



**BEFORE** Independent Commissioner appointed by Tasman District Council

**IN THE MATTER** of the Resource Management Act 1991

**AND**

**IN THE MATTER** of an application by CJ Industries Ltd for to discharge contaminants to land (backfill material) RM220578

**EVIDENCE OF RYAN CHARLES SMITH NICOL ON BEHALF OF CJ INDUSTRIES LIMITED (GROUNDWATER AND CLEANFILL)**

**4 November 2022**

**1. INTRODUCTION**

1.1 My full name is Ryan Charles Smith Nicol. I am a Hydrogeologist with Pattle Delamore Partners (PDP) and have been employed in that role since 2012.

1.2 The applicant has applied for resource consents authorising the extraction of gravel, stockpiling of topsoil, and reinstatement of quarried land, with associated amenity planting, signage and access formation at 134 Peach Island Road, Motueka:

- (a) RM200488 land use consent for gravel extraction and associated site rehabilitation and amenity planting and
- (b) RM200489 land use consent to establish and use vehicle access on an unformed legal road and erect associated signage

1.3 The applicant has also applied for a discharge permit authorising the discharge of contaminants to land, in circumstances where the contaminants may enter water (RM220578).

1.4 I produced evidence addressing clean fill parameters and a groundwater assessment for the purposes of the land use consents application. That evidence is most relevant to the

discharge permit application, but was filed at that point because aspects of my evidence (in particular, clean fill parameters) were also relevant to the land use activities, to other witnesses' assessments of those activities, and to the proposed consent conditions (e.g. conditions relating to clean fill parameters and backfilling requirements). I indicated by the use of grey shading the aspects of my evidence that were principally relevant to the discharge permit rather than the land use activities.

- 1.5 This evidence does not repeat the evidence already filed, and so this statement should be read together with my statement dated 15 July 2022.

### **Qualifications and Experience**

- 1.6 My qualifications and experience are set out in my statement dated 15 July 2022.
- 1.7 I have visited the proposed Peach Island quarry site on 26 September 2022.

### **Purpose and Scope of Evidence**

- 1.8 The purpose of my evidence dated 15 July 2022 was to assess the groundwater effects of the proposal, and to provide recommendations to avoid, remedy or mitigate adverse effects on groundwater resources at Peach Island. This evidence:
- (a) provides an update with respect to the assessment of groundwater effects, proposed methods to manage contaminant discharges, and methods to avoid, remedy or mitigate effects on groundwater;
  - (b) addresses submissions lodged on RM220578; and
  - (c) responds to matters raised in the s 42A report on the discharge permit application.

### **Code of Conduct**

- 1.9 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014 and I agree to comply with it. My evidence is within my area of expertise, however where I make statements on issues that are not in my area of expertise, I will state whose evidence I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.

## 2. EXECUTIVE SUMMARY

2.1 CJ Industries is seeking resource consent for the discharge of contaminants to land, in circumstances where the contaminants may enter water.

2.2 Following the filing of my evidence dated 15 July 2022, updates to the GMP (dated 2 September 2022) were made. These updates included:

- (a) Additional detail for managing uncertainty in groundwater level depths to avoid inundation of excavations.
- (b) Clarification of “Stable Weather conditions”.
- (c) Minor adjustments to the proposed groundwater quality trigger levels.
- (d) Adjustments to determining if an adverse changes in water quality has occurred.
- (e) Adjustment of proposed random chemical testing of clean fill material.

2.3 In response to a request for further information from Tasman District Council (Council) dated 11 August 2022, further clarification/updates to the following items were made (in addition to the items in paragraph 2.2 above) in my response dated 2 September 2022:

- (a) Updated range of groundwater level fluctuations.
- (b) Groundwater level increase rates.

2.4 Groundwater sampling was undertaken at Peach Island in September 2022 and also at the applicant’s 83 Douglas Road Quarry site in October 2022 where a similar activity to what is proposed at Peach Island currently occurs. The results of the Peach Island groundwater sampling indicated that the measured concentrations generally complied with the proposed trigger values, with the exception of iron and manganese concentrations in one private drinking-water supply bore 21033 (1.29 g/m<sup>3</sup> and 0.061 g/m<sup>3</sup> respectively) which exceeded the proposed trigger values of 0.3 g/m<sup>3</sup> (iron) and 0.04 g/m<sup>3</sup> (manganese). The results of the Douglas Road sampling indicated groundwater chemistry downgradient of the consented quarry site were below the proposed Peach Island groundwater chemistry trigger levels and therefore no adverse

effects on downgradient groundwater users are indicated by that sampling, although I acknowledge it is only from a single sampling round.

- 2.5 The removal of the naturally occurring strata and backfilling with clean fill will result in some level of change to the physical structure of the aquifer and groundwater chemistry and therefore meets the definition of a contaminant as defined in the TRMP (Chapter 2) and in the RMA. However, this does not mean that water will be “contaminated” as this term is normally thought of.
- 2.6 The area in which the groundwater chemistry changes are expected to occur will be within the quarry footprint and the immediately surrounding area on the downgradient (northerly) side of the quarry. It is recommended that groundwater monitoring should occur over an area up to 1 km downgradient of the proposed quarry within groundwater bores that are accessible to the applicant to assess the extent of any water chemistry changes. Groundwater chemistry changes across the wider aquifer system are not expected to occur.
- 2.7 The immediate downgradient area where changes to groundwater chemistry may occur is similar to the area within a surface water way in which a discharge is allowed to cause a change in water chemistry. However, for this consent application, additional consent conditions are put in place to ensure that any change in water chemistry due to the quarry does not cause any downgradient water supply bore to fail the drinking-water standards and become unsuitable as a source of water supply. On that basis, the effects on groundwater quality are considered to be consistent with the NPS-FM (2020).

