

Irrigation Water Take Application

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1. Introduction

This document and attachments comprise a Resource Consent Application and an Assessment of Environmental Effects associated with a water take permit for irrigation of an 18-hectare orchard development at Katavich Rd, Waiharara, on behalf of Mate Yelavich and Co Ltd.

The background details of this application using Northland Regional Council's (NRC) "Application for Resource Consent" form is provided in **Appendix A**. Further details of various items where marked on the form are provided in the **Section 2**.

1.1 Report Structure

The report comprises:

- **Section 2** – a description of the proposed activity and suggested consent conditions;
- **Section 3** - background details of the application;
- **Section 4** – an assessment of environmental effects;
- **Section 5** – an assessment of cultural effects;
- **Section 6** - an assessment of statutory considerations;
- **Section 7** – a discussion of the notification process;
- **Section 8** – a discussion of consultation.

2. Description of Proposed Activity

2.1 Location

Figure 1 provides a map of the project area. The subject property is located at 9 Katavich Rd, Waiharara.

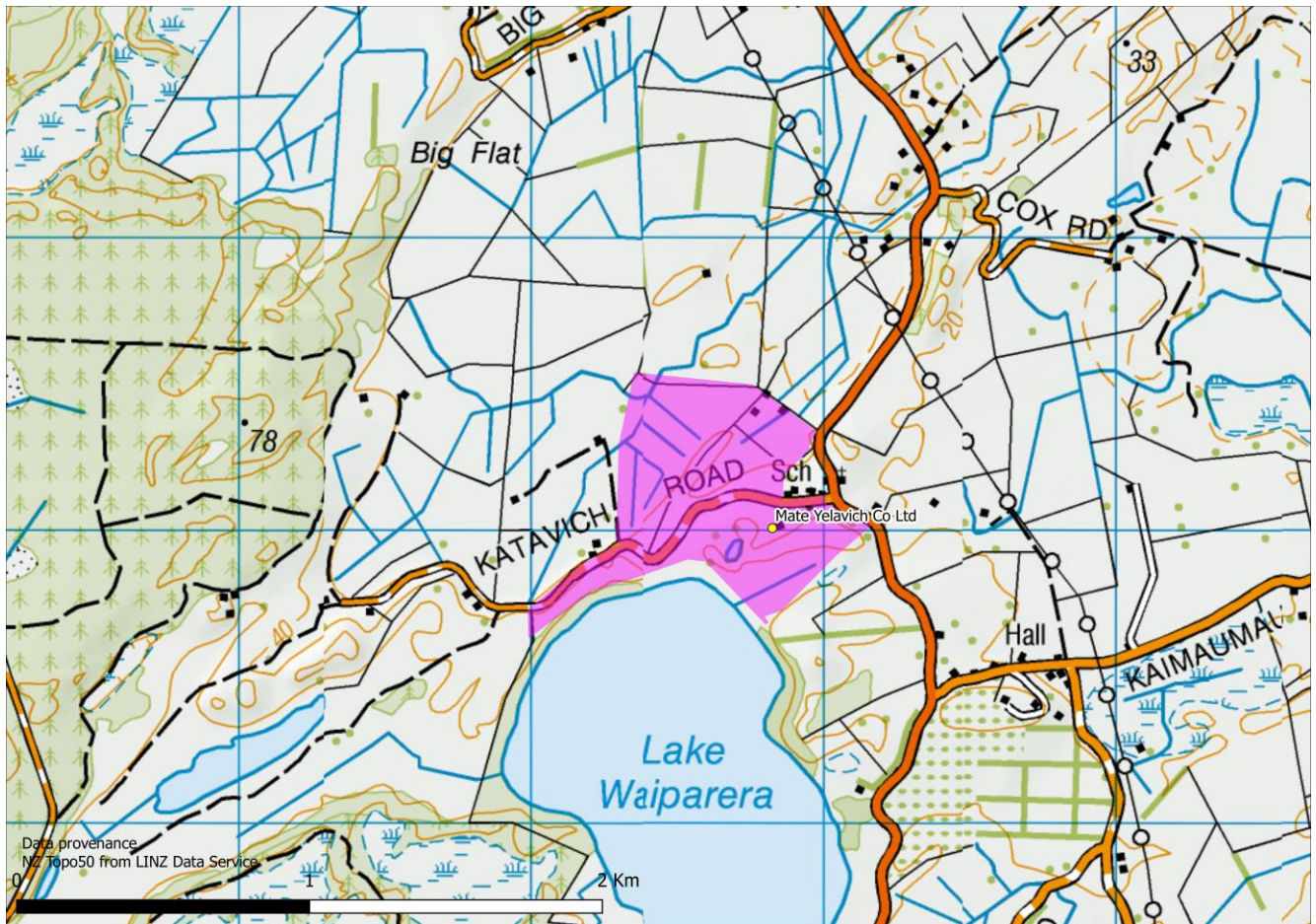


Figure 1. Project locality map.

2.2 Description of Proposed Activity

The resource consent application for Mate Yelavich and Co Ltd is to take and use groundwater for a new 18 ha orchard development. The groundwater take will be exercised from October to April, in accordance with the following volumes:

- Maximum daily volume of 450 m³/day; and
- Maximum annual volume of 52,000 m³/yr.

The current shellbed bore on the property will be used as the irrigation bore for the new avocado orchard, and the bore details are shown in **Table 1**.

Table 1. Bore details of the proposed application.

| IRISID | Easting | Northing | Depth (m) | Diameter (mm) | Cased Interval (m) | Screened Interval (m) | Static Water Level (mBGL) | Aquifer |
|------------|---------|----------|-----------|---------------|--------------------|-----------------------|---------------------------|------------------|
| LOC.315970 | 1616835 | 6134014 | 117 | 110 | 104 | 110-117 | 23.5 | Aupouri shellbed |

The maximum daily volume has been calculated at 25 m³/ha/day over the Total Orchard Area, in accordance with the decision made in the Motutangi-Waiharara Water User Group (MWWUG) decision¹.

The maximum annual volume has been calculated from the canopy area, which for this orchard (given the topographic and existing building constraints) is 72% of the Total Orchard Area or 13 ha². The maximum annual volume has been calculated on the basis of 400 mm/annum, which is consistent with the Council Officers' recommendation in the MWWUG Hearing. This irrigation requirement is adequate to meet up to a 1 in 10 years drought requirement (**Section 3.1.4**).

2.2.1 Consent Duration, Lapse and Review

A consent duration of 30 years is sought subject to a lapse period of 5 years from commencement of consent, and review conditions have been proposed for the purposes laid out in **Section 2.3**.

2.3 Proposed Consent Conditions

This section contains the proposed conditions for the water permit sought by the Applicant.

Water Extraction Volumes

- The rate of take shall not exceed the limits set out as follows:
 - Maximum daily volume of 450 m³/day (being any 24 consecutive hours); and
 - Maximum annual volume of 52,000 m³/annum (being 1 July to 30 June).

Notification of Irrigation

- The Consent Holder shall advise the Council's assigned Monitoring Officer in writing when irrigation is to commence for the first time each season, at least five days beforehand.

Metering and Abstraction Reporting

- The Consent Holder shall install a meter to measure the volume of water taken, in cubic metres, from each production bore. Each meter shall:
 - Be able to provide data in a form suitable for electronic storage;
 - Be sealed and as tamper-proof as practicable;
 - Be installed at the location from which the water is taken; and

¹ The maximum daily volume can also be calculated on the basis of 41.6 m³/day per canopy hectare (4.16 mm irrigation system capacity) on the basis of a peak daily soil requirement of 3.74 mm/day per canopy hectare and allowing for 10% system losses in delivery and application.

² The maximum annual volume can also be calculated on the basis of approximately 96 days at full daily volume, which is equivalent to approximately 400 mm/year. In practice the maximum daily rate will only be required on consecutive days during the peak of summer and when this coincides with drought.

- (d) Have an accuracy of +/-5%.

The Consent Holder shall, at all times, provide safe and easy access to each meter installed for the purposes of undertaking visual inspections and water take measurements.

4. The Consent Holder shall verify that the meter required by Condition 3 is accurate. This verification shall be undertaken prior to 30 June:
- (a) Following the first taking of water from each production bore; and
 - (b) At least once in every five years thereafter.

Each verification shall be undertaken by a person, who in the opinion of the Council's Compliance Manager, is suitably qualified. Written verification of the accuracy shall be provided to the Council's assigned Monitoring Officer by 31 July following the date of each verification.

5. The Consent Holder shall, using the meter required by Condition 3, keep a record of the daily volume of water taken from each production bore in cubic metres, including all nil abstractions.
6. If the instantaneous rate of taking is equal to or greater than 10 litres per second, then the water meter required by Condition 3 shall have an electronic datalogger for automatic logging of meter data. A copy of the electronic data records shall be forwarded to Council's assigned Monitoring Officer by the 7th of the following month, and immediately on written request from the assigned monitoring officer.
7. The Consent Holder shall measure, and keep a record of, the static water level in each production bore at least once each month. This measurement shall be taken at least eight hours after cessation of pumping. The Consent Holder shall also monitor electrical conductivity at least once a month during any irrigation season when the bore is in use.
8. A copy of the records required to be kept by Conditions 5, 6 and 7 for the period 1 July to 30 June (inclusive) shall be forwarded each year to the Council's assigned Monitoring Officer by the following 31 July. In addition, a copy of these records shall be forwarded immediately to the Council's Compliance Manager on written request. The records shall be in an electronic format that has been agreed to by the Council.

Advice Note: If no water is taken during the period 1 July to 30 June (inclusive) then the Consent Holder is still required to notify the Council's Monitoring Manager in writing of the nil abstraction. Water use record sheets in an electronic format are available from the Council's website at www.nrc.govt.nz/wur.

9. Easy access for a water level probe shall be provided and maintained at the production bore wellhead to enable the measurement of static water levels in the bore.

Water Use Efficiency

10. The Consent Holder shall prepare an Irrigation Scheduling Plan (ISP) that outlines how irrigation decisions will be made. The ISP shall be prepared by a suitably qualified and experienced person and submitted to the Council's Compliance Manager for written approval. The ISP shall, as a minimum, address:
- Water balance and crop water requirements;
 - Subsurface drainage; and
 - Overall irrigation strategy.

For each irrigation area, the ISP should include:

- (a) A description of how water requirement for each irrigation cycle is calculated;
- (b) Method(s) for assessing current soil moisture levels;
- (c) Method(s) for assessing potential evapotranspiration (PET) and rainfall to date;
- (d) Assessment of other inputs such as effluent irrigation and effect on irrigation requirement;
- (e) Soil moisture target to be maintained in each zone by irrigation;

- (f) How measured data will be used to assess irrigation requirements over the next irrigation cycle; and
- (g) A description of proposed method(s) for remaining within consent limits at each borehole or group of boreholes.

Advice Note: The ISP seeks to ensure that an irrigation efficiency of a minimum 80% is achieved.

11. The Consent Holder shall not exercise this consent until the ISP required by Condition 10 has been certified by the Council's Compliance Manager.
12. The ISP certified in accordance with Condition 11 shall be implemented prior to the first irrigation season, unless a later date has been approved in writing by the Council's Compliance Manager.
13. The Consent Holder shall, within six months of the first exercise of this consent, undertake an audit of the irrigation system and the ISP described in Condition 10 using a suitably qualified and experienced person. The irrigation system audit shall be prepared in accordance with Irrigation New Zealand's "Irrigation Evaluation Code of Practice" (dated 12 April 2010), including recommendations on any improvements that should be made to the system to increase water efficiencies. The results of the audit and its recommendations shall be submitted in writing to the Council's assigned Monitoring Officer within one month of the audit being undertaken. A follow-up audit shall occur at five yearly intervals throughout the term of this consent, with a focus on the efficiency of water use.
14. The Consent Holder shall, within three months of notification in writing by the Council's Compliance Manager, implement any recommendations of the audit referred to in Condition 13.
15. The reticulation system and components shall be maintained in good working order to minimise leakage and wastage of water.
16. there shall be no significant ponding of irrigated water within any irrigated area, or significant runoff from either surface or subsurface drainage to a water body, as a result of the exercise of this consent.

Review Condition

17. The Council may, in accordance with Section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions annually during the month of June for any one or more of the following purposes:
 - (a) To deal with any adverse effects on the environment that may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or
 - (b) To review the allocation of the resource.

The Consent Holder shall meet all reasonable costs of any such review.

Lapsing Condition

18. This consent shall lapse on the **30 June 2023**, unless before this date the consent has been given effect to.

Advice Note: An application can be made to the Council in accordance with Section 125 of the Act to extend the date after which the consent lapses. Such an application must be made before the consent lapses.

