

**Before the Hearing Commissioners appointed by Hawke's Bay
Regional Council & Hastings District Council**

In the matter of the Resource Management Act 1991
(**the Act**)

And in the matter of an application by The Te Mata
Mushroom Company Limited to
discharge contaminants into air from a
composting and mushroom growing
operation and associated activities at
174-176 Brookvale Road, Havelock
North

And in the matter of an application by The Te Mata
Mushroom Company Limited to
expand an existing intensive rural
production activity at 174-176
Brookvale Road, Hastings

Statement of evidence of Tracy Joanne Freeman

17 July 2019

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INTRODUCTION

Qualifications and experience

- 1 My full name is Tracy Joanne Freeman, currently residing in Melbourne, Australia. I am the Director and Principal Air Quality Consultant of Air Quality Professionals Pty Ltd. I am the sole employee of this company which was founded in October 2012. I have a Master's Degree in Chemical Engineering from the National University of Singapore, and a First Class Honours Degree in Chemical and Process Engineering from the University of Canterbury, New Zealand.
- 2 I have 26 years' experience in air quality consulting. The first 18 years of my experience were based in New Zealand, and I moved to Australia in March 2011. I am a financial member of the Clean Air Society of Australia and New Zealand (CASANZ). From 2010 to 2014 I was the Chair of the Odour Special Interest Group of CASANZ, a group comprised of many of the foremost consultants and regulators in odour assessment in Australia and New Zealand.
- 3 I have investigated and assessed odour issues for a wide range of activities including composting plants, wastewater treatment plants, industrial waste treatment facilities, landfills, refuse transfer stations, recycling parks, broiler farms, turkey farms, pig farms, rendering plants, abattoirs and fellmongeries. In these matters I have advised a range of stakeholders at various times, including applicants, local government, and environmental regulators.

Expert witness Code of Conduct

- 4 I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note dated 1 December 2014. I have read and agreed to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

PURPOSE AND SCOPE OF EVIDENCE

- 5 The Te Mata Mushroom Company (TMM) operates a mushroom growing factory near Havelock North, Hawke's Bay. The factory includes a compost making facility where the compost substrate for growing the mushrooms is prepared. I have been involved in the assessment of odour emissions at the TMM site since 2009. At that time, I worked for Beca Infrastructure Ltd based in Christchurch. The operation was granted a new resource consent on 13 April 2011, DP100128A. As part of the technical supporting information for that consent application, I prepared a report on odour emissions and mitigation options for the composting operation in 2010¹.
- 6 I was next involved with the TMM site in 2015, when I was engaged to provide technical advice regarding an odour impact assessment for the proposed upgrade and expansion of the mushroom growing operation conducted by TMM in Hawke's Bay.
- 7 As an outcome of that engagement, I prepared a report 'Odour Assessment – Te Mata Mushrooms' dated 19 December 2016, under the letterhead of Air Quality Professionals Pty Ltd.
- 8 The purpose of this evidence is to:
- 8.1 Confirm my original assessment dated 2016 in respect of the odour effects arising from the proposal;
 - 8.2 Confirm where my original assessment changes due to the new mitigation timetable proposed by TMM; and
 - 8.3 Respond to comments provided in submissions and in the Section 42A reports of both Hastings District Council (HDC) and Hawke's Bay Regional Council (HBRC).

¹ Beca Infrastructure Ltd (2010), "Te Mata Mushrooms Odour Source Assessment", prepared for Te Mata Mushrooms Ltd, February 2010.

TECHNICAL REPORT – SUMMARY OF CONCLUSIONS

- 9 My report ‘Odour Assessment – Te Mata Mushrooms’ dated 19 December 2016 is at Appendix 6 of the application lodged with the HDC and Appendix 2 of the application lodged with HBRC.
- 10 In that report, I acknowledged that there would always be the potential for residual odour to occur due to the composting operations, despite the mitigation strategy proposed at that time. I formed the view that the proposed strategy outlined for reduction of odour from the current composting activities at the TMM site represented best practice for odour mitigation in some parts of the process and, in the remaining parts of the process, the best practicable option or best practice except for the option of complete enclosure.
- 11 I concluded that in future after the proposed upgrades are implemented (which included the proposed increase in production rate), greatly reduced odour emissions would be anticipated on Mondays, Tuesdays, Thursdays and Fridays. Where possible, these odours would also be emitted outside of the times of day when meteorological conditions are most conducive to poor atmospheric dispersion (i.e. around sunrise and sunset), further reducing the potential for any residual odour emissions to cause offensive or objectionable odours.
- 12 However, I was not able to form an opinion as to whether following the completion of all upgrades, the residual odour emissions would have the potential to cause an offensive or objectionable effect that would be considered to be more than minor. In forming such an opinion in any situation I consider the following aspects:
- 12.1 Magnitude of odour emission
 - 12.2 Footprint of the odour source and method of release of odour into the air
 - 12.3 Time of day when the odour is emitted

- 12.4 Wind directions during low wind speeds and when the atmosphere is stable
 - 12.5 Hedonic tone (degree of unpleasantness) of the odour
 - 12.6 Frequency and duration of the odour emission
 - 12.7 Sensitivity of the receiving environment.
- 13 This is essentially a “source-receptor-pathway” risk assessment concept, and it is also essentially a FIDOL assessment – referring to the common understanding of the factors which influence the likelihood that an odour might cause an offensive or objectionable effect. The FIDOL factors identify the Frequency, Intensity, Duration, Offensiveness (or Unpleasantness), and Location (and land use activities) of the odour. The FIDOL factors are referred to in the HBRC Section 42A Officer’s Report, and I agree with the context in which those factors are discussed by Mr. Barrett.
- 14 I agree that the sensitivity of the receiving environment is a complex issue in this case, and that some members of the nearby population may be sensitised from exposure to the mushroom composting odour and likely to complain no matter what TMM does if they stay on the site. Therefore, complaints and off-boundary odour occurrence will need monitoring and I support the concept recommended by the HBRC reporting officer of independent odour monitoring, however I understand that TMM has some concerns about the practicality and scope of the system recommended in the Section 42A report.
- 15 In my report, I used a qualitative rating to identify the changes in residual odour emissions at the site that result from the proposed mitigation measures. The qualitative rating estimates the relative contribution each source makes to the potential for adverse odour effects at sensitive receptors beyond the site boundary and was assigned the classification high, moderate or low, or in-between these classifications (moderate-high, low-moderate). In assigning these ratings, I took into account the quantity and degree of unpleasantness of the odour emission, the time of day when the activity is carried out (particularly early in the morning whilst meteorological conditions

place odour nuisance at greater risk), my observations of the odour strength from each source, size and volumetric flow rates from each source, and my experience with the typical rate of downwind dispersion of odours from such sources. This rating system was used to prioritise odour mitigation options, but is not a direct expression of whether any odour observed beyond the site boundary has the potential to be an offensive or objectionable effect – except of course that an odour source with a “high” rating is more likely to cause an offensive or objectionable effect than an odour source with a “low” rating.

