IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER OF	a review of resource consent conditions under 128 of the Resource Management Act 1991
BY	**MANAWATU-WANGANUI REGIONAL COUNCIL**
AND	an application for change of consent conditions under section 127 of the Resource Management Act 1991
BY	**HOROWHENUA DISTRICT COUNCIL**

STATEMENT OF EVIDENCE OF OLIVIER MICHEL NICOLAS AUSSEIL (WATER QUALITY) ON BEHALF OF HOROWHENUA DISTRICT COUNCIL

2 September 2016

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EXECUTIVE SUMMARY

1. My name is **Olivier Michel Nicolas Ausseil** (pronounced “O-Say”).

2. I am Principal Scientist – Water Quality at Aquanet Consulting Ltd.

3. My evidence is given in relation to the review of resource consent conditions initiated by Horizons Regional Council ("**Horizons**") and the application for change of consent conditions by Horowhenua District Council ("**HDC**") in relation to the Levin Landfill located at 665 Hokio Beach Road (the "**Landfill**").

4. My evidence covers the following:

   (a) My involvement in the Notice of Review process and application for change of consent conditions;

   (b) The nature of the Hokio Stream and Tatana Drain;

   (c) Analysis of the evidence with regards to the discharge of leachate from the Levin Landfill in the Tatana Drain and the effects of the discharge on water quality and freshwater ecology; and

   (d) Consent conditions.

5. In my view there is no doubt that the Hokio Stream is a natural waterway supporting a wide range of ecological, recreational and cultural values, in spite of some evident water quality degradation. The list of river values identified in Schedule B of the One Plan for the Hoki_1 Water Management Zone are, in my opinion, applicable to the Hokio Stream; and One Plan Schedule E water quality targets, ANZECC Guidelines and NPSFM State Attributes for ecosystem and human health are relevant to the protection or maintenance of these values in the Hokio Stream. How these may be applicable to the review process under consideration is primarily a planning and/or legal question, and outside my field of expertise.

6. The evidence available to me has led me to the conclusion that the Tatana Drain was artificially created, and is akin to a “farm drainage canal”, which is specifically excluded from the RMA definition of a “river”, and thus does not constitute a “river” in that sense. I note this is the only material point of disagreement between water quality experts recorded in the water quality Joint Witness Statement ("**JWS**").

7. Artificial waterways may however provide habitat for a range of aquatic species. The upper section of the Tatana Drain is very shallow and presents extremely limited aquatic habitat. However, the lower part of the drain is likely to provide some, albeit limited actual or potential habitat for aquatic species, including invertebrates and fish.

8. There is, in my opinion, clear evidence of leachate contamination of the Tatana Drain via shallow groundwater from the Landfill. The Tatana Drain flows into the Hokio Stream, so the leachate captured by the Tatana Drain follows the same pathway. It seems likely that some leachate also travels via shallow groundwater under the drain and into the Hokio Stream. There are thus currently two pathways, via surface and groundwater, by which leachate from the Landfill reaches the Hokio Stream. The Tatana Drain and then the Hokio Stream also receive some contamination

from upstream sources, the immediately surrounding land use and potentially from historical activities on that land.

9. A significant water quality monitoring dataset is available for the Hokio Stream for a broad range of parameters covering most (but not all) key contaminants potentially present in leachate. This dataset provides the basis for a reasonably sound assessment of effects. However:

   (a) Based on the evidence of Mr Douglass, it appears that the upstream monitoring location (HS1) may receive some influence from the groundwater flow path from the unlined landfill, and a new monitoring location is recommended further upstream. The downstream monitoring site (HS3) seems however adequate to capture all the effects from any direct (via Tatana Drain) or indirect (via groundwater) leachate discharge to the Hokio Stream.

   (b) The water quality JWS indicates that we had not been able to source any pesticide/SVOC monitoring data (question 3). Since that date I have been able to source a single set of results for groundwater downgradient from the old landfill (bores B1, B2, B3, C2 and C2DS), reported in the 2014-2015 annual monitoring report, but these results look incomplete. I have requested the full set of results, and will report on any findings during the hearing.

