12 March 2019

Our ref: *18180*
Council ref: *APP-20181676*

Environment Southland
Cnr. North Rd and Price
St, Invercargill

Attn: Rebecca Robertson (SWLP)

Dear Rebecca

***Re: Request for Further Information under Section 92(1) of the Resource Management Act 1991 – Application* Insert details from s92 request**

Our response to your request for further information dated January 31st is below. We have also included a response to the additional questions received by email on March 4th (referred to as Questions 7 and 8). Your questions are included in italics for convenience.

Note that to address the matters raised by Question 6 below, we wish to amend the application as follows:

- Existing well E44/0370 to be included in the consent applied for.
- Proposed Bore 1 (which is very close to E44/0370) to be removed from the application, although one or more monitoring wells may still be required in this area.
- Purpose of proposed consent to be changed to include dairy shed washdown and stock drinking water, as well as irrigation. For clarity, the washdown water will continue to be managed in accordance with the existing discharge consent (20171428-01).
- We propose a condition that would require the existing groundwater take consent AUTH-20171428-02 to be surrendered before a new consent may be exercised.
- Proposed condition 5 (see AEE, Section 1.4) to be amended to read *"The total volume of water taken under this consent and AUTH-301933 (or any replacement permit for AUTH-301933) shall not exceed the annual water allocation specified in AUTH-301933 or the replacement permit, plus 43,600 m^3/year."* The allocation under AUTH-301933 allows for irrigation only, and without this change the total volume of water available to the applicant would be reduced by the allocation allowed under AUTH-20171428-02 for dairy washdown and stock drinking water (43,600 m^3/year).

The annual limit sought is unchanged, with the allocation issue raised to be addressed by surrendering the existing groundwater take consent after the consent sought is granted.

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We note that, based on the log and pump test details for E44/0370, a yield of 20-30 L/s may be possible for this bore if the pump and other infrastructure are upgraded.[1] If so, this would provide approximately half of the water applied for (4,320 m^3/day is equivalent to 50 L/s if pumping continuously).

Nonetheless, in the modelling discussed below, we have retained the assumption from the original application that all of the water sought would be pumped from a single well, being the closest well to the relevant potentially affected well. This is obviously conservative relative to the likely actual situation, as is the assumption that all water will be used in a short period of pumping at the maximum rate, when in fact a significant portion of the annual allocation will now be spread out throughout the year for use as stock and dairy washdown water. This means that the maximum period that irrigation at the maximum rate can occur during irrigation season will be less, reducing the peak drawdown (albeit with a longer period of low-level drawdown for the rest of the year).

Details of the references given below can be found in Section 7 of the *Hydrogeological Assessment*.

1. Question 1 – bore co-ordinates

Please provide map references (NZTM 2000) for the proposed 7 bore locations identified on the Well Location Plan.

The coordinates of the existing well and 6 proposed wells are as follows:

- **E44/0370**: 1242502 mE, 4925081 mN
- **Bore 2**: 1241566 mE, 4926393 mN
- **Bore 3**: 1241032 mE, 4926645 mN
- **Bore 4**: 1240999 mE, 4925789 mN
- **Bore 5**: 1239935 mE, 4927181 mN
- **Bore 6**: 1242995 mE, 4924073 mN
- **Bore 7**: 1243920 mE, 4925199 mN

All bore locations are approximate. Note that the co-ordinates for the existing well appear to be incorrect in the Beacon GIS viewer. The co-ordinates given are believed to be more accurate, but have not been surveyed. More precise co-ordinates for this bore can be obtained (either by survey or using a handheld GPS unit) when the new bore(s) are installed and the coordinates for these are provided to ES.

2. Question 2 – bore locations relative to waterbodies etc

Please provide further details regarding the proposed bore locations in proximity to surface waterbodies including any wetlands, proximity to septic tank outfalls, name of driller and method of construction.

Figures 1 and 2 show the approximate location of the proposed wells relative to surface water bodies. There are no established wetlands on the site, although there are areas near Murrays Creek (particularly

[1] The driller reported 1.14 m of drawdown when pumping at 3.3 L/s. The available drawdown of approx. 12 m suggests that a pumping rate 6-10 times higher may be achievable for this well.

on the north branch near the eastern site boundary and near the confluence in the south-eastern part of the site), which have been retired from grazing and are being progressively planted with natives. The nearest Regionally Significant Wetlands shown in the Beacon GIS viewer are 10-20 km away and are either upstream or in different catchments.

