Before the Hearing Panel appointed by Canterbury Regional Council

IN THE MATTER OF The Resource Management Act 1991

AND

IN THE MATTER OF Applications CRC204106, CRC204107, CRC204143, CRC211629 and RC204105 to establish, operate, maintain and rehabilitate an aggregate quarry by Taggart Earthmoving Limited

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SUMMARY STATEMENT

SECTION 42A REPORTING OFFICER
CANTERBURY REGIONAL COUNCIL
GROUNDWATER – AMBER KRELEGER

DATED: 07/07/2021

INTRODUCTION

1. My name is Amber Kreleger. I am a Senior Groundwater Scientist employed by the Canterbury Regional Council.
2. While this is a Council Hearing, I acknowledge that I have read the Environment Court's Code of Conduct for Expert Witnesses as contained in section 7 of the Environment Court Practice Note 2014, and have complied with it in the preparation of this summary.
3. Matters related to groundwater have been raised often during previous days of the hearing, therefore it might take me some time to go through my statement. Some matters will be dealt with by Mr Simpson, with support of Mrs Rutter, who will present after me.

SCOPE OF REPORT

4. This report is an addendum to my primary Section 42A report which is included as Appendix 4 of the Section 42A Officer's Report circulated on 8 April 2021. The purpose of this addendum is to provide a summary of my report, respond to matters raised in the Applicant's evidence and respond to matters raised during the hearing.
5. In preparing this addendum report, I have reviewed the following information:
    a. Statement of evidence for Taggart Earthmoving Limited (19 April 2021) provided by
        i. Paul Taggart – CEO/Director
        ii. Tracy Singson – Contaminated Land Service Leader
        iii. Neil Thomas – Hydrogeologist
    b. Addendum to Statement of Evidence provided by Neil Thomas on 30 April 2021.
    c. Evidence presented and matters raised during the hearing.

JOINT WITNESS STATEMENT

6. I participated in expert witness conferencing related to groundwater science and my points of agreement and disagreement with the other experts have been documented in two signed Joint Witness Statements.

SECTION 42A REPORT SUMMARY

7. The Applicant proposes to excavate aggregate and deposit fill at the Rangiora Racecourse site to a depth beyond the highest groundwater level. The site is located in a community supply drinking water protection zone (DWPZ) for the Rangiora water supply back up bore and there are several domestic wells within 500 m downgradient of the site.

8. Restricting the fill to only virgin excavated natural material (VENM) will help to reduce the risk of contaminant discharges to groundwater. However, as noted by Ms Iles in her evidence, it is crucial to ensure that the backfill is indeed uncontaminated VENM. This requires adequate verification procedures of the imported material. Any changes to groundwater quality, due to intermittent saturation of compliant VENM, are expected to be aesthetic and not a risk to human health. This is relevant for the downgradient groundwater users.

9. Safeguarding a 1 m separation between the excavation depth and the real-time groundwater levels at all times prevents standing groundwater in the pit and decreases the risks of contaminants (fuel spills and pathogens) directly entering groundwater. This will require diligent and continuous groundwater level monitoring, including forecasting procedures and alarm systems, regular quarry depth surveys, and the availability of enough emergency backfill to fill the excavation during periods of rising groundwater levels.

10. As this 1 m separation does not provide for much treatment, fuel spills and other contaminant discharges must be prevented at all times.

11. The intention of the original proposal is in line with the above, but I highlighted the following concerns in my primary Section 42A Report:

    a. The proposed VENM verification and testing procedures are inadequate (see primary Section 42A report by Ms Samantha Iles).

    b. There is potentially not enough emergency backfill available to safeguard a 1 m separation in each 2 ha quarry stage when excavation depths go beyond average groundwater levels. This increases the risk of standing groundwater in the excavation.

12. Based on the above concerns I proposed several changes to the mitigation and monitoring to reduce the risks and effects for groundwater quality and downgradient groundwater users. The main changes I proposed in my primary Section 42A Report are:

    a. VENM verification, testing and tracking procedures, ideally including the testing of every load or an investigation of every source site; and

    b. Reduced maximum excavation depth and excavation area.

