

Before the Southland Regional Council (Environment Southland)
Hearing Commissioners

Under the Resource Management Act 1991 (**RMA**)
In the matter of the proposed Southland Water and Land Plan (**pSWLP**)

Evidence of Susan Bennett on behalf of Southland District Council (SDC), Gore District Council (GDC) and Invercargill City Council (ICC)

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**anderson
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Introduction

- 1 My full name is Susan Bennett. I hold a BA (Hons) in Natural Sciences from Cambridge University, UK, where I specialised in Chemistry and Molecular Biology.
- 2 I am employed as Principal Environmental Scientist with MWH NZ Ltd, now part of Stantec based in Dunedin. Prior to joining the Dunedin office at the start of 1997, I worked for MWH in Hong Kong for five years.
- 3 I have over 25 years' experience in environmental consulting, primarily involved with wastewater, stormwater, solid waste and biosolids management. My specialist area is the environmental effects of discharges.
- 4 Since joining MWH in 1991, I have worked on a range of environmental management projects in Hong Kong, Australia and New Zealand. Relevant projects in the Southland region over the past ten years include:
 - (a) Wastewater projects: consenting of Te Anau, Riversdale and Nightcaps wastewater discharges, development of initial phases of wastewater strategy and biosolids strategy for Southland District, application for changes to the Maitava wastewater discharge consent;
 - (b) Stormwater projects: consenting of Gore, Southland and Invercargill stormwater discharges to freshwater and review of monitoring information to determine ongoing monitoring requirements for Gore stormwater; and
 - (c) Solid Waste projects: consenting of Bluff Closed Landfill.
- 5 I acted as either technical lead for the projects for these projects, or as technical specialist providing input and review of the environmental effects, particularly water quality.
- 6 I am familiar with the Southland region.
- 7 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Key points

- 8 In my opinion the proposed Southland Water and Land Plan (**pSWLP**), as modified by the S42A report, prioritises water quality with minimal provision for other essential uses of land, such as infrastructure.

- 9 The objectives and policies contained within the pSWLP are generally absolute in requiring that water quality is not affected, which is not achievable for new or changing discharges.
- 10 The current rule cascade renders a significant number of the discharges from infrastructure as non-complying activities. This is often due primarily to the environment of the discharge rather than the nature of the discharge itself. Typically, the effects associated with the discharges would not be minor, in terms of the way the term is typically used in the RMA. With appropriate mixing, water quality might not be significantly degraded – or might still be maintained, in terms of compliance with the standards defined in Appendix E, and hence in my view should be able to gain a consent. However, given the directive and absolute nature of Objective 6 and Policy 15, the discharge would probably be considered "contrary to" them.
- 11 The evidence from the officers from the three Territorial Authorities (**TAs**) describes the nature of the infrastructure which will be affected by the pSWLP. This has highlighted the importance of the infrastructure to the Southland Region and the potential impact of the pSWLP on the provision of these services.
- 12 As noted in the TA officers' evidence, improvements are planned in a number of areas of their infrastructure. In my view, the pSWLP should provide a clear consenting pathway for these discharges, such that the continued operation and required improvements in infrastructure are appropriately classified, provided for and managed.
- 13 If consent cannot be achieved through the activity being non-complying and it being contrary to overly restrictive objectives and policies, this renders control and planning of infrastructure impossible and such improvements fall into a limbo. For important community infrastructure, this is unsatisfactory.

The problem with the pSWLP

Objective 6

- 14 The S42A Report has recommended that Objective 6 be retained as notified, which requires that "*there is no reduction in quality of freshwater, and water in estuaries and coastal lagoons, by: ...*" maintaining or improving water quality. The objective is not qualified to a specific set of values that are to be protected and hence requires an absolute absence of any reduction in water quality.
- 15 It is not possible to have "*no reduction in quality*" for a new discharge or a discharge which is increasing in volume or reducing in quality due to population increases. Any new or changing discharge from infrastructure will contribute a change in contaminant load to the receiving environment and will reduce water

quality. This is the case even if, after reasonable mixing, all the required values in the water body are protected and even if the new discharge represents an improvement upon the existing overall environmental situation.

- 16 An example of this concern is the implementation of a change from failing septic tanks to a Community Sewage Scheme, with a direct discharge to water following appropriate treatment. This could represent a significant improvement in overall water quality against relevant water quality objectives, particularly protection of public health. In theory, such a scheme would potentially replace a number of direct discharges to land and water from the septic tanks, in areas close to residential buildings, which can cause public health effects, with a single better treated discharge in a location with reduced public access. The discharge could be treated such that the relevant Plan standards and other objectives of the water body are met after reasonable mixing. However, the discharge of the treated wastewater to water will result in a reduction in water quality beyond reasonable mixing. Therefore, the discharge cannot be consistent with the absolute nature of the objective in its current form.
- 17 In the submission, the change sought by the TAs included the addition of "overall" and the addition of "to ensure freshwater objectives are met" to the end of the Objective. I consider that these amendments appropriately frame the Objective so that new or changing discharges can be consistent with the Objective.
- 18 This is on the basis that new or changing discharges only result in changes in water quality, such that the objectives for the water body are met. These freshwater objectives are defined by Policy 15 in the Plan Standards in Appendix E of the current Plan, which have been carried through and also would be defined for additional parameters (i.e. nitrogen and phosphorus) or tightened (i.e. bacteria) through the limit setting process as indicated in the Introduction to the pSWLP. I consider that this approach would be appropriate from a scientific point of view for managing water quality.

Policy 15

- 19 The S42A report has recommended some changes to the policy from that notified. However, I consider that these changes have not sufficiently addressed the concerns that were raised in the TAs' submission.
- 20 Policy 15(1) still requires that new discharges which reduce water quality are avoided, which I understand to mean "not allowed". Whilst the policy allows for reasonable mixing, it is not limited to achieving specific objectives and is absolute. The policy does not specify the parameters of concern, nor a specific concentration which should be maintained. Therefore, it applies even at concentrations which would be below detection and to all potentially affected parameters, even those of no environmental relevance.

- 21 As I discussed earlier, any new discharge will reduce water quality, as it will contain contaminants which are added to the water body, even if the discharge has received advanced treatment, there will be residual contaminants which will affect water quality for some of the measurable parameters. Hence, a new discharge will be contrary to this policy.
- 22 I consider that the addition of "unless the effects can be avoided, remedied or mitigated" as requested by the TAs, appropriately frames the policy and will enable appropriate new discharges to comply with the policy.
- 23 With respect to Policy 15(2), the S42A report says, in paragraph 7.55, that a mixing zone in surface water should not be available for discharges to land, which then subsequently discharge to surface water. I understand that this refers to recharge of surface water from the aquifer to which the discharge occurred. The resultant implication is that at the point of discharge from the aquifer containing the discharge into the surface water, adverse effects should be avoided, remedied or mitigated.
- 24 In addition, I note that Policy 15(2) requires that "*discharges to land that will reduce surface or groundwater quality ...*" are avoided. Whilst the reduction in water quality is appropriately limited to addressing adverse effects in this policy, it does not reference reasonable mixing and specifically requires no reduction in groundwater quality. The discussion in paragraph 7.49 of the S42A report implies that remediation of the discharge should occur prior to discharge to groundwater, such that no adverse effects occur in the groundwater. This means that remediation must occur in the unsaturated (or vadose) zone underlying the discharge prior to reaching groundwater.
- 25 I recognise that treatment is undertaken within the plant and soil interface and also within the vadose zone. Indeed this is an important benefit of a land disposal system. However, this is dependent on there being sufficient depth of unsaturated soil before the discharge reaches the aquifer. In much of Southland, there is elevated groundwater for at least part of the year and hence treatment potential is reduced during these periods. Also, this treatment is efficient for many parameters, but is not as efficient for nitrogen. Nitrogen in the form of ammonia generally remains within the soil and is not significantly leached (except in peat soils), but in the form of nitrate, it is generally leached down to the aquifer. If there is no carbon in the aquifer system, this nitrate will be conserved and reduced through dilution as the groundwater moves away from the discharge area.
- 26 Adverse effects from this plume of nitrogen in the groundwater typically relate to the use of the groundwater for drinking. However, the discharge can be managed to ensure that the maximum concentrations specific in the NZDWS are not exceeded. Adverse effects in any surface water body to which the plume in the

groundwater discharges will depend upon the specifics of the water body, but can again be predicted and managed appropriately, without requiring that there be no mixing zone.

