Ruamahanga River at Waihenga

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

Ruamahanga River at Waihenga has an upstream catchment area of ~236,089 ha. The catchment is 8.0% dairy/dairy support, 19.0% native bush, 54.2% sheep and beef and 0.6% arable. The remaining area (18.2%) is a variety of 'other' land uses including lifestyle, mixed, horticulture and urban of which no mitigations are applied. During BAU, 50th and 95th DIN percentiles decrease 10.5% and 1.8% by 2080. Land retirement of 347 ha occurs by 2080 (0.15% of the catchment at a rate of ~5.5ha/yr from 2017) and while pole planting is occurring, it is considered to have no effect on reducing loads from nitrogen species (i.e. Ammoniacal-N and Nitrate-N). Tier 1 mitigations such as stock exclusion and effluent management applies a 0.1% reduction in loads to modelled nitrogen species on sheep and beef farms, and 1.6–4.1% on dairy support/dairy farms. Further BAU reductions in DIN at Waihenga are attributed to nearly 100% land treatment of the upstream waste water treatment plants (WWTP- Masterton, Carterton and Greytown) by 2080.

Silver and Gold scenarios increased retirement of land to 10,637 ha (4.5% of catchment at a rate of 168.8 ha/yr from 2017). Additional mitigations on top of tier 1 include 100% land treatment of WWTP, constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3). These contribute to further decreases in DIN median and 95th percentiles, with reductions of 18.0% and 7.5% simulated by 2080 in both scenarios. Minor increases in DIN concentrations occur in these scenarios by 2080, due to WWTP loads incorporating population growth.

Location

Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	13451 (5.7%)	5413 (2.3%)	1487 (0.6%)	128058 (54.2%)	44818 (19.0%)	42862 (18.2%)	236089

Table 2. Mitigation (area in ha)

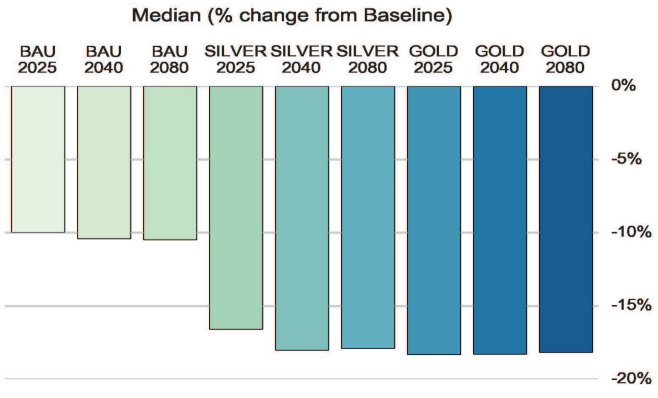
Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	107	245	347	5272	10637	10637	10637	10637	10637

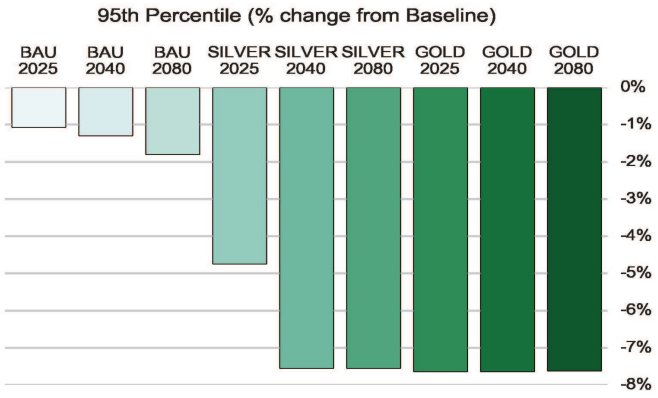
Disclaimer: This fact sheet should be read in conjunction with the report "IZ090000_RP_Rua_Scenarios_Ecological Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. Modelled DIN is the sum of Nitrate-N and Ammoniacal-N loads. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.456	0.411	0.409	0.408	0.381	0.374	0.375	0.373	0.373	0.373
95th Percentile (mg/L)	0.976	0.966	0.963	0.958	0.93	0.902	0.902	0.902	0.902	0.902
Median (% change from Baseline)		-10.0%	-10.4%	-10.5%	-16.6%	-18.0%	-17.9%	-18.3%	-18.3%	-18.2%
95th Percentile (% change from Baseline)		-1.1%	-1.3%	-1.8%	-4.7%	-7.5%	-7.5%	-7.6%	-7.6%	-7.6%





Ruamahanga River at Wardells

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

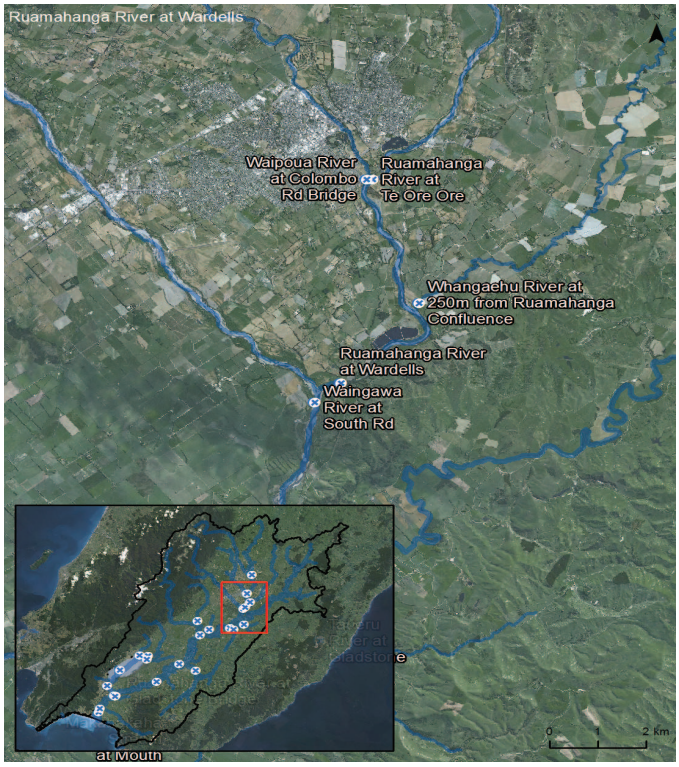
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

