In the matter of the Resource Management Act 1991

And

In the matter of an application for Resource Consents by Oceania Dairy Limited to construct and operate a pipeline to discharge treated wastewater into the ocean.

STATEMENT OF EVIDENCE OF PAUL DUDER FOR OCEANIA DAIRY LIMITED

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INTRODUCTION

1 My full name is Mr Paul Duder.

2 I hold a Diploma in Dairy Science and Technology (Massey University), and a Bachelor of Engineering (Auckland University).

3 Since 2015 I have been a Principal with Babbage Consultants Ltd, based in Auckland.

4 I have over 25 years' experience in Operations Management, Project Management and Project Engineering completing multi-disciplinary projects in the food industry generally but with a particular focus on the primary processing sector in New Zealand.

5 In 2013 Babbage was engaged as Project Manager for YiLi (YiLi being the 100% owner of Oceania Dairy Limited). YiLi have recently bought into the New Zealand market at this site and as the purchasers of Westland Milk Products. The company engaged Babbage, in relation to its long-term expansion of the Glenavy plant. As part of the overall site development plan, an increase in the capacity of the plant's wastewater treatment and disposal systems would be required.

6 In relation to this project, I confirm that I report directly to YiLi's International Capital Works Team who are responsible for the delivery of capital works in New Zealand. and I confirm that Babbage is engaged to represent YiLi and to prepare the necessary applications and expert reports to support the application for an ocean outfall at this site.

CODE OF CONDUCT

7 I have read and am familiar with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and agree to comply with it. I confirm that this evidence is within my area of expertise, in the fields of project management and engineering design, except where I state that this evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions I express in this evidence.

8 I accept that in this evidence, I have stated to be Yili's representative to this hearing.

SETTING FOR THIS APPLICATION

9 The existing plant is fully operational on the existing Oceania Cooneys Road site.

10 YiLi's medium to long term plan for the site is to continue to grow the ODL business in terms of both its direct milk supply from dairy farmers, as well as the range of goods produced at the site.

11 The site is located next to Arterial roads and State Highway 1 and is near the main trunk rail corridor.

12 The site is located 20 km from Waimate, and approximately 5km from the Coast as the crow flies.

13 The site holds an existing consent to discharge wastewater to land – over land immediately surrounding the plant comprising an effective area of 278 ha as is explained in the evidence of Mr Lodge.

14 However, with those physical factors governing the site, there are a number of more nuanced factors which have determined the nature and scope of the application. These are as follows:

14.1.1 To the west of the current land-based discharge fields, the hills rise steeply making the land unsuitable for centre pivot irrigators;

14.1.2 The applicant is a foreign-owned company, and even if it were available, it will be difficult for it to purchase land at this location.

14.1.3 The crop cycles on the current land mean that there are always periods of the year (predominately winter months) where land-based irrigation is not appropriate.

14.1.4 As will be indicated later in this hearing by Dr Wilson, nutrient losses are also a factor in terms of farms receiving wastewater from a processing plant, particularly after their nutrient budgets have been already determined to fit in compliance with the Morven Glenavy scheme. This, however, is not within my area of expertise.

15 Against that background it became imperative to find other, more sustainable options for the disposal of treated wastewater, to support the future expansion of the site.

SCOPE OF EVIDENCE

16 My evidence will cover the following matters:

16.1 Consideration of alternative options;

16.2 Description of wastewater treatment process;

16.3 Monitoring of treatment performance;

16.4 Level of treatment and quality of water discharge;

16.5 Control of discharge rates to meet design of diffusers;

16.6 Changes to proposed treatment solution since lodgement.

ALTERNATIVE OPTIONS CONSIDERED

17 Three alternative options were investigated and reported on in Section 8 of the AEE, namely:

- Discharge to a municipal system
- Discharge to freshwater
- Discharge to land

18 A further three options were investigated and not reported on as these were deemed either impractical, too expensive or unlikely to be deemed acceptable from a consenting perspective namely:

- Re-charge to ground water
- Evaporation
- Electrolysis

19 And a further option around minimising the quantity of wastewater was investigated and responded to in item 2i (page 9) of the response to the Section 92 request covering:

- The current ODL practice of recovering RO retentate,
- The current ODL practice of recovering caustic cleaning solutions,
- The current ODL practice of recovering final cleaning rinse flushes, and
- The proposed implementation of a COW water recovery system

20 The following provides further and/or additional information on each of the items aforementioned:

DISCHARGE TO MUNICIPAL SYSTEM

21 The information presented in the AEE remains correct.

22 We did not undertake consultation with Waimate District Council or Timaru District Council (as proposed by WIC in their submission) to investigate the possibility of connecting to their treatment facilities as we believed (from our experience with other councils) that:

- WDC and TDC current treatment plants would be significantly undersized to deal with the ODL volumes

- Councils are generally unable to source the necessary extraordinary funding to consent and construct the upgraded facilities outside their capital expenditure plans in a timely manner

- Any upgraded facility would likely require resource consent for the discharge and the pragmatic options that council have for the disposal of wastewater are the same as those available directly to ODL

- The distance for connection either by pipe or by tanker was deemed impractical

23 Accordingly, our experience is that unless councils have an already constructed and consented facility with suitable unallocated treatment capacity then municipal treatment facilities are not a viable option for handling the volumes of waste generated from today's typical dairy factory.

24 The reticulation to Waimate in any case would have been prohibitively expensive in terms of both the construction and servicing of a 20 km line which is upgradient of the plant and would have required to be physically pumped to Waimate.

25 Accordingly, stand-alone treatment is recommended.

26 For these reasons the option for discharge to a municipal system was dismissed.

DISCHARGE TO FRESHWATER

27 The information presented in the AEE remains correct.

28 It was deemed early on in the process that discharge to freshwater was likely to have significant adverse environmental, social and cultural effects.

29 For these reasons the option for discharge to a freshwater waterway was dismissed.

DISCHARGE TO LAND

30 It was recognised early on that disposal of wastewater to land by irrigation is the preferred option, when it is able to be done in such a way that respects the land itself. For this reason ODL intend to retain the existing land disposal system to enable it to

be used at a time and in a way that best supports the land and in a way that is mindful of farming activities, cropping needs, rainfall and time of year.

31 However, there is always a seasonal difficulty with land-based systems (no matter how much land is available) because the improvement in an existing land based discharge comes, in simple terms, by removing water to an alternative system, when the land doesn't "want" the water.

32 Utilising additional land irrigation to accommodate for future expansion has the following challenges:

- The total area required for irrigation of up to 10,000m3/day is in the order of 2,500ha. I have relied on other experts in determining this number.

- Ideally this area would be currently under boarder dyke irrigation and converted to a cut and carry farming operation. The reason that I have said that it would be ideally under boarder-dyke is because we know through conversion that we can achieve a better reduction in nutrient loss rate – when the starting point is boarder dyke. With properties already under centre pivot irrigation, it is much harder to achieve nutrient targets, for wastewater application – and particularly so where there is a need for year-round application.

- To achieve the land area required would involve piecing together suitable land areas that are currently in dairying with boarder-dyke irrigation and owned by farmers willing to have dairy wastewater irrigated on their farms.

- Conversion to both pivot irrigation and cut and carry is very capital intensive, especially due to the piecemeal nature of the land areas (example given in S42 response)

- Operationally, even with increased land area, the issue will still exist whereby:

    - Land areas will become waterlogged at some stage of the year thus making irrigation undesirable, and

- The fresh water needed to flush the many km's of pipelines (required to mitigate odour events) is not available year-round (restricted to the operation of the MGI irrigation race)

33 We have not consulted with MGI (as proposed by WIC in their submission) about increasing the annual operation of the MGI irrigation race because:

a) Operation of the race would be required year-round, which we anticipated would be challenging to achieve, and

b) Obtaining a water flush capability year-round in itself does not alleviate the other more significant challenges.

