THE WEST COAST
REGIONAL COUNCIL

State of the Environment

WEST COAST REGION | SUMMARY 2022

Authors and data analysts involved in the collection of information and development of this report:

Hydrology
Rose Beagley – Hydrology Data Analyst
Jake Langdon – Hydrology Team Leader

Water Quality
Jonny Horrox – Science Team Leader – Water Quality
Emma Perrin-Smith – Senior Resource Science Technician
Millie Taylor – Resource Science Technician

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Introduction

The West Coast natural environment is generally in good shape. While the greater majority of our land, water, air, and ecosystems are healthy compared to other parts of the country, there is still plenty of work to be done to improve aspects of water quality in some catchments.

The Council is constantly collecting information on the quality of our natural resources. Council regularly monitors groundwater, lakes, rivers, coastal beaches, and air quality across the region at 127 locations. The State of Environment Report (SOE) is produced every three years and covers data from July 2017 to July 2021 to tie into the previous SOE Report.

We are continually improving our monitoring programmes to gain a better understanding of our natural resources and environment. Better data allows us to make more informed decisions when setting appropriate policy for resource use.

In partnership with Poutini Ngāi Tahu, Council facilitates a growing number of community groups who focus on a range of environmental topics. Through these groups we seek to understand community values and encourage the groups to make recommendations to Council for potential non-regulatory or regulatory solutions.

We need to maintain and, where possible, improve the current state of our freshwater resources. The West Coast Regional Council is committed to leading this work, and with your help, we can improve things together.

We hope this document provides a useful summary for understanding the state of our natural environment and the pressures the West Coast faces. Additional information will be available on the Council website for those wanting more technical detail on water quality, so please visit our website or contact us directly.

Rachel Vaughan
Planning and Science Manager

Heather Mabin
Chief Executive

What we are doing:

The current focus on freshwater

The West Coast Regional Council is the smallest Regional Council in New Zealand yet must deliver the same services and functions as the other regions of New Zealand. Resourcing is therefore one of our biggest challenges. Council prioritises its resource management efforts in areas where the greatest resource pressures occur and in specific areas as directed by Central Government policy.

National resource management policy is currently focusing attention on freshwater health and subsequently Council continues to expand planning and science capacity.

The National Policy Statement for Freshwater Management (NPSFM) requires Councils to work with communities to understand how they value waterways, and to set goals based on economic, social, cultural, and environmental factors. The NPSFM recognises Te Mana o te Wai and sets out objectives and policies that direct local government to manage water in an integrated and sustainable way. A key requirement of the NPSFM is that the quality of our rivers, lakes, and groundwater must be maintained or improved.

In May 2018, the Council's Resource Management Committee approved the West Coast Regional Council National Policy Statement for Freshwater Management – Regional Implementation Strategy 2018. This document sets out Council's strategy for implementing the NPSFM and includes a detailed Progressive Implementation Program (PIP), which outlines key milestones for achieving full implementation of the NPSFM by 2030. The strategy has been reviewed by the Ministry for the Environment (MfE), which has resulted in minor adjustments to the PIP. The updated PIP has been publicly available since November 2018. Both the strategy and PIP are available on our website: https://www.wcrc.govt.nz/our-services/resource-management-planning/Pages/Freshwater-Management.aspx

Four Freshwater Management Units (FMUs) have been identified by Council across the West Coast region in order to effectively manage water resources in areas where issues and community values may vary. Council initiated FMU engagement in 2018, and completed this in 2021. FMU Groups operated in partnership with Poutini Ngāi Tahu, Te Rūnaga o Ngāti Waewae, and Te Rūnanga o Makaawhio to recognise and respect the principles of the Treaty of Waitangi and develop recommendations that consider manawhenua cultural values. The engagement process assisted Council in determining community values for their respective FMU's. Council will now translate this into policy that best serves the communities needs and upholds mandatory government legislation.

There are many areas where Council is working to improve resource quality on the West Coast, and the NPSFM is currently one of our main focus points.

WHY DO WE DO MONITORING?

Our monitoring programmes help us gain a better understanding of our natural resources and environment. Better data allows us to make more informed decisions when setting appropriate rules and limits on resource use.

The West Coast is known to be the wettest region in New Zealand.

Average rainfall between

1,775mm

and

11,275mm

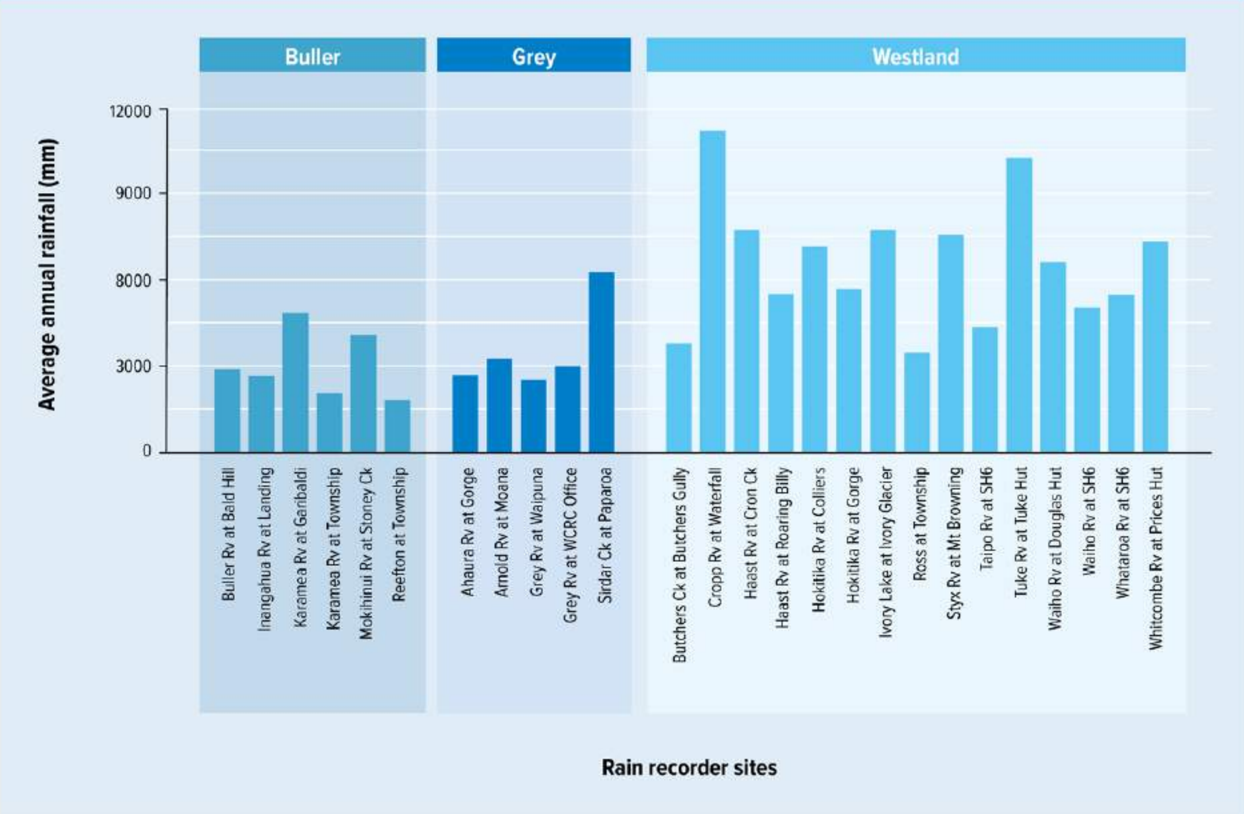
per year during the 2017 – 2021 reporting period.

West Coast rainfall summary

for the 2017 – 2021 hydrological years

The West Coast is known to be the wettest region in New Zealand, recording average annual totals of between 1,775mm and 11,275mm of rainfall per year during the 2017 – 2021 reporting period. Annual rainfall is generally higher in the mid to southern region, particularly in the Southern Alps at higher altitudes (Figure 1).

FIGURE 1: Annual rainfall averages across region

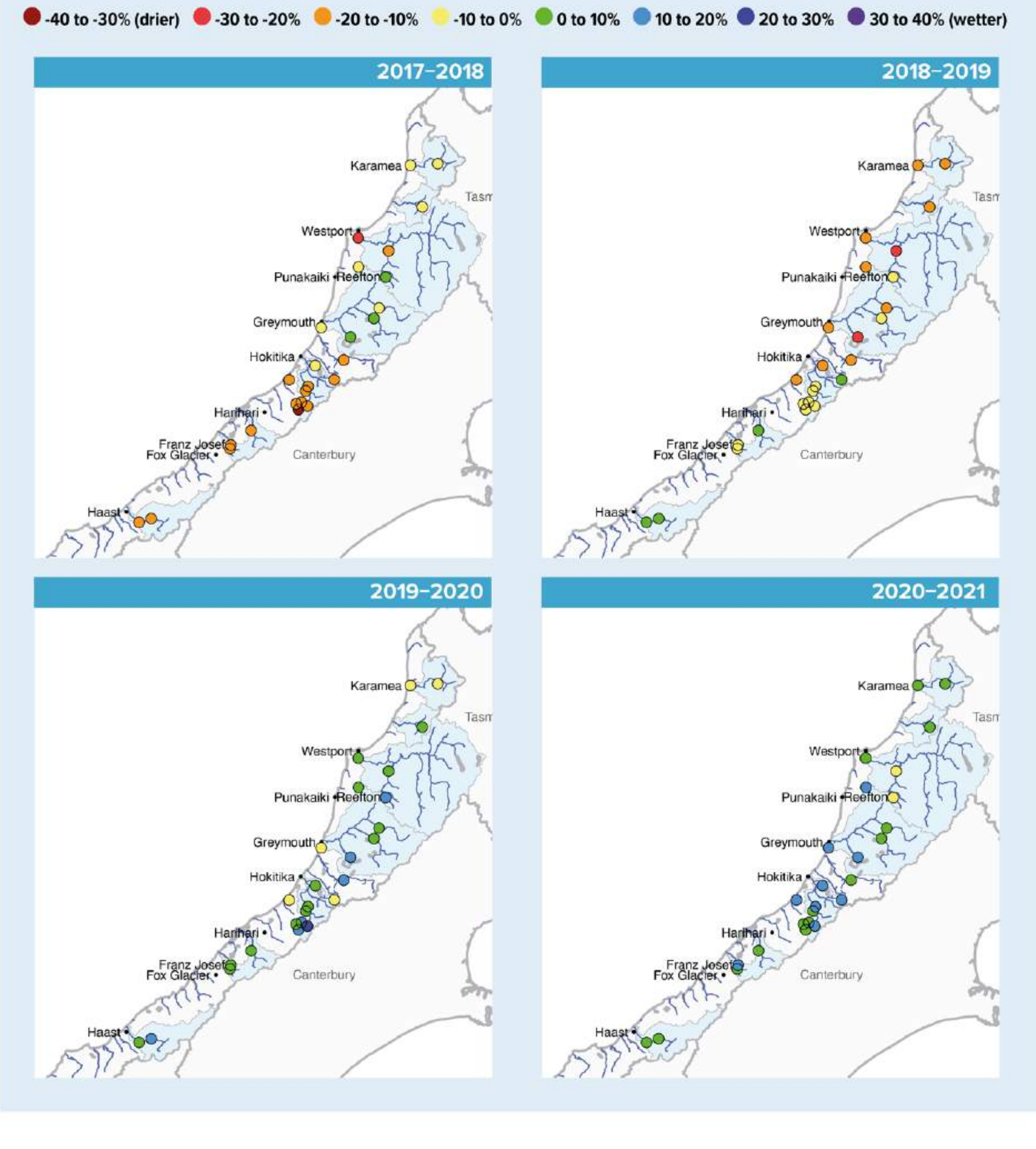


Annual Rainfall Variability

Annual rainfall totals were observed to be lower than normal in 2017/18 and 2018/19. Notably, in 2017/18 Westland rain gauges recorded an average of 10% to 20% less rainfall than their historical averages. Conversely, in 2018/19 a similar pattern was observed in the regions north where 10% to 20% less rainfall than average was recorded at monitoring sites.