Ruamahanga River at Wardells has an upstream catchment area of ~64,284 ha. The catchment is 6.0% dairy/dairy support, 16.0% native bush, 59.9% sheep and beef and 0.3% arable. The remaining area (17.9%) is a variety 'other' land uses including lifestyle, mixed, horticulture and urban of which no mitigations are applied. During BAU, 50th and 95th DIN percentiles decrease by up to 19.9% and 2.9%, respectively by 2080. Land retirement of 225 ha occurs by 2080 (0.35% of catchment at a rate of ~3.5 ha/yr from 2017). Pole planting is considered to have no effect on the nitrogen loads. Reductions in BAU are due to tier 1 mitigations, stock exclusion and effluent management, which applies a 0.1% reduction in loads to modelled nitrogen species (i.e. Ammoniacal-N and Nitrate-N) on sheep and beef farms, and 1.6–4.1% on dairy support/dairy farms. The most significant reductions in DIN at Wardells are attributed to nearly 100% land treatment of the upstream Masterton Waste Water Treatment Plant (WWTP) by 2080.

Silver and Gold scenarios lead to land retirement increases of 3,008 ha (4.7% of catchment at a rate of 47.7 ha/yr since 2017). Further mitigations such as 100% land treatment of Masterton WWTP, constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) contribute to decreases in median and 95th percentiles of 26.8% and 8.2% respectively, simulated by 2080 in both scenarios.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	2322 (3.6%)	1518 (2.4%)	161 (0.3%)	38490 (59.9%)	10298 (16.0%)	11495 (17.9%)	64284

Table 2. Mitigation (area in ha)

Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	132	225	1241	3008	3008	3008	3008	3008

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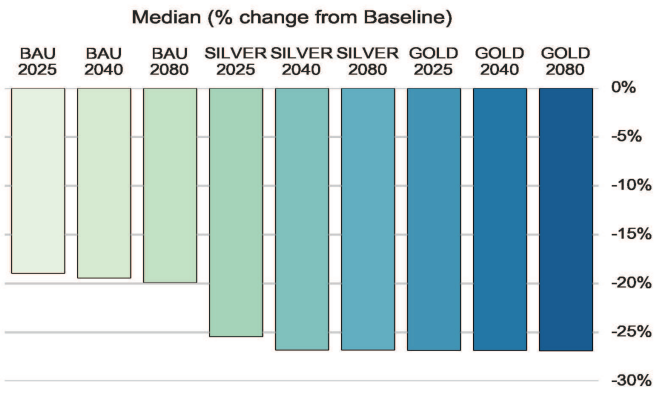
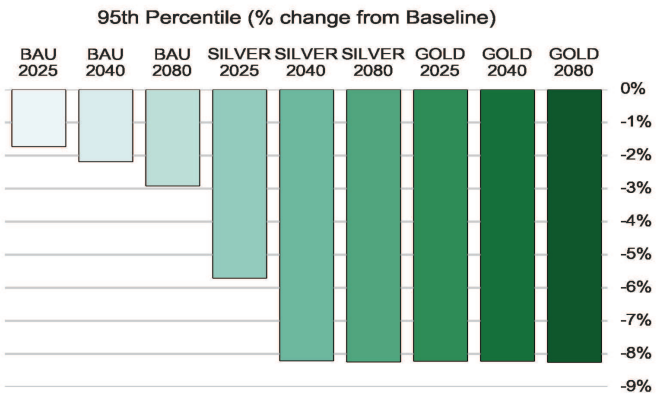
Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.681	0.552	0.549	0.546	0.508	0.499	0.499	0.498	0.498	0.498
95th Percentile (mg/L)	1.3	1.278	1.272	1.262	1.226	1.193	1.193	1.193	1.193	1.193
Median (% change from Baseline)		-18.9%	-19.4%	-19.9%	-25.4%	-26.8%	-26.8%	-26.8%	-26.8%	-26.8%
95th Percentile (% change from Baseline)		-1.7%	-2.2%	-2.9%	-5.7%	-8.2%	-8.2%	-8.2%	-8.2%	-8.2%





Tauanui River at Mouth

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

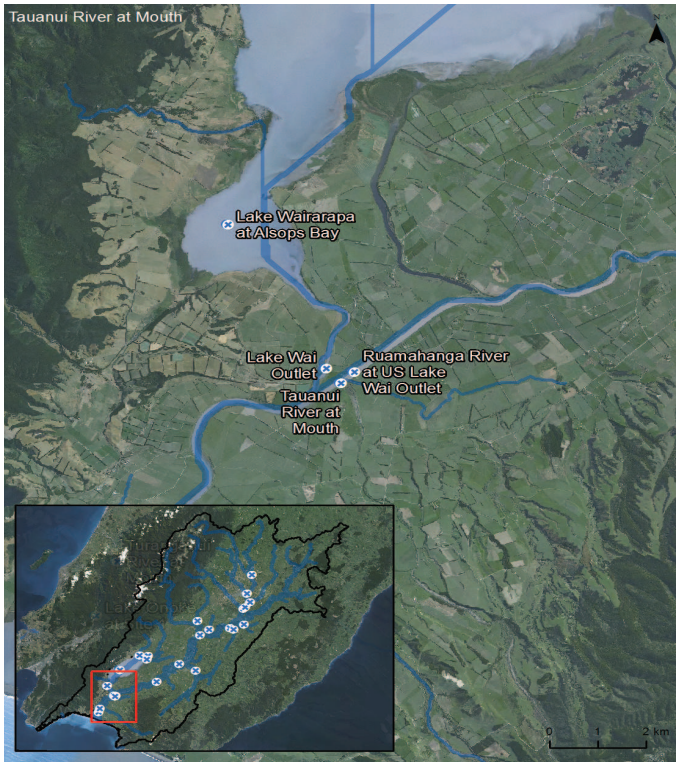
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

A catchment of ~4,155 ha drains to the Tauanui River Mouth. The catchment is largely native bush (61.0%), with some sheep and beef (14.9%) and no dairy/dairy support. The remaining area (24.1%) is a variety of 'other' land uses including lifestyle, sheep and mixed of which no mitigations are applied. During BAU 2080, median (50th) and 95th percentiles of DIN increase by up to 0.3% and 0.2%, respectively. While tier 1 mitigations (stock exclusion and effluent management) are being applied, their small nutrient reductions are being offset by minor changes in flows and Nitrate-N loads driven by groundwater fluxes from the MODFLOW-MT3D model. Furthermore, in BAU 2080 there is no land retirement in the catchment.

