Action for healthy waterways in the Bay of Plenty: economic impact on the agriculture sector and commentary

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1. Introduction

In 2019, the Bay of Plenty Regional Council (BOPRC) assessed the economic impact, for the Bay of Plenty agriculture sector, of five of the proposals set out in the *Essential Freshwater: Action for healthy waterways* discussion document[2] (Ministry for the Environment, 2019; Bermeo, Carter, Dare, & Barns, 2019). The aim of this was to assist with assessment of such costs across the country and in turn inform submissions and support the Regional Sector. Where possible, this paper summarises and updates that assessment, and provides general commentary about the final decisions announced on 28 May 2020 (Ministry for the Environment, 2020; New Zealand Government, 2020), including their anticipated environmental benefits.

The full range of costs and benefits of implementing the freshwater regulations and National Policy Statement for Freshwater Management 2020 are much broader, but have not been comprehensively assessed. For example, implications for BOPRC, ratepayers and other sectors are not considered here.

The paper assesses the proposed farm planning and final stock exclusion requirements in some detail. Brief comments are made about restrictions on rural land use intensification, nutrient attributes, the new *E. coli* attribute (for swimming sites during the bathing season), and the input limit on synthetic nitrogen fertiliser.

The regional context for these policies is described in section 2. Section 3 explains each of the proposals and/or final decisions, assesses their impacts where possible and/or provides commentary. Section 4 provides a summary table, discussion and overall conclusions.

2. Regional context

As an initial step in the process to implement the National Policy Statement for Freshwater Management (NPS-FM), BOPRC established nine Water Management Areas (WMAs) across the region (Figure 1).

2.1 Water quality

Based on attributes in the 2017 version of the NPS-FM, river water quality in the Bay of Plenty is generally good, relative to other regions, due largely to the significant extent of native and exotic forestry, which make up 69% of the region's land area.

Carter et al. (2018) describe in detail the results of water quality assessments across the region, up until 2018. In summary, no river and stream long term monitoring sites failed bottom lines under the

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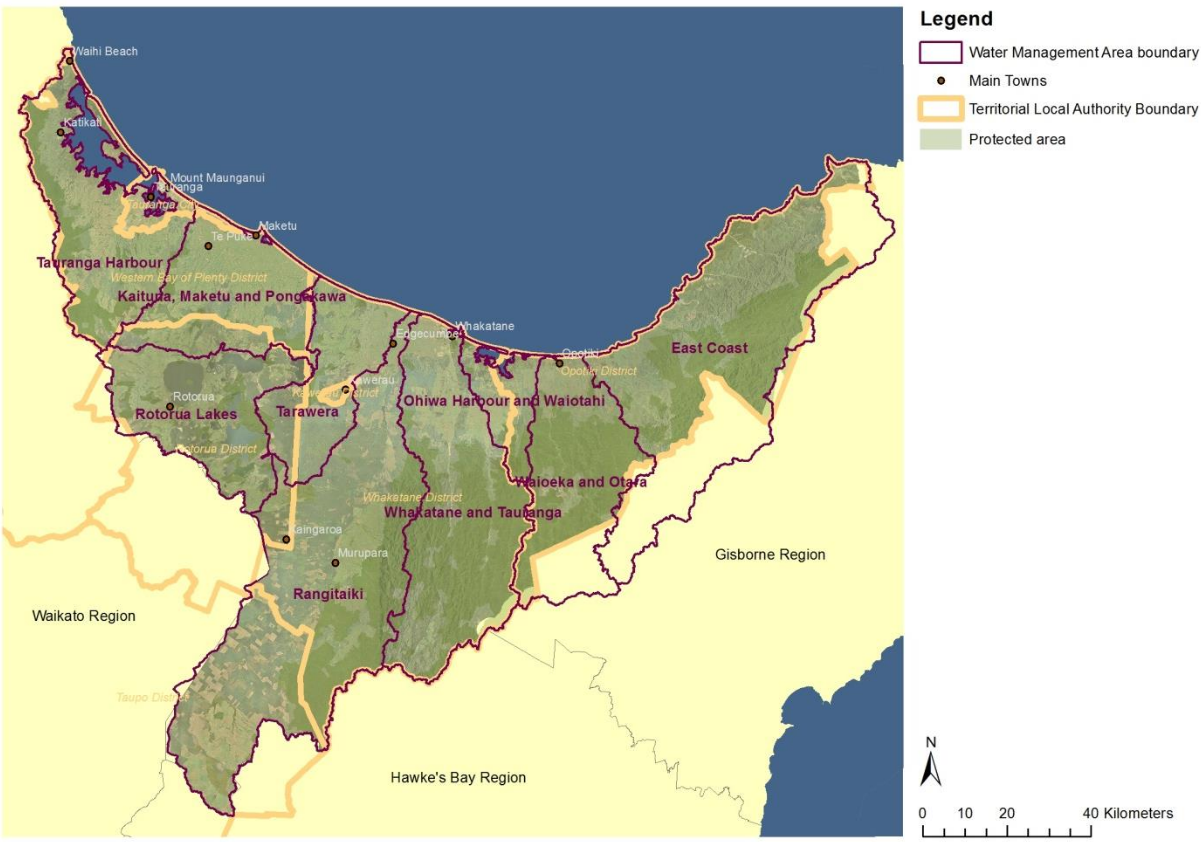
[2] Including a draft National Policy Statement for Freshwater Management, proposed National Environmental Standards for Freshwater, and draft regulations under s. 360 of the Resource Management Act 1991 for stock exclusion.

2017 version of the NPS-FM or regionally-recommended (Carter, Suren, & Scholes, 2017) ecosystem health attributes (i.e., nitrate and ammonia toxicity, dissolved oxygen, periphyton, benthic cyanobacteria, invertebrate communities). However, while nutrient toxicity bottom lines are not breached at long term monitoring sites, elevated nutrient levels around the region contribute to degradation in sensitive receiving environments, and other sites may breach these bottom lines (as discussed in section 3.3).

Figure 1: Bay of Plenty: Water Management Areas



Thirty-one out of 42 monitored freshwater swimming sites across the region (or 74%) were considered to be suitable for swimming under the pre-existing *E. coli* attribute ("Table 9" in the NPS-FM 2020), while 11 sites (or 26%) were considered not suitable for swimming (Dare, 2019).

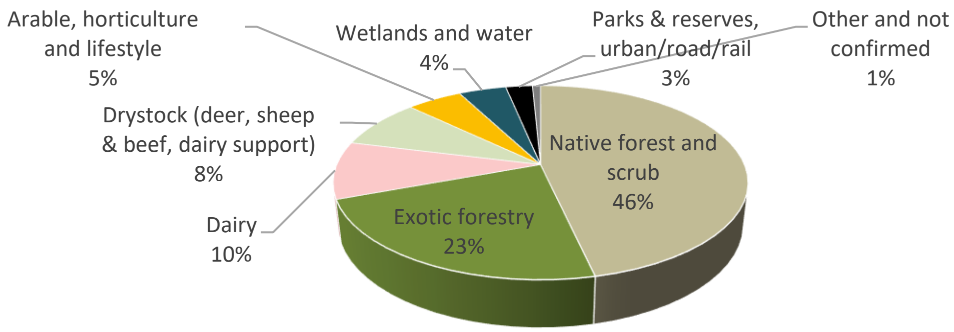
Lakes, as receiving environments, are sentinels of change, reflecting integrated signals of climatic and catchment processes. In the Rotorua Lakes, water quality and trends vary by attribute and site, with several lake sites failing NPS-FM or regionally-recommended bottom lines. Five of the twelve Rotorua Lakes do not currently meet their Trophic Level Index (TLI) targets set in the operative Regional Natural Resources Plan. TLI scores will vary from year to year reflecting natural processes (e.g. climate), the measurement approach and the ongoing management of anthropogenic impacts (Carter, Suren, Dare, Scholes, & Dodd, 2018) .

Like lakes, harbours and estuaries in the region (e.g. Tauranga, Ōhiwa, Maketū, Waihī and Waiōtahe) are also particularly sensitive receiving environments, and in some cases are severely degraded (Park, 2018; Lawton & Conroy, 2019). These receiving environments are expected to be the main drivers of land and freshwater management in their respective WMAs in the future.

2.2 Land use and the agriculture sector

The Bay of Plenty region covers an area of 1.2 million hectares. Nearly half of this area is in native bush and scrub (mostly within protected areas), and nearly one-quarter is in exotic forestry (Figure 2). The next most common land uses are dairy, drystock and horticulture. There is currently a strong trend of conversion from pasture and arable to horticulture (kiwifruit and avocado in particular) in suitable areas.

Figure 2: Land use in the Bay of Plenty as of 2017



About a third of the region's land is Māori-owned[3], under a range of tenure forms. The majority of Māori-owned land is in exotic or native forest.

Small farms are a feature of the Bay of Plenty; most of these are dedicated to horticulture.

2.3 Regional economy and importance of the agriculture sector

The regional GDP in 2018/19 was $17.2b, or $53,700 per capita, 5.7% of New Zealand's GDP (StatsNZ, 2020). The Bay of Plenty economy is fairly diverse (Figure 3), and between 2006/07 and 2018/19 it grew, in real terms, by 31% (Infometrics Economic profile). In 2017/18, agriculture (including horticulture) was the fourth largest direct contributor to the region's GDP (8%). Primary manufacturing, which includes the manufacturing of meat, dairy, fruit and cereal products, was the sixth largest contributor (7%).

Horticulture, particularly kiwifruit, is the most valuable industry within the agriculture sector, accounting for the largest proportion of the agriculture GDP contribution described above. In 2015/16, kiwifruit accounted for about 50% of the agriculture sector's direct contribution to regional GDP (Scrimgeour, Hughes, & Kumar, 2017; StatsNZ, 2019).