- 16 The applicant has revised the timetable for implementation of mitigation measures, and I attach in Appendix A a flow chart which summarises the new programme. I have numbered each step in the mitigation progression from 1 to 4 for ease of reference. The proposed mitigation measures are the same as those contemplated at the time I prepared my report in 2016, however the timing for implementation of these mitigation measures and the production rate proposed at the time of implementation of each step has been clarified in response to concerns raised by the other expert witnesses and the HDC and HBRC reporting officers.
- 17 After Step 1 is implemented, the extended eaves and extraction system will be in place over both ends of the two existing bunkers, and a new biofilter will be in place to handle the additional air flows. Bale breaking and mixing/blending, other Phase 1 activities and filling of Phase 2 tunnels will only occur between the hours of 8am and 6pm. The main odour sources after Step 1 is implemented will be as follows:
- 17.1 Bale break, occurring by the current process of laying the bales out in windrows and spreading the gypsum/chicken litter mix over top.
- 17.2 Bunker-to-bunker transfers, with the main odour emission occurring during the movement of compost in a front end loader bucket from one end of the bunker to the other end. There will be some odour emitted from the bucket, but I consider this to be small compared to the total amount of odour generated inside the bunkers during transfer operations that will be captured, extracted and treated.

- 17.3 Emptying of Phase 2 tunnels, which I have observed to be a minor odour source attributed to the mature state of the compost.
 - 17.4 Filling of Phase 2 tunnels, which will now occur on Wednesdays rather than Tuesdays to accommodate the restricted operating hours as I am told by Mr. Whittaker that carrying out both emptying of Phase 2 tunnels, cleaning, and refilling with new Phase 1 compost can result in long hours of operation if this is all carried out in one day. The main odour emission sources during the filling of Phase 2 tunnels are from compost in a front end loader bucket travelling from the mouth of the Phase 1 bunker to the hopper, the deposit of compost into the hopper, and conveyance into the tunnels. The hopper and conveyor will be enclosed at Step 2 of the mitigation plan.
 - 17.5 Emissions from ventilation of the Phase 2 tunnels, which is a relative minor odour source compared to the sources described above.
 - 17.6 Residual minor odour emissions from bale dunking, pond aeration, and biofilter.
- 18 After Step 1 is implemented, TMM proposes to increase production from 120 tonnes per week (Tpw) to 160 Tpw, a 33% increase on current production rates. This increase in production will result in the following changes to patterns of odour emissions:
- 18.1 A 33% increase in odour emissions during bale breaking on Thursdays, through a slightly longer duration of activity and more activity occurring at once.
 - 18.2 A 33% increase in trips by front end loaders to transfer Phase 1 compost from bunker to bunker on Mondays and Fridays which is mainly accommodated through the recent purchase of a bigger front end loader with a bigger bucket, but the process will also take slightly longer to complete. This increase will be more than offset by the overall reduction in odour emissions from this source due to the installation of the extended eaves and extraction system.

- 18.3 A 33% increase in duration of filling Phase 2 tunnels.
- 19 Whilst some increases in odour duration and/or intensity may occur due to the production increase, considering the overall FIDOL factors the risk of increased offensive or objectionable odour effects from these emissions is low provided that the operating hours remain within the 8am to 6pm period.
- 20 Overall, I consider that the risk of offensive or objectionable odour effects arising from the production 160 Tpw under the scenario described will be no different in reality to the risk of odour arising from the production of 120 Tpw.
- 21 Mr. Curtis has recommended that the third Phase 1 bunker be constructed as soon as possible, with one reason being reducing the duration of the odour emission from front end loader buckets while travelling from one end of the bunker to the other. Whilst I agree that it is preferable to minimise the duration of external exposure of this odour source, I consider that provided the activity is conducted between the hours of 8am to 6pm and the eaves and extraction system is in place to capture bunker fugitive emissions, the magnitude of the odour emission from the compost in the front end loader buckets should not be sufficient to alone justify early installation of the Phase 3 bunker, for production up to about 200 Tpw.
- 22 After Steps 3 and 4 are implemented, TMM proposes to increase production from 160 Tpw to 250 Tpw, a further 56% increase in production rate. However, after Steps 3 and 4 are implemented, the only remaining odour sources from the composting operation will be:
- 22.1 Residual uncaptured odour emissions from the bale break machine.
- 22.2 Odour from compost in front end loader buckets during Phase 1 bunker-to-bunker transfers and during unloading of Phase 1 compost into the hopper connected to the Phase 2 conveyor system.
- 22.3 Any uncaptured fugitive emissions from the Phase 1 tunnels during filling, Phase 1 bunker-to-bunker transfers, and emptying of bunkers.

- 22.4 Emptying of Phase 2 tunnels (which I have previously commented is a minor source).
- 22.5 Residual odour emissions from the biofilters, wetted bales, and aerated pond. These odour emissions will be minor.
- 23 With a well-designed and implemented capture and ventilation system for the Phase 1 bunkers and the bale break machine, and continued focus on not commencing Phase 1-related activities before 8am, odour emissions from the site will be minimised and the production rate becomes largely irrelevant. I therefore consider that the risk of odour arising from the production rate of 250 Tpw (with all upgrades installed) will be no different to the risk of odour arising from the production of 160 Tpw.
- 24 I agree with the comments by the Reporting Officer and Mr. Curtis, that the design of the capture and ventilation system for the Phase 1 bunkers is critical to the success of the proposed mitigation strategy. The design and costing of this system is beyond my expertise, and I rely on the evidence of Mr. Holyoake that this system can be practically achieved and implemented.
- 25 The existing biofilter treats air ventilated from within the Phase 1 bunkers. The biofilter is working well for current air flows which were measured at a maximum of 4.1 m³/s by Beca in 2011². That report by Beca was attached to my 2016 report. In my odour assessment report in 2016, I recommended that no additional air should be treated by this biofilter at its current size, and I still hold this opinion. Therefore, two new biofilters will need to be constructed at the site – one for the additional extraction air from the Phase 1 existing bunkers (and, later, the third Phase 1 bunker), and one for the air extracted from the new Phase 2 loading building which will also treat air ventilated from the Phase 2 tunnels. The detailed design and costing of the biofilters is beyond my expertise, however I have recommended to TMM that the design specifications for any new biofilters should include the following:

² “Te Mata Mushrooms Composting Biofilter Compliance Testing”, Beca Infrastructure Ltd (2011).

- 25.1 Design airflow loading rate will be 50m³/h per m³ of biofilter media, with the same graded bark media design as the current, successfully operating biofilter which has a media depth of 1.75m (plus a base of 0.25m river gravel).
- 25.2 The existing biofilter and the new biofilter cell will both be operated with the following design ranges for temperature, moisture content and pH:
- (i) Inlet air temperature maximum normal operations 40°C, with short excursions up to a maximum limit of 45°C acceptable.
 - (ii) Bed pressure drop not to exceed 100 mm water-gauge.
 - (iii) Media moisture content maintained at 50 – 80 weight percent, dry bark basis.
 - (iv) Mean pH a minimum of 6.0 in the upper two-thirds layer of the bed (a lower pH may occur in the lower part of the bed), with lime to be added if the pH drops below 6.0.
- 25.3 The following monitoring is proposed:
- (i) Continuous temperature monitoring in the inlet air to the biofilters (already in place).
 - (ii) The bed media pressure-drop and moisture in each biofilter shall be recorded weekly.
 - (iii) The bed pH in each biofilter shall be tested every 2 months.
- 26 Some of my recommended monitoring conditions for the biofilter vary from those included in the HBRC Officer's Report, and I will comment further on these later in my evidence.
- 27 The only alternative mitigation option that could be implemented other than the mitigation actions detailed in Steps 1 to 4, would be full enclosure of the

Phase 1 composting process from bale break to transfer into Phase 2 tunnels. I am not aware of any composting operation in New Zealand using full enclosure, although I have heard of facilities overseas with full enclosure. Mr. Whittaker has consistently advised me that full enclosure is neither practical nor economically feasible for the TMM site, and hypothetical costing of such an option is beyond my expertise.