In Silver and Gold scenarios the amount of retired land increases to 8 ha from BAU, or 0.2% of the catchment at a retirement rate of ~0.1 ha/yr from 2017, and while pole planting is occurring in the catchment, it is considered to have no effect on nitrogen species (i.e. DIN). In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to cumulative nutrient reductions in the DWC's of ~3.8% on sheep and beef farms. In a catchment of largely native bush, these combined effects lead to minor reductions in the 50th and 95th DIN percentiles of up to 0.7% and 2.1% respectively by 2080.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	-	-	-	617 (14.9%)	2535 (61.0%)	1003 (24.1%)	4155

Table 2. Mitigation (area in ha)

Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	5	8	8	8	8	8

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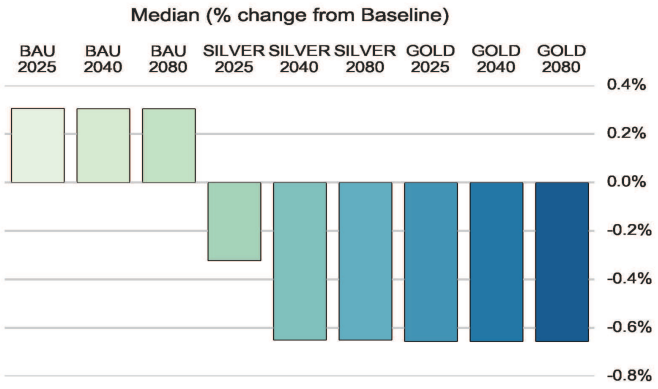
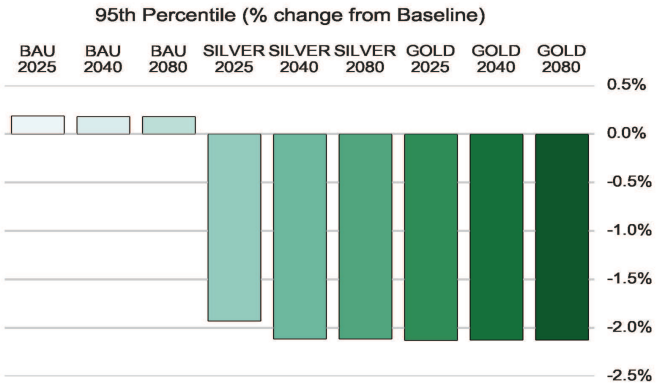
Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.133	0.134	0.134	0.134	0.133	0.132	0.132	0.132	0.132	0.132
95th Percentile (mg/L)	0.349	0.35	0.35	0.35	0.342	0.342	0.342	0.342	0.342	0.342
Median (% change from Baseline)		0.3%	0.3%	0.3%	-0.3%	-0.6%	-0.6%	-0.7%	-0.7%	-0.7%
95th Percentile (% change from Baseline)		0.2%	0.2%	0.2%	-1.9%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%





Taueru River at Gladstone

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

JACOBS

Ruamāhanga Whaitua Committee

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

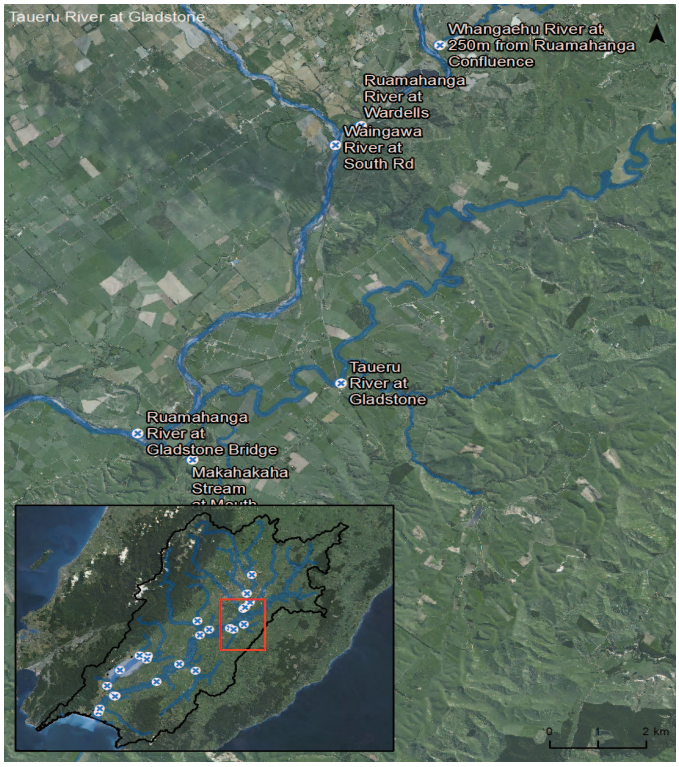
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Taueru River at Gladstone has an upstream catchment area of ~49,244 ha. The catchment is 1.1% dairy/dairy support, 0.5% native bush, 80.5% sheep and beef and 1.2% arable. The remaining area (16.7%) are all 'other' land uses including lifestyle, plantation forestry, mixed and horticulture of which no mitigations are applied. During BAU, 50th and 95th DIN percentiles decrease ~0.1% by 2080. No land retirement occurs in BAU, and pole planted land is considered to have no effect on nitrogen species (i.e. Ammoniacal-N and Nitrate-N). The minor reductions are attributed to tier 1 mitigations (stock exclusion and effluent management) reducing DIN loads by ~0.1% on sheep and beef landuses and 1.6–4.1% on dairy support/dairy farms (the latter of which makes up a small proportion of the catchment).