The agriculture sector also has a significant indirect (through industries supplying agriculture) and induced (through household spending) impact on the regional economy. In the Bay of Plenty, it is estimated that horticulture has a flow-on impact on the regional economy of about half its direct contribution to regional GDP, while the pastoral and arable sectors have a flow-on impact of about a third of their direct contribution.[4] The agriculture sector is a significant employer in the region, and creates important indirect and induced employment also.

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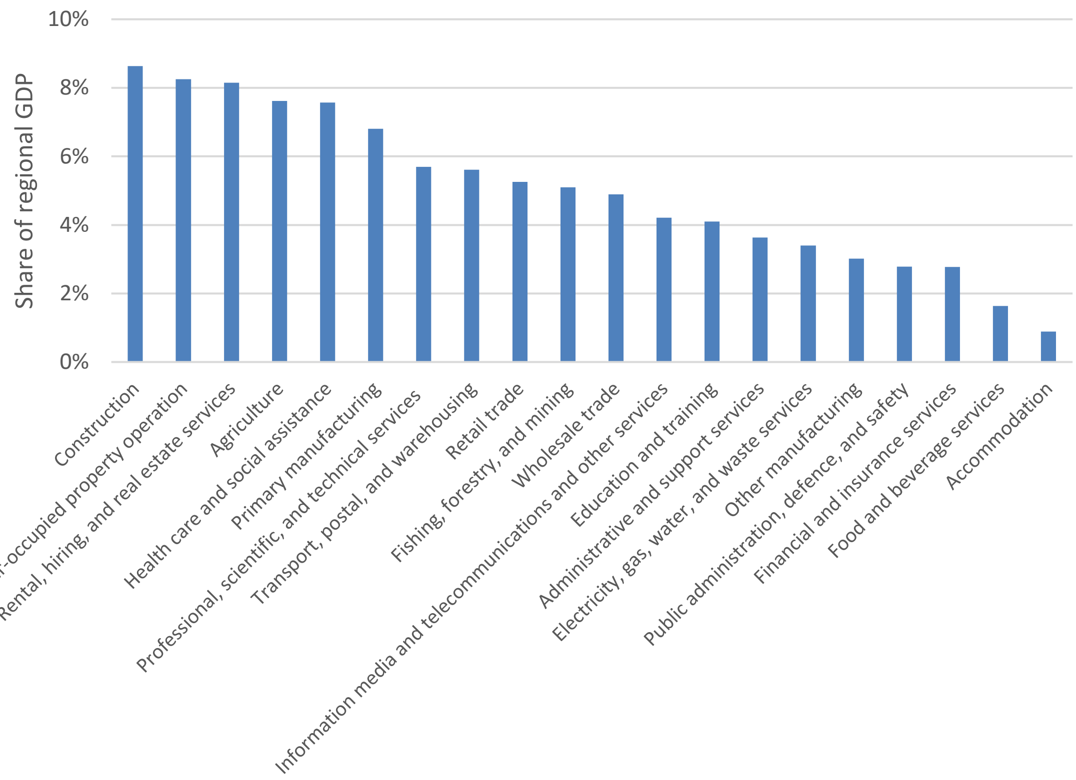
[3] Māori-owned land is defined in this case as land included in the Māori Land Online database as at December 2015, with various corrections and amendments from other sources, including some land returned under Treaty Settlements. Māori land included here should be considered indicative only as not all Māori land in the Bay of Plenty is necessarily identified as such.

[4] Bay of Plenty input-output tables generated by Butcher Partners Ltd., based on Statistics New Zealand 2013 input-output tables.

Figure 3: Share of Bay of Plenty regional GDP by industry, 2017/18 (Source: StatsNZ)



2.4 A balanced and considered approach to water quality improvements

The vast majority of people in the Bay of Plenty would agree with the objectives that the proposals and new requirements seek to achieve, i.e., to stop degradation and improve water quality and ecosystem health. However, given the importance of the agriculture sector to the region (particularly in the context of recovering from the impacts from COVID-19), and the potential costs of the proposals and final decisions, it is important to consider:

- the extent of water quality improvements required;
- how they will be achieved (i.e., the effectiveness and efficiency of the proposals/requirements); and
- the timeframe for making the required changes.

The analysis and commentary presented in this paper are aimed at contributing to those considerations. This is particularly relevant because final decisions have either not yet been made for some proposals or it is acknowledged these will be reviewed in the future (e.g., Dissolved Inorganic Nitrogen attribute, farm planning, nitrogen fertiliser input use limit).

3. Assessment and commentary of proposals and final decisions

3.1 Farm planning

3.1.1 Proposal

The original proposal (September 2019) generally required farmers/growers to have a farm plan with a freshwater module by 2025. Importantly, the actions a farmer commits to in the farm plan were not subject to the same timelines. These could be reasonably spread over time, as measurable objectives, targets and timeframes are set in regional plans.

The farm plan would identify waterbodies, critical source areas, erosion-prone areas, and other risks (e.g. irrigation, fertiliser application, effluent, winter grazing, stock holding, etc.) to waterbodies. For these areas and risks, it would set out a schedule of actions to manage risk. Plans would need to be developed by a qualified farm planner, independently audited and progress reports submitted to the regional council. It is envisaged that the requirement for farm plans will be phased in through future national regulations, with higher risk activities and catchments under more pressure being prioritised. It is also assumed that farm plans will at least identify and require "Good Management Practice" (GMP), with implementation being enforceable by regional councils.

The farm planning requirement was originally proposed to be included in the National Environmental Standards for Freshwater, and applicable only to horticultural farms of 5 hectares or greater, and arable and pastoral farms of 20 hectares or greater. However, recent amendments to the Resource Management Act 1991 create powers to make separate regulations for farm planning. Final decisions announced in May 2020 did not include specific requirements for farm planning, and acknowledged that policy work on this is ongoing.

3.1.2 Approach

As described in section 2, small farms are a feature of the Bay of Plenty. This is significant because an important proportion of Bay of Plenty farms would be below the size thresholds set out in the original proposal.

The assessment is based on 2017 Agricultural Production Census (APC)[5] data (for number of farms by farm type and size) for the region (StatsNZ, 2018), and spatial datasets of land use and property boundaries. The APC also has information about the number of existing nutrient planning documents (i.e. nutrient budgets, Good Agricultural Practice, Nutrient Management Plans and other nutrient planning documents), which are assumed to partially fulfil the requirements of a farm plan under the proposal.

[5] The APC is sent to all GST-registered farming businesses and completion is compulsory. However, registration for GST is not compulsory for businesses with a turnover of less than $40,000 per year, but those businesses can choose to register voluntarily. There is therefore a partial and unquantifiable coverage of farming businesses below this turnover level.
For the purpose of the APC, a farm is defined as *one or more blocks of land, managed as a single operation, which is engaged in agricultural activity. This includes farming of livestock, horticulture, viticulture, nurseries, forestry, growing grain and seed crops, and land that could be used for these purposes.*
The proportion of eligible businesses that responded to the 2017 APC was 85.5 percent nationally. These businesses represented 88.3 percent of the total estimated value of agricultural operations. Values are imputed for farmers who do not return a completed questionnaire. Imputation involves replacing missing items with values based on other information available.

We have estimated the number of new farm plans required by land use. The estimated costs of developing, certifying, auditing and implementing farms plans are expressed in terms of changes to operating profit. This includes the cost of extending any existing or expected currently required farm nutrient planning documents to fulfil the requirements of the proposal.

Development/certification and auditing costs are assumed to be $3,500 (one-off) and $1,750 every year per farm plan respectively.[6] The costs are assumed to be 50% less when a farmer already has an existing nutrient management document.

It is assumed that farm plans will require GMP, defined as the M1 mitigation bundle described in Matheson et al. (2018), except for stock exclusion and riparian buffers/setbacks as those are evaluated separately under section 3.2. Furthermore, for drystock (deer, sheep and beef, and dairy support), practices only up to M1.9 are considered given the relatively high cost of other practices within that mitigation bundle. Most mitigation practices require a more efficient use of inputs, less intensity and could generally be considered expected levels of practice. Implementation costs are treated as a yearly reduction in baseline profit.

The characterisation of mitigation costs was assessed for 13 different "average" farming and growing systems across the Kaituna-Pongakawa-Waitahanui and Rangitāiki WMAs (Matheson, Djanibekov, Bird, & Greenhalgh, 2018). In the absence of a similar characterisation for other parts of the region, this analysis was used for the rest of the region in the following assessment. The analysis should therefore be considered only indicative.

3.1.3 Assessment and commentary

Figure 4 shows the number of farms by farm type and Figure 5 shows the number of farms by total size, as reported in the 2017 APC (StatsNZ, 2018).

A breakdown of the number of farms by size and farm type is only available for the Tauranga Moana, Kaituna-Pongakawa-Waitahanui, Rangitāiki and Rotorua Lakes WMAs (Figure 6). These four WMAs cover 80% of all Bay of Plenty farming businesses that responded to the 2017 APC, and 48% of the region's land area. Across these four WMAs, 48% of horticultural farms, 38% of pastoral farms and 69% of arable farms would be exempt from the farming planning requirements based on total size thresholds. In terms of area across the region, an estimated 20% of land in horticulture, 10% of land in pasture and 50% of land in arable land uses would be below these thresholds.

Under the Bay of Plenty Regional Natural Resources Plan, Nutrient Management Plans (effectively a type of farm plan) are already required as a consent condition in the Lake Rotorua catchment, on a different basis than the proposed national requirement. Likewise, there would be other industry-required farm plans, which are assumed to at least partially fulfil the conditions of the proposal.

