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TE RAUHITANGA TAIAO

State of the Environment Monitoring

Auckland Water Quantity Statement June 2005- May 2006

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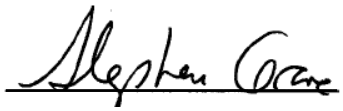
STATE OF THE ENVIRONMENT MONITORING: AUCKLAND WATER QUANTITY STATEMENT JUNE 2005- MAY 2006

R McKean
G Crowcroft
D Henehan

Peer reviewed by:
Stephen Crane  Date: 31 May 2007

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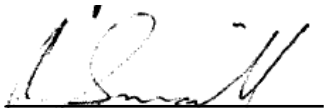
Alastair Smaill  Date: 31 May 2007

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1 Introduction

In the Auckland Region, policy governing water management is included in the Auckland Regional Policy Statement (ARC, 1999) (ARPS) and the Proposed Auckland Regional Plan: Air, Land and Water (ARC, 2001) (PARP:ALW). The ARPS and the PARP: ALW both include a series of anticipated environmental outcomes encompassing maintenance of sufficient water for present and future generations and protecting the ecosystems, natural character and intrinsic values of water bodies. This report addresses these outcomes in respect of stream and aquifer levels and the quantity of water abstracted in the Auckland Region for the period June 2005 through May 2006. Most reporting is on high use management areas defined in the PARP: ALW (2001).

This report includes assessment of rainfall, stream flow, groundwater level data & resource consent data for the twelve months June 2005 to May 2006 and compares it against methods in the PARP: ALW (2001) and baseline information. The stream flow is compared with the Mean Annual Low Flow (MALF) for the site as no minimum flows have been set in the PARP:ALWP1. For further information on the region's water resources refer to the Auckland Water Resource Quantity Statement: *Auckland Water Resource Quantity Statement 2002, Technical Publication 171* (Crowcroft & Bowden, 2002)2. For the purposes of reporting the Auckland region is split into 8 water resource reporting areas (Fig. 1). Chapters 3-10 contain rainfall, surface water and groundwater resource information for each water resource reporting area, together with water allocation and use figures for each area for the year 1st June 2005 – 31st May 2006.

[1] The MALF is determined from frequency analysis as being the lowest 1 day flow in every 2.33 years. The MALF values in this report are not adjusted for pumping effects and thus can be expected to be lower than the MALF for natural flows.

[2] All ARC reports are available on the ARC Internet site at http://www.arc.govt.nz or by contacting the ARC, email publications@arc.govt.nz or phone (09) 366 2000.

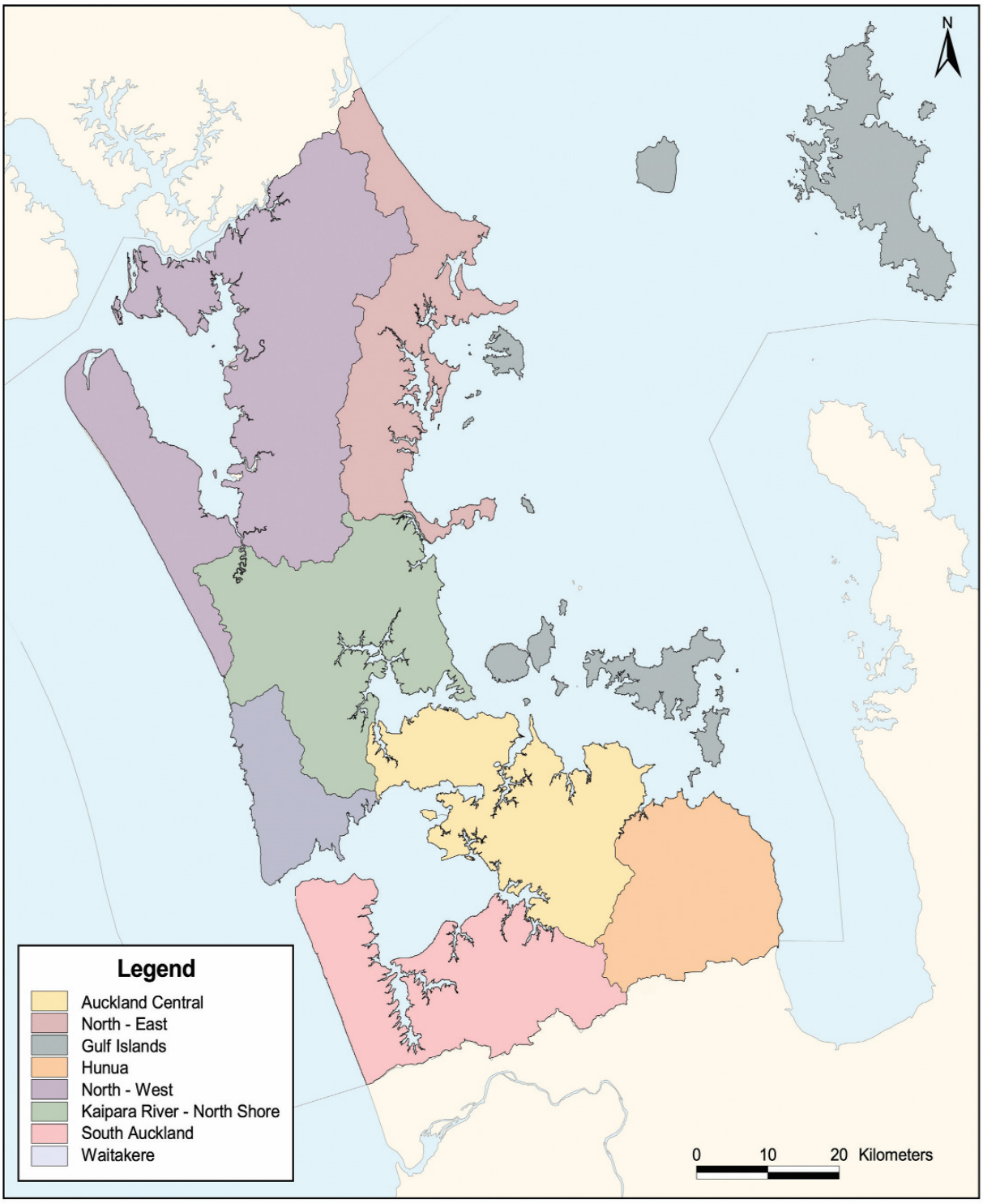


Figure 1: Location of water resource reporting areas

1.1 Regional Rainfall

The Auckland region was 7% wetter than the last hydrological year with increased rainfall recorded at most monitoring sites (Fig. 2). Winter rainfall was below average. The overall winter climate pattern was dominated by more frequent anticyclones (highs) over the North Island. Rainfall in August 2005 was less than 50% of normal in much of Auckland (Fig. 3). During the spring months Auckland was warm and wet and received above average rainfall in many parts. Some parts of the region received above 200 % of the average rainfall in October. December 2005 and January 2006 had average rainfall but February 2006 was extremely dry in parts of Auckland. The rainfall levels were around 80% less than normal in Auckland and in late summer this led to soil moisture deficits.

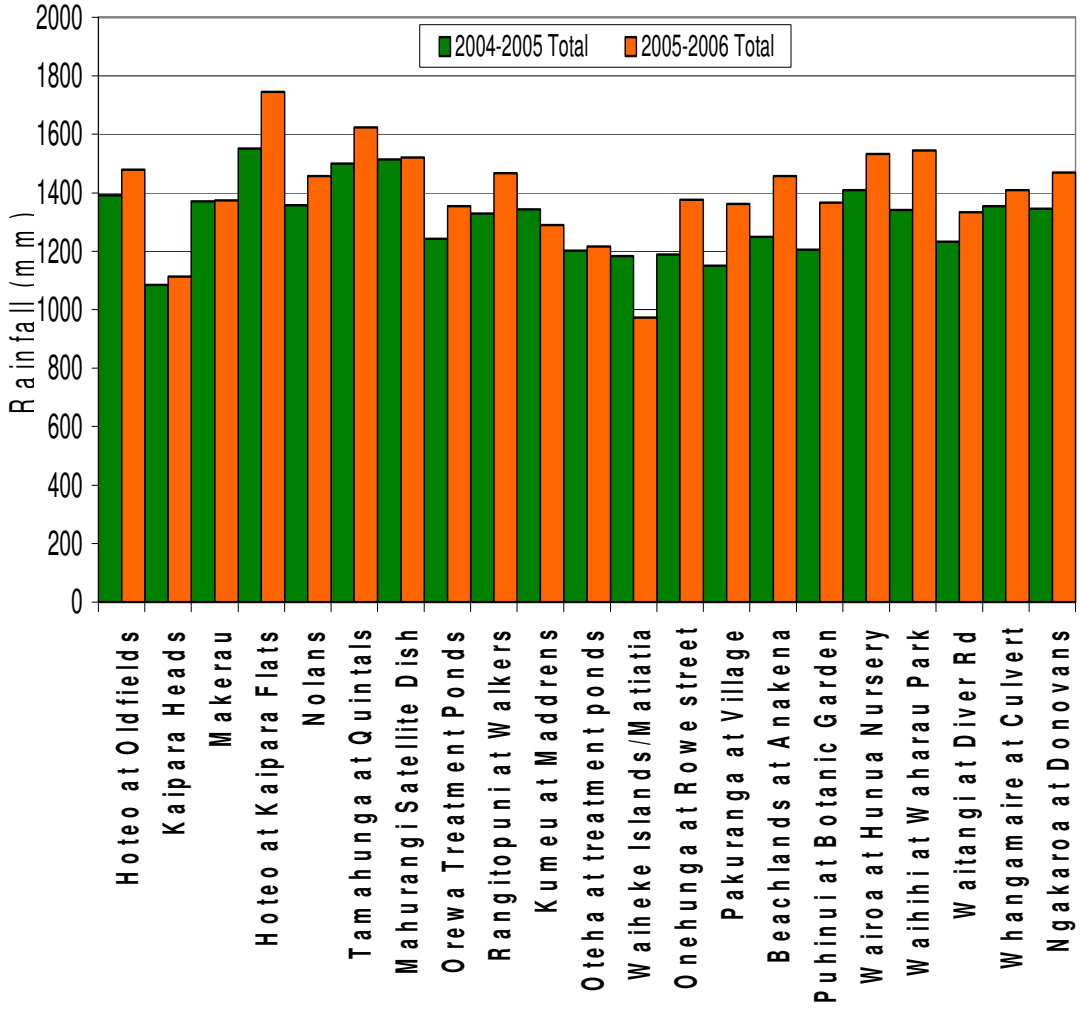


Figure 2: Comparison of 2004-2005 rainfall totals with 2005-2006 rainfall totals at selected monitoring sites across the Auckland Region.