10. My conclusions should be considered with these limitations in mind.

11. With regards to the effects on the Hokio Stream water quality, my analysis concurs with the evidence presented by Mr Brown in his S42A report. Essentially the monitoring data available do not indicate any measurable effects on the concentrations of key contaminants between the upstream and downstream monitoring sites. The validity of this conclusion should be confirmed or otherwise once sufficient monitoring has been undertaken at the new upstream monitoring location.

12. The concentrations of key contaminants of concern from landfill leachate such as ammoniacal nitrogen or metals meet the relevant One Plan or ANZECC “Aquatic ecosystem” Trigger Values at all three monitoring sites. This indicates a generally low risk of toxic effects from these contaminants on aquatic life within the Hokio Stream. This conclusion is based on concentrations measured at each site, not on a differential between sites, and is thus valid in spite of the uncertainty associated with the location of the upstream site as outlined above.

13. Overall, and based on the information available, there is no evidence that more than minor effects are occurring, or are at risk of occurring, on aquatic life in the Hokio Stream as a result of the discharge of leachate, via surface and groundwater pathways, including cumulatively with any effects of current land use and any residual effects from historical activities (including discharges) on the land traversed by the Tatana Drain.

14. I also agree with Mr Brown’s assessment that what aquatic life may be present in Tatana Drain would likely be exposed to toxic effects from ammonia. The ammoniacal nitrogen concentrations in Tatana Drain decrease from top to bottom, and so does the risk of toxic effects.

QUALIFICATIONS AND EXPERIENCE

15. I have the following qualifications and experience relevant to the evidence I shall give:

16. I hold a PhD of Environmental Biosciences, Chemistry and Health from the University of Provence, France. I also hold a Master of Science Degree of Agronomical Engineering from the National Higher Agronomical School of Montpellier, France, and a DEA (equivalent Masters Degree) in Freshwater Environmental Sciences from the University of Montpellier II, France.

17. I have over 14 years' experience in New Zealand as a scientist working in local government and as a private consultant working for regional councils and local authorities, central government and government agencies, and the private sector. Prior to that, I worked as a Research Engineer between 1998 and 2001 for the French Atomic Energy Commissariat during my PhD studies.

18. Prior to forming Aquanet Consulting Ltd, I was employed by the Regional Planning Group of Horizons from July 2002 to June 2007, where I held the positions of Project Scientist, Environmental Scientist- Water Quality, and Senior Scientist - Water Quality.

19. My responsibilities at Horizons first included (2002 to 2005) undertaking a large number of ecological assessments of wetlands and wetland remnants in the Region, including the Horowhenua coastal dune wetlands and wetlands directly associated with Lake Horowhenua. This involved on-field and GIS-based habitat and vegetation mapping, as well as contribution to the development of an ecological database and a region-wide wetland prioritisation exercise.

20. My responsibilities at Horizons then involved leading the water quality and aquatic biodiversity monitoring and research programme and providing technical support to policy development. I was the primary author of three technical reports underpinning the river classification, river values framework and water quality standards in the notified version of the Proposed One Plan for the Manawatu-Wanganui Region.

21. Since July 2007, I have been Principal Scientist at Aquanet Consulting Limited. In this position, I have been engaged by 17 different regional, district or city councils, the Ministry for the Environment, the Department of Conservation, Fish and Game New Zealand, and a number of private companies to provide a variety of technical and scientific services in relation to water quality and aquatic ecology.

22. I am a certified Commissioner under the Ministry for the Environment "Making good decisions" programme. I was a Hearing Commissioner appointed by Horizons to hear New Zealand Defence Force's consent applications to discharge treated wastewater from the Waiouru wastewater treatment plant to the Waitangi Stream, in June 2011 and February 2012.

23. I have worked as a technical advisor on behalf of the consenting authority, the applicant and/or submitters on well over 150 resource consent applications, compliance assessments and/or prosecution cases for a wide range of activities. In July 2010, I ran a training workshop for Horizons staff on the technical assessment of resource consent applications for discharges to water.