EXPIRY DATE: 30 June 2048

3. Background Information

3.1 Site Conditions

3.1.1 Soils

There is no Landcare Research S-map soil data available for this site, however there is Fundamental Soil Layer information, pre-dating S-Map, which describes the soil around the property as typic sandy brown soils³ occurring in areas without regular summer drought periods, nor winter waterlogging; and acidic medic organic soils⁴, occurring in wetlands or under acidic forest leaf litter. These soils display the following properties:

- **Physical properties** – Brown soils are relatively stable topsoils with a well-developed structure. Mesic organic soils occur in areas of wetlands or under forests which produce acidic litter, with low bulk density, bearing strength and thermal conductivity but high total available – water capacity.
- **Chemical properties** – Brown soils have low to moderate base saturation. Part of Mesic organic soils have mineral material but is dominated by organic matter.
- **Biological properties** – Brown soils are associated with high biological activity (earthworms are prominent). Organic soils have restricted biological activity of organisms due to the anaerobic conditions, leading to a slow decomposition rate.

3.1.2 Geology

The property is underlain by the Aupouri Aquifer – an extensive sequence of sand, peat and shellbed that covers an area of approximately 79,000 ha extending from Ahipara in the south to Ngataki in the north. The aquifer is underlain by older low permeability Cenozoic and Mesozoic age basement rocks.

Fine sand is the dominant sediment within the Aupouri Aquifer, which vary in thickness from a few meters near the hard rock boundaries to over 100 m in some places. The sand sequence is interspersed with multiple discontinuous layers of alternating iron pan (sand stone), clay and peat, which reside across the entire peninsula typically in the upper portion of the aquifer. These deposits are associated with ancient wetlands.

The aquifer is underlain to the east by volcanic basement rocks that outcrop forming Mount Camel. These rocks most likely extend at some depth across the subsurface of the Aupouri Peninsula together with greywacke, argillite and indurated conglomerate deposits of the same age.

3.1.3 Hydrogeological Interpretation

The surficial sand deposits generally become progressively younger, unconsolidated and mobile towards the west. These younger sands have higher permeability than the sands in the east, which tend to be more weathered and contain cemented iron pans close to the surface.

With increasing depth, the presence of shell-rich sands increases, which is important from a water yield perspective as the shellbeds typically have significantly higher hydraulic conductivity (ability to transmit water) than the finer sands. The shellbed is the target aquifer for orchard irrigation water and typically resides at depths from 70 – 140 m below ground level.

All the basement rocks in the area are known to be low permeability.

3.1.4 Irrigation Requirements

The peak water requirement is 41.6 m³/day per canopy hectare, which is equivalent to 4.16 mm per day. The irrigation requirement was simulated on a daily basis with the Soil Moisture Water Balance Model (SMWBM) using

³ <https://soils.landcareresearch.co.nz/describing-soils/nzsc/soil-order/brown-soils/>

⁴ <https://soils.landcareresearch.co.nz/describing-soils/nzsc/soil-order/organic-soils/>

historical rainfall and evaporation data from 1957 to 2016. The simulation results are portrayed statistically on a monthly basis in **Figure 3**, which is a box and whisker plot showing the monthly median, lower quartile (25th percentile), upper quartile (75th percentile) and minimum and maximum recorded monthly values. The graph shows the seasonal irrigation profile and likelihood of water requirements each month.

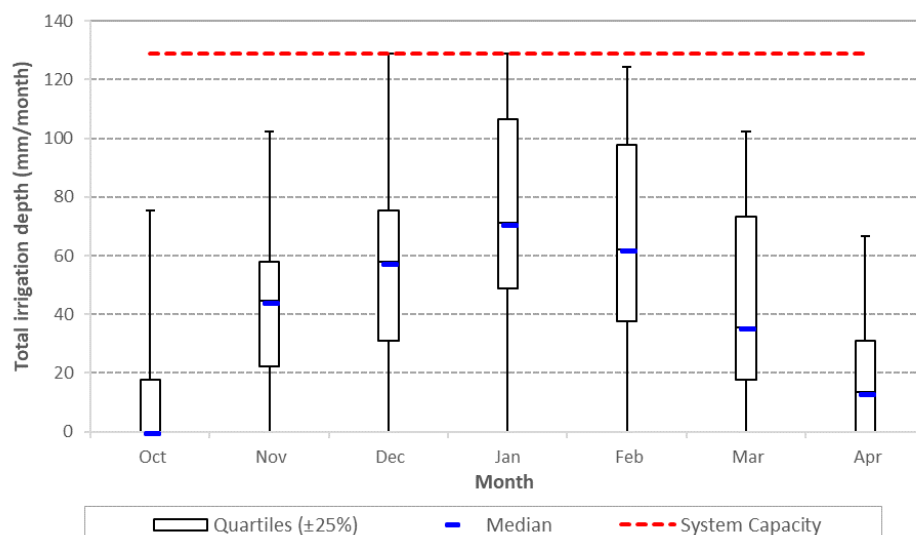


Figure 2. Simulated monthly statistical irrigation profile.

During the irrigation season, the rate of application will remain the same, but the number of days between irrigation events will increase during the shoulders of the season (i.e. typically in spring and autumn), which is exemplified in the monthly statistics shown in **Figure 3**.

Table 3 provides information on the frequency of monthly irrigation requirements and the number of days irrigation is likely required. The 1-year recurrence interval represents the typical monthly requirements and indicates that on average irrigation will not be required in October and April, and between November and March will vary from 18 mm to 47 mm per month.

In a 10-year drought year, the irrigation requirement for the season is likely to approximately 400 mm, with peak monthly totals up to approximately 120 mm, hence the amount of water being applied for is adequate to fully meet the requirements up to the 10-year drought.

Table 2. Frequency of monthly and annual irrigation requirements (mm) and days of irrigation [days].

| Average Recurrence Interval | Oct | Nov | Dec | Jan | Feb | Mar | Apr | Annual |
|-----------------------------|---------|----------|----------|----------|----------|----------|---------|-----------|
| 1 yr | 0 [0] | 23 [6] | 31 [7] | 47 [11] | 40 [10] | 18 [4] | 0 [0] | 250 [60] |
| 2 yr | 0 [0] | 44 [11] | 58 [14] | 69 [17] | 62 [15] | 36 [9] | 16 [4] | 307 [74] |
| 4 yr | 18 [4] | 58 [14] | 76 [18] | 107 [26] | 98 [24] | 74 [18] | 31 [7] | 369 [89] |
| 5 yr | 18 [4] | 62 [15] | 76 [18] | 107 [26] | 98 [24] | 80 [19] | 40 [10] | 382 [92] |
| 10 yr | 31 [7] | 76 [18] | 104 [25] | 117 [28] | 116 [28] | 84 [20] | 50 [12] | 401 [96] |
| 100 yr | 53 [13] | 102 [25] | 124 [30] | 129 [31] | 124 [30] | 100 [24] | 64 [15] | 545 [131] |

Table 3 provides the orchard water balance under dryland and irrigated conditions and **Figure 3** shows the mean monthly seasonal breakdown of this data. The data represents the mean annual water balance components from the 59-year simulation. It is evident that under the irrigated orchard profile, soil moisture content typically resides at a higher status (which is the intention) during summer, and surface runoff, sub-soil drainage, soil evaporation and canopy interception all increase.

However, avoidable losses due to surface runoff have not change appreciably, and the additional runoff that has occurred is due to rainfall excess rather than too much irrigation, demonstrating that the irrigation applications of 4.16 mm/day are efficient.

Table 3. Summary of average annual water balance components under irrigated and unirrigated profiles (mm/yr unless specified otherwise).

| Annual Average | Dryland | Irrigated |
|------------------------------------|---------|-----------|
| Average Soil Moisture Content (mm) | 92 | 104 |
| Sub-Soil Drainage | 452 | 522 |
| Surface Runoff | 93 | 105 |
| Soil ET | 467 | 547 |
| Canopy Interception | 179 | 284 |
| TOTAL | 1,191 | 1,458 |

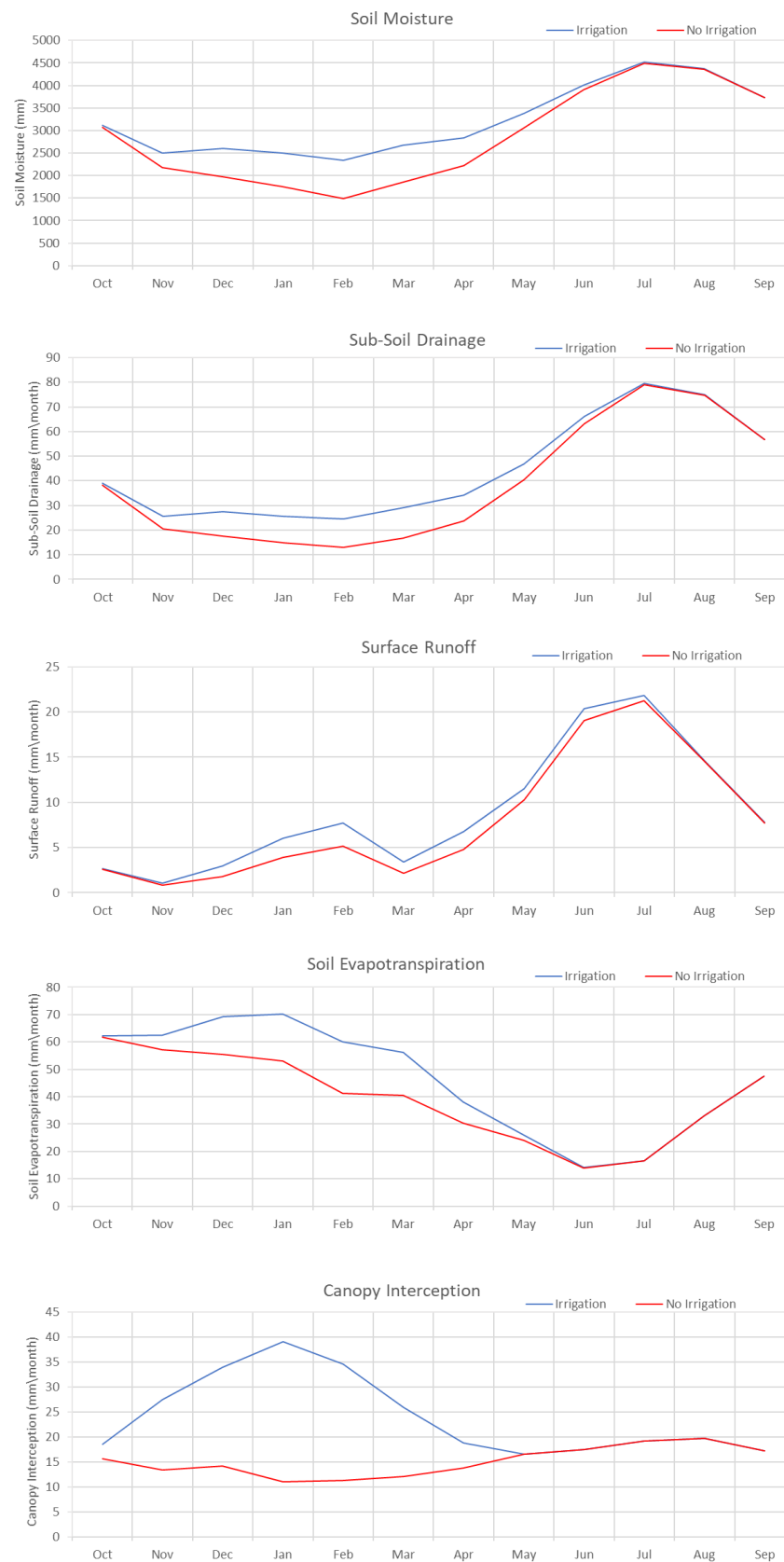


Figure 3. Comparison of water balance components.

3.3 Relevant Statutory Documents

3.3.1 Section 104(1)(b) of the RMA

Schedule 4 of the RMA requires that when applying for a resource consent for any activity an assessment of activities against the matters in any relevant provisions of a statutory document referred to in s104(1)(b) of the RMA must be provided. These matters are described below and **Section 6** provides an assessment against the relevant documents.

The documents referred to in Section 104(1)(b) of the RMA are:

- a national environmental standard;
- other regulations;
- a national policy statement;
- a New Zealand coastal policy statement;
- a regional policy statement or proposed regional policy statement;
- a plan or proposed plan;

The following section provides details of the relevant Regional Planning provisions, while assessment of which documents listed is above are relevant is provided in **Table 4**.