### 3. EVIDENCE

#### Discharge permit

- 3.1 The discharge permit seeks consent to discharge a contaminant to land in circumstances where it may enter water. The discharge of clean fill meets the RMA definition of contaminant:

**contaminant** includes any substance (including gases, odorous compounds, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat—

(a) when discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or

(b) when discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged

3.2 This broad RMA definition of contaminant means that deposited material can be a contaminant even where it does not “contaminate” water, in the sense of adversely affecting water quality. That is the situation here. The removal of the natural strata at the proposed quarry site and backfill with clean fill material in areas of the quarry that will be inundated by groundwater will cause a change in the physical structure of the land (i.e. a change in the hydraulic conductivity of the aquifer where fill is placed) and a potential change in the chemistry of the groundwater could also occur as the natural strata in the quarry excavations will be replaced with material that may have a different structure, porosity, geology, and/or chemistry. This change in the groundwater environment may also cause some changes in groundwater characteristics in the area immediately downgradient of the quarry, however any such changes will be attenuated with increasing distance from the filled areas, such that widespread changes in groundwater characteristics are not expected.

3.3 As set out in my earlier evidence and reiterated here, the conditions of consent are designed to ensure that even within the localised area where changes in groundwater characteristics may occur, they will not be changes that cause an adverse effect on groundwater quality or on any groundwater users.

3.4 By implementing the Groundwater and Clean Fill Management Plan (“**GMP**”), the effect of the placement of the clean fill should have less than minor effects on groundwater quality, and are not anticipated to cause an adverse effect on nearby downgradient groundwater users or the wider aquifer system.

#### **Amendments to assessment and GMP as part of discharge permit application**

3.5 Additional changes have been made to the GMP following the filing of my evidence dated 15 July 2022. These changes were made to incorporate management of the discharge component of the activity and to address Council requests for further information dated 11 August 2022. This section of my evidence provides a summary of the changes that have been made to the GMP (dated 2 September 2022).

3.6 The main changes to the GMP are:

- (a) Additional detail regarding how the applicant will manage uncertainty in knowing groundwater level depths to avoid inundation of excavations.
- (b) Clarification of “Stable Weather conditions” during which excavation and backfilling activities would occur.
- (c) Minor adjustments to the proposed groundwater quality trigger levels.
- (d) Adjustments to determining if adverse changes in water quality are occurring.
- (e) Adjustment of proposed random chemical testing of clean fill material.

Additional detail for each of these changes are discussed below.

3.7 As exposure of groundwater within an excavation is considered to be a potential source of contamination to groundwater, avoiding accidental exposure of groundwater within excavations at the proposed Peach Island quarry is required. The GMP was updated to manage uncertainty regarding the depth to groundwater to avoid accidentally exposing groundwater during excavations. Groundwater levels beneath a particular excavation will be managed operationally via a combination of automated groundwater level monitoring and physical checks of groundwater on the day of excavation. This process is summarised below and also in Table 2 of the GMP dated 2 September 2022.

- (a) Groundwater level elevations will be continuously monitored using telemetry at the site in dedicated monitoring bores 24543, 24544, 24545 and 24546.
- (b) The groundwater level elevation data measured in the four bores listed above will be used to create interpolated groundwater level contours that will be available to the Quarry Operator and excavator operator(s).
- (c) Prior to excavations taking place, the Quarry Operator and excavator operator(s) shall check the interpolated groundwater level based on the groundwater level elevation map produced using the data from bores

24543, 24544, 24545 and 24546 for the location of where the excavation will occur.

- (d) To assess the occurrence of groundwater beneath the excavation, the excavator operator(s) will undertake a temporary excavation down to a depth of 1 m below the working level of the excavation on the day. This check on the occurrence of groundwater will be used to inform the depths to which excavations can occur. Only the digging implement of the excavator shall enter the temporary excavation and if groundwater is encountered, the excavation shall be back filled using only the material removed from it within 30 minutes of encountering groundwater to at least 0.3 m above the level at which groundwater was encountered.
- (e) Excavations between 0.3 m and 1 m above groundwater level shall be undertaken during stable weather conditions (defined in paragraph 3.8 below) and will be backfilled using clean fill material within the same day as extraction.
- (f) The Quarry Operator will ensure that there will be sufficient clean fill material on site to enable backfilling of excavations to depths between 0.3 m and 1 m above groundwater level to at least 1 m above groundwater level within the same day as extraction.

3.8 To avoid confusion, the previously used terminology of “dry weather conditions” has replaced with “Stable Weather conditions”. Excavations to depths between 0.3 and 1 m above groundwater level will only occur at the proposed quarry if stable weather conditions are met. Stable weather conditions are defined in the GMP as occasions when the requirements listed below are met:

- (a) Groundwater levels measured in the dedicated onsite monitoring bores 24543, 24544, 24545 and 24546 display either a declining or stable trend.
- (b) The flow record for the Motueka River at the TDC recorder site at Woodmans Bend displays either a declining or stable trend.

3.9 In addition to this, excavations will cease when any of the following occur:

- (a) TDC issue any flood warnings for the Motueka River catchment.

- (b) Any weather warnings are issued for the Nelson/Tasman region that might be expected to cause groundwater levels at the quarry to rise.
- (c) When groundwater levels measured in bores 24543, 24544, 24545 and 24546 display an increasing trend.

Backfilling will still be allowed to occur during any of these scenarios to ensure that at least 1 m of material is maintained above groundwater level, up to the elevation of the existing ground surface.