Autumn was a very wet season with over 200% of the normal rainfall in April and May 2006 (Fig. 3). The extreme rainfall helped to reduce soil moisture deficits and eventually led to soil saturation towards the end of May. During April, depressions (or "lows") were much more frequent than average in the Tasman Sea. This pattern resulted in frequent warm northwesterlies over the North Island (NIWA April 2006). One incident involved severe flooding in Papakura, Auckland on the 18th April which led to people having to evacuate their homes.

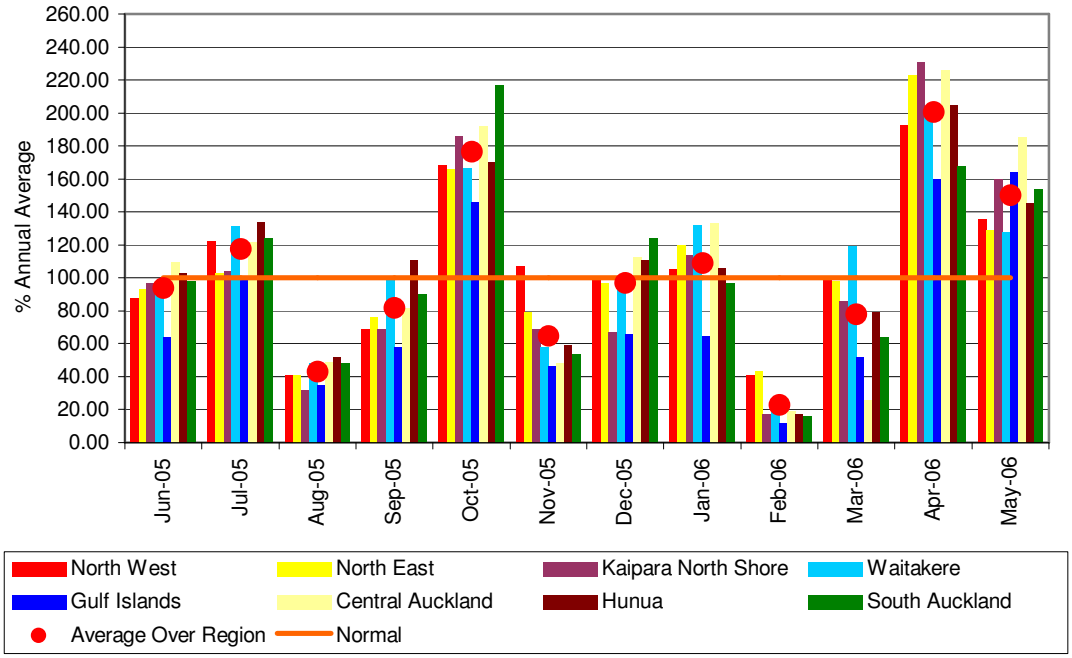


Figure 3: Regional monthly rainfall percentage compared with long term mean, June 2005 to May 2006

1.2 Surface Water Management

The surface water of the Auckland Region is composed of rivers, small streams, small lakes, dammed water and wetlands (Crowcroft & Bowden, 2002). The monitoring of surface water sites is extremely important especially in small streams. High levels of water abstraction can have a detrimental affect on the stream water quality and ecology so environmental monitoring is important during the summer when water levels are low and demand is greater.

Surface water in Auckland is mainly abstracted from dams, lakes and run-of-stream flow. For a number of these streams there is constant pressure from water demand and abstraction. The ARC has defined eight stream catchments in the PARP: ALW (2001) that are under pressure from high water use as "high use stream management areas" (Table 1). In 2005-2006 flows at 4 monitoring sites dropped below the MALF (Table 1).

Table 1: High use stream management areas & number of days flow fell below the site MALF during 2005-2006.

Water resource reporting area	High use Stream name	Monitoring site	No. of days below MALF
North West	Whangaripo	-	
North East	Mahurangi River	6806 Mahurangi	0
North West	Waitoki Waikahikatea Waipapakura	45415 Kaukapakapa	0
Kaipara River North Shore	Waimauku and Kumeu	45315 Kumeu River 45311 Kaipara River	6 20
Auckland Central	Puhinui	43807 Puhinui	0
	Taitaia	-	
	Hays Creek	-	
South Auckland	Ngakoroa Waitangi	43829 Ngakoroa 43602 Waitangi	3 31

1.3 Groundwater Management

Most of the abstracted groundwater in the Auckland Region is from high use management aquifers (Table 2). These aquifers are considered at risk from over-pumping or water abstraction. The PARP: ALW (2001) has set a maximum availability that can be abstracted from the aquifer during the year or an average minimum groundwater level. Table 2 displays the availability, allocation and use for 2004-2005 and 2005-2006.

Groundwater levels are closely monitored to ensure that aquifer availability is sustainable in the long term. If aquifers are over-abstracted the impact does not just affect the ability of abstractors to take water but may also affect the flow and level of water in our streams (Bannister, Crowcroft & Johnson 2003). This report uses envelope plots to show the groundwater levels for the current hydrological year. The envelopes are based on long term monitoring data. Minimum, maximum and mean monthly groundwater levels are used, together with 1 standard deviation from the mean groundwater level to form the envelopes.

The Region's basaltic aquifers respond quickly to changes in rainfall and water abstraction. Intensive periods of rain and extended water abstraction can be clearly seen in rising and falling groundwater levels. The groundwater levels in the Central Park bore (6498007) in Auckland Central show clearly the high levels of rainfall in October and May and the extremely dry period in February (Fig 24). The low levels of groundwater in February will be representative of the reduced rainfall and increased water abstraction during the summer.

1.4 Water Allocation and Use

Water allocation in high use aquifers in the 2005-2006 hydrological year was similar to the previous year. Currently Kumeu – Waitemata zone 1, Omaha - Waitemata, and Waiwera Geothermal high use aquifers are fully allocated.

Table 2: High use aquifer management areas, annual availability, allocation and use figures for 2005 – 2006. Note that groundwater availabilities are not set for five high use aquifers.

High Use Aquifer Management Area	Aquifer	Availability m^3 (000)	2004-2005		2005-2006 (TP 323)	
			Allocation m^3 (000)	Use m^3 (000)	Allocation m^3 (000)	Use m^3 (000)
Clevedon	Clevedon Waitemata - East	379	157	97	155	86
	Clevedon Waitemata - West	964	877	534	815	423
Manukau City Waitemata	Manukau - Waitemata	660	357	125	359	148
Franklin Kaawa	Bombay - Drury Kaawa	718	341	239	296	234
	Glenbrook/Waiau Pa Kaawa	1,560	1,249	939	1,249	991
	Karaka Kaawa	617	520	171	484	168
	Pukekohe Kaawa	1,860	1,247	1,425	1,210	1,282
	Pukekohe West Kaawa	1,780	466	203	466	236
	Waiuku Kaawa	2,450	1,002	331	994	380
Franklin Volcanics	Pukekohe Central Volcanic	856	535	245	652	286
	Pukekohe North Volcanic	420	116	92	120	91
	Pukekohe South Volcanic	650	129	73	148	88
	Pukekohe West Volcanic	420	276	219	296	299
	Bombay	-	140	72	62	34
	Glenbrook	-	110	42	162	101
Kumeu - Waitemata	Kumeu – Waitemata zone1	211	229	158	245	160
	Kumeu – Waitemata zone2	586	532	264	540	180
	Kumeu – Waitemata zone3	762	73	19	70	31
Omaha - Waitemata	Omaha - Waitemata	105	69	50	70	39
Tomarata Waitemata	Tomarata Waitemata	638	135	64	135	0.3
Onehunga-Mt Wellington Volcanic	Onehunga-Mt Wellington Volcanic3	15,038	9,354	5,683	8,959	5,200
Parakai	Parakai geothermal	-	249	168	249	172
Waiwera	Waiwera geothermal	-	492	456	492	422
Manukau City Kaawa	Manukau Kaawa	-	167	60	196	24
Waiheke		-	155	80	108	23
Drury Sand-Volcanic		-	144	97	159	104

[3] In this report the Onehunga and Mt Wellington aquifers have been lumped together.

Allocation numbers in some areas have changed due to updating of the ARC consent database. The significant differences are

- Omaha – Waitemata: the allocation, in common with figures for all high use aquifers, is based on consented abstractions. At Omaha, ARC has undertaken two surveys that have assessed the volume of water required for other purposes such as permitted activities and stock and domestic use at 50,000 m^3/year.

Under Section 14 of the Resource Management Act 1991 (RMA) surface water and groundwater is allowed to be taken "as of right" for individual domestic use, stock drinking water and fire fighting. Water that is taken for other purposes requires resource consent unless it is allowed as a permitted activity in a regional Plan.

Water allocated to resource consent holders fell to 138Mm^3 in the 2005-2006 hydrological year, a decrease of 14Mm^3 from the previous year (Table 3). Water use dropped due to the high summer rainfall and large consent holders not fully exercising their allocation. Approximately 75% of the total water allocated to 1439 resource consents was used in 2005/2006. Consent holders are required to monitor weekly water use and submit readings quarterly. The return rate on these quarterly submissions is very good and only 9% of consent holders failed to make any returns. Around 14.5% of active consent holders actually used more water than they were allocated. Consent holders who have exceeded their allocation will be contacted to assess the reasons for overusing. The investigation will result in some having to apply for increasing their water allocation. Where the overuse cannot be resolved by increasing current water allocation, appropriate enforcement action will be taken to prevent this in the future. 518 of the resource consents are inactive or have not used any of their allocated water, this equates to 15.5Mm^3 of total water allocated.