Table 4. Summary of relevance of Section 104 statutes.

| Statute | Relevance | Requirement of Statute |
|---|--|---|
| National Environmental Standards | There are no national environmental standards that are applicable to the proposed activity. | None |
| Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 | This regulation applies to a water permit that allows fresh water to be taken at a rate of 5 litres/second or more and is consumptive. Therefore, this regulation is relevant for this water take consent. | In summary, the regulations require permit holders to keep records that provide continuous measurement of the water taken under a water permit, including water taken in excess of what the permit allows. These records are to comprise measurements of the volume of water taken each day (in cubic metres) or each week (if approved by the Regional Council), and must be in an appropriate format for auditing, and in a form suitable for electronic storage. The regulations also specify the required accuracy of any metering device (to within $\pm 5\%$ of the actual volume taken if from a full pipe (e.g. bore)). |
| National Policy Statement for Freshwater Management 2014 | <p>The following objectives and policies of the NPS are relevant to this proposal:</p> <p><i>Water Quality</i></p> <ul style="list-style-type: none"> • Objectives A1, A2, and A4. • Policies A2, A3, and A7. <p><i>Water Quantity</i></p> <ul style="list-style-type: none"> • Objective B2, B3 and B5. • Policies B2 to B6. <p><i>Integrated Management</i></p> <ul style="list-style-type: none"> • Objective C1. • Policies C1 and C2. | <p><i>Water Quality</i></p> <ul style="list-style-type: none"> • Objective A1 seeks to safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the use and development of land, and of discharges of contaminants. • Objective A2 required that the overall quality of fresh water within a region is maintained or improved while improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated. |

| Statute | Relevance | Requirement of Statute |
|---|--|---|
| | | <ul style="list-style-type: none"> Objective A4 seeks to enable communities to provide for their economic well-being, including productive economic opportunities. Policies A2, A3, and A7 are considered relevant to this application and give effect to Objectives A1, A2, A4. <p><i>Water Quantity</i></p> <ul style="list-style-type: none"> Objective B2 seeks to avoid any further over-allocation of fresh water and phase out existing over-allocation. Objective B3 seeks to improve and maximise the efficient allocation and efficient use of water. Objective B5 seeks to provide for communities' economic wellbeing within freshwater quantity limits. Policies B2 to B6 are considered relevant to this proposal. <p><i>Integrated Management</i></p> <ul style="list-style-type: none"> Objective C1 seeks to improve integrated management of fresh water and the use and development of land in whole catchments, including the interactions between fresh water, land, associated ecosystems and the coastal environment. Policies C1 and C2 are relevant to this application and give effect to Objective C1. |
| Regional Policy Statement for Northland | <p>The Regional Policy Statement (RPS) was made operative on 9 May 2016. The RPS provides a broad direction and framework for managing Northland's natural and physical resources. These include land, water, air, soil, minerals, plants, animals and all built structures.</p> <p>The following Objectives are considered relevant to this proposal:</p> <ul style="list-style-type: none"> Objective 3.2, 3.3, 3.5, and 3.10. <p>The following Policies give effect to the above Objectives, and therefore are considered relevant to this application:</p> <ul style="list-style-type: none"> Policy 4.3.2, 4.3.3. | <ul style="list-style-type: none"> Objective 3.2 seeks to maintain and improve water quality for human use and ecological health. Objective 3.3 seeks to safeguard the flows and flow variability required to maintain water's life-supporting capacity, for ecological processes, and to support indigenous species. Objective 3.5 requires that the region's resources are sustainably managed in a way that is attractive for business and investment that will improve the economic wellbeing of the region and its communities. Objective 3.10 requires efficient use and allocation of common natural resources with a particular focus on maximising the security and reliability of supply for users. Policy 4.3.2 requires regulatory methods to avoid over-allocation of region-wide ecological flows and water levels. Policy 4.3.3 requires the allocation and use of water efficiently within allocation limits. |
| Regional Plans | <p>The Proposed Regional Plan for Northland (pRPN) sets out policies and rules for how Northland's water, soil, air and coast are used and was publicly notified on 6 September 2017 and closed for submissions on 26 March 2018. The pRPN will replace the Regional</p> | <p>From the pRPN:</p> <ul style="list-style-type: none"> Objective F.0.1 seeks to manage the use, development, and protection of Northland's natural and physical resources which enables people and |

| Statute | Relevance | Requirement of Statute |
|---------|--|--|
| | <p>Water and Soil Plan for Northland (RWSPN), which has been operative since 28 August 2004.</p> <p>At present, the rules in both these plans have legal effect, with weight given to whichever plan has the more restrictive rule for the same activity if there is a conflict between the two plans, or the later plan if no submissions were received on certain aspects.</p> <p>Both plans address groundwater abstractions that have the potential to adversely affect the environment. However, there are no specific aquifer allocation limits set in the RWSP.</p> <p>The following objectives and policies of the pRPN are considered relevant to this proposal:</p> <ul style="list-style-type: none"> • Objective F.0.1. • Policy D.2.2. • Policy D.2.5. • Policy D.4.5. • Policy D.4.13. • Policy D.4.17. • Policy D.4.18. • Policy D.4.20. • Policy D.4.23. <p>The following objectives and policies of the RWSPN are considered relevant to this proposal:</p> <ul style="list-style-type: none"> • Objective 7.4. • Objective 10.4.1. • Policy 10.5.1. • Policy 10.5.2. • Policy 10.5.4. • Policy 10.5.7. • Policy 10.5.9 | <p>communities to provide for their social, economic and cultural well-being while</p> <ol style="list-style-type: none"> 1. sustaining the natural resources to meet the reasonable foreseeable needs of future generations, 2. safeguarding life-supporting capacities of water, and 3. avoiding, remedying, or mitigating adverse effects on the environment. <ul style="list-style-type: none"> • Policy D.2.2 requires that regard is had to the social, cultural, and economic benefits of the proposed activity when considering resource consents. • Policy D.2.5 requires an authority to have regard to community and tangata whenua values • Policy D.4.5 seeks to maintain overall water quality. • Policy D.4.13 seeks to achieving freshwater quantity related outcomes and inn particular manage the taking, use, damming, and diversion of fresh water so that (with relevance to this application) saline intrusion in, and land subsidence above, aquifers is avoided (amongst other things). • Policy D.4.17 considers allocation limits for aquifers and requires rules and applications to meet allocation limits • Policy D.4.18 concerns conjunctive surface water and groundwater management. • Policy D.4.20 requires the reasonable and efficient use of water for irrigation and sets requirements for a resource consent application to take water for irrigation purposes. • Policy D.4.23 <p>From the RWSPN:</p> <ul style="list-style-type: none"> • Objective 7.4 requires the maintenance or enhancement of water quality of natural water bodies. • Objective 10.4.1 maintains the sustainable use and development of the region's groundwater resources while avoiding, remedying, or mitigating actual and potential adverse effects on groundwater quantity and quality. • Policy 10.5.1 seeks to ensure the sustainable use of resources by avoiding takes that exceed recharge. Saltwater intrusion, reduced groundwater quality, significant drawdown, and adverse effects on surface water resources can arise where takes exceed recharge. |

| Statute | Relevance | Requirement of Statute |
|---------|-----------|---|
| | | <ul style="list-style-type: none"> Policy 10.5.2 recognises that aquifers are at risk in certain circumstances and that adverse effects on water quality should be avoided. Policy 10.5.4 seeks that groundwater allocations take into account reduction in recharge that may occur in time. Policy 10.5.7 requires the Northland Regional Council to consider effects of a groundwater take and use on surface water bodies. Policy 10.5.9 seeks to avoid, remedy or mitigate any ground subsidence as a result of groundwater takes, use or diversion, where this is likely to cause adverse flooding, drainage problems, or building damage. |

3.3.2 Activity Status

The activity status of the proposed activity under both the RWSPN and pRPN is considered a discretionary activity – details of this conclusion are summarised in **Table 5**.

Table 5. Summary of activity status against Regional Plan Provisions.

| Plan | Relevant Rules | Comment |
|-------|---|---|
| RWSPN | Rule 25.03.01 of the plan states that “The taking, use or diversion of groundwater from an aquifer, and any associated discharge of groundwater onto or into land or into water, which does not meet the requirements of the permitted, controlled or non-complying activity rules is a discretionary activity.” In essence, the discretionary activity rule is for takes that are not for domestic or stock watering purposes (Rule 25(A)) and exceed the permitted activity thresholds (Rule 25.01.01) of a daily volume of 10 m ³ /d and instantaneous rate of 5 L/s per bore. | Under this plan and until such time as the equivalent provisions within the Proposed Regional Plan for Northland (pRPN) are no longer contested, the proposed activity would be considered Discretionary Activity. |
| pRPN | <p>Rule C.5.1.10 states that the taking and use of fresh water is a discretionary activity unless it is one of the following:</p> <ol style="list-style-type: none"> 1) a permitted activity under C.5.1.1 'Minor takes – permitted activity', or 2) a permitted activity under C.5.1.2 'Temporary take for road construction or maintenance – permitted activity', or 3) a permitted activity under C.5.1.3 'Water take from an off-stream dam – permitted activity', or 4) a permitted activity under C.5.1.4 'Water take from an artificial watercourse – permitted activity', or 5) a permitted activity under C.5.1.5 'Water take associated with bore development, bore testing or dewatering – permitted activity', or 6) a controlled activity under C.5.1.6 'Replacement water permits for registered drinking water supplies - controlled activity', or 7) a controlled activity under C.5.1.7 'Takes existing at the notification date of the plan - controlled activity', or | The proposed groundwater take does not conform to any of the activities in listed in 1) to 10) above, and as indicated in the following Section Error! Reference source not found. does not exceed an allocation limit, therefore the proposed activity constitutes a Discretionary Activity under the pRPN. |

| | | |
|--|---|--|
| | <ul style="list-style-type: none"> 8) a restricted discretionary activity under C.5.1.8 'Supplementary allocation – restricted discretionary activity', or 9) a discretionary activity under C.5.1.9 'Takes existing at the notification date of this plan – discretionary activity', or 10) a non-complying activity under C.5.1.11 'Water take below a minimum flow or water level-non-complying activity', or 11) a non-complying activity under C.5.1.12 'Water take that will exceed an allocation limit - non-complying activity', or 12) a prohibited activity under C.5.1.13 'Water takes that will exceed an allocation limit - prohibited activity'. | |
|--|---|--|

3.3.3 Allocation Zones

The Aupouri Peninsula Aquifer is divided into different allocation zones for management purposes. The Mate Yelavich property sits within the Aupouri- Other allocation zone. The allocation limit, current level of allocation and the level of allocation should this consent be granted are shown in **Table 6**.

Table 6 also considers other applications pending and shows that the granting of this consent and that of Yelavich and Te Raite Station, will increase the allocation status to 2.8% of full allocation (i.e. a very low level of allocation).

The proposed take will not exceed the allocation limit, hence under the pNRP this consent maintains Discretionary Activity status.

Table 6. Aupouri Aquifer Limits⁵ and Allocation Status.

| Sub-aquifer | Allocation Limit | | Allocation Status (Current) | | Allocation Status | |
|-----------------|----------------------|------------------------|-----------------------------|-------|--|-----|
| | | | | | If Granted: Te Raite Station (157,500), Robert Campbell (360,000) Yelavich (52,000) | |
| | m ³ /year | % mean annual recharge | m ³ /year | % | m ³ /year | % |
| Aupouri - Other | 21,991,289 | 15 | 53,184 | 0.2 % | 622,684 | 2.8 |

⁵ According to NRC's allocation maps at <http://gis.nrc.govt.nz/LocalMaps-Viewer/?map=895e0785f7054d47b10a72edc38022dc>

4. Assessment of Environmental Effects

The proposed Yelavich take (52,000 m³/year), and three other pending applications including Anton Mathews (12,000 m³/year), Robert Campbell Family trust (360,000 m³/year), and Wedding & Doody (304,000 m³/year) are located in the Motutangi-Waiharara Groundwater Model (MWGM) domain (WWA, 2017). A further three pending applications including Tiri Avocados Limited (581,250 m³/year), Valic NZ Limited (173,700 m³/year) and Wataview Orchards (33,750 m³/year) are located in the Waiharara-Paparore Model domain (WWA, 2018b).

The cumulative drawdown of all current and pending applications has been evaluated using analytical methods superimposed on the drawdown profile from Waiharara-Paparore Groundwater Model (WWA, 2017) and Tuscany Avocados (WWA, 2018a) - noting that this included the existing takes and newly granted MWWUG (Motutangi – Waiharara Water User Group) takes.

The methodology and results of the groundwater and surface water impact analysis are detailed in **Appendix B**.

4.1 Pumping Interference Effects

Drawdown due to proposed take was analysed using Theis (1935) and Feather & Williamson Solution (Unpublished)⁶. A maximum additional drawdown from Yelavich take ranging between 1.3 m (Feather & Williamson) and 1.8 m (Theis) was estimated in the deep aquifer adjacent to the pumping bore location. A drawdown of 0.03 m was calculated in the shallow aquifer near the pumping bore with the Feather & Williamson Solution.

