Under	the Resource Management Act 1991 (**RMA**)
In the matter of	an application by **Dunedin City Council** for resource consents for the operation, closure and aftercare of the Green Island Landfill, Dunedin.

Statement of evidence of Kylie Dodd

4 March 2025

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Qualifications and experience

1 My name is Kylie Dodd. I am currently employed as a Technical Director at GHD Pty Ltd (GHD), specialising in environmental toxicology and risk assessment.

2 My formal qualifications include:

(a) Bachelor of Science (Honours) (University of New England, Australia, 2001); and

(b) Doctor of Philosophy (Environmental Chemistry) (University of New England, Australia, 2005).

3 I am an environmental scientist with almost 20 years of experience in this field. The focus of my work is the investigation of environmental contamination and the assessment of the human health and ecological risks that can occur as a result. I have led water quality studies and human health and environmental risk assessment projects across the Asia Pacific region and have provided technical advice and independent peer review to health and environmental regulators in Australia and New Zealand.

4 I have read the Code of Conduct for Expert Witnesses (Section 9) in the *Environment Court of New Zealand – Te Kōti Taiao o Aotearoa – Practice Note 2023*. This evidence has been prepared in accordance with it, and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Scope of evidence

5 I have been asked to prepare evidence in relation to the human health and environmental risks associated with discharges into the Kaikorai Stream from the Green Island landfill (hereafter referred to as 'the site' or 'the landfill') located at 9 Brighton Road, Green Island. In particular, I have been asked to address any outstanding issues that arise from the independent review commissioned by ORC in November 2023.

6 The evidence provided herein includes the following:

(a) A summary of the key findings of the interim human health and ecological risk assessment (HHERA) undertaken for discharges from the landfill into the Kaikorai Stream.

(b) A summary of the data gaps and uncertainties associated with the interim HHERA.

(c) Responses to Otago Regional Council (ORC) peer review comments provided on the HHERA in the *Notification Recommendation Report*.

Executive summary

7 A HHERA was undertaken to evaluate whether contamination originating from the landfill may represent a risk to the human users or the environment of the Kaikorai Stream catchment.

8 The HHERA consolidated and relied upon the data gathered from the landfill and the Kaikorai Stream and Kaikorai Estuary as part of the annual monitoring program undertaken at the landfill between 2019 and 2023. Sampling was not specifically undertaken for the purpose of informing the HHERA.

9 The available dataset did not suggest that discharges from the landfill into the Kaikorai Stream had resulted in contaminant impacts in surface water that were readily discernible from those that are associated with the broader catchment.

10 The HHERA was classified as an interim rather than a definitive study because several gaps were identified in the available dataset.

11 In particular the HHERA concluded that insufficient data had been collected to characterise temporal variability in contaminant inputs to the waterway, both from the landfill and at a catchment scale.

12 The HHERA provided several recommendations to address the identified data gaps, such that a more robust risk assessment can be undertaken in the future.

13 The *ORC* Notification *Recommendation Report*, dated 12 November 2024 provides several comments in relation to the HHERA report, which can be broadly summarised as follows:

(a) The HHERA concluded that there are no discernible impacts on surface water quality attributable to the landfill, that there is no discharge of leachate into the receiving environment and that there are no adverse effects occurring. Sufficient information has not been provided to support this conclusion.

(b) The framework and methodology used in the HHERA was not adequate to identify and assess risks to receptors (human health or ecological) and did not account for the nuanced ecological values and cultural values of the Kaikorai Stream.

14 In response to the comments provided in the *ORC* Notification *Recommendation Report* I note that:

(a) The HHERA did not conclude that there was no impact on surface water quality attributable to the landfill or that leachate is not discharging into the receiving environment. Rather, the HHERA:

(i) Found that that an impact of the landfill on the water quality within Kaikorai Stream was not readily discernible in the available dataset, and

(ii) Highlighted several areas where the dataset requires supplementation, to allow a robust conclusion to be reached.