- 27 Given these issues, I consider that the discharge of wastewater to land will be contrary to the S42A recommended form of Policy 15(2), unless prior treatment is undertaken, primarily to remove nitrogen and possibly also bacteria, dependent upon the depth to groundwater. This additional treatment results in increased costs of the provision of land discharge. Given the costs of implementing land discharge, the additional costs of nutrient reduction may render land discharge not feasible.
- 28 Policy 15(2) conflicts with Appendix E which states that Plan Standards given in the Appendix "apply following reasonable mixing with the receiving waters". I consider that the Plan standards in Appendix E provide guidance on what constitutes an adverse effect and that from a scientific perspective a consideration of mixing is generally appropriate to this assessment. Therefore, the policy is not consistent with the Appendix, which creates confusion in how it should be implemented.
- 29 The outcome of Policy 15(2) is that many discharges to land (without prior nutrient reduction) will be contrary to this Policy and would limit the feasibility of obtaining consent for discharges to land, which is contrary to other policies in the pSWLP which prefer discharges to land, over those to water.
- 30 An example is the proposed new discharge to land from the Te Anau WWTP at the Kepler Block, which has recently received consent. This discharge is a slow rate application of treated sewage to land. The discharge is expected to result in a plume of elevated nitrogen in the underlying groundwater which will travel towards the Waiau River, where it will mix with the River across a wide area. I performed the assessment of effects on water quality and aquatic ecosystems for the consent application.
- 31 In my assessment of the discharge, I stated that the effect of the discharge on the Waiau River after mixing would not be detectable and hence it complied with the Plan standards for the Waiau River, which are that "The natural quality of the water shall not be altered". This standard applies after reasonable mixing as noted at the start of Appendix G of the operative Regional Water for Southland. This Appendix has been carried forward to the pSWLP unchanged as Appendix E.
- 32 If Policy 15(2) had been operative such that a mixing zone was not allowed in groundwater or surface water, I consider that the discharge would have been contrary to it. This is because a plume with elevated nitrogen in the groundwater was predicted with potential associated adverse effects and a mixing zone was

required in the surface water (being the Waiau River) to which the plume discharged for which the Plan standard is "the natural quality of the water shall not be altered", which I interpreted as meaning no detectable change should occur.

- 33 Therefore, I consider that Policy 15(2) should allow for a zone of reasonable mixing for adverse effects. To be consistent, I similarly consider that Policy 15(3) should also allow for reasonable mixing.
- 34 Policy 15(4) requires that discharges to artificial watercourses that reduce water quality be avoided, with no framing of the degree of reduction and hence is also absolute. This policy applies to both new and existing discharges. A number of discharges from the Southland infrastructure occur to artificial watercourses. This often allows for further treatment (generally filtration) of the discharge in these artificial watercourses before it reaches the natural watercourse. In its current form, the policy would result in such discharge being required to result in no reduction in water quality, which is not possible, and would mitigate against this form of discharge when the consent is renewed. This may result in more direct forms of discharge to natural watercourses being preferred. I consider that the addition of "unless the effects can be avoided, remedied or mitigated" to the end of this policy is necessary to avoid unduly limiting the ability of such discharges to gain consent.
- 35 The S42A report recommended that the second clause 3 of Policy 15 be revised to require that "groundwater quality meets the New Zealand Drinking Water Standards for New Zealand 2005 (revised 2008) (**NZDWS**) where water is used for drinking". The underlined text is the additional text recommended by the S42A report.
- 36 The TAs' submission stated that the NZDWS were designed for application to a water supply, and were not appropriate for application to general water quality. The NZDWS are a comprehensive statement of the relevant standards for drinking water quality both for health (maximum acceptable values, MAV) and aesthetic purposes (guidelines values, GV). It also specifies the methods that a treatment plant can use to achieve the standards, and includes sampling and testing protocols to demonstrate compliance with the NZDWS. By requiring that groundwater comply with the NZDWS where it is used for drinking, the implication is that these other elements, including the significant sampling programme, is required. This is considered inappropriate to apply to groundwater, even where it is used for drinking, when not part of the Council water supply scheme. Its imposition would result in considerable, and inappropriate, expense.
- 37 As such much of the NZDWS are not relevant for application to general water quality, even if that is limited to groundwater quality, where groundwater is used

for drinking. The inclusion of the whole NZDWS in the policy is confusing and inappropriate.

- 38 A potential response to this concern is to specify that the groundwater quality meet the MAVs to protect human health where water is used for drinking. However, I consider such application of the MAVs is also not appropriate. The purpose of water treatment plants is to remove contaminants such that water is of drinking water quality. Contaminants may be present naturally, which mean that the groundwater would not comply with the MAVs, but, if a concern, they are removed before supply of the water from the treatment plant. Therefore, the groundwater quality may not comply with the NZDWS but this does not impact on human health.
- 39 Given the context for the pSWLP, I understand that the concern which gave rise to this policy is increasing nitrogen and bacterial concentrations in groundwater in some areas of the Southland Region. I consider that this issue would be more properly addressed through the limit setting framework rather than in this policy. These concerns are appropriately addressed through the limit setting framework on a freshwater management unit basis with the community identifying where this is a concern and understanding the economic and environmental effects of imposing the limit.
- 40 Therefore, I recommend that the second clause 3 of Policy 15 be deleted.
- 41 The S42A report has recommended the inclusion of a new clause 5 into Policy 15. This clause essentially requires that for existing discharges, water quality is improved where it is degraded to the point of being over-allocated. As per my comments on other aspects of this Policy and Objective 6, the improvement in water quality is not limited and is absolute, and hence is not considered appropriate. Also, the pSWLP currently does not have any definition or clarification of how to identify water bodies where the water quality is degraded to the point of over allocation. The appendices in the notified plan discuss over allocation in terms of water quantity but not in terms of quality. I understand that this will be defined through the load assessment undertaken under the NPS-FM and the limit setting process. However, in the interim and without further specification, this clause is left open to interpretation and hence there will be considerable uncertainty in how this clause is interpreted on a case by case basis. I recommend that this clause be deleted from the pSWLP and included at a later date once the load assessment and limit setting process is suitably advanced.

