BEFORE THE HAWKE'S BAY REGIONAL COUNCIL

UNDER	The Resource Management Act 1991 (RMA)
IN THE MATTER	of an application by **RAVENSDOWN LIMITED** (Ravensdown) for new and replacement water and discharge permits for the operation of the Napier Works and the establishment of a habitat enhancement project.

MEMORANDUM OF COUNSEL FOR RAVENSDOWN REQUESTING A DIRECTION THAT EXPERTS CONFERENCE

26 MAY 2022

Counsel acting:

Stephen Christensen

Project Barrister

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MAY IT PLEASE THE COMMISSIONERS

1 In this memorandum I seek a direction from the Hearings Panel/Commissioners that the experts engaged by the parties in relation to this application formally conference and produce joint witness statements that will become evidence for you to consider in due course.

2 Ravensdown has made an application for a suite of resource consents in relation to the ongoing operation of, and environmental enhancements associated with the company's superphosphate manufacturing plant at Awatoto.

3 The application was publicly notified and received a relatively small number of submissions, an outcome which I submit is a reflection of the extensive and successful consultation that the applicant undertook.

4 The activities for which consents are sought include discharges to air from large-scale manufacturing, and discharges of treated stormwater from a large industrial site to land and to the adjacent estuarine environment.

5 The nature of the applications means that the AEE and supporting documents are technical in nature and involve experts from a number of disciplines.

6 Technical experts engaged by the Council reviewed the application and this led to an extensive further information request pursuant to section 92 of the Act.

7 A formal response to that request is now with Council and its experts for review. A copy of the section 92 response and its covering letter are attached to this memorandum for your reference.

8 Ravensdown considers there is a large degree of alignment between its experts and those engaged by the Council as to the nature of the effects of the proposed activities and how they are most appropriately managed.

9 There do however remain some issues where the experts are not necessarily agreed, and where issues may be resolved or at least clarified and narrowed through conferencing.

10 Ravensdown considers that if expert conferencing occurs it is likely to significantly reduce the amount of technical material that will need to be traversed in evidence and at any hearing, thereby enhancing the efficiency of the process for the benefit of all participants. Ravensdown considers (and I have advised) that informal meetings between experts, while potentially worthwhile, are unlikely to produce the disciplined

and focused outcomes of an expert conference, and are unlikely to avoid the need for experts to produce extensive evidence on matters that are largely agreed between them.

11 I am instructed that the applicant and Council have arranged for their respective experts on the topics of stormwater management, land disposal and aquatic ecology to meet together on 1 June 2022. I am also instructed that Mr Shade Smith, an expert engaged Ngāti Kahungungu Iwi Inc (a submitter) is available to meet on these topics on 1 June also. I am not aware whether Dr Nick Jones who made a submission on behalf of Hawke's Bay DHB has been contacted or is available to meet on that day.

12 Discussions between the applicant and Council officers are ongoing as they seek to identify another date in June when the respective experts on air quality and related plant and health effects are available to meet.

13 Other than the experts for Ngāti Kahungungu and Hawke's Bay DHB identified above I am instructed that that no other submitter has at this stage indicated they intend to call expert evidence.

14 I therefore respectfully request that the Commissioners make a direction requiring the experts engaged by Ravensdown and the Council, together with any other experts engaged by submitters that are available, to formally conference (as opposed to informally meet) in relation to this application.

15 The purpose of the conferencing will be to:

a. identify the relevant technical matters that are agreed between the experts.

b. Identify the relevant technical matters that are not agreed, and why.

c. Identify the proffered conditions that are agreed and any amended or different conditions the experts agree are more suitable.

d. Identify any conditions that are not agreed.

16 Each conference should be directed to produce a signed joint witness statement addressing the above matters, which will then become part of the record and form information for the Commissioners to consider in determining the application.

17 As noted in the Mitchell Daysh letter of 18 May 2022 accompanying the section 92 response, Ravensdown also requests that the Works Manager, Mr Andrew Torrens, be allowed to attend expert conferencing as an observer and that he be enabled to provide guidance and feedback to the experts of the implementation and practicality of any conditions they might propose.

18 Finally I note that given a number of experts will attend each conference it will be most helpful if the conferences were facilitated. To that end I am advise that Mitchell Daysh (Mr Daysh and Ms Anderson) are happy to contact potential independent facilitators in the Napier area for availability, and to give those names to Council, if that will assist.

19 Counsel is appreciative of your consideration of this request.

Stephen Christensen
Counsel for Ravensdown Limited
26 May 2022

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Reference: MDL001259

18 May 2022

Malcolm Miller and Sven Exeter
Hawke's Bay Regional Council
Private Bag 6006
Napier 4142

Dear Malcolm and Sven,

RE: Ravensdown Ltd, APP-126684

Your letter dated 3 May 2022 requested further information under section 92 of the Resource Management Act 1991 ("RMA") in respect of the Ravensdown Ltd ("Ravensdown") applications for the various discharges permits and associated land use consents for the Awatoto site.

The Ravensdown project team and technical advisors have reviewed the letter and accompanying memoranda from the Councils technical advisors. The response to the requests for further information in your letter (using the same numbering for your reference) and referencing the attached memoranda from the relevant technical advisors are set out in Table 1 below.

The team have also identified a number of questions where Ravensdown declines to provide further information in accordance with section 92A(1) of the RMA. These questions and the reasons for declining are also set out in Table 1.

As discussed at our meeting 1 April 2022 and in the subsequent communications, Ravensdown see the benefits of discussions between their technical team and the Councils technical reviewers. We have reflected on the very detailed further information requests and the attached responses, and the fact that there are no substantive technical challenges from submitters. Ravensdown propose that instead of an informal meeting, it would be more useful and focussed for the Hearing Panel to request that the technical experts meet in an expert conferencing format and produce joint witness statements covering those matters not in agreement and the reasons why.

We request that this expert conferencing be undertaken over two sessions (prior to a prehearing meeting) with Ravensdown's technical team listed below. Council would need to confirm the corresponding technical experts:

Air, Vegetation and Health:

- Richard Chilton - Tonkin + Taylor Ltd
- Dr Stephen Trolove - New Zealand Institute for Plant and Food Research Ltd
- Dr Francesca Kelly - Environmental Medicine Ltd

Water and Land:

- Dr Ngaire Phillips - Streamlined Environmental Ltd
- Dr Sharon De Luca - Boffa Miskell
- David Delagarza - Aurecon (note that David is only available until 15 June after which he is overseas on extended leave).
- Ian Milner - LandVision HB
- Alexandra Johansen - Bay Geological Services Ltd

We would also request that Andrew Torrens from Ravensdown be allowed to be present as an observer at these meetings to provide feedback as necessary on the implementation and practicality of any conditions proposed by the experts. Andrew is an expert in his own right however due to him being the consent applicant lead, it would obviously not be appropriate for him to be included in expert conferencing.

We expect that the outputs from this expert conferencing would be ideal as reference material for the prehearing meeting with submitters that we propose is held on 23 June 2022.

It is noted that proposed consent conditions have not been amended as part of this response. Changes to these will be made following the expert conferencing and prehearing meetings.

I look forward to hearing from you in response to this letter.

Yours sincerely,

Anita Anderson
Mitchell Daysh Ltd

Anita.Anderson@mitchelldaysh.co.nz

Table 1: Ravensdown Resource Consent Application, Further Information Request Assessment Table

Key	Technical response provided	Decline to provide response	Formatting / Structure - provide clarification

#	Further Information Requested	Response / Reference to Technical Memo
	AIR (PDP, 1 Feb 2022) ***Pre application review of draft - 12 Nov 2021***	
1.	Please provide further information on the issue with the acid plant discharge flowrates, including updated information identifying when the calibration issue occurred, and information to demonstrate whether emissions from the plant have been compliant with the limits in the resource consent.	Attachment 1 - Tonkin + Taylor, 17 May 2022
2.	Please provide information on monitoring options that Ravensdown might implement for assessing fugitive emissions of particulate from the manufacturing plant in order to better understand them and reduce the potential contributions to fine particulate measured at the former Winstone site.	Attachment 1 - Tonkin + Taylor, 17 May 2022
3.	Please provide an updated assessment of emissions associated with the acid plant based oncorrected emission data.	Attachment 1 - Tonkin + Taylor, 17 May 2022
4.	Please update the section on ambient monitoring of sulphur dioxide to clearly demonstrate the contribution from normal acid plant start-ups.	Attachment 1 - Tonkin + Taylor, 17 May 2022
5.	Please provide information on the potential effects associated with nitrogen dioxide emissions from the acid plant.	Attachment 1 - Tonkin + Taylor, 17 May 2022
6.	Please provide additional information on particulate emissions from the manufacturing plant stacks and how these might be responsible for the high concentrations of PM_{10} measured on the Winstone site.	Attachment 1 - Tonkin + Taylor, 17 May 2022
7.	What mitigation will be implemented to reduce particulate emissions from the manufacturing plant to acceptable levels?	Attachment 1 - Tonkin + Taylor, 17 May 2022

#	Further Information Requested	Response / Reference to Technical Memo
8.	Please also assess whether there is potential for similar levels of PM_{10} as those measured at the Winstone site to be experienced at other locations within the Awatoto airshed.	Attachment 1 - Tonkin + Taylor, 17 May 2022
	VEGETATION (JS Ecology Ltd, 16 Feb 2022) ***No review of pre application draft*** ***Comfortable with the proposed reduction in the fluoride emission limit to 1kg/hr from 1.5 kg/hr however due to late inclusion couldn't provide anything further.***	
	Acidic aerosols	
9.	Climate change effects: Referring back to the AEE comments on climate change and also comments within the Vegetation Assessment itself, it seems that climate-related effects such as drought or pests and diseases which cause stress to vegetation can result in greater susceptibility to other stressors such as air emissions. Please provide a discussion of this aspect and assessment of potential effects on both horticultural and conservation vegetation, including effects on pollination and fruit set.	Attachment 2 - New Zealand Institute for Plant and Food Research Ltd, May 2022
10.	Multiple exposures to acidic emissions: The Executive Summary states: "For the growing season outside of the flowering period (i.e. from November to April) the risk is only for multiple exposures, so emission of pH of <4.0 on up to 3 different days should not be considered a breach of resource consent." There does not appear to be any data or references within the body of the report to support the number of exposures stated as being acceptable. Please provide supporting data and discussion of potential effects.	Attachment 2 - New Zealand Institute for Plant and Food Research Ltd, May 2022
11.	Please discuss the discrepancy between the findings of the literature survey that potential adverse effects on pollination and fruit set can occur for emissions of pH 2.75 – pH 4.7 and proposed consent condition (18) which stipulates a minimum pH of 4 during the flowering season (August to September). Is condition 18 sufficiently rigorous to safeguard vegetation during the flowering period of horticultural crops? Please also consider potential effects of acidic emissions on flowering and fruiting of conservation vegetation which does not necessarily flower between August and September.	Attachment 2 - New Zealand Institute for Plant and Food Research Ltd, May 2022

#	Further Information Requested	Response / Reference to Technical Memo
	Fluoride emissions	
12.	The report states that F emissions could be a cause for concern if F-sensitive crops or vegetation is planted within 1km of the site and the proposed maximum emission rate was maintained for 12 hours or longer. Please discuss what these concerns are and how the proposed mitigating factors will address those concerns.	Attachment 2 - New Zealand Institute for Plant and Food Research Ltd, May 2022
	Synergistic effects	
13.	Mixtures of pollutants: The range of emissions from the Ravensdown Plant that have the potential to cause adverse effects on surrounding vegetation (fluoride, sulphur dioxide, dust & acidic aerosols) have been modelled separately and discussed in the technical reports as separate effects. Section 3.1.2 (P11 para 4) raises the possibility of the combined effects of acidic aerosols and fluoride emissions with other chemicals that may be applied to horticultural crops. Discussion of the potential for combined or synergistic effects of these pollutants acting together with each other or with horticultural or agricultural chemicals is needed.	Attachment 2 - New Zealand Institute for Plant and Food Research Ltd, May 2022
	Former Winstone's site and foreshore reserve	
14.	The Crop and Food report does not discuss the implications of fluoride and dust emissions that are above MfE guideline values for the former Winstone Aggregate site and foreshore reserve to the immediate east of the Ravensdown Works. Although the former Winstone's site is currently zoned as Industrial, there is potential for that area to be re-zoned and rehabilitated and restored for conservation and recreational use. If conservation vegetation were to be planted along this stretch of the coast there may be issues with damage to vegetation and difficulties in getting restoration planting established. This possibility requires some discussion given the proposed 35 year life of the air discharge consent being sought.	Ravensdown decline to provide further information in accordance with Section 92A(1) of the RMA. Reasons: • The resource consent application considers the existing zoning of the site and surrounds. • Any future changes to zones are speculative and not relevant to the application. • Future activities on surrounding land would need to take into account any existing activities and lawful discharges from Ravensdown as these will comprise part of the existing environment.

#	Further Information Requested	Response / Reference to Technical Memo
	Sulphur dioxide modelling	
15.	If SO_2 emissions are re-modelled by Tonkin & Taylor to take account of historic discrepancies with measurement of the acid plant discharge flow rates please provide an updated assessment of the results of the modelling for SO_2.	Attachment 2 - New Zealand Institute for Plant and Food Research Ltd, May 2022
	AQUATIC ECOLOGY (Coast & Catchment, 25 Feb 2022) ***Pre application review of draft - 18 Nov 2021***	
16.	Please provide assessment on the effects of wind-blown material from the site on water quality in surrounding waterways, particularly those above the pump station.	Attachment 3 - Streamlined Environmental Ltd, 13 April 2022
17.	Please provide the implications for the assessment of water quality and ecological effects below the pump station, if wind-blown material is adversely affecting upstream waterways (noting that the assessment highlights that it is difficult to determine the relative contribution of the discharge to downstream effects when significant upstream sources arealso evident).	Attachment 3 - Streamlined Environmental Ltd, 13 April 2022
18.	Please provide assessment of the potential for, and significance of, adverse ecological effects arising from the combined effects of multiple contaminants.	Attachment 3 - Streamlined Environmental Ltd, 13 April 2022
19.	Please provide commentary on whether conclusions about ecological effects would change,if it was confirmed that Spectrus BD1500 does bioaccumulate.	Attachment 3 - Streamlined Environmental Ltd, 13 April 2022
20.	Please provide commentary on the potential exceedances of proposed water quality standards were derived from predictions of discharge quality at Stages 1 to 3, and dilution estimates for high and low tides. Is it reasonable to assume that for those parameters predicted to exceed proposed standards at each Stage, that the exceedances will occur everytime the discharge occurs? If not, how frequent are exceedances expected to be?	Attachment 3 - Streamlined Environmental Ltd, 13 April 2022
21.	Please correct the macrofaunal results presented in the Phillips et al. reports and provide updates.	Attachment 3 - Streamlined Environmental Ltd, 13 April 2022

#	Further Information Requested	Response / Reference to Technical Memo
22.	The absence of recommended conditions that require the continuation of existing receiving environment monitoring, with the addition of chlorophyll-a and water clarity measurements, and potentially, including the evaluation of the fish IBI. Please suggest appropriate consent conditions.	Attachment 3 - Streamlined Environmental Ltd, 13 April 2022
23.	Please provide the basis for the proposed unionised ammonia-N standard, including how it is going to be measured and how measurements are going to be standardised to pH 8 and 20 °C. Consideration should be given to whether it would be preferable to base the standardon total ammoniacal-N (NH3-NH4+-N), which is typically measured and easily interpreted. Please provide comments on this matter.	Attachment 4 - Ravensdown, 10 May 2022
	AEE (Mott MacDonald, 3 March 2022) ***Pre application review of draft Project Description, Water - 5 Nov 21***	
24.	Please confirm if backflow prevention devices are already installed and maintained and provide commentary from a suitably qualified and experienced person on the risk of contaminants entering groundwater via the on-site bores, i.e. • headworks are constructed and maintained to prevent any leakage and/or movement of water or contaminants between the ground surface and groundwater and that there are no openings through which contaminants might enter the well. • gaps around any pipework and/or cables at the wellhead.	Attachment 4 - Ravensdown, 10 May 2022
25.	The water balance model results are summarised in Table 12. Please provide the data to support these statements about capture and bypasses.	Attachment 5 - Aurecon, 18 May 2022
26.	We note that this detail can be included in the future and could be part of consent conditions and that solids carry through may be minimal due to the treatment train (with a bioreactor and clarifier etc). How will contaminated sediment accumulation and wetland vegetation be managed at the Stage 2 wetland? Note that wetlands typically need vehicle access around the full perimeter for maintenance - will this be included?	Attachment 5 - Aurecon, 18 May 2022
27.	AEE - Appendix A, drawing 509619-0000-DRG-CC-1002-C has a label: 'Proposed Irrigation Apparatus (By Others)'. Please confirm what "By Other's" means.	Attachment 5 - Aurecon, 18 May 2022

#	Further Information Requested	Response / Reference to Technical Memo
	A4: LAND DISCHARGE EFFECTS AND MANAGEMENT (Mott MacDonald, 3 Mar 2022) ***Pre application review of draft - 5 Nov 21***	
28.	The Executive Summary should be revised or an appropriate response (as per S92 RMA) to ensure clear summary statements are made about whether contaminant risks are likely to be present or absent based on a conceptual site model which requires there to a be linkage of source pathway and receptor relationship and where such a potential contaminant risk linkage has been identified, estimated concentrations of contaminants are then compared against national guidelines.	Attachment 6 - LandVision HB, 10 May 2022
29.	The Monitoring and Reporting section should be revised (or an appropriate response (as per S92 RMA)) to include a section on how baseline chemical analysis of the discharge water at Stage 1 and 2 will be used to adjust the proposed monitoring programme to match more closely the actual contaminants presence in the baseline samples.	Attachment 6 - LandVision HB, 10 May 2022
30.	Please update Table 6 to include a total increased concentrations row and included the heavy metals Pb and As.	Attachment 6 - LandVision HB, 10 May 2022
31.	Please revise comparisons to MfE guidelines to be against new Table 6 totals row and include MfE Guidelines in references.	Attachment 6 - LandVision HB, 10 May 2022
32.	Please confirm the reference for the MfE guidelines used for Table 7.	Attachment 6 - LandVision HB, 10 May 2022
33.	Please include sampling for all contaminants of concern and comparison to relevant guidelines for animal feed.	Attachment 6 - LandVision HB, 10 May 2022
34.	Provide a map of the SPZs with the full site boundary including the land discharge area. The names of the SPZs and distances from or if the site is included within a SPZ should be provided in the Appendix and where relevant in existing text that refer to the SPZ, notably the Executive Summary.	Attachment 7 - Bay Geological Services Ltd, 20 April 2022
35.	Please consider and provide commentary on the revised well locations (refer Figure 10 below with recommended locations) and increase the number of sampled monitoring wells to all three wells.	Attachment 7 - Bay Geological Services Ltd, 20 April 2022

#	Further Information Requested	Response / Reference to Technical Memo
36.	The Health Risk Assessment should be revised or an appropriate response (as per S92 RMA) to ensure clear summary statements are made about whether contaminant risks are likely to be present or absent based on a conceptual site model which requires there to a be linkage of source pathway and receptor relationship and where such a potential contaminant risk linkage has been identified, estimated concentrations of contaminants are then compared against national guidelines.	Attachment 8 - Environmental Medicine Ltd, 17 May 2022
	A5: WATERTAKE EFFECTS ASSESSMENT (Mott MacDonald, 3 Mar 2022) ***No review of pre application draft***	
37.	Please provide saltwater intrusion risk assessment.	Attachment 7 - Bay Geological Services Ltd, 20 April 2022
	A8: ECONOMIC ASSESSMENT (Mott MacDonald, 3 Mar 2022) ***No review of pre application draft***	
38.	We note that the Effects of emissions-to-air from the Ravensdown Napier Fertiliser Works on vegetation (Plant and Food Research, 2021) report concludes that there are unlikely to be any adverse effects on economics from the air discharge i.e. crop damage. Please provide comments from an economics expert on the actual and potential adverse economic effects from the proposed activities, if any.	Ravensdown decline to provide further information in accordance with Section 92A(1) of the RMA. Reasons: • The assessment undertaken by New Zealand Institute for Plant and Food Research Ltd and included in the suite of application documents showed that there were no effects on crops in the surrounding area, therefore an economic assessment is not justified or required.
	A9: PLANNING ASSESSMENT (Mott MacDonald, 3 Mar 2022) ***No review of pre application draft***	
39.	Ravensdown Planning Assessment (A9, Page 8) states:	Attachment 4 - Ravensdown, 10 May 2022

#	Further Information Requested	Response / Reference to Technical Memo
	"The Napier City Council ("NCC") sewerage system does not extend to the Napier Works. Five onsite wastewater treatment devices (septic tanks) are used for the collection and treatment of wastewater from amenities (cafeteria, showers, toilets, laboratory)." It is understood from the site visit that the septic tanks are currently pumped out to trucks and the wastewater is disposed at the NCC municipal wastewater treatment plant. The future plan is for the amenities (cafeteria, showers, toilets and laboratory) wastewater to be piped to the NCC municipal wastewater treatment plant. Please confirm that the above is correct along with the expected timeframe for start dates and completion of the pipe connection.	
	R2: MANUFACTURE PLANT PROCESS REPORT (Mott MacDonald, 3 Mar 2022) ***No review of pre application draft***	
40.	In Section 5.2 Structural site improvements, this list does not appear to be complete, as some of the roof and roller door items discussed elsewhere are not included and in the Management Plans. Please confirm which list of improvements is most current.	Attachment 4 - Ravensdown, 10 May 2022
	R5: WATER DISCHARGES HIGH LEVEL OPTIONS (Mott MacDonald, 3 Mar 2022)	
41.	Executive Summary, Conclusions: "Overall, the highest scoring option in the MCDA process was a combination of options." This combination of options remains ill defined, and changes considerably as the design evolves. As it contains within it many possible combinations of source separation, treatment and discharge location, it would have been advisable to define the permutations of that option and return them for assessment by the stakeholders to select a preferred option that was well defined and agreed to be the BPO. Why was the option not returned for assessment as the BPO after better definition (and a number of significant changes) was achieved in the design?	Questions 41 to 63 Ravensdown decline to provide further information in accordance with Section 92A(1) of the RMA. Reasons: • The Water Discharges High Level Options assessment was a pre application process record report prepared to meet obligations under section 105(1) of the RMA as follows: *Matters relevant to certain applications:* *(1) If an application is for a discharge permit or coastal permit to do something that would contravene section 15 or section 15B, the*
42.	Please provide "Ravensdown Napier discharge to the lower Tūtaekurī River and Waitangi Estuary: Water quality and ecology monitoring, 2019", Aquanet Consulting, December 2019, (if not already provided to HBRC).	
43.	Given the sources of wastewater described above, the direct discharge of industrial products and adjuncts into the hard standings and drainage system, and the high base flow (below), why has this wastewater been classified and treated as stormwater?	