The superimposition of the Feather and Williamson Solution onto the conservative drawdown from Tuscany (WWA, 2018a) and Waiharara-Paparore Groundwater Model (WPGM) (WWA, 2018b) shows that the proposed take is unlikely to cause additional drawdown for existing take bores. The cumulative drawdown for bores that are within 3 km ranged from 2 m to 3 m, summarised in **Appendix B**.

The interference effects on existing groundwater uses considering the available drawdown of the aquifer (>100 m) is considered less than minor.

4.2 Surface Water Effects

As discussed in **Appendix B**, there are four potential surface water features that may be impacted by the proposed take:

- Lake Waiparera to southwest (0.3 km)
- Unnamed drain to north (0.6 km)
- Lake Waikaramu to the east (4.7 km)
- Kaimaumau wetland to east (6.4 km)

The maximum additional drawdown in the shallow aquifer is less than 0.03 m. The drawdown in the shallow aquifer ranged between 0.1 m to 0.4 m in this area. This drawdown in porous media would translate to an insignificant impact within a standing or flowing water body.

The findings of the MWGM were accepted with respect to impacts on the wetland (and by inference surface waters) with the Commissioners indicating in paragraph 153, “our view is that there are many influences on the

⁶ Feather & Williamson solution a multi-layer model based on Hemker and Mass (1987) and Hunt and Scott (2007).

wetland that are far greater than the MWWUG abstractions". Given that the additional impacts predicted from this bore are similarly negligible, the same conclusion can be drawn.

Considering that the additional impact predicted from the proposed take is negligible, the same conclusion can be drawn.

The impact on surface water due to proposed abstract in deep aquifer will be less than minor.

4.3 Saline Intrusion

The risk of saltwater/freshwater interface up-coning and lateral migration was in **Appendix B.3.1** based on the analysis conducted in MWGM report (Section 5.2.6, WWA, 2017).

Due to the existence of low permeable bedrock underlying the deep shellbed aquifer, saltwater lateral migration along the base of the shellbed is a more likely mechanism of saltwater intrusion. The proposed take is located in the central sand area. As detailed in **Appendix B**, the additional drawdown is unlikely to change the potential saltwater lateral migration profile at the sentinel locations assessed from MWGM report (WWA, 2017)

The impact on saltwater intrusion due to proposed take will be less than minor.

4.4 Ground Settlement

The potential maximum ground settlement was estimated from the cumulative drawdown in **Appendix B**.

Within 1.5 km of proposed take, the estimated cumulative subsidence is 0.02 m, with a maximum drawdown of 0.41 m and 2.62 m in shallow and deep aquifer, respectively. In a rural setting, settlement effects of this magnitude (or less as would be more realistic) are less than minor for the following reasons:

- There is no sensitive urban infrastructure like water or wastewater mains or high-rise buildings to rupture or crack; and
- The changes in land surface due to farm machinery (e.g. rotary hoeing) would likely mask impacts of this magnitude (<0.3 m) if materialised.

In summary, the potential settlement effects are considered less than minor.

4.5 Water Quality

The potential risk to water quality of the proposed groundwater take lies in leaching to groundwater through the application of the fertiliser and pesticides.

However, there are a range of factors that make the leaching of these constituents unlikely to impact water quality:

- In practice orchardists in this area tend to apply fertiliser efficiently via fertigation as part of their irrigation water using a small dosage regularly, which is driven by both the soil conditions (i.e. high permeability and lacking in nutrients) and economic considerations.
- Inefficient irrigation practice will lead to root rot, thus because orchardists will actively avoid this, excessive leaching of nutrients is unlikely.
- Both fertiliser and approved pesticides are applied in accordance with permitted activity rules within the pRPN and rules needing to be met to become certified under the AvoGreen Assured program by the

Avocado Industry Council Ltd. One of the key aims is “environmental sustainability by only using sprays when required”.

- Due to the presence of significant amounts of organic matter within the shallow sand deposits, shallow groundwater is likely to be reducing. Under such conditions, nitrate concentrations are likely to be low in groundwater (consistent with available groundwater quality data) due to denitrification within the aquifer system. The presence of organic matter is also likely to substantially decrease the mobility of any pesticide compounds prone to leaching.

Therefore, impacts on water quality of this take are considered no more than minor.

4.6 Consideration of Alternatives

An AEE must include a description of alternative locations or methods for undertaking an activity, if it is likely that the activity will result in any significant adverse effect on the environment.

The effects of the proposed taking and using of groundwater were assessed above as being no more than minor on the environment and less than minor on other groundwater users. As such, no alternatives have been considered for this proposal.

5. Assessment of Cultural Effects

Northland Regional Council have an internal procedure where they circulate all applications to local Iwi and Maori Groups that have registered with the Council as having an interest in the area. If a local Iwi or Maori Group is considered to be affected by the effects of the proposed activity the Group must be notified as part of the consultation process.

The proposed groundwater abstraction lies within the rohe of Te Aupōuri, Ngāti Kurī, and Ngāi Takoto iwi. Consultation with these iwi has not been carried out stage based on the understanding that if physical effects of an application are less than minor, then any meta-physical (cultural and spiritual) effects would commensurately also be less than minor.

In this rohe we are aware that at least two of the three iwi groups have recently lodged applications for water takes, and we are aware of a third planning to do so. That signals that the taking of water itself is not an activity that iwi are adverse too.

Therefore, given the less than minor impact of this proposal, we do not consider iwi consultation is necessary for this application.

6. Assessment Of Statutory Considerations

Table 7 to Table 10 provide assessments of the relevant statutory documents as were identified in **Section 3.3**.

Overall, this resource consent application is consistent with the objectives and policies of the National Policy Statement for Freshwater Management 2014, incumbent regional plan (RWSPN) and proposed regional plan (pRPN).

Table 7. Assessment against relevant objectives and policies for the National Policy Statement for Freshwater Management 2014.

| No. | Objective / Policy | Assessment |
|-------------------------|---|---|
| Water Quality | | |
| Objective A1 | <ul style="list-style-type: none">Seeks to safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the use and development of land, and of discharges of contaminants. | This proposal is consistent with these objectives and policies and either supports them or at the least maintains them. |
| Objective A2 | <ul style="list-style-type: none">Required that the overall quality of fresh water within a region is maintained or improved while improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated. | |
| Objective A4 | <ul style="list-style-type: none">Seeks to enable communities to provide for their economic well-being, including productive economic opportunities. | |
| Policies A2, A3, and A7 | <ul style="list-style-type: none">Give effect to Objectives A1, A2, A4 | |
| Water Quality | | |
| Objective B2 | <ul style="list-style-type: none">Seeks to avoid any further over-allocation of fresh water and phase out existing over-allocation. | This proposal is consistent with these objectives and policies. |
| Objective B3 | <ul style="list-style-type: none">Seeks to improve and maximise the efficient allocation and efficient use of water. | |
| Objective B5 | <ul style="list-style-type: none">Seeks to provide for communities' economic wellbeing within freshwater quantity limits. | |
| Policies B2 to B6 | <ul style="list-style-type: none">Give effect to Objectives B2 to B5. | |
| Integrated Management | | |



| No. | Objective / Policy | Assessment |
|--------------------|---|--|
| Objective C1 | <ul style="list-style-type: none"> Seeks to improve integrated management of fresh water and the use and development of land in whole catchments, including the interactions between fresh water, land, associated ecosystems and the coastal environment. | This proposal is consistent with these objective and policies. |
| Policies C1 and C2 | <ul style="list-style-type: none"> Give effect to Objective C1. | |

Table 8. Assessment against relevant objectives and policies for the Regional Policy Statement for Northland.

| No. | Objective / Policy | Comment |
|----------------|--|---|
| Objective 3.2 | <ul style="list-style-type: none"> Seeks to maintain and improve water quality for human use and ecological health. | This proposal is consistent with this objective as it will at the least maintain water quality. |
| Objective 3.3 | <ul style="list-style-type: none"> Seeks to safeguard the flows and flow variability required to maintain water's life-supporting capacity, for ecological processes, and to support indigenous species. | The proposal is consistent with this objective as it will have a no more than minor impact on surface water resources. |
| Objective 3.5 | <ul style="list-style-type: none"> Requires that the region's resources are sustainable managed in a way that is attractive for business and investment that will improve the economic wellbeing of the region and its communities. | The proposal is consistent with this objective as it will efficiently utilise a natural resource to facilitate development of economic wellbeing. |
| Objective 3.10 | <ul style="list-style-type: none"> Requires efficient use and allocation of common natural resources with a particular focus on maximising the security and reliability of supply for users. | The proposal is consistent with this objective. |
| Policy 4.3.2 | <ul style="list-style-type: none"> Requires regulatory methods to avoid over-allocation of region-wide ecological flows and water levels. | The proposal does not exceed allocation limits, hence is consistent with this policy. |
| Policy 4.3.3 | <ul style="list-style-type: none"> Requires the allocation and use of water efficiently within allocation limits. | The proposal will use water efficiently and will not exceed allocation limits, hence is consistent with this policy. |



Table 9. Assessment against relevant objectives and policies for the Proposed Regional Plan for Northland.

| No. | Objective / Policy | Comment |
|-----------------|--|---|
| Objective F.0.1 | <ul style="list-style-type: none"> Seeks to manage the use, development, and protection of Northland's natural and physical resources which enables people and communities to provide for their social, economic and cultural well-being while <ol style="list-style-type: none"> sustaining the natural resources to meet the reasonable foreseeable needs of future generations, safeguarding life-supporting capacities of water, and avoiding, remedying, or mitigating adverse effects on the environment. | The proposal is consistent with this objective. |
| Policy D.2.2 | <ul style="list-style-type: none"> Requires that regard is had to the social, cultural, and economic benefits of the proposed activity when considering resource consents. | As discussed in Section 6, proposal will facilitate the economic and social benefits of both the landowner, their employees and the wider community through flow on effects of purchases made to operate and maintain the orchard. |
| Policy D.2.5 | <ul style="list-style-type: none"> Requires an authority to have regard to community and tangata whenua values | The proposal is not inconsistent with either community values, as there has been conversion to market gardening and horticulture in the area that has benefitted the community and tangata whenua through employment opportunities. |
| Policies D.4.5 | <ul style="list-style-type: none"> Seeks to maintain overall water quality | This proposal is consistent with this policy as it will not impact water quality. |
| Policy D.4.13 | <ul style="list-style-type: none"> Seeks to achieve freshwater quantity related outcomes and in particular manage the taking, use, damming, and diversion of fresh water so that (with relevance to this application) saline intrusion in, and land subsidence above, aquifers is avoided (amongst other things). | This proposal is consistent with this policy as it will avoid the saline intrusion and subsidence impacts, as discussed in Section 4.3 and 4.4. |
| Policy D.4.17 | <ul style="list-style-type: none"> Considers allocation limits for aquifers and requires rules and applications to meet allocation limits. | This proposal is consistent with this policy as the proposed take will not exceed allocation limits within the Aupouri-Motutangi zone. |
| Policy D.4.18 | <ul style="list-style-type: none"> Concerns conjunctive surface water and groundwater management. | This application is not inconsistent with this policy, in that the groundwater take will not adversely impact on surface water through stream depletion. |
| Policy D.4.20 | <ul style="list-style-type: none"> Requires the reasonable and efficient use of water for irrigation and sets requirements for a resource consent application to take water for irrigation purposes. | This proposal is consistent with this policy as the daily irrigation rate and annual volume are considered efficient and just meet 10-year drought requirements, but provide reduced reliability for more severe droughts. |



| No. | Objective / Policy | Comment |
|---------------|---|--|
| Policy D.4.23 | <ul style="list-style-type: none"> Requires conditions on water permits that <ol style="list-style-type: none"> clearly define the take amount in instantaneous take rates and total volumes, including by reference to the temporal aspects of the take and use, and require that the water take is metered and information on rates and total volume of the take is provided electronically to the regional council, and for water permits for takes equal to or greater than 10 litres per second, require the water meter to be telemetered to the regional council, and clearly define when any restrictions and cessation of the water take must occur to ensure compliance with freshwater water quantity limits set in this plan, and require the use of a backflow prevention system to prevent the backflow of contaminants to surface water or ground water from irrigation systems used to apply animal effluent, agrichemical or nutrients, and specify when and under what circumstances the permit will be reviewed pursuant to Section 128(1) of the RMA, including by way of a common review date with other water permits in a catchment. | The proposal is only partially consistent with this policy, as the applicants are arguing that so long as pumping data is recorded electronically and available for the council upon request, telemetry is not required. All other provisions will be met. |

