Water allocation and use efficiency in the Bay of Plenty region

Analysis of data and identification of opportunities to improve efficiency.

Resource Policy Document September 2021

Prepared by Glenys Kroon

With assistance from Sharon Pimlott, Adell Gilchrist, Sandra Barns

Freshwater Policy

Bay of Plenty Regional Council

BAY OF PLENTY REGIONAL COUNCIL TOI MOANA

Contents

Executive summary

This report describes:

- The national and regional context regarding efficiency of water allocation and use (quantity).
- The activities and volumes that water is allocated to in the region.
- Information about water metering and records provided by water users to the Bay of Plenty Regional Council (the Regional Council).
- What the allocation and use information can tell the Regional Council about allocative efficiency.
- Opportunities to improve efficiency to better meet the requirements of the National Policy Statement for Freshwater Management 2020 (NPSFM).

Water allocation and use data for the Bay of Plenty region indicates there are significant differences between consented allocation and actual use, even during peak irrigation periods in a very dry year. Low levels of use compared to allocation highlight opportunities to achieve more efficient outcomes for water allocation.

Information about water take and use consents, particularly in older consents, is sometimes unclear. Older resource consents typically have metering and reporting requirements that are less than optimal, with many users not required to report, or providing poor-quality data. Improving allocative efficiency and phasing out existing over allocation as required by the NPSFM will require good quality information and data for both allocation and use. Until that is in place, caution is needed in interpreting data, but some confidence can be taken from the consistent patterns across use categories, the increasing availability of high-quality telemetered data and broad analysis of all metering data.

Improved data collection and analysis is critical to support future efforts to document progress and inform robust practices to improve efficient allocation and use of water. By using a combination of quality telemetered data and broader but lower quality manual reported data, a base line regarding efficiency can be established and opportunities to make improvements are identified.

Efficient allocation decisions could be better informed if efficient use models or standards were adopted (e.g. municipal use, dairy shed use, stock watering), and/or historic use patterns were always considered when re-consenting. At present, SPASMO - IR[1] is the only model used by the Bay of Plenty Regional Council and there are indications that this model would benefit from a re-evaluation to check that it aligns with best farming practices. A comparison of allocation with use of resource consents indicated that growers and farmers appear to use significantly less water than SPASMO – IR provides for, even in very dry seasons.

Long-term consents without robust review provisions, or not undertaking reviews identified in consents contributes to inefficient allocation. Analysis of all metering data from consent holders reporting during the very dry 2019/2020 water year showed that 44% used between 0%-20% of their annual allocation, with only 21% using more than 50%. A more detailed analysis of the use patterns of individual irrigation consent holders highlighted that many never exceeded 50% of their weekly quantity, even in peak weeks of early January to mid-February.

Some of the recommendations identified in this report (telemetry, greater consent specificity and consideration of historic use) have already been adopted by the Regional Council, but time is needed for the benefits to be seen.

[1] Soil Plant Atmosphere System Model - Irrigation

The report does not consider technical efficiency (for example, it excludes consideration of whether the irrigation infrastructure is efficient in delivering the right amount of water to the plant at the optimum time) or whether some activities are higher priorities or economically more efficient than others.

Key recommendations to improve efficiency and awareness of efficiency are:

(i) Improve clarity about what is allocated - for example by, specifying the use period and where multiple activities are provided, determining if the separate activity needs separate accounting.

(ii) Improve the quality of water use reporting and analysis to support consent review and to monitor efficiency improvements.

(iii) Recognise the importance of rate of take and seasonality of take for surface water accounts when assessing efficiency.

(iv) Ensure that the effects of dams, diversions, or takes from groundwater affecting surface water (and vice versa) are correctly understood and accounted for.

(v) Develop additional tools and review SPASMO –IR to ensure decisions on efficient allocation are well informed.

(vi) Include consideration of management methods, practices and the capacity of the infrastructure to take and use water when determining allocation volume.

(vii) Undertake reviews of existing consents and/or provide for shorter consent timeframes to ensure the allocation remains efficient.

1 Improving the efficiency of water allocation and use

The purpose of this report is to analyse information the Regional Council has about water allocation and use in order to identify opportunities to improve the efficiency in water allocation, as is required by the NPSFM 2020.

1.1 National context

Improving the efficiency of water allocation is a requirement of the National Policy Statement 2020 (see Box 1) and important to maximise the benefits of water available for allocation. Inefficient water allocation and use can deny other potential users access to water, with social, economic, and cultural implications. Good quality recording and reporting of water use enables opportunities for more efficient allocation to be identified and is an integral part of achieving efficiency of use and maximising benefits.

The Ministry for the Environment took the first steps towards improving information about the efficiency of water allocation compared to use in a national report in 2009-10.[2] At that time, the water metering regulations were not in effect and limited metering data was available. Estimates of the allocation compared to use provided by the Bay of Plenty Regional Council for that report are no longer considered accurate.

The 2010 Water Metering Regulations and the subsequent amendment (Resource Management (Measurement and Reporting of Water Takes) Amendment Regulations 2020 captured existing consents, requiring all water takes over 5 l/s to meter and report.

National Policy Statement Freshwater Management 2020

Policy 11: Freshwater is allocated and used efficiently, all existing over-allocation is phased out and future over-allocation is avoided.

Implementation section 3.28 Water allocation

Every regional council must make or change its regional plan to include criteria for:

(1) (a) deciding applications to approve transfers of water take permits; and

(b) deciding how to improve and maximise the efficient allocation of water (which includes economic, technical and dynamic efficiency).

(2) Every regional council must include methods in its regional plan(s) to encourage the efficient use of water.

Implementation section 3.29 Freshwater accounting systems

(1) Every regional council must operate and maintain, for every FMU: …

(b) A freshwater quantity accounting system.

(4) Every regional council must publish information from those systems regularly and in a suitable form.

(6) The freshwater quantity accounting system must record, aggregate and regularly update, for each FMU, information on the measured, modelled or estimated:

(a) Amount of freshwater take; and

(b) The proportion of freshwater taken by each major category of use; and

(c) Where a take limit has been set, the proportion of the take limit that has been allocated.

(7) In this clause, freshwater take refers to all takes and forms of water consumption, whether metered or not, whether subject to a consent or not and whether authorised or not.

[2] Aqualinc Research Ltd., (October 2010).

1.2 Other regions

Extracting and analysing information about water allocation and efficiency of use is an area of development for most regional councils. Few have reliable and comprehensive reporting of all consented water use or robust estimates of unconsented use. Accounting methods are inconsistent between councils – for example some councils 'smooth' the rates of take for surface water allocation so that accounts reflect the minimum rate required to achieve the daily volume, while others, including the Bay of Plenty Regional Council 'stack' or combine maximum rates of take. The Waikato Regional Council uses a hybrid approach, smoothing in big catchments such as the Waikato and Waipa, and stacking in others. Smoothing the rate of take generally makes more water available, and maybe most appropriate for larger water bodies.

Some councils (Marlborough, Canterbury, and Hawke's Bay) have reviewed consents where consent holders are not using significant portions of their allocation, under s129 or s126 of the Resource Management Act 1991. Undertaking such reviews (where they are not clearly mandated in the consent document) is an onerous process, requiring robust planning and evidence.

A Taranaki Regional Council report[3] published in 2019-2020 notes that, of 67 irrigation consents, 14 reported no use and two used more than 50% of their allocation, despite the irrigation season being drier than average.

In 2005, the Waikato Regional Council assessed improvements to their water allocation processes and procedures in the Waihou Catchment. The primary water uses in the catchment were irrigation (54%), municipal supply networks (29%), and industry (16%).[4] The report highlights issues of inefficiency relating to high rate takes, failure to account for seasonal variability, low use compared to allocation, and failure to account for discharges. It noted that, if all takes in the Waihou River were averaged over 24 hours there would be a 30% increase in the allocable volume of water. The report recommended prioritisation of use types, reduced rates of take, improved accounting, and secondary allocation.

The Horizons Regional Council has telemetry installed on most consented water takes. Their 'WaterMatters' website has an interactive tool for looking at allocation versus use, which is reported daily.[5]

A 2009 study by the Hawke's Bay Regional Council (HBRC)[6] provided detailed information on water use by activity type and month. While the Hawke's Bay climate is drier in summer than the Bay of Plenty (which may lead to a higher percentage use of allocated water), both regions are major fruit-producing areas. The HBRC analysis showed relatively low percentages of use versus allocation across residential, cropping, orcharding and grape-growing activities in 2009. Water use as a percentage of allocation ranged from 7% to 19% across activities, and from 7% to 22% by month during the irrigation season.

Environment Canterbury compared methods of estimating water usage when considering whether and how to determine naturalised stream flows[7]. The assessment highlighted the variability between methods of assessing crop water requirements. Actual use was consistently much lower than estimated demand and allocation for all methods.

---

[3] Taranaki Regional Council. 2020.

[4] Aqualinc Research Ltd, 2005.

[5] "Water Matters," Horizons Regional Council, accessed 3 February 2021 (Water Matters link).

[6] Harkness, M., 2009.

[7] ECAN Technical Report link

1.3 The Bay of Plenty regional context

The Regional Council manages 1,275 resource consents for take and use of water. Most consents are for groundwater (71%), but the largest by volume are from surface water. Box 2 and Table 1 shows current practices of water accounting by type of take. Meeting the requirements of the NPSFM will require that accounting practices become more robust. In addition to maintaining a freshwater accounting system, Regional Council is required to publish this information regularly in a suitable form, recording, aggregating and updating information on the freshwater take, the proportion for major categories of use, and the proportion of take in relation to the limit. Fresh water accounts must include non-metered, permitted, and unauthorised takes.

Current practices

- Surface water consents that directly affect groundwater (e.g. spring-fed ponds) are accounted for in groundwater.
- Surface water accounts tally the maximum allowed rate of take authorised by all resource consents in catchment.
- Consents for frost protection are separately accounted for.
- Takes from farm dams are generally accounted for according to the rate of take from the dam.
- Older groundwater irrigation consents without seasonal limits are assessed as seasonal for accounting purposes and the volume calculated by multiplying the daily volume by 85.
- Older frost consents without seasonal limits are assessed as seasonal for accounting purposes by multiplying the daily volume by 15.
- Older consents, for any purpose other than irrigation or frost, without an annual limit are assessed for accounting purposes by multiplying the daily volume by 365.
- Groundwater takes that affect surface water (e.g. shallow bore next to river) are accounted for according to the estimated effect, as informed by Bay of Plenty Regional Council (BOPRC) science team.