Table 3: Key water use and allocation statistics for Auckland Region for 2005 – 2006.

Key Water Statistics	2004-2005	2005-2006
Number of consents	1,499	1,439
Groundwater take consents	1,172	1,132
Surface water take consents	327	307
Water allocated	152Mm^3	138Mm^3
Water Used	118Mm^3	104Mm^3
Inactive consents	22%	21%
Quarterly meter returns	90%	91%
Failed quarterly returns	4%	9%
Consents with use exceeding water allocation	12%	14.50%

The number of applications to take water and/or drill new bores can be used as an indirect measure of new water demand in the region. In the last 5 years the number of applicants for new bore has risen from 96 to 130. The number of applications to drill bores for domestic and stock has gradually risen over the past 5 years whilst irrigation and industry has dropped or remained the same. This may reflect regulatory changes and the increase of rural residential lifestyle block use in the region.

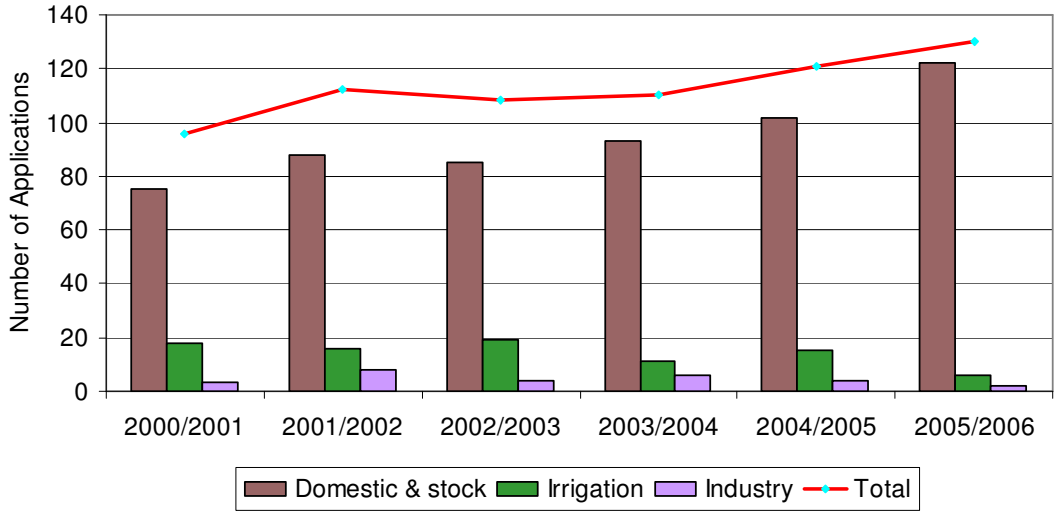


Figure 4: Numbers of applications to drill bores for domestic and stock supply, industrial use and irrigation supply.

According to figures provided by Watercare Services Ltd., Rodney District Council and Franklin District Council, approximately 1.25 million people were supplied with reticulated water in the Auckland Region (Table 4). Total reticulated supply was 87Mm^3, or an average of 70,000 litres per capita. The six local network operators supplied by Watercare Services Ltd. collectively serve a population of about 1.21 million people. Of the total volume supplied, 25% is for industrial and commercial purposes, 0.8% is for agricultural purposes and 61% is for domestic use (data from Watercare Services Ltd, pers. comm.). The majority of water taken by Franklin District Council and Rodney District Council is delivered to domestic properties, 97% and 82% respectively. (Data from Franklin District Council and Rodney District Council pers. comm.).

Table 4: Volumes of surface water, groundwater and total water in millions of cubic metres (Mm^3) and percentage of regional allocation for municipal supply in 2005-2006.

	Allocated Surface water (Mm^3)	Allocated Groundwater (Mm^3)	Total Allocation (Mm^3)	Percent of total allocated water
Watercare Services Ltd.	91	6.9	96.5	61
Franklin District Council	1	2.5	3.5	2.2
Rodney District Council	0.8	0.7	1.5	1
Total municipal supply	92.8	8.7	102	64.2

The majority of water allocated for municipal supply is from surface water in Hunua and Waitakere (Fig 5). This represents the large resource consents held by Watercare Services Ltd. If these allocations are removed (Fig 6), groundwater represents the larger percentage of allocated water in regions such as Auckland Central and South Auckland.

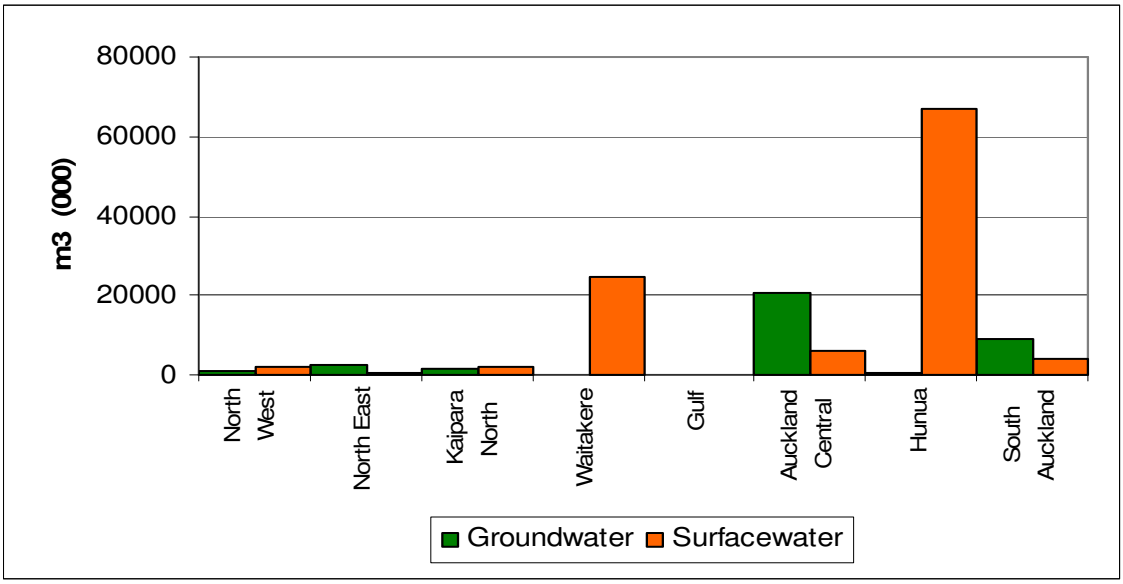


Figure 5: Comparison of surface water and groundwater allocation in each of the eight regions of Auckland including Watercare's allocation.

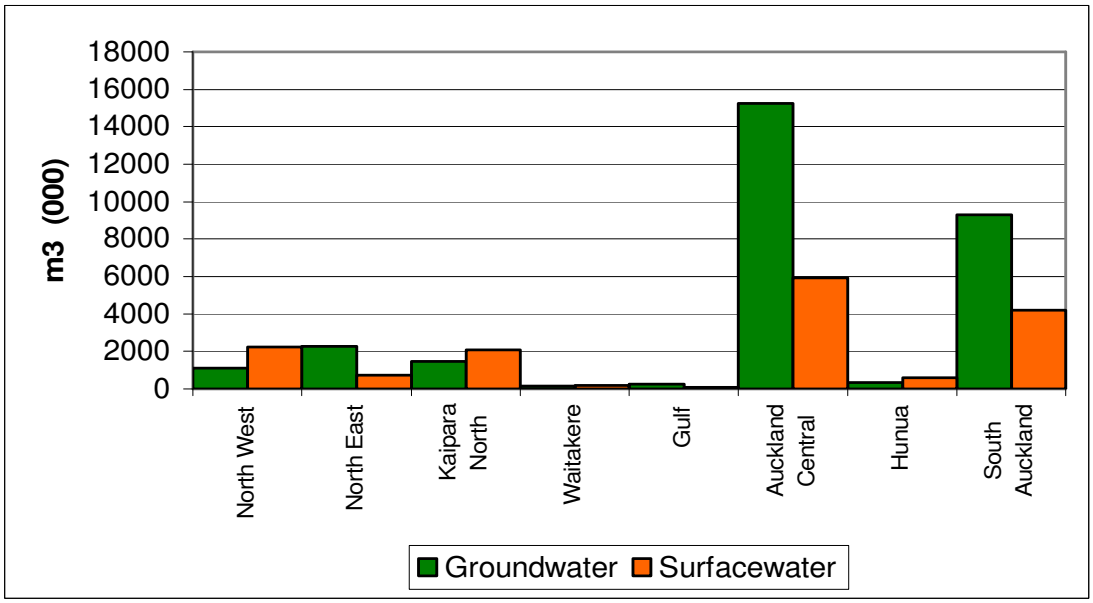


Figure 6: Regional water allocation and use excluding Watercare Services Ltd allocation in 2005-2006

The volume of water used for irrigation, compared to that allocated, was low (~ 5Mm^3 of 12Mm^3 allocated) (Fig 7). This is similar to the allocation and use for industry (17Mm^3 allocated and 3.4Mm^3 used). The water allocation and usage for municipal, 102Mm^3 and 94Mm^3 respectively, has dropped from last year due to large inactive consents.