- 28 At the TMM site, full enclosure would require a building over the concrete pads outside the Phase 1 bunkers. I understand that there would be practical issues around full enclosure related to health and safety of workers, due to the movement and operation of front end loaders within the enclosed space and decreased visibility due to steamy vapours. In addition, the extracted air volumes from the enclosed space requiring treatment would be massive, and very costly to treat as biofilters are sized based on the volume of air delivered to them. Alternatively, the whole Phase 1 composting operation would need to be redesigned and retrofitted with new in-bunker equipment so that there is less reliance on front end loaders for transfer and mixing of Phase 1 compost. I also understand from Mr. Whittaker that there is significant potential for disease contamination between Phases 1 and 2 and 3 if all are enclosed.

RESPONSE TO MATTERS RAISED IN THE SECTION 42A REPORT

- 29 I have reviewed the HDC's section 42A report issued on 8 July 2019. Matters relating to odour are addressed primarily under section 8.2.3, although other references to odour can be found throughout the report. Most of the uncertainties raised by the reporting officer are acknowledged in the joint expert witness statement, or are dealt with by the new mitigation timetable that TMM has now provided. I provide comment on two statements in the section 42A report in the following sub-paragraphs.

29.1 Page 32 and Figure 17 of the section 42A report refers to a summary of wind monitoring data that I provided in my 2016 report based on data collected at the Arataki Road monitoring station. As I explained in my 2016 report, the data collected at that site is unreliable due to

the height and location of the wind sensors and the way calm winds are recorded. Conclusions about wind patterns near the TMM site should not be inferred from this data.

29.2 In the last paragraph on page 33, my report dated December 2016 is described as failing to address more recent complaints, and therefore inadequate and not able to be properly relied on. I respond to this criticism by noting that my report, which was originally drafted in September 2016 and later finalised in December 2016, addressed all available complaints data at the time, with complaints up to August 2016 available for my analysis at the time. This is therefore not a failure in the Odour Assessment Report. Since that time, I acknowledge that many new complaints have been registered. I also reiterate that, as agreed by all the experts in the Joint Witness Statement, that the complaints record is of little usefulness for odour assessment in this case – *“the complaints data since 2015 provides an indication of community dissatisfaction, but because no incidents were investigated and there is no record of locations or number of complaints it is of limited value in understanding the extent of impacts”*. My reasons for holding this opinion include:

- (i) HBRC stopped responding to or investigating complaints in December 2015, except for a brief period in February and March 2018. Therefore, none of the complaints were validated as offensive or objectionable odours, nor was TMM verified as the source of the alleged odour.
- (ii) The complaint record includes no information on the location where the alleged odour occurred, nor an indication of how many different people are complaining (or, for example whether a small number of people are generating a large number of complaints).
- (iii) A heightened frequency of complaints is likely due to publicity about the TMM consent applications and

enforcement actions by HBRC – this could also include complaints occurring on days when activities occurring at the TMM site would ordinarily not be expected to cause offensive or objectionable odours.

- (iv) Some members of the local community are likely sensitised to the TMM odour, and therefore affecting their perception of the offensiveness of any odour detected. However, whether this is widespread or limited to a few individuals is not clear.
- (v) The complaint record contains little data on the nature of the odour event that is being complained about – such as where, when, and duration.

30 I have also reviewed the Regional Council's section 42A report issued on 9 July 2019. Matters relating to odour are addressed throughout the report and primarily under paragraphs 111 - 150. I concur with most of the reporting officer's comments, and support most of the recommended consent conditions subject to some comments provided in the following paragraphs.

31 At paragraph 39, the reporting officer correctly states that my wind analysis puts the site upwind of the sensitive residential receptors under about 30% of all winds. This is referenced again in paragraph 119. I wish to make it clear that this does not mean that odour would be noticed under all 30% of those wind conditions, as the wind speed and atmospheric stability are also very important parameters that determine the rate of dispersion of odour after release from a source:

31.1 **Wind speed:** For emissions occurring close to ground or entrained in building downwash eddies, low wind speeds (roughly less than about 2 - 3 metres per second (m/s) and particularly those less than 1 m/s) tend to result in noticeable odour at greater downwind distances than at higher wind speeds.

- 31.2 **Atmospheric stability:** The atmospheric stability is a measure of the vertical mixing, or turbulence, of the atmosphere close to ground. During low wind speeds around sunset and sunrise, and overnight, the atmosphere can be very stable with “inversion” caps keeping pollutants emitted close to the ground from rising high into the atmosphere. If such conditions coincide with odour emissions from sources located close to the ground, such as the odour sources at TMM, the dispersion of odour downwind from the source can be slow with odour nuisance more likely to be noticed by downwind sensitive receptors. These stable atmospheric conditions only occur under very low wind speeds (typically less than 2 m/s), and do not occur during the daytime, so avoiding odour discharges during stable conditions (such as around sunrise) can be a good way of reducing or limiting the risk of odour nuisance.
- 32 In Appendix B I have attached the wind roses from the wind analysis in my 2016 report. I have added an inset box to show how small the frequencies of low wind speeds are blowing towards the Arataki subdivision. By far the dominant wind direction under low wind speeds is from the southwest (away from residential dwellings), which is to be expected as this represents the drainage flow direction for Hawke’s Bay from the inland upper slopes out to the sea.
- 33 In Appendix 4 of the section 42A report, the reporting officer provides a helpful analysis of complaint data, assuming every single complaint relates to an offensive or objectionable observed on the day the complaint was logged. I was interested particularly in the trend of breakdown of complaints by day of the week from 2012 to 2019 shown in Figure A4.4, and especially the frequency of occurrence of complaints on a Thursday. I note that with the exception of black column showing 2018 data, which contains an anomalous number of complaints on a Thursday contrary to annual trends, the frequency of complaints on a Thursday (when bale break occurs) is not much different to those occurring on a Wednesday (when no active composting activities

occur), and certainly a lot less than the frequency of complaints occurring on a Tuesday or Friday.