Box 2 Current freshwater accounting practices at Bay of Plenty Regional Council

Table 1 Summary of Bay of Plenty Regional Council water accounting practices

Authorised by Resource Consent	Authorised by s14 RMA (drinking water)	Authorised by Regional Plan - Permitted	Unauthorised
• Accounts show amount allocated (rate of take for surface water, volume for groundwater) • 61% of resource consents are metered and report • All new consents are required to telemeter • Most return water is not accounted back into system • Dams and diversions may affect flow, but not accounted for	• Volume estimated by Aqualinc report[8] • Number and location of takes unknown • Some resource consents include all farm use, or specifically mention stock drinking or domestic water = potential to double count • Not currently included in water accounts • Not metered	• Volume estimated by Aqualinc report • Number and location of takes unknown • Not currently included in water accounts • Not metered	• Programme to consent dairy shed in place • Dairy volume estimated in Aqualinc report • Anecdotal information suggests some horticultural irrigation is unconsented • Not currently included in water accounts

1.3.1 Surface water consents

Most surface water consents are for horticultural irrigation and frost protection, but the volume is dominated by commercial/industrial, municipal, and other takes (e.g. pumping floodwater back into streams, lake levelling etc.) (Figure 1). The pumping of floodwater and lake levelling are non-typical activities, and generally have little effect on water availability. The large-scale industrial water takes are mainly non-consumptive because the water is returned to the stream at the same or similar time and place. If the non-typical and industrial takes are excluded, approximately 60% of the volume is allocated for municipal purposes and 36% for horticultural irrigation, frost protection or pasture irrigation.

[8] Rutter H 2015

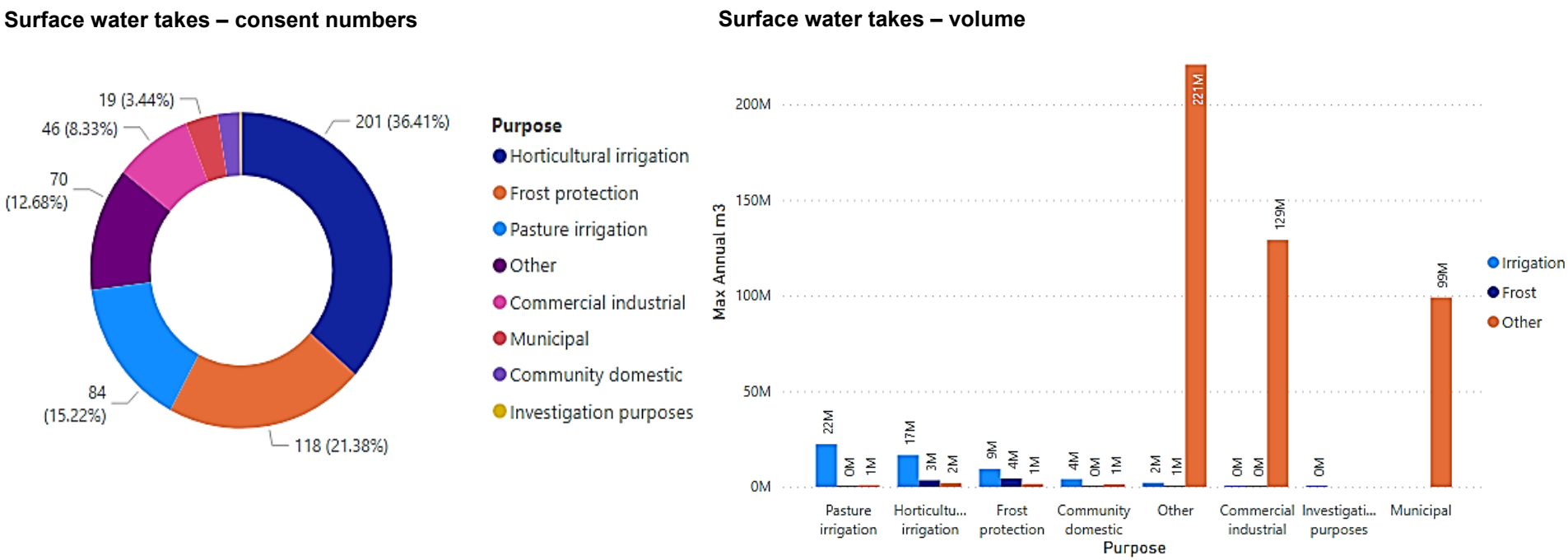


Figure 1 Surface water resource consents – use, purpose and annual volume allocated

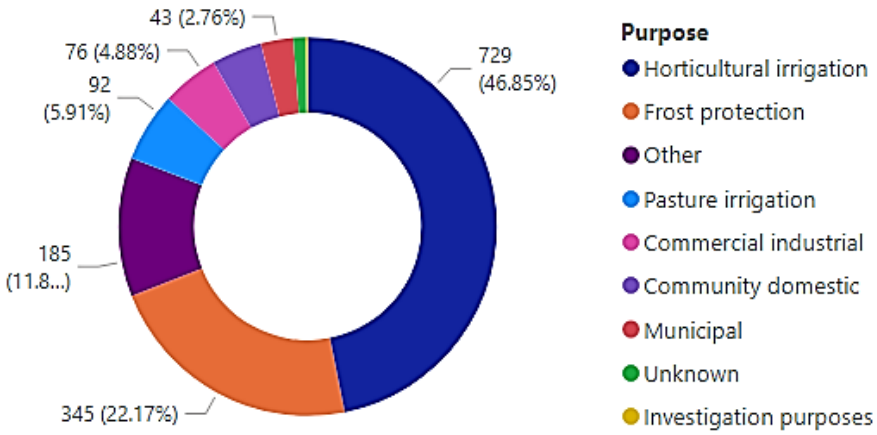
1.3.2 Groundwater consents

Groundwater presents a similar picture to surface water regarding the activities for resource consents but differs by volume. However comparatively little groundwater is allocated to non-typical uses or to commercial industrial uses. Consents to dewater are included in the analysis as they are considered to affect groundwater availability. Dewatering[9] consents may be unused for long periods. The relative volumes of groundwater allocated for horticultural irrigation, frost protection and pasture irrigation are higher than surface water, making up 55% of total groundwater volume across the region. Allocation for municipal use is significant at 27% of the total groundwater volume.

[9] Pumping water from ground for the purpose of keepin **Surface water takes – consent numbers** g foundations, quarries, mines, construction sites etc. from flooding

Excluded from Figure 2 is geothermal groundwater (i.e. fresh water warmer than 30ºC in the Tauranga Geothermal field). Regional Council has 187 active consents to take geothermal groundwater. About 30% of these relate to pool or space heating, and a further 40% to horticultural irrigation or frost protection. The water metering regulations exclude geothermal water takes, but they may be metered in accordance with resource consent conditions.

Groundwater takes – consent numbers



Groundwater water takes - volume

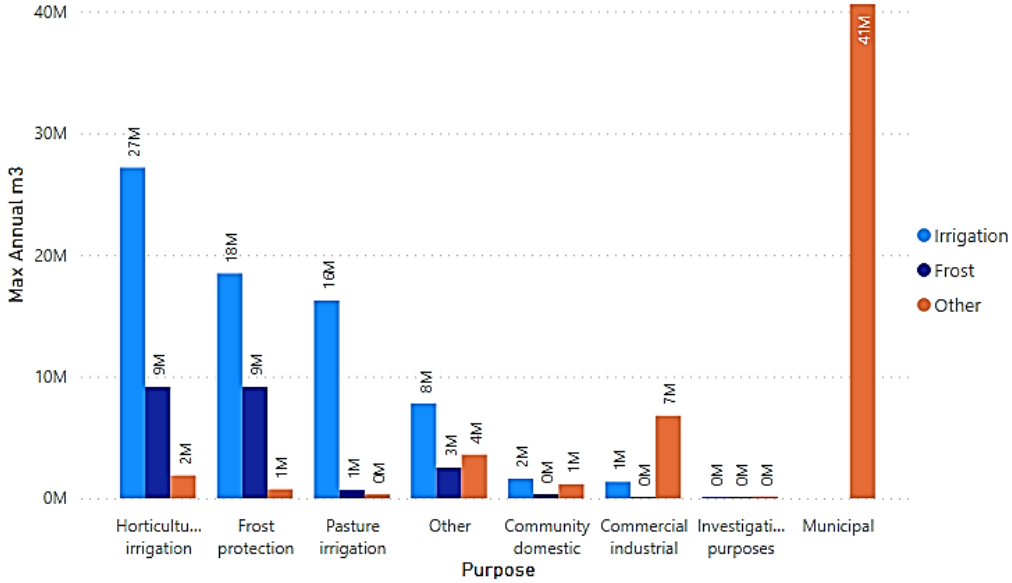
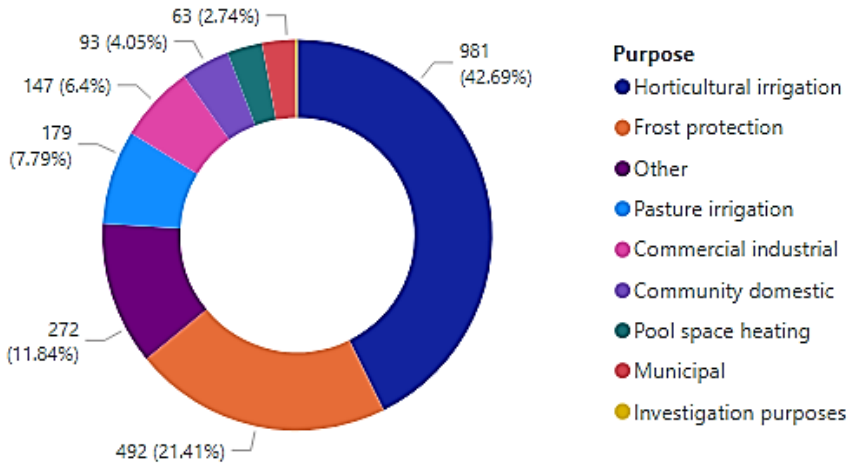


Figure 2 Groundwater resource consents – use, purpose and annual volume allocated

1.3.3 Surface and groundwater consents

Overall, the largest category of resource consents is for horticultural irrigation (43%) followed by frost protection (21%). Municipal and commercial/industrial consents tend to be small by number, but large by volume. Many consents have more than one use type (e.g. frost and irrigation) and appear in both categories. Overall, when non-typical allocation (other in Fig. 4) and the generally non-consumptive (surface water) industrial allocation is excluded, water allocation by volume is dominated by the rural land uses (pasture irrigation, horticultural irrigation and frost protection) and municipal use.

All water takes by purpose – consent numbers



All water takes - volume

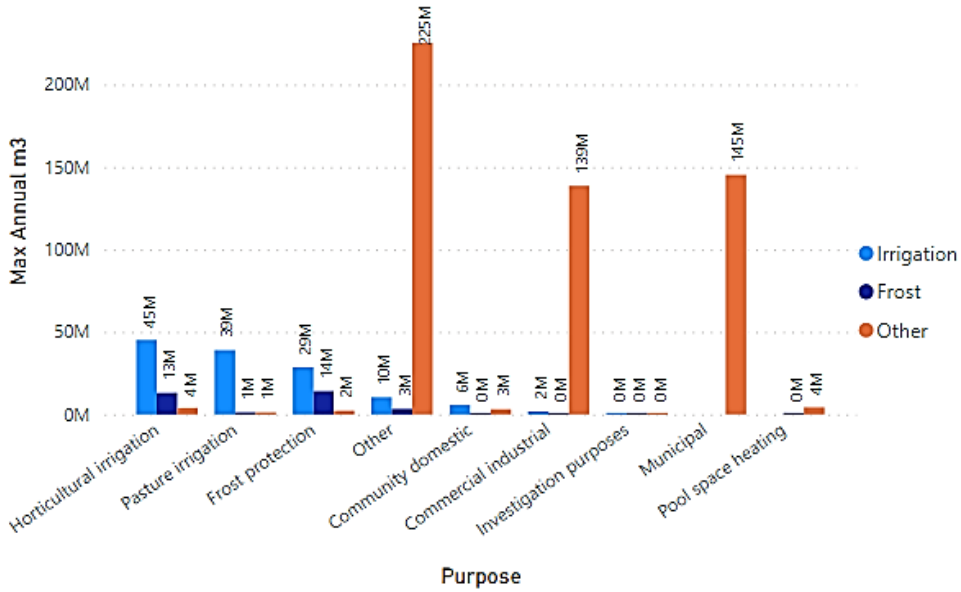


Figure 3 All resource consents to take water - use purpose and annual volume allocated

The consent information shown in Figures 1, 2 and 3, shows that the Regional Council has good high-level information about water allocation. Further refining this information is complex. Consents are subject to differing restrictions on location, purpose, volume, rate, time, and seasonality of take. For example, a use may imply seasonality (e.g. frost protection), but the consent may not stipulate seasonality. In situations where water is allocated to multiple purposes (for example frost protection and irrigation), the resource consent is counted in both categories. Determining the appropriate method to account for non-typical surface water activities such as pumping floodwater or lake levelling and taking account of the effect of dams (including hydroelectric dams) is complex.