3.10 Minor updates to the groundwater quality triggers were made to some of the trigger values in Table 3 of the draft GMP. The proposed trigger values use half maximum acceptable values (MAV) and the guideline values (GV) sourced from the New Zealand Drinking Water Standards (DWSNZ) 2005 (Revised 2018) (MOH). The use of the proposed groundwater quality trigger values are generally consistent with the trigger values approved as part of consent conditions for a resource consent (CRC204349) granted to Fulton Hogan Limited for a similar activity at Miners Road, Canterbury. The differences from that consent are related to trigger values for electrical conductivity, hardness and iron. As there is no GV provided for electrical conductivity in the DWSNZ, no trigger level has been provided for electrical conductivity. The DWSNZ provide a GV of 200 g/m<sup>3</sup> for hardness but also state that the taste threshold for hardness is 100 to 300 g/m<sup>3</sup>. In addition, the DWSNZ also state that hardness values below 100 g/m<sup>3</sup> can result in corrosion of pipework. Therefore, a trigger level for hardness of 200 g/m<sup>3</sup> is considered to be suitable. Iron was not included as a trigger for the afore mentioned consent CRC204349 for a similar activity at Miners Road, Canterbury but has been included as a trigger as part of the proposed Peach Island quarry. The trigger value for iron of 0.3 g/m<sup>3</sup> is the aesthetic guideline value proposed by Taumata Arowai (2022), which will come into effect on 14 November 2022.

3.11 In the initial version of the GMP, the MAV was applied as a trigger level for the downgradient drinking water supply bores as these bores are located at a greater downgradient distance from the quarry boundary compared to the downgradient, dedicated monitoring bores. However, for consistency the trigger levels provided in Table 3 of the GMP ( half MAV) are now proposed to be used to assess changes in water quality in both the dedicated monitoring bores and downgradient drinking water supply bores. The GMP was amended to reflect this change.



- 3.12 As an additional check on the quality of the fill material, the GMP has been updated from the specification of random chemical testing of fill material of 1 in 50 trucks (in the previous draft) to a requirement of random chemical testing of fill material every 1 sample per 500 m<sup>3</sup> of material trucked to the site. In addition, random chemical testing to verify the quality of the placed fill material at the site will be undertaken annually. This random chemical testing at the trucks and in the placed fill is consistent with the WasteMINZ (2018) guidelines.

### **Other parts of response to request for information**

- 3.13 This section of my evidence provides a summary of my response to the request for further information from Council dated 11 August 2022. My response is dated 2 September 2022. As noted in paragraphs 3.5 to 3.113.12, a number of changes to the GMP were made to address concerns from TDC in their RFI. Other than those changes, the main items of the response are:
- (a) Updated range of groundwater level fluctuations.
  - (b) Groundwater level increase rates.
- 3.14 Further groundwater level data was made available to me after the filing of my evidence dated 15 July 2022. The updated groundwater level data indicates that groundwater level fluctuations at the proposed Peach Island Quarry site are in the order of 2 to 3.5 m with the highest groundwater level recorded in bore 24545 (Piezo 3 – 0.5 m below ground level (bgl)), measured on 9 November 2020 and the lowest groundwater level recorded in 24544 (Piezo 2 – 5.1 m bgl), measured on 18 August 2020.
- 3.15 An assessment has been undertaken to determine how quickly groundwater levels increase in response to a high flow event in the Motueka River/high rainfall event. Daily average flow data recorded in the Motueka River at the TDC Woodmans Bend recorder site shows that flows within the Motueka River increased from 124 m<sup>3</sup>/s on 7 November 2020 to 649 m<sup>3</sup>/s on 8 November 2020, indicating a high flow/flood event. Rainfall at the nearby NIWA rainfall recorder site in Motueka (agent number 12429) was also high, at 83.6 mm recorded by on 8 November 2020. Changes in groundwater levels within the monitoring bores at the proposed Peach Island Quarry indicated groundwater level increases in the order of 1 m/day in bores located closest to the river with decreasing rates further away from the river. This additional information provides further support

for my opinion that by ensuring there will always sufficient back fill material and earthmoving machinery on site to raise the excavated area by 1 m (or up to the pre-quarry land surface), the quarry will be able to avoid any exposure of groundwater in the pit, even if groundwater levels start to display a rising trend.

### **Assessment of groundwater chemistry at Peach Island and downgradient of CJ Industries' quarry at Douglas Rd**

- 3.16 Additional testing has been undertaken to further establish background water chemistry in the Peach Island Aquifer. Groundwater sampling at Peach Island was undertaken by PDP in five bores (24543, 24544, 24545, 24546 and 21033) in September 2022. The locations of these bores are shown in Figure 1 attached.
- 3.17 CJ Industries also operate a quarry at 83 Douglas Road under resource consents RM150896 (granted in 2016) and RM210649 (granted in 2021). One of these quarry consents involves the extraction of gravel aggregate down to a depth of 4 m below existing ground level with the excavated pit backfilled using clean fill material (note this consent does not require that clean fill meet the current WasteMINZ (2018) definition). The resource consent for quarrying at 83 Douglas Road also allows for the exposure of groundwater within the excavation pit. This quarry is nearing the end of its operational life. Gravel extraction has ended and backfilling of the excavation pit with clean fill material is nearing completion. The applicant's 83 Douglas Road quarry site is located around 2 km downstream of the proposed Peach Island site and is expected to have generally similar geology to the proposed Peach Island site.
- 3.18 The overall proposed quarrying and backfilling activities at Peach Island are expected to be similar to the activities undertaken at the 83 Douglas Road site except the proposed Peach Island quarry will be operated with more stringent controls particularly regarding the type of fill material used as backfill and additional controls on excavation depths to avoid exposure of groundwater. Therefore, the quarrying and backfilling activities at CJ Industries 83 Douglas Road site provides a useful case study for effects on groundwater chemistry that may occur at Peach Island.
- 3.19 There has been previous groundwater sampling of bores in the vicinity of the 83 Douglas Road site. However, the available data is intermittent, and it is unclear where some of the samples were collected from, or the methods used to collect the samples. Further to

this, no groundwater quality sampling that incorporates multiple downgradient bores sampled on the same day has been undertaken previously at Douglas Road as it is not required under the resource consents for the site.