Most of the proposed bore co-ordinates are more than 50 m from the waterways on site, with the exception of Bores 5 and 7 (each 20-30 m from the relevant waterway). Note that the co-ordinates given are approximate and the actual bore locations are to be within 50 m of those positions. Also, because the water take is from a semi-confined aquifer, the distance to the waterway has only a small influence on stream depletion effects. For example, the maximum stream depletion rate of 1.27 L/s calculated for a distance of 50 m is unchanged to two decimal places when the distance is reduced to 0.1 m.

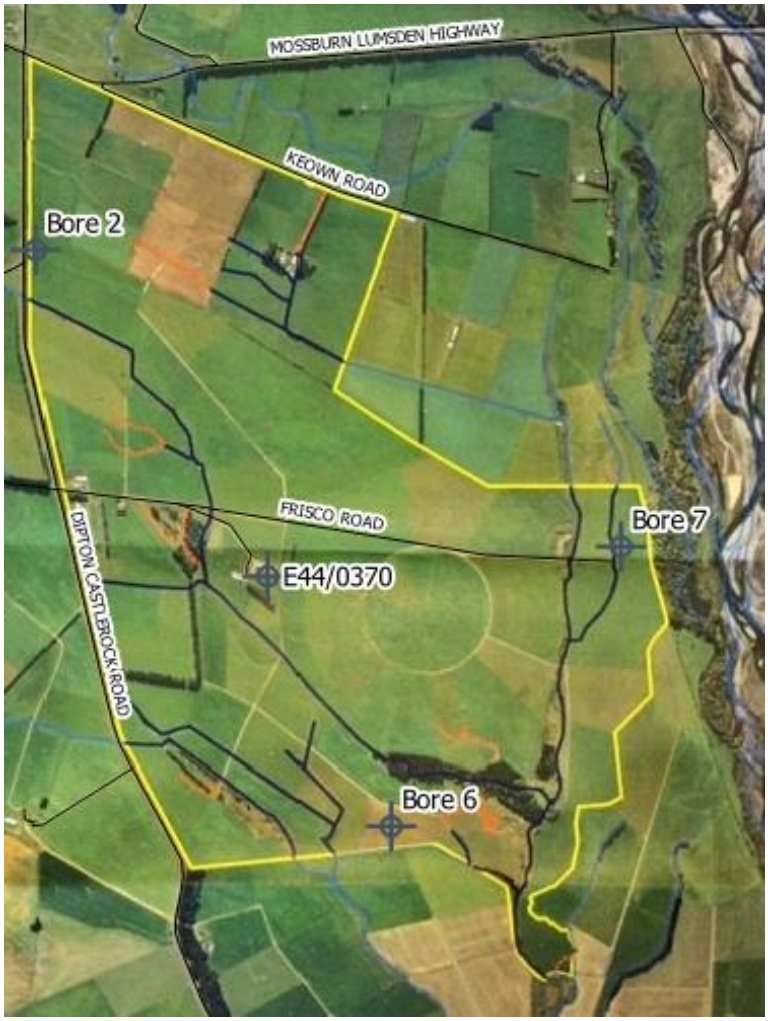

Figure 1 – Possible bore locations in eastern part of farm, overlaid on ES farm map showing waterways and buffer zones