Some water takes do not require consents or records. Unconsented takes can be small (e.g. domestic drinking water authorised under the RMA, or as a permitted activity in the Regional Natural Resources Plan), but they can also be relatively large (e.g. stock drinking water, illegal uses). Table 1 provides a high-level look at the authorisation of takes, showing the variation in recording requirements within and across take types.

A further complication to accurate accounting is the changes to consenting and allocation practices over time. Early resource consents, especially those that originate pre-RMA, have few requirements and restrictions. They may not specify the irrigation period, not require metering or efficiency measures and may be from dams, where Council has little information regarding their functioning. This makes determining allocation status difficult. The location, purpose, volume, rate, time, and season of application for each consent is necessary for assessing allocation status (i.e. over or under allocated) and identifying ways to improve and maximise allocative efficiency, including options for transferring consents. The Regional Council's accounting system is improving, but the underlying information it relies on was not designed to support temporal analysis of allocation or efficiency, or to be published regularly or easily provided to tangata whenua and external stakeholders.

Information gathered as part of the 2016 Region-wide Water Quantity Proposed Plan Change 9 to the Regional Natural Resources Plan[10] showed that approximately two-thirds of the region's streams with water allocated and some groundwater aquifers were allocated above the default limit. While there will be changes made to allocation limits and minimum flows to meet the NPSFM requirements and improvements in accounting methods, it is likely that many water resources will remain over allocated. The Regional Council is required to set out how it will phase out over allocation, so that take limits to meet environmental flows will be achieved targets for environmental outcomes will be achieved.

In 2015, the Toi Moana Bay of Plenty Growth Study[11] identified water as a key enabler to economic growth in the region. To support the Regional Growth Strategy and assist with implementing the NPSFM 2014, BOPRC contracted Aqualinc Research Ltd to assess freshwater opportunities and barriers to sustainable economic growth[12]. The research compared water supply and demand in the Water Management Areas and modelled a range of development scenarios. It concluded that under the current allocation limits (10% of $Q^5 7$[13] day for surface water and 35% of average annual aquifer recharge for groundwater) there would be a surplus of surface water and/or groundwater if irrigation and frost protection were based on reasonable and efficient use. Exceptions were noted in the Pongakawa and Waitahanui[14] catchments, where potential future needs may not be met from available surface or groundwater at the current limits.

Although Aqualinc Research did not analyse metering data, the authors found there was potential to reduce current allocation by applying a 'reasonable use test'. They noted that:

- [h]igh flows and volumes allocated for frost protection in particular need to be rationalised.
- If irrigation and frost protection consents are subject to reasonable use tests, there is no need for large-scale water infrastructure.
- Surface water use efficiency would be improved by allocating water based on reasonable use, implementing water user groups, and irrigation rostering.
- Many older consents are 'locking up' water needed for economic growth. Mechanisms to review consent conditions during their term should be explored to ensure allocations are efficient.

[10] Kroon, G. 2018.

[11] Ministry of Primary Industries (2015) Toi Moana Bay of Plenty Growth Study

[12] McIndoe I, Kashima A, 2018

[13] $Q^5 7$ – the mean 7-day flow that has a 20% (1 in 5) probability of occurring in any one year.

[14] Note that the regional default allocation limit does not apply to the Waitahanui stream.

2 Detailed sub regional and individual water use data analysis

To get more information regarding water use, water-metering data from three important Water Management Areas of the region was analysed. This allows us to have a more detailed look at use patterns and activities than would be possible if the whole region was analysed and may help inform decisions about allocative efficiency. Unless otherwise stated, use data relates to both manual and telemetered records.

2.1 Rangitāiki Water Management Area

The Rangitāiki Water Management Area (WMA) is a large catchment in the eastern part of the region. Two dams (Lake Matahina and Lake Aniwanawa), associated with hydroelectric power generation, are in the catchment. These dams are non-consumptive and are not shown in the diagrams below. However, the dams have a major effect on water availability, both above due to restrictions on increases to abstraction and below due to fluctuations in flow. Reducing the gap between allocation and use for irrigators remains an opportunity to increase benefits in both situations.

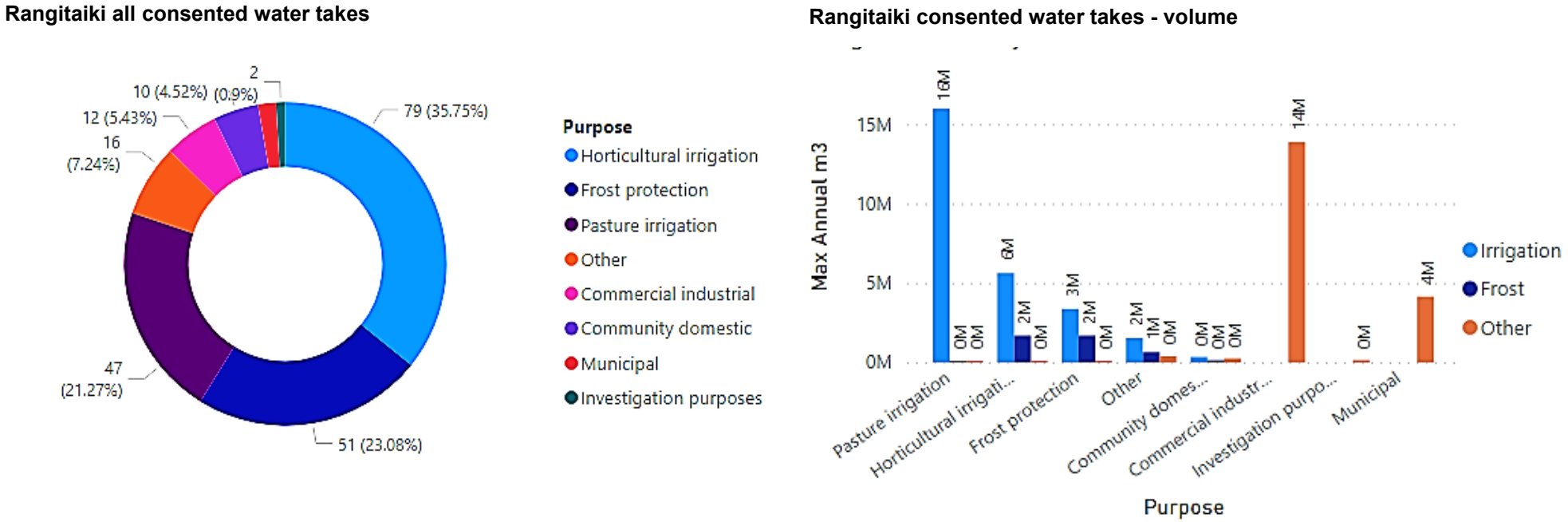


Figure 4 Rangitaiki WMA water allocation by consented activity and volume (groundwater and surface water). Consents with multiple purposes, are shown in each category.

Figure 4 shows that horticultural irrigation consents are numerically the largest category, with a relatively even split between pasture irrigation and frost protection (usually within a horticultural irrigation consent). Pasture irrigation dominates the volume allocated because the scale of pastoral farms is generally much larger than horticulture. The Rangitāiki WMA contains many of the region's irrigated dairy farms.

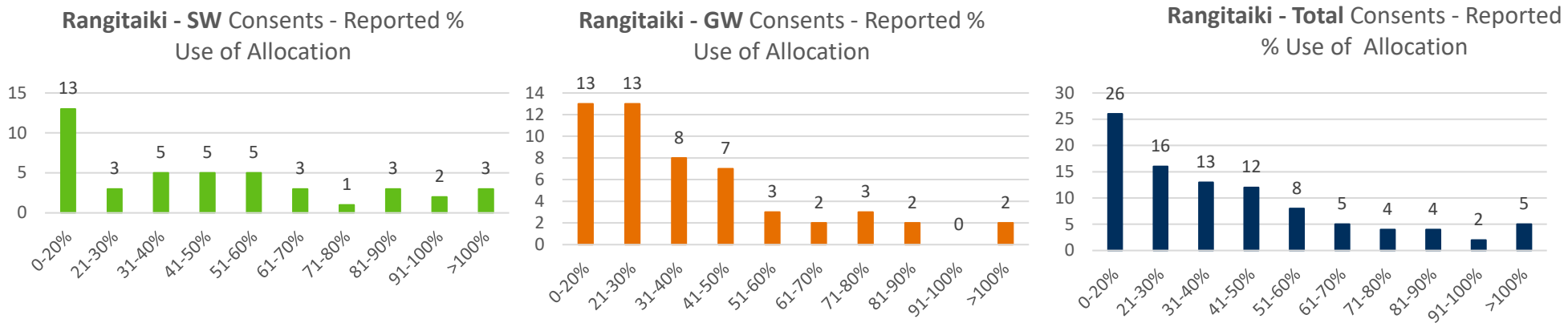


Figure 5 *Water use compared to consented allocation in Rangitaiki WMA 2019/20 water year (Surface water, ground water, total) Number of consents on vertical axis. Data refers to metered consents only.*

Figure 5 highlights the extent of unused allocation in the WMA during the 2019/20 irrigation year (1 July – 30 June) based on metering data. While it would be expected that consented users would use a high percentage of their allocation during an exceptionally dry year, analysis showed that 49% of groundwater consents and 37% of surface water users reported using between 0%-30% of their annual allocation (Figure 5).