13. I also highlighted that the Applicant should clarify

    a. The working of the groundwater level alarm and the method of forecasting of rising groundwater levels;

b. The process of establishing groundwater quality trigger levels after baseline monitoring, and the subsequent assessment of samples against these triggers; and,

c. The dynamics of further excavating the quarry after emergency backfill has been placed to safeguard 1 m separation with real-time groundwater levels.

MATTERS RAISED

14. I will now comment on some matters raised in the evidence statements and summaries provided by the Applicant before and during hearing as it relates to groundwater quality and my previously mentioned concerns.

Amended VENM acceptance and screening process

15. I rely on the expertise of Ms Iles for the review of the amended staged VENM acceptance and screening procedure. Based on her review, I accept the amended proposal as being adequate to help mitigate risks for groundwater quality, provided any amendments she proposes in her Summary Statement are incorporated.

16. As the amended proposal includes a quality assurance for each VENM source site, I no longer see the need to assure the quality of every imported VENM load.

17. Provided the waste acceptance procedures are followed I expect that the risks to the groundwater environment and downgradient users from depositing compliant VENM below the highest groundwater level are low and will not leave drinking water taken from downgradient bores unpalatable or unsafe for drinking. However, I also note that in her summary statement, she made the point that it is not possible to fully eliminate the risks of the proposed quarrying and backfilling activities.

Groundwater levels at the site

18. Mr Thomas correctly concluded that the key area of disagreement between us is with respect to groundwater levels across the site.

19. On day 2 of the hearing, Commissioner Iseli asked Mr Thomas if this disagreement matters as in reality the Applicant is restricted to excavations by real-time groundwater levels at their own risk. Mr Thomas highlighted that the disagreement matters in cases of rising groundwater levels.

20. Based on discussions afterwards, during groundwater conferencing, I agree with the view of Commissioner Iseli, which is why I have decided to forgo my previous proposal of lower excavation depth restrictions.

21. But I also agree with Mr Thomas that the rate or speed of groundwater level rise depends on real-time groundwater levels on the site. It matters if groundwater levels of 6 m bgl are rare or common, as in the first situation there is a higher chance of rising groundwater into the excavation.

22. It is relevant to note that extracting gravels from less than 5 m bgl would not make the project economically viable, as expressed by the applicant in the AEE. Therefore, it is important for all parties to have more certainty around groundwater levels and fluctuations on the site.

23. I appreciate that Mr Thomas provided more recent groundwater level monitoring, collected from newly installed bores on the eastern end of the site. I agree that the results show that in the period of 21 April 2021 to 30 April 2021 groundwater levels in this area were probably below 6.5 m bgl as the bores were dry.

24. The comments I like to make are:

a. The data of these two bores does not give us more information on groundwater levels for the whole site and groundwater fluctuations on the site;

b. We are currently experiencing extremely low groundwater levels in Canterbury. Long-term data from CRC monitoring bores in the area shows that measured groundwater levels are within the 5% lowest values in the data set. That is, 95% of groundwater levels recorded by CRC in this area over time are higher than the current groundwater levels. I have provided this information at the back of my summary, which I am happy to clarify if requested.

25. Based on my attached assessment of long-term data, in addition to the information already provided in my primary Section 42A Report, I expect that groundwater levels are likely higher than 6 m bgl, most of the time.

26. Mr Thomas agrees with me that baseline groundwater level monitoring gives more insight into how groundwater levels vary on site and during the year, but the Applicant has not provided any suitable baseline monitoring since the first measurements in April 2017.

27. We agreed a baseline period of groundwater level monitoring of at least 12 months should be included in the consent conditions, but unfortunately this will not resolve our disagreement as it stands now.