Silver and Gold scenarios lead to a significant increase in land retirement to 3,310 ha (6.7% of catchment at a rate of 52.5 ha/yr from 2017). Further mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) contribute to decreases in simulated median and 95th percentiles of up to 8.9% and 8.1% by 2080 in both scenarios.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	298 (0.6%)	246 (0.5%)	587 (1.2%)	39655 (80.5%)	242 (0.5%)	8217 (16.7%)	49244

Table 2. Mitigation (area in ha)

Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	1213	3310	3310	3310	3310	3310

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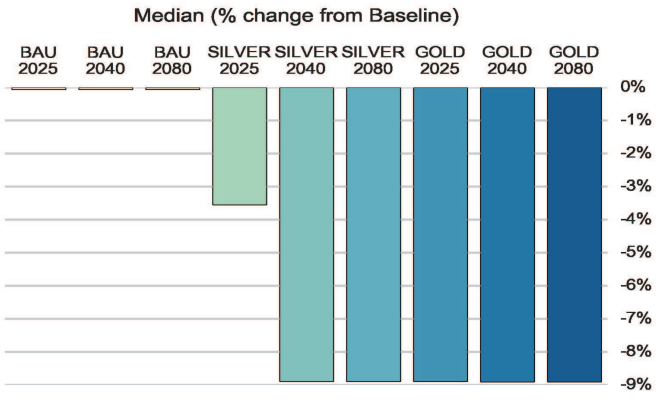
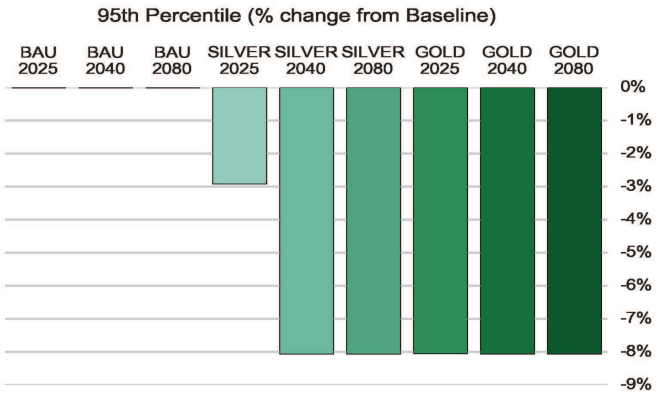
Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.736	0.735	0.735	0.735	0.71	0.67	0.67	0.67	0.67	0.67
95th Percentile (mg/L)	1.43	1.43	1.43	1.43	1.389	1.315	1.315	1.315	1.315	1.315
Median (% change from Baseline)		-0.1%	-0.1%	-0.1%	-3.5%	-8.9%	-8.9%	-8.9%	-8.9%	-8.9%
95th Percentile (% change from Baseline)		-0.0%	-0.0%	-0.0%	-2.9%	-8.1%	-8.1%	-8.0%	-8.1%	-8.1%





Tauherenikau River at Websters

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

JACOBS

Ruamāhanga Whaitua Committee

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Tauherenikau River at Websters catchment is ~14,481 ha. The catchment is largely native bush (77.7%), with some sheep and beef (6.5%) and dairy/dairy support (4.7%). The remaining area (11.0%) is a variety of 'other' land uses including lifestyle and mixed which no mitigations are applied. During BAU, median (50th) percentiles of DIN decrease up to 1.1% and the 95th DIN percentile increases by up to 4.8% by 2080. Tier 1 mitigations (stock exclusion and effluent management) applies a 0.1% reduction in loads to modelled nitrogen species (i.e. Ammoniacal-N and Nitrate-N) on sheep and beef farms, and 1.6–4.1% on dairy support/dairy farms. While the mitigations reduce loads from these landuses, the increase in the DIN 95th percentile is likely due to a minor change in flows (from groundwater fluxes and consented cease take rules) that may influence the quickflow (and EMC's) in the catchment. No land is retired in any of the scenarios and while pole planting is occurring in the catchment, it is considered to have no effect on nitrogen species (i.e. DIN).

In Silver and Gold scenarios, in addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to cumulative nutrient reductions in the DWC's of ~24–25.7% (dairy/dairy support) and ~3.8% on sheep and beef farms. These combined effects lead to DIN reductions in the 50th and 95th percentiles of up to 10.9% and 13.2% respectively by 2080.

Location

Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	267 (1.8%)	419 (2.9%)	-	944 (6.5%)	11255 (77.7%)	1596 (11.0%)	14481

Table 2. Mitigation (area in ha)

Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	0	0	0	0	0	0

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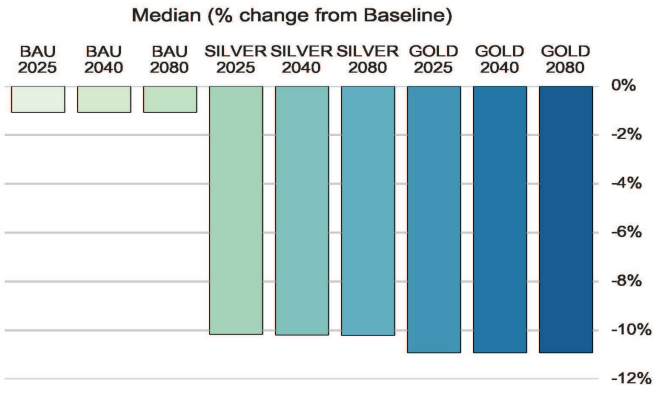
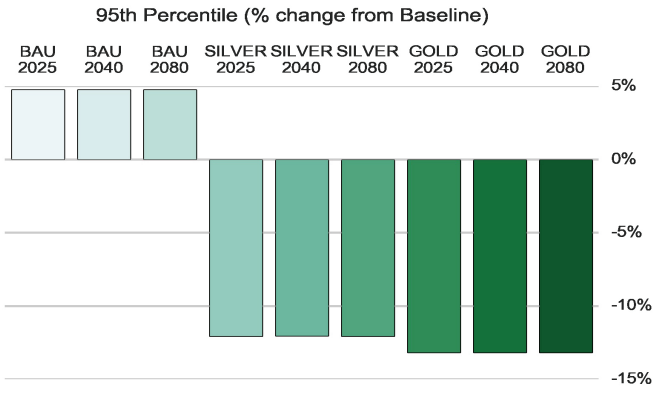
Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.069	0.068	0.068	0.068	0.062	0.062	0.062	0.061	0.061	0.061
95th Percentile (mg/L)	0.29	0.304	0.304	0.304	0.255	0.255	0.255	0.252	0.252	0.252
Median (% change from Baseline)		-1.1%	-1.1%	-1.1%	-10.1%	-10.2%	-10.2%	-10.9%	-10.9%	-10.9%
95th Percentile (% change from Baseline)		4.8%	4.8%	4.8%	-12.1%	-12.0%	-12.1%	-13.2%	-13.2%	-13.2%





Turanganui River at Mouth

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

JACOBS

Ruamāhanga Whaitua Committee

Introduction

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Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

A catchment of ~6,740 ha drains to the Turanganui River Mouth. The majority of the catchment is native bush (51.8%), with some sheep and beef (26.8%) and dairy and dairy support (4.5%). The remaining area (16.9%) is a variety of 'other' land uses including lifestyle and mixed of which no mitigations are applied. During BAU, median (50th) and 95th percentiles of DIN decrease up to 2.1% by 2080. This is due to Tier 1 mitigations, stock exclusion and effluent management, which applies a 0.1% reduction in loads to modelled nitrogen species (i.e. Ammoniacal-N and Nitrate-N) on sheep and beef farms, and 1.6–4.1% on dairy support/dairy farms. In addition, 152 ha of land or 2.3% of the catchment is retired at a rate of ~2.4 ha/yr from 2017 and while pole planting is occurring in the catchment, it is considered to have no effect on nitrogen species (i.e. DIN).