(b) The HHERA highlights a variety of ecological and cultural values that are associated with the Kaikorai Stream, including mahinga kai. It is however necessary to develop a robust understanding of the nature and extent of the water quality impacts associated with discharges from the landfill before a detailed assessment of risks to these values can be undertaken. The HHERA also highlights several data gaps that could be addressed to support a detailed assessment of the risks associated with food gathering in the catchment.

(c) Overall, the reviewers appear to have misinterpreted the scope and limitations of the interim HHERA. However, I am in general agreement with the review conclusion that additional data should be collected to support a robust characterisation of the health and environmental risks associated with discharges from the landfill into the Kaikorai Stream. The additional data collected should be considered in the context of the water quality of the wider catchment, which I consider also requires additional characterisation.

Overview of human health and ecological risk assessment

15 Environmental monitoring is undertaken at the landfill and within the Kaikorai Stream on a routine basis. This monitoring has identified the presence of a variety of contaminants within the Kaikorai Stream at concentrations that could have been associated with discharges from the landfill but were also consistent with those that typically occur in urbanised catchments with a more than 100-year history of industrial sources of contamination.

16 The objectives of the interim HHERA were to evaluate whether contamination originating from the landfill may represent a risk to the human users or the environment of the Kaikorai Stream catchment and to inform:

(a) Changes to the ongoing monitoring of contamination in the Kaikorai Stream throughout the proposed Green Island Landfill operations and closure program.

(b) A better understanding of the risk to human health from chemicals such as per- and polyfluoroalkyl substances (PFAS), which have been measured at low levels in most of the surface water monitoring sites.

(c) A better understanding of the risks associated with the recreational use of, and food gathering that occurs within, the catchment.

17 The HHERA consolidated and relied upon the data gathered from the landfill and the Kaikorai Stream as part of the routine monitoring undertaken at the landfill between 2017 and 2023. Sampling was not specifically undertaken for the purpose of informing the HHERA.

18 The HHERA focused on the following substances: metals (aluminium, cadmium, chromium, copper, lead, nickel, zinc), nutrients (ammonia, nitrate, phosphorus), cyanide, total organic carbon, chloride, and PFAS.

19 The available data indicated that discharges from the landfill into the Kaikorai Stream may occur via:

(a) The direct discharge of surface water (stormwater) during pond and drain overflow events.

(b) The migration and discharge to Kaikorai Stream of leachate via groundwater, noting that the extent to which this occurs is controlled via the leachate interception trench system installed in the northern, western and eastern boundaries of the landfill.

20 The HHERA considered the potential for discharges from the landfill into Kaikorai Stream to be associated with risks to:

(a) Recreational and cultural users of the waterway who may come into direct contact with impacted surface waters (e.g. during activities such as swimming) and/ or may catch and consume aquatic biota (e.g. fish).

(b) Aquatic organisms inhabiting the Kaikorai Stream and Kaikorai Estuary and higher trophic level aquatic, semi-aquatic and terrestrial species that feed on these organisms.

21 The HHERA was an interim and screening level assessment, which included the following scope of work:

(a) The comparison of the concentrations of chemicals measured onsite and within the Kaikorai Stream and Kaikorai Estuary with Tier 1 screening criteria sourced from New Zealand and international guidelines. Where available, preference was given to the criteria presented in New Zealand guidelines.

(b) The comparison of the chemical concentrations measured upstream (i.e., ambient levels) and downstream of the landfill along Kaikorai Stream.

(c) A more detailed weight-of-evidence (WoE) assessment for zinc and PFAS.

22 The key findings of the HHERA were:

(a) A variety of chemicals were identified in surface water and groundwater samples collected within and in the immediate vicinity of the landfill (e.g. within the leachate interception trench) at concentrations above those measured upstream of the landfill in the Kaikorai Stream (i.e. ambient levels). These results indicate that the landfill is a possible source of contamination if these landfill sources were allowed to discharge to the Kaikorai Stream.