24. In 2012 I contributed to the preparation of compliance assessment reports for 13 closed and active landfills, including the Levin landfill on behalf of Horizons.

25. My work routinely involves providing assessment of effects on water quality and/or aquatic ecology, recommending or assessing compliance with, resource consent conditions, and designing or implementing water quality/aquatic ecology monitoring programmes. I have designed and

implemented a large number of monitoring programmes both at the scale of a specific activity and at a wider catchment or regional scale. As part of my previous role at Horizons I redesigned the state of the environment water quality monitoring programme. I also undertook a detailed review of Environment Southland's water quality monitoring programme in 2010 and of Environment Bay of Plenty's in 2012.

26. I have authored or co-authored a number of catchment- or region-wide water quality reports for Greater Wellington Regional Council (whole region), Hawke's Bay Regional Council on 7 catchments (2008 and 2016), and for Environment Canterbury on the Hurunui catchment and Pegasus Bay.

27. I have authored or co-authored a number of reports making recommendations for water quality limits for regional plan change processes, for Horizons Regional Council, Hawke's Bay Regional Council and Greater Wellington Regional Council.

28. I am a member of the New Zealand Freshwater Sciences Society and the Resource Management Act Law Association (RMLA).

29. I confirm that I have read the 'Code of Conduct' for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

BACKGROUND AND ROLE

30. My involvement in the notice of review and application for change of consent conditions processes began on 16 August 2016. I had no prior involvement in this process, or previous related review or consenting processes. As stated above, I was however involved in the preparation of a compliance assessment report of the Landfill for Horizons in 2012. To date I have not had any direct involvement with the Neighbourhood Liaison Group ("**NLG**").

31. I undertook a detailed site visit on 19 August and obtained relevant documents and data from MWH and HDC staff.

32. I participated in expert caucusing on 25th August 2016, and contributed to the preparation of the water quality JWS, dated 25 August 2016.

SCOPE OF EVIDENCE

33. My evidence addresses the following matters:

    (a) The nature of the Hokio Stream and Tatana Drain;

    (b) Analysis of the evidence with regards to the presence of leachate from the Landfill in the Tatana Drain;

    (c) The effects of the above on water quality and freshwater ecology

    (d) Consent conditions.

NATURE OF HOKIO STREAM AND TATANA DRAIN

Hokio Stream

34. The Hokio Stream takes its source at the outlet of Lake Horowhenua. I understand the lake outlet, and thus the primary source of flow of the Hokio Stream, is regulated by way of a level control structure. I am generally familiar with the Hokio Stream and the Lake Horowhenua catchment, including natural wetlands in the general area.

35. Paragraphs 10 to 14 of Mr Brown's S42A report provides a description of the One Plan water management zone and Schedule E values as applicable to the Hokio Stream. I agree with Mr Brown's assessment and will not repeat this assessment here.

36. Paragraphs 25 to 33 of Mr Brown's S42A report provide a useful description of the native fish communities in the Lake Horowhenua catchment, and the role of the Hokio Stream as a migration pathway from and to the lake and its tributaries for many freshwater fish species. Again, I agree with Mr Brown's assessment and will not repeat it here, although I would add that the Hokio Stream itself provides habitat to many fish species (i.e. not just as a migration pathway). I understand there are no monitoring data on the state of macroinvertebrate communities in the Hokio Stream, so these cannot be described with any confidence.

37. Paragraphs 35 to 36 of Mr Brown's report provide a short summary of the background water quality in the Hokio Stream, based on a recent report produced by Horizons. Again, I agree with Mr Brown's evidence. Paragraph 34 explains how the water quality in the Hokio Stream is largely influenced by the lake, and that it carries large loads of planktonic cyanobacteria in late summer/early autumn. This large organic load is likely to have flow-on implications in the Hokio Stream, potentially including low dissolved oxygen and spikes in ammoniacal nitrogen concentrations in the Hokio stream as a result of the biodegradation of the organic load. This may explain, at least in part, the relatively elevated ammoniacal nitrogen concentrations present in the Hokio Stream upstream of the Tatana Drain confluence (Site HS1).