3.20 In order to provide a direct comparison between background water chemistry at Peach Island and data for bores downgradient of the Douglas Road site, the sampling in October 2022 was undertaken. Groundwater samples were collected from four bores in the vicinity of the 83 Douglas Road site. Based on groundwater contours from TDC (Weir and Thomas, 2018), groundwater flow directions in the vicinity of the 83 Douglas Road site are in a general northeast direction, indicating losses from the Motueka River, a similar situation to what has been observed by the groundwater level monitoring at Peach Island (i.e. Motueka River flow losses contributing to recharge of the Peach Island Aquifer). Based on the groundwater flow directions, three bores considered to be downgradient of the Douglas Road excavation area were sampled (21555 (screened between 14 and 16 m bgl), 24306 (no depth information) and 24345 (no depth information)). There are no bores in the area considered to be upgradient of the 83 Douglas Road excavation area. However, samples were also collected from a fourth bore (20927 (screened between 12 and 14 m bgl)) located approximately 300 m southeast of the closest extent of the 83 Douglas Road excavation area. This bore is considered to be generally cross-gradient of the excavation area and therefore is expected to be representative of background water quality. An additional sample of exposed groundwater within the open excavation at the applicant's 83 Douglas Road site was also collected to assess any direct changes in groundwater chemistry as a result of the quarrying activities at the site. The locations of the four bores and the sample of the exposed groundwater in the 83 Douglas Road quarry excavation relative to the Douglas Road backfill area are shown in Figure 2, attached.

3.21 All groundwater samples taken at Peach Island in September 2022 and at Douglas Road in October 2022 were collected by a PDP staff member who is a suitably qualified and experienced person to carry out such sampling. All groundwater samples were collected as per the requirements of NEMS (2019) for the sampling and measuring of discrete groundwater quality data. Monitoring bores located at Peach Island that did not have an existing pump were sampled using low flow sampling techniques as outlined in NEMS (2019). Bores with a pump were pumped until at least three well casing volumes had been removed and field parameters had stabilised as outlined in NEMS (2019), so as to

ensure the samples were representative of the surrounding groundwater. All samples to be analysed for dissolved metals were filtered on site using 0.45 µm filter and collected into acid preserved bottles after filtering, which is in accordance with best practice sampling procedures.

- 3.22 A summary of the groundwater chemistry results from the sampling at Peach Island in September 2022 are provided in Table 1, attached. The results have been compared against the proposed trigger values as outlined in the GMP. The data show that groundwater chemistry in the vicinity of the proposed Peach Island quarry is generally of good quality with the exception of an exceedance of the trigger values for iron (0.3 g/m<sup>3</sup>) and manganese (0.04 g/m<sup>3</sup>) in private drinking-water supply bore 21033 (iron concentration of 1.29 g/m<sup>3</sup> and manganese concentration of 0.061 g/m<sup>3</sup>). There were no other exceedances of the proposed trigger levels in the Peach Island bores with concentrations generally well below their respective trigger level and no detections of any hydrocarbon and VOC compounds.
- 3.23 A summary of the groundwater quality results from the sampling at the applicant's 83 Douglas Road site in October 2022 are provided in Table 2, attached. The data have been compared against the proposed trigger values for the proposed Peach Island quarry. The data show that the results from the cross gradient bore (representative of background water chemistry i.e. not downgradient of the existing quarry at 83 Douglas Road) and the three downgradient bores did not have concentrations that exceeded any of the proposed Peach Island quarry trigger levels. Concentrations in the downgradient bores generally had slightly higher concentrations compared to the cross-gradient bore, indicating a change in the total cations and anions, possibly as a result of the upgradient quarry activities. The results of the sample of the exposed groundwater within the 83 Douglas Road quarry excavation exceeded the proposed Peach Island trigger levels for total alkalinity (trigger value of 100 g/m<sup>3</sup> and measured concentration of 210 g/m<sup>3</sup>), total hardness (trigger value of 200 g/m<sup>3</sup> and measured concentration of 220 g/m<sup>3</sup>), aluminium (trigger value of 0.1 g/m<sup>3</sup> and measured concentration of 1.92 g/m<sup>3</sup>), iron (trigger of 0.3 g/m<sup>3</sup> and measured concentration of 1.98 g/m<sup>3</sup>), manganese (trigger value of 0.04 g/m<sup>3</sup> and measured concentration of 1.69 g/m<sup>3</sup>), and *E coli* (trigger value of 1 MPN/100 ml and measured concentration of 400 MPN/100 ml). It is difficult to determine the source of the elevated parameters in the quarry pit water sample, although

elevated total alkalinity and total hardness indicate that concrete could be source of the contamination as concrete is allowed to be used as fill material at the Douglas Road site.