(b) The chemical concentrations measured in surface water samples collected in Kaikorai Stream, downstream of the landfill, were generally consistent with those measured upstream of the landfill. The available dataset therefore did not suggest that discharges from the landfill into the Kaikorai Stream had resulted in contaminant impacts in surface water that were readily discernible from those that are associated with the broader catchment.

(c) The chemical concentrations measured in surface water samples collected in Kaikorai Stream were below the Tier 1 screening criteria relevant to the assessment of the potential for risks to human health. The available dataset therefore did not suggest that discharges from the landfill into the Kaikorai Stream had resulted in a likely risk to human health.

(d) The chemical concentrations measured in surface water samples collected in Kaikorai Stream were generally below the Tier 1 screening criteria relevant to the assessment of the potential for risks to the environment. The available dataset therefore did not suggest that discharges from the landfill into the Kaikorai Stream had resulted in a likely risk to the environment.

(e) Exceptions to this were reported for nitrate, zinc, and PFAS, which were reported at concentrations above the Tier 1 screening criteria relevant to the assessment of the potential for risks to the environment. Elevated concentrations of these contaminants were however reported both upstream and downstream of the landfill, suggesting an influence of the broader catchment.

Data gaps and uncertainties associated with the HHERA

23 The HHERA was classified as an interim rather than a definitive study because several gaps were identified in the dataset available to evaluate the risks to human health and the environment that are associated with the contamination status of the Kaikorai Stream. In particular, the HHERA concluded that insufficient data had been collected from within the Kaikorai Stream to characterise temporal variability in contaminant inputs to the waterway, both from the landfill and at a catchment scale.

24 To address these data gaps the HHERA recommended an ongoing monitoring program both within and downstream of the landfill and at a broader catchment scale. It was recommended that the monitoring program should focus on understanding the following:

(a) Nutrient impacts, toxicity, and eutrophication;

(b) Metal impacts, bioavailability, and toxicity; and

(c) PFAS impacts and bioaccumulation in the aquatic food chain.

25 The HHERA also recommended engagement with local stakeholders to provide insights into fishing activities in the area and the specific cultural values of the waterway, including those associated with food gathering and processing (mahinga kai).

26 Who might be responsible for coordinating a catchment-wide monitoring program is discussed in the evidence of Mr Henderson.

Response to review comments

27 Dr Claire Conwell of SLR undertook a technical audit of the HHERA and the Surface Water Report., as reported in *RM23.185 - Green Island Landfill Surface Water Quality Technical Memorandum 02*, dated 24 October 2024. The comments relevant to the HHERA are presented and addressed in. Table 1, Appendix A.

28 The ORC prepared a *Notification Recommendation Report*, dated 12 November 2024. The comments relevant to the HHERA are presented and addressed in Table 2, Appendix A.

29 The comments predominantly relate to a misinterpretation of the scope and limitations of the interim HHERA by the reviewers. I am in general agreement with the reviewers' conclusion that additional data should be collected to support a robust characterisation of the health and environmental risks associated with discharges from the landfill into the Kaikorai Stream.

30 I understand that Dr Claire Conwell is no longer employed by SLR and that the HHERA has subsequently been subject to review by Timonthy Baker and Peter Wilson of SLR. I have reviewed the statement of evidence provided by Timonthy Baker and Peter Wilson (both dated 21 February 2025) and note that a number of issues raised by Dr Conwell are not reflected in their submissions.

31 Both Timothy Baker and Peter Wilson have recommended that the HHERA be revised within 3 years, once additional monitoring has been undertaken. I agree with this recommendation.

Conclusion

32 I consider that the dataset reviewed to inform the preparation of the HHERA, did not suggest that discharges from the landfill into the Kaikorai Stream had resulted in contaminant impacts in surface water or risks to human health and the environment that were readily discernible from those that are associated with the broader catchment.