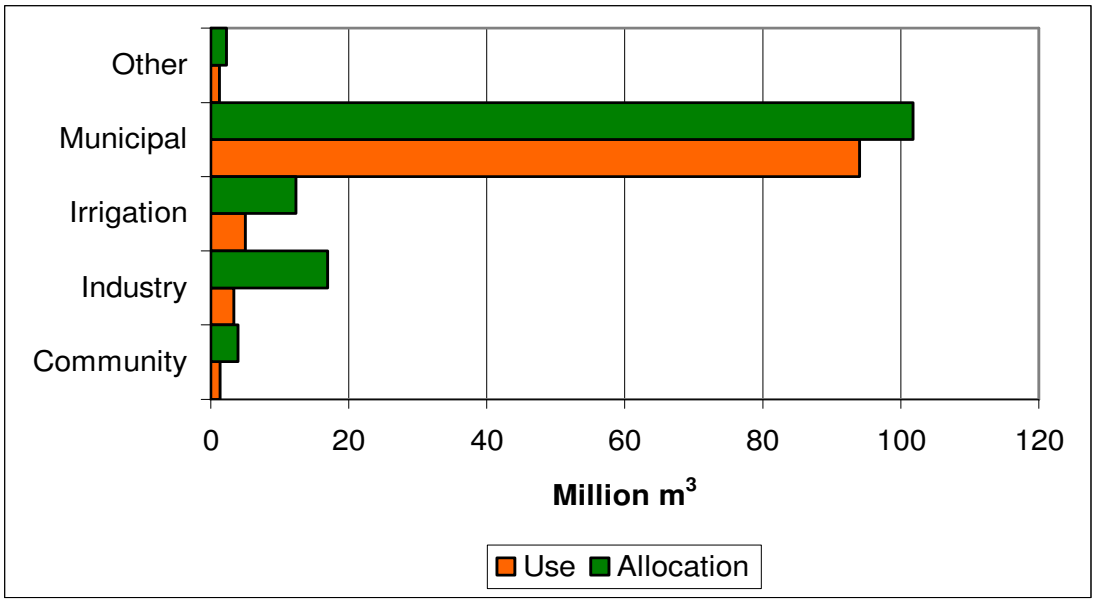


Figure 7: Total Allocation and Use for each purpose 2005-2006.

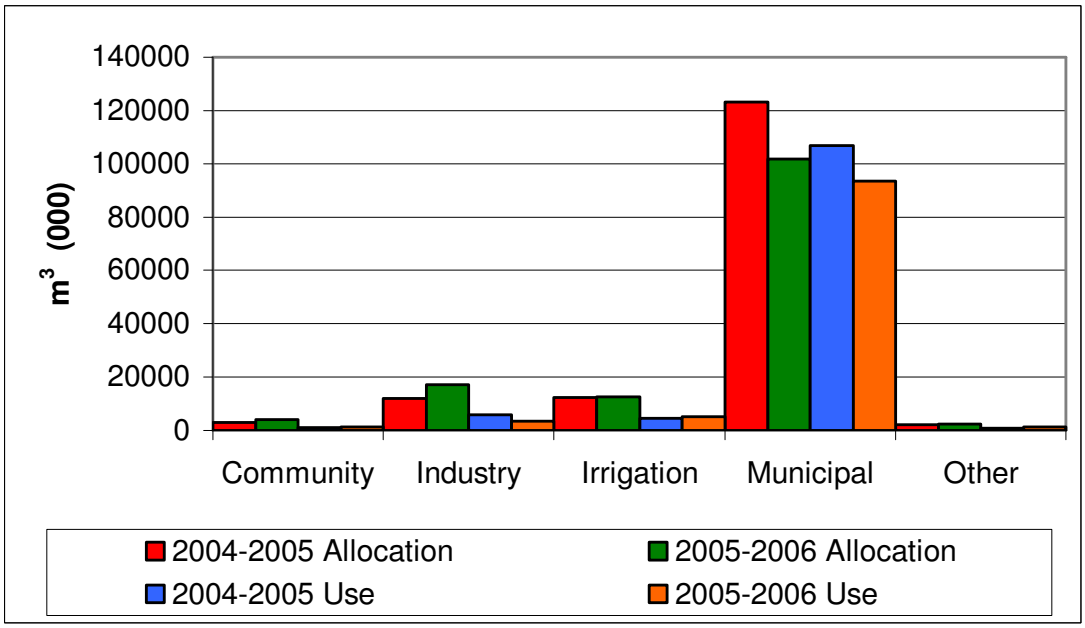


Figure 8: Comparison of Allocation and Use for each sector between hydrological years 2004-2005 and 2005-2006.

Allocation and use of water in 2005-2006 have both fallen for the municipal sector compared with 2004-2005 (Fig 8). For industry and community sectors allocation has risen. Consent holders are prioritised into three different groups, High, Medium and Low for monitoring purposes. The monitoring priority is based on the resource from which the water is abstracted from and the quantity allocated. As Fig. 9 shows, the high priority category comprises the least consents but has the highest allocation and use. In contrast the low priority category comprises the highest number of consents but has the lowest use and allocation.

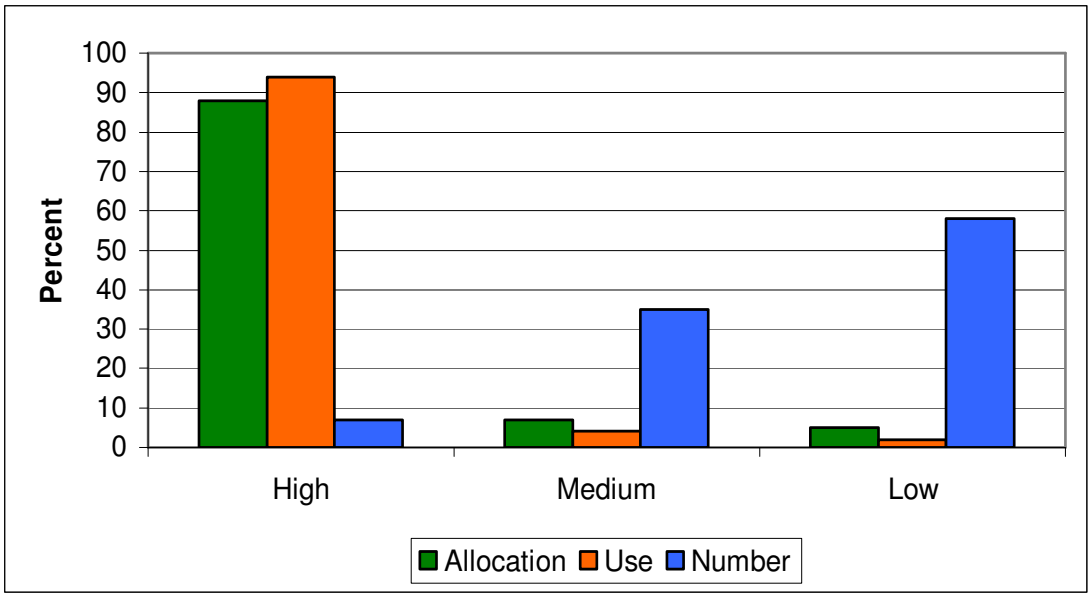


Figure 9: Percentage of consent holders in each monitoring category and the percentage of water allocated and used.

1.5 Irrigation

The Auckland Region consists of a comparatively small land area. However, the region has 44% of the national total area of "indoor" fruit, vegetable and flower production, 66% of the indoor capsicum growing area, 60% of the indoor tomato growing area, 26% of the national onion growing area and 7% of potatoes (Ministry of Agriculture and Forestry (MAF) Agricultural Production Survey, 2002). According to the MAF survey, about 2 percent of productive land in the Auckland Region is under irrigation (6,200ha).

From 1stJune 2005 to 31st May 2006 there was 12.4Mm^3 water allocated for irrigation and 5Mm^3 was actually used. The total area irrigated in the region is 6196 ha based on resource consents. Therefore in 2005-2006, 2001m^3 of water was allocated per hectare. However, actual irrigation of 5Mm^3 equates to about 806m^3 per ha. There was a slight decrease in water usage for irrigation for the year and this is attributed to the 7% increase in rainfall for the region.

1.6 Industry

In 2005-2006 there were 195 current consents to take water for industrial purposes. Of these 72% were for manufacturing operations and processing plants; a drop from 97% in 2004-2005. The food sector represented 16% of the consents, a rise from 2% in 2004-2005. There has also been a rise in consents granted for dewatering of quarries and excavations and the provision of cooling, circulation or wash-water for quarries.

The total volume of water allocated for these activities was 17Mm^3, with 16% of the allocated volume used. This excludes water provided by reticulated systems to industrial enterprises. Of the water allocated 85% was from groundwater and 15% was allocated from surface water. All the food industry consents were allocated water from groundwater sources.

2 North West

2.1 Rainfall

The total rainfall in the North West was between 0.2% and 12.4 % higher than average (Table 5). In August, September 2005 and February 2006 there was a 50% reduction in total rainfall. July, October 2005, April and May 2006 were above the average with October 40% and April 50-60% above normal rainfall (Fig 10).

Table 5: Comparison of 2005 – 2006 rainfall with long term mean at 4 sites

Site Number	Site Name	Mean Annual Rainfall June-May (mm)	Total Rainfall June 2005-May 2006 (mm)	% Deviation from Average Rainfall
643510	Hoteo at Oldfields	1390	1479	+ 6.4
644211	Kaipara Heads	1085	1113	+ 2.6
645519	Makerau	1371	1374	+ 0.2
644511	Hoteo at Kaipara Flats	1552	1744	+ 12.4