- 34 In paragraph 70 of the section 42A report, the reporting officer refers to a visit that he made to the local area on Wednesday 9 July – a day when nine complaints were received. The officer makes no comment on whether he verified the presence of offensive or objectionable odour effects, and while he makes the comment that on this day “removal of a significant volume of accumulated spent compost” was occurring, he does not comment on whether he was able to reach a conclusion that the cause of complaints was the removal of spent compost or some other source.
- 35 The complaints included in the graphs in Appendix 4 of the section 42A report include complaints up to 20 May 2019, and therefore do not include the nine complaints from Wednesday 9th July. However, as an example it is easy to imagine how adding nine Wednesday complaints to the bar chart in Figure A4.4 could mislead the interpretation of the distribution of complaints as a function of day of the week (and activities occurring on that day).
- 36 Figure 5 of the section 42A officers report provides a map of complaint locations coded by year from 2013 – 2019. This information is very useful. Looking primarily at the complaints from 2016 onwards, as shown by the larger and more brightly coloured dots on the map, the complaints appear to mainly be occurring from 20 or so properties around Devine Close and Te Heipora Place, plus nearby residences on Arataki Road. This impacted area extends about 440m from the Phase 1 bunkers on the TMM site. I have marked this area and distance on the figure from the section 42A report, and attached this in Appendix C – refer to the pink-shaded arc. There is also a secondary area of less frequent complaints extending about 530m from the Phase 1 bunkers – this is also shown on my figure in Appendix C as the yellow-shaded arc. Some other complaints also occur outside of this second arc but are relatively few compared to the number of houses located at that distance from the TMM site.

- 37 The main reason I have included this analysis is that it provides confidence to me that the mitigation measures on site will be effective at reducing offensive and objectionable odour effects. As the intensity of odour emissions at the site reduces, and odour emissions are avoided during early morning hours, the areas enclosed by those pink and yellow arcs should essentially contract and move closer to the TMM boundary.
- 38 At paragraph 123, the reporting officer states that “The odour from this operation is often described as being deeply unpleasant, and while the mitigation proposed will see a greater proportion of odour captured and treated, the potential for offensiveness will remain for any odour releases that are uncaptured or untreated”. This is correct for active Phase 1 composting odours, but less accurate for more mature compost odour emissions such as from Phase 2 compost, as the degree of unpleasantness of the odour reduces to a more natural organic smell as the compost maturation process proceeds.
- 39 At paragraph 148, the reporting officer recommends that until mitigation measures are implemented, Phase 1 composting and bale breaking activities should only occur between the hours of 8 am to 6pm, as adverse odour effects are less likely to occur during these times. I agree with this recommendation, and note that I proposed restrictions on early morning operations in my report in 2016 as a potential mitigation measure. I have discussed the feasibility of this with Mr. Whittaker on a number of occasions – to which he has always advised me that he is happy to implement such restrictions but is mindful of allowing enough time in the working day to complete yard operations, including contingency time for breakdowns.
- 40 I would also like to comment on some of the recommended consent conditions attached to the HBRC Reporting Officer’s report.
- 41 Conditions 14-15 require all Phase 1 composting activities to be carried out in a “fully enclosed” building or buildings. When the compost is sitting in the bunkers and tunnels undisturbed, it is fully enclosed. However, the “extended eaves and extraction” method proposed for capture of odours from the Phase 1 bunkers during bunker-to-bunker transfers is not “full

enclosure”. This is recognised in Condition 17, but for clarity I recommend that:

- 41.1 Conditions 14-15 refer to Condition 17 as a permitted exception to the requirements for full enclosure; or
- 41.2 The words “fully enclosed” be deleted from conditions 14 and 15.
- 42 Conditions 28 and 29 require TMM to continuously measure and record the dissolved oxygen (DO) concentration in the aerated pond, and to maintain DO concentrations at no less than 1.0 milligrams per litre (mg/L) at all times. This condition is appropriate in my opinion. As noted in my 2016 report, the continuous measurement and recording on DO concentrations in the aerated pond is already occurring. I provide an updated graph of recorded DO concentrations in Appendix D, which shows that this consent condition is being consistently met.
- 43 Operating specifications and monitoring frequency for the biofilter(s) are provided in Conditions 25-27.
- 43.1 **Temperature:** TMM already continuously monitors biofilter inlet temperature and this is automatically logged on an hourly basis. I provide an updated graph of recorded temperatures in Appendix E.
- (i) Optimal temperature is a compromise between that giving maximum microbial activity, and that maximizing the adsorption of odorous compounds onto the medium³. The reference at footnote (3) recommends that biofilters are operated at temperatures of less than 40°C if this can be practically achieved, but I am not aware of any “absolutely must not ever exceed” temperature limit, within reason.

³ Cudmore & Gostomski (2005). Biofilter Design and Operation for Odor Control – the New Zealand Experience. In, *Biotechnology for Odor and Pollution Control*, Shareefdeen & Singh (Eds), Springer-Verlag Berlin Heidelberg 2005.

- (ii) Some consents conditions will specify a maximum of 35°C, with brief excursions up to say 40°C accepted; some conditions will specify a maximum of 40°C (as is recommended by the reporting officer here); and some will allow brief excursions up to say 45°C. The heat absorption capacity of the biofilter media will reduce peak temperatures quickly after the gases enter the biofilter unless that high temperature is sustained for a long enough period of time.
- (iii) The graphs in Appendix E shows that the biofilter inlet temperature generally fluctuates in the 15°C - 40°C range, but does occasionally exceed 40°C. This tends to happen more often in summer. The air inside the bunkers is quite hot due to the heat of composting, and the temperature is cooled by the incoming air used for ventilation. However, with ambient temperatures being warmer in summer, less cooling of the bunker air occurs. I do not consider these occasional excursions above 40°C to be a problem for the existing biofilter.
- (iv) Over November 2018 to January 2019, the graphs in Appendix E show that the biofilter inlet air temperatures exceeded 40°C on quite a few occasions, which I understand are due to hot weather particularly in the month of January. The temperature also approached 49°C briefly on one day in November. I am not aware of any specific issues that this caused for the biofilter, and Mr. Whittaker has advised me that there were no fan breakdowns over this period. Therefore, the cause of that particular exceedance is unexplained. However, I am not concerned that this could affect the performance of the biofilter unless such incidents become common, in which case investigation of the causes of such peak temperatures should be carried out.

(v) Therefore, I recommend that for biofilters at the TMM site, the inlet air temperature maximum normal operations should be less than 40°C, with short excursions up to a maximum limit of 45°C acceptable. I note that these limits are slightly different to those previously advised to TMM and included in the July 9th Section 92 response – however I have revised the recommended temperature limits having conducted a detailed review of the available monitoring data.

43.2 **Pressure:** I consider that requiring twice-daily monitoring of bed pressure is unnecessarily onerous. Bed pressure drop does not change quickly, and is best monitored for long term trends that would indicate when media tilling or replacement is required. I recommend that recording of biofilter pressure on a weekly basis is sufficient.

43.3 **pH:** TMM has been monitoring pH on a 6-monthly basis as required by the current consent. The collated data is shown in the graph in Appendix F. The pH declines over time and the biofilter needs lime added occasionally to increase the pH. The graph shows that the pH can decline quite a lot over a 6 month period, and I recommend monitoring on a 2-monthly basis for better management of pH. Preferably, a mean pH a minimum of 6.0 should be maintained in the upper two-thirds layer of the bed (a lower pH may occur in the lower part of the bed), with lime to be added if the pH drops below 6.0.

43.4 Condition 35 requires the installation of a meteorological monitoring station. I fully support this condition, and recommended this in my 2016 report. I recommended the use of an ultrasonic type of wind sensor, not a mechanical vane/ball-cup type, as this gives accurate readings at very low wind speeds.

