IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of applications for consents (**APP-2005011178.01**) by the **TARARUA DISTRICT COUNCIL** to the **HORIZONS REGIONAL COUNCIL** for resource consents associated with the operation of the Ekatahuna Wastewater Treatment Plant, including a discharge into the Makahi River, a discharge to air, and a discharge to land via pond seepage, Bridge St, Ekatahuna

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STATEMENT OF SUPPLEMENTARY EVIDENCE OF DR OLIVIER MICHEL NICOLAS AUSSEIL (FRESHWATER QUALITY) ON BEHALF OF TARARUA DISTRICT COUNCIL

5 April 2017

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1. INTRODUCTION

1.1 My name is Olivier Michel Nicolas Ausseil (pronounced "O-Say").

1.2 I have the qualifications and experience set out in my Statement of Evidence dated 14 March 2017.

1.3 My evidence is given in relation to the application for resource consents for the discharges from the Eketahuna Wastewater Treatment Plant (WWTP) lodged by Tararua District Council (TDC).

1.4 I confirm that I have read the 'Code of Conduct' for expert witnesses, now contained in the Environment Court Practice Note 2014 and that both my Statement of Evidence and this Supplementary Evidence have been prepared in compliance with that Code.

2. SCOPE OF EVIDENCE

2.1 My evidence addresses the following matters:

(a) Response to, and clarification of, points raised in the evidence of Ms Kate McArthur on behalf of Kahungunu ki Tamaki nui-a-rua Trust and Mr Adam Canning, on behalf of Fish and Game New Zealand;

(b) A response to the Hearing Panel's Minute n. 2, specifically paragraphs 2.2 and 2.3;

(c) Additional comments on consent conditions, noting that my comments have been incorporated in the version of conditions appended to Ms Manderson's Supplementary Evidence.

3. EVIDENCE OF MS MCARTHUR

3.1 In paragraph 15, Ms McArthur raises the point that a summary of water quality in the Makakahi at Hamua was not provided. I have discussed this with Mr Brown, and I understand that he is preparing a summary, which will be tabled at the start of the hearing.

3.2 In paragraph 24, Ms McArthur states her view that the periphyton biomass targets in the One Plan should be applied as absolute maximum. This is, in my view, inconsistent with the technical documentation recommending water quality targets for the One Plan[1]. I also note that the NPSFM (2014) allows for 8% of samples exceedance. The basis for this approach is set out in the technical report[2] supporting the development of the National Objective Framework (NOF) for periphyton:

[1] Ausseil and Clark (2007). Recommended water quality standards for the Manawatu-Wanganui Region.
[2] Snelder T., Biggs B., Kilroy C. and Booker D. (2013) National Objective Framework for Periphyton. Prepared for the Ministry for the Environment. November 2013.

> *"Natural variability in the frequency of floods and therefore biomass accrual periods, means that some naturally occurring excursions beyond each threshold can be expected occasionally, even in relatively non-enriched systems. Streams and rivers are resilient and ecological health will usually recover quickly from such excursions if they are infrequent and of a short duration. Therefore, an exceedance frequency of once in the average year, based on monthly measurements of periphyton chlorophyll a, is proposed."*

3.3 In my view, applying periphyton targets as absolute maximums (1) sets unrealistic expectations and (2) does not reflect the fact that short-term, infrequent exceedances are unlikely to have a more than a temporary or minor effect.

3.4 As I explain in paragraph 5.12 of my evidence, a similar argument has recently occurred in relation to the Feilding WWTP discharge to the Oroua River. The Environment Court agreed that the periphyton targets should not be applied as absolute maxima[3].

3.5 In paragraphs 28 to 31, Ms McArthur discusses the potential monitoring sites and zone of reasonable mixing. I cover aspects relative to zone of reasonable mixing and monitoring sites in response to paragraph 2.2 of the Hearing Panel's Minute N.2. I note however that the four-site approach proposed by Ms McArthur seems overly complicated and unlikely to yield more certain conclusions than the current monitoring sites. It is, in my view, preferable to move the discharge away from the influence of the Ngatahaka Creek, and assess the actual effects of the discharge on the basis of the comparison of upstream/downstream of the discharge.

3.6 In paragraph 38, Ms McArthur states that no changes will be made to the plant to reduce the EWWTP contribution to SIN and other contaminants that are contributing to a cumulative water quality issue (MCI and periphyton) in the Makakahi River. Whilst this statement is correct for SIN, it is incorrect with regards to the other contaminants from the discharge (*E.coli*, DRP, POM) that may cause or contribute to the changes seen in the Makakahi River between upstream and downstream of the discharge. I address this point further in response to paragraph 2.3 of the Hearing Panel's Minute N.2.