In Silver and Gold scenarios retired land peaks at 131 ha, or 1.9% of the catchment at a retirement rate of ~2 ha/yr from 2017. In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to cumulative nutrient reductions in the DWC's of ~24–25.7% (dairy/dairy support) and ~3.8% on sheep and beef farms. In a catchment of primarily native bush, these combined effects lead to DIN reductions in the 50th and 95th percentiles of up to 4.4% and 4.1% respectively by 2080.

Location

Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	260 (3.9%)	38 (0.6%)	-	1810 (26.8%)	3491 (51.8%)	1141 (16.9%)	6740

Table 2. Mitigation (area in ha)

Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	2	67	152	123	131	131	131	131	131

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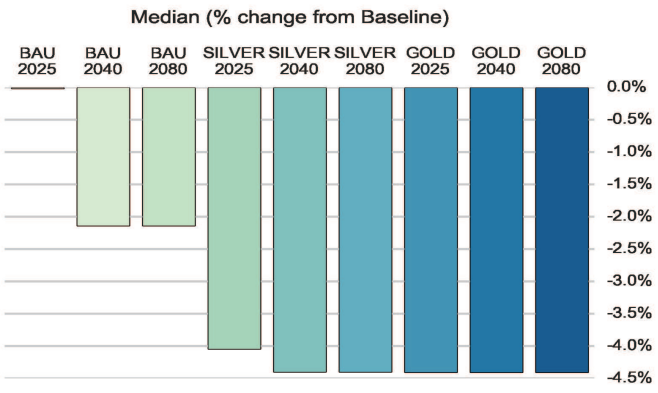
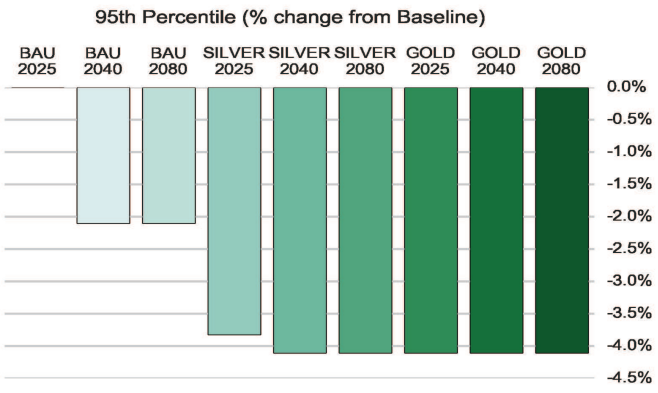
Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.166	0.166	0.163	0.163	0.16	0.159	0.159	0.159	0.159	0.159
95th Percentile (mg/L)	0.659	0.659	0.645	0.645	0.634	0.632	0.632	0.632	0.632	0.632
Median (% change from Baseline)		-0.0%	-2.1%	-2.1%	-4.0%	-4.4%	-4.4%	-4.4%	-4.4%	-4.4%
95th Percentile (% change from Baseline)		-0.0%	-2.1%	-2.1%	-3.8%	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%





Waingawa River at South Rd

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

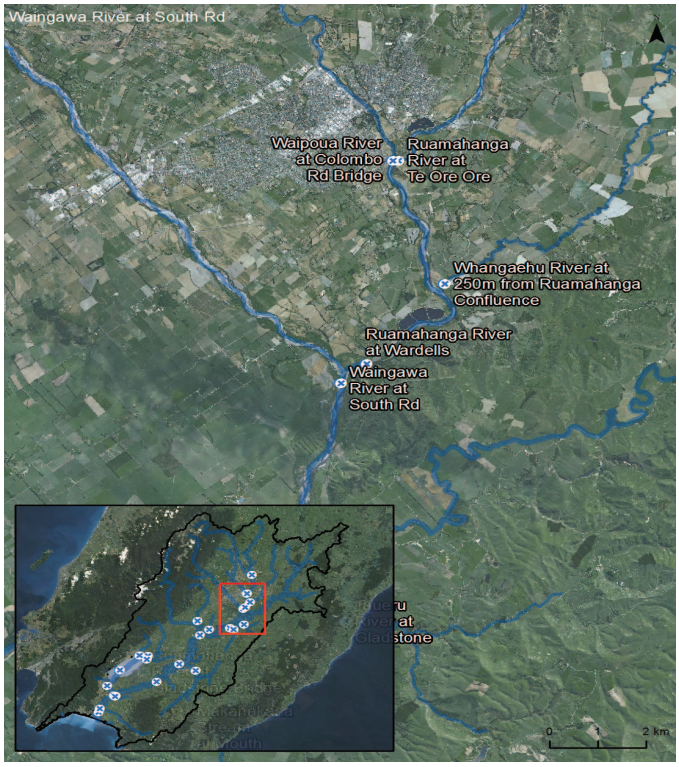
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Waingawa River at South Road catchment is ~14,969 ha. The catchment is primarily native bush (65.8%), with some sheep and beef (16.0%) and dairy and dairy support (2.3%). The remaining area (15.9%) is a variety of 'other' land uses including lifestyle and mixed of which no mitigations are applied. During BAU, median (50th) and 95th percentiles of DIN decrease by up to 1.7% and 0.4% respectively by 2080. This is due to tier 1 mitigations, stock exclusion and effluent management, which applies a 0.1% reduction in loads to modelled nitrogen species (i.e. Ammoniacal-N and Nitrate-N) on sheep and beef farms, and 1.6–4.1% on dairy support/dairy farms. During the BAU 2080 land retired is 7 ha, and while pole planting is occurring in the catchment it is considered to have no effect on nitrogen species (i.e. DIN).

