1 December 2020

Landpro Reference: 19474
Council Reference: RM20.360

Attention: Sarah Davidson
Otago Regional Council
Via email

Dear Sarah

Request for Further Information under Section 92(1) of the Resource Management Act 1991 – Cromwell Certified Concrete

Thank you for your request for further information request dated 12 November 2020. This is our response.

1 Pumping test

> "*Please provide a pumping test that meets ORC Form 5 requirements specified on Page 18 of Form 5 for the proposed increased groundwater take. Specific requirements for takes greater than 750m3/day are a 48-hour constant rate pumping test undertaken at the maximum proposed rate. Water level monitoring should include drawdown and recovery in the pumped bore and at least two observation bores within the area of localized drawdown. Static levels must also be monitored for 24 hours prior to the commencement of the test, and a step drawdown aquifer test must be taken with a minimum of 4, 1-hour pumping steps followed by measurement of recovery. An interpretation of the test by a suitably qualified and experienced person must also be provided.*"

We understand that you are effectively asking for further information on aquifer characteristics. You refer to specific pumping tests as "requirements". However, as we understand the situation there is no current regional plan provision that provides for such specific pumping tests to be undertaken as a requirement. The Otago Regional Council (ORC) is entitled to request further information but a specific method in an application form is not a legal "requirement".

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We appreciate that under RMA Section 67(g) regional plans can specify information to be included in resource consent applications. However, our understanding of RMA Section 92 is that further information requests should:

- "directly relate to the actual and potential effects of the proposed activity on the environment and how any adverse effects may be avoided, remedied or mitigated
- be focused and lead to a better understanding of the nature of the proposed activity
- consider the implications of affected persons excluding trade competitors or the effects of trade competition (s104(3)(a)(i))
- where necessary, clarify aspects of the proposal to understand its likely effects and ensure that conditions are reasonable."[1]

You will appreciate that a key purpose of a pumping test is to estimate the hydraulic properties of an aquifer to then use that information to assess potential bore interference and stream depletion. In that context it is generally accepted that it is useful to complement any pumping test result with other pumping test information and a broad understanding of the hydrogeology of an area. A pumping test was provided, reviewed by PDP, and accepted for this bore five years ago. It is not reasonable or justifiable to do another aquifer test because of an increase in the amount of water sought. An increase in the amount of water proposed to be taken from a bore in this location is highly unlikely to change the hydraulic properties of the aquifer.

We do accept that ORC needs reassurance that the aquifer characteristics are robustly determined and the subsequent assessments are similarly robust. To assist with that we have carefully reviewed all the aquifer test information that we have for this area.

We have also made a request for aquifer test information from bores in this location held only by ORC. However, it appears that it is currently not possible to obtain aquifer test information for bores in this location from ORC. The following figure summarises the information for other bores that Landpro currently has available for the area.

[1] https://www.qualityplanning.org.nz/node/565

Figure 1 Illustration of bores with aquifer testing information

This information together with the original review undertaken by PDP strongly support a conclusion that the transmissivity value of 1,100 m^2/day used in the original application is appropriately conservative. The above information would support the choice of a higher transmissivity which would decrease the estimated drawdown. Consequently we consider that our original conclusions about effects on neighbouring bore are valid and this additional assessment strongly indicates that our assessment of the level of drawdown almost certainly over-estimates the drawdown effects on neighbouring bores.

We consider that there is a sufficient body of information to be able to draw a robust conclusion about the level of adverse effects on groundwater levels in neighbouring bores and an additional aquifer test is not warranted.

We consider that the information provided here satisfies your request for further information. If you do not consider that this is the case could you let us know.

2 Breakdown of water use

> *"The stated water use in the application specifies water will be used for gravel washing, dust suppression and irrigation, and potable use. No breakdown of the different uses has been provided to demonstrate the likely percentage of consumptive use. Please provide this breakdown."*

An assessment of the breakdown of water use has been undertaken and is outlined in the following table.

	Volume (m^3)/day	Percentage of total
Crushing Plant	2,768	91.5%
Water Cart	240 (20m^3 x 12 times/day)	8%
Irrigation	15	0.5%
Potable Use/Washdown	1 (rounding up)	Negligible
TOTAL:	3,024	100

The reason for requesting this information was not specified. However, we assume that it was to assist in estimating the proportion of water that is likely to be returned to the aquifer. This is discussed in the next section.