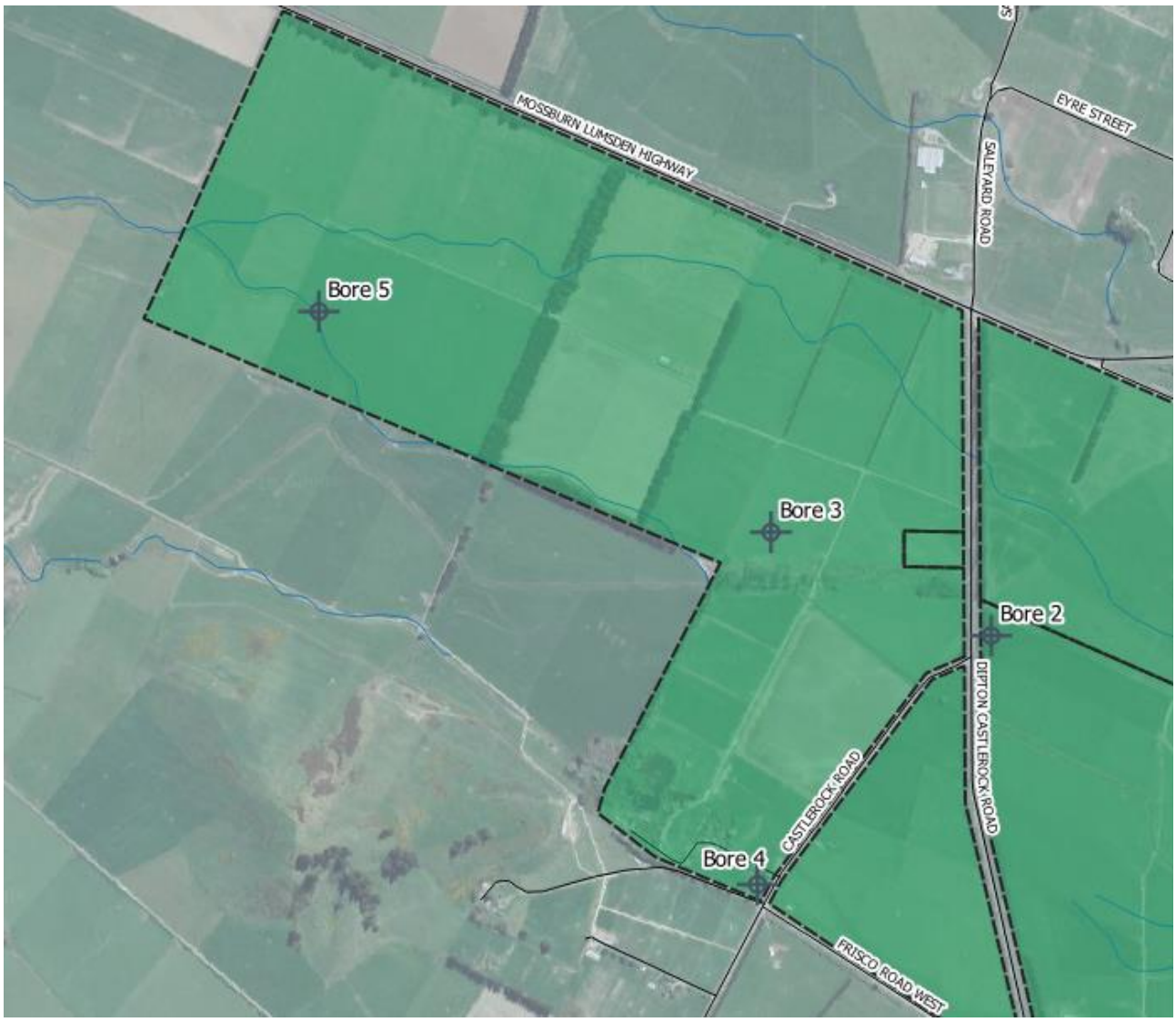

Figure 2 - Possible bore locations in western part of farm, overlaid on farm boundaries and LINZ approximate waterway centrelines (ES farm map unavailable for this part of site)

There are 7 wastewater disposal systems on the site:

- at the dairy shed near Frisco Rd,
- at the office on Frisco Rd,
- at the house on Frisco Rd, between the office and dairy shed,
- at the house on Keown Rd, near the north-eastern corner of the property,
- at the remaining 3 houses on site at 59, 72 and 78 Castlerock Rd.

Bore 4 is the only one of the proposed new bores which is in the vicinity of one of these properties (approx. 150 m from the house at 72 Castlerock Rd). The proposed bores are therefore not expected to indirectly affect water quality by mobilising any contaminants released from the wastewater systems, particularly given that the groundwater take is to be from the underlying semi-confined aquifer.

The driller and construction method have not been confirmed, but we would be happy to agree to a condition that this information be provided to Environment Southland before drilling commences.

