A model for assessing unconsented or permitted water use in the Bay of Plenty region

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Executive summary

Councils have a responsibility to manage water resources. Part of this management relates to allocation. The Proposed National Environmental Statement (NES) on Ecological Flow and Water Levels requires allocation limits to be set for water bodies. The difficulty councils face is that not all allocation can be quantified. If water is allocated under resource consent it can be tracked and monitored, however there is allocation authorised under the Resource Management Act (RMA) and the Bay of Plenty Regional Council's Regional Water and Land Plan (WLP) that cannot. The impact of these unknown and unquantified water takes cannot be assessed due to lack of record. Therefore to quantify permitted takes, as authorised under RMA and WLP, a model has been developed to provide potential volumes that these rules allow.

The RMA allows for water to be taken for reasonable domestic and stock water use provided that the use does not or is not likely to have an adverse effect on the environment. The WLP rules allow small takes for any purpose such as dairy shed wash-down, horticultural spray makeup, irrigations of garden/small glasshouse operations, domestic and stock water needs.

The total volume of water actually used under the RMA and WLP is unknown, nor are the cumulative effects of such takes on a water body. A model has been developed to quantify the potential volumes of water provided for under these provisions for each surface water catchment in the Bay of Plenty region. Therefore the results of the model provide the potential total permitted take if all of these permitted provisions were exercised to their fullest simultaneously. This is an unrealistic stance, but is as the rules are written.

The model has been audited an found to be consistent with the provisions of the RMA and WLP, and that the data sets used are reasonable for calculating water use in this region.

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Part 1: Project outline

1.1 Introduction

Bay of Plenty Regional Council is reviewing Chapter 5 Water Quantity and Allocation of the Regional Water and Land Plan (WLP). The surface water and groundwater resources can be quantified, as can the allocation for consented water takes, however the permitted takes are not quantified. To better understand the potential water volume available as allocation to permitted takes a model has been developed based on the permitted provisions of RMA and WLP.

1.1.1 Unconsented and permitted activities

Section 14(3)(b) of the Resource Management Act permits water use for certain activities without the need to obtain a resource consent. This allows for water to be taken for reasonable domestic and stock water use provided that the use does not or is not likely to have an adverse effect on the environment.

This provision is qualitative rather than quantitative. The term 'reasonable' is not quantified. To estimate the potential volume of the water resources used under this provision, a volume needed to be determined for the model. This was done by using set water use figures for domestic consumption and that of stock.

The permitted rules in the WLP are quantitative, specifying the amount of water that can be taken without resource consent:

Rule 38 Permitted - Take and Use of Groundwater up to 35 m^3/day per property.

Rule 41 Permitted - Take and Use of Surface Water up to 15 m^3/day per property.

The intent of both WLP rules is to allow small takes for any purpose such as dairy shed wash-down, horticultural spray makeup, irrigations of garden/small glasshouse operations, domestic and stock water needs. The WLP rules do not exclude a use.

For our region the potential volume of water used under the RMA provision and the permitted rules of the WLP is unknown. These water takes form part of the over-all allocation of water, so need to be understood and determined. To aid with this calculation a spreadsheet model has been developed to calculate the potential volume of water taken by these provisions for each catchment in the Bay of Plenty region.

1.1.2 Model overview

A spreadsheet (the model) has been developed that calculates potential permitted water use within a catchment for both domestic supply, stock watering and dairy shed wash down. The model follows a similar model developed by Waikato Regional Council (Technical Report 2007/47).

The model methodology loosely follows that of Waikato Regional Council however water use has been adapted to the Bay of Plenty conditions based on regional plan rules and/or water use figures supplied by Bay of Plenty district councils, and other relevant land use parties.

The approach staff have adopted attempts to calculate the number of people (households) from census and typical water use per person from other data sources, use typical stock drinking water data from Aquas 2007 report, and stock numbers from AgriBase™ (2010) (dairy, beef, sheep, deer) per surface water catchment. The water use has then been calculated by multiplying the activity and its water needs together.

The model focuses on rural (non-municipal/non-urban) permitted water take and use. This assumes that urban populations and consented water takes would have their domestic and stock water needs met by resource consent.

There are two parts to the model. The estimated water required to meet reasonable domestic and stock watering needs as allowed under the RMA (assuming no adverse environmental effects); and the estimated permitted use against the permitted allocation of the WLP (15 m^3/day surface water and 35 m^3/day groundwater). For WLP the worst case scenario for each catchment would be the maximum (50 m^3/day) use of the permitted water take by each property within the catchment.

The model provides a reasonable first assessment of the potential situation of permitted abstraction from ground and surface water resources within the Bay of Plenty catchments. These are set out in Part 2 of this report.

Part 2: The model and data used

1.1 Introduction

The model is contained in the MASTER tab of the Master permitted takes model spreadsheet (Objective ID A1058481). MASTER contains the worked model data. All research and working for the model have been done within the workbook, so that tabs contain information that may not be used in the model but have informed the research for the model. Tables in this report and appendices are created from this workbook.

1.2 Model aims and objectives

- To develop a method for estimating potential water use by permitted takes in the Bay of Plenty by the following users:
  - Domestic water use in non-urban areas (Appendix 1).
  - Typical stock drinking water for dairy, beef, sheep, deer, other large stock and other small stock (Appendix 2).
  - Dairy shed wash down water (Appendix 3).
- Outline how the model works and how it could be run in the future (Part 3, 4 and 5 of this report).
- To calculate and establish a worst case scenario for each catchment, based on the assumption that all land properties within a catchment are taking their full water allowance (+50 m^3/day) under the RMA and WLP permitted take rules (Appendix 4).

1.3 Assessment of domestic use estimates

There are different aspects to domestic water use that staff have considered in creating the permitted takes model. These are discussed below.

1.3.1 People per household

The Census 2006 data has been used to gain estimates of the average number of people living in a household within each catchment of the Bay of Plenty region. The census data is in mesh blocks, these mesh blocks do not correspond to catchment boundaries and as such some interpolation of the data has been done using the mapping tool ArcMap, in order to gain the most accurate estimate of population per catchment as possible.

1.3.2 Households per catchment

Two methods were used to estimate the number of households per catchment:

Census 2006

Population estimates from Census 2006 data. Due to the fact that the meshblocks are a different shape and area to catchments they had to be proportioned out, this process will have introduced some errors.

Address point

The assumption has been made that each address point represents a household with a standard population size. The appropriate population size for each catchment was based on meshblock estimates (Census 2006) of people per household for that catchment.

For the model the address point data has been applied as the estimate of population, this provides a worst case scenario compared with the census data calculations.

1.3.3 Household water use estimates

A literature review was conducted. Comparisons were made between domestic use values used by the Bay of Plenty Regional Council's Guide to the On-Site Effluent Treatment Regional Plan (EBOP, 2006); Horizons Regional Council; Ministry of Health document on household water supply (MOH, 2006); and data provided by Western Bay of Plenty District Council and Tauranga City Council on water use within their districts. From this data a range of 180 litres/person/day to 300 litres/ person/day was considered to be most appropriate for use in the model. The table below shows the figures applied in the model.

Domestic water use	Average daily demand (ADD)	Peak daily demand (PDD)	Units litres/person/day
Per person (all ages)	180	300	l/p/d

1.3.4 Properties with consented takes

It has been assumed that properties where there is a consented water take, the household water needs are accounted for within the consent and not from permitted takes. All non-industrial surface and groundwater water consents were identified and the assumption was then made that each consent would be supplying at least one household, equivalent to an average population of 2.8 people/household, Brown et.al. (2007). Thus permitted takes have been taken as zero for properties that have a consented water take. This was done to minimise double counting of water.

1.3.5 Urban areas

Water supply to urban areas falls under the consented takes category, as such all urban areas where town supply is available have been removed from the model.

1.4 Assessment of stock use estimates

For stock water use estimates there are various aspects of water use that need to be considered in creating the permitted takes model. These are discussed below.

1.4.1 Water use requirements for various types of stock

Staff have reviewed Bay of Plenty Regional Council (BOPRC) information and discussed values with consent and compliance staff who suggest that the figures devised by Aquas (2007) for Horizons Regional Council are considered appropriate for application in the Bay of Plenty region. Both the Average Daily Demand (ADD) and Peak Daily Demand (PDD) figures have been applied to provide an upper and a lower range of potential permitted water use.

The table below lists the stock water use figures as applied in the model. The stock has been grouped slightly differently to Aquas (2007), the model includes only dairy, beef, deer, sheep, large stock and small stock. Dairy, beef, deer and sheep were considered to be the primary stock in the Bay of Plenty accessing permitted water takes. All other stock was grouped into either large or small stock units.

Stock	Average daily demand (ADD)	Peak daily demand (PDD)	Units litres/head/day
Dairy cattle: Milking cow	45	70	l/h/d
Beef cattle: Mature beef cattle, herd replacement stock and bulls	30	55	l/h/d
Sheep: Ewes, hoggets and rams	3	4.5	l/h/d
Deer: Hinds and stags (all ages)	6	12	l/h/d
All other large stock	30	55	l/h/d
All other small stock	3	4.5	l/h/d

The large stock group includes horses, donkeys and camelids; these have been assigned the same water allowance as beef. The small stock group includes dogs, poultry and goats; these have been assigned the same water allowance as sheep.

1.4.2 Livestock numbers in the Bay of Plenty

Livestock numbers have been obtained from the AgriBase™ dataset as at August 2010. AgriBase™ has been compiled by grouping farm stock numbers according to land ownership not catchment. In cases where a single landowner/farm has parcels in adjacent catchments, stock numbers have been split proportional to the area of land in each catchment. Not all dairy farmers in the region subscribe to AgriBase™, so there are dairy farms that are not identified within the AgriBase™ data set.

1.4.3 Stock numbers for non AgriBase™ land areas

Stock numbers in areas not covered by AgriBase™ have been calculated from an estimate of the land use area (high or low producing grassland), obtained from LCDB2 (LINZ, 2001). Land use data for the Bay of Plenty region was last captured in 1996 and was considered out of date for use in this model.

Bay of Plenty land management staff suggest that it is reasonable to assume that high producing exotic grassland is dairy and low producing exotic grassland and shrub land is beef, deer or sheep.

The New Zealand Dairy Statistics suggest an average stocking rate of 2.83 cows/ha for dairy cows (LIC 2009). Fleming (2003) suggests a range of between 7 and 22 stocking units per hectare, equivalent to between 1.16 and 3.6 units for beef animals per hectare. BOPRC land management staff suggest that a figure of 15 stocking units or 2.6 beef animals/ha is appropriate for the Bay of Plenty region.

To work out stock water use for non-AgriBase™ land areas average stocking rates for dairy and beef were used in the calculations; 2.8 head/ha for dairy and 2.6 head/ha for cattle beef. Using these figures produces reasonable results, but

discretion is needed as high producing grassland is not always dairy, particularly for East Cape catchments.

1.5 Dairy shed wash-down/cooling water

Dairy shed use of 70 litres/cow/day was considered reasonable (Aquas, 2007) and has been used within the model. A lower figure of 55 litres/cow/day applied by BOPRC consents staff for dairy shed use was considered an underestimate, mostly due to an increasing trend in dairy shed water use. It was suggested that a figure of up to 70 litres/cow/day would not be uncommon for a rotary dairy shed.

Part 3: Model development calculations

1.6 Spatial techniques (GIS) applied to estimates of population and stock

The following summarises the GIS techniques used to develop the model and outlines some of the possible losses introduced through using this process.

1.6.1 Livestock data

- Sum the number of dairy cows, beef cattle, sheep and deer per surface water catchment based on AgriBase™ data captured up to August 2010.
- Subtract stock numbers from catchment estimates that fall on properties with current water use consents (excluding municipal and or industrial water takes). AgriBase™ stock numbers are then split proportional to the area represented by the spilt polygon.
- Identify the catchment area not covered by AgriBase™.
- Using LCDB2, LINZ (2001), estimate the area per catchment covered by high and low producing exotic grassland.
- Calculate permitted water use per catchment by applying the ADD and PDD figures from Appendix 4.

1.6.2 Population data

- Clip meshblocks to catchments and proportion population according to the percentage of meshblock in each catchment. Remove urban areas and calculate catchment population.
- Sum the number of households per property from address data and convert to a catchment population estimate by multiplying household numbers by household population density on a catchment by catchment basis; assuming each address point represents one household.
- Calculate the number of electricity supply points per catchment and convert to an estimate of population by, multiplying electricity supply points by household population density on a catchment by catchment basis, assuming that each electricity supply point represents one household.
- Calculate the number of households supplied by current consented takes and subtract the number of people from catchment estimates. Current consented takes exclude municipal and industrial water takes. This calculation assumes that each consent supplies at least one household with a population density equivalent to the meshblock household density for that catchment.

1.6.3 Other uses and possible losses

The model deals with the major land use practices and water uses occurring in the Bay of Plenty that are considered to be high users of the permitted provisions (domestic, stock and dairy). Other uses not calculated for in the model include; irrigation of sports grounds, small scale horticultural practices, other urban environments and leakage (loss) from the system (infrastructure).

Horticultural practices of between 0.3 ha (15 m^3/day from surface water) and 0.7 ha (35 m^3/day from ground water) would fall within the permitted takes category at an irrigation application rate of 5 mm per day. These land uses are considered to be somewhat minor for the Bay of Plenty region as most horticultural developments are substantial and require resource consent for their water use. Therefore these takes were not calculated for in the model due to difficulty with identifying such small scale land use and/or location of use.

Part 4: Permitted take rule calculations scenario

1.7 Outline

Prediction of the worst case scenario for the Bay of Plenty under the current permitted takes allowance has been estimated; that all properties within a catchment are taking their full permitted take allowance; that is +50 m^3/day (surface and groundwater and RMA provisions). The WLP is written in a manner that allows +50 m^3/day to be taken per property from water resources without resource consent.

The method used is as follows:

- Assess the ownership of parcels to determine 'property'.
- Join adjacent parcels together where the owner is the same.
- Establish the number of parcels (property) in each catchment.
- Calculate possible water taken out of each catchment as a permitted take.

1.8 Spatial techniques (GIS) applied to estimate the worst case scenarios

- The layer called BOP.TL_Parcel_Title_Point was used; this layer provides a point for each parcel, except parcels such as road parcels, river parcels, railways. Each parcel point has the legal description and owner information attached. This data was then joined to the BOP.TL_PARCEL layer which then provided special parcels with owner information. Once this was done the urban areas defined by the model were clipped out.
- A file was then added to the data's attribute table to define if it had an owner, three categories were used, 'yes' – a proprietor was named, 'no' – no proprietor identified, and 'queen' – for land owned by the crown (see Figure 1).
- After assessing the definition of the word property in the WLP (pg. 439, '*the land described in a particular certificate of title, or a group of contiguous certificates of title owned or leased by the same owner or lease holder, or land which is designated as a road or reserve, or is Māori land.*'), a dissolve was done in Arc to merge into one parcel each instance where a proprietor owned more than one parcel adjacent to each other. This was done to get the best estimate of properties within a catchment.
- The next step was to determine the catchment that each parcel was in, enabling the number of parcels within each catchment to be established. This was done by a union between the BOP.Catchment_BOPSurface layer and the processed properties layers. This data could then be exported into excel to be processed further.

1.8.1 Possible errors

There are a number of areas where under and over estimation of actual catchment data could have entered.

- The parcel layer used does not have proprietor information for every property. The reason for this data being missing is partly due to information being progressively updated, or partly unknown. This data is updated every one to three months by VNZ (Verification New Zealand) and forwarded to our GIS team who update our records, for this reason the model may need the GIS processing updated before it is used in order to have the most up-to-date information. This problem will lead to some under-estimation of the number of properties within a catchment. A more detailed look at each catchment will identify if this is significant for that particular catchment.