Emergency backfill volumes

28. Mr Taggart provided an adjusted calculation of the required emergency backfill for a maximum excavation area of 1 ha instead of 2 ha. In this case there would be enough emergency backfill available on-site (34,500 m^3 in total) to excavate to 4 m bgl. For an excavation to 5 m bgl there would be a 5,500 m^3 shortfall. Mr Taggart explained that this volume can be trucked in from Cones Road.

29. He also explained that the motor scraper is not needed during emergency backfilling. My previous understanding, based on further information supplied by the Applicant, was that use of the motor scraper was required during emergency backfilling, which would have been highly impractical due to the restriction of 3.5 hours of use per day.

30. I agree with Mr Taggart's amended calculations and importing the relatively small shortfall of 5,500 m^3 from the Cones Road site seems reasonable and practicable, provided backfill volumes used in the calculations are available on-site and off-site and can be deposited in a timely manner.

31. I propose that stockpile volumes of 23,000 m^3 VENM and 11,500 m^3 excavated gravel are incorporated in the consent conditions if consent is granted.

Backfilling during rising groundwater levels

Water level forecast model

32. Commissioner Rogers asked Mr Taggart to explain how emergency backfilling will be managed when the groundwater level alarm goes off at 2 am.

33. The response provided by Mr Taggart highlighted that the Applicant has not adequately assessed the required forecasting model and procedures to prevent any situation like this happening.

34. All groundwater experts agree that sending out the Quarry Manager at night to start backfilling in the dark, potentially in torrential rain, is a situation that needs to be avoided at all times.

35. Experts agreed that

    a. management actions should be in place well before the 1 m separation is breached, so anticipation is key.

    b. the forecasting model should adequately anticipate rising groundwater levels and prevent beaching of the 1 m separation

    c. it is hard to define what the ideal procedure should look like, but we have listed the minimal requirements for such a forecasting model in the Joint Witness Statement.

    d. these minimal requirements still would not guarantee a suitable forecasting model is achieved.

36. Building a groundwater level forecasting model requires baseline monitoring and input from, and testing by, expert scientists. Experts should be available at all times to solve issues with the model. If consent is granted, approval by CRC of the model and the related management strategies should be required before the Applicant can start any quarry related activities.

37. In my opinion it should be possible to design an adequate forecasting model, but the weight of approval by CRC is paramount, as technically the Applicant would already have a consent in hand, if granted.

Timeframes

38. As I stated before, anticipation of rising groundwater levels is key. Experts investigated the importance of this further by estimating how many trucks might be required to move 10,000 m^3 of emergency backfill. Mr Taggart had indicated to Mr Simpson that quarry trucks can handle 10 m^3 material, 20 m^3 if a trailer was added.

39. Looking at trucks only, 10,000 m^3 would require 1,000 trucks. Inadequate forecasting could potentially lead to the scenario described by Commissioner Rogers. If emergency backfilling is only allowed during operating hours, the Applicant must deposit 10,000 m^3, which is a layer of 1 m in an excavation of 1 ha, in 8 hours, to reinstate the 1 m safeguard within one day. This would require 125 trucks per hour, or more than two trucks per minute.

40. This simple calculation shows that, to work with realistic and practical timeframes, excavation campaigns need to cease well ahead of time for appropriate emergency backfilling to start. And this depends on an adequate forecasting model.

Area of excavation

41. Safeguarding 1 m separation with real-time groundwater levels is dependent on adequate emergency backfilling management. As emergency backfilling management depends on the amount of backfill that can be moved into the excavation pit in a timely fashion, restricting the size of the excavation that is open to rising groundwater levels reduces the required volumes and reaction times.

42. In my primary Section 42A report I proposed excavation depths within 1 m or below the highest groundwater levels should be restricted to an area of 0.5 ha. In my view this size provides a better opportunity for timely emergency backfilling, reduces the risk of standing groundwater in the pit, and therefore reduces the risks of contaminants in the pit accidentally entering directly into groundwater.

43. In theory, an adequate forecasting model and related emergency backfilling management should be suited to the size of the excavation. Which means, in theory, a larger excavation area should be possible.