4. EVIDENCE OF MR CANNING

4.1 In paragraph 7 of his evidence, Mr Caning provides comments on the 2015 Aquanet report. Mr Canning makes no mention of the subsequent responses to the requests for further information, to Mr Brown's S42A report or to my evidence, which all provide further information, and,

[3] Environment Court (Decision, 14 July 2016) NZENvC132, paragraph 17. "*We consider that any proposal to set an absolute limit of 120 milligrams of chlorophyll a per square metre, as set out as WPSI's primary position in paragraph 8 of the memorandum is unnecessary, unrealistic and impracticable*"

importantly, an update of the assessment on the basis of data available as of now.

4.2 In paragraph 7b, Mr Canning states that the 2015 Aquanet report provides no indication of the load calculation methodology used in the report. This is incorrect. Section 2.3.1, p16 of the report is dedicated to setting out the load calculation methodology. It is important to note that my evidence provides an update of this assessment, on the basis of data available now.

4.3 In paragraph 8 of his evidence, Mr Canning states that periphyton is the primary driver of poor macroinvertebrate and fish community. This statement is incomplete and misleading. Whilst it is well documented that excessive periphyton growth can have detrimental effects on macroinvertebrate community, it is but one of the many mechanisms that can affect macroinvertebrate and fish communities. The influence of other factors, such as temperature[4], deposited fine sediment[5] or direct toxicity (e.g. from metals[6]) is abundantly documented in the scientific literature. In the specific context of a point-source discharge from oxidation pond systems, the deposition of particulate organic matter is another well-documented, although often underestimated, cause of direct effects on benthic macroinvertebrate communities[7]. The One Plan sets a Particulate Organic Matter (POM) concentration target specifically to control potential effects of oxidation pond discharges on macroinvertebrate communities[8].

4.4 At paragraph 8a Mr Canning indicates that, in order to achieve an MCI score of 120, the periphyton biomass must be kept below 50mg/m^2. The One Plan target for the Makakahi catchment was set at 120 mg/m^2. This is a level known to not be harmful to fisheries. In fact, the most productive trout fisheries often have moderate levels of enrichment, as explained in the technical report underpinning the development of the periphyton Attribute State of the NPSFM (2014)[9]:

"It must first be acknowledged that increased primary production at sites having maximum periphyton biomass greater than 50 mg/m^2 may increase the productivity of salmonid fisheries, with only small reductions in the occurrence of sensitive invertebrate taxa. The MFE guidelines (Biggs 2000b) suggest productive trout fisheries are maintained at maximum chlorophyll

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[4] Quinn J. and Hickey, C. (1990). Characterisation and classification of benthic invertebrate communities in 88 New Zealand rivers in relation to environmental factors. New Zealand Journal of Marine and Freshwater Research, 1990, Vol. 24: 387 – 409.

[5] Clapcott, J., Young, R., Harding, J., Matthaei, C., Quinn, J. and Death, R. (2011).Sediment Assessment Methods. Protocols and guidelines for asessing the effects of deposited fine sediment on in-stream values. Research for the New Zealand Ministry for the Environment, Wellington

[6] Hickey, C. Clements, W.(1998). Effects of heavy metals on benthic macroinvertebrate communities in New Zealand Streams. Environmental toxicology and chemistry 17: 2338-2346.

[7]Quinn J. and Hickey, C. (1993), Effects of sewage waste stabilisation lagoon effluent on stream Invertebrates. Aquatic Ecosystem Health 2: 205 –219

[8] Ausseil and Clark (2007). Recommended water quality standards for the Manawatu-Wanganui Region.

[9] Snelder T., Biggs B., Kilroy C. and Booker D. (2013) National Objective Framework for Periphyton. Prepared for the Ministry for the Environment. November 2013. p10.

a values up to 120 mg/m^2 (for filamentous periphyton taxa) and 200 mg/m^2 (for diatom taxa)."

5. HEARING PANEL'S MINUTE N. 2

Paragraph 2.2 – Zone of Reasonable Mixing and monitoring sites

5.1 Paragraph 2.2 the Hearing Panel's Minute N.2 requests more information on the mixing zone and monitoring sites.

5.2 The 330m mixing zone referred to in the Minute appears in the set of conditions proposed by Ms Morton. I have not recommended that mixing zone, nor have I seen or heard any technical evidence to support it. I have not been able to gain clarity as to its rationale, but understand it may simply be a "place holder". This may be understandable given that he exact location of the discharge is not known.

