

REPORT

Hahei Water Supply Strategy Paper

DRAFT

Prepared for

Thames Coromandel District Council

515 MacKay Street
Thames

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42109921

Project Manager:

.....
Chris Simpson
Principal

URS New Zealand Limited

Project Director:

.....
Ian Fraser
Principal

Level 5, Landsborough House
287 Durham Street, Christchurch
PO Box 4479, Christchurch
New Zealand
Tel: 64 3 374 8500
Fax: 64 3 377 0655

Author:

(Optional)

.....
Zeb Etheridge
Senior Hydrogeologist

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Section 1

Introduction

Thames Coromandel District Council is in the process of reviewing the supply and management of reticulated water to the Hahei community. The principal issues that need to be considered include;

- whether the existing groundwater systems can be managed co-operatively and sustainably within the capacity of the aquifer resource,
- whether the existing systems are sufficient to meet future supply growth demands,
- what options are available to optimise and improve management of the existing systems,
- what alternate options are available for water supply

URS submitted a proposal to undertake a review of water supply options in April 2008. The proposed scope of work comprised preparation of an options paper to include the following tasks:

- Summary of existing municipal and private supply networks,
- Population, growth and demand statistics,
- Groundwater resource assessment and sustainability,
- Storage and treatment options,
- Alternate supply options including surface water, groundwater

One of the key questions to be addressed by this study is whether the Hahei community would best be served by a combined reticulation system, as individual supplies as at present or some combination of the two.

Section 2

Hahei water supplies

2.1 Background

Hahei is a coastal community on the Coromandel Peninsula with approximately 555 dwellings and a resident population of 524¹. Hahei experiences a relatively low annual demand in line with the small resident population, with spikes over the holiday period when the population can increase almost tenfold with the influx of tourists. This places the water and wastewater plant under significant pressure and results in a requirement for disproportionately high infrastructure capacity. This general situation is recognised by the Ministry of Tourism (MOT): a financial assistance package was introduced in 2005 to enable District Councils to upgrade water and wastewater infrastructure in small communities with high tourism demands. TCDC made an application to the MOT for financial assistance with the Hahei water and wastewater systems upgrade and were awarded a contribution towards investigation costs with a further allocation of funds agreed for the final infrastructure upgrades.

2.2 Current Water Supply

Community water supply in Hahei is provided by both TCDC and by private network associations as follows:

- Thames Coromandel District Council scheme (TCDC - 152 properties)
- Hahei Water Supply Association scheme (HWSA - 168 properties)
- Grange Road Water Association scheme (GWSA- 64 properties)
- Hahei Holiday Resort (HHR)
- Roof water (assumed to supply the remaining 180 properties)

Further details of each of the suppliers are provided below which are based on information provided in the GHD 2007 report and the 2005 URS report. Flow records for the last five years for each of the supply schemes were requested from Environment Waikato. These data are presented in this report.

The extent of the reticulated network presently serviced by TCDC is shown on Figure 2-1, an area which is commonly termed the Area of Benefit (AoB). The areas served by the private network associations are also indicated.

¹Thames-Coromandel 2007/08 Peak Population Study Draft Report

Section 2

Hahei water supplies

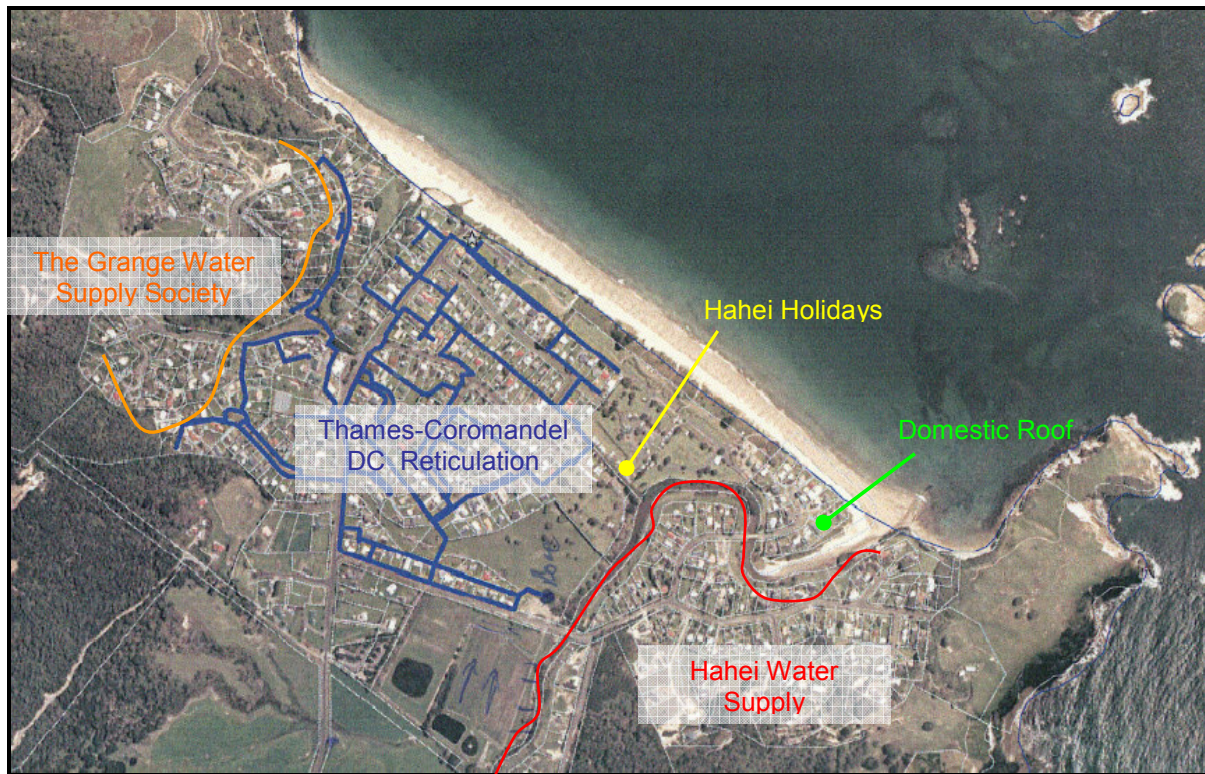


Figure 2-1 Municipal Water Reticulation and Private Water Associations in Hahei

2.2.1 TCDC Scheme

This supply consists of a single 100mm diameter borehole, cased to 32m depth and open hole to the base at 91.4m depth. The bore has a resource consent abstraction limit of 175 m³/day. The bore feeds three 95 m³ butynol lined timber reservoirs and 3.1 km of reticulation consisting of pipe diameters from 100 mm and smaller. Capacity problems were experienced in the 2003/2004 period of peak demand and subsequently the bore pump was subsequently lowered in December 2004 to provide greater available drawdown to improve the sustainability of the supply.

Figure 2-2 plots flow data for the TCDC Hahei water supply between 2004 and 2008. The data show that the full 175 m³/d consented volume is used during the peak summer season. Of particular note are the periods of sustained high demand in 2006 and 2007; for instance, daily demand remained in the 160-175 m³/d range between 1 and 13/1/07. Water use over winter is generally in the 20-60 m³/d range. Water use generally remained high over the 2005 winter. The 30 day moving average is included in the plot, which highlights the seasonal water use trend.

Section 2

Hahei water supplies

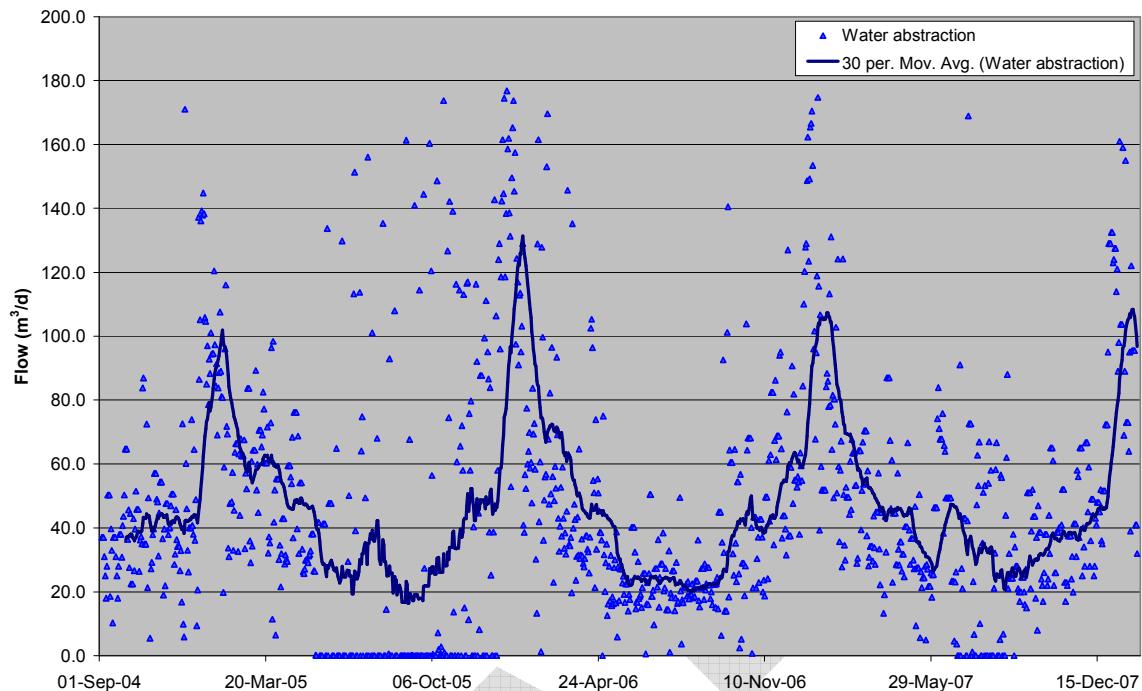


Figure 2-2 TCDC water scheme flow data

2.2.2 Hahei Water Supply Association

This water system supplies 168 households within a consent limit of 300 m³/d. The bore is located approximately 30 metres from the TCDC Pa Road bore site and draws water from the same aquifer. The water is supplied to residents by a trickle feed system that fills 1,500 litre storage tanks that are kept on each resident's property. Some problems arise when high numbers of people stay or visit at one property and the tank is drained quickly.

