greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Climate and Water Resources Summary for the Wellington Region

Warm Season (November to April) 2016/2017

Release date: 25 May 2017

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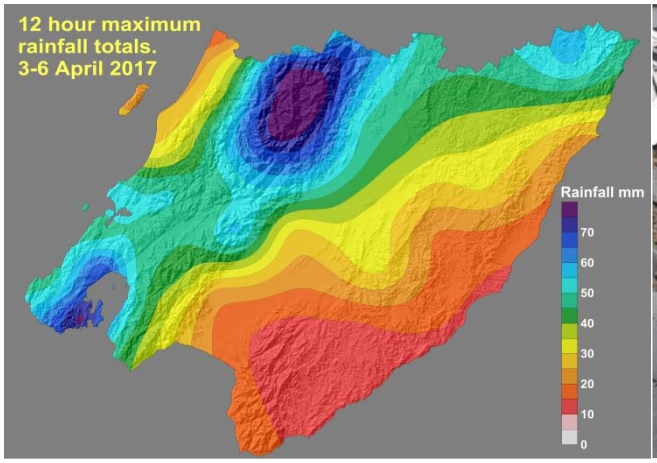


Map of the maximum rainfall totals recorded over 12 hours during the ex-cyclone Debbie rainfall events across the Greater Wellington region

Slip in Millward St, Newtown, after heavy rain overnight on 5th April
Photo: Kevin Stent/Fairfax

The remnants of ex-tropical cyclone Debbie crossed the region between the 3rd and 6th April 2017. While being spared the severe flooding that affected areas such as Edgecumbe and the Bay of Plenty, the severe weather certainly made its presence felt over the region.

Three days of persistent rain in the Wairarapa and eastern hills resulted in 150mm of rainfall recorded in Masterton - which is twice the average expected for the entire month of April. This is estimated to be a 1 in 10-year rainfall event for the town.

In contrast, parts of Wellington, Porirua and Hutt cities were hit with very intense rainfall overnight on 5th April. Berhampore had impressive 94mm of rain over a 12 hour period.

Houses were evacuated due to flooding in the Owhiro Stream and two slips threatened homes in Kingston and Newtown. Slips also partially blocked SH2 on the Rimutaka Hill whilst Wellington Airport suspended flights due to the heavy rain affecting landing systems. Surface flooding caused traffic issues region-wide.

In this report you will find:

More information

For more information on monitoring sites and up-to-date data please visit http://www.gw.govt.nz/environmental-science/. Several climate sites are operated by NIWA and/or MetService, and GWRC is grateful for permission to present the data in this report.

Disclaimer

Report release date: May 2017

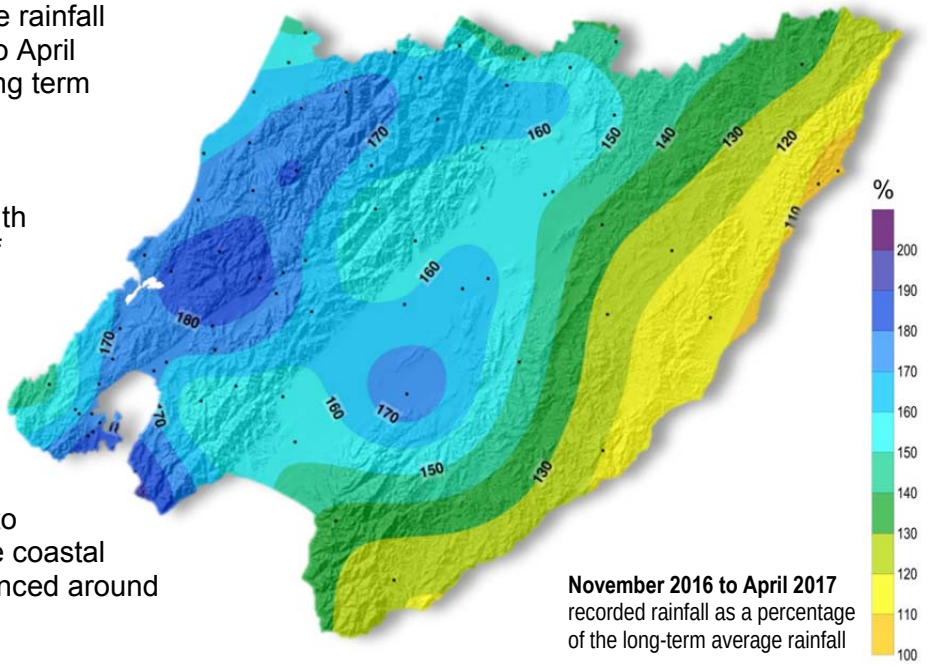
The warm season from November 2016 to April 2017 saw above average rainfall across the whole region with highest departures from the average occurring around the urban areas of Wellington, Porirua and Hutt Valley.

Rainfall (November to April)

The map to the right presents the rainfall recorded during the November to April period as a percentage of the long term average.

All parts of the region had above average rainfall over the six month period but there was a pattern of increasing rainfall anomaly moving from east to west.

Areas with the highest above average rainfall were Wellington, Porirua and Hutt Valley as well as the tops of the Tararua Range - with up to 175 to 200% of normal. To the east, the coastal area around Castlepoint experienced around average (100%) rainfall.



November 2016 to April 2017 recorded rainfall as a percentage of the long-term average rainfall

This November to April period and the above average rainfall recieved across the region has bucked the trend of the previous couple of years when rainfall totals have been below average (and at times very dry).

The recorded rainfall shows there was an east to west gradient of increasing rainfall when compared to normal. (The dots on the map indicate rainfall recording sites)

Separate rainfall maps for individual months are shown on the following page.

Another way to consider the weather is to look at the number of days that it rained. If more than 1mm of rain is recorded in a day this is called a 'Rain Day' and if there is more than 25mm this is termed a 'Heavy Rain Day'.

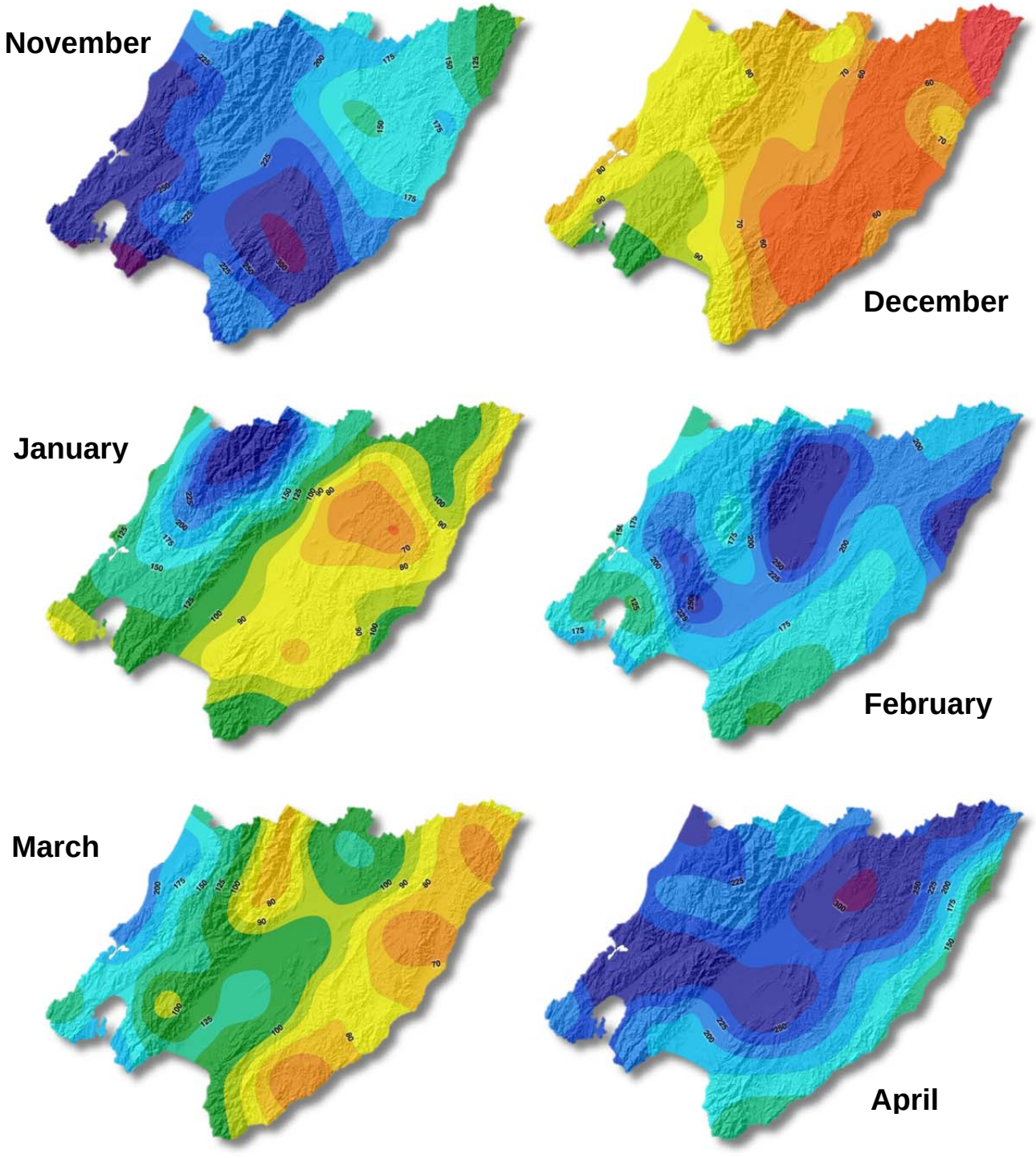
The table below shows that all areas had more Rain and Heavy Rain days than normal. Most areas had around twice the average number of Heavy Rain days.

Number of Rain Days and Heavy Rain Days during May to October across the region (long-term average in brackets.)