3. Question 3 – stream depletion calculations

Stream depletion is discussed in the application and the Technical Comment Report included in the application. Environment Southland's Technical Specialist – Soils and Groundwater completed a review of this application and has identified that other groundwater take reports for small, spring fed streams in Southland use a stream bed conductance estimate of between 1-10m/day. The application as submitted estimates the stream bed conductance at 0.1m/day for all surface waterbodies. Therefore, please provide justification for the lower conductance rate or provide an updated assessment using a more conservative stream bed conductance for:
- The Oreti River;
- Murray Creek; and
- Other smaller surface waterbodies identified in the updated map as requested above.

Firstly, for your convenience when reading the comments below, we have repeated the equation for stream bed conductance, which is a function of the hydraulic conductivity (K″), and the width (b) and bed thickness (B″) of the water body:

$$\lambda = \frac{K''\, b}{B''}$$

We have not reviewed the examples cited of assumed stream bed conductances of 1-10 m/day for small, spring-fed streams. However, in simple terms the b and B'' inputs are likely to roughly cancel out in such streams, for instance, the width and stream bed thickness may both be 1 m. In such cases the bed conductance would approximately equal the hydraulic conductivity (within an order of magnitude, at least). Based on Table 1.2 of Kruseman and de Ridder (2000), a hydraulic conductivity value of 1-10 m/day would be appropriate for a stream with a bed of fine-medium sand. This may have been the case for the water bodies covered by these other assessments (and potentially even further west in the Murrays Creek catchment where groundwater and surface water are known to be closely connected). However, this would not be an appropriate hydraulic conductivity value to use in the case of the site.

While λ is extremely difficult to measure (as it requires accurate stream depletion data from a pump test, and for all other aquifer properties to be precisely known), the following evidence suggests that the estimated stream bed conductance of 0.1 m/day is appropriate in this case:

- The dominant soil type in the Murrays Creek catchment is Morven, a moderately stony silty loam with an estimated clay content of 15-34 % (SMap, 2019). Other soils found in the area (primarily Dipton, Eureka, Claremont and Makarewa) are reported as having a similar or higher clay content and are generally stoneless-slightly stony. Given that the site is at the lower end of the (admittedly small) Murrays Creek catchment, the materials in the stream bed would be expected to be similar to the surrounding soils due to historical erosion and sedimentation. In the table referred to above from Kruseman and de Ridder (2000), the most appropriate soil class is clay/sand/gravel mixes, for which a hydraulic conductivity range of 10^{-3} to 10^{-1} m/day is given. The hydraulic conductivity value implied by the λ value selected is 0.033 m/day (assuming b = 3 m and B'' = 1 m), which is near the middle of the expected range.
- The hydraulic conductivity of the stream bed is typically assumed to be the same as that of the aquitard (Hunt, 2012, p60-61). In this case, the hydraulic conductivity of the aquitard is estimated to be approx. 0.009 m/day (based on the pump test for E44/0339 – see Table 3 of *Hydrogeological Assessment*). Use of a stream bed hydraulic conductivity value approx. three

times greater than the conductivity of the aquitard in calculating the stream bed conductance is obviously more conservative than this standard approach.

- The assumed stream bed conductance is also greater than that used for the Ōreti River in the groundwater take application for well E44/0623 (Landpro, 2016). The modelling undertaken for that application used a stream bed conductance of 0.017 m/day (based on K" = 0.005 m/day, B" = 8.7 m and b = 30 m). Therefore, the value used in the *Hydrogeological Report* (primarily to assess effects on the smaller streams) is also expected to be conservative with respect to the Ōreti, in the event that one of the proposed wells near it is used for some or all of the water take.
- A streambed conductance of 0.1 m/day is also used in the examples given in the original research paper detailing the equation used to model the stream depletion effects (Ward and Lough, 2011). While these examples are generic in nature, it does indicate that 0.1 m/day is not an atypical value for this parameter.

4. Question 4 – interference on additional bores

Environment Southland's Technical Specialist – Soils and Groundwater Quantity has reviewed the application and has concerns regarding the interference with neighbouring bores as a result of the proposal. Please provide an assessment adverse effects in accordance with Appendix L.3 of the Proposed Southland Water and Land Plan of the following bores:

o E44/0370, E44/0341, E44/0012, E44/0480 and E44/0527 located within the Lumsden Aquifer; and
o E44/0132, E44/0127, E44/0490 and E44/0126 located within the Castlerock Groundwater Management zone which may be potentially affected.