33 The HHERA was however classified as an interim rather than a definitive study because several gaps were identified in the available dataset. I therefore consider that additional data would be required to support a more detailed and robust assessment.

34 It is my opinion that the monitoring program should be designed so that it provides a robust understanding of the following at both a site-specific and catchment-scale:

(a) Nutrient impacts, toxicity, and eutrophication

(b) Metal impacts, bioavailability, and toxicity

(c) PFAS impacts and bioaccumulation in the aquatic food chain

35 I also consider that the monitoring program should be designed in accordance with the recommendations provided in the ANZG framework such that sufficient data is collected to allow for the statistical analysis of spatial and temporal variability in discharges from the site and stressors in the wider catchment.

36 Who might be responsible for coordinating a catchment-wide monitoring program is discussed in the evidence of Mr Henderson.

Kylie Dodd

4 March 2025

Appendix A

Detailed response to review comments

Table 1 Summary of the comments provided in the technical audit by Claire Conwell (SLR)

Comment		Response
1	As it stands, the current framework and screening method is not structured to adequately identify and assess risks to receptors (human health or ecological receptors). It is also commented here, the authors of the HHERA are based in Australia, and have relied largely on their working knowledge of the ANZG Water Quality Management Framework, and their working knowledge of current PFAS/PFOA thresholds. The critical and nuanced ecological values and cultural values (including mahinga kai), which are fundamental and integrated into the New Zealand Policy Statement for Freshwater Management, are not accounted for.	The interim HHERA included the collation and a Tier 1 screening assessment of the available data, undertaken in accordance with the ANZG Water Quality Management Framework. The ANZG framework is appropriate for use in this context as it provides detailed guidance on the assessment, monitoring and management of water quality in New Zealand (and Australia). Although I am based in Australia, I regularly work on water quality assessment projects in New Zealand and understand that there are local nuances to the cultural and ecological values associated with waterways in New Zealand. The HHERA highlights the cultural significance of the Kaikorai Stream and that fact it is an important resource for cultural practises such as food gathering. It is not however possible to undertake a detailed assessment of risk to these values before the nature and extent of any water quality impacts associated with discharges from the landfill are better understood. The HHERA also highlights several areas where the collection of additional data would support a more robust assessment of risks to these values.
2	The basis of the HHERA for human health has relied on two data points to assess risk. This is inadequate data set, and the limitation of this has not been accounted for in any of the updated reports provided.	The HHERA relied on the available dataset, which in the case of receiving environment surface water included the data collected at sampling points in the Kaikorai Stream (GI1, GI2, GI3, GI5), and Kaikorai Estuary. The HHERA was classified as an interim rather than a definitive study because several gaps were highlighted in the dataset available to evaluate the risks to human health and the environment. This includes limitations in the extent to which the dataset allows for a robust understanding of the temporal and spatial variability in surface water quality in the receiving environment and the contribution of the landfill to downstream water quality.
3	Overall, I agree with the objective of the approach [*of the HHERA*] to provide an integrated assessment of risks to both human health and ecological receptors. However, on the basis of the information and the approach provided in the HHERA, it is my opinion that the conclusion in the report that 'the monitoring data does not indicate a discernible impact to surface water quality from the landfill' has not been robustly supported.	The reviewer has misinterpreted the HHERA findings. The HHERA did not conclude that there was no impact on surface water quality attributable to the landfill. Rather, the HHERA: - Found that an impact to water quality within Kaikorai Stream was not discernible in the available dataset, and - Highlights several areas where the dataset requires supplementation, to reach a robust conclusion. Given these findings, the HHERA was classified as an interim rather than definitive assessment.