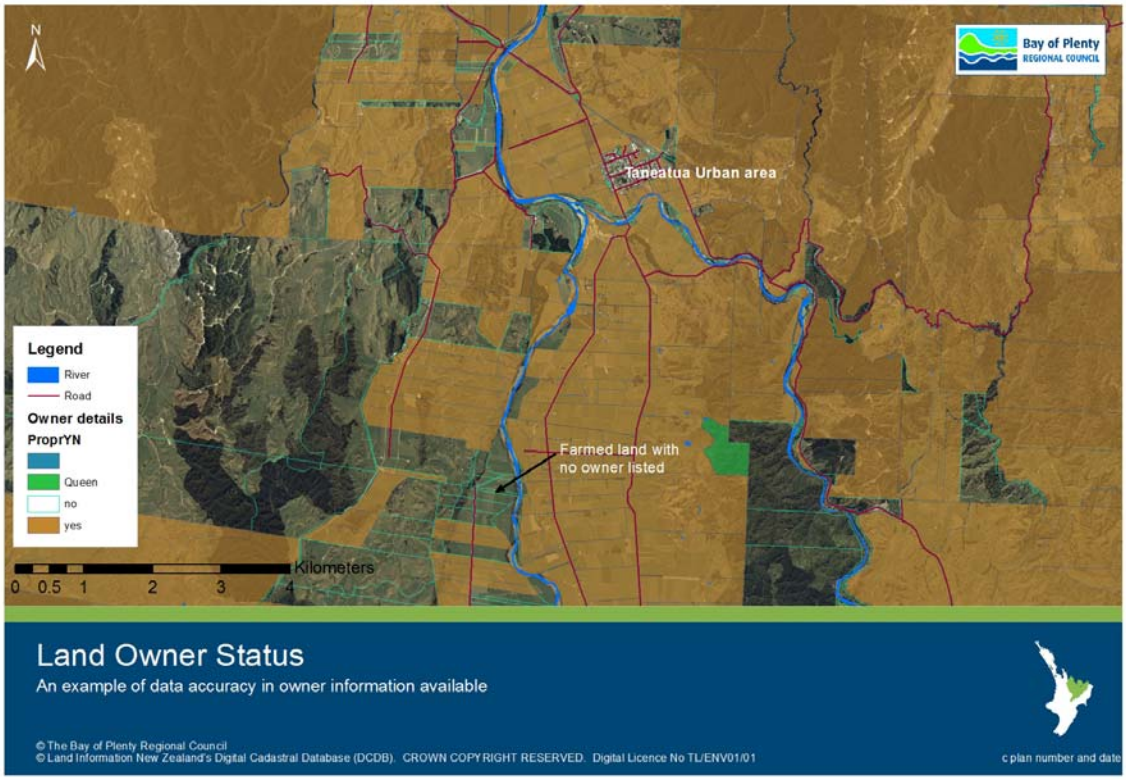

Figure 1: GIS land owner status mapping example.

- Where a property is made up of more than one parcel and these parcels are separated from each other so as they have no touching boundaries, for example where a property is found on either side of a road, railway or waterway, in this situation the GIS processing will not have identified that the parcels should be counted as one property and so some over-estimation of property numbers will have occurred.
- If a group of parcels is run as one property but the individual parcels have different owner details this will introduce some over-estimation of property numbers within a catchment, for example a husband is named as owner of one parcel and the wife of the neighbouring parcel.
- Where a property is within more than one catchment the GIS processing will split the property into parts according to the catchment lines. This means that some properties will be counted more than once. This will lead to some over-estimation, since it is currently impossible to know which catchment they will take water from, or how much of their water they will take from each catchment, over-estimation in this case is considered the safest option.

1.9 Spreadsheet processing

Once the GIS processing was done to assign a catchment to each property the resulting information was exported into excel for further processing. The following steps were taken within excel:

- Properties with no owner information or that are crown owned were deleted. These areas include national parks, reserves, roads, railways and waterways. It was assumed that they would have no permitted take.
- Properties were sorted into their catchment groups and the number of properties within each catchment was calculated.
- This information was then put into the model.
- The number of consented takes for each catchment was taken off the total number of properties in each catchment, this resulting number was then multiplied by 50 to get the maximum permitted take volume per catchment in m^3/day; 15 to get the maximum permitted surface water take volume per catchment; and 35 to get the maximum permitted groundwater take volume per catchment.
- As a comparison, the numbers defined in the model for addresses per catchment, and number of households per catchment, were also multiplied by 50; 15; and 35, to gauge the potential permitted m^3/day from surface and groundwater; surface water only; and groundwater only respectively.
- The calculations and results are in the model spreadsheet titled ‘Master spreadsheet Permitted Takes Model 3 March 2012.xlsx’.

Part 5: Running the model

1.10 What the model does

The model takes inputted raw data, makes a series of calculations, outputting results that provide an estimate of how much water is potentially being taken under the permitted takes rule, all done on a surface water catchment by catchment basis. Note that all urban areas have been removed from the model as town supply water use is accounted for under consented water takes.

1.11 How the model is set out

The model is located within a spreadsheet, 'Master spreadsheet Permitted Takes Model 3 March 2012.xlsx'. The model itself is held in the page titled 'Master' and contains the worst case scenario data and results. The other pages within the spreadsheet hold raw data, research data, tables for the report, calibration data and investigations.

The model itself is set out in sections. Firstly the catchments are set out vertically in the first three columns of the spreadsheet. From here across the sheet the data is set out as such, population and property statistics; number of consents held per catchment; calculated domestic water use; stock numbers and water requirement; calculated stock water use; non-AgriBase™ land areas and calculation of stock water requirements. And finally summary data of potential water use requirements for each catchment under the permitted take rule.

Note further data is included in the spreadsheet page 'Water Use BOP', including the AgriBase™ forestry, goats and small stock numbers (excluding goats), also the non-AgriBase™ beef only calculations. If subsequent model adaptions make them necessary, then these data sets can be used.

1.12 How the model works

The model works on a surface water catchment by catchment basis, so all domestic and stock data has been broken up into the relevant catchments via GIS processing.

The model is run by entering sets of raw data for each catchment, there are four sets of raw data that need to be inputted into the model to enable acceptable results. This data is then processed via spreadsheet math formulas and results are outputted for each catchment. The details of each of the sets of data is outlined below, along with an explanation of the processing that takes place within the spreadsheet with the raw data.

1.12.1 Population statistics and domestic water use

There are two sets of data here:

- Data gathered from New Zealand census data (in this instance 2006 data) including number of households per catchment, and population per catchment.
- Data on the numbers of addresses per catchment (calculated via GIS).

The census data on population has been divided by the number of households to give an estimate of the number of people per household in the catchment.

The number of addresses per catchment has been multiplied by the estimated number of people per household to get an estimation of population per catchment based on address point data. This is the data that is given the most credit and is therefore used further in the model, with the other population statistics kept for comparison purposes.

A third set of data called '# Properties', shows the results of the GIS processing outlined in Part 4 of this report, and estimate of the number of properties with owners in the Bay of Plenty. This data feeds into the worst case scenario calculations at the end of the spreadsheet. This provides the potential water volumes per catchment that could be taken as permitted.

Electricity point data is available in 'Water Use BOP' spreadsheet tab, however it is considered to be unreliable compared to the other data sets and is not used further in the model.

1.12.2 AgriBase™ stock water use

The data obtained through AgriBase™ has been entered for each catchment, beef, dairy, deer, forestry, goat, sheep, large stock and small stock are all detailed in 'Water Use BOP' tab. Note that although the specific information for forestry and goats is included, the forestry information is not used in any model calculations and the goat information is added to the small stock numbers (see cell Z1 'Water Use BOP') and applied to the 'Master' model this way.

Calculations of stock ADD and PDD have been done by taking the number of each stock type in each catchment and multiplying this by the relevant (ADD or PDD) water use requirements of that type of stock per day. This data has been sourced from the Aquas 2007 report page 23. For dairy, the shed washdown water per head has also been added to the drinking water per head. This data is linked to 'Master' from the 'Regional Water Use' tab of the spreadsheet.

The requirements for each stock type is then added together, then the stock water requirements accounted for through consented takes is subtracted to give the total (ADD or PDD) water requirements of stock within the catchment. The stock numbers are for the whole catchment and so the water requirements of stock on farms with consented takes is included in the number, which is why this needs to be subtracted to get an idea of the numbers taking water via permitted takes.

1.12.3 Consented takes stock water use

For each catchment the numbers of stock housed on farms where consented takes are active has been entered. The stock has been divided up into the same categories as the AgriBase™ stock statistics. As has been done with the AgriBase™ stock numbers, the consented stock ADD and PDD has been calculated.

This is important because the AgriBase™ data includes farms taking water via permitted takes and those via consents. So the water requirements of properties with consented takes needs to be taken away from the catchment total in order to get the permitted takes water requirements.

1.12.4 Non-AgriBase™ stock water use

Determine area

The raw data entered into the speadsheet in the Land Coverage – Non-AgriBase™ section of the spreadsheet (High Producing Grassland, Low Producing Grassland, Land with no Livestock and AgriBase™ Dairy) has been sourced from LINZ 2001 Land Cover Database. GIS calculations have been done to determine these numbers, this information is held in the GIS layer 'BOP.Water_AgriBase_LCDB2_Catchments'.

Determine stocking rates

Two figures have been defined to determine the number of stock that high and low producing grassland can support:

- New Zealand Dairy Statistics suggest an average stocking rate of 2.83 cows/ha for dairy cows (LIC 2009).
- BOPRC land management staff suggest that a figure of 2.6 beef animals/ha is appropriate to the Bay of Plenty region.

The model uses a stocking rate of 2.8 dairy cows/ha for high producing grassland and 2.6 beef/ha for low producing grassland.

Determine water use

These figures are multiplied by the area of high or low producing grassland in the catchment to estimate the stock numbers for the areas not covered by AgriBase™ data. The ADD and PDD stock drinking water requirements are also calculated to determine the amont of water used by stock for this area.

Calculation

The processed data in this section is calculated as follows:

(Area of high producing grassland * 2.8 stocking rate for dairy* the ADD/PDD for dairy drinking water and shed washdown requirements l/h/day) + (Area of low producing grassland * 2.6 stocking rate for beef * the ADD/PDD for beef drinking water requirements l/h/day)/(factors to account for units).

The figure ADD/PDD for AgriBase™ and non-AgriBase™ is then added to give the overall amount of water likely to be used in the catchment by stock (see column 'Total stock water').

1.12.5 Worst Case Scenario working

This section is found at the end of the 'Master' spreadsheet. The worst case for a catchment would be that the entire permitted water allowance was taken each day by all properties within the catchment. To estimate how much water this would be for each catchment the number of properties (defined by the GIS processing described in Section 4) has been multiplied by 15 (the max permitted take from surface water per property in m^3/day), 35 (the max permitted take per property from ground water in m^3/day), and 50 (the total max permitted take per property in m^3/day).

This has also been done for the number of addresses and the number of households for the purpose of comparison.

1.13 Running the model

To run the model you will need the relevant sets of raw data for each catchment, there are four sets of raw data that need to be inputted into the model to enable acceptable results. This data is then processed via speadsheet math formulas and results are automatically outputted for each catchment.

The data you need in order to run the model is outlined below:

- Population statistics per catchment.
- AgriBase™ stock numbers per catchment.
- Number of consented water takes per catchment.
- Number of stock on properties with consented takes per catchment.
- Areas of high producing and low producing grassland per catchment for locations not covered by AgriBase™ data.

Much of this data will need to be gathered and processed in ArcGIS in order to arrange the data on a per catchment basis before it is able to be put into the model. See Part 3 and 4 of this report for details of GIS processing required.

1.14 Possible future scenarios

Possible model runs for future consideration:

- Horticulture, this needs to be considered carefully. It may be an increasing industry, how will this affect water needs, changing land use.
- Areas of forestry being converted to dairy, beef or sheep farming.
- Catchments where farm irrigation needs may be likely to increase.
- Increase in population in rural areas.
- Increased number of lifestyle blocks, population moving out of urban areas to rural.

1.15 Model sensitivity

Brown, et. al. (2007) ran a series of sensitivity tests on the Waikato Regional Council model in order to identify which parameters have the most influence on results. Considering that water use estimates for the Bay of Plenty have been based on similar figures to those of Waikato Regional Council, it is considred that the same sensitivities would apply.

Those parameters having the greatest influence on results require the greatest level of accuracy in order for the model to be applicable. Brown, et. al. (2007) suggests the model is most sensitive to changes in dairy numbers and people numbers. This is mostly due to their high requirement for water.

A large change in beef numbers, on the other hand had an insignificant effect. A 50% increase in beef stock resulted in a 1.5% increase in water use, while an equivalent increase in dairy water use resulted in a 31% increase in water use Brown, et al. (2007).

The accuracy of stock estimates for the Bay of Plenty model is limited by AgriBase™ 2010 data and its associated accuracies. This data is supplied by the farmer but may change over time. Concerns of model accuracy should only be expected in those catchments with poor AgriBase™ coverage. Stock water use has been substantially assessed by several parties and water use statistics appear to be sound. Long term, dairy modernisation may result in increased water use but may be associated with increased efficiencies.

People numbers have been based on address title points and a comparison with meshblock data provided. It would appear that address data points over-estimate population figures, however population estimates for rural areas are low and would only have an influence if large scale land conversions occurred. Such an undertaking would more than likely fall into the urban category and should therefore not affect the model.

Part 6: Discussion of model results

There are two allocation regimes to be considered:

- First the allocation allowed under the RMA for reasonable domestic use and stock watering (not quantified, but qualified as having no more than minor environmental impacts).
- Second the allocation allowed under the WLP for any purpose being quantified as 15 m^3/day per property from surface water and 35 m^3/day per property from groundwater, qualified as having no more than minor environmental impacts.

Water can be taken from any sources (groundwater, stream, lake, wetland) to supply these requirements.

The results of RMA allocation allowance and WLP allocation allowance are shown in Table 1 as Average Daily Demand (ADD) and Peak Daily Demand (PDD) in m^3/day per greater catchment.

As it cannot be determined what resource the water is being taken from, it is not possible to assess the impact of the take on the resource. Therefore assessment of this figure against allocation can not be assessed for either surface water or groundwater. All that can be provided is the potential volume of water that can be taken from an area without Regional Council knowledge or any records kept, due to the fact that the take is allowed for under the RMA and WLP.

The model calculation for the RMA provision is based on the reasonable water use for the population and stock in a catchment. The model calculation for the WLP provisions are based on an allocated water use per property in a catchment. This data is shown in Appendix 4.1.

Table 1: Summary table estimating RMA and WLP potential permitted water use.

Greater catchment	RMA: total ADD m^3/day	RMA: total PDD m^3/day	WLP: 50 m^3/ day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Kaituna total	10642637	14642416	372550	11015187	15014966
Mōtū total	12638931	15939877	168200	12807131	16108077
Ōhiwa total	3702967	5058675	88600	3791567	5147275
Pongakawa total	4831799	6440846	85100	4916899	6525946
Rangitāiki total	15809907	21460292	275650	16085557	21735942
Tauranga total	9868145	14541571	499700	10367845	15041271
Waioeka total	4973591	6242721	86850	5060441	6329571
Waitahanui total	2011489	2866585	49350	2060839	2915935
Whakatāne total	7380662	10197376	104900	7485562	10302276
Total	71860129	97390358	1730900	73591029	99121258

The model does not calculate actual use as this information is not available. This information is not required for permitted activities. The model results are based on the assumption that the permitted provisions of the RMA and WLP are exercised to their fullest potential.

Part 7: Conclusion

The body of work contained in this report attempts to quantify water use, governed by Section 14(3)(b) RMA and Rules 38 and 41 WLP. The NES requires allocation to be set for water resources, therefore to implement this council needs to be able to quantify allocation to support permitted takes. The cumulative effect of permitted and consented allocation is unknown. There is concern that permitted use may result in an adverse effect on the environment and resource users.

One of the consequences of the way permitted takes are written is a substantial lack of knowledge with regards to the number, water source and volume of these takes within a catchment. Mostly due to there being no requirements for landowners to submit any information to Council. The permitted takes model, described in this report, is based on an assessment of those uses permitted by Section 14(3)(b) RMA and Rules 38 and 41 WLP.

BOPRC hold information for dairy discharge consents, providing some indication of dairy numbers, and have a good understanding of stocking densities for all livestock, however individual farm practices result in a high degree of variability and the potential for error. AgriBase™ (2010), produced by AsureQuality, provides detailed information on an individual farm basis, with regards to whole of farm land use practices. AgriBase™ describes 70% of the land area in the Bay of Plenty and includes stock numbers for primary stock land use in the Bay of Plenty i.e. dairy, beef, sheep and deer. Only 6% of the land area carrying stock, in the remaining land area, is not described by the AgriBase™ dataset. Consequently water use in these areas had little bearing on water budgets in the majority of the Bay of Plenty catchments.

Domestic water use and human populations are adequately described by Census 2006 and or address location data. Use of address data figures in the model appears to be slightly conservative. Water use figures applied by the model, as per stock water use have been substantially researched and adopted at national, regional and district council level across New Zealand.

The results, presented on a surface water catchment basis, and available from the BOPRC's GIS data store, provide insight into ADD and PDD for the major water uses (domestic and stock water). The ADD and PDD figures provide for fluctuation in seasonal water use and/or land use practice.

The model would benefit from 'ground truthing' against a catchment field survey of permitted takes to provide greater certainty around the results of the model.

The model presented here is the first step in assessing the quantity of water used by permitted takes from a catchment. Like all models, lumped catchment calculations do not describe the variability that may exist between individual domestic household use and or individual farm design and operating efficiencies. The model requires some thought surrounding its appropriateness in the catchment in which allocation is being considered.

Part 8: References

AgriBase™, 2010. AsureQuality – Independent Quality Assurance, AgriBase™ Data Environment Bay of Plenty Regional Council – July 2010. Auckland, New Zealand.

Aquas, 2007: Reasonable Stock Water Requirements – Guidelines for Resource Consent Applications. Technical Report for Horizons Regional Council – December 2007.

Banks, B (2011). Land Management Officer, Bay of Plenty Regional Council, May 2011.