3 Soakage pit operation and evaporation losses

"*The application notes soakage pits are used, where groundwater is returned to the source aquifer. Please provide more information on the operation of the soakage pits, including evaporation losses*."

The soakage pits receive runoff washwater from the crushing operations as illustrated in the aerial photo below. Runoff water is directed firstly to the eastern smaller pond and then on to the western elongated rectangular pond. Sediment that collects in the first pond is used for backfill on site or sale. The pits have operated successfully for many years with minimal maintenance. You will be aware that there is a programme of groundwater quality monitoring to assess the potential for sediment to travel into groundwater. I have seen the groundwater quality monitoring results that demonstrate that this is not happening.

Figure 1: Aerial image of the soakage ponds with adjacent crushing plant

You have asked about evaporation losses. The graph below illustrates the monthly balance at Cromwell between rainfall and evapotranspiration.

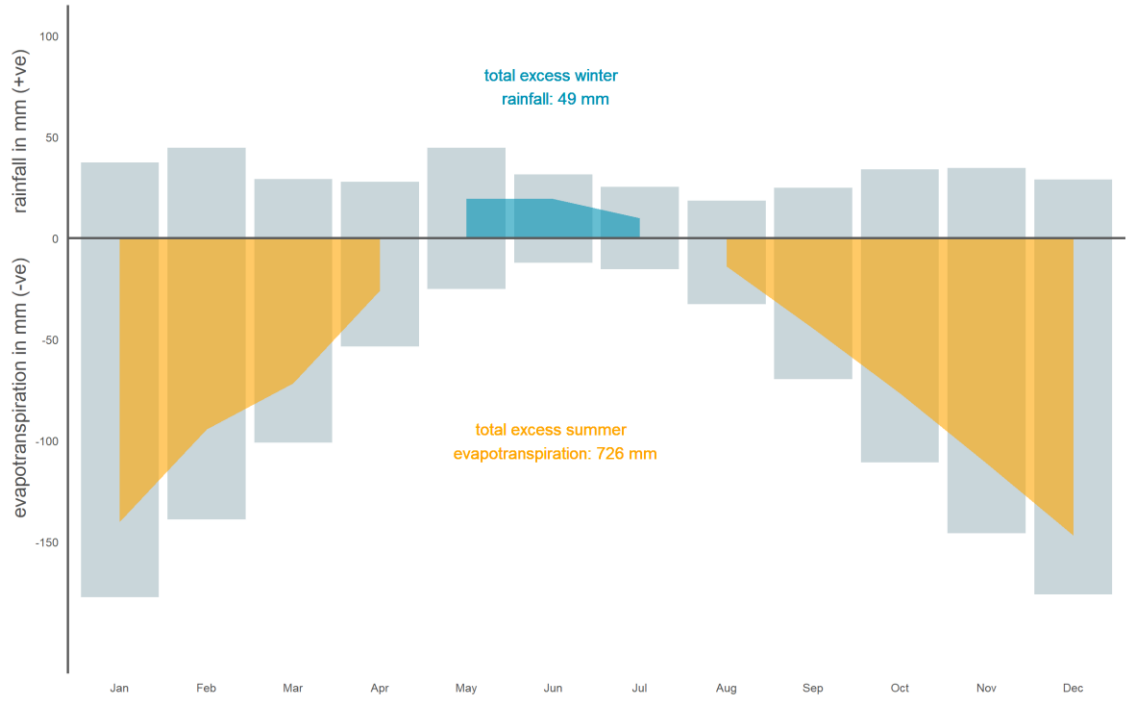


Figure 2: Average monthly climate data for Cromwell (evapotranspiration significantly exceeding rainfall during the summer months) Data source: NIWA Cliflo database, Cromwell EWS station, May 2006-December 2018.

Grow Otago[2] estimates the soil moisture deficit to be an annual mean of approximately 420 mm and the total area of the soakage pits is approximately 4,140 m^2. Therefore on average the ponds will lose approximately 1,739 m^3/year as evaporation.

As noted above, we assume that the reason that this information has been requested is because the reviewer expressed concerns that there should be a more accurate estimate made of return flows.

