Appendix

Appendix 1.1

Appendix 1.1 – Requirements of the National Policy Statement on Urban Development Capacity

Application of Objectives and Policies

	All local authorities	Local authorities that have a medium-growth urban area within their district or region	Local authorities that have a high-growth urban area within their district or region
Objectives that apply	All	All	All
Policies that apply	PA1 – PA4	PA1 – PA4	PA1 – PA4
		PB1 – PB7 PC1 – PC4 PD1 – PD2	PB1 – PB7 PC1 – PC4 PD1 – PD2
			PC5 – PC14 PD3 – PD4

Objectives

The following objectives apply to all decision-makers when making planning decisions that affect an urban environment.

Objective Group A – Outcomes for planning decisions

OA1: Effective and efficient urban environments that enable people and communities and future generations to provide for their social, economic, cultural and environmental wellbeing.

OA2: Urban environments that have sufficient opportunities for the development of housing and business land to meet demand, and which provide choices that will meet the needs of people and communities and future generations for a range of dwelling types and locations, working environments and places to locate businesses.

OA3: Urban environments that, over time, develop and change in response to the changing needs of people and communities and future generations.

Objective Group B – Evidence and monitoring to support planning decisions

OB1: A robustly developed, comprehensive and frequently updated evidence base to inform planning decisions in urban environments.

Objective Group C – Responsive planning

OC1: Planning decisions, practices and methods that enable urban development which provides for the social, economic, cultural and environmental wellbeing of people and communities and future generations in the short, medium and long-term.

OC2: Local authorities adapt and respond to evidence about urban development, market activity and the social, economic, cultural and environmental wellbeing of people and communities and future generations, in a timely way.

Objective Group D – Coordinated planning evidence and decision-making

OD1: Urban environments where land use, development, development infrastructure and other infrastructure are integrated with each other.

OD2: Coordinated and aligned planning decisions within and across local authority boundaries.

Policies

Outcomes for planning decisions

Policies PA1 to PA4 apply to any urban environment that is expected to experience growth.

PA1: Local authorities shall ensure that at any one time there is sufficient housing and business land development capacity according to the table below:

Short term	Development capacity must be feasible, zoned and serviced with development infrastructure.
Medium term	Development capacity must be feasible, zoned and either: • serviced with development infrastructure, or • the funding for the development infrastructure required to service that development capacity must be identified in a Long Term Plan required under the Local Government Act 2002.
Long term	Development capacity must be feasible, identified in relevant plans and strategies, and the development infrastructure required to service it must be identified in the relevant Infrastructure Strategy required under the Local Government Act 2002.

PA2: Local authorities shall satisfy themselves that other infrastructure required to support urban development are likely to be available.

PA3: When making planning decisions that affect the way and the rate at which development capacity is provided, decision-makers shall provide for the social, economic, cultural and environmental wellbeing of people and communities and future generations, whilst having particular regard to:

a) Providing for choices that will meet the needs of people and communities and future generations for a range of dwelling types and locations, working environments and places to locate businesses;

b) Promoting the efficient use of urban land and development infrastructure and other infrastructure; and

c) Limiting as much as possible adverse impacts on the competitive operation of land and development markets.

PA4: When considering the effects of urban development, decision-makers shall take into account:

a) The benefits that urban development will provide with respect to the ability for people and communities and future generations to provide for their social, economic, cultural and environmental wellbeing; and

b) The benefits and costs of urban development at a national, inter-regional, regional and district scale, as well as the local effects.

Evidence and monitoring to support planning decisions

Policies PB1 to PB7 apply to all local authorities that have part, or all, of either a medium-growth urban area or high-growth urban area within their district or region.

The application of these policies is not restricted to the boundaries of the urban area.

PB1: Local authorities shall, on at least a three-yearly basis, carry out a housing and business development capacity assessment that:

a) Estimates the demand for dwellings, including the demand for different types of dwellings, locations and price points, and the supply of development capacity to meet that demand, in the short, medium and long-terms; and

b) Estimates the demand for the different types and locations of business land and floor area for businesses, and the supply of development capacity to meet that demand, in the short, medium and long-terms; and

c) Assesses interactions between housing and business activities, and their impacts on each other.

Local authorities are encouraged to publish the assessment under policy PB1.

