**Pattle Delamore Partners Limited**

# TECHNICAL MEMORANDUM

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| **INVESTIGATION** | Resource Consent Application Review for Rockburn Wines Limited | **PROJECT** | Otago Regional Council Consent Reviews |
| **CLIENT** | **Otago Regional Council** | **PROJECT NO** | C032635125 |
| **CLIENT CONTACT** | Kirstyn Lindsay | **PREPARED BY** | Cameron Jasper |
| **CLIENT WORK ORDER NO/ PURCHASE ORDER** | RM20.003/PO011582 | **SIGNATURE** |  |
| | | **DATE** | 24 February 2020 |

## 1. Introduction

Pattle Delamore Partners Ltd (PDP) has been engaged by Otago Regional Council (ORC) to review potential impacts to groundwater related to a resource consent application from Rockburn Wines Limited (the Applicant) to replace their existing permit to take surface water (via a diversion into a race) for the purpose of dripline irrigation of 24 ha of grape vines and frost fighting. The Applicant's current deemed permit 98526.V1 (expiring 1/10/2021) allows for the take of surface water from the Park Burn and one of its major tributaries (both takes above the confluence between the Park Burn and major tributary). The 98526.V1 permit allows for a take up to 100,000 L/hour (about 28 L/s). The Applicant holds other permits to take from and discharge to the Park Burn under permits 98527.V1 and 98655 respectively and does not seek replacement consent. The applicant is also a shareholder of deemed permit 95789 for taking water from the Amisfield Burn and seeks replacement under a separate application. Given that the Park Burn is an unreliable source of surface water in terms of the scale/variability of flows that can be diverted with the current infrastructure, the Applicant occasionally utilises deemed permit 95789 (Amisfield Burn water) noted above to supplement their irrigation supply.

The surface water take from the main stem of the Park Burn is a simple open channel diversion controlled via a sluice gate and conveyed by an unlined water race. The race from the main stem diversion is piped across the major tributary in the vicinity of the second take location. The second take (at the major tributary of the Park Burn) is diverted into a race that connects with the race diverting water from the main stem of the Park Burn. A telemetered flow monitoring station is maintained below the confluence of the two races. The combined diversion is then routed via an unlined race to the Rockburn reservoir above the irrigated 24 ha area vineyard. The Rockburn reservoir (5,880 $m^3$) is used for irrigation and frost fighting purposes and has a spillway that, when the reservoir is full, directs excess water back into the Park Burn via an unlined overflow ditch. The unlined race network described above is relevant to only the deemed permit 98526.V1 and this application for replacement consent.

The Applicant has proposed a consent to replace deemed permit 98526.V1 with maximum total rates of take from the Park Burn at 28 L/s, 73,000 $m^3$/month, and 237,933 $m^3$/year and a duration of 35 years. Historically (based on the analyses of the 2015-2020 diversion records from the telemetered site) the Applicant has taken up to about 226 L/s, 140,814 $m^3$/month, and 702,906 $m^3$/year. The Applicant had been operating under condition 3 of deemed permit 98526.V1 which allows for a combined take (permit 98526.V1 plus 98527.V1) from the Park Burn up to 112 L/s in terms of the maximum instantaneous take. According to the records provided there are a few instances where the maximum instantaneous rate of take exceeded the combined rate above. The Applicant notes that they are not seeking replacement consent for permit 98527.V1 and will therefore endeavour to ensure and maintain a maximum instantaneous rate of take below 28 L/s. The

Applicant has proposed the maximum monthly and annual abstraction volumes above based on Aqualinc efficiency of use calculations with regards to the 24 ha vineyard. During times of low residual flow in the Park Burn and the major tributary at the take locations, the Applicant is unable to take surface water due to the geometry/design of the takes. This implies that during periods of high flows, when the Applicant is proposing to divert no more than a combined maximum of 28 L/s, that both takes cannot fully divert all the water in the channel(s).