4	The following frameworks are commonly applied for assessing risks: - Risk management – Guidelines AS ISO 31000:2018 (Standards Australia 2018); and - EIANZ Ecological Impact Assessment Guidelines (EcIA) (Roper-Lindsay et al., 2018). Combining the two guidelines into the risk assessment process recognises the keys steps in Ecological Impact Assessment as described in the EIANZ guidelines – i.e., assigning an environmental capacity to absorb change (adapted from the EIANZ approach to assigning ecological sensitivity), and assessment of the magnitude of the impact. In addition, the HHERA has not incorporated an assessment of risk quotients which is a common deterministic tool applied in ecotoxicological risk assessments. The risk quotient is an effective screening tool to estimate low or high risks of contaminants of potential concern. It is recommended any future updates the HHERA integrate the three approaches above to provide a robust process. These are guidelines – and can be appropriately adapted to suite the site-specific conditions of the catchment	Both the AS ISO 31000,2018 and EcIA can be integrated into future iterations of the HHERA, noting the following: - The AS ISO 31000:2018 guidelines are generic risk management guidelines. Specifically, this document provides guidelines on managing risk faced by organizations and is not specific to a risk or organisation type, industry or sector. This document does not provide guidance of direct technical relevance to a detailed water quality risk assessment. - The EcIA guideline provides high-level guidance on assessing the ecological impact of a project and does not provide specific guidance on assessing chemical toxicity or environmental risk. - The HHERA was undertaken in accordance with the ANZG framework, which provides the most detailed technical guidance on assessing water quality and associated risks to human health and the environment and is the primary framework that underpins water quality assessments in New Zealand. A risk quotient is a ratio, of one of the following: 1. Quotient = Contaminant Concentration / Concentration Benchmark (e.g. a water quality guideline) 2. Quotient = Contaminant Dose / Toxicity Reference Value The interim HHERA compared the measured contaminant concentrations with concentration benchmarks (Point 1 above), and it is agreed that this should also be undertaken in any future HHERA. The estimation of contaminant doses and the comparison of these estimates with toxicity reference values (Point 2 above) may be a useful Tier 2 assessment approach if the dataset collected during future monitoring points to the potential for adverse effects to human users of the waterway and/or secondary or tertiary consumer organisms.
5	The limitations to the available data have been acknowledged in the [*HHERA*] report but have not been explicitly stated. There is a lack of clarity about the compositing of data to derive 95th percentile statistics, and an inconsistent assessment of whether threshold endpoints have been exceeded on the basis of whether an annual maximum, median, or 95th percentile data comparison is used, and what statistic has been assessed as most appropriate. A defined and consistent approach to adopting appropriate summary statics is required.	The HHERA (Section 3.3.1) summarises and provides a rationale for the statistical approach used. This approach was applied consistently throughout the HHERA. The statistical approach used in the HHERA is relatively simple and conservative as the dataset does not support the application of a more complex approach. The design of future monitoring programs should be undertaken with reference to the guidance provided by ANZG, including looking to understand temporal variability in conditions in the Kaikorai Stream and Estuary and supporting a more robust statistical approach to evaluating the water quality dataset.