#	Further Information Requested	Response / Reference to Technical Memo
44.	Has the existing discharge from the site been tested for pollutant parameters outside of the current consent conditions, and in line with the known chemicals in the various waste streams (A3, Table 2)?	*consent authority must, in addition to the matters in section 104(1), have regard to—* *(a) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and* *(b) the applicant's reasons for the proposed choice; and* *(c) any possible alternative methods of discharge, including discharge into any other receiving environment.* The report includes the information that was provided to the Technical Focus Group (TFG) as part of the Multi Criteria Decision Assessment (MCDA) process to inform their preferences for the discharge environment and method of discharge. Option 4, a "combination of options" was selected and accepted by Ravensdown for this application and further refined as set out in the Section 5 of the AEE (Water Discharge Project Description). Accordingly, while the report was provided as a background reference report for the application, and referenced as such in Table 2 of the AEE, it only explains the selection process for the applications made. The report is not an effects assessment report and Ravensdown will not be debating or revisiting its decision making on the option chosen through a further information (s92) process.
45.	The Spectrus products (A3, Table 2) have been noted to have ecological effects that are potentially more than minor (A3). Have alternative products for this process and/or alternative treatment methods for this waste stream?	
46.	Why were effective chemical and biological treatment systems commonly used in industrial treatment processes not considered?	
47.	Why was there no investigation of each waste stream ("up the pipe") so that treatment solutions could be tailored to the contaminants, and potentially downsized and focussed on particular contaminants?	
48.	In regard to 'Section 7 Options Considered', please explain why the other 5 treatment solutions are not carried forward.	
49.	Please provide the information that evidences a lack of first flush events. What information has been gathered on first flush events, and how key contaminant concentrations vary through events.	
50.	Please explain with evidence why a value of just 25mm rainfall has been assumed for full treatment.	
51.	What information has been collected by the applicant on the flows from the individual waste stream and how the contaminants in these vary.	
52.	Has source separation and separate treatment been considered, and if not, why not?	
53.	Of the 2,000m^3/week, how much is dilution water from the bore supply?	
54.	In regard to 'Section 7.3.2 Wetland treatment train (Option 1b)', why was this combination of treatment processes selected, and not others?	

#	Further Information Requested	Response / Reference to Technical Memo
55.	In Table 17 the volume of treatment devices is noted. Is this the working volume (standing water that will be displaced with the arrival of new wastewater) or an empty volume in the treatment devices capable of accepting and attenuating flows?	
56.	What level of storm event would be treated by the pond and membrane filter option before bypassing would occur?	
57.	Please provide the outputs from the site-wide sampling, and how these have fed into the preferred solution developed in the Water Discharge Strategy (R6).	
58.	Please explain why separation of contamination sources was not carried out at an earlier stage and used in the build up of treatment options, rather than after the fact and only for one option. Knowing this information would greatly assist in the sizing, costing, and evaluation of each option.	
59.	The price for the membrane filtration system (Option 1c) seems excessive, given that an entire biological treatment plant can be procured for a small town for this value. Please provide a more realistic price for this option, and confirm what assumptions were made when requesting the quotation.	
60.	Was a cost estimate for a membrane filtration system for the “Combination of options” (Option 4) produced, noting that this would be a much smaller flow and therefore units, focussed on the contaminants in the “high contaminant treatment” area (see Figure 19).	
61.	Please explain how costs for Option 4 were generated without site-wide contaminant survey information.	
62.	In regard to section 10.4, please explain what waste concerns were raised about the membrane option, and the high energy concerns. Was an assessment of the brine and power consumption for this option completed?	
63.	Why was land treatment added to Option 4 in the Preferred Outcome (Section 10.4) when this was not in the description of the option (Section 7.6), nor endorsed by NCC or mana whenua (Section 10.4)?	

#	Further Information Requested	Response / Reference to Technical Memo
	R6: WATER DISCHARGE STRATEGY (Mott MacDonald, 3 Mar 2022) ***Pre application review of draft - 5 Nov 21 (*Mott MacDonald) *and 10 Nov 2021 (Coast & Catchments)***	
64.	Please confirm if the minor depressions noted above are at the lower point of the catchment and intended to direct contaminated stormwater flows towards the Neutralising Pit.	Attachment 5 - Aurecon, 18 May 2022
65.	Please confirm how bunded areas in the Acid Plant South catchment are drained and discharged to.	Attachment 5 - Aurecon, 18 May 2022
66.	What data is available on the volumes of water that are reused on site?	Attachment 5 - Aurecon, 18 May 2022
67.	Will the proposed treatment and management strategy remove the need to dilute wastewater prior to discharge?	Attachment 5 - Aurecon, 18 May 2022
68.	Why has sampling of contaminant sources not been undertaken prior to the option assessment work and application. As noted in the report, Adaptive Management Plans are appropriate where there are unknowns in a scheme, but this is only unknown because data has not been collected. Collection of source contaminant data is not an onerous task, and would be expected to demonstrate a suitable option evaluation and selection of BPO for a long term discharge consent.	Attachment 5 - Aurecon, 18 May 2022
69.	Assessing the impact of operational changes should not be limited to treatment upgrades. Given the importance of source control for this scheme, sampling and monitoring should also include untreated waste streams to demonstrate improved source control over time. Please confirm if this is intended for the sampling and monitoring programme.	Attachment 5 - Aurecon, 18 May 2022
	Process water management	
70.	Where will this process water be reused?	Attachment 5 - Aurecon, 18 May 2022
71.	How much has been calculated as reusable?	Attachment 5 - Aurecon, 18 May 2022
72.	Will the inhibitors, fouling agents, and biocides used in the process water be detrimental to reuse opportunities?	Attachment 5 - Aurecon, 18 May 2022

#	Further Information Requested	Response / Reference to Technical Memo
73.	The cooling system is mentioned above. Is there also discharge of process water from the boiler system?	Attachment 5 - Aurecon, 18 May 2022
74.	Why is the discharge from the truck wash not covered in the process water group, when it is clearly not stormwater?	Attachment 5 - Aurecon, 18 May 2022
75.	Please provide the carbon footprint assessment that was used in the MCDA or if one was not undertaken, please prepare a wholistic carbon assessment for all options in accordance with ISO 14067 & ISO 14044 or relevant guidelines.	Ravensdown decline to provide further information in accordance with Section 92A(1) of the RMA. Reasons: • Refer to response to Questions 41 to 63 above regarding the options assessment process. • It is considered that any carbon footprint differences between options would likely be negligible and would not influence the choice of treatment option. • A wholistic carbon assessment for all options is disproportional to the benefit it would provide. • Ravensdown's total carbon footprint and greenhouse gas emissions inventory are reported as part of the co-operatives environmental and sustainability commitments - https://integratedreporting.ravensdown.co.nz/
	M1: SOURCE CONTROL MANAGEMENT PLAN (Mott MacDonald, 3 Mar 2022) ***No review of pre application draft***	
76.	It is unclear if the area between Superstore 1 and the Manufacture Plant (refer to Figure 1 & 2 in review memo) is covered under the action schedule so this needs to be clarified. Please confirm that this area is covered in the action schedule.	Attachment 4 - Ravensdown, 10 May 2022

#	Further Information Requested	Response / Reference to Technical Memo
77.	Please include additional information in the action table that describes how the actions are prioritised, including for example; risk or discharge, cost, and impact of change.	Attachment 4 - Ravensdown, 10 May 2022
	M2: ADAPTIVE MANAGEMENT PLAN (Mott MacDonald, 3 Mar 2022) ***No review of pre application draft***	
78.	Please amend diagram on page 6 and Figure 1 (more labels and feedback loops - see review memo). This can be provided now or later as evidence.	Attachment 4 - Ravensdown, 10 May 2022
79.	Please add source control measures to Table 1.	Attachment 4 - Ravensdown, 10 May 2022
80.	Please include establishment of a source control baseline through monitoring in Year One of Table 1.	Attachment 4 - Ravensdown, 10 May 2022
	CONDITIONS (Mott MacDonald, 3 Mar 2022) Provided initial high-level commentary on the proposed consent conditions and recommend that these are discussed once S92 responses have been received. Specific questions relevant to conditions (underlined).	
	Discharge to Air, Condition 5: The consent holder shall ensure regular sweeping of yard and road areas using mechanical cleaning to minimise emissions of dust beyond the boundary of the site. Question: During the site visit we are advised by Andrew Torrens (Ravensdown) that the mechanical mobile sweepers have had clogging issues and were not operating. Please provide commentary on this issue, what will change going forward, and the proposed consent condition.	Attachment 4 - Ravensdown, 10 May 2022

1

ATTACHMENT 1

Tonkin + Taylor

Tonkin+Taylor

Job No: 1012315
17 May 2022

Ravensdown Limited
90 Waitangi Road
Awatoto
Napier 4110

Attention: Andrew Torrens

Dear Andrew

Response to HBRC section 92 request for further information

Ravensdown Limited applied for resource consents (APP-126684) for its Napier Fertiliser Works from Hawke's Bay Regional Council (HBRC) for various discharges to the environment and water takes in late 2021. This included a consent application for the discharge of contaminants into air from the Works. HBRC has requested further information under section 92 of the Resource Management Act 1991 (RMA), dated 3 March 2022. Included in the s92 request were eight information requests relating to air discharges.

The purpose of this letter is to provide technical responses to the air discharge-related questions raised in the HBRC s92 request. The following sets out each of the s92 questions (italic text), using the numbering in the letter dated 3 March 2022, followed by our response.

This report has been prepared in accordance with Tonkin & Taylor Limited's (T+T) letter of engagement dated 1 November 2019.

1 Acid plant flow rates

Request:

1 Please provide further information on the issue with the acid plant discharge flowrates, including updated information identifying when the calibration issue occurred, and information to demonstrate whether emissions from the plant have been compliant with the limits in the resource consent.

Response:

A review of air emissions and control systems associated with the Acid Plant was undertaken by Chemetics Inc (Chemetics)[1] in 2021. The Chemetics report identified that the continuous gas flow meter in the Acid Plant stack gave results that were inconsistent with other flow and temperature measurements and should be investigated. The subsequent investigation identified that flow rates, and consequently SO_2 emission rates, may have been under-reported prior to July 2021 when the error was identified.

[1] Chemetics 2021. Emission Reconsenting Report – Ravensdown Limited, Napier, New Zealand. Report prepared for Ravensdown Limited by Chemetics Inc. Chemetics Project No. 217073-35836. Issue C: Final Issue. September 12, 2021.

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At the time that the Air Quality assessment was finalised, T+T relied on the reported flow rate data. The historical context to this issue, along with the actions and consequences is summarised below.

Historical context

- The in-stack flow meter was installed in 2012, which was calibrated for a single flow-rate point, corresponding to the maximum load for sulphuric acid manufacturing.
- The in-stack SO2 meter was serviced yearly. However, calibration was only carried out for SO2 concentration measurement and not for the continuous measurement of airflow.
- The Chemetics report identified an issue with potential inaccuracies with the airflow measurements. The inaccuracy was confirmed by Ravensdown through pitot flow rate measurements.

Consequences

- The analysis by Ravensdown identified that the in-stack flow rate was underreported at low acid manufacturing product rates, resulting in SO_2 mass flow rates being underreported in the T+T Air Quality Assessment.

Actions in response

- The in-stack flow meter was recalibrated using multi point calculations, i.e., using Chemetics calculations and manual flow measurements.
- The Chemetics calculation has now been included in the Ravensdown's regular stack emission testing procedures that will check the air flow against plant conditions.
- Chemetics calculation and historical plant data (only available from 2015) have been used to estimate the correct air flow, enabling the SO_2 emission rates presented in the Air Quality Assessment to be corrected.

A comparison of the uncorrected and corrected SO_2 emission rates for the period from 2015 is presented in Figure 1.1 and Figure 1.2. This shows that the SO_2 emissions have complied with the limit of 60 kg/hr with the exception of a single result. Given this finding, and that no change is proposed to the emission rate limit of 60 kg/hr (until such time that the new converter is commissioned), the assessment against 1-hour and 24-hour assessment criteria presented in the T+T Air Quality Assessment remains appropriate.

Figure 1.1 provides an updated timeseries plot to that that given in the T+T Air Quality Assessment (Figure 3.2), that includes the corrected emission rates. Figure 1.1 also presents the 75^{th} percentile values for the corrected and uncorrected SO_2 emission rates, which shows an increase from 18.7 kg/hr to 28.1 kg/hr. This revised value of 28.1 kg/hr has been used in an updated dispersion modelling assessment to predict annual average SO_2 ground level concentrations, as discussed in section 4 below.

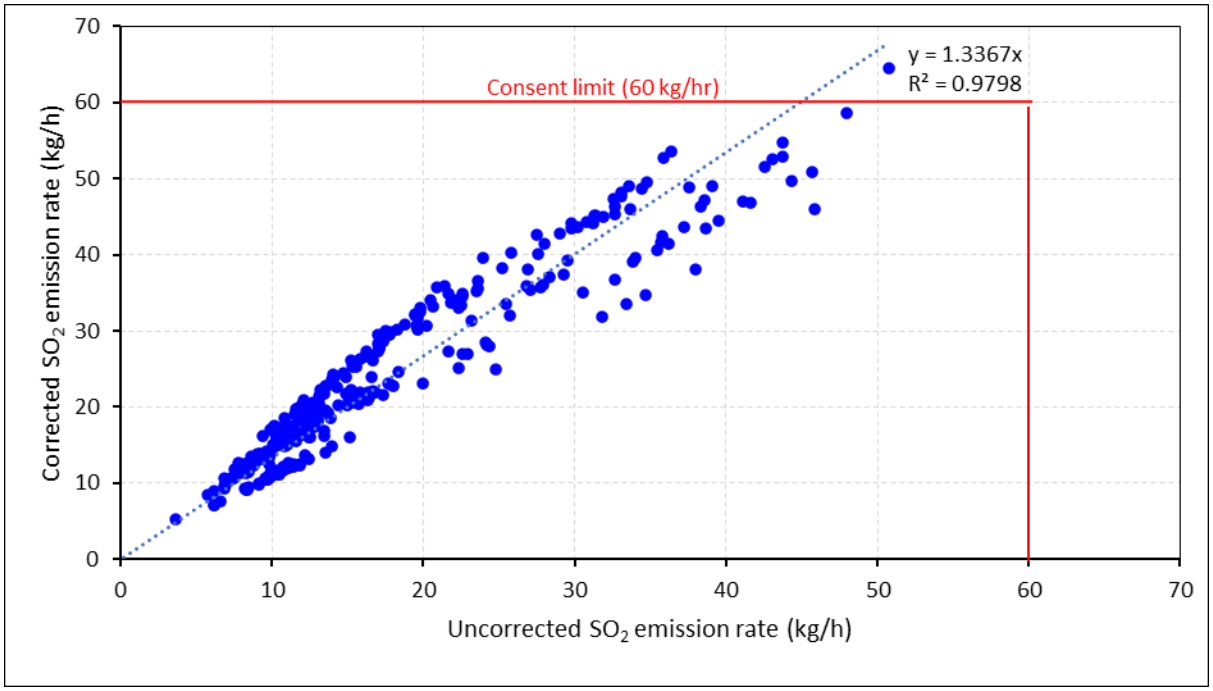

Figure 1.1: Comparison of SO_2 emission rates with the uncorrected and corrected gas flow rates for the period January 2016 to 1 August 2021.

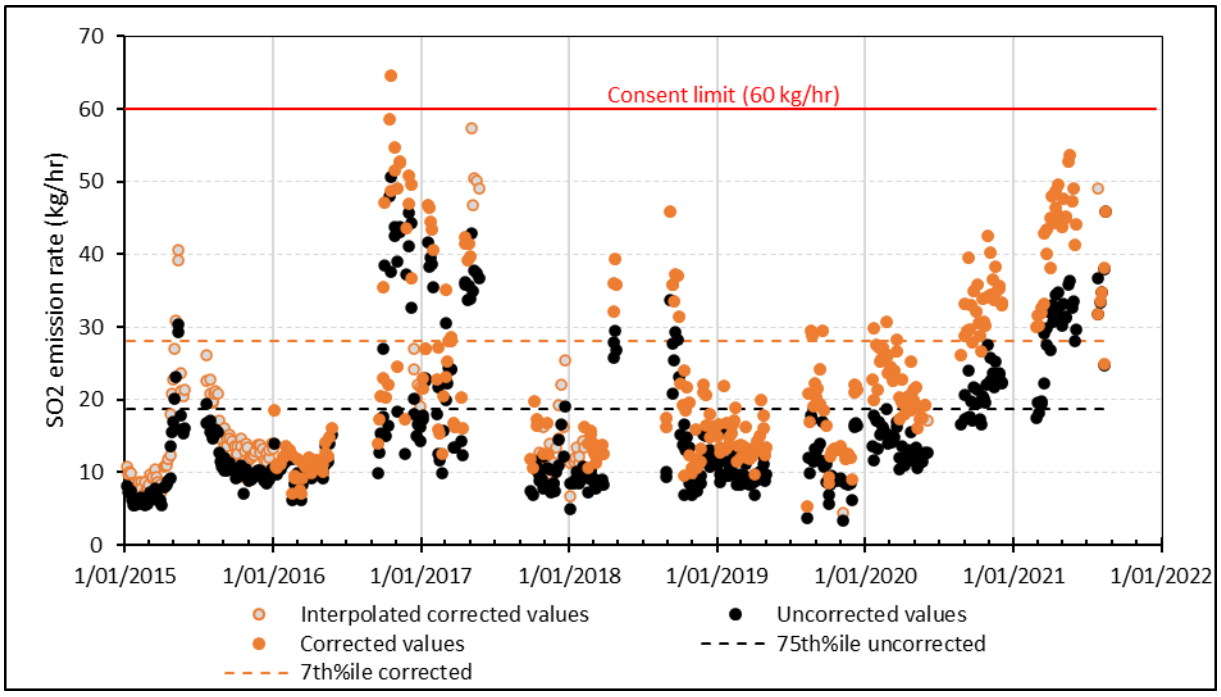

Figure 1.2: Timeseries comparison of corrected and uncorrected SO_2 emission rates for the period 1 January 2015 to 1 August 2021.

The calculation of SO_3 emission rates will be similarly affected by the correction to the flow rate results. That is, corrected SO_3 emission rates will be approximately 30-40% higher than those presented in the T+T report. However, given the low predicted SO_3 concentrations relative to the assessment criteria presented in Section 6.2.4 of the T+T Air Quality Assessment, this increase will not materially alter the conclusions.

2 Fugitive particulate monitoring options

Request:

2. Please provide information on monitoring options that Ravensdown might implement for assessing fugitive emissions of particulate from the manufacturing plant in order to better understand them and reduce the potential contributions to fine particulate measured at the former Winstone site.