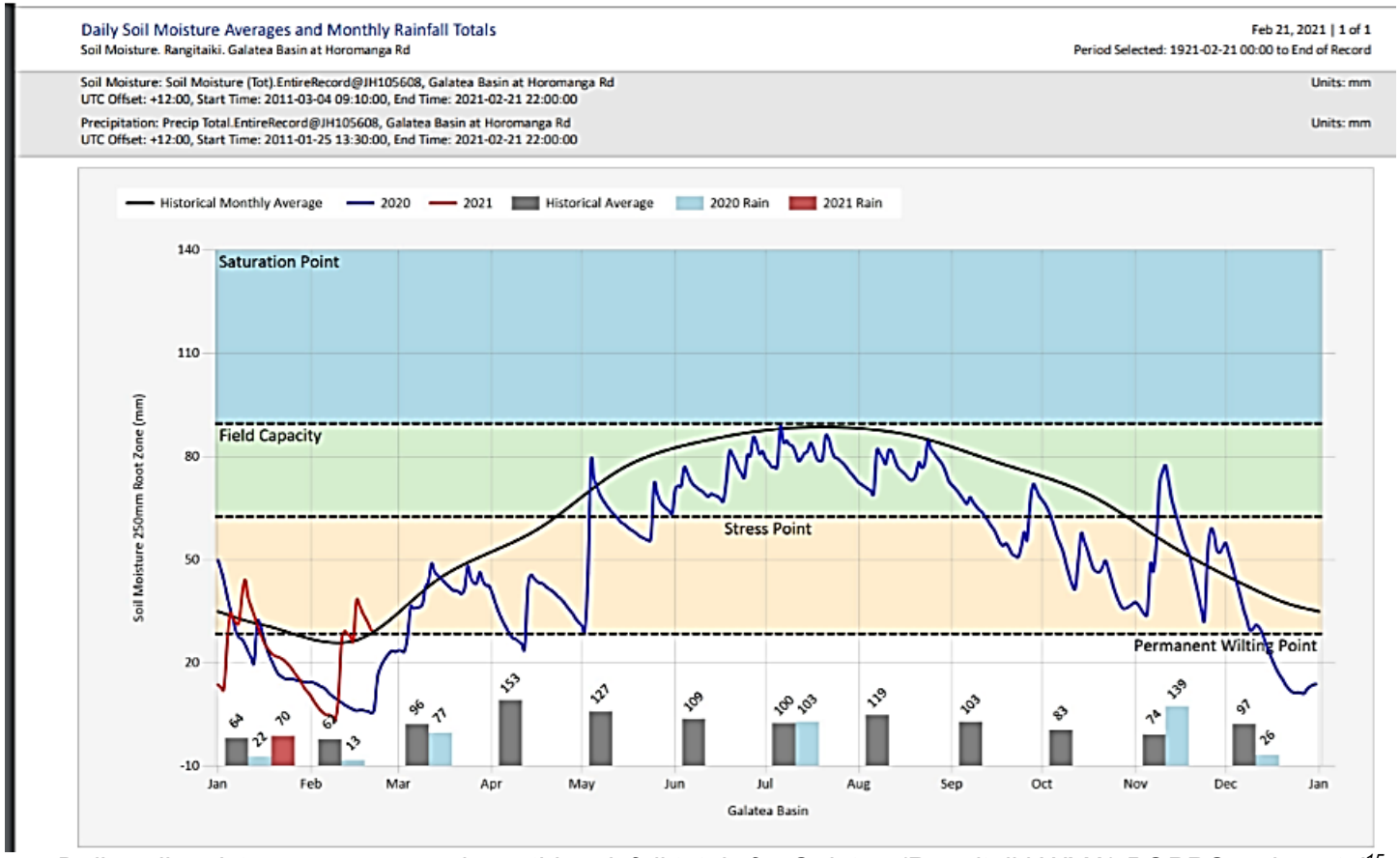


Figure 6 Daily soil moisture averages and monthly rainfall totals for Galatea (Rangitāiki WMA) BOPRC web portal[15]

It is interesting to further compare reported use with soil moisture and rainfall conditions in the area. Figure 6 shows rainfall and soil moisture conditions from January 2020. January and February were particularly dry months with rainfall below historical averages. Soil moisture levels were below permanent wilting point from early January until early March (the blue line) and did not get above stress point until May. Despite this, both pastoral and horticultural irrigators appeared to reduce volumes in March, with little irrigation occurring in April.

[15] https://envdata.boprc.govt.nz

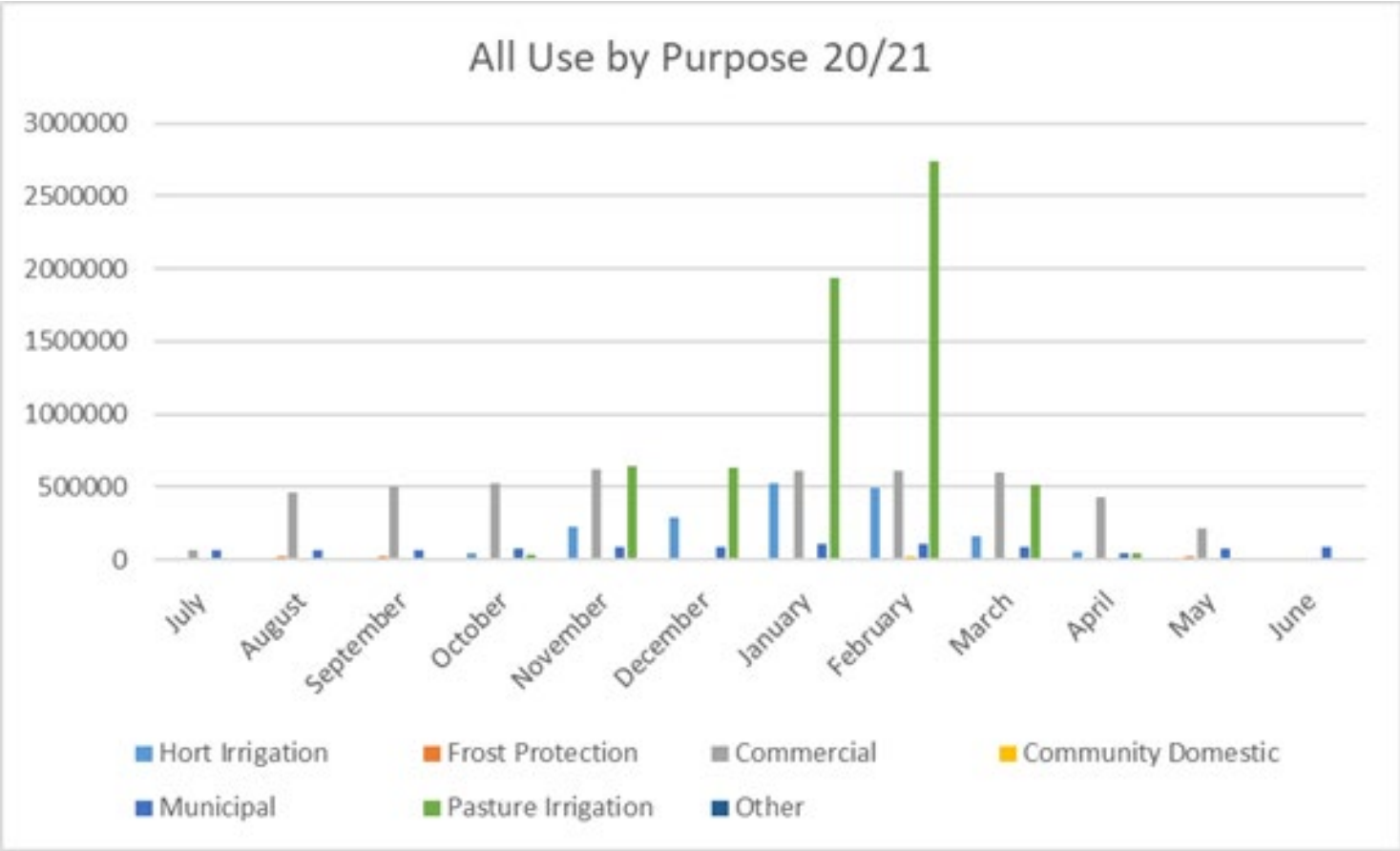


Figure 7 *Monthly water use (ground and surface) in Rangitāiki WMA for 2019/2020 water year by activity for the 2019/2020 water year. (telemetered only) It was assumed where the consent provides for frost and irrigation use, October to April is for irrigation and May to September is frost protection.*

The pattern of water use as well as the total volume is important to help understand opportunities for efficiency, especially in surface water. For both horticultural and pastoral irrigators, water use peaked in January and February. Figure 7 shows that pastoral irrigator's volumes in November, December and March were generally less than 20% of the peak. Horticultural irrigators showed a similar pattern, with shoulder months being around 50% of the peak. Industrial use shows a more consistent pattern, with a winter reduction.

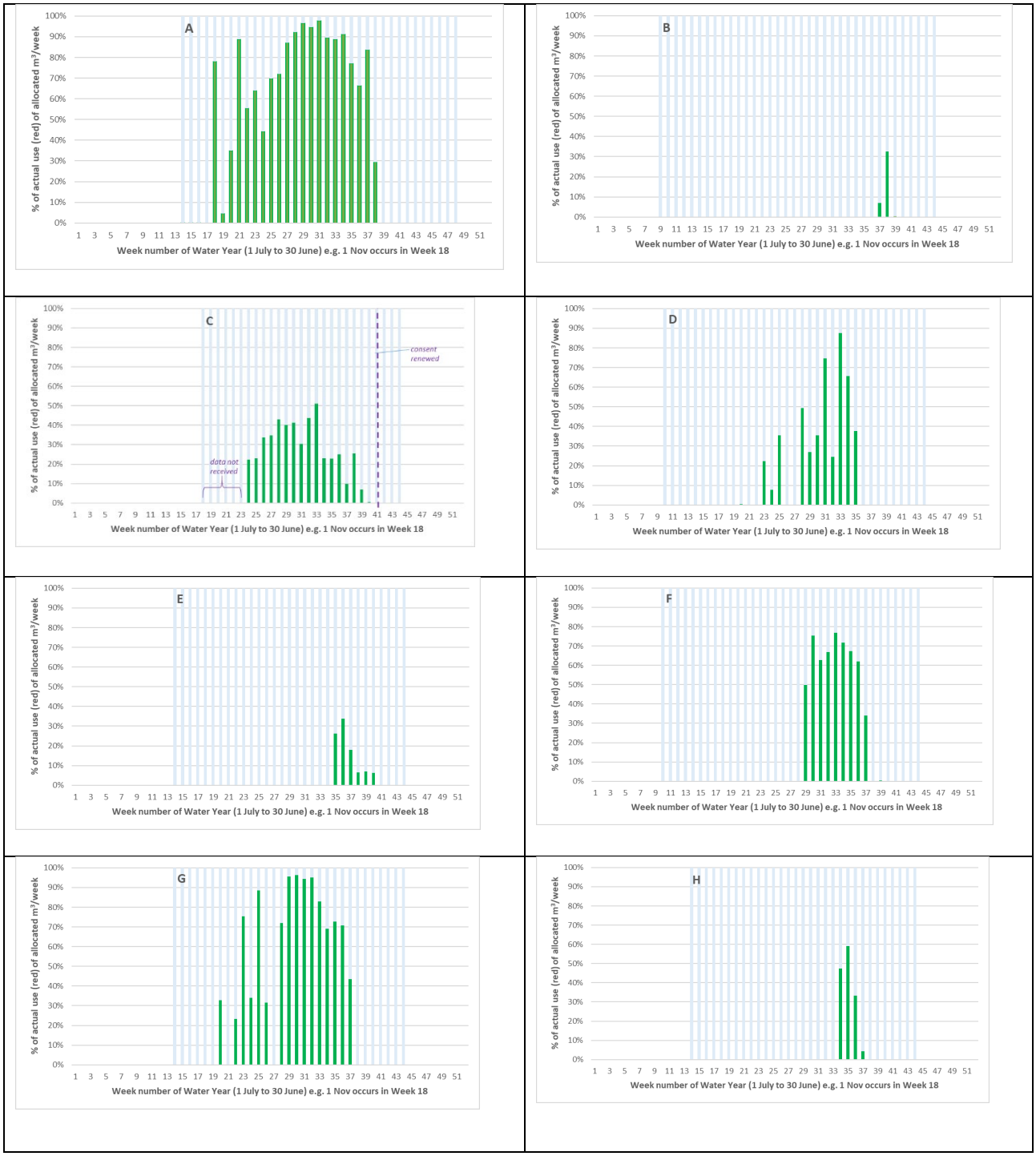


Figure 8 *Weekly water use compared to allocation for 8 pasture irrigators in Rangitāiki WMA. Green line = % of allocation reported as taken, blue line = allocation period.*