	Kapiti Coast		Porirua	Hutt Valley & Wellington		Ruamahanga		Eastern Wairarapa
	Lowland	Hills	Lowland	Lowland	Hills	Lowland	Hills	
Rain Days (>1mm)	72 [53]	104 [78]	60 [45]	59 [47]	86 [68]	60 [44]	99 [84]	51 [50]
Heavy Rain Days(>25mm)	8 [3]	37 [21]	10 [4]	9 [4]	20 [10]	6 [3]	39 [25]	5 [3]

Rainfall by the month

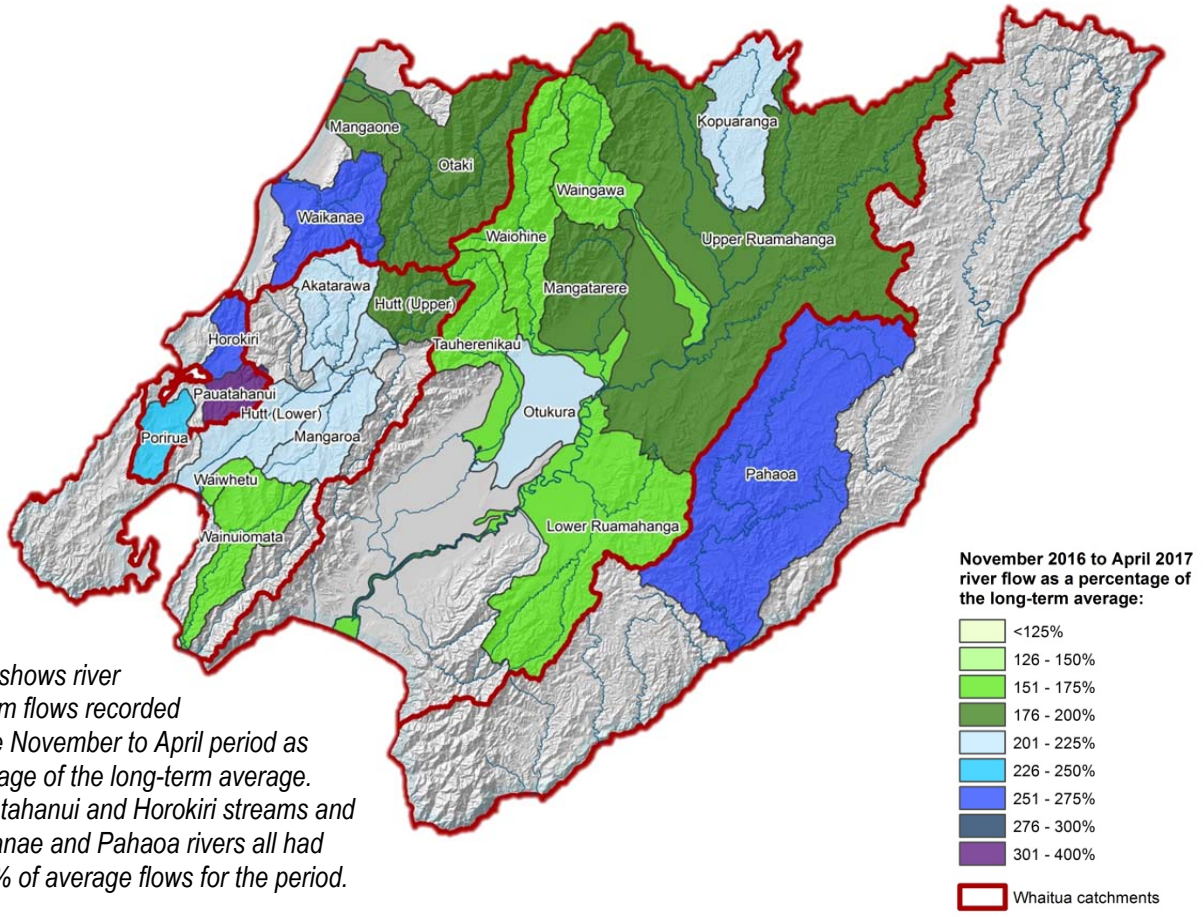
The maps below show the percentage of average rainfall for each month of the November 2016 to April 2017 warm season. The months of November, February and April had above average rainfall across the entire region. January and March saw the eastern Wairarapa experience below average rainfall while western and southern areas had average to above average conditions. The only month where the whole region was below average was December - at the start of the summer season.



River flow

The map below shows the mean recorded river and stream flows, between November and April, for various monitored catchments as a percentage of the long-term average flow for this period.

The entire region experienced above average flows during November to April with all monitored river sites registering greater than 150% of normal.



The map shows river and stream flows recorded during the November to April period as a percentage of the long-term average. The Pauatahanui and Horokiri streams and the Waikanae and Pahaoa rivers all had over 250% of average flows for the period.

First the earthquake – then the flooding. 15th November

While still coming to terms with the effects of the 14th November earthquake the south-west of the region was hit by heavy rainfall the very next day that caused flooding in a number of areas throughout Wellington, Porirua, Hutt Valley and up to Waikanae. Slips and surface flooding resulted in a number of road closures including SH1, SH2, SH58, Paekakariki Hill Rd and Grays Rd.

Surface flooding affected houses and properties throughout Upper Hutt and Lower Hutt, while the Waiwhetu Stream flowed over its banks and into neighbouring properties.

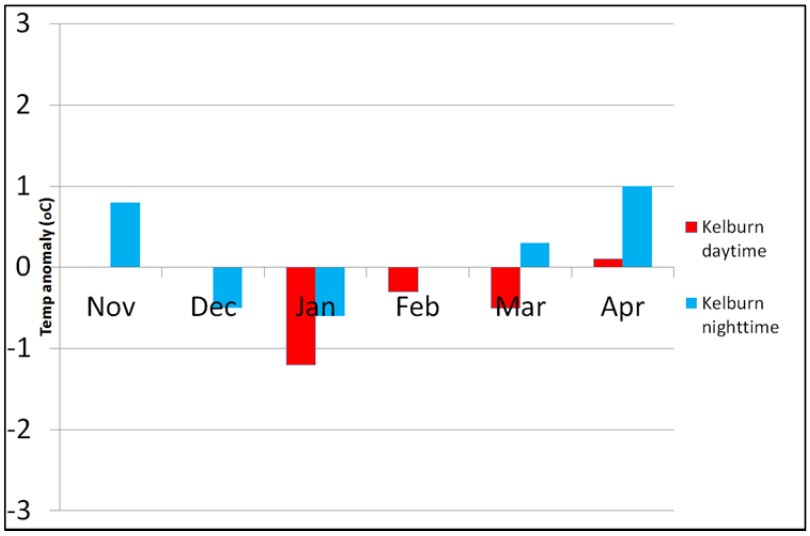
GWRC rainfall monitoring sites measured up to 80mm of rainfall in just six hours around the Porirua and Pauatahanui areas. High river lows were recorded with the Pauatahanui Stream reaching a level that had an estimated 1 in 20-year return period (5% chance of occurring in any year).

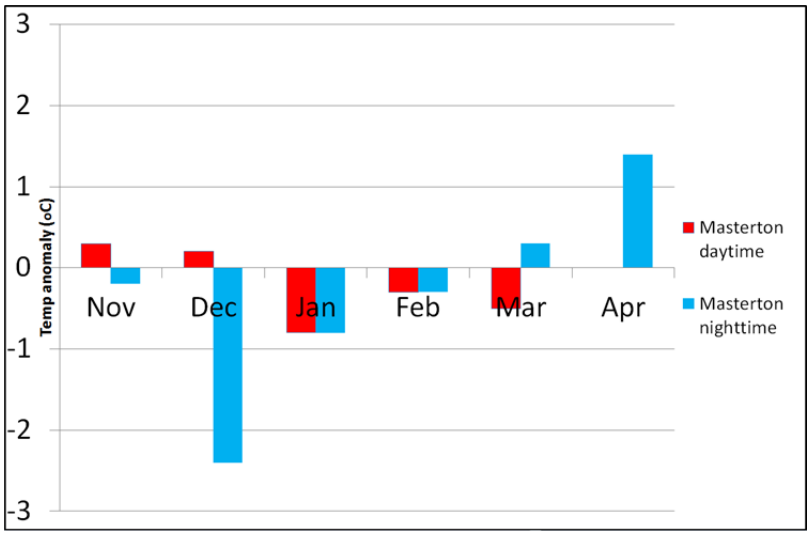
Other notable flows were recorded in the Porirua and Horokiri streams (1 in 8-year return period), Waiwhetu Stream and Wainuiomata River (1 in 5-year return period), and the Waikanae River (1 in 7-year return period).

Air temperatures

Air temperature is measured at a number of meteorological monitoring sites across the region. It is useful to look at the anomalies (i.e., departures from normal) in averages of extreme temperature indicators (i.e., daytime maximum and nighttime minimum) across the region to help interpret how dominant and widespread the climate anomalies have been.

The graphs below show the monthly daytime maximum and nighttime minimum temperature anomalies for Kelburn (upper panel) and Masterton (lower panel). The graphs show that most of the period from December onwards was marked by below average temperatures, with a change in April to above average temperatures but only for the nighttime minimum. December and January had the largest anomalies for both Kelburn and Masterton characterising an unseasonably cold holiday season as discussed in the climate briefing for summer (http://www.gw.govt.nz/assets/Our-Environment/Environmental-monitoring/Environmental-Reporting/Seasonal-Update-Summer-March-2017.pdf).





Average daytime and nighttime temperature anomalies for Kelburn (top) and Masterton (bottom) for the warm season period. Colder than average temperatures were seen for most of the period, except November and April.

SOURCE: Data from MetService meteorological stations.

Global climate drivers

Climate variability and climate change

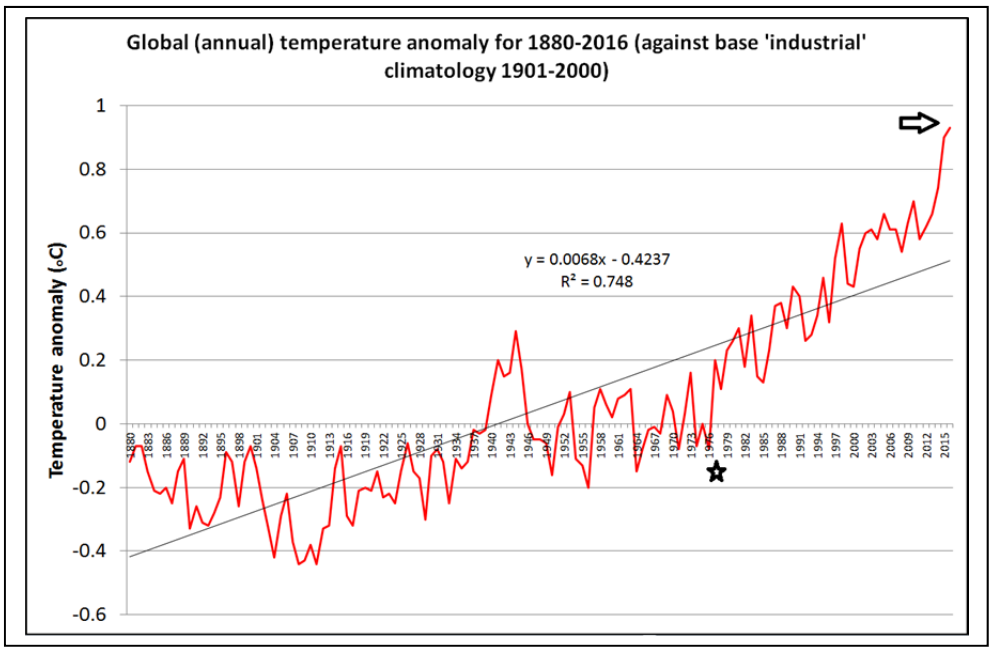
People often ask if the variable weather patterns in our region are a result of climate change. While natural climate variability has always been quite pronounced in our region, weather extremes are expected to get worse as a result of human-induced climate change and "global warming" caused by greenhouse gas emissions (http://www.royalsociety.org.nz/expert-advice/papers/yr2016/climate-change-implications-for-new-zealand/).

