BEFORE A HEARINGS PANEL APPOINTED BY THE OTAGO REGIONAL COUNCIL

IN THE MATTER OF	the Resource Management Act 1991 ("the Act" or "the RMA")
AND	
IN THE MATTER OF	An application RM23.185 by Dunedin City Council for the continued operation and closure of the Green Island Landfill, Dunedin

STATEMENT OF EVIDENCE OF DR PETER STANLEY WILSON ON BEHALF OF OTAGO REGIONAL COUNCIL

21 FEBRUARY 2025

INTRODUCTION

1. My full name is Dr Peter Stanley Wilson.

2. I am a Principal Marine and Water Quality Scientist at SLR Consulting, where I have worked since February 2019. Prior to this role, I held the position of Coastal Water Quality Scientist at the Waikato Regional Council for four years. In these roles, my responsibilities have focused on marine science, research, and resource management with a focus on sediment and water quality.

3. I have a Bachelor of Science degree in chemistry and a Master of Science with Honours degree in chemistry, both from the University of Waikato. I also have a PhD in marine biogeochemistry from Auckland University of Technology.

4. I have 12 years of experience in local government, consulting, and academia with a focus on resource management; ecological impact assessments; and designing, implementing, and reporting on monitoring programmes, including regional state of the environment programmes and a regional coastal recreational water quality programme. I have provided technical advice and reported on a range of coastal and marine activities and discharges, including marine farms, ports, marinas, and dredging. I have also provided technical advice and reported on a range of freshwater activities, with a focus on stormwater and wastewater discharges. I routinely assess activities against the requirements of the Resource Management Act 1991 and relevant national and regional policies, plans, and standards. I have prepared and presented ecological evidence previously at Council hearings and the Environment Court.

SCOPE OF EVIDENCE

5. My evidence addresses the potential effects of the proposed activities on surface water quality in the receiving environment of the Green Island Landfill (the landfill). Specifically, the potential effects of stormwater (and potentially leachate) discharges on water quality in the Kaikorai Stream and Estuary. The key aspects considered during my review of the application documents include:

(a) Reviewing the surface water quality data and assessment of effects on the receiving environment resulting from the management of stormwater and leachate at the landfill;

(b) Reviewing the groundwater/surface water interactions as these relate to surface water quality; and

(c) Assessing the proposed monitoring schedule, including locations, frequency, parameters, and limits.

6. My evidence builds on the earlier reviews of the application documents completed by Dr Claire Conwell and is based on my reviews of the following documents:

(a) Green Island Landfill Closure, Assessment of Environmental Effects, Updated October 2024, prepared by Boffa Miskell. (**AEE**);

(b) Waste Futures - Green Island Landfill Closure Surface Water Report, updated October 2024, prepared by GHD (Appendix 6 of the AEE; **Surface Water Report**);

(c) Waste Futures - Green Island Landfill Closure Groundwater Technical Assessment, updated October 2024, prepared by GHD (Appendix 5 of the AEE; **Groundwater Report**);

(d) Green Island Landfill Interim Human Health and Environmental Risk Assessment, dated 20 June 2024, prepared by GHD (**HHERA**);

(e) Green Island Ecological Impact Assessment, updated October 2024, prepared by Boffa Miskell (**Ecological Report**);

(f) Preliminary assessment of the impacts of the Green Island Landfill leachate on the receiving environment using passive samplers and toxicity testing, dated 13 March 2024, prepared by Cawthron (Attached to the Ecological Report; **Cawthron Report**). An addendum was also produced, dated 18 December 2023 (**addendum to the Cawthron Report**);

(g) RM23.185 – Green Island Landfill Surface Water Quality Technical Review, dated 9 November 2023, prepared by Dr Claire Conwell (SLR) (**Surface Water Quality Technical Review**);

(h) RM23.185 - Green Island Landfill Surface Water Quality Technical Memorandum 02, dated 24 October 2024, prepared by Dr Claire Conwell (SLR). This is a review of the updated reports prepared in October 2024. (**Surface Water Quality s92 Response Review**);

(i) RM23.185 - Green Island Landfill Groundwater Quality Technical Review, dated 10 November 2023, prepared by Anna Lukey (SLR) (**Groundwater Quality Technical Review**); and

(j) RM23.185 - Green Island Landfill Groundwater Quality Technical Memorandum 02, dated 24 October 2024, prepared by Tim Baker (SLR) (**Groundwater Quality s92 Response Review**).