Details from Beacon of the bores referenced are given in the table below. Well E44/0370 is owned by the applicant and now forms part of the application, and therefore drawdown on this well has not been considered.

The table also includes modelled drawdown at these wells resulting from the proposed take (as per the calculations in Appendix B of the *Hydrogeological Assessment*), assuming that all of the water will be taken from the proposed well closest to the relevant neighbouring well. This is a very conservative assumption as it ignores the fact that approx. half of the proposed water take is now likely to come from well E44/0370, with the remaining half (approx.) to come from one or more of the proposed wells.

Well	Purpose	Aquifer	Depth, m	Distance (nearest proposed well), m	Modelled drawdown from proposed take, m	Comments
E44/0341	Domestic + stock supply	Lumsden	30	1,600 (Bore 2)	0.19	Near E44/0339
E44/0012	Domestic + stock supply	Lumsden	30	1,050 (Bore 2)	0.38	Between E44/0256 and E44/0339
E44/0480	Irrigation	Lumsden	35.5	1,150 (E44/ 0370)	0.34	Near E44/0623
E44/0527	Dairy use	Lumsden	24.7	1,050 (Bore 6)	0.38	South of mapped extent of Lumsden Aquifer; no other nearby Lumsden aquifer extraction consents.
E44/0132	Domestic supply	Castlerock	Un-known	1,350 (Bore 7)	0.17	Initial water level unknown, but probably ~ 2 mbgl based on nearest wells (E44/0131 and E44/0477)
E44/0127	Domestic supply	Castlerock	6	1,000 (Bore 2)	0.24	Initial water level 0.96 mbgl.
E44/0490	Domestic supply	Castlerock	7	700 (Bore 3)	0.32	Initial water level unknown, may be approx. 2 mbgl based on nearest relevant wells (E44/0494 and E44/0646, although these are ~1,2 km away)
E44/0126	Domestic supply, dairy use	Castlerock	20	1,100 (Bore 6)	0.23	Initial water level 11.3 mbgl

Note: distance measured from closest proposed bore, and rounded to nearest 50 m.

Wells E44/0480, E44/0012, and E44/0341 are in the same general area as wells E44/0256, E44/0339 and E44/0623, which were considered in the application (see Section 3 and particularly Table 4 of the *Hydrogeology Assessment*). These additional wells are likely to have similar geology and existing drawdown to the wells already considered in this, and therefore similar remaining available drawdown after accounting for existing takes (wells E44/0256, E44/0339 and E44/0623 were found to have between 1.6 and 7.4 m of remaining available drawdown). On this basis, the modelled drawdown on those wells is highly unlikely to have a significant adverse effect.

The only other well identified as being in the Lumsden Aquifer is E44/0527, which is to the south of the site and outside the mapped extent of the Lumsden Aquifer. Bore logs for the area provided by Environment Southland during preparation of the application do not include this well. However, if E44/0527 is screened within material geologically connected to the Lumsden Aquifer, there are no other Lumsden Aquifer takes near the site (the nearest is the applicant's current dairy wash water and stock water take, ~4.5 km away). Therefore, existing drawdown is likely to be negligible, and the modelled drawdown would be expected to have a negligible effect on the use of this well.

There is limited information on the construction, geology, and water level in the Castlerock Aquifer bores. However, the information which is recorded in Beacon suggests that these typically have ≥5 m of available drawdown. Existing drawdown is likely to be very small, given the lack of large groundwater takes in the Castlerock Aquifer, and the limited connectivity between this and the underlying Lumsden Aquifer. The modelled drawdown of ~0.2-0.3 mbgl is negligible in this context, and is considered highly unlikely to result in any of these bores being drawn down by more than 20 % of the available drawdown (including the cumulative effect with any existing drawdown).

5. Question 5 – effects on bore E44/0300

Please provide further assessment of the adverse effects on bore E44/0300, this assessment should account for current water permits being exercised fully.

We understand that the total consented allocation from the Lumsden Aquifer has been essentially unchanged since at least 2015.[2] As early as 2005, approx. 4.3 million m^3 of groundwater extraction per year had been consented from the Lumsden Aquifer (SKM, 2005) – approx. 75 % of current consented use. As shown in Figure 5 of the *Hydrogeological Assessment,* the annual drawdown at well E44/0300 has also been highly consistent since approx. 2010, a period which included a significant drought (Summer 2017-18).

