

IN THE MATTER OF

the Resource Management Act 1991

AND

IN THE MATTER OF

applications for resource consent (**APP-2005011178.01** and **APP-2018201909.00**) to Horizons Regional Council associated with the construction of a wetland as part of the proposed upgrades to and ongoing operation of the Eketahuna Wastewater Treatment Plant

BY

TARARUA DISTRICT COUNCIL
Applicant

**STATEMENT OF EVIDENCE OF JOHN MILTON CRAWFORD (WASTEWATER)
ON BEHALF OF TARARUA DISTRICT COUNCIL**

12 November 2018

BUDDLEFINDLAY
Barristers and Solicitors
Wellington

Solicitors Acting: **David Allen / David Randal / Esther Bennett**
Email: david/allen@buddlefindlay.com
Tel 64-4-499 4242 Fax 64-4-499 4141 PO Box 2694 DX SP20201 Wellington 6140

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INTRODUCTION

Background and role

1. My full name is **John Milton Crawford**.
2. I am currently employed by Beca Limited in the capacity of Principal – Wastewater Engineering. I have been in this role since May 2017, a period of 18 months. My technical specialty is in wastewater treatment systems, re-use and disposal schemes.
3. Prior to this role at Beca, I spent a brief period as a self-employed engineering consultant. It was during this time that I appeared at the previous hearing of this matter.
4. Prior to the self-employed role, I was employed by Opus International Consultants Ltd (Opus) for a period of 31 years. At Opus, I held the position of Principal Environmental Engineer based in Hamilton. For a period of 10 years, I was also the Technical Leader for Environmental Engineering at Opus.
5. My first brief evidence dated 14 March 2018 was given in relation to the application for resource consents for the discharges from the Eketahuna Wastewater Treatment Plant ("**EWWT**P") lodged by Tararua District Council ("**TDC**").
6. This brief of evidence is given on behalf of TDC in relation to its application ("the **Wetland Application**") under section 88 of the Resource Management Act 1991 ("**RMA**") for resource consents relating to the construction of a wetland as part of the wider proposed upgrades to and ongoing operation of the EWWT. This includes responding to queries raised by the Panel in its minute dated 29 October 2018 ("the **Ninth Memorandum**"), a subsequent update to my first brief of evidence and comment on the Council Officers' Section 42A Reports, as relevant to my area of expertise.
7. In light of the limited scope of the Wetland Application and the hearing that will take place on 27 November 2018, I address matters relating to the Wetland Application in Part A. My responses to matters raised that fall outside the scope of the Wetland Application, and 27 November hearing, are addressed as "other matters" under Part B.

Qualifications and experience

8. In addition to the qualifications and experience as set out in my first brief of evidence dated 14 March 2017, I have since and am currently providing strategic and technical advice for WWTP and discharge systems upgrading or replacement at Rawene, Kerikeri, Snells Beach, Clarkes Beach, Te Kauwhata, Te Awamutu, Cambridge, Katikati, Hamilton, Waipawa, and Waipukurau. These current projects represent various combinations of pond and high rate treatment and discharges to both land and surface water.
9. In October 2017 I was engaged by Raukawa Charitable Trust to provide support to their Te Rōpū Whai tikanga ā-wai (the "**the Trust**"). This engagement is in relation to proposals by South Waikato District Council ("**SWDC**") for the upgrading infrastructure and renewal of discharge consents for four WWTPs in both the Waihou and Waikato River catchments. Over the past 12 months I have assisted the Trust in development of success criteria, evaluation of options proposed by SWDC and review of draft consent conditions to the point where the Trust has been happy to endorse the consent applications prior to submission to the Regional Council for processing.
10. I have recently been appointed Technical Adviser to Queenstown Lakes District Council to assist them with development and procurement of the next stages of development (related to population growth) of the Queenstown and Wanaka WWTPs and as Peer Reviewer for development of the new Cardrona WWTP.