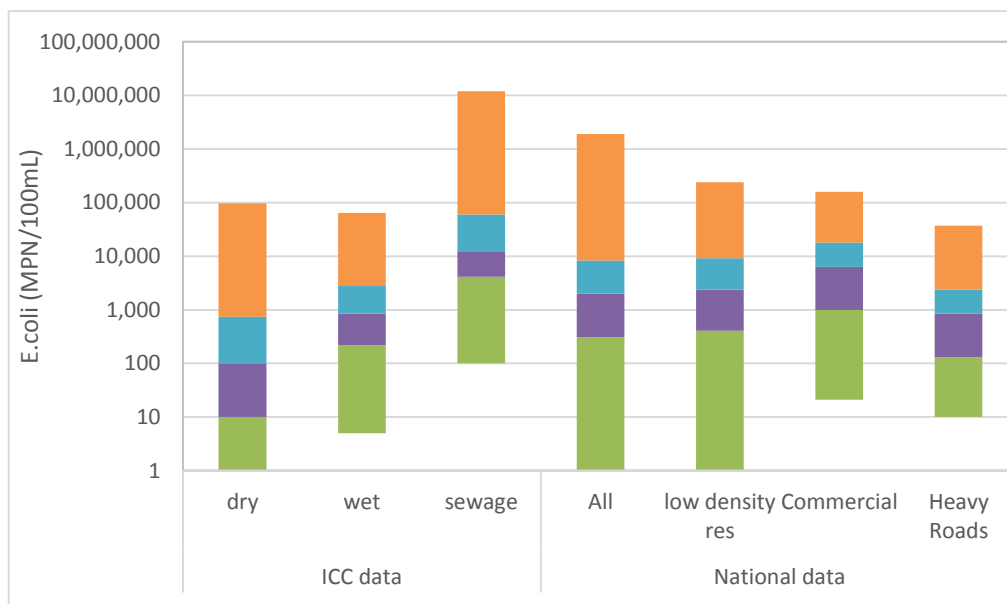
Definition of mixing zone

- 42 The pSWLP contains a definition of a "reasonable mixing zone". This term is used in a number of the policies and rules to define the point at which the Plan Standards from Appendix E should be complied with or adverse effects are to be avoided, remedied or mitigated.
- 43 The RMA allows for reasonable mixing, which essentially allows for discharges to not comply with relevant standards at the point of discharge but at some later point after mixing with the received water body. The size of the reasonable mixing zone depends upon a number of factors, including the nature of the discharge and the receiving water body, and the presence and nature of sensitive receivers. The size of the mixing zone can be different for different values. An example of this is that the area within which a discharge can exert acutely toxic effects could be smaller than that where nutrient effects or public health effects may occur.
- 44 In my view, whilst it useful for the pSWLP to provide guidance on what could be an appropriate mixing zone, the potential variability in the assessment means that this is a consideration that should be taken on a case by case basis, rather than rigidly constrained to a maximum size in the pSWLP.
- 45 To illustrate this issue, I have reviewed the potential mixing zones for the Southland District Council wastewater schemes that could result from the definition of the reasonable mixing zone in the pSWLP and compared them with the mixing zones specified in their current consents. This was conducted through an estimation of channel width based on aerial photographs, rather than site visits.
- 46 For many of the schemes, the mixing zones in the current consent and from the pSWLP definition are similar, with the pSWLP defined zone generally being somewhat smaller. However, for the Tuatapere scheme which discharges to the Waiau River, the mixing zone would reduce from 300m in the current consent to 200m under the pSWLP definition. Similarly for the Edendale scheme, which discharges to the Maitai River, the mixing zone would reduce from 425m to 200m. Whilst this reduction may be appropriate, it requires an evaluation of why the current mixing zones are larger and whether they are still appropriate, which would be appropriately done at the time that renewal of these consents is sought. However, this case by case assessment is currently not provided for in the strict definition given in the pSWLP.
- 47 The amendments as suggested in the TAs' submission would retain the guidance provided by the notified plan, but would provide for this required flexibility in individual assessments.

Rule 15

- 48 Rule 15 is identified in the pSWLP as the rule which controls the discharge of stormwater.
- 49 To assess the impact of this Rule and its cascade, it is important to understand the nature of the discharges from the reticulated stormwater networks in the Region.
- 50 Under the conditions of the consent granted in 2011 for the discharges from the Invercargill Stormwater network, monitoring of the discharges was conducted for a representative sample (18 in number) of all the discharges from the network as a whole.
- 51 The sampling undertaken was through collection of grab samples. Both dry weather and wet weather samples are required by the current consent conditions. I note that this recognises that more than strictly stormwater runs through these systems, and that no system is completely watertight. Dry weather samples were collected when there had been minimal rainfall for at least 72 hours prior and hence represent the baseflow in the system without inflow from rain related flows. Wet weather samples were taken in a period of wet weather, and were not timed to represent first flush but indicated the general quality of discharge during wet weather.
- 52 The primary parameter which controls the Rule cascade is faecal coliforms. Monitoring of the Invercargill discharges was undertaken for *E.coli* rather than faecal coliforms. However, *E.coli* is a subset of faecal coliforms, and provides an indication of when the faecal coliforms standards is breached. Essentially, if *E.coli* exceeds the standard, then the faecal coliforms concentration will as well.
- 53 There were a number of discharges where highly elevated concentrations of *E.coli* were recorded. These sites also had elevated ammoniacal nitrogen in comparison to other sites, which is also an indicator of sewage.
- 54 The following figure presents the range of *E.coli* data from this monitoring as compared to the nationally available data from URQIS¹, which represents the national data set. The data set was split between dry weather data, wet weather data and that from sites in both weather conditions, which appeared to contain sewage.

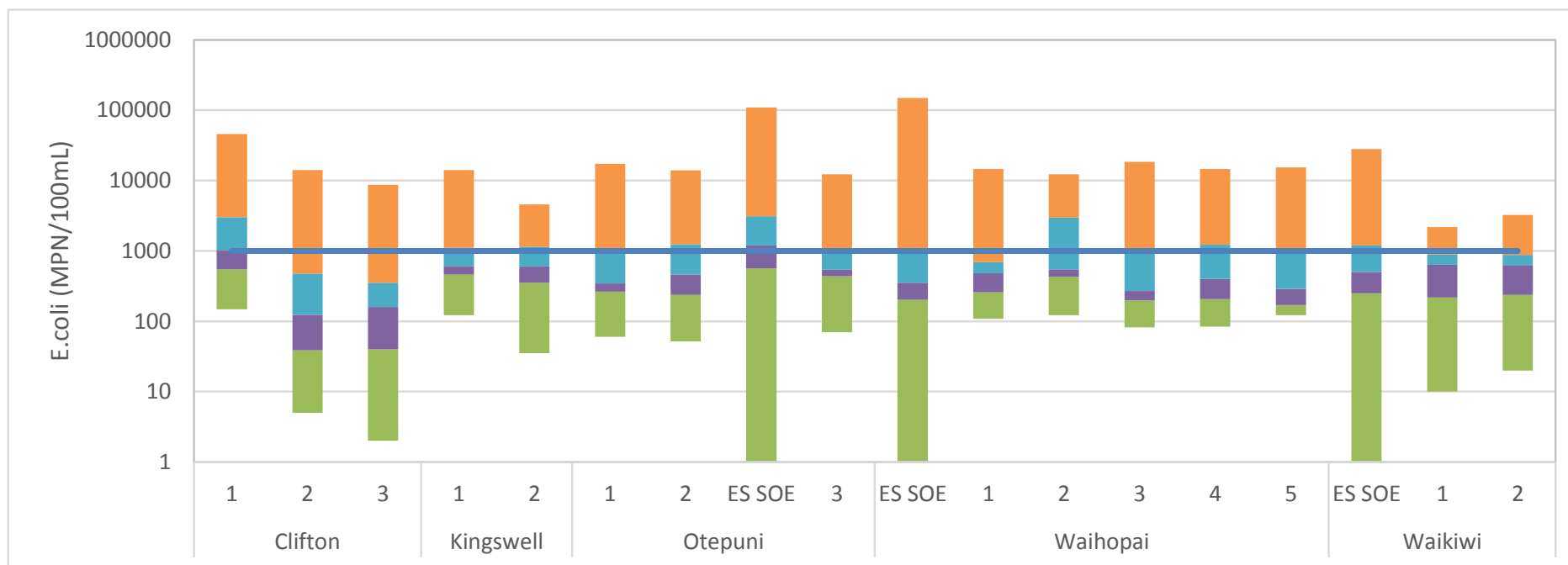
¹ URQIS is a nationally available resource for the New Zealand public, institutions and companies who need access to urban runoff data. The database is updated with new data at irregular intervals. <http://urqis.niwa.co.nz/>. It provides a summary of available data on stormwater discharge quality from a range of sources around the country.