More recently, our network shows that the West Coast has been wetter than average. Demonstrating this, in 2019/20 the Cropp rain gauge, located near the headwaters of the Hokitika River, measured the West Coast's highest annual rainfall total between 2017 and 2021, with 12,796mm. This is it's fourth wettest hydrological year on record.

FIGURE 2: Percentage Deviation from Average Annual Rainfall



Monitoring our water quantity

Council operates a network of water level and rainfall recorders across the region (Figure 3). This network is used for flood warning, consenting, water allocation, and limit setting. Some of the water level recorders have been recording data for 55 years.

Since 2017, one flow/water level and seven rainfall sites have been added to the network, and over the next few years more rainfall and flow/water level site builds are planned. These additions provide invaluable input into flood forecasting models and information during flood events.

The current monitoring program consists of:

27 RAINFALL SITES

14 FLOW AND WATER LEVEL SITES

22 MANUAL GROUNDWATER SITES

2 WATER LEVEL ONLY SITES

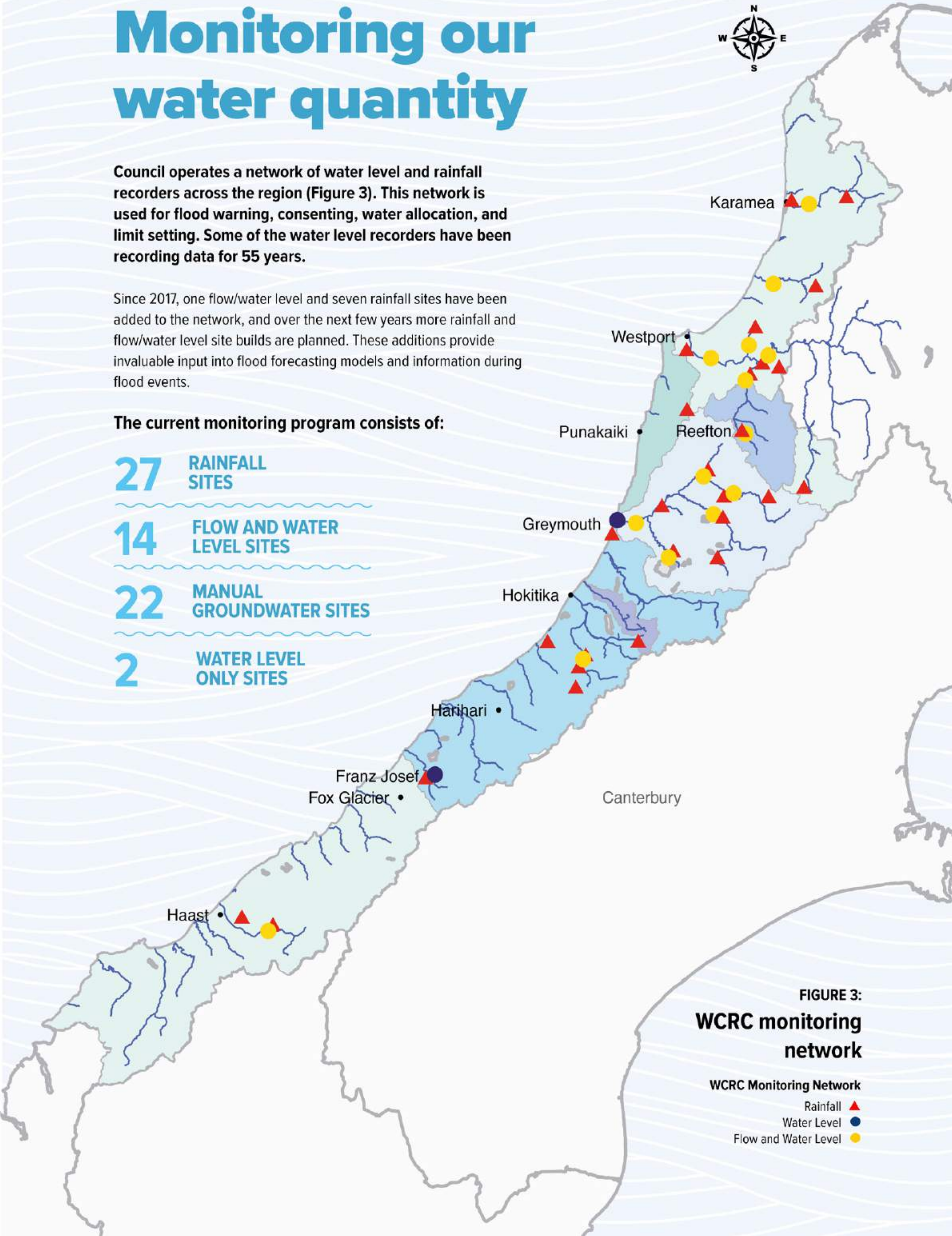


FIGURE 3:
WCRC monitoring network

West Coast river flows summary
for the 2017 – 2021 hydrological years

Statistics information

Hydrological year: Runs from July 1st to June 30th.

Median flow: Has been used over mean for the maps and timeseries plots, as it is not influenced by the relatively infrequent outlier flows i.e. flood events. The median is exceeded half the time and the other half, obviously not.

TABLE 1: Summary of flow statistics across region

Site	Data available (years)	7 day mean annual low flow (m^3/s)	Median annual flow (m^3/s)	Mean annual flow (m^3/s)	1st July 2017 - 1st July 2021: Minimum recorded: Flow (m^3/s)	Minimum recorded: Date	Maximum recorded: Flow (m^3/s)	Maximum recorded: Date	Maximum recorded: Return period
Ahaura Rv at Gorge	53	26	65	99	25	31-Dec-17	1787	08-Nov-18	3.4
Arnold Rv at Lake Brunner	51	24	51	59	25	31-Dec-17	234	09-Nov-18	4.2
Buller Rv at Te Kuha	58	105	275	427	62	05-Mar-19	5635	03-Dec-19	4.1
Buller Rv at Woolfs	58	73	178	252	32	07-Mar-19	3728	03-Dec-19	6.6
Grey Rv at Dobson	53	91	243	357	67	31-Dec-17	3900	09-Nov-18	2.4
Grey Rv at Waipuna	52	14	34	57	11	06-Mar-19	971	17-Sep-19	2.3
Haast Rv at Roaring Billy	50	44	123	192	45	03-Jul-20	5893	26-Mar-19	16.4
Hokitika Rv at Gorge	50	24	61	102	22	12-Sep-18	3057	08-Nov-18	28.5
Inangahua Rv at Landing	58	13	39	73	11	05-Mar-19	2517	08-Jul-18	29.6
Ivory Lake at Ripplerock	20	0.04	0.33	0.76	0.03	09-Sep-18	22	26-Mar-19	3.1
Karamea Rv at Gorge	44	25	72	121	18	06-Mar-19	2197	17-Sep-19	2.6
Mawheraiti Rv at Atarau Bridge	6	3	11	23	1	04-Mar-19	446	03-Dec-19	2.4
Mokihinui Rv at Welcome Bay	30	15	44	88	13	31-Dec-17	1906	03-Dec-19	2.6

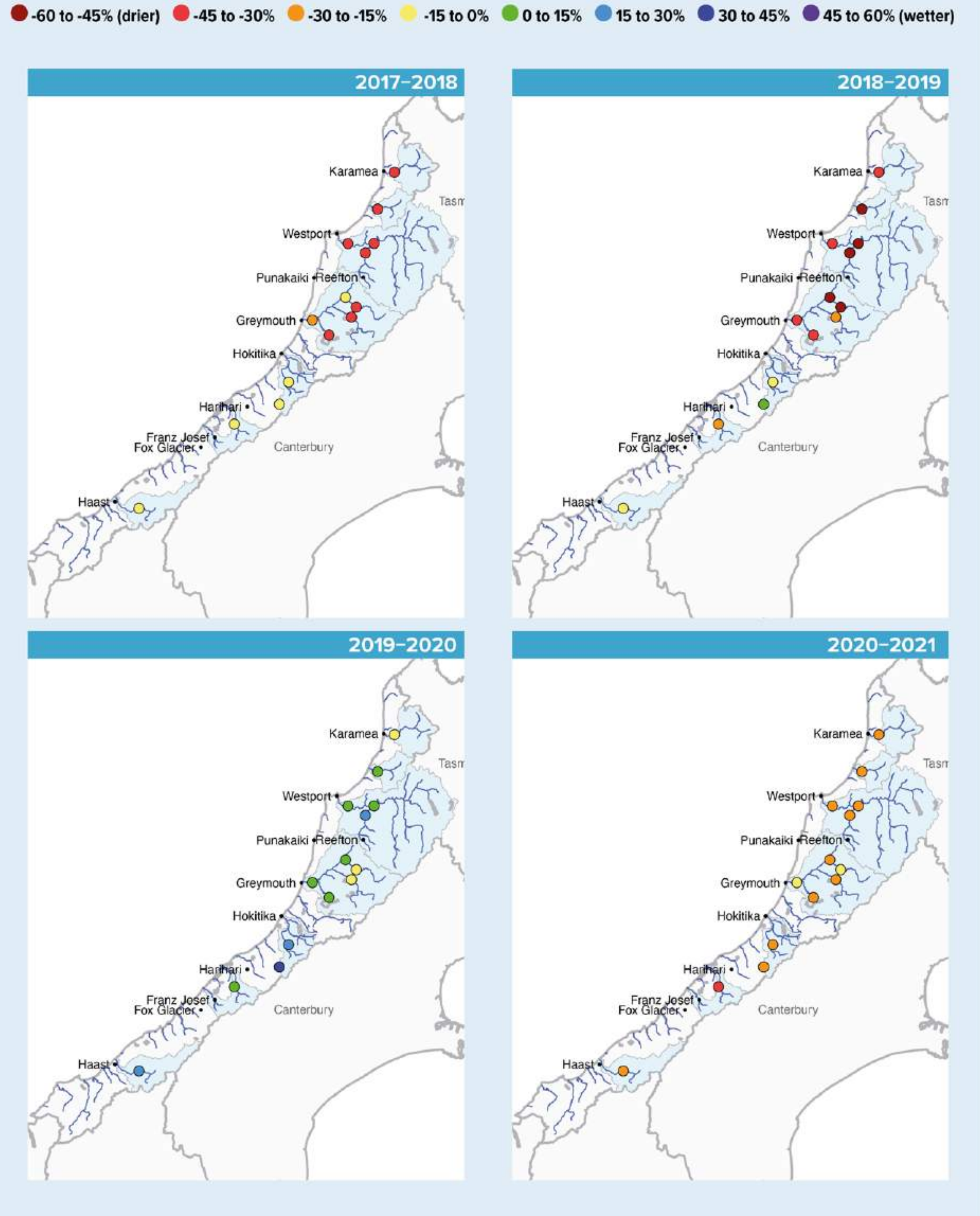
Each year rainfall and river flow data is collected and adds to the records for the region.

There are 55 years of data for some sites.

Summer Flow Variability

Median summer (Dec – Feb) river flows over the 2017-2021 reporting period were generally lower than normal (Figure 4), with the summer of 2018/19 having the notably lowest flows. In contrast, the summer of 2019/20 was wetter than normal, with deviations higher to the south than the north.

FIGURE 4: Percentage Deviation from Median Summer Flow



Major Rivers

Seasonal Patterns

The northern West Coast rivers - Karamea, Mokihinui, Buller, and Grey (Figures 5, 6, 7 and 8) show very similar seasonal patterns throughout their recording history, exhibiting a wide range of median flows around Spring and Winter, and a low and narrow range of median flows around early Autumn.

Comparatively, **the Hokitika and Haast Rivers** (Figures 9 and 10) exhibit a wide range of median flows in Spring and Summer, with median flows tending to be lowest in Winter. This differs to the northern West Coast rivers, likely due to the combined influence of being nestled within the Southern Alps and at a higher latitude, thus experiencing increased orographic rainfall and higher rates of snowfall. During winter, precipitation in the upper reaches of the catchments falling as snow keeps the median flows lower, whilst in Spring and Summer, median flows are higher as they are supplemented by both glacier and snow melt.

Long-term median: average monthly median flow for the entire data set.

Long-term range: defined by the maximum and minimum monthly median flows for the entire data set

Normal range: +/- 25% of the average monthly median flow for the entire data set.