44. As I currently cannot guarantee that a suitable forecasting model will be achieved and approved if consent is granted, I propose to restrict deeper excavations to an area of 0.5 ha as a precautionary approach.

Dynamics of excavating and emergency backfilling

45. I now understand the emergency backfilling dynamics could involve a scenario in which VENM is deposited first as part of rehabilitation, then gravel is deposited on top as emergency backfill, followed by deposition of more VENM if required. And then, these layers will be removed again as the excavation campaign restarts.

46. Although these dynamics still seem impractical to me, from a groundwater perspective I am no longer concerned, provided the amended VENM quality assurance procedures are strictly followed.

Groundwater quality: contaminant trigger values

47. During conferencing the experts have reached an agreement on how to set trigger values for contaminant concentrations in groundwater quality samples. We also reached agreement when and what actions should be triggered when these values are exceeded.

48. I expect that any significant contaminant concentration increases on the site can be picked up by the groundwater quality monitoring procedures if trigger values are set this way.

49. We also agreed on trigger levels for domestic bores, although we were not able to reach agreement or state our disagreements on how to include trigger values for domestic supply bores that are close to or already exceeding the Guidance Values or half the Maximum Acceptable Values in the Drinking Water Standard New Zealand.

50. In my opinion, we should not allow the groundwater quality in these bores to be degraded any further. It is not clear yet how many bores this will affect.

Model re-run fuel spill

51. I have reviewed the results of Mr Thomas' amended contaminant transport model for a spill from a 320-litre diesel fuel tank on site and I agree with Mr Thomas that the risks for downgradient groundwater quality and drinking water users caused by an accidental fuel spill are relatively low, especially if any contaminated material is removed from the site in a timely fashion, which this modelling doesn't account for.

52. During the questioning of Mr Thomas, Commissioner Rogers asked if a sucker truck would be available for the event that a spill coincides with heavy rainfall. I would support the timely availability of a sucker truck, firstly because ponding in the excavation pit should be prevented at all times, secondly because I don't agree with Mr Thomas' statement that rainfall will dilute fuel in a way that it becomes less risky to groundwater.

53. I do note that one of the mitigation measures in the proposed conditions includes removal of the contaminant source. This should be possible when the spill is witnessed. An accidental spill or deposition of any contaminant that occurs without witnesses will be hard to track back when contaminants exceed trigger levels in downgradient bores. This means that the Applicant should probably rely on other mitigation measures in this situation.

54. A mitigation measure that has not been discussed during conferencing is a 'pump-and-treat' system, where contaminated groundwater is pumped up between the site and downgradient bores to prevent the contaminant plume from travelling further. If

the source is not cleaned up, a system like this should be put in place until contaminant concentrations coming into the pump-and-treat system are back to acceptable levels.

E. coli / microbial contamination

From the site

55. In his Statement, Mr Thomas presented the same calculations he provided in the AEE. His expectation is that microbial contaminants in exceedance of the NZDWS values can travel a maximum distance of 150 m from the site.

56. There is disagreement between the experts around this. As I have highlighted in my primary Section 42A report,

    a. It is unclear which removal rates the Applicant has referred to.

    b. CRC prefers to use a one-year time of travel for the protection of community drinking water supply bores. Where there is large uncertainty over the travel distances, CRC recommends using a maximum distance of 2.5 km upgradient of the drinking water source.

57. Based on the information above and the approach used by CRC, there is a risk that *E. coli* contamination in the excavated pit could travel further than 150 m.

58. While I have a conceptual understanding of how microbial contamination in groundwater is assessed, Dr Rutter has extensive experience in this field. Dr Rutter will present her view on the microbial contamination risk after my presentation, and I am in support of her technical assessment.

59. In my view, an adequate water level forecasting model should prevent groundwater ponding in the quarry, which reduces the risk from microbial contamination from bird life or other sources.

From other sources

60. I agree with Mr Thomas that shallow groundwater downgradient of the site is already at risk from microbial contamination, as there are several properties in the area which are not part of the reticulated wastewater system. These properties are likely to rely on septic tanks and/or land disposal for their wastewater.