CODE OF CONDUCT STATEMENT

7. While this is not an Environment Court hearing, I nonetheless confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023.

8. I am satisfied that the matters I address in my evidence are within my field of expertise. I am not aware of any material facts that I have omitted that might alter or detract from the opinions I express in my evidence.

BACKGROUND CONTEXT

9. The proposed activities are described in detail in the AEE and Surface Water Report and are not repeated here.

10. The key consideration regarding the effects of the proposed activities on surface water quality in the receiving environment is the discharge of stormwater (and potentially leachate) from the site. The fate of water generated on the site is determined by the site water management, where water is categorized by catchment into one of three categories[1]:

(a) **Clean water**: non-contaminated water (no leachate), potentially containing low sediment concentrations flows directly to the Kaikorai Stream. This generally includes vegetated areas such as the landfill margins, covered sides of the landfill, and capped surfaces;

[1] Surface Water Report, Section 4.1.

(b) **Stormwater**: non-contaminated water (no leachate), potentially containing elevated sediment concentrations, is diverted to stormwater ponds prior to discharging to the Kaikorai Stream. This includes areas with exposed earthworks or catchments that are being or have recently been capped; and

(c) **Leachate**: contaminated (and potentially contaminated) water is diverted to a leachate pond, drain, or channel/swale to be pumped to the Green Island Wastewater Treatment Plant (**GIWWTP**). This includes runoff that comes into contact or has the potential to come into contact with waste material.

11. Under the current regime, clean water discharges directly to the Kaikorai Stream surrounding the landfill and stormwater primarily discharges via the Eastern Sediment Pond. Water levels within the pond are managed by a weir (with overflow discharging to the Kaikorai Stream via a constructed wetland).

12. The proposed extension and then closure of the landfill will result in catchments being recategorised from leachate management areas to stormwater management areas. according to current and future operations (existing Western Sedimentation Pond and wetland and the conversion of the Northern Leachate Pond to the Northern Sedimentation Pond).

CURRENT STATE OF THE RECEIVING ENVIRONMENT

13. In this section I summarise the current state of the Kaikorai Stream and Estuary as the receiving environments of stormwater discharges from the landfill.

Kaikorai Stream

14. Otago Regional Council (**ORC**) have a long-term monitoring location in the Kaikorai Stream at Brighton Road, approximately 300 m upstream of the discharge from the landfill's Eastern Sedimentation Pond and wetland. A summary of this data is presented in the Surface Water Report (Section 3.5), and my interpretation is below (Table 1).

Table 1: Summary of water quality data for Kaikorai Stream at Brighton Road (Source: LAWA.org.nz)

Parameter	5-year median	State (lowland urban streams)	NPS-FM Attribute band	10-year trend	5-year trend
E. coli (n/100 mL)	1,414	In the worst 25%	E	Very likely degrading	Indeterminate
Clarity (m)	1.03	In the worst 50%	A	Very likely degrading	Indeterminate
Total nitrogen (mg/L)	0.78	In the best 50%	—	Very likely degrading	Indeterminate
Total oxidised nitrogen (mg/L)	0.43	In the best 50%	—	Very likely degrading	Indeterminate
Dissolved inorganic nitrogen (mg/L)	0.45	In the best 50%	—	Very likely degrading	Likely improving
Ammoniacal nitrogen (toxicity) (mg/L)	0.011	In the best 50%	B	Very likely improving	Likely degrading
Nitrate nitrogen (toxicity) (mg/L)	0.42	In the best 50%	A	Very likely degrading	Likely improving
Dissolved reactive phosphorus (mg/L)	0.0084	In the best 25%	B	Likely degrading	Very likely degrading
Total phosphorus (mg/L)	0.027	In the best 50%	—	Very likely degrading	Very likely degrading

15. I note that the Attribute Band for ammoniacal nitrogen on LAWA (reported as B and shown in my Table 1, above) differs from that presented in the Surface Water Report (reported as C) but the same 5-year median concentration is presented (0.011 mg/L).