Table 10. Assessment against relevant objectives and policies for the Regional Water and Soil Plan for Northland.

| No. | Objective / Policy | Comment |
|------------------|--|--|
| Objective 7.4 | <ul style="list-style-type: none"> Requires the maintenance or enhancement of water quality of natural water bodies. | This proposal is consistent with this objective as the effects of the take and use of the water will have no more than minor impacts on the shallow aquifer and other surface water bodies, as discussed in Section 4.2 . |
| Objective 10.4.1 | <ul style="list-style-type: none"> Seeks to maintain the sustainable use and development of the region's groundwater resources while avoiding, remedying, or mitigating actual and potential adverse effects on groundwater quantity and quality. | Ditto above. |
| Policy 10.5.1 | <ul style="list-style-type: none"> Seeks to ensure the sustainable use of resources by avoiding takes that exceed recharge. Saltwater intrusion, reduced groundwater quality, significant drawdown, and adverse effects on surface water resources can arise where takes exceed recharge. | This proposal is consistent with this policy as the cumulative allocation in this aquifer management zone is only 11% of mean annual recharge, which is a low limit on a national scale. |



| No. | Objective / Policy | Comment |
|---------------|---|---|
| Policy 10.5.2 | <ul style="list-style-type: none"> Recognises that aquifers are at risk in certain circumstances and that adverse effects on water quality should be avoided. | This proposal is consistent with this policy in that current water quality will be maintained. |
| Policy 10.5.4 | <ul style="list-style-type: none"> Seeks that groundwater allocations take into account reduction in recharge that may occur in time. | This proposal is consistent with this policy in that the analysis assumed no rainfall for the entire 96 days of pumping. |
| Policy 10.5.7 | <ul style="list-style-type: none"> Requires the Northland Regional Council to consider effects of a groundwater take and use on surface water bodies. | This proposal is consistent with this policy as the effects of the take and use of the water will have no more than minor impacts on the shallow aquifer and other surface water bodies, as discussed in Section 4.2 . |
| Policy 10.5.9 | <ul style="list-style-type: none"> Seeks to avoid, remedy or mitigate any ground subsidence as a result of groundwater takes, use or diversion, where this is likely to cause adverse flooding, drainage problems, or building damage. | This proposal is consistent with this policy as subsidence effects will be no more than minor in the context of a rural setting, as discussed in Section 4.4 . |

7. Consultation

Schedule 4 of the RMA requires that an AEE should identify (amongst other things) the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted.

Potentially affected parties in relation to this application could include other groundwater users and occupiers of the land within the pumping induced groundwater cone of depression.

However, it should also be noted that while it is considered good practice and “neighbourly” to undertake consultation, under Section 36A of the RMA there is no requirement for an applicant or council to undertake any consultation with any person in regard to an application.

In this case, consultation has been undertaken with the Principal of the Waiharara School, located adjacent to the property at 8 Katavich Road, Waiharara. The Affected Person Written Approval Form is attached as **Appendix C**.

No other water users and landowners have been consulted with because the assessment of effects and in particular the bore interference assessment provided in **Section 4.1** concludes that no other groundwater users are considered affected.

8. Notification

Section 95 sets out the decision-making steps for the determining of public notification and limited notification of applications and the timeframe Councils have for making the notification decision.

A notification assessment has been carried out in accordance with the stepped process as documented in **Table 11**.

Table 11. RMA Section 95A public notification of consent applications assessment.

| Step | Question | Assessment |
|---|--|------------|
| Step 1: mandatory public notification in certain circumstances | a) The applicant has requested that the application be publicly notified | NO |
| | b) Public notification is required under section 95C | NO |
| | c) The application is made jointly with an application to exchange recreation reserve land under section 15AA of the Reserves Act 1977 | NO |
| Step 2: if not required by step 1, public notification precluded in certain circumstances | a) The application is for a resource consent for 1 or more activities, and each activity is subject to a rule or national environmental standard that precludes public notification. | NO |
| | b) The application is for a resource consent for 1 or more of the following, but no other, activities: (i) a controlled activity; (ii) a restricted discretionary or discretionary activity, but only if the activity is a subdivision of land or a residential activity; (iii) a restricted discretionary, discretionary, or non-complying activity, but only if the activity is a boundary activity; (iv) a prescribed activity (see section 360H(1)(a)(i)). | NO |
| Step 3: if not precluded by step 2, public notification required in certain circumstances | a) The application is for a resource consent for 1 or more activities, and any of those activities is subject to a rule or national environmental standard that requires public notification. | NO |
| | b) The consent authority decides, in accordance with section 95D, that the activity will have or is likely to have adverse effects on the environment that are more than minor. | NO |
| Step 4: public notification in special circumstances | Determine whether special circumstances exist in relation to the application that warrant the application being publicly notified. | NO |

Therefore, in accordance with s95A(9)(b) RMA, the consent authority should not publicly notify this application but may determine whether to give limited notification under s95B.

9. Summary and Conclusions

Mate Yelavich co Ltd own an orchard at 9 Katavich Rd, Waiharara and are seeking a groundwater take to facilitate the development of an orchard with Total Orchard Area of 18 ha.

The groundwater take will be exercised from October to April, in accordance with the following volumes:

- Maximum daily volume of 450 m³/day; and
- Maximum annual volume of 52,000 m³/yr.

A consent duration of 30 years is sought, subject to a lapse period of 5 years.

If granted, this consent taken with another application we are aware of, will take the allocation status for the Aupouri-Other allocation zone to approximately 2.8% of full allocation. The activity status thus remains Discretionary.

The AEE has demonstrated that the potential adverse effects of the proposed water take and use on the environment will be less than minor, and the effects on persons will also be less than minor.

The proposal is also considered to be consistent with the relevant objectives and policies of the NPS, the RPS, the PRP, the RWSPN, and Part 2 of the RMA. The applicant considers that in light of the less than minor effects of the application, the decision made following the recent hearing for the MWWUG consent applications, the consent should proceed without public notification and be granted on a non-notified basis.

10. References

- Feather and Williamson (currently unpublished). An Analytical Tool for Drawdown Analysis in Multi-Layered Aquifer Systems. (App soon to be publicly available on www.wwa.kiwi)
- Hemker, C.J., and Maas, C., 1987. Unsteady flow to wells in layered and fissured aquifer systems. *Journal of Hydrology*, 90 (1987) 231-249.
- Hunt, B. and Scott, D., 2007. Flow to a well in a two-aquifer system. *Journal of Hydrologic Engineering*, 12(2), 146-155.
- HydroGeo Solutions, 2000. Aupouri Aquifer Sustainable Yield Groundwater Modelling Study. Consultancy report prepared for Northland Regional Council.
- Lincoln AgriTech, 2015. Aupouri Aquifer Groundwater Model. Consultancy report prepared for Northland Regional Council.
- SKM, 2007b. King Avocado Orchard Groundwater Take Consent Application (AEE Final). Consultancy report prepared for King Avocado Limited.
- Williamson Water Advisory, 2017. Motutangi-Waiharara Groundwater Model Factual Technical Report – Modelling. Consultancy report prepared for Motutangi-Waiharara Water Users Group.
- Williamson Water Advisory, 2018a. Resource Consent Application & Assessment of Environmental Effects. Consultancy report prepared for Tuscany Valley Avocados Limited.
- Williamson Water Advisory, 2018b. Waiharara-Paparore Groundwater Model Factual Technical Report – Modelling. Consultancy report prepared for Tiri Avocados Limited, Valic NZ Limited, and Wataview Orchard Limited.
- Williamson Water Advisory, 2018b. Waiharara-Paparore Groundwater Model. Factual Technical Report – Modelling. Prepared for Tiri Avocados Ltd; Valic Nz Ltd; Wataview Orchard. WWA0045 | Rev 2_Final. 3 August 2018.

Appendix A. Form A - Application For Resource Consent

APPLICATION FORM FOR RESOURCE CONSENT



Putting Northland first

| | |
|-------------------|----------------------|
| Whāngārei Office | Phone: (09) 470 1200 |
| | Fax: (09) 470 1202 |
| Kaitiāia Office | Phone: (09) 408 6600 |
| Ōpua Office | Phone: (09) 402 7516 |
| Dargaville Office | Phone: (09) 439 3300 |
| Free Phone | 0800 002 004 |
| E-mail | mailroom@nrc.govt.nz |
| Website | www.nrc.govt.nz |

**This application is made under Section 88/127
of the Resource Management Act 1991**

To: Consents Department
Northland Regional Council
Private Bag 9021
Whāngārei Mail Centre
Whāngārei 0148

IMPORTANT NOTES TO APPLICANTS

- (a) Please read **fully** the notes below and the Information Brochures and Explanatory Notes available from the Council, **before** preparing your application and any supporting information.
- (b) The Resource Management Act 1991 sets out the information you must provide with your application for a resource consent. If you do not provide adequate information, your application cannot be received nor processed by the Council and will be returned to you. If you are unsure of what information should be included with your application, please contact the Council before submitting the application.
- (c) Applications require notification (public advertising calling for submissions) unless the Council is satisfied that the adverse effects on the environment of the activity for which consent is sought will be minor; and written approval has been obtained from every person who the Council is satisfied may be adversely affected by the granting of the consent. The Council also has available a form "Form 8A – Affected Person's Written Approval", to help you record such approvals for applications that may be processed without public notification.

PART A – GENERAL

| APPLICANT | Full Names |
|--|------------------------------|
| (1) Full Name of Applicant(s): (in full e.g. Albert William Jones and Mary Anne Jones. For Companies, Trusts and other Organisations, commonly used name) | Mate Yelavich and Co Limited |
| Phone Number – Business: | Fax: |
| Home: | Mobile: |
| E-mail: | mikeyelavich@gmail.com |

For applications by a company, private trusts or other entity/organisations, the Directors; Trustees and Officers' full names must be supplied and Section (12) completed and signed.

| | |
|----------------------------------|----------------------------------|
| (2) Postal Address: (in full) | 9 Katavich Road, Waiharara, 0484 |
| | |
| | |
| | |

| | |
|--|--|
| (3) Residential Address: (if different from postal address) | |
| | |
| | |
| | |

| | |
|---|--|
| (4) Address for Service of Documents: (if different from postal address e.g. Consultant) | Jon Williamson (jon.williamson@wwa.kiwi) |
| | c/o Williamson Water Advisory |
| | PO Box 314 |
| | Kumeu, 0812 |
| Auckland | |

| | |
|---|-----|
| (5) Owner/Occupier of Land/ Water Body: (if different from the Applicant) | N/a |
| | |
| | |
| | |

| | |
|---|--|
| (6) Type(s) of Resource Consent sought from the Regional Council: | |
| You will need to fill in a separate Assessment of Environmental Effects Form for each activity. These forms can be obtained from the Northland Regional Council. | |
| Coastal Permit | |
| <input type="checkbox"/> Mooring | <input type="checkbox"/> Marine Farm |
| <input type="checkbox"/> Other (specify) _____ | <input type="checkbox"/> Structure |
| | <input type="checkbox"/> Pipeline/Cable |
| Land Use Consent | |
| <input type="checkbox"/> Vegetation Clearance | <input type="checkbox"/> Quarry |
| <input type="checkbox"/> Earthworks | <input type="checkbox"/> Construct/Alter a Bore |
| <input type="checkbox"/> Other (specify) _____ | <input type="checkbox"/> Structure in/over Watercourse |
| | <input type="checkbox"/> Dam Structure |
| Water Permit | |
| <input type="checkbox"/> Stream/Surface Take | <input type="checkbox"/> Damming |
| <input type="checkbox"/> Other (specify) _____ | <input checked="" type="checkbox"/> Groundwater Take |
| | <input type="checkbox"/> Diverting Water |
| Discharge Permit | |
| <input type="checkbox"/> Domestic Effluent to Land | <input type="checkbox"/> General Discharge to Land |
| <input type="checkbox"/> Air | <input type="checkbox"/> Water |
| <input type="checkbox"/> Other (specify) _____ | <input type="checkbox"/> Farm Dairy Effluent to Land/Water |

| | |
|---|--|
| (7) Other Resource Consents required from the District Council: | |
| Where other Resource Consents are required for the same activity, they must be applied for at the same time. Not doing so will delay the processing of this application. | |
| What other Resource Consents are required from the District Council? | |
| <input type="checkbox"/> None | <input type="checkbox"/> Land Use Consent |
| <input type="checkbox"/> Have the applications been made? | <input type="checkbox"/> Subdivision Consent |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |

| |
|--|
| (8) Description of the Activity: |
| Please briefly describe the activities and duration for which Consent(s) are being sought. It is important you fill this out correctly, as the Council cannot grant Consent for any activity you do not apply for. |
| Groundwater take consent to enable development of 18 ha Total Orchard Area of avocados. |
| The details of the take are as follows: |
| Daily rate - 450 m3/day (25 m3/day per Total Orchard Area) |
| Annual volume - 52,000 m3/annum (based on a maximum of 400 mm per annum over 13 ha canopy area) |

(9) Location of Property/Waterbody to which Application relates:

Describe the location in a manner which will allow it to be readily identified, e.g. street address, legal description, harbour, bay, map reference etc. Attach appropriate plans and/or diagrams.