Comparison of Invercargill City Council *E.coli* concentrations in stormwater discharges against national data²

- 55 The wet weather discharges are above the faecal coliforms standard of 1,000 MPN/100mL for a number of discharges, indicating the typically elevated concentrations in stormwater as a result of contamination from surface run-off, even where sewage is not indicated as being present.
- 56 I am also familiar with the monitoring data that has been collected for the Southland and Gore District Council networks. The results in the graph are consistent with the results from those networks. It is important to note that the concentrations in the Invercargill stormwater are similar to that in the national database, which indicates that these elevated concentrations are typical and expected.
- 57 It is also important to understand the nature of the receiving water bodies into which these discharges occur to understand the impact of the Rule cascade. The quality of the receiving water bodies for the Invercargill stormwater network is presented below. This is based on the data from both the five years of monitoring undertaken by Invercargill City Council under its consents and the Environment Southland State of the Environment (**SOE**) monitoring, which is for a much longer period, and includes significantly more data points. The data is grouped by catchment, with 1 being the most upstream location, then progressing downstream in order.

² Each quartile of the data sets are shown in a different colour, i.e. the lowest 25% of each data set is in the green band. The interface between the blue and purple band is the median and the orange band is the top 25% of the data.

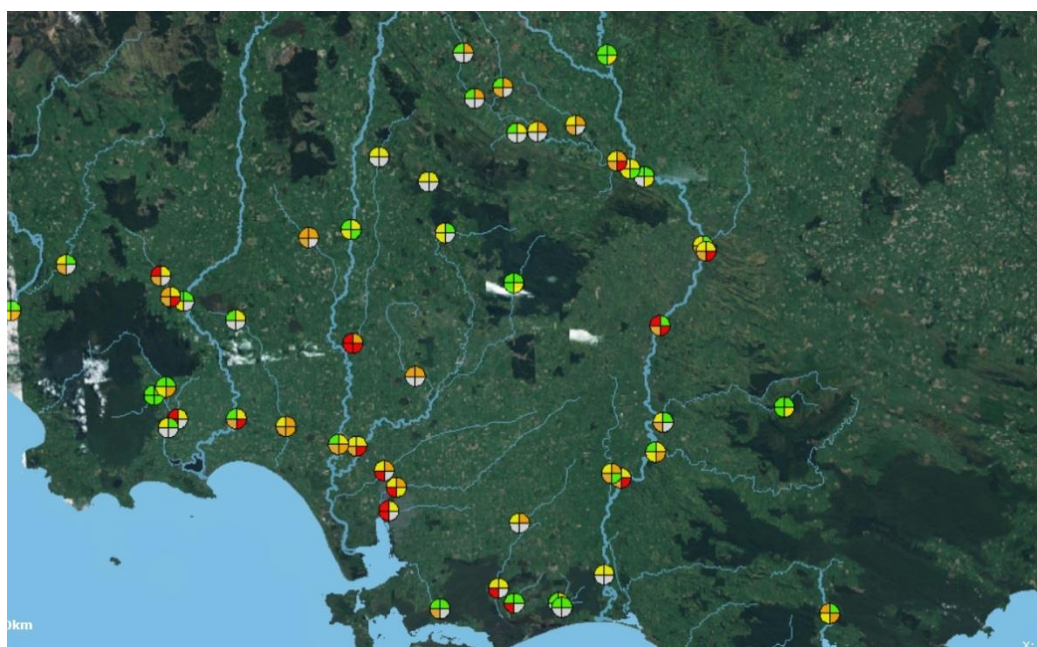


Range of *E.coli* in the receiving water bodies from ICC and ES SOE monitoring³

³ Each quartile of the data sets are shown in a different colour, i.e. the lowest 25% of each data set is in the green band. The interface between the blue and purple band is the median and the orange band is the top 25% of the data.

The data is grouped by catchment, with 1 being the most upstream location, then progressing downstream in order.

- 58 This shows that the *E.coli* concentrations, in all of the streams, often exceed 1,000 MPN/100mL, on more than 25% of the sampling occasions. For the ICC monitoring where rainfall was noted, the wet weather samples generally had higher concentrations than the dry weather.
- 59 Given that *E.coli* is a subset of faecal coliforms, this indicates that the Regional Plan standard for these water bodies is not complied with for between a quarter and half of the time. The standard is exceeded upstream as well as through the catchment of the stormwater network, and there is minimal change through the locations of the discharges, except in Otepunui Creek, as indicated by the ES SOE data and in Clifton Creek where the upstream location had much higher concentrations than the downstream samples.
- 60 This assessment of water quality is consistent with a number of water bodies around the Region, as shown by the figure below taken from the Environment Southland Beacon system. The circles contain a summary of compliance with the National Objectives Framework (**NOF**) from ES state of the environment monitoring between July 2009 and June 2014.



NOF Water Quality (July 2009 - June 2014) (Source: ES Beacon)

- 61 The top left quadrant of the circles indicate compliance with the *E.coli* limits in the NPS-FM. Essentially, if the quadrant is red or orange, the median of the data is greater than 540 MPN/100mL. If it is yellow, then the median is greater than 260 MPN/100mL. Given the typical variability of bacteria concentrations as illustrated in the above graphs, if the median *E.coli* concentration is greater than these values, the maximum faecal coliforms concentrations will be greater than 1,000 MPN/100mL. This is the case at a number of these sites around the Region.

- 62 Stormwater is defined in the pSWLP by a narrow definition namely "surface water run-off subsequent to precipitation". As discussed by Mr Loan, the larger reticulated stormwater networks will contain more than just run-off, and can include drainage water and streams from rural areas intercepted by the stormwater network. Also, there is a risk of sewage being present in stormwater networks, either through cross-connection from private sewage pipes, or from overflows from the public sewer system. The degree of this risk depends upon the age and nature of the stormwater system.
- 63 For smaller, newer networks, the discharge would contain mainly run-off and hence provided a pragmatic view of the Rule is taken, these discharges could remain under Rule 15. However, given the risk of sewage being present, the discharges could be assessed under Rule 15(c) as a non-complying activity.
- 64 For large and/or old networks such as those in Invercargill and Gore, it is probable that the discharge will contain more than just run-off; this means that Rule 15 does not apply and the discharge is dealt with under Rules 5 and 6. As discussed, in wet weather, the discharge can contain elevated faecal coliforms, which is normal for stormwater but which exceed the Plan standard. This is the case even where sewage contamination of the discharge is not suspected.
- 65 Furthermore, many of the water bodies to which the discharge occur already do not comply with the Plan standard for faecal coliforms upstream of the urban area, for example Waihopai River and Otepuni stream, as shown in the previous graph. Therefore, the discharges from these stormwater networks will fall under Rule 6 and hence be non-complying activities.
- 66 This means that the discharges from most of the reticulated stormwater discharges in the Region would be a non-complying activity, either under Rule 15(c) or Rule 6, even though they are normal and expected discharges from this type of infrastructure.
- 67 I note that sewage is specifically excluded from the discretionary activity rules (Rule 15(b) and Rule 5). As discussed above, there is a risk of sewage being present in a reticulated stormwater network, for a number of reasons as discussed by Mr Loan and Mr Bayliss, particularly in the larger and older systems.
- 68 The consent for the Invercargill stormwater network has expired and the application to replace it is currently being processed. Under the operative RPWS, the discharge of raw sewage is a prohibited activity, which means that consent for the sewage in the discharge from the network cannot be sought.