Figure 2-3 plots water abstraction for the HWSA scheme between 1997 and 2007. The 30 period moving average is included in the plot to highlight seasonal variations (note that flow records are not daily and hence this does not represent the 30 day moving average). Note that a number of erroneous meter readings have been excluded. The data indicate that peak water usage over the summer is generally in the 200 – 250 m³/d range, with a maximum recorded daily flow of 328 m³.

Section 2

Hahei water supplies

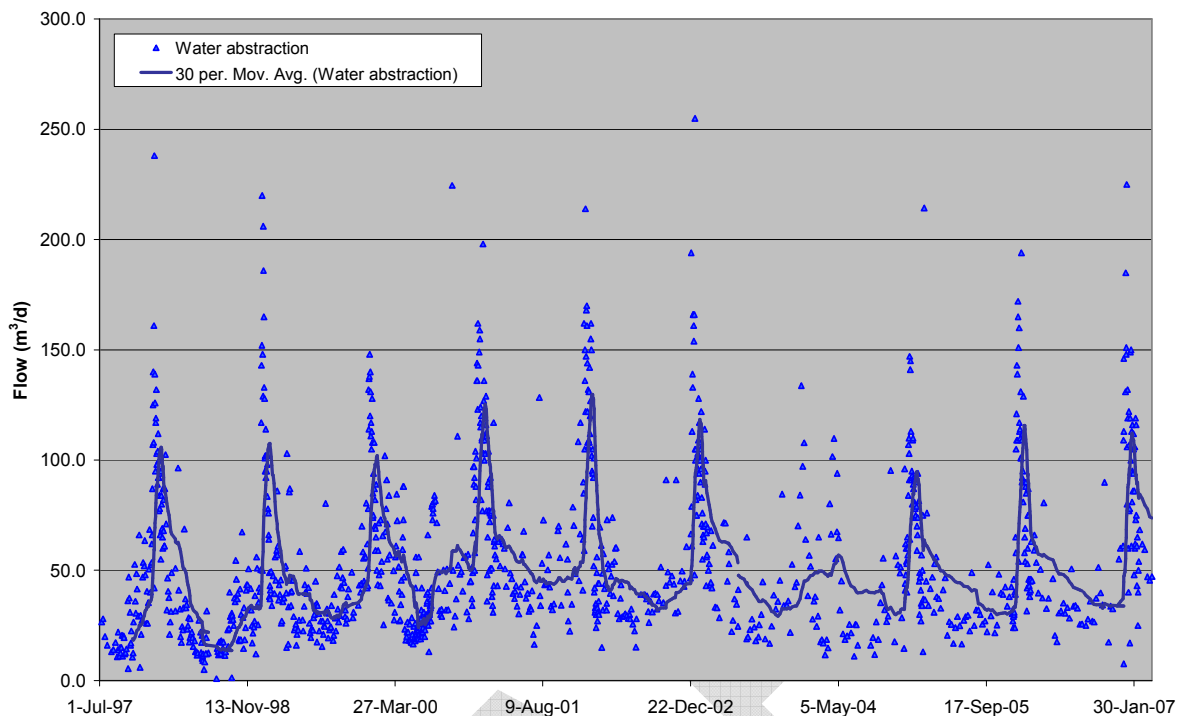


Figure 2-3 HWSA water scheme flow data

2.2.3 Grange Road Water Supply Association

This water system comprises two bores from which water is pumped to three plastic reservoirs at the top of Grange Road. The association supplies water to 64 properties within a resource consent limit of 100m³/d.

Figure 2-4 plots water abstraction for the GWSA scheme between 1997 and 2006. The 30 period moving average is again included in the plot. Note that a number of erroneous meter readings have again been excluded from the plot. The data indicate that peak water usage over the summer is generally up to 80 m³/d, although a peak reading of 130 m³/d was recorded in January 1999 which exceeds the 100 m³/d consent limit. The peak flow of 125 m³/d in April 2000 is likely to be erroneous and the January 1999 peak reading may also be incorrect.

Section 2

Hahei water supplies

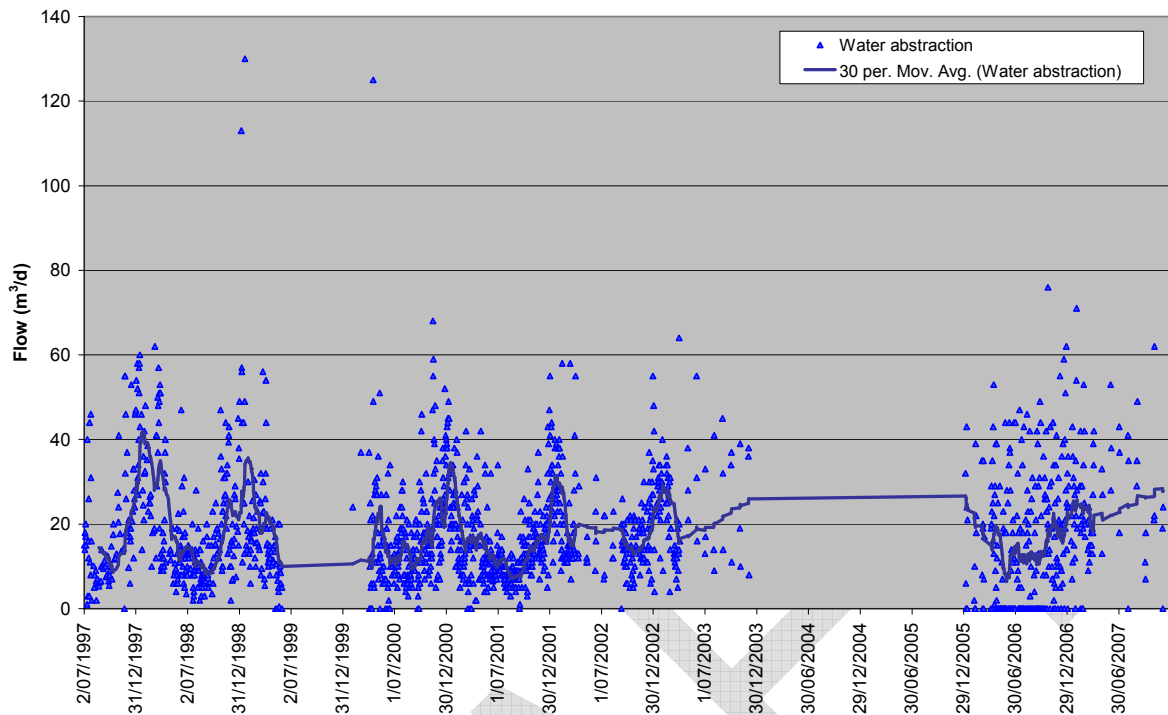


Figure 2-4 Grange Road water scheme flow data

2.2.4 Hahei Holiday Resort

Hahei Holidays Ltd utilise four bores (TBC) with a resource consent to draw a maximum of 175m³/d to supply the camp ground. The water is pumped to storage tanks of various sizes and materials.

Figure 2-5 plots water abstraction for the HHR between 2002 and 2009. The 30 period moving average is also plotted. The data indicate that peak water usage over the summer is generally in the 160-175 m³/d range.

Section 2

Hahei water supplies

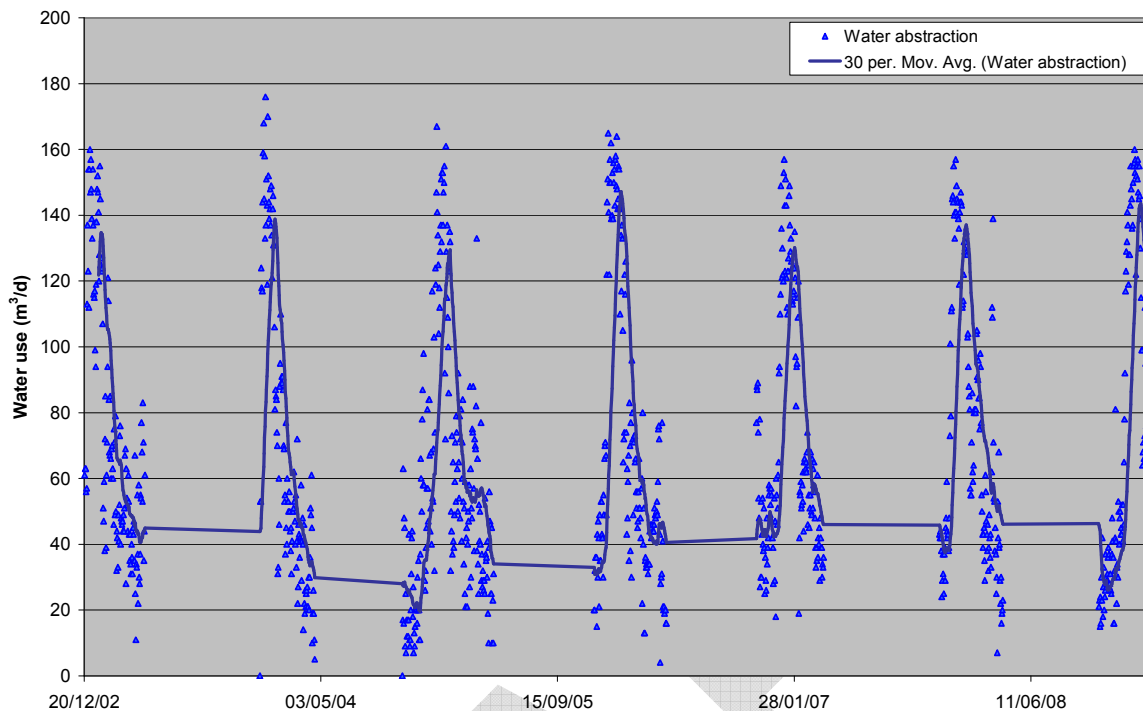


Figure 2-5 Hahei Holiday Resort water flow data

2.2.5 Roof Water

There are approximately 180 households that are not covered by the above schemes. It has been assumed that these are supplied by rainwater that is supplemented with water delivery if rainwater storage proves to be inadequate.

Section 2

Hahei water supplies

2.3 Trends in Water Use

Figure 2-6 plots average daily water abstraction for each supply for all years with a complete record. A long term increase in daily water use, average over the year, is evident for the HWSA Scheme. Average daily water use increased from around 35 m³ in 1997 to 73 m³/d in 2001. Average water use in 2007 was 90 m³/d. There are no discernible long term trends in the data from the rest of the schemes.