To determine the extent to which surface water was used at the peak of the season, telemetered data was analysed on a weekly basis for eight pastoral irrigators who provided quality reporting via telemetry (Figure 8). If most of the allocated surface water is used in the peak weeks, and most users have the same peak, there is little 'spare' surface water that could be made available to others, even if overall usage is low. Of the eight consents analysed on a weekly basis:

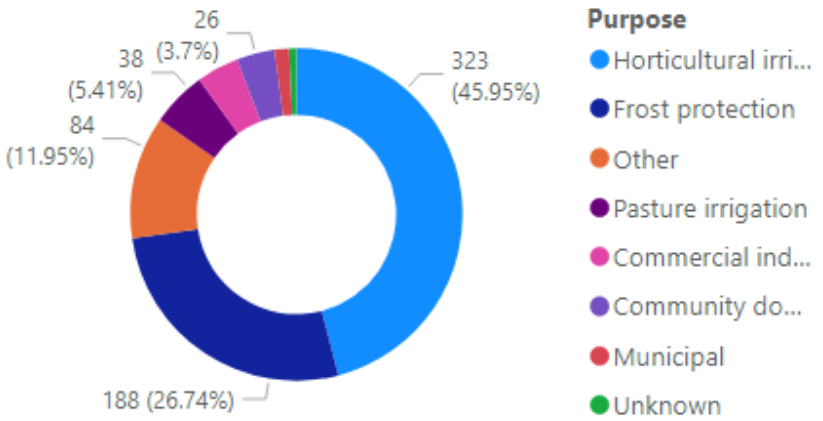
- Two used more than 90% of allocated volume in any single week
- Three only took water for 2–4 weeks
- Three regularly took more than 50% of their weekly allocation
- The peak take period was between weeks 29–35 (early January – mid February).

This indicates that while there is a significant peak in the taking of water for two summer months, utilisation in peak for most consented users is low. This confirms an opportunity to improve allocation efficiency.

2.2 Kaituna, Pongakawa and Waitahanui Water Management Area

The Kaituna, Pongakawa and Waitahanui WMA is in the heart of the kiwifruit growing area and supports highly productive dairy farms. The future Tauranga City Waiari stream water supply is also in the Kaituna catchment. Consumptive water allocation (by volume) is almost equally spilt between horticultural irrigation, municipal and industrial. Metering returns show that the dominant water use is for industrial purposes.

KPW all consented water takes



KPW consented takes - volume-

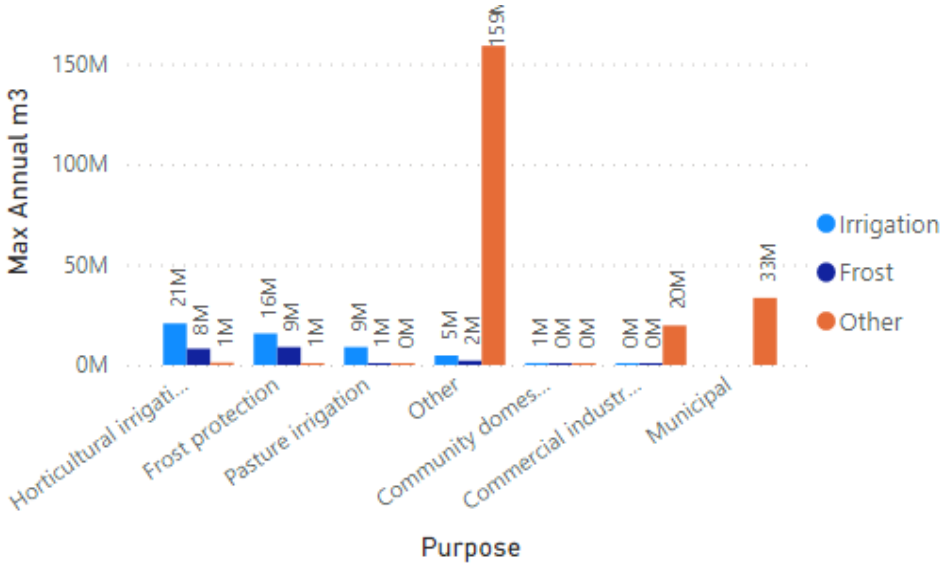


Figure 9 *Kaituna Pongakawa Waitahanui WMA allocation by consented activity and volume (groundwater and surface water). Consents with multiple purposes will be shown in each category.*

Figure 9 shows the number and percentage of consents by activity in this WMA. Flood control consents (non -typical use shown as “other”) for Wairakei Stream and Bell Road Pump Station – approx. 159M m^3. As this ‘use’ relates to getting rid of unwanted water rather than utilising water, it is excluded from further analysis. The industrial water use is at a constant level throughout the year.

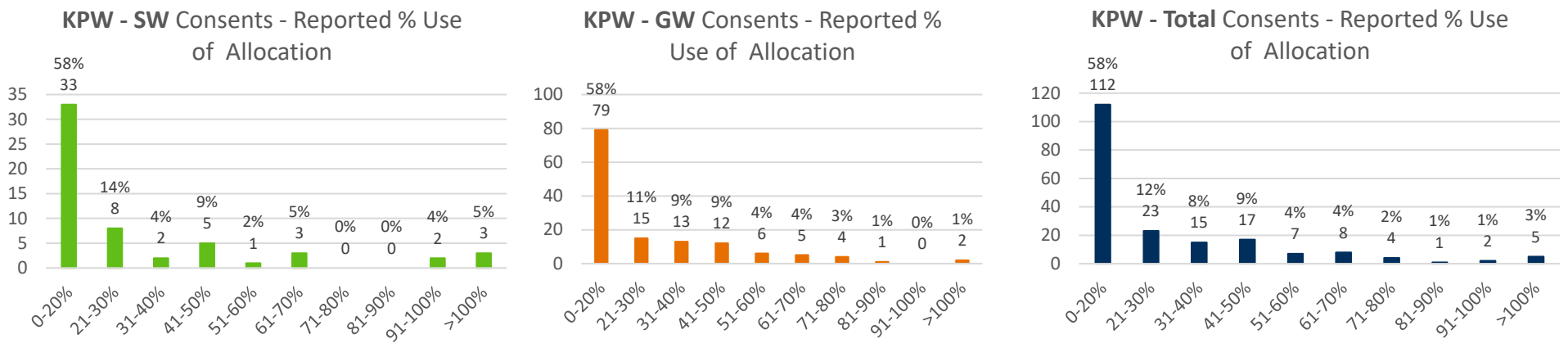


Figure 10 *Water use compared to consented allocation in Kaituna, Pongakawa Waitahanui WMA (Surface water, ground water, total) for 2019/2020 water year. Data refers to metered consents only.*

In a similar pattern to that noted in the Rangitaiki, Figure 10 highlights low levels of use compared to allocation by consent holders. The metering data shows that 69% of surface water users and 72% of groundwater users took 30% or less of their annual allocation. Only 13% of groundwater and 16% of surface water consent holders used more than half of their allocation.

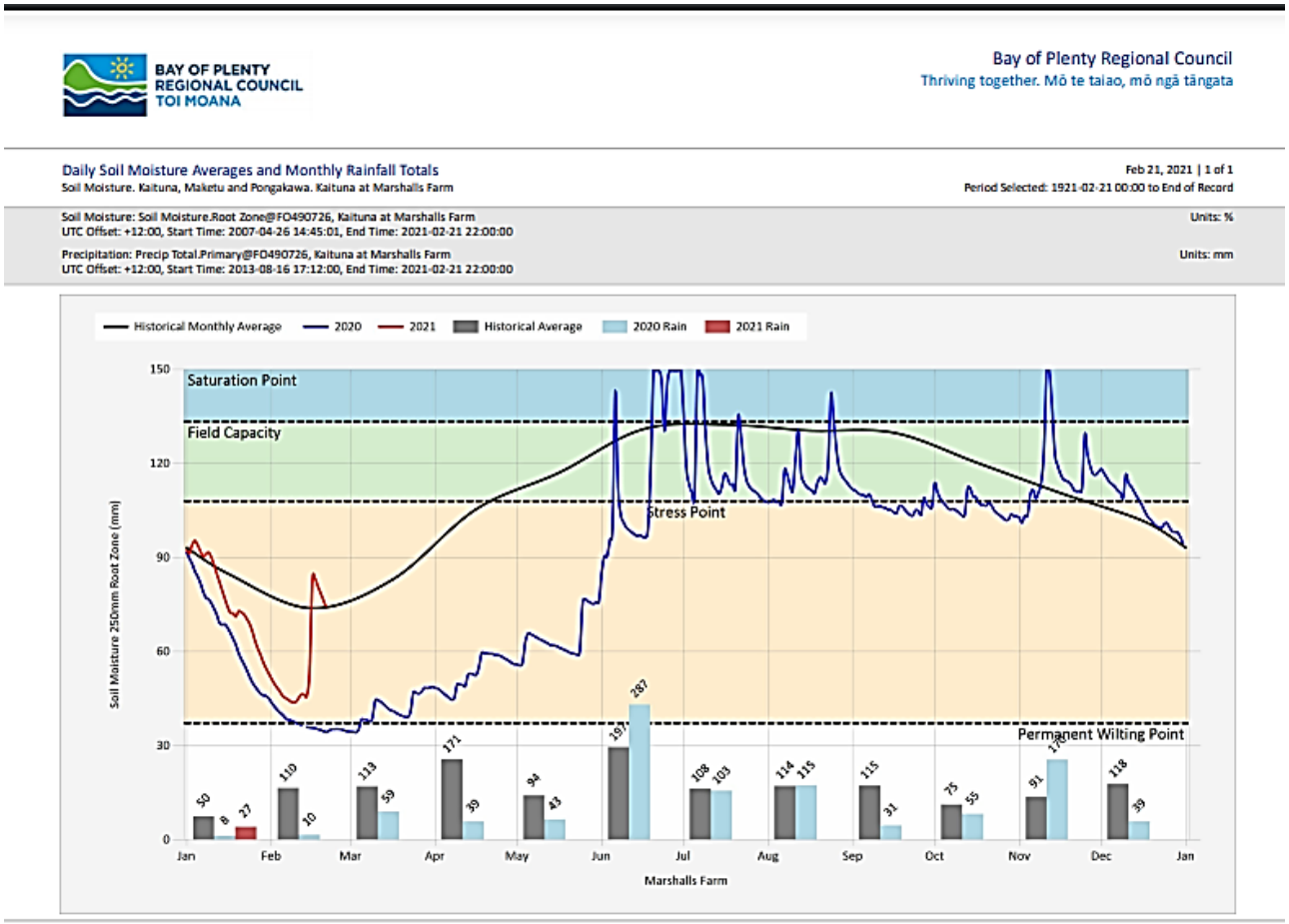


Figure 11 Soil moisture and rainfall data for Marshall's farm, Te Puke. BOPRC web portal [16]

Like the Rangitaiki WMA, the summer of 2019/2020 was extremely dry, with many streams reaching historical low levels. The blue line in Figure 12 shows January rainfall and soil moisture levels below historic averages, with soil moisture not getting above stress point until early June. Again, irrigators used only a small portion of their allocation, reducing volumes in March by more than 50% from the February peak.