61. I also agree that the risk of microbial contamination from the proposed quarry site (birdlife related) is probably lower than the risks from these discharge sites (human effluent related).

Comparison of effects with Miners Road Investigation

62. Commissioner Iseli explored with Mr Thomas the relevance of the results of the Miners Road Quarries Investigation.

63. I highlighted the Miners Road Quarries Investigation in my primary Section 42A report because the quality assurance of the VENM in the original application was inadequate. It gives an indication what might happen if the backfill material includes material not considered VENM. I emphasise that none of the quarry operators at Miners Road are allowed to excavate beyond 1 metre above the highest groundwater level.

64. As the amended staged VENM acceptance and screening procedure has improved from the original application, and is agreed upon by Ms Iles, I expect that the backfill used at the Racecourse site will have significantly lower risks than the material historically deposited at the Miners Road Quarries, provided the waste acceptance procedures are followed.

CONCLUSIONS

65. The amended mitigation measures agreed on between the experts reduce the risks for the receiving groundwater environment and downgradient groundwater users compared to the original proposal.

66. Important aspects of the emergency backfill management, groundwater level forecasting and monitoring and groundwater quality monitoring procedures are still not fully clear or agreed upon and will be dealt with during the first year of the consent, if granted. There is no guarantee these aspects will or can be dealt with adequately.

67. I expect that, theoretically, any risks for the receiving groundwater environment and downgradient drinking water bores will be low provided the Applicant adheres to all the combined rigorous validation, testing, monitoring, forecasting, survey and training procedures at all times.

68. But even with full compliance, risks for downgradient drinking water bores are not eliminated. There is always a chance that non-compliant material is deposited unknowingly, or contaminant plumes are missed by the monitoring bores.

69. Downgradient groundwater users rely on a combination of rigorous procedures and technical information to assess if their risks will stay at an acceptable low level at all times.

70. Any non-compliance or breach of the protocols or conditions, due to human error or otherwise, immediately increases the risks for downgradient drinking water bores.

71. I expect that the groundwater monitoring and/or backfill management procedures the Applicant currently works with at the Ashley River/Rakahuri or Miners Road are not as rigorous as those combinedly required for the Racecourse site. The combination of procedures and protocols and managing these on a day to day base to prevent non-compliance will be onerous on the Applicant and staff should be properly trained or qualified.