6	There are some inconsistencies in the endpoints applied – it is largely focused on the benchmarking of single exceedance against the ANZG DGVs, but for ammoniacal nitrogen and nitrate, the assessment has not referred to the National Bottom Lines (NBL) set out in the National Policy Statement for Freshwater Management, which are also relevant thresholds to assess.	This comment is noted. The NBL were included in the Surface Water Report and can be included in future iterations of the HHERA for completeness. It is noted that the inclusion of the NBL for ammonia/nitrate in the current version of the HHERA would not change the overall outcomes.
7	The overall readability [*of the HHERA*] can be markedly improved by removing the narrative text taken directly from the ANZG WQMF regarding SSD derivation, and DGV derivation. This text is unnecessary and makes the report cumbersome and the framework difficult to follow.	The presence of chemicals in surface water at concentrations above the generic water quality guidelines does not by default indicate that environmental toxicity will occur – this is dependent on a variety of site-specific factors. Understanding the SSD approach and toxicity data that underpins the ANZG water quality guidelines is important to the water quality assessment process as it allows for a critical assessment of guideline exceedances on a site and contaminant specific level.
8	On the basis of the above, it is my opinion that the risks to human health and the environment, with particular regard to PFAS, but also in regard to metal contaminants, and nutrients (ammoniacal nitrogen and nitrate), have not been robustly assessed. Refining the framework, endpoints, and risk assessment steps are required to improve the scientific justifications to support the conclusions reached in the HHERA.	I agree that the risks to human health and the environment have not been robustly assessed. Hence, the HHERA has been classified as an interim rather than a definitive assessment, with recommendations provided throughout regarding the data gaps to be filled to allow for a robust and comprehensive assessment.
9	In my opinion, the HHERA (in its current format) does not contribute to the ability to robustly assess cumulative effects. The recommendation to address the need for an integrated assessment across the ecological, surface water, and now the HHERA remains consistent with the 2023 SW Memo.	Cumulative effects relate to the combined impact on the environment of multiple stressors over time (e.g. water quality impacts occurring in a catchment due to a variety of sources). It is agreed that the HHERA does not provide a robust assessment of cumulative water quality effects in the Kaikorai Stream and Estuary. The site-specific and catchment-wide monitoring recommended in the HHERA would assist in facilitating a robust assessment of cumulative effects.

10	The addendum to the ecotoxicology assessment (Cawthron Report 3895) was reviewed considering the comments above. The addendum indicated there were no differences in the response of blue mussel embryo bioassay between the upgradient and down gradient locations. The HHERA has concluded that this demonstrates there is no adverse effect of the landfill leachate. In my opinion, this is an oversimplification of the results of the bioassay. The results presented in the addendum need to be viewed in conjunction with the results of the other two bioassays conducted (Microtox and algae), and an assessment provided about the relative sensitivities of each of the bioassays. The HHERA has not acknowledged this aspect, not have the caveats or data limitations to the Cawthron Report been acknowledged in the HHERA.	The ecotoxicity testing was not undertaken specifically for the purpose of informing the HHERA and was reviewed during the preparation of the HHERA report, for completeness. I acknowledge that limitations and nuances of the ecotoxicity testing are not discussed in detail in the HHERA. Notwithstanding this, the HHERA does not conclude that the ecotoxicity testing demonstrates there is no adverse effect of the landfill leachate. Rather, the HHERA concludes that the toxicity testing demonstrates that the chemistry of the surface water in Kaikorai Stream may be associated with some level of toxicity to aquatic organisms but that the source of this toxicity is not understood. One round of simple ecotoxicity testing is not sufficient to draw robust conclusions around the nature, extent or source of ecotoxicity in a complex urban setting such as the Kaikorai Stream. It is noted that significant aquatic toxicity (as defined by a statistical difference in the effects measured in a test solution relative to a control solution) were identified in the Microtox test but not in the mussel test or algal test. While the Microtox test is widely used as a toxicity screening assay, due to its relative simplicity, speed and cost effectiveness (relative to other toxicity assays), the biological relevance of bioluminescence for aquatic communities has not been uniformly established. The limitations of the Microtox test further exacerbate the uncertainty associated with the ecotoxicity testing results.
11	The assessment of no adverse effects to water quality, in particular in regard to the assessment of cumulative effects, has not been supported on the basis of the current format of the available data. The data requires further interrogation, including assessment of long-term median, 95th percentile, and seasonal time trends analyses, to support the conclusions set out in the 2024 SW report and HHERA.	Refer to Comment 3 of this table.
12	The framework and thresholds adopted in the HHERA are incomplete, and the conclusions cannot be support by the current assessment provided. The framework requires updating to incorporate Australian Standards as well as the EIANZ EcIA approach, and a consistent level of data compliance thresholds applied (i.e. median data values and 95th percentile data values).	Refer to Comment 3 and 4 of this table

	The HHERA also requires the data limitations be fully acknowledged, such as the minimal data requirements to inform the HHERA (including data sets to calculate 95th percentiles), whether site specific modified default guideline values are appropriate (especially considering the estuarine conditions in the downstream receiving environment), incorporation of other lines of evidence to support the risk assessment scientific conclusions (such as incorporating the calculation of risk quotient of target contaminants).	The HHERA addresses the uncertainty associated with the dataset in detail and provides general recommendations for addressing these data gaps. The design of the monitoring program required to address the data gaps, including specifying the sampling locations, timing of sampling and number of rounds of sampling was outside the scope of the HHERA. Refer to Comment 4 of this table.