16. The general description provided by ORC about this monitoring location on LAWA is that "*water quality is poor. The Kaikorai Stream flows through residential and industrial areas and water quality is compromised by the many stormwater outfalls that discharge into the stream.*"[2] The Surface Water Report expands on this and notes that it "*has been impacted by past and current land use practices, which include heavy industrial, landfilling (including the Maxwell closed landfill on the opposite side of the estuary from Green Island landfill), quarrying, and agricultural activities.*"[3] This also applies to Abbots Creek, which flows into the Kaikorai Stream adjacent to the landfill.

17. Trends in nitrogen (dissolved inorganic, ammoniacal, and nitrate) differ depending on whether the most recent 5 or 10 years of data are included. Over 10 years, all nitrogen parameters other than ammoniacal nitrogen were 'very likely degrading'. Over the most recent five years, dissolved inorganic

[2] https://www.lawa.org.nz/explore-data/otago-region/river-quality/dunedin-coast-fmu/kaikorai-stream-at-brighton-road

[3] Surface Water Report, Section 3.5

nitrogen and nitrate nitrogen are 'likely improving'. This could reflect more recent catchment improvements resulting in reduced nutrient loads.

18. Nationally, lowland urban streams are subjected to a range of environmental stressors from urban land use, with some examples specific to this monitoring location listed in paragraph 16 of my evidence above from the Surface Water Report. As such, despite water quality being classified as poor, all reported parameters other than *E. coli* and clarity in in the best 50% of lowland urban streams in New Zealand. The 5-year median *E. coli* concentrations are notably high (1,414 n/100 mL) and below the national bottom line.

19. Metal concentrations in the water are not reported on LAWA, however, they are measured quarterly in the landfill's monitoring programme, including upstream of the landfill in Kaikorai Stream at Brighton Road and Abbots Creek. Results from July 2017 to July 2023 are reported in the landfill Annual Compliance Monitoring Report July 2022 – June 2023.[4] Results are assessed against the ANZG (2018)[5] toxicant default guideline values (**DGV**) for marine and freshwater at the 80% species protection level. The 80% species protection is the lowest level of protection provided by ANZG; however, considering the degraded state of the Kaikorai Stream and Estuary, this likely provides protection to most species present.

20. Overall, concentrations of lead, nickel, chromium, and cadmium in the Kaikorai Stream and Abbots Creek were typically below the ANZG (2018) DGV for both marine and freshwater.

21. Since 2017, copper concentrations have exceeded the DGV four times in the Kaikorai Stream and once in Abbots Creek. Cyanide concentrations exceeded the DGV on two occasions, occurring in the Kaikorai Stream and Abbotts Creek at the same time. Aluminium concentrations exceeded the DGV once in Abbots Creek and twice in Kaikorai Stream.

22. As noted in the Surface Water Quality Technical Review and Surface Water Quality s92 Response Review, zinc is notably missing from the suite of

[4] Appendix B of the Surface Water Report.
[5] ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

metals tested. Zinc is a contaminant of concern as there are elevated levels of zinc in sediments in Kaikorai Estuary (discussed in the following section).

23. In general, metal concentrations in Kaikorai Stream and Abbotts Creek are typically close to, but below the ANZG (2018) DGV for 80% species protection.

Kaikorai Estuary

24. Kaikorai Estuary is an extensively modified, moderate-sized tidal lagoon. The catchment is dominated by pasture (48%) and urban areas (21%).

25. Fine-scale intertidal monitoring of the estuary has been reported in 2018[6] and 2020[7]. Monitoring of the upper estuary, near the mouth of the Kaikorai Stream, shows elevated levels of mud and sediment nitrogen (i.e., it is muddy and nutrient enriched). The mid-estuary location appears to be more of a sheltered, depositional area and shows a general increase from 2007 to 2020 in mud content, elevated but not increasing sediment nitrogen, and concentrations of zinc that exceed the ANZG (2018) default guideline values (DGVs) for toxicants in sediment. The 2020 monitoring report describes this as being at levels with 'possible' ecological effects. The outer estuary, closest to the entrance is sandier than the other monitoring locations, containing lower levels of mud, nutrients, and sediment metals.