Some key observations about climate variability and change in our region during the period November 2016 to April 2017:

- The period started with above normal temperatures in November, progressing to below normal temperatures from December to March, and returning to above normal temperatures in April. Summer was unseasonably cold and unsettled
- Globally, the calendar year 2016 was the hottest on record with almost 1 degree above the 20th century 'industrial' reference climatology. The rate of global warming has more than doubled after the mid-1970s and continues to increase faster than the linear rate (see figure below)
- The oceanic water temperatures (following page) were warmer than normal around New Zealand at the beginning of November with some 'La Nina-like' cooling in the central Pacific (left panel). A vigorous 'blob' of cold water prevailed around the country in summer (right panel), returning to warm conditions (and neutral ENSO) in May (bottom panel).
- A series of low pressure anomalies south of New Zealand (negative Southern Annular Mode) brought a predominance of cold southerlies and unsettled weather
- A couple of ex-Tropical cyclones had a major influence with only a short break in between them in April, with record rainfall totals in many areas.

Global Land and Ocean annual temperature anomalies 1880-2016.

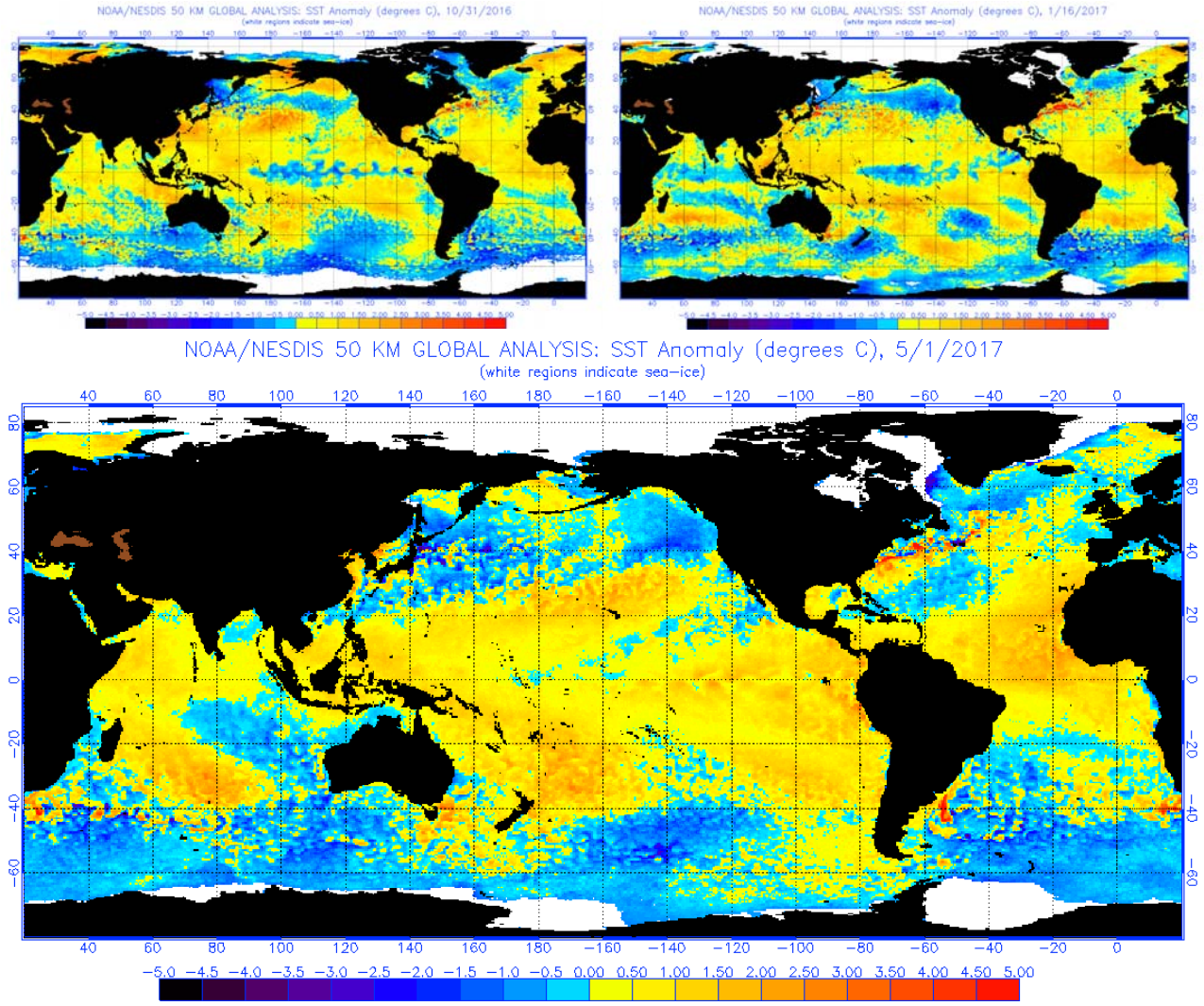
Source: NOAA (USA).



The arrow shows that 2016 was the hottest year on record, followed by 2015 and 2014. The temperature anomalies are calculated in respect to the 20th century 'industrial' average, showing a global anomaly of about 1°C. The trendline shows a linear warming of about 0.7°C per century, explaining about 75% of the total variance of the time series. Since the late 70s (marked with a star) the rate of warming has more than doubled, sitting at almost 2°C per century

Global climate drivers and extreme weather events

Climate drivers are global mechanisms that can influence the weather in our region. The El Niño/Southern Oscillation[1] (ENSO) phenomenon remains neutral despite a weak La Niña signature during the beginning of the period (left hand side panel below). The sea ice extent (in white) was the lowest on record during summer, being barely discernible in the NZ sector in January (right).

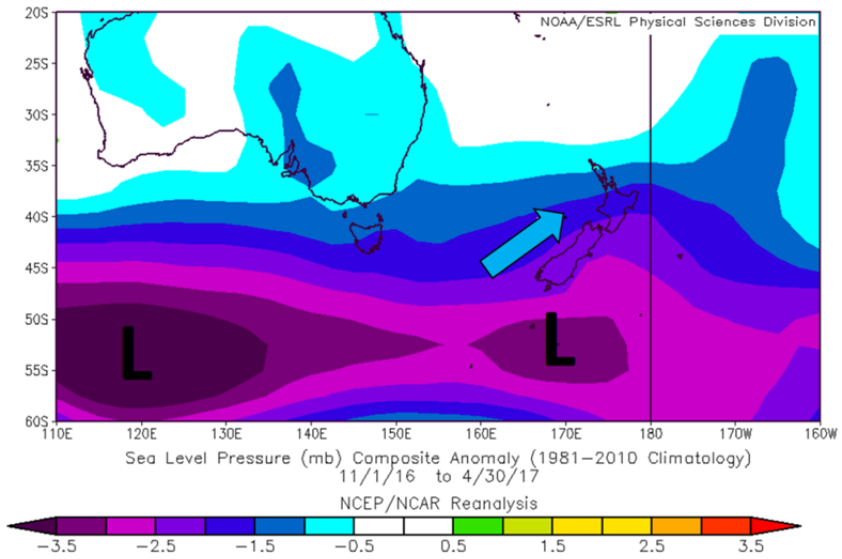


Sea surface temperature anomalies on 31st Oct 2016 (left), 16th Jan 2017 (right) and 1st May 2017 (bottom). Warm waters around NZ are replaced with cold waters in summer while a La Nina-like pattern dissipates, returning to warm NZ waters by the end of the period. The sea ice around Antarctica (white) appears much depleted in January, and the whole summer had the lowest sea ice extent on record. Source: NOAA/USA.

While the ENSO phenomenon was near neutral with little influence on the warm season weather patterns affecting New Zealand, the Southern Annular Mode (SAM) was significantly negative during most of the period, helping explain the unsettled weather. Sea level pressure anomalies (shown below) reveal a pattern of low pressure to the south of NZ (shown with an L). This pattern (negative

[1] https://www.niwa.co.nz/education-+-and-training/schools/students/enln

SAM) caused more southerlies and more cold fronts than normal into New Zealand during the warm season (shown by the arrow).



Mean sea level pressure anomaly between November 2016 and April 2017.

Low pressure anomalies to the south (as showb by the L) contributed to increased southerly winds (as shown by the arrow), with more storms, unseasonably cold temperatures and unsettled weather. This pattern largely corresponded to a persistent negative phase of the Southern Annular Mode (SAM).

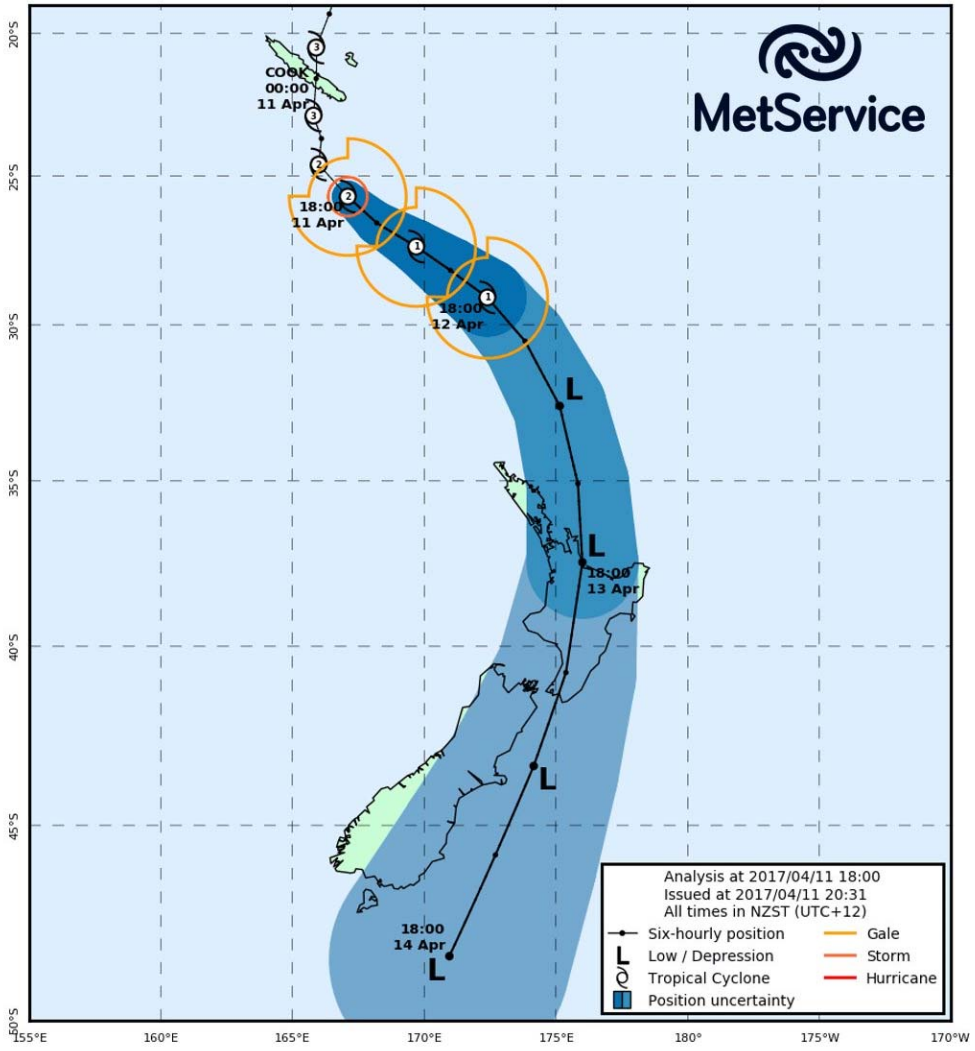
Tropical influences

The warm season (November to April) also corresponds to the formal tropical cyclone season in the South Pacific. This year the season was very unusual, with the first tropical cyclone (TC) of the season forming very late (TC Bart in late February). This was followed by a burst of intense tropical cyclones causing significant rainfall in New Zealand (either directly or indirectly): ex-TC Debbie (indirectly) and ex-TC Cook (directly), both in April. As discussed under the rainfall analysis section earlier in the report, the remarkable tropical moisture associated with both cyclones caused record-breaking heavy falls in many parts of New Zealand, including the Wellington region with a very short time interval between each system.