Table 2 Summary of the comments in the ORC Notification Recommendation Report

Comment		**Response**
1	The application identifies all relevant sensitive areas and receptors but does not fully describe the attributes of the sensitive areas.	The HHERA consolidated and provided a Tier 1 screening assessment of the available water quality dataset, with the level of species protection defined to support this process. The Tier 1 screening process is generic, in that the screening levels used in the process are designed to protect a selected percentage of biota and support ecological processes. Detailed identification and descriptions of the attributes of these sensitive areas are provided in the *Ecological Impact Assessment* prepared by Boffa Miskell Ltd., which was included as part of the consent application. This information was considered in the HHERA but not repeated in full.
2	Water quality results have been benchmarked against appropriate guidelines; however, it is not correct to assume that no exceedance of guideline values equates to no discharge of leachate.	The HHERA did not conclude that no leachate discharge is occurring. Rather, the HHERA: - Found that an impact on water quality within Kaikorai Stream was not readily discernible in the available dataset, and - Highlighted several areas where the dataset requires supplementation, to reach a robust conclusion. Given these findings, the HHERA was classified as an interim rather than definitive assessment and noted a number of specific limitations to the available dataset, which would need to be addressed to provide greater certainty around the nature and extent of impact.

3	Any adverse effects on surface water are likely to be cumulative effects, rather than acute toxicological effects from the landfill. This is supported by the available water chemistry data which notes very few exceedances of default guideline values or national bottom-line criteria.	It is agreed that consideration needs to be given to the potential for the risks associated with both: - Acute toxicological effects, such as those that may occur over a relatively short timeframe as a result of a specific discharge event (e.g. overflow following heavy rainfall) - Chronic cumulative effects to the receiving environment that may occur over time as a result of long-term discharges from the landfill and other contaminant sources within the catchment. The landfill and other contaminant sources within the catchment have been present for an extended period. Hence, samples collected from the Kaikorai Stream provide an indication of the condition of this waterway that has occurred as a result of the cumulative input from the site and other sources. The water quality guidelines used to assess the dataset are also specifically designed to assess chronic exposure of aquatic communities to contaminants The HHERA acknowledges the fact that the dataset available at the time of reporting was insufficient to allow for a robust assessment of temporal variability in the cumulative effects of water quality stressors in this catchment and recommends a more detailed catchment-scale characterisation. The HHERA also highlights the fact that the available dataset was insufficient to identify whether the landfill may be associated with short-term discharges of potential concern. For this reason, the HHERA provides only a preliminary/interim assessment. It has been recommended that key data gaps are filled and the HHERA is revisited.
4	Low level and diffuse discharges of leachate contaminants via groundwater to the surface water environment would result in chronic, long-term cumulative impacts.	The basis for this comment is unclear. The water quality guidelines used in the HHERA are designed to evaluate the potential for chronic toxic effects to receptors (i.e., humans and aquatic species). These Tier 1 screening levels are designed to be conservative (i.e. to be lower than the concentrations at which adverse health or environmental impacts would occur in a site-specific setting). Therefore, chemical concentrations below these levels are unlikely to pose chronic risks to the environment. While the limitations to the dataset collected to date from the receiving environment are acknowledged, it cannot be inferred that low-level and diffuse discharges from the landfill into the surface water environment will result in chronic long-term adverse effects. For most contaminants toxicity occurs only when a threshold concentration or dose is exceeded, with the water quality guidelines being designed to identify situations where this may occur.