38. With regards to the nature of the Hokio Stream, in my view there is no doubt that the Hokio Stream is a natural waterway supporting a wide range of ecological, recreational and cultural values, in spite of some evident water quality degradation. The list of river values identified in Schedule B of the One Plan for the Hoki_1b WMZ are, in my opinion, applicable to the Hokio Stream, and One Plan Schedule E water quality targets, ANZECC Guidelines and NPSFM State Attributes for ecosystem and human health are relevant to the protection or maintenance of these values in the Hokio Stream. This point was agreed by all water quality experts (JWS, response to question 13).

39. I note however, that how water quality targets and guidelines may be applicable to the review process under consideration is primarily a planning and/or legal question and largely outside my field of expertise.

Tatana Drain

40. The nature of the Tatana Drain was examined in caucusing (JWS, page 7, in response to question 13).

41. As indicated in the JWS, it is likely that the flats bounded by the sand dunes to the north and south would have historically formed part of a floodplain/wetland complex. This includes the paddock now traversed by the Tatana Drain. The wetland would have been hydrologically connected with the Hokio Stream, probably via groundwater and possibly temporary inundation by flooding waters from the Hokio Stream. However, the question as I understand it is whether a "river" was historically present within this location and whether the Tatana Drain should be seen as a modified version of this "river".

42. Examination of aerial photographs can provide some insight into this question. I have been provided with electronic copies of aerial photographs for the area dated 1942, 1968, 1970, 2001, 2004, 2005, 2011 and 2016. I have also examined the May 1995 photograph presented as Photo 1 in Mr Brown's report (page 8).

43. The earliest photograph available to me dates back from 1942. I note that the road was already constructed at the time, which is likely to have changed the local hydrology and hydrogeology, so the photograph should not be taken as a representation of the natural hydrology in the area. The 1942 aerial photograph shows the presence of non-pasture vegetation in the paddock, most likely some form of wetland vegetation. The photograph clearly shows two drains traversing the paddock in South-North direction (Figure 1). There is no indication on this photograph of a waterway running in an east-west direction at or near the location of the Tatana Drain. In my experience, drains are generally installed to drain water away from the land and towards the nearest watercourse. If a watercourse had been present at, or near the current location of Tatana Drain, it stands to reason that the drains would have been installed towards that waterway, not away from it. The orientation of the drains away from the current location of the Tatana Drain and towards the Hokio Stream makes it implausible that there would have been a waterway at or near the current location of the Tatana Drain.