Response:

Installation and operation of a nephelometer at various locations around the Manufacturing site to monitor for PM_{10} is proposed as part of Ravensdown's onsite health and safety monitoring (and outside of the consent requirements). This system will provide on-site alerts of elevated dust levels for operators, signalling the need for investigation and actions to reduce dust emissions. The former Winstone's site monitor is downwind of the Manufacturing plant in prevailing winds and fugitive emissions are anticipated to be the primary contributor to dust measurements. It is therefore expected that this system would be a suitable monitoring option for understanding and evaluation options for reducing fugitive particulate emissions from this source, if the offset monitoring shows any concerns.

3 Updated acid plant assessment

Request:

3. Please provide an updated assessment of emissions [impacts] associated with the acid plant based on corrected emission data.

Response:

T+T considers that the only aspect of the air quality effects assessment affected by the flow rate error is in relation to the annual average concentration predictions for SO_2 and SO_3, concentrations and annual sulphur deposition.

Predicted 1-hour average SO_2 and SO_3 concentrations, and 24-hour average SO_2 concentrations presented in the T+T air quality assessment were derived from modelling of acid plant emissions at the existing consent emission rate limit. The corrected emission rates described in section 2, above, have complied with this limit for all but one test result and the limit for the existing plant configuration is not proposed to be changed. Given this, we consider that the dispersion modelling assessment of 1-hour and 24-hour average concentrations presented in the T+T Air Quality Assessment Report (based on the proposed consent emission rate limit) remains applicable.

The annual average SO_2 and SO_3 concentrations and sulphur deposition rate predictions were based on the 75th percentile of measured (uncorrected) SO_2 and SO_3 emission rates (a value of 18.7 kg/hr and 0.09 kg/hr respectively). Based on the re-analysis of the flow rate data provided by Ravensdown, these emission rate values (derived from the 75th percentile of measurements) have been corrected to 28.1 kg/hr and 0.14 kg/hr respectively.

3.1 Approach

A revised assessment of annual average SO_2 and SO_3 ground level concentrations (GLC) and annual sulphur deposition rates is presented below. The approach used has been to pro-rate the predicted concentrations from the T+T Air Quality Assessment using the revised emission rate values, rather than re-running the dispersion model. This is ordinarily appropriate where there is a single discharge source, as the predicted model results are directly proportionate to the emission rates. However, in this instance the dispersion modelling also includes emissions from the Manufacturing Plant stack(s). However, we consider the approach of pro-rating the modelling results conservative, as the

correction will apply to the less influential emissions from the Manufacturing Plant stack(s), which would otherwise be unaffected.

3.2 Updated model results – existing site configuration

The revised annual average SO_2 GLC are summarised in Table 3.1 (which updates Table 6.7 in the T+T Air Quality Assessment). This shows the maximum predicted cumulative concentration at the most impacted receptor location (i.e., Waitangi Regional Park) increasing from 1.7 µg/m³ to 2.0 µg/m³. This concentration remains well within the Ambient Air Quality Guideline (AAQG) of 10 µg/m³ for the protection of lichens (the most stringent of the vegetation guidelines).

Revised annual average SO_3 GLCs are summarised in Table 3.2 (updating Table 6.8 of the T+T Air Quality Assessment). The revised model predictions for SO_3 assume emission rates for SO_3 are pro-rated by the same ratio as those for SO_2. As demonstrated in Table 3.2, the revised concentration remains significantly below the human health criteria published by the OEHHHA (1 µg/m³).

This data has been communicated with Plant and Food Research and the minor change in concentrations does not alter the conclusions reached in Section 3.2.2 of the vegetation effects assessment by Plant and Food Research (2021)[2].

Table 3.1: Summary of predicted annual average SO_2 GLC compared with assessment criteria

18.	Averaging period	Location	Model predicted GLC (µg/m³)	Cumulative off-site GLC (µg/m³)*	Assessment Criteria (µg/m³)
Most impacted off-site location where exposure for the averaging period is relevant	Annual**	Waitangi Regional Park	~~0.66~~ **0.99**	~~1.7~~ **2.0** [1]	10

* Site discharges plus background. Background concentrations are in square brackets.
** Annual average results relate to vegetation impacts
Strike through and bold-underlined text represent corrected values.

Table 3.2: Summary of predicted annual average SO_3 GLC compared with assessment criteria

Receptor Type	Averaging period	Location	Model predicted GLC (µg/m³)	Cumulative off-site GLC (µg/m³)*	Assessment Criteria (µg/m³)
Most impacted off-site location where exposure for the averaging period is relevant	Annual	C22	~~0.002~~ **0.003**	~~0.002~~ **0.003** [0]	1

*Site discharges plus background. Background concentrations are in square brackets.
Strike through and bold-underlined text represent corrected values.

3.3 Updated model results – proposed site configuration

The T+T Air Quality Assessment provided predicted annual average SO_2 concentrations and sulphur deposition rates associated with the proposed site configuration (i.e., the combining of the existing Manufacturing Plant stacks and the upgrade of the Acid Plant converter). In terms of the dispersion model configuration, the same emission rate values were used for the existing and future site

[2] Pant & Food Research 2021. Effects of emissions-to-air form the Ravensdown Napier Works on vegetation. Report prepared for Ravensdown Limited by The New Zealand Institute for Plant and Food Research Limited.

configuration for both the Manufacturing Plant and Acid Plant. The only change to the model was in relation to the Manufacturing Plant configuration (i.e., three stacks being combined into a single stack).

As noted in Sections 6.3.3 and 6.3.4.1 of the T+T Air Quality Assessment, the proposed site configuration results in a very minor reduction for annual average SO_2 concentrations and sulphur deposition rates. Given this context, it is considered that:

- The pro-rated model predictions for the existing site configuration presented in Section 3.2 will provide a conservative overstatement of impacts when applied to the proposed future site configuration; and
- The conclusions reached regarding the low predicted sulphur oxides concentrations and deposition rates relative to the assessment criteria will remain unchanged.

4 Ambient SO_2 monitoring from normal acid plant start-ups

Request:

4. Please update the section on ambient monitoring of sulphur dioxide to clearly demonstrate the contribution from normal acid plant start-ups.

Response:

Section 5.3 of the T+T Air Quality Assessment included a detailed analysis of ambient SO_2 concentrations measured at the former Winstone monitoring site, which included the periods when acid plant start-up occurred. Further analysis of ambient SO_2 concentrations at the dates and times of the Acid Plant start-up since 2015, which are listed in Table 4.1, has been undertaken.

The monitoring data over the 5-day heating period leading up to when sulphur was introduced to the sulphur furnace has been evaluated. This ensures any emissions associated with gradual heating up of the Acid Plant are considered. A nominal period of 3 hours after sulphur has been introduced to the furnace has also been included. The analysis also considers whether the SO_2 monitoring site is downwind of the acid plant during each start-up period.

The measured SO_2 concentration during each start up period by wind direction is summarised in Figure 4.1. This analysis clearly highlights the period of high concentrations that occurred on 11 April 2018 during a start-up, which is discussed in Section 5.3 of the T+T Air Quality Assessment. As noted in the report, the cause of this issue was identified as being due to the then use of a 3 m high temporary stack that was fixed to the furnace during pre-heating of the furnace. This was addressed by the installation of a permanent 13 m high stack during the 2018 winter shutdown. Other protocols associated with both plant shut-down and start-up have also been implemented. Concentrations during start-up have been significantly lower since these measures were implemented.

Further analysis is provided in Appendix A, which provides a table colour coding each hour for each start up period based on SO_2 concentrations and wind direction.

This analysis demonstrates that Acid Plant start-ups have not been responsible for peak concentrations of SO_2 measured at the former Winstone monitoring site since the measures implemented during the 2018 winter shutdown period.

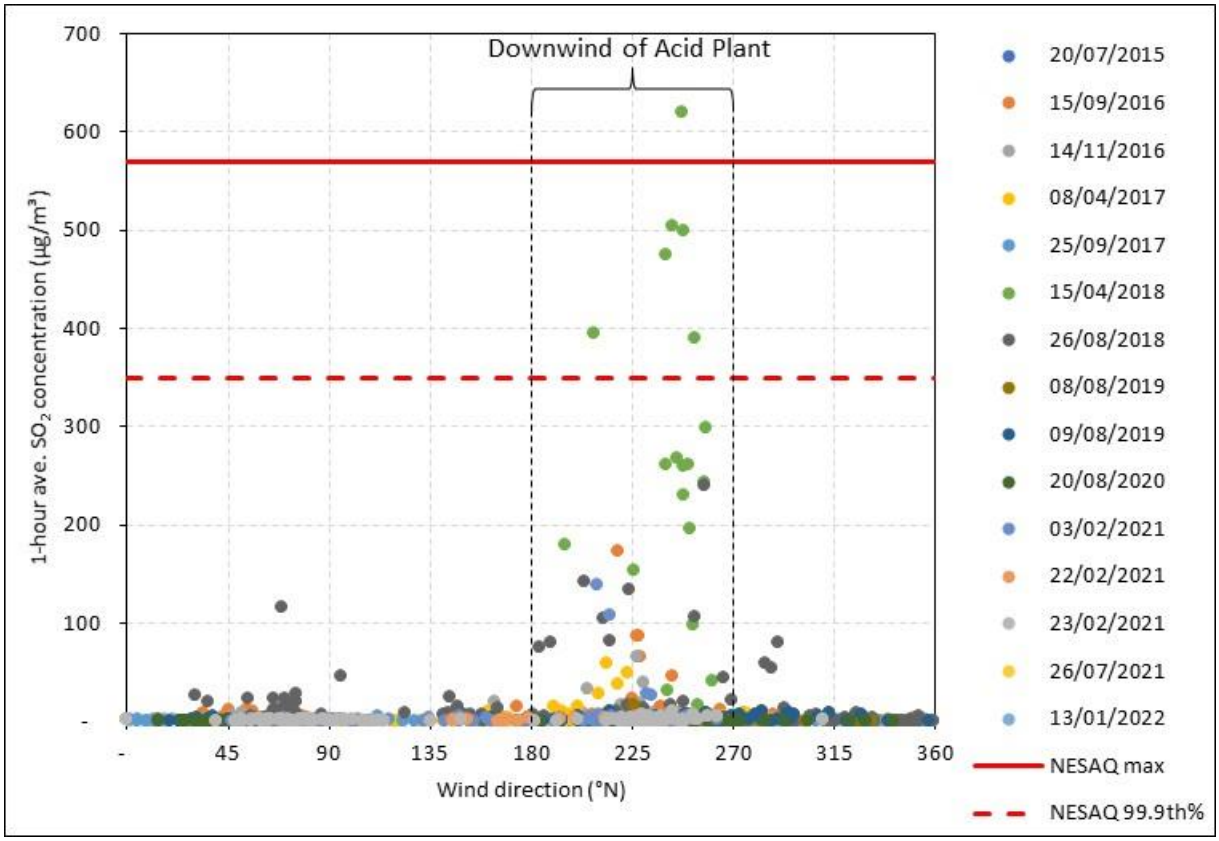

Figure 4.1: Analysis of measured 1-hour average SO_2 concentrations by wind direction that associated with normal Acid Plant start-up. Values represent concentrations measured in the preceding 5 days prior to sulphur being introduced into the burner.

Table 4.1: Acid Plant start-ups (sulphur introduced to furnace) included in the analysis

Date	Sulphur On	Comment
20/07/2015	13:45	Annual Shut Down
15/09/2016	18:40	Annual Shut Down - Maximum level of 2000 ppm recorded
14/11/2016	11:35	Plant shut down due to issues following a 7.8 magnitude earthquake
8/04/2017	11:17	Steam valve failed and had to be replaced.
25/09/2017	14:20	Annual Shut Down
15/04/2018	13:30	Plant shut down since 27/3/2018 following a power outage.
26/08/2018	13:30	Annual Shut Down
8/08/2019	20:00	Annual Shut Down. Gas leak - plant stopped immediately. Second start carried out.
9/08/2019	21:00	
16/01/2020	14:55	Planned shut down since 13/12/2019.
20/08/2020	14:02	Annual Shut Down
3/02/2021	15:00	Planned shut down since 13/12/2020.
22/02/2021	12:00	Plant shut down due to leaking sulphur gun.
23/02/2021	14:45	Plant shut down due to PLC programming issues
26/07/2021	16:45	Annual Shut Down. Gas leak - plant stopped immediately. Second start carried out.
13/01/2022	13:45	Planned Shut Down.

5 Potential effects associated with nitrogen dioxide emissions

Request:

5. Please provide information on the potential effects associated with nitrogen dioxide emissions from the acid plant.

Response:

PDP's technical review[3] (Section 4.2) comments that there would be merit in understanding the effects of NO_2 emissions relative to the ambient air quality standard specified in the National Environmental Standards for Air Quality.

T+T is not aware of the effects of NO_X emissions having been considered for the consenting of other acid plants in New Zealand. NO_X emission rates from acid plants are low compared to SO_2 emission rates and the emissions are discharged via a relatively tall stack. The USEPA published emission factors (AP42) for sulphuric acid production[4] does not list NO_X emissions as a contaminant of interest. Given this context NO_X emissions from the Acid Plant stack have not been measured.

Chemetics (2021) notes that Ravensdown's acid plant will give rise to some NO_X emissions, albeit that the plant is expected to have relatively low emission rates. It also notes that the *"IFC/World Bank Group guidelines are currently 200 mg/Nm³ for NO_X… emitted from sulphuric acid plants".*

In the absence of NO_X emission testing data, we have used the guideline NO_X emission concentration of 200 mg/Nm³ to evaluate the potential effects of NO_2 emissions. The estimated NO_X emission rate

[3] PDP 2022. APP126684 Technical Review of Air Quality Aspects of Ravensdown Awatoto. Letter report prepared by Pattle Delamore Partners Limited for Hawkes Bay Regional Council, dated 1 February 2022.
[4] USEPA 1995. AP-42 Compilation of Air Pollutant Emission Factors – Volume I: Stationary Point and Area Sources. Fifth Edition. Chapter 8.10 – Sulfuric Acid.

is 1.8 g/s, calculated as shown in Table 5.1. 1-hour and 24-hour NO_2 concentrations have been derived in a pro rata basis from the modelling results for SO_2 and using the 'Proxy Method' recommended by the MfE (2016), as shown in Table 5.2 .

This analysis shows that the NO_X discharges from the acid plant (assuming an emission concentration of 200 mg/Nm³) are predicted to give rise to a negligible contribution to ambient NO_2 concentrations beyond the site. NO_2 concentrations are predicted to remain well below the NESAQ and AAQG values (1-hour average of 200 µg/m³ and 24-hour average of 100 µg/m³).

For predicted NO_2 concentrations to reach the NESAQ, the NO_X emission concentration from the Acid Plant would need to be in the order of 20,000 mg/Nm³. This is approximately 100 times higher than the IFC/World Bank Group emission guideline (200 mg/Nm³). Based on this, we conclude that cumulative NO_2 concentrations are not expected to approach the NESAQ as a result of NO_X discharges from the Acid Plant stack.

Table 5.1: NO_X emission rate calculation

Parameter	Value	Unit	Comment
NO_X emission factor	200	mg/Nm³	IFC/World Bank according to Chemetics
Velocity	10	m/s	Based on velocity for peak model results for SO_2
Diameter	1.2	m	
Temperature	69	°C	Based on velocity for peak model results for SO_2
Gas flow rate	8.9	Nm³/s	Calculated
NO_X emission rate	1.8	g/s	Calculated

Table 5.2: Pro-rating against model predictions of 1-hour and 24-hour SO_2 ambient concentrations

Parameter	Value	Unit	Comment
SO_2 emission rate	60	kg/hr	applies to 1-hour and 24-hour average results
1-hour max SO_2	340	µg/m³	West of Acid Plant
24-hour max SO_2	24	µg/m³	Receptor 24
Pro-rated NO_X 1-hour	10.2	µg/m³	West of Acid Plant
Pro-rated NO_X 24-hour	0.72	µg/m³	Receptor 24
Primary NO_2 assumption	10%		Assumed but typical for external combustion appliances
Applying MfE NO to NO_2 Proxy Method			
1-hour NO_2	96.0	µg/m³	Using the MfE Proxy Method - all other locations - 95 µg/m³
24-hour NO_2	75.1	µg/m³	Using the MfE Proxy Method - all other locations - 75 µg/m³

6 Particulate emission from the Manufacturing Plant Stacks

Request:

6. Please provide additional information on particulate emissions from the manufacturing plant stacks and how these might be responsible for the high concentrations of PM_{10} measured on the Winstone site.

Response:

With regard to PM_{10} and $PM_{2.5}$ emissions from the Manufacturing Plant, the PDP review focuses on emissions from the Bradley Mills (Section 5.1.2). PDP states that the assumed PM_{10} and $PM_{2.5}$ size fractions appear to be conservative and that there would be *"… merit in undertaking some size specific monitoring that can be used to understand the contributions of fine particles in future assessments."*

T+T and Ravensdown attempted to quantify the proportion of $PM_{2.5}/PM_{10}$ in the discharge from the mills through stack testing in 2021. This was undertaken by K2 Environmental. However, due to the very low total suspended particulate (TSP) concentrations (1 mg/m³ or less), K2 reported that there was insufficient sampled particulate to enable the $PM_{2.5}/PM_{10}$ proportions to be determined. In light of this, T+T made conservative assumptions regarding likely $PM_{2.5}/PM_{10}$ fractions in the mill baghouse exhausts.

If the intent of the question relates to the existing Den and Hygiene scrubbers, there is no available stack testing information relating to these sources regarding particulate matter emissions, with the focus having been on fluoride emissions from these stacks. Notwithstanding this, the Den and Hygiene scrubber stacks are relatively tall, and would provide for good dispersion of any particle discharges compared to those released at or near ground level. Given this context, we do not consider that the Den or Hygiene scrubbers are likely to be the cause of the measured high PM_{10} concentrations at the former Winstone monitoring site.

7 Mitigation to reduce particulate from the Manufacturing Plant

Request:

7. What mitigation will be implemented to reduce particulate emissions from the manufacturing plant to acceptable levels?

Response:

The dispersion modelling indicates that the Bradley Mill emissions give rise to elevated PM_{10} and $PM_{2.5}$ concentrations close to the site. T+T considers that this is likely due to the configuration of the exhaust from the Bradley Mill baghouses, which do not provide for good dispersion, rather than the adequacy of the baghouses at filtering emissions. The exhausts from the Bradley Mill baghouses are, in most cases, not directed vertically and are in all cases below the ridge height of the buildings that they protrude from. This means that the discharges from the mills will experience significant building downwash effects, resulting in localised impacts close to the source under certain wind conditions.

T+T has carried out dispersion modelling of the Bradley Mill vents to examine the effect of configuring the mill vents so that they discharge vertically and so that they discharge 3 m above the ridge height of the building from which the vents protrude. The modelling indicated that there would be very little improvement in precited concentrations. This is likely to be due to the need for significantly higher exhausts to overcome the modelled downwash effect. In practice, reconfiguration of the vents to be vertical and to extend beyond the immediate building roof ridge is expected to improve dispersion to a greater extent than suggested by the modelling.

Peak PM_{10} concentrations at the former Winstone site occur under moderate strong wind conditions. Under these conditions there is likely to be wind entrainment of dust material in and around the Manufacturing Plant and mills, transporting that material towards the ambient monitor on the former Winstone site.

Given the above context, T+T considers that elevated PM_{10} concentrations measured at the former Winstone monitoring site are likely to be due to a combination of emissions from the Bradley Mills and wind entrainment of dust (fugitive emissions).

Mitigation measures that T+T recommends be implemented are as follows:

- Investigate the implementation of the dust mitigation measures recommended in Section 5 of the JSEA technology report, that include the following:
  - Configuration of the Bradley Mill exhausts so that they discharge vertically at least 3 m above the immediate building roof ridge height and unimpeded.
  - Improved house-keeping to more regularly remove the build-up of dusty material within the Manufacturing Plant and adjacent rock stores, or improving the integrity of the building envelope.
  - Installation and operation of a nephelometer to monitor for elevated dust levels with on-site alerts for operators, signalling the need for investigation and actions to reduce dust emissions.

Ravensdown have considered these recommendations in the Source Control Management Plan[5] included in the application package.

8 Potential impact of PM_{10} at other locations within Awatoto airshed

Request:

8. Please also assess whether there is potential for similar levels of PM_{10} as those measured at the Winstone site to be experienced at other locations within the Awatoto airshed.