Brown, E. Clements, B and Haigh, A. 2007: A Model for Assessing the Magnitude of Unconsented Surface Water Use in the Waikato Region. Environment Waikato Technical Report 2007/47. ISSN 1172-4005.

Census, 2006. Statistics New Zealand, GIS Datasets supplied to the Bay of Plenty Regional Council. http://www.stats.govt.nz/Census/2006CensusHomePage.aspx (April, 2011).

DBH, 2007: Building Code Review Consultation, Department of Building and Housing, Wellington, New Zealand. http://wwwdbh.govt.nz (April 2011).

EBOP, 2006. Dealing with your wastewater – A guide to the On-Site Effluent Treatment Regional Plan 2006. 628.543. Bay of Plenty, 17574 and 17575.

Fleming, P.2003: Farm Technical Manual. Lincoln University, Farm Management Group, Christchurch New Zealand.

HRC, 2006. Assessments of the Proposed Water-Use Guidelines for Public Water Supplies: Technical report prepared for Horizons Regional Council by Aquas Consultants Ltd.

LIC, 2009: New Zealand Dairy Statistic 2008-2009, Livestock Improvement Corporation; and

LINZ, 2001. Land Cover Database, LCDB2 produced by Land Information New Zealand. www.**linz**.govt.**nz**.

Lumsden, M. (2011). Land Management Officer - Bay of Plenty Regional Council, May 2011.

TCC, 2011: Water – How we use it and how to use less, Tauranga City Council, Tauranga, New Zealand. http://www.tauranga.govt.nz/sustainable-living/water.aspx (15 March 2011).

MoH, 2006. Household Water Supplies: The Selection, Operation and Maintenance of Individual Household Water Supplies. Ministry of Health, Wellington, New Zealand.

MoED, 2006. Future Trends in Water Use. Ministry for Economic Development, Wellington, New Zealand. http://www.med.govt.nz/templates/MultipageDocumentPage 12538.aspx#P2589_61514 (11 March 2011).

Mackay, D (2011). Water Management – Consents Officer, April 2011.

Pickles, S (2011) Pollution Prevention Team Leader, Bay of plenty Regional Council, April 2011.

Appendices

Appendix 1:
Domestic water use

Appendix 1 – Estimated domestic water use per catchment based on population, household, address and consent data (Master spreadsheet A2:N167)

CATCHMENTS			POPULATION STATISTICS					# Properties	Consents	Domestic water use (m^3/d)			
			Meshblock (Census 2006)			GIS address	Address pop		GW+SW	StatsNZ (2006) pop		Address pop	
GREATER	ID	CATCHMENT	Households	Population	Pop/house	# Addresses	Address*P/h		# Consented takes	Pop ADD	Pop PDD	Addr_ADD	Addr_PDD
Kaituna	17	Maketu Estuary Coastal	297.0	803.6	2.7	493	1334.1	234	0	144650	241083	240141	400235
Kaituna	30	Mangorewa	227.1	673.5	3.0	247	732.7	465	10	115887	193145	126539	210898
Kaituna	54	Lake Rotoiti	387.8	1166.7	3.0	920	2767.5	766	2	208914	348190	497066	828444
Kaituna	59	Hauraki	123.1	355.0	2.9	119	343.1	201	0	63898	106497	61755	102925
Kaituna	60	Awahou	116.7	326.1	2.8	112	313.0	162	1	58186	96977	55842	93069
Kaituna	62	Waiteti	334.8	894.0	2.7	394	1052.0	363	0	160927	268212	189360	315600
Kaituna	71	Waimehia area	62.3	162.5	2.6	131	341.5	153	1	28786	47977	61007	101679
Kaituna	73	Awahou Point area	18.1	50.5	2.8	27	75.3	38	0	9095	15159	13560	22600
Kaituna	78	Okawa Bay area	37.3	95.0	2.5	89	226.9	23	0	17093	28488	40839	68065
Kaituna	79	Pohue Bay area	101.3	328.6	3.2	233	755.7	203	1	58564	97607	135449	225748
Kaituna	80	Waiohewa	52.2	169.6	3.2	105	341.2	198	2	29349	48915	60243	100404
Kaituna	84	Waimata	3.5	11.9	3.4	0	0.0	16	0	2142	3570	0	0
Kaituna	87	Ngongotaha	207.1	620.8	3.0	321	962.1	315	5	109050	181750	170483	284139
Kaituna	88	Waiowhiro area	1.0	4.8	4.8	0	0.0	8	0	859	1431	0	0
Kaituna	90	Rotokawa area	48.1	136.5	2.8	55	156.1	131	1	24054	40089	27589	45982
Kaituna	94	Utuhina	43.3	121.5	2.8	28	78.6	154	0	21863	36438	14147	23579
Kaituna	102	Puarenga	46.6	140.5	3.0	30	90.4	106	1	24740	41234	15727	26212
Kaituna	158	Hamurana area	286.7	787.7	2.7	332	912.3	305	0	141791	236319	164218	273697
Kaituna	159	Hururu	16.7	55.8	3.3	24	80.0	54	0	10037	16728	14407	24011
Kaituna	160	Upper Kaituna	63.0	169.4	2.7	60	161.4	218	3	29036	48393	27598	45996
Kaituna	161	Parawhenuamea	168.4	491.0	2.9	251	731.8	412	20	77887	129812	121232	202053
Kaituna	162	Te Puke East	56.3	141.7	2.5	81	204.0	436	3	24144	40240	35366	58943
Kaituna	163	Waiari	187.6	536.3	2.9	199	568.7	466	10	91383	152304	97226	162044
Kaituna	164	Ohineangaanga	75.6	200.1	2.6	122	323.2	643	3	34593	57655	56741	94568
Kaituna	165	Raparapahoe	155.4	424.9	2.7	184	503.2	407	9	72047	120078	86139	143565
Kaituna	166	Rangiuru Soiuth	16.7	52.0	3.1	47	146.2	82	5	6561	10935	23512	39187
Kaituna	167	Kopuaroa	125.0	343.2	2.7	133	365.2	228	7	58314	97190	62278	103797
Kaituna	168	Papamoa	36.1	101.3	2.8	36	101.1	72	0	18238	30396	18197	30329
Kaituna	169	Lower Kaituna	427.8	1237.4	2.9	438	1266.9	760	84	178992	298320	184302	307171
Motu	4	Tahurua Coastal	5.6	14.1	2.5	0	0.0	3	0	2533	4221	0	0
Motu	5	Whangaparaoa	28.4	70.9	2.5	37	92.5	86	0	12762	21270	16650	27750
Motu	6	Waiokaha Coastal	63.0	148.3	2.4	143	336.7	283	0	26692	44487	60606	101010
Motu	12	Waikura	20.3	45.7	2.3	2	4.5	13	0	8228	13713	812	1353
Motu	13	Raukokore area	44.8	102.6	2.3	2	4.6	40	0	18473	30789	824	1374

CATCHMENTS			POPULATION STATISTICS					# Properties	Consents	Domestic water use (m^3/d)			
			Meshblock (Census 2006)			GIS address	Address pop		GW+SW	StatsNZ (2006) pop		Address pop	
GREATER	ID	CATCHMENT	Households	Population	Pop/house	# Addresses	Address*P/h		# Consented takes	Pop ADD	Pop PDD	Addr_ADD	Addr_PDD
Motu	15	Waikawa Coastal	39.8	97.3	2.4	114	279.0	232	1	17074	28456	49776	82960
Motu	19	Kereu	50.7	134.8	2.7	14	37.2	44	0	24264	40440	6700	11167
Motu	21	Te Kaha Coastal	118.6	319.4	2.7	197	530.7	504	1	57009	95015	95039	158398
Motu	26	Mangahaupapa	21.6	51.6	2.4	0	0.0	7	0	9283	15471	0	0
Motu	31	Haparapara area	37.4	103.3	2.8	1	2.8	20	0	18590	30984	497	828
Motu	33	Waikakariki	1.8	6.3	3.5	0	0.0	7	0	1134	1890	0	0
Motu	35	Pokohinu Coastal	13.0	34.6	2.7	72	191.2	156	0	6223	10371	34411	57351
Motu	41	Motu area	79.3	250.5	3.2	154	486.7	673	0	45083	75138	87606	146009
Motu	43	Whituare Coastal	2.0	6.3	3.1	12	37.7	137	0	1130	1884	6782	11304
Motu	45	Mangatutara	7.0	24.9	3.6	0	0.0	0	0	4477	7461	0	0
Motu	46	Hawai	16.3	59.0	3.6	1	3.6	19	0	10624	17706	653	1088
Motu	49	Pehitaiti Coastal	26.3	80.2	3.1	34	103.7	72	0	14431	24051	18670	31116
Motu	51	Torere	32.5	92.9	2.9	36	102.9	101	0	16722	27870	18529	30881
Motu	52	Omarumutu Coastal	99.6	268.4	2.7	136	366.4	383	2	47340	78901	64983	108304
Motu	53	Te Kahika	3.3	13.5	4.0	0	0.0	1	0	2434	4056	0	0
Motu	66	Tirohanga Coastal	103.7	279.5	2.7	91	245.2	248	3	48857	81428	42678	71130
Motu	70	Waiaua	69.6	196.4	2.8	55	155.2	238	1	34837	58061	27435	45724
Motu	81	Rawea	15.1	36.0	2.4	13	31.1	80	0	6480	10800	5590	9317
Motu	93	Mangaotane	0.0	0.6	0.0	1	0.0	25	0	99	165	0	0
Ohiwa	48	Maraetotara Coastal	1.3	4.3	3.3	0	0.0	2	0	770	1284	0	0
Ohiwa	57	Wainui area	89.8	254.6	2.8	210	595.7	226	0	45833	76389	107219	178698
Ohiwa	63	Kutarere area	108.7	289.3	2.7	206	548.3	425	0	52069	86781	98695	164491
Ohiwa	64	Waiotahi	147.9	430.9	2.9	108	314.6	381	0	77564	129273	56631	94385
Ohiwa	65	Waiotahi Beach Coastal	69.9	178.4	2.6	217	554.2	292	1	31660	52766	99295	165492
Ohiwa	77	Nukuhou	157.5	473.6	3.0	735	2210.3	450	3	83619	139365	396225	660376
Pongakawa	16	Newdicks Coastal	64.5	155.8	2.4	52	125.6	75	0	28039	46731	22605	37675
Pongakawa	20	Pukehina Beach Coastal	99.7	244.8	2.5	266	653.0	27	0	44064	73440	117539	195899
Pongakawa	22	Kaikokopu area	241.7	694.0	2.9	420	1206.1	363	30	109404	182340	201594	335991
Pongakawa	23	Pongakawa area	139.5	403.8	2.9	158	457.2	300	28	58096	96827	67711	112852
Pongakawa	24	Pukehina Coastal	317.7	799.9	2.5	440	1107.7	155	1	143531	239218	198939	331565
Pongakawa	25	Wharere	175.6	553.3	3.2	261	822.3	387	27	84275	140459	132699	221165
Pongakawa	27	Ohinepanea Coastal	104.2	279.3	2.7	122	326.9	195	16	42548	70913	51128	85214
Pongakawa	28	Pokopoko	220.9	636.6	2.9	173	498.7	331	29	99543	165905	74716	124526
Rangitaiki	36	Mangamako area	514.0	1582.8	3.1	1207	3716.7	955	66	248320	413867	632426	1054044

CATCHMENTS			POPULATION STATISTICS					# Properties	Consents	Domestic water use (m^3/d)			
			Meshblock (Census 2006)			GIS address	Address pop		GW+SW	StatsNZ (2006) pop		Address pop	
GREATER	ID	CATCHMENT	Households	Population	Pop/house	# Addresses	Address*P/h		# Consented takes	Pop ADD	Pop PDD	Addr_ADD	Addr_PDD
Rangitaiki	42	Lower Tarawera area	1169.2	3461.4	3.0	2504	7413.2	2219	67	587341	978901	1298665	2164442
Rangitaiki	47	Waikamihi	37.6	110.6	2.9	89	261.7	96	0	19904	33174	47102	78503
Rangitaiki	50	Otakiri	11.5	30.3	2.6	48	126.6	41	1	4972	8287	22319	37198
Rangitaiki	61	Mangawiki	56.6	158.0	2.8	154	429.9	151	9	23915	39859	72867	121445
Rangitaiki	83	Waikanapiti	25.4	82.7	3.3	31	101.0	214	0	14886	24810	18175	30292
Rangitaiki	92	Lake Okataina	35.1	110.0	3.1	2	6.3	21	0	19795	32991	1129	1881
Rangitaiki	99	Mangate	0.0	0.1	0.0	0	0.0	5	0	22	36	0	0
Rangitaiki	100	Mangawhio	0.2	0.6	3.5	2	7.0	12	0	101	168	1260	2100
Rangitaiki	101	Lake Okareka	174.6	433.7	2.5	282	700.5	172	1	77621	129368	125642	209403
Rangitaiki	104	Lake Tarawera	141.9	380.8	2.7	524	1406.0	346	1	68057	113429	252601	421002
Rangitaiki	105	Waiaute	12.2	37.7	3.1	2	6.2	23	0	6793	11322	1115	1858
Rangitaiki	107	Lake Tikitapu	12.2	32.3	2.7	1	2.7	4	0	5819	9699	477	795
Rangitaiki	108	Lake Rotokakahi	5.1	12.6	2.5	3	7.5	21	0	2264	3774	1345	2242
Rangitaiki	113	Lake Rotomahana	41.9	120.1	2.9	66	189.2	95	0	21622	36036	34050	56750
Rangitaiki	114	Pokairoa	36.5	101.2	2.8	55	152.3	112	1	17716	29526	26918	44863
Rangitaiki	117	Lake Rerewhakaaitu	55.9	149.3	2.7	84	224.4	133	1	26384	43974	39903	66505
Rangitaiki	120	Okaro	6.3	18.8	3.0	5	14.9	17	0	3380	5634	2674	4457
Rangitaiki	126	Horomanga	111.6	341.1	3.1	272	831.4	210	22	49300	82166	137540	229233
Rangitaiki	130	Whirinaki	104.7	284.0	2.7	478	1297.3	201	6	48192	80321	230581	384302
Rangitaiki	131	Pouarua area	24.9	82.4	3.3	12	39.8	44	1	14237	23728	6566	10944
Rangitaiki	132	Otamatea	11.8	39.1	3.3	33	109.8	24	0	7045	11742	19770	32949
Rangitaiki	154	Waikowhewhe area	70.6	252.5	3.6	206	737.2	168	5	42227	70379	129484	215806
Rangitaiki	155	Kaingaroa area	215.9	674.7	3.1	371	1159.7	185	8	116950	194917	204248	340413
Rangitaiki	156	Wheao	27.9	85.5	3.1	88	269.9	223	1	14833	24721	48025	80042
Rangitaiki	157	Mangatiti area	4.2	12.9	3.1	23	70.3	11	0	2327	3879	12655	21091
Tauranga Harbour	1	Tuapiro	178.5	498.2	2.8	140	390.8	252	26	76617	127695	57282	95470
Tauranga Harbour	2	Uretara	187.9	522.5	2.8	279	775.9	308	5	91554	152591	137156	228594
Tauranga Harbour	3	Te Mania	62.9	163.6	2.6	457	1188.1	386	8	25710	42850	210114	350190
Tauranga Harbour	10	Oturu	99.0	306.7	3.1	228	706.3	177	1	54645	91075	126575	210959
Tauranga Harbour	11	Kopurererua	409.1	1235.0	3.0	627	1893.0	819	20	211428	352380	329863	549772
Tauranga Harbour	14	Waimapu	657.2	1918.8	2.9	985	2875.8	973	26	331717	552861	503986	839977
Tauranga Harbour	18	Wairoa	146.2	426.0	2.9	143	416.6	250	1	76156	126926	74472	124120
Tauranga Harbour	58	Wairoa	528.7	1548.1	2.9	803	2351.2	972	14	271283	452138	415834	693057
Tauranga Harbour	133	Waiau	368.9	927.6	2.5	623	1566.5	457	2	166066	276777	281070	468449