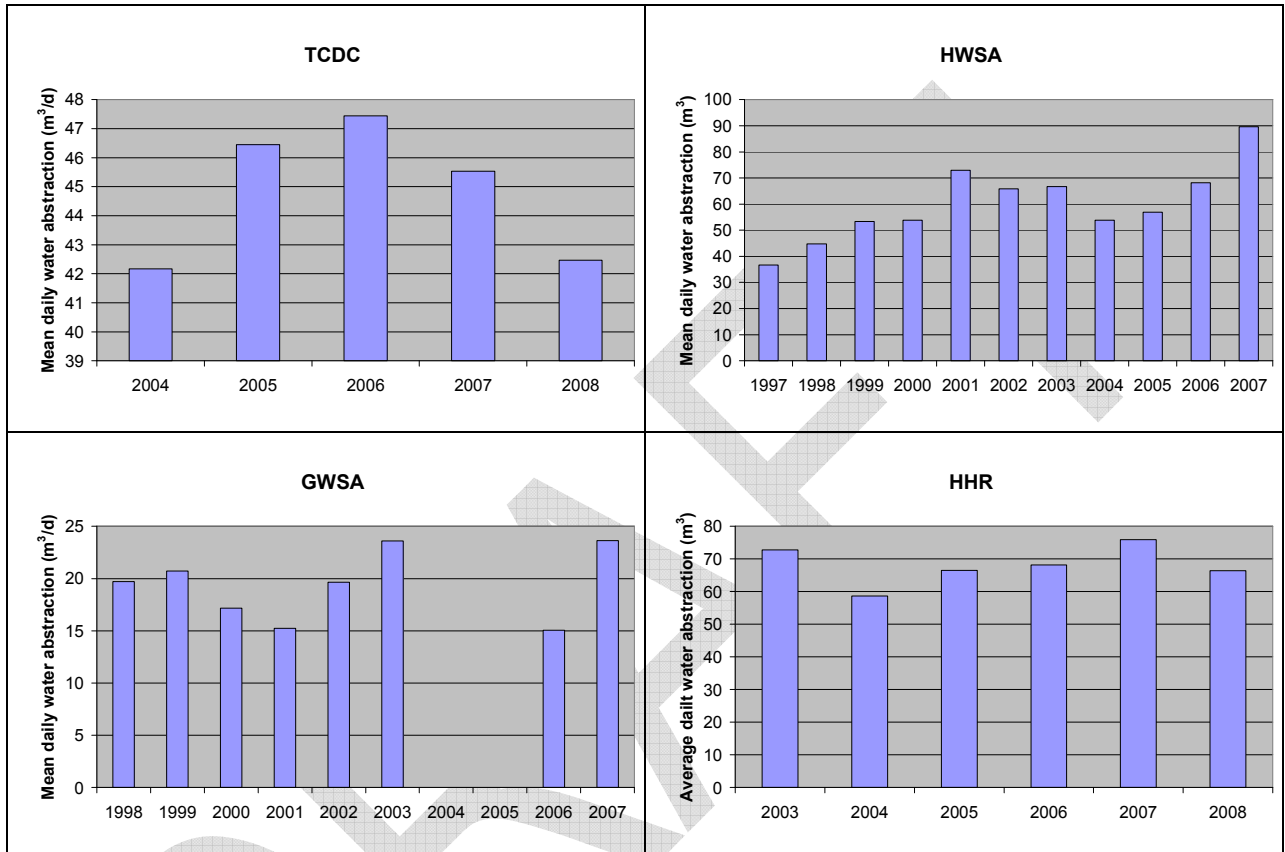


Figure 2-6 Average daily water abstraction for all supplies

Section 3

Demand assessment

The population of Hahei comprises a resident population of 524 and a peak population of around 4800 during the Christmas and New Year holiday period². In order to make predictions of water demand growth over the next 10 years, the following factors must be considered:

- i) Population growth
- ii) Growth in tourism
- iii) Changes in per capita household water consumption (increase or decrease)

The following data have been used to make this assessment:

- Thames-Coromandel District Council Population, Household and Dwelling Projections 2007.
- Hahei Water Scheme; Tourism Demand Subsidy Scheme Final Application; September 2005
- Thames-Coromandel 2007/08 Peak Population Study Draft Report
- Strategic Plan for Tourism in The Coromandel to the Year 2020
- Personal communication from John North, TCDC community contact for Hahei

The population, household and dwelling projections study predicts usually resident populations for seven main areas plus the remaining unspecified smaller areas (as one group) of the Coromandel between 2006 and 2041. The closest large populated area to Hahei is Whitianga, for which an average annual growth rate of 1.8% is predicted between 2006 and 2010 (based on a medium migration scenario). The annual average growth rate predicted for the TCDC district over this period is 0.86%.

According to information in the 2005 Tourism Demand Subsidy Scheme Application, provided directly by TCDC, the population in Hahei is predicted to rise by 3.3% per annum over the next 10 years. The number of dwellings is predicted to rise by 3.5% annually over the same period³.

The growth in visitor numbers to the Coromandel was predicted to rise at 2.3% per annum between 2003 and 2009⁴ and 1.5% per annum between 2006 and 2013⁵. These figures are not broken down further into individual townships and visitor locations.

John North has provided the following response in regard to our question on the best estimate of water demand growth:

Growth, i.e. increased water demand, basically will be from two areas:

1) Reduction in absentee owners

Almost 90% of Property owners in Hahei are absentee owners and their properties are utilised as holiday homes with peak usage during January. The peak coincides with the camp site peak occupancy. Camp site is at capacity during the peak period so there will be no change. Growth in the resident population due to ageing is not likely to have a major impact on Hahei, predominantly due to isolation from Medical facilities. A maximum change in residents of 0.75% per year over 20 years i.e. Absentee owners declines to 75% by year 2030 was suggested.

² Thames-Coromandel 2007/08 Peak Population Study Draft Report

³ Hahei Water Scheme; Ministry of Tourism; Tourism Demand Subsidy Scheme Final Application; September 2005

⁴ New Zealand Regional Forecasts 2003-9 p.63

⁵ Towards 2020: A Strategic Plan for Tourism in The Coromandel to the Year 2020; 3rd Edition; Thames / Coromandel and Hauraki Districts of New Zealand

Section 3

Demand assessment

2) Potential Growth

There are only the 'Green field' areas in Hahei that are potentially subdividable and these will probably be of a larger section size (1000 to 1500m). An estimate of 80 -100 new sections has been made. There are relatively few other undeveloped sections in Hahei (less than 20)

If 100 new sections were developed over the next 20 years with an average population of 2.5 per section, the additional population of 250 people would represent an annual growth rate of 2.5%. Combined with the 0.75% per annum increase associated with reduced absentee owners, the total growth rate projection would be 3.25%.

3.1 Average Daily Demand Growth

Due to the variability in growth projections, a low rate and a high rate scenario have both been used in this study.

Demand management in Hahei currently comprises intermittent restrictions (e.g. sprinkler bans during drought and/or peak demand periods) and metering of the TCDC reticulated area. The staff recommendations in the proposed Waikato Regional Plan include a suggestion that all resource consents should be required to produce a demand management plan. If included in the final plan, this may lead to further demand reductions.

In order to account for the uncertainties above, two demand scenarios have been considered:

1. Low demand scenario: Low population growth plus demand management. Water demand in new dwellings is reduced due to the introduction of compulsory demand management measures by Council, such as use of roof water for non-potable supply. Studies have shown that this can reduce demand by 30%. Projected demand: current per capita demand minus 30%, with a 1.8% growth rate based on the Thames-Coromandel District Council Population, Household and Dwelling Projections 2007 study; predicted demand growth = 0.3% per annum.
2. High demand scenario: 3.25% based on the assessment undertaken by John North. Per capita and household water consumption are assumed to remain static.

Given that the campsite and permanent dwellings are already at capacity during the peak season, no significant growth in annual demand is expected from tourism.

3.2 Peak Demand Growth

Peak demand growth has been projected using the 1.5% per annum visitor number growth estimate set out in the Strategic Plan for Tourism in The Coromandel to the Year 2020 document.

3.3 Demand Projections

Predictions of demand by 2019 based on the 0.3% and 3.25% average growth scenarios plus the projected 1.5% growth in visitor numbers for peak demand are summarised in Table 3-1 below. Demand projections for 2014 and 2019 have been made for the low and high growth scenarios using two baseline figures. An average peak demand has been calculated for each supply, comprising daily water abstraction averaged over the Christmas holiday period (generally between 25 December and 10 January). The highest average peak demand (i.e. the holiday period during which most water was used over the available record period) has then been used as a baseline for demand projection, on the basis that sustained periods of high demand that exceed existing capacity could require development of additional water sources and/or resource consent variations. The maximum daily demand recorded over the period for which we have been provided data has also been used as a separate baseline figure, to provide an indication of when the existing resource consent limits could potentially be reached.

Section 3

Demand assessment

Table 3-1 Average peak demand projections for water supply schemes

Supply scheme	Average peak demand (m ³)	Daily consent limit (m ³)	High growth scenario (4.75% PA)		Low growth scenario (1.8% PA)	
			2014	2019	2014	2019
TCDC	140	175	173	207	153	165
HWSA	148	300	183	218	161	175
GWSA	50	100	62	74	55	59

The highest peak season average daily demand was recorded between 25/12/05 and 12/1/06 for the TCDC supply scheme, between 29/12/01 and 9/1/02 for the HWSA scheme and between 27/12/98 and 10/1/99 for the GWSA scheme. It is important to note that the different supply areas experience their periods of greatest sustained demand at different times. This indicates that there may be potential to reduce the requirement for development of additional water resources and/or resource consent variations or water storage through operating the individual supplies as a combined network. Further assessment would be required to confirm the extent to which this would alleviate some of the current issues with the Hahei water supply.

The TCDC scheme is projected to exceed resource consent limits within six years under the high growth scenario. The Grange Road scheme is likely to have spare capacity on average over the peak period for the foreseeable future. All schemes are predicted to continue to have some spare capacity on average over the peak period for the foreseeable future under the low growth scenario.

Table 3-2 Peak demand projections for water supply schemes

Supply scheme	Peak demand (m ³)	Daily consent limit (m ³)	High growth scenario (4.75% PA)		Low growth scenario (1.8% PA)	
			2014	2019	2014	2019
TCDC	177	175	219	261	193	209
HWSA	255	300	316	376	278	301
GWSA	76 ¹	100	94	112	83	90

1. We have assumed that the 1999 peak reading of 130 m³/d is incorrect because the meter reading on the following date yields a negative flow value. The data are therefore unreliable at this point in the record.