Property Address: 9, Katavich Road, Waiharara, 0484
(see rate demand)

Locality: North Auckland

Legal Description: Lot1 DP 162175

Blk: _____ SD: _____

Other Location Information: _____

PART B – ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

You must include an assessment of the effects of your activity on the environment as part of your application.

The Resource Management Act 1991 requires that each application include an assessment of the actual and potential effects of the activity on the environment in accordance with the Fourth Schedule.

To assist you to supply this assessment of effects, the Council has prepared specific forms for various consent activities. For minor activities, all that will be required is for you to complete the specific form. Where the potential effects of the activity are more significant, we recommend you undertake a full assessment of effects, with professional assistance if necessary.

If you are unsure of what information to include with your application and the assessment of effects, please contact the Council before submitting your application. A pre-lodgement meeting with relevant Consent Staff is recommended.

PART C – GENERAL**(10) Renewal of an Existing Resource Consent:**

☐ Yes ☒ No ☐ A change in conditions of a current Resource Consent

(11) Fee/Deposit Enclosed with Application(s):

Application to be processed as: ☐ Notified ☐ Limited Notified ☒ Non-notified

| | |
|--|--|
| <input type="checkbox"/> Coastal Permit: \$ _____ | <input type="checkbox"/> Land Use Consent: \$ _____ |
| <input checked="" type="checkbox"/> Water Permit: \$ <u>3,296.00</u> | <input type="checkbox"/> Discharge Permit: \$ _____ |
| <input type="checkbox"/> Bore Permit: \$ _____ | <input type="checkbox"/> Change Conditions: \$ _____ |

(12) Signature of Applicant(s) or Persons authorised to sign on behalf of Applicant(s):**IMPORTANT NOTES TO APPLICANTS**

- (a) Your application must be accompanied by the minimum fee (deposit) as determined by the Council. A schedule of the fee/deposits for different consent applications is annexed. Please note that applications by private trusts and other group entities require the personal guarantees of the Trustees and/or Officers for the payment of costs to be submitted with the application.
- For complex applications, the Council may require an additional deposit pursuant to Section 36(3) of the Act, based on the estimated costs for processing such complex applications and may require progressive monthly payments during consent processing.
 - The final fee is based on actual and reasonable costs including disbursements and where this fee exceeds the fee/deposit, the additional fee is subject to objection and appeal.
- (b) All accounts are payable by the 20th of the month following the date of invoice. Any actual and reasonable costs, including but not limited to legal costs, debt collection fees or disbursements incurred as a result of any default in payment, shall be recoverable from the Applicant and is so notified in compliance with the Credit Contracts and Finance Act 2003. Submitting this Application authorises the Council to, if necessary, provide your personal information to a Credit Reporter in order to employ in its debt collection services in compliance with the Credit Reporting Privacy Code 2004, should payment default occur.
- (c) Resource Consents usually attract an annual fee to recover the reasonable costs of the Council's monitoring, supervision and administration of the Consent during its term.
- (d) The information you provide is official information. It will be used to process the application and, together with other official information, assist the management of the region's natural and physical resources. Access to information held by the Northland Regional Council is administered in accordance with the Local Government Official Information and Meetings Act 1987 and the Privacy Act 1993.

Application Form continued on next page

I/we declare that, to the best of my/our knowledge and belief, the information given in this Application and attached Assessment of Environmental Effects is true and correct. I/we unconditionally guarantee jointly and severally to pay the actual and reasonable costs of processing this Application as and when charges become due and payable. I/we acknowledge that I/we understand the consequences of signing this Application.

Signature: _____ PP. _____

Full Name (print): Jon Williamson

Date: 13/08/2018

Signature: _____

Full Name (print): _____

Date: _____

Continue with Trustees' and Authorised Officers' signatures below, as necessary.

Personal details and signatures of Trustees*, or Officers authorised to sign on behalf of and to bind Trusts, Societies and Unincorporated Entities.

* Private and Family Trusts only

Full Name and Status:

(Trustee, Officer etc)

Full Residential Address:

Signature:

Full Name and Status:

(Trustee, Officer etc)

Full Residential Address:

Signature:

Full Name and Status:

(Trustee, Officer etc)

Full Residential Address:

Signature:

Full Name and Status:

(Trustee, Officer etc)

Full Residential Address:

Signature:

CHECKLIST – Have you remembered to...

- ☐ Complete all details set out in this Application Form
- ☐ Include an Assessment of Effects of the activity on the environment, set out in the attached form
- ☐ Sign and date the Application Form

- ☐ Include a Site Plan
- ☐ Include the appropriate fee as set out in the "Schedule of Minimum Estimated Initial Fees"
- ☐ Complete details of Trustees and/or Authorised Officers on this page

Appendix B. Environmental Impact Analysis

B.1 Drawdown analysis

The drawdown analysis was conducted based on the peak daily groundwater take of 450 m³/day, which will be applied to 18 ha development area. The drawdown was evaluated after 116-days of pumping, which equates to a total take of 52,200 m³ at the end of the irrigation season. The drawdown effect was analysed using:

- **Theis solution:** Analytical solution to compute drawdown in abstraction layer with a confined nonleaky condition.
- **Feather & Williamson solution:** Analytical solution to compute drawdown in a multi-layer aquifer system.

The hydrogeological parameters of the abstraction layer were sourced from relevant pumping test data in the region, shown in **Table B1**.

Table B1. Summary of hydrogeological parameters of shellbed analysed from pumping test data.

| Bore | Screen depth | Depth | Lithology | Transmissivity | Thickness | Specific storage | Leakance | Analysis method | Source |
|---------------------------|--------------|-------|-------------|---------------------|-----------|------------------|----------|----------------------------------|---|
| | mBGL | mBGL | | m ² /day | m | m ⁻¹ | d | - | |
| King Avo1 | 110.5 | - | Shell | 305 | 26 | 2.692E-05 | 0.0003 | - | Aupouri Aquifer Groundwater Model (Lincoln AgriTech, 2015) |
| King Avo2 | 110.5 | - | Shell | 370 | 17 | 6.471E-05 | 0.0003 | - | |
| 184 | 101 | 110 | Shelly sand | 140-340 | - | - | - | - | Aupouri Aquifer Sustainable Yield Groundwater Modelling Study (HydroGeo Solutions, 2000) |
| SKM101b | 84.5-100 | 100 | Sand/shell | 496 | 15.5 | - | - | - | King Avocado Orchard Groundwater Take Consent Application (AEE Final) (SKM, 2007b) |
| SKM102b | 112-122 | 122 | Sand/shell | 130 | 10 | - | - | - | |
| SKM103b | 114-124 | 124 | Sand/shell | 300 | 10 | - | - | - | |
| SKM104b | 82-94 | 94 | Sand/shell | 444 | 12 | - | - | - | |
| Stanisich Pumping bore | 87-101 | - | Shell | 485 | 14 | - | - | Single well Jacob | Motutangi-Waiharara Groundwater Model Factual Technical Report – Modelling. (Williamson Water Advisory, 2017) |
| | | | | 512 | | - | - | Theis Recovery | |
| | | | | 471 | | - | - | Single well Jacob leaky solution | |
| Stanisich Monitoring bore | 77-85 | - | Shell | 356 | 8 | 4.400E-03 | - | Theis (point match) | |
| | | | | 138 | | 1.550E-04 | 0.00183 | Hantush-Jacob | |

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| | | | | | | | | | |
|---------------------------|-------------------|---|-------|------------|-----------|-----------------|-----------------|---------------------|--|
| | | | | 408 | | 3.070E-04 | 0.00135 | Hantush-Jacob | |
| | | | | 348 | | 3.130E-04 | 0.000736 | Hantush-Jacob | |
| Honeytree Pumping bore | 62-68,68-71,84-93 | - | Shell | 618 | 18 | - | - | Single well Jacob | |
| | | | | 511 | | - | - | Theis Recovery | |
| Honeytree Monitoring bore | 63-69,69-72,86-95 | - | Shell | 751 | 18 | 3.000E-04 | - | Theis (point match) | |
| | | | | 784 | | 3.000E-04 | - | Cooper Jacob | |
| | | | | 579 | | 1.630E-05 | 0.00015 | Hantush-Jacob | |
| | | | | 484 | | 2.170E-05 | 0.000284 | Hantush-Jacob | |
| | | | | 707 | | 1.700E-05 | 0.0000509 | Hantush-Jacob | |
| De Bede Pumping bore | 91-97 | - | Shell | 377 | 6 | - | - | Single well Jacob | |
| | | | | 363 | | - | - | Theis Recovery | |
| | | | | 273 | | | | | |
| Minimum | | | | 130 | 6 | 1.63E-05 | 5.09E-05 | | |
| Median | | | | 444 | 14 | 1.55E-04 | 3.00E-04 | | |
| Average | | | | 444 | 14 | 5.38E-04 | 6.25E-04 | | |
| Maximum | | | | 784 | 26 | 4.40E-03 | 1.83E-03 | | |

B.1.1 Theis drawdown solution

The median values from **Table B1** were used to represent the regional deep shellbed aquifer hydrogeologic condition. The estimated drawdown after 116-days of pumping at various distance from pumping bore is shown in **Figure B1**. At 0.1 m radius of pumping bore, 1.8 m drawdown was calculated, and a drawdown of 0.02 m was estimated at 10km radius of pumping bore.

Due to the existence of discrete low-permeable geological materials (e.g. iron pan, silt, peat), the regional aquifer is a leaky confined system, showing a progressive confinement with depth. The non-leaky condition implied in the Theis solution led to an overestimation of the drawdown in deep shellbed. However, this is considered to be appropriate to conservatively estimate the potential maximum drawdown which is resulted from proposed groundwater take.

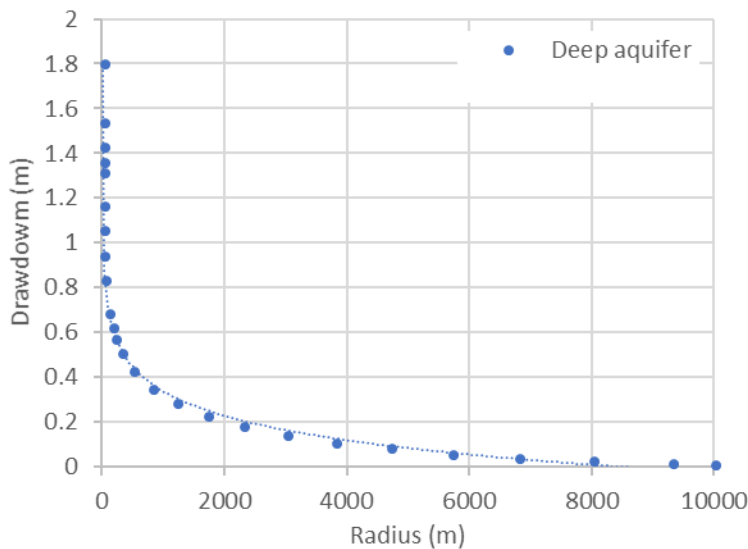


Figure B1. Calculated drawdown of abstraction layer (Theis).

B.1.2 Feather & Williamson solution

Based on the solution achieved for a two-aquifer system from Hunt and Scott (2007), Feather and Williamson (2013) had developed a more generalized solution for drawdown calculation in a multi-layer aquifer system. By assigning the hydrogeologic parameters and thickness of individual layers, the drawdown is calculated in each individual layer following an inversion of Laplace transformation of groundwater flow equation. A 6-layer single well pumping model was setup, and the hydrogeologic parameters of Layer 1 to Layer 5 were sourced from MWGM (WWA,2017). The median values from **Table B1** were used to represent the hydrogeologic condition of shellbed layer 6, shown in **Table B2**.