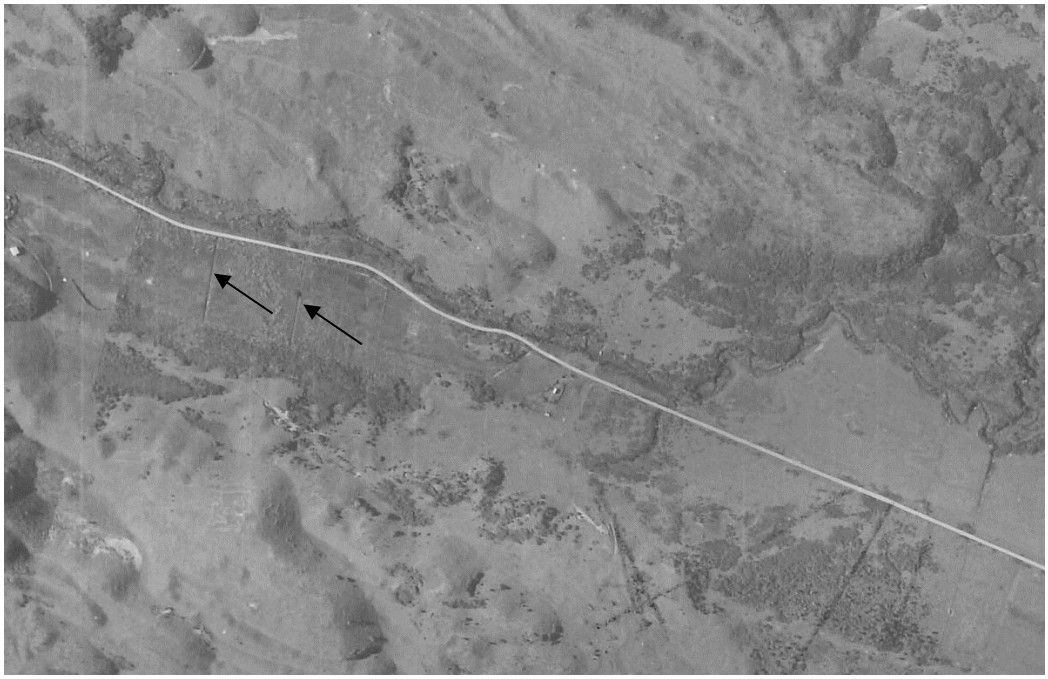

Figure 1: 1942 aerial photograph of the landfill area. The black arrows point to the two drains described in paragraph 43.

44. The 1968 and 1970 photographs I have been provided with are, unfortunately, of insufficient definition to confidently comment on. It is possible that the wetland vegetation evident in the 1942 aerial photograph was still present in 1968, but is less apparent on the 1970 photograph. On both photographs, some form of straight line is visible in the approximate current location of the Tatana Drain or the fenceline immediately south of it. I cannot say whether this line is a fenceline or a drain.

45. All aerial photographs from 1995 (refer to Mr Brown's Photo 1) to 2016 clearly show the presence of the Tatana Drain in its current location. Other drains, notably along the southern berm of the road, as well as two shorter drains parallel to the road and flowing towards the lower section of Tatana Drain are also visible.

46. I have considered Mr Brown's evidence at paragraph 17, where he considers four factors relevant to the nature of the Tatana Drain, and I comment on these factors below:

    (a) I agree that the area under consideration was once a wetland. However, I do not agree that this necessarily means that the drain is a "river" under the RMA definition. Drains are typically installed in wet soils/areas. By definition wet soils/areas would have all once supported some form of wetland vegetation and ecosystem. If the logic that, because the area was once a wetland any drain traversing it should be seen as a "river" under the RMA definition, then it follows that every surface farm drain should inescapably be considered as a "river". This seems inconsistent with the RMA definition of a river, which specifically excludes "farm drainage canals", because under this logic the exclusion would never apply.

    (b) I can confirm that surface flow was also present in the Tatana drain during my site visit on 19 August 2016. The lower section of the drain (near the road) and the adjacent paddock area were in fact partially submerged at the time, following a wet period. That there would be permanent flow in the drain even in summer is not particularly surprising given the area was originally a wetland.

    (c) Although "Map 1" does not seem to have been included in Mr Brown's evidence, I have seen the REC network map for the location. The REC surface hydrological network is based on the topographical map network, which, in my experience includes both natural and artificial waterways. Further, my experience with the REC hydrological network is that whilst it is most generally correct for sizeable streams and rivers (typically order 3 and above), it is often unreliable for first or second order tributaries, particularly on flat terrain. For example, I have recently identified that the REC network in a sand dune area northwest of Bulls contained significant inaccuracies, including the "connection" of a third order tributary to the wrong catchment. In my opinion the REC network should not be taken as evidence of the presence/absence of a waterway, or whether that waterway should be seen as natural or artificial.

    (d) I do not fully understand the area referred to in Mr Brown's paragraph 17d. I will seek clarification prior to the hearing.

47. The above considerations and the evidence available to me has led me to the conclusion that the Tatana Drain was artificially created within an area that was historically a wetland. In my opinion, the Tatana Drain is akin to a "farm drainage canal", which is specifically excluded from the RMA

definition of a “river”, and thus does not constitute a “river” in that sense. I note this is the only material point of disagreement between water quality experts recorded in the JWS.