CATCHMENTS			POPULATION STATISTICS					# Properties	Consents	Domestic water use (m^3/d)			
			Meshblock (Census 2006)			GIS address	Address pop		GW+SW	StatsNZ (2006) pop		Address pop	
GREATER	ID	CATCHMENT	Households	Population	Pop/house	# Addresses	Address*P/h		# Consented takes	Pop ADD	Pop PDD	Addr_ADD	Addr_PDD
Tauranga Harbour	134	Waihi Beach	232.0	549.6	2.4	708	1677.1	793	0	98932	164886	301873	503122
Tauranga Harbour	135	Tahawai	48.2	135.9	2.8	122	344.2	184	5	21918	36529	59415	99025
Tauranga Harbour	136	Ongare/Tanners Point	300.6	789.4	2.6	400	1050.6	385	36	125074	208457	172086	286810
Tauranga Harbour	137	Katikati Streams	41.1	138.8	3.4	53	179.0	69	1	24367	40612	31606	52677
Tauranga Harbour	138	Te Rereatukahia	109.9	310.1	2.8	134	378.1	208	10	50741	84569	62976	104959
Tauranga Harbour	139	Waitekohe	111.7	295.0	2.6	146	385.5	202	13	46923	78205	63216	105361
Tauranga Harbour	140	Waione	90.2	248.0	2.8	153	420.9	245	23	33258	55429	64366	107277
Tauranga Harbour	141	Aongatete	186.8	521.5	2.8	176	491.3	317	18	84833	141388	79391	132318
Tauranga Harbour	142	Whatakao	103.0	297.9	2.9	142	410.7	230	9	48935	81558	69238	115396
Tauranga Harbour	143	Wainui	191.0	517.0	2.7	229	619.9	397	10	88189	146982	106716	177859
Tauranga Harbour	144	Apata	192.0	548.3	2.9	244	696.7	332	7	95093	158488	121808	203014
Tauranga Harbour	145	Waipapa	405.5	1191.4	2.9	586	1721.6	628	14	207043	345072	302477	504128
Tauranga Harbour	146	Te Puna	173.0	511.1	3.0	319	942.3	392	7	88267	147112	165890	276483
Tauranga Harbour	147	Ohourere	104.6	300.0	2.9	124	355.6	162	0	53998	89997	64007	106678
Tauranga Harbour	148	Mangapapa/Opuiaki	97.1	285.1	2.9	30	88.1	144	0	51313	85521	15862	26436
Tauranga Harbour	149	Omanawa	235.3	690.2	2.9	203	595.4	389	15	116308	193847	99251	165418
Tauranga Harbour	150	Kaitemako	10.6	32.1	3.0	22	66.4	51	0	5769	9615	11951	19918
Tauranga Harbour	152	Waitao area	147.6	398.9	2.7	170	459.3	233	5	69374	115623	80249	133748
Tauranga Harbour	153	Maungatawa area	48.4	140.6	2.9	70	203.4	133	1	24787	41311	36097	60162
Tauranga Harbour	170	Matakana Island	65.8	184.6	2.8	67	187.9	188	5	30706	51177	31292	52153
Waioeka	67	Kukumoa Creek	74.5	192.0	2.6	150	386.8	246	4	32702	54503	67761	112935
Waioeka	68	Otara	106.6	308.9	2.9	78	226.0	500	7	51943	86571	37024	61706
Waioeka	72	Te Karaka Stream	66.1	173.3	2.6	27	70.8	114	2	30242	50404	11804	19674
Waioeka	74	Waioeka area	52.7	154.0	2.9	62	181.4	344	3	26144	43573	31067	51779
Waioeka	76	Apanui	115.5	341.7	3.0	114	337.2	354	14	54054	90089	53244	88740
Waioeka	89	Pakahi	18.1	47.6	2.6	14	36.8	74	0	8559	14265	6624	11040
Waioeka	95	Tutaetoko	9.2	20.7	2.3	9	20.3	29	0	3728	6213	3659	6098
Waioeka	103	Te Waiti	13.7	28.7	2.1	2	4.2	14	0	5164	8607	756	1260
Waioeka	106	Mangaoira	0.4	1.6	4.5	0	0.0	1	0	292	486	0	0
Waioeka	109	Tauranga	0.5	2.1	4.5	0	0.0	1	0	380	633	0	0
Waioeka	111	Waiata	0.8	3.4	4.5	0	0.0	7	0	616	1026	0	0
Waioeka	112	Wairata	5.5	19.6	3.6	7	25.0	32	0	3530	5883	4501	7501
Waioeka	115	Omaukora	4.1	10.8	2.7	0	0.0	2	0	1944	3240	0	0
Waioeka	118	Opato	14.4	38.8	2.7	1	2.7	15	0	6986	11643	487	811

CATCHMENTS			POPULATION STATISTICS					# Properties	Consents	Domestic water use (m^3/d)			
			Meshblock (Census 2006)			GIS address	Address pop		GW+SW	StatsNZ (2006) pop		Address pop	
GREATER	ID	CATCHMENT	Households	Population	Pop/house	# Addresses	Address*P/h		# Consented takes	Pop ADD	Pop PDD	Addr_ADD	Addr_PDD
Waioeka	124	Te Pato	0.5	2.2	4.5	0	0.0	3	0	394	657	0	0
Waioeka	127	Tataweka	0.1	0.5	4.3	0	0.0	1	0	92	153	0	0
Waioeka	129	Koranga	0.0	0.1	4.3	19	82.3	30	0	23	39	14820	24700
Waitahanui	29	Otamarakau Coastal	3.2	10.2	3.2	11	35.1	32	0	1832	3054	6319	10531
Waitahanui	32	Waitahanui	71.0	204.4	2.9	137	394.6	172	14	29530	49217	63768	106280
Waitahanui	34	Hauone Coastal	45.2	129.3	2.9	202	578.2	99	5	20692	34487	101504	169173
Waitahanui	37	Pikowai Coastal	20.1	50.8	2.5	100	252.5	77	1	8684	14474	44989	74981
Waitahanui	38	Ruataniwha Coastal	1.4	3.2	2.3	33	74.9	20	0	576	960	13481	22468
Waitahanui	39	Mimiha Coastal	60.6	155.0	2.6	202	516.7	186	0	27891	46485	93001	155001
Waitahanui	40	Ohinekoao Coastal	21.6	57.0	2.6	67	176.7	39	0	10267	17112	31803	53005
Waitahanui	55	Lake Rotoehu	55.6	166.0	3.0	129	384.8	119	0	29873	49788	69259	115432
Waitahanui	69	Lake Rotoma	64.7	173.2	2.7	397	1062.5	263	0	31183	51972	191252	318753
Whakatane	44	Whakatane Area	545.9	1720.6	3.2	1243	3917.8	819	19	298921	498202	694427	1157378
Whakatane	56	Waioho	102.7	320.3	3.1	260	810.8	189	4	55405	92342	143691	239485
Whakatane	82	Waimana	291.7	935.0	3.2	877	2811.2	506	2	167146	278577	504860	841433
Whakatane	91	Oromoeroa	214.2	794.6	3.7	758	2811.7	405	2	141689	236148	504768	841281
Whakatane	116	Kanihi	0.0	0.0	0.0	0	0.0	1	0	0	0	0	0
Whakatane	119	Waiiti	1.2	3.7	3.1	2	6.1	7	0	673	1122	1104	1839
Whakatane	121	Ohora	7.7	26.4	3.4	0	0.0	1	0	4748	7914	0	0
Whakatane	122	Tauranga	10.3	35.4	3.4	13	44.7	23	0	6376	10626	8039	13398
Whakatane	123	Ohane	0.8	2.9	3.6	0	0.0	1	0	515	858	0	0
Whakatane	125	Upper Whakatane	88.9	279.7	3.1	412	1296.5	162	0	50350	83916	233367	388946
Whakatane	128	Waikare	5.6	11.2	2.0	0	0.0	11	0	2020	3366	0	0
Totals			**17095.9**	**49088.7**		**29945**	**86634.1**	**35478**	**860.00**	**8387060**	**13978433**	**15145234**	**25242056**
Average					2.9								
Max					4.8								
Min					0.0								

Appendix 2:
Stock water use

Appendix 2 – Stock drinking water requirements (Aquas, 2007) + dairy shed use

Farming enterprise	Type of animal	Average daily demand (ADD) litres/head/day	Peak daily demand (PDD) litres/head/day
Dairy	Milking cow	45	70
	Dry stock	30	45
	Dairy shed use	70	70
Beef	Mature beef cattle, herd replacement stock and bulls	30	55
Sheep	Ewes, hoggets and rams	3	4.5
Deer	Hinds and stags (all ages)	6	12
Horses	Working horses	55	70
	Grazing horses	35	50
Goats	Milking goats	5	10
	Dry goats	3.5	7
Pigs	Mature pigs	11	18
	Brood sows	22	35
	Pigs up to 120 kg	7	11
Poultry *all figures are for litres/100 birds/day	Layer and breeder hens	30*	45*
	Non-laying hens and chickens	18*	29*
	Turkeys	55*	70*

NB: Green shaded data used in model.

Appendix 2.2 – AgriBase^{TM} estimated stock numbers (Master spreadsheet O2:AB164)

CATCHMENTS			STOCK NUMBERS (AgriBase™)						RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)		RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)	
							Apply beef	Apply sheep	ADD	PDD	ADD	PDD	ADD	PDD	ADD	PDD
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD
Kaituna	17	Maketu Estuary Coastal	27	161	0	0	0	2	8061	12764	19331	24034	8061	12764	19331	24034
Kaituna	30	Mangorewa	3169	7925	3053	11041	161	693	507117	822737	1061867	1377487	507117	822737	1061867	1377487
Kaituna	54	Lake Rotoiti	907	56	7	5849	20	43	48048	81503	51968	85423	48048	81503	51968	85423
Kaituna	59	Hauraki	529	1734	208	916	205	112	104382	168872	225762	290252	104382	168872	225762	290252
Kaituna	60	Awahou	626	2583	366	737	133	5636	160119	255225	340929	436035	160119	255225	340929	436035
Kaituna	62	Waiteti	1408	4700	884	4470	175	372	278820	448462	607820	777462	278820	448462	607820	777462
Kaituna	71	Waimehia area	721	690	214	849	108	708	61872	103465	110172	151765	61872	103465	110172	151765
Kaituna	73	Awahou Point area	16	12	443	65	0	5	3888	7351	4728	8191	3888	7351	4728	8191
Kaituna	78	Okawa Bay area	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kaituna	79	Pohue Bay area	175	0	177	160	21	94	7704	14047	7704	14047	7704	14047	7704	14047
Kaituna	80	Waiohewa	430	0	22	2228	13	109	20433	35146	20433	35146	20433	35146	20433	35146
Kaituna	84	Waimata	32	0	0	262	0	1	1749	2944	1749	2944	1749	2944	1749	2944
Kaituna	87	Ngongotaha	1868	2689	912	11558	163	473	217974	356178	406204	544408	217974	356178	406204	544408
Kaituna	88	Waiowhiro area	63	0	0	495	4	1	3498	5917	3498	5917	3498	5917	3498	5917
Kaituna	90	Rotokawa area	791	0	12	4041	66	115	38250	65981	38250	65981	38250	65981	38250	65981
Kaituna	94	Utuhina	1311	0	682	5218	28	1073	63135	110139	63135	110139	63135	110139	63135	110139
Kaituna	102	Puarenga	928	2269	115	4834	2	54	75042	121533	233872	280363	75042	121533	233872	280363
Kaituna	158	Hamurana area	344	801	923	2729	33	415	62325	102029	118395	158099	62325	102029	118395	158099
Kaituna	159	Hururu	519	1688	1122	2876	10	140	107610	174291	225770	292451	107610	174291	225770	292451
Kaituna	160	Upper Kaituna	732	1078	346	3949	31	417	61350	97278	136810	172738	61350	97278	136810	172738
Kaituna	161	Parawhenuamea	606	1211	40	1510	1726	313	73020	116988	157790	201758	73020	116988	157790	201758
Kaituna	162	Te Puke East	119	0	0	121	4	14	4095	7373	4095	7373	4095	7373	4095	7373
Kaituna	163	Waiari	1579	1131	519	1649	26	194	105507	178483	184677	257653	105507	178483	184677	257653
Kaituna	164	Ohineangaanga	1541	1776	1221	3521	246	51	108192	185686	232512	310006	108192	185686	232512	310006
Kaituna	165	Raparapahoe	1238	1169	530	2725	27	2645	98691	162679	180521	244509	98691	162679	180521	244509
Kaituna	166	Rangiuru Soiuth	55	266	0	96	9	25	1200	1978	19820	20598	1200	1978	19820	20598
Kaituna	167	Kopuaroa	606	4877	0	762	37	69	221940	349410	563330	690800	221940	349410	563330	690800
Kaituna	168	Papamoa	120	1890	0	260	8	23	89739	140614	222039	272914	89739	140614	222039	272914
Kaituna	169	Lower Kaituna	1067	10566	74	658	37	239	419889	658910	1159509	1398530	419889	658910	1159509	1398530
Motu	4	Tahurua Coastal	182	16	0	621	2	3	8112	14048	9232	15168	8112	14048	9232	15168
Motu	5	Whangaparaoa	1061	744	0	2599	19	25	73752	123288	125832	175368	73752	123288	125832	175368
Motu	6	Waiokaha Coastal	1549	1060	0	9059	111	129	125064	206846	199264	281046	125064	206846	199264	281046
Motu	12	Waikura	2	0	0	0	0	1	63	115	63	115	63	115	63	115
Motu	13	Raukokore area	294	0	0	126	1	19	9285	16878	9285	16878	9285	16878	9285	16878

CATCHMENTS			STOCK NUMBERS (AgriBase™)						RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)		RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)	
							Apply beef	Apply sheep	ADD	PDD	ADD	PDD	ADD	PDD	ADD	PDD
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD
Motu	15	Waikawa Coastal	689	0	0	347	39	27	22962	41723	22962	41723	22962	41723	22962	41723
Motu	19	Kereu	542	0	0	200	21	21	17553	31960	17553	31960	17553	31960	17553	31960
Motu	21	Te Kaha Coastal	403	30	0	40	38	30	14790	26670	16890	28770	14790	26670	16890	28770
Motu	26	Mangahaupapa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motu	31	Haparapara area	5	0	0	0	2	1	213	390	213	390	213	390	213	390
Motu	33	Waikakariki	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motu	35	Pokohinu Coastal	319	11	0	0	23	16	10803	19652	11573	20422	10803	19652	11573	20422
Motu	41	Motu area	17	295	11	2	0	4	13869	21744	34519	42394	13869	21744	34519	42394
Motu	43	Whituare Coastal	127	0	0	30	9	12	4206	7669	4206	7669	4206	7669	4206	7669
Motu	45	Mangatutara	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motu	46	Hawai	135	151	0	0	2	6	10923	18132	21493	28702	10923	18132	21493	28702
Motu	49	Pehitaiti Coastal	90	438	0	0	6	29	22677	36071	53337	66731	22677	36071	53337	66731
Motu	51	Torere	106	229	0	0	4	19	13662	22166	29692	38196	13662	22166	29692	38196
Motu	52	Omarumutu Coastal	780	2161	2	272	84	146	123585	199146	274855	350416	123585	199146	274855	350416
Motu	53	Te Kahika	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motu	66	Tirohanga Coastal	950	1974	332	1547	28	197	122445	198210	260625	336390	122445	198210	260625	336390
Motu	70	Waiaua	478	2309	128	548	108	92	124173	198276	285803	359906	124173	198276	285803	359906
Motu	81	Rawea	895	131	0	2671	100	148	44202	76581	53372	85751	44202	76581	53372	85751
Motu	93	Mangaotane	513	0	0	3291	4	6	25401	43272	25401	43272	25401	43272	25401	43272
Ohiwa	48	Maraetotara Coastal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ohiwa	57	Wainui area	1140	1259	155	338	77	332	96105	159940	184235	248070	96105	159940	184235	248070
Ohiwa	63	Kutarere area	928	882	200	1906	93	381	78381	130587	140121	192327	78381	130587	140121	192327
Ohiwa	64	Waiotahi	2144	6030	92	1315	90	715	345012	555209	767112	977309	345012	555209	767112	977309
Ohiwa	65	Waiotahi Beach Coastal	329	1173	0	132	5	441	64524	103059	146634	185169	64524	103059	146634	185169
Ohiwa	77	Nukuhou	4764	7688	366	6464	940	1009	541113	888838	1079273	1426998	541113	888838	1079273	1426998
Pongakawa	16	Newdicks Coastal	20	262	0	1	0	1	12396	19449	30736	37789	12396	19449	30736	37789
Pongakawa	20	Pukehina Beach Coastal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pongakawa	22	Kaikokopu area	781	7471	18	774	74	176	305628	481224	828598	1004194	305628	481224	828598	1004194
Pongakawa	23	Pongakawa area	2954	12965	72	5423	72	3901	454605	726131	1362155	1633681	454605	726131	1362155	1633681
Pongakawa	24	Pukehina Coastal	72	2532	0	0	6	27	116361	181652	293601	358892	116361	181652	293601	358892
Pongakawa	25	Wharere	1705	10992	392	2484	47	530	336012	535664	1105452	1305104	336012	535664	1105452	1305104
Pongakawa	27	Ohinepanea Coastal	411	4057	0	444	27	145	128142	201538	412132	485528	128142	201538	412132	485528
Pongakawa	28	Pokopoko	3799	3092	1203	7979	78	721	90438	166202	306878	382642	90438	166202	306878	382642
Rangitaiki	36	Mangamako area	2059	24346	255	385	345	817	962115	1515685	2666335	3219905	962115	1515685	2666335	3219905