The Applicant has stated that there are no designated aquifers within the area with the closest being the Lowburn Alluvial Ribbon Aquifer (within the Low Burn surface water catchment) about 5 km to the southwest of the Applicant's points of take along the Park Burn. According to the ORC database, there is a potentially affected draft/recommended aquifer (Pisa Groundwater Management Zone) flanking the western side of Lake Dunstan downstream of the Applicant's takes along the Park Burn. Although this groundwater management zone extent mostly corresponds to the extent of the Late Pleistocene river deposits (gravelly alluvium between Lake Dunstan and SH6) and Holocene river deposits (gravelly alluvium extending up the valleys of the lower foothills to the bedrock base of the Pisa Range metamorphic rocks flanked by glacial till deposits), it appears that ORC has primarily delineated this zone based on the topography of the land surface where the foothills extending from the Pisa Range transition into the lower flatter areas on the western side of Lake Dunstan and up the lower valley fill areas of Five Mile Creek, Park Burn, and Amisfield Burn.

Bores in the area appear to be primarily concentrated towards Lake Dunstan within the extent of the alluvium between SH6 and the lake. The hydrogeologic setting is such that any surface water flow within the Park Burn that is lost to groundwater above (upgradient) and outside of the Pisa Groundwater Management Zone is expected to arrive as groundwater inflow on the northwest side of the zone. Additionally, surface water flow losses within the Pisa Groundwater Management Zone above the point of inflow into Lake Dunstan are expected to bolster the groundwater supply.

According to LAWA, the Park Burn surface water catchment is overallocated. It is also noted on the LAWA database that the Park Burn is likely to naturally run dry due to losses to groundwater. The Applicant's two take locations from the Park Burn appear to be just above and outside of the Pisa Groundwater Management Zone, which has, according to ORC, 2,234,080 $m^3$/year of groundwater available for allocation.

Mid-summer flow gaugings (with all surface water abstractions ceased 24 hours prior to the survey) on 16 January 2019 provided by the Applicant demonstrates that the Park Burn gains within its upper reaches and then loses significantly to groundwater as it flows out of the hard rock (schist) Pisa Range over the gravelly alluvium towards the point of discharge into Lake Dunstan. According to the flow gauging survey and field observations provided by the Applicant, it is possible that the Park Burn in its natural setting will not always reach Lake Dunstan. This agrees with the LAWA database that notes this waterway is likely to run dry in its natural setting. The flow gauging results show that about half of the Park Burn flow (at the time of the gaugings) was lost to groundwater across the upper area of the Pisa Groundwater Management Zone and SH6. Access to the lower Park Burn was limited by the quarry in the vicinity of Lake Dunstan, so it was unclear at the time of the survey if the Park Burn would have reached Lake Dunstan. Although satellite imagery suggests that the Park Burn surface water does not reach Lake Dunstan, the imagery could have occurred at a time when surface water diversions were active.

The Applicant has concluded, based on observations from similar work on the Amisfield Burn where it was possible to access the lower reaches, that the Park Burn has the potential to completely lose to groundwater before reaching Lake Dunstan in its natural setting. Based on the review of hydrogeologic conditions and the gauging results above, this conclusion is considered reasonable. Additionally, the Applicant has noted that there has been no previous flow monitoring for the Park Burn.

The Park Burn in the vicinity of the Applicant's current takes represents a combination of hard rock aquifer, snowmelt, and precipitation contributions outside of the groundwater management zone. It is expected that the existing/proposed takes reduce natural groundwater recharge to the proposed Pisa Groundwater Management Zone and could therefore potentially impact groundwater levels at supply wells and surface water bodies, the overall groundwater resource and reduce the potential for contaminant dilution. A consideration of these potential effects is outlined below.

### 2.1 Effects on the overall groundwater resource

It is understood that surface water inflows from the Park Burn and other streams flowing towards Lake Dunstan are included in ORC's calculation of allocation status for the proposed Pisa Groundwater Management Zone. ORC may therefore wish to consider accounting for the takes in the groundwater allocation block, in addition to surface water, to recognise the potential reduction in recharge. Specific effects on current groundwater resource users are considered in Section 2.3 of this memo. Given the amount sought by the Applicant (237,933 $m^3$/year), the most conservative scenario is that, in the natural setting, all this water would be lost to groundwater that recharges the Pisa Groundwater Management Zone. This is less than the 2,234,080 $m^3$/year of groundwater considered available for allocation, so the effects on the overall groundwater resource are expected to be less than minor. However, we note that with the other deemed permits where replacements consents are sought that are currently being reviewed by ORC, the allocation limit could be exceeded if they were viewed as groundwater abstractions. Although, as noted above, this is not a new abstraction. Given it is a proposed limit, further consideration should be given to how these permits should be best accounted for in the groundwater and surface water allocation blocks.