Response:

The T+T report provides a modelling assessment of PM_{10} and $PM_{2.5}$ emissions associated with emissions from the Bradley mills (Section 6.2.5). This includes contour plots of predicted 24-hour and annual average PM_{10} and $PM_{2.5}$ concentrations (Figures 6.16 to 6.19). These plots provide a good understanding of the expected spatial distribution associated with particulate emissions from the site. As expected, the pattern clearly shows peak impacts extending to the immediate east of the site in line with prevailing west-southwest winds.

In addition to these modelled discharges, strong winds may give rise to wind entrainment of dusty material. Such winds are predominantly from an offshore direction (i.e., northeast), which would transport dust towards the southwest over Ravensdown land and the adjoining unoccupied farmland.

Because of the direction of the prevailing winds, elevated concentrations of PM_{10}/$PM_{2.5}$ are not expected to occur at the nearest residential dwellings (Receptor C24 – located to the north of the Manufacturing plant) or further afield at the residential area north of Awatoto (C19).

[5] Ravensdown Napier Works, Source Control Management Plan, November 2021

9 Applicability

This report has been prepared for the exclusive use of our client Ravensdown Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Hawkes Bay Regional Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:

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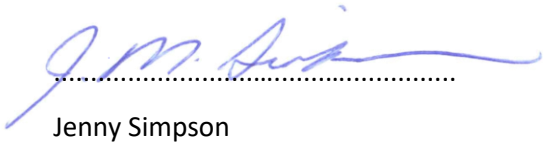
Richard Chilton
Technical Director – Air Quality

Authorised for Tonkin & Taylor Ltd by:



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Jenny Simpson
Project Director

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Appendix A: Tabular analysis of SO_2 data during start up

-

1-hour average SO2 concentrations (red high, green low)

Date	Time	-5 days	-4 days	- 3 days	- 2 days	- 1 day	X	1	2	3
20/07/2015	13:45									
15/09/2016	18:40									
14/11/2016	11:35									
08/04/2017	11:17									
25/09/2017	14:20									
15/04/2018	13:30									
26/08/2018	13:30									
08/08/2019	20:00									
09/08/2019	21:00									
16/01/2020	14:55									
20/08/2020	14:02									
03/02/2021	15:00									
22/02/2021	12:00									
23/02/2021	14:45									
26/07/2021	16:45									
13/01/2022	13:45									

Wind direction (shading when monitor is downwind of Acid Plant)

Date	Time	-5 days	-4 days	- 3 days	- 2 days	- 1 day	X	1	2	3
20/07/2015	13:45									
15/09/2016	18:40									
14/11/2016	11:35									
8/04/2017	11:17									
25/09/2017	14:20									
15/04/2018	13:30									
26/08/2018	13:30									
8/08/2019	20:00									
9/08/2019	21:00									
16/01/2020	14:55									
20/08/2020	14:02									
3/02/2021	15:00									
22/02/2021	12:00									
23/02/2021	14:45									
26/07/2021	16:45									
13/01/2022	13:45									

2

ATTACHMENT 2

New Zealand Institute for Plant and Food Research Ltd

PFR SPTS No. 22443

Effects of emissions-to-air from the Ravensdown Napier Fertiliser Works on vegetation: Response to further information request

Trolove S: Reviewed by Searle B; Clothier B, Doley D

May 2022

This document provides responses to the Hawke's Bay Regional Council's request for further information concerning the vegetation effects of the Ravensdown resource consent applications. The questions are repeated in full below using the numbering in the request for further information letter dated 3 March 2022.

Question 9

Climate change effects: Referring back to the AEE comments on climate change and also comments within the Vegetation Assessment itself, it seems that climate-related effects such as drought or pests and diseases which cause stress to vegetation can result in greater susceptibility to other stressors such as air emissions. Please provide a discussion of this aspect and assessment of potential effects on both horticultural and conservation vegetation, including effects on pollination and fruit set.

Response

The likely effects of climate change on susceptibility to damage from atmospheric pollutants can be estimated by investigating whether effects are observed from similar emissions in a climate that is slightly warmer and drier than that in Hawke's Bay. To that end, we have examined whether there were effects of the fluoride (F) and sulphur dioxide (SO_2) emissions (Greenfield 2013) from the Kurri Kurri Aluminium Smelter in the Hunter Valley, New South Wales, Australia, on grape yields and quality. These effects are reported by Doley and McNaughton (2014). This smelter is located near Maitland in the Hunter Valley, receives slightly less annual rainfall than Napier (727 mm/y c.f. 864 mm/y) and has slightly hotter summer temperatures, with an average January temperature of 23.8°C, compared with 19.5°C for Napier (Climate-data.org 2022). The crop investigated for pollution effects was grapes, which are sensitive to F and are also grown near the Napier Works, so make a good model crop to examine for pollution effects. Australia and New Zealand also use the same emission standards, which is another reason why the comparison is useful.

The maximum seasonal F concentration that any vineyard was exposed to in any season during the Hunter Valley study (Doley & McNaughton 2014) was 0.22 µg/m^3, which is just below the 90-day critical limit of 0.25 µg/m^3 set for F-sensitive crops (MfE 2002). This concentration is more than double the modelled F concentration immediately outside the Ravensdown boundary (Figure 11,

Trolove et al. 2021) and greater than 10 times the modelled F concentration at Brookfields Vineyard, where F concentrations in grape yields are currently monitored (Figure 10, Trolove et al. 2021). The seasonal average ambient F concentration for the vineyards in the Hunter Valley was approximately 0.1 µg/m^3 (Doley & McNaughton 2014). Grape leaf F concentrations reached a maximum of 45 mg/kg, which is greater than the average maximum leaf concentration of 10 mg/kg (range 8–13 mg/kg) at currently monitored Brookfields Vineyard, or similar to the value of 37 mg/kg (range 20–53 mg/kg) at the closer vineyard that was located at the now Brookfields orchard site, but has since been pulled out (Figure 10, Trolove et al. 2021). No data were provided on SO_2 emissions or effects. No harmful effects of F emissions were observed on the vines during the 30 years of monitoring (Doley & McNaughton 2014). Since no economic loss was observed due to F emissions from the Kurri Kurri Aluminium Smelter to a F-sensitive crop, under hotter conditions and higher F emissions than Napier, it is most probable that there would continue to be no damage observed to crops grown near Napier if the climate warmed and dried.

Question 10

Multiple exposures to acidic emissions: The Executive Summary states: “For the growing season outside of the flowering period (i.e. from November to April) the risk is only for multiple exposures, so emission of pH of <4.0 on up to 3 different days should not be considered a breach of resource consent.” There does not appear to be any data or references within the body of the report to support the number of exposures stated as being acceptable. Please provide supporting data and discussion of potential effects.

Response

Doley (2006) stated that “sulphuric acid injures plants directly if the pH is below about 2.0 for one to four exposures (Proctor 1983), whilst 16 or more regular exposures over a growing season may result in injury at pH 3.5 (Cape 1993) or 4.0 (Rinallo 1989; 1992)”. Data that support his statement that yield or quality for some crops have declined from ≥16 exposures throughout the season following sprays of pH 3.5 or 4.0, and a discussion of potential effects, are as follows. Eighteen sprays at pH 3.0 and at pH 4.0, applied weekly to developing apple fruit, decreased fruit set, increased fruit drop, decreased fruit weight and yield, and increased russeting compared with treatments receiving deionised water or ambient rainfall (Rinallo 1992). Fruit exposed to repetitive sprays of pH 3.0 (and to a lesser extent, those exposed to pH 4.0) also showed a decline in fruit quality, including lower dry matter, calcium, sugars and ascorbic acid (Rinallo et al. 1993). Applications of acid rain at pH 3.0 over the growing season was found to delay ripening in ‘Golden Delicious’ apples, compared with sprays at pH 3.5 (Forsline et al. 1983b). Two grape varieties out of nine that were sprayed weekly from the week before flowering until harvest (approximately 18 sprays at pH 2.75) showed a significant decrease in soluble solids compared with vines receiving ambient rainfall, which had a pH ranging from 3.3 to 7.0 (Forsline et al. 1983a). Eighteen applications of 24 mm of simulated acid rain, at either pH 3.0 or 4.0 (depending on the cultivar), significantly reduced the yield of wheat (Singh & Agrawal 2004). The sprays were applied twice weekly from 15 days after germination. Pot trials have shown reductions in yield for carrots and mustard greens when 10 mm of simulated acid rain at pH 4.0 was applied three times per week throughout the growing season (Lee et al. 1980). There was no significant (p<0.05) decrease for the other 16 crops tested at this pH. Pell & Puente (1987) found no effect of yield from more than 30 applications of acid rain at pH ≥3.0 on oats.

The studies mentioned above were designed to investigate the effects of acid rain, which would likely result in a higher frequency and higher volume of exposure to acidic liquid than a crop located hundreds or thousands of metres from the Napier Works. Studies designed to investigate the effects of factory emissions on crops normally focus on the amount of SO_2 and F emitted, rather than the pH

of the emissions. This may be because of the difficulties of measuring the pH of aerosol emissions in the field (Trolove & Searle 2022). Modelling suggests that the Napier Works complies with the emission limits for SO_2 and F, except for a small area of land adjacent to the Napier Works when the maximum allowable emission rate is used in the model (see Question 4).

No studies were found to indicate the number of sprays a crop could tolerate before yield or quality was significantly affected. Two studies were found where damage was observed with <16 sprays of pH between 2.7 and 4.0. Mai et al. (2010) found that 10 sprays of simulated acid rain at pH ≤4.1 between budding and late flowering decreased the yield of rape. And Klymenko and Klymenko (2003) observed leaf damage to one acid-sensitive peach variety after the third spray of a sulphuric acid solution at pH 3. In their study, peach trees were sprayed monthly with 2 mm of simulated acid rain at pH of 2, 3, 4 and 5, beginning at full flowering and continuing for five months. Yield decreased by 50% for the pH-sensitive variety that received five sprays at pH 3, but there was no effect at pH 4.

In summary, there are insufficient data in the scientific literature to decide on the number of exposures that would be acceptable. Two possible approaches are:

1. Maintain the status quo, and keep the discharge limit at pH 2.7. This would be based on the lack of reports of acid damage with the current discharge limit of pH 2.7, and the assumption that frequent exposure to acidic sprays applying the volume of liquid used in these studies (several millimetres of acid rain, or sprayed to runoff) from the Napier Works is unlikely.

2. A conservative approach, which I recommended in my report (Trolove et al. 2021), is to acknowledge the possibility that a crop might be planted that is susceptible to a small number of exposures of between pH 2.7 and 4.0. For practical purposes from the Napier Works' perspective, I have allowed three exceptions. It is unlikely that the same orchard would be exposed to more than one of these low pH emission events per growing season, since it is highly unlikely that the wind would be blowing in exactly the same direction at the same intensity on all three occasions.

Additional comments from David Doley

I agree with your response. The experimental methodology of acid rain studies may be important in their interpretation. Rinallo's group used rain exclusion covers in all their experiments. This provided a consistent acid application treatment, which would have been appropriate in Italy. Forsline et al. (1983b) applied acidic solutions to trees in the field as a supplement to natural rainfall (which was recorded throughout the study) and, in one experiment, used tunnel-type covers over trees to exclude rainfall. Rain exclusion (their Table 3) had no significant effect on most fruit attributes but did significantly hasten ripening. This effect could have occurred if the rain shelters increased temperatures around the covered trees. The results of acidic spray experiments conducted with rain exclusion shelters can be compared with experiments conducted in the presence of natural rainfall events. My understanding of these experiments, like yours, is that acidic precipitation at the concentrations and frequencies likely to occur near the Ravensdown Works are very unlikely to have adverse effects on orchard fruit development or quality.

Question 11

Please discuss the discrepancy between the findings of the literature survey that potential adverse effects on pollination and fruit set can occur for emissions of pH 2.75 – pH 4.7 and proposed consent condition (18) which stipulates a minimum pH of 4 during the flowering season (August to September). Is condition 18 sufficiently rigorous to safeguard vegetation during the flowering period of horticultural

crops? Please also consider potential effects of acidic emissions on flowering and fruiting of conservation vegetation which does not necessarily flower between August and September.

Response

To provide context for my answer to this question, Condition 18 of the proposed consent states *"The pH of the condensate from the den and hygiene stacks or the Manufacturing stack, shall be no lower than 2.7 except in the period August to September when the pH shall be no lower than 4.0".* I have divided my answer to the question above into three parts. First, I will discuss whether there is a need to raise the minimum pH from 4.0 to 4.7, then I will discuss whether there is a need to increase the minimum pH outside of the period August to September, and finally I will consider conservation vegetation (which I have assumed to be trees and shrubs, particularly native species).

First, is there a need to raise the minimum pH for emissions above 4.0? As mentioned in the question above, the literature reports negative effects of acidity on a proportion of pollen at pHs above 4.0 for some acid-sensitive species, e.g. a 50% reduction in viability for pollen tube growth at pH 4.7 for northern evening primrose (Cox 1984) and a reduction in viability at pH ≤4.6 for red maple (van Ryn et al. 1988). These laboratory-based studies do not necessarily indicate an amount of crop yield loss or imply an effect on the ability of conservation vegetation to regenerate. This is because exposure events at a particular field typically only last a matter of minutes or hours (Doley 2005), which is a fraction of the pollination period (usually a few weeks, depending on the crop). Also, plants produce a much greater amount of pollen and flowers than is required for maximum crop yield (hence the need for thinning perennial fruit crops). Craker & Waldron (1989) compared seed set in maize sprayed with either pH 3.6 or 5.6 solution immediately prior to pollination. Silks were then pollinated with a range of amounts of pollen, from limited to ample. A reduction in seed set was only observed in the treatment with limited pollen, and they concluded that there should be no yield reductions in situations with ample pollen, which is presumably the case in a monoculture cropping situation. Field trials investigating the effects of acid rain on maize showed little (a 6% reduction in yield for one cultivar) or no reduction in yield when treated with acid rain at pH 3.0 when grown under conditions of little stress (Banwart et al. 1987; Porter 1987). However, heat or moisture stress may limit pollen viability, and there have been reports, for one out of two maize cultivars tested, of reductions in maize yield upon exposure to simulated acid rain under conditions of moisture stress, over-and-above the reductions caused by the moisture stress itself (Banwart et al. 1987; Banwart 1988).

So while large percentage reductions in pollen viability have been recorded during in vitro studies, field studies typically show no, or much smaller reductions, in final yield. This is because of mitigating factors such as the amount of pollen or flowers produced or seed set, and that the flowering period is much longer than the likely period of exposure to acidity. For field studies that indicate a decline in yield due to effects on seedset or fruitset, the pH is below 4.0 (e.g. Banwart 1988; Klymenko & Klymenko 2003), which would give a greater effect on pollen viability than at pH above 4.0 (van Ryn et al. 1988). There appears to be no field trial evidence to justify raising the minimum pH above 4.0.

I now consider whether the pH should be raised above 2.7 outside the flowering period of stonefruit (August–September), given that other crops flower outside these months. In my report (Trolove et al. 2021), I have recommended a minimum pH of 4.0 during August to October, to allow for the possibility that there may be an effect of a pH 3.0 emission on the fruitset of peach (Klymenko & Klymenko 2003) – which flowers in August–September, and an effect of a pH 2.7 emission on the fruitset of apple (Searle et al. 2008) – which flowers in October. Other crops, e.g. arable crops, flower later in spring or in summer. No studies were found where a single spray during flowering in the pH range of 2.7–4.0 has reduced yields in these other crops. However, there are studies that indicate a reduction in yield

resulting from multiple exposures to acidity in this pH range, e.g. in cucumber (Jacobson et al. 1987), tomato (Dursun et al. 2002), wheat (Singh & Agrawal 2003) and maize (Banwart 1988). The conservative recommendation to protect crops against multiple exposures (recommendation 2 in my response to Question 11) should be adequate to protect these crops during flowering. This is because of mitigating factors such as volume of pollen or flowers produced, and that the flowering period is much longer than the likely period of exposure to acidity.

In regards to possible effects of emissions on flowering and fruiting of New Zealand native vegetation, there appear to be no studies in the scientific literature, probably because acid rain is not considered to be a problem in New Zealand (Holden & Clarkson 1986). So to be conservative, we may assume that there would be some effect of acidity on the pollination and seed set of some species. But, as above, the large amount of flowers and seed set mean it is likely that the effects of acidity would have negligible impact on the ability of conservation plantings to regenerate. The seedbank of native plants below 10- to 20-year-old restoration plantings by the Hamilton City Council was approximately 2200 seeds per 0.169 m^2, of which one-third were woody species (Overdyck & Clarkson 2012). This is vastly more than the number of trees or shrubs that could grow in such an area, should a space arise. I therefore conclude that a possible low percentage reduction in seed set is likely to have negligible consequences on the growth and regeneration of conservation vegetation planted near the Napier Works. I am of the opinion that the measures I have suggested to protect against multiple exposures should provide adequate protection for native vegetation, i.e. emissions should be >pH 4.0, with three exceptions allowed (between pH 2.7 and 4.0). To adequately protect the range of vegetation that could be planted, these conditions may need to be in place for most of the year, since New Zealand native vegetation has a wide range of flowering times, e.g. Ngaio and some genotypes of kowhai may flower as early as July, and lacebark finishes flowering as late as March–April.

In summary, there are scant scientific data to make firm recommendations. The most pragmatic approach would be to adjust the pH of emissions to >4.0 during the months of August to October (rather than August to September, as suggested in Condition 18). This would cover the flowering period of stonefruit and apples. The pH could be no lower than 2.7 for the remainder of the season. This recommendation would be based on the fact that there is no evidence of yield loss in neighbouring properties with the current operating procedures and consent conditions where the pH limit is >2.7.

Question 12

The report states that F emissions could be a cause for concern if F-sensitive crops or vegetation is planted within 1km of the site and the proposed maximum emission rate was maintained for 12 hours or longer. Please discuss what these concerns are and how the proposed mitigating factors will address those concerns.

Response

The concerns are that if the Napier Works operates at its consent limit of emission rate of 1.0 kg F/h for a 12-h period, then modelling suggests that F concentrations would exceed the critical concentration for F-sensitive crops of 1.8 µg/m^3 at 1.0 km from the stack, rising to over 3 µg/m^3 just outside the factory boundary (Chilton 2021). The critical concentration of 1.8 µg F/m^3 for 12 h or more was put in place by the Ministry for the Environment (MfE 2002) to protect F-sensitive crops from loss of economic yield. These guidelines are conservative. A F exposure of 3 µg/m^3 to plants grown immediately outside the Napier Works for 12 h gives a dose of 36 µg/m^3 h. This is well below doses at which F injury has first been observed in grapes (a F-sensitive crop), which ranges from 180 to 626 µg/m^3 h in the review by Weinstein (1984). The risk of damage will vary, depending on crop species, cultivar and growth stage (Trolove et al. 2021). Given the conservative nature of the

guidelines, the risk of economic damage to a crop or consequential damage to F-sensitive vegetation by a small exceedance of the guideline is low.

Although theoretical modelling suggests that the Napier Works could emit F concentrations that would exceed the critical concentration for F-sensitive crops if it released F at the maximum permissible rate for 12 h, this is not how Ravensdown operate in practice. Ravensdown has stated that operating at a level so close to the consent maximum would represent an unacceptable risk to Ravensdown of exceeding the consent limit, so in practice, emission concentrations are much lower (Andrew Torrens, Ravensdown, pers. comm.). Data of emissions from the manufacturing stack for the period January 2015 to August 2021 (Chilton 2021) show only two occasions where F emission rates exceeded 1.0 kg F/h, and these have been addressed. Only a further four measurements exceeded 0.5 kg F/h, and the 75th percentile for emissions was 0.12 kg F/h. Fugitive F emissions would add to these totals, and fugitive plus stack emissions are accounted for in measurements taken at ambient measuring stations. The ambient measuring station located at the back paddock is just inside the Napier Works' boundary. During the period January 2015 to July 2021, no measurement has exceeded the critical concentration of 1.8 µg F/h, and only two measurements have exceeded 0.7 µg F/h (Chilton 2021). This suggests that, while modelling of F concentrations based on an emission rate at the consent limit may represent a theoretical risk of damage to F-sensitive crops and vegetation grown within 1 km of the Napier Works, in practice the risk of damage is very low.

Therefore, given that the likelihood of economic damage from a small exceedance of the critical concentration is low, and that the likelihood of such an exceedance occurring is low, I conclude that the likelihood of economic damage occurring to a F-sensitive crop or vegetation is very low.

Additional comments in response to review feedback from David Doley

In reviewing this question, Dr Doley suggested it was necessary to consider the possible effects of F accumulation in pastures on grazing animals. This was considered particularly important, since the land within 1 km of the Napier Works boundary is normally sown in pasture. This aspect of environmental health was addressed in the ANZEC (1990) guidelines, but it was excluded in later revisions of ambient air quality guidelines that were based exclusively on human health effects (MfE 2002). The ANZEC guidelines give a F concentration of 40 µg/g or less for forage that animals are consuming continuously for a 3-month or seasonal period, to avoid injury. So this represents a risk if animals are grazed for long periods in the paddocks close to the Napier Works, if the animals are regularly moved to paddocks further away, then the risk is greatly reduced, since the F concentration in vegetation declines exponentially with distance from the works (Trolove et al. 2021).