CATCHMENTS			STOCK NUMBERS (AgriBase™)						RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)		RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)	
							Apply beef	Apply sheep	ADD	PDD	ADD	PDD	ADD	PDD	ADD	PDD
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD
Rangitaiki	42	Lower Tarawera area	4721	30111	165	770	663	195470	1707723	2675240	3815493	4783010	1707723	2675240	3815493	4783010
Rangitaiki	47	Waikamihi	782	1623	10	2718	14	59	105306	170007	218916	283617	105306	170007	218916	283617
Rangitaiki	50	Otakiri	516	1091	0	735	5	25	28257	48158	104627	124528	28257	48158	104627	124528
Rangitaiki	61	Mangawiki	879	2001	433	1275	30	196	77934	129588	218004	269658	77934	129588	218004	269658
Rangitaiki	83	Waikanapiti	11	0	0	0	1	1	363	665	363	665	363	665	363	665
Rangitaiki	92	Lake Okataina	165	0	224	743	0	9	8550	15147	8550	15147	8550	15147	8550	15147
Rangitaiki	99	Mangate	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rangitaiki	100	Mangawhio	5	0	0	1	0	0	153	280	153	280	153	280	153	280
Rangitaiki	101	Lake Okareka	315	0	285	3032	4	6	-2880	-3525	-2880	-3525	0	0	0	0
Rangitaiki	104	Lake Tarawera	1192	0	1907	11813	7	63	59766	104110	59766	104110	59766	104110	59766	104110
Rangitaiki	105	Waiaute	88	363	0	14	4	4	19149	30551	44559	55961	19149	30551	44559	55961
Rangitaiki	107	Lake Tikitapu	19	0	0	273	0	0	1389	2274	1389	2274	1389	2274	1389	2274
Rangitaiki	108	Lake Rotokakahi	358	0	105	2655	0	5	19350	32920	19350	32920	19350	32920	19350	32920
Rangitaiki	113	Lake Rotomahana	1109	4393	87	13226	17	80	271905	430361	579415	737871	271905	430361	579415	737871
Rangitaiki	114	Pokairoa	558	3941	2454	1981	16	83	198825	320267	474695	596137	198825	320267	474695	596137
Rangitaiki	117	Lake Rerewhakaaitu	182	4912	784	878	7	56	228393	358922	572233	702762	228393	358922	572233	702762
Rangitaiki	120	Okaro	178	233	51	1091	4	20	19584	31932	35894	48242	19584	31932	35894	48242
Rangitaiki	126	Horomanga	324	12546	109	354	3080	244	495006	794719	1373226	1672939	495006	794719	1373226	1672939
Rangitaiki	130	Whirinaki	347	1354	160	4526	60	45	74697	119111	169477	213891	74697	119111	169477	213891
Rangitaiki	131	Pouarua area	2826	2859	0	33507	7	35	-52179	-86141	147951	113989	0	0	147951	113989
Rangitaiki	132	Otamatea	2957	6051	8381	16428	2	21	94248	167883	517818	591453	94248	167883	517818	591453
Rangitaiki	154	Waikowhewhe area	965	926	0	555	117	143	50937	87978	115757	152798	50937	87978	115757	152798
Rangitaiki	155	Kaingaroa area	1156	4534	1679	5232	41	149	183276	296078	500656	613458	183276	296078	500656	613458
Rangitaiki	156	Wheao	660	779	355	963	35	59	44022	75006	98552	129536	44022	75006	98552	129536
Rangitaiki	157	Mangatiti area	2225	0	11007	21610	1	20	197712	351849	197712	351849	197712	351849	197712	351849
Tauranga Harbour	1	Tuapiro	1196	187	417	845	94	217	51600	91719	64690	104809	51600	91719	64690	104809
Tauranga Harbour	2	Uretara	562	1078	69	558	43	163	69237	112808	144697	188268	69237	112808	144697	188268
Tauranga Harbour	3	Te Mania	504	407	0	1027	71	133	22002	36966	50492	65456	22002	36966	50492	65456
Tauranga Harbour	10	Oturu	143	1	0	124	6	50	5037	9048	5107	9118	5037	9048	5107	9118
Tauranga Harbour	11	Kopurererua	1778	1351	2810	3268	126	603	145038	247965	239608	342535	145038	247965	239608	342535
Tauranga Harbour	14	Waimapu	4259	2391	473	6787	166	72546	470925	756319	638295	923689	470925	756319	638295	923689
Tauranga Harbour	18	Wairoa	1823	1456	1625	10406	57	434	164190	273600	266110	375520	164190	273600	266110	375520
Tauranga Harbour	58	Wairoa	3354	1309	1255	12235	190	1237	212358	360745	303988	452375	212358	360745	303988	452375
Tauranga Harbour	133	Waiau	119	66	22	108	10	33	7395	12614	12015	17234	7395	12614	12015	17234

CATCHMENTS			STOCK NUMBERS (AgriBase™)						RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)		RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)	
							Apply beef	Apply sheep	ADD	PDD	ADD	PDD	ADD	PDD	ADD	PDD
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD
Tauranga Harbour	134	Waihi Beach	31	0	0	57	4	2	1227	2191	1227	2191	1227	2191	1227	2191
Tauranga Harbour	135	Tahawai	410	208	122	466	36	134	23559	40195	38119	54755	23559	40195	38119	54755
Tauranga Harbour	136	Ongare/Tanners Point	266	498	0	90	14	70	30600	49725	65460	84585	30600	49725	65460	84585
Tauranga Harbour	137	Katikati Streams	10	186	0	0	0	2	8676	13579	21696	26599	8676	13579	21696	26599
Tauranga Harbour	138	Te Rereatukahia	323	471	0	116	20	177	17895	30630	50865	63600	17895	30630	50865	63600
Tauranga Harbour	139	Waitekohe	709	658	22	307	30	175	16365	31181	62425	77241	16365	31181	62425	77241
Tauranga Harbour	140	Waione	183	619	0	163	8	103	31716	50262	75046	93592	31716	50262	75046	93592
Tauranga Harbour	141	Aongatete	735	1218	324	557	162	476	85653	141097	170913	226357	85653	141097	170913	226357
Tauranga Harbour	142	Whatakao	852	539	127	1969	34	721	57489	96472	95219	134202	57489	96472	95219	134202
Tauranga Harbour	143	Wainui	1317	0	1110	1751	129	663	48114	87071	48114	87071	48114	87071	48114	87071
Tauranga Harbour	144	Apata	893	118	148	2212	53	346	40089	69813	48349	78073	40089	69813	48349	78073
Tauranga Harbour	145	Waipapa	1733	575	292	1590	126	1121	86790	149889	127040	190139	86790	149889	127040	190139
Tauranga Harbour	146	Te Puna	1665	999	197	3032	60	682	107523	181433	177453	251363	107523	181433	177453	251363
Tauranga Harbour	147	Ohourere	947	915	380	3797	30	395	75711	126204	139761	190254	75711	126204	139761	190254
Tauranga Harbour	148	Mangapapa/Opuiaki	223	119	118	2229	6	90	19890	32777	28220	41107	19890	32777	28220	41107
Tauranga Harbour	149	Omanawa	1101	2044	3	2558	81	358	135756	220423	278836	363503	135756	220423	278836	363503
Tauranga Harbour	150	Kaitemako	241	0	2	11	1	19	7362	13469	7362	13469	7362	13469	7362	13469
Tauranga Harbour	152	Waitao area	1484	2	401	3142	1030	240	87222	156911	87362	157051	87222	156911	87362	157051
Tauranga Harbour	153	Maungatawa area	315	150	0	465	22	121	14778	24862	25278	35362	14778	24862	25278	35362
Tauranga Harbour	170	Matakana Island	282	2381	0	30	39	27	103680	163238	270350	329908	103680	163238	270350	329908
Waioeka	67	Kukumoa Creek	665	2988	1	641	77	694	160725	255981	369885	465141	160725	255981	369885	465141
Waioeka	68	Otara	914	4782	1	1273	35	133	166617	266061	501357	600801	166617	266061	501357	600801
Waioeka	72	Te Karaka Stream	378	1052	72	104	24	92	58842	94390	132482	168030	58842	94390	132482	168030
Waioeka	74	Waioeka area	441	1668	1	668	32	194	91842	146666	208602	263426	91842	146666	208602	263426
Waioeka	76	Apanui	1387	5054	7	1837	57	136	10263	26761	364043	380541	10263	26761	364043	380541
Waioeka	89	Pakahi	287	0	0	97	15	9	9378	17087	9378	17087	9378	17087	9378	17087
Waioeka	95	Tutaetoko	96	164	1	100	12	34	11028	18035	22508	29515	11028	18035	22508	29515
Waioeka	103	Te Waiti	24	0	0	48	1	1	897	1596	897	1596	897	1596	897	1596
Waioeka	106	Mangaoira	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waioeka	109	Tauranga	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waioeka	111	Waiata	9	0	19	33	5	0	633	1147	633	1147	633	1147	633	1147
Waioeka	112	Wairata	484	0	21	1090	29	25	18861	33485	18861	33485	18861	33485	18861	33485
Waioeka	115	Omaukora	175	0	0	574	1	5	7017	12286	7017	12286	7017	12286	7017	12286
Waioeka	118	Opato	109	0	119	516	8	4	5784	10203	5784	10203	5784	10203	5784	10203

CATCHMENTS			STOCK NUMBERS (AgriBase™)						RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)		RMA stock water use (m^3/d)		RMA stock water use + WLP shed (m^3/d)	
							Apply beef	Apply sheep	ADD	PDD	ADD	PDD	ADD	PDD	ADD	PDD
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD	Stock ADD	Stock PDD	Stock + shed ADD	Stock+ shed PDD
Waioeka	124	Te Pato	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waioeka	127	Tataweka	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waioeka	129	Koranga	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waitahanui	29	Otamarakau Coastal	6	309	0	19	0	1	14145	22050	35775	43680	14145	22050	35775	43680
Waitahanui	32	Waitahanui	1842	4435	599	5933	50	203	174753	282519	485203	592969	174753	282519	485203	592969
Waitahanui	34	Hauone Coastal	731	3519	0	1789	18	69	42945	71220	289275	317550	42945	71220	289275	317550
Waitahanui	37	Pikowai Coastal	1821	667	0	2223	13	63	71085	120495	117775	167185	71085	120495	117775	167185
Waitahanui	38	Ruataniwha Coastal	110	41	0	211	0	4	5790	9888	8660	12758	5790	9888	8660	12758
Waitahanui	39	Mimiha Coastal	2615	1263	477	4078	61	599	154008	262361	242418	350771	154008	262361	242418	350771
Waitahanui	40	Ohinekoao Coastal	374	0	6	677	2	50	13497	24024	13497	24024	13497	24024	13497	24024
Waitahanui	55	Lake Rotoehu	118	856	26	1488	4	12	46836	73692	106756	133612	46836	73692	106756	133612
Waitahanui	69	Lake Rotoma	470	24	137	4061	0	26	28263	47566	29943	49246	28263	47566	29943	49246
Whakatane	44	Whakatane Area	3658	17636	309	3997	3780	959	650943	1041502	1885463	2276022	650943	1041502	1885463	2276022
Whakatane	56	Waioho	3866	5450	78	4561	84	280	378645	621297	760145	1002797	378645	621297	760145	1002797
Whakatane	82	Waimana	3854	10610	238	2079	151	636	585573	944449	1328273	1687149	585573	944449	1328273	1687149
Whakatane	91	Oromoeroa	1063	4567	30	333	143	137	186405	299925	506095	619615	186405	299925	506095	619615
Whakatane	116	Kanihi	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Whakatane	119	Waiiti	5	0	0	0	11	4	492	898	492	898	492	898	492	898
Whakatane	121	Ohora	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Whakatane	122	Tauranga	40	0	0	0	42	22	2526	4609	2526	4609	2526	4609	2526	4609
Whakatane	123	Ohane	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Whakatane	125	Upper Whakatane	660	0	70	4564	200	156	40380	69380	40380	69380	40380	69380	40380	69380
Whakatane	128	Waikare	36	0	0	0	38	0	2220	4070	2220	4070	2220	4070	2220	4070
Totals			**128004**	**304318**	**55421**	**349851**	**17404**	**306842**	**16191978**	**26276195**	**37494238**	**47578455**	**16191978**	**26276195**	**37494238**	**47578455**

NB: It is assumed that water use is covered by consent, therefore no permitted takes are calculated for in these catchments.

Appendix 2.3 – Land use classification from LCDB2 (outside of AgriBase™) areas

LCDB2NAME
Afforestation (imaged, post LCDB 1)
Afforestation (not imaged)
Alpine Grass-/Herbfield
Alpine Gravel and Rock
Broadleaved Indigenous Hardwoods
Built-up Area
Coastal Sand and Gravel
Deciduous Hardwoods
Dump
Estuarine Open Water
Fernland
Forest Harvested
Gorse and Broom
Grey Scrub
Herbaceous Freshwater Vegetation
Herbaceous Saline Vegetation
High Producing Exotic Grassland
Indigenous Forest
Lake and Pond
Landslide
Low Producing Grassland
Major Shelterbelts
Mangrove
Manuka and or Kanuka
Matagouri
Mixed Exotic Shrubland
Orchard and Other Perennial Crops
Other Exotic Forest
Pine Forest - Closed Canopy
Pine Forest - Open Canopy
River
River and Lakeshore Gravel and Rock

LCDB2NAME
Short-rotation Cropland
Sub Alpine Shrubland
Surface Mine
Tall Tussock Grassland
Transport Infrastructure
Urban Parkland/ Open Space
Vineyard

KEY: **High producing grassland**
Low producing grassland and shrublands
No livestock
Remove

Appendix 2.4 – Estimated stock water use from LCDB2, outside AgriBase™ areas (Master spreadsheet AK2:AS164

CATCHMENTS			Land coverage – Non-AgriBase™			AgriBase™	Non-AgriBase™ beef and dairy (RMA)		Non-AgriBase™ Beef and dairy (RMA+WLP)		(%)
			(ha)	(ha)	(ha)	(ha)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)	
GREATER	ID	CATCHMENT	High producing grassland	Low producing grassland	Land with no livestock	AgriBase™ dairy	Beef/dairy ADD	Beef/dairy PDD	Beef/dairy ADD	Beef/dairy PDD	AgriBase™ land coverage
Kaituna	17	Maketu Estuary Coastal	56	2	9	88.32	7196	11237	18146	22187	57.00
Kaituna	30	Mangorewa	487	0	1213	16691.34	61359	95451	156785	190877	90.75
Kaituna	54	Lake Rotoiti	587	13	8031	3670.10	75003	116964	190040	232000	29.83
Kaituna	59	Hauraki	96	0	15	1227.03	12047	18740	30786	37479	91.72
Kaituna	60	Awahou	141	0	202	2497.43	17760	27626	45386	55252	87.91
Kaituna	62	Waiteti	687	6	796	5332.40	87055	135540	221797	270282	78.17
Kaituna	71	Waimehia area	169	2	18	750.91	21381	33301	54407	66327	79.97
Kaituna	73	Awahou Point area	34	0	1	92.92	4329	6735	11064	13469	72.38
Kaituna	78	Okawa Bay area	0	0	45	28.37	38	59	97	118	38.76
Kaituna	79	Pohue Bay area	78	0	42	265.29	9769	15196	24965	30392	68.98
Kaituna	80	Waiohewa	238	1	164	808.96	30018	46711	76625	93318	66.75
Kaituna	84	Waimata	4	0	73	121.69	471	733	1204	1466	61.34
Kaituna	87	Ngongotaha	307	0	627	6561.80	38720	60231	98951	120462	87.53
Kaituna	88	Waiowhiro area	2	0	7	222.23	226	351	576	702	96.24
Kaituna	90	Rotokawa area	167	0	138	1254.19	21016	32691	53706	65382	80.47
Kaituna	94	Utuhina	119	12	783	3446.84	15963	25095	39320	48452	79.04
Kaituna	102	Puarenga	339	16	3087	2923.52	43991	68773	110504	135286	45.93
Kaituna	158	Hamurana area	197	7	97	1282.60	25438	39727	64132	78421	80.98
Kaituna	159	Hururu	84	0	588	2095.25	10537	16391	26929	32783	75.71
Kaituna	160	Upper Kaituna	235	6	1974	3612.63	30045	46873	76017	92845	61.99
Kaituna	161	Parawhenuamea	240	0	422	2465.53	30241	47042	77283	94084	78.83
Kaituna	162	Te Puke East	10	0	148	537.88	1215	1889	3104	3779	77.35
Kaituna	163	Waiari	378	2	2164	4556.32	47831	74445	122003	148618	64.17
Kaituna	164	Ohineangaanga	86	0	156	1841.73	10773	16758	27531	33516	88.40
Kaituna	165	Raparapahoe	124	1	637	4534.11	15646	24353	39899	48606	85.61
Kaituna	166	Rangiuru Soiuth	28	0	71	314.68	3523	5480	9003	10960	76.08
Kaituna	167	Kopuaroa	223	1	75	2696.50	28146	43812	71772	87437	90.03
Kaituna	168	Papamoa	82	9	15	665.88	10937	17198	26911	33172	86.33
Kaituna	169	Lower Kaituna	893	4	663	4407.35	112793	175540	287778	350525	73.87
Motu	4	Tahurua Coastal	79	3	211	550.70	10266	16044	25817	31595	65.22
Motu	5	Whangaparaoa	3005	2069	9845	3292.76	540049	884903	1129098	1473951	18.08
Motu	6	Waiokaha Coastal	304	0	1282	4641.16	38323	59613	97936	119227	74.53
Motu	12	Waikura	3128	6	3060	4402.87	394503	613793	1007495	1226785	41.55