[16] https://envdata.boprc.govt.nz

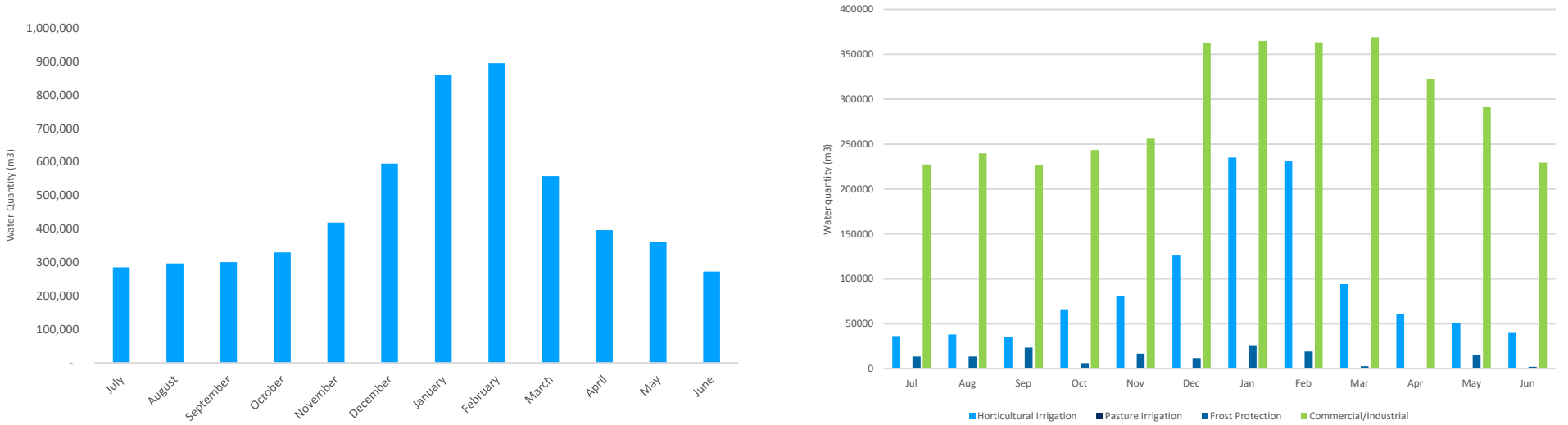


Figure 12 Monthly surface water use (telemetered only) in the Kaituna, Pongakawa Waitahanui WMA for the 2019/2020 water year and monthly surface water use by purpose for the 2019/2020 water year.

As noted in section 2.1, the pattern of water use as well as the total volume is important when identifying opportunities for efficiency. Reported monthly water use in the KPW WMA is dominated by a large industrial consent that takes water in a consistent manner across the whole year. Consequently, the pattern of water use is less peaky, although January and February remain the peak months. The metering returns from horticultural irrigation shows a few anomalies, with use recorded for every month of the year. This is likely due to mixed use consents, including frost protection or dairy shed use.

Horticultural irrigation is the next largest metered user of water in the catchment. The horticultural irrigation data appears somewhat confounded by frost protection or other uses, as it appears to occur at moderate levels throughout the year. Further analysis to clarify the actual purpose for which this water was allocated and used/not used, is needed. Like the Rangitaiki, January and February were the biggest months were the most water was taken, with March water use being less the peak months.

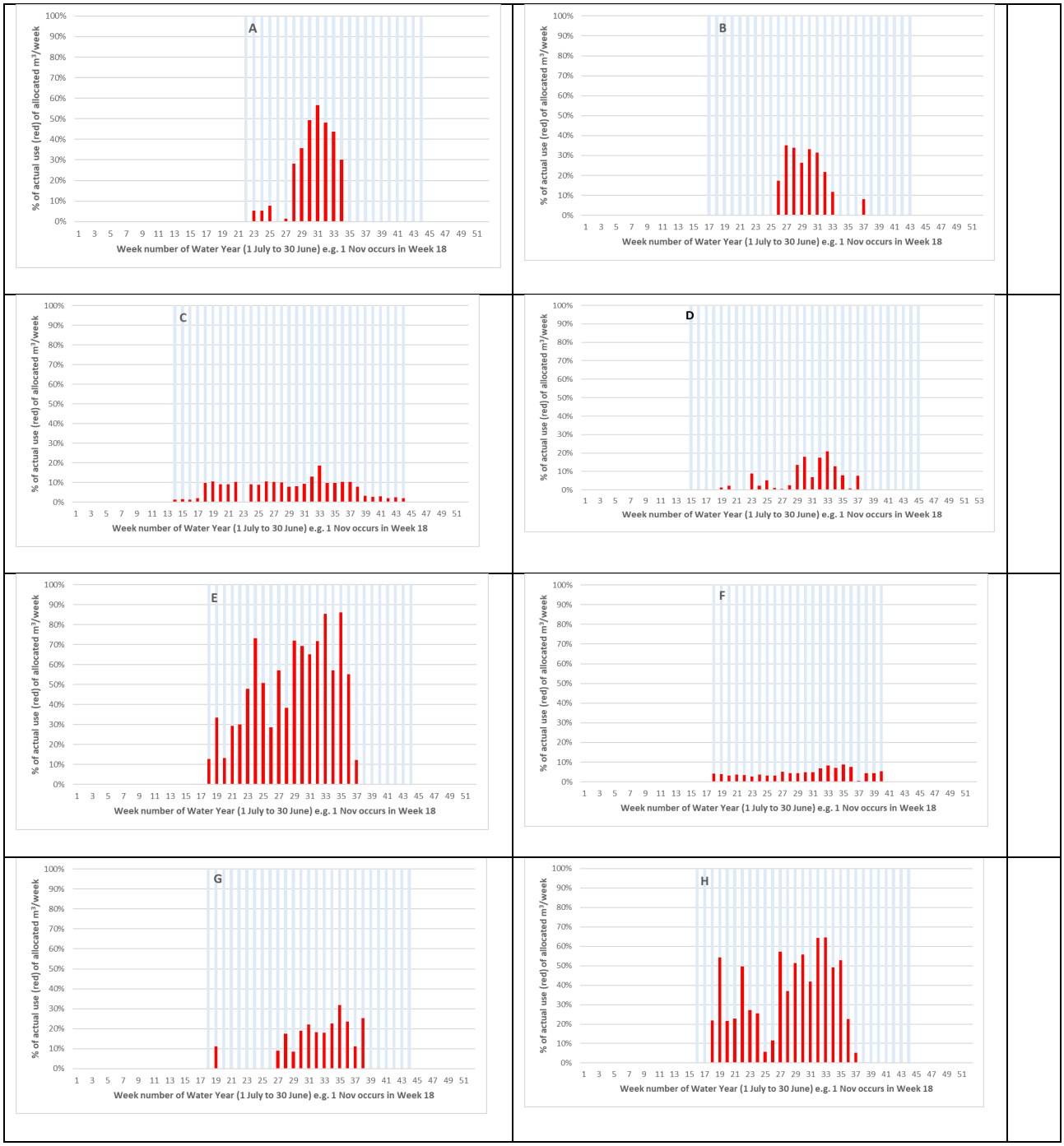


Figure 13 *Weekly water use compared to allocation for 8 horticultural irrigators in the Kaituna/Pongakawa/Waitahanui area. Red line = % of allocation reported as taken, blue line = allocation (Note consents A, D, F and G include pasture irrigation or dairy shed use)*

From the data shown in Figure 10, we saw that total seasonal water use was low (58% of users taking between 0%–21% of their allocated volume). A more detailed analysis of week-by-week usage (Figure 13) was carried out for eight horticultural/mixed use irrigators that reported by telemetry basis:

- Only one user ever exceeded 80% of allocated volume in a single week
- Three used more than 50% of allocated volume in a single week
- The peak take period varied for consent holders from week 27–35 (early January – mid February).

This again highlights the extent of allocated but unused water in the catchment and opportunities to improve the efficiency of allocation. After week 37 (end of February) very little water is used.

A large-scale industrial user (data not shown) had a relatively constant use pattern throughout the year, but weekly use never exceeded 50% of allocation in the 2019/20 water year. The scale of that allocation and the use pattern indicate considerable opportunity to achieve efficiencies. In addition, it appears that much of the water is returned immediately to the stream, creating an opportunity for nett use accounting.

3 Discussion – what are the opportunities to improve the efficiency of allocation and use?

3.1 Continuing improvement in the quality, coverage, and analysis of water use data for the region

Comprehensive and high-quality metering data is essential to a robust analysis of the efficiency of allocation and use. New and existing consents must meet the requirements of the Water Metering Regulations (Resource Management Measurement and Reporting of Water Takes Amendment Regulations 2020). The regulations require that all consents to take water are metered and reported, unless the rate of take is less than 5 l/s.

The NPSFM section 3.29 relates to freshwater accounting systems and requires Council to regularly publish information about freshwater accounting systems, including the amount of freshwater taken. This includes information about unmetered, non-consented, and unauthorised takes. To ensure that data is nationally recognised and comparable the Regional Council is working towards achieving the National Environmental Monitoring Standard for Water Meter Data (NEMS) QC600. Consent metering information from December 2020 indicated that of 1,067 cold groundwater and surface water takes:

- 257 (24%) reported via telemetry
- 396 (37%) reported via manual metering systems
- 414 (39%) were not captured by the metering regulations and did not report.

The requirements for recording and reporting water use in the Bay of Plenty region vary by activity type, and within that by consent. Permitted takes and takes under section 14(3)(b) are not required to record or report. Recent consents generally require telemetry with recording at 15-minute intervals and daily reporting.

Estimates of the volume or use periods for consented but unmetered takes, permitted takes and unauthorised takes were not included in this report, but will need to be included in future. At present, comprehensive analysis of the quantity of water used by activity type is not possible. This hinders the Regional Council's ability to improve allocative efficiency, phase out over-allocation, and avoid future over-allocation as required by the NPSFM 2020 (Policy 11). However, using available data highlights opportunities for improvements and establishes a starting point to measure future improvements.

A more detailed assessment, including more comprehensive data analysis and interviews with consent holders to identify the underlying reasons for particular use patterns could help identify the factors that inform the user's water use decisions. This would help identify opportunities for improvement, understand effects on water resources and gauge trends over time. At present, we do not understand why most irrigators choose not to use allocated water, even when soil moisture conditions are very low, or whether the higher users achieve better production.