5	The assessment is confounded to an extent by the influence of activities in the upper catchment which are contributing contaminants to the downstream receiving environment, and by the limited integration of the surface water quality data into the ecological impact assessment. These have not been adequately addressed in the Surface Water Report or the HHERA. An integrated assessment across ecological, surface water, and HHERA is required to appropriately assess any cumulative effects.	It is agreed that the HHERA is confounded to some extent by the influence of activities in the upper catchment. This is however often the case in water quality assessments undertaken in urban settings and is accounted for in the water quality assessment framework outlined by ANZG. In this case, this issue was addressed by assessing water quality data collected upstream, downstream and within the landfill. The HHERA acknowledges the limitations of the dataset and recommends that gaps in the understanding of the contaminant status of both the broader catchment, discharges from the landfill and the downstream receiving environment are addressed.
6	The goal of the HHERA to provide an integrated assessment of risks to human health and ecological receptors is supported. However, the framework currently presented in the HHERA falls short of fully integrating the nuanced ecological values and sensitivities, including mahinga kai.	The HHERA highlights a variety of ecological and cultural values that are associated with the Kaikorai Stream, including mahinga kai. It is however necessary to develop a robust understanding of the nature and extent of the water quality impacts associated with discharges from the landfill before a detailed assessment of risks to these values can be undertaken. The HHERA also highlights several data gaps that could be filled to support a detailed assessment of the risks associated with food gathering in the catchment.
7	Dr Conwell does not agree that the 'no discernible impact' conclusion in the HHERA has been robustly supported, nor have the risks to human health and the environment from PFAS, metal contaminants, and nutrients (ammoniacal-nitrogen and nitrate) been robustly assessed.	Refer to Comment 3 in Table 1
8	Dr Conwell recommends that future updates of the HHERA integrate the following three approaches: - Risk management – Guidelines AS ISO 31000:2018; (Standards Australia 2018) - EIANZ Ecological Impact Assessment Guidelines (EcIA) (Roper-Lindsay et al., 2018) - An assessment of risk quotients.	Refer to Comment 4 in Table 1

9	The surface water quality assessment does not include any further statistical analyses beyond summary statistics. Doing so would assist to confirm the conclusion that there are no discernible effects on offsite stormwater quality from the landfill from stormwater or leachate. This was a recommendation of the 2023 memorandum. The Applicant did not undertake any additional assessment in response to this recommendation. As such, this recommendation remains: *Dr Conwell recommends that statistical summaries and time trends analyses be undertaken to inform the integrated assessment of effects with respect to cumulative effects and inform the HHERA*.	Refer to Comment 5 in Table 1. The dataset available at the time of the preparation of the HHERA did not support complex statistical analysis. Additional monitoring programs should be designed to support a statistical assessment of both temporal and spatial variability in the catchment, such that any material impacts of the landfill can be identified and subject to detailed risk assessment. Specific guidance on the design of water quality monitoring programs is provided by ANZG. The design of ongoing monitoring should also be informed by the outcomes of and uncertainties associated with the groundwater and surface water assessments.
10	The Applicant concludes that there are no discernible impacts on surface water quality attributable to the landfill. Dr Conwell considers that sufficient information has not been provided to support this conclusion. The fact that default guideline values are generally not exceeded does not suggest, without further evidence, that there is no discharge of leachate into the receiving environment, especially in this heavily impacted catchment, nor does it mean that there are no adverse effects occurring.	Refer to Comment 3 in Table 1. The HHERA did not conclude that there is no discharge of leachate into the receiving environment or that there are no adverse effects occurring. Rather, the HHERA concluded that: - Any discharge of leachate in the receiving environment was not readily discernible in the available dataset. - A likelihood of adverse effects on human health or the environment, as a result of discharges from the landfill, was not apparent in the available dataset. - The available dataset was associated with significant limitations and would need to be supplemented to support a more robust assessment