CATCHMENTS			Land coverage – Non-AgriBase™			AgriBase™	Non-AgriBase™ beef and dairy (RMA)		Non-AgriBase™ Beef and dairy (RMA+WLP)		(%)
			(ha)	(ha)	(ha)	(ha)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)	
GREATER	ID	CATCHMENT	High producing grassland	Low producing grassland	Land with no livestock	AgriBase™ dairy	Beef/dairy ADD	Beef/dairy PDD	Beef/dairy ADD	Beef/dairy PDD	AgriBase™ land coverage
Motu	13	Raukokore area	72	6	7163	1862.68	9571	15021	23723	29172	20.46
Motu	15	Waikawa Coastal	135	0	1664	3370.53	17068	26550	43618	53100	65.20
Motu	19	Kereu	68	162	11677	2309.88	21125	36364	34364	49604	16.25
Motu	21	Te Kaha Coastal	483	0	3072	693.74	60836	94636	155455	189255	16.33
Motu	26	Mangahaupapa	169	0	1095	14340.78	21348	33208	54556	66417	91.90
Motu	31	Haparapara area	20	0	4942	7884.75	2517	3916	6434	7832	61.38
Motu	33	Waikakariki	0	0	3855	3.89	0	0	0	0	0.10
Motu	35	Pokohinu Coastal	201	0	1277	308.22	25351	39435	64786	78870	17.25
Motu	41	Motu area	20335	39	25913	31139.50	2565280	3991276	6551004	7977001	40.22
Motu	43	Whituare Coastal	30	0	241	147.29	3827	5962	9735	11869	35.17
Motu	45	Mangatutara	0	0	103	10552.54	0	0	0	0	99.03
Motu	46	Hawai	22	0	3525	3835.43	2725	4239	6965	8479	51.95
Motu	49	Pehitaiti Coastal	106	6	379	462.07	13837	21644	34694	42501	48.50
Motu	51	Torere	86	0	1214	6058.45	10856	16887	27744	33775	82.33
Motu	52	Omarumutu Coastal	578	7	635	1600.00	73409	114345	186740	227676	56.72
Motu	53	Te Kahika	0	0	43	13180.89	0	0	0	0	99.67
Motu	66	Tirohanga Coastal	153	1	172	2445.13	19333	30095	49284	60046	88.26
Motu	70	Waiaua	306	7	511	8796.25	39189	61120	99259	121190	91.42
Motu	81	Rawea	264	18	1329	21718.72	34642	54286	86304	105947	93.09
Motu	93	Mangaotane	2942	28	7988	7334.92	372862	580608	949512	1157258	40.10
Ohiwa	48	Maraetotara Coastal	0	0	0	65.16	0	0	0	0	100.00
Ohiwa	57	Wainui area	402	0	1163	2122.97	50692	78855	129547	157709	57.56
Ohiwa	63	Kutarere area	195	6	197	1787.85	24961	38948	63118	77105	81.82
Ohiwa	64	Waiotahi	523	21	685	13527.39	67560	105554	170072	208065	91.67
Ohiwa	65	Waiotahi Beach Coastal	59	0	31	552.24	7447	11584	19030	23167	85.97
Ohiwa	77	Nukuhou	763	3	1203	8351.17	96294	149849	245760	299315	80.92
Pongakawa	16	Newdicks Coastal	55	12	10	147.55	7795	12377	18506	23089	65.90
Pongakawa	20	Pukehina Beach Coastal	4	0	20	37.56	491	764	1256	1529	61.24
Pongakawa	22	Kaikokopu area	234	0	78	2995.05	29543	45956	75499	91912	90.54
Pongakawa	23	Pongakawa area	459	1	1925	10878.91	57920	90127	147857	180063	82.02
Pongakawa	24	Pukehina Coastal	74	0	5	927.39	9382	14594	23976	29188	92.13
Pongakawa	25	Wharere	500	0	96	5494.04	62987	97980	160968	195961	90.22
Pongakawa	27	Ohinepanea Coastal	181	0	47	1869.11	22806	35476	58282	70952	89.14

CATCHMENTS			Land coverage – Non-AgriBase™			AgriBase™	Non-AgriBase™ beef and dairy (RMA)		Non-AgriBase™ Beef and dairy (RMA+WLP)		(%)
			(ha)	(ha)	(ha)	(ha)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)	
GREATER	ID	CATCHMENT	High producing grassland	Low producing grassland	Land with no livestock	AgriBase™ dairy	Beef/dairy ADD	Beef/dairy PDD	Beef/dairy ADD	Beef/dairy PDD	AgriBase™ land coverage
Pongakawa	28	Pokopoko	799	8	1630	7714.98	101329	157794	257992	314457	76.00
Rangitaiki	36	Mangamako area	1244	78	4560	27854.06	162863	255027	406769	498934	82.56
Rangitaiki	42	Lower Tarawera area	2001	29	11315	20668.22	254297	396192	646405	788300	60.77
Rangitaiki	47	Waikamihi	76	0	206	1923.02	9557	14867	24424	29733	87.22
Rangitaiki	50	Otakiri	64	0	139	678.72	8119	12630	20750	25260	76.92
Rangitaiki	61	Mangawiki	185	0	1179	3532.86	23342	36309	59651	72618	72.14
Rangitaiki	83	Waikanapiti	33	0	542	2662.93	4116	6403	10520	12807	82.25
Rangitaiki	92	Lake Okataina	8	2	1528	4387.91	1195	1904	2796	3506	74.04
Rangitaiki	99	Mangate	0	0	1194	1604.86	0	0	0	0	57.34
Rangitaiki	100	Mangawhio	7	4	4007	1105.45	1165	1906	2448	3190	21.58
Rangitaiki	101	Lake Okareka	22	2	399	1277.93	2923	4584	7262	8923	75.13
Rangitaiki	104	Lake Tarawera	82	261	6487	7479.97	30639	53308	46674	69342	52.27
Rangitaiki	105	Waiaute	53	259	10161	954.31	26833	47342	37206	57714	8.35
Rangitaiki	107	Lake Tikitapu	8	0	275	368.76	959	1492	2450	2983	56.65
Rangitaiki	108	Lake Rotokakahi	13	0	1278	632.49	1654	2573	4228	5147	32.89
Rangitaiki	113	Lake Rotomahana	165	88	1653	6297.67	27746	45076	60178	77508	76.76
Rangitaiki	114	Pokairoa	357	10	2104	10660.11	45810	71481	115827	141498	81.18
Rangitaiki	117	Lake Rerewhakaaitu	134	4	863	2654.75	17160	26774	43403	53017	72.62
Rangitaiki	120	Okaro	17	0	25	341.58	2181	3393	5574	6786	88.89
Rangitaiki	126	Horomanga	227	0	857	18978.06	28568	44439	73007	88878	94.60
Rangitaiki	130	Whirinaki	302	9	2931	48588.70	38788	60540	97984	119736	93.74
Rangitaiki	131	Pouarua area	70	169	2182	21298.59	22007	37886	35786	51665	89.79
Rangitaiki	132	Otamatea	85	24	861	10442.91	12517	19981	29132	36596	91.50
Rangitaiki	154	Waikowhewhe area	314	76	16464	8901.34	45544	72499	107133	134088	34.56
Rangitaiki	155	Kaingaroa area	555	58	705	69027.94	74414	117007	183163	225756	98.13
Rangitaiki	156	Wheao	49	0	1483	22442.00	6161	9584	15746	19169	93.61
Rangitaiki	157	Mangatiti area	21	0	18	20469.91	2688	4182	6858	8353	99.81
Tauranga Harbour	1	Tuapiro	425	0	279	4484.07	53487	83202	136689	166404	86.44
Tauranga Harbour	2	Uretara	201	0	174	2623.31	25268	39306	64574	78612	87.52
Tauranga Harbour	3	Te Mania	321	0	159	840.18	40483	62973	103455	125946	63.62
Tauranga Harbour	10	Oturu	79	0	60	213.84	9924	15437	25361	30874	60.71
Tauranga Harbour	11	Kopurererua	475	2	1424	4097.73	60008	93386	153126	186504	68.31
Tauranga Harbour	14	Waimapu	788	1	2365	6099.47	99401	154643	253920	309162	65.91

CATCHMENTS			Land coverage – Non-AgriBase™			AgriBase™	Non-AgriBase™ beef and dairy (RMA)		Non-AgriBase™ Beef and dairy (RMA+WLP)		(%)
			(ha)	(ha)	(ha)	(ha)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)	
GREATER	ID	CATCHMENT	High producing grassland	Low producing grassland	Land with no livestock	AgriBase™ dairy	Beef/dairy ADD	Beef/dairy PDD	Beef/dairy ADD	Beef/dairy PDD	AgriBase™ land coverage
Tauranga Harbour	18	Wairoa	462	8	2124	8690.09	58875	91764	149444	182333	77.01
Tauranga Harbour	58	Wairoa	570	0	442	4878.73	71826	111730	183556	223460	82.82
Tauranga Harbour	133	Waiau	469	0	112	2140.33	59134	91987	151121	183973	78.65
Tauranga Harbour	134	Waihi Beach	63	0	163	1684.28	7923	12324	20247	24649	88.19
Tauranga Harbour	135	Tahawai	181	0	76	918.10	22767	35415	58182	70830	78.12
Tauranga Harbour	136	Ongare/Tanners Point	176	0	250	998.86	22117	34404	56521	68808	70.13
Tauranga Harbour	137	Katikati Streams	37	0	40	187.86	4694	7301	11995	14602	70.79
Tauranga Harbour	138	Te Rereatukahia	103	0	220	1556.80	12940	20129	33069	40258	82.83
Tauranga Harbour	139	Waitekohe	96	0	253	1801.92	12081	18792	30873	37585	83.76
Tauranga Harbour	140	Waione	106	0	114	606.05	13384	20819	34203	41638	73.34
Tauranga Harbour	141	Aongatete	199	0	231	4238.27	25139	39107	64233	78201	90.77
Tauranga Harbour	142	Whatakao	216	2	245	2424.36	27315	42529	69593	84806	83.98
Tauranga Harbour	143	Wainui	337	0	595	2906.19	42462	66059	108473	132070	75.72
Tauranga Harbour	144	Apata	182	0	80	947.63	22933	35674	58607	71348	78.34
Tauranga Harbour	145	Waipapa	442	0	412	2788.90	55722	86679	142401	173358	76.55
Tauranga Harbour	146	Te Puna	290	0	107	1730.97	36559	56869	93428	113739	81.34
Tauranga Harbour	147	Ohourere	154	0	804	2095.17	19420	30209	49630	60419	68.63
Tauranga Harbour	148	Mangapapa/Opuiaki	108	0	6326	9989.67	13651	21235	34885	42469	60.82
Tauranga Harbour	149	Omanawa	261	12	3067	5173.70	33855	52921	85078	104144	60.77
Tauranga Harbour	150	Kaitemako	72	0	12	151.91	9032	14049	23081	28099	64.53
Tauranga Harbour	152	Waitao area	202	5	673	2122.82	25839	40312	65377	79849	70.69
Tauranga Harbour	153	Maungatawa area	39	3	70	924.15	5156	8087	12804	15735	89.22
Tauranga Harbour	170	Matakana Island	330	7	4259	1383.66	42111	65651	106807	130347	23.14
Waioeka	67	Kukumoa Creek	214	0	47	1450.95	26974	41960	68934	83919	84.76
Waioeka	68	Otara	719	17	728	2123.23	91971	143437	232960	284426	59.19
Waioeka	72	Te Karaka Stream	263	0	71	835.89	33149	51566	84711	103128	71.44
Waioeka	74	Waioeka area	416	102	542	8356.48	60404	96177	141968	177740	88.74
Waioeka	76	Apanui	419	0	117	2433.49	52843	82200	135044	164401	81.94
Waioeka	89	Pakahi	669	8	3146	10203.74	84877	132203	215946	263272	72.74
Waioeka	95	Tutaetoko	34	0	505	5364.46	4290	6674	10964	13348	90.87
Waioeka	103	Te Waiti	38	2	360	9127.79	4869	7613	12225	14969	95.80
Waioeka	106	Mangaoira	0	0	2	1809.15	0	0	0	0	99.88
Waioeka	109	Tauranga	0	0	54	2343.97	32	59	32	59	97.74

CATCHMENTS			Land coverage – Non-AgriBase™			AgriBase™	Non-AgriBase™ beef and dairy (RMA)		Non-AgriBase™ Beef and dairy (RMA+WLP)		(%)
			(ha)	(ha)	(ha)	(ha)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)	
GREATER	ID	CATCHMENT	High producing grassland	Low producing grassland	Land with no livestock	AgriBase™ dairy	Beef/dairy ADD	Beef/dairy PDD	Beef/dairy ADD	Beef/dairy PDD	AgriBase™ land coverage
Waioeka	111	Waiata	0	8	1056	2889.76	652	1195	652	1195	73.08
Waioeka	112	Wairata	339	26	2217	13493.19	44776	70221	111238	136683	83.93
Waioeka	115	Omaukora	1	0	33	2272.03	123	192	316	384	98.54
Waioeka	118	Opato	71	0	1170	11385.28	8886	13822	22707	27644	90.18
Waioeka	124	Te Pato	0	0	502	3215.85	0	0	0	0	86.51
Waioeka	127	Tataweka	0	0	4806	10239.88	3	4	6	8	68.06
Waioeka	129	Koranga	7905	39	3208	2114.02	999014	1554863	2548328	3104177	15.94
Waitahanui	29	Otamarakau Coastal	16	0	1	71.41	1978	3077	5055	6154	81.42
Waitahanui	32	Waitahanui	287	0	3737	7513.90	36132	56205	92337	112410	65.12
Waitahanui	34	Hauone Coastal	103	4	16	2276.38	13227	20660	33324	40758	94.90
Waitahanui	37	Pikowai Coastal	84	3	872	2054.02	10852	16949	27353	33450	68.15
Waitahanui	38	Ruataniwha Coastal	0	1	2	310.57	103	180	154	231	99.08
Waitahanui	39	Mimiha Coastal	404	2	617	5781.81	51078	79491	130331	158744	84.97
Waitahanui	40	Ohinekoao Coastal	49	7	27	848.33	6788	10717	16460	20389	91.07
Waitahanui	55	Lake Rotoehu	193	0	1324	3396.04	24361	37895	62255	75789	69.12
Waitahanui	69	Lake Rotoma	24	0	1356	1376.49	3061	4761	7821	9522	49.94
Whakatane	44	Whakatane Area	885	1	1488	15685.32	111542	173527	284949	346934	86.86
Whakatane	56	Waioho	196	0	75	10091.26	24658	38357	63015	76714	97.39
Whakatane	82	Waimana	1035	6	2917	15137.07	130848	203675	333639	406467	79.27
Whakatane	91	Oromoeroa	1129	37	8149	6626.56	145151	226585	366492	447925	41.57
Whakatane	116	Kanihi	27	7	971	5809.37	3874	6170	9095	11391	85.26
Whakatane	119	Waiiti	36	0	5486	3696.42	4549	7076	11624	14151	40.10
Whakatane	121	Ohora	0	0	348	6299.74	0	0	0	0	94.76
Whakatane	122	Tauranga	85	12	12199	9336.85	11663	18411	28303	35051	43.16
Whakatane	123	Ohane	163	121	4168	2287.38	30022	49332	61990	81300	33.94
Whakatane	125	Upper Whakatane	268	48	18503	26000.31	37535	59423	90126	112014	58.01
Whakatane	128	Waikare	17	6	10277	4063.49	2566	4116	5859	7409	28.29
Totals			**72388.93**	**4053.72**	**310191.27**	**894654.29**	**9437195**	**14767912**	**23625426**	**28956143**	**11361.70**

Appendix 2.5 – Stock water use covered by consent (Master spreadsheet AC2:AL164)