5.3 Although it is difficult to comment without knowing the exact point of discharge, I expect that reasonable mixing (in the sense of the mixing having occurred across the full width of the river) is likely to occur within 100-150 m of the discharge point (due to the relatively short run/riffle sequences and tight bends in that general reach). I agree with Ms McArthur that 330 m seems an overly extended mixing zone, which does not seem to align with the One Plan guidance on mixing zones.

5.4 With regards to determining the extent of the Zone of Reasonable Mixing (ZRM) and where monitoring should occur, I make the following observations:

(a) The extent of the Zone of Reasonable Mixing, and a suitable location for downstream monitoring could be determined once the exact location of the discharge is known. The discharge permit for the Taihape WWTP, granted in May 2014 contains a condition[10] that could be transferrable to the Eketahuna situation;

(b) Water quality sampling (i.e. the taking of water sampling and field measurements) can occur at, or close to, the end of the zone of reasonable mixing. If safe access is not possible at that point, then sampling should be undertaken at the first point further downstream with safe access to the river;

(c) It is important that ecological sampling occurs at suitable (periphyton in runs, macroinvertebrate in riffles) and well matched (substrate, shading) sites. One also needs to be aware that river beds change with significant floods, and ecological monitoring sites may need to shift accordingly. Consent conditions commonly require that

[10] Discharge Permit 105518, condition 18: "The consent holder shall undertake a dye test within one month of the consent being granted. The test shall be carried out in conjunction with Manawatu-Wanganui Regional Council's Environmental Scientist to determine the reasonable mixing zone within the Hautapu River and an appropriate monitoring site downstream of the discharge point"

periphyton/macroinvertebrate monitoring be undertaken in the first suitable run/riffle downstream of the ZRM.

5.5 A condition similar to Condition W25 of the Feilding WWTP discharge Permit may be useful in this situation:

"The Permit Holder shall have an appropriately qualified and experienced freshwater ecologist undertake macroinvertebrate sampling in the Oroua River. The freshwater ecologist shall ensure that the physical characteristics (substrate, depth, velocity, shading) of the upstream and downstream sites are, as much as practicable, similar/adequately matched. [...] The locations of the assessment and sampling shall be:

a. upstream of the discharge point in the first riffle upstream within 100m of the discharge point and

b. downstream of the discharge point in the first riffle within 400m of the discharge point."

5.6 With regards to monitoring sites for Option 1:

(a) Option 1 offers little choice for the location of the "upstream" site; it would have to be located within the short run-riffle area shown in Figure 1 below. The "downstream" site could remain at its current location (this would in effect shorten the ZRM to c. 120 m);

(b) Two issues arise: access to the upstream site and comparability with the downstream site;

(c) Whilst water quality sampling will be able to be undertaken from the true right bank, water along that bank if relatively deep and swift. Any measurement or assessment involving wading (such as monthly periphyton assessments) would have to be undertaken from the true left bank. Access through private farmland would have to be arranged;

(d) The upstream site is located within a very "gorgy" reach of the river, and is likely to be more shaded than the downstream site. Substrate (gravel) may also be smaller and more mobile at the upstream site than at the downstream site. This means that all other things being equal (including nutrient concentrations), I would expect more periphyton growth at the downstream site. The risk is that an increase may be measured between these two sites that is not caused by the discharge. In other words, this arrangement is likely to over-estimate the effects of the discharge on periphyton growth.

