish flesh.

As a consequence, there has been a varied approach in the application of the guidelines throughout the country, as well as variation in the authority responsibilities. A number of councils undertake routine monitoring of shellfish gathering waters in line with their summer recreational water quality monitoring programmes (eg, Northland RC, Greater Wellington RC, Hawke's Bay RC, Taranaki RC, Environment Canterbury and Environment Southland), although the frequency and duration of sampling varies between these councils. In contrast, other councils do not undertake any monitoring of shellfish gathering waters from a recreational perspective (eg, Waikato RC, West Coast RC only conducts issues-based monitoring and Auckland Council defers the responsibility of monitoring to the Auckland Regional Public Health Board).

Overall, it was felt that unless credible and defensible guidelines could be established, it was questionable whether councils should be assigning resources to monitoring water quality at recreational shellfish sites. Could a more risk-based approach – like the SIC assessment for contact recreation sites – be developed (eg, there is a very rigorous risk-based approach for commercial shellfish growers)?

Guidance needed:
If the existing guidelines are to be used to achieve the primary objective stated above, several revisions or clarifications need to be made. These include:

- *A revision/clarification of the technical background relating to the correlation between indicator bacteria concentrations and illness risk;*
- *Development (if appropriate) of single sample exceedance criteria so that correlations to conditions resulting in exceedance events (eg, rainfall) can be predicted and communicated;*
- *More guidance on the duration and frequency of monitoring;*
- *Definition of the timeframe over which compliance should be assessed; and*
- *Development of a 'decision-tree' approach to further monitoring/investigations should a site show consistent 'contamination' problems.*

It would also be useful to include some guidance on whether viruses (eg, norovirus) would be a better indicator than faecal coliforms and to provide some brief guidance on the monitoring of shellfish flesh, specifically how, when and the agency responsible. Most councils appear to consider that the responsibility for shellfish flesh monitoring should rest with Public Health Units (or agencies that discharge wastewater to coastal waters, as a condition of resource consent), but this monitoring appears to be falling through the gaps and the public continue to contact councils for this information/advice.

[10] Environment Bay of Plenty. 2009. *Microbiological quality of shellfish in estuarine areas.* Joint agency research report.

7.0 NEXT STEPS

The Recreational Water Quality Working Group will seek the approval of the Resource Managers Group to present this paper to the Ministry for the Environment in March 2013 so that it can be used to guide the Ministry's intended review of the existing national microbiological water quality guidelines for recreational waters. The Working Group will need to be closely involved in this process and consideration will also need to be given to other microbiological and statistical specialists that should be recruited to assist, including involvement of the co-publisher of the existing guidelines – the Ministry of Health.

It is also recognised that another survey of council recreational water quality monitoring and reporting practices might be needed in 2013 to assist with the review of the MfE/MoH (2003) guidelines. The last survey was completed in early 2011 but, due to time constraints, did not examine monitoring and reporting practices in any detail.

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Alex Connolly (Taranaki RC)[11] is also a member of the Recreational Water Quality Working Group but did not attend the November workshop. Kirsten Meijer (Environment Southland) and Greg Larkin (Environment Southland) were members of the Working Group up until their departure from Environment Southland in mid 2012).

Juliet Milne (Greater Wellington RC) coordinated the feedback sessions at the 2012 SIG meetings. The following council science staff attended the SWIM session on 21 May 2012:

- Alex Connolly (Taranaki RC)
- Fleur Tiernan (Marlborough DC)
- Jane Kitson (formerly Environment Southland)
- Jonny Horrox (West Coast RC)
- Kirsten Meijer (Environment Southland)
- Michele Stevenson (Environment Canterbury)
- Paul Scholes (Bay of Plenty RC)
- Emma Simpson (Northland RC)
- Summer Greenfield (Greater Wellington RC)

The following council science staff were present at the Coastal SIG meeting on 26 July 2012:

- Anna Madarasz-Smith (Hawke's Bay RC)
- Emily Roberts (Taranaki RC)
- Hilke Giles (Waikato RC)
- Jarrod Walker (Auckland Council)
- Lesley Bolton-Ritchie (Environment Canterbury)
- Megan Carbines (Auckland Council)
- Megan Oliver (Greater Wellington RC)
- Oliver Wade (Hawke's Bay RC)
- Stephen Park (Bay of Plenty RC)

The follow council staff also provided comment on a draft version of this paper:

- Alex Connolly (Taranaki RC)
- Bill Vant (Waikato RC)
- Emily Roberts (Taranaki DC)
- John Ballinger (Northland RC)
- Jonny Horrox (West Coast RC)
- Logan Brown (Horizons RC)
- Louise Bennett (Gisborne DC)
- Nick Ward (Environment Southland)
- Paul Fisher (Nelson CC)
- Paul Scholes (Bay of Plenty RC)
- Rachel Ozanne (Otago RC)
- Steffi Henkel (Marlborough DC)
- Trevor James (Tasman DC)
- Hilke Giles (Waikato RC)

[11] Alex replaced Erin Zydervelt after she left Taranaki RC.