The maximum daily demand for the TCDC schemes already exceeds the resource consent limit, and hence any growth will exacerbate this situation. Again we note that the maximum daily demand is recorded on different days for the different supply schemes. For instance, a high daily demand of 289 m³ was recorded for the HWSA abstraction on 22/1/06, whereas only 103 m³ was abstracted from the TCDC supply on this date. Conversely, whereas 151 m³ of water was drawn from the HWSA abstraction on 4/1/06, 177 m³ of water was drawn from the TCDC supply on this date. If the supplies were operated jointly it would be possible to level these peak demands and therefore achieve a much better compliance with the resource consent limit.

Section 3

Demand assessment

The long term average daily demand for each of the schemes, along with projected average demand by 2019 under the low and high growth scenarios, excluding visitor number growth (since this will not have a significant influence on mean annual demand), is summarised below:

Table 3-3 Long term average demand projections for water supply schemes

Supply scheme	Average demand (m ³ /d)	Data record	High growth scenario (3.25% PA) 2019 demand (m ³ /d)	Low growth scenario (0.3% PA) 2019 demand (m ³ /d)
TCDC	47	Sept 04 – Feb 08	62	48
HWSA	59	July 97 – Apr 07	78	61
GWSA	18	July 97 – Jan 07	24	19
HHR	70	Dec 02 – Feb 09	93	72

In reality there are physical restrictions which mean that there are significant differences in the growth potential of the individual supply zones. Developable land area is very limited in the area supplied by the GWSA and hence application of the high growth scenario to this network would probably be inappropriate. Growth potential for the HWSA and HHR is also limited. The TCDC scheme has the greatest growth potential since this network would supply the only significant areas of developable land within the area. These differences should be considered in the water resource planning process.

Section 4

Groundwater resource assessment

4.1 Hydrogeology

The geology of the Hahei area comprises valley floor alluvial sediments, typically less than 40m thick, overlying volcanic rock. The valley sides comprise rhyolite domes, with the Grange Dome and Hahei Dome to the north west and west and the Wigmore Dome to the east. The geology to the south of the township comprises the Hot Water Beach Ignimbrite, protruded by the Purangi Dome. Each of these geological formations yield water in productive quantities. The aquifer units utilised for the Hahei town water supply are as follows:

- Wigmore Dome: TCDC, Hahei Water Supply Association, Hahei Holiday Resort
- Grange Dome: Grange Road Water Supply Association

4.2 Water Quality

Ancient mineralisation and geothermal fluids provide a source of mineralised water on the Coromandel Peninsula and can result in elevated concentrations of heavy metals, hydrogen sulphide and low pH. Epithermal mineralisation has been delineated during gold exploration in the Hahei Dome, leading to elevated heavy metals in some locations. Geothermal waters are also found at depth. Other areas of mineralisation are frequently associated with rhyolitic volcanic rocks but are difficult to predict reliably. A proposed potable water supply borehole sunk by TCDC at Grierson Close in 2005 encountered elevated mineral content directly related to geothermal activity (antimony and arsenic), to the extent that treatment would be required before the water could be used. The cost of the treatment required precludes the use of this borehole for potable supply.

Other bores may not have been tested for heavy metals and hence the distribution of mineralised waters may be more widespread than is apparent from current information. Low pH is encountered in all of the three community water supplies. Elevated iron has been recorded in the Grange Road Water Association supply. The Hahei Water Supply Association bore water is treated for iron.

Land disposal of treated effluent is undertaken in the Hahei area, most significantly on an area of land approximately 80m away from the TCDC and HWSA bores. This activity appears to have a limited effect on the security of the deep aquifer from which water is drawn. However, some nutrient and microbiological impacts are evident in the shallow unconfined aquifer.

4.3 Groundwater Resources

An assessment of the groundwater resources in the Hahei area was undertaken as part of a previous URS study entitled Hahei Groundwater Management Plan, completed in 2005. The assessment comprised water balance calculations, using rainfall volumes minus runoff, evapotranspiration and baseflow losses to estimate the average annual aquifer yields. The resultant groundwater resource estimates along with allocation figures are presented below.

Table 2-3 Groundwater Resource Estimates

	Gd	Hd	Pd	Wd	HWBI	Alv
Total Recharge	135	670	500	1200	580	630
Total Allocated	100	0	0	650	0	20
Remaining Unallocated (m³/d)	35	670	500	550	580	610
Unallocated Resource	26%	100%	100%	46%	100%	97%

These data indicate that the groundwater resources in the northwest [Gd] and southwest [Wd] are presently allocated at relatively high levels. Other areas to the south [Hd, Pd & HWBI] and in the alluvial aquifer [Alv] remain essentially unallocated.

Section 4**Groundwater resource assessment**

The study notes that the methodology used represents a gross simplification of the actual hydrogeological system. The approach is likely to have provided a conservative assessment, however, and provides a reasonable initial estimate of resource availability. Refinements in the methodology would probably result in an increased resource estimate.

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Section 5

Water treatment and compliance with DWSNZ
2005

5.1 Drinking Water Standards for New Zealand 2005

Drinking water suppliers are required to take all practicable steps to ensure they supply drinking water that complies with the New Zealand Drinking Water Standards (NZDWS) under the Health (Drinking Water) Amendment Act (HDWAA) 2007, implemented in July 2008. Assessment of compliance with the new drinking water standards is therefore a key part of this study.

The core components of compliance with DWS05 and the HDWAA 2007 are:

- Maximum acceptable values (MAVs) are defined for a range of chemical, biological and radiological determinands. Potable water quality should comply with these MAVs.
- Suppliers are required to introduce and implement Public Health Risk Management Plans (PHRMPs)
- Monitoring must be undertaken to demonstrate compliance with certain water quality parameters. These comprise Priority 1 determinands, which are the same for all sources, and Priority 2 determinands, which are defined based on the specific catchment, treatment processes and distribution system.
- An assessment must be undertaken to determine the level of treatment required to minimise the risk from protozoa and the appropriate treatment system installed.

Compliance with DWS becomes mandatory on the following dates:

Table 5-1 DWS Compliance dates

Type of supplier	Compliance date for main duties
New Drinking-Water Suppliers	1 July 2009
Large Drinking-Water Suppliers	1 July 2009
Medium Drinking-Water Suppliers	1 July 2010
Minor Drinking-Water Suppliers	1 July 2011
Small Drinking-Water Suppliers	1 July 2012
Neighbourhood Drinking Water-Suppliers	1 July 2013
Rural Agricultural Drinking Water Supplies	1 July 2013 or later depending on when standards are amended to explicitly recognize this category of supply

Under the HDWAA 2007:

- **minor drinking-water supply** means a drinking-water supply that is used to supply drinking water to between 501 and 5 000 people (inclusive) for at least 60 days per year
- **small drinking-water supply** means a drinking-water supply that:
 - a) is used to supply drinking water to between 101 and 500 people (inclusive) for at least 60 days per year; and
 - b) is not a drinking-water supply to which paragraph (a) or (b) of the definition of neighbourhood drinking-water supply applies
- **Neighbourhood drinking-water supply** means a drinking-water supply that is used to supply drinking water to:

Section 5

Water treatment and compliance with DWSNZ 2005

- a) between 25 and 100 people (inclusive) for at least 60 days per year; or
- b) any number of persons for at least 60 days per year if –
 - i) the number of those persons when multiplied by the number of days per year during which those persons receive water from that supply is 6000 or greater; but
 - ii) the number of those persons is not greater than 100 on 60 or more days in any year

Assuming a holiday population of 4000 for two weeks over the Christmas period, of which 2000 stay on the campsite, the holiday population per dwelling is estimated at 3.6 persons. If an average of one permanent resident per household is also assumed, the individual supplies are likely to fall into the Small Drinking Water Supply category and hence compliance by 1 July 2012 will be mandatory.

Small, neighbourhood and rural agricultural drinking-water supplies have two options for demonstrating compliance with the water quality standards under DWS:

- 1) *Comply with the requirements in sections 4, 5 and 7 to 9.*
- 2) *Follow a Public Health Risk Management Plan (PHRMP) compliance criteria approach (sections 10.2 to 10.5). These are referred to as Participating Supplies.*

Section 10.2 of the DWS, revised 2008 version, states:

The following compliance requirements must be met.

- 3) *A PHRMP must have been approved by a drinking-water assessor (DWA) and be in the process of being implemented.*
- 4) *Appropriate bacterial and chemical treatment, as determined from the catchment assessment in the PHRMP must be in use.*
- 5) *Appropriate protozoal treatment (Table 10.1) must be in use.*
- 6) *Water quality must be monitored and meet the requirements of section 10.4.*
- 7) *The remedial actions that have been specified in the PHRMP must be undertaken when a MAV is exceeded or treatment process controls are not met.*

When the water supplier can show these requirements have been met, the supply will be deemed to comply with the DWSNZ, otherwise the compliance requirements for the supply revert to those in sections 4, 5 and 7 to 9.

Section 10.5 defines the responses required in the event of an MAV breach or treatment failure.

5.1.1 Public Health Risk Management Plans

A PHRMP is a systematic assessment of every aspect of providing safe drinking water which will identify and manage events that could cause water quality failures. It covers three aspect of the water supply (catchment and intake, treatment, storage and distribution). It helps to identify whether any of the following four barriers to contamination are missing: preventing contaminants from entering the water, removing particles from the water, killing germs and preventing recontamination after treatment.

A PHRMP will include a schematic and description of the supply, a review of the risks to the supply and the issues requiring action for each supply component (e.g. reticulation), a prioritisation of the issues requiring action and a plan to manage the risks/issues.

We understand that PHRMPs have not yet been completed for Hahei and hence there has been no comprehensive assessment of the supplies within the framework of NZDWS. The outcome of a PHRMP could include a need for monitoring of additional water quality parameters, requirements for treatment plant and/or reticulation system upgrades.

Section 5

Water treatment and compliance with DWSNZ 2005

A summary of the existing water treatment systems and an assessment of the status of each supply in relation to DWS05, based on currently available information, are presented below.

5.1.2 TCDC Scheme

5.1.2.1 Chemical compliance

Water quality data held by Environment Waikato for the Hahei supplies has been obtained and reviewed in order to highlight any potential DWS compliance issues.