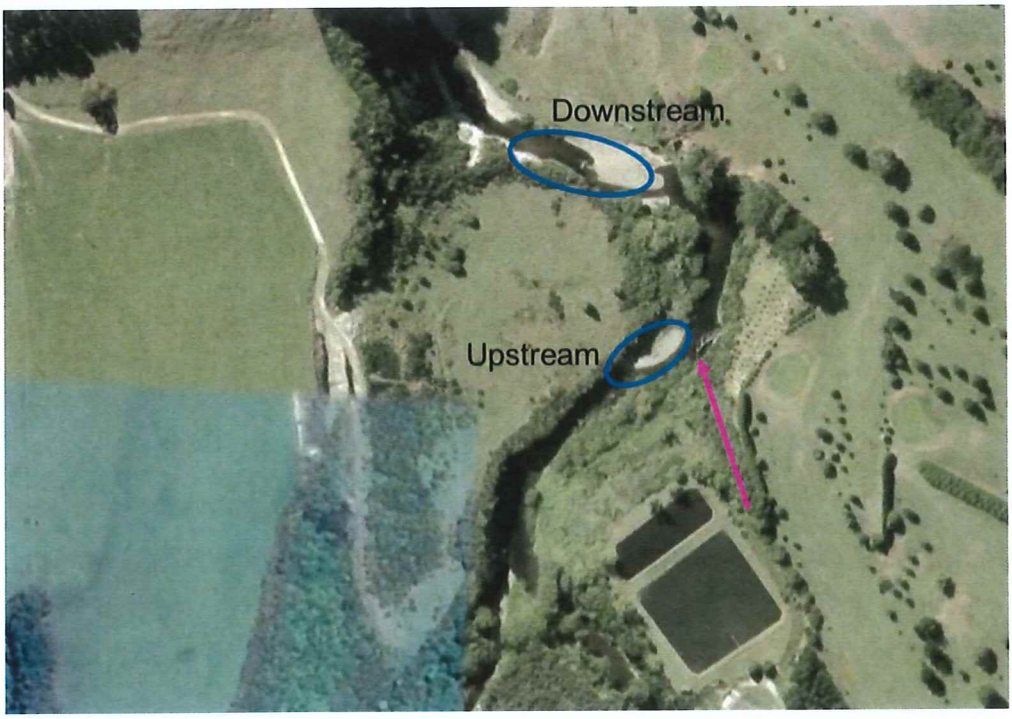

Figure 1: Potential monitoring locations in relation to "Option 1" discharge location.

5.7 With regards to Option 2:

(a) My understanding is that Option 2 would involve the construction of a sizeable wetland area, which may be unlined to allow greater land passage;

(b) The resulting discharge to the river would be a somewhat diffuse discharge over the length the adjacent reach of river;

(c) Monitoring locations should be upgradient and downgradient of the wetland are, as shown on the map attached to Ms Manderson's evidence. Although the two monitoring sites would be separated by a relatively long distance (several hundred metres), the downstream site would in fact be located only a short distance from the downstream end of the reach receiving the discharge;

(d) There are ample opportunities to identify well matched upstream and downstream sites in this reach of river, and access is unlikely to be an issue.

Paragraph 2.3 – Effects on aquatic life

5.8 Paragraph 2.3 of the Hearing Panel's Minute N.2 refer to Mr. Carlyon's statement that the experts agree that the discharge has significant adverse effects on aquatic life. I cannot speak for other experts, but this is an

incorrect interpretation of the evidence I have given. I have not concluded that the discharge caused a significant adverse effect on aquatic life. I have concluded that the changes we see in macroinvertebrate communities between the upstream and downstream sites do represent significant adverse effects; however, the mechanism(s) of effects, and thus the causes are not able to be elucidated. In particular, the role that contaminant inputs from the Ngatahaka Creek (e.g. SIN, fine sediments) play in these effects, versus those from the discharge (ammonia, POM, DRP, SIN) remain unclear. I note that Ms McArthur also agrees (e.g. at paragraph 19 of her evidence) with my view that what is measured in the Makakahi River at the downstream monitoring site are the cumulative impacts of diffuse contaminants via the Ngatahaka Creek and the Eketahuna WWTP discharge.

5.9 My intention is not to argue semantics, or a planning point. However, the distinction is important in order to (1) correctly identify the cause of the problem and therefore the solution and (2) setting realistic expectations, as any upgrade or changes to the Eketahuna WWTP will only ever be able to address issues that it is creating (not the changes caused by inputs from the Ngatahaka Creek).

5.10 The question posed by the Panel in relation to the provisions of S107 is primarily a planning question. However, I understand that the question of whether the proposed upgrades will address the ecological effects of the discharge is relevant in this context. I summarise my conclusion in this regard below.

5.11 As I set out in Paragraph 5.20 of my evidence, mechanisms of effects by which treated domestic wastewater discharges are known to impact on macroinvertebrate communities include:

(a) Direct toxicity, for example from ammonia;

(b) Deposition of particulate organic matter;

(c) Periphyton growth, caused by the DRP and/or SIN content of the discharge.

5.12 Mechanisms by which inputs from the Ngatahaka Creek may affect macroinvertebrate communities in the Makakahi River include

(a) Deposition of fine sediment;

(b) Periphyton growth, caused by the DRP and/or SIN inputs from the Ngatahaka Creek.