In Silver and Gold scenarios there is a slight decrease in retired land compared to BAU (only 5 ha). In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to cumulative nutrient reductions in the DWC's of ~24–25.7% (dairy/dairy support) and ~3.8% on sheep and beef farms. In a catchment of primarily native bush, these combined effects lead to minor DIN reductions in the 50th and 95th percentiles of up to 2.9% and 0.5% respectively by 2080.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	215 (1.4%)	127 (0.9%)	-	2389 (16.0%)	9856 (65.8%)	2382 (15.9%)	14969

Table 2. Mitigation (area in ha)

Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	7	7	0	5	5	5	5	5

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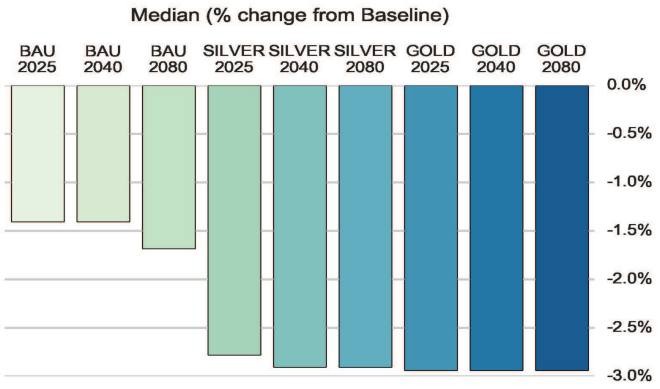
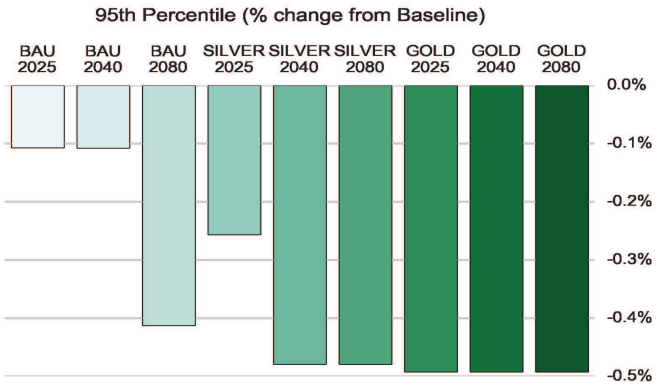
Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.099	0.097	0.097	0.097	0.096	0.096	0.096	0.096	0.096	0.096
95th Percentile (mg/L)	0.253	0.252	0.252	0.252	0.252	0.251	0.251	0.251	0.251	0.251
Median (% change from Baseline)		-1.4%	-1.4%	-1.7%	-2.8%	-2.9%	-2.9%	-2.9%	-2.9%	-2.9%
95th Percentile (% change from Baseline)		-0.1%	-0.1%	-0.4%	-0.3%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%





Waiohine River at Bicknells

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

JACOBS

Ruamāhanga Whaitua Committee

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

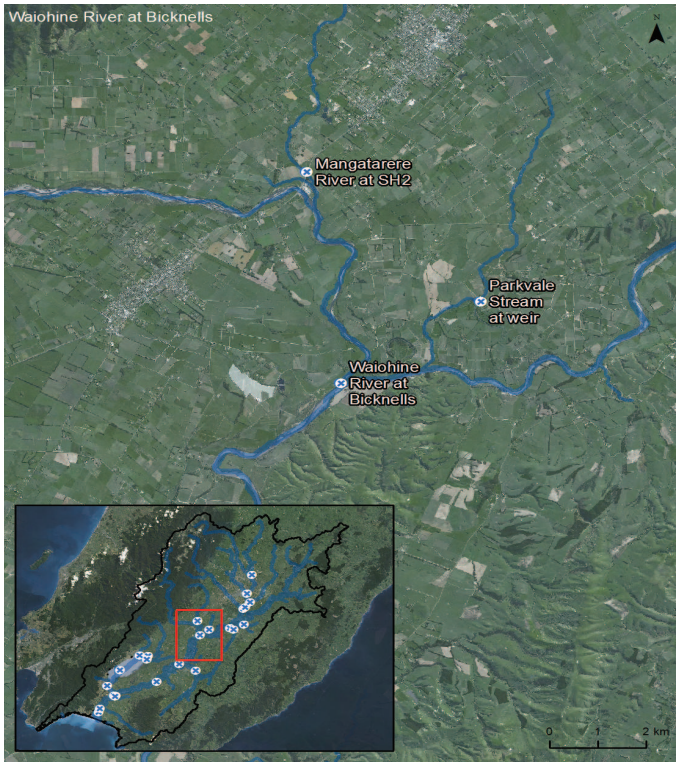
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Waiohine River at Bicknells is a reporting site slightly upstream of the confluence with the Ruamahanga River. The upstream catchment area is ~39,320 ha. The catchment is 18.0% dairy/dairy support, 60.1% native bush, 9.1% sheep and beef and 0.6% arable. The remaining area (12.1%) are all 'other' land uses including lifestyle, mixed, urban and horticulture of which no mitigations are applied. During BAU, 50th and 95th DIN percentiles decrease by up to 10.8% and 3.7%, respectively by 2080. No scenarios involve land retirement and pole planting is considered to have no effect on nitrogen species (i.e. Ammoniacal-N and Nitrate-N). The reasons for decreases in DIN at Bicknells is due to stock exclusion and effluent management (tier 1) applying a 0.1% reduction in loads to modelled nitrogen species on sheep and beef farms, and 1.6–4.1% on dairy support/dairy farms. The greatest influence in loads however is due to significant reductions from land treatment of the Carterton WWTP, ~85% of volume by 2080. This occurs along the Mangatarere River, which joins the Waiohine River upstream of Bicknells.