[6] A cost of between $5,000 and $7,000 is realistic to develop a farm plan from scratch (L. Matheson, pers. comm.). The lower cost of $3,500 is assumed on the basis that industry groups, central government and/or the regional council would be expected to provide support for plan development (e.g. through a part-funding, templates and guidance).

Figure 4: Number of farms by farm type in the Bay of Plenty (Source: APC 2017, StatsNZ)

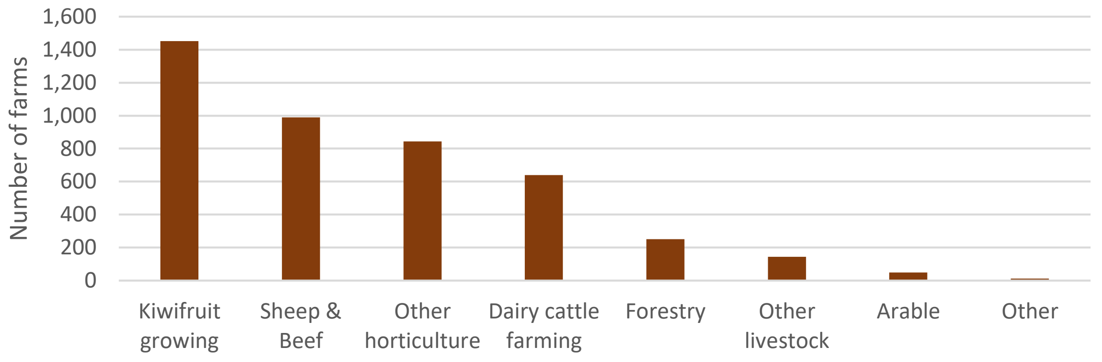


Figure 5: Number of farms by farm size in the Bay of Plenty (Source: APC 2017, StatsNZ)

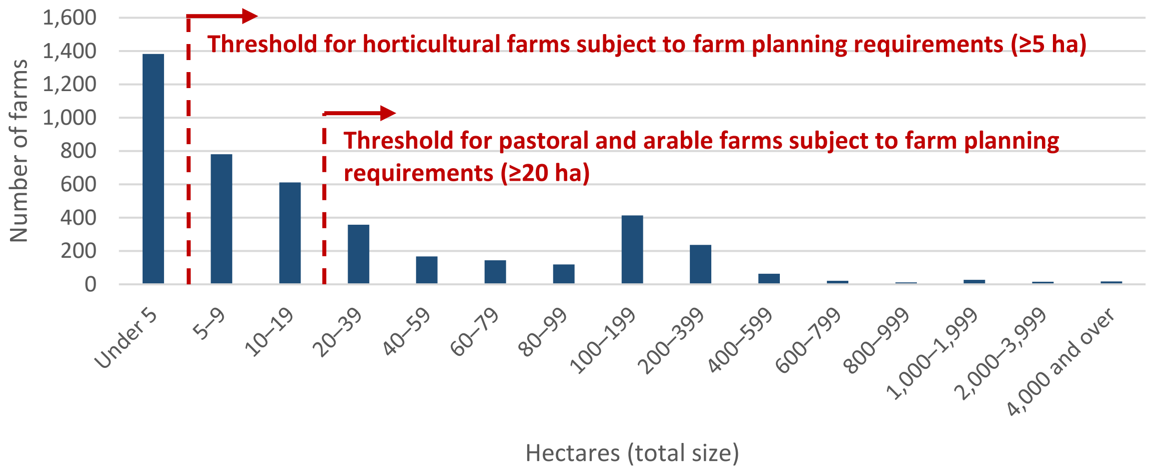
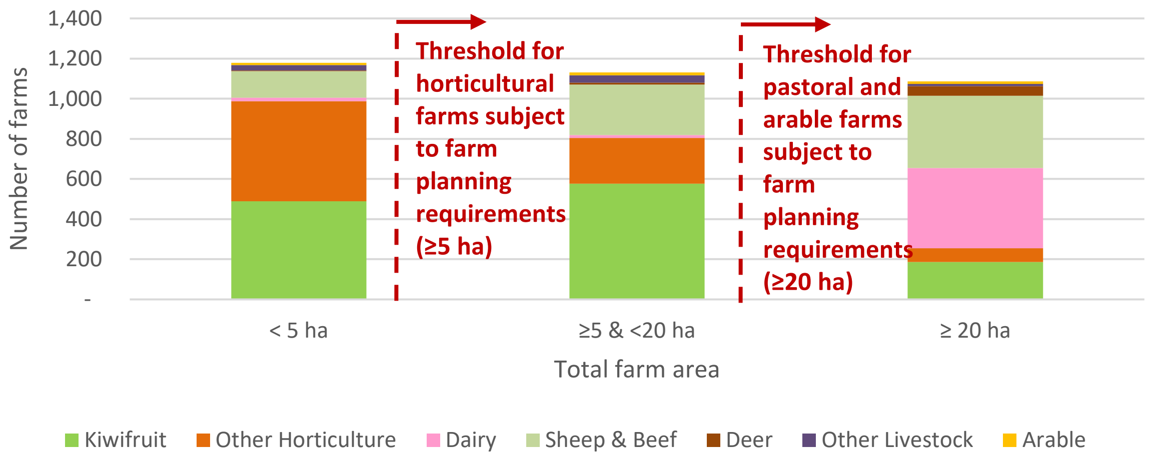


Figure 6: Number of farms by farm size and farm type in the Tauranga Moana, Kaituna-Pongakawa-Waitahanui, Rangitāiki and Rotorua Lakes WMAs (Source: APC 2017, StatsNZ)



Overall, the cost of farm plans (including development, auditing and GMP implementation) is estimated to result in a 5% reduction in annual operating profit across all affected land uses in the region, from $764m to $726m (Table 1). The biggest impact would be on drystock farmers (18% drop in overall operating profit, ranging from 8% to 24% for different farm systems). The least impact would be on kiwifruit growers (4% overall drop, 2% for gold, 8% for green) due largely to their much larger baseline profits relative to other land uses. Dairy farming would see an overall 5% drop in operating profit, although this would range from virtually no impact for more intensive farming systems to an 18% reduction for less intensive systems. These estimates do not take into account the costs of servicing debt, which would vary for individual landowners.

Impacts will vary by land use and for individual landowners, although the main cost to implement GMPs can be spread across a reasonable timeframe. The impact would potentially be significant for drystock farmers and less intensive dairy farmers.

In reality, farm plans will tailor mitigation practices to individual properties, taking into account specific property characteristics, circumstances and risks. They will encourage farmers to actively consider and manage risks, promoting voluntary behaviour change and effectively setting out contaminant reduction pathways. If linked to a requirement to prepare and report an audited OVERSEER file (or other assessment of contaminant losses), farm plans will generate important baseline information. This information is currently either unavailable (e.g. nutrient losses from horticulture, baseline farming practices) or inaccessible (e.g. Fonterra-managed OVERSEER files for dairy farms). The main exception to this is properties in most of the Rotorua Lakes catchments, which are currently required to maintain accessible OVERSEER files. By tailoring mitigation practices, farm plans are also likely to maximise environmental benefits and minimise costs. The cost estimate presented here is therefore likely an overestimate.

Table 1: Summary assessment of implications of developing, auditing and implementing Farms Plans in the Bay of Plenty region

Land use	Total number of farming businesses	Total area (ha)	Estimated number of farming businesses within size thresholds	Estimated total area within size thresholds (ha)	Estimated total effective area within size thresholds (ha)	Assumed number of existing nutrient management documents	Baseline EBIT/ha/year	Post-mitigation EBIT/ha	Mitigation cost/ha/year	Estimated Baseline profit/year	Farm Plan development/auditing costs per year	Estimated Farm Plan implementation costs/year	Estimated profit after mitigation/year
Kiwifruit	1,452	16,057	884	13,595	10,876	884				$ 500.1m	-$ 0.77m	-$ 19m	$ 481m
Green		*10,745*	*592*	*9,097*	*7,278*	*592*	*$19,500*	*$ 17,608*	*-$ 1,892*	*$ 167.6m*	*-$ 0.52m*	*-$ 13m*	*$ 154.2m*
Gold & other		*5,312*	*292*	*4,498*	*3,598*	*292*	*$78,400*	*$ 76,533*	*-$ 1,867*	*$ 333.2m*	*-$ 0.26m*	*-$ 6m*	*$ 326.7m*
Other horticulture	845	3,735	316	2,338	1,871	313	$19,500	$ 17,608	-$ 1,892	$ 58.2m	-$ 1.2m	-$ 5m	$ 51,7m
Sheep & beef	990	96,508	479	85,621	68,497	120	$133-$421	$109-$396	-$20 - -$25	$ 13.9m	-$ 0.7m	-$1.7m	$ 11.4m
Arable/grain growing	50	8,037	50	4,192	3,354	12	$ 2,345	$2,192	-$ 153	$ 15.1m	-$ 76,125	-$ 0.95m	$ 14m
Dairy	639	119,426	605	111,856	89,485	303	$1,115-$2,582	$955-$2,532	-$418 - $20	$ 175m	-$ 0.79m	-$ 7.83m	$ 166.4m
Deer	48	6,801	46	6,554	5,243	12	$ 229	$ 206	-$ 23	$ 1.2m	-$ 70,000	-$ 0.1m	$ 1m
Total	**4,024**	**250,565**	**2,379**	**224,157**	**179,326**	**1,632**				**$ 764.3m**	**-$ 3.6m**	**-$ 35m**	**$ 725.6m**

As an example of the likely environmental benefits of farms plans, Figure 7 illustrates the impact of GMP adoption on nitrogen and phosphorus base flow losses (Matheson, Djanibekov, Bird, & Greenhalgh, 2018). This scale of change in contaminant losses, plus reductions in sediment and pathogens which were not assessed, is likely to be achievable through the adoption of GMPs, through farm plans. When applied in the Kaituna-Pongakawa-Waitahanui and Rangitāiki WMA draft catchment model (Carter, Tingey, & Scholes, 2020 in prep), these mitigation practices led to reductions in contaminant loads to receiving environments, as summarised in Table 2, and a general improvement in water quality in relation to *E. coli* and sediment. The draft model results also showed that these reductions would be insufficient to achieve moderate states of ecological health in the Maketū and Waihī estuaries, suggesting that either more stringent mitigation and/or land use change would be required.