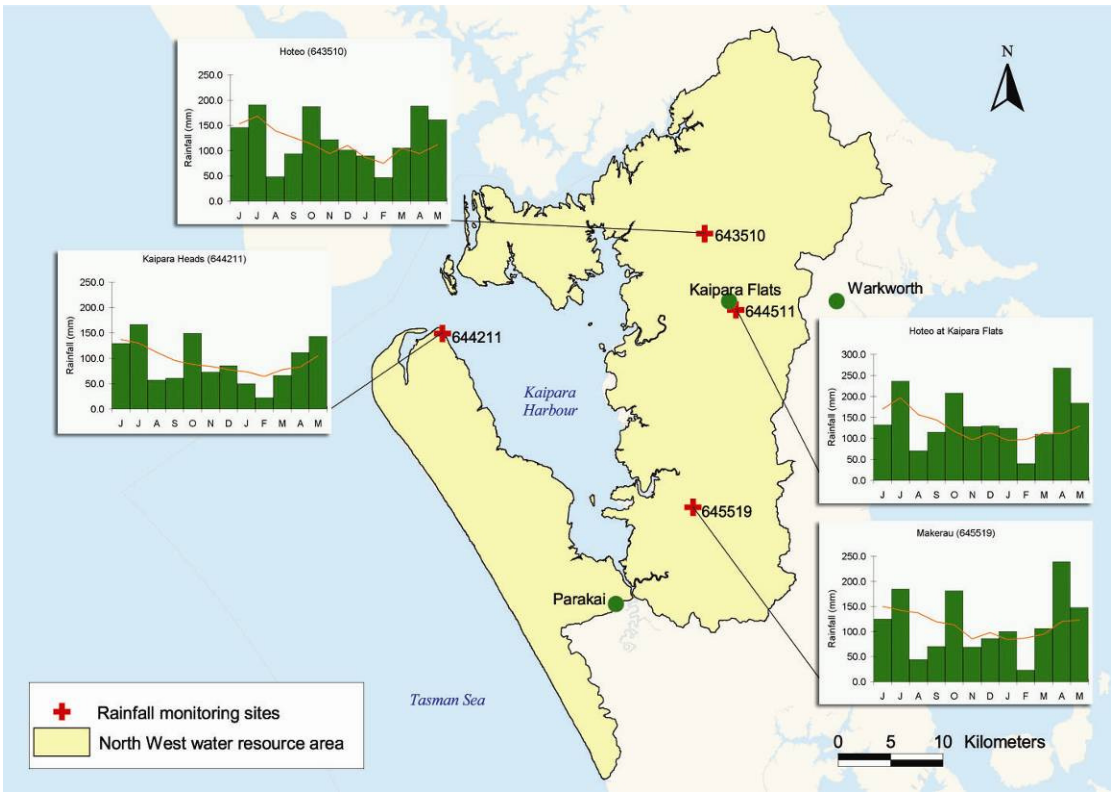


Figure 10: Total monthly rainfall (bars) and long term mean monthly rainfall (line) at 4 sites in the North West water resource area.

2.2 Surface Water

In the North West water resource area there are four high use management streams, Whangaripo, Waititoki, Waikahikatea and Waipapakura (Fig 11). The Whangaripo stream is a tributary of the Hoteo River and currently there are no flow-monitoring sites for this stream.

The Waitoki, Waikahikatea and Waipapakura currently have no monitoring sites but they are all sub-catchments of the Kaukapakapa River. The flow-monitoring site on the Kaukapakapa River is located at Taylors (45415), catchment area 61.92km^2. The MALF of the site is 16.5 l/s and the lowest recorded flow was 26 l/s.

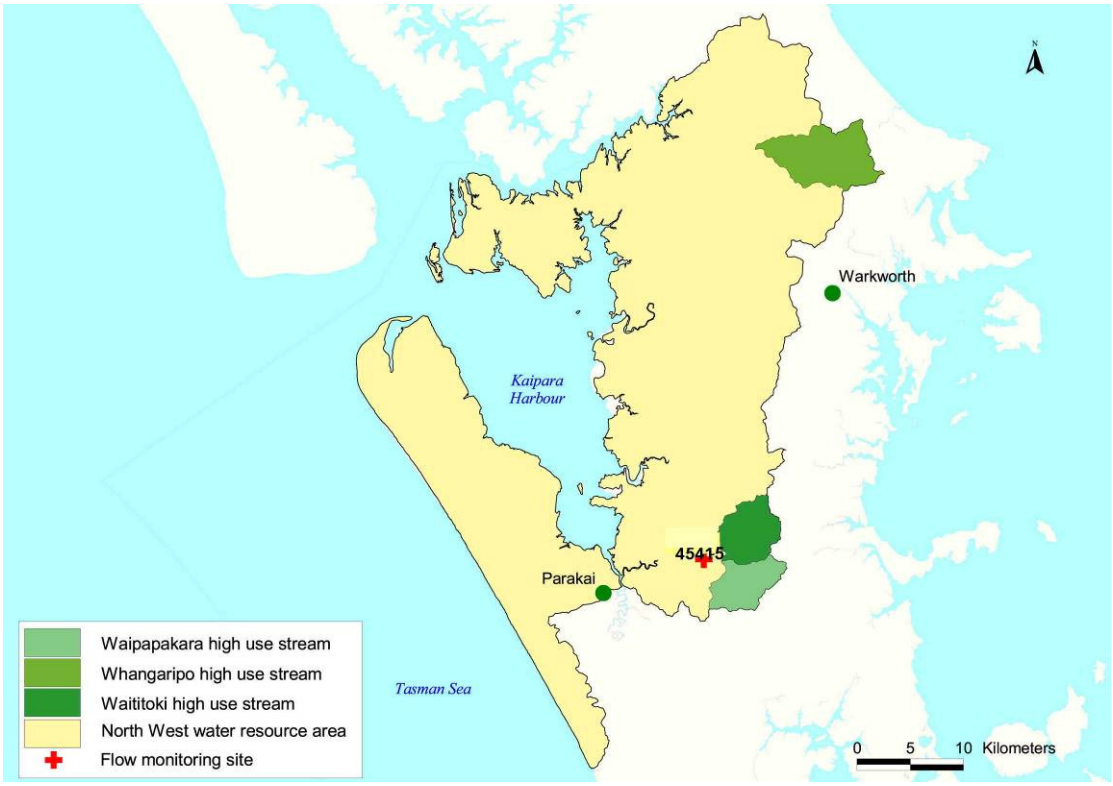


Figure 11: North West water resource, high use stream management areas and flow monitoring site.

2.3 Groundwater

In the North West water resource area the Parakai geothermal aquifer is the only high use management aquifer (Fig 12). The PARP: ALW sets the groundwater management level in Parakai bore 86 (6464007) at 2.5m above mean sea level (amsl), averaged over a 12-month period. The average groundwater level recorded at Parakai between 1 June 2005 and 31 May 2006 was 2.8m amsl.

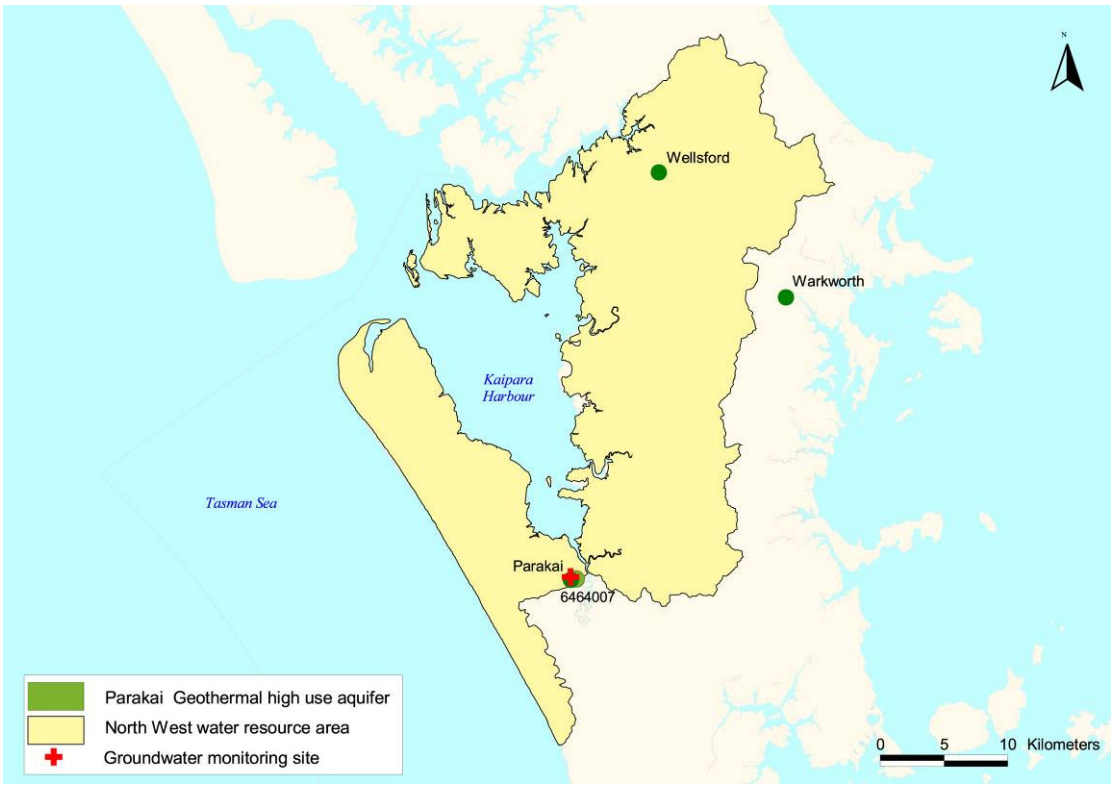


Figure 12: North West water resource area, high use aquifer management area and groundwater monitoring site.

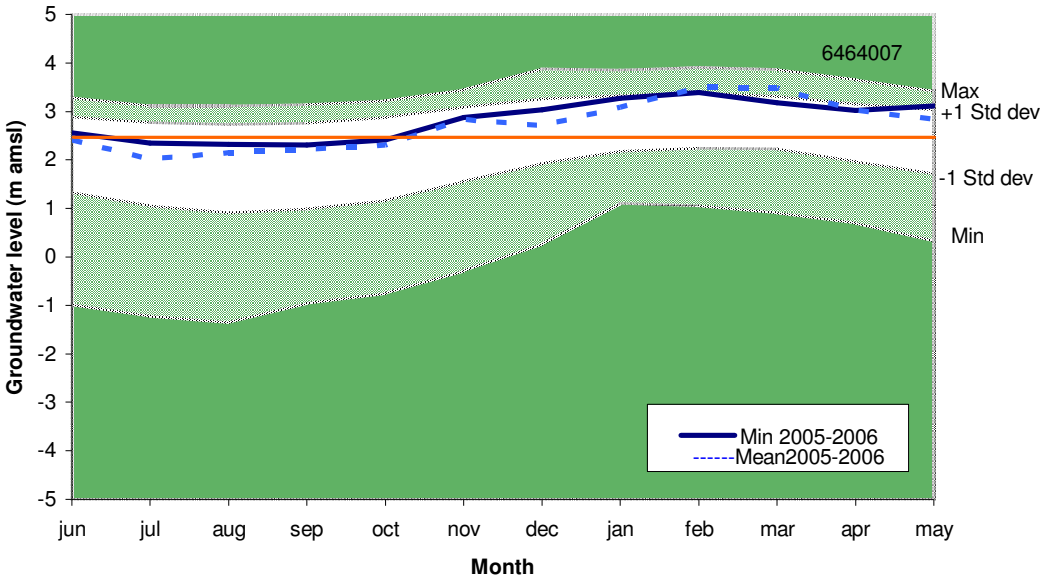


Figure 13: Groundwater envelope for Parakai geothermal bore 86 (6464007). The orange line indicates the groundwater management level of 2.5m amsl.