CATCHMENTS			Estimated stock numbers covered by consent						Consented Stock Water Use (RMA)		Consented Stock Water Use (RMA+WLP)	
							Apply beef	Apply sheep	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Consented_ ADD	Consented_PDD	Consented_ ADD	Consented_PDD
Kaituna	17	Maketu Estuary Coastal						0	0	0	0	0
Kaituna	30	Mangorewa	5	60	0	10	1	6	2928	4602	7128	8802
Kaituna	54	Lake Rotoiti	0	0	0	0	0	0	0	0	0	0
Kaituna	59	Hauraki						0	0	0	0	0
Kaituna	60	Awahou	0	0	33	0	0	1	201	401	201	401
Kaituna	62	Waiteti						0	0	0	0	0
Kaituna	71	Waimehia area	0	0	0	0	0	1	3	5	3	5
Kaituna	73	Awahou Point area						0	0	0	0	0
Kaituna	78	Okawa Bay area						0	0	0	0	0
Kaituna	79	Pohue Bay area						0	0	0	0	0
Kaituna	80	Waiohewa						0	0	0	0	0
Kaituna	84	Waimata						0	0	0	0	0
Kaituna	87	Ngongotaha	46	0	24	1310	2	4	5526	8841	5526	8841
Kaituna	88	Waiowhiro area						0	0	0	0	0
Kaituna	90	Rotokawa area						0	0	0	0	0
Kaituna	94	Utuhina						0	0	0	0	0
Kaituna	102	Puarenga	317	1,271	0	1,200	0	4	70317	111823	159287	200793
Kaituna	158	Hamurana area						0	0	0	0	0
Kaituna	159	Hururu						0	0	0	0	0
Kaituna	160	Upper Kaituna	611	0	0	2293	0	5	25224	43946	25224	43946
Kaituna	161	Parawhenuamea	196	0	40	67	1693	11	57144	104726	57144	104726
Kaituna	162	Te Puke East	0	0	0	0	0	0	0	0	0	0
Kaituna	163	Waiari	11	41	0	0	0	2	2181	3484	5051	6354
Kaituna	164	Ohineangaanga	0	950	0	0	20	10	43380	67645	109880	134145
Kaituna	165	Raparapahoe	250	0	0	1,190	2	8	11154	19251	11154	19251
Kaituna	166	Rangiuru Soiuth	50	251	0	85	0	1	13053	20707	30623	38277
Kaituna	167	Kopuaroa	126	345	0	0	0	1	19308	31085	43458	55235
Kaituna	168	Papamoa						0	0	0	0	0
Kaituna	169	Lower Kaituna	351	1,764	177	72	15	66	91836	146355	215316	269835
Motu	4	Tahurua Coastal						0	0	0	0	0
Motu	5	Whangaparaoa						0	0	0	0	0
Motu	6	Waiokaha Coastal						0	0	0	0	0
Motu	12	Waikura						0	0	0	0	0
Motu	13	Raukokore area						0	0	0	0	0

CATCHMENTS			Estimated stock numbers covered by consent						Consented Stock Water Use (RMA)		Consented Stock Water Use (RMA+WLP)	
							Apply beef	Apply sheep	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Consented_ ADD	Consented_PDD	Consented_ ADD	Consented_PDD
Motu	15	Waikawa Coastal						0	0	0	0	0
Motu	19	Kereu						0	0	0	0	0
Motu	21	Te Kaha Coastal						0	0	0	0	0
Motu	26	Mangahaupapa						0	0	0	0	0
Motu	31	Haparapara area						0	0	0	0	0
Motu	33	Waikakariki						0	0	0	0	0
Motu	35	Pokohinu Coastal						0	0	0	0	0
Motu	41	Motu area						0	0	0	0	0
Motu	43	Whituare Coastal						0	0	0	0	0
Motu	45	Mangatutara						0	0	0	0	0
Motu	46	Hawai						0	0	0	0	0
Motu	49	Pehitaiti Coastal						0	0	0	0	0
Motu	51	Torere						0	0	0	0	0
Motu	52	Omarumutu Coastal	24	0	0	0	4	2	846	1549	846	1549
Motu	53	Te Kahika						0	0	0	0	0
Motu	66	Tirohanga Coastal	50	0	213	20	3	7	2949	5593	2949	5593
Motu	70	Waiaua						0	0	0	0	0
Motu	81	Rawea						0	0	0	0	0
Motu	93	Mangaotane						0	0	0	0	0
Ohiwa	48	Maraetotara Coastal						0	0	0	0	0
Ohiwa	57	Wainui area						0	0	0	0	0
Ohiwa	63	Kutarere area						0	0	0	0	0
Ohiwa	64	Waiotahi						0	0	0	0	0
Ohiwa	65	Waiotahi Beach Coastal	0	0	0	0	0	0	0	0	0	0
Ohiwa	77	Nukuhou	19	0	0	0	0	4	582	1063	582	1063
Pongakawa	16	Newdicks Coastal						0	0	0	0	0
Pongakawa	20	Pukehina Beach Coastal						0	0	0	0	0
Pongakawa	22	Kaikokopu area	146	1216	0	18	0	7	59175	93263	144295	178383
Pongakawa	23	Pongakawa area	651	4,838	0	0	6	3528	248004	390671	586664	729331
Pongakawa	24	Pukehina Coastal	0	0	0	0	0	0	0	0	0	0
Pongakawa	25	Wharere	246	4,764	0	34	16	80	222582	348403	556062	681883
Pongakawa	27	Ohinepanea Coastal	158	1,431	0	0	4	25	69330	109193	169500	209363
Pongakawa	28	Pokopoko	793	3,737	714	308	15	239	198330	317060	459920	578650
Rangitaiki	36	Mangamako area	161	4,555	0	40	16	102	210711	329224	529561	648074

CATCHMENTS			Estimated stock numbers covered by consent						Consented Stock Water Use (RMA)		Consented Stock Water Use (RMA+WLP)	
							Apply beef	Apply sheep	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Consented_ ADD	Consented_PDD	Consented_ ADD	Consented_PDD
Rangitaiki	42	Lower Tarawera area	466	4,220	99	129	45	64097	398502	613710	693902	909110
Rangitaiki	47	Waikamihi						0	0	0	0	0
Rangitaiki	50	Otakiri	0	858	0	20	2	6	38748	60287	98808	120347
Rangitaiki	61	Mangawiki	14	1018	0	20	2	14	46392	72293	117652	143553
Rangitaiki	83	Waikanapiti						0	0	0	0	0
Rangitaiki	92	Lake Okataina						0	0	0	0	0
Rangitaiki	99	Mangate						0	0	0	0	0
Rangitaiki	100	Mangawhio						0	0	0	0	0
Rangitaiki	101	Lake Okareka	320	0	0	4500	5	8	23274	38161	23274	38161
Rangitaiki	104	Lake Tarawera	320	0	0	4500	5	8	23274	38161	23274	38161
Rangitaiki	105	Waiaute						0	0	0	0	0
Rangitaiki	107	Lake Tikitapu						0	0	0	0	0
Rangitaiki	108	Lake Rotokakahi						0	0	0	0	0
Rangitaiki	113	Lake Rotomahana						0	0	0	0	0
Rangitaiki	114	Pokairoa	0	370	0	0	0	2	16656	25909	42556	51809
Rangitaiki	117	Lake Rerewhakaaitu	19	0	0	1,750	0	1	5823	8925	5823	8925
Rangitaiki	120	Okaro						0	0	0	0	0
Rangitaiki	126	Horomanga	380	3,561	200	76	22	133	174132	274721	423402	523991
Rangitaiki	130	Whirinaki	0	282	45	1	3	21	13116	20544	32856	40284
Rangitaiki	131	Pouarua area	3700	2500	0	47500	10	50	366450	593025	541450	768025
Rangitaiki	132	Otamatea	3,700	2,500	0	47,500	10	50	366450	593025	541450	768025
Rangitaiki	154	Waikowhewhe area	4	549	0	0	15	4	25287	39493	63717	77923
Rangitaiki	155	Kaingaroa area	297	1635	17	8	7	20	82881	131500	197331	245950
Rangitaiki	156	Wheao	0	376	0	1	5	2	17079	26609	43399	52929
Rangitaiki	157	Mangatiti area						0	0	0	0	0
Tauranga Harbour	1	Tuapiro	30	0	0	77	0	24	1203	2105	1203	2105
Tauranga Harbour	2	Uretara	0	0	0	0	0	0	0	0	0	0
Tauranga Harbour	3	Te Mania	223	230	0	0	0	1	17043	28370	33143	44470
Tauranga Harbour	10	Oturu	0	0	0	0	0	0	0	0	0	0
Tauranga Harbour	11	Kopurererua	44	0	0	0	0	10	1350	2465	1350	2465
Tauranga Harbour	14	Waimapu	67	105	251	587	3	55	10257	17101	17607	24451
Tauranga Harbour	18	Wairoa						0	0	0	0	0
Tauranga Harbour	58	Wairoa	25	0	0	0	2	1	813	1490	813	1490
Tauranga Harbour	133	Waiau	0	0	0	0	0	0	0	0	0	0

CATCHMENTS			Estimated stock numbers covered by consent						Consented Stock Water Use (RMA)		Consented Stock Water Use (RMA+WLP)	
							Apply beef	Apply sheep	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Consented_ ADD	Consented_PDD	Consented_ ADD	Consented_PDD
Tauranga Harbour	134	Waihi Beach						0	0	0	0	0
Tauranga Harbour	135	Tahawai	45	0	0	77	4	4	1713	3060	1713	3060
Tauranga Harbour	136	Ongare/Tanners Point	21	0	0	7	1	3	690	1255	690	1255
Tauranga Harbour	137	Katikati Streams						0	0	0	0	0
Tauranga Harbour	138	Te Rereatukahia	0	320	0	0	2	3	14469	22524	36869	44924
Tauranga Harbour	139	Waitekohe	36	775	0	18	17	158	36993	57957	91243	112207
Tauranga Harbour	140	Waione	66	0	0	50	11	69	2667	4771	2667	4771
Tauranga Harbour	141	Aongatete	37	0	0	0	0	0	1110	2035	1110	2035
Tauranga Harbour	142	Whatakao	35	0	0	0	0	376	2178	3617	2178	3617
Tauranga Harbour	143	Wainui	222	0	210	127	4	249	9168	16642	9168	16642
Tauranga Harbour	144	Apata	52	0	0	200	0	1	2163	3765	2163	3765
Tauranga Harbour	145	Waipapa	117	0	0	54	3	326	4740	8310	4740	8310
Tauranga Harbour	146	Te Puna	17	0	0	0	2	312	1506	2449	1506	2449
Tauranga Harbour	147	Ohourere	2	212	0	0	1	0	9630	15005	24470	29845
Tauranga Harbour	148	Mangapapa/Opuiaki						0	0	0	0	0
Tauranga Harbour	149	Omanawa	15	0	0	0	0	0	450	825	450	825
Tauranga Harbour	150	Kaitemako						0	0	0	0	0
Tauranga Harbour	152	Waitao area	27	0	0	10	0	0	840	1530	840	1530
Tauranga Harbour	153	Maungatawa area	103	0	0	225	2	5	3840	6810	3840	6810
Tauranga Harbour	170	Matakana Island	83	238	0	0	2	2	13266	21344	29926	38004
Waioeka	67	Kukumoa Creek	0	0	0	0	0	2	6	9	6	9
Waioeka	68	Otara	97	1,737	0	55	0	9	81267	127213	202857	248803
Waioeka	72	Te Karaka Stream	4	0	213	0	6	0	1578	3106	1578	3106
Waioeka	74	Waioeka area	0	0	0	0	0	0	0	0	0	0
Waioeka	76	Apanui	108	5,836	0	97	6	39	266448	415402	674968	823922
Waioeka	89	Pakahi						0	0	0	0	0
Waioeka	95	Tutaetoko						0	0	0	0	0
Waioeka	103	Te Waiti						0	0	0	0	0
Waioeka	106	Mangaoira						0	0	0	0	0
Waioeka	109	Tauranga						0	0	0	0	0
Waioeka	111	Waiata						0	0	0	0	0
Waioeka	112	Wairata						0	0	0	0	0
Waioeka	115	Omaukora						0	0	0	0	0
Waioeka	118	Opato						0	0	0	0	0

CATCHMENTS			Estimated stock numbers covered by consent						Consented Stock Water Use (RMA)		Consented Stock Water Use (RMA+WLP)	
							Apply beef	Apply sheep	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)
GREATER	ID	CATCHMENT	BEEF	DAIRY	DEER	SHEEP	LARGE_STOCK	SMALL_STOCK	Consented_ ADD	Consented_PDD	Consented_ ADD	Consented_PDD
Waioeka	124	Te Pato						0	0	0	0	0
Waioeka	127	Tataweka						0	0	0	0	0
Waioeka	129	Koranga						0	0	0	0	0
Waitahanui	29	Otamarakau Coastal						0	0	0	0	0
Waitahanui	32	Waitahanui	724	1394	200	5,840	9	48	103584	166791	201164	264371
Waitahanui	34	Hauone Coastal	188	3,010	0	700	8	8	143454	224666	354154	435366
Waitahanui	37	Pikowai Coastal	613	0	0	789	1	7	20808	37352	20808	37352
Waitahanui	38	Ruataniwha Coastal						0	0	0	0	0
Waitahanui	39	Mimiha Coastal						0	0	0	0	0
Waitahanui	40	Ohinekoao Coastal						0	0	0	0	0
Waitahanui	55	Lake Rotoehu						0	0	0	0	0
Waitahanui	69	Lake Rotoma						0	0	0	0	0
Whakatane	44	Whakatane Area	4,093	5,268	0	7,271	21	82	382539	628119	751299	996879
Whakatane	56	Waioho	3	0	0	0	0	2	96	174	96	174
Whakatane	82	Waimana	0	480	0	0	0	0	21600	33600	55200	67200
Whakatane	91	Oromoeroa	11	1,256	0	0	0	10	56880	88570	144800	176490
Whakatane	116	Kanihi						0	0	0	0	0
Whakatane	119	Waiiti						0	0	0	0	0
Whakatane	121	Ohora						0	0	0	0	0
Whakatane	122	Tauranga						0	0	0	0	0
Whakatane	123	Ohane						0	0	0	0	0
Whakatane	125	Upper Whakatane						0	0	0	0	0
Whakatane	128	Waikare						0	0	0	0	0
Totals			**20539**	**63953**	**2436**	**128836**	**2033**	**70336**	**4167177**	**6643676**	**8643887**	**11120386**

Appendix 3:
Dairy shed water use

Appendix 3.1 - Dairy shed water use (Aquas 2007)

Water use in the dairy shed	
Source	**Water requirements**
Aqualinc (2004a)	65 l/h/d – shed and yard requirements.
Aqualinc (2004b)	Total use: 70 l/h/d.
Dexcel (2007a)	Wash down water *per cleaning event:* 50 l/h/d (150 in herd); 48 l/h/d (250 in herd); 43 l/h/d (500 in herd).
Dexcel (2007b)	50 l/h/d but could range from 30 to 100 l/h/day (2 wash downs/day).
Dexcel (2007c)	70 l/cow/day.
NZSFA (2007)	70 l/h/d.
Lincoln Environmental (2003)	*Estimates based on research/consultation:* Milk cooling: At upper ratio of cooling water to milk volume (3:1), peak cooling requirements approach 70 l/h/d. Average requirements are likely to be 40 to 50 l/p/d. Plant washing: 3.5 to 5.5 l/h/d. Yard wash down: 50 l/h/d adopted by ARC based on 1999 study of waste water on 20 farms in Franklin District. (Other research shows variability and range from 20 to 80 l/p/d.)
Fleming (2003)	70 l/h/d.