43.5 Condition 13 requires defines the requirements to demonstrate that mitigation measures have been successful, and requires the absence of non-compliance with condition 3 in the preceding 6-month period. There are some conceivable situations that need to be

excepted from this definition – such as unforeseeable equipment breakdowns or other events outside the control of TMM like exceptionally wet weather, natural disasters and so on. In addition, the composting operation runs continuously 24 hours per day, every day of the year and despite the best possible planning there may be some situations where odour is released during the construction or commissioning of the new mitigation works. I consider it reasonable to exclude such events from the definition in Condition 13, provided that TMM and the building contract take all reasonable measures to avoid odour releases or, if this is not possible, to avoid odour releases occurring when wind is blowing towards the Arataki subdivision under light wind speeds.

44 The HBRC Reporting Officer's report includes the evidence of Mr. Curtis as Appendix 5. I am generally in agreement with the content of Mr. Curtis's evidence, although I note the following comments.

44.1 At paragraph 28, Mr. Curtis discusses the design of the capture hoods for the Phase 1 bunkers. In the last sentence he states that "*In particular any system would need to be suitably designed to capture emissions as winds become stronger*". I note that whilst stronger winds can create pressure drops across building openings and effectively override the ventilation system and "suck" odour into the outside air, in this case I do not consider that stronger winds are a significant issue at this site as during stronger winds the dilution of odour and speed of dispersion downwind is much faster, and the stronger winds tend to coincide with turbulent atmospheric conditions (which are conducive to rapid mixing of odour).

44.2 At paragraph 38, Mr. Curtis discusses the bale break operation and the current practice of materials being exposed for extended periods of time on a Thursday. He states that "*based on an analysis of complaints by HBRC, [Thursday] now seems to be one of the main days when complaints occur*." I have already referred to the complaint analysis provided in Appendix 4 of the HBRC section 42A officers report, and I disagree

with the statement that Thursday is one of the main days when complaints occur.

44.3 At paragraph 58, Mr. Curtis states that *“I am unable to provide any assurance that the residual odours, following the implementation of mitigation, will not on occasions still result in odour nuisance”*. At a fundamental level I agree with this statement. However, if we look at all those factors that I listed earlier in paragraph 12 that combine to create the degree of risk of offensive or objectionable odour effects occurring, the influence of every factor that is under TMM’s control has been minimised through the implementation of best practice or best practicable option (excluding full enclosure). I therefore am confident that the potential for offensive or objectionable adverse effects will be substantially reduced compared to the current situation.

44.4 This type of staged approach to implementation of mitigation options is commonplace. Until the mitigation measures are implemented and the operation is monitored for a period of time, we will not know for certain whether further measures are required.

RESPONSE TO MATTERS RAISED IN SUBMISSIONS

45 Most of the submissions in opposition to the application refer to odour as a reason for their opposition. Many submissions mention that the current exposure to odour is unacceptable, and I do not dispute this.

46 Another recurrent theme in the submissions is the concern that “a bigger operation will create more bad smells”. Whilst I understand this concern, it is simply not the case with this application, as the mitigation measures proposed will result in much lower levels of residual odour emissions, even at full future production, than currently occur.

47 I have read the submission by HDC, submission number 162, and in particular the report by Ms Simpson attached to the HDC submission. Most of Ms Simpson’s concerns expressed in the submission relate to the timing

and order of mitigation upgrades and production increases, which may now be reviewed following the new mitigation programme proposed by TMM. I do wish to comment on Ms Simpson's paragraph at the bottom of page 6 of her report – *“Following a number of improvements in odour control, the current (since early 2016) level of odour effects is anticipated to be reduced compared to the pre-2015 situation. The Odour Assessment anticipates that the potential for adverse odour impacts is still high on a Tuesday but would have reduced somewhat on Mondays and Fridays (from high to moderate-high). Given that it is approaching mid-2017, there should now be evidence available (such as from community feedback) to verify this assessment. Ground-truthing of the current scenario would increase confidence in the findings related to future scenarios.”*

- 48 The improvements at the site over 2015 and 2016 were described in my report and are also listed in Mr. Whittaker's evidence. I still agree with the comments I made in my 2016 report that the potential for adverse effects should have reduced somewhat on Mondays and Fridays. Therefore, I looked with interest at the graphs in the HBRC Section 42A report, Appendix 4. Complaint numbers on Mondays and Fridays in 2017 and 2018 remained at about the same level as in 2015 and 2016, which is a little surprising given the large odour source which was removed by the change to the bunker-to-bunker transfer process. The previous mode of operation was that after being placed in the first bunker for 5 days, the compost was removed and placed in a windrow for 6 to 8 hours during which it was turned, then placed back into another bunker as a means of turning the substrate. However, we can't know if other factors that affect complaint frequencies, as I have discussed earlier, have influenced the numbers of complaints in 2017 and 2018.

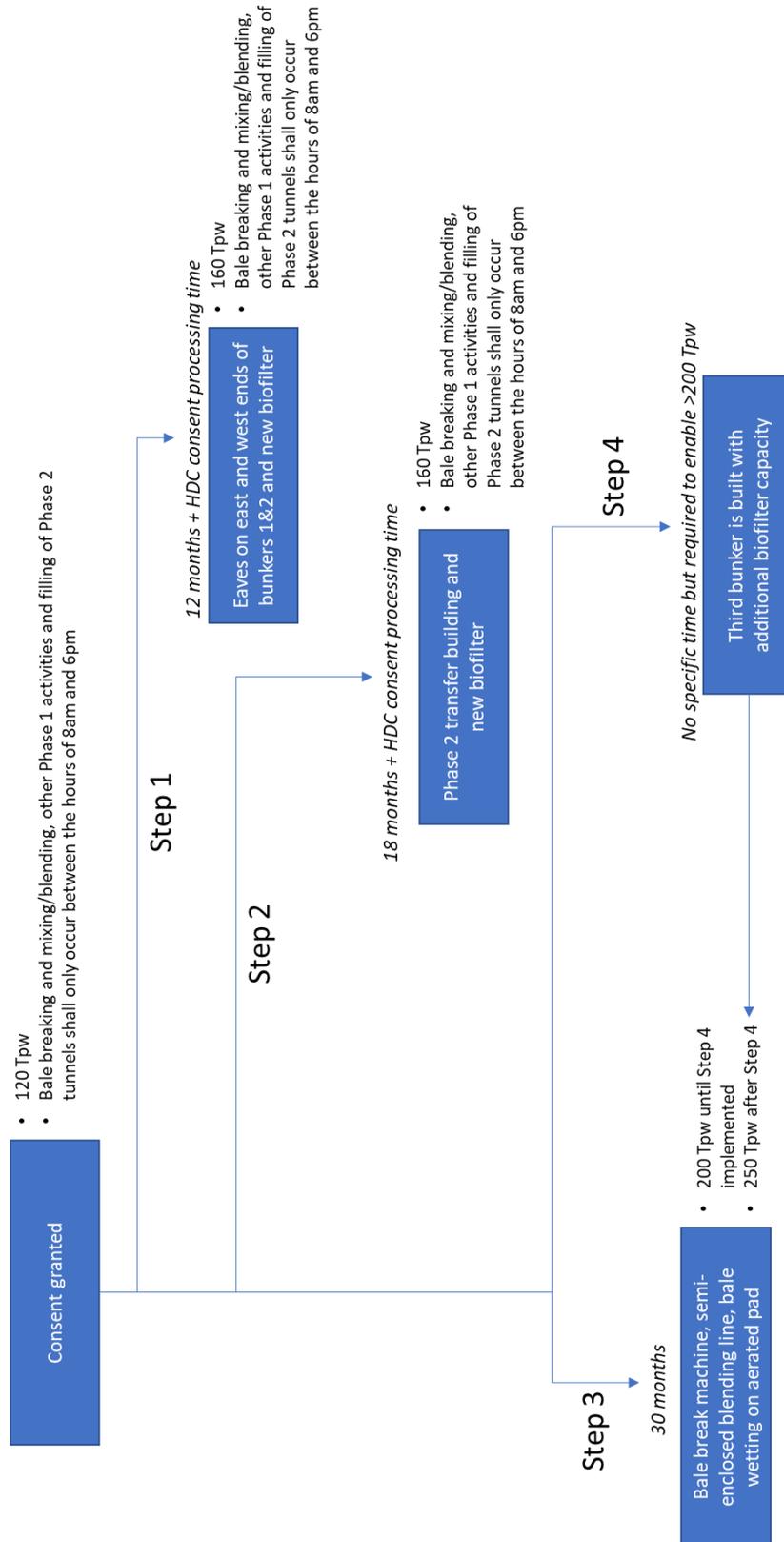
To date, complaints are much lower in 2019, on all days not just Mondays and Fridays, which could indicate a reduction in offensive or objectionable odour, but I suspect is more likely to reflect a change in complainant reporting patterns particularly if a small number of complainants were responsible for the majority of the complaints.