34 It is also worth noting that if ODL was to construct and make use of a holding pond with a capacity of 90 days (as is typical in a farming activity to cover the winter period) then the volume that would need to be held would be circa 900,000m3.

35 The design and construction of a holding pond would need to take into account the relatively high ground water levels (-2.5m) that can exist and ensure that storage remains around 1m above the ground water level at all times.

36 Based upon these criteria a concept design of a pond results in a typical depth of 3m and an overall area in the region of 300,000m2 or 30ha. I cannot recommend this as a viable solution because a) Yili have insufficient land area to support such a pond and b) there may be some risk with long term open pond storage creating an odour.

37 For these reasons the option of adding further land area and irrigation of wastewater to land was dismissed.

RECHARGE TO GROUND WATER

38 It is possible from an engineering perspective to discharge wastewater as a recharge to ground water.

39 Even if treated to a very high level and supported by science, it was believed that there is no precedence for this and such a solution would be 'breaking new ground' in the dairy industry and thus prove extremely difficult to obtain consent for. For these reasons the option for discharge by recharge to ground water was dismissed.

EVAPORATION

40 It is possible from a technology and engineering perspective to discharge wastewater (eliminate volume) as a water vapour discharge to atmosphere through evaporation.

41 The primary obstacle to evaporating wastewater is that it is an extremely energy intensive process. For each kg of wastewater to be evaporated would take approximately 2,500 kJ of energy. This energy would need to come from either electricity or coal.

42 For the full 10,000m3 per day this would equate to 2,200 tonnes per day of coal (more than 10x what ODL currently use on site) or 290 MW of electrical energy (approximately 50x the current Alpine Energy supply capacity to site or equivalent to just over half the capacity of the Benmore Power station).

43 For these reasons the option for discharge by evaporation was dismissed.

ELECTROLYSIS

44 It is possible from a technology and engineering perspective to discharge wastewater (eliminate volume) through conversion of the water through electrolysis into Oxygen and Hydrogen gas.

45 There are many practical obstacles to this solution including:

- the energy requirements to undertake electrolysis is approximately 18 times that of evaporation outlined above (i.e. astronomically high)
- the capital cost of the process and storage of the end gas products is also extremely high
- storing large volumes of Hydrogen gas is extremely problematic (its highly explosive)

46 For these reasons the option for discharge by electrolysis was dismissed.

WASTEWATER MINIMISATION

47 Minimisation of both water usage and wastewater volumes is both a current and ongoing priority for ODL. Currently installed initiatives include:

- The current ODL practice of recovering RO retentate,
- The current ODL practice of recovering caustic cleaning solutions,
- The current ODL practice of recovering final cleaning rinse flushes

A common misunderstanding is the belief that if a dairy site recovers all their wastewater for re-use then the need to discharge wastewater can be eliminated. This would be achievable if a dairy site was a 'closed loop' and the water within the site simply went round and round, however a dairy site is not a closed loop because every day they import large volumes of water through the front gate in the milk that is taken in.

48 Every day, depending upon product mix and time of the season, ODL currently import in the order of 1,000m3 of water onto site in the milk. This means that every day the site must dispose of at least that same quantity of water from site otherwise it would continuously and endlessly build up on site.

Therefore, it should be understood that the practice of water recover, even if we could recover 100% of the waste water in a day, does reduce the volume but cannot alleviate the requirement altogether for a waste water discharge stream day on day.

Water recovery does also reduce the amount of bore water required on a daily basis and reducing the bore water take volume lowers the demand on the aquafers which is deemed a positive outcome.

For this reason, ODL are intending to implement their fourth significant water conservation initiative by implementing COW water recovery allowing the COW water (water imported, evaporated and then condensed from the milk) to be used in the process as potable water. This will further reduce the demand on the bore water take and correspondingly reduce the volume of wastewater discharge.

For these reasons it needs to be understood that ODL have a focus on water recovery and re-use however these initiatives only reduce but do not alleviate the requirement to deal with wastewater.