Table B2. Hydrogeologic parameterisation in the single-well pumping model.

| Layer | Transmissivity (m ² /day) | Horizontal hydraulic conductivity (m/s) | Vertical anisotropy (-) | Storativity (-) | Layer thickness (m) |
|-------|--------------------------------------|---|-------------------------|-----------------|---------------------|
| 1 | 140 | 4.05E-05 | 80 | 2.50E-01 | 40 |
| 2 | 75 | 3.47E-05 | 80 | 1.25E-02 | 25 |
| 3 | 60 | 3.47E-05 | 80 | 1.00E-02 | 20 |
| 4 | 210 | 3.47E-04 | 1 | 1.12E-02 | 7 |
| 5 | 18 | 6.94E-05 | 30 | 1.50E-03 | 3 |
| 6 | 444 | 3.67E-04 | 1 | 2.17E-03 | 14 |

The estimated drawdown in deep and shallow aquifer is shown in **Figure B2**. At 0.1 m radius of pumping bore, 1.3 m and 0.03 m drawdown were calculated for deep and shallow aquifer, respectively. At the same distance from the pumping bore, the calculated drawdown from Feather & Williamson model is lower than the drawdown

from Theis solution, indicating the vertical leakance simulated in the model. Drawdown estimated from Feather & Williamson model is a more realistic solution for the leaky-confined aquifer system.

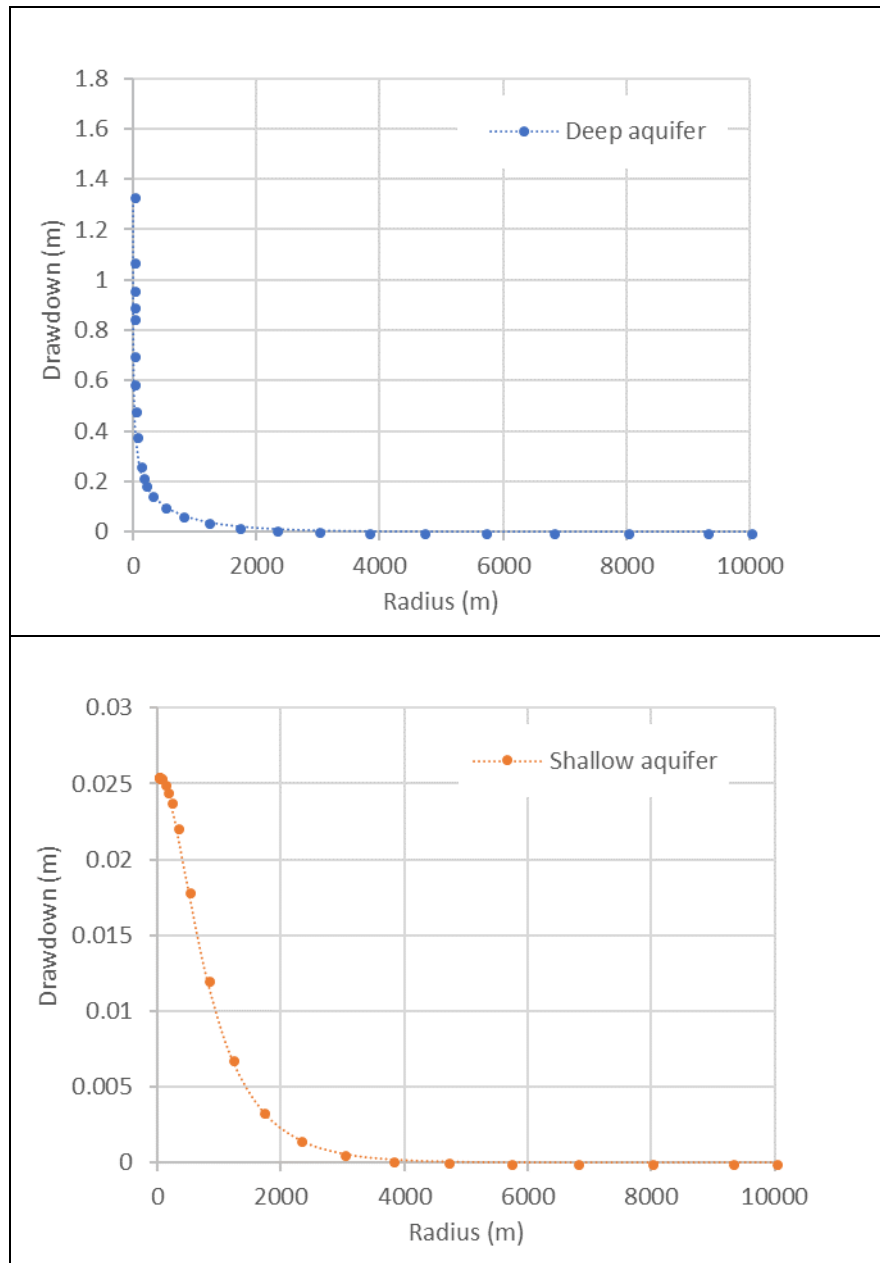


Figure B2. Estimated drawdown in deep aquifer and shallow aquifer (Feather & Williamson).

B.2 Cumulative impact

The cumulative impact was assessed based on Yelavich proposed take and other consents that are in different consenting and application stages in the region, and these are shown in **Table B3**.

Table B3. Irrigation takes included in the cumulative impact analysis.

| Category | Irrigation takes | Daily rate (m ³ /day) |
|----------------------------|---|----------------------------------|
| Consented irrigation takes | Motutangi - Waiharara Water User Group Consents and other active consents | 16,775* |
| Consentlodged | Tuscany irrigation take | 375 |
| | Tiri Avocados Limited | 3,876 |
| | Valic NZ Limited | 1,158 |
| | Wataview Orchards | 225 |
| Consent in application | Anton Matthews | 94 |
| | Mate Yelavich Co Ltd | 450 |
| | Wedding and Doody | 2,375 |
| | Robert Campbell Family Trust | 3,350 |

*This is retrieved from Scenario 2 MWGM (WWA,2017)

The cumulative impact was assessed by overlying the estimated drawdown from MWGM (WWA, 2017), Tuscany (WWA,2018a), WPGM (WWA, 2018b) and simulated drawdown from the four consents in pending application process shown in **Table B3**. The drawdown profile from MWGM, Tuscany and WPGM together is referred as the base drawdown. The drawdown simulation selected are shown in **Table B4**, representing the conservative drawdown assessment with respect to shallow and deep aquifers.

Table B4. Selected drawdown simulation for cumulative impact assessment.

| Aquifer | Base drawdown simulation | Additional drawdown |
|--|---|----------------------------------|
| Deep aquifer - Feather & Williamson | MWGM Scenario 4c + WPGM Scenario 4c + Tuscany Layer 6 Feather & Williamson drawdown | Feather & Williamson L6 drawdown |
| Shallow aquifer - Feather & Williamson | MWGM Scenario 2 + WPGM Scenario 2 + Tuscany Layer 1 Feather & Williamson drawdown | Feather & Williamson L1 drawdown |

Based on the cumulative drawdown in deep aquifer shown in **Figure B3**, the drawdown was analysed at neighbouring bores that are within 3 km radius, as shown in **Table B5**. The cumulative drawdown ranged from 2 m to 3 m, summarised in **Table B5**. However, according to the Feather and Williamson analysis, the existing groundwater take bores are likely to be outside of the radius of influence from the proposed take, hence, no additional drawdown was observed at these locations.

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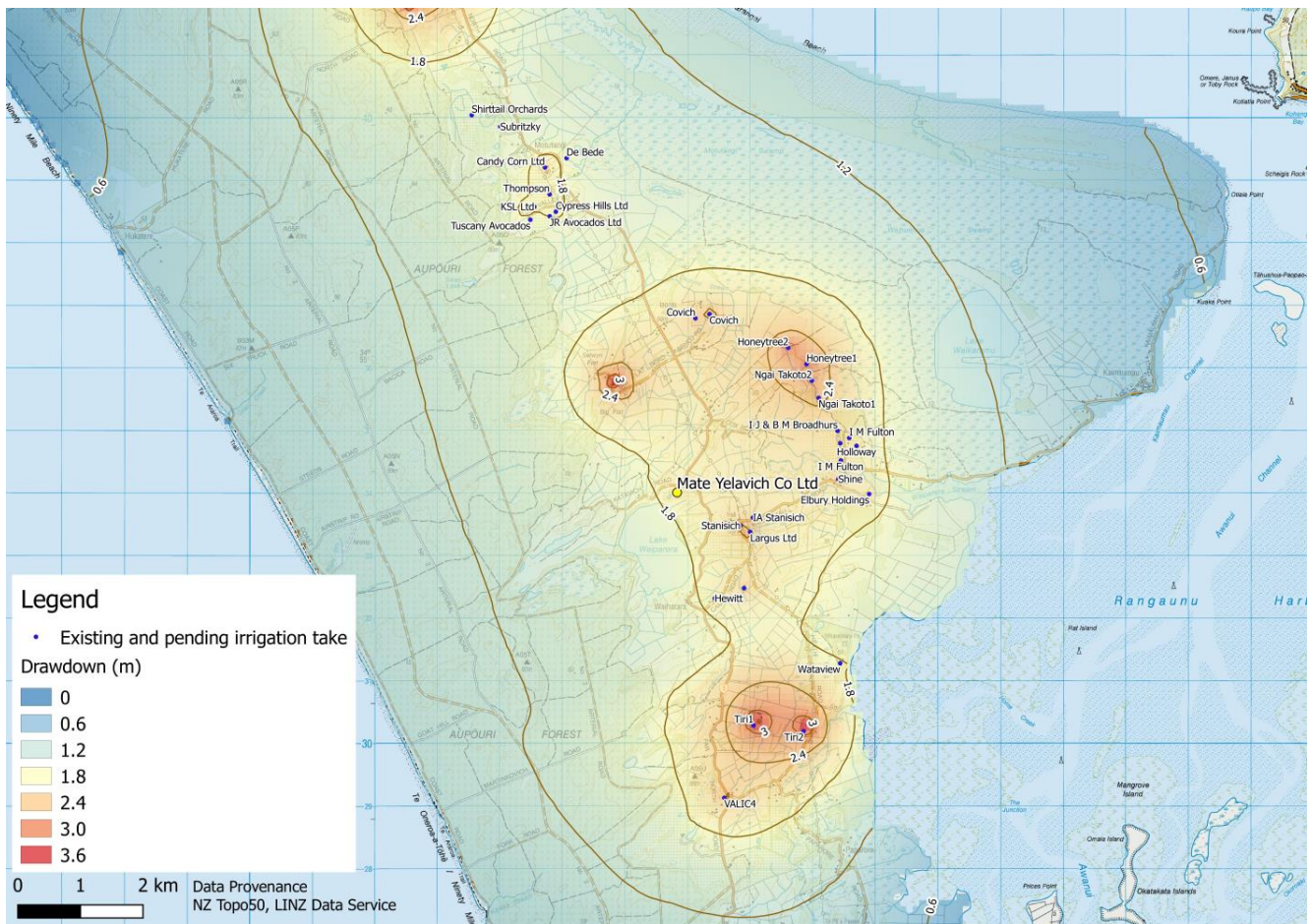


Figure B3. Cumulative drawdown of Deep aquifer – Feather & Williamson

Table B5. Drawdown estimated for existing groundwater take locations.

| Neighbouring Bore | Distance from Yelavich Bore (km) | Base drawdown | Cumulative drawdown | Additional drawdown |
|----------------------|----------------------------------|---|-------------------------------------|----------------------|
| | | MWGM Scenario 4c + WPGM Scenario 4c + Tuscany Layer 6 Feather & Williamson drawdown | Deep aquifer - Feather & Williamson | Feather & Williamson |
| Stanisich | 1.1 | 2.2 | 2.3 | 0.0 |
| IA Stanisich | 1.3 | 2.0 | 2.1 | 0.0 |
| Largus Ltd | 1.3 | 2.2 | 2.2 | 0.0 |
| Hewitt | 1.8 | 2.1 | 2.1 | 0.0 |
| Shine | 2.6 | 2.2 | 2.2 | 0.0 |
| I M Fulton | 2.7 | 2.0 | 2.0 | 0.0 |
| Ngai Takoto1 | 2.7 | 2.5 | 2.5 | 0.0 |
| J P Broadhurst | 2.7 | 2.0 | 2.1 | 0.0 |
| I J & B M Broadhurst | 2.7 | 2.1 | 2.1 | 0.0 |
| Ngai Takoto2 | 2.8 | 2.8 | 2.8 | 0.0 |
| Covich | 2.8 | 2.2 | 2.4 | 0.0 |
| I M Fulton | 2.9 | 2.0 | 2.0 | 0.0 |
| Covich | 2.9 | 2.8 | 2.9 | 0.0 |
| Honeytree1 | 2.9 | 3.0 | 3.0 | 0.0 |
| Honeytree2 | 2.9 | 3.0 | 3.0 | 0.0 |
| Holloway | 3.0 | 2.0 | 2.0 | 0.0 |

The cumulative drawdown in the shallow aquifer is shown in **Figure B4**. The maximum additional drawdown in the shallow aquifer is less than 0.03 m near the proposed take at Yelavich. Compared to the base drawdown, the major changes of drawdown profile are centred around near Robert Campbell Family Trust bore.