Silver and Gold scenarios lead to further mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3). Coupled with 100% land treatment of Carterton WWTP, decreases in median and 95th percentiles of up to 18.1% and 4.7% are simulated by Gold 2025. Slight increases in percentiles occur through 2040 and 2080 scenarios, due to the WWTP load incorporating population increase in the region.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	6070 (15.4%)	1036 (2.6%)	227 (0.6%)	3595 (9.1%)	23641 (60.1%)	4750 (12.1%)	39320

Table 2. Mitigation (area in ha)

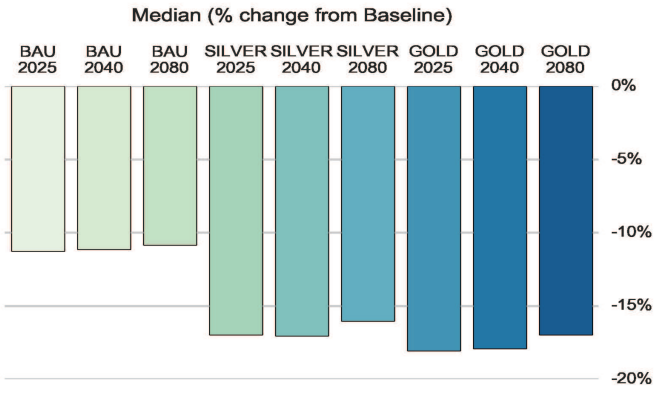
Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	0	0	0	0	0	0

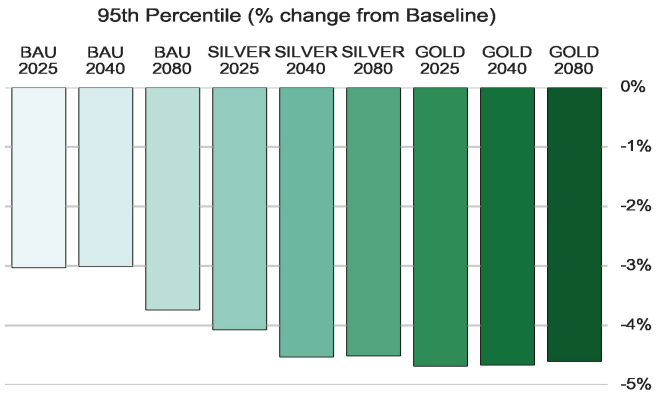
Disclaimer: This fact sheet should be read in conjunction with the report "IZ090000_RP_Rua_Scenarios_Ecological Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. Modelled DIN is the sum of Nitrate-N and Ammoniacal-N loads. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.219	0.195	0.195	0.196	0.182	0.182	0.184	0.18	0.18	0.182
95th Percentile (mg/L)	0.676	0.656	0.656	0.651	0.649	0.646	0.646	0.645	0.645	0.645
Median (% change from Baseline)		-11.3%	-11.1%	-10.8%	-17.0%	-17.0%	-16.0%	-18.1%	-17.9%	-17.0%
95th Percentile (% change from Baseline)		-3.0%	-3.0%	-3.7%	-4.1%	-4.5%	-4.5%	-4.7%	-4.7%	-4.6%





Waipoua River at Colombo Rd Bridge

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

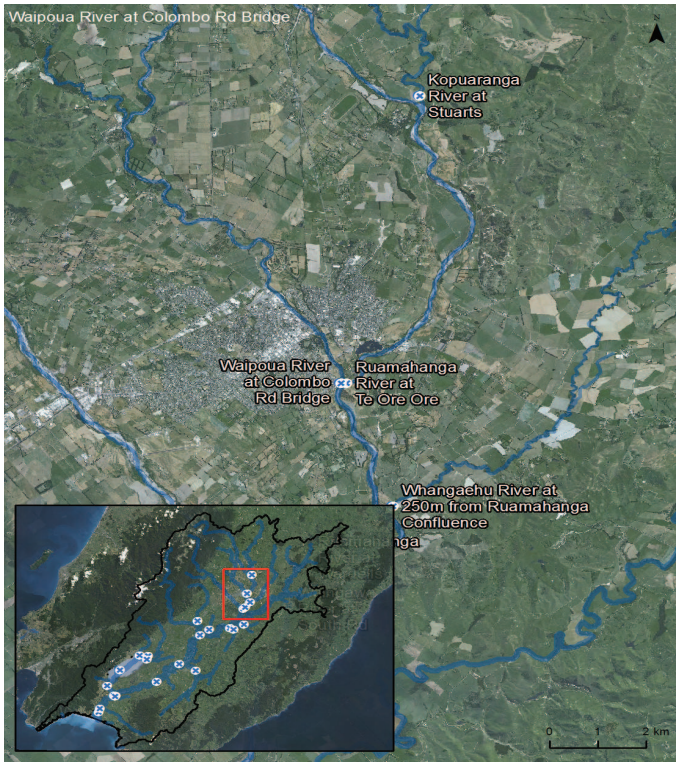
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Waipoua River at Colombo Road Bridge is a reporting site in the upper Ruamahanga, with an upstream catchment area is ~17,542 ha. The catchment is 4.8% dairy/dairy support, 16.1% native bush, 56.5% sheep and beef and 0.6% arable. The remaining area (22%) are all 'other' land uses including lifestyle, mixed, urban and horticulture of which no mitigations are applied. During BAU, 50th and 95th DIN percentiles decrease 18.6% and 2.9% by 2080. This is largely attributed to 163 ha of land retirement in this catchment, in addition to stock exclusion and effluent management (tier 1 mitigations) applying a 0.1% reduction in loads to modelled nitrogen species (i.e. Ammoniacal-N and Nitrate-N) on sheep and beef farms, and 1.6–4.1% on dairy support/dairy farms. Furthermore, groundwater fluxes from MODFLOW-MT3D (providing baseflow into the Waipoua River) have had a noticeable decline in Nitrate-N in this catchment, which contribute to the large DIN reductions.