26. The 2020 fine-scale monitoring report concludes that there was no obvious change in the benthic macrofaunal communities in response to mud or other sediment characteristics. This suggests that the benthic communities are influenced by other unmeasured factors such as broader catchment influences, variable hydrological effects from Kaikorai Stream and the closing of the estuary mouth resulting in low salinity.[8] Overall, there is no clear measured stressor dominating or influencing the benthic macrofaunal communities.

[6] Robertson BP, Robertson BM. 2018. Kaikorai Estuary: Fine Scale Monitoring 2018. Report prepared by Wriggle Coastal Management for Otago Regional Council. 37p.
[7] Forrest BM, Stevens LM, Rabel H. 2020. Fine Scale Intertidal Monitoring of Kaikorai Estuary. Salt Ecology Report 042, prepared for Otago Regional Council, June 2020. 42p.
[8] See executive summary of the 2020 fine scale intertidal monitoring report.

27. The mouth of the estuary regularly closes, increasing water levels and reducing the flushing. The estuary mouth typically opens following a storm event or if ORC opens it mechanically to lower water levels in the estuary.[9]

28. Overall, the mid and upper sections of the estuary have elevated levels of mud and sediment nitrogen. Elevated levels of zinc are present in the mid-section of the estuary, where it is more sheltered and depositional.

SUMMARY OF THE POTENTIAL EFFECTS ASSESSED BY THE APPLICANT

29. An assessment of effects on surface water is provided in Section 5 of the Surface Water Report.

30. Briefly, the assessment compares contaminant concentrations measured in the Kaikorai Stream and Abbotts Creek, upstream of the landfill, with a monitoring location in Kaikorai Stream adjacent to the landfill and another downstream of the landfill.

31. In general, the monitoring results indicated that water quality at the upstream monitoring locations exhibited the influence of an impacted, urban or peri-urban catchment. Monitoring locations adjacent and downstream of the landfill did not exhibit any significant changes in dissolved metal or nutrient concentrations that would indicate significant water quality impacts from the landfill.[10] Cyanide and PFAS were detected at low concentrations, upstream, adjacent, and downstream of the landfill.

32. Monitoring results from the sedimentation ponds revealed generally poorer water quality than in the Kaikorai Stream, which the report notes is not unexpected considering the pond's purpose to detain water and settle sediments. Water from the pond discharges via the eastern constructed wetland and into the Kaikorai Stream, which will result in some level of mixing.

33. I note that total suspended solids and *E. coli*/enterococci do not appear to be monitored or assessed in the Surface Water Report and that zinc only appears to have been monitored in the sedimentation ponds, not in the

[9] Surface Water Report, Section 3.4
[10] Surface Water Report, Section 5.2

Kaikorai Stream. I consider these to be contaminants of concern due to the elevated mud and zinc levels in Kaikorai Estuary and *E. coli* and/or enterococci as an indicator of the suitability for contact recreation.

34. The HHERA further synthesised and assessed the monitoring results in the context of risk to human health and the environment. Using a tiered approach, the assessment identified the following contaminants of potential concern associated with the landfill to further assess:

    (a) Nutrients including ammonia and nitrate;

    (b) Chromium;

    (c) Lead;

    (d) Zinc; and

    (e) PFAS.

35. The tier-1 screening assessment concluded that all contaminants of potential concern were below their relevant human health-based criteria and posed a low risk to the health of recreational users of the downstream aquatic environment.[11] I note, however, that *E. coli* and/or enterococci (indicators of faecal bacteria) were not considered in the assessment as they aren't included in the landfill monitoring programme. As noted above, the Kaikorai Stream has notably elevated *E. coli* concentrations, which would likely have made the water unsuitable for swimming based on those results.

36. Based on the ecological risk, zinc and PFAS were assessed in further detail.

37. For zinc, the report concludes that there is a "*low risk that discharges from the landfill are resulting in measurable adverse chronic effects on aquatic organisms but that it is possible that, at a catchment scale, marginal adverse effects on aquatic organisms are possible due to the presence of elevated concentrations of zinc*."[12]

38. For PFAS, a weight of evidence approach concluded that although PFAS is present within the Kaikorai Stream and Estuary it has been recorded at low concentrations that are unlikely to adversely affect fauna. A bioaccumulation

[11] HHERA, at page 23.
[12] HHERA, at page 37.

assessment suggests that a large number of locally caught fish would need to be consumed to exceed food safety New Zealand limits.