Figure 7: Impact on N and P losses from mitigation practices likely to be required under farm plans (Source: Matheson et al 2018)

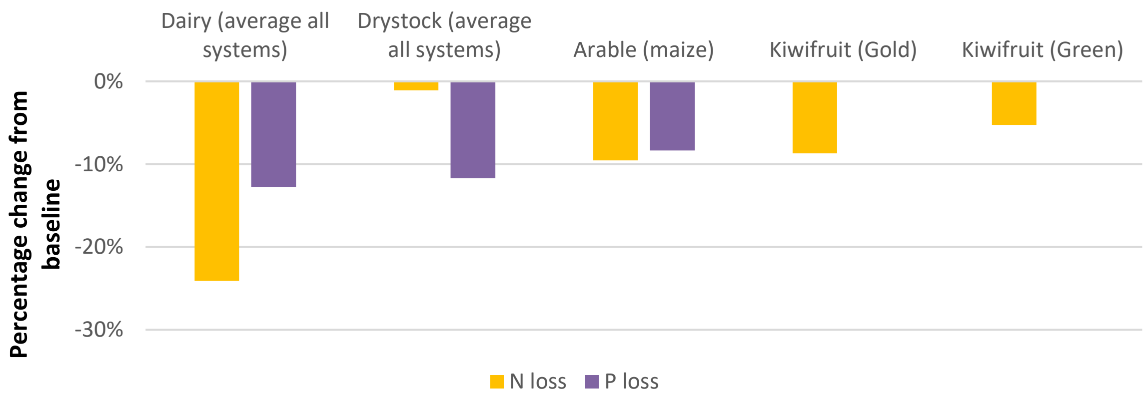


Table 2: Estimated change in contaminant load to receiving environments in the Kaituna-Pongakawa-Waitahanui and Rangitāiki WMAs draft catchment model from application of mitigation practices (Source: Carter et al, 2020 in prep)

	Total nitrogen	Total phosphorus	Total Suspended Solids
Maketū Estuary	-8%	-4%	-3%
Waihī Estuary	-10%	-9%	-2%
Lake Matahina	-6%	-3%	0%

Based on BOPRC's experience with Plan Change 10 (Lake Rotorua), it is assumed that a qualified farm planner (full time equivalent) could realistically deliver about 40 farm plans per year, if that is the only thing they did. It would therefore take about 12 qualified full-time farm planners to deliver the estimated 2,379 farm plans required across the region by 2025. This assumes that less work would be required where nutrient management documents are already in place, that all necessary information would be readily available and that farm planners will also undertake some certification and auditing roles. However, most farm planners also undertake other activities and are unlikely to be dedicated exclusively to developing, certifying and auditing farm plans. It is also unlikely that all necessary information would be readily available.

Capacity constraints have already been identified in relation to delivering Nutrient Management Plans under Plan Change 10 for Lake Rotorua, and in relation to delivering farm plans under Waikato's Plan

Change 1.[7] Therefore it is uncertain if it would be possible to deliver this number of farm plans by 2025 with currently available capacity. An increase in the availability of qualified farm planners, prioritisation of land uses, contaminants, or areas, and possibly an extension of the originally proposed timeframe, will be required.

An increasing demand for farm planners around the country as a result of this proposal could lead to increased costs for landowners, if that increased demand is not matched by increased supply, particularly if timeframes are tight. Likewise, there is a risk that the quality of farms plans and audits may be compromised if farm planners are under pressure to complete large backlogs of farm plans and audits in a short timeframe.

3.1.4 Summary and conclusions

Significant benefits are expected to be achieved from farm plans including tailored mitigation practices which will result in better environmental outcomes, and in some cases also improved farm financial performance. They will also generate important baseline information in terms of contaminant losses and farming practices. The costs of developing farm plans by 2025, and auditing them once in place, are generally not major, relative to baseline operating profits of affected land uses and expected benefits (although this will vary for individuals). The main cost will be in implementing plans, which are assumed to require GMPs. However, these costs can be spread over a longer timeframe. The capacity of qualified farm planners to deliver farm plans could be an issue.

Despite the capacity issue and given expected benefits, consideration could be given to extending the farm planning proposal to farms below the proposed size thresholds, even if it is under a longer timeframe. As noted, a significant proportion of farms in the Bay of Plenty are below the proposed size thresholds.

3.2 Stock exclusion

3.2.1 Proposal and final decision

The Resource Management (Stock Exclusion) Regulations 2020 set out the final requirements. These require stock exclusion from lakes, rivers over 1m wide and natural wetlands for dairy, dairy support, beef, pigs and deer. There is a general 3m setback (or buffer) requirement, except for pre-existing permanent fences or vegetation that effectively prevents stock access to lakes or rivers over 1m wide. The requirements apply to land of any slope, except for low-intensity beef and deer on land that is not defined as "low slope" (understood to be where the average slope for the parcel is < 10°).

The requirements apply from either:

- 3 September 2020 for all new pastoral systems;
- 1 July 2023 for dairy, pigs, intensive beef and deer, and identified natural wetlands; or
- 1 July 2025 for dairy support, low intensity beef and deer on low slope land, and natural wetlands supporting threatened species or on low slope land.

[7] Statement of primary evidence of Lee Antony Matheson, on behalf of NZIPIM – Waikato Branch, to the hearing on Waikato Regional Council's proposed Plan Change 1 (Waikato and Waipa catchments – Healthy Rivers).

The original proposal had a number of variations. Importantly, the original proposal did not include the setback exemption for pre-existing stock exclusion, and the proposed setback was 5m rather than 3m. Also, timeframes in the original proposal were generally tighter.

3.2.2 Approach

The assessment focuses on rivers and streams over 1m wide, lakes and wetlands only. Wetlands and lakes are those identified in the BOPRC land use dataset, Price & Fitzgerald (2018) and a LINZ lake dataset, acknowledging this may not be a comprehensive list. For rivers and streams, wetted widths at Mean Annual Low Flow, as estimated by Booker (2015) based on the River Environment Classification (REC) dataset, are used to identify rivers and streams over 1m wide. GIS analysis was used to estimate the length of fencing required and area of pastoral land that would need to be retired in setbacks.

For the scale of this analysis, it was not possible to easily identify areas where beef cattle or deer are farmed intensively. Therefore, the analysis assumes that the requirement would apply to all beef and deer on land that is not low slope. In addition, BOPRC's land use dataset does not distinguish between sheep (which are excluded from the requirement) and beef, nor between dairy support and intensive beef. These limitations are likely to result in an over-estimation of the costs of the requirement, although it is uncertain by how much.

Likewise, BOPRC does not have sufficient information to determine where exactly there is pre-existing stock exclusion. In the original analysis this was less of an issue because it was assumed that most existing fences would not have complied with the proposed setback requirements anyway, so would have had to be moved (at effectively the same cost as a new fence). The vast majority of dairy farmers would have already fenced waterbodies subject to the proposal under the Sustainable Dairying Water Accord (DCANZ & DairyNZ, 2019). Given pre-existing fences are not subject to the 3m setback requirement, dairy is therefore excluded from the analysis as it is assumed to already comply. For drystock, the extent of current stock exclusion is uncertain, but assumed to cover 50% of the waterbody margins subject to the requirements.

Relevant costs assumed in the analysis are summarised in Table 3 below[8]:

Table 3: Assumed stock exclusion costs

Land Use	Fencing costs ($/km)	Setback weed control ($/ha/year)	Lost profit in setbacks ($/ha/year)
Sheep & beef, dairy support	$14,000	$130	$133-421
Deer	$26,000		$229

Where there is no pre-existing stock exclusion, it is assumed that farm systems would remain viable under the required setbacks, i.e., that the same stocking rates are able to be maintained, although this would likely vary between farms. The riparian practices modelled in Matheson et al. (2018) did assess ongoing farm viability but were different than those set out in the final requirements.

[8] From Matheson et al. 2018. Fencing costs are broadly consistent with those quoted in the *Essential Freshwater: Action for healthy waterways* discussion document. They do not include setback planting and maintenance costs, other than weed control, or any subsidies.

3.2.3 Assessment and commentary

Table 4 shows the total area of the affected land uses in the region, the estimated area that would need to be retired from grazing into setbacks and the estimated length of fencing required.

Table 4: Estimates of grazing area to be retired in setbacks and length of fence lines required

Land use	Total area (ha)	Total area in setbacks (ha)	Total length of fence lines (km)
High intensity beef grazing & dairy support	11,220	42	116
Sheep and beef	100,398	321	803
Deer	10,318	17	54
Total	**121,936**	**380**	**973**

It is estimated that across the region, about 0.3% of the total grazing area (or 380 hectares) for the affected land uses will need to be retired into setbacks. Furthermore, an estimated 973 kilometres of fence lines would be required. The majority of this area and fence line length will be on sheep and beef land, largely due to the greater proportion of that land use in the region and the lower level of pre-existing fencing. These estimates are significantly lower than those estimated for the original proposal due to the fact that pre-existing fencing, particularly for dairy, is now assumed to be compliant with the final requirements, regardless of setback width. In addition, the narrower 3m setback requirement, where there is no pre-existing fencing, results in an estimated 70% reduction in the area to be retired compared to the original proposal.