### 2.2 Effects on surface water bodies

The specific effects on surface water and ecology from the abstractions are being considered by others reviewing this application. From a groundwater perspective, reduced recharge to an aquifer can affect any connected wetlands or spring fed-streams via a reduction in groundwater levels. There are no wetlands identified by ORC as regionally significant wetlands in the potentially affected area. The closest significant wetland is the Bendigo Wetland, which is hydraulically connected to Lake Dunstan at the north of the lake. Inspection of aerial imagery does not indicate any obvious wetlands or spring-fed streams bordering the courses of the Park Burn in the potentially affected area between the takes and Lake Dunstan. This is expected given the natural hydrogeologic setting where groundwater becomes relatively deep and disconnected from the Park Burn. On this basis, adverse effects on connected surface water bodies as a result of reduced groundwater recharge are not expected to occur as a result of the activity. Ultimately, there will however, be a reduction in groundwater flow into Lake Dunstan/the Clutha River. There are no current allocation limits for these water bodies, although ORC have commenced a process to develop limits.

### 2.3 Effect on nearby bores

The Applicant has identified the closest groundwater take consent is about 2.2 km to the southeast of the Park Burn takes and stated that, based on the separation distance, that no adverse effects are expected. A review of bores on the ORC database shows a domestic bore (G41/0202) about 940 m east-southeast of the Applicant's Park Burn tributary take. This bore is noted as shallow (5 m deep) at about 150 m distance from the main stem of the Park Burn. This bore does not appear to be well located based on satellite imagery, however dwellings in the vicinity of this bore are similarly located near the Park Burn. The ORC database does not include depth to groundwater information for this bore. The GNS geologic map suggests that this shallow bore is completed within gravelly Holocene river deposits in close vicinity to glacial tills. Given the information above, it is unknown to what extent, if at all, this bore relies on elevated groundwater levels as a result of natural

groundwater mounding (via losses to groundwater) in the vicinity of the Park Burn. A simple assessment of groundwater throughflow in the immediate vicinity of bore G41/0202 across a 150 m wide area (with a 4 m saturated thickness) considering the ground surface gradient (about 0.03 m/m) as a proxy for the lateral hydraulic gradient and a low-range (86.4 m/day) hydraulic conductivity for gravels, results in a groundwater flow of about 17 L/s. Such a flow if intercepted by the shallow domestic bore's small capture zone could likely accommodate long-term drawdown effects as well as domestic use. This throughflow is expected to occur naturally (with or without the surface water takes) as a result of the overall groundwater system primarily due to recharge above the current locations of the Applicant's diversions along the Park Burn.

Just over 2 km southeast of the Applicant's Park Burn takes where the topography opens up to the wider, flatter area of the Pisa Groundwater Management Zone in the vicinity of SH6, well depths, according to the ORC database, are consistently 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.

Given that the Park Burn is interpreted to only reach the lake on occasion during higher flow events (likely stormwater dominated flows) and that mounding effects associated with these flows in the relatively permeable alluvium would only be expected to be temporary (on the order of hours to days), it is unlikely that these bores rely on direct mounding effects specific to flows from the Park Burn. The proposed magnitude of the abstraction, the constant head boundary effects from Lake Dunstan (with a likely direct hydraulic connection) as well as the other recharge to the overall groundwater resource within the Pisa Groundwater Management Zone together with this being an existing abstraction, means that the levels in supply bores are unlikely to be adversely affected.

Given the assessment above, adverse effects on neighbouring bores due to lowered groundwater levels or reduced capacity for contaminant dilution are not expected to occur as a result of the proposed take from the Park Burn.

## 3.0 Conclusion

In conclusion our assessment of the proposed take indicates the following.

- The taking of surface water is expected to reduce groundwater recharge.
- It is considered that sufficient information has been provided for assessing the effects on groundwater.
- Based on the absence of potentially affected bores and connected surface water bodies, no residual flow specific to groundwater effects is considered necessary.
- No specific groundwater conditions are considered necessary.
- Given the recharge from Park Burn has been provided for in ORC's allocation calculations for the proposed Pisa Groundwater Management Zone, ORC may wish to consider accounting for the takes in the groundwater allocation for this area. Given it is a proposed limit, further consideration should be given to how these permits should be best accounted for in the groundwater and surface water allocation blocks.

verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.