There are no data for F concentrations of pasture grown near the Napier Works. The data that most closely approximates pasture come from a sample of watercress, which is also a soft, leafy herb like grass or clover, and grows to a similar height as pasture. This was collected by mana whenua and me from amongst grass growing near the streambank at the head of the Awatoto drain in September 2021. The watercress had a F concentration of 11 µg/g, which is well below the 40 µg/g guideline. According to the modelling of Chilton (2021), the area where the watercress was growing would be exposed to 90-day average F concentrations of 0.05 µg/m^3, based on F emissions at the 75th percentile of measured manufacturing rates (Figure 1). In the modelling, 90-day F concentrations rose to approximately twice this concentration (0.1 µg/m^3) immediately outside the boundary of the Napier works (Figure 1), so if we assume that pasture growing near the Napier Work's boundary could be double the concentration measured in the watercress, i.e. 0.22 µg/g, this gives a value of approximately half the ANZEC (1990) guideline value, which would not be a cause for concern.

This is only a single datapoint, and vegetation F concentrations around the Napier Works vary widely over the season (e.g. Trolove & Sorensen 2021). Pasture F concentrations can be calculated

theoretically, to determine possible risk from higher rates of exposure to F, assuming the Napier Works is emitting F at the 75th percentile of measured manufacturing rates (Chilton 2021). The F concentration in a plant leaf is a function of the ambient F concentration (µg/m^3), the exposure duration (h) and the F uptake coefficient (m^3/(g h)). The ambient F concentration can be obtained from the modelling of Chilton (2021), and I will assume an average F concentration for the field immediately west of the Ravensdown boundary of 0.075 µg/m^3 (Figure 1). Detailed data on uptake coefficients are scarce, but values ranging from 0.1 m^3/(g h) to 0.3 m^3/(g h) were reported for grapevine leaves by Doley (1984), and values of approximately 0.3 m^3/(g h) and 0.5 m^3/(g h) were reported for wheat and barley, respectively (Gritsan 1992). The calculations are shown in Table 1. Whether or not the F emissions may be a cause for concern depends on the value of uptake co-efficient, with an uptake co-efficient of 0.1 m^3/(g h) giving a pasture F concentration below levels of concern, and a co-efficient of 0.5 m^3/(g h) giving pasture concentrations of concern.

To summarise, theoretical calculations indicate that pasture F concentrations may or may not be a cause for concern, depending on the value assumed for the F uptake co-efficient for pasture, for which no data are available. There are no reports of injury to stock in the Ravensdown complaints register, and the only data point available (for watercress) indicates that pasture F concentrations may be well below values that may cause concern. In the absence of good data to make a firm conclusion about the risk to animal health, I recommend that F concentrations in pasture adjacent to the Napier Works be monitored monthly. If pasture concentrations exceed 40 µg/g, then measures to reduce animal F consumption should be considered, such as being moved to paddocks further from the factory, or the provision of supplementary feed.

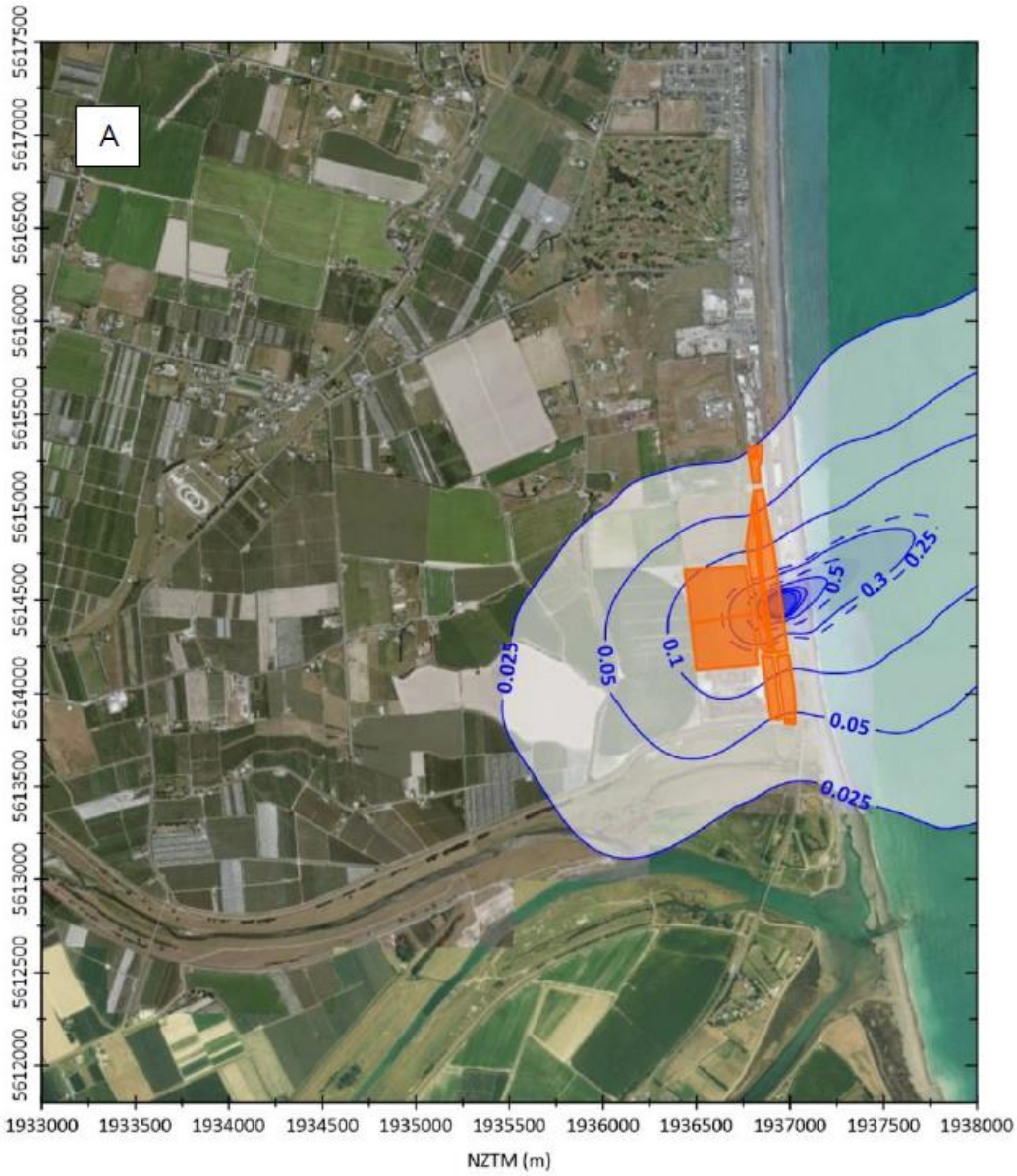

Figure 1. Modelled 90-day average atmospheric fluoride (F) concentrations (µg/m^3) at ground level around the Napier Works for the existing stack scenario. Ravensdown-owned land is shaded orange. The model assumed the Napier Works was emitting F at the 75th percentile of measured manufacturing rates. Source: Chilton (2021).

Table 1. The effect of different uptake co-efficients on estimated pasture F concentrations, based on exposure to 0.075 µg F/m^3 for 90 days. The guideline concentration for pasture is ≤40 µg/g (ANZEC 1990).

Ambient F	Exposure	Dose	Uptake coefficient	Pasture F
µg/m^3	days	µg h/m^3	m^3/(g h)	µg/g
0.075	90	162	0.1	16.2
0.075	90	162	0.2	32.4
0.075	90	162	0.3	48.6
0.075	90	162	0.4	64.8
0.075	90	162	0.5	81

Question 13

Mixtures of pollutants: The range of emissions from the Ravensdown Plant that have the potential to cause adverse effects on surrounding vegetation (fluoride, sulphur dioxide, dust and acidic aerosols) have been modelled separately and discussed in the technical reports as separate effects. Section 3.1.2 (P11 para 4) raises the possibility of the combined effects of acidic aerosols and fluoride emissions with other chemicals that may be applied to horticultural crops. Discussion of the potential for combined or synergistic effects of these pollutants acting together with each other or with horticultural or agricultural chemicals is needed.

Response

The interaction of emissions from Ravensdown with other agrichemicals is a possibility, but is far from proven. In the incident referred to in my report (Section 3.1.2 page 11 paragraph 4 of Trolove et al. 2021), I mention that Doley (2005) suggested that an interaction between Hi-Cane + mineral oil and Ravensdown emissions was one possible explanation for the observed damage to apple foliage on Brookfields orchard in spring 2005, but concluded that the cause "remains obscure". It is also possible that the observed symptoms may have been caused by Hi-Cane + mineral oil alone, with no contribution from Ravensdown emissions. AgFirst Consultants (2005) stated that leaf and bud burn can be caused [solely] by the application of hydrogen cyanamide [Hi-Cane] + mineral oil, even when applied at label rates. Atmospheric F concentrations over the time of this incident ranged between 0.09 and 0.11 µg/m^3 (Doley 2005), which is approximately four times higher than present-day modelled F concentrations (90-day average, assuming the Napier Works was emitting F at the 75th percentile of measured manufacturing rates, Chilton 2021). So even if there was an interaction between Hi-Cane and emissions from the Napier Works in 2005, the risk is now considerably lower because of the lower emission rates from the Napier Works.

Research has been conducted on the effects of these pollutants acting together with each other; namely F and acidity, which are the two pollutants that have concentrations closest to concentrations of concern. The report by Trolove et al. (2021) mentions two experiments by Geelen where condensed liquor from the Awatoto stack was used. This liquor contained F and was acidic. 'Braeburn' trees and fruit sprayed with two applications of the liquor containing F at 34 µg/mL and at pH 2.7 showed no visible signs of damage (Geelen 2006a). In a second experiment (Geelen 2006b), sweetcorn and pea seedlings were sprayed with two different solutions of undiluted condensate from the Napier Works' stack, one at pH 2.6 and the other pH 4.5, and both had a F concentration of approximately 115 mg/L. Both species showed no visible signs of damage at either pH. Searle et al. (2007) investigated the effect of spraying acid and F, and their interaction, on 'Sciearly'/Pacific Beauty™ apple trees. They found minimal damage to leaves at pH 2.7, but significant leaf injury symptoms at pH 1.4. The presence of boat-shaped leaves, which was induced by a pH 1.4 spray, was significantly reduced by the presence of 34 µg/mL F, indicating that interactions between acidity and F can be beneficial to vegetation. Whilst the presence of either acid (at pH 2.7 or 1.4) or F (34 µg/mL) reduced fruitset, the presence of both pollutants gave no additional effect, indicating that there was no interaction between these contaminants with respect to fruitset (Searle et al. 2008). Many of the other experiments in the scientific literature on the effects of F will also have observed any effects of acidity, since many atmospheric F pollutants studied are also acidic, e.g. fluorosilic acid, gaseous silicon tetrafluoride and hydrogen fluoride.

It is theoretically possible that there could be an interaction between emitted acidity and an agrichemical spray, since a change in the pH of an agrichemical may affect its absorption by leaves. For example, an increase in the acidity of sprays may enhance (Zhiqian et al. 1992) or reduce (Liu 2002) the foliar uptake of agrichemicals. In practice this is unlikely, since manufacturers usually include or recommend the use of a pH buffer in combination with their agrichemical sprays, which

would mitigate the effects of a certain quantity of acid addition. No research or reports were found claiming that aerosol acidity had influenced the performance of an agrichemical.

I was unable to find reports of interactions between these pollutants and agrichemicals in the scientific literature. I conclude therefore, that, if interactions occur, they are uncommon. The guideline concentrations for F have been in place since 1990 in Australia (ANZEC 1990). During this time a range of different agrichemicals have been used, and there were no reports of damage linked back to emissions of F, either singly or in combination with another chemical, following adherence to these guidelines during 30 years of monitoring 12 vineyards in the Hunter Valley, Australia (Doley & McNaughton 2014). In the Awatoto–Meeanee area, there have been no reports of damage to crops or amenity plants by the abovementioned pollutants, either alone or in combination with another pollutant, during the current resource consent period (2007–2021, Trolove et al. 2021). It appears that the current regulations are working. A lack of reports of damage does not mean that damage has not occurred, it may be at a low level that is not easily observed, or it may simply not have been reported. However, there is no evidence of interactions between the contaminants of concern and other agrichemicals.

I conclude that it is unlikely that an interaction with emissions from the Napier Works would cause damage of economic significance to vegetation, but not impossible. There are insufficient data to offer a 100% watertight conclusion on this matter, given the myriad of interactions that might possibly occur.

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Confidential report for:

Ravensdown Limited

PUBLICATION DATA

Trolove S: Reviewed by Searle B; Clothier B, Doley D. May 2022. Effects of emissions-to-air from the Ravensdown Napier Fertiliser Works on vegetation: Response to further information request. A Plant & Food Research report prepared for: Ravensdown Limited. Milestone No. 94840. Contract No. 38177. Job code: P/441018/01. PFR SPTS No. 22443.

Report prepared by:

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May 2022

Report approved by:

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May 2022

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3

ATTACHMENT 3

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13 April 2022

Anita Anderson
Mitchell Daysh
Anita.Anderson@mitchelldaysh.co.nz

Re: Response to s92 request for further information related to the Aquatic Ecology component of Ravensdown consent application

Dear Anita

Please find below my response to questions raised by Dr Shane Kelly (representing the Hawke's Bay Regional Council) relating to aquatic ecology. Please note that I have repeated the questions verbatim. The numbering has been taken from the Hawke's Bay Regional Council request for further information letter dated 3 March 2022.

Q16. Please provide assessment on the effects of wind-blown material from the site on water quality in surrounding waterways, particularly those above the pump station.

I have assumed that "wind-blown" material refers to dust and similar materials located on the surface of the facility, rather than via the Manufacturing Plant Stack. I am not aware of any monitoring that has been undertaken specifically to address wind-blown contamination reaching adjacent waterways. However, the water quality monitoring programme undertaken by Ravensdown includes sites adjacent to (as well as upstream and downstream) of the Ravensdown facility. As part of its discharge consent, Ravensdown collects monthly water quality samples from sites upstream and downstream of the discharge point to characterise ambient receiving environment water quality. These samples are analysed for nutrients, metals/metalloids and a range of other physico-chemical parameters. Six-monthly (summer and winter) rainfall-event related samples are also required to be collected and analysed for a similar suite of parameters. It is my opinion that this monitoring would detect contamination associated with wind-blown material.

I also note that dispersion modelling has shown that the planned new Manufacturing Plant stack and proposed reduction in maximum fluoride emission rates will lead to a reduction in fluoride ground levels (Mitchell Daysh, 2021).

Finally, I note that various dust suppression and dust control measures are proposed as part of Ravensdown Napier Works Source Control Management Plan (Torrens & Caley, 2021). This is one of a suite of actions proposed to eliminate or minimise fugitive emissions to the local air shed environment. This would presumably have flow-on benefits to aquatic receiving environments.

Q17. Please provide the implications for the assessment of water quality and ecological effects below the pump station, if wind-blown material is adversely affecting upstream waterways (noting that the assessment highlights that it is difficult to determine the relative contribution of the discharge to downstream effects when significant upstream sources are also evident).

As stated in Q16, it is my opinion that the current Ravensdown monitoring programme would detect any effects of wind blown material, including consequences for the downstream receiving environment. Therefore, I consider that the conclusions of effects described in the Ecological Effects report would remain unchanged.

Q18. Please provide assessment of the potential for, and significance of, adverse ecological effects arising from the combined effects of multiple contaminants.

The current discharge is comprised of multiple contaminants, including contaminants expected from stormwater (such as metals and metalloids), as well as those potentially arising through processes undertaken on site. Some of these contaminants can be readily measured and compared against standards (e.g. ANZ (2018) guidelines). Others (such as most process chemicals) are not routinely measured and therefore effects are assessed using a risk assessment approach (section 4.4 of our effects report, Phillips et al. 2021a). The potential effects of these multiple contaminants are assessed by undertaking Whole Effluent Toxicity (WET) testing of the discharge. As these contaminants are co-occurring and interacting in the discharge, the WET testing can be considered to represent a "real world" assessment of the effects of the discharge as a whole. Standard test organisms and procedures are used, reflecting different types of organisms likely to be found in the receiving environment. WET testing results for 2011, 2015, 2019 and 2020 consistently indicate that the discharge would not cause significant ecotoxic adverse effects to organisms in the receiving environment once diluted 1:100. The improved discharge quality resulting from the proposed treatment system is likely to further reduce any effects.

Q19. Please provide commentary on whether conclusions about ecological effects would change, if it was confirmed that Spectrus BD1500 does bioaccumulate.

Since completing our report, we have identified additional information on Spectrus BD1500. Specifically, we located a further four Safety Data Sheets (SDS), three of which state that BD1 is polymeric. Based on this characteristic, it would not be bioavailable and not expected to bioaccumulate. The fourth SDS provided a bioaccumulation concentration factor (BCF) of <1, which is orders of magnitude below the BCF threshold of 1,000 used in our assessment (and

which is derived from USEPA). Therefore, these data consistently show that bioaccumulation of Spectrus BD1500 is not expected. Potential effects are no longer expected to be more than minor, and are instead likely to be negligible, as the potential for effects we initially identified related to uncertainty as to bioaccumulation potential.

Q20. Please provide commentary on the potential exceedances of proposed water quality standards were derived from predictions of discharge quality at Stages 1 to 3, and dilution estimates for high and low tides. Is it reasonable to assume that for those parameters predicted to exceed proposed standards at each Stage, that the exceedances will occur every time the discharge occurs? If not, how frequent are exceedances expected to be?

Ravensdown Napier have proposed a discharge strategy (Mitchell Daysh, 2021), such that discharge to land via spray irrigation would be the first option. Discharge to the Ravensdown Drain or Habitat Abundance Restoration Area (HARP) within 3 hours of high tide would be the alternative option when discharge to land was not permitted. Discharge to the Ravensdown Drain or HARP irrespective of tidal state would only be considered as a last resort. It is not possible to determine the frequency with which each of the three options would occur. However, any exceedance of guidelines would only occur through discharge to the estuary, which would occur at times when there is significant rainfall (and hence dilution) and which may mitigate any exceedances. In addition, the preference for discharge to land significantly reduces the frequency at which such exceedances could occur.

Q21. Please correct the macrofaunal results presented in the Phillips et al. reports and provide updates.

I have provided an updated report section in Appendix 1. The changes include an updated graph and accompanying text, which is based on corrections to the Boffa Miskell (2019) report made by Boffa Miskell following errors identified by Dr Kelly during his review. I note that the conclusions in the revised report (Boffa Miskell, 2022) have not changed as a consequence of these revisions.

As this information only relates to background information the changes do not affect the assessment of effects or overall conclusions in our effects report.

Q22. The absence of recommended conditions that require the continuation of existing receiving environment monitoring, with the addition of chlorophyll-a and water clarity measurements, and potentially, including the evaluation of the fish IBI. Please suggest appropriate consent conditions.

The recommended changes in our report were related to the 5 yearly monitoring programme that was a requirement of the current discharge consent. As this monitoring programme has not been proposed for the new consent, the consent conditions we proposed are no longer relevant. It should be noted however that the discharge to the estuary will occur primarily via the HARP (Habitat Abundance Restoration Area), an area of wetland that will be rehabilitated as part of the proposed consent conditions. This will thus become the relevant receiving environment for monitoring purposes.

It also is worth noting that the challenge with monitoring in this environment is that there are multiple upstream contributors to water quality in the receiving environment downstream of Ravensdown's discharge and Ravensdown is just one of these contributors. What's more, Ravensdown will become an increasingly small contributor as a consequence of the proposed treatment system. The overall receiving environment monitoring is better suited to being coordinated with HBRC's 5 yearly State of the Environment reporting on the wider catchment state. Ravensdown has proposed to greatly improve water quality, with this being reflected in the future state discharge limits proposed and will also reduce the quantity being discharged to the Tutaekuri River. Monitoring of the HARP wetland, where the influence of Ravensdown's periodic discharge will be able to be separately identified, is considered to be more appropriate, as is proposed in the Adaptive Management Plan (Torrens 2021).

Yours sincerely

Dr Ngaire Phillips
Director/Aquatic Ecology & Ecotoxicology Specialist

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Appendix 1

Updated section of Phillips et al. (2021a) incorporating changes in the revised Boffa Miskell (2019) report (Boffa Miskell, 2022).