PB2: The assessment under policy PB1 shall use information about demand including:

a) Demographic change using, as a starting point, the most recent Statistics New Zealand population projections;

b) Future changes in the business activities of the local economy and the impacts that this might have on demand for housing and business land; and

c) Market indicators monitored under PB6 and PB7.

PB3: The assessment under policy PB1 shall estimate the sufficiency of development capacity provided by the relevant local authority plans and proposed and operative regional policy statements, and Long Term Plans and Infrastructure Strategies prepared under the Local Government Act 2002, including:

a) The cumulative effect of all zoning, objectives, policies, rules and overlays and existing designations in plans, and the effect this will have on opportunities for development being taken up;

b) The actual and likely availability of development infrastructure and other infrastructure in the short, medium and long term as set out under PA1;

c) The current feasibility of development capacity;

d) The rate of take up of development capacity, observed over the past 10 years and estimated for the future; and

e) The market's response to planning decisions, obtained through monitoring under policies PB6 and PB7.

PB4: The assessment under policy PB1 shall estimate the additional development capacity needed if any of the factors in PB3 indicate that the supply of development capacity is not likely to meet demand in the short, medium or long term.

PB5: In carrying out the assessment under policy PB1, local authorities shall seek and use the input of iwi authorities, the property development sector, significant land owners, social housing providers, requiring authorities, and the providers of development infrastructure and other infrastructure.

PB6: To ensure that local authorities are well-informed about demand for housing and business development capacity, urban development activity and outcomes, local authorities shall monitor a range of indicators on a quarterly basis including:

a) Prices and rents for housing, residential land and business land by location and type; and changes in these prices and rents over time;

b) The number of resource consents and building consents granted for urban development relative to the growth in population; and

c) Indicators of housing affordability.

PB7: Local authorities shall use information provided by indicators of price efficiency in their land and development market, such as price differentials between zones, to understand how well the market is functioning and how planning may affect this, and when additional development capacity might be needed.

Local authorities are encouraged to publish the results of their monitoring under policies PB6 and PB7.

Responsive Planning

Policies PC1 to PC4 apply to all local authorities that have part, or all, of either a medium-growth urban area or high-growth urban area within their district or region.

The application of these policies is not restricted to the boundaries of the urban area.

PC1: To factor in the proportion of feasible development capacity that may not be developed, in addition to the requirement to ensure sufficient, feasible development capacity as outlined in policy PA1, local authorities shall also provide an additional margin of feasible development capacity over and above projected demand of at least:

- 20% in the short and medium term, and
- 15% in the long term.

PC2: If evidence from the assessment under policy PB1, including information about the rate of take-up of development capacity, indicates a higher margin is more appropriate, this higher margin should be used.

PC3: When the evidence base or monitoring obtained in accordance with policies PB1 to PB7 indicates that development capacity is not sufficient in any of the short, medium or long term, local authorities shall respond by:

a) Providing further development capacity; and

b) enabling development

in accordance with policies PA1, PC1 or PC2, and PC4. A response shall be initiated within 12 months.

PC4: A local authority shall consider all practicable options available to it to provide sufficient development capacity and enable development to meet demand in the short, medium and long term, including:

a) Changes to plans and regional policy statements, including to the zoning, objectives, policies, rules and overlays that apply in both existing urban environments and greenfield areas;

b) Integrated and coordinated consenting processes that facilitate development; and

c) Statutory tools and other methods available under other legislation.

Minimum targets

Policies PC5 to PC11 apply to all local authorities that have part, or all, of a high-growth urban area within their district or region. Local authorities that have part, or all, of a medium-growth urban area within their district or region are encouraged to give effect to policies PC5 to PC11.

The application of these policies is not restricted to the boundaries of the urban area.

PC5: Regional councils shall set minimum targets for sufficient, feasible development capacity for housing, in accordance with the relevant assessment under policy PB1 and with policies PA1 and PC1 or PC2, and incorporate these minimum targets into the relevant regional policy statement.

PC6: A regional council's minimum targets set under policy PC5 shall be set for the medium and long term, and shall be reviewed every three years.

PC7: When the relevant assessment required under policy PB1 shows that the minimum targets set in the regional policy statement are not sufficient, regional councils shall revise those minimum targets in accordance with policies PC5, and shall incorporate these revised targets into its regional policy statement.