RESPONSE TO SUBMITTERS

39. In this section I respond to submissions relating to surface water quality.

40. Te Rūnanga o Ōtākou have requested that the Applicant, in collaboration with mana whenua, should investigate the potential migration of leachate into the Kaikorai Stream and the cumulative impacts leachate has on the Kaikorai Stream and Estuary. Similarly, Otago Fish and Game Council raise a number of concerns relating to surface water quality as a result of potential offsite migration of leachate.

41. I agree that there is a high level of uncertainty about whether leachate is migrating offsite. I also agree that the Applicant should further investigate the potential migration of leachate, and I understand that this may be achieved with additional groundwater monitoring.

42. If leachate is found to be migrating offsite, I recommend that additional targeted monitoring is conducted. The approach should be described in an adaptive monitoring plan, which I discuss later in my evidence in the Consent Condition section.

43. Otago Fish and Game Council also raised concerns about the uncertainty of the HHERA. I agree that there is limited information feeding into the assessment at this time. Draft consent condition [52] requires a review of the HHERA within three years and the preparation of an updated report. In my opinion, an additional three years of monitoring will provide greater certainty of the risk to human health and the environment. The assessment is dependent on additional data, and it would be difficult to speed this process up without sacrificing certainty.

44. I support the consideration of Risk Management – Guidelines AS ISO 31000:2018 (Standards Australia 2018) and an assessment of risk quotients in a revised HHERA. I do not consider the EIANZ Ecological Impact Assessment Guidelines (Roper-Lindasy et al., 2018) to be essential in providing a robust assessment of human health and environmental risk as this is only one approach to conducting ecological impact assessments (albeit widely used).

CONCLUSIONS AND RECOMMENDATIONS

45. In this section, I outline the surface water quality aspects I think warrant further consideration based on my understanding of the potential effects of the proposed activity and the state of the receiving environment. These are:

    (a) Potential leachate migration;

    (b) Contribution of discharges to a degraded system; and

    (c) Cumulative effects.

Potential Leachate Migration

46. A key assumption in the surface water quality assessment is that all of the leachate generated on-site is collected via the collection trench, thus preventing offsite migration. The groundwater technical review finds that this may not be the case; given the collection trench does not extend to the depths of the Abbotsford Mudstone (marine deposit basement), and there remains the potential for groundwater flow beneath the trench and above the low permeability mudstone. This issue is further discussed by Tim Baker in his evidence[13].

47. Findings in the Cawthron Report indicated the presence of leachate organics in groundwater samples and suggested that there may also be dissolved metals in groundwater contributing to the observed ecotoxicological effects in test species.

48. I understand that additional groundwater monitoring is being recommended that will assist in identifying whether leachate is migrating offsite.[14] If leachate is migrating offsite, the volumes are presumably small and will be diffuse rather than a point source discharge into the receiving environment. This would likely make measuring the effects of such leachate migration difficult considering the degraded state of the Kaikorai Stream and Estuary. A targeting monitoring approach (e.g., monitoring locations where leachate is likely entering the receiving environment) may be beneficial if offsite migration is confirmed to assist with quantifying the effects.

[13] Tim Baker EIC, from paragraph 7.2.
[14] See recommendations in Mr Baker's EIC, section 10.

Contribution of Discharges to a Degraded System

49. The assessment of effects of stormwater discharges from the landfill on the Kaikorai Stream and Estuary is based on whether contaminant concentrations are higher downstream of the landfill than upstream. As described earlier in my evidence[15], both systems are impacted by a range of historical and current catchment-derived stressors and can be considered degraded.

50. A key principle of Te Mana o Te Wai in the National Policy Statement for Freshwater Management (2020) (**NPS-FM**) is that the wellbeing and health of water are prioritised. So, if there is evidence of upper catchment stress to downstream receiving environments, the state of water quality (in downstream receiving environments) should not be further degraded and, instead, should be improved where possible. As such, there are limitations to how the effects of the current and proposed activities on the Kaikorai Stream and Estuary have been assessed as they are based on the ability to detect changes in water quality from discharges in a degraded environment.