48. For completeness, it is important to note that an artificial waterbody may provide habitat for a range of aquatic species. The first section of the Tatana Drain (i.e. the section running along the fenceline) is very shallow and presents extremely limited aquatic habitat. However, the lower part of the drain (the part flowing northern direction towards the Hokio Stream) is wider and deeper and acted like a backflow channel during the time of my site visit, and is likely to provide some, albeit limited, actual or potential habitat for aquatic species, including invertebrates and fish.

DISCHARGE OF LEACHATE FROM THE LANDFILL AND ITS EFFECTS ON WATER QUALITY AND ECOLOGY

Leachate discharge

49. Table 2 in Mr Brown’s S42A report provides a useful summary of the monitoring data available for the Tatana Drain. The data shows elevated concentrations of ammoniacal nitrogen, BOD and chloride in the upper part of the drain (sites SW1, SW2) gradually decreasing in the lower parts of the drain (SW3, SW4). The chemical “signature” of high ammonia, high chloride and high BOD concentrations in the Tatana Drain is consistent with that of nearby groundwater (bores C2, B1, B2, B3) and that of landfill leachate generally.

50. This provides, in my opinion, clear evidence that there is leachate contamination of the Tatana Drain via shallow groundwater from the landfill. The Tatana Drain flows into the Hokio Stream, so the leachate captured by the Tatana Drain follows the same pathway, i.e. enters the Hokio Stream by way of surface water. It seems likely that some leachate also travels via shallow groundwater under the drain and into the Hokio Stream. There are thus currently two pathways, via surface and groundwater by which leachate from the landfill reaches the Hokio Stream. This is covered in the water quality JWS in response to question 1b (page 2).

51. It is noted that the Tatana Drain and then the Hokio Stream also receive some contamination from the immediately surrounding land use, although much lower concentrations of contaminants such as ammoniacal nitrogen would be expected if that was the only source of contamination, as explained in paragraph 6 (page 5) of the JWS.

Data available

52. A sizeable water quality monitoring dataset (four times per year since 1994) is available for the Hokio Stream for a broad range of parameters covering most (but not all) key contaminants potentially present in leachate. This dataset provides the basis for a reasonably sound assessment of effects, with, however, the following limitations:

    (a) Based on the evidence of Mr Douglass, it appears that the upstream monitoring location (HS1) may receive some influence from the groundwater flow path from the unlined landfill, and a new monitoring location is recommended further upstream. The downstream monitoring site (HS3) seems however adequate to capture all the effects from any direct (via Tatana Drain) or indirect (via groundwater) leachate discharge to the Hokio Stream. This responds to the question posed by the water quality experts in to paragraph 1b of the JWS.

(b) The water quality JWS indicates that we had not been able to source any pesticide/SVOC monitoring data. Since that date I have been able to source a single set of results for groundwater downgradient from the old landfill (bores B1, B2, B3, C2 and C2DS), reported in the 2014-2015 annual monitoring report, but these results look incomplete. I have requested the full set of results, and will report on any findings during the hearing. Mercury should also be added to the list of analytes for surface water samples.

(c) My conclusions should be considered with these limitations in mind.

Effects on the Hokio Stream

53. I have conducted, with assistance from my staff, a detailed analysis of the water quality data available for the Hokio Stream (Sites HS1, HS2 and HS3). This includes, for each analytical parameter and at each monitoring site:

(a) Calculation of key descriptive statistics at each site (mean, median, various distribution percentiles, standard deviation, confidence interval, number of samples, etc.) (Appendix A, and Appendix C for downgradient bores);

(b) Determination of the most relevant water quality guideline or target (One Plan targets or ANZECC Trigger Values for 95% species protection level);

(c) Calculation of the proportion of samples meeting the relevant water quality guideline or target;

(d) Comparison of upstream (HS1) and downstream (HS3) data using a non- parametric signed-rank Wilcoxon test, as recommended in Scarsbrook and McBride[1] (2007) (Appendix B); and

(e) As a visual summary, graphs of mean or median concentrations ±95% confidence interval, and showing the relevant guideline are presented in Appendix D.