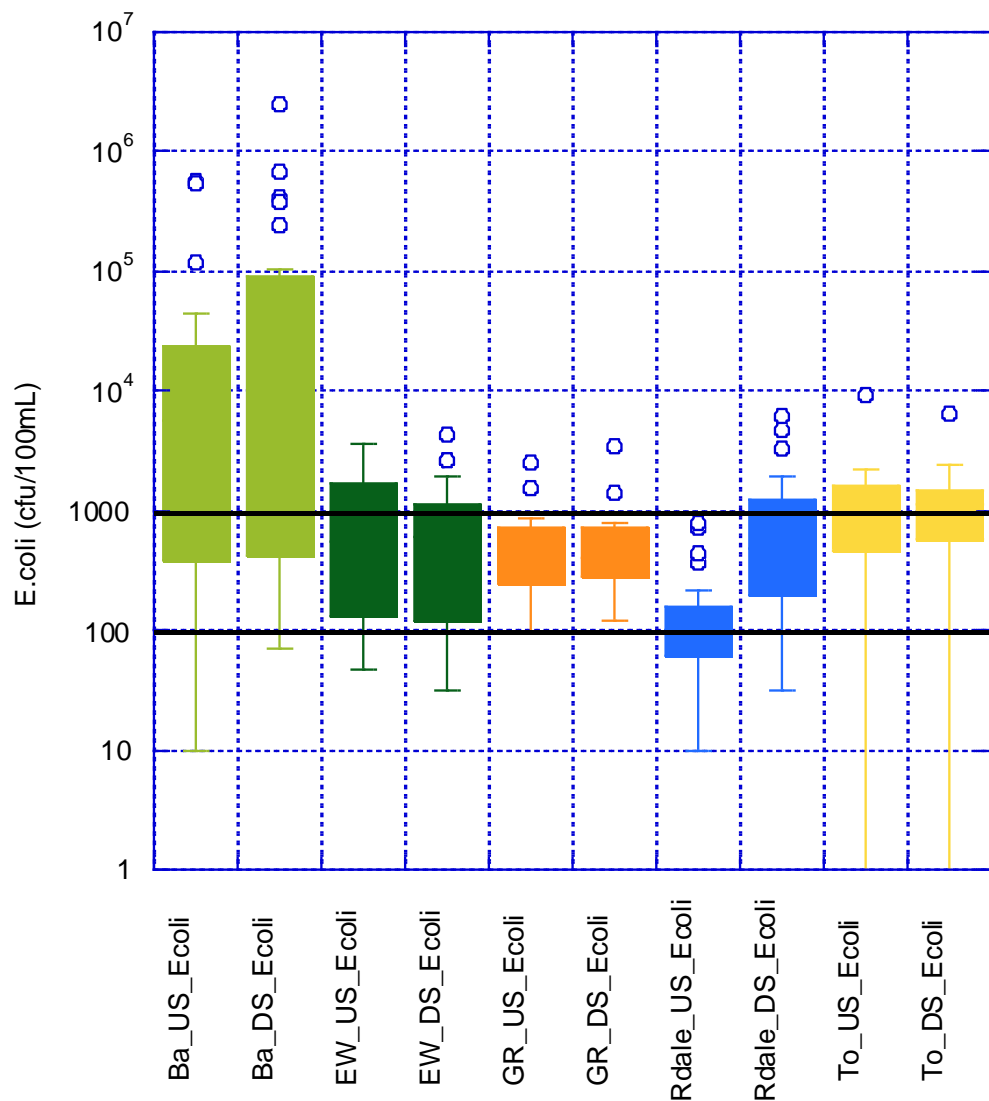
- 69 As part of the application for new consents, Invercargill City Council has volunteered conditions for identifying and dealing with illegal sewage connections, including a long term monitoring programme to specifically identify the presence of sewage on an ongoing basis throughout the term of the consent. This is a practical response to reducing the risk posed by sewage discharges to the network. These conditions could not be imposed by Environment Southland as sewage cannot be allowed/controlled by the consent. Therefore, they had to be volunteered by Invercargill City Council.
- 70 I understand that the pSWLP does not resolve this situation, as sewage discharges as part of the discharges from the stormwater network are non-complying and given the objectives and policies framework, very difficult to consent and hence control. I consider that this is unsatisfactory situation as it does not enable the appropriate control and management of sewage discharges in stormwater.
- 71 The changes to Rule 15 proposed in Mr Dunning's evidence would mean that sewage can be included in discharge from a reticulated stormwater network and hence provides a consenting route and appropriate control.

Rule 33 – Community Sewage Schemes

- 72 Rule 33 is identified in the pSWLP as the rule which controls the discharge from community sewage schemes (**CSS**). Given the definitions of on-site wastewater system and CSS, as revised by the S42A report, all of the wastewater schemes operated by the three TAs, are defined as CSS.
- 73 Mr Evans, Mr Loan and Mr Bayliss have described the wastewater schemes in the three districts. As described, a large number of the CSS in the Region discharge directly to water. Rule 33 only allows for discharge of effluent to land. This means that all the CSS which discharge to water fall under Rule 5 or Rule 6.
- 74 The discharges occur into similar receiving bodies as those described above for stormwater. These water bodies are often not compliant with the Plan standards, particularly in relation to faecal coliforms. The following graphs show the data collected as required by the consents for the wastewater schemes. This includes samples from upstream and downstream of the CSS discharges in the Maitai and Waiau freshwater management units (**FMU**). Variability in the upstream and downstream receiving water quality, where data is available, is shown. The plots are colour coded for each scheme as given in the footnotes to the graphs. The upstream site is the left box and the associated downstream site is the right box for each scheme.

- 75 For the Matuara schemes, faecal coliform data was not available, but *E.coli* data was and is presented. As before, it is assumed that the *E.coli* limit is the same as the faecal coliform standard from the pSWLP (i.e. a 1:1 ratio of *E.coli* to faecal coliforms). This ratio has not been confirmed for the relevant schemes, but is consistent with observations elsewhere for pond-based treated wastewater discharges.
- 76 For the Waiau schemes, faecal coliforms data was available and has been presented.