51. The key issues in the Kaikorai Estuary, identified in the 2020 fine-scale monitoring report, are elevated muddiness, sediment nutrient enrichment, and in the mid-harbour, elevated levels of zinc.

52. No monitoring data of total suspended solids has been presented in the Surface Water Report or annual monitoring report so it's not possible to assess the effects of the discharges on sediment loads in the Kaikorai Stream or Estuary. This is a key stressor on aquatic habitats and should be considered in future monitoring of the discharges from the landfill to inform its contribution to the state of the estuary.

53. Nutrients in the sedimentation ponds are measured in the forms of nitrate and ammoniacal nitrogen. The annual monitoring report assesses measured concentrations against the current consent condition limit (1.69 mg/L) and the ANZECC (2000) freshwater guideline for 80% protection of species. I note that the ANZECC (2000) value is a toxicity threshold and that staying below this value will protect species from toxicity effects, but it does not manage for nutrient load effects (i.e., nutrient enrichment) in receiving environments. The current consent limit of 1.69 mg/L is an order of

[15] Paragraphs 13 to 28

magnitude less than the toxicity threshold and has typically been met in the Eastern and Western Sedimentation ponds since 2018. I consider this an appropriate limit for water quality in the sedimentation ponds to manage nutrient enrichment in the Kaikorai Estuary.

54. Ammoniacal nitrogen is measured in the sedimentation ponds and assessed against the ANZG (2018) freshwater (2.3 mg/L) and marine (1.7 mg/L) DGVs for 80% species protection and the current consent limit of 17.33 mg/L (note this is an order of magnitude higher than the toxicity thresholds and may not protect species near the discharge point if discharging at this limit). Concentrations corrected for pH and temperature are presented in Table C6 of the annual monitoring report for the 2022 to 2023 period. During this time, concentrations were generally an order of magnitude lower than the marine DGV for 80% species protection, which is more conservative than the freshwater DGV. As such, the risk to aquatic species from stormwater discharges is low, however, this still contributes to the nitrogen load.

55. Zinc concentrations measured in the stormwater ponds from 2003 to 2023 are presented in Figure C5-2 of the annual monitoring report. Since 2007, concentrations in the Eastern Sedimentation Pond have been below the ANZG (2018) DGV for 80% species protection of freshwater species (0.04 mg/L) on all but three occasions. On two of these occasions, concentrations were below the marine DGV (0.085 mg/L). The current consent limit is 0.008 mg/L and concentrations in both ponds have generally been at or below this value. I consider the current consent value of 0.008 mg/L to be appropriate to manage zinc loads in the Kaikorai Estuary.

56. *E. coli* and/or enterococci are not monitored by the landfill so its contribution to the Kaikorai Stream, with known elevated concentrations, is not known. This is a key indicator relating to human health and should be considered in future monitoring of the discharges from the landfill to inform its contribution to water quality in the Kaikorai Stream and Estuary.

57. In general, the stormwater discharges from the landfill do contain nutrients and zinc (and presumably suspended sediment) that will contribute to some extent to the state of the Kaikorai Estuary. The relationship between contaminant concentrations in the water and how they might correlate to sediment concentrations is complex and so it is very difficult to predict how the measured water quality might result in sediment quality in the estuary.

58. Based on the identified issues in the Kaikorai Estuary (muddiness, nutrient enrichment, and elevated zinc), it would be beneficial to reduce the inputs of these where possible.

59. The 2020 fine-scale monitoring report concluded that there was no obvious change in the benthic macrofaunal communities in response to mud or other sediment characteristics. As such, it is unlikely that the discharges from the landfill alone would result in measurable changes in benthic communities in the estuary. Instead, catchment-wide improvements would be required and there would likely be a lag time of years between the catchment improvements and measurable changes in the benthic communities (i.e., ecosystem health).

60. The Council must also consider if discharges on their own or in combination with other discharges would result in the rendering of fresh water unsuitable for consumption by farm animals. I have reviewed the draft ANZG (2023) Livestock drinking water quality guidelines[16], and conclude that meeting and ANZG (2018) toxicity guidelines for 80% species protection also results in meeting the livestock drinking water guidelines. Typically, the livestock guidelines are much higher than the equivalent toxicity guidelines for aquatic organisms.