2.4 Water Allocation and Use

Much of the North West water resource area is rural farmland used for dairying and dry stock (Crowcroft and Bowden, 2002). The region has large allocations for surface water which are for pasture irrigation with only 3.5% of this being used. There is also a large quantity of groundwater allocated and only 10% was used. Very little of community or other water allocations were exercised to their limit. The groundwater for other purposes was mainly for private spa pool use. There was a higher level of use than allocation in municipal surface water (Fig 14) and an application has been received from a consent holder to increase their water allocation.

The number of consent holders for groundwater has fallen from 59 in May 2005 to 53 in May 2006. In May 2005 there were 30 surface water consent holders with a decrease to 28 in May 2006.

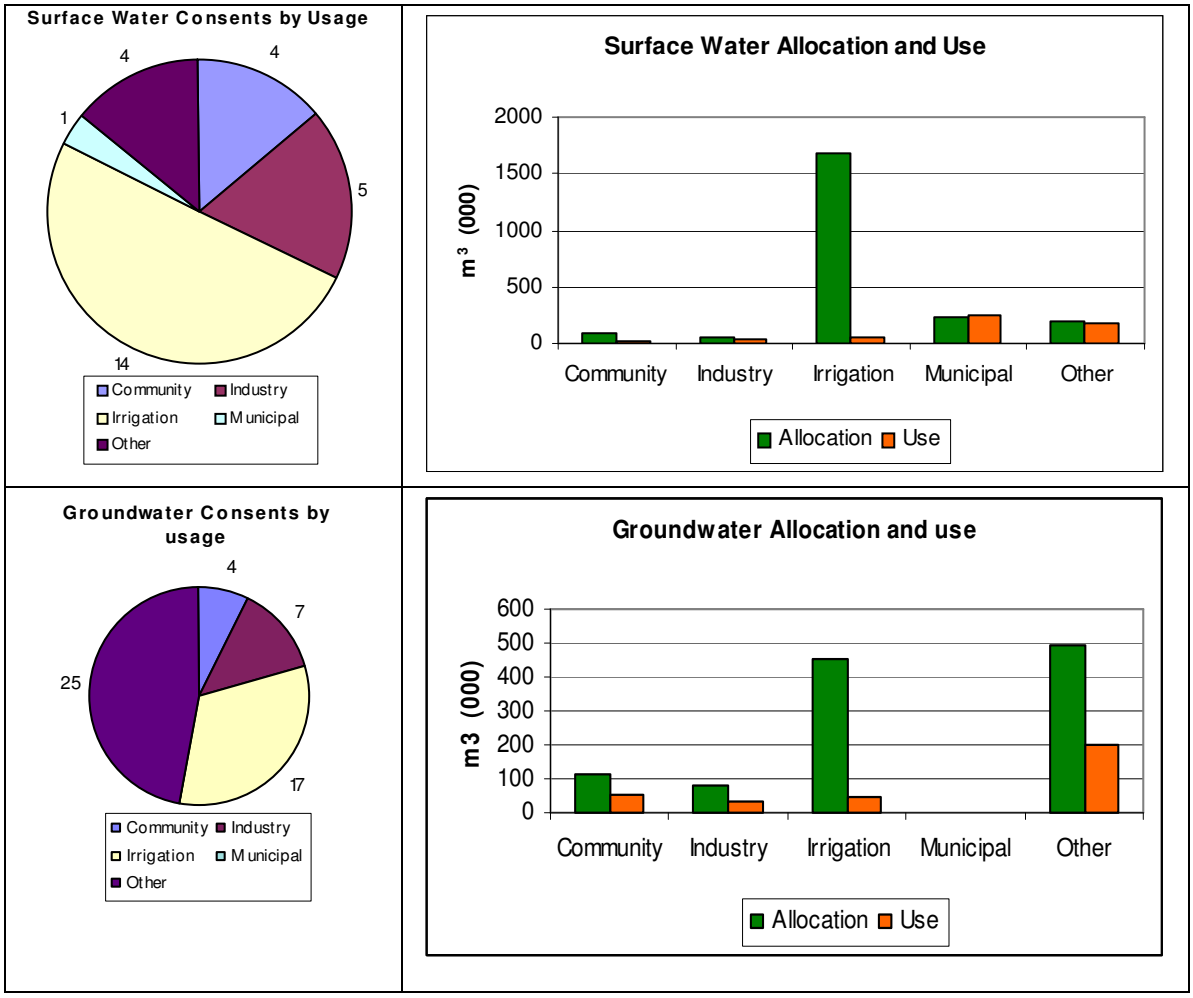


Figure 14: Surface water and groundwater allocation and use for North West water resource area and the number of consents held for each purpose

3 North East

3.1 Rainfall

The North East water resource area experienced an increase of 8% in rainfall from the average (Table 6). Following average rainfall in June and July 2005 there was a dry period in August and September 2005 with the rainfall total around 30-50% lower than average. October 2005 experienced a wet period with the rainfall total around 30% higher than average. November 2005 through to January 2006 experienced average rainfall and was followed by an extremely dry period in February 2006 leading to a higher than average rainfall levels in April and May 2006(Fig 15).

Table 6: Comparison of 2005 – 2006 rainfall with long term mean at 4 sites

Site Number	Site Name	Mean Annual Rainfall June-May (mm)	Total Rainfall June 2005-May2006 (mm)	% Deviation from Average Rainfall
642614	Nolans	1359	1457	+ 7.2
643713	Tamahunga at Quintals	1499	1624	+ 8.3
644616	Mahurangi Satellite Dish	1515	1520	+ 0.3
646619	Orewa Treatment Ponds	1243	1354	+ 8.9

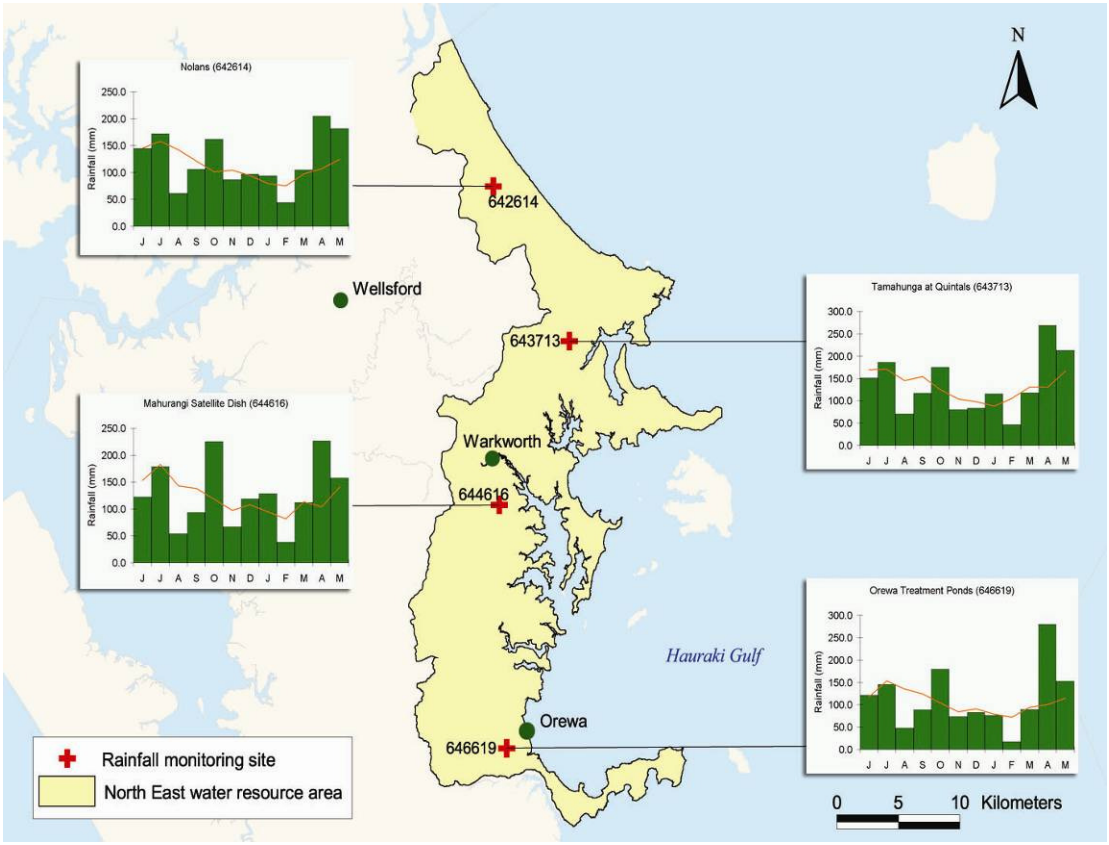


Figure 15: Total monthly rainfall (bars) and long term mean monthly rainfall (line) at 4 sites in the North East water resource area.

3.2 Surface Water

The flow-monitoring site is located on the Mahurangi River at the rear of the Mahurangi College at Warkworth (6806), catchment area 46.80km^2 (Fig 16). The Mahurangi is the only high use management stream in the North East water resource area. In the 2004-2005 records show the lowest flow was 53.3l/s, below the MALF of 57.5l/s. For the 2005-2006 records the lowest flow recorded was 95l/s, a considerable increase of around 40l/s from the previous year.