PC8: Regional councils shall amend their proposed and operative regional policy statements to give effect to policies PC5 to PC7 in accordance with section 55(2A) of the Act without using the process in Schedule 1 of the Act.

PC9: Territorial authorities shall set minimum targets for sufficient, feasible development capacity for housing, as a portion of the regional minimum target, in accordance with the relevant assessment under policy PB1, and with policies PA1, PC1 or PC2, and PD3 and incorporate the minimum targets as an objective into the relevant plan.

PC10: If a minimum target set in a regional policy statement is revised, the relevant territorial authorities shall also revise the minimum targets in their plans in accordance with policy PC9.

PC11: Territorial authorities shall amend their relevant plans to give effect to policies PC9 and PC10 in accordance with section 55(2A) of the Act without using the process in Schedule 1 of the Act.

Note that using section 55(2A) of the Act for policies PC8 and PC11 only applies to setting minimum targets and not to plan changes that give effect to those minimum targets.

Future development strategy

Policies PC12 to PC14 apply to all local authorities that have part, or all, of a high-growth urban area within their district or region.

Local authorities that have part, or all, of a medium-growth urban area within their district or region are encouraged to give effect to policies PC12 to PC14

The application of these policies is not restricted to the boundaries of the urban area.

PC12: Local authorities shall produce a future development strategy which demonstrates that there will be sufficient, feasible development capacity in the medium and long term. This strategy will also set out how the minimum targets set in accordance with policies PC5 and PC9 will be met.

PC13: The future development strategy shall:

a) identify the broad location, timing and sequencing of future development capacity over the long term in future urban environments and intensification opportunities within existing urban environments;

b) balance the certainty regarding the provision of future urban development with the need to be responsive to demand for such development; and

c) be informed by the relevant Long Term Plans and Infrastructure Strategies required under the Local Government Act 2002, and any other relevant strategies, plans and documents.

PC14: The future development strategy can be incorporated into a non-statutory document that is not prepared under the Act, including documents and strategies prepared under other legislation. In developing this strategy, local authorities shall:

a) Undertake a consultation process that complies with:
   - Part 6 of the Local Government Act; or
   - Schedule 1 of the Act;

b) be informed by the assessment under policy PB1; and

c) have particular regard to policy PA1.

Coordinated planning evidence and decision-making

Policies PD1 and PD2 apply to all local authorities that have part, or all, of either a medium growth urban area or high-growth urban area within their district or region. The application of these policies is not restricted to the boundaries of the urban area.

PD1: Local authorities that share jurisdiction over an urban area are strongly encouraged to work together to implement this national policy statement, having particular regard to cooperating and agreeing upon:

a) The preparation and content of a joint housing and business development capacity assessment for the purposes of policy PB1; and

b) The provision and location of sufficient, feasible development capacity required under the policies PA1, PC1 and PC2.

PD2: To achieve integrated land use and infrastructure planning, local authorities shall work with providers of development infrastructure, and other infrastructure, to implement policies PA1 to PA3, PC1 and PC2.

Policies PD3 and PD4 apply to all local authorities that have part, or all, of a high-growth urban area within their district or region.

Policy PD3 a) applies to all local authorities that have part, or all, of a medium-growth urban area within their district or region and choose to set minimum targets under policies PC5 to PC11.

PD3 b) and PD4 apply to all local authorities that have part, or all, of a medium-growth urban area within their district or region and choose to prepare a future development strategy under policies PC12 to PC14.

The application of these policies is not restricted to the boundaries of the urban area.

PD3: Local authorities that share jurisdiction over an urban area are strongly encouraged to collaborate and cooperate to agree upon:

a) The specification of the minimum targets required under PC5 and PC9 and their review under policies PC6, PC7 and PC10; and

b) The development of a joint future development strategy for the purposes of policies PC12 to PC14.

PD4: Local authorities shall work with providers of development infrastructure, and other infrastructure, in preparing a future development strategy under policy PC12.

Appendix 1.2

National Policy Statement on Urban Development Capacity

Appendix: Residential Housing Demand Modelling Methodology

1. Overview

Understanding residential housing demand is a key element of the National Policy Statement on Urban Development Capacity (NPS-UDC). The NPS-UDC defines demand under policy PB2 which covers housing demand and development capacity.