54. My conclusions are as follows:

(a) Ammoniacal nitrogen concentrations meet the One Plan targets at all three sites, and no significant differences were detected between sites.

(b) SIN and DRP concentrations largely exceed the One Plan targets at all three sites, but no significant differences were detected between sites.

(c) A statistically significant difference in nitrate-nitrogen concentration was detected between sites HS1 an HS3, although this did not result in any material change in annual median or annual 95th percentile, which are the statistics used as indicators of risk of nitrate toxicity in the NPSFM 2014. All three sites fall into the NPSFM band A for annual median concentrations and Band B for 95th percentile concentration. In other words, the difference does not appear to result in any material change in the toxicity risk from nitrate-nitrogen.

[1] **Scarsbrook M. R. and McBride G. B. (2007)**. Best practice guidelines for the statistical analysis of freshwater quality data. *Prepared for the Ministry for the Environment by the National Institute for Water and Atmospheric Research (NIWA). NIWA client report: HAM2007-088.*

(d) No differences were detected between the sites in the concentrations of aluminium, arsenic, cadmium, chromium, copper, lead, manganese, nickel or zinc.

(e) Differences were detected in the concentrations of chloride, boron and iron. These differences have no relevance to a risk of environmental effects, as boron concentrations were well below ANZECC trigger values at all sites, and chloride and iron are not toxic in aquatic systems.

(f) Median concentrations of all metals except aluminium were well below ANZECC trigger values, indicating a low risk of toxic effects at all three sites.

(g) Median concentrations of aluminium were slightly greater that the ANZECC trigger value at both HS1 and HS3 (and no difference were detected between the sites). I note that it is not uncommon to measure moderately elevated aluminium concentrations in streams and rivers. Aluminium is extremely abundant in the natural environment and its potential toxic effects on aquatic life are only exerted at low of high pH. There is no indication that the leachate discharge from the landfill contributes to these concentrations, but given the uncertainties surrounding the upstream site, this should be assessed again once monitoring has been undertaken at the new recommended upstream monitoring location.

55. In essence, my analysis confirms the conclusions drawn by Mr Brown, i.e. that data available indicates no discernible difference between upstream and downstream. As indicated above, this conclusion is limited by uncertainties relating to the location of the monitoring sites.

56. Importantly, my analysis also indicates that the risk of toxic effects associated with metals is low at all three sites (noting that additional information may be required for aluminium as outlined above).

57. Mr Brown has suggested that surface water sampling be changed to be monthly during the summer months. The JWS indicates that "*from a groundwater scientist would be useful to understand whether there is a variability in the amount/location of groundwater reaching the Hokio Stream that may not be captured by quarterly sampling. This would enable better targeting [of the] monitoring and analysis of the results* " (question 3, page 4).

58. I have discussed the above with Mr Douglass and understand that although the stream flows are likely to be lower in summer, the groundwater fluxes into the stream are also likely to be lower during that period, with the reverse situation occurring in winter.

59. In my view, it is uncertain whether monitoring targeted at the summer period would have a greater chance of picking up any effects. In my opinion a year-round monitoring programme is preferable in order to capture a wide range of climatic, groundwater flux and stream flow conditions. The relatively low frequency of sampling (four times per year) of the current surface monitoring programme is compensated by the considerable length of data record (over 20 years). In my opinion, the sampling undertaken over that period is likely to have captured a wide range of climatic, groundwater flux and stream flow conditions, and in all likeliness would have been able to at least provide some indication if significant effects were indeed occurring. My view is that the frequency of the existing monitoring programme is suitable and consistent with the lack of effects detected to date, and should be maintained.

60. My conclusion is that, based on the data available, there is no evidence that more than minor effects are occurring, or are at risk of occurring, on aquatic life in the Hokio Stream as a result of the discharge of leachate, via surface and groundwater pathways, including cumulatively with any effects of current land use and any residual effects from historical activities (including discharges) on the land traversed by the Tatana Drain.