On average, New Zealand is expected to be directly visited by at least one ex-tropical cyclone each season (within a distance less than 550 km), so the total of two cyclones affecting the country in the season (if we count the indirect influence of Debbie as one) is not exceptional. However, it is notable that they occurred very close to each other with little time for saturated soils to recover between them. For the whole South-western Pacific the total number of three storms remains well below the climatological average of about 10 tropical cyclones per season, making this one of the least active seasons on record.

Ex-TC Cook in particular posed a significant threat to the Wellington region, crossing the Wairarapa in the first hours in the morning of April 14th (see below). This cyclone path bore remarkable similarity to the infamous cyclone Giselle which sank the Wahine in 1968, but luckily Cook lost intensity quickly as it moved south, whereas Giselle had intensified further as it moved to our region.

At the closing of this report a severe strong tropical cyclone (TC Donna) had become the strongest ever measured South Pacific TC in the month of May (i.e., outside the formal warm season). This very late TC activity is consistent with predicted climate change impacts.



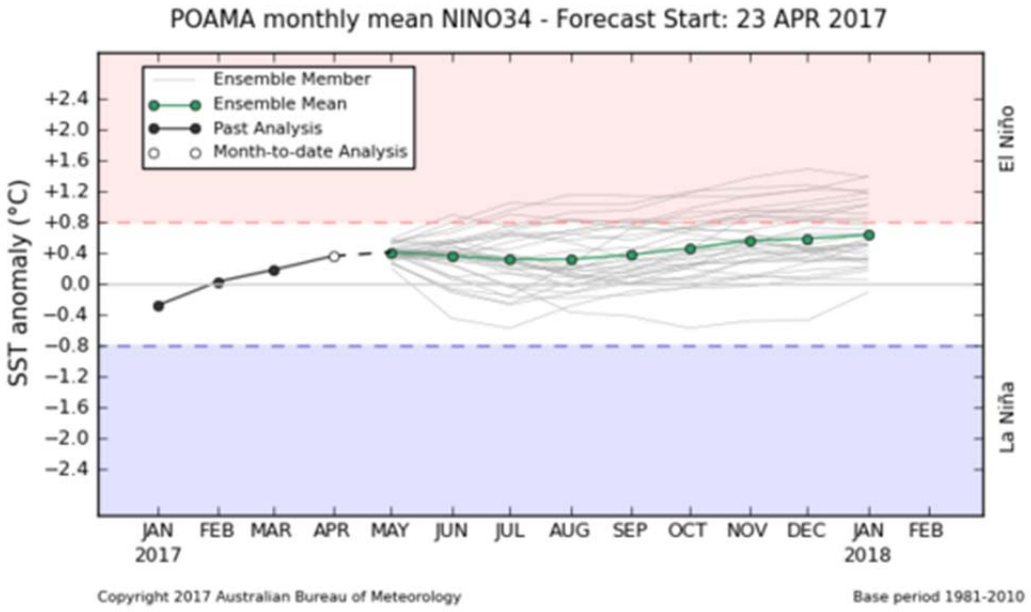
Predicted trajectory of ex-TC Cook directly crossing most of the North Island and the Wellington Region in April 2017. The actual observed path was very close to the predicted path. Source: MetService.

Seasonal climate outlook update

The ENSO phenomenon is expected to remain borderline between neutral and El Niño for the remainder of the year (see below). La Niña did not eventuate, although as discussed above the warm season had some tropical influences that resembled a very late La Niña summer pattern, with heavy tropical-influenced rainfall events late in the season (i.e. March and April) and the strongest ever recorded May tropical cyclone in history in the southwestern Pacific (TC Donna). Thanks to the influence of ex-tropical cyclones most of the soil across the North Island was still saturated at the closing of this report.

The unseasonably cold and unsettled summer, followed by a warmer late autumn marked by tropical influences, suggests a combination of different factors influencing the climate anomalies. Prolonging tropical influences beyond the normal reach of the traditional warm season is consistent with climate change predictions. A more normal rainfall and temperature pattern as we head into winter should be accompanied by highly replenished soil moisture levels during the coming cold season, making frosts less likely.

The next seasonal climate outlook for winter will be released with our regular seasonal briefing by mid-June.



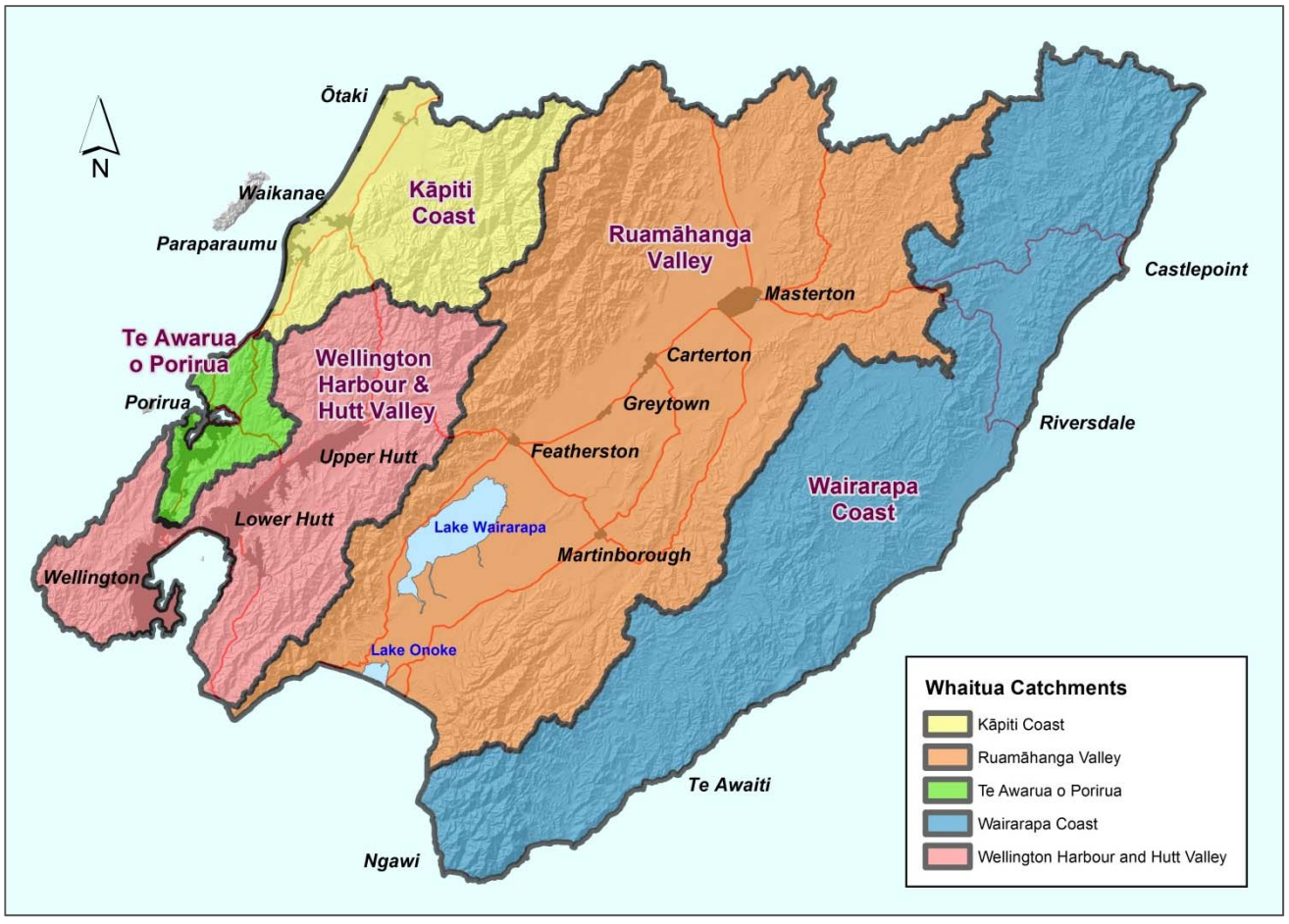
ENSO predictions as of 23 Apr 2017, showing borderline conditions between El Niño and neutral phase for the remaining of the year. Source: BOM (Australia)

What happened in each whaitua catchment?

Climate and water resource summaries are provided in the following sections for each of the five Wellington region whaitua catchment areas (as shown below). The whaitua catchments provide an important sub-regional basis for environmental management in the Wellington region[2], and roughly coincide with the different climate and water resource zones.

Click the following links for November 2016 to April 2017 summaries for:

- Wellington Harbour and Hutt Valley
- Te Awarua-o-Porirua
- Kāpiti Coast
- Ruamāhanga Valley
- Wairarapa Coast



Map of the five whaitua catchment areas in the Wellington region. Each whaitua roughly coincides with a climatic zone, expressing the marked east-to-west contrast that we experience in our region.

[2] http://www.gw.govt.nz/whaitua-committees/

Wellington Harbour and Hutt Valley climate summary

- **Much wetter than average**
- **Very high rain totals in November and April**
- **Significant flooding on 15th November**

Flooding – 15 November. The day after the earthquake!
The Hutt, Mangaroa and Wainuiomata rivers and the Waiwhetu Stream all reached 1 in 5-year flood levels. The Waiwhetu Stream overflowed into neighbouring properties.