The daily water applied to land either as aggregate washing or via the water tank keep dust down is approximately 3,000 m^3/day and use the Grow Otago maximum (1950 – 1984) monthly soil moisture deficit for January of 175 mm. Then if we increase the evaporation up to 185 mm to take account of some climate change and/or a really hot and windy January. Then if we assume that evaporation occurred over this whole area, up to about 60,000 m^2 we would have:

[2] http://growotago.orc.govt.nz/docs/climate_tables.html

Input ~ say 30 days x 3,000 = 90,000 m^3

Evaporation ~ 185 mm over say an evaporation surface area of 60,000 m^2 = 11,100 m^3

This indicates that about 12% of the water applied to land would evaporate in the hottest month of the year, with about 88% going back into the aquifer.

The amounts taken for irrigation and potable water use are negligible.

While the above calculations are crude they do strongly indicate that the amount of consumptive water use will be significantly less than 20%. Therefore, the earlier estimates of 30% consumptive use is still supported as a conservative estimate of water use.

4 Assessment of effects of flows further downstream in the Amisfield Burn

> "*As the Amisfield Burn flows towards Lake Dunstan, the depth to groundwater decreases and it may become connected to groundwater. The Amisfield Burn is identified in Schedule 1A of the Regional Plan: Water for Otago (RPW) and provides habitat for koaro. Please provide an assessment of effects of the increased groundwater take on the flow further downstream of the Amisfield Burn, as this could impact spawning fish species.*"

Our original report stated "*At the time of the assessment in 2016, stream depletion and aquifer allocation effects were considered to be insignificant. That situation will not change as a consequence of the proposed increase in abstraction. The evidence that the vertical distance between the Amisfield Burn and the underlying groundwater surface is approximately 20 metres has not changed. Therefore, this means that it is virtually certain that there is no connection between the underlying groundwater and the Amisfield Burn.*" That situation has not changed.

You may be aware of some commonly used stream depletion guidelines[3] that use a rule of thumb of twice the width of a stream and five times the depth of water in the stream. Using these would

[3] Smith M (2009) Techniques for evaluating stream depletion effect: A supplement to the guidelines for the assessment of groundwater abstraction effects on stream flow(2000), Report No. R09/53, Environment Canterbury.

also strongly indicate that the abstractions could not affect a stream so far above groundwater levels.

If the abstraction of water occurred closer to Lake Dunstan the distance between the Amisfield Burn and groundwater would be less but the proposal is to abstract water from the current bore locations not from bore locations closer to the lake.

Figure 3 Illustration showing bore locations and Amisfield Burn (bore locations from ORC GIS, including bore G41/0101 that does not exist)

We think that the question is assuming that there would be some physical connection between groundwater and the overlying Amisfield Burn. However, the technical evidence does not support this. Evidence provided by Pattle Delamore Partners for the ORC at a recent resource consent hearing[4] supports this view. Those authors stated: "*A review of bores on the ORC database shows that the closest potentially effected (sic) bores are generally in the vicinity of SH6 flanking each side of the Amisfield Burn. These bores are around 30 m deep (within the area of Late Pleistocene and Holocene gravelly river deposits at the land surface) with relatively deep groundwater levels up to about 20 m bgl. The bores transition to have slightly shallower depths with shallower depth to groundwater*

[4] https://www.orc.govt.nz/media/8962/rm20007-smallburn_limited-groundwater-assessment.pdf

observations toward Lake Dunstan in the vicinity of the Amisfield Burn. This is most notably demonstrated by bore G41/0346 (15 m deep with a 3.5 m depth to groundwater) adjacent to Lake Dunstan and the Amisfield Burn point of discharge into the lake."

Therefore, it would take more than 400 m towards the lake before the depth to groundwater would even approach the ECan 'rule of thumb' depth of 10 m (five time the 2 metre width of the Amisfield Burn) to groundwater. Even then stream depletion still needs a physical connection. If there is approximately 10 m of unsaturated gravelly alluvium between groundwater and the overlying stream this would not provide a physical mechanism for a groundwater abstraction to affect surface water 10 metres above.

Therefore after further analysis of the available information we consider that there is extremely strong evidence that the proposed abstraction will not adversely affects flows at any point in the Amisfield Burn.