- **Normal range**
- **Long-term range**
- **2017/18**
- **2018/19**
- **2019/20**
- **2020/21**
- **Long-term median**

FIGURE 5: Karamea Rv at Gorge

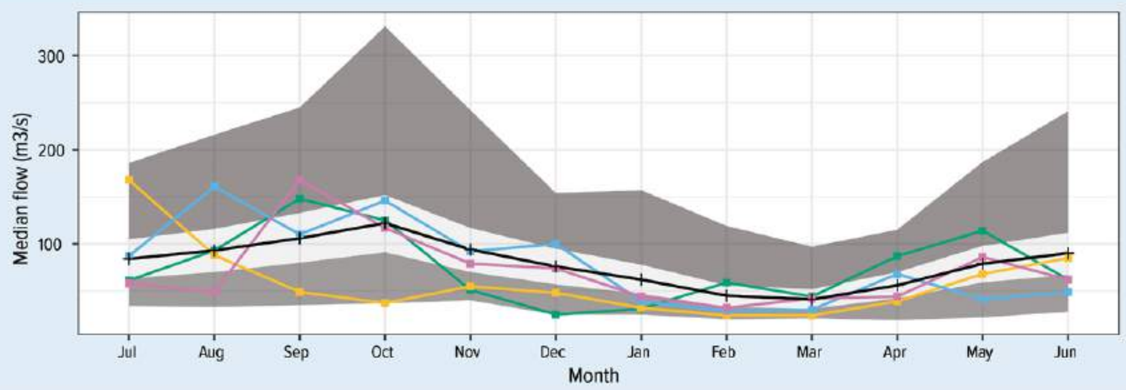


FIGURE 6: Mokihinui Rv at Welcome Bay

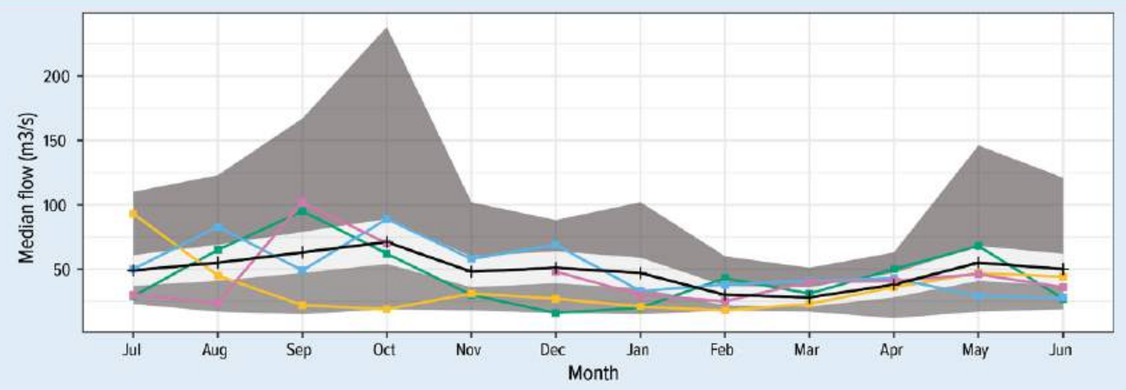


FIGURE 7: Buller Rv at Te Kuha

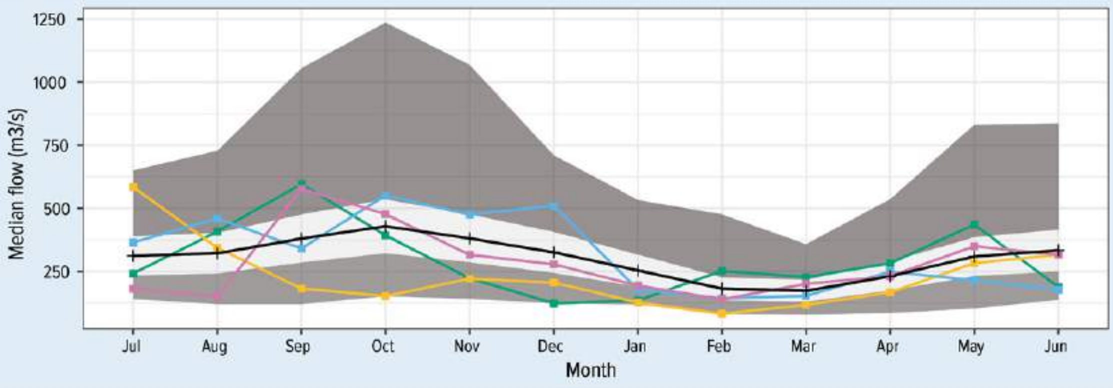


FIGURE 8: Grey Rv at Dobson

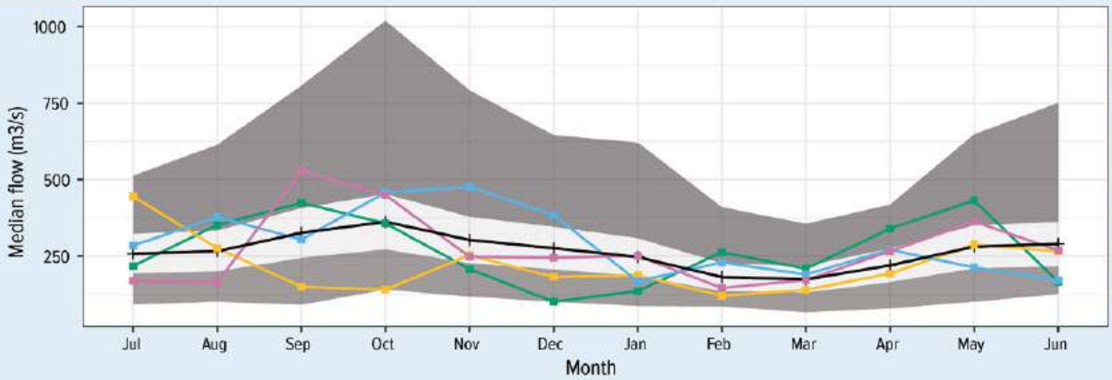


FIGURE 9: Hokitika Rv at Gorge

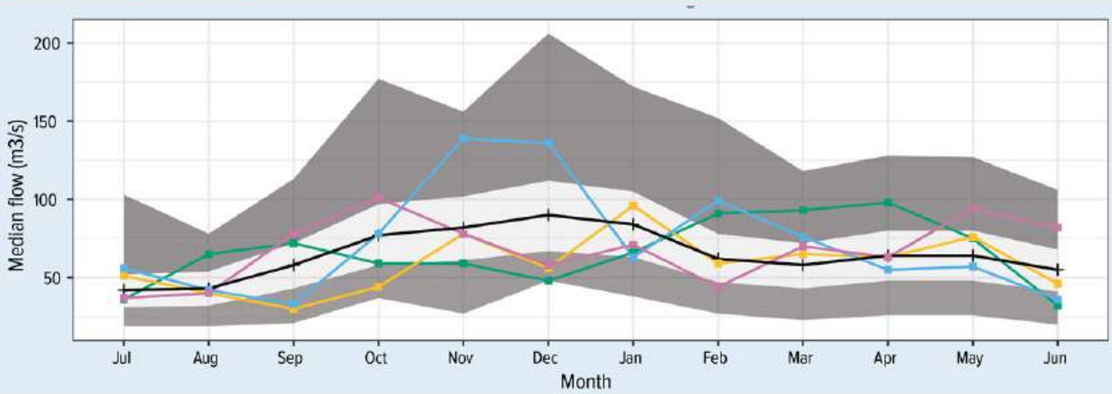
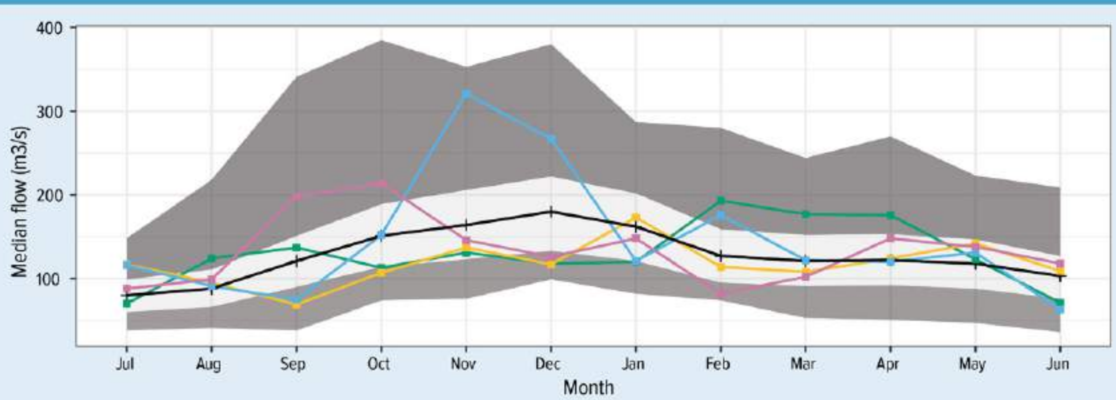


FIGURE 10: Haast Rv at Roaring Billy



Notable Anomalies

*Climate information obtained from NIWA climate summaries (monthly and seasonal).**

From November to January 2017-18, all six major rivers experienced considerably lower than normal flows. This was the result of higher than normal mean sea level pressure to the east and southeast of the country, and lower than normal to the west, a combination which delivered more frequent warm northerly and northeasterly winds than normal, and therefore less rainfall than normal.

Similarly, from September through to March in 2018-19, the northern West Coast rivers experienced considerably lower than normal median flows. This was due to frequent high pressure systems, above average sea temperatures, and slightly lower than normal pressure to the north of NZ and higher than normal to the south resulting in more easterly to northeasterly winds than normal and a distinct lack of southerlies. The dry weather led to what the NZ Drought Index defines as meteorological drought conditions in the Buller District in early February 2019.

In November and December 2019, the Haast and Hokitika Rivers had significantly higher median flows than normal. This was due to the southern hemisphere storm tracks being displaced northwards across the entire Southern Ocean, resulting in more persistent north-westerlies and thus frequent rainfall along and near the Southern Alps.

** Available online at www.niwa.co.nz/climate/summaries*

The West Coast's land cover

Land cover can influence water quality. The West Coast's land cover profile is characterised by:

A **predominance** of **forest cover** (about two thirds of land area), of which most is **indigenous forest** (Figure 11).

Approximately **10%** of land has **anthropogenic activity** (including farming, mining, exotic forestry, urban), and exotic shrubland. The remaining **90%** is in a **natural state**.

A relatively **substantial area** of **natural bare/lightly vegetated surfaces** (e.g., gravel or rock, permanent snow and ice, etc.).

The key changes in land cover between 1997 and 2018/2019* in the West Coast region are:

Indigenous forest
decreased in area by
▼ 6,098 ha

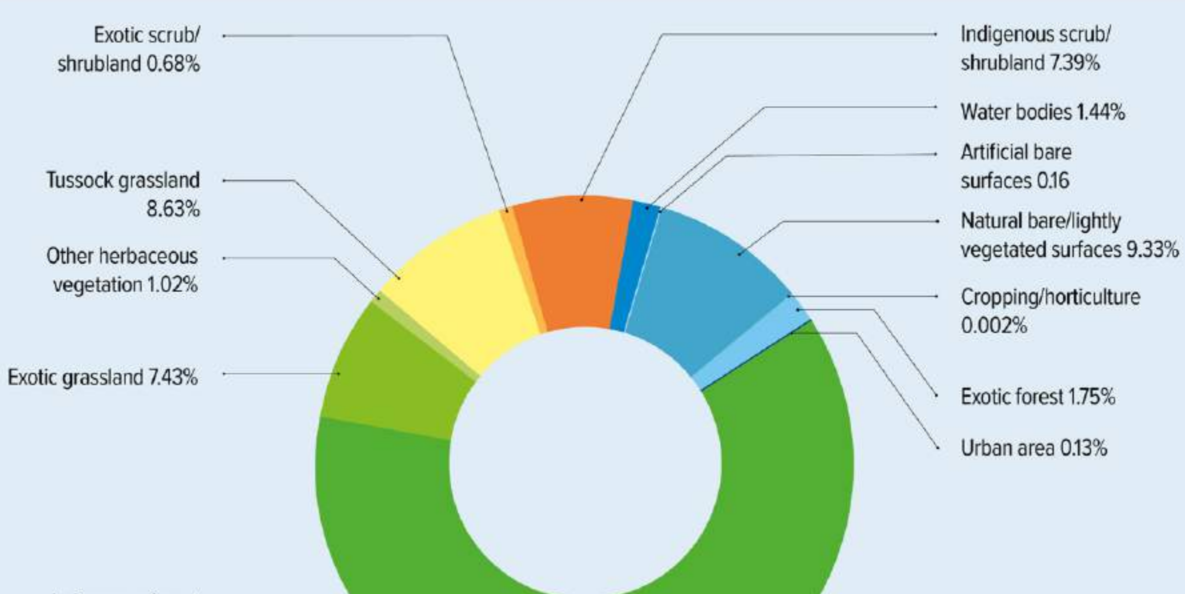
Exotic grassland
increased in area by
▲ 14,239 ha

Exotic forest
decreased in area by
▼ 2,014 ha

Scrub and shrubland
(exotic and indigenous) decreased in area by
▼ 6,677 ha

** The 2018-19 data is that latest information provided for landcover. This information is provided by Landcare Research.*

FIGURE 11: Landcover by percentage cover for the West Coast region as of 2018/2019



Our regions water quality

The West Coast region is renowned for its natural and physical attributes, including its lakes, rivers, and coastal areas. Our water resources not only support a wide variety of eco-systems but also provide a range of benefits that support agriculture, industry, tourism, and the health and well-being of people and communities. Reduced water quality increases risks to public health and affects our ability to use freshwater environments for recreational and commercial purposes. Freshwater ecosystems on the West Coast are rich in animal and plant biodiversity and work via complex processes. Modified freshwater environments, and reduced water quality and quantity, have negative consequences for ecosystem health.