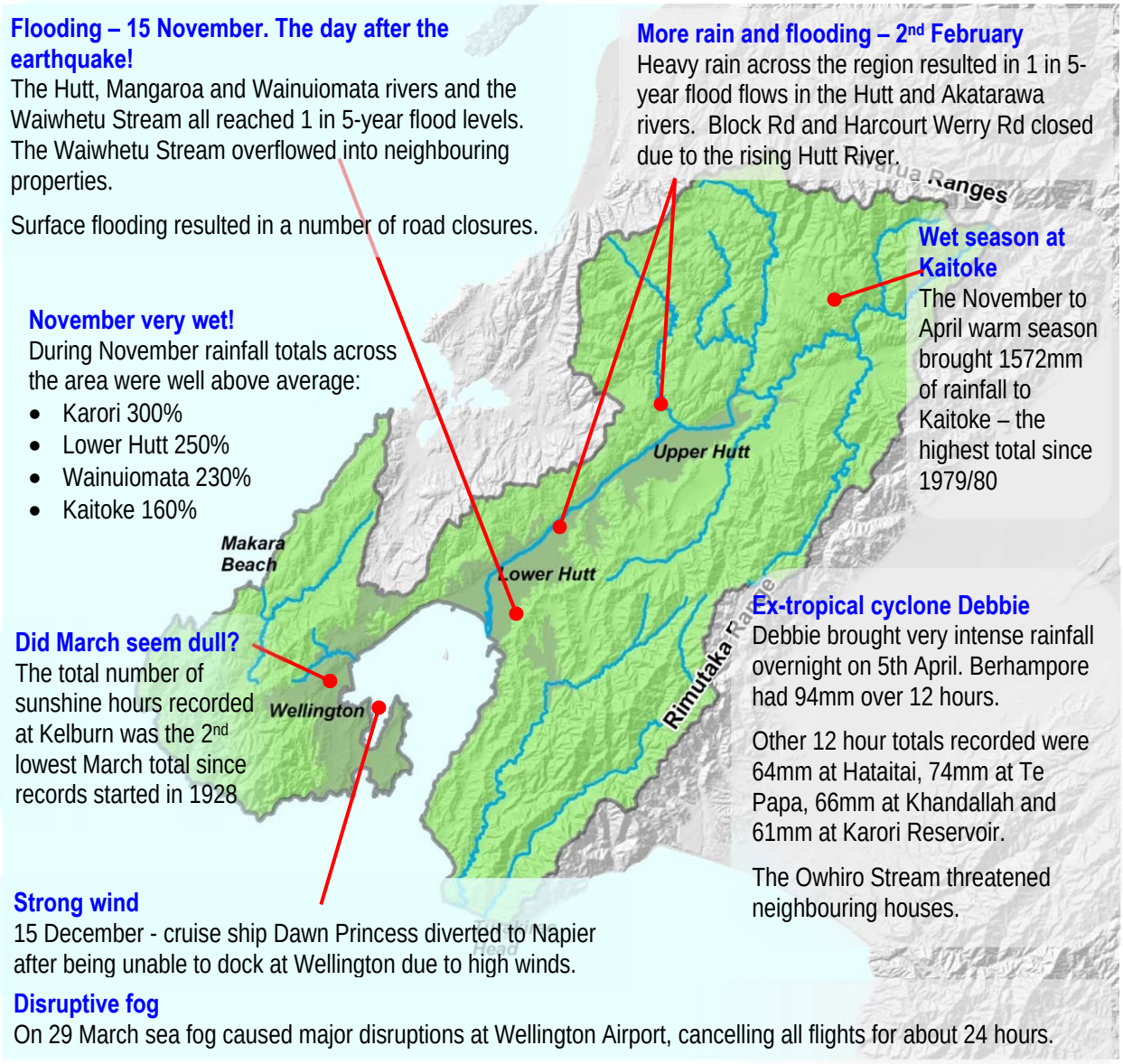
Surface flooding resulted in a number of road closures.

More rain and flooding – 2nd February
Heavy rain across the region resulted in 1 in 5-year flood flows in the Hutt and Akatarawa rivers. Block Rd and Harcourt Werry Rd closed due to the rising Hutt River.

Wet season at Kaitoke
The November to April warm season brought 1572mm of rainfall to Kaitoke – the highest total since 1979/80

November very wet!
During November rainfall totals across the area were well above average:

- Karori 300%
- Lower Hutt 250%
- Wainuiomata 230%
- Kaitoke 160%



Did March seem dull?
The total number of sunshine hours recorded at Kelburn was the 2nd lowest March total since records started in 1928

Ex-tropical cyclone Debbie
Debbie brought very intense rainfall overnight on 5th April. Berhampore had 94mm over 12 hours.

Other 12 hour totals recorded were 64mm at Hataitai, 74mm at Te Papa, 66mm at Khandallah and 61mm at Karori Reservoir.

The Owhiro Stream threatened neighbouring houses.

Strong wind
15 December - cruise ship Dawn Princess diverted to Napier after being unable to dock at Wellington due to high winds.

Disruptive fog
On 29 March sea fog caused major disruptions at Wellington Airport, cancelling all flights for about 24 hours.

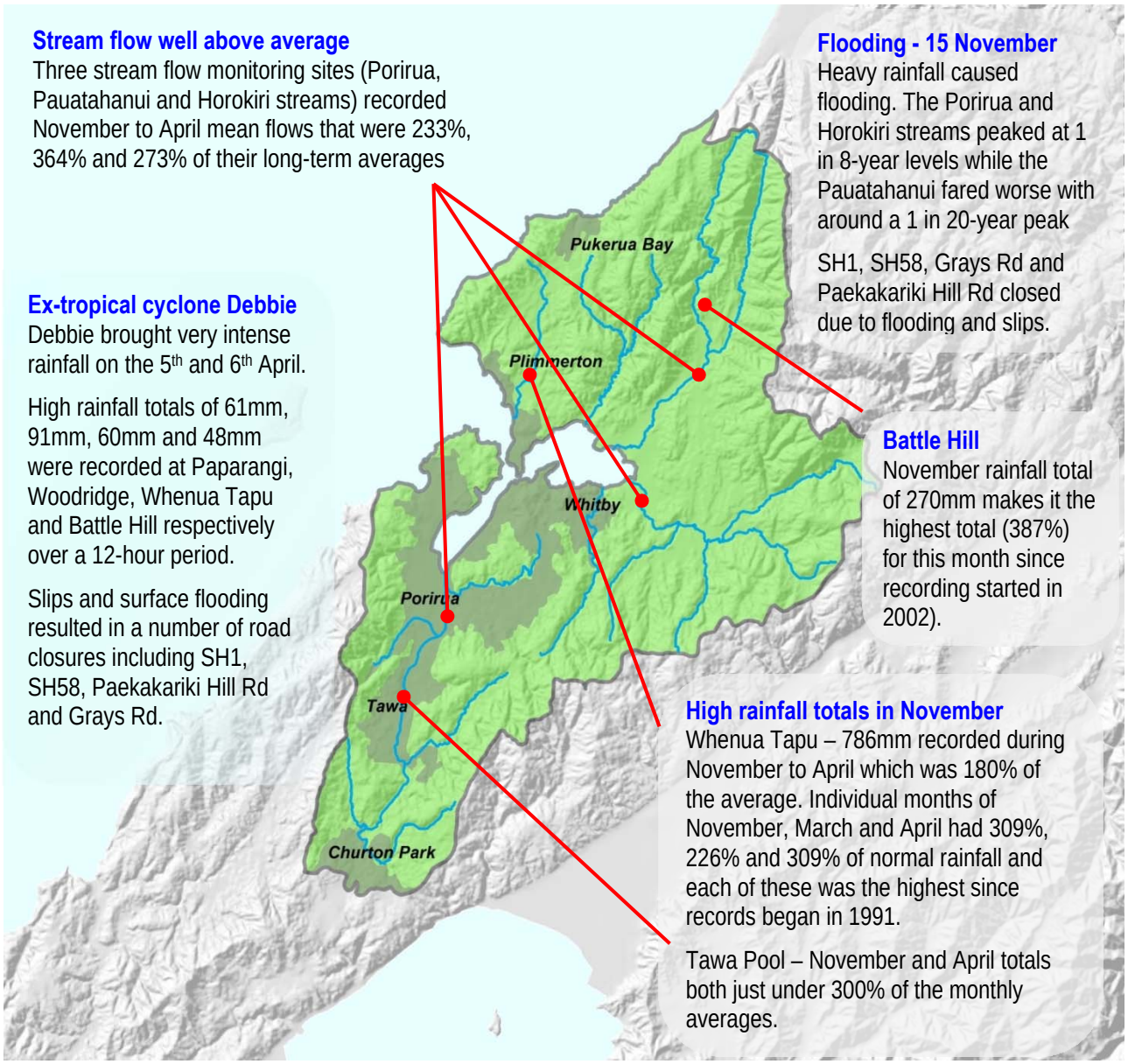
Want to look at the summary tables and graphs?

Rainfall

River flows

Te Awarua-o-Porirua climate summary

- **Much wetter than average**
- **Significant flooding on 15th November**



Stream flow well above average
Three stream flow monitoring sites (Porirua, Pauatahanui and Horokiri streams) recorded November to April mean flows that were 233%, 364% and 273% of their long-term averages

Flooding - 15 November
Heavy rainfall caused flooding. The Porirua and Horokiri streams peaked at 1 in 8-year levels while the Pauatahanui fared worse with around a 1 in 20-year peak

SH1, SH58, Grays Rd and Paekakariki Hill Rd closed due to flooding and slips.

Ex-tropical cyclone Debbie
Debbie brought very intense rainfall on the 5th and 6th April.

High rainfall totals of 61mm, 91mm, 60mm and 48mm were recorded at Paparangi, Woodridge, Whenua Tapu and Battle Hill respectively over a 12-hour period.

Slips and surface flooding resulted in a number of road closures including SH1, SH58, Paekakariki Hill Rd and Grays Rd.

Battle Hill
November rainfall total of 270mm makes it the highest total (387%) for this month since recording started in 2002).

High rainfall totals in November
Whenua Tapu – 786mm recorded during November to April which was 180% of the average. Individual months of November, March and April had 309%, 226% and 309% of normal rainfall and each of these was the highest since records began in 1991.

Tawa Pool – November and April totals both just under 300% of the monthly averages.