CONCLUSIONS AND RECOMMENDATIONS

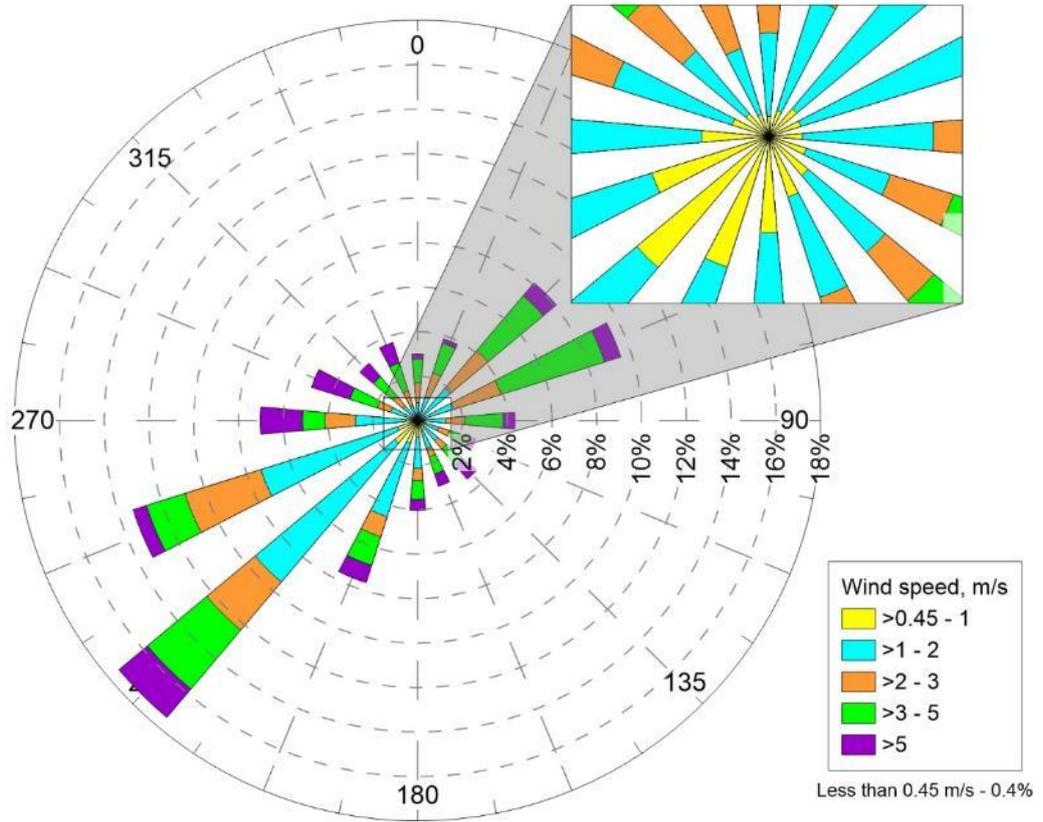
- 49 TMM has proposed a comprehensive mitigation plan for the composting operation which will capture and treat most of the odours generated during the composting process, particularly those odours with the most unpleasant characteristics. However, the receiving environment has become increasingly sensitive to odours over the last few years with the encroachment of residential housing towards the TMM site.
- 50 Like Mr. Curtis, I am unable to state confidently that the residual odours, following the implementation of mitigation, will not on occasions still result in odour nuisance that would be considered to be an offensive or objectionable effect.
- 51 What I can confidently say is that the proposed mitigation measures represent best practice for odour mitigation in many parts of the process and, in the remaining parts of the process, the best practicable option or best practice except for the option of complete enclosure – which is not considered feasible for the reasons given in Mr. Whittaker’s evidence as well as my own.
- 52 If the mitigation measures are implemented, I believe that the potential for offensive or objectionable odour effects will be dramatically reduced compared to the current situation.
- 53 I support the staged mitigation approach, as acknowledged in the Joint Witness Statement. The consent conditions recommended in the HBRC Officer’s Report for odour monitoring (subject to agreement on appropriate scope), a comprehensive odour management plan, and the on-site meteorological monitoring will all assist in the detailed implementation of the mitigation strategy.
- 54 In my opinion, consent can be granted subject to conditions. I have seen the proposed conditions **attached** to Mr. Drury’s evidence, which were prepared in consultation with Mr. Holyoake and myself, and agree with them.