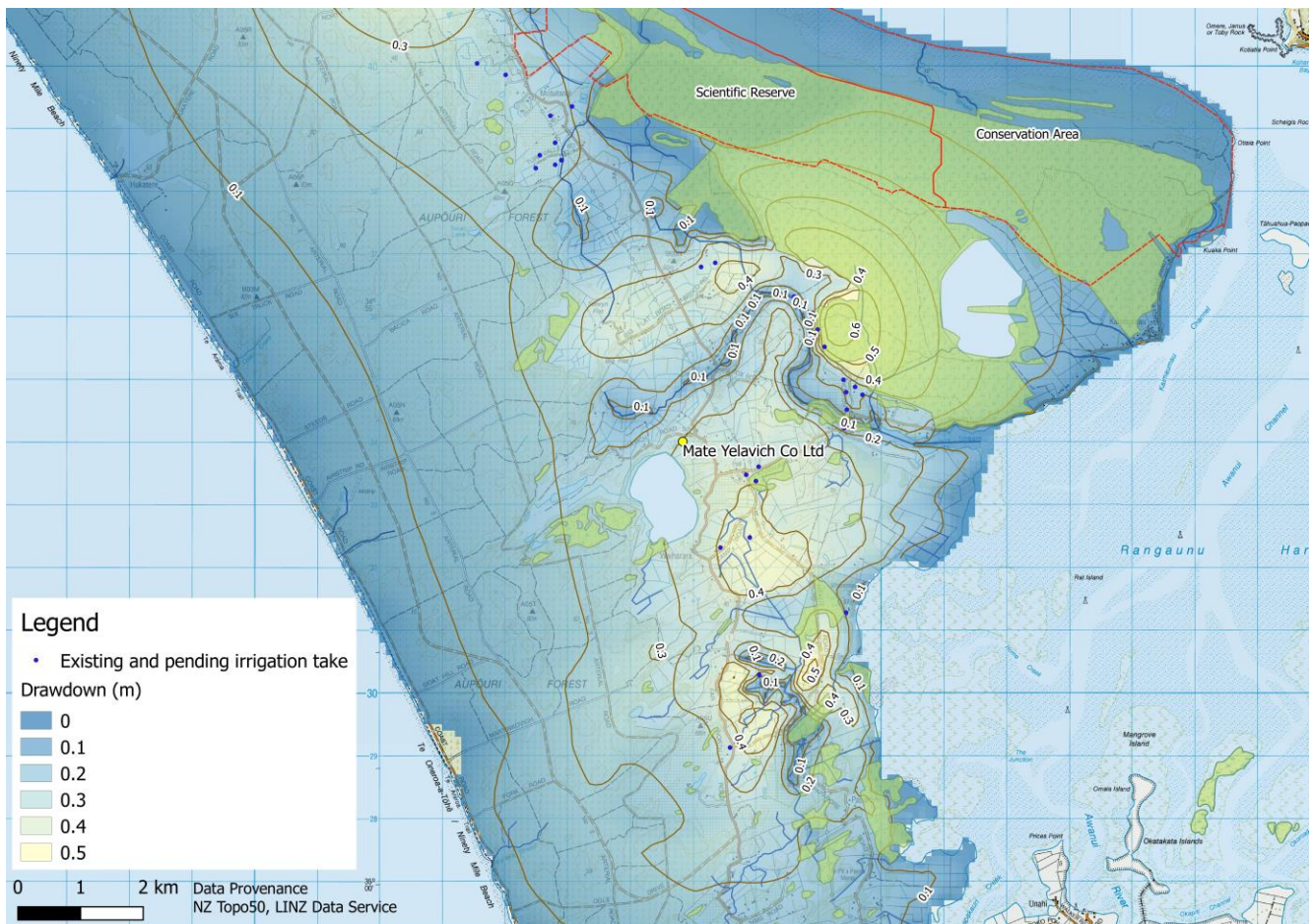


Figure B4. Cumulative drawdown of shallow aquifer - Feather & Williamson

B.3 Surface water impact

The surface water features in the area adjacent to Mate Yelavich Co Ltd are shown in **Figure B5** and include:

- Lake Waiparera to southwest (0.3 km)
- Unnamed drain to north (0.6 km)
- Lake Waikaramu to the east (4.7 km)
- Kaimaumau wetland to east (6.4 km)

The maximum additional drawdown in the shallow aquifer is less than 0.03 m. The drawdown in the shallow aquifer ranged between 0.1 m to 0.4 m in this area. This magnitude of drawdown in porous would translate to an even smaller impact within the standing or flowing water body.

As a lake perching above the regional aquifer, Lake Waiparera is hydrological disconnected with the regional aquifer. The groundwater take in the deep aquifer is unlikely to induce any change in the hydrologic functionality of the lake.

The findings of the MWGM were accepted with respect to impacts on the wetland (and by inference surface waters) with the Commissioners indicating in paragraph 153, “our view is that there are many influences on the

wetland that are far greater than the MWWUG abstractions". Given that the additional impacts predicted from this bore are similarly negligible, the same conclusion can be drawn.

Therefore, the proposed take for the deep aquifer is unlikely to pose significant impact on the surficial hydrological features.

B.3.1 Saltwater intrusion

Saltwater potential upconing and lateral migration were analysed in MWGM report (Section 5.2.6, WWA,2017) using Ghyben-Herzberg analytical solution. Due to the existence of low permeable bedrock underlying the deep shellbed aquifer, saltwater lateral migration along the base of the shellbed is a more likely mechanism of saltwater intrusion.

The proposed take is located in the central sand area. The nearest coastline is approximate 2.7 km away that is located southeast of the proposed take. The simulated groundwater level at coastal sentinel location of 63 – 65 shown in **Figure 42** and **Figure 43** in MWGM report (Section 5.2.6, WWA, 2017) indicated an average pressure of 7 mAMSL, which is above the minimum pressure (2 mAMSL) to prevent the saltwater inland migration. The conservative non-leaky solution, shown in **Figure B3**, indicated a cumulative drawdown of less than 2 m at the nearest coastal location under extremely dry condition (i.e. no recharge). The proposed take is unlikely to change the potential saltwater lateral migration profile from that assessed in MWGM report (WWA,2017).

B.3.2 Ground Settlement

Groundwater settlement was calculated using the Bouwer (1977)⁷ equation:

$$S_u = (P_{i2} - P_{i1}) \frac{Z_1}{E}$$

where S_u = vertical subsidence (m)
 $P_{i2} - P_{i1}$ = Increase in intergranular pressure due to drop of the water table
 Z_1 = layer thickness
 E = modulus of elasticity of the soil

The following characteristics were assumed for the aquifer:

- Porosity = 0.25
- Unsaturated water content = 0.08
- Specific weight of aquifer material (consolidated silty sand) = 20 kN/m³ (Silty sand density ranges between 1,410 kg/m³ and 2,275 kg/m³⁸, corresponding to specific weight of 14 kN/m³ and 22 kN/m³)
- Specific weight of water = 9.81 kN/m³.

The deep shellbed material is denser and less compressible compared to the mixture of sand, silt and peat overlying above. The subsidence analysis was conducted using three separate layers representing the conceptual hydrogeological units of the sub-surface environment, and the parameter values used are shown in **Table B6**, which were selected from the elasticity values referenced in **Table B7**.

⁷ Bouwer, H., 1977. Land Subsidence and Cracking Due to Ground-Water Depletion. Ground Water 15, 358–364. doi:10.1111/j.1745-6584.1977.tb03180.

⁸ Density ranges for different soil types: http://structx.com/Soil_Properties_002.html

Table B6. Elasticity and depth of each zone for subsidence estimate.

| Stratigraphy | Total depth | Modulus of elasticity (kPa)* |
|-------------------------------|-------------|------------------------------|
| Silty sand (unsaturated zone) | 5 | 10,000 |
| Silty sand (saturated zone) | 70 | 20,000 |
| Shellbed (saturated zone) | 25 | 50,000 |

* Modulus of elasticity (E) was sourced from Bouwer, 1977

Table B7. Modulus of elasticity [E] for unconsolidated materials (Bouwer, 1977).

| Material | E (kg/cm ²) | E (kPa) |
|-----------------------|-------------------------|-------------------|
| Peat | 1 – 5 | 98 – 490 |
| Loose clay | 10 – 50 | 981 – 4,903 |
| Medium clay and silt | 50 – 100 | 4,903 – 9,807 |
| Dense clay and silt | 100 – 1,000 | 9,807 – 98,067 |
| Loose sand | 100 – 200 | 9,808 – 19,613 |
| Dense sand | 500 – 2,000 | 49,033 – 196,133 |
| Dense gravel and sand | 2,000 – 10,000 | 196,133 – 980,665 |

The cumulative drawdown profile is an overlap of cone of depressions from all the groundwater takes assessed in the region. The drawdown magnitude around the proposed take will not attenuate as a circular pattern. Therefore, maximum cumulative drawdown was extracted within a 1.5 km radius of the proposed take, and the estimated maximum subsidence was calculated by combining the Feather and Williamson analysis for the shallow aquifer with the Theis analysis for the deep aquifer, as shown in **Table B8**.

Table B8. Calculated subsidence (m) within 1.5 km of the pumping bore.

| Scenario | Shallow aquifer - Feather and Williamson | Deep aquifer - Feather and Williamson- |
|------------------------------|--|--|
| Drawdown (m) | 0.41 | 2.62 |
| Unit 1. Sand (unsaturated) | 1.4×10^{-4} | |
| Unit 2. Sand (saturated) | 1.2×10^{-2} | |
| Unit 3. Shellbed (saturated) | | 1.1×10^{-2} |
| Maximum Cumulative | 0.02 | |

Within 1.5 km of proposed take, the estimated cumulative subsidence is 0.02 m, with a maximum drawdown of 0.41 m and 2.62 m in shallow and deep aquifer, respectively. In a rural setting, settlement effects of this magnitude (or less as would be more realistic) are less than minor for the following reasons:

- There is no sensitive urban infrastructure like water or wastewater mains or high-rise buildings to rupture or crack; and

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- The changes in land surface due to farm machinery (e.g. rotary hoeing) would likely mask impacts of this magnitude (<0.3 m) if materialised.

In summary, the potential settlement effects are considered less than minor.

Appendix C. Consultation Written Approval Form

| FORM 8A AFFECTED PERSON'S WRITTEN APPROVAL (Section 95E(3)(a)/95F(c) of the Resource Management Act 1991) | |
|--|--|
| TO: | Northland Regional Council |
| Full name of person giving written approval: | Antoinette Michelle O'Neill |
| I am the owner occupier (delete one) of the property located at: | 8 Katavich Rd R.D4 (Give address of property) Kaitiaki |
| I have authority to sign on behalf of all the other owners / occupiers (select one) of the above property. Note: If you are signing on behalf of a trust or company, please provide additional written evidence that you have signing authority. | |
| This is written approval to the following activity that is subject of a resource consent application: | |
| Applicant's Name: | Michael Yelavich (MATE YELAVICH + CO LTD) |
| Application Number (if known): | APP. 039841.01.01 |
| Description of Proposal: | GROUNDWATER USAGE FOR ORCHARD. |
| Location: | 9 KATAVICH ROAD WAIHAKARA |
| I have read the full application for resource consent, the Assessment of Environmental Effects (AEE), and any site plans as follows: | |
| Document name and date: | Assessment of Environmental Effects |
| Plan number(s) and date(s): | |
| In signing this written approval, I understand that the Northland Regional Council must decide that I am no longer an affected person, and the Northland Regional Council must not have regard to any adverse effects on me. | |
| I understand that I may withdraw my written approval by giving written notice to the Northland Regional Council before the hearing, if there is one, or, if there is not, before the application is determined. | |
| Signature* of person giving written approval (or person authorised to sign on behalf of person giving written approval) | 7/03/2018 Date |
| Address for service of person giving written approval: | 41- Waiharara School Antoinette O'Neill 8 Katavich Road R.D4 Kaitiaki. |
| Telephone: | 09 4068830 |
| Fax/Email: | principal@waiharara.school.nz |
| Contact person: (name and designation, if applicable) | Antoinette O'Neill |
| * A signature is not required if you give your written approval by electronic means. | |
| NOTES: (1) There is no obligation for you to sign this form and no reasons need to be given. Therefore, if you do not understand what this form is, or details about the application, then DO NOT SIGN IT . (2) Conditional written approvals cannot be accepted. (3) If this form is not signed, the application may need to be notified with an opportunity for submissions. | |

AFFECTED PERSONS WRITTEN APPROVAL FORM OCTOBER 2013 (REVISION 5)