- 3.24 The results of the exposed groundwater in the quarry excavation indicate that there is degradation of the exposed groundwater within the pit. However, the water samples from the downgradient bores at Douglas Road do not display any changes in groundwater chemistry of concern and therefore are not adversely affecting downgradient groundwater users. Further to this, the closest downgradient bore for drinking-water supply purposes at Douglas Road (24306) is in the order of 50 m from the backfilled quarry pit and does not show any degradation of water quality (including *E. coli* detections). This can be compared to the closest drinking water supply bore at Peach Island, which is around 88 m downgradient of the proposed Peach Island quarry.
- 3.25 The Douglas Road groundwater sampling undertaken in October 2022 provides an example of a more significant quarry activity than what is proposed for Peach Island , because the proposed Peach Island quarry activity will be undertaken with stricter controls and operational management (i.e. more limitations on the type of fill material than, no uncontrolled exposure of groundwater) compared to the operational quarry at 83 Douglas Road. Therefore, the Douglas Road site provides a worst-case scenario that indicates any changes in groundwater chemistry of downgradient bores at Peach Island will not result in adverse effects on downgradient groundwater users.

### **Cultural impact assessment**

- 3.26 I understand that a Cultural Impact Assessment is being prepared but is not yet finalised. I will respond to any technical groundwater quality or quantity matters raised in the Cultural Impact Assessment that are relevant to clean fill or groundwater by way of reply evidence.

### **Consistency with policy direction**

- 3.27 The provisions relevant to groundwater are found in Chapters 5 ,8, 12, and 33 of the TRMP (Chapter 33 specifically relates to discharges to land and freshwater) and in the National Policy Statement for Freshwater Management 2020 (“NPSFM”). I note that in the NPSFM, “freshwater” is expressly defined to include groundwater (Clause 1.5). As set out in my evidence of 15 July 2022, I remain of the opinion that the proposed quarry,

implemented in accordance with the GMP, can operate in a manner that is consistent with the provisions relevant to groundwater as found in the TRMP and NPSFM.

### **Matters raised in submissions**

- 3.28 A summary of the submissions on the discharge permit relating to groundwater and/or clean fill are:
- (a) Groundwater quality downgradient of CJ Industries' Douglas Road quarry.
  - (b) Removal and replacement of existing gravel with fill material changing properties of the aquifer.
  - (c) Backfilling of excavations with contaminated material causing degradation of groundwater quality and allowing 2% of contaminants in the clean fill material.
  - (d) Mobilisation of contaminants from flooding.
  - (e) Duration of post quarry monitoring.
  - (f) Consistency between the GMP and other proposed management plans.
  - (g) Proposed water quality triggers and parameters to be tested (specifically nitrate-N).
- 3.29 Groundwater quality monitoring undertaken in bores located downgradient of CJ Industries 83 Douglas Road quarry is detailed in paragraphs 3.17 to 3.25. The groundwater quality data collected during October 2022 provides the best indication of groundwater quality effects from that operation and indicates that the less restricted quarrying activities (compared to what is proposed at Peach Island) at the applicant's Douglas Road quarry are not causing adverse effects on downgradient groundwater users (i.e. no exceedance of the proposed Peach Island groundwater chemistry trigger values).
- 3.30 Concerns have been raised by submitters regarding the proposed activity changing the physical structure of the aquifer and the "filtering properties of the land". The extraction of naturally deposited gravel and backfilling with clean fill material at the proposed Peach Island quarry will result in a change to the physical structure of the aquifer as well as a

potential change in chemistry of the groundwater. The GMP requires that only natural clean fill material can be accepted by the applicant for back filling purposes and this material must meet the requirements of Table 1 of the GMP for acceptance of clean fill material. As a result of the replacement of naturally deposited strata, some change in the physical structure of the aquifer and water chemistry is expected. Physical changes in the aquifer structure could cause increased variations in hydraulic conductivity and therefore variations in the rate of groundwater flow and groundwater quality across the site. Natural variations in hydraulic conductivity are expected within the heterogeneous existing strata, and therefore further changes to hydraulic conductivity and groundwater levels as a result of the proposed activity are expected to be generally within the existing range of hydraulic conductivities and groundwater levels.

- 3.31 Concerns regarding the deposition of contaminants during quarrying activities have been raised by submitters, specifically that “that if 1,000,000 tonnes of gravel are extracted and up to 2% is allowed to be backfilled with contaminants this could be 20,000 tonnes of contaminants”. Section 3.0 and Table 2 of the GMP provides a definition of acceptable clean fill material sourced from offsite that can be used as backfill at the proposed Peach Island quarry which includes the requirement that any biodegradable material must not exceed 2% by volume per load. This is not indicating 2% of contaminants, but organic material. The 2% rate is a practical requirement recognising that incidental amounts of biodegradable material can become incorporated into some loads. No material from any site listed on the Tasman District Council Hazardous Activities and Industries List (HAIL) register or any site where the Quarry Operator has a reasonable expectation of HAIL activities will be accepted. Further to this, material sourced from offsite will only be accepted by completing either a PSI/DSI or by chemically testing a representative composite sample of imported fill material to demonstrate that total soil contaminant concentrations do not exceed regional soil background concentration limits (Cavanagh, 2015). Further to this, the GMP outlines that all fill material will be inspected offsite for any prohibited materials as well as random chemical testing of fill material being undertaken (outlined in paragraph 3.12). These controls will avoid contaminated material being accepted and used for back fill at the proposed quarry. Further to this, only 400,000 and 550,000 tonnes of aggregate is estimated will be excavated from the proposed Peach Island.