Use of modelled drawdown based on full use of consent allocations is appropriate where there is uncertainty about the actual effects of current groundwater use, but would be unreasonably conservative in a situation such as this where the effects of current usage are well understood. The modelled drawdown at well E44/0300 was only included in our assessment for comparison with the actual measured drawdown, to demonstrate that the model results are conservative in the case of E44/0300 (and E44/0254) and are likely to be equally so for other wells.

Accordingly, we consider that the analysis contained in the *Hydrogeological Assessment* is sufficient to demonstrate that the interference effects of the proposed take will be "acceptable" under clause a(iv) of Appendix L.3 of the LWP. Regardless, the modelled drawdown of the proposed water take at 3.25 km (the distance from well E44/0300 to the closest of the proposed wells, Bore 3) is approx. 3 cm, which would have a negligible effect upon the reliability of the groundwater level record at well E44/0300 (c.f. clause a(v) of Appendix L.3).

The modelled 3 cm of drawdown at E44/0300 was calculated using the same assumptions as for the modelling included in the application. This result is therefore extremely conservative as it assumes that

[2] The data provided by ES late last year shows that at that time, only one consent to take water from the Lumsden Aquifer had been granted after 2015, and this (AUTH-20171076) was a replacement permit for an earlier consent, with no increase in annual allocation.

all water would be taken from Bore 3, whereas under the revised application it is likely that approx. half of the water required will be pumped from E44/0370, which is approx. 4.5 km from E44/0300 (see footnote on page 2 of this letter).

6. Question 6 – applicant's existing take

It has come to Environment Southland's attention through the consideration of this application there is an eleventh take occurring from the Lumsden Aquifer which had been previously been accounted for in the allocation records for the Castlerock Groundwater Management Zone. A review of the Bore Logs for E44/0370 on the applicant's property has resulted in the allocation of this take being transferred to the Lumsden Aquifer. This take is for 43,800m^3 per year. Therefore, the remaining allocation for the Lumsden Aquifer is 73,878m^3 per year. Please advise if you wish to amend the annual volume sought in the application to align with the updated remaining allocation volume.

We were also unaware that bore E44/0370 was drawing from the Lumsden Aquifer until receiving your letter. As per the introductory comments to this letter and previous discussions, we had not actively considered this bore and the associated consent as part of the application as it is not for irrigation, and we understood it to be from the Castlerock Aquifer. Nonetheless, having obtained and reviewed the bore log, we accept that this take is from the Lumsden Aquifer, and we have amended our application as described above to address the allocation issues resulting from this.

7. Question 7 – irrigation area

Can you please confirm the consented irrigation area will not be changing in size, location and rate of application as a result of the proposal? I note in the application, six different blocks make up the property, however only four of these are captured by AUTH - 301933 (Lot 2 DP 3186 & Lots 3, 4 & 5 DP 636).

As noted in Section 2.1 of the AEE, the applicant has plans to install additional irrigation pivots in the future. However, this is allowed for under their existing irrigation consent AUTH-301933, is not specific to the current proposal, and will not occur in the next few years. AUTH-301933 was granted on the basis of an irrigation area of up to 400 ha, compared to 234 ha currently under pivot. The applicant is aware that an assessment of their farming activity against Rule 20 of the LWP may be required if and when the irrigation area is increased.

As noted in Section 5.6 of the AEE, the water sought in the current application will not increase the total annual volume available for irrigation, but is a back-up supply for irrigation water when AUTH-301933 cannot be exercised due to low flows. On its own, the quantity of water applied for would be enough to allow irrigation of 75 ha of pasture (if all of the volume sought was used for irrigation), and would not be sufficient to support expansion or intensification of the current irrigation system.

8. Question 8 – stocking rates

Condition 11 of AUTH – 301933 states: Before the consent holder increases stocking rates on the irrigated property above 3.3 cows/hectare, it shall submit a nutrient management to the Council's Director of Environmental Management for approval. Can you please confirm the current stocking rate for the irrigated property (being Lot 2 DP 3186 & Lots 3, 4 & 5 DP 636)? It would be great if you could also please clarify if, as a result of the current proposal the stocking rate will increase above 3.3 cow/hectare?