Natural factors, such as climate, geology, and topography help determine how human pressures affect the state of water quality and ecosystem health in a particular waterbody. The types of pressures vary, for example, faecal contamination versus nutrients versus sediment discharges, which will impact on a waterbody's values in different ways. Values themselves will differ among waterbodies, for example, popular for swimming versus important whitebait habitat. What this demonstrates is a need to consider the site-specific context of each water body when assessing river quality and health.

The majority of waterways in the West Coast region drain catchments with indigenous landcover (for example native bush, tussock, ice, and rock). Most of these waterways come from higher altitude headwaters that have good water quality, and which often buffer the impact of contaminants entering downstream. Council maintains ground and surface water quality monitoring programmes for assessing state and trends in a variety of catchment types. Most of these are from the smaller subset of lowland catchments that are affected by agricultural, industrial, and urban pressures. Trends for many water quality attributes have been explored, as well as determining the state of these attributes relative to guidelines and legislation.

Agricultural landcover and intensity has increased as native forest and shrubland has decreased by the same amount. Most monitoring sites have agricultural activity

WHY DO WE DO MONITORING?

No two waterbodies are the same. Values differ, as well as any of the pressures a waterbody may face. Monitoring takes into account the site-specific context of each waterbody when river quality and health are assessed.

in their catchment, which may explain some of the increasing trends observed for sediment, nitrogen and *E. coli*. On a positive note a smaller proportion of sites have shown improvement in these attributes. Similar to the rest of New Zealand, decreasing ammonia levels might reflect improved handling of point source contaminants and better soil nutrient management. This may have been offset by an increase in diffuse pollutants in some catchments.

Nitrates have increased in a number of surface waters with mixed trends in groundwater – some improving and some declining. Nitrates were below toxicity thresholds for people and aquatic life. Nitrogen levels in rivers are usually high enough to support prolific algal growth but this is not particularly common due to frequent, high rainfall events.

Faecal contamination and swimmability is a hot topic in New Zealand. Faecal contamination and pathogen risk, as indicated by *E. coli* levels in ground and surface waters, is an ongoing issue for West Coast water quality. These impacts are human induced. In isolated instances, feral animals can cause elevated E.coli/pathogen levels but data gathered does not show this is an issue for the West Coast.

Despite the West Coast's predominantly cool, wet climate, the occasional hot, dry period can drive up temperatures in vulnerable streams where periodic stress on the aquatic animals is likely. Intrinsic factors that make waterways susceptible to warming include: smaller size, lower altitude catchments, brown water colouration, warm and dry summer microclimates, and a lack of recharge sources. Warmer waterways tend to be inland and to the north of the region.

Dissolved oxygen is important for all aquatic animals. It is influenced by intrinsic factors like temperature, turbulence, and aquatic plant biomass. Significantly low dissolved oxygen was recorded at 7% of Council's monitoring sites. The majority of aquatic animals living in streams are freshwater invertebrates, which include organisms such as crustaceans, molluscs, worms, and freshwater insects. Invertebrates perform important ecosystem services and become food for fish, birds, and people. They are affected by impacts on water and habitat quality, therefore they are useful indicators of stream health. Invertebrate community's indicative of poor water quality were encountered at 24% of sites, with another 24% having fair quality but typical of moderate impacts from pollution.

Council monitors Lakes Haupiri and Brunner on a regular basis. These lakes have adequate nutrient status and ecological conditions. This has not changed for many years although oxygen levels on their lake beds have declined over time.

Faecal bacteria – *E. coli*

Water contaminated with faeces from warm blooded animals can be a risk for people and stock that are drinking or coming into contact with it. The presence of *E. coli* in water indicates contamination from faecal matter. Concentrations of *E. coli* are used to estimate the risk of disease-causing organisms like campylobacter.

From November to March, Council monitors *E. coli* and Enteroccocci at rivers, lakes, and coastal beaches used for swimming. Council applies criteria from the Ministry for the Environments (MfE) microbiological water quality guidelines for marine and freshwater recreational areas to this data. Rivers were more frequently unsuitable for swimming, particularly during, and shortly after, rain events (Figure 12).

The Council also measures *E. coli* in all its monitored rivers. 48% of river sites monitored year round met the National Policy Statement for Freshwater Management (NPSFM) annual criteria for swimmability, above the bottom line (Figure 13). Not many sites displayed strong trends in *E. coli* over the last ten years, with 9% of sites declining and 7% improving (Figure 13).

FIGURE 12: Swimming suitability on the West Coast based on MfE single sample microbial guideline criteria for freshwater and marine swimming areas

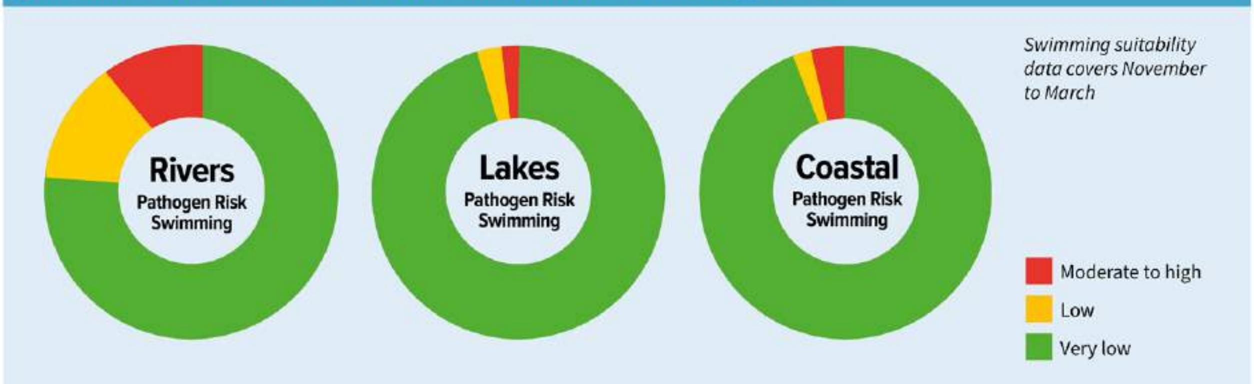
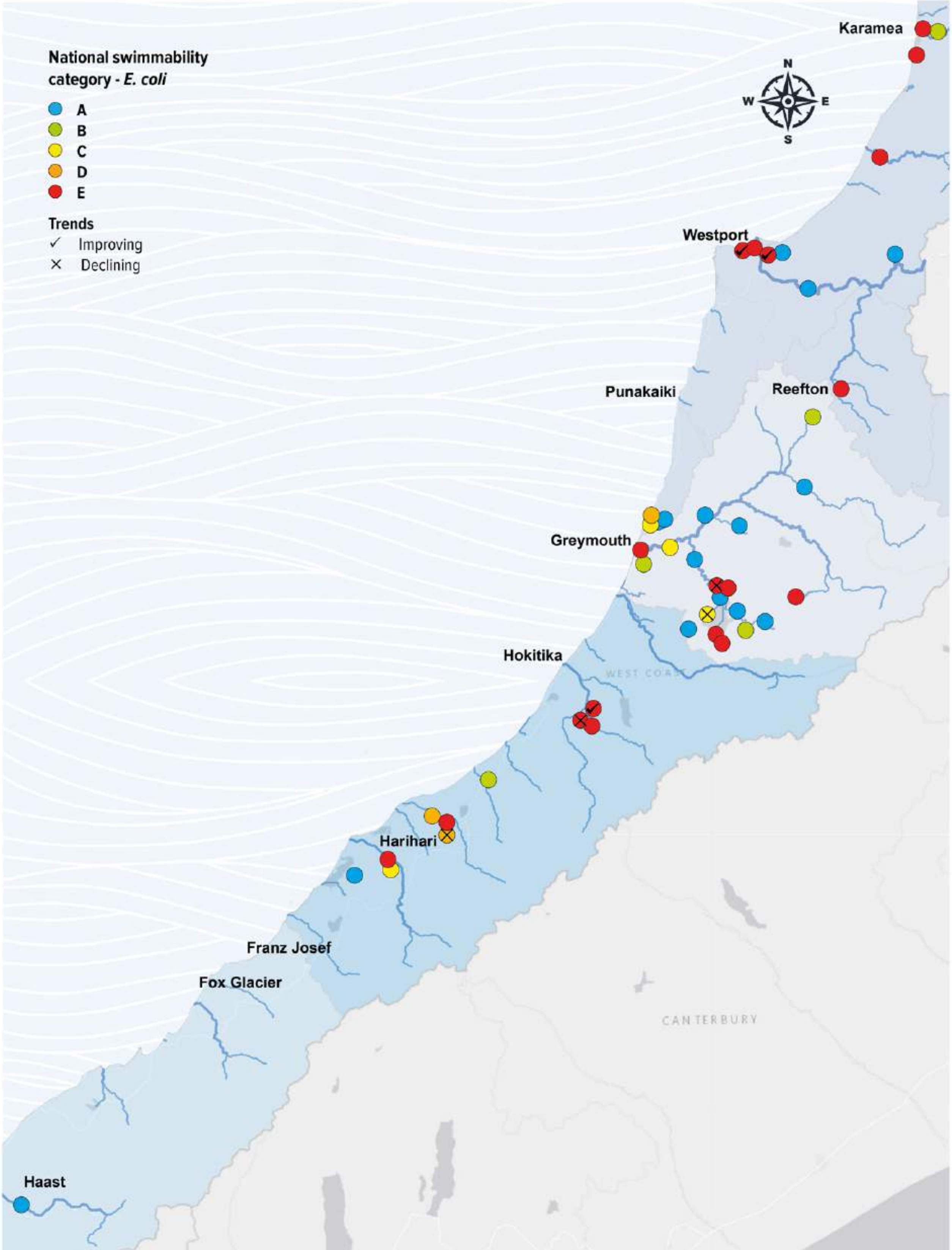


FIGURE 13:
E. coli levels at West Coast river monitoring sites (NPSFM criteria)



Water clarity, turbidity and suspended sediment

Fine particles, like suspended silts, reduce clarity and make water more turbid. There are also dissolved substances that reduce clarity, some of which occur naturally, for example, the brown 'tea staining' seen in many West Coast forest streams.

Elevated suspended sediment is the main cause for poor clarity and turbidity, and is generated by any activity that involves land disturbance. Associated problems include diminished amenity value and impacts on stream ecology from reduced vision, light, and streambed smothering. The majority of West Coast river monitoring sites have human activity within their catchments. 62% of sites had suspended fine sediment similar to that representative of natural reference conditions around New Zealand. A number of sites had levels of suspended sediment that would significantly affect ecological communities, with these sites considered below the national bottom line. But it is important to note that natural processes are in part responsible for this at some sites. Changes in turbidity and clarity over time can relate to quite specific activities, particularly in smaller catchments, for example, development associated with individual farms and mines. Turbidity improved at 16% of sites and declined at 7%. Clarity improved at 11% of sites and declined at 27% of them (Figure 14).