- 3.32 Mobilisation of contaminants during flooding has been raised by submitters. As outlined in paragraph 3.31 above, fill acceptance criteria will avoid any contaminated material being accepted for back fill purposes. Therefore, mobilisation of contaminants from material placed as back fill at the proposed Peach Island quarry during flood events is not expected.
- 3.33 Post quarrying/backfilling, monitoring of groundwater quality for a period of at least two years is proposed in the GMP. Given that the pattern of any groundwater quality changes is likely to have been well established during the period of quarry operations, this period of monitoring after the cessation of quarrying activities is considered to be sufficient to capture any longer-term patterns of groundwater quality changes that may have occurred as a result of the proposed quarry activities. Additional monitoring beyond two years following the cessation of quarrying and back filling would be unlikely to capture any additional changes that would not have been observed from groundwater quality monitoring undertaken up to that point. The proposed post quarrying/backfilling groundwater quality monitoring is therefore considered to be sufficient, based on the expected scale of changes that might occur.
- 3.34 A query regarding the consistency of the GMP with other proposed management plans was raised by a submitter. The applicant's counsel approached the submitter's counsel for clarification on the inconsistencies on 27 September 2022 but at the time of the preparation of my evidence, no clarification has been received by the applicant's counsel. One submitter queried the meaning of "GCFMP", a term used occasionally in the GMP. I confirm that this refers to the Groundwater and Clean Fill Management Plan, which should be referred to by the acronym GMP.
- 3.35 The proposed groundwater quality parameters and trigger levels are provided in Table 3 of the GMP and includes both nitrate-N and ammoniacal-N species of nitrogen. The proposed trigger levels are the GV and half MAV of the DWSNZ 2005 (MOH, 2018). The removal of the natural strata and back filling with natural clean fill material is expected to result in a change in the physical structure of the aquifer and groundwater chemistry. Provided that the clean fill acceptance criteria as outlined in the GMP is adhered to, any changes in groundwater chemistry are expected to be within the proposed trigger levels and therefore will not adversely affect down gradient groundwater users. Further to this, the proposed trigger levels are generally consistent with previously granted resource consents for similar activities. Given that the Peach



Island Aquifer is an unconfined aquifer in an area of rural land-use activities and on-site discharges of wastewater and stormwater, and areas of the aquifer are at times subjected to inundation from flood events in the Motueka River, it is possible that concentrations of some groundwater quality parameters may occasionally exceed the relevant MAV and GV from time to time, irrespective of any effects from the proposed quarry and its associated clean filling.

### **Matters raised in s 42A report**

- 3.36 In this section, I respond to matters raised in the s42A officers report on the discharge permit, specifically Sections Item 2.2 of the s42A officers report and the recommended condition relevant to groundwater.
- 3.37 I have reviewed the proposed conditions and I am in general agreement with the conditions that have been proposed by the Officer.
- 3.38 Proposed condition 48 requires a minimum of three groundwater samples to be collected at least two months apart prior to commencement of quarrying activities to establish background water quality levels. I have recommended that a further round of sampling is undertaken in November 2022, prior to the hearing of this application. Given that groundwater sampling at Peach Island has previously been undertaken in September 2022 and a second sampling round will be undertaken in November 2022, proposed condition 48 will be satisfied by the time of the hearing. The November sampling will occur after this evidence has been filed, but I expect that the results from that sampling will be available to be presented at the hearing.
- 3.39 Proposed condition 51 requires that the discharge of clean fill material will not result in a change in water quality within any existing water supply bore within 1 km downgradient of the proposed of more than 50% of the relevant MAV and GV of the DWSNZ 2005 (2018). The applicant has installed dedicated monitoring bores located upgradient and downgradient for assessing groundwater chemistry changes at the proposed Peach Island quarry. As these bores are the closest to the downgradient margin of the quarry they will be the first to show any changes in groundwater chemistry. Monitoring of bores located further downgradient will be beneficial for assessing water chemistry changes, provided the bores are made available for groundwater monitoring purposes (i.e. privately owned water supply bores etc). The criteria in proposed condition 51 should refer to the values

in Table 3 of the GMP to avoid any confusion or uncertainty about what the limiting values might be. I agree with the approach of using 50% of the relevant MAV, because that relates to health effects, but propose using the GV trigger values listed in Table 3 of the GMP to allow for natural variations of the groundwater chemistry. It is also my opinion that proposed condition 19 should be also be adjusted to reflect this wording and simply refer to the limits in Table 3 of the GMP as the reference values that samples are compared to

- 3.40 Proposed condition 89 refers to excavation controls and states that “.....*All excavations shall be undertaken in accordance with the GMP to ensure that excavations do not occur below a level 0.3 m above actual ground water level at the time of excavation...*”. The GMP allows for temporary excavations to depths less than 0.3 m above groundwater level to confirm the occurrence of groundwater and inform the depth to which excavations will occur on that day. Therefore, I propose that this condition is amended to read “All excavations other than test pit excavation shall be undertaken in accordance with the GMP ...”. I agree that excavations below 1 m above groundwater level shall be undertaken during stable weather conditions and will be backfilled to at least 1 m above groundwater level at the end of the same working day.
- 3.41 Proposed conditions 94 to 96 of the s42A report refer to clean fill material that will be considered suitable for backfilling purposes. I am in agreement with these conditions.
- 3.42 Proposed conditions 103 to 108 of the s42A report refer to groundwater quality monitoring and requires groundwater samples to be collected every three months after the commencement of quarrying activities at the proposed site and continue for at least two years after the cessation of quarrying/backfilling. Proposed condition 104 indicates that an adverse effect is considered to have occurred if there is a change in concentration of more than 20% when compared against the results of the three samples collected prior to quarrying commencing (proposed condition 48). It is possible that natural variations in groundwater chemistry could result in changes in water chemistry of more than 20%. Such a change could occur due to natural variability of the water quality, irrespective of any effect from the quarry. Proposed condition 104 appears to be inconsistent with proposed condition 51 which allows changes in groundwater quality of up to half of the relevant MAV and GV which are limits that are focussed on avoiding adverse effects. In my view the proposed conditions in the GMP are a better approach that is focussed on avoiding any adverse effect on nearby groundwater users as a result

of the proposed activity rather than the proposed conditions 103 to 108 of the s42A report.