4. Description of the receiving environment and effects of existing discharge

4.6 Marine Ecology of the receiving environment

4.6.1 General introduction

The marine/estuarine receiving environment has received historical discharges from various land use activities and continues to receive a range of discharges (including discharges from Ravensdown activities) that compromise the marine/estuarine ecological values. These discharges and modifications to the receiving environment have likely contributed, in a cumulative manner, to the existing ecological values.

4.6.2 Previous studies

Boffa Miskell, 2019, updated 2022

As part of ecological surveys undertaken for Death & Ekelund (2019), Boffa Miskell (2022) reported on macrofaunal sampling undertaken in March 2019 and compared these results with two previous surveys undertaken in 2011 and 2015. They found significant differences in the macrobenthic assemblages between 2011 and 2019 (**Figure 14**). High variability in benthic assemblages (whilst dominated by pollution tolerant species at all sites) was detected over time.

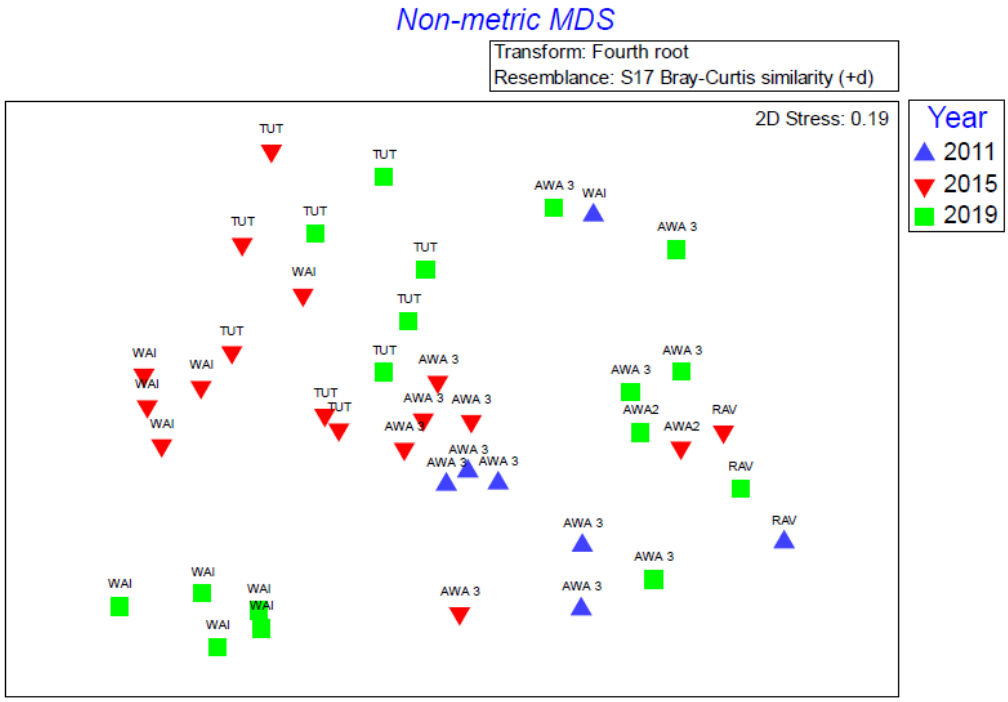

Figure 1. nMDS plot of benthic macroinvertebrate assemblage at samples sites on 3 sampling occasions. Source: Boffa Miskell (2019).

Boffa Miskell (2019) noted that there had been a reduction in the number of taxa and abundance over time, with a similar trend being observed at the distant impact site TUT. In contrast, other measures of diversity at these sites had not decreased. They also noted that the reference site WAI had no significant changes in summary indices over time, other than increases in the number of taxa and abundance of total benthic invertebrates. The authors concluded that species assemblages within the impact and distant impact sites (AWA3 and TUT) are typical of upper estuarine environments that naturally reciee higher concentrations of fine sediment and freshwater runoff. On this basis they concluded that it was likely that the natural habitat differences between sites within the estuary was the main driving factor in differences in species assemblages observed between sites.

These results as a whole do not appear to indicate degradation in ecosystem health between sites or over time (throughout the sample period between 2011 and 2019), resulting from impacts associated with stormwater and process water discharges. Spatial and temporal changes that have occurred appear to be as a result of natural variation over time and natural habitat differences within the estuary.

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ATTACHMENT 4

Ravensdown

ravensdown

Memorandum

To: **Anita Anderson**

From: **Andrew Torrens**

Date: **10 May 2022**

Subject: **Response to HBRC Further Information Request**

Ravensdown's responses to the Hawke's Bay Regional Council further information request (dated 3 March 2022) are detailed below using the numbering in their letter.

23. *Please provide the basis for the proposed unionised ammonia-N standard, including how it is going to be measured and how measurements are going to be standardised to pH 8 and 20 °C. Consideration should be given to whether it would be preferable to base the standard on total ammoniacal-N (NH_3-NH_4^+-N), which is typically measured and easily interpreted. Please provide comments on this matter.*

    Ravensdown Response

    Ravensdown requested information on unionised ammonia-N from Analytical Research Laboratories Limited who have advised that there is no reference method to directly test for unionised ammonia-N. Therefore, Ravensdown propose testing for total ammoniacal-N and using the accepted empirical relationship[1] to determine the unionised fraction. As described in the reference, the fraction of unionised ammonia-N (f) can be determined by the equation,

    $$f = 1/(10^{pKa-pH} + 1)$$

    where $pKa = 0.09018 + 2727.92/T$

    This relationship between unionised and total ammoniacal-N holds true for the temperature range 0-50°C.

24. *Please confirm if backflow prevention devices are already installed and maintained and provide commentary from a suitably qualified and experienced person on the risk of contaminants entering groundwater via the on-site bores, i.e.*

    - *headworks are constructed and maintained to prevent any leakage and/or movement of water or contaminants between the ground surface and groundwater and that there are no openings through which contaminants might enter the well.*
    - *gaps around any pipework and/or cables at the wellhead.*

    Ravensdown Response

    Ravensdown can confirm that swing check backflow prevention devices are installed. Bore Head Inspection reports for both bores were completed by WaterForce on 12 April 2019 (attached), concluding that the head works construction was compliant and that the bore head protection was secure.

[1] EMERSON, K.; RUSSO, R.C.; LUND, R.E. et al. *Aqueous ammonia equilibrium calculations: Effect of pH and temperature.* Journal of Fisheries Research Board of Canada, v.32, p.2379-2383, 1975

39. *Ravensdown Planning Assessment (A9, Page 8) states:*

"The Napier City Council ("NCC") sewerage system does not extend to the Napier Works. Five onsite wastewater treatment devices (septic tanks) are used for the collection and treatment of wastewater from amenities (cafeteria, showers, toilets, laboratory)."

It is understood from the site visit that the septic tanks are currently pumped out to trucks and the wastewater is disposed at the NCC municipal wastewater treatment plant. The future plan is for the amenities (cafeteria, showers, toilets and laboratory) wastewater to be piped to the NCC municipal wastewater treatment plant. Please confirm that the above is correct along with the expected timeframe for start dates and completion of the pipe connection.

Ravensdown Response

Ravensdown can confirm that this is correct. Ravensdown are currently working on a project to have a pumped waste connection with the NCC treatment plant. Ravensdown wish to complete the project as soon as practical. We are currently negotiating with other landowners a pathway to the connection point.

40. *In Section 5.2 Structural site improvements, this list does not appear to be complete, as some of the roof and roller door items discussed elsewhere are not included and in the Management Plans. Please confirm which list of improvements is most current.*

Ravensdown Response

Section 5.2 of R2 (Worley/JESA Manufacture Plant Process Report) discusses particulate emissions from grinding mills. Ravensdown have installed and commissioned electrostatic sensors on all four mills. The Source Control Management Plan (November 2021) provides the most up to date site improvement action schedule for the Napier Works (Section 8).

76. *It is unclear if the area between Superstore 1 and the Manufacture Plant (refer to Figure 1 & 2 in review memo) is covered under the action schedule so this needs to be clarified. Please confirm that this area is covered in the action schedule.*

Ravensdown Response

The area between Superstore 1 and the Manufacture Plant has been included. This area has been noted as "Between Despatch 1 and Manufacturing". There are two actions for this area, both high priority.

77. *Please include additional information in the action table that describes how the actions are prioritised, including for example; risk or discharge, cost, and impact of change.*

Ravensdown Response

Section 5 of the SCMP discusses prioritisation of the actions presented in Section 8. The conditions applied to each action were:

- The risk of contamination of stormwater, or fugitive airborne release.
- The resulting impact on water or air quality.
- The estimated cost of completion.
- The estimated time required for completion.

Professional opinion and experience were applied to the conditions to determine the priority given to each action.

The SCMP is a living document, and therefore the actions and their priority may change therefore a revised Table 1 has not been provided.

78. *Please amend diagram on page 6 and Figure 1 (more labels and feedback loops - see review memo). This can be provided now or later as evidence.*

Ravensdown Response

Figure 1 is labelled as a schematic representation. The intention is to provide a high level, simplistic overview of the vision for Ravensdown's water discharge. Similarly, the diagram on page 6 is intended to convey the intention of the adaptive management process. We believe both figures are fit for purpose when read in context as presented.

79. *Please add source control measures to Table 1.*

Ravensdown Response

Table 1 states "Completion of actions detailed in the Source Control Management Plan" for each of the six years presented. The SCMP is a living document, and therefore the actions and their priority may change therefore a revised Table 1 has not been provided.

80. *Please include establishment of a source control baseline through monitoring in Year One of Table 1.*

Ravensdown Response

Ravensdown have stated we will monitor and report on the discharge and the receiving environment. Ravensdown have committed to the implementation of a treatment system that will achieve standards set out in the proposed consent conditions. The contaminant loading being discharged into the treatment train is the responsibility of Ravensdown and not subject to the discharge standards therefore requested revision to Table 1 has not been provided.

CONDITIONS:

Discharge to Air, Condition 5: The consent holder shall ensure regular sweeping of yard and road areas using mechanical cleaning to minimise emissions of dust beyond the boundary of the site.

During the site visit we are advised by Andrew Torrens (Ravensdown) that the mechanical mobile sweepers have had clogging issues and were not operating. Please provide commentary on this issue, what will change going forward, and the proposed consent condition.

Ravensdown Response

Proposed Condition 5 will be captured by the Source Control Management Plan which includes an action to create a thorough standard operating procedure for routine sweeping of all hardstand surfaces. It is noted that mechanical sweepers are not used during rainfall events, or on freshly manufactured products, due to the moist product adhering to the sweeper bristles. Completion of actions from the Source Control Management Plan will reduce the volume of water on hardstand surfaces and areas effected, therefore improving the efficacy of mechanical sweeping.

Bore Head Inspection Report

Hawkes Bay Regional Council has received this Bore Head Inspection report from the following contractor.

Inspection Details

Inspection Contractor: WaterForce

Inspection Date: 12/04/2019 01:30 p.m.

Bore Owner: Ravensdown

Bore Address: 808 Waitangi Road, Awatoto, Hawkes Bay

Customer Email: Helen.Hurring@ravensdown.co.nz

Consent Number: AUTH-116104-03

Bore Number: 15989

GPS Easting: -39.556626

GPS Northing: 176.922242

Inspection Items

Inspection Item	Answer	Comment
Flange gaskets in place and in good condition	Yes	No signs of leaking.
Top plate cable glands in place and in good condition	Yes	No cables go into bores.
Other top plate penetrations sealed and secure. Are all flange bolts installed.	Yes	Missing bolts added.
Welded connections in good condition	Yes	Some surface rust.
Surface coating of all pipe work in good condition	Yes	Some surface rust.
Tamper tags in place (where applicable	Yes	As per watermeter verification.

Pipework supports in place (where required)	Yes	
Is there protection of the groundwater resource from surface contamination? Hawkes Bay Regional Council requires ALL bores to have either a concrete apron or other impervious material like Bentonite to seal between the bore casing and the surrounding ground. Is there any visible concrete apron or seal?	Yes	These two bores are flowing artesian wells, positive head. Height above ground (mm) Level to top of casing: 200.00
Backflow prevention device installed	Yes	Installed on outlets of pumps. This is where all water from both bores goes first, then throughout factory. What type of device is installed? Swing check

Overall

WaterForce confirm that Bore No: 15989 has been inspected by a suitably qualified service technician and deemed the following:

Head Works Construction: Compliant

Bore Head Protection Above And At Ground Level: Secure

IMPORTANT NOTE: If your bore head works and or bore head protection is shown to be compliant and secure on this report, this only relates to your Hawkes Bay Regional Council consent conditions.

This does not mean your bore is of potable quality nor compliant and secure in regards to the Drinking-water Standards for New Zealand 2005 (Revised 2018) and or the New Zealand Building Code - Clause G12 Water Supplies.

Overall Comments

(must include any potential contamination issues that might arise due to the location of the bore eg spray sheds, septic tanks, animals)

This is for the southern bore. Both very similar.
Acid tanks nearby. But low risk.
150m from sea.

HBRC Note:
Historic consent number: WP060639Tb
New consent number: AUTH-116104-03

Inspected By: Tim Ireland

Close up of Bore:

Photo taken approximately 10m away showing bore and surrounding area

Bore Head Inspection Report

Hawkes Bay Regional Council has received this Bore Head Inspection report from the following contractor.

Inspection Details

Inspection Contractor: WaterForce

Inspection Date: 12/04/2019 01:30 p.m.

Bore Owner: Ravensdown

Bore Address: 808 Waitangi Road, Awatoto, Hawkes Bay

Customer Email: Helen.Hurring@ravensdown.co.nz

Consent Number: AUTH-116104-03

Bore Number: 15986

GPS Easting: -39.556626

GPS Northing: 176.922242

Inspection Items

Inspection Item	Answer	Comment
Flange gaskets in place and in good condition	Yes	No signs of leaking.
Top plate cable glands in place and in good condition	Yes	No cables go into bores.
Other top plate penetrations sealed and secure. Are all flange bolts installed.	Yes	Missing bolts added.
Welded connections in good condition	Yes	Some surface rust.
Surface coating of all pipe work in good condition	Yes	Some surface rust.
Tamper tags in place (where applicable	Yes	As per watermeter verification.

Pipework supports in place (where required)	Yes	
Is there protection of the groundwater resource from surface contamination? Hawkes Bay Regional Council requires ALL bores to have either a concrete apron or other impervious material like Bentonite to seal between the bore casing and the surrounding ground. Is there any visible concrete apron or seal?	Yes	These two bores are flowing artesian wells, positive head. Height above ground (mm) Level to top of casing: 200.00
Backflow prevention device installed	Yes	Installed on outlets of pumps. This is where all water from both bores goes first, then throughout factory. What type of device is installed? Swing check valve.

Overall

WaterForce confirm that Bore No: 15986 has been inspected by a suitably qualified service technician and deemed the following:

Head Works Construction: Compliant

Bore Head Protection Above And At Ground Level: Secure

IMPORTANT NOTE: If your bore head works and or bore head protection is shown to be compliant and secure on this report, this only relates to your Hawkes Bay Regional Council consent conditions.

This does not mean your bore is of potable quality nor compliant and secure in regards to the Drinking-water Standards for New Zealand 2005 (Revised 2018) and or the New Zealand Building Code - Clause G12 Water Supplies.

Overall Comments

(must include any potential contamination issues that might arise due to the location of the bore eg spray sheds, septic tanks, animals)

This is for the northern bore. Both very similar.
Acid tanks nearby. But low risk.
150m from sea.

HBRC Note:
Historic consent number: WP060639Tb
New consent number: AUTH-116104-03

Inspected By: Tim Ireland

Close up of Bore:

Photo taken approximately 10m away showing bore and surrounding area

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ATTACHMENT 5

Aurecon

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Memorandum

To	**Helen Hurring, Andrew Torrens**	From	**David Delagarza**
Copy	**Stephen Daysh, Anita Anderson**	Reference	**509619**
Date	**2022-05-18**	Pages (including this page)	**5**
Subject	**Ravensdown Water Discharge Consent - Section 92 Responses**		

This Memo is intended to respond to relevant stormwater comments received from HBRC as part of Section 92 information request for the water discharge consent at the Ravensdown Napier site.

As previously agreed following your discussions with the HBRC staff, we are not providing individual responses to the comments in the Water Discharge High Level Options Assessment review. It is noted that this document details the process that was undertaken for the purposes of identifying the most suitable treatment and discharge solutions for the site. Throughout the options assessment process, the project team understood that a combination of options would likely be required. However, there are numerous potential iterations of treatment and discharge options. As such, the initial options assessment focused determining the best treatment and discharge options by assessing each option individually for the site against common inflow parameters. This approach allowed for weighing each option on its own, independent of other potential components. Once the initial options analysis identified the most applicable options, the design was progressed to include the combination of options in the final design.

One point of clarification is surrounding the relative contribution from process water versus stormwater to the overall water discharge. There were several comments relating to individual waste streams, which generally appear to be directed at process water inputs. While there are some process water inputs to the water discharge, these are all located within the acid plant area, and do not contain any of the primary contaminants of concern (i.e. nutrients, fluoride, and heavy metals). All of the contaminants of concern originate from the north side of the site, where there are no process water discharges. As these inputs occur from stormwater-only discharges through multiple catchpits and stormwater lines throughout the site, there are limited opportunities to address individual waste streams.

Specific responses to individual comments in other documents are outlined below using the numbering in the HBRC request for further information letter dated 3 March 2022:

#	Comment	Engineer Response
Assessment of Environmental Effects		
25.	The water balance model results are summarised in Table 12. Please provide the data to support these statements about capture and bypasses.	The volumetric outputs for the MUSIC model have been appended to the end of this memo.;

26.	[regarding conceptual wetland detail] We note that this detail can be included in the future and could be part of consent conditions and that solids carry through may be minimal due to the treatment train (with a bioreactor and clarifier etc). How will contaminated sediment accumulation and wetland vegetation be managed at the Stage 2 wetland? Note that wetlands typically need vehicle access around the full perimeter for maintenance - will this be included?	All inflow to the wetlands will be routed through the settling basin, which will minimise the amount of sediment entering the wetlands. All wetlands require ongoing maintenance and renewal, and there will be a programme to maintain the wetlands. The wetlands will be designed per common design guidelines, to include access and means for removal of sediment. Removal of accumulated solids, including discharge to an appropriate location, will be included in the maintenance plan and the design will allow for means of access.
27.	AEE - Appendix A, drawing 509619-0000-DRG-CC-1002-C has a label: 'Proposed Irrigation Apparatus (By Others)'. Please confirm what "By Other's" means.	The detailed design of this irrigation system will be completed by a specialist irrigation designer.
R6: WATER DISCHARGE STRATEGY		
64.	Please confirm if the minor depressions noted above are at the lower point of the catchment and intended to direct contaminated stormwater flows towards the Neutralising Pit.	It is unclear where the reference to the depressions is. Ultimately, all stormwater originating from the site will be discharged through the stormwater system and treated in the treatment train.
65.	Please confirm how bunded areas in the Acid Plant South catchment are drained and discharged to.	All bunded areas in the acid plant, including those in the southern section of the plant, are drained and discharged through the neutralising pit.
66.	What data is available on the volumes of water that are reused on site?	No records are available regarding the historic amount of water reused on the site.
67.	Will the proposed treatment and management strategy remove the need to dilute wastewater prior to discharge?	Initially, we propose to continue applying dilution water to achieve the best possible outcomes inside the Waitangi Regional Park.. In the longer term, the system design will allow for removing the need to applying dilution water, except as needed to maintain wetland water levels and provide irrigation flows.

68.	Why has sampling of contaminant sources not been undertaken prior to the option assessment work and application. As noted in the report, Adaptive Management Plans are appropriate where there are unknowns in a scheme, but this is only unknown because data has not been collected. Collection of source contaminant data is not an onerous task, and would be expected to demonstrate a suitable option evaluation and selection of BPO for a long term discharge consent.	As noted in the introduction to this memo, there are no process water inputs that contribute significant levels of the contaminants of concern to the water – these inputs originate from stormwater inputs. Significant sampling of the stormwater system has been undertaken and has been used throughout the development of the options. However, the results from the sampling have shown that contaminant levels vary widely from sample to sample and contaminants can occur in unexpected locations. As such, a critical factor for the overall success will be the implementation of source control measures. Once these measures have been implemented, ongoing sampling will be needed to determine how effective they have been and what further treatment may be needed. Multiple sample points have been included in the proposed design to allow for ease of routine sampling. There is variability in the efficacy in stormwater treatment systems, especially those which are biologically-based, including the proposed bioretention basin and wetland. As such, the adaptive management strategy is intended to allow for the completed treatment train to be designed, engineered and maintained to meet the required discharge water quality as needed.
69.	Assessing the impact of operational changes should not be limited to treatment upgrades. Given the importance of source control for this scheme, sampling and monitoring should also include untreated waste streams to demonstrate improved source control over time. Please confirm if this is intended for the sampling and monitoring programme.	Ongoing sampling and monitoring is an important element of the adaptive management approach. Sampling points have been specified/detailed up and downstream of treatment devices. This will allow Ravensdown to assess the effect of the SCMP actions and the efficiency of treatment devices.
70.	Where will this process water be reused?	Water is primarily returned to the manufacturing process, primarily through the scrubbers as make up water.
71.	How much has been calculated as reusable?	The overall water balance on the site depends on the day to day industrial operations and rainfall. Except where heavily contaminated with nitrogen, all water may be reused.
72.	Will the inhibitors, fouling agents, and biocides used in the process water be detrimental to reuse opportunities?	No. Nitrogen contamination is the only issue.
73.	The cooling system is mentioned above. Is there also discharge of process water from the boiler system?	Yes. There is a negligible amount of blow down from the boiler.