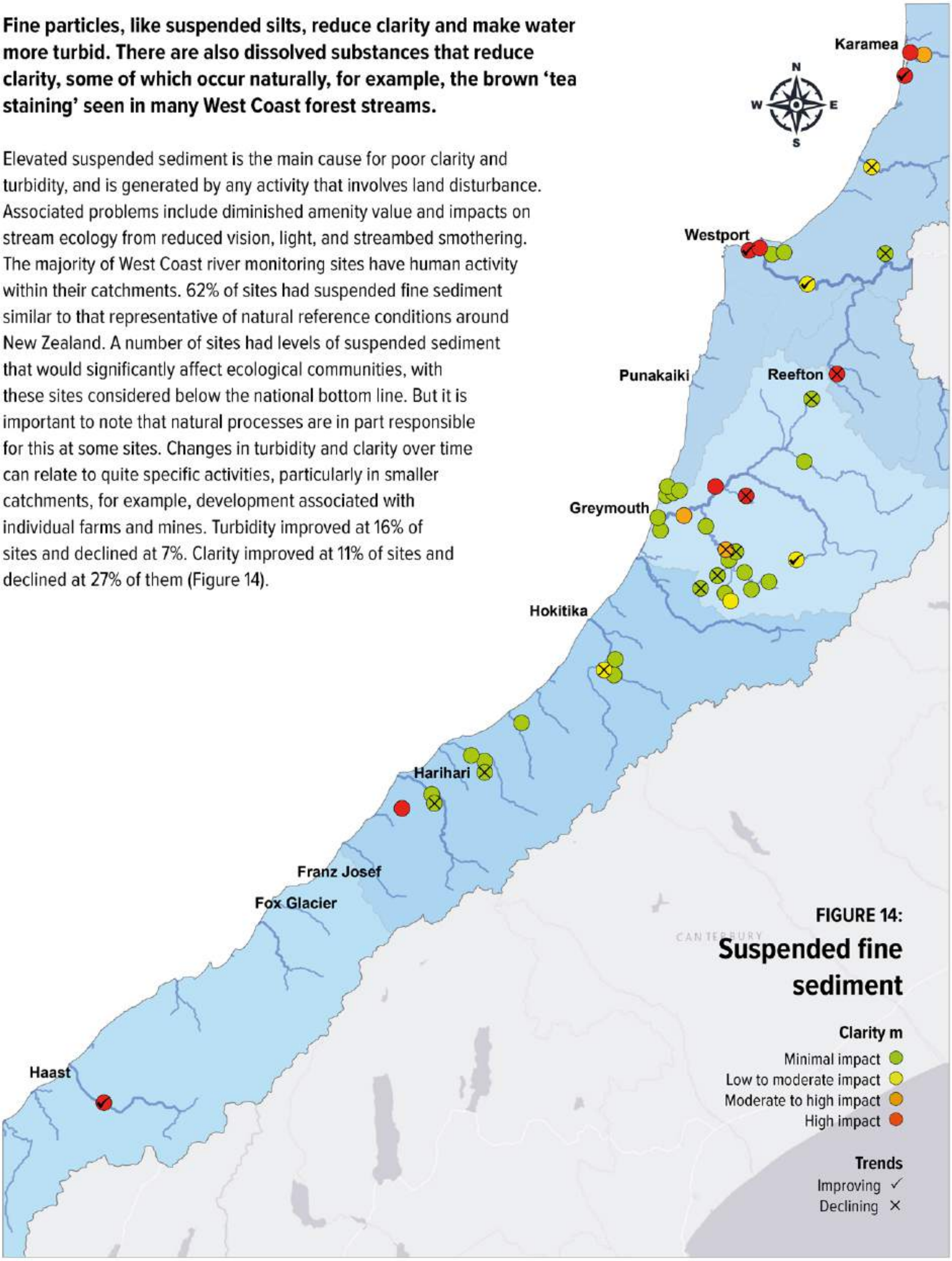


FIGURE 14: Suspended fine sediment

Nitrogen

Nitrogen is an essential nutrient required for plant growth. Total nitrogen consists of all nitrogen forms found in waterways. Nitrate and ammonia are highly soluble components of total nitrogen and are readily used by plants and algae to help them grow.

Nitrates and ammonia can leach from land to rivers, particularly when conditions are wet. Too much nitrogen can cause excessive algal growth or be toxic. In agricultural catchments, nitrate generally comes from nitrogen fertiliser and livestock urine, while ammonia comes more from point-sources such as discharges from sewerage treatment plants, farm dairy effluent, and industrial operations.

Ammonia levels improved at 23% of West Coast monitoring sites, which might indicate improvements in the way discharges have been managed (Figure 15). Ammonia levels tended to be between low and moderate in most West Coast waterways, with small streams located in intensively farmed catchments most likely to reach higher levels (Figure 15). Nitrate levels are typically low in West Coast waterways (Figure 16). Various forms of nitrogen have increased in around a quarter of West Coast waterways affected by urban and agricultural activity, most likely in response to an intensification of these activities.

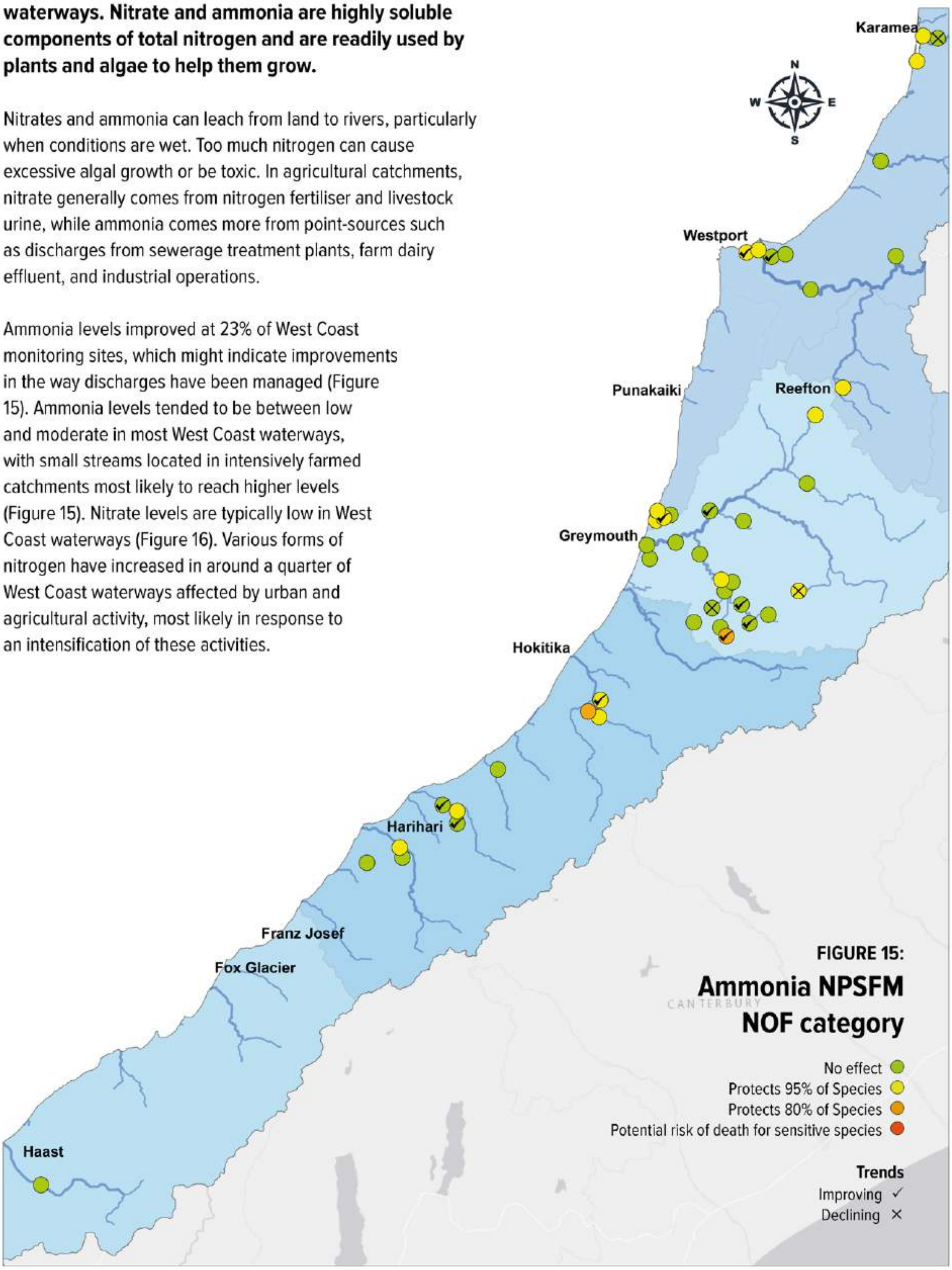
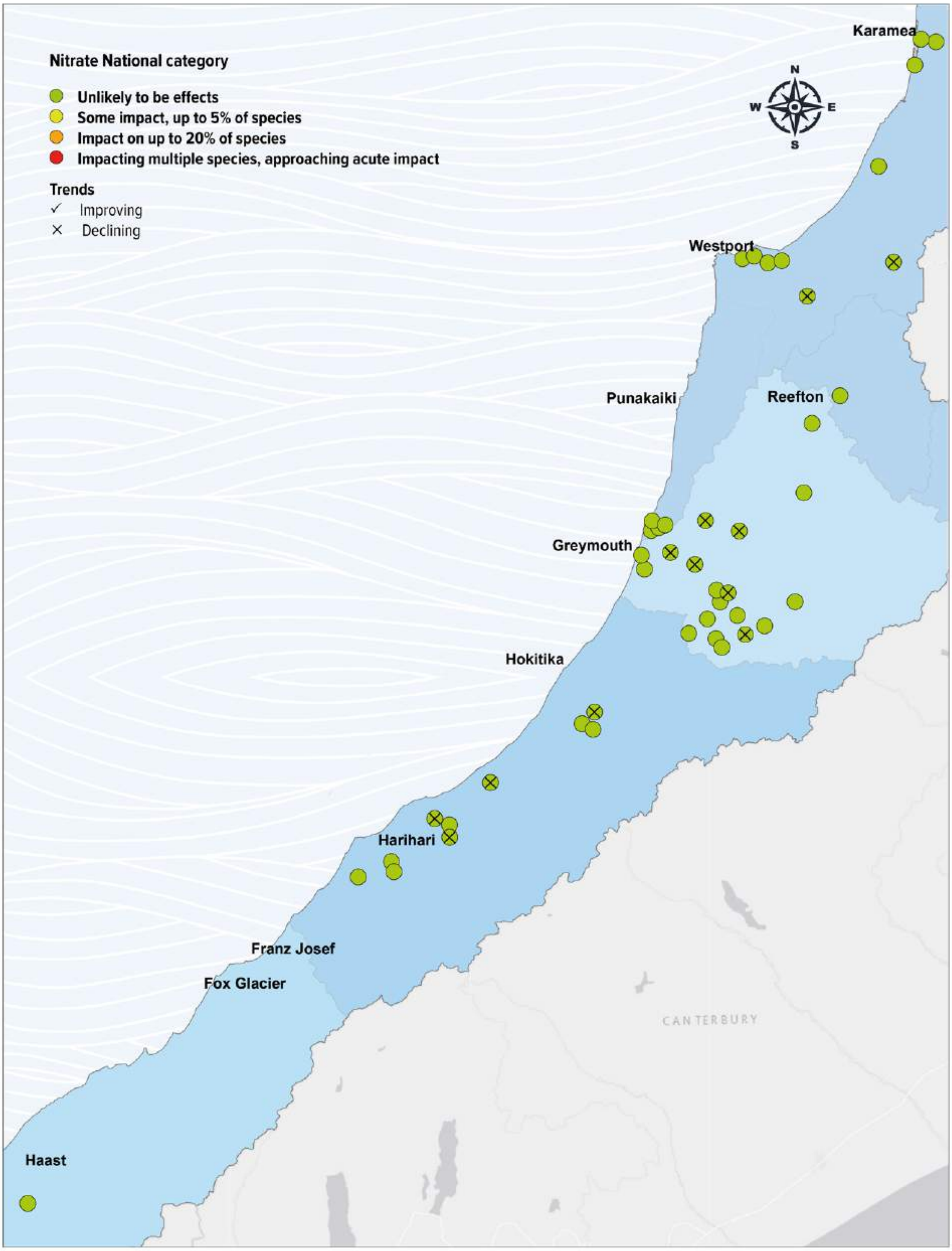


FIGURE 15:
Ammonia NPSFM NOF category

FIGURE 16:

Nitrate levels at West Coast river monitoring sites (NPSFM criteria)



Phosphorus

Phosphorus is an essential nutrient for plants and is a natural component of healthy rivers. Agricultural and urban land use can add phosphorus to waterways, which may cause excessive algal growth and have a negative effect on river habitats. Council monitors the state and trends for both total phosphorus and dissolved reactive phosphorus. Dissolved reactive phosphorus (DRP) is the form of phosphorus immediately available to support plant and algae growth.