3.2 Applying or developing tools and criteria to inform allocation decisions

The Bay of Plenty Regional Natural Resources Plan (RNRP) and Regional Policy Statement (RPS) have objectives, policies, and methods to achieve efficient water allocation. All resource consent applications are evaluated against these provisions. However, there are limited tools to determine efficient quantities. The Regional Council has adopted SPASMO to inform efficient irrigation requirements.

From the BOPRC website[17]:

Efficiency of use

All water take resource consent applications in the Bay of Plenty are assessed for the efficiency of the resource use.

When it comes to irrigation, the efficiency assessment model used is called "SPASMO-IR",[18] which stands for Soil, Plant, Atmosphere, and System Model - Irrigation. Under this model the crop type, soil data, irrigation area and climate station information are entered to determine the maximum recommended allocation on a weekly and seasonal basis.

SPASMO has been designed with an efficiency of application value of 80% and a probability of water volume requirements of 90%. The 80% efficiency value is the level used for the design of irrigation systems as a minimum requirement for varying types of sprinkler system. Using a probability of 90% assumes that nine out of every ten years, the irrigation amount will be sufficient to meet the crop's requirements. Consent conditions will limit weekly and seasonal volumes and include seasonal durations.

When it comes to frost protection, an allowance of 3 mm per hectare per hour is a general guide for application depths to protect crops from up to -3-degree frost. Water volumes are usually calculated on requiring water for 15 days each frost season, unless the applicant can provide property specific information that shows a trend of there being more than 15 days of frosts.

- The amount of irrigation the SPASMO model determines as efficient varies across the region dependant on the variables identified above. A comparison of volumes allocated (as informed by SPASMO) reported as used, showed low utilisation by most growers/farmers when considered on a weekly and seasonal basis during the dry 2019/20 irrigation season (see sections 2.1 and 2.2). SPASMO may benefit from a review to confirm that estimates reflect crop water requirements and grower/farmer practices. A more detailed investigation of a larger sample of growers/farmers would help to identify the reasons for the apparent over estimation of plant water requirements.

- This assessment of metering data aligns with the findings of a 2011 kiwifruit industry report "Water foot printing the Kiwifruit supply chain" undertaken by Landcare Research which investigated water use in the Kiwifruit supply chain.[19] The authors surveyed actual water use for 10 green kiwifruit growers in the Bay of Plenty across four seasons (2006/20007 – 2009/2010). Findings relating to irrigation water use include:

- As expected, irrigation was higher in areas experiencing low rainfall, although the correlation was poor.

- There was no correlation between irrigation and production in a single orchard. Factors such as soil type, microclimates and plant management have significant influence.

- Frost protection volumes were highly variable

[17] https://www.boprc.govt.nz/media/747252/4310-getting-consent-for-your-water-take-a4-info-sheet-web-use-only.pdf

[18] Green S 2011.

[19] Hume H and Coelho C 2011.

For frost protection of kiwifruit and other vulnerable crops, the Regional Council now typically allocates growers frost protection water volumes of up to 3 mm/ha/hour, allowing for frosts of up to 10-hour duration for up to 15 days per year for new orchards. Allocation for orchards seeking replacement consents is now based on historical frost water use. The Landcare Research report indicated that even on a frostier than average year, only 13% of water upon which BOPRC historically based allocation was used.

Since 2021, all new irrigation and frost protection consents have conditions that require the consent holder to link irrigation to the soil moisture content, manage leakage, undertake annual audits and report on various aspects of efficiency of use compared to allocation. Assessments of renewal applications now includes consideration of the previous usage pattern. If accurate data is collected and utilised, future efficiency assessments will be significantly enhanced.

Large-scale industrial water users (for example pulp and paper, dairy processing, wood, and meat processing) are allocated significant volumes of water in the region. Because these water users are relatively small in number but often very large in scale and unique in their activity, there are likely to be significant benefits to working with the industry to ensure the allocation and use remains efficient. Many are non-consumptive, with the water returned to the river following use. Current accounting practices may not capture the return water, although future accounts will address this, consistent with national guidance for freshwater accounting[20].

There are no records or metering data available for unconsented water use such as stock drinking, dairy shed (milk cooling and washdown), small-scale irrigation, unauthorised takes, and domestic use. Collecting more information about these takes would assist in determining efficiency of allocation and use. Nationally assessments of efficient water use in the dairy industry have been undertaken[21], and could inform assessment of efficiency.

Municipal water allocation is the dominant category of consumptive water allocation in the region. Supplying drinking water is a statutory obligation of local councils. The NPSFM 2020 sets out a hierarchy of obligations under the concept of Te Mana o te Wai that prioritises the health and well-being of the water body and freshwater ecosystem. Secondly, the hierarchy identifies the health needs of people (such as drinking water) and thirdly, the ability of people and communities to provide for their social, economic, and cultural well-being. The special characteristics and priority afforded to municipal use requires a long-term approach with allowance for growth in demand. Although it might be expected that municipal suppliers have ‘banked’ water to meet their future responsibilities, comparison of allocation with use showed that approximately half of allocated water is used, higher than other categories assessed.

Determining the efficient volume for municipal supplies is dependent on several variables. Some municipal supplies are mainly non-domestic in nature - including industrial, commercial and irrigation or agricultural needs while others are more focussed on domestic use. This report has not attempted to determine efficiency of use or determine the end use of municipal supplies. The future plan change presents an opportunity to create a robust Water Management Plan for municipal water supplies and could drive a ‘best practice’ approach to improve efficiency of allocation and use.

[20] Ministry for the Environment Guide to freshwater accounting.

[21] Higham, C.D. 2017

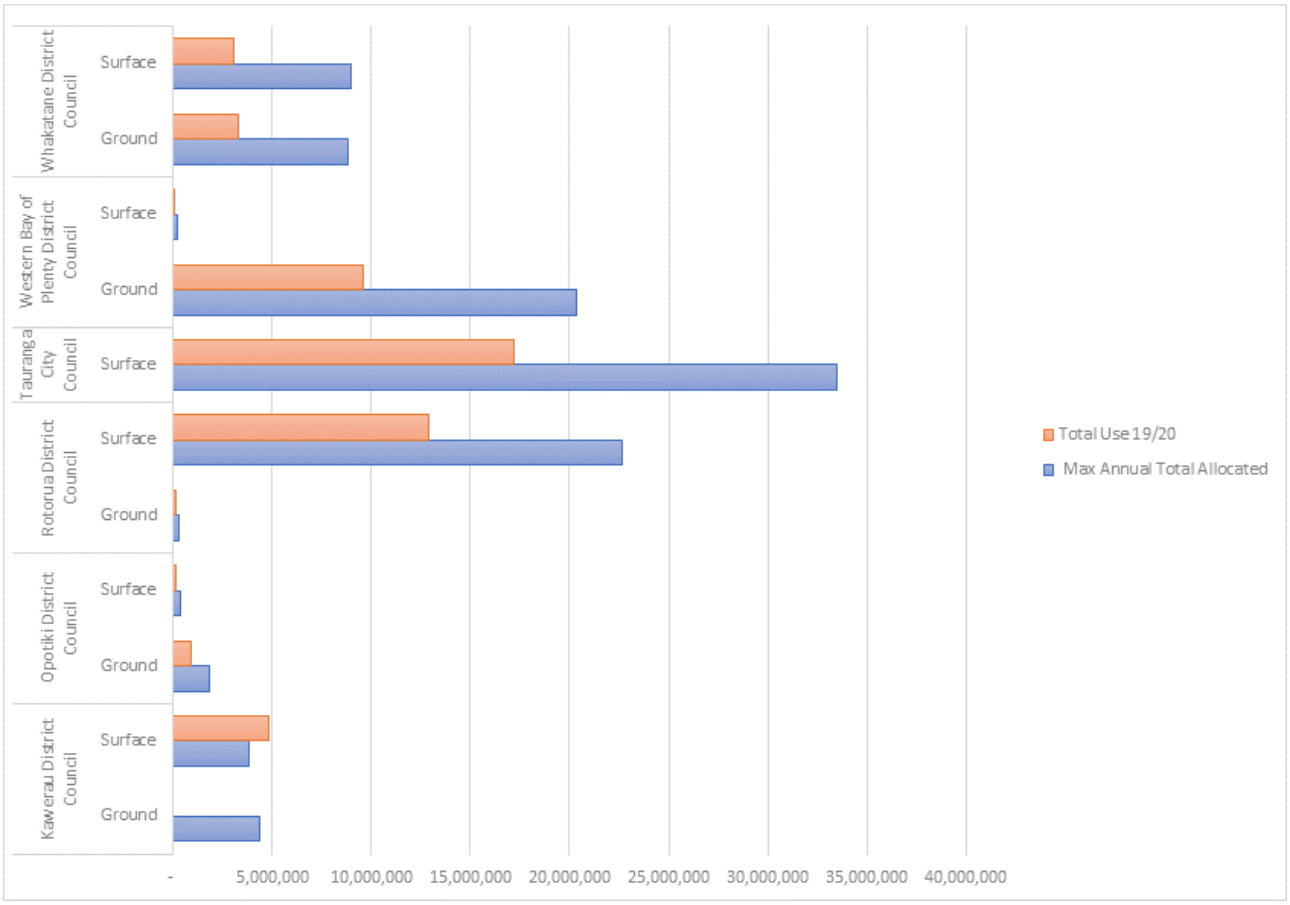


Figure 14 Summary data relating to municipal water allocation in use. Figures relate to m^3/year.

This data shows that approximately 50% of water allocated to municipal supply was used during the 2019/2020 water year.

3.3 Ensuring that the allocation remains efficient over time.

While obtaining comprehensive data on the full extent of unused allocation is difficult, an assessment of metering data from 646 water consents during the 2019/2020 water year revealed that 14% reported zero use and 44% used less than 20% of their allocation. When surface water was considered separately, the use figures were even lower – 50% used less than 20% of their allocation. This represents a low standard of efficiency but is not inconsistent with reports from other regions.