Code of conduct

11. I confirm that I have read the 'Code of Conduct' for expert witnesses contained in the Environment Court Practice Note 2014.
12. My evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Scope of evidence

13. My evidence relates to the following matters:
 - (a) Part A: Wetland Application:

- (i) Queries raised by the Panel in its minute dated 29 October 2018 relating to the wetland application ("the **Ninth Memorandum**"); and
 - (ii) Matters raised in the Council Officers' Section 42A Reports as they relate to the Wetland Application.
- (b) Part B: Other matters:
- (i) An update to my previous EWWTP evidence;
 - (ii) Queries raised by the Panel in the Ninth Memorandum outside the scope of the Wetland Application; and
 - (iii) Matters raised in the Council Officers' Section 42A Reports outside the scope of the Wetland Application.

PART A: WETLAND APPLICATION

Queries raised by the panel relating to the wetland

14. I now address, where relevant to the areas in which I am providing evidence for TDC, issues raised by the Panel in its Ninth Memorandum.
15. **2.6 Wetland standards:** From my perspective, the wetlands are not part of the treatment process train of Eketahuna WWTP. The end of pipe effluent standards that I have suggested in my first brief of evidence do not assume a contribution by the wetland. Any further treatment gains provided by the wetland are incidental.
16. **2.7 SIN:** There is no intention to increase the amount of nitrate in the effluent prior to the wetland. This would require a fundamental change in the type of treatment plant, rather than addition of tertiary polishing processes. Very few oxidation pond systems naturally nitrify (convert ammonia-N and organic-N (collectively TKN) to nitrite and nitrate) fully and reliably. What we see from Eketahuna is already low concentrations of effluent nitrogen (by oxidation pond standards). Based on the latest information available, i.e including 12 effluent samples from 2017 and 6 from 2018, the average soluble inorganic nitrogen (SIN) for the 2016 – 2018 period (Total of 30 data points) is 6.0mg/l and the Total N is 9.3mg/l. Both of these are low compared to typical oxidation pond performance. The SIN in particular is already low for a pond system.
17. The panel are correct in that the ammoniacal nitrogen makes up the majority of SIN in the final effluent. The current average is made up as 5.6mg/l NH₄-N

+ 0.4mg/l TON (Total oxidized nitrogen. 90th percentile SIN is 10.1 + 1.1 mg/l respectively). The reason that the TON is so low is that pond systems naturally denitrify readily. That is, almost all of the nitrite and nitrate that is oxidized from TKN is subsequently denitrified due to anoxic conditions that develop at lower depths in the pond and which can develop more generally during the hours of darkness after the pond algae cease their photosynthetic activity for the day.

18. Wetlands downstream of an oxidation pond based WWTP will therefore rarely receive a great deal of nitrite or nitrate to denitrify. This is as opposed to a nitrifying activated sludge plant from which substantial amounts of oxidized nitrogen can be found in the effluent, depending upon the plant configuration.
19. Given the low concentrations of nitrogen, and its limited in stream effects as set out in the evidence of Dr Ausseil, it is not proposed to undertake any further processing of the wastewater at the plant to reduce it further. To do so would involve installing a higher rate fixed film or activated sludge style process that would cost in the order of \$1M to \$1.2M as discussed in paragraph 8.11 of my first brief of evidence.

Matters raised in Council Officers' Section 42A Reports relating to the wetland

Logan Brown – Freshwater and Partnerships Manager

20. **Paragraph 10:** In this paragraph of his report, Mr Brown makes several references to recently installed floating wetlands for wastewater treatment purposes. It is not that while there may have been 1 or 2 successes with these particular wetlands in New Zealand, they have primarily failed for reasons of both structural integrity and unwanted process outcomes.
21. **Paragraph 12:** In this paragraph of his report, Mr Brown discusses the percentage of effluent SIN that is nitrate. I have no reason to dispute the percentages he quotes. However, the percentage calculations are based on low effluent nitrogen numbers and so, as previously described by Dr Ausseil, this is not necessarily contributing to any detectable effect in the river.
22. **Paragraph 14:** As above, there is no intention to fundamentally change the Eketahuna WWTP to decrease the effluent ammonia level further and increase the amount of nitrate available for denitrification in the proposed wetland. That would involve spending large amounts of money to achieve little, if any, benefit.