74.	Why is the discharge from the truck wash not covered in the process water group, when it is clearly not stormwater?	There are two truck washes that input water to the site – one within the Sandfords site, and one within the Ravensdown site. At the Sandfords site, Ravensdown is currently working with Sandfords to eliminate the discharge of contaminants from their truck wash to the stormwater system. From Ravensdown's site, the contaminants from the truck wash are functionally similar to those within stormwater from the site (i.e. nutrients and heavy metals) and therefore are to be treated using the same approach as the rest of the site. All water from the truck wash will be routed through the proposed clarifier.

David Delagarza

Lead Engineer – Water

Aurecon

Appendix A – Output from the MUSIC water balance model

Device	Mean Annual Values					Rain Events in period of record (15 years)		
	Total Inflow (ML)	ET Loss (ML)	Pipe Out (ML)	Weir Bypass (ML)	Efficiency (%)	Number of days with overflow	Total days with Rain	% of rain events captured
Bioretention basin	15.37	0.66	13.89	0.81	94.7%	35	1538	97.7%
Holding pond	14.29	0.36	13.56	0.37	97.4%	3	1538	99.8%
Detention basin	56.92	0.7	52.65	3.59	93.7%	19	1538	98.8%
Wetland	56.24	2.72	49.68	3.85	93.2%	20	1538	98.7%

6

ATTACHMENT 6

LandVision HB

memo

LandVision

To: Anita Anderson, Mitchell Daysh

From: Ian Millner, Land Vision

Date: 10/05/2022

Re: Ravensdown Ltd - Further information response

Please find below my response to the Hawke's Bay Regional Council further information request in relation to the land discharge component of the Ravensdown resource consent applications. The questions are repeated in full below using the numbering in the request for further information letter dated 3 March 2022.

Q28 - The Executive Summary should be revised or an appropriate response (as per S92 RMA) to ensure clear summary statements are made about whether contaminant risks are likely to be present or absent based on a conceptual site model which requires there to a be linkage of source pathway and receptor relationship and where such a potential contaminant risk linkage has been identified, estimated concentrations of contaminants are then compared against national guidelines.

The land discharge report assessed potential effects relating to:

- The loss or potential loss of applied contaminants to the confined aquifer.
- The capacity within the site to effectively manage stormwater applications in a manner that accommodates the volumes expected from the treatment process.
- Whether the site has any inherent characteristics that would deem it unsuitable for the proposed activity.

In summary the report found:

- The soils on site are suitable for irrigation of stormwater.
- The soils on site are well suited to the adhering of contaminates and have significant capacity to do so.
- The site sits on top of sedimentary layers that impede the loss of drainage water from the site to the confined aquifer. Water applied to the site will either be transpired by plants on site, evaporated directly off the site or drain (over time) via surface and subsurface flow into the surrounding drainage network and HBRC pumping station.
- There is a set of standard management and monitoring methods that can effectively manage risk relating to contaminant loads and losses that can effectively guide an adaptive management approach.
- The closest potable supply wells include two NCC municipal supply Well Nos. 5913 and 16352, approximately 1.6 and 1.7 km NNW from the northern boundary of the proposed irrigation area.

The wells are screened greater than 74.00 and 110.97 m depth, respectively across the deep confined gravel aquifer. There are four wells within 1200 m of the site that hold resource consents for activities involving abstraction of potable water, including water bottling, with records showing three of the bores are screened across the deep confined gravel aquifer.

Therefore, it is concluded that the discharge of treated process water stormwater to land, based on analysis of soil chemistry, geology (including depth to confined aquifer), and agricultural systems, will have no effect on the current condition of the source protection zone. This is because the annual additions of contaminants in the treated irrigation water are quantitatively small and will either be bound tightly to soil colloids on site or taken up and removed in the harvested forage and the site sits over a thick layer of low permeability sediments.

Q29 - The Monitoring and Reporting section should be revised (or an appropriate response (as per S92 RMA)) to include a section on how baseline chemical analysis of the discharge water at Stage 1 and 2 will be used to adjust the proposed monitoring programme to match more closely the actual contaminants presence in the baseline samples.

Analysis with the discharge report is based on a conservative assumption of stage 1 concentrations. The suggested monitoring program is also therefore based on a conservative assumption that stage 1 proposed concentrations will be the default for this activity. We do not recommend altering suggested monitoring programme to accommodate stage 2 at this time.

Q30 - Please update Table 6 to include a total increased concentrations row and included the heavy metals Pb and As.

Upon review of the discharge report it appears that table numbers have become detached from table numbers in the report narrative. The units used on table 7 were reported as kg/ha when they should be mg/kg. this has been corrected. The correct sequence of tables and explanatory text is as follows.

The Stage 1 modifications are proposed to be implemented as soon as practicably possible after the grant of the new discharge permit(s), with Stage 2 improvements being implemented within five years of granting of the new discharge permit(s). The approximate loading rates of the nutrients and other elements are presented as Stage 1 and Stage 2 in Table 4.

Table 4: Estimates of annual nutrient loads and other elements (kg/ha) to the forage cropping area [reference source data table when complete]

Element	DRP	Total N	F	Al	Cu	Cd	Cr	Zn
Stage 1	6.9	18.6	7.9	0.6	0.02	0.001	0.09	0.38
Stage 2	5.3	7.5	7.9	0.25	0.01	0.0001	0.009	0.09

Due to the efficacy of the proposed treatment clarifier, the dissolved reactive phosphate (DRP) additions are estimated to be a very small ~7 kg P/ha in Stage 1 and ~5 kg P/ha in Stage 2 (Table 3) and so present no issue for the site, as the removal of P from the site in the cut and carry forage will exceed the input of P in the irrigated water (see Section 3.3 below). Similarly, N inputs will be ~19 kg/ha in Stage 1 and drop to ~8 kg/ha in Stage 2 (Table 3) and, as with P, will be removed in far greater quantity with the forage than these small inputs.

In terms of non-essential elements, the most significant addition will be F at 7.9 kg/ha annually but by way of comparison single superphosphate (SSP) contains between 120-204 g F/kg P

(Kieran Murray, personal communication) which means that at an annual addition of 330 kg SSP/ha between 3.6 and 6.1 kg F/ha would be applied onto farmland. It is well known that P fertiliser application increases soil F concentrations with long term applications (Gray 2018). While this soil accumulation creates an increased risk to grazing livestock through geophagy (soil ingestion) there is no risk to the pasture growing in those soils as plants do not take up F through their root systems.

Table 5: Estimates of total additions of fluoride and metallic elements (kg/ha) to the forage cropping area over the 35 year consent period

Element	F	Al	Cu	Cd	Cr	Zn
Stage 1	289	21.9	0.70	0.035	3.15	14
Stage 2	289	9.1	0.35	0.0035	0.315	3.15

Table 5 shows the total loading (kg/ha) over the 35 year consent period for the non-essential elements added in the spray irrigation. These loads can be converted to soil concentrations considering soil bulk density. The laboratory bulk density of the soils taken for analysis average 0.64 g/mL (range 0.54 to 0.72). Using the average laboratory bulk density this means that in a hectare to a depth of 15cm (the depth the soil samples were collected at) there is approximately 960,000 kg of soil. The total additions of the elements in Table 5 over 35 years equates to the potential increase in soil concentrations after 35 years, assuming no losses, shown in Table 6.

Table 6: Estimates of increase in concentrations of fluoride and metallic elements (mg/kg) on the forage cropping area over the 35 year consent period

Element	F	Al	Cu	Cd	Cr	Zn
Stage 1	301	22.8	0.73	0.036	3.28	14.5
Stage 2	301	9.5	0.36	0.0036	0.328	3.28

The effect of the accumulation of non-essential elements added in the discharge water (using Stage 1 levels as the worst-case scenario) shows that the soil F levels are likely to increase by a third (Table 7) while the other elements Cu, Cd, Cr and Zn show very small changes in baseline concentrations. Furthermore, the As, Cd, Cr, Cu and Pb levels are all significantly below the most protective (rural lifestyle, 25% produce) MfE soil contamination standards for health (Table 7b).

Table 7: Increase in estimated baseline soil concentrations of fluoride and metallic elements (mg/kg), using Stage 1 values, on the forage cropping area over the 35 year consent period

Element	F	Al	Cu	Cd	Cr	Zn	Pb	As
Baseline	613	nd	15.3	0.46	22.6	78.1	21.8	8.5
+35 years	904	nd	16.0	0.50	25.9	92.6	21.8	8.5

Table 7b: Ministry for the Environment soil contamination standards for health

Land Use	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium III (mg/kg)	Chromium VI (mg/kg)	Copper (mg/kg)	Lead (mg/kg)
[1]**Rural/lifestyle block** 25% produce	17	0.8	>10,000	290	>10,000	160
[2]**Residential** 10% produce	20	3	>10,000	460	>10,000	210
[3]**High-density residential** 0% produce	45	230	>10,000	1500	>10,000	500

[1] Non-urban property where 25% of resident diet is made up of home-grown produce. [2] Urban properties where 10% of resident diet is made up of fruit and vegetables grown on the property. [3] Properties with limited soil contact and no vegetable gardens.

Table 7 show there are no additions of Pb or As.

Q31 - Please revise comparisons to MfE guidelines to be against new Table 6 totals row and include MfE Guidelines in references.

As above the comparison of table 7 to 7b (MFE standards) indicates there are no issues.

Q32 – Please confirm the reference for the MfE guidelines used for Table 7.

The reference for table 7 is:

Ministry for the Environment. 2011. *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health*. Wellington: Ministry for the Environment.

Q33 – Please include sampling for all contaminants of concern and comparison to relevant guidelines for animal feed.

Estimates of predicted soil concentrations for the various contaminants were provided in Table 7 of the report (as below). These estimates are conservative as they are based on stage 1 treatment efficacy.

Table 7: Increase in estimated baseline soil concentrations of fluoride and metallic elements (kg/ha), using Stage 1 values, on the forage cropping area over the 35 year consent period

Element	F	Al	Cu	Cd	Cr	Zn	Pb	As
Baseline	613	nd	15.3	0.46	22.6	78.1	21.8	8.5
+35 years	904	nd	16.0	0.50	25.9	92.6	21.8	8.5

These values were then compared with values found in Longhurst 2004 (this paper is quoted extensively in the MFE standards above and is referenced in report) as below.

Table 9: Comparison of some elements mean soil content (mg/kg) for the site with soils throughout New Zealand

Element	As	Cd	Cu	Pb	Zn
This site	8.5	0.46	15.3	21.8	78.1
NZ	2.3-9.5	0.1-0.67	8.7-32.3	6-16	70-96

As these values represent a benchmark of heavy metal contamination across 398 sites throughout the country, they are considered a realistic yardstick of the potential for secondary effects of toxicity from the consumption of stock feed. The Longhurst paper usefully also analysed metal concentrations in forage samples from the same sites.

These are summarised as below.

Metal (mg kg^{-1})	Cu	Cd	Cr	Zn
Median for grass	11	.06	N/A	92
Interquartile range	10-12.5	.04 - .10	N/A	56 - 110

The authors consider that the continual monitoring of soil concentrations will be an effective proxy for concentrations within forage harvested on site. To confirm this, we propose to test once yearly (in the autumn) for the first two years of land discharge to ascertain those foliar concentrations are within the range described in the Longhurst paper.

As Chromium is not analysed in the Longhurst paper it is proposed the MFE standards (2011) are used as a default.

It is noted that a monitoring approach for fluoride has been recommended due to the existence of a different pathway (aerial) from that described in the land discharge and effects report.

7

ATTACHMENT 7

Bay Geological Services Ltd

Bay Geological Services Ltd.
A C Johansen
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mobile: +64 275 014 984
email: *alexandra@baygeo.co.nz*

20 April, 2022 ref BGS274-01a

Malcolm Miller
Manager Consents
Policy and Regulation Group
Hawkes Bay Regional Council
Private Bag 6006
Napier 4142

Sven Exeter
Principal Planner
Mott MacDonald Limited New Zealand

(*Consultant for HBRC*)

Dear Malcolm and Sven,

YOUR REF: APP-126684
WATER PERMIT APPLICATION FOR WELL NOS. 15986 AND 15989
RAVENSDOWN LIMITED, 200 WAITANGI ROAD, AWATOTO, NAPIER

Following your letter dated 3 March, 2022 requesting Further Information in accordance with Section 92 of the RMA (1991), we are pleased to provide a full response to Questions 34 and 37 as follows:

The Hawkes Bay Regional Council (HBRC) and Mott McDonald (MM) queries are as follows:

AEE
A4: Land Discharge Effects and Management

34. *Provide a map of the SPZs with the full site boundary including the land discharge area. The names of the SPZs and distances from or if the site is included within a SPZ should be provided in the Appendix and where relevant in existing text that refer to the SPZ, notably the Executive Summary.*

35. *Please consider and provide commentary on the revised well locations (refer Figure 10 below with recommended locations) and increase the number of sampled monitoring wells to all three wells.*

A5 Watertake Effects Assessment

37. *Please provide saltwater intrusion risk assessment.*

A. Source Protection Zone

The HBRC proposed TANK Plan Change 9 (PC9) provides maps of Source Protection Zones (SPZ) across the region. The Awatoto and Taradale SPZ's, and the Napier Water Source Protection Well sites are displayed in Figure 1 along with the approximate Project Area. The Napier SPZ's are also now discussed in Section 3.3 of the Report with a map included in Appendix B.

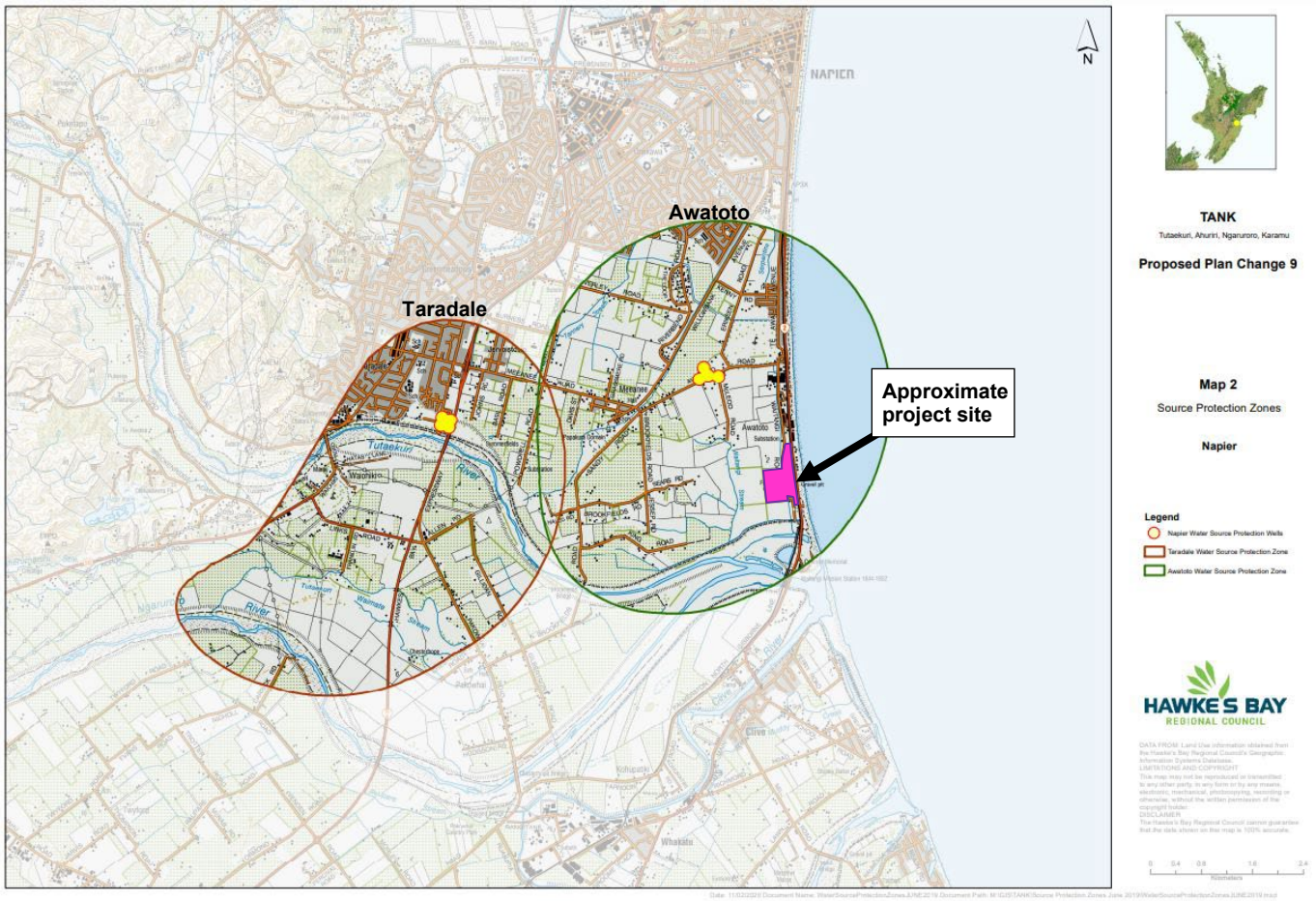

Figure 1. TANK PC9 Awatoto and Taradale SPZ map showing the Project Area (source: HBRC).

The map displayed in Figure 2 shows the Awatoto SPZ along with the Project Site boundaries and land discharge area which lies toward the southeast of the zone.

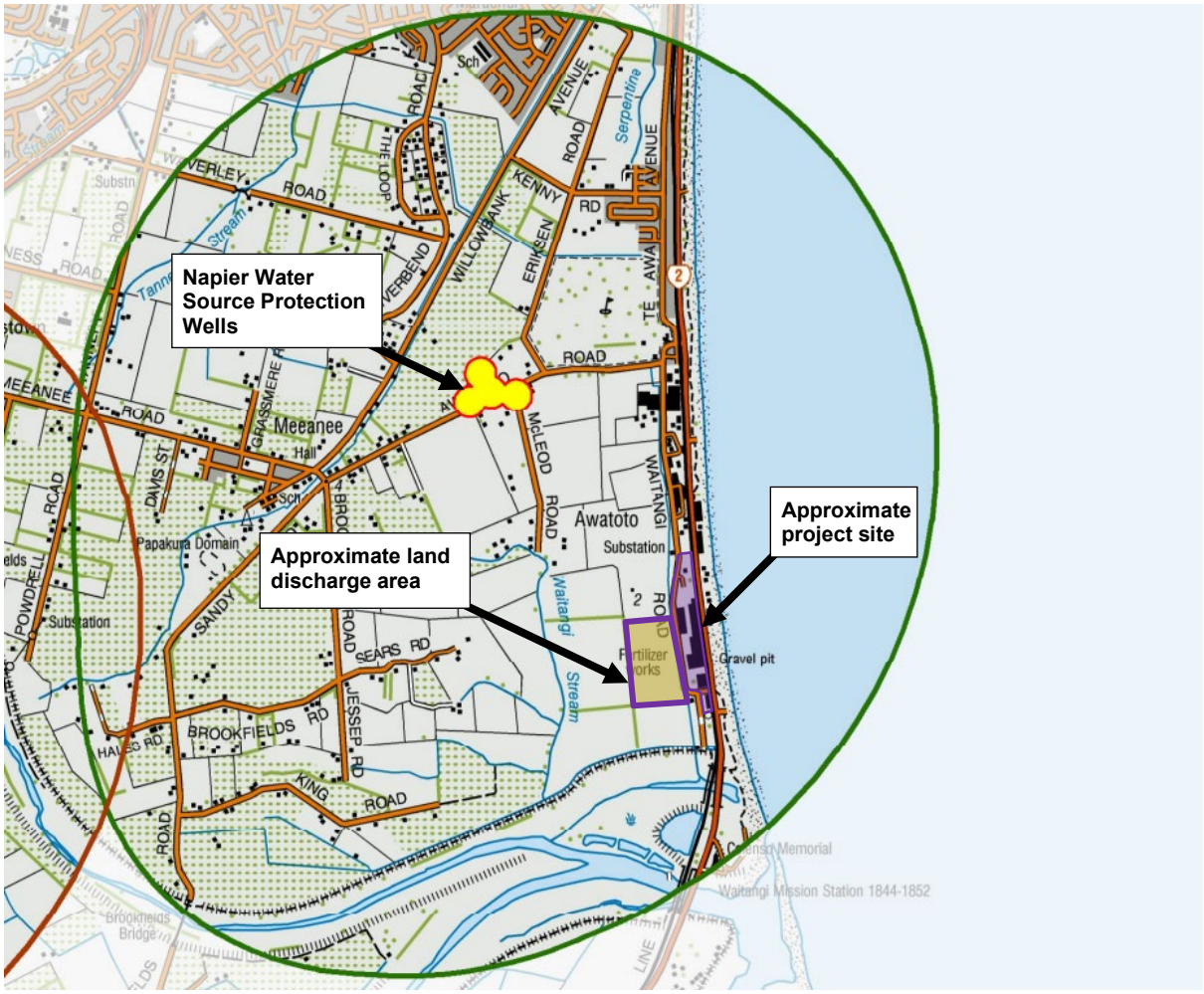

Figure 2. The Awatoto SPZ map showing the Project Area and proposed Land Discharge area (source: HBRC, Ravensdown).