5.13 Whether the proposed upgrades will address the effects of the discharge will depend on the mechanism(s) of effects at play.

5.14 Ammoniacal nitrogen concentrations measured in the Makakahi River at the downstream site are not at levels where toxic effects are known to

occur, and this seems a very unlikely mechanism of effect (refer to paragraph 5.7 of my evidence).

5.15 As I explain above, the deposition of Particulate Organic Matter is a well-documented mechanism by which oxidation pond discharge can have detrimental effects on macroinvertebrate communities. My understanding of the proposed upgrades is that they will include flocculation/coagulation and clarification of the effluent, which, if well designed and operated, should remove most of the particulate organic matter present in the discharge.

5.16 With regards to the potential role of periphyton, it is relevant to note that biomass levels in the Makakahi downstream are most generally not at levels where, in my experience, significant adverse effects on macroinvertebrates would be expected. On all occasions when macroinvertebrates were sampled (February 2013, March 2014, January 2015 and March 2016), the periphyton biomass was well below the One Plan target of 120 mg/m^2. The worst effects on macroinvertebrate communities in the Makakahi were seen in March 2014 and January 2015. On these occasions, periphyton biomass was either marginally below (March 2014, 42 mg/m^2) or marginally above (January 2015, 59 mg/m^2) the more stringent 50 mg/m^2 periphyton biomass target recommended for the protection of high aquatic biodiversity values[11].

5.17 Further, on all months when macroinvertebrates were sampled, the periphyton biomass was higher in the Ngatahaka Creek than in the Makakahi River downstream, including in 2014 and 2015 (March 2014: 65 mg/m^2; January 2015, 106 mg/m^2), but the macroinvertebrate communities were in better health in the Ngatahaka Creek than in the Makakahi River at the downstream site. If the periphyton biomass was the key driver of the effects on macroinvertebrate communities in the Makakahi River downstream, one would have expected similarly, or more degraded macroinvertebrate communities in the Ngatahaka Creek.

5.18 Whilst I would not discount periphyton growth as a possible contributor to the changes seen in the Makakahi River between the upstream and the downstream site, the ecological data does not support its role as the sole or main driver.

5.19 Notwithstanding the above, the increases in periphyton biomass seen in the Makakahi River are likely to be associated with the increases in DRP and/or SIN measured at the downstream site.

(a) If DRP is the key driver of increased periphyton growth, then the upgrades (which include chemical coagulation/flocculation and

[11] Biggs, B. (2000). New Zealand Periphyton Guidelines.

clarification) are likely to significantly reduce the inputs from, and therefore the effects of, the discharge;

(b) If SIN is the key driver of increased periphyton growth, then the proposed upgrades will not reduce the effects of the discharge. It should be noted however that, in the current situation, even if the discharge from the EWWTP was completely removed from the river, there would still be a significant increase in SIN concentrations in the Makakahi River between upstream and downstream under all river flow conditions, including during low river flows. Only during low river flows would a moderate improvement (about a third of the current increase) be seen compared with the current situation.

5.20 As noted in paragraph 5.22, water quality data indicates that the growth of periphyton in the Makakahi River is likely to be controlled by SIN during periods of low flows. It thus seems likely that SIN plays a significant role, although possibly alongside DRP, in the growth of periphyton measured in the Makakahi River at the downstream site

5.21 As I have explained above, I am of the opinion that physically moving the discharge away from the confluence will be the only way by which the effects of the discharge itself on stream water quality and ecology will be able to be measured, before and/or after the proposed upgrades are implemented.

6. PROPOSED CONSENT CONDITIONS

6.1 I have commented above on possible conditions regarding the determination of the zone of reasonable mixing and location of the monitoring sites once the exact location of the discharge is known.