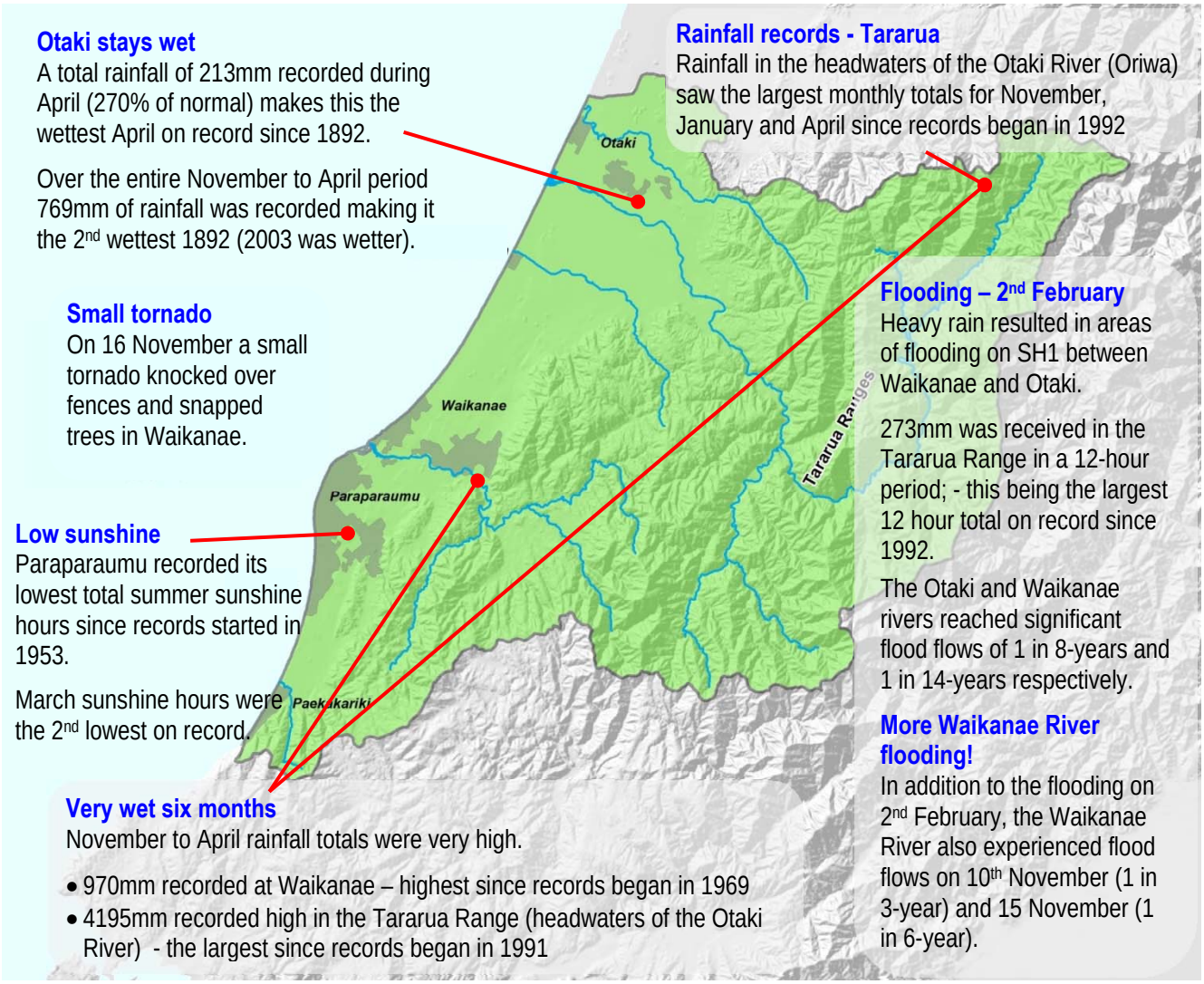
Want to look at the summary tables and graphs?

Rainfall

River flows

Kāpiti Coast climate summary

- **Much wetter than average – up to twice the normal Nov-Apr total**
- **December the only month with below average rainfall**
- **Low sunshine hours**



Otaki stays wet
A total rainfall of 213mm recorded during April (270% of normal) makes this the wettest April on record since 1892.

Over the entire November to April period 769mm of rainfall was recorded making it the 2nd wettest 1892 (2003 was wetter).

Small tornado
On 16 November a small tornado knocked over fences and snapped trees in Waikanae.

Low sunshine
Paraparaumu recorded its lowest total summer sunshine hours since records started in 1953.

March sunshine hours were the 2nd lowest on record.

Very wet six months
November to April rainfall totals were very high.

- 970mm recorded at Waikanae – highest since records began in 1969
- 4195mm recorded high in the Tararua Range (headwaters of the Otaki River) - the largest since records began in 1991

Rainfall records - Tararua
Rainfall in the headwaters of the Otaki River (Oriwa) saw the largest monthly totals for November, January and April since records began in 1992

Flooding – 2nd February
Heavy rain resulted in areas of flooding on SH1 between Waikanae and Otaki.

273mm was received in the Tararua Range in a 12-hour period; - this being the largest 12 hour total on record since 1992.

The Otaki and Waikanae rivers reached significant flood flows of 1 in 8-years and 1 in 14-years respectively.

More Waikanae River flooding!
In addition to the flooding on 2nd February, the Waikanae River also experienced flood flows on 10th November (1 in 3-year) and 15 November (1 in 6-year).

Want to look at the summary tables and graphs?

Rainfall

River flows

Ruamāhanga Valley climate summary

- **Very wet and above average river flow**
- **Ex-tropical cyclones brought high rainfall**

Ex-tropical cyclone Debbie

Masterton received 150mm of rainfall over the 3rd to 6th April. This is twice the average expected for the entire month of April! Rainfall totals of 178mm, 162mm and 135mm were recorded at Tanawa Hut, Mauriceville and Tauherenikau.

The Ruamahanga River peaked at a 2-year level at the Martinborough Bridge. Jenkins Dip floodway was in operation.

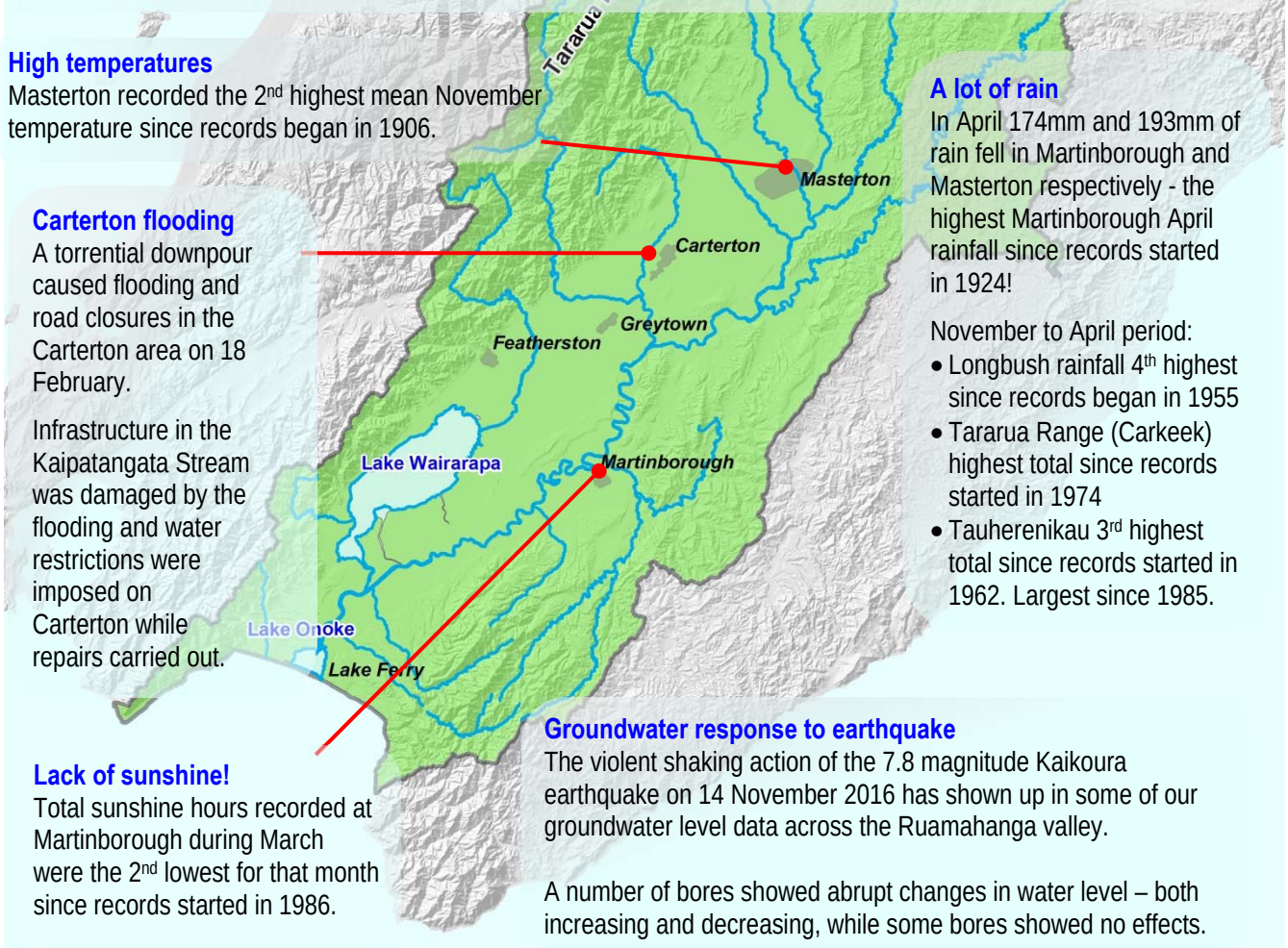
High temperatures

Masterton recorded the 2nd highest mean November temperature since records began in 1906.

Carterton flooding

A torrential downpour caused flooding and road closures in the Carterton area on 18 February.

Infrastructure in the Kaipatangata Stream was damaged by the flooding and water restrictions were imposed on Carterton while repairs carried out.



A lot of rain

In April 174mm and 193mm of rain fell in Martinborough and Masterton respectively - the highest Martinborough April rainfall since records started in 1924!

November to April period:

- Longbush rainfall 4th highest since records began in 1955
- Tararua Range (Carkeek) highest total since records started in 1974
- Tauherenikau 3rd highest total since records started in 1962. Largest since 1985.

Lack of sunshine!

Total sunshine hours recorded at Martinborough during March were the 2nd lowest for that month since records started in 1986.

Groundwater response to earthquake

The violent shaking action of the 7.8 magnitude Kaikoura earthquake on 14 November 2016 has shown up in some of our groundwater level data across the Ruamahanga valley.

A number of bores showed abrupt changes in water level – both increasing and decreasing, while some bores showed no effects.