Water supplied to the TCDC scheme is currently treated with pH correction only. pH has been assigned a guideline range of 7.0-8.5 under DWS 2005. pH was below 6.5 for sustained periods between May and August 2007. The problem appears to have been rectified since this time; pH has been within the defined range for the majority of the time since September 2007 (70 of a total 80 samples analysed were within the prescribed range). Turbidity has exceeded 1.0 NTU on three occasions out of a total 290 samples analysed over a two year period. The maximum recorded turbidity was 1.36 NTU. The supply therefore complies with the turbidity requirements of NZDWS. The high turbidity in the raw water is likely to be due to oxidation of iron.

5.1.2.2 Bacterial Compliance

E. coli is not currently monitored, as far as we have been able to ascertain. Monitoring would be required twice a week or monthly (depending on whether the source achieves Secure Groundwater status – see below) under Section 4 of the DWS, when implemented, assuming that the supply is not disinfected. An alternative monitoring regime could be agreed under section 10 of the standards (Alternative Compliance Criteria for Small Supplies).

5.1.2.3 Protozoal Compliance

The treatment processes and monitoring requirements for protozoal compliance are defined in accordance with the risk associated with the source water. The Drinking Water Standards 2005 state that groundwater is considered secure when it can be demonstrated that contamination by pathogenic organisms is unlikely because the groundwater is both not directly affected by surface or climatic influences (Groundwater Security Criterion 1 and 3) and is abstracted from a bore head that provides satisfactory sanitary protection (Groundwater Security Criterion 2).

Criterion 1 can be demonstrated through groundwater residence time determination (water aging); the criteria is that the results must indicate that less than 0.005% of the water has been present in the aquifer for less than one year.

Criterion 2 states that the bore head must be judged to provide satisfactory sanitary protection by a person deemed appropriately qualified by the MOH. In practice this usually means a certified engineer.

Criterion 3 requires E. coli monitoring to demonstrate that E. coli are absent from the source water.

A groundwater sample from the Pa Road borehole was analysed for CFCs, Tritium and SF6 in 2005 in order to determine the age of the source water. The results (reported by GNS) indicated a mean age of between 190 and >350 years, with a young fraction of 0.000%. The borehole therefore satisfies Groundwater Security Criterion 1 and may be granted interim security status. The GNS Groundwater Residence Time Determination report states that additional sampling should be undertaken to confirm the young fraction estimate, however.

The wellhead was sealed in 2004 to improve the sanitary protection. An inspection would need to be undertaken in consultation with the local Drinking Water Assessor in order to confirm compliance with Criterion 2.

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Water treatment and compliance with DWSNZ 2005

Compliance with Criterion 3 for Hahei would probably involve twice weekly E. coli sampling for three months, reduced to monthly sampling for the following nine months, assuming that the bore was granted interim security status.

The benefits of secure groundwater status include reduced E. coli monitoring requirements (under the bacterial compliance criteria) and a zero log credit requirement for protozoal compliance. This could ultimately mean that disinfection is not required and hence the existing system could meet NZDWS. The same regulatory approach broadly applies to Participating Supplies.

5.1.3 Hahei Water Supply Association

We understand that the Hahei Water Supply Association (HWSA) water treatment comprises water softening in addition to ion exchange to remove iron; the supply is not disinfected. Some residents use filter units to further treat the water before consumption.

The HWSA bore is cased to 24m depth, however we have no details of whether the casing was grouted in or just driven down to total depth. The total depth of the bore is approximately 35m. No water samples have been collected for age analysis.

Water quality data from samples taken from two of the Hahei Water supply wells between 2006 and 2008 by EW have been reviewed. Analyses undertaken include the major ions, some metals, physical parameters (e.g. pH, alkalinity) and nutrients. No microbiological data are available.

Data from Well 60-192 records pH in the 6.6-6.8 range, which is below the Guideline Value (GV) minimum of 7.0. All other parameters are within the Maximum Acceptable Values (MAVs) and GVs.

Water quality parameters are all within the MAVs and guideline values for well 72-2461 with the exception of 1 iron exceedance (0.33 recorded compared to GV of 0.2 ppm) and pH (6.5-6.8 compared to GV range of 7.0-8.5). The hardness levels are low (around 30-40 ppm), and hence we assume that 'softening' actually refers to pH correction rather than treatment for hardness.

The following work would be required to evaluate whether the well could be classified as Secure:

- a) Age analysis of water
- b) Wellhead security: Inspection of the well head and review of drillers log or discussion with well driller to assess grouting. If neither of these possible, grout integrity survey would be required using borehole geophysics
- c) E. coli sampling at prescribed sample frequency as per TCDC supply above.

5.1.4 Grange Road Water Supply Association

The Grange Road Water Association abstraction points are located on Patricia Place and comprise two wells drilled to 40m and 36m (Bore 1 and Bore 2 respectively). The wells are cased to 25m and 26m and are both cased at 100mm diameter.

We understand that the water treatment comprises pH adjustment only.

A review of the available water quality data has revealed no compliance issues, aside from low pH and iron concentrations, which exceed the DWS guideline values for aesthetic determinands. Compliance with the guideline values will not be mandatory. No microbiological data are available.

The water has not been age-tested. Evaluation of secure status for this supply will be as specified above for the HWSA supply.

5.1.5 Hahei Holiday Resort

The HHR supply comprises **three wells (TBC)**, of which bore construction details are available from two. Both wells were drilled in 1978 to depths of 76m and 142.5m. Casing diameter and depths are 100mm

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and 24.4m and 31.8m. The geological log for Welarc No 4616 is dated 1985, casting some doubt over the specified drill date.

Water treatment comprises pH adjustment and chlorination.

Water samples have been collected from three boreholes on the Hahei Holiday Resort site. Iron and pH in wells 60-190, 60-189 and 72-2799 do not meet the GVs, although pH is treated so we assume that the samples are collected prior to treatment. A high zinc level of 9.95 ppm compared to the GV of 1.5 ppm was recorded in one sample from well 72-2799. This result is significantly higher than other samples collected from this well (6 in total, collected over a two year period, all recording <1 ppm zinc), and is therefore likely to be spurious.

The water has not been age-tested. Evaluation of Secure status for this supply will be as specified above for the HWSA supply.

5.2 Water Supply Gradings

None of the Hahei water supplies have been graded by the MOH. The TCDC scheme is Unclassified. The remaining supplies are not included on the MOH Register of Community Drinking-Water Supplies in New Zealand 2007.

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Water supply analysis

The potential for supply issues to arise at Hahei over the foreseeable future has been evaluated through consideration of demand projections over the next 10 years in the context of:

- Supply capacity and resource consent limits
- Potential well interference effects and saline intrusion risks
- Overall water resource availability

In addition to this, the implications of the future requirement to achieve compliance with the New Zealand Drinking Water Standards have been considered.

6.1 Supply Capacity

6.1.1 TCDC Scheme

A pumping test was undertaken on the on the former Hahei Developments bore at Pa Road in 1991. The well was pumped at up to 200 m³/d. Flow records indicate that up to 177 m³/d have been abstracted in recent years. The Groundwater Management Plan report prepared by URS in November 2005 notes that there have been times over the high use Christmas holiday period when demand has exceeded capacity to supply and water shortages have been experienced in the past. The main restrictions were well design and efficiency. The well pump was lowered in 2004, which seems to have resolved the issue in that no supply shortages have been experienced since this time (John North pers. comm.).

The well diameter is 150mm; this means that diameter (pump size) is unlikely to be the limiting factor for yield from this well. The capacity of the well is discussed further in the context of well interference effects below.

6.1.2 HWSA Scheme

Flow records indicate that a peak daily supply of 328 m³ has been drawn from the HWSA source. No pumping water level data are available from this well and hence the total well capacity cannot be calculated from flow and level data. Well capacity is discussed further with regard to well interference below.

Both supply wells are 100mm in diameter, limiting the maximum pump capacity to around 330 m³/d.

6.1.3 GWSA Scheme

Flow records indicate that up to 130 m³/d have been drawn from the Grange Road supply well, although this peak figure may be erroneous. A peak flow of 76 m³/d was drawn from the well on 23/10/06, which is similar to peak flows in previous years. We have not been able to establish the maximum capacity of this well at the time of this report issue. The wells are 100mm in diameter, which again limits the maximum capacity of a submersible pump to around 330 m³/d

6.1.4 Hahei Holiday Resort supply

A peak daily demand of 176 m³ is recorded on the holiday resort flow record. Four wells have been installed on the resort. **The number of bores in operation is unknown.** All wells are 100 mm in diameter and hence the above comment regarding maximum pump capacity applies. A pumping test was undertaken on well 60.190 by Environment Waikato in 2006 at a rate of 100 m³/d; a maximum drawdown of 22 m was recorded after 21.5 hours of pumping. The static water level at the time of the test was approximately 4.5m below ground level (bgl), giving a pumping water level of 26.5m bgl at the end of the test. The pump is believed to be located at 30m depth; the well extends to 43.4m depth and the casing to 31.8m. This means that the pump is located towards the base of the casing and that the 100 m³/d test rate is close to the maximum capacity of the well under the current configuration. Based on a specific capacity of 4.5 m³/d/m drawdown, and assuming that the pump was installed 3m above the base of the

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well, a maximum yield of 160 m³/d could theoretically be drawn from the well. In reality the maximum yield would be less than this, and installation of the pump and drawing water levels down below the base of the casing is bad practice in that it can lead to overheating of the pump and allows air to enter the confined aquifer system, which can lead to biofouling and water quality issues. The maximum practical well yield is therefore likely to be 100 m³/d.

A step drawdown test was initiated on the then new standby well 72.2315 as part of the EW investigation. The test was abandoned after two half hour steps at 40 and 50.8 m³/d due to low available pump capacity. 11.4m of drawdown was observed at the end of the second step. The static water level was 3.5m at the start of the test. The well is cased to 65m and extends to 85m total depth. Assuming a minimum specific capacity of 3.0 m³/d/m, the maximum estimated well yield available for a drawdown of 61.5m is 185 m³/d. We understand, however, that this well suffers from some water quality issues (presumably iron) and is therefore not used by the resort on a routine basis.

Both of the above wells are 100mm in diameter.

6.2 Resource Consent Limits

Each of the water supplies have recorded peak daily water use either at or above the daily limits specified on their Resource Consents. The TCDC peak water use approached the consent limit in both 2005-2006 and 2006-2007. Any significant growth in the demand for water from this scheme will lead to exceedances of the consent limit over the peak season. Peak demand for water from the HWSA and Grange Road schemes are generally well below their consent limits, although occasional spikes at or above the limit have been recorded. The Holiday Resort demand is generally 10-15 m³ below the daily consent limit, with no peak demand growth projected since the resort is already at full capacity during the peak season.