Silver and Gold scenarios increases land retirement to 454 ha (2.5% of the catchment at a rate of 7.2 ha/yr). Mitigations such as stock exclusion (tier 1), constructed wetlands and optimal fertiliser use (tier 2), and riparian planting/buffer strips (tier 3) result in further DIN reductions. Subsequently, decreases in simulated median and 95th percentiles of 23.7% and 6.4% occur by 2080 in both scenarios.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	173 (1.0%)	670 (3.8%)	113 (0.6%)	9862 (56.5%)	2802 (16.1%)	3832 (22.0%)	17452

Table 2. Mitigation (area in ha)

Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	79	163	314	454	454	454	454	454

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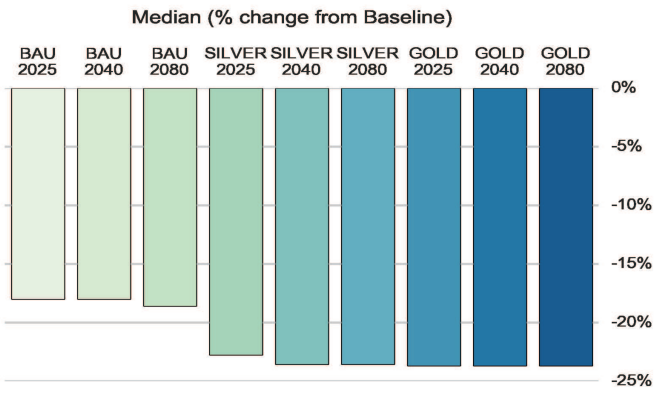
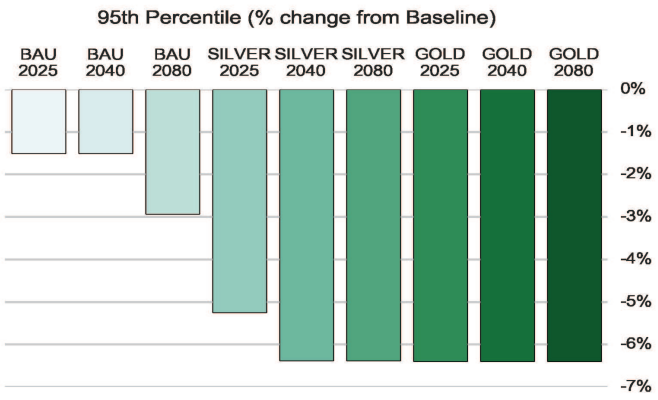
Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.806	0.661	0.661	0.656	0.623	0.616	0.616	0.615	0.615	0.615
95th Percentile (mg/L)	1.88	1.851	1.851	1.824	1.781	1.76	1.76	1.759	1.759	1.759
Median (% change from Baseline)		-18.0%	-18.0%	-18.6%	-22.8%	-23.6%	-23.6%	-23.7%	-23.7%	-23.7%
95th Percentile (% change from Baseline)		-1.5%	-1.5%	-2.9%	-5.2%	-6.4%	-6.4%	-6.4%	-6.4%	-6.4%





Whangaehu River at 250m from Ruamahanga Confluence

Dissolved Inorganic Nitrogen (DIN)

Revision 1

Date: 2017-11-20

JACOBS

Ruamāhanga Whaitua Committee

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Inorganic Nitrogen (DIN) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to ecosystem health and periphyton.

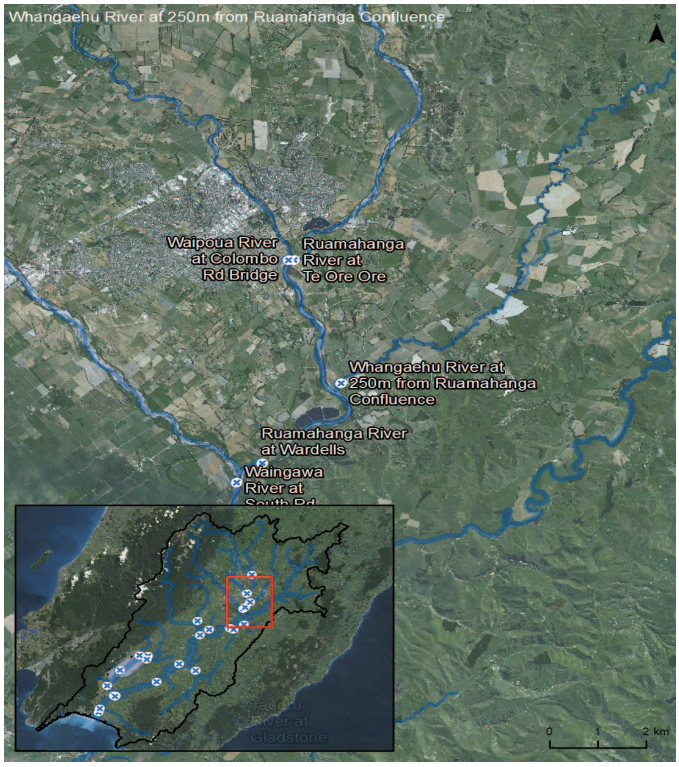
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Whangaehu River at 250m from Confluence has a catchment area of ~14,578 ha. The catchment is primarily sheep and beef (70.9%), with some dairy and dairy support (8.4%) and no native bush. The remaining area (20.4%) is a variety of 'other' land uses including lifestyle, mixed, forestry and arable of which limited mitigations are applied. During BAU, median (50th) and 95th percentiles of DIN decrease by up to 2.8% and 2.4% respectively by 2080. This is due to tier 1 mitigations (stock exclusion and effluent management) which applies a 0.1% reduction in loads to modelled nitrogen species (i.e. Ammoniacal-N and Nitrate-N) on sheep and beef farms, and 1.6–4.1% on dairy support/dairy farms. No land is retired in the BAU 2080 scenario, and while pole planting is occurring in the catchment, it is considered to have no effect on nitrogen species (i.e. DIN).

In Silver and Gold scenarios, there is a significant increase in land retirement up to 1,286 ha, or 8.8% of the catchment at a rate of ~20.5 ha/yr from 2017. In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to cumulative nutrient reductions in the DWC's of ~24–25.7% (dairy/dairy support) and ~3.8% on sheep and beef farms. In a catchment of primarily sheep and beef and dairy/dairy support, these combined effects lead to DIN reductions in the 50th and 95th percentiles of up to 19.5% and 17.7% respectively by 2080.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	915 (6.3%)	299 (2.1%)	45 (0.3%)	10335 (70.9%)	5 (0.0%)	2979 (20.4%)	14578

Table 2. Mitigation (area in ha)

Mitigation	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	452	1286	1286	1286	1286	1286

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Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	1.407	1.367	1.367	1.367	1.138	1.133	1.133	1.132	1.132	1.132
95th Percentile (mg/L)	1.508	1.472	1.472	1.472	1.303	1.241	1.241	1.241	1.241	1.241
Median (% change from Baseline)		-2.8%	-2.8%	-2.8%	-19.1%	-19.5%	-19.5%	-19.5%	-19.5%	-19.5%
95th Percentile (% change from Baseline)		-2.4%	-2.4%	-2.4%	-13.6%	-17.7%	-17.7%	-17.7%	-17.7%	-17.7%