Based on the assumed costs described above and the estimates of setbacks and fence lines identified in Table 4, total costs of fencing required across the region would be up to $14.3m (or just over a third of the total fencing cost estimated for the original proposal). As capital costs, these could be spread over several years. For example, if this cost is annualised over 25 years (the typical life of a fence) at a 6% interest rate, the cost would be $1.1m per year. Lost profit in setbacks is estimated to be $126,800 per year. This is only 4% of the estimated lost profit in the original proposal. The distribution of these costs across different land uses is detailed in Table 5 below. To put these costs in context, the estimated baseline profit for these land uses across the region is estimated to be about $15m per year.

Table 5: Estimated fencing costs and lost profit from proposed stock exclusion requirements

Land use	Total fencing costs	Lost profit in setback per year (including weed control costs)
Sheep & beef (including high intensity grazing and dairy support)	$12.9m	$120,800
Deer	$1.4m	$6,000
Total	**$14.3m**	**$126,800**

3.2.4 Summary and conclusions

The costs of the final requirements will be significantly lower than those estimated for the original proposal. This is due to the exemption from the setback requirements for pre-existing fences, therefore making the vast majority of dairy farms compliant. While there is some uncertainty about the extent of pre-existing fencing for drystock, the pre-existing fencing exemption and the reduced setback requirement for new fencing would also significantly reduce costs for drystock farmers.

In general, significant benefits are expected from stock exclusion including reduced contaminant losses, reduced risk for recreation and creating opportunities for habitat and aesthetic improvements through riparian planting in setbacks (although riparian planting per se is not part of the proposal).

Although stock exclusion and setbacks will reduce contaminant losses into waterways, there is uncertainty about the level of effectiveness of different setback widths to mitigate against different contaminants in different circumstances and locations (e.g. Valkama et al. (2018), Zhang et al. (2010)). Therefore, it is not possible to determine what would be an 'optimal' setback width. Nonetheless, the exemption from setback requirements for pre-existing fences, and the narrower setback requirement would presumably also result in lower environmental benefits. This will be particularly the case where pre-existing fences have no, or a minimal, setback.

The costs include new fencing and lost profit from setbacks. Timeframes for the proposal vary by waterbody type and land use. As capital costs, fencing costs could also be spread over several years, which would make the cost more manageable for landowners. However, this is subject to landowners being able to access the necessary funds either from available cash flow or additional debt. It is also noted that regional and central government will likely assist farmers to comply with these requirements through funding support (e.g. through the Jobs for Nature programme also aimed at assisting with recovery from COVID-19).

3.3 Nutrient attributes[9]

3.3.1 Proposal and final decisions

The discussion document proposed the introduction of two new attributes for Dissolved Inorganic Nitrogen (DIN) and Dissolved Reactive Phosphorus (DRP) in the NPS-FM.

The DIN attribute was not ultimately included in final decisions, but the Minister for the Environment has highlighted its inclusion will be reconsidered again in a year, subject to further research/evidence on environmental and economic implications (New Zealand Government, 2020). It is understood that any future potential inclusion of a DIN attribute would be different to the original proposal.

The DRP attribute was included under Appendix 2B of the NPS-FM 2020, requiring action plans rather than resource use limits to achieve objectives, but no national bottom lines are set.

[9] The NPS-FM 2020 has two types of attributes: those that require resource use limits (Appendix 2A) and those that require action plans (Appendix 2B). For the former type (which include the originally proposed DIN and DRP attributes, and the pre-existing nitrate and ammonia toxicity attributes), regional councils are required to set objectives, resource use limits and methods in regional plans which improve water quality where it is worse than the bottom lines, and either maintain or improve water quality where it is better than the bottom lines. One exception to this general requirement applies where the regional council can demonstrate that failure to meet bottom lines is due to naturally occurring processes. The timeframes to achieve those objectives would be set in regional plans.

DIN and DRP in-stream concentration and exceedance criteria are also required to be set to give effect to periphyton and receiving environment objectives. This was already a requirement, although perhaps not as clear, under the NPS-FM 2017.

Furthermore, the final decisions strengthened the bottom lines for nitrate and ammonia toxicity ("Table 5" and "Table 6" in the NPS-FM 2020) as summarised in Table 6 below, with the aim of protecting 95% of species from toxic effects. The new bottom lines are set at the bottom of attribute band "B".

Table 6: Nitrate and ammonia toxicity national bottom lines under NPS-FM 2017 and NPS-FM 2020

Attribute	Annual median bottom line (mg/L)		Annual maximum (ammonia) and 95th percentile (nitrate) bottom line (mg/L)	
	NPS-FM 2017	NPS-FM 2020	NPS-FM 2017	NPS-FM 2020
Ammonia toxicity (NH_4-N)	1.30	0.24	2.20	0.40
Nitrate toxicity (NO_3-N)	6.9	2.4	9.8	3.5

3.3.2 Commentary and preliminary assessment

Ecosystems are complex; there are multiple drivers that influence ecosystem health (e.g. river flow, substrate, nutrients, habitat availability/suitability, riparian vegetation, degree of sedimentation, water temperature, dissolved oxygen, etc.). A range of management activities across different drivers is likely to be required to improve overall ecological health. In the Bay of Plenty, nutrients present in the water explain only a small amount of total variability in Macroinvertebrate Community Index scores (an indicator of ecosystem health). Factors such as habitat, land cover, sedimentation and riparian vegetation are also important determinants of ecosystem health (Snelder, Image, & Suren, 2019). Thus, targeting a single driver of ecosystem health (such as a defined nutrient concentration) could be considered over-simplistic and may not achieve the environmental results sought. Ideally, a case-by-case assessment of the key factors behind poor ecosystem health would be required, which may not necessarily be elevated nutrient levels in every case.

Given that, final decisions in relation to DIN and DRP attributes, and the clearer direction in relation to managing nutrients for periphyton and receiving environments, are welcome changes from the original proposals.

In terms of the strengthened ammonia and nitrate toxicity bottom lines, no Natural Environment Regional Monitoring Network (NERMN, or long-term monitoring) sites currently fail these bottom lines (Carter, Suren, Dare, Scholes, & Dodd, 2018). However, there are currently no NERMN monitoring sites in lowland modified waterways (i.e., drainage canals) and drains. Recent supplementary monitoring of such locations for the Kaituna and Rangitāiki Plains shows some of these sites may fail the new national bottom lines (Suren & Carter, 2018). This is likely to be representative of highly modified lowlands in other parts of the region.

Figure 8 and Figure 9 show the assessed toxicity band and state for these sites. Thirteen sites are assessed as failing the ammonia toxicity bottom line, while three are assessed as failing the nitrate toxicity bottom line. However, eight of the first thirteen sites, and two of the second three sites, are drains.

Figure 8: Assessed ammonia and nitrate toxicity bands for modified waterways and drains, Kaituna and Rangitāiki Plains (Source: Suren & Carter, 2018)