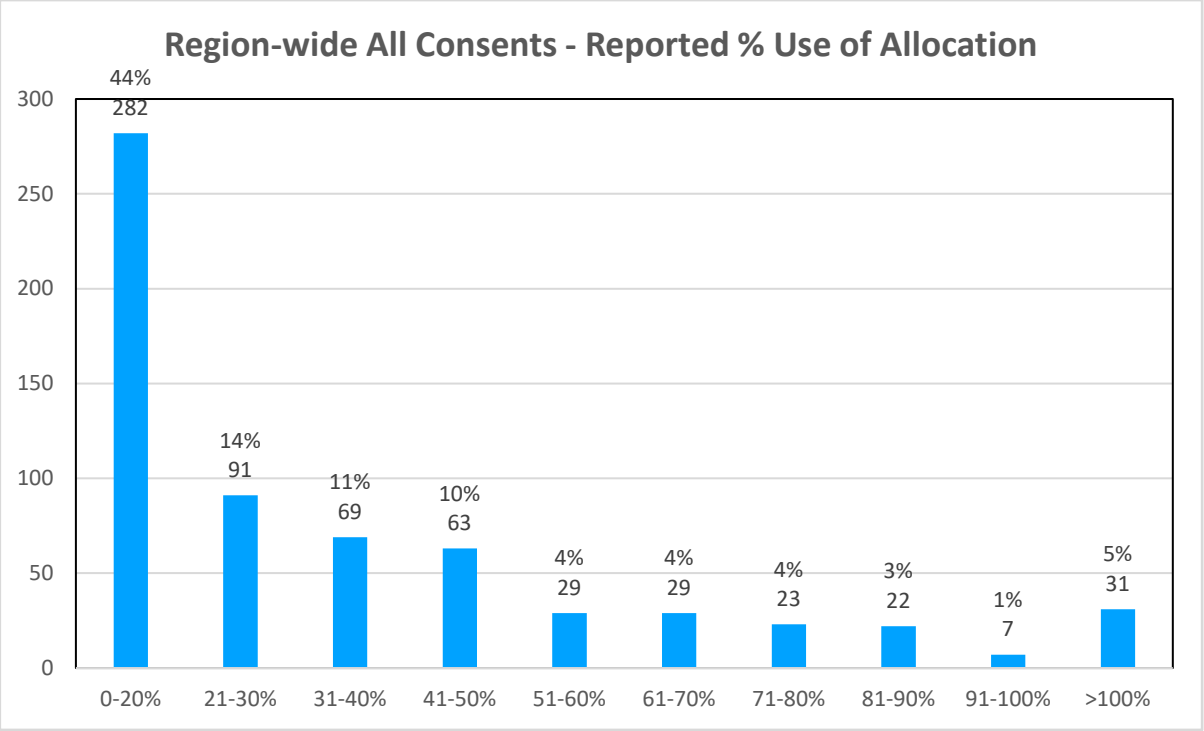


Figure 15 Region-wide metering data of water use compared to allocation Bay of Plenty

In 2019, the Regional Council sought feedback from growers and farmers regarding unused water allocation. Existing consent holders expressed confidence in the current regime and did not see the need for change. Tension was noted between current consent holders and those without water. Existing rights holders wished to retain their allocation for reasons of future value and flexibility. They felt that the normal consent expiry process would free up allocation in the future. They sought assurance from Regional Council that all users (including municipal and industrial) would be treated similarly if consents were reviewed to reduce volumes.

Central to the problem is that there are no real incentives to a water user to minimise the amount of water they seek, or to give up water they are allocated but no longer require. Existing rights holders maximise their future opportunities by retaining access to as much of the resource as possible. When the resource is fully allocated, unused or 'banked' allocation blocks newcomers' access. Ensuring the allocation remains efficient over time requires active intervention or incentives. This may include consent review and/or enhancing the ability to transfer water to others, either temporarily or for the remaining duration of the resource consent.

In the Bay of Plenty, almost half of resource consents to take water were granted prior to the RMA. The circumstances under which these permits were granted resulted in the maximum term of 35 years being applied, with expiry in 2026. As time has passed, it is probable that many of these permits are inefficient.

Consent review may be appropriate to ensure that the activity has been established as indicated in the resource consent application, that the infrastructure needed to take and use the water is in place and that the activity is current.

3.4 Recognising the importance of the rate, time, and seasonality of takes for surface water

The critical factor when assessing the allocation status of surface water in the Bay of Plenty is the rate of take as allocation is assessed as the sum of maximum daily rates

(stacking the rates of takes). Resource consents with an allocation rate higher than that required to achieve the full daily volume lock up water that is unavailable to other users. Water users often prefer the flexibility, convenience, or savings through use of off-peak electricity of being able to take a large volume in a short time. Some users have infrastructure that can't easily operate at a lower rate of take.

'Stacking' rates of takes assumes that all will operate at the same time and there is no lag time to a downstream location. Where multiple high rate, low volume takes are spread across a catchment and managed by separate individuals, and when data shows that few actually use their full allocation, this is a very conservative assumption. Waikato Regional Council accounts for surface water takes in the Waikato and Waihou rivers as if they operated over 24 hours.[22] The report noted that '*the size of the river buffers against any change in levels and velocity as a result of averaging over 24 hours*." Northland Regional Council averages some surface water takes over a 24-hour period for accounting purposes. Horizons Regional Council set allocation limits as a daily volume, thereby averaging the rate of take across 24 hours[23].

An analysis of telemetered surface water takes in parts of the region showed a range of between 1 hour 15 minutes and 24 hours and an average of just over 14 hours to achieve full volume at the allowable pumping rate. In addition, it appears that some consent holders do not utilise the allowed rate of take, even when taking near the daily volume limit. Where practical, better alignment of the rate of take with daily volume allowed is a simple way of improving efficiency. Effects of rates of take at the point of take can be addressed in consent conditions.

Rostering of takes is one way that multiple high-rate low volume takes can achieve improved efficiency. It requires a high level of management and compliance input to ensure that users are co-ordinated and lag times (e.g., a take 3 km upstream takes time to affect flow downstream) are considered. It maybe suited to small rivers with a small number of large takes in proximity.

Alternatively, a 'reality' factor based on the number of takes and the volume enabled compared to the 24-hour volume could be applied. Such a decision would need to be made at a local catchment level, to enable the various characteristics to be considered. Averaging, rostering and the application of a reality factor may increase the reliance on monitoring and enforcement of the minimum flow compared to stacking, but better reflect the reality of the likelihood of abstractions causing flow to fall to the minimum. Irrespective of how allocation is tallied, the taking of water should always stop before it causes the minimum flow to be breached.

Secondary allocation of surface water can make more water available for taking at times when stream flows are higher, while not affecting the reliability of primary flow consent holders or the minimum flow. Various methods of allocation exist – sharing of water between the stream and out of stream users or a block of water available when flow reaches a particular flow. Secondary consent holders must stop taking water before the stream flow reaches a level that primary users would have their volumes reduced. Secondary allocation is potentially suitable for uses such as frost protection or where the consent holder has an offline storage dam or can cope with extended periods of no taking. Bay of Plenty Regional Council partially uses secondary allocation for frost protection because surface water for frost protection is not included in the main accounts and sometimes excluded from consideration of default limits. Formally establishing secondary allocation limits and accounts is required to manage secondary allocation.

[22] 2008 Proposed Waikato Regional Plan Proposed variation no. 6 Water allocation. Appendix 2

[23] Pers comm Raelene Mercer Senior Environmental Scientist Horizons Regional Council

Managing water accounts monthly or on a seasonal basis will highlight times when water is available, either for taking for storage or for uses such as frost protection that occur outside of the high demand period.

3.5 Understanding the effects of dams, diversions and the relationship between ground and surface water

While most surface water takes are directly from a river or stream and are correctly accounted for according to the rate of take, there are circumstances when further consideration of how the take affects flow is required. This includes takes from dams or ponds on watercourses that may or may not be ephemeral. A student project identified many dams in the Western Bay of Plenty area. Understanding the locations and functioning of ponds/dams is important to accurate water accounting.

Some groundwater water takes significantly affect stream flow and maybe accounted for as surface water and vice versa. Ensuring that these takes are correctly assigned to the appropriate resource is important.

3.6 Establishing water user groups, enhancing the transferability of water or building water storage

Water user groups, transferring water between users or to new users and installing storage are often identified as opportunities to improve efficiency. There are no Council supported water user groups in the Bay of Plenty, although some group supply schemes (via either municipal supply or local people working together) operate. There are efficiencies in-group use, as multiple users will tend to result in a spread pattern of abstraction and the group can apply conditions that require users to work together. Future implementation of minimum flow requirements for surface water may lead to water users working together to roster use to avoid breaching minimum flow requirements.

The issue of transferring water to new users (other than via property sale) was discussed during withdrawn Proposed Plan Change 9 hearings. Significant concern was raised by tangata whenua and the general farming community about ‘water barons’ and about selling water and equity. In addition, transfer could lead to ‘paper over allocation’ becoming actual use where there is significant levels of unused allocation now. However, transfer is an opportunity to improve efficiency. The NPSFM requires regional councils to include criteria for deciding applications to approve transfers of water permits in regional plan(s).

In response to water shortages, water users often identify the construction of dams as a solution. The Aqualinc study[24] found that in general, large-scale storage was not required if efficiency of allocation and use was improved. However, in future, when minimum flows for surface water are more clearly identified and given effect, users may benefit from farm scale storage to improve reliability. Better data availability would better inform future decision making regarding these opportunities.

[24] McIndoe I, Kashima A 2018.

4 Conclusions

Most of the water allocated by resource consent in the Bay of Plenty appears to be not used, even during very dry seasons. While there will always be a gap between allocation and use, the extent of non-use of water allocated by resource consent highlights the opportunity to improve the efficiency of allocation.

The Regional Council's water allocation consent and water use recording systems are continuing to improve, as old resource consents expire, and new standards are applied. These improvements, together with comprehensive assessments of data and other opportunities identified will enable the Council to deliver its requirements under the NPSFM to improve and maximise the efficient allocation of water and encourage efficient use.

References

Aqualinc Research Limited 2010. Update of Water Allocation Data and Estimate of Actual Water Use of Consented Takes 2009-10. Bay of Plenty Regional Council internal document.

Bay of Plenty Regional Council website information for consent applicants -Getting consent for your water take

Dobson, J. (2015). Environment Canterbury Regional Council. Technical Report Investigations and Monitoring Group – Naturalising flows and estimating water abstraction in Canterbury Report No. R15/124

Environment Waikato Technical Report 2005/10. Assessment of Improvements to Environment Waikato's Water Allocation Processes and Procedures Prepared by Aqualinc Research Ltd November 2004 ISSN: 1172-4005

Green, S. (2011). The SPASMO-IR tool to determine reasonable water use for the Bay of Plenty region. A report prepared for Bay of Plenty Regional Council, SPTS No. 5908, August 2011.

Harkness, M. (2012). Flow naturalisation for six Hawkes Bay Catchments: Tutaekuri, Ngaruroro, Waipawa, Tukipo, Tukituki and Maraetōtara. Report. Prepared for Hawkes Bay Regional Council.

Higham, C.D. (2017). Water use on pastoral dairy farms in New Zealand. An analysis of measurements, predictions and water footprinting

Horizons Regional Council accessed 3 February 2021. Water Matters

Hume, H. and Coelho, C. (2011). Assessment of the water footprint of fresh kiwifruit: methods and scoping Final Report. Contract: MAF POL 0910-11522. Landcare Research

Kroon, G. (2016). Assessment of surface water availability and estimates of current allocation levels Version 1.2 December 2018

MBIE and MPI (2015).Toi Moana Bay of Plenty Growth Study Opportunities Report May 2015

McIndoe, I. Kashima, A. (2018). Freshwater Constraints to Economic Development Bay of Plenty Regional Council, 1. Aqualinc Research Limited

Ministry for the Environment A Guide to Freshwater Accounting under the National Policy Statement for Freshwater Management 2014

National Policy Statement for Freshwater Management 2020

Resource Management (Measurement and reporting of water takes) Amendment REgulations 2020

Rutter, H. (2015). Assessing unconsented or permitted water use in the Bay of Plenty region. Bay of Plenty Regional Council. Aqualinc Research Limited

Taranaki Regional Council 2020. Irrigation water compliance monitoring programme Annual report 2019 – 2020

Waikato Regional Council. 2008. Proposed Waikato Regional Plan Proposed variation no. 6 – Water allocation. Hearings Committee version. Analysis of alternatives, benefits and costs under s32 of the Resource Management Act 1991.