Cumulative Effects

61. The topic of cumulative effects is partially addressed in my comments in the previous sub-section regarding the contribution of discharges to a degraded state.

62. In general, the effects of the proposed stormwater discharges have been assessed based on the ability to detect change in the receiving environment. As noted, the Kaikorai Stream and Estuary are degraded environments, with a range of catchment-derived pressures. As such, it is appropriate to consider how the stormwater discharges from the landfill contribute to contaminant loads in these environments rather than just focus on whether they further degrade water quality. I agree with the Surface Water Quality s92 Response Review[17] that cumulative effects have not been adequately addressed in the Surface Water Report.

[16] https://www.waterquality.gov.au/sites/default/files/documents/livestock-drinking-water-guidelines-draft.pdf
[17] Surface Water Quality s92 Response Review, at page 10.

CONSENT CONDITIONS

63. The key consent conditions relating to surface water quality are those regarding ongoing monitoring. These are detailed in the section titled 'Groundwater and Surface Water Monitoring' [from draft condition 38].

64. In general, I consider the surface water monitoring parameters and frequency listed in Table 1 to be appropriate. The exception to this is in regard to metals, total suspended solids and *E. coli*/enterococci.

65. Table 1 requires annual monitoring of metals at the listed monitoring locations; however, I consider that quarterly sampling would be more appropriate, considering that zinc measurements in the Kaikorai Stream and Abbotts Creek have not been included. This information will also be important to inform the revised HHERA in three years. Importantly, I also recommend that copper is included in the monitoring suite as this is a key urban contaminant and is missing from the list.

66. I consider that total suspended solids should be included in the suite of monitoring parameters to understand the potential effects of sediment in the stormwater discharges on muddiness in the Kaikorai Estuary. I also consider that *E. coli* and/or enterococci are included to inform the effects on human health. This can also inform the revised HHERA.

67. I agree with the inclusion of condition 52 that the HHERA is reviewed and updated within three years of consent being granted.

68. During the closure process, the Northern Leachate Pond will be reclassified as the Northern Sediment Pond. I consider it to be appropriate that the Northern Sediment Pond is included as a monitoring location as it will also discharge to the Kaikaori Stream and Estuary. Consideration should be given to monitoring this while it is still the Northern Leachate Pond, as the Surface Water Report notes that it can overflow into the Kaiorkorai Stream in prolonged high rainfall events.[18]

Monitoring Triggers

69. Draft consent condition 42 requires all monitoring results from GI1, GI2, GI3, GI 5, the estuary, and the south eastern and eastern constructed wetlands

[18] Surface Water Report, at Section 4.1.3.

(i.e., all surface water locations that are not leachate or sediment ponds) to be assessed against a range of guideline values, listed by the document they are contained in. In my opinion, it would be clearer to include the triggers to be assessed against in a table and to assign trigger values to as many parameters as appropriate. For any parameter without a suitable guideline from which to derive a trigger, a typical range from historical data could be derived. An example of such table is attached to my evidence as **Attachment 1** (this table includes more columns/information than necessary as it shows multiple thresholds from different sources); I also include additional parameters for quarterly monitoring as discussed earlier in my evidence.

70. In this table, I have extracted guideline values from the documents listed in draft consent condition 42(a-e) and the Surface Water Report (Appendix C of the annual monitoring report attached to the Surface Water Report) where they have used 'adopted limits' established under condition 6(ii) of expired resource consent 3840C_V1. I understand that these adopted limits in non-leachate or sediment ponds are typically ANZG (2018) or NPS-FM (2000) guidelines.

71. For sediment ponds, I understand that 'adopted limits' established under condition 6(ii) of expired resource consent 3840C_V1 were based on historical data. I consider these limits to be helpful to determine if ongoing measurements deviate substantially from historical water quality (i.e., could indicate an issue or anomaly). I recommend that new triggers are established using monitoring results from the most recent five years. This could be, for example, the mean of the past five years, plus or minus two standard deviations or using a similar approach used to derive the initial limits. Where possible, these triggers should be the same or less than ANZG (2018) freshwater or marine toxicity guidelines for 80% species protection.