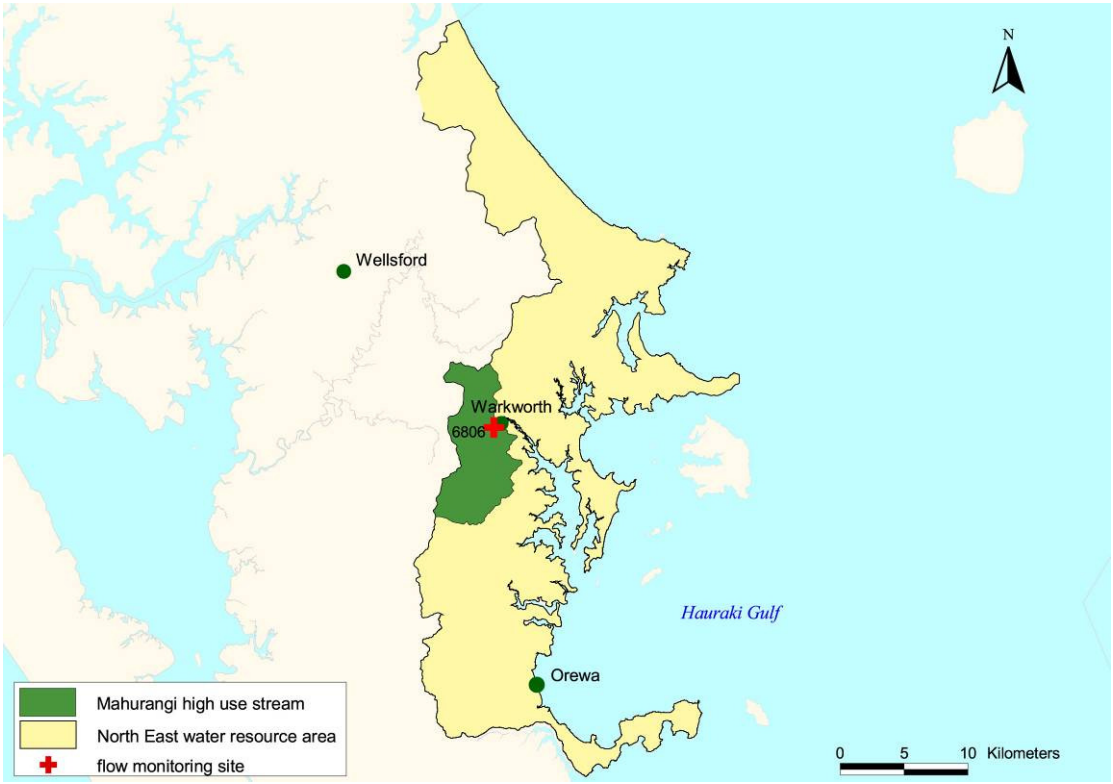


Figure 16: North East water resource area, high use stream management area and flow monitoring site.

3.3 Groundwater

The North East region contains three high use management aquifers, the Tomarata Waitemata, Omaha Waitemata and the Waiwera Geothermal aquifer (Fig 17). There is currently no monitoring site on the Tomarata Waitemata aquifer. The aquifer is managed by ensuring that the consent holder's water abstraction remains within the consent conditions.

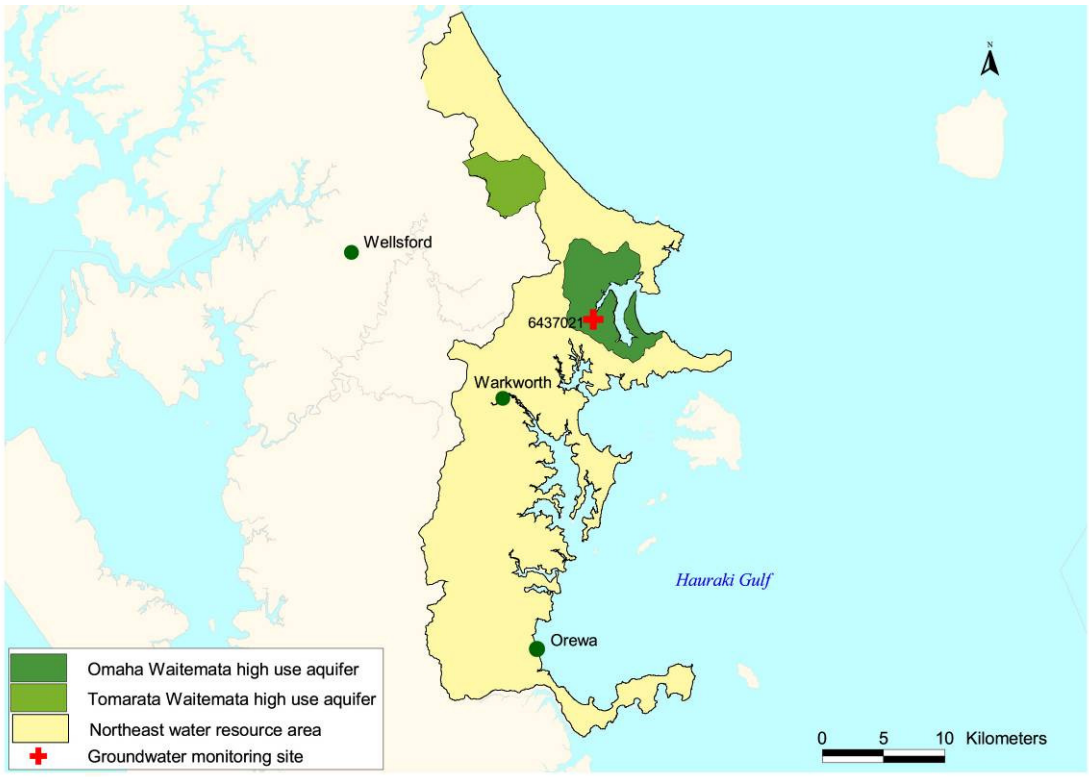


Figure 17: North East water resource area, high use aquifer management areas and groundwater monitoring site

The Omaha Waitemata aquifer has several ARC groundwater monitoring sites. The Omaha 25 (6437021) monitoring site, which is located in the main horticultural region of the Omaha Flats, has been set a management water level of 3.25m amsl by the PARP:ALW. In 2005-2006 the average groundwater level recorded was 4.6m amsl (Fig 18). There are currently 29 consents for the Omaha Waitemata aquifer. The consented water allocation and usage is well within the water availability of 105,000 m^3/year.

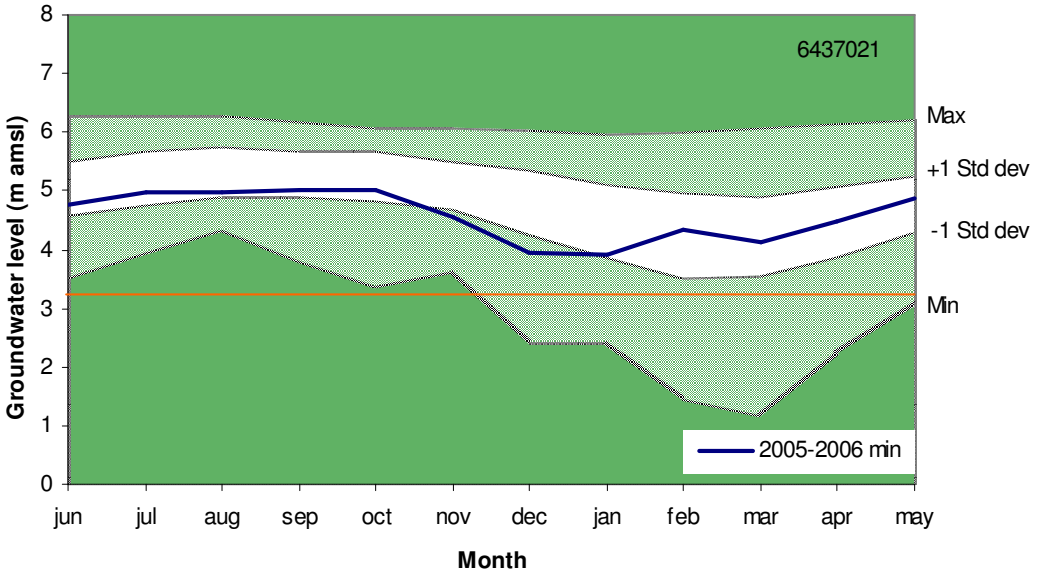


Figure 18: 2005 – 2006 Groundwater envelope for Omaha Waitemata aquifer bore 6437021. The orange line indicates the groundwater management level of 3.25m amsl

The Waiwera geothermal aquifer has a bore (6457041) located above the Waiwera beachfront (Fig 19). The PARP: ALW has set a management level of 0.5m amsl. The average groundwater level for June 2005 to May 2006 was 0.6m amsl. The water allocation and usage has remained the same as last year for the high use management aquifer. The consent holders that extract water from the aquifer use the water for public and private pools.

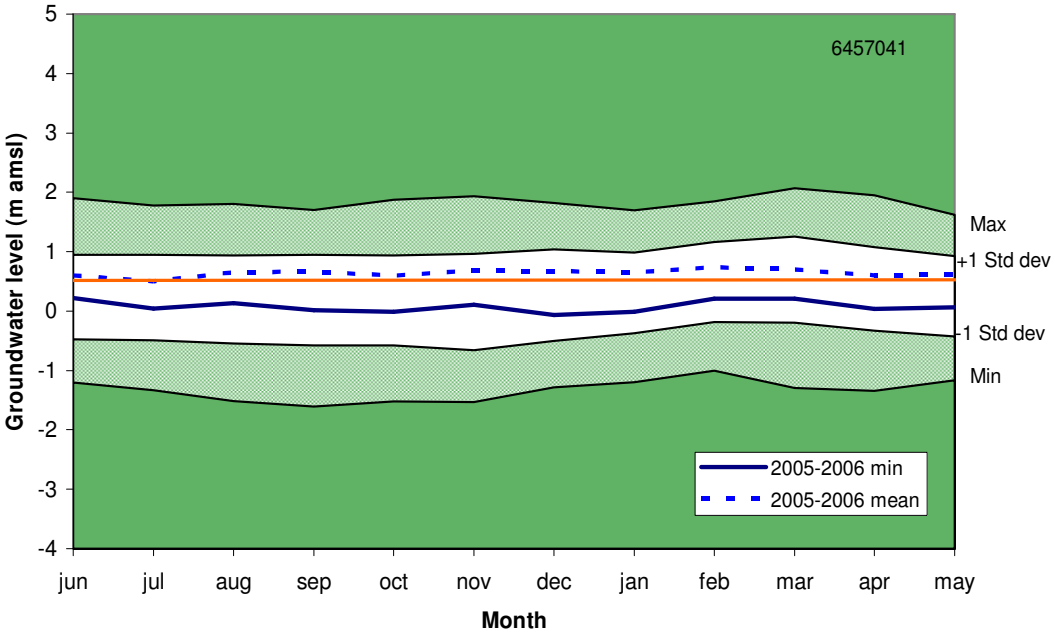


Figure 19: 2005 – 2006 Groundwater envelope for Waiwera geothermal aquifer bore 6457041. The orange line indicates the groundwater management level of 0.5m amsl