The NPSFM NOF has A to D categories for DRP to indicate the potential for adverse effects on ecological communities (Figure 17). Six sites were below the national bottom line for DRP (D category - potential for adverse effects).

DRP levels improved at 9% of monitoring sites and declined at 14% of them. Improved stock and nutrient management, and greater use of phosphorus by algae as a result of increased nitrogen and algae, may be responsible for decreasing phosphorus levels.

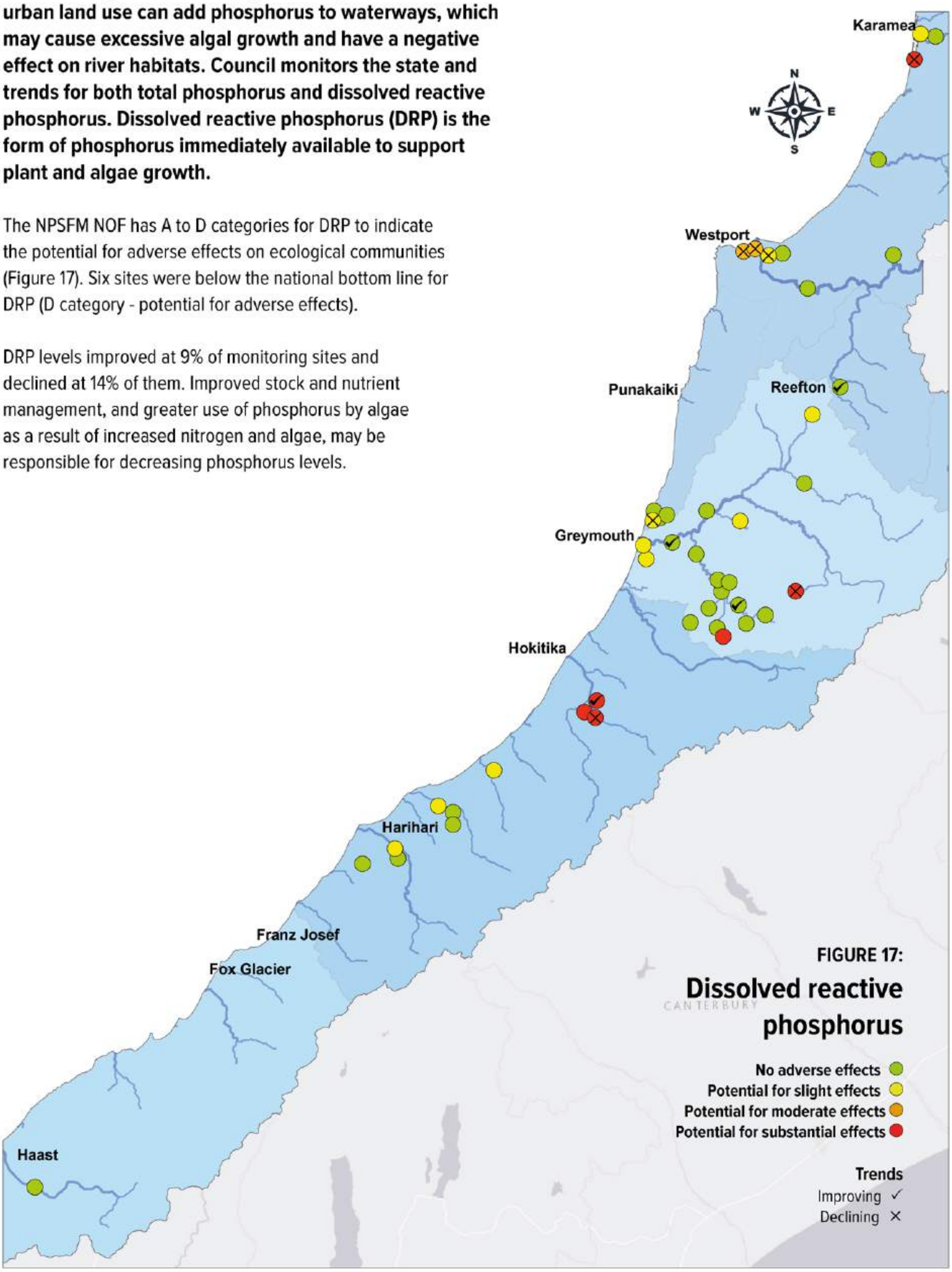


FIGURE 17:
Dissolved reactive phosphorus

Water temperature and dissolved oxygen

Dissolved oxygen has been measured continuously at 24 sites over several summers. Reduced oxygen impairs the growth of aquatic organisms and very low oxygen levels will kill them. Consequently, dissolved oxygen concentrations are critical to stream ecosystem health.

Poor oxygen levels often occur when there are: high temperatures, low water turbulence, and an abundance of plants or algae (plants use oxygen at night). A total of 7% of sites experienced significantly low dissolved oxygen concentrations (Figures 18 and 19). While some streams are naturally disadvantaged, increasing riparian shade through planting and reducing nutrients will be beneficial. Trends have not been evaluated for temperature or oxygen.

Aquatic fauna experience stress from high water temperatures. Temperature also affects water composition including the solubility of oxygen and toxicity of ammonia. While late December has the longest and strongest sunlight, peak stream temperatures on the West Coast can occur from late November through March depending on weather patterns. Intrinsic factors that make waterways susceptible to warming include: smaller size, lower altitude catchments, brown water colouration, warm and dry summer microclimates, and a lack of recharge sources. Temperature has been continuously measured at 31 sites, 33% of which have experienced periodic summer temperatures high enough to cause thermal stress to a range of organisms (Figure 20). Of these sites, 62% have periodically had temperatures sufficient to affect sensitive species.

FIGURE 18: Dissolved oxygen levels in some West Coast Rivers

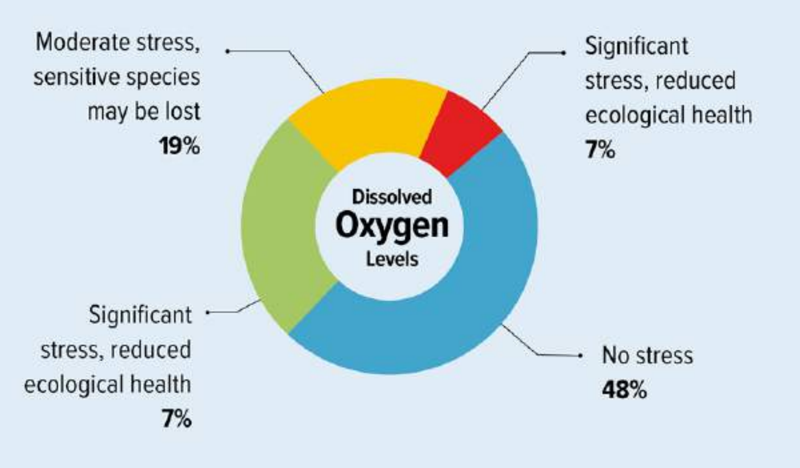


FIGURE 19: Percentage of times non-municipal groundwater supplies met NZDWS for *E. coli*

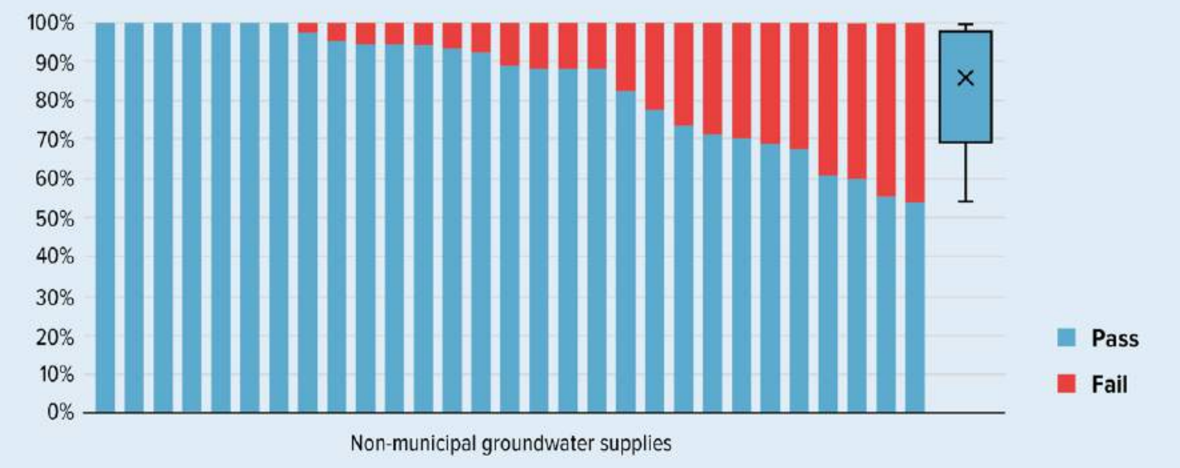
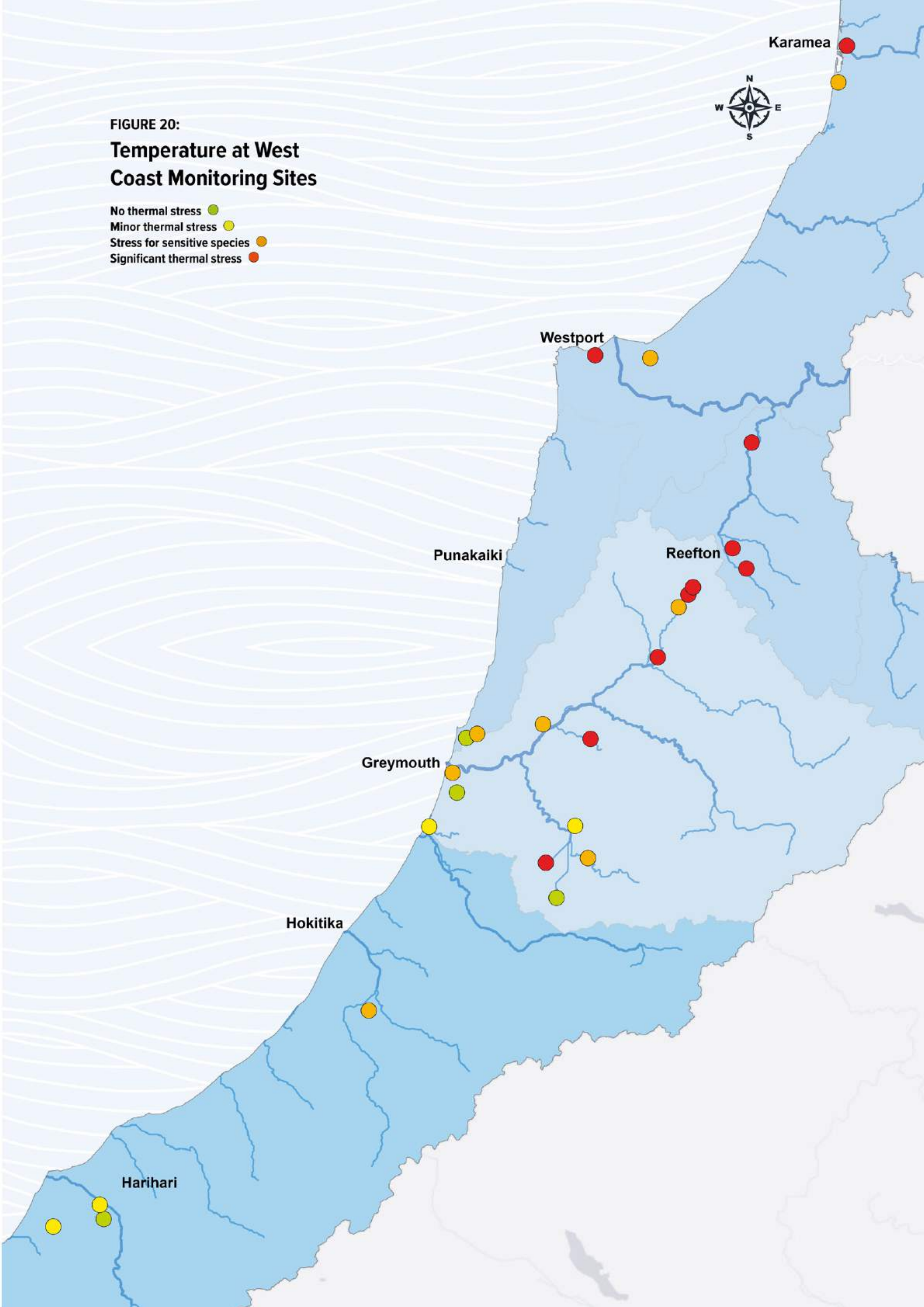


FIGURE 20:

Temperature at West Coast Monitoring Sites



Freshwater invertebrates and periphyton

Freshwater invertebrates include organisms such as crustaceans, molluscs, worms, and freshwater insects. Invertebrates perform important ecosystem services, and provide food for native fish and birds.