5 Permitted activity

> "*The taking of up to 1000 m3/day, at a maximum rate of take of 100 l/s from Lake Dunstan is a permitted activity under Rule 12.1.2.2 of the RPW. It has been observed that the water levels in the mine pit pond fluctuate in response to changes in the water level in Lake Dunstan. Please provide an assessment against this Rule, to determine if the activity is permitted under this Rule.*"

We are not aware of any study that has been undertaken on levels in the soakage ponds and Lake Dunstan levels. However, we would expect there to be a relationship given the porosity of the aquifer and the proximity to the lake.

The fact that there is likely to be a relationship between the soakage pond levels and the level of water in Laker Dunstan is not evidence to extend the definition of Lake Dunstan for the purpose of the Regional Plan: Water for Otago (RPW) Rule 12.1.2.2. We don't consider that any reasonable interpretation of RPW Rule 12.1.2.2 could extend the definition of Lake Dunstan to include a pond 900 metres away from the lake. So we do not consider that the proposed take is a permitted activity under RPW Rule 12.1.2.2.

6 Other matters

Bore interference and Bore G41/0456 pump test

The e3 Scientific report (thanks for providing that) refers to a pump test of G41/0456 while the earlier ORC report referred to a pumping test on G41/0455. There may be a bore numbering error in the earlier report. We have attached a copy of the full original pumping test as Appendix A.

The basis for assessing effects on persons

We note that the e3 Scientific report states that the Landpro assessment of effects should not be considered and instead "*Regardless of this, the significance of bore interference must be determined based on the provisions of the current Regional Water Plan for Otago…*" Just in case any weight is given to this comment; this is not an accurate statement of the requirements of the RMA notification provisions. Those provisions, particularly Section 95E, require an assessment of effects not simply a comparison with a methodology in a regional plan schedule that is specific to the RPW information requirements. We are not aware of any case law that supports the view that a method specified in a plan for information provision overrides the requirement of the RMA to consider effects.

Kind Regards

Mike Freeman

Senior Scientist/Planner

Matt Curran

Senior Planner

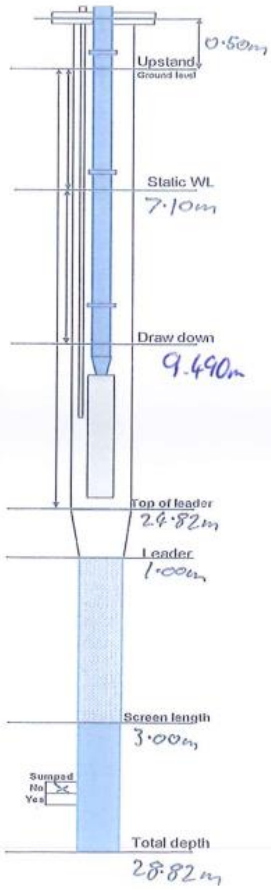
Appendix A Copy of full pumping test for bore G41/0456

mcneill DRILLING ■ DISTRIBUTION ■ PUMPING SINCE 1918

Client Name:	Amisfield Quarry (Mcneill)	Home No.	
		Cell No.	
Address	1248 Cromwell – Kingsgate Hwy SH8 Cromwell	Consent No.	
Grid Reference	E- 1305502	N- 5017223	
Driller	Neil Simmons		
Machine/Rig:	DR24	Fleet No. 282	
Drill Method:	Dual rotary		
Bore diameter mm	300mm		
Start date:	19/11/15	Finish Date: 20/11/15	
Development Hours:	5.25	Development Method: air surge	
Screen Slot: 2.5 mm	ID 256 mm	OD 273 mm	
PVC slotted	Top m	Bottom m	
Total casing used:	26.27 m	Total Depth: 28.82 m	
Sump length: N/A	m	Sump Diameter:	mm
Test Pumping	Air lifted	Pumped ✓	Rate: 25.5 LPS
Test Pump period	8 Hrs	Pump intake: 25m	m
Bacterial Water test	Yes	No	
Chemical Water test	Yes	No	
Casing top sealed	Yes ✓	No	
Impervious seal at ground	Yes	No	
Over Drilled	Yes	No ✓	m

Comments:

0 – 22.2 Gravels
22.2 – 24 Sandy Gravels
24 – 28.9 Gravels



Type of Test: 8 hour test

Project: Amisfield Quarry

Name of abstraction well: 12" Main — Location GPS: E1305502

Name of observation well: — Location GPS: N 5017223

Distance of observation well from abstraction well:

Depth: 28.82m — Diameter: 12"

Lining details: Casing: Steel

Perforations / screen: 2.5m slots 3m S/S

Date of test: Start: 1/12/15 — Finish: 1/12/15

Pump: Type: 2 / Phase — Depth of pump inlet: 25m

Initial water level: 7.290m — Above / ~~below~~ datum: 500m

Datum point: 500m — Above / ~~below~~ ground level:

Logger serial no: — Logger level below datum:

Observers: Richard Cook

Remarks:

Weather: Hot with some Wind No Rain

Date	Actual Time	Intervals Hours	Elapsed Time (t) (min)	Water level above / below datum (m)	Change in water levels (s)	Remarks
1/9/15	6.40			7.290		
	6.41		1	9.510	2.220	
	6.42		2	9.430	.080	
	6.43		3	9.420	.010	
	6.44		4	9.425	.005	
	6.45		5	9.425	Nil	25.3 LPS
	6.50		10	9.440	.015	25.3 LPS
	6.55		15	9.445	.005	25.3 LPS
	7.00		20	9.445	Nil	25.4 LPS
	7.05		25	9.450	.005	25.4 LPS
	7.10		30	9.455	.005	25.4 LPS
	7.20		40	9.460	.005	25.5 LPS
	7.30		50	9.460	Nil	25.6 LPS
	7.40	1	60	9.465	.005	25.6 LPS

Date	Actual Time	Intervals Hours	Elapsed Time (t) (min)	Water level above / below datum (m)	Change in water levels (s)	Remarks
	8.10			9.465	Nil	25.5 LPS
	8.40			9.475	.010	25.5 LPS
	9.10			9.480	.005	25.6 LPS
	9.40			9.480	Nil	25.5 LPS
	10.10			9.485	.005	25.5 LPS
	10.40			9.485	Nil	25.5 LPS
	11.10			9.485	Nil	25.4 LPS
	11.40			9.485	Nil	25.5 LPS
	12.10 pm			9.490	.005	25.5 LPS
	12.40			9.490	Nil	25.5 LPS
	1.10			9.490	Nil	25.5 LPS
	1.40			9.490	Nil	25.5 LPS
	2.10			9.490	Nil	25.5 LPS
	2.40			9.490	Nil	25.5 LPS

Recovery Data

Type of Test: 8 Low test

Project: Amisfield Quarry

Name of abstraction well: 12" Main Location GPS: E1305502

Name of observation well: .. Location GPS: N5017223

Distance of observation well from abstraction well: ..

Static Water Level: 7.290 Pumping Drawdown: 9.490 90 percent of recovery: ..

Date	Actual Time	Elapsed Time (t) (min)	Water level above / below datum (m)	Change in water levels (s)	Remarks
1/12/15	2.40pm	0 sec	9.490		
		.10 sec	7.560	1.93	
		20 sec			
		30 sec	7.410	.150	
		40 sec	7.340	.070	
		50 sec	7.330	.010	
	2.41	1 minute	7.330	Nil	
	2.42	2 minutes	7.325	.005	
	2.43	3 minutes	7.325	Nil	
	2.44	4 minutes	7.320	.005	
	2.45	5 minutes	7.320	Nil	
	2.46	6 minutes	7.320	Nil	
	2.47	7 minutes	7.320	Nil	
	2.48	8 minutes	7.320	Nil	
	2.49	9 minutes	7.320	Nil	
	2.50	10 minutes	7.320	Nil	
	2.51	11 minutes	7.320	Nil	
	2.52	12 minutes	7.320	Nil	
	2.53	13 minutes	7.320	Nil	
	2.54	14 minutes	7.320	Nil	

Date	Actual Time	Elapsed Time (t) (min)	Water level above / below datum (m)	Change in water levels (s)	Remarks	Date
	2.55	15 minutes	7.320	Nil		
	3.00	20 minutes	7.320	Nil		
	3.05	25 minutes	7.320	Nil		
	3.10	30 minutes	7.320	Nil		
	3.15	35 minutes	7.320	Nil		
	3.20	40 minutes	7.320	Nil		
	3.25	45 minutes	7.320	Nil		
	3.30	50 minutes	7.320	Nil		
	3.35	55 minutes	7.320	Nil		
	3.40	60 minutes	7.320	Nil		