- 3.43 Paragraph 7.15 of the s42A report references proposed condition 12 of the GMP which recommends that commencement of quarrying should occur at the greatest upgradient distance from a water supply bore. The intention of the condition proposed in the GMP was that quarrying works should commence at the most upgradient location within a stage area, not necessarily the furthest upgradient stage area. The purpose of this proposed condition in the GMP was to provide additional time to collect further downgradient groundwater samples for understanding seasonality in background groundwater chemistry. I do not consider that there is a conflict with the proposal to commence work in Stages 2 and 3 and then move to Stage 1.
- 3.44 Paragraph 7.18 of the s42A Officers report raises concerns regarding the volume of clean fill required to backfill at least 1 m above groundwater level. The applicant is proposing to excavate areas of the proposed quarry when there will be sufficient clean fill material available at the site to backfill any excavation. During times of low groundwater levels, daily excavations would not necessarily be to depths of less than 1 m above ground level, depending on the working depth of the excavation for that particular day. A recommendation by the Officer's hydrogeologist to "have a base level to quarry to" is not considered suitable for the proposed Peach Island quarry due to the range of groundwater levels as noted in paragraph 3.14 of my evidence.
- 3.45 Paragraph 7.43 of the s42A report lists groundwater related matters considered by the Officer to still be outstanding or in contention. Paragraph 7.43a raises concerns about whether the applicant will be able to prevent inundation of excavations during prolonged periods of groundwater level increase. As described in 3.44 of my evidence above, accidental inundation of excavations will be managed by the footprint of excavations being restricted to no more than 1,600 m<sup>2</sup>, and by a requirement to have a sufficient stockpile of fill material at the site to backfill the excavation. The largest range of groundwater levels measured to date at the site is 3.5 m (bore 24544) and the period of time between the lowest and the highest water level measurements in this bore was 83 days. The maximum rate of groundwater level increase in this bore was in the order of 1 m/day (paragraph 3.15 of my evidence). Further to this, no excavations are proposed if groundwater levels display an increasing trend (as defined under "stable

weather conditions”) so no excavations would be occurring during prolonged periods of groundwater level increase. Therefore, it is expected that the applicant will be able to manage excavations and backfilling to avoid inundation of the excavations.

3.46 Paragraphs 7.43b, 7.43c, 7.43d and 7.43e raise concerns regarding the use of trigger level proposed in the GMP and whether they are suitable to avoid adversely affecting downgradient groundwater users. The Officer has noted the definition of a contaminant as defined in the TRMP in Paragraph 4.9 of the s42A report which is any material that will change the physical structure of the land and chemical and biological condition of the groundwater. While no fill material with concentrations exceeding the regional soil background concentrations limits will be accepted as backfill, the removal of naturally deposited strata with natural clean fill material will result in some level of change to the physical structure of the aquifer and groundwater chemistry. Therefore, an area of the aquifer downgradient of the proposed quarry could be expected to display some level of change in water chemistry.

3.47 The s42A report raises a concern that the limits based on 50% of the MAV and the guideline values in the drinking-water standards may allow for significant deterioration in groundwater quality which is not acceptable in terms of the National Policy Statement for Freshwater Management (NPS-FM) (NZG, 2020). However:

- (a) The potential change in groundwater characteristics only applies to the local groundwater environment immediately downgradient of the clean fill activity. Beyond this zone, any changes in the characteristics of the water are attenuated back to their background levels. This attenuation zone could be considered as a form of “reasonable mixing zone”. Discharges to surface water are provided a reasonable mixing zone in the TRMP (Policy 33.1.3.5), which allows for changes in water quality for a specific reach, provided that the discharge does not result in degradation of water quality beyond the area where the change in water chemistry will occur. That approach in the TRMP is presumably acceptable in terms of the NPS-FM.
- (b) I agree with the s42A officer that no changes in the characteristics of groundwater quality changes are anticipated or monitoring required beyond a 1 km zone downgradient of the quarry and that lack of any

wider impact is achieving the NPS-FM requirements. If there were to be no allowance for an attenuation zone then I would expect that all onsite wastewater discharges, stormwater soakage systems and solid waste facilities and many rural land-use activities would be considered unacceptable, because they will all cause localised changes to groundwater characteristics in the immediate vicinity of the discharge. As far as I am aware, a large number of consents have been granted on terms that allow localised changes in groundwater characteristics since the NPS-FM 2020 came into force. For all those common-place rural activities to be deemed to be unacceptable would be an unrealistic outcome of what the NPS-FM is intended to achieve.

- (c) The approach proposed by the applicant is an even higher standard in that it has additional limits within the attenuation zone to ensure users of drinking-water wells are protected against adverse effects. The proposed trigger limits in the GMP allow for some change in groundwater chemistry within a localised area downgradient of the quarry, but also restrict any changes to half MAVs and less than the GVs to ensure that groundwater users are not adversely affected.
- (d) Provided that bores for groundwater quality monitoring purposes are accessible to the applicant, the distance downgradient of the proposed quarry within which groundwater chemistry changes should be monitored to determine if any changes in chemistry have occurred, has been assumed to be 1 km downgradient (based on proposed condition 51 of the s42A report) although this is considered to be very conservative and the actual distance downgradient in which changes in groundwater chemistry occur is expected to be smaller. While specific to *E. coli* and turbidity, the decision documents for resource consents RM210649 and RM200392 issued by TDC for similar quarrying activities note that bores more than 300 m downgradient of the excavation pits are unlikely to show changes in *E. coli* and turbidity concentrations as a result of the activities. Further to this, a recent sampling survey of groundwater quality from the applicant's 83 Douglas Road site indicates that no adverse effects on groundwater users have occurred at the closest

downgradient user (located around 50 m downgradient of the quarry).