6.3 Well Interference Effects

As noted previously, the TCDC supply well is located approximately 30m from the HWSA supply wells and hence there is significant potential for well interference effects. This risk is managed through use of trigger levels and a Resource Consent requirement for the two supplies to work cooperatively. A Tier 2 trigger level of 30m bgl has been defined for the TCDC Pa Road bore, on the basis that this equates to a 3m head of water over the HWSA pump. Abstraction from both the TCDC and HWSA wells must terminate if the Tier 2 trigger level is reached. Pumping can only recommence once 90% full recovery is achieved.

Figure 6-1 plots water level data from the TCDC well since July 2004 along with the Tier 1 and Tier 2 trigger levels. The data indicate that the Tier 2 trigger level was exceeded in January 2006 and January 2007. Flow data and records of pumping hours indicate that the pump was not switched off in response to this trigger level breach, as required under the Resource Consent requirements set out in the Pa Road Supply Borehole Monitoring Programme document (URS November 2005). The Tier 1 trigger level was breached in December 2007 and January 2008. Again there is no indication of a change in operation of the bore in response to this trigger level breach. Given that the required response to a breach of trigger levels is a reduction in pumping, and that the breaches occur during the peak demand period, the only solution available at present would be supply restrictions or water tankering.

The pump in the TCDC well is installed at around 40m depth, meaning that significant additional drawdown and hence yield is available in this well beyond the 30m Tier 2 trigger level. We understand that the pump in the HWSA well is installed at 31m depth, however, and this is the basis for the trigger level.

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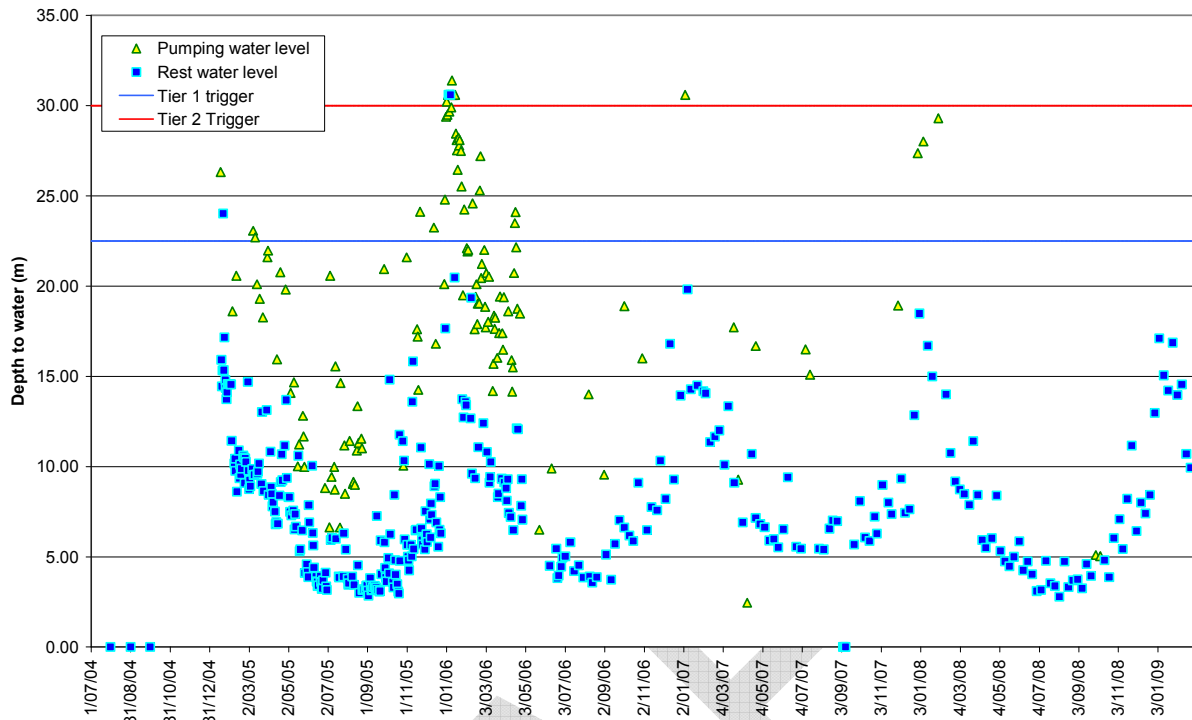


Figure 6-1 TCDC well water levels and trigger levels

6.4 Saline Intrusion Risks

Groundwater levels in parts of Hahei are drawn down significantly below sea level during the peak season, giving rise to concerns over the potential for saline intrusion. An aquifer test was undertaken in 2006 by EW on the Hahei Holiday Resort well with the aim of investigating the yield that can be drawn from the supply wells without inducing the flow of saline water from the coast. The study found that water quality in the pumped well (the main supply well for the resort) and also the standby well, located closer to the coast, was generally good with no evidence of saline intrusion.

The report included a groundwater contour plot from February 2006 (Figure 6-2), indicating the extent of water level drawdown below sea level. The data indicate that groundwater levels remain well above sea level in the GWSA wells. Greater utilisation of these wells to meet the peak season demand for the town could therefore potentially reduce the risk of saline intrusion by reducing the level of drawdown in the TCDC, HWSA and holiday resort wells. Well interference issues between the TCDC and HWSA wells could also be reduced through this approach.

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Water supply analysis

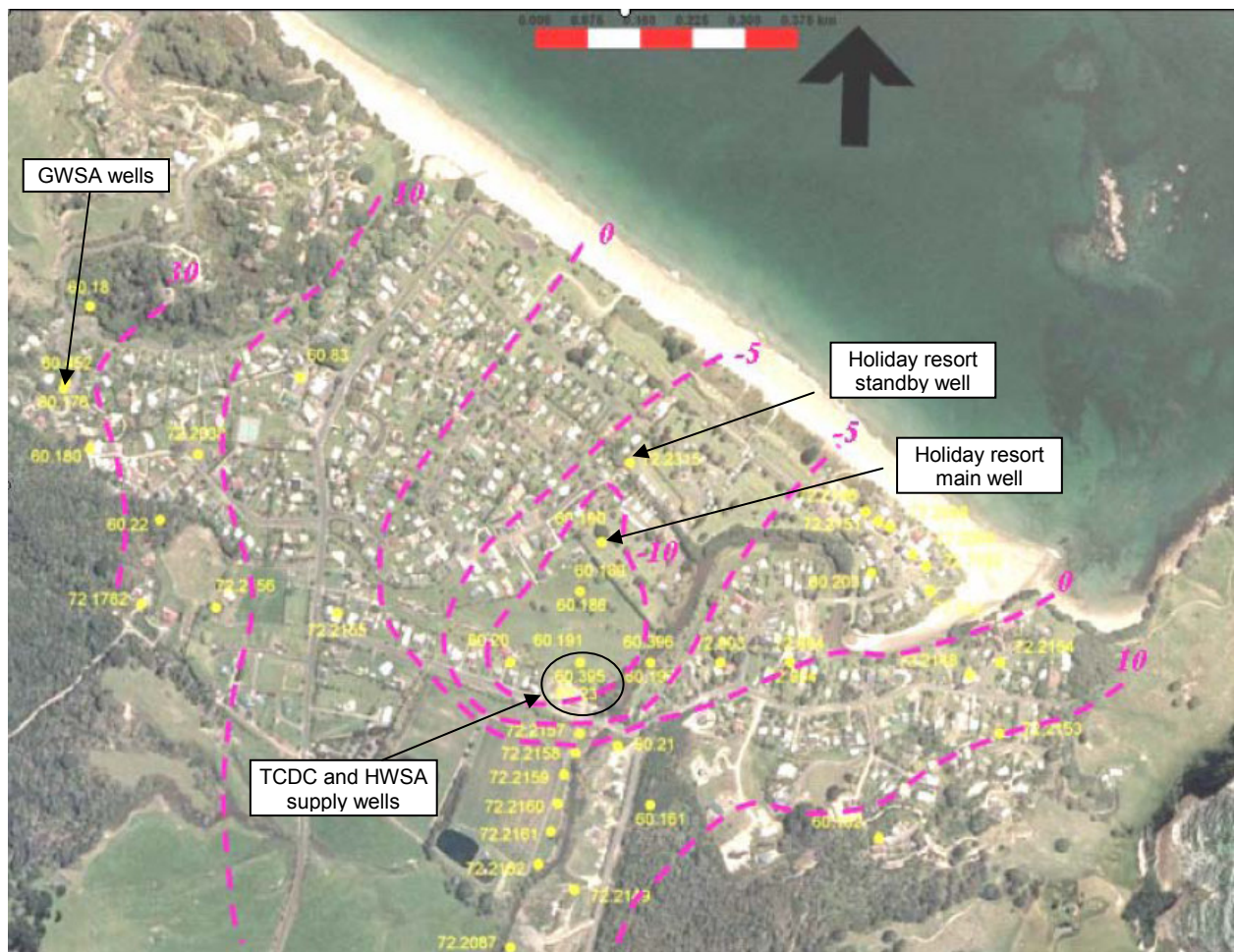


Figure 6-2 Groundwater contours in m above seal level from February 2006⁶

Electrical conductivity has been monitored in the TCDC Pa Road bore since July 2004. Trigger levels have been defined for EC at 37 $\mu\text{S}/\text{cm}$ and 50 $\mu\text{S}/\text{cm}$ (Tier 1 and 2 respectively). A Tier 1 breach triggers a requirement for additional sampling; the required response to a breach of the Tier 2 trigger level is immediate cessation of pumping and a review of the situation by EW. Figure 6-3 plots electrical conductivity and flow from the TCDC well between 2004 and 2009 as point data and as a 30 day moving average. The data indicate that neither the Tier 1 nor Tier 2 EC triggers have been breached over this period. The data also show that although EC increases in line with water abstraction rates, it reduces again when flow rates decrease. There is no trend of increasing EC over time. The increasing EC at times of high flow may relate to influx of older, more mineralised water from deeper in the aquifer when the water levels are drawn down, or could alternatively be indicative of small influxes of saline water from the coastal zone via the fracture flow network. This could be investigated further through analysis of hydrochemistry data.

⁶ Hahei Holiday resort Aquifer Flow Test Report; Environment Waikato 2006.