Signed:  Date: 07/05/2021

Name: Amber Kreleger

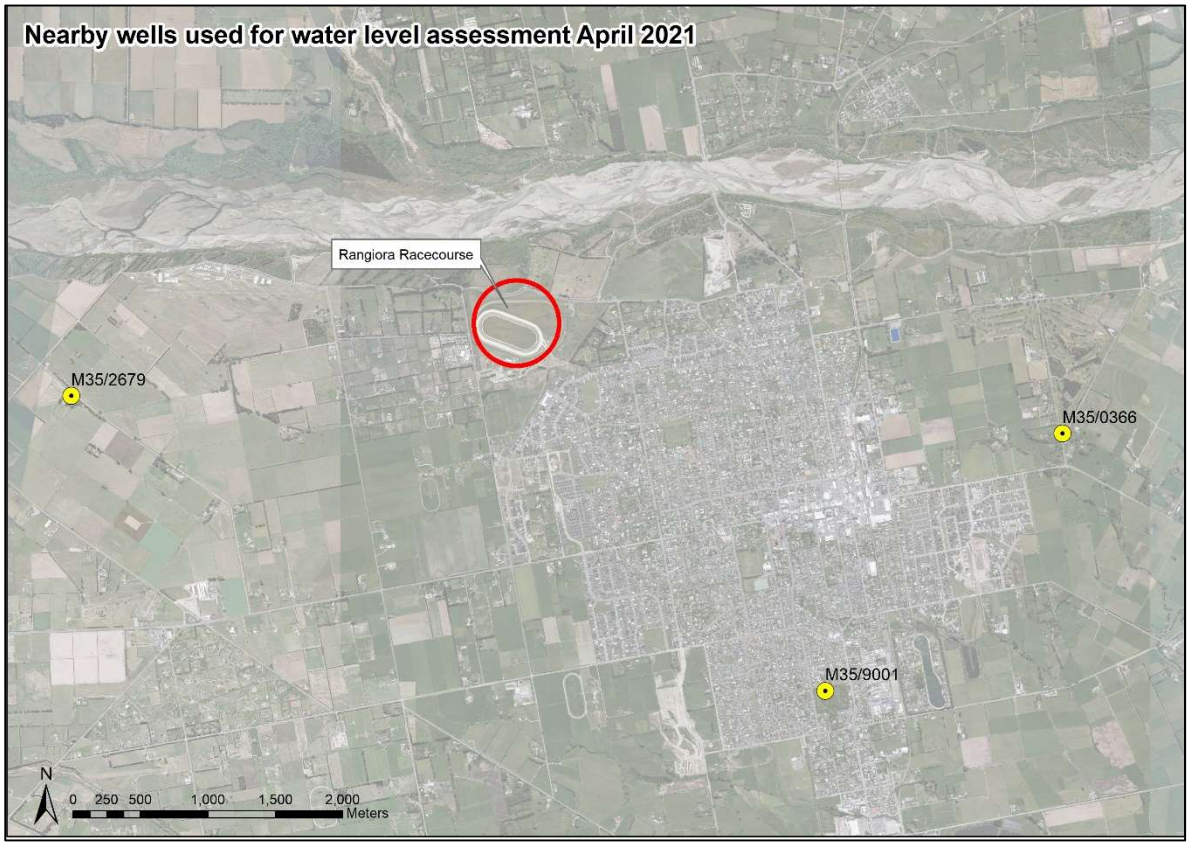
Review:  Date: 07/05/2021

Name: Michael Massey

Principle Science Advisor - Contaminated Land

ASSESSMENT OF GROUNDWATER LEVELS

72. Location nearby CRC Monitoring bores with recent data



73. Details nearby CRC Monitoring bores

bore	M35/2679	M35/0366	M35/9001
Distance from site	3,000 m west	3,800 m east	3,300 m southeast
Depth (bgl)	9.1 m	15.28	1.65
Method of observation	recorder	telemetry	manual
Frequency of observation	Every 15 minutes	Every 15 minutes	monthly
Full data record	December 1983 – April 2021	November 1978 – April 2021	April 2001 – April 2021
Period used in assessment	April 1992 – April 2021, observed daily data at 12pm	April 1992 – April 2021, observed daily data at 12pm	April 2001 – April 2021
Number of measurements used	9,169	10,241	239

74. Normal distribution of groundwater level observations (m bgl) in nearby CRC monitoring bores

percentile	M35/2679	M35/0366	M35/9001
5%	-8.88	-4.26	-1.06
10%	-8.77	-3.71	-0.992
15%	-8.62	-3.54	-0.96
20%	-8.48	-3.47	-0.92
25%	-8.39	-3.41	-0.84
30%	-8.28	-3.36	-0.796
35%	-8.16	-3.32	-0.767
40%	-8.03	-3.27	-0.73
45%	-7.87	-3.23	-0.689
50%	-7.72	-3.19	-0.63
55%	-7.55	-3.14	-0.58
60%	-7.32	-3.1	-0.54
65%	-7.10	-3.06	-0.47
70%	-6.88	-3	-0.404
75%	-6.52	-2.93	-0.365
80%	-6.12	-2.85	-0.33
85%	-5.81	-2.75	-0.26
90%	-5.56	-2.65	-0.208
95%	-5.27	-2.52	-0.139

75. Groundwater levels observed in period 21-30 April 2021

Bore	GWL (m bgl)	percentile
M35/2679	Dry (below 9.1)	1%
M35/0366	4.41 – 4.44	4%
M35/9001	-1.02	7%

76. Observed groundwater levels