DESCRIPTION OF WASTEWATER TREATMENT PROCESS

49 I **attach** a diagram at Appendix A which demonstrates both the current and the proposed wastewater treatment systems. The blue treatment path shows the discharge to land treatment pathway, and the red shows the additional treatment proposed for discharge to ocean.

50 The treatment systems associated with the ocean outfall, are all available in the market and being currently operated. We have used supplier-based information to inform us of the performance parameters of the systems.

51 Also attached is a chart in Appendix B which shows the comparatives that can be achieved to strip nutrients and BOD from the discharge waters prior to discharge through the ocean outfall.

52 The comparison is between the column A which sets out the parameters for the current discharge following DAF treatment, and the parameters which result following further treatment under Column C.

53 I have then listed a Column labelled “consent” which sets out the parameters which on current industry specifications, the manufacturers of the plant are able to confirm as operating outcomes from their treatment systems.

54 I have then added a further column headed Dr Bolton-Ritchie to show the deviations between our plant specifications and her recommendations in evidence where these differ from the overall position of the Babbage wastewater design team.

55 The current treatment process on site involves:

- Storage and buffering of raw wastewater
- DAF treatment for primarily the removal of fats and oils
- Lime dosing
- Followed by discharge to land.

56 In addition to these current treatment steps the following further treatment steps would be added:

- Anoxic Treatment
- Aerobic Treatment
- Filtration
- Storage and buffering (incl pH adjustment if required)
- UV treatment
- Storage and buffering
- Followed by discharge to ocean.

57 The physical change over from a land-based system to ocean outfall, will effectively be controlled by the energy centre at Oceania – having regard to seasonal weather conditions and the operation of the land-based discharge.

58 In general, I anticipate that the ocean outfall will operate for long stretches over the winter period when irrigation demand is not required, and to deal with seasonal fluctuations such as a wet spring.

MONITORING OF TREATMENT PERFORMANCE

59 The overall treatment process will include extensive monitoring in order to ensure:

- Correct and optimal operation of the various stages of the treatment process
- Compliance of water quality standards prior to discharge to ocean

60 Monitoring will be done through a combination of 'on-line' instrumentation and composite sampling tested by a certified laboratory.

LEVEL OF TREATMENT AND QUALITY OF WASTEWATER DISCHARGED

61 The final quality of the wastewater prior to discharge to ocean is as per the attached drawing and in accordance with the Table 4.1 other than the pH which is now proposed to be within the range of 7-9 as proposed by Forest & Bird.

CONTROL OF DISCHARGE RATES TO MEET DESIGN OF DIFFUSERS

62 The highly treated wastewater would be stored in a buffer tank prior to discharge to ocean. The purpose of this storage is to:

- Allow for pH adjustment if required
- Allow for controlled flow rate discharge to the ocean outfall such that the flow rate meets the design criteria for both:
    - The UV residence time (i.e. not exceeding a design flow rate), and
    - The design basis for the diffusers (i.e. not below a design flow rate for proper diffuser operation)

63 The rate of discharge will be directly measured and controlled by control valve and/or pump. The exact process engineering solution will be determined during detailed system design.

CHANGES TO PROPOSED TREATMENT SOLUTION SINCE LODGEMENT OF APPLICATION

64 From an operational and maintainability perspective it is intended that the system will be designed such that a surge tank at the foreshore is not required.

A launch chamber would still be required for the MTBM (Micro Tunnel Boring Machine).

This is to be confirmed during detailed engineering design.

SUMMARY AND CONCLUSION

65 A number of options for the disposal of treated wastewater were investigated including:

- Disposal to ocean
- Disposal to a municipal system
- Disposal to freshwater
- Disposal to land
- Disposal by recharge to ground water
- Disposal by evaporation
- Disposal by electrolysis

66 Although land-based disposal is the preferred option it was considered not practical or viable due to the availability of suitable land areas, the capital cost, the complexity of integrating disposal with farming operations, lack of flush water and the inevitable wet weather events.

67. As a result, the most pragmatic alternative when balancing the demands of the environment, operability, buildability and capital cost was to highly treat the wastewater and then discharge it to the ocean.

Paul Duder
28th May 2020