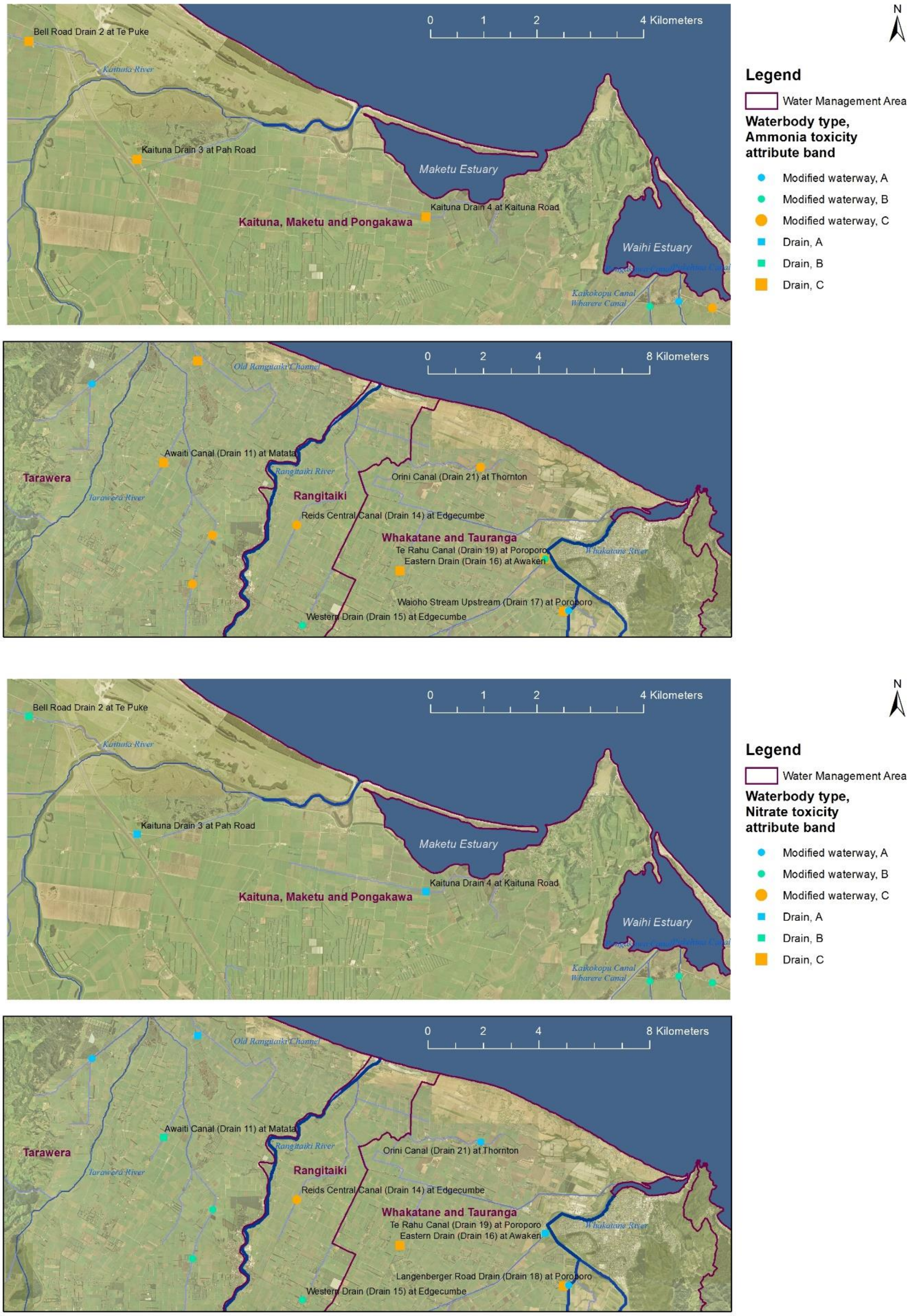
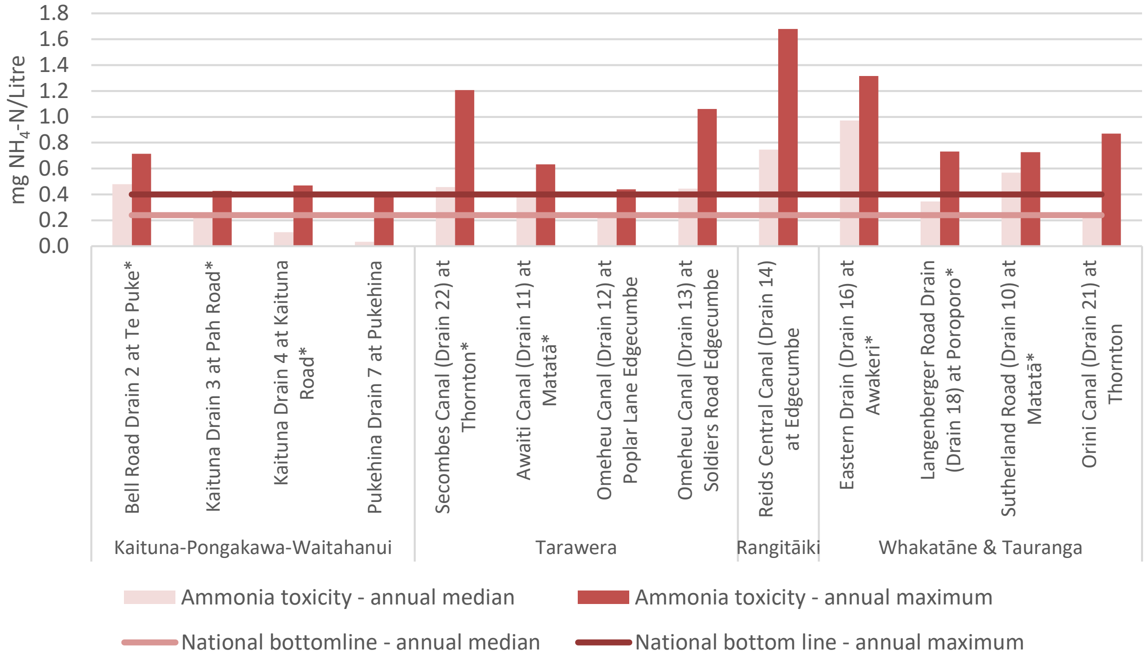
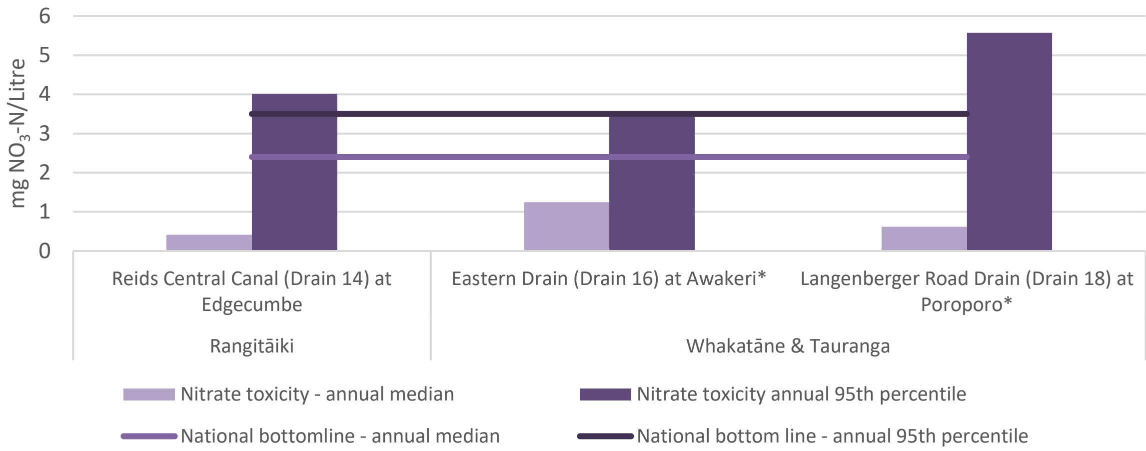


Figure 9: Assessed state relative to national bottom lines for ammonia and nitrate toxicity, for modified waterbodies and drains* in the Kaituna and Rangitāiki Plains [sites that fail national bottom lines shown only] (Source: Suren & Carter, 2018)





In general, when the difference between the assessed state and national bottom lines is large (Figure 9), the effort required to meet bottom lines is likely to be significant. However, when the difference is not large, as in several of the sites above, it is possible that at least for some of those sites bottom lines will be able to be achieved through implementation of other requirements (e.g., adoption of GMP through farms plans), without any significant additional cost.

It is too early to assess the implications of the strengthened bottom lines in more detail. First, it is uncertain if specific objectives will be set for these locations, given they are likely to have a narrower set of freshwater values than more significant waterbodies. Second, if specific objectives are set, at this point it is unclear whether toxicity attributes would actually be the most constraining factors. For instance, estuary/receiving environment objectives (e.g. as for Maketū and Waihī estuaries) or periphyton objectives may require more significant contaminant reductions.

3.4 Restrictions on land use intensification

3.4.1 Proposal and final decisions

The original proposal sought to restrict increases in irrigated area and high risk land use changes beyond specified size thresholds. The final requirement is set out in regulations 15-25 of the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-FW). It applies until 1 January 2025 (in theory, Plan Changes giving effect to the NPS-FM 2020 should have been notified by then), although consents granted under this requirement may extend until 1 January 2031. The requirement restricts, as discretionary activities:

- conversions from forestry to pasture beyond 10 hectares overall;
- conversions to dairy beyond 10 hectares overall;
- conversions to irrigated dairy beyond 10 hectares overall;
- conversions to dairy support beyond the maximum area used for that purpose between 1 July 2014 and 30 June 2019.

For any of these activities, a resource consent will only be granted if the activity does not increase contaminant (e.g., nitrogen, phosphorus, sediment and microbial pathogens) loads in the catchment or concentrations in freshwater or other receiving environments, relative to loads and concentrations as at the close of 2 September 2020.

A significant change from the original proposal to the final decision for the Bay of Plenty is that conversions to irrigated horticulture (e.g. kiwifruit, avocado) are not restricted as originally proposed. As described above, this type of conversion is a significant land use change trend in the Bay of Plenty at present. Although there is some uncertainty about contaminant losses from irrigated horticulture, in general these are expected to be lower than losses from alternative land uses, subject to adherence to GMP, and the economic value they generate is much greater.

3.4.2 Commentary

The original assessment focused on conversions to irrigated horticulture, given that is currently the predominant form of land use change, and therefore where the proposal was expected to have the greatest impact. However, as described above, that is no longer the case under the final requirement.

There are likely to be very few, if any, high risk land use changes covered by the requirement in the Bay of Plenty prior to 2025. Community engagement undertaken by BOPRC for the Kaituna-Pongakawa-Waitahanui and Rangitāiki WMAs, as well as by MacIndoe & Kashima (2018) throughout the region, indicate that type of land use change will be rare.

While intensification and land use change could theoretically occur under existing regional rules in the catchments of lakes Rerewhakaaitu, Rotomahana, Tarawera, Rotokakahi, Tikitapu, Tarawera, Ōkataina and Rotomā, the area available for land use change in these catchments is very limited. Furthermore, conversions from forestry to pasture in the Rotorua Lake catchment are not currently considered to be financially viable[10], therefore it is likely they would not be financially viable in the catchments of other Rotorua Lakes either.

Consequently, BOPRC has no basis on which to estimate the extent of any such conversions before 2025. Costs for any landowners wishing to undertake such conversions would include administration

[10] CNI Iwi Land Management Ltd, Māori Trustee, Federated Farmers of New Zealand v BOPRC [2019] NZEnv C 136, paragraphs 225 and 318(f)

(i.e. obtaining a resource consent and establishing baseline losses for the property) and assessing yearly contaminant losses (e.g. through an OVERSEER file).