Macroinvertebrates are affected by impacts on water and habitat quality; therefore, they are useful indicators of stream health. From the sites tested, 47% had macroinvertebrate community's indicative of slightly reduced water quality (Figure 21). Invertebrate community's indicative of poor water quality were found at 24% of sites, with another 24% having fair quality but typical of moderate impacts.

Periphyton is the algae growing on the bed of streams and it plays a key role by turning dissolved nutrients into food for invertebrates that are themselves food for fish and birds. However, too much periphyton can cause problems. Periphyton blooms (thick slimy mats or long filamentous growths that cover much of the streambed), can make a stream unsuitable for water sports and reduce biodiversity by making the streambed habitat unsuitable for many sensitive invertebrate species. Periphyton blooms are most likely to occur during periods of long, dry summer weather. Significant blooms have not been common on the West Coast, possibly due to the wet climate. Of our monitored streams, no measured periphyton abundances were below the National Policy Statement for Freshwater Management (NPSFM) national bottom line. Sawyers Ck @ Dixon Park had brief algal blooms indicating moderate effects on ecosystem health at times (Figure 22).

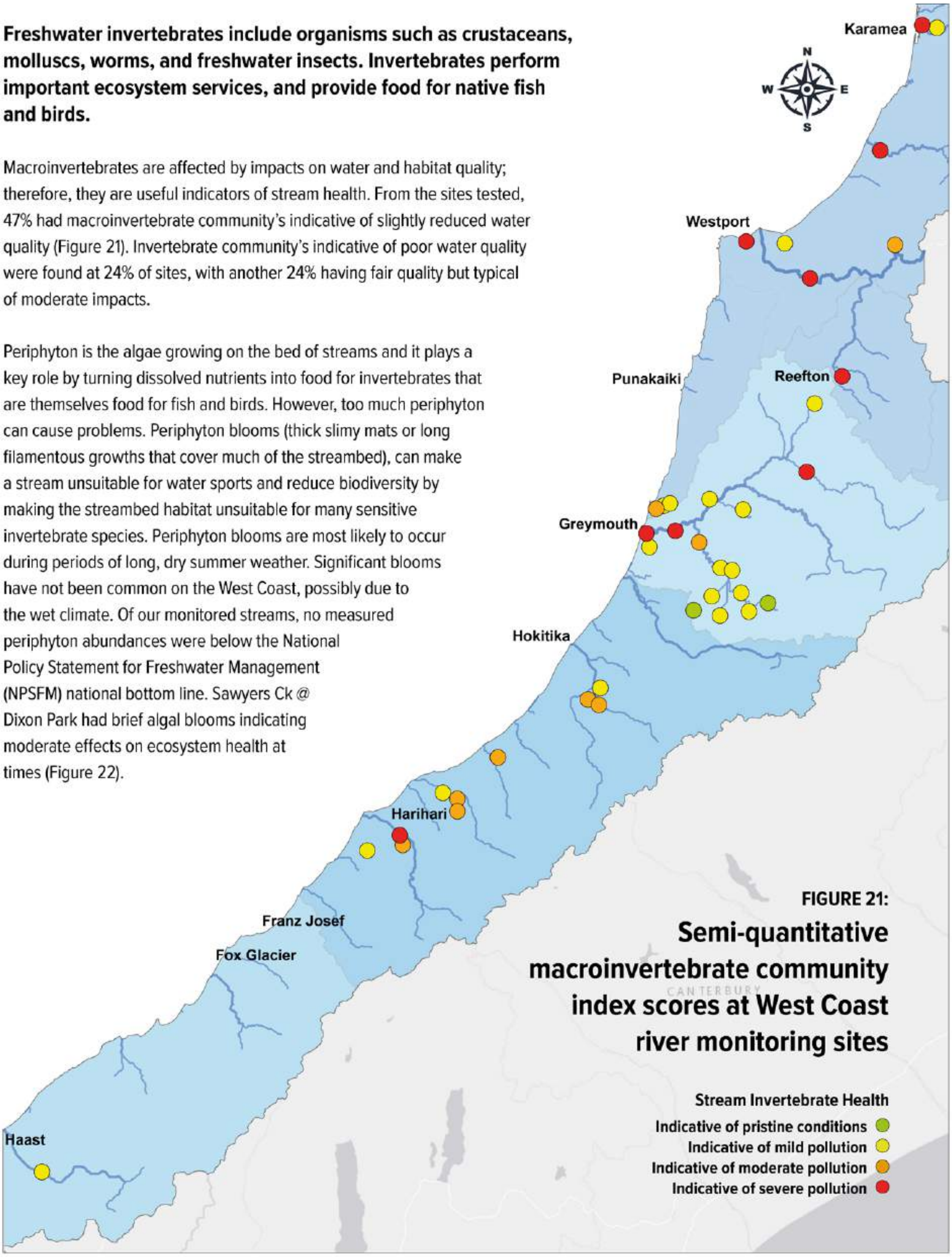
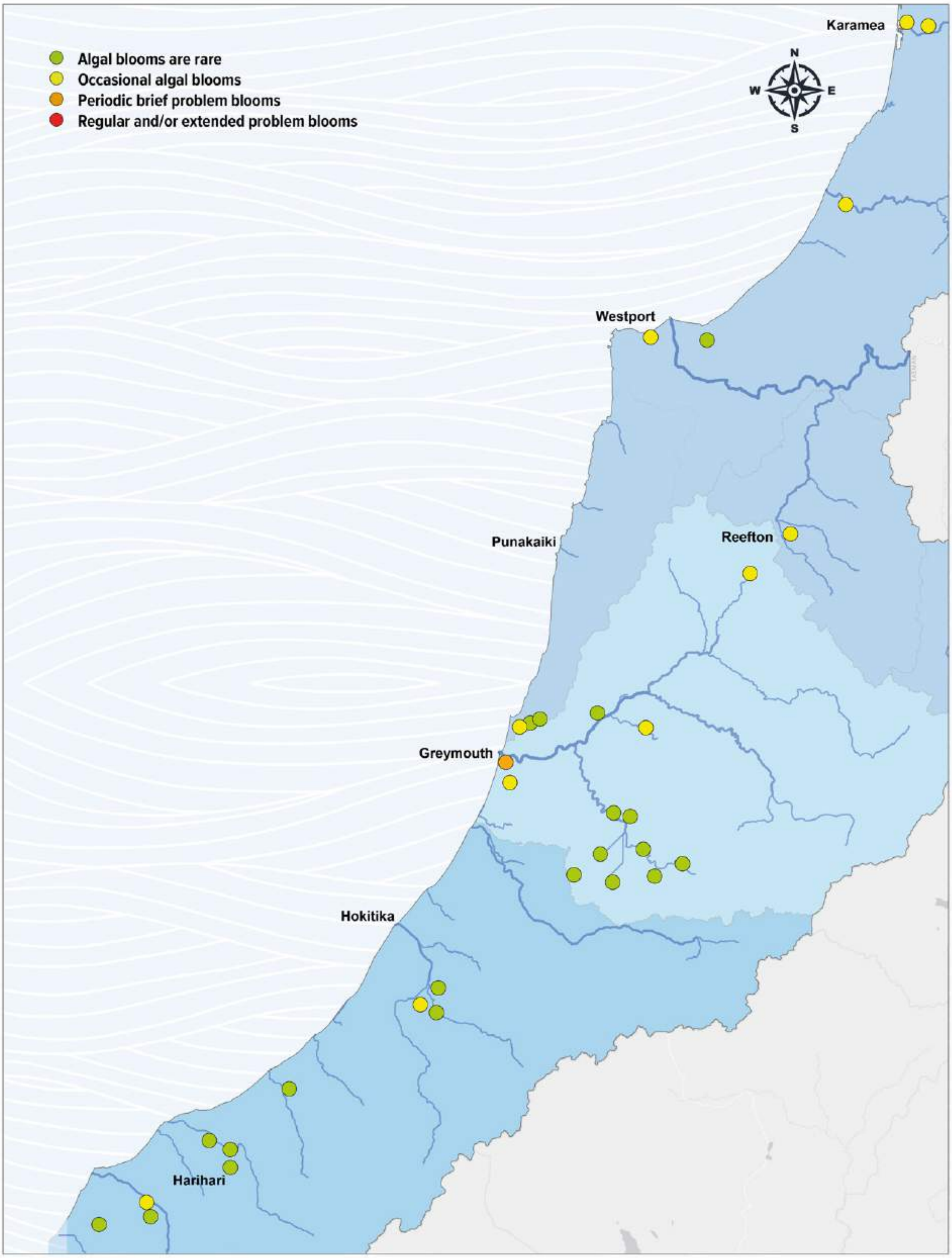


FIGURE 21:
Semi-quantitative macroinvertebrate community index scores at West Coast river monitoring sites

FIGURE 22:

Periphyton NPSFM NOF Category Chlorophyll-a



Lake Brunner and Lake Haupiri

These lakes are monitored regularly to track their health as they reside in catchments that have significant human land use. Both lakes are popular recreational destinations for people within and beyond the region. These lakes have been monitored by Council for many years and a comprehensive data record has been created.

Central government policy ascribes A (good) to D (poor) states for several lake attributes. An increase in nutrients can lead to levels of algal growth that could threaten the lakes health. Nutrient levels were in A or B states, with no obvious changes apparent (Table 2). Free floating algae (indicated by chlorophyll) was low, as was faecal contamination (indicated by *E. coli*).

Growth of phytoplankton (free floating algae) in both lakes is primarily limited by the availability of phosphorus. Currently, oxygen at the bottom of Lake Brunner remains high enough to avoid undesirable cycles of phosphorus release from the lake bed, although low oxygen conditions are increasingly common. Fortunately, there were no significant deteriorating trends for any key lake health attributes.

The Trophic Level Index (TLI) is a key measure used by Council to assess the health of Lake Brunner. Council has a target TLI threshold in the Land and Water Plan. This had been met in 2018 and 2019, but in 2020 the TLI exceeded the threshold. Lower TLI scores indicate lower nutrient status which is better for lake health. In New Zealand, lakes with TLI scores between 2–3 are considered to have low levels of nutrients and algae.