23. **Recommendation at 45(a) Monitoring:** I have no objection to monitoring the effluent upstream and downstream of the wetland. However, only one of those monitoring points is necessary for demonstrating compliance. The other would be of use only as a wetland monitoring tool and, if adopted, sampling could be undertaken at a lesser frequency than the compliance monitoring site.
24. **Recommendation 45(d) Nitrification:** For the reasons discussed above and as I will discuss below, I do not consider investigation of additional nitrification in the oxidation pond system is warranted.

PART B: OTHER MATTERS

An update to my previous EWWTP evidence

25. This section provides an update to section 8.1 of my previous brief of evidence. I provide this update (**Table 1**) by way of a replacement for Table 2. Eighteen more sets of performance data have been received and added to the data set. These cover monthly treatment plant performance monitoring. In addition, I have separated performance analysis to more accurately demonstrate changes in performance. As can be seen by comparison with Table 2 in my previous evidence, there has been a small decrease in effluent quality, since the 2008 to 2012 period, in terms of ammonia, total nitrogen and E.coli (0.3 log₁₀).

Table 1: Historic Effluent Quality Indicators

| Analyte | Long Term (2008-18) Performance | | 2008-12 Performance | | 2013-15 Performance | | 2016-18 Performance | | HRC Proposed conditions (Post July 2018) | |
|---------------------------|---------------------------------|-----------|---------------------|-----------|---------------------|-----------|---------------------|-----------|--|-------------|
| | Mean | 90th %ile | Mean | 90th %ile | Mean | 90th %ile | Mean | 90th %ile | Mean* | 90th %ile** |
| scBOD ₅ (mg/L) | 2.8 | 5.0 | 3.1 | 4.5 | 2.4 | 4.4 | 2.9 | 5.0 | <3 | <6 |
| TSS (mg/L) | 27 | 51 | 28 | 50 | 30 | 57 | 22 | 42 | <15 | <30 |
| Ammonia (mg/L) | 3.9 | 8.0 | 3.1 | 6.7 | 3.8 | 6.9 | 5.6 | 10.1 | <4 | <11 |
| Total Nitrogen (mg/l) | 7.8 | 13.2 | 6.9 | 12.6 | 7.9 | 12.1 | 9.3 | 15.9 | | |
| D.R phosphorus (mg/l) | 0.8 | 1.9 | 0.7 | 1.8 | 1.2 | 2.1 | 0.9 | 2.0 | <0.5 | <0.7 |
| Microbiological | Median | 90th %ile | Median | 90th %ile | Median | 90th %ile | Median | 90th %ile | Median | 90th %ile |
| E.coli (MPN/100ml) | 545 | 6379 | 485 | 6835 | 559 | 2590 | 998 | 7265 | <50 | <200 |

* No more than 8 exceedances in 12 samples

** No more than 2 exceedances in 12 sample

26. The effluent ammonia concentration has deteriorated with time. However, the actual number is still low for a wastewater oxidation pond system. It is not proposed to provide further treatment plant upgrades in this respect. To reliably convert further ammonia to nitrite and nitrate would require a fundamental change to the treatment plant which, in my opinion, is not warranted based on the lack of measured effect.
27. Council are likely to receive claims of low cost upgrade alternatives, from various quarters, for removal of ammonia from oxidation ponds. However, in my experience, these have not demonstrated sufficient efficacy or reliability on which to base a reliable, planned and consented ammonia reduction decision.
28. Based on the estimated influent E.coli numbers used in my previous evidence (Section 8.13), the current average performance represents approximately an average 3.7 log₁₀ inactivation of E.coli. This is very similar to the long term average and so it would still be advisable to budget on a 2 log₁₀ inactivation requirement when designing the new UV disinfection system.
29. Based on the evidence of Dr Ausseil with regard to in stream effects, my recommendations with regard to proposed treatment plant effluent quality remain unchanged and I repeat here, Table 6 from my previous brief of evidence.