A key element of uncertainty in relation to this proposal is the baseline contaminant load and concentration, “as at the close of 2 September 2020”. While the onus to demonstrate that any proposed conversion captured by the proposal would not increase contaminant load and concentration would be on the resource consent applicant, these are not monitored on a real-time basis to enable a 2 September 2020 baseline to be easily defined. Furthermore, while OVERSEER can estimate average annual base flow losses for nitrogen and phosphorus, there are currently no equivalent tools to accurately estimate sediment and microbial pathogen discharges at a property level, or surface flow losses generally. These issues could therefore effectively make the restrictions a moratorium on the land use changes listed above, if the requirement is strictly interpreted and enforced.

Consequently, the requirement is expected to provide very strong protection against any high risk land use changes, ensuring that no increase in contaminant losses occurs as a result.

3.5 *E. coli* attribute table for swimming sites during the bathing season

3.5.1 Proposal and final decision

Under the NPS-FM 2020, a new attribute table for *E. coli* (“Table 22”) is included, applicable only to swimming sites during the bathing season, in addition to the pre-existing *E. coli* attribute table (“Table 9”) applicable everywhere. “Table 9” is included in Appendix 2A of the NPS-FM 2020, requiring limits on resource use, although it does not set a national bottom line. “Table 22” on the other hand is included in Appendix 2B of the NPS-FM 2020, requiring action plans. A national bottom line is set under “Table 22”, which is defined as a 95th percentile concentration of 540 *E. coli* per 100 ml. In other words, where water quality is worse than the bottom line, it must be improved to at least that level. The original proposal was effectively the same as the final decision.

3.5.2 Commentary

The new attribute table is based on the 2003 Microbiological Water Quality Guidelines (Guidelines), which are acknowledged to be outdated and in need of review within the discussion document itself (Ministry for the Environment, 2019) and also in Milne et al. (2017). Yet final decisions do not acknowledge this. Furthermore, the 2017 NPS-FM amendments which introduced the pre-existing *E. coli* attribute table (“Table 9”) were found to be a sound approach to determine long-term grading in terms of suitability for swimming (McBride & Soller, 2017), as opposed to short-term surveillance monitoring which the Guidelines were originally developed for.

Under “Table 9”, only 11 of 42 monitored sites throughout the Bay of Plenty are considered not suitable for swimming (Dare, 2019). Under “Table 22”, 20 out of 42 monitored sites fail the *E. coli* bottom line for swimming sites during the bathing season (Figure 10).[11]

Figure 11 shows the assessed current state (95th percentile and median) relative to the “Table 22” bottom line (95th percentile), for monitored sites that fail the bottom line. The large differences between 95th percentiles and medians suggest that the bottom line failures are likely to be driven mainly by rainfall events, when most people are unlikely to be swimming.

[11] Unlike “Table 9”, “Table 22” does not specify the methodology to determine attribute band. This assessment is based on 5 years of monitoring over the bathing season between 2014/15 and 2018/19. If the period required was shorter (e.g., a single bathing season), it is likely that more sites would fail the bottom line.

Even under the current “Table 9”, the process to achieve a suitable for swimming state is very complex and potentially costly. For example, the annualised cost of fully fencing the catchment upstream of the Kaiate Falls (one of the swimming sites considered not suitable for swimming under “Table 9”) is estimated to be nearly five times the estimated annual catchment profit, and it is uncertain whether that intervention will actually make the site suitable for swimming (Matthews, 2018). This swimming site is very popular with locals and visitors, so work continues at a catchment-wide level to try to improve water quality. It would generally be reasonable to expect that the “Table 22” bottom line could be achieved for sites where the difference between the current state and bottom line is relatively small (e.g. through GMP, stock exclusion, land use change, etc.). However, for sites where the difference is large, it may not be possible to meet the bottom line without very significant change and cost, if at all.

Figure 10 - *E. coli* attribute bands for monitored swimming sites under “Table 9” and “Table 22” attribute tables

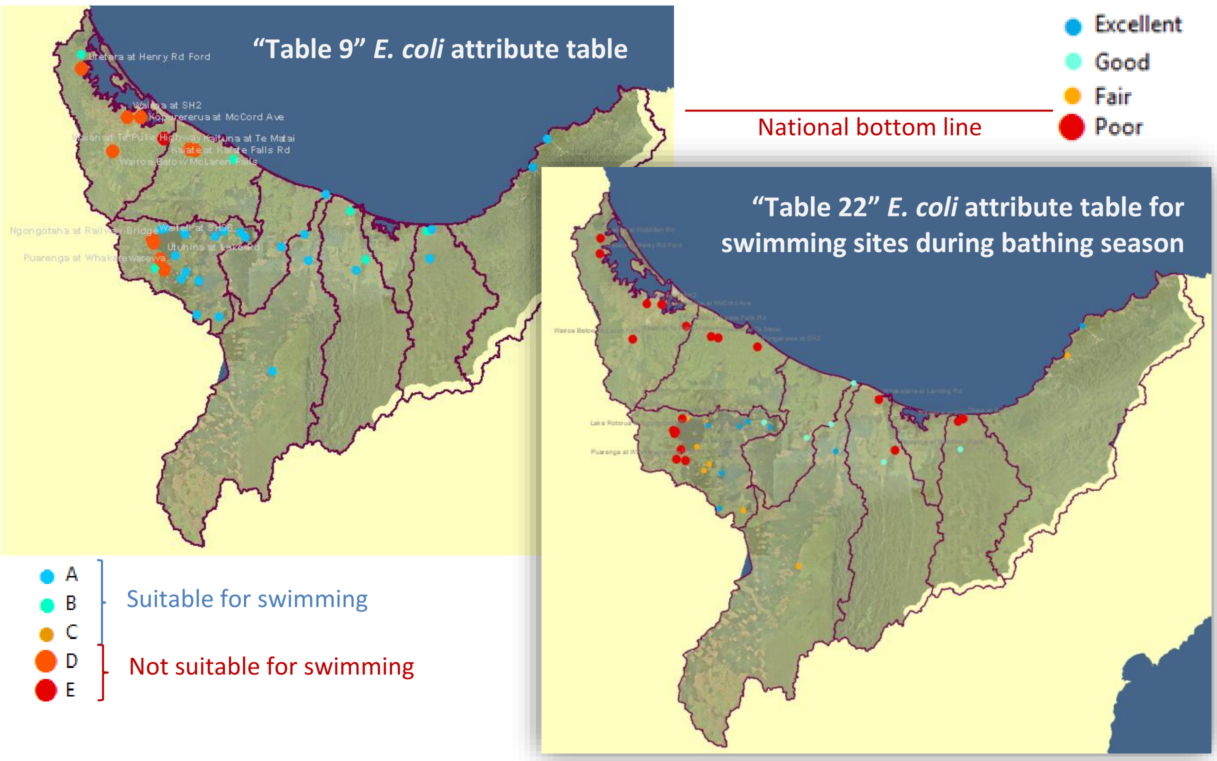
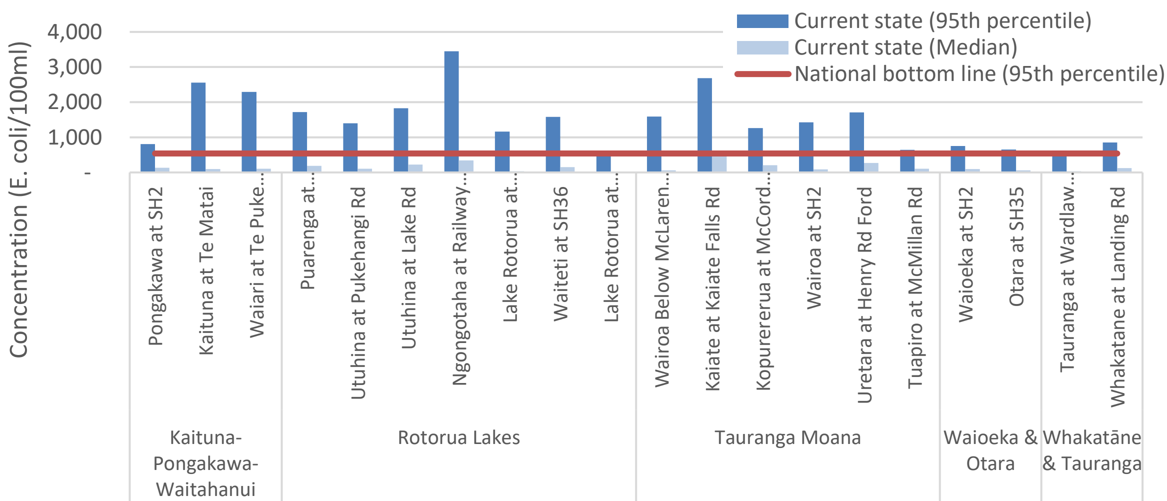


Figure 11 - Assessment of current state relative to “Table 22” *E. coli* bottom line for sites that fail it



3.6 Input limit on synthetic nitrogen fertiliser

3.6.1 Proposal and final decision

Part 2, Sub-Part 4 of the NES-FW sets out this requirement. For dairy and drystock farmers, it limits application of synthetic nitrogen fertiliser to 190 kg/ha/year for a contiguous landholding. Application rates beyond this limit would be treated as a non-complying activity, subject to conditions. Dairy farmers are also required to report their synthetic nitrogen fertiliser use to regional councils.

The discussion document only briefly mentioned this option, as an alternative to specific measures for catchments highly impacted by nitrogen. When announcing the final decisions, the Minister indicated this requirement will be reviewed in 2023.