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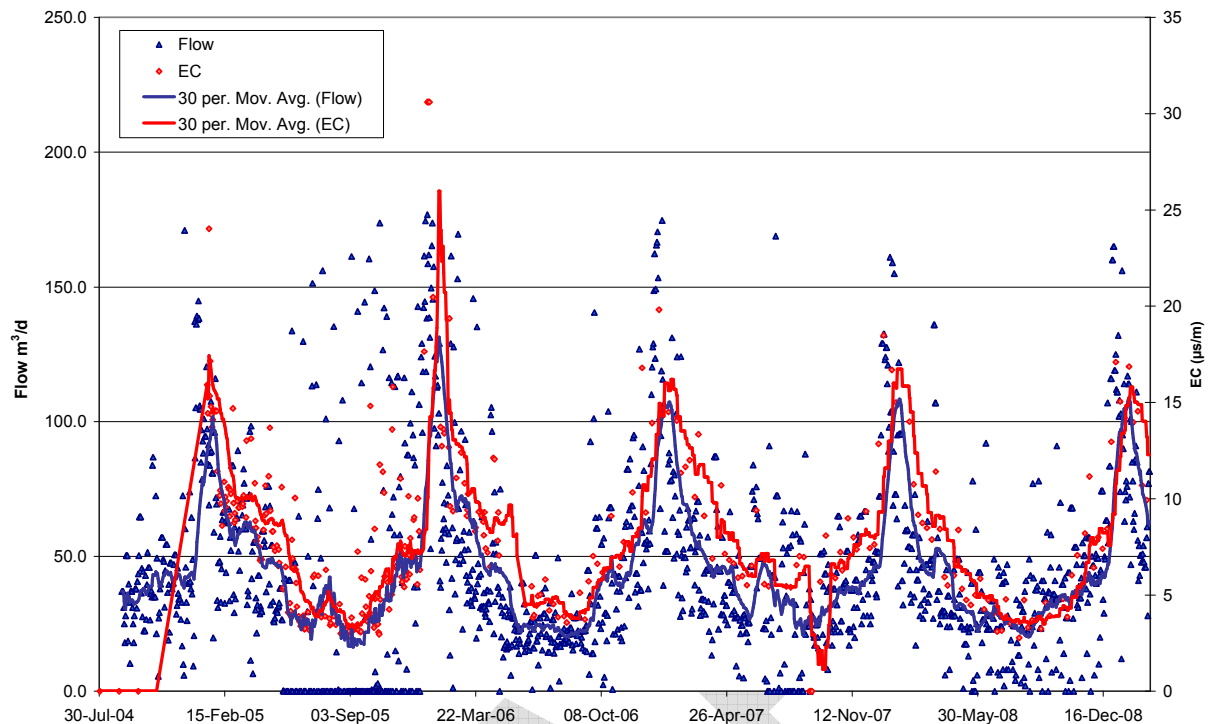


Figure 6-3 EC and flow data from TCDC well

A plot of water levels over time on the Hahei Holiday Resort standby well (72.2315) is presented in Figure 6-4. The data show a rapid decline in groundwater levels to approximately 6m below sea level at the start of the Christmas period. Water use is significantly lower after February (around 50-70 m³/d compared to circa 150 m³/d over the Christmas period), but recovery is slow, presumably due to limited recharge at this time of year, meaning that the water level at this location is still approximately 1.5m below sea level at the beginning of May. This sustained drawdown of groundwater levels below sea level creates a significant risk of saline intrusion in the long term. The risk is greatest at the HHR wells since they are closest to the coast.

The saline intrusion risk is currently being investigated by EW. A sentinel well has been drilled on the coastal margin in front of the HHR in order to monitor water quality and provide an early warning of increasing salinity at the coast. The installation comprises a shallow piezometer to approximately 10m depth and a deeper piezometer from 38.2 – 104.2m depth. There is no evidence of saline intrusion in this well at present, with electrical conductivity in the normal range and well below 50 µs/cm. The well recorded approximately 30m of tightly packed silt/clay overlying the rhyolite aquifer, indicating that the deeper groundwater is well protected from downward migration of saltwater. The subsea extent of this confining unit is unknown, however. The sentinel well, in which EC and water levels are logged continuously, should provide an early warning of saline ingress, assuming that the monitoring well intersects the same flow zone as the wells (this could be confirmed through water level data from the abstraction wells and monitoring well).

As discussed in Section 2-4, the GWSA operate at significantly below their Resource Consent limit for most of the time. Spare capacity is occasionally available during the peak Christmas period, with significant spare capacity consistently available from February onwards. Groundwater levels in the Grange Road area are significantly above sea level according to the EW contour plot (Figure 6-2). It would therefore be possible to use the Grange Road wells to both balance the demand from the other networks during peak demand periods and also potentially to recharge the aquifer at Pa Road and the Holiday Resort from February onwards in order to minimise the periods over which groundwater levels are below sea level. This would mitigate against the saline intrusion risk.

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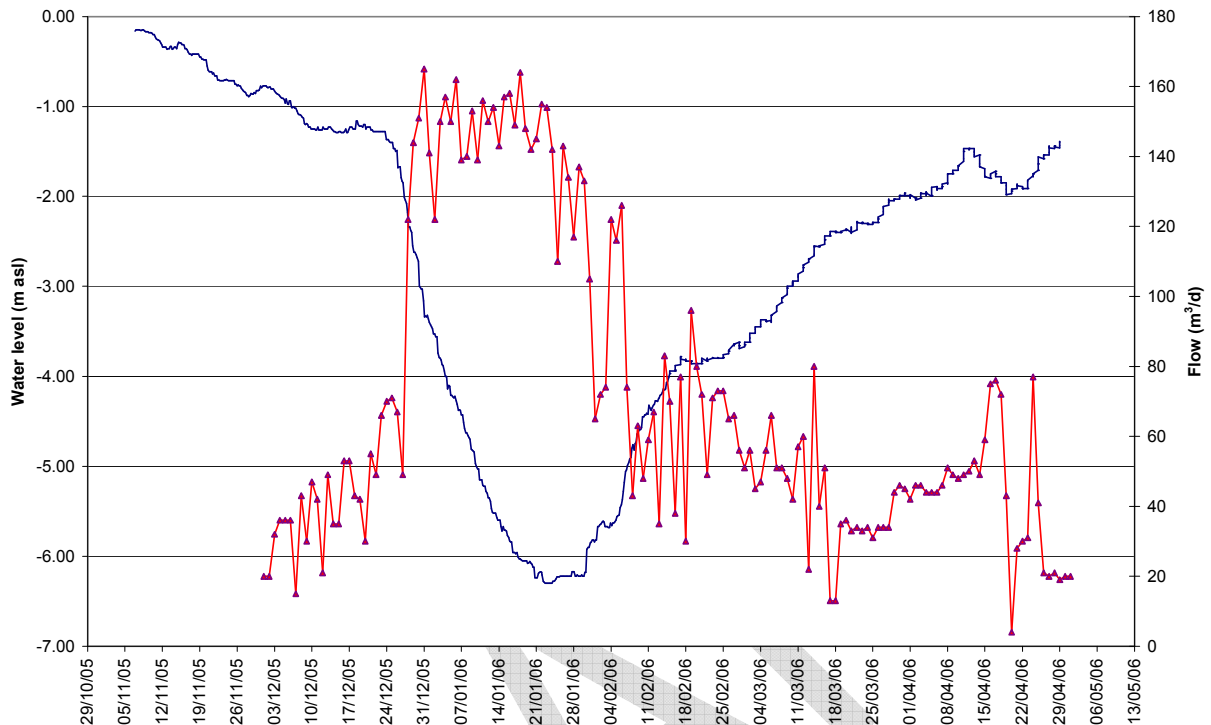


Figure 6-4 Groundwater abstraction and water levels at Hahei Holiday Resort

6.5 Water Resource Availability

The combined water allocation for the TCDC, HWSA and HHR is 650 m³/d. These supplies are drawn from the Wigmore Dome sub-catchment, for which an average daily recharge of 1200 m³ has been estimated. The resource estimate (undertaken as part of the 2005 URS Hahei Groundwater Management Plan study) is considered to be conservative. Average daily water use for each of the schemes is significantly below the water recharge estimate. The combined long term average daily water use for TCDC, HWSA and HHR is 176 m³. Assuming an average demand growth of 3.25% per annum, the combined demand from these schemes would be 233 m³/d by 2019. This represents approximately 20% of the estimated recharge and on this basis it is unlikely that the resource capacity of the Wigmore Dome sub-catchment will be over-utilised in the foreseeable future.

The GWSA average daily water use of 18 m³/d, which would reach 24 m³/d by 2019 under the high growth scenario, represents a small proportion of the estimated 135 m³/d recharge to the Grange Dome aquifer from which this supply draws water. Water resources in this sub-catchment again appear to be sufficient for future requirements.

Further unallocated water resources are believed to be available in the Hahei Dome, Purangi Dome, and Hot Water Beach Ignimbrite to the south and east of the town.

6.6 Compliance with NZDWS

A review of water quality data from the individual Hahei water supply bores has indicated good compliance with NZDWS overall. Water samples from all supplies record a number of results that fall outside of the Guideline Values (pH for all supplies, plus iron for the GWSA and HHR supplies). pH correction is already in place for all supplies, with iron removal plant installed on the HWSA supply.

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The TCDC supply well has been age-tested and found to draw water with a mean residence time of over one hundred years. This supply could therefore potentially obtain Secure status, which would minimise monitoring and treatment requirements. The HWSA and HHR bores draw water from the same Rhyolite aquifer, overlain by 20m or more of low permeability, fine materials, and hence age testing may reveal water of a similar age to the TCDC supply. The GWSA supply wells draw water from the Grange Dome aquifer, which is overlain by approximately 5m of clay. This reduced protection from surface water infiltration may result in a younger water and hence the likelihood of achieving a Secure Groundwater designation is less certain for this supply. In all cases further sampling and wellhead inspection would be required in order to determine whether secure status can be achieved. Disinfection through UV or chlorination would be required in the event that secure status cannot be achieved.