Tracy Joanne Freeman
17 July 2019

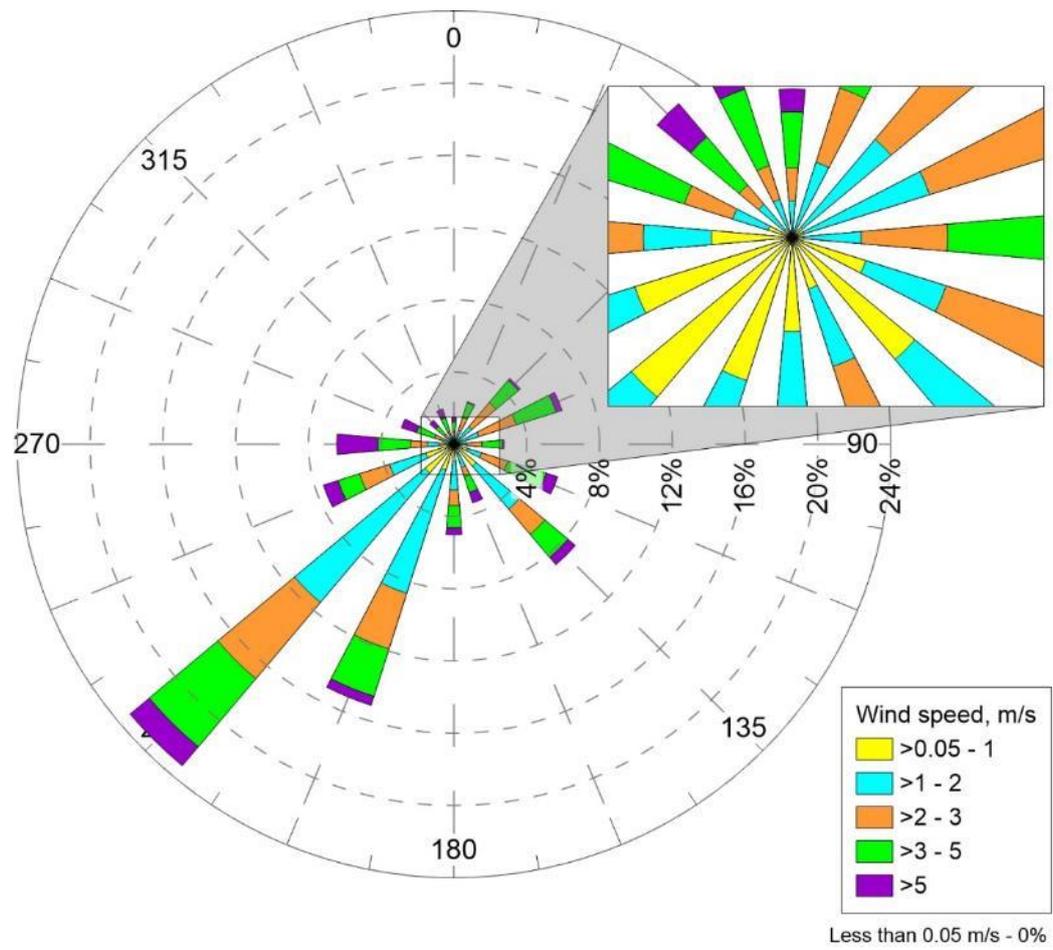
APPENDIX A – FLOW CHART SHOWING PROPOSED MITIGATION PLAN (JULY 2019)



APPENDIX B – WIND ROSES



Windrose showing hourly-average wind observations from Whakatu meteorological data station January 2010 to December 2015.



Windrose for CALMET simulation of wind occurrence at TMM site, hourly average winds 2012.