As a starting point, Councils should understand aggregate demand, the composition of demand (by type, location and price point) and demographic change using the most recent Statistics New Zealand population projections to determine short, medium and long-term housing demand.

2. Method

This section briefly summarises the methodology used to determine residential housing demand for Wellington City Council, Porirua City Council, Hutt City Council, Upper Hutt City Council and Kapiti Coast District Councils. These councils are contributing to a joint report led by Wellington City Council that covers the requirements highlighted in the NPS-UDC evidence and monitoring guidelines.

Baseline population and household forecasts have been undertaken by Informed Decisions (.id) on behalf of councils contributing to the NPS-UDC capacity assessment.

.id provide a comprehensive set of online forecasts which show how population, households and dwellings will change between 2013 and 2043 by small component areas of each council.

Information on the population and dwelling forecasts are presented in a variety of formats. These include tables that show changes over time, tables with detailed demographic profile information and dwelling estimates and interactive maps showing the spatial distribution of change over selected time periods are also available.

The population and dwelling forecasts for each council were last updated by .id on the following dates:

Council Area	Forecast updated
Hutt City Council	April 2016
Kapiti Coast District Council	Feb 2017
Porirua City Council [1]	Feb 2019
Upper Hutt City Council	Nov 2016
Wellington City Council	July 2016

1. The latest forecast figures updated in Feb 2019 have not been included in the report.

Population, household and dwelling forecasts for each council can be accessed via their website, or alternatively from the following web links.

Council Area	Web link
Hutt City Council	forecast.idnz.co.nz/hutt
Kapiti Coast District Council	forecast.idnz.co.nz/kapiti
Porirua City Council	forecast.idnz.co.nz/porirua
Upper Hutt City Council	forecast.idnz.co.nz/upper-hutt
Wellington City Council	forecast.idnz.co.nz/wellington

General Modelling Approach

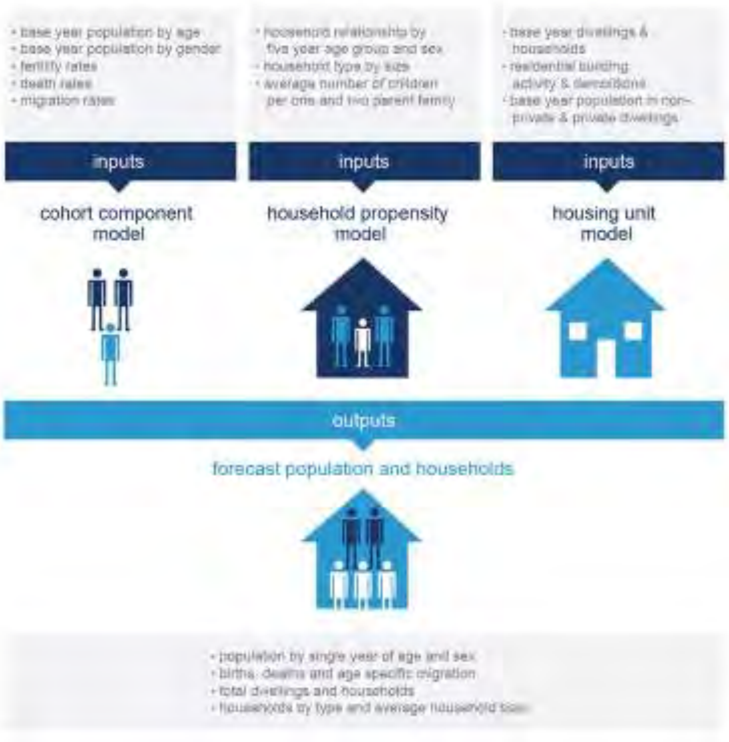
In general the forecast modelling approach adopted by .id is based on an analysis of the current population and household structure which often reveals the role and function of an area and the degree to which an area may be in some form of demographic transition.

Demographic changes such as births, deaths and local and international migration rates are applied to a base population in each area. At the same time .id take into account urban development drivers such as new residential development opportunities and vacancy rates etc. The combination of various assumptions results in a series of population forecasts and households by type. The diagram below describes the general approach.

Small Area Modelling Approach

The modelling approach used by .id for producing small-area forecasts is based on a bottom