BEFORE THE COMMISSION
APPOINTED BY THE OTAGO REGIONAL COUNCIL

UNDER	the Resource Management Act 1991 (RMA)
IN THE MATTER	Of an application by Dunedin City Council for resource consent being processed with reference RM20.280
	BIG STONE FORESTS LIMITED, ŌTOKIA CREEK AND MARSH HABITAT TRUST, SOUTH COAST NEIGHBOURHOOD SOC INC, BRIGHTON SURF LIFESAVING CLUB INC, DAVID GRANT
	('The Submitter Group')

NOTES OF COMMENTS TO PANEL FROM ANDREW RUMSBY FOR SUBMITTER GROUP

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May it please the Commissioners:

Richard Coombe

1. Site Specific Assessment (Response to Anthony Kirk and Rich Coombe comments)
2. Introduction of Wasteminz guidelines (2018) states "The Guidelines are not intended to be a detailed technical manual, but rather a source of information from which facility operators and regulatory authorities can seek comprehensive technical, planning, and legal advice from appropriately qualified experts.
3. My interpretation of what the WasteMINZ guidelines are saying is that the design, operations, and monitoring of a landfill needs to meet the requirements of the site, not just meet the Wasteminz guidelines. Therefore, I do not believe a site-specific assessment has been fully undertaken for the site.
4. A site-specific assessment and landfill design would undertake a Risk Assessment assessing reasonable maximum exposure using most likely credible failure scenarios and maximum credible failure scenarios[1] involving:
    a. Identification of site-specific parameters and pathways, including groundwater conditions, proximity to sensitive users and connectivity to surface water;
    b. seismic risk and maximum credible seismic displacement.
    c. sensitivity of the receiving environment (including an assessment of risk of secondary toxicity to apex receptors, including humans, from bioaccumulating substances).

    These factors should all be considered when designing a landfill liner and the hydrogeological impacts on the environment.
5. The applicant has not presented the evidence that this robust preliminary design process has been followed. As far as we can determine it seems that a generic conceptual design and waste acceptance criteria has been

[1] Note: the term maximum credible failure scenarios are equivalent to maximum credible accident scenario used in the accident investigation, chemical engineering, nuclear and aviation sectors (See American Institute of Chemical Engineers definition)

taken from NZ guidelines which has not been verified as being appropriate for the site.

6. Mr Coombe has presented two different lifetimes for HPDE liners (466 years) and recently 150 years (based upon the Ontario Guidelines). However, I disagree that the Ontario say that a 1.5mm HPDE liner has an engineering design life of 150 years, rather it states if a certain type of liner configuration is used then it needs to have an engineering design life of at least 150 years.
7. Currently it is unclear what the design lifetime of engineering controls proposed by the applicant is. Any liner design should have an engineering design life that is longer than the waste receivable period (i.e. 40 years) and an aftercare period of 30 years. It should also contain an appropriate safety factor (i.e. 35 years). However, the safety factor may need to be longer if the landfill is likely to have significant amounts of persistent organic pollutants (and this will depend on the half-life of these compounds within the landfill).
8. Mr Coombe noted that some of the examples I have given where there were problems with leachate collections were older landfills. However, some of the landfills I have cited (Hampton Downs and Tirohia) are modern landfills and have similar designs to those proposed for Smooth Hill. I also note in the Redvale landfill (another modern landfill), the leachate head is up to 10 m when the design criteria were 300 mm, even though it has a leachate collection system which complies with the Wasteminz guidelines. In all the landfills above the leachate collection system has failed to meet its design parameters either within the operational period of the landfill or in the immediate aftercare period.

Anthony Kirk

9. In his statement to the Commissioner Mr Kirk stated that the PFOS guideline was draft and therefore it is not used. This is only partially correct. PFAS guidelines have never been published by Water Quality Australia. However, they are published within the National Environmental Management Plan for PFAS (version 1 and version 2) as final guidelines (NEMP). The NEMP has been developed for both Australia and New Zealand, and these water quality guidelines are routinely used in New Zealand when investigating PFAS contaminated sites and in consent

discharge conditions. The PFAS guidelines used by Mr Ife were from the NEMP version 2.

10. I disagree with Mr Kirk's statement that the Mann-Kendall statistical test can be used as a seasonality test.
11. Mr Kirk states his approach and number of samples is consistent with the recommendations of USGS (2020) and indicates that he would use a Mann-Kendall seasonality test. I disagree with his statement that the methodology he has proposed for setting triggers levels is consistent with the USGS (2020) methodology. The USGS (2020) guidance[2] is does not indicate that a trend analysis can be done with a minimum of 12 data points or that Mann Kendell would be appropriate when there is seasonality in the data (i.e., changes in groundwater levels or stream flows).
12. The USGS (2020) guidance states that "a statistical test like the Mann-Kendall or OLS regression does not detect that there are seasonal patterns, rather the pattern registers as random noise in the process. This is because those tests are designed to detect monotonic or linear changes. Because trend tests (parametric or nonparametric) are fundamentally about being able to see a trend signal stand out above the noise, this seasonality will hinder our ability to truly observe the trend". Therefore, the Mann-Kendall test is not a robust test if seasonality is likely to occur (or if the dataset contains censored data).
13. The USGS do not state that for seasonality test that there should be three seasonal monitoring events. What USGS (2020) states is that for the seasonal Kendall (sK) Test "When the product of the number of seasons and number of years is more than about 25, the distribution of sK can be approximated quite well by a normal distribution".
14. In USGS (2011) Technotes 6 for the National nonpoint source monitoring for Statistical analysis of Monotonic Trends it states for short term (3 years) monitoring project that analysis of covariance (ANCOVA) is more appropriate than trend analysis. It also suggests that 5 years of monthly data are the minimum for monotonic trend. But it goes on to say that longer periods or record and/or more intensive sampling frequency would generally provide a greater sensitivity to detect small changes.

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[2] USGS (2020) Statistical methods in Water Resources. Chapter 12 Trend Analysis (accessed from https://pubs.er.usgs.gov/publication/tm4A3).

15. I do not believe that trend analysis appropriate technique for setting trigger levels for the following reasons:
    a. It may be unenforceable.
    b. If there is seasonal variability within the dataset, then that variability may obscure the trend which we are trying to detect.
    c. Using trend analysis does not give certainty that ecological or human health guidelines will not be exceeded (especially in the case of a gradual leak where the trend analysis approach describe would lead to a gradual increase in the trigger value over time, especially if a non-parametric test were used such as the Mann Kendell analysis).
    d. The statistical tools can be slow to detect a trend and thereby a significant and irreversible environmental harm could occur before a leak could be investigated and remedial measures undertaken.

Mr Welsh

16. I agree with Mr Welsh that a landfill gas operation and maintenance plan be prepared for the landfill.
17. He proposes that a 5% v/v oxygen limit should not be placed in the consent (as was the case for AB Lime and Kate Valley landfills) but that the landfill operator should develop one.
18. The lower flammability limit of oxygen is 12% v/v[3]. Therefore, the only question is what safety factor that should be applied. The oxygen limit will need to be conservative as the point where landfill gas is being monitored may not necessarily reflect the highest concentration of oxygen within the landfill.
19. Typically, a safety factor of greater than 50% is used (i.e. the limit would be lower than 6% v/v oxygen which is not different from 5% v/v in an operational sense).
20. In my opinion, there is no advantage of delaying setting the oxygen limit and there are advantages of placing it within the consent itself as has occurred in other recent landfill consents (i.e. it offers certainty and enforceability).

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[3] Limits of Flammability of Gases and Vapors. US Bureau of Mines Bulletin 503 (see Figures 21-23 pages 46-48 and accompanying text)(accessed from https://shepherd.caltech.edu/EDL/PublicResources/flammability/USBM-503.pdf)

Mr Dickson

21. Mr Dickson stated that having a prohibition of lithium batteries is unachievable as there is no way of getting them out of domestic waste stream.
22. This partly contradicts Mr Henderson evidence where he is talking about waste stream being contaminated with food waste and that this issue can be solved through education. I believe the same approach could work for lithium batteries.
23. A condition like AB lime consent condition regarding lithium batteries could be imposed which would give the council some leeway for incidental amounts of lithium batteries.

Updated Consent Conditions

24. I am also concerned with the parameters which are suggested to be monitored at monthly interval (Basic suite of monitoring parameters). Most of the contaminants that are proposed occur naturally and may not be sensitive to a landfill liner leak. Some of the most sensitive and potential best indicator compounds the short chain PFAS compounds, which the applicant is not assessed (even though the data will obtained as part of many PFAS suites),
25. The PFAS suite proposed in the conditions is limited to assessing of PFOA, PFOS and PFHxS. These PFAS compounds may not be the most toxic PFAS compounds or the most common in landfill leachate (5:3 FTCA is usually many order of magnitude higher in landfill leachate than any of these compounds). The compounds chosen for reporting are only the ones that NZ has regulations currently. However, there are overseas regulations for many other PFAS compounds and therefore it is possible to set trigger values for them.
26. Parameters such as COD (potential for oxygen depletion), Bis Phenol A and Total Organic Fluorine are not included within the analytical suite at all. In my opinion analysis of these compounds is necessary. Draft ANZG (2022) Bis Phenol A guidelines exist, and it is likely they will be finalised soon.
27. The parameters chosen by the applicant for monitoring as part of this consent are not the ones that I consider to be the most toxic compounds from a human health or ecological point of view (i.e., the ones that are

likely to bio-magnify in the environment or have very low environmental threshold (i.e. PFOS)).

28. I recommend adding the following parameters to the monthly regime:
    a. PFAS analysis with a detection limit of 10 ug/m^3 as it detects highly mobile PFAS compounds (i.e., PFBS and PFBA) together with the more toxic and bioaccumulative PFAS compounds (6:2 Fluorotelomer sulfonate, PFOS, PFHxS, and PFOA).
    b. Bis phenol a – key marker compound of contamination.
    c. Total Organic Fluoride – it picks up a wide range of PFAS compounds plus some pharmaceutical compounds. Somewhat insensitive[4] but background should be below detection limit and a detection would indicate a significant problem. Relatively cheap analysis costs.
    d. Adsorbable Organic Halides – picks up a wide range of organic halogens including Stockholm compounds. Somewhat insensitive but background should be below detection limit and a detection would indicate a significant problem and that further analysis of SVOC would be warranted.
29. VOCs/SVOCs monitored only annually (only if AOX, PFAS, TOF and Bis phenol a monitored more frequently). BOD/COD should also be included in the annual analytical suite.
30. Below I proposed what I consider to be some appropriate trigger levels for key parameters.

Potential trigger levels

Parameter	**Proposed trigger level**	**Rationale**
Most Cations/Anions	2 standard deviation from background mean	Showing a statistically meaningful change. Less than 1 in 20 chance of a false positive.
Ammonia	2 standard deviation from background mean	

[4] Method detection limit is within parts per billion range depending on laboratory and matrix.

Nitrate	2 standard deviation from background mean or 50% national attribute value set by ORC, whichever is lower	Protective of surface water and aquatic life
Boron	2 standard deviation from background mean or 80% ecosystem trigger value ANZG (2021) whichever is lower.	Protective of aquatic life. May be an important key indicator
Arsenic	2 standard deviation from background mean or 80% ecosystem trigger value ANZG (2021) whichever is lower	Protective of human health and aquatic life
Zinc (and other divalent metals)	2 standard deviation from background mean or 80% ecosystem trigger value ANZG (2021) whichever is lower	Protective of aquatic life. May be an important key indicator
Bis Phenol a	2 standard deviation from background mean or draft 80% ecosystem trigger value ANZG (2021) whichever is lower	Protective of aquatic life. May be an important key indicator
Total organic Fluorine	Three times method detection limit or 2 standard deviation from	Key indicator of significant leachate escape

	background mean (whichever is higher)	