Table 2: Proposed Effluent Quality Standards

| | Following implementation of proposed upgrades | |
|---|---|-------------------------|
| | Mean | 90th %ile ^{1*} |
| scBOD ₅ (g/m ³) ¹ | ≤ 5 | ≤ 8 |
| Total suspended solids (g/m ³) | ≤ 15 | ≤ 30 |
| Ammoniacal nitrogen (g/m ³) | ≤ 10 | ≤ 15 |
| DRP (g/m ³) | ≤ 0.5 | ≤ 1.0 |
| | Median | 90 th %ile. |
| <i>E.coli</i> (MPN/100ml) | 260 | 1,000 |

Responses to Panel questions outside the scope of the Wetland Application

30. I now address, where relevant to the areas in which I am providing evidence for TDC, issues raised by the Panel in its Ninth Memorandum.

¹ scBOD₅ is Soluble Carbonaceous Biochemical Oxygen Demand.

31. **2.2 Characterization - Concentration:** Since the time of the preparation of my first brief of evidence, I am aware of 18 additional days of effluent characterization having been completed. I have commented on the effect of those additional days above. I am not aware of any influent characterization having been undertaken.
32. **2.2 Characterization – Flow:** Since the hearing, daily effluent flow rate and quantity data has been provided through to October 2018. This has largely confirmed and is in close agreement with the previous work undertaken using 2016 daily flows and back calculation process for earlier dates. Table 3 below provides the summarised flow statistics for 2016. I have omitted 2017 as much of that data is absent. My understanding is that that absence is due to an effluent flow meter malfunction. For consistency, I have used an extension of outflow data set used at the first hearing. This is a conservative approach and ensures that the conclusions provided are on a worst case basis. The reason that I say this is that there is apparent disagreement between the influent and effluent flow meters and the effluent flow meter produces a worse case than the influent meter. As can be seen in Table 3 below, the 2018 effluent flows, to date are slightly lower than for 2016 when comparing individual statistics.

Table 3: 2016 and 2018 Effluent Flow Statistics

| Statistic | 2016 | 2018 (to October) |
|------------------|-------------------------|--------------------------|
| | Out (m ³ /d) | Out (m ³ /d) |
| Dry weather flow | 175 | 195 |
| Average | 637 | 604 |
| Median | 503 | 465 |
| 90%ile | 1464 | 1289 |
| 95%ile | 1669 | 1411 |
| Maximum | 1877 | 1738 |

33. **2.4 Package Plant:** The question from the Panel refers to the “... installation of the *package plant*”. This should probably be corrected to “..... installation of the *additional unit processes*”. In the water industry, the term ‘package plant’ normally refers to a small, self-contained ‘off the shelf’ treatment plant of a standard design and construction that is largely built ‘off-site’. Reference to such an installation could give an incorrect impression of what is intended at the site, which is the installation of some additional unit

processes (e.g lamella, UV, wetlands) to enhance the quality of the output from the existing treatment plant.

34. **2.4 Timing:** My recommended project implementation duration has not changed. I am not able to comment on why no influent characterization has been undertaken.

Matters raised in Council Officers' Section 42A Report outside the scope of the Wetland Application

Fiona Morton - Planning

35. **Paragraph 33 I & I:** Ms Morton refers, at paragraph 33 of her report, to Mr Brown's recommendation about reducing infiltration and inundation into the wastewater system. I believe that she is referring to 'inflow and infiltration'. It is true that any I&I reductions achieved in the sewer system will be beneficial to both the treatment system and to the wetland. However, I&I programmes are never fully successful.
36. **Paragraphs 40 and 91:** At paragraphs 40 and 91 of her Section 42A Report, Ms Morton queries whether TDC intends to pursue the lining of the treatment ponds. For the reasons discussed in paragraphs 11.26 to 11.30 of my previous brief of evidence, I do not consider retrospective lining of the Eketahuna oxidation ponds to be warranted unless it can be demonstrated that there is considerable leakage occurring from the ponds.

John Milton Crawford

12 November 2018