6.2 Condition 8 proposed by Ms Morton sets out receiving water quality and ecological targets/standards. I make a number of comments in relation to this condition, noting that my comments have been incorporated in the version tabled by Ms Manderson:

(a) The condition proposed by Ms Morton does not include a date at which it starts to apply. We know that a number of the proposed clauses are currently exceeded (in particular clause n.), and it is also unclear whether the discharge causes the change. This condition would be either not complied with from the start of the consent, or be un-enforceable, depending on which interpretation is made to the effects "caused" by the discharge. I suggest that the condition should apply after the discharge has been shifted to its new location, and upgrades have been commissioned;

(b) Clause d. (conspicuous change in clarity) is covered by clause g. (20% change in clarity). Clause d is redundant and should be removed; this is the approach taken in recent consents (e.g. Feilding);

(c) Clause 8e. (render water unsuitable for farm animals) is typically extremely problematic from a compliance point of view, as it is open to interpretation. The risks posed by the discharge to microbiological water quality are best managed by end-of-pipe standards for *E. coli*. I recommend this clause be removed. Again, this recommendation is consistent with recent decisions;

(d) Clause 8f refers to "no more than minor" effects on aquatic life. I agree with Ms McArthur (at paragraph 40 e. of her evidence) that a clear definition of how compliance with this condition will be assessed must be provided. I also note that this wording is different from that of S107(1)(g) which refers to "significant adverse" effects. The intention of the "no more than 20% reduction in QMCI" water quality target in the One Plan is to provide a numerical measure of significant adverse effect, specifically for point-source discharges. I am unsure of what meaning Ms Morton places on "no more than minor", but my understanding is that it is a more stringent test than "significant adverse" effects. If this is the case, this condition would constitute a departure from the provisions of the One Plan, or from consents recently granted in the Region. I am unsure of the reasons for this approach, and note that this clause is not discussed by Mr Brown in his evidence;

(e) In any situation, the approach taken in recent consents (e.g. AFFCO Feilding, Feilding WWTP), which I have supported, is to remove narrative clauses relative to "effects on aquatic life" as they are open to interpretation (as shown in the recent PNCC review case), and rely instead on the 20% change in QMCI condition.

(f) I note that clause 8k. proposes to assess compliance with the periphyton targets in a manner that is consistent with the provisions of the NPSFM. Given that the intent of the NPSFM framework (i.e. to allow some infrequent exceedances) is similar to that I recommended for the One Plan periphyton target, I am comfortable with this approach;

(g) Clause 8.l. prescribes that there must not be a change in NPSFM periphyton bands between upstream and downstream. In my view this is inconsistent with one of the overall guiding principles of the One Plan targets, that movement within the target is acceptable, and I recommend that the clause be removed.

(h) Clause 8.o. is, in my view an incorrect use of the ANZECC Guidelines. I note that toxicants other than ammonia have not been raised as an

issue in technical evidence. If toxicants other than ammonia are seen as a material issue, I recommend that a condition consistent with the ANZECC Guidelines framework be drafted. Condition W19 of the recent Feilding decision would be a useful starting point[12].

6.3 Conditions 28 and 29 require the formation of an expert Panel to assess the effects of the discharge. I understand this condition was copied from the Feilding WWTP decision. I am very familiar with this condition, as I contributed, along with Mr Brown and Ms McArthur, to its development. The key reasons for recommending this condition in the Feilding situation were that it is the second largest discharge in the region, that it was demonstrably causing significant adverse effects on periphyton growth and aquatic life. The proposed system for Feilding involved a dual land/water discharge regime, which meant that the assessment of effects on water quality and ecology was going to be complex. It was also likely that the assessment would be subject to significant scrutiny, and an expert Panel was seen as a way to guarantee independence and limit litigation. This, in my view, justified taking a rather heavy-handed and costly approach. The Eketahuna WWTP obviously serves a much smaller community and produces a much smaller discharge. The assessment of the effects in a future should be reasonably straightforward, assuming the discharge is shifted from its current location.

Dr Olivier Michel Nicolas Ausseil

4th April 2017

[12] a. The permit holder shall assess **annually** the dissolved aluminium in-river monitoring results against a trigger concentration of 0.055 g/m^3 and run a Wilcoxon Signed Rank test on the last ten consecutive samples to determine if there are any significant increases in dissolved aluminium concentration between upstream and downstream results.
b) In the event that a significant increase is detected between upstream and downstream results, an investigation into the risk of toxic effects due to dissolved aluminium shall be undertaken within one month of detecting the significant increase. The findings shall be reported in the annual report required by Condition W29.
c) The investigations should be consistent with the ANZECC guidelines framework (2000) and should consider, but not be limited to, water chemistry aspects (such as pH, water hardness, dissolved versus total concentrations etc.), then and, if and as required, biological aspects.
d) If the investigation in b) and c) shows a likelihood of toxic effects then measures to address that situation shall be proposed by the permit holder and implemented subject to certification by the Regulatory Manager.
Advice Note: To perform the statistical test, analysis needs to be against a minimum of ten upstream and downstream paired results from the monthly sampling.