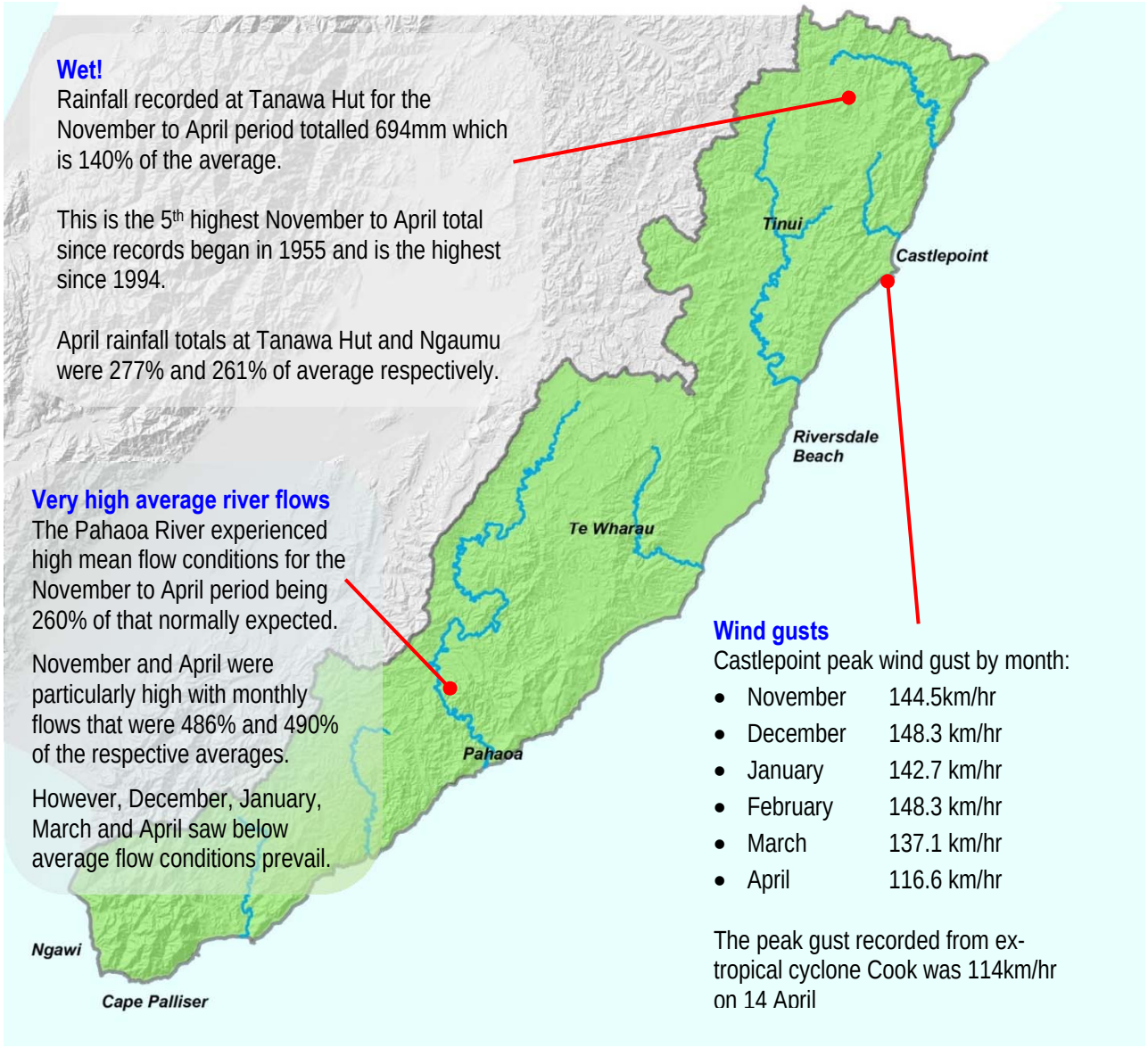
Want to look at the summary tables and graphs?

Rainfall

River flows

Wairarapa Coast climate summary

- **Wetter than average**
- **April exceptionally wet**
- **Some notable wind gusts**



Want to look at the summary tables and graphs?

Rainfall

Soil moisture

Rainfall statistics

Rainfall was above average for the November to April period at all locations.

December had below average rainfall across the region and March had pockets of below average rainfall. Rainfall was above average most of the remaining time.

Whaitua	Location	Nov %	Dec %	Jan %	Feb %	Mar %	Apr %	Nov-Apr (mm)	Nov-Apr (%)
Wellington Harbour & Hutt Valley Click to see cumulative rainfall plots	Kaitoke	210	76	172	173	120	234	1572	163
	Lower Hutt	246	84	125	118	155	279	800	160
	Wainuiomata	224	95	112	97	83	167	971	132
	Karori	284	87	98	107	138	212	817	157
	Wellington	346	111	106	138	201	347	783	208
Te Awarua-o-Porirua Click to see cumulative rainfall plots	Battle Hill	387	73	164	211	198	273	1000	206
	Whenua Tapu	309	73	102	114	226	309	786	181
	Tawa	281	84	144	182	166	291	752	182
Kāpiti Coast Click to see cumulative rainfall plots	Otaki	211	95	154	123	176	282	769	164
	Waikanae	283	87	147	140	196	232	970	176
	Paekakariki	252	76	114	175	206	191	778	190
	Tararua (Otaki headwaters)	218	79	342	212	140	210	4195	194
Ruamāhanga Click to see cumulative rainfall plots	Masterton	173	72	64	236	94	317	543	151
	Featherston	215	77	77	208	122	243	720	157
	Longbush	262	57	86	174	76	261	550	153
	Tararua (Waiohine headwaters)	236	68	244	156	76	236	3210	165
Wairarapa Coast Click to see cumulative rainfall plots	Tanawa Hut	130	48	112	191	61	277	694	137
	Ngaumu	156	57	47	186	50	261	509	122

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Cumulative rainfall plots

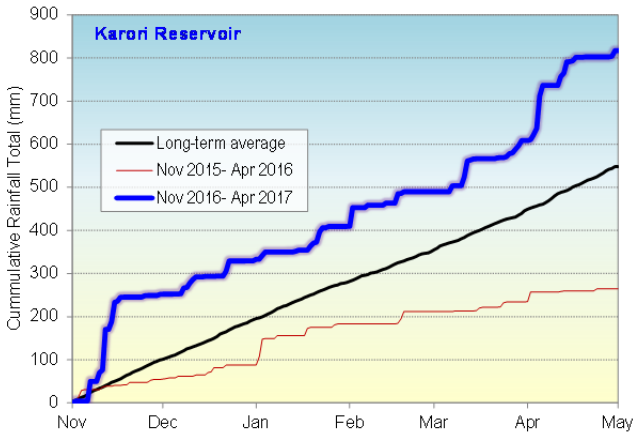
Cumulative rainfall totals for the November 2016 to April 2017 period are detailed for various rain gauges sites across the regional whaitua areas as denoted by the blue trace on the following plots. The November 2015 to April 2016 period is denoted by the red trace and the black trace represents the long-term average rainfall accumulation.

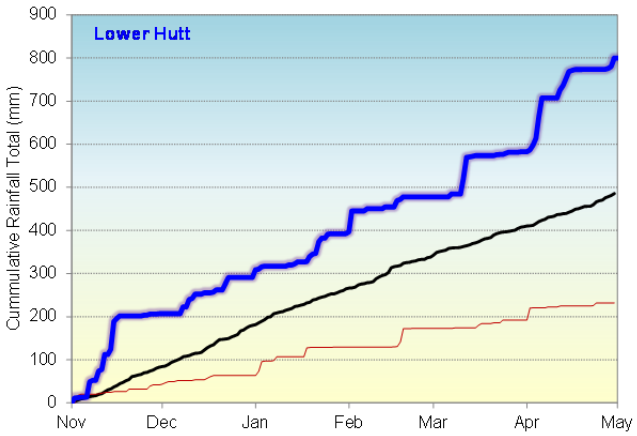
Wellington and Hutt Valley

The plots highlight that the rainfall accumulation during the November to April period was well above average. The rainfall at Karori was 269mm higher than the average and 552mm greater than the same period in 2015/16.

Rainfall in Lower Hutt during November to April was 568mm greater than the same period in 2015/16 and 314mm above the average.

Early November and early April were very wet periods evidenced by the sharp rise in the cumulative rainfall trace.

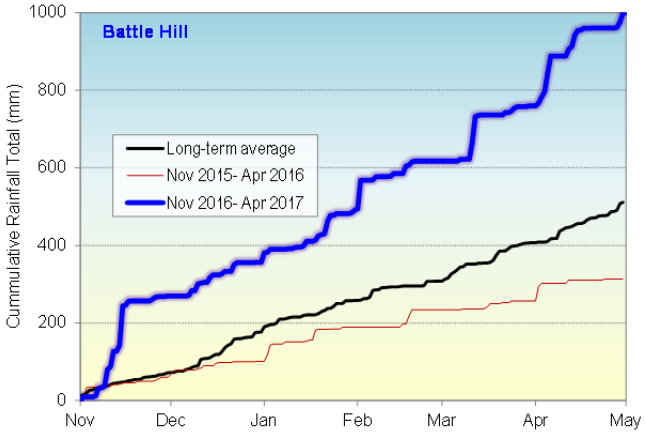


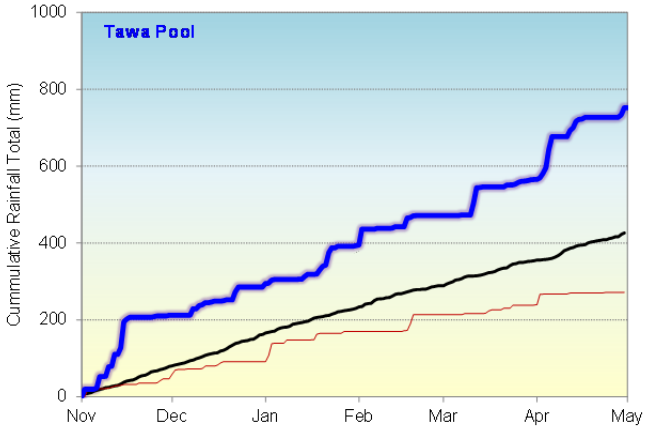


Porirua Harbour

The plots show that the rainfall accumulation trends in the November to April period at the two sites within the Te Awarua-o-Porirua whaitua area were similar but that the rainfall at Battle Hill accumulated at a faster rate with November being particularly wet.

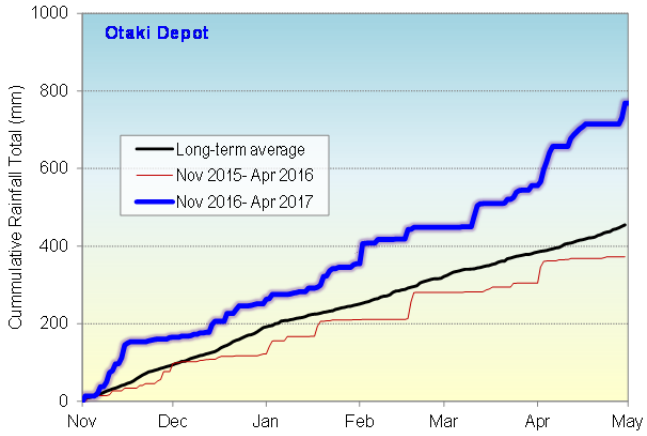
Rainfall for the period was 176% and 195% of average at the Tawa Pool and Battle Hill sites respectively, and about 300% of the 2015/16 total at both locations.

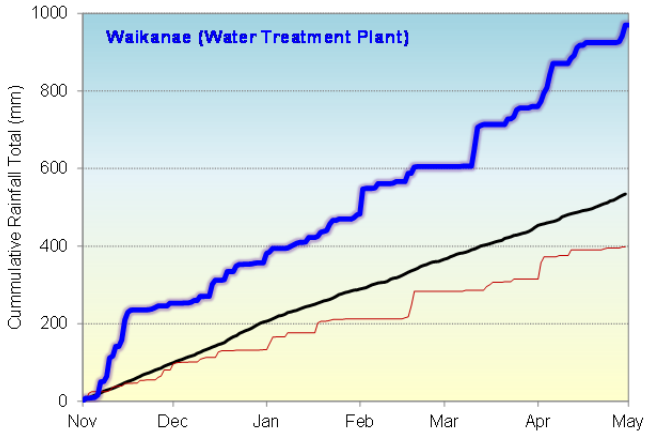




Kapiti Coast

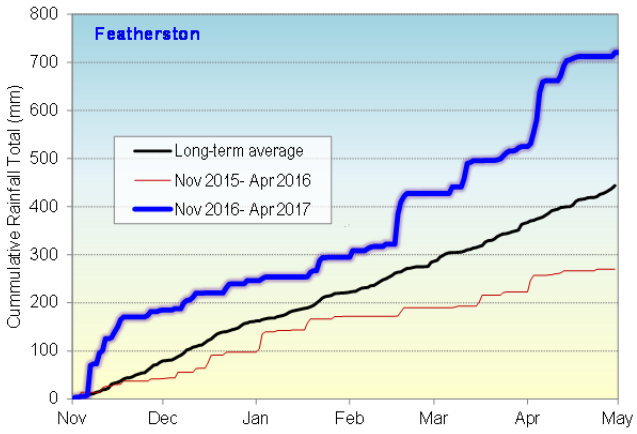
Rainfall recorded at Otaki and Waikanae over the November to April period was 169% (314mm) and 181% (436mm) greater than average respectively. Rainfall at Waikanae was 577mm higher than the same period in 2015/16.