The applicant has advised that the current stocking rate is 2.5-2.7 cows per hectare, and this is not intended to increase. Obviously, this is significantly less than the 3.3 cows per hectare trigger in the condition referenced from consent AUTH–301933. Again, the applicant is aware that any future increase in stocking rates may have implications under Rule 20 of the LWP.

I trust that the information set out above satisfies the request for further information. However, if you have any further queries, please do not hesitate to contact.

Yours sincerely,

Tim Muller
Environmental Scientist
tim@landpro.co.nz

Attached: Bore E44/0370 log

1268

MCNEILL DRILLING CO. LTD

WATER BORE/WELL SUMMARY FORM

CLIENTS NAME: Castle Rock Dairys Ltd C/o Farmright Ltd	RESOURCE CONSENT NO: 204818
FULL ADDRESS: 8 Diana Street, Lumsden	BORE SIZE: 150mm
RAPID NO: 24	START DATE: 17.10.2007
GRID REFERENCE:	FINISH DATE: 19.10.2007
DRILLER: Rolly Harrex	
MEASURED FROM: Ground Level	MACHINE: UDR650
TOTAL DEPTH BORE: 29.78	DRILL METHOD: Tubex 140
TOP LEADER: 27.73	
STATIC WATER LEVEL: 3.51	
SCREEN :SLOT: 2.5mm	LENGTH: 2m
TYPE: Stainless Steel	SIZE: 125mm
PVC SLOTTED: TOP:	BASE:
SCREEN/LEADER/SUMP: 2.12	SUMP SIZE:
TOTAL CASING USED:	
AIRLIFTED/PUMPED AT: 3.3 Litres Per Second	
TEST PUMP PERIOD: 3 Hours	
DRAWDOWN FROM SWL: 1.14	
AIR/PUMP INTAKE:	
BACTERIAL WATER TEST: ICC	
CHEMICAL WATER TEST: ICC	

ENTERED

EXTRA NOTES:
BORE LOG:
00.00 - .50 Top Soil
.50 – 15.7 Clay Bound Gravels
15.7 – 30.4 Sandy Coarse Gravels

9/11/07

Invercargill city council
"CITY OF WATER AND LIGHT"

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WATER TESTING LABORATORY

Lake Street Invercargill
ph(03) 216 2189 fax (03) 216 2789

25-Oct-07

Lab Reference Number: B 10733

McNeill Drilling Water Test Report: Invercargill

Name: Castle Rock Farming Co.

Address:

Order No: D64133

Date Received: 19/10/2007 13:00

Date Sampled: 19/10/2007 11:00

Sample Description: Water

Bacteriological Analysis

Test	*Result*	*Units*	*Method*
Total Coliform:	less than 1	Colony Forming Units per 100ml	*(APHA 21ed 9222 B)*
Faecal Coliform:	less than 1	Colony Forming Units per 100ml	*(APHA 21ed 9222 D)*
Enterococci:	less than 1	Colony Forming Units per 100ml	*(APHA 21ed 9230 C)*

Physical and Aggregate Properties

Test	*Result*	*Units*	*Method*
pH:	6.72		*(APHA 21ed 4500-H+ B)*
pH after Aeration:	7.85		*(APHA 21ed 4500-H+ B)*
Turbidity:	1.79	NTU	*(APHA 21ed 2130 B)*
Total Hardness:	48	mg per litre as CaCO3	*(APHA 21ed 2340 C)*
Calcium Hardness:	35	mg per litre as CaCO3	*(APHA 21ed 2340 C)*
Magnesium Hardness:	13	mg per litre as CaCO3	*(APHA 21ed 2340 C)*

Chemical Analysis

Test	*Result*	*Units*	*Method*
Iron:	0.07	mg per litre	*(APHA 21ed 3500-Fe B)*
Nitrate Nitrogen:	1.04	mg per litre as N	*(NWASCO 38)*
Ammoniacal Nitrogen:	0.02	mg per litre as N	*(NWASCO 38)*
Chloride:	10	mg per litre	*(APHA 21ed 4500-Cl-B)*
Manganese:	0.01	mg per litre	*(APHA 21ed 3500-Mn B)*

Bacteriologically this water sample showed no sign of contamination. A soft water sample that was corrosive.

9/11/07

A. Cocker
Lab Manager

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