6.7 Summary of Key Information

The following points must be considered when evaluating supply options for Hahei:

- 1) The TCDC and HWSA wells reach their maximum capacity during some peak seasons. Water levels in the TCDC well have been drawn down to the point at which abstraction from the HWSA well could be affected – and/or vice versa.
- 2) The TCDC supply has reached its Resource Consent daily abstraction limits on isolated occasions during the peak season. Further increases in demand would exacerbate this situation.
- 3) The TCDC scheme demand averaged 140 m³/d over the Christmas peak period in 2005-2006. Under the 4.75% growth scenario, average daily water use over a high demand peak season (such as 05-06) is predicted to equal the resource consent limit of 175 m³/d within six years. Given that sustained periods of abstraction close to the resource consent limit during the peak season coincide with water levels at or below the Tier 2 trigger level, which itself represents the point at which well interference effects between the TCDC and HWSA bores becomes a significant issue, this indicates the potential for significant problems with both of these supplies.
- 4) Water levels in the vicinity of the TCDC, HWSA and HHR supplies are drawn down significantly below seal level for much of the year, thereby creating a saline intrusion risk. A sentinel well recently drilled by EW on the coastal margin indicates that significant saline intrusion is unlikely to have occurred to date, however.
- 5) Age testing and wellhead security assessments are required to determine whether all of the current supply wells would be classified as Secure under NZDWS. All supplies require and are treated for pH correction; the HWSA supply is also treated for iron. The HHR supply would also require treatment for iron in order to comply with the aesthetic Guideline Values under DWS, although this is not mandatory. Blending could potentially reduce treatment requirements for iron if the supplies were operated jointly.

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Supply options

Potential water sources in Hahei include surface water (Wigmore Stream), shallow groundwater and deep groundwater (current source). Development of additional storage, combined reticulation and further roof water development could also potentially be used to resolve peak season demand issues.

The Wigmore Stream is not considered to be an attractive option for town supply since water treatment requirements would be significantly greater than for the current groundwater source, and resource consenting issues would likely prove a significant obstacle.

Shallow groundwater in the area of the town is likely to yield low quality water due to land disposal practices. Treatment costs would be significantly greater than the current deep groundwater supply.

7.1.1 Deep Groundwater

Deep groundwater (referring to the confined igneous aquifers from which the majority of the town is currently supplied) could potentially be developed further, assuming that additional sources with sufficient yield and water quality could be developed away from the current HWSA, TCDC and HHR wells. As noted previously, an investigation well drilled recently in Grierson Close encountered poor water quality and hence the opportunity for development of significant additional supply sources may be limited. Basic water balance calculations have indicated that additional resources are potentially available for development, and that current water use does not represent an excessive proportion of the recharge estimate. Development of new resources is risky and expensive and on this basis this option is currently less attractive than some of the alternatives.

7.1.2 Storage

The TCDC supply includes approximately 360 m³ of storage capacity at present. The HWSA includes 1500 L of storage on each property supply, providing 252 m² of storage in total. The GWSA scheme includes three reservoirs with a combined capacity of ### m³.

Under the low growth scenario, peak day demand requirements by 2019 in excess of the current resource consent limits are predicted to be 34 m³ for the TCDC supply and 1 m³ for the HWSA scheme. The GWSA is predicted to have 10 m³ of spare capacity within its Resource Consent at this time. Additional storage could be considered, but this would not remedy the existing saline intrusion risk, nor would it alleviate well interference effects between the TCDC and HWSA wells.

The peak Christmas period demand for the TCDC scheme is predicted to reach an average of 207 m³/d by 2019, i.e. 32 m³/d above the current consent limit. This equates to a demand excess of 448 m³ over the two week peak period. The cost of developing 200 m³ of additional storage has been estimated at \$360k.

7.2 Combined Reticulation

Modification of the currently separate supplies into a combined reticulation system could potentially resolve some of the peak demand issues and the saline intrusion risk. Peak daily and season demands vary between individual networks, in that the greatest recorded daily demand for the different schemes has occurred on different days according to the flow data record. This means that peak demand would be balanced to some extent if the town was supplied under a combined reticulation scheme using the existing wells. The GWSA scheme also has spare capacity relative to the Resource Consent limit. This would further alleviate peak demand issues; greater utilisation of these wells instead of the TCDC, HWSA and HHR wells could also reduce the saline intrusion risk. Recharge of the aquifer in the area of the latter wells with water from the GWSA wells at the end of the peak season could potentially reduce the saline intrusion risk further.

A further option would be a partially combined system, whereby additional storage would be developed to hold water drawn from the GWSA bores when spare capacity is available in the run up to and during the peak Christmas period, or alternately the GWSA wells could be developed to supply water to one or more of the other networks at their maximum available capacity. This water would be donated to the other

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reticulated network(s), and in particular TCDC, in order to reduce the pressure on the aquifer in the Pa Road area. The GWSA scheme would continue to supply the area currently covered by this scheme.

This approach of managing saline intrusion risk by taking higher proportions of water from inland wells during key periods in the annual water cycle has been used successfully in other parts of the world (e.g. the Chalk aquifer in Brighton, England). Further review of this option is recommended. The relatively detailed level of study required to estimate the cost of combining the supplies into a combined or partially combined reticulation system is beyond the scope of this current review, however.

7.3 Roof Water

Roof water already supplies approximately 180 properties in the town but could potentially be used in more properties to offset the demand for mains water during peak periods. The low demand growth projection assumes that demand management is implemented through development of additional roof water supply systems. In order to fully evaluate the potential contribution of roof water in meeting projected future water demand, additional work is required however. This would comprise simple water balance modelling using long term rainfall data and average roof area figures in order to estimate water availability during wet and dry years from these systems. Typical system costs could be used as part of a cost benefit assessment for this option once this work is completed. However, we understand that there may be statutory limitations which could control the extent to which demand can be managed in this way.

Section 8

Conclusions and recommendations

8.1 Conclusions

Our main conclusions are:

- Current water use represents a relatively small percentage of the estimated aquifer recharge, although total allocation based on peak daily abstraction limits is higher. The overall resource capacity is not considered to represent a significant issue at present.
- Groundwater levels in the area of the TCDC, HWSA and HHR wells are drawn significantly below sea level for much of the year according to available water level data. Saline intrusion could therefore potentially become an issue over time. Further work is required to manage this risk.
- The TCDC supply has reached its daily abstraction limits specified in the Resource Consent. The HWSA scheme is predicted to reach its daily abstraction limit within 4 years under the high growth scenario. Obtaining approval for an increased consent limit is likely to be problematic in the context of the saline intrusion risk.
- Peak water demand for the TCDC and HWSA schemes leads to well interference issues; this situation would worsen if significant demand growth occurs in the future. The situation is currently dealt with through trigger levels, which form part of the consent conditions. There is no evidence that these triggers have been acted upon to date. Breach of the Tier 2 trigger for groundwater level requires that abstraction temporarily ceases. This could necessitate water restrictions and/or tankering to meet demand until water levels recover or demand reduces again.
- Supply options that could potentially assist with projected peak period shortages are development of additional roof water systems, construction of additional storage capacity and combined reticulation.
- Further work is required to confirm the potential contribution of additional roof water systems to reducing peak demand;
- Costs for development of the additional storage required to meet projected peak demand growth have been estimated at \$360k for a volume of 200 m³.
- Operation of the individual schemes as a combined supply could potentially resolve projected capacity issues for the TCDC and HWSA schemes, Resource Consent compliance issues during peak periods, and could also reduce the level of drawdown in the TCDC/HWSA/HHR supply well zone by drawing more water from the currently under-utilised GWSA wells. Aquifer recharge from the GWSA wells to this zone could also be considered as a saline intrusion risk mitigation strategy.
- The Hahei water supply schemes are classified as Small Supplies under NZ Drinking Water Standards, and as such can opt for the participatory approach under which water quality is regulated through development of Public Health Risk Management Plans.
- Age testing and well security assessment is required to determine whether the individual supply wells can be classified as Secure, thereby removing the need for treatment for protozoa. If some supplies are found to be Secure and others not, this may have implications for the case for merging the individual networks into a combined supply.
- Development of a PHRMP to cover the individual supplies is required under NZDWS and could provide additional information that would assist in defining the best long term supply for the town.
- The risks and issues associated with water supply differ between the individual networks. The saline intrusion risk is greatest at the Hahei Holiday Resort due to coastal proximity, whereas saline intrusion is not currently an issue for the GWSA. The HWSA and TCDC scheme suffer from well interference issues and could also potentially be impacted by saline intrusion. The supply capacity of the TCDC scheme is at its limit and this could restrict the potential to supply new developments in the town. The GWSA potentially has spare capacity that could form part of the solution to the issues faced by the other schemes. The individual supply networks therefore need to work together to

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Conclusions and recommendations

manage the risks and issues that have been discussed in this study to ensure that water resources in Hahei are utilised sustainably.

8.2 Recommendations

This report has highlighted additional data requirements that would assist in resolving a number of areas of current uncertainty:

- Yield data for the GWSA, HWSA and HHR supply wells should be obtained in order to define maximum well capacities. This would assist in evaluation the potential for combined or partially combined reticulation to resolve the potential future supply shortages;
- The spare capacity of the GWSA wells should be modelled in combination with well yield data in order to determine the extent to which utilisation of this capacity could reduce water level drawdown at the other wells and thereby moderate the saline intrusion risk, meet the projected capacity shortages for the TCDC scheme and reduce well interference issues between the TCDC and HWSA wells;
- Water level data from the EW sentinel well should be reviewed to determine for what proportion of the time groundwater levels are drawn down below sea level. This information could then be used as a basis for determining the measures required to achieve a net flow of groundwater towards the coast on an annual basis, if this is not occurring at present.
- The feasibility of recharging the Wigmore Dome aquifer with water from the Grange Dome at the end of the peak season should be considered further;
- The costs associated with combining the current individual networks into a combined and/or partially system should be estimated;
- Age testing and wellhead security inspections should be completed for all supplies to determine whether they each meet the Secure Groundwater criteria;
- The potential for additional use of roof water to significantly offset demand during the peak season should be considered.
- The advent of saline intrusion could potentially create significant water supply issues for the town. On this basis we recommend that a holistic solution to the water supply issues facing Hahei should be developed as a matter of priority by acting upon the recommendations of this study. Having an agreed solution, even if this was not fully implemented at the time, would ensure that the town could respond to the issue quickly and rationally.

A Public Health Risk Management Plan should be developed for the supplies in order to evaluate whether any additional issues are present which could have a bearing on the best long term supply option for Hahei. This is also required for compliance with NZDWS.

Section 9

Limitations

URS New Zealand Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Thames Coromandel District Council and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 1 April 2008.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between May 2008 and March 2009 and is based on the information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

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