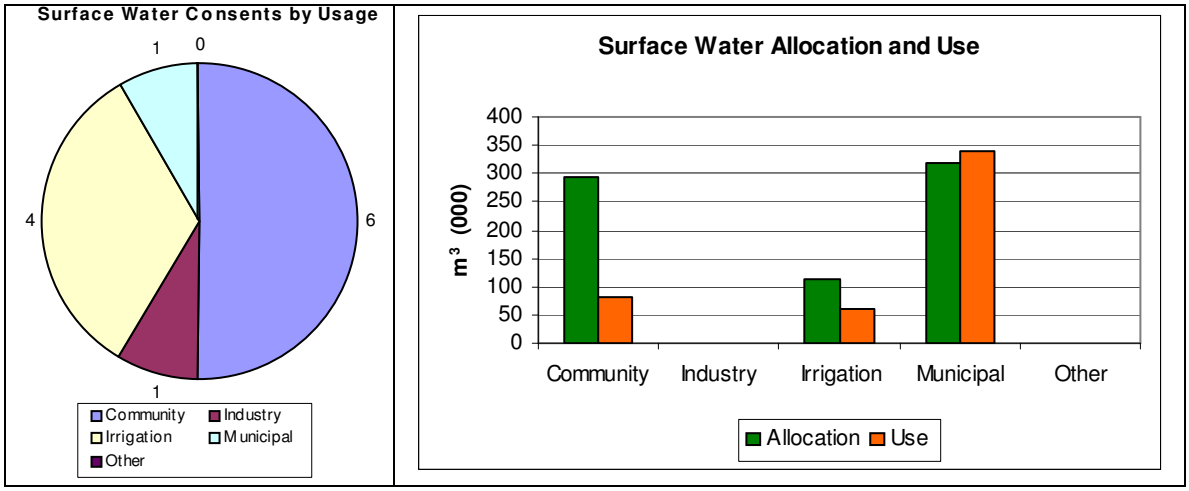
3.4 Water Allocation and Use

Omaha high use aquifer has an availability of 105,000m^3/year. The aquifer is fully allocated to 29 consent holders (70,000m^3/year). The remaining volume of water required is for other purposes such as permitted activities and stock and domestic use (50,000m^3). The 50,000m^3 of water for stock and domestic use is an estimated total and explains the total allocation exceeding the availability. During 2005-2006 consented water use was within allocations

The Waiwera geothermal aquifer is fully allocated, although a groundwater availability figure is not set in the PARP: ALW (2001). One of the main management issues for Waiwera is to avoid cold saline water intrusion hence the inclusion of a minimum annual average water level in the ARC beachfront monitoring bore. Water levels below this point are indicative of conditions permitting saltwater and cold freshwater entering the geothermal aquifer. The monitoring bore is very sensitive to large abstractions from 2 nearby bores.

Only 28% of surface water that was allocated for community purposes was used (Fig 20). This was due to 3 resource consents being inactive from the previous year. In Warkworth municipal supply surface water usage has risen above the set daily allocation. An application to increase the surface water allocation has been received. Groundwater usage for other purposes has increased since May 2005 but is still well within allocation.

There are 12 issued surface water consents in May 2006 which is similar to 14 in May 2005. The number of groundwater consent holders has fallen slightly from 140 in May 2005 to 138 in May 2006.



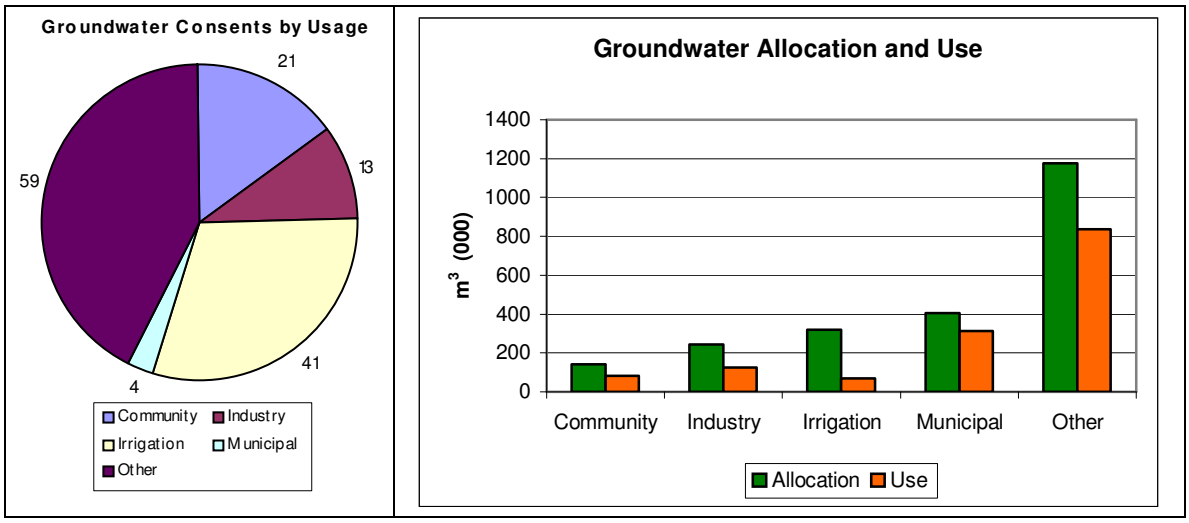


Figure 20: Surface water and groundwater allocation and use for North East water resource area and the number of consents held for each purpose.

4 Kaipara River – North Shore

4.1 Rainfall

The North Shore 2005-2006 rainfall totals were higher than the mean annual rainfall (Table 7). October 2005, April and May 2006 received approximately 50% more rainfall than normal. September, November and December 2005 received below average rainfall while August 2005 and February 2006 were extremely dry with approximately a 70% reduction in rainfall from the previous year (Figure 21).

Table 7: Comparison of 2005-2006 rainfall with long term mean at 3 sites

Site Number	Site Name	Mean Annual Rainfall June-May (mm)	Total Rainfall June 2005-May2006 (mm)	% Deviation from Average Rainfall
647614	Rangitopuni at Walkers	1330	1467	+ 10.3
647513	Kumeu at Maddrens	1343	1291	-3.9
647727	Oteha at treatment ponds	1201	1217	+ 1.3

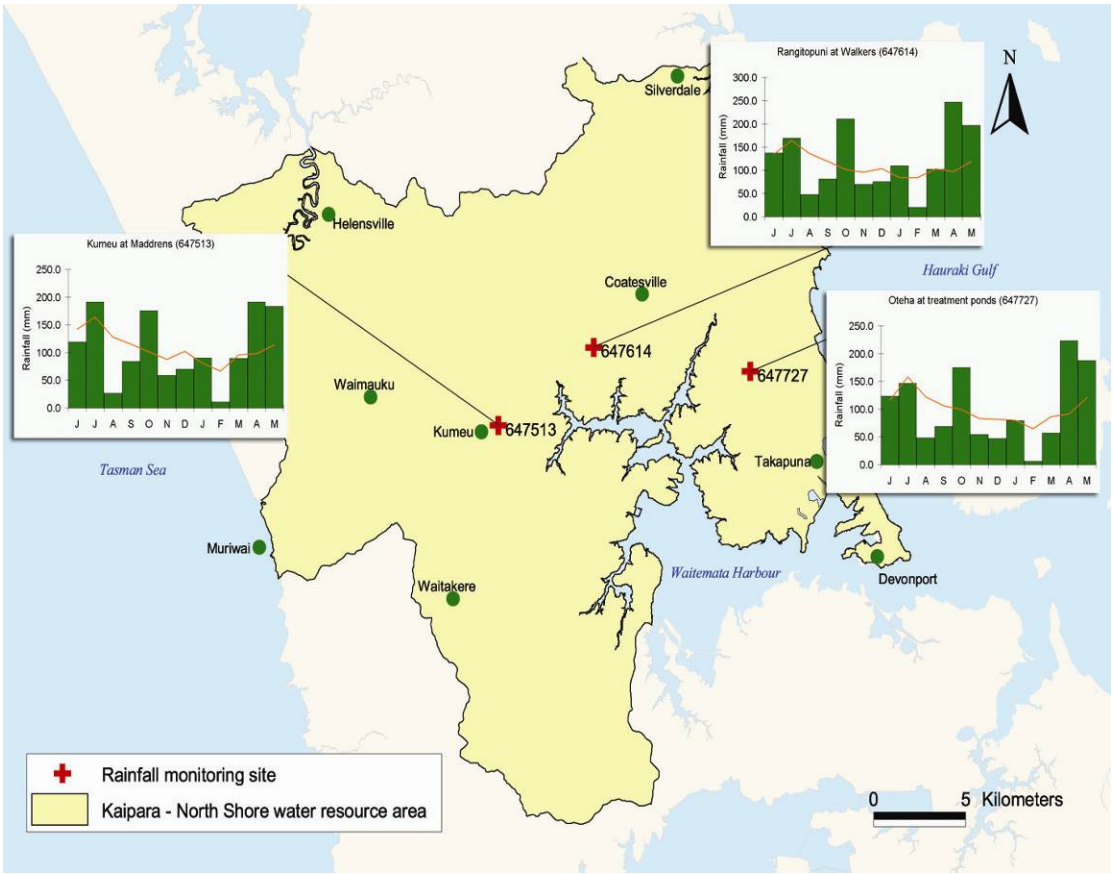


Figure 21: Total monthly rainfall (bars) and long term mean monthly rainfall (line) at 3 sites in the Kaipara River – North Shore water resource area