Adaptive Monitoring

72. The Surface Water Quality Technical Review recommended that an adaptive monitoring plan be developed. I agree with this approach and consider it to be appropriate to include in consent conditions. In my opinion, the adaptive monitoring plan should provide details on additional, targeted monitoring in the event that leachate is confirmed to be migrating offsite. In

this scenario, the surface water components of an adaptive monitoring plan should include:

(a) Additional monitoring locations where leachate is likely to be entering the receiving environment;

(b) Sampling methodology, including parameters to be measured (it may be appropriate to include ecotoxicity-specific monitoring);

(c) Appropriate thresholds or guidelines to assess results against; and

(d) If appropriate, guidance on how long the additional monitoring should continue (i.e., set time, or until a certain threshold is reached).

Dr Peter Stanley Wilson
21 February 2025

ATTACHMENT 1

Table A1: Recommended monitoring parameters, frequency, and triggers for GI1, GI2, GI3, GI5, the estuary, and the south eastern and eastern constructed wetlands. Based on draft consent condition 40, Table 1.

	Frequency of Monitoring	Measurement/Analyte	ANZG (2018) Freshwater 80% Toxicant DVG (µg/L – unless stated otherwise)	ANZG (2018) Marine 80% Toxicant DVG (µg/L – unless stated otherwise)	'Adopted' ORC Consent 3840_V1 Condition 6(ii) (µg/L – unless stated otherwise)	Other Guideline (µg/L – unless stated otherwise)	Source	Recommended Trigger (µg/L – unless stated otherwise)
C	Quarterly (reduced to 6 monthly, two years following landfill closure)	pH (pH units)	—	—	7.2-8.0 (pH units)	7.2-8.0 (pH units)	ANZECC (2000)	7.2-8.0 (pH units)
		Electrical conductivity (mS/cm)	—	—	—			Based on historical data
		Dissolved oxygen (mg/L)	—	—	—	11-day minimum: 4.0 mg/L 7-day mean minimum: 5.0 mg/L	NPS-FM (2020)	11-day minimum: 4.0 mg/L 7-day mean minimum: 5.0 mg/L
		Boron	2500	—	—			2500
		Ammoniacal nitrogen	2300	1700	—	200 annual median: 1300 95th %ile: 2200	Regional Plan: Water Schedule 16A NPS-FM (2020) 80% species protection (below national bottom line)	1700
		Nitrate nitrogen	—	—	1700	3600 annual median: 2400 95th %ile: 3500	Regional Plan: Water Schedule 16A NPS-FM (2020) 80% species protection (national bottom line)	2400
		Chloride	—	—	—			Based on historical data
		PFOS (first three years)	—	—	—			0.13
		PFOA (first three years)	—	—	—			220
		Aluminium	150	—	—			150
		Arsenic	140	—				140
		Cadmium	0.8	36	—			0.8
		Chromium	40	85	40			40
		Copper	2.5	8	2.5			2.5
		Iron	—	—	—			Based on historical data
		Lead	9.4	12	—			9.4
		Manganese	3600	—	—			3600
		Nickel	17	560	—			17
		Zinc	31	21	—			21
		Total suspended solids	—	—	—	New parameters (noting that Kaikorai Stream, upstream of the landfill likely exceeds these currently)		Based on historical data
		E. coli	—	—	—		NPS-FM (2000) national bottom line	540 MPN/100 mL
		Enterococci	—	—	—		Recreational Water Quality Guidelines	280 MPN/100 mL

D	Annually	Sodium	—	—				Based on historical data
		Potassium	—	—				Based on historical data
		Calcium	—	—				Based on historical data
		Bicarbonate	—	—				Based on historical data
		Sulphate	—	—				Based on historical data
		Dissolved reactive phosphorus	—	—				Based on historical data
		Volatile organic compounds (VOC)	—	—				Based on historical data
		Semi volatile organic compounds (SVOC)	—	—				Based on historical data
		PFOS	—	—		0.13	PFAS National Environmental Management Plan (version 2.0)	0.13
		PFOA	—	—		220		220
		Cyanide	18	14	18			14
		Chemical oxygen demand (COD)	—	—				Based on historical data
		Biological oxygen demand (BOD)	—	—				Based on historical data