3.6.2 Commentary

Fertiliser use in the Bay of Plenty is generally understood to be significantly lower than the national limit, except perhaps for a dozen highly intensive farms (P. de Monchy, pers. comm.). For instance, the typical rate for dairy in the Bay of Plenty is understood to between 130 and 150 kg/ha/year, while for drystock it would generally be below 20 kg/ha/year (J. Efford, pers. comm.). The requirement is therefore expected to have a marginal environmental impact in the Bay of Plenty, limited to a few catchments with highly intensive farms (e.g., upper Rangitāiki).

By setting a limit that is generally much higher than current use, the requirement may create a risk that farmers may actually increase fertiliser use (e.g. to compensate for the impact of other requirements). Even if farmers were using fertiliser beyond the limit, farmers may opt to replace fertiliser with imported feed, which would also result in higher nitrogen losses. The requirement to report fertiliser use to regional councils is helpful to at least monitor this risk. However, it is unclear why this does not extend also to drystock farmers. Management of fertiliser use would be best suited to farm plans given the need to tailor it to individual circumstances. The national restriction would have little impact across the Bay of Plenty.

4. Summary, discussion and conclusions

Table 7 summarises the assessed or anticipated costs of the proposals or final decisions considered, their timeframes and a high level description of the benefits expected. For farm plans and stock exclusion, which are expected to have the most significant long term impacts across the whole region, this information is also presented in comparison to baseline operating profit for the Kaituna-Pongakawa-Waitahanui and Rangitāiki WMA farm systems modelled by Matheson et al (2018) (Figure 12).

Table 7 - Summary of estimated costs, timeframes and expected benefits

Proposal/final decision	Estimated costs	Timeframe	2020-25	2025-35	2035+	Expected benefits
Farm plans	Farm plan development and auditing costs assumed to be $3,500 (one-off) and $1,750 (every year) respectively per property, adding up to $3.6m/year across the region. Farm plan implementation costs up to $35m per year in lost profit across the region (likely overestimate), but spreadable over a longer timeframe.	To be confirmed in outstanding regulations. Farm planner capacity is likely to be a significant constraint to delivery in the short to medium term. Implementation to be determined within each farm plan, presumably informed by risk and regional priorities.				• Generating baseline contaminant loss and farming practice information. • Potentially improved financial performance and resilience of individual farms, subject to complementary education and support services. • Tailored adjustments to farming practices lead to reduction in contaminant losses and improved ecosystem health. • Platform for other modules (e.g. greenhouse gases, biodiversity, animal welfare, etc.). • Subject to size thresholds, many properties in the Bay of Plenty are below proposed thresholds.
Stock exclusion	Fencing costs: up to $14.3m (likely overestimate) across the region, or $1.1m per year annualised over 25 years at a 6% interest rate. Lost profit in retired setbacks is estimated to be $0.13m per year across the region (including weed control but not riparian planting).	Timeframe varies by land use, location and waterbody type, ranging from 2020 to 2025.				• Lower than original proposal due to narrower setback width and setback exemption for pre-existing stock exclusion. • Reduced streambank erosion and contaminant losses through filtering. • Opportunity for riparian planting in setbacks which in turn increases shading,

Proposal/final decision	Estimated costs	Timeframe	2020-25	2025-35	2035+	Expected benefits
	Setback exemption for pre-existing fencing effectively makes the dairy sector compliant, and reduction in setback width from 5m to 3m results in significantly reduced costs relative to the original proposal.					improves habitat, sequesters carbon, improves aesthetic values and biodiversity. • Increased amenity and recreational opportunities, lower risk of sickness from swimming. • Employment for fencing contractors.
Nutrient attributes	Uncertain. While no long term monitoring sites fail new nitrate and ammonia toxicity national bottom lines presently, several modified waterways (drainage canals) and drains do fail them. It is unclear the extent to which freshwater objectives will be set for these sites, and if toxicity attributes will be the most constraining factors.	Timeframe to achieve objectives, if applicable, to be determined within Regional Plan				Uncertain. As noted under costs, subject to objectives and further assessment. However, in theory new bottom lines should protect 95% of species, but not necessarily support ecosystem health in sensitive receiving environments (i.e., lakes and estuaries).
Restriction on land use intensification	Exclusion of irrigated horticulture conversions (e.g. kiwifruit, avocado), the predominant rural land use change trend in the Bay of Plenty, would result in significantly lower costs than the original proposal. High risk land use changes are expected to be rare by 2025, any would have to incur administration costs. However, the proposal could effectively be a moratorium on such land use changes due to difficulty to establish baseline and property-level contaminant losses.	2020 – 2025, regulation would cease to apply once the Regional Plan has implemented the NPS-FM.				• Very strong protection against high risk land use changes to ensure no increase in contaminant losses.
***E. coli* attribute table for swimming sites during bathing season**	Action plans requiring improvement to the bottom line in at least 15 catchments across the region. Required improvement would be very significant, if at all possible, in some locations.	Timeframes to be specified in action plans and Regional Plan.				• Significantly higher water quality relative to pre-existing *E. coli* attribute table, if achievable.
Input limit on synthetic nitrogen fertiliser	Minor administration costs for dairy farmers in monitoring and reporting fertiliser use. Potentially marginally reduced productivity for a dozen highly intensive farms.	The regulation applies from 1 July 2021, but subject to review in 2023.				• Marginal water quality improvements in the catchments of highly intensive farming operations (e.g. Upper Rangitāiki?). • Reduced fertiliser costs for affected farms.

Figure 12- Estimated impact of farm plan and stock exclusion proposal on Kaituna-Pongakawa-Waitahanui and Rangitāiki WMA farms (based on Matheson et al. 2018)[12]

[12] Annualised stock exclusion costs assume costs are spread over 25 years at a 6% interest rate, and that exclusion from large waterbodies is required for all drystock on steeper land, regardless of intensity. This includes fencing, lost profit and weed control in setbacks but excludes riparian planting and any subsidies or government support. This also assumes that all farm systems will remain viable with the required setback, i.e., that no reduction in stocking rates is necessary. It is assumed effective area is 90% of total area on average, that dairy farming is already fully compliant given Sustainable Dairying Water Accord and setback exemption for pre-existing fences. It is assumed only 50% of waterbody margins subject to the regulations are already fenced off for drystock.

Figure 12 highlights the difference in baseline profit for the different land uses and farming/growing systems considered. In particular, costs for drystock would generally be greater as a proportion of baseline profit. Although the impact on dairy at farm level does not appear that significant, the operating profit figures do not take into account debt servicing, which is generally more significant for dairy. The average debt level for dairy farms in the Bay of Plenty in 2017-18 was $24,638 per hectare (DairyNZ, 2019), although there would be wide variation on that figure for individual farmers.

Still focusing on the farm plans and stock exclusion proposals, Table 8 follows from Table 1 with the addition of annualised stock exclusion costs (subject to the same assumptions as in Figure 12). The overall impact of both proposals on the regional primary sector annual operating profit is estimated to be a 5.2% reduction (compared to 5.5% in the original assessment), with drystock being more heavily impacted due to lower baseline profits and fewer farm systems 'levers' to pull.

The estimated reduction in baseline annual operating profit for sheep & beef and deer is 26% and 24% respectively, compared to 32% and 33% respectively under the original proposal. The change is explained by the significantly less stringent stock exclusion requirements. Annualised stock exclusion costs would obviously be sensitive to the period over which the costs are spread and the interest rate assumed.

Table 8 - Estimated region-wide impact on operating profit by industry of farm plan proposal and stock exclusion requirements

Land use	Total number of farming businesses	Total area (ha)	Estimated number of farming businesses within size thresholds	Estimated total area within size thresholds (ha)	Estimated Baseline operating profit/year	Estimated profit after Farm Plans & mitigation/year	Estimated operating profit after FPS, mitigation and stock exclusion (annualised)	Percentage change from baseline operating profit
Kiwifruit	1,452	16,057	884	13,595	$ 500.1m	$ 481m	$ 481m	-4%
Other horticulture	845	3,735	316	2,338	$ 58.2m	$ 51,7m	$ 51.7m	-11.2%
Sheep & beef	990	96,508	479	85,621	$ 13.9m	$ 11.4m	$10.3m	-25.8%
Arable/grain growing	50	8,037	50	4,192	$ 15.1m	$ 14m	$14m	-6.8%
Dairy	639	119,426	605	111,856	$ 175m	$ 166.4m	$166.4m	-4.9%
Deer	48	6,801	46	6,554	$ 1.2m	$ 1m	$0.94m	-24.3%
Total	**4,024**	**250,565**	**2,379**	**224,157**	**$ 764.3m**	**$ 725.6m**	**$724.3m**	**-5.2%**

In comparison to the original proposal, costs, particularly for stock exclusion, are significantly lower. Consequently, the risk that the new requirements would lead to some landowners going out of business and defaulting on their loans is significantly lower also. The analysis presented here does not look at ongoing viability of farming businesses.

It is also acknowledged that regional councils and central government are likely to provide significant support for farmers to comply with the requirements. This may include funding support through the Jobs for Nature programme, for example.

The assessment presented here should be considered indicative and preliminary. There a number of uncertainties and assumptions, described in more detail within the assessment for each proposal/final decision, that must be noted. The analysis has relied on readily available information, able to be sourced and analysed in a limited timeframe.

Importantly, the analysis assumes no adjustment by landowners. In reality, landowners are likely to respond to any regulatory changes in a number of ways, which would reduce the overall impact of the proposals. For example, landowners may choose to change land use (e.g. from drystock to forestry, or dairy to horticulture) as a way to avoid some of the costs of the proposals (although acknowledging those choices will also carry other costs).

It will be important for final decisions that remain outstanding and for signalled reviews of the announced requirements (e.g. synthetic nitrogen fertiliser input limit, farm plans, DIN attribute) to focus on expected environmental benefits, while recognising regional differences and practicality of effective implementation.

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