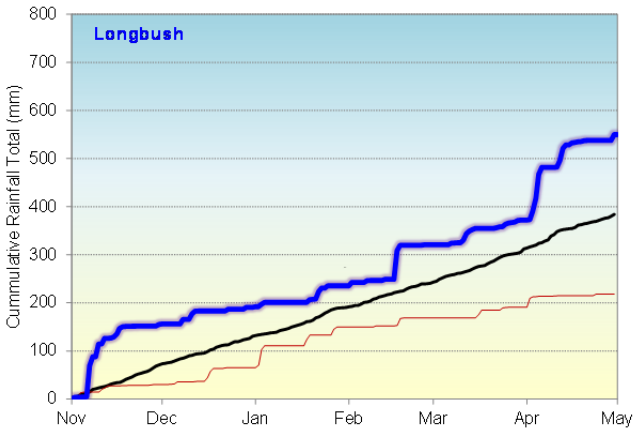




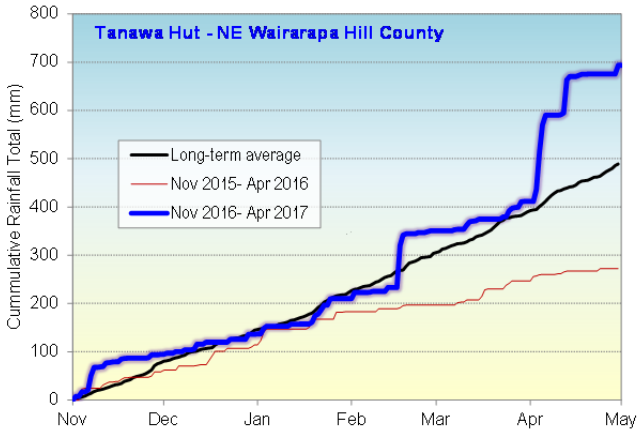
Ruamahanga

Rainfall in the Ruamahanga area started with a very wet November before the rainfall accumulation started to track back towards the average in mid-February before a number of heavy rainfall events over the next three months caused the November to April totals to be 162% (276mm) and 143% (166mm) of average at Featherston and Longbush respectively.





Wairarapa Coast



In contrast to the other whaitua areas the Tanawa Hut rain gauge in the Wairarapa Coast area showed rainfall accumulation trending towards average, or slightly below, up until mid-February.

Three large rainfall events in February and April resulted in the November to April total accumulation being 694mm, which is 205mm higher than the average for the period.

River flows - averages

Percentage of average river flow for each month and whole of the November 2016 to April 2017 period.

Flows across the region have been generally above normal over the warm season. However, December stands out as a month where flows were around average to below average everywhere while March and April saw some below average results in the Ruamahanga area.

		Flow as a percentage of average						
Whaitua	**River**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**Nov-Apr**
Wellington Harbour & Hutt Valley	Hutt River - Kaitoke	226	86	202	227	117	246	182
	Hutt River - Taita Gorge	263	88	182	278	160	317	210
	Akatarawa River	250	96	233	360	168	276	221
	Mangaroa River	291	74	117	262	142	384	217
	Waiwhetu Stream	251	102	106	144	134	275	173
	Wainuiomata River	199	99	143	221	103	333	171
Te Awarua-o-Porirua	Porirua	358	116	129	135	182	387	233
	Pauatahanui	467	139	188	356	348	653	364
	Horokiri	425	103	102	173	293	524	273
Kāpiti Coast	Otaki	207	91	276	285	86	256	192
	Mangaone	210	91	192	290	159	296	194
	Waikanae	348	108	254	389	187	367	269
Ruamāhanga	Kopuaranga	188	95	150	229	120	428	211
	Waingawa	193	68	202	214	55	204	153
	Waiohine	197	72	216	214	63	212	160
	Mangatarere	224	97	135	296	90	306	196
	Tauherenikau	213	80	161	216	100	230	166
	Otukura	256	112	98	148	111	468	220
	Ruamahanga	198	65	172	218	55	289	220
Wairarapa Coast	Pahaoa	486	51	10	158	16	490	261

** Analyses have been completed on provisional data which may be subject to change once it is processed and archived*

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River flows – highest

Maximum river and stream flows recorded during the November 2016 to April 2017 period. The estimated return period is given for each event.

Whaitua	River	Maximum Flow		
		Flow (m^3/s)	Date	Return Period (years)
Wellington Harbour & Hutt Valley	Hutt (Kaitoke)	321	2 February	5
	Hutt(Taita Gorge)	1043	15 November	5
	Akatarawa	415	2 February	5
	Mangaroa	164	15 November	2
	Waiwhetu	18	15 November	5
	Wainuiomata	47	15 November	5
Te Awarua-o-Porirua	Porirua	54	15 November	8
	Pauatahanui	80	15 November	20
	Horokiri	56	15 November	8
Kāpiti Coast	Otaki	1259	2 February	8
	Mangaone	13	2 February	2
	Waikanae	281	2 February	14
Ruamāhanga	Kopuaranga	63	5 April	3
	Waingawa	182	14 April	1
	Waiohine	595	2 February	1
	Mangatarere	160[1]	18 February	N/A
	Tauherenikau	200	15 November	1
	Otukura	8	6 April	2
	Ruamahanga (Upper)	413	5 April	1
	Ruamahanga (Lower)	915	6 April	1
Wairarapa Coast	Pahaoa	540	8 Nov	3

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[1] Recording sensor damaged during this flood event. This is an estimate of flow only.

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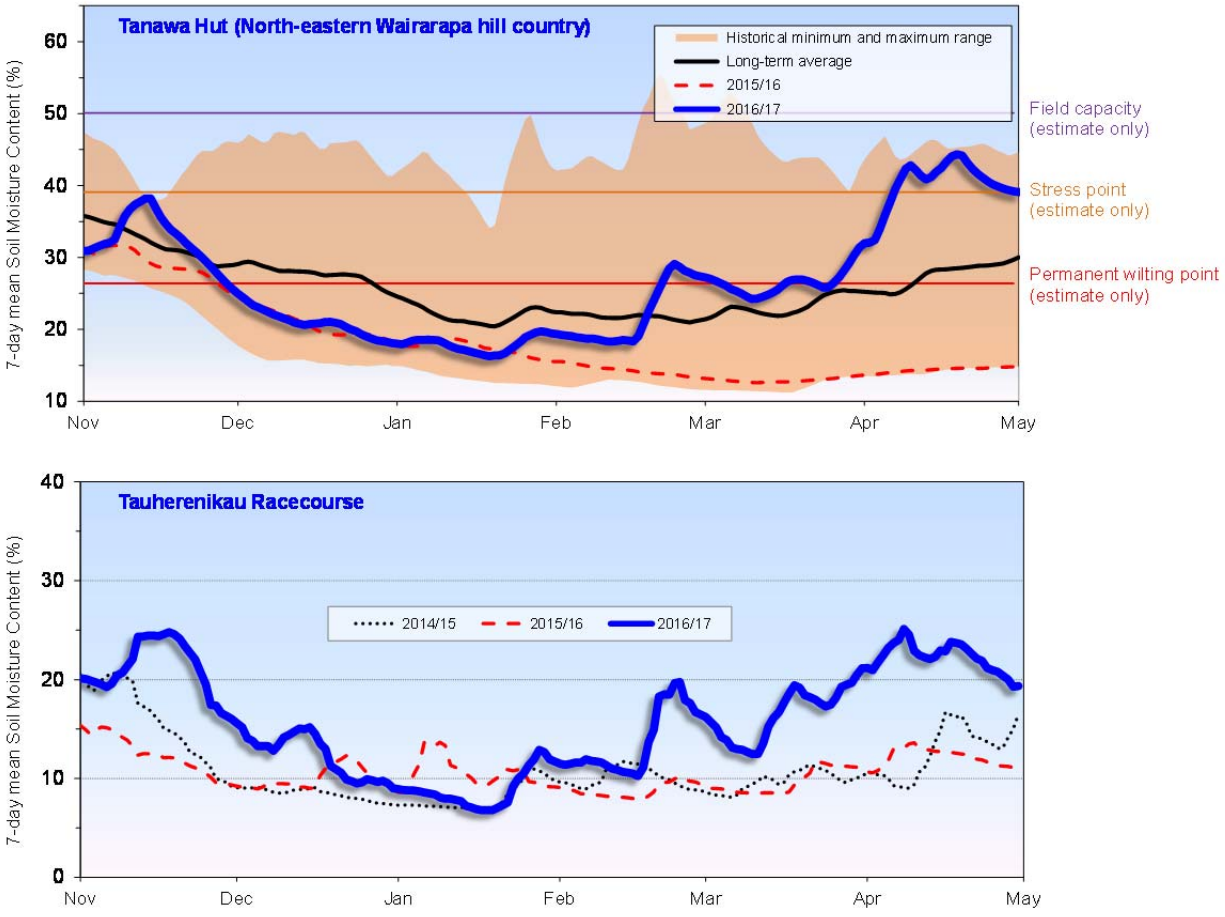
Soil moisture content

Wairarapa Coast

November 2016 to April 2017 soil moisture content at monitoring sites at Tanawa Hut in north-east Wairarapa (Wairarapa Coast whaitua) and Tauherenikau racecourse (Ruamāhanga whaitua) are plotted below.

Soil moisture at Tanawa Hutt was slightly below average from December to mid-February and then well above average during April. Levels at Tauherenikau were largely higher than the previous two warm seasons and reached its lowest level in January. From mid-February soil moisture was substantially higher than previous years.



Drought monitoring

NIWA maintains a 'drought monitor' and 'drought index' website that provides more information on soil moisture conditions (and other hydrological and climatic information relevant to drought assessment):

https://www.niwa.co.nz/climate/information-and-resources/drought

https://www.niwa.co.nz/climate/information-and-resources/drought-monitor

Climate Briefings

Additionally to the operational (seasonal) reports, the Environmental Science department, GWRC, produces monthly climate briefings specifically targeting the farming community in periods of significant climate anomalies such as an El Niño year. Those can be accessed at the bottom of the Climate and Water Resource webpage:

http://www.gw.govt.nz/seasonal-climate-and-water-resource-summaries-2/

The Greater Wellington Regional Council's purpose is to enrich life in the Wellington Region by building resilient, connected and prosperous communities, protecting and enhancing our natural assets, and inspiring pride in what makes us unique

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