61. With regards to Tatana Drain, I have reached the conclusion that it was an artificial water course, although aquatic life, potentially including fish, may inhabit the lower section of the drain. I agree with Mr Brown's assessment that what aquatic life may be present in Tatana Drain would be exposed to some degree of toxic effects from ammonia. Data are insufficient to comment further on the degree of effects, but chronic toxicity effects seem likely and acute effects are possible. The ammoniacal nitrogen concentrations in Tatana Drain decrease from top to bottom, and so does the risk of toxic effects.

CONSENT CONDITIONS

62. In this section is comment on current and proposed conditions relevant to groundwater quality.

63. Condition 2A: The JWS provides some comments on this condition (question 4, pages 4 and 5).

64. Condition 3: My recommendations regarding the surface water monitoring programme are as follows:

    (a) Following Mr Douglass's advice, a new "upstream" monitoring site should be added on the Hokio Stream. This site should be located upgradient of any groundwater influx from the closed landfill area. This site should be monitored at the same frequency and for the same analytes as the other surface water monitoring sites;

    (b) One regular surface water quality monitoring site should be added on the Tatana Drain, at the Southeast corner of the drain (i.e. where it angles away from the fenceline and towards the road/Hokio Stream), as recommended in the JWS (Question 3, page 4);

    (c) Mercury should be added to the list of analytes in surface water samples;

    (d) SVOC/VOC analysis of the groundwater bores located downgradient of the landfill should be undertaken annually as a matter of course (as opposed to triggered by previous results), and full results reported in the quarterly/annual reports; and

    (e) Surface water monitoring should be maintained at the current frequency (quarterly).

65. Condition 11A and 11aa. In my view, the condition 11(aa) as proposed in the Officer's report incorrectly applies the guidelines and is likely to lead to frequent unnecessary reporting requirements for the following reasons:

    (a) As I explain in my evidence, I consider that the ANZECC ecosystem health Trigger Values are suitable for the Hokio Stream. Their application, at the same level of protection, to the Tatana Drain is, in my view questionable given its artificial nature, but is for the hearing panel to decide. Depending on that decision the condition may need to be re-worded to account for the differences between the Hokio Stream and the Tatana Drain.

(b) ANZECC ecosystem health Trigger Values (95% species protection level) have been exceeded on occasion by individual samples at all three Hokio Stream sites (e.g. aluminium). It is likely that this will continue, regardless of the effects of the discharge, leading to frequent monitoring requirements under the proposed condition. Given the current water quality of the Tatana Drain, it seems likely that this reporting requirement will be triggered following each sampling round. This is a known situation, so the need for reporting under a form of urgency (as soon as practicable) seems questionable.

(c) ANZECC ecosystem health Trigger Values for metals should be compared with median concentrations calculated from a number of samples rather than individual samples[2]. In my view the condition is based on an incorrect application (i.e. single-sample comparison) of the ANZECC trigger values. In my view, it is more appropriate to require reporting of results on an annual basis so the appropriate comparison with the ANZECC Trigger Values can be undertaken.

(d) I assume this condition is intended to refer to toxicants only (the ANZECC ecosystem health also include other determinands such as DRP, nitrate, turbidity, etc). If my assumption is correct, then the condition needs to refer specifically to Table 3.4.1, page 3.4-5 of the ANZECC Guidelines document.

(e) Ammoniacal nitrogen is covered by both the ANZECC ecosystem health Trigger Values and the One Plan targets. The condition should clarify whether its intent is to include or exclude ammoniacal nitrogen.

Olivier Michel Nicolas Ausseil

2 September 2016

[APPENDIX A – APPENDIX D ARE PROVIDED SEPARATELY]

[2]ANZECC Guidelines (2000), page 3.4-15: "Judgment on whether a chemical concentration exceeds a guideline value should not rely on results of analysis of a single sample, except possibly if the concentration is high enough to potentially cause acute toxicity. It is better to collect a number of samples and to compare the median value with the guideline value".