Therefore, I expect that any changes in groundwater chemistry at this site will similarly be limited to an area downgradient of the proposed quarry and will not result in any noticeable changes or cause adverse effects on groundwater users within that area or the wider groundwater aquifer.

3.48 Paragraph 7.43f raises concerns whether the proposed response to contamination observed from groundwater sampling is robust enough. If an exceedance of a proposed trigger level occurs, then the GMP currently requires repeat sampling of the bore in which the exceedance occurred as well as the upgradient monitoring. If the repeat sampling indicates another exceedance in a downgradient bore, all quarry activities shall cease and an investigation into the source of the elevated concentrations undertaken. The TDC Hydrogeologist has recommended in the s42A report that all monitoring bores should be resampled regardless if an exceedance of the trigger levels has occurred and that any exceedance should be assumed to be from the proposed quarrying activities until proven otherwise. I agree that repeat sampling could assist with determining the source of the trigger level exceedance. However, the investigation into the source of an exceedance should include reviewing all accepted clean fill material as well as other sources of contamination such as other landuse activities and bore head security which can lead to groundwater contamination before assuming that the changes are associated with the quarrying activities. The response to an exceedance of a trigger level is outlined in Sections 7.1 and 7.2 of the GMP and includes; repeat sampling of the bore in which the exceedance occurred, investigating the cause of the exceedance (including material used as clean fill, land use activities, bore head security etc), cease any activities that caused the exceedance (if associated with the quarrying activities), provide an alternate drinking-water supply to any downgradient users in which the exceedances proven to be associated with the quarry activities have occurred following repeat sampling. This process as provided in the GMP is a suitable and robust response to managing exceedances of the proposed Table 3 (GMP) trigger level concentrations.

3.49 Paragraphs 7.44 to 7.57 of the Officers s42A report raise concerns regarding any potential groundwater quality changes downgradient of the proposed quarry not meeting the outcomes and requirements of the NPS-FM (2020). The NPS-FM applies to all freshwater including groundwater. The Officer has acknowledged in paragraph 7.47 of the s42A report that indirect effects of the proposed activities on surface water ways via

groundwater are considered to be negligible due to significant dilution effects. The NPS-FM (2020) proposes national water quality bottom line concentrations for specified parameters including nitrogen species (i.e. nitrogen-N (Table 6 of the NPS-FM) and ammoniacal-N (NPS-FM)). However, the national water quality bottom line concentrations are listed in the NPS-FM for rivers and lakes, not groundwater, and as a result of the accepted significant dilution effects, any elevated concentrations within groundwater would have a negligible effect on concentrations in surface water ways with the relevant NPS-FM national bottom line concentrations. For example, in the very unlikely event that nitrate-N concentrations reached the proposed trigger level of 5.65 g/m<sup>3</sup> in monitoring bores downgradient of the site, there would be significant dilution effects before any concentration of this magnitude reached any surface water way, thus retaining the national bottom line nitrate-N concentration of 2.4 g/m<sup>3</sup>.

- 3.50 Paragraph 8.2 raises concerns that the proposed trigger levels will exceed the NPS-FM bottom line for nitrate-N. As outlined in paragraph 3.49, the NPS-FM bottom line concentrations are for river environments and therefore should not be applied directly to groundwater. As noted in paragraph 3.49 there is sufficient dilution in surface waterways to avoid adverse effects. It is not appropriate to apply the rivers and lakes bottom lines in the NPS-FM to groundwater.

#### **4. CONCLUSION**

- 4.1 The main potential effect on groundwater from the proposed quarry at Peach Island is the mobilisation of contaminants from inundated fill material.
- 4.2 Although only natural clean fill material from sites that meet the requirements of Section 3 of the proposed GMP will be used as backfill, the removal of the naturally occurring strata and backfilling with clean fill will result in some level of change in the physical structure of the aquifer and groundwater chemistry.
- 4.3 The area in which the changes are expected to occur will not be the wider aquifer system but within an area limited to the quarry and also an area immediately downgradient of the quarry. Groundwater quality monitoring within 1 km downgradient of the proposed quarry will define the exact scale and extent of any changes.
- 4.4 Provided the quarry is operated in accordance with the GMP, effects on groundwater quality will be managed to avoid breaching the limits in Table 3 of the GMP and thereby

avoid adverse effects on groundwater users within 1 km downgradient of the quarry. Beyond 1 km downgradient of the proposed quarry, no changes in groundwater chemistry are expected. The area within 1 km downgradient of the proposed quarry in which some changes in water chemistry is expected to occur is considered to be conservatively large. This approach is similar to the area within a surface water way in which a discharge is allowed to cause a change in water chemistry.

4.5 Any changes in water chemistry within 1 km downgradient of the proposed quarry will be at a level that will not be detectable by downgradient users and the proposed trigger levels afford a level of change in groundwater chemistry that will not adversely affect downgradient groundwater users (i.e. half MAV) and is therefore considered to be consistent with the NPS-FM.

4.6 Therefore, provided that the quarry is operated in accordance with the GMP, I consider that the effects on groundwater quality from the proposed activity are less than minor.

Ryan Charles Smith Nicol

4 November 2022



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