APPENDIX C – FIGURE 5 FROM HBRC SECTION 42A REPORT

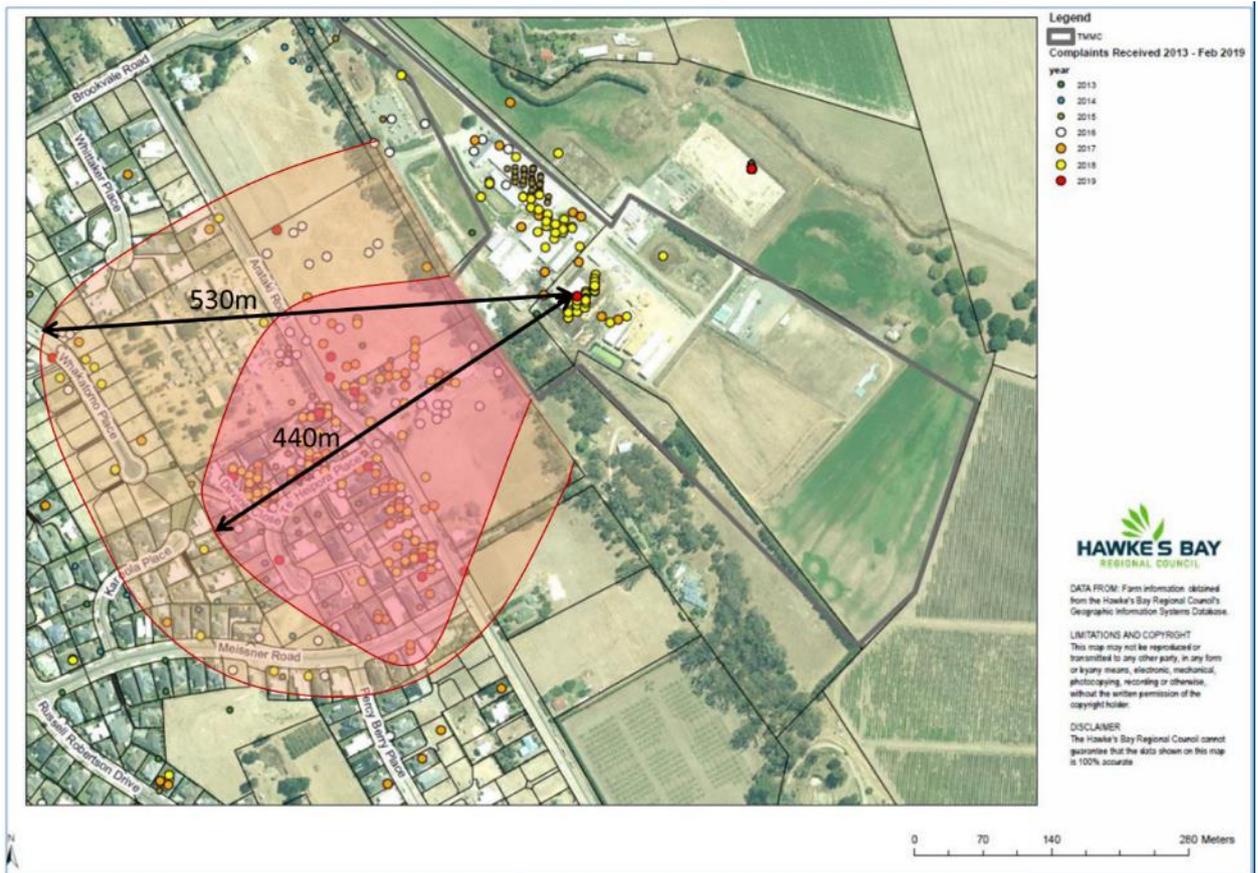
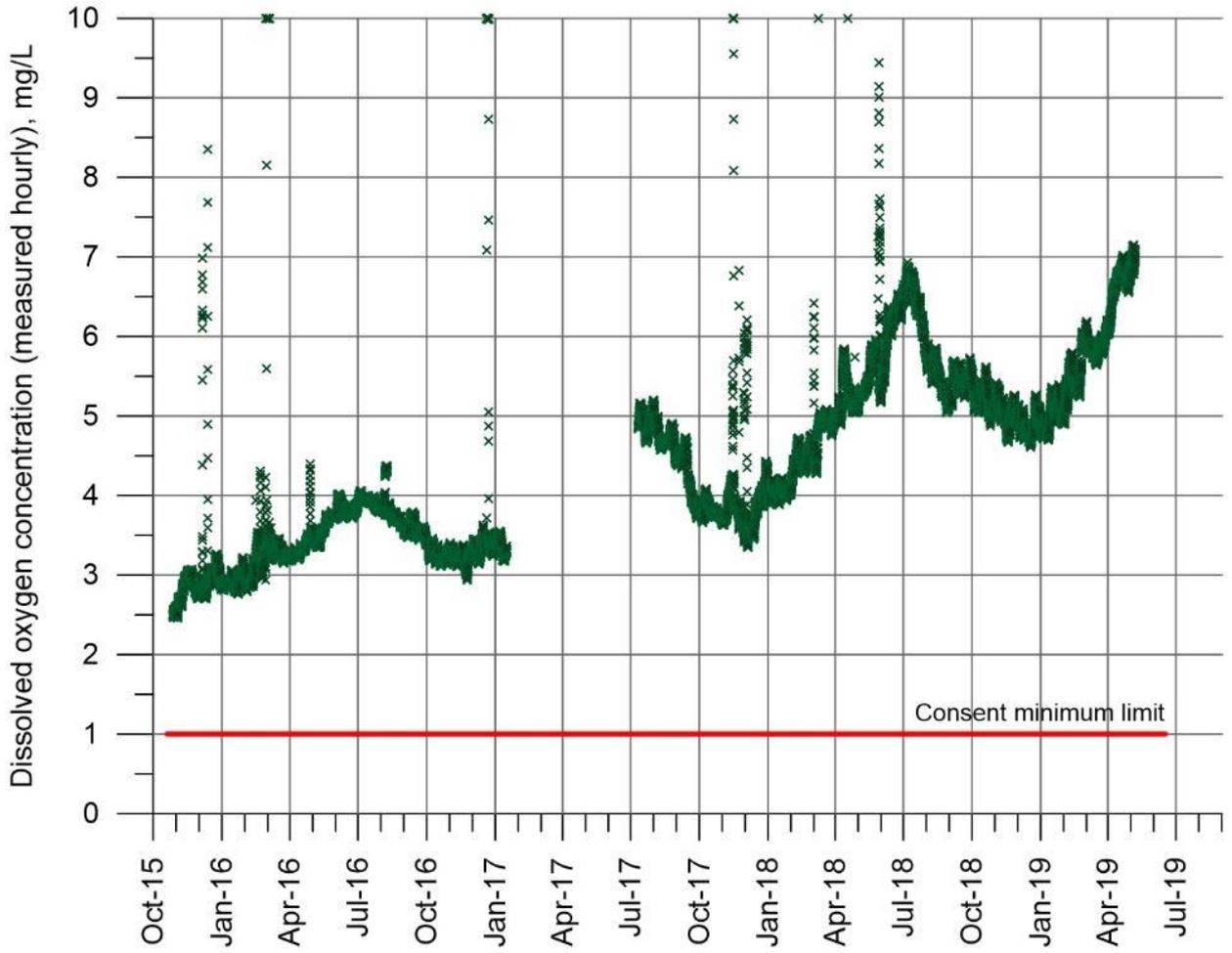
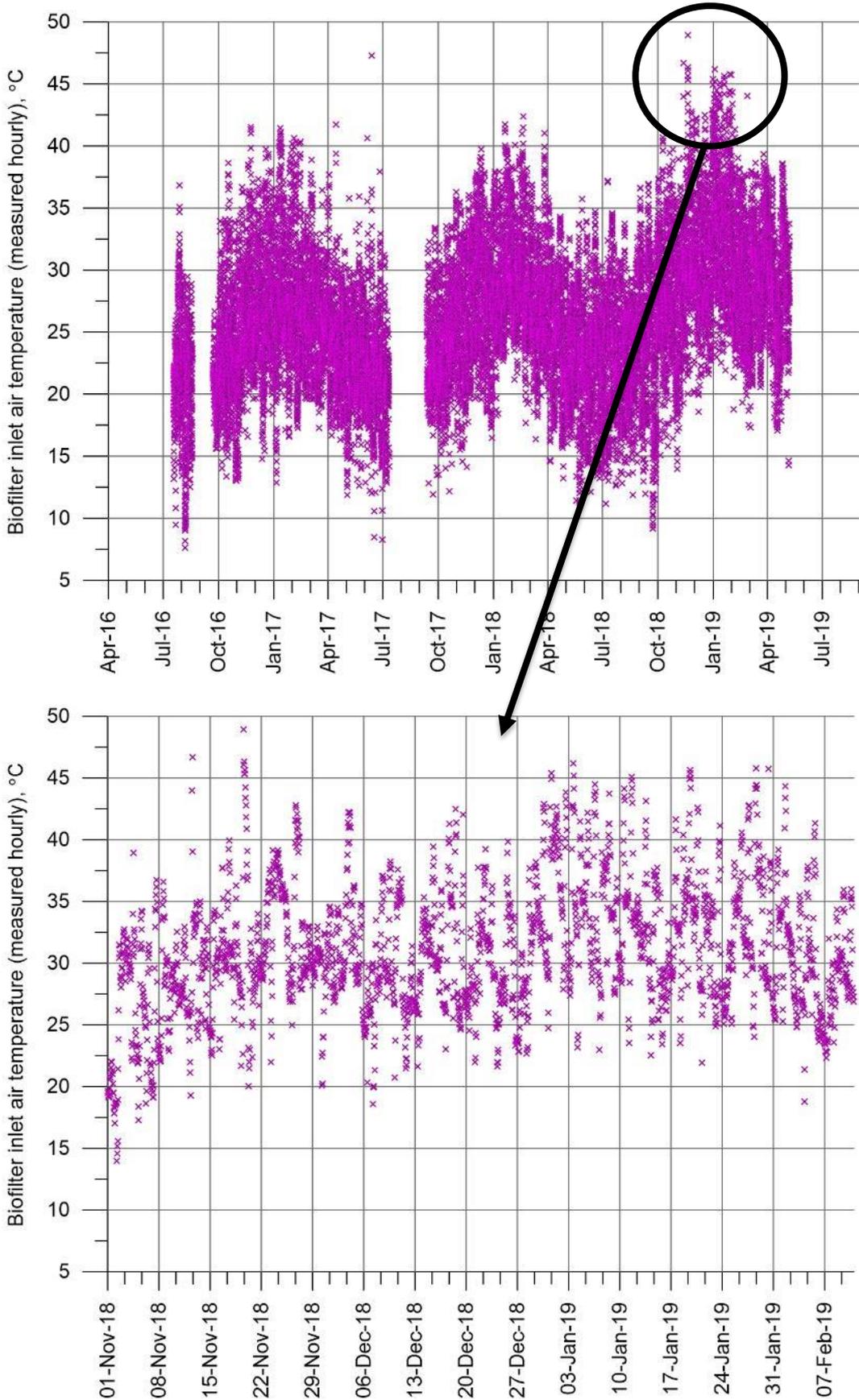


Figure 5 from HBRC Officer's Report – with areas of heightened complaint frequency annotated by yellow and pink shaded arcs. (Shaded arcs and distance annotations added by Tracy Freeman).

APPENDIX D – DISSOLVED OXYGEN MEASUREMENTS IN POND



APPENDIX E – BIOFILTER INLET TEMPERATURE



APPENDIX F – BIOFILTER pH