Mataura FMU – *E.coli* concentrations in the receiving water⁴

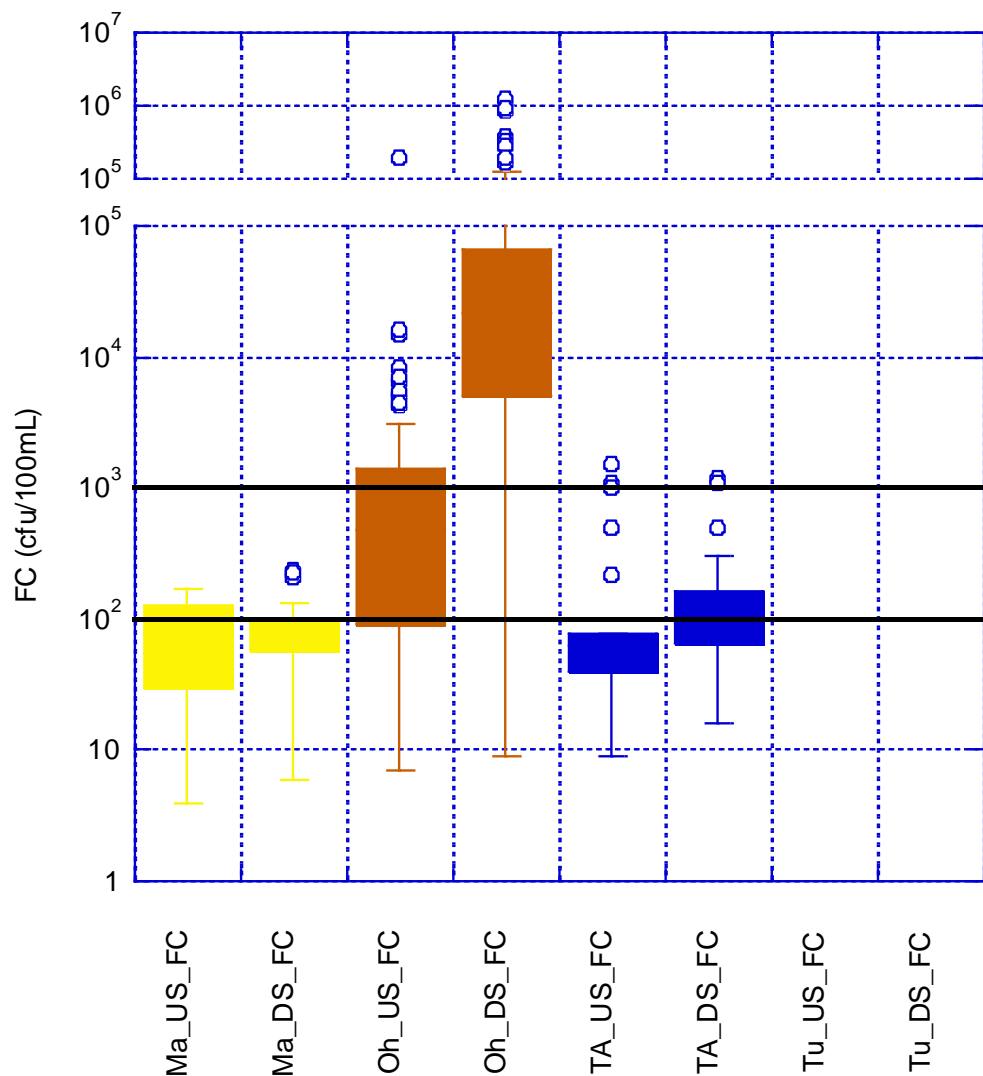


⁴ The plots are colour coded for each scheme as given in the footnotes to the graphs. The upstream site is the left box and the associated downstream site is the right box for each scheme. Schemes in Mataura catchment and colours used are: Balfour – **light green**, Edendale-Wyndham – **dark green**, Gorge Road – **orange**, Riversdale – **blue**, Tokanui – **yellow**.

Box-whisker plots show:

- ☐ a "box", which shows where the middle 50 percent of the data lies. The upper quartile (75th percentile) is the top of the box, the lower quartile (25th percentile) is the bottom of the box and the interquartile range (25th to 75th percentile) is the shaded box
- ☐ "whiskers", which show variability in dataset. The whiskers extend out to the nearest actual data point that is closest to being 1.5 times the interquartile range from the upper and lower quartile
- ☐ "open circles", which are outliers beyond the whiskers. There is one open circle per outlier
- ☐ The higher horizontal black line(s) is the water quality standard from Appendix E

Waiau FMU – faecal coliforms concentrations in the receiving water⁵



⁵ The plots are colour coded for each scheme as given in the footnotes to the graphs. The upstream site is the left box and the associated downstream site is the right box for each scheme. Schemes in Waiau catchment and colours used are Manapouri – **yellow**, Ohai – **brown**, Te Anau – **dark blue**, Tuatapere – **red**.

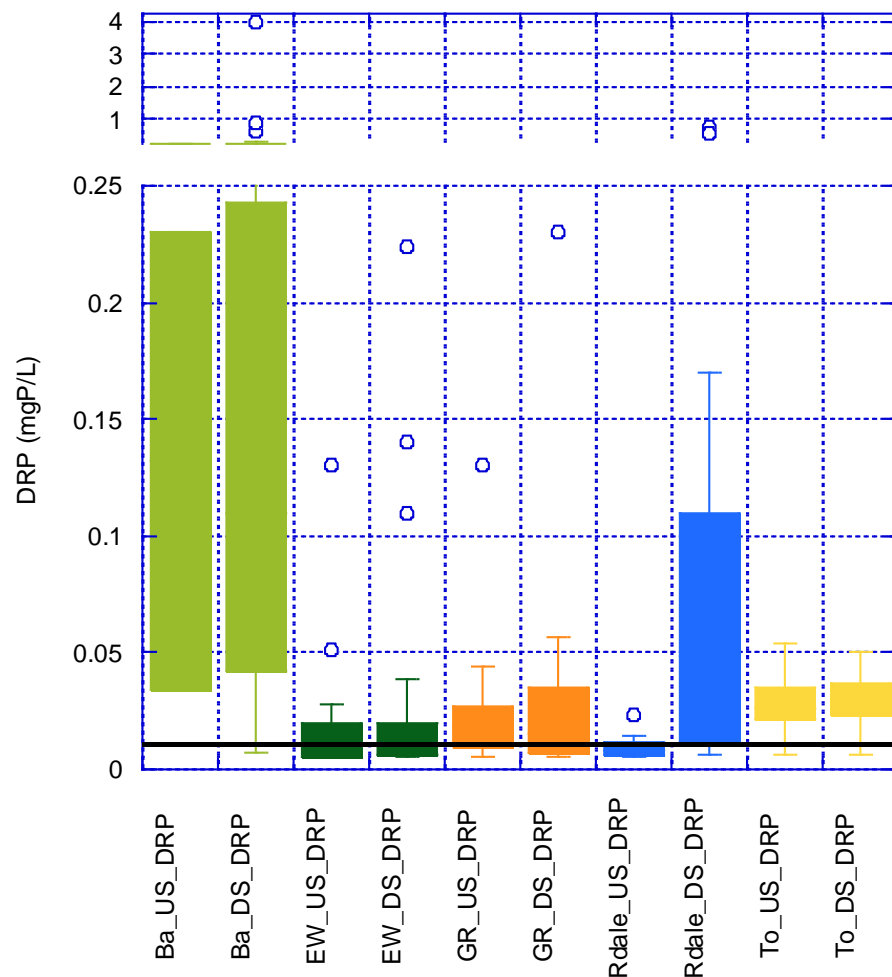
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- ☐ "open circles", which are outliers beyond the whiskers. There is one open circle per outlier
- ☐ The higher horizontal black line(s) is the water quality standard from Appendix E

- 77 For the schemes in the Mataura FMU, the following is observed:
- (a) The receiving water around all the schemes, occasionally exceeded the Plan standard and for two schemes (Balfour and Tokanui), the receiving water typically exceeded it.
 - (b) For all schemes except Riversdale, concentrations were comparable upstream and downstream for *E.coli*. This indicates that the effect of the discharge is minimal. For the Riversdale scheme, higher concentrations of *E.coli* were observed downstream of the WWTP, which resulted in the Plan standard being exceeded when it had not been upstream. A change to the Riversdale scheme has been recently consented, which should address this issue.
- 78 For the schemes in the Waiau FMU, the following is observed:
- (a) The receiving water around all the schemes typically complied with the plan standard, except for Ohai, which exceeded it downstream.
 - (b) For the Manapouri, Te Anau and Tuatapere schemes, microbiological concentrations were comparable upstream and downstream. This indicates that the effect of the discharge is minimal.
 - (c) For the Ohai scheme, higher concentrations of faecal colforms were observed downstream of the WWTP. The Ohai discharge is into a small stream, with minimal dilution available. I understand that this has been addressed in the application for the new consent for Ohai, which is currently being processed.
- 79 In summary, a number of the receiving water bodies for the wastewater schemes currently do not comply with the plan standard and hence the discharge from the CSS to water will fall under Rule 6, as a non-complying activity.
- 80 As stated by Mr Evans and Mr Ruru, it is recognised that changes in the discharges are required to address water quality concerns, which result from the discharges. This may mean a change to a land based discharge, as proposed for Riversdale, or an upgrade to the quality of a continuing discharge to water.
- 81 As discussed by Mr Evans, to be cost effective, an upgrade to a CSS needs to be undertaken as a discrete event rather than as a series of incremental upgrades to address different aspects of the discharge. It is expected that some schemes will need to be upgraded to address issues arising from the limit setting process, as well as the existing plan standards.