TABLE 2: **Key lake health attribute states and trends for Lakes Brunner and Haupiri***

	HAUPIRI		BRUNNER	
Attribute	State	Trend	State	Trend
Total nitrogen	B	→	B	→
Total phosphorous	B	→	A	→
Chlorophyll (algae)	A	→	A	→
Ammonia-N	A	→	A	→
Nitrate-N	–	→	–	→
Dissolved reactive phosphorus	–	→	–	→
E. coli (swimmability)	A	–	A	–
Suspended sediment	–	→	–	→
g340 (brown colouration)	–	→	–	→
g440 (brown colouration)	–	→	–	→
Clarity	–	→	–	↑
Lake bed oxygen	C	↓	B	↓
Trophic level index	–	→	–	→

** States and trends from April 2016 to April 2021*
Note: arrows indicate increasing (up) or decreasing (down) trends. Horizontal means no significant trend.

Regular monitoring shows nutrient levels were at A or B states in both lakes. Free floating algae (indicated by chlorophyll) was low, as well as *E. coli* contamination.

Groundwater quality

Groundwater is an important source of drinking water, irrigation water, and a major contributor to surface water flows. The Council monitors a broad range of physical and chemical attributes at a number of wells across the region to track state and trends in groundwater quality.

Microbial contamination can be an issue for potable groundwater. *E. coli* is commonly used as an indicator of pathogen risk. The NZ Drinking Water Standard for *E. coli* is stringent requiring there to be no *E. coli* in the sample (less than 1 *E. coli*/100 ml). Of the monitored wells that were used for human consumption (but not municipal), around half met the NZDWS for *E. coli* 90% of the time (Figure 22). A quarter of sites passed between 70 to 90% of the time, with the bottom quarter pass rate of 55 to 70%.

While sometimes above the guideline, *E. coli* levels were normally low with an overall median of < 1 *E. coli*/100ml. Likely causes of contamination were inadequate wellhead protection and the bore being located in close proximity to a potential contaminant source.

High nitrate levels are undesirable in drinking water. West Coast groundwater's remain relatively dilute overall, and exceedances of the NZ Drinking Water Standards maximum allowable limit for nitrate (11.3 mg/L), are rare (Figure 23). 94% of groundwater bores passed the nitrate drinking water standard 100% of the time, with a mixture of declining and improving trends. While not toxic, high levels of naturally occurring iron can be a nuisance in groundwater used for domestic purposes. 71% of groundwater bores passed the iron aesthetic drinking water standard 100% of the time.

Short residence times* (less than 10 years) are typical for groundwater resources in the region. There are three geographically distinct groundwater types:

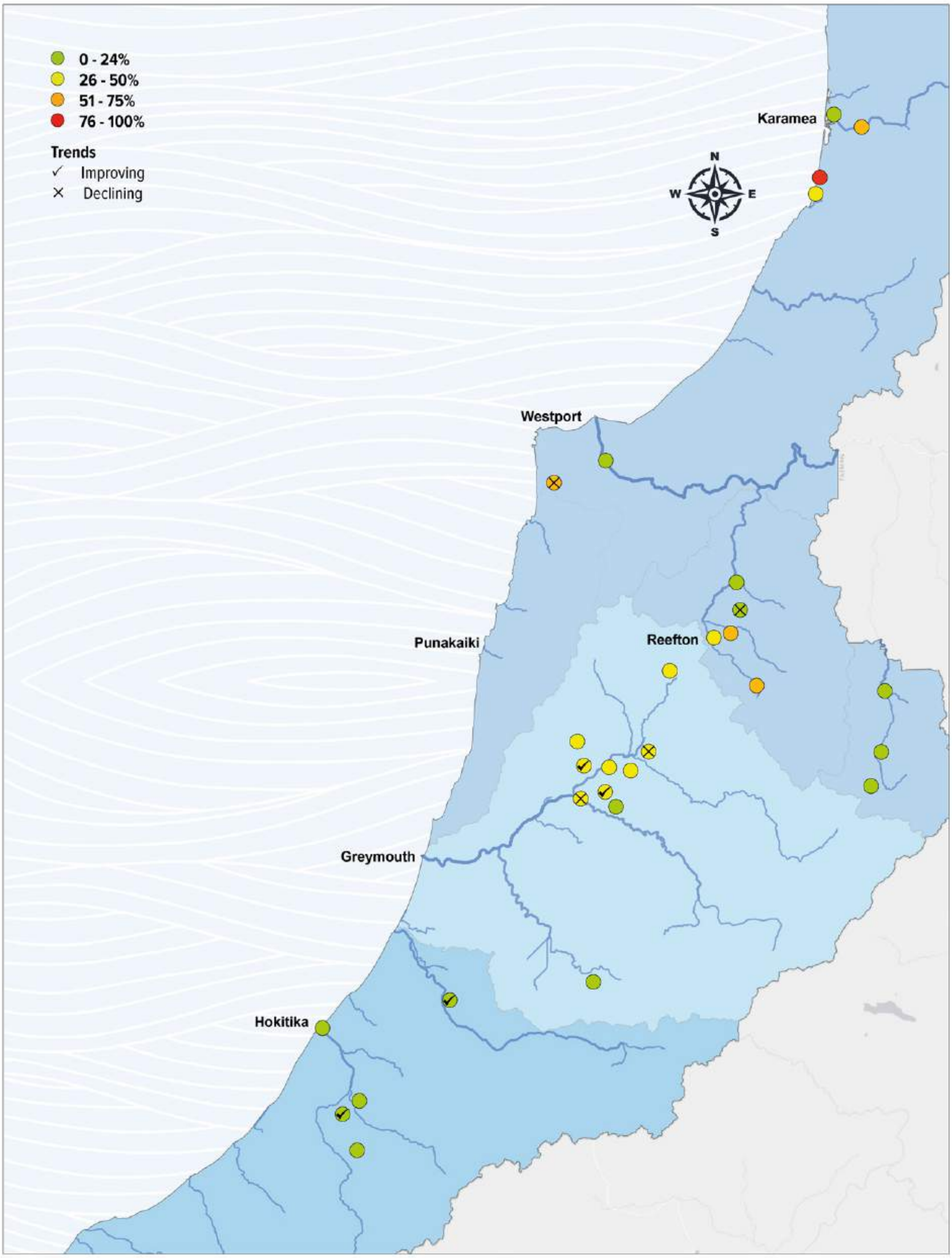
a) those in unimpacted alpine foothills;
b) impacted coastal and fluvial areas; and
c) dilute valley aquifers impacted by human land use.

West Coast waterways are well connected to adjacent gravel aquifers. There does not appear to be a relationship between groundwater depth and age, which indicates a lack of confining layers throughout large parts of the regions aquifers. Aquifers with shorter retention times will contribute land sourced contaminants like nitrates to streams faster. A lack of confining layers makes it easier for contaminants to reach groundwaters from the surface.

** Residence time refers to the time between rain hitting the ground and the same water resurfacing (stream, lake, sea).*

FIGURE 23:

Groundwater nitrate as a percentage of the NZ drinking water standards (11.3mg/L)



Air quality

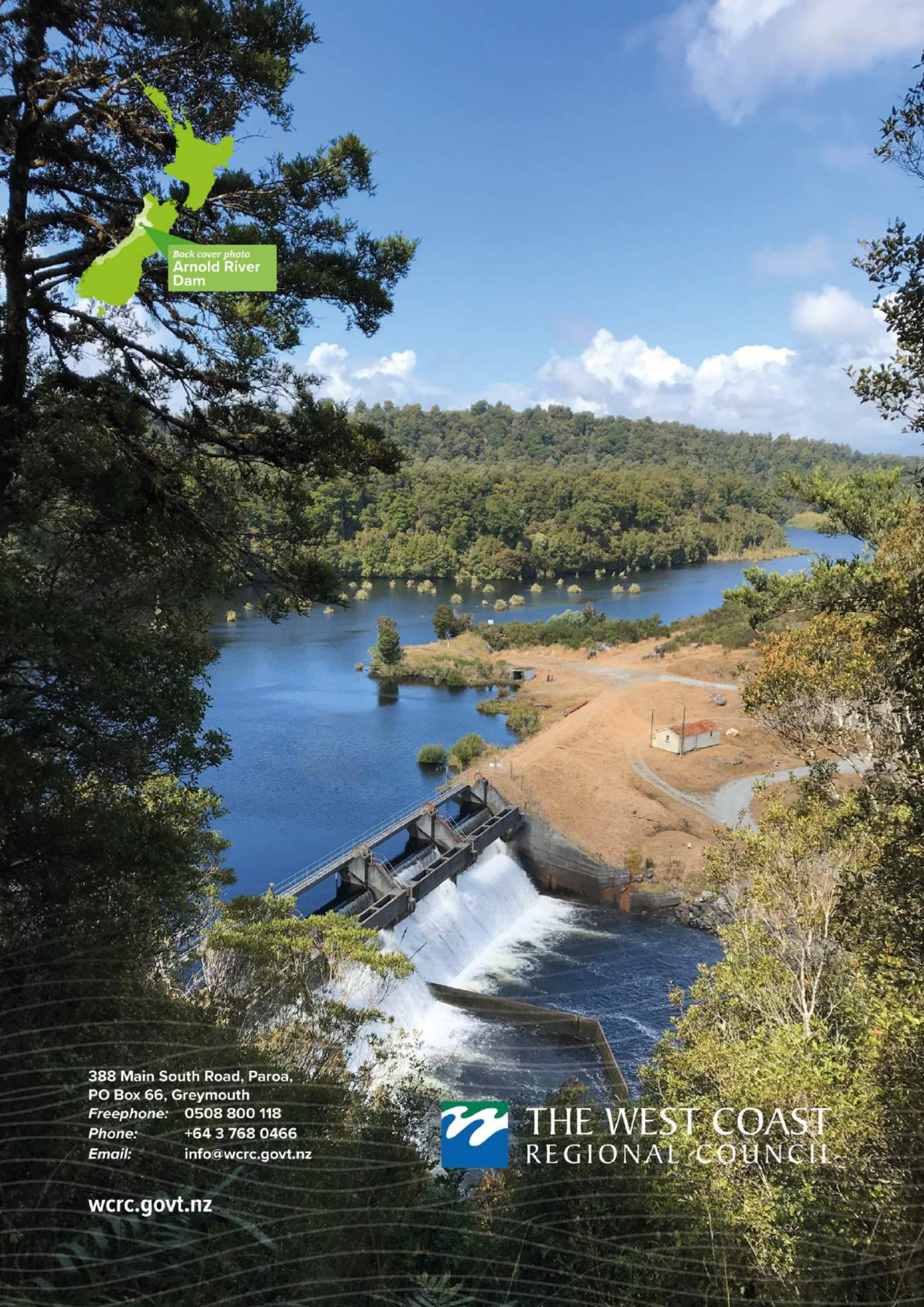
The West Coast Regional Council has one permanent air quality monitoring site, located in Reefton. As a result of its geography, climate, and domestic heating habits, Reefton has suffered from poor air quality over the winter months.

Council has monitored PM_{10} in Reefton since 2006. PM_{10} are particles in the air smaller than 10 micrometers in diameter, which affect human health when frequent and abundant. The main source of PM_{10} in Reefton is from domestic heating. Small contributions come from industry, traffic, and outdoor burning. The town is surrounded by hills that impede air movement. During winter, cold temperatures and reduced air flow cause an inversion layer to form, restricting the movement of polluted air.

Reefton generally has satisfactory air quality, but emissions from domestic heating have periodically exceeded the PM_{10} National Environmental Standard (NES) over the winter months (Figure 24). An exceedance occurs when there has been an average of more than 50 micrograms/m^3 of PM_{10} recorded over a 24 hour period. The NES allowed one exceedance per year from 2020 onward. There were two exceedances of the standard in 2020 and none in 2021. The Reefton air quality site was relocated in September 2016. Reduced numbers of exceedances since 2016 is positive, but this may relate in part to the shift in monitoring site. Further work is being undertaken in the airshed to broaden Council's knowledge of the distribution and composition of air quality in Reefton.

FIGURE 24: NZ National Environmental Standard for Air Quality

The NZ National Environmental Standard for Air Quality allowed unlimited exceedances up to and including 2016. From 2017 to 2020 three exceedances were allowed, with one allowed from 2021 onwards. An exceedance is a daily average PM_{10} of over 50 ug/m^3



388 Main South Road, Paroa,
PO Box 66, Greymouth
Freephone: 0508 800 118
Phone: +64 3 768 0466
Email: info@wcrc.govt.nz

wcrc.govt.nz

THE WEST COAST REGIONAL COUNCIL