Appendix 4:
Analysis

Appendix 4 - Model estimates of potential permitted water use

Greater Catchment	Catchment	RMA: Total ADD m^3/day	RMA: Total PDD m^3/day	WLP: 50m^3/day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Kaituna	Maketu Estuary Coastal	277618	446456	11700	289318	458156
Kaituna	Mangorewa	1340991	1775063	22750	1363741	1797813
Kaituna	Lake Rotoiti	739074	1145867	38200	777274	1184067
Kaituna	Hauraki	318303	430656	10050	328353	440706
Kaituna	Awahou	442156	584357	8050	450206	592407
Kaituna	Waiteti	1018977	1363344	18150	1037127	1381494
Kaituna	Waimehia area	225586	319771	7600	233186	327371
Kaituna	Awahou Point area	29352	44261	1900	31252	46161
Kaituna	Okawa Bay area	40936	68183	1150	42086	69333
Kaituna	Pohue Bay area	168118	270187	10100	178218	280287
Kaituna	Waiohewa	157301	228868	9800	167101	238668
Kaituna	Waimata	2953	4410	800	3753	5210
Kaituna	Ngongotaha	675638	949008	15500	691138	964508
Kaituna	Waiowhiro area	4074	6619	400	4474	7019
Kaituna	Rotokawa area	119546	177345	6500	126046	183845
Kaituna	Utuhina	116603	182170	7700	124303	189870
Kaituna	Puarenga	271133	352891	5250	276383	358141
Kaituna	Hamurana area	346745	510217	15250	361995	525467
Kaituna	Hururu	267106	349245	2700	269806	351945
Kaituna	Upper Kaituna	240424	311579	10750	251174	322329
Kaituna	Parawhenuamea	356305	497894	19600	375905	517494
Kaituna	Te Puke East	42565	70094	21650	64215	91744

Greater Catchment	Catchment	RMA: Total ADD m^3/day	RMA: Total PDD m^3/day	WLP: 50m^3/day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Kaituna	Waiari	401037	565444	22800	423837	588244
Kaituna	Ohineangaanga	250284	371590	32000	282284	403590
Kaituna	Raparapahoe	306559	436680	19900	326459	456580
Kaituna	Rangiuru Soiuth	34765	53174	3850	38615	57024
Kaituna	Kopuaroa	673231	857885	11050	684281	868935
Kaituna	Papamoa	267147	336414	3600	270747	340014
Kaituna	Lower Kaituna	1508109	1932745	33800	1541909	1966545
Kaituna Total		10642637	14642416	372550	11015187	15014966
Motu	Tahurua Coastal	35049	46763	150	35199	46913
Motu	Whangaparaoa	1271580	1677069	4300	1275880	1681369
Motu	Waiokaha Coastal	357807	501283	14150	371957	515433
Motu	Waikura	1008370	1228252	650	1009020	1228902
Motu	Raukokore area	33832	47423	2000	35832	49423
Motu	Waikawa Coastal	116356	177783	11550	127906	189333
Motu	Kereu	58618	92730	2200	60818	94930
Motu	Te Kaha Coastal	267384	376424	25150	292534	401574
Motu	Mangahaupapa	54556	66417	350	54906	66767
Motu	Haparapara area	7143	9050	1000	8143	10050
Motu	Waikakariki	0	0	350	350	350
Motu	Pokohinu Coastal	110770	156644	7800	118570	164444
Motu	Motu area	6673129	8165404	33650	6706779	8199054
Motu	Whituare Coastal	20723	30842	6850	27573	37692

Greater Catchment	Catchment	RMA: Total ADD m^3/day	RMA: Total PDD m^3/day	WLP: 50m^3/day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Motu	Mangatutara	0	0	0	0	0
Motu	Hawai	29110	38269	950	30060	39219
Motu	Pehitaiti Coastal	106701	140347	3600	110301	143947
Motu	Torere	75964	102851	5050	81014	107901
Motu	Omarumutu Coastal	526577	686396	19050	545627	705446
Motu	Te Kahika	0	0	50	50	50
Motu	Tirohanga Coastal	352587	467566	12250	364837	479816
Motu	Waiaua	412497	526820	11850	424347	538670
Motu	Rawea	145266	201014	4000	149266	205014
Motu	Mangaotane	974913	1200529	1250	976163	1201779
Mōtū Total		12638931	15939877	168200	12807131	16108077
Ohiwa	Maraetotara Coastal	0	0	100	100	100
Ohiwa	Wainui area	421001	584477	11300	432301	595777
Ohiwa	Kutarere area	301934	433923	21250	323184	455173
Ohiwa	Waiotahi	993815	1279760	19050	1012865	1298810
Ohiwa	Waiotahi Beach Coastal	264959	373827	14550	279509	388377
	Nukuhou	1721258	2386688	22350	1743608	2409038
Ōhiwa Total		3702967	5058675	88600	3791567	5147275
Pongakawa	Newdicks Coastal	71847	98552	3750	75597	102302
Pongakawa	Pukehina Beach Coastal	118795	197428	1350	120145	198778
Pongakawa	Kaikokopu area	1020572	1346976	16650	1037222	1363626
Pongakawa	Pongakawa area	1239063	1587937	13600	1252663	1601537

Greater Catchment	Catchment	RMA: Total ADD m^3/day	RMA: Total PDD m^3/day	WLP: 50m^3/day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Pongakawa	Pukehina Coastal	516516	719645	7700	524216	727345
Pongakawa	Wharere	1065639	1388750	18000	1083639	1406750
Pongakawa	Ohinepanea Coastal	421372	541524	8950	430322	550474
Pongakawa	Pokopoko	377995	560034	15100	393095	575134
Pongakawa Total		4831799	6440846	85100	4916899	6525946
Rangitaiki	Mangamako area	3386681	4454032	44450	3431131	4498482
Rangitaiki	Lower Tarawera area	5465163	7440351	107600	5572763	7547951
Rangitaiki	Waikamihi	290441	391852	4800	295241	396652
Rangitaiki	Otakiri	87636	126927	2000	89636	128927
Rangitaiki	Mangawiki	279261	392460	7100	286361	399560
Rangitaiki	Waikanapiti	29058	43763	10700	39758	54463
Rangitaiki	Lake Okataina	12475	20534	1050	13525	21584
Rangitaiki	Mangate	0	0	250	250	250
Rangitaiki	Mangawhio	2601	3469	600	3201	4069
Rangitaiki	Lake Okareka	132904	218326	8550	141454	226876
Rangitaiki	Lake Tarawera	359041	594454	17250	376291	611704
Rangitaiki	Waiaute	82879	115533	1150	84029	116683
Rangitaiki	Lake Tikitapu	4316	6052	200	4516	6252
Rangitaiki	Lake Rotokakahi	24923	40309	1050	25973	41359
Rangitaiki	Lake Rotomahana	673643	872129	4750	678393	876879
Rangitaiki	Pokairoa	591539	756598	5550	597089	762148
Rangitaiki	Lake Rerewhakaaitu	655539	822284	6600	662139	828884

Greater Catchment	Catchment	RMA: Total ADD m^3/day	RMA: Total PDD m^3/day	WLP: 50m^3/day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Rangitaiki	Okaro	44142	59484	850	44992	60334
Rangitaiki	Horomanga	1334503	1741780	9400	1343903	1751180
Rangitaiki	Whirinaki	478302	698189	9750	488052	707939
Rangitaiki	Pouarua area	42351	62608	2150	44501	64758
Rangitaiki	Otamatea	391720	485998	1200	392920	487198
Rangitaiki	Waikowhewhe area	313944	464262	8150	322094	472412
Rangitaiki	Kaingaroa area	773617	1065176	8850	782467	1074026
Rangitaiki	Wheao	136003	202426	11100	147103	213526
Rangitaiki	Mangatiti area	217225	381294	550	217775	381844
Rangitāiki Total		15809907	21460292	275650	16085557	21735942
Tauranga Harbour	Tuapiro	257458	366682	11300	268758	377982
Tauranga Harbour	Uretara	346427	495473	15150	361577	510623
Tauranga Harbour	Te Mania	347961	525491	18900	366861	544391
Tauranga Harbour	Oturu	157043	250951	8800	165843	259751
Tauranga Harbour	Kopurererua	722597	1078811	39950	762547	1118761
Tauranga Harbour	Waimapu	1388851	2065477	47350	1436201	2112827
Tauranga Harbour	Wairoa	490026	681973	12450	502476	694423
Tauranga Harbour	Wairoa	903378	1368891	47900	951278	1416791
Tauranga Harbour	Waiau	444206	669656	22750	466956	692406
Tauranga Harbour	Waihi Beach	323347	529961	39650	362997	569611
Tauranga Harbour	Tahawai	155716	224610	8950	164666	233560
Tauranga Harbour	Ongare/Tanners Point	294067	440203	17450	311517	457653

Greater Catchment	Catchment	RMA: Total ADD m^3/day	RMA: Total PDD m^3/day	WLP: 50m^3/day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Tauranga Harbour	Katikati Streams	65297	93878	3400	68697	97278
Tauranga Harbour	Te Rereatukahia	124510	186418	9900	134410	196318
Tauranga Harbour	Waitekohe	102265	165937	9450	111715	175387
Tauranga Harbour	Waione	173615	242507	11100	184715	253607
Tauranga Harbour	Aongatete	314537	436876	14950	329487	451826
Tauranga Harbour	Whatakao	234049	334404	11050	245099	345454
Tauranga Harbour	Wainui	263302	397001	19350	282652	416351
Tauranga Harbour	Apata	228764	352434	16250	245014	368684
Tauranga Harbour	Waipapa	571918	867625	30700	602618	898325
Tauranga Harbour	Te Puna	436771	641585	19250	456021	660835
Tauranga Harbour	Ohourere	238558	342511	8100	246658	350611
Tauranga Harbour	Mangapapa/Opuiaki	78967	110012	7200	86167	117212
Tauranga Harbour	Omanawa	463165	633065	18700	481865	651765
Tauranga Harbour	Kaitemako	42394	61486	2550	44944	64036
Tauranga Harbour	Waitao area	232987	370648	11400	244387	382048
Tauranga Harbour	Maungatawa area	74179	111259	6600	80779	117859
Tauranga Harbour	Matakana Island	391789	495747	9150	400939	504897
Tauranga Total		9868145	14541571	499700	10367845	15041271
Waioeka	Kukumoa Creek	506580	661995	12100	518680	674095
Waioeka	Otara	649750	825343	24650	674400	849993
Waioeka	Te Karaka Stream	228997	290831	5600	234597	296431
Waioeka	Waioeka area	381637	492945	17050	398687	509995

Greater Catchment	Catchment	RMA: Total ADD m^3/day	RMA: Total PDD m^3/day	WLP: 50m^3/day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Waioeka	Apanui	188288	253141	17000	205288	270141
Waioeka	Pakahi	231948	291399	3700	235648	295099
Waioeka	Tutaetoko	37131	48960	1450	38581	50410
Waioeka	Te Waiti	13878	17825	700	14578	18525
Waioeka	Mangaoira	0	0	50	50	50
Waioeka	Tauranga	32	59	50	82	109
Waioeka	Waiata	1285	2342	350	1635	2692
Waioeka	Wairata	134599	177668	1600	136199	179268
Waioeka	Omaukora	7333	12670	100	7433	12770
Waioeka	Opato	28978	38658	750	29728	39408
Waioeka	Te Pato	0	0	150	150	150
Waioeka	Tataweka	6	8	50	56	58
Waioeka	Koranga	2563148	3128877	1500	2564648	3130377
Waioeka Total		4973591	6242721	86850	5060441	6329571
Waitahanui	Otamarakau Coastal	47149	60365	1600	48749	61965
Waitahanui	Waitahanui	543728	714079	7900	551628	721979
Waitahanui	Hauone Coastal	213403	316781	4700	218103	321481
Waitahanui	Pikowai Coastal	190117	275616	3800	193917	279416
Waitahanui	Ruataniwha Coastal	22295	35456	1000	23295	36456
Waitahanui	Mimiha Coastal	465750	664516	9300	475050	673816
Waitahanui	Ohinekoao Coastal	61760	97418	1950	63710	99368
Waitahanui	Lake Rotoehu	238271	324834	5950	244221	330784

Greater Catchment	Catchment	RMA: Total ADD m^3/day	RMA: Total PDD m^3/day	WLP: 50m^3/day/property	Total water allowance RMA+WLP ADD m^3/day	Total water allowance RMA+WLP PDD m^3/day
Waitahanui	Lake Rotoma	229016	377520	13150	242166	390670
Waitahanui Total		2011489	2866585	49350	2060839	2915935
Whakatane	Whakatane Area	2496079	3411574	40000	2536079	3451574
Whakatane	Waioho	966851	1318996	9250	976101	1328246
Whakatane	Waimana	2133172	2901448	25200	2158372	2926648
Whakatane	Oromoeroa	1289435	1820901	20150	1309585	1841051
Whakatane	Kanihi	9095	11391	50	9145	11441
Whakatane	Waiiti	13220	16889	350	13570	17239
Whakatane	Ohora	0	0	50	50	50
Whakatane	Tauranga	38869	53059	1150	40019	54209
Whakatane	Ohane	61990	81300	50	62040	81350
Whakatane	Upper Whakatane	363873	570340	8100	371973	578440
Whakatane	Waikare	8079	11479	550	8629	12029
Whakatāne Total		7380662	10197376	104900	7485562	10302276
Total		**71860129**	**97390358**	**1730900**	**73591029**	**99121258**

Appendix 5:

Appendix 5 – Permitted water use application background to report

1.1 Permitted water use in New Zealand

Section 14(3)(b) of the Resource Management Act (RMA) permits water use for certain activities without the need to obtain a resource consent. This allows for water to be taken for reasonable domestic and stock water use provided that the use does not or is not likely to have an adverse effect on the environment.

1.2 Bay of Plenty region permitted water use

The Bay of Plenty Regional Water and Land Plan stipulates the following rules for permitted water takes:

- "*Rule 38 Permitted – Take and Use of Groundwater"* allows up to 35 m^3/day/property.
- "*Rule 41 Permitted – Take and Use of Surface Water"* allows up to 15 m^3/day/property.

The intent of both rules is to allow minor takes for any purpose that are unlikely to have adverse effects on the environment.

1.3 Quantify permitted take for model

Various parties throughout New Zealand have considered water use for their particular area of concern; dariy, horticulture, rural potable water supply, in an attempt to better quantify the volumes required for a particular use. A few of these estimations are include below, for further detailed information refer to Appendix ??? In Part 3 the figures decided upon for use in the model are discussed.

1.4 National recommendations for water use – non-urban domestic and stock water use

Domestic use

The Ministry of Health (MoH, 2006) recommends an average household requirement of 300 litres per person per day (l/p/d) for households sourcing their own water. The Department of Building and Housing recommends 250 l/p/d (DBH, 2007). The DBH study was based on an assessment of 12 residential homes on the Kapiti Coast (BRANZ, 2007) and suggested little variability for indoor use but up to a threefold increase for external use in summer compared to winter.

Stock use

Dairy Insight and Fonterra (2006) estimated dairy cow water use at 50 litres per cow per day (l/c/d) but this was dependent on the herd size and the type of dairy. The same document suggests a possible range of 30-100 l/c/d for dairy shed use.

1.5 Regional recommendations for water use – non-urban domestic and stock water use

Domestic use

BOPRC document "*Dealing with your waste water – A Guide to the On-Site Effluent Treatment Regional Plan 2006",* suggests for a household with standard facilities the waste water volume is estimated at 180 l/p/d. For occupancy assume 1.5 people per bedroom;

e.g. 3 bedrooms x 1.5 = 4.5 people per household X 180 l/p/d = 810 litres/household/day (l/h/d).

Western Bay of Plenty District Council (WBOPDC) completed a study in 2011 on water use in dist rict households. This indicated water use of 600 - 660 litres per household per day (l/h/d) for metered properties and up to 800 l/h/d for unmetered properties. Occupancy estimates were calculated as 2.7 people per household.

Tauranga City Council (TCC) completed a study in 2011 on water use in district households. This indicated water use of 493 l/h/d for metered properties, where previously unmetered the water use was up to 1000l/h/d. Occupancy estimates were calculated as 2.5 people per household.

Waikato Regional Council suggests household water use of between 185 and 300 l/p/day with peak summer water use of 240 to 260 l/p/day (Brown, et al., 2007).

Domestic water use in Hawkes Bay was applied at Peak Daily Demand (PDD) of 300 l/p/d and Average Daily Demand (ADD) of 185 l/p/d.

Horizons Regional Council provides a breakdown of public water supply use in that region (Table 1). A number of these figures are squewed by uses other than domestic use, e.g. industrial and or agricultural use from the scheme.

Table 1 Representative public water supply for the Horizons region (l/person/day) (HRC, 2006).

Water System	ADD	PDD	Residential Water Costs
Bulls	662	883	Metered - $1.00 / m^3
Hunterville urban	432	595	Metered - $2.50 / m^3
Eketahuna	1,720	2,145	Unmetered – $192.40 / yr
Levin	432	642	Unmetered – $212 / yr
Feilding	418	661	Unmetered - $350 / yr

Stock use

BOPRC staff generally apply the guidelines from 'Managing Farm Dairy Effluent' produced by Dairy Insight and Fonterra (2006) which suggests a minimum of 50 l/c/d for dairy shed use. However a figure of up to 70 l/c/d would not be uncommon for a rotary dairy shed. Typically staff use a figure of 55 l/c/d.

Waikato Regional Council use figures from Fleming (2003) as a reasonable estimate of stock water use. Stock use (in litres per head per day) was estimated as follows; 140 l/h/d for dairy cow shed and drinking, 45 l/h/d for beef cattle, 7l/h/d for deer and 3 l/h/d for sheep. Dairy use was identified as the most consumptive and greatest user and a likely maximum use of 70 l/c/d for drinking and 70 l/c/d for dairy shed use was adopted (Fleming, 2003). Both of these figures were considered by Waikato Regional Council (Brown et.al., 2007) to be an upper conservative estimate.

Horizons Regional Council adopted an approach recommended by Aquas Consultants (2007), which suggested a PDD of 70 l/c/d and ADD of 45 l/c/d for dairy cow drinking. Dairy shed use was applied at 70 l/c/d. PDD for sheep and beef was applied at 4.5 l/sheep/d and 55 l/animal/d respectively. Appendix 4 details the drinking water requirements for a range of stock uses (from Aquas 2007).

Hawkes Bay Regional Council has adopted the PDD and ADD approach outlined in Appendix 4 and proposed by Horizons Regional Council in 2007. Dairy shed use was based on an ADD of 50 l/c/d and a PDD of 70 l/c/d (Hawkes Bay Regional Council, 2011). For shed use 70 l/c/d was suggested as sufficient for up to 285 cows in order to meet permitted take requirements.