- 82 The limit setting process will commence in Southland this year. It is expected that this will result in limits on nutrients, being nitrogen and phosphorus, as well as potentially resulting in more limiting bacterial limits for some areas.
- 83 An indication of whether nutrients need to be addressed can be gained from reviewing the upstream and downstream concentration of nitrogen and phosphorus in the receiving water. A summary of the available information from the consent required monitoring of schemes in the Maitava FMU is presented below. The data has been compared to the trigger values for protection against nutrient effects from the ANZECC 2000 Guidelines, which are shown as the black lines on the graphs. These graphs are in the same format as the previous graphs for bacteria.

Mataura FMU – Dissolved Reactive Phosphorus concentrations in the receiving water⁶

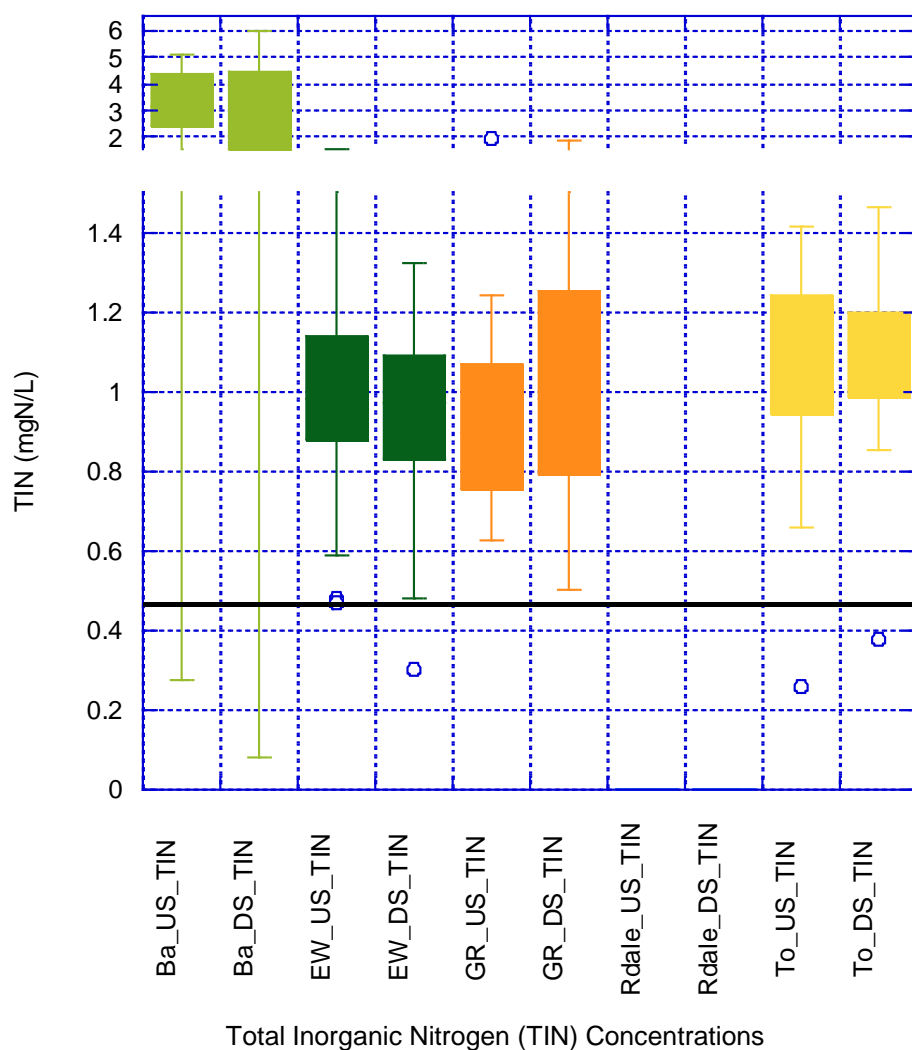


⁶ The plots are colour coded for each scheme as given in the footnotes to the graphs. The upstream site is the left box and the associated downstream site is the right box for each scheme. Schemes in Mataura catchment and colours used are: Balfour – light green, Edendale-Wyndham – dark green, Gorge Road – orange, Riversdale – blue, Tokanui – yellow.

Box-whisker plots show:

- a "box", which shows where the middle 50 percent of the data lies. The upper quartile (75th percentile) is the top of the box, the lower quartile (25th percentile) is the bottom of the box and the interquartile range (25th to 75th percentile) is the shaded box
- "whiskers", which show variability in dataset. The whiskers extend out to the nearest actual data point that is closest to being 1.5 times the interquartile range from the upper and lower quartile
- "open circles", which are outliers beyond the whiskers. There is one open circle per outlier
- The horizontal black line(s) is the nutrient based guideline from ANZECC 2000 Guidelines

Mataura FMU – Total Inorganic Nitrogen concentrations in the receiving water⁷



⁷ The plots are colour coded for each scheme as given in the footnotes to the graphs. The upstream site is the left box and the associated downstream site is the right box for each scheme. Schemes in Mataura catchment and colours used are: Balfour – light green, Edendale-Wyndham – dark green, Gorge Road – orange, Riversdale – blue, Tokanui – yellow.

Box-whisker plots show:

- a "box", which shows where the middle 50 percent of the data lies. The upper quartile (75th percentile) is the top of the box, the lower quartile (25th percentile) is the bottom of the box and the interquartile range (25th to 75th percentile) is the shaded box
- "whiskers", which show variability in dataset. The whiskers extend out to the nearest actual data point that is closest to being 1.5 times the interquartile range from the upper and lower quartile
- "open circles", which are outliers beyond the whiskers. There is one open circle per outlier
- The horizontal black line(s) is the nutrient based guideline from ANZECC 2000 Guidelines

- 84 For the schemes in the Mataura FMU, the following is observed:
- (a) All schemes typically reached or exceeded the nutrient guideline values where data was available.
 - (b) For all schemes except Riversdale, concentrations were comparable upstream and downstream for nitrogen and phosphorus, where data was available. This indicates that the wastewater discharge has minimal impact on receiving water concentrations. For the Riversdale scheme, higher concentrations of DRP were observed downstream of the WWTP.
- 85 The need for and scale of any upgrades required will depend upon the outcomes from the limit setting process. I envisage that a number of schemes will be required to address bacterial concentrations, particularly if more stringent swimming based standards are adopted, and some schemes will need to address nutrients, although whether this would need to address nitrogen and/or phosphorus reduction and the extent of any required reduction is unclear.
- 86 As discussed by Mr Evans, an upgrade of a wastewater treatment plant to address nitrogen reduction only, is different from one to reduce phosphorus only, or one to reduce both nutrients. These upgrades are also quite different from an upgrade to reduce bacterial concentrations. These requirements can be combined to result in quite different solutions. Given my assessment of the condition of the receiving water bodies, the limit setting process could result in a wide variety of required upgrades to achieve disparate objectives.
- 87 In summary, the current version of pSWLP as given in the S42A report will result in many of the discharges from CSS being non-complying activities, largely as a result of upstream water quality. This will mean that seeking consent for these discharges will be difficult, especially given my discussion on the Objective 6 and Policy 15.
- 88 The limit setting process may result in the need for upgrades to address concerns which are not specifically required by the current plan standards as given in Appendix E. These upgrades will need to be carefully staged to ensure that the most cost-effective solutions are employed and to avoid significant effects on the social and economic environment of the Region, as discussed by Mr Ruru.
- 89 The flexibility to allow a staged approach to upgrades is best served by ensuring that the discharges from CSS are discretionary activities in the pSWLP.

Rule 33 – pond leaks

- 90 The TAs' submission on Rule 33 requested that the conditions on Rule 33(a) be deleted. This request has been partially accepted but the previous conditions have been replaced with a requirement to demonstrate that the storage pond does not have visible cracks or defects that would allow leakage. The result of such cracks or defects being identified are that the discharge from the CSS becomes a non-complying activity. There are practical issues with inspecting an operational pond to confirm that they are crack and defect free. A potential effect of the rule as written is that, when seeking to reconsent an existing oxidation pond, the TAs may be required to drain an operational pond so that they can inspect it to confirm compliance with the rule such that the application could be treated as discretionary activity. This would be catastrophic to the functional operation of the oxidation pond.
- 91 I note that a discharge through the base of the pond from such cracks or defects, whilst not strictly desirable, may not result in adverse effects. This would depend upon the conditions directly under the pond and between the pond and the nearest sensitive receiver. Therefore, I consider that it is not appropriate that this should lead to the discharge being considered a non-complying activity. It is appropriate for it to be part of the consideration of whether consent should be granted for the scheme, and the nature of the conditions that should be imposed especially to consider the degree to which such leaks could result in adverse effects, as has been suggested in the revised Rule included in Mr Dunning's evidence.

Rule 33 – sewer overflows

- 92 The TAs' submission is for overflows from sewer networks to be included into Rule 33, essentially as discretionary activities, with the potential for new overflows if they cannot be designed and located to minimise risk to be non-complying activities.
- 93 The pSWLP defines CSS as "a scheme that collects and treats sewage ...". Sewer overflows occur within the collection network, which is part of the overall scheme and hence it is considered appropriate for them to be treated under the collective rule for CSS being Rule 33.
- 94 I understand that the typical response to a sewer overflow is that it should not occur, as the discharge of raw sewage onto land or into water is considered repugnant. There is an expectation that such discharges will have gross environmental effects and a significant public health impact.
- 95 However, as discussed in Mr Loan and Mr Bayliss evidence, sewer overflows do occur from the sewer networks of both Invercargill and Gore Districts. They are

an expected discharge which results from the nature of the system. Their frequency and volume are in the process of being reduced through specific capital projects and ongoing renewal of the network to replace aging infrastructure. This will be an extensive and expensive process.

- 96 In the operative RPWS, the discharge of raw sewage is a prohibited activity. This has been modified in the pSWLP to be a non-complying activity, presumably in recognition of the fact that these discharges can and do occur and hence consent should be able to be sought. As previously discussed, the current nature of the Objective 6 and Policy 15 would render obtaining consent for sewer overflows as a non-complying activity highly problematic.
- 97 I will provide a summary of how overflows from sewer networks are dealt with at a number of other locations in New Zealand.
- 98 In Auckland, sewer overflows from the Watercare network in the Existing Urban Area and the Indicative Future Urban Area are covered by a global wastewater network discharge consent granted in 2014 for 35 years. As part of the consent application, a risk assessment methodology based on the range of receiving environment types, values and effects related to modelled and recorded overflow volume and frequency information was developed. Under this consent, there is an ongoing process of reviewing the wastewater network strategy every six years. There is a preference to achieve two overflows per annum per location, but a risk assessment method can be used to allow an increased frequency for each individual discharge where that is demonstrated as the Best Practicable Option (BPO). I understand that this is the case for a number of discharges. This establishes a forward programme of works based on the BPO which is included in the Asset Management Plan.
- 99 This approach is consistent with the Part E6 of the Auckland Unitary Plan with overflows falling under a number of rules with status from permitted to discretionary. The "*discharge of untreated wastewater overflows onto or into land and/or into water from an existing separated wastewater network servicing existing urban areas (excluding wastewater treatment plants)*" is a controlled activity, provided amongst other conditions that:
- (1) A programme must be in place to reduce network overflows to an average of no more than two events per discharge location per annum by 2040
 - (2) Emergency overflow points must be designed and located so that any discharges minimise nuisance, damage, public health risk, and ecological effects and do not cause scouring and erosion at the point of discharge.
- 100 In Christchurch, prior to the earthquakes, the wastewater network had 114 overflow points, with 22 of these sites known or expected to overflow. In 2002,

consent was granted to discharge from 12 of these sites. At that time, these were the only sites predicted to overflow more often than once in every two years. Consent was granted on the basis that the network was improved such that these sites discharged no more frequently than once every two years (a 2 year average return interval or ARI) by 2010.

- 101 Works totalling \$40 million, the original anticipated costs of the upgrade, were completed, however compliance with the existing consent was not achieved. It was estimated that a further \$110 million would be required to achieve the 2 year standard at all outfalls for the duration of the consent. This indicates the extensive and expensive nature of the works required to reduce sewer overflows in a system which is similar to the ones in the Southland Region.
- 102 Christchurch City Council applied in 2009 to increase the maximum frequency at which discharges may occur to, on average, once every six months. This frequency was not common to all sites but was the maximum frequency for all. The application included an assessment of the various effects that can occur from the overflows including ecological effects. The decision on the consent stated that they "conclude from studies provided that even if short term impacts occur, the long term ecological health of the river is unlikely to be significantly affected." They note that this is a result of the already impacted nature of the waterways affected. This consent was granted in 2010, before the earthquakes, which has resulted in many more overflows from the system.
- 103 Consents have been granted in other Regions for overflow discharges from specific pump stations. These include conditions which relate to treatment of the discharge which can include screening, and disinfection to reduce effects. The consents also include conditions relating to notification of the discharges to Regional Council and the relevant public health authority.
- 104 In my view, it is important that the Regional Council has the ability to consent these sewer overflow discharges and include appropriate conditions which relate to the treatment of the discharges as necessary, the planned reduction in the volume and frequency of the discharges, hence providing a transparent framework for the reduction in the discharges and their effects. The ability to require notification of such discharges to the relevant authorities so that public health impacts can be minimised by appropriate advice to the public is similarly important.
- 105 I understand that this is best promoted by the discharges having a discretionary status.

Rule 47

- 106 Rule 47 controls the discharge of leachate from closed landfills. The S42A report recommends that the rule remain unchanged from that notified. This means that closed landfills are a permitted activity provided that a risk assessment was performed (in accordance with the methodology stipulated in the rule), that it identified that the environmental risk was low, and that the risk assessment was lodged with Environment Southland before 1 November 2015. Otherwise the discharge is discretionary.
- 107 This has meant that closed landfills with an equivalent level of environmental risk are treated very differently as a result of an arbitrary date in the Rule. This is demonstrated by the application process for the closed Bluff Landfill for which application for consent was lodged in December 2016.
- 108 A risk assessment for the closed Bluff landfill had not been undertaken and lodged by the deadline in the rule. Therefore, an application for consent was lodged as the previous consent was due to expire in 2017. I undertook a risk assessment for the landfill using the same methodology as specified in the rule, which determined the environmental risk was low. As a result of the rules in the current and proposed Plans, the discharge is a discretionary activity.
- 109 I consider that the rule as currently written results in inequitable treatment of closed landfills that have the same degree of environmental risk, for no resource management purpose. The deletion of the deadline for lodgement of the risk assessment will correct this inequality. The deadline also acts against the discovery, disclosure and hence appropriate management of new closed landfills, given that a consent would be required. In my view, this is contrary to the appropriate management of closed landfills in the region.

Conclusion

- 110 In summary, in my view there are a number of issues with the pSWLP which will mean that the effective management of the Southland region's infrastructure will be complicated.
- 111 These primarily result from:
- (a) The policies strictly seeking to protect water quality in an absolute manner without focusing this on the identified value and objectives of the water body.
 - (b) Consents for stormwater and wastewater are frequently treated in the pSWLP as non-complying activities, generally as a result of the upstream water quality in the receiving environment, which already does not comply

with the standards in Appendix E. This status is not consistent with providing for such infrastructure to be operated, and upgraded over the long term.

112 I consider that the proposed changes to the plan as given in Mr Dunning's evidence, would resolve these identified issues.

A handwritten signature in blue ink, consisting of a series of loops and a trailing line.

Susan Bennett

11 May 2017