B. Monitor Bore Locations

The technical reviewers assessed the intended locations of planned shallow Monitor Bores located across the planned land discharge, and suggested an additional Monitor Bore and alternative locations for two monitoring bores. The addition of a third shallow monitoring bore serves to increase opportunities to both intercept potential contaminants and also provide a hydraulically upgradient sampling site from which to obtain a baseline.

However, as indicated in the Hydrogeological Assessment (Bay Geological Services Ltd, 2021), the hydraulic gradient of the near-surface groundwater is unknown, but is predicted to be influenced by topography rather than reflect the hydraulic gradient of the deeper (>50 m below ground level (bgl)) aquifer. The Hydrogeological Assessment proposed that three monitor bores be drilled across the site to map groundwater contours in the unconfined aquifer and establish the groundwater flow direction in conjunction with water level data from the BioRich monitor bores.

The locations for the Monitor Bores as proposed by MM are generally accepted, but it is suggested that two of the proposed Monitor Bores are drilled to establish the hydraulic gradient (using the Biorich data) prior to the remaining Monitor Bore being drilled.

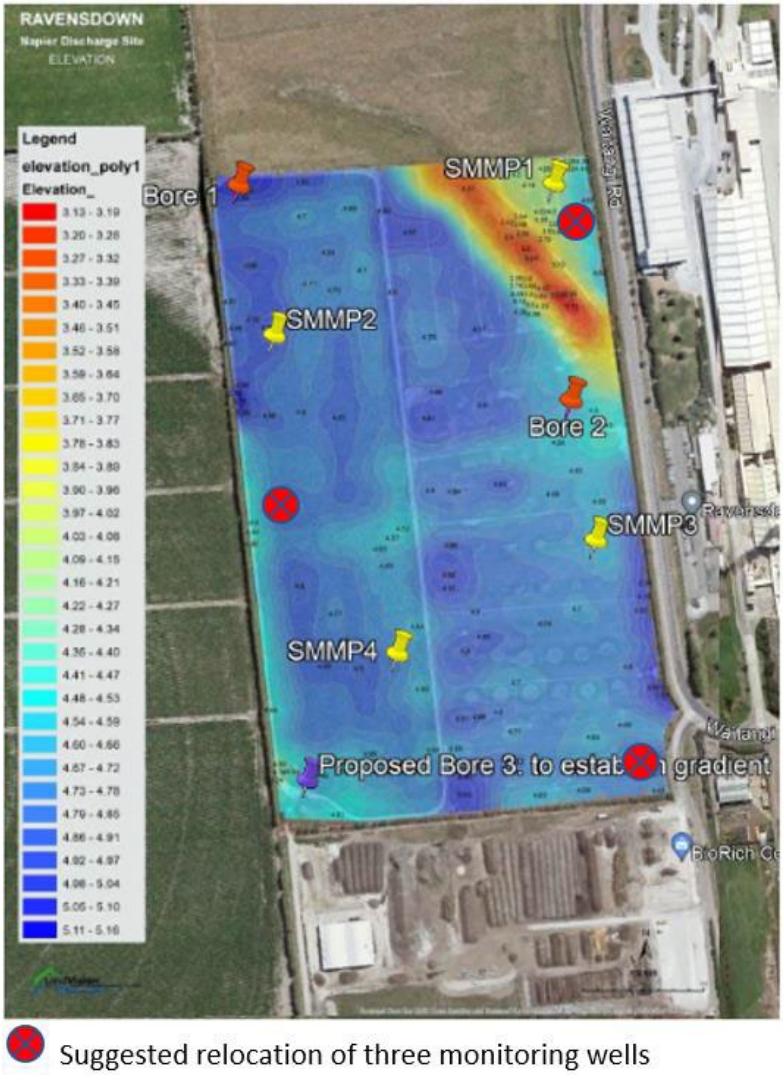

Figure 10: proposed soil moisture monitoring points(SMMP) and Proposed monitoring bores imposed on an elevation map of discharge site

Figure 3. Proposed Monitor Well Locations as suggested by Mott McDonald.

C. Saltwater Intrusion

The HBRC/MM review of the Application has highlighted that it does not address the possible landward migration of seawater as a result of pumping the two existing 150 mm diam. Applicant Well Nos. 15986 and 15989 at a combined rate not to exceed 80 l/s.

A client report for HBRC completed by PDP (2014) reviews the effect of tides on groundwater wells along the Hawkes Bay coastline. An approximate 12-hourly sinuous response is typically noted in pump test data collected from coastal bores, and the PDP (2014) study deduced that measurable groundwater fluctuation as a result of tidal flux is observed at approximately 6 km from the coast (refer Figure 1). The Applicant's Production Wells are located approximately 100 m west of the Mean High-Water Springs (MHWS), and when applying the tidal effect contours determined by PDP (2014), an effect of >0.6 m and inferred as <1.0 m is predicted as a response to tidal flux within the vicinity of the site.

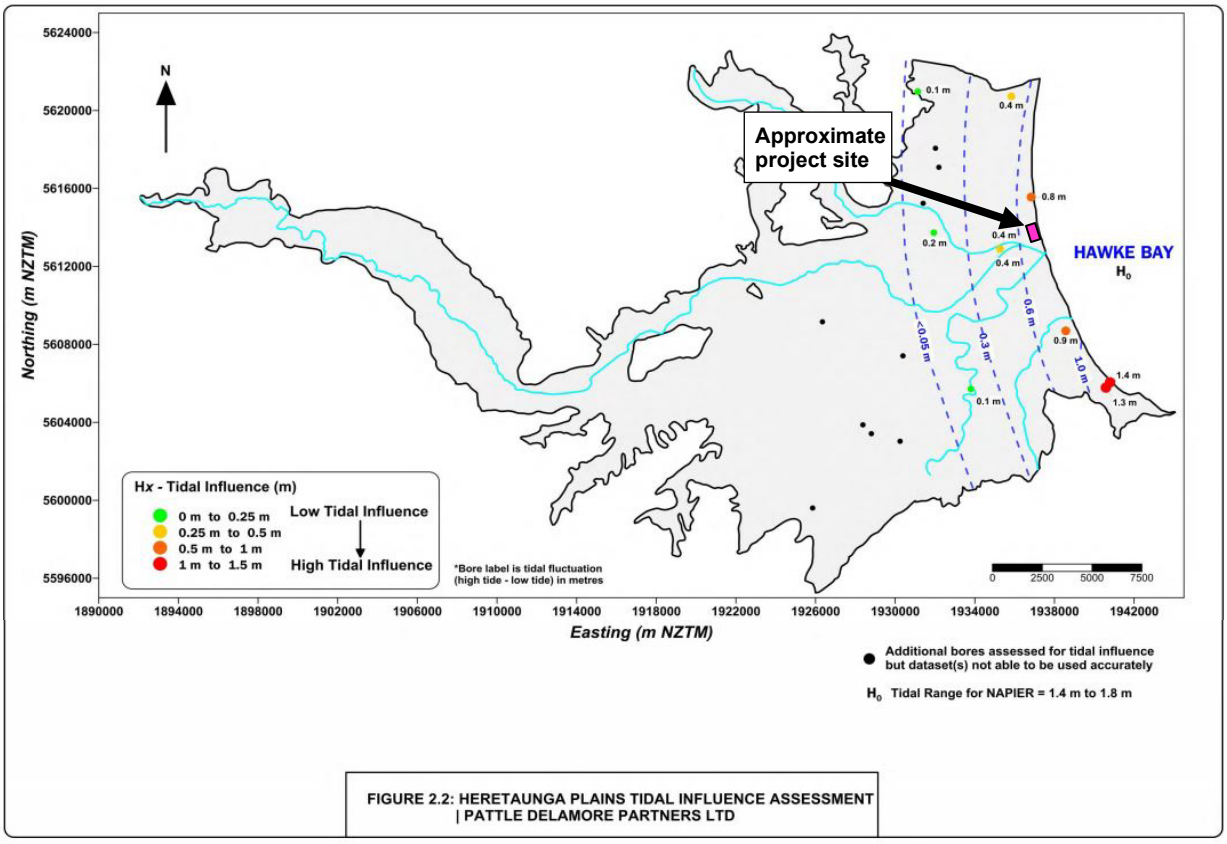

Figure 4. Tidal Influence Assessment across the Heretaunga Plains showing Project Site (PDP, 2014)

An HBRC report by Rakowski and Knowling (2018) discussed the uncertainty regarding whether the freshwater aquifer is hydraulically connected seaward. A Land Information New Zealand (LINZ) chart NZ 56 Table Cape to Blackhead Point maps 'springs in seafloor' which was investigated by NIWA (Mountjoy, 2019) who concluded that there was no evidence for fluid expulsion in terms of seafloor features in the area of mapped 'springs' in the available data (Mountjoy, 2019). The report reviewed an earlier study which inferred that offshore units equivalent to the last glacial fluvial gravels underlying the Heretaunga Plains, extend as an elongate basin toward the northeast bound by the Kidnappers Ridge to the southeast, and potentially extend half way across Hawke Bay, although some distance from the mapped 'springs'. However, the seaward extension of the fluvial gravels has yet to be confirmed (Mountjoy, 2019).

A report commissioned by Napier City Council (NCC) to assess potential effects of proposed new municipal well fields at Awatoto and Guppy Roads was completed by GNS (Rawlinson and White, 2019). The criteria for the assessment included a key issue that the proposed takes should not contribute to the intrusion of saltwater into fresh water aquifers. The report determined that the largest decline in head at the coast is 1.0 m, and therefore the effects of the scenario of combined pumping of 650 L/s or less at the proposed bore fields (Awatoto pumping at 500 l/s) would not contribute to the intrusion of salt water into fresh water aquifers.

Regional monitoring has determined that the piezometric pressure along the coast is about 8 to 9 m above mean sea level (amsl) in the main aquifer system (Callander et al, 2011). The 2012 winter SWL of Production Well Nos. 15986 and 15989 is recorded as +7 and +6 m above ground level (agl) respectively, with an approximate elevation of 4.80 m amsl. The high artesian head recorded at the coast indicates a level of hydraulic resistance between the sea and the aquifer (Rakowski and Knowling, 2019).

In determining potential for saline intrusion, tools such as the Ghyben-Herzberg principal and site-specific model developed by PDP (Callander et al, 2011) can be used. The Ghyben-Herzberg principal provides a theoretical estimate of the saltwater-freshwater boundary for small discharges (Verruijt, 1968), where the interface is approximately 40 times the elevation of the water table amsl as displayed in Figure 5. Using the elevation and SWL, the water table is approximately 19.25 m amsl, resulting in a saltwater-freshwater interface of 770 m depth. However, the solution does not represent a real groundwater system as it is based on static conditions, but could be used to indicate a range of groundwater level pressures above which no sea water intrusion problems should exist (Callander et al, 2011).

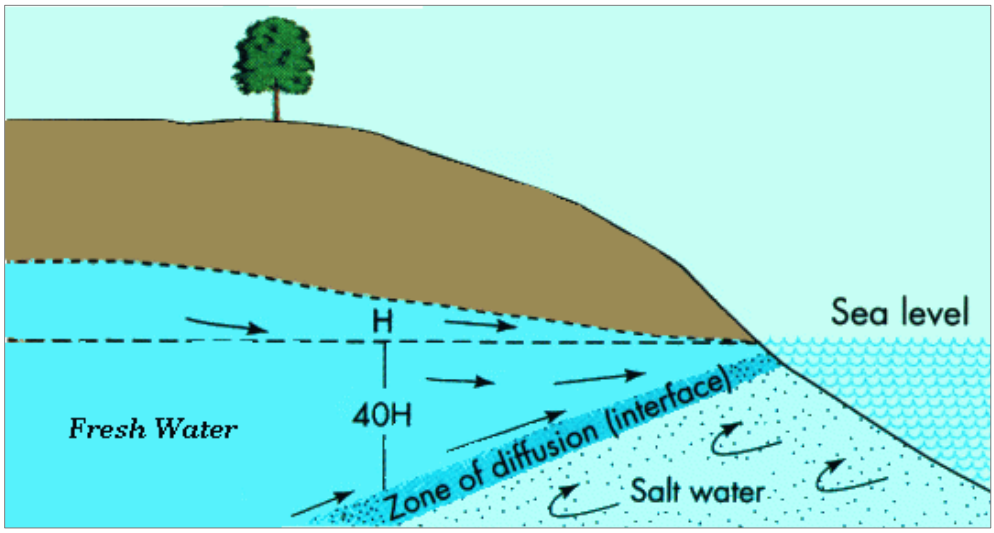

Figure 5. Schematic diagram representing Ghyben Herzberg relationship between saltwater and freshwater under hydrostatic conditions.

The model developed by PDP (Callander et al, 2011) cannot be used in this hydrogeological setting, as the wells are positioned at the coast and present high piezometric pressures. This suggests a blind aquifer with a possible barrier to the saltwater interface.

It is understood that HBRC monitor a series of groundwater bores along the coastline for saline intrusion.

It is noted that the proposed maximum rate of take will not increase from that currently consented, and therefore it is not expected that any changes to the saline intrusion risk would occur as a result of the Applicant's proposed take. However, an appropriate monitoring schedule of water level and quality, particularly Electrical Conductivity is recommended to ensure that the Applicant's take does not exacerbate the potential for saline intrusion.

Please do not hesitate to contact the undersigned should further information be required.

Yours faithfully

Bay Geological Services Ltd

Alexandra Johansen
Principal Hydrogeologist

D. References

Bay Geological Assessments Ltd, 2021: Hydrogeological Assessment of Proposed Irrigation Area, 165 and 195 Waitangi Road, Awatoto, Napier. Client Report No. BGS292_01. BGSL, Napier, New Zealand.

Callander, P., Lough, H., Steffens, C., 2011: New Zealand Guidelines for the Monitoring and Management of Sea Water Intrusion Risk on Groundwater. Client Report No. C02085500R001, Envirolink project 420-NRLC50. Pattle Delamore Partners (PDP), Christchurch, New Zealand.

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Rawlinson, Z.J., White, J.T., 2019: Scenario Modelling to Assess Effects of Proposed New Municipal Well Fields at Awatoto and Guppy Roads, Napier. GNS Science. 26 p. Consultancy Report 2019/12. Lower Hutt, New Zealand.

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Report Limitations

This letter report is written based on conditions as they existed at the time of the desktop study, and there is no interpretation made on potential changes that may occur across the site. Subsurface conditions may exist across the site that are not able to be detected or revealed by the investigation within the scope of the project, and are therefore not taken into account. The third-party information used for the assessment has not been independently verified, and Bay Geological Services Ltd. accepts no responsibility for any errors or omissions.

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ATTACHMENT 8

Environmental Medicine Ltd

Environmental Medicine Limited
www.envirodoctors.com
PO Box 28 424 Remuera
Auckland 1541 New Zealand
Phone: (649) 920 9779
Email: doctor@envirodoctors.com

17 May 2022

Ravensdown Limited
90 Waitangi Road
Awatoto
Napier 4110

Attention: Andrew Torrens

Dear Andrew

Response to HBRC section 92 request for further information:

Ravensdown Limited applied for resource consents (APP-126684) for its Napier Fertiliser Works from Hawke's Bay Regional Council (HBRC) for various discharges to the environment and water takes in late 2021. The Assessment of Effects documentation lodged with the consent application included an Assessment of Environmental Health Effects (AEE Health) that related to the discharge of contaminants into air, water and groundwater from the Works.

HBRC has requested further information under section 92 of the Resource Management Act 1991 (RMA), dated 3 March 2022. Included in the s92 request was an information request relating to the assessment of human health effects through exposure pathways.

The purpose of this letter is to provide a technical response to the health-related questions raised in the HBRC s92 request. It has been prepared in accordance with Environmental Medicine Limited engagement to advise Ravensdown about public health effects related to the RMA proposals.

There were no specific requests for further information related to public health effects assessment contained in the letter of 3 March 2022 from HBRC. However, the accompanying peer review requested further information about contaminant source pathways and potential risks linked to receptors (question 36 below).

The Health Risk Assessment should be revised or an appropriate response (as per S92 RMA) to ensure clear summary statements are made about whether contaminant risks are likely to be present or absent based on a conceptual site model which requires there to a be linkage of source pathway and receptor relationship and where such a potential contaminant risk linkage has been identified, estimated concentrations of contaminants are then compared against national guidelines.

Accordingly, this letter reviews and clarifies the work contained in the AEE (Health) to:

- Identify receptors relevant to public health effects;
- Identify sources of contaminants (hazards);
- Identify exposure pathways from sources to receptors;
- Identify contaminant risk linkages; and
- Compare estimated concentrations of contaminants against guidelines (national/international as relevant).

Identify receptors relevant to public health effects

This part of the AEE (Health) is referred to as **Community Characterisation** and considers both the location and sensitivity of people in the community in a context of likely exposure.

In the Background and Scope sections of the Community Characterisation the potential exposure routes are set out and sources and pathways that are under consideration are summarised. The community characterisation proceeds to assess the location and sensitivity of people who might be exposed.

Identify sources of contaminants (hazards)

This part of the AEE (Health) is referred to as **Identification of Hazards** and considers both epidemiological and toxicological information to determine whether contaminants have hazardous potential for humans. The AEE (Health) has listed potential hazardous contaminants using information sourced from technical reports by other experts.[1] A further report is included as information for this letter.[2] The technical assessors for discharges to air, water and groundwater and associated effects on estuarine ecology and vegetation have identified sources of contaminant substances within the processes at the Works. The AEE (Health) has assessed the potential for hazardous properties of contaminants and any associated risk to human health from exposure arising from the sources.

Identify exposure pathways from sources to receptors

This part of the AEE (Health) uses information from the community characterisation and from the assessment of dispersal from sources. For the AEE (Health), pathways were included following consideration of potential human exposure through:

- air direct effects (inhalation),
- air effects on drinking water (deposition on rain collection sites),
- air effects on food crops (leaf uptake or through soil),
- water direct contact recreation effects,
- water and groundwater in relation to community water sources,
- water and groundwater in relation to food crops,
- community receiving environment.

Identify contaminant risk linkages

The basis for this part of the AEE (Health) has been an exposure assessment that determines the location of people related to dispersed concentrations of contaminants. Additionally, risks from potential contamination of drinking water and mahinga kai have been considered to assess risk linkage.

Summarised listings of potential hazards are in the AEE (Health) and only contaminants that were health hazards, based on health assessment criteria, have been included in the exposure risk assessment.

Compare estimated concentrations of contaminants against guidelines

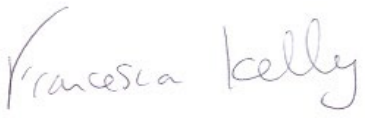
This part of the AEE (Health) uses information from relevant national and international guidelines. This includes the National Environmental Standard (NES), ambient air exposure guidelines (WHO, MfE), the Drinking Water Standards (WHO, NZMOH) and Nutrient Reference Values and other food quality guidance provided by Food Standards Australia and New Zealand (FSANZ). The guidelines referenced are conservative and include protection of those who may be vulnerable to health effects because of age or personal health, including pregnancy and infancy.

[1] Tonkin + Taylor (Air Discharge Effects Assessment), Plant and Food Research (Vegetation Effects Assessment) and Streamlined Environmental (Estuarine Ecological Effects Assessment)

[2] Bay Geological Services Ltd (Hydrogeological Assessment)

Summary of Contaminant Risks

Based on the described process, Section 6 of the AEE (Health) contains a clear summary of the risk associated with inhalation, ingestion including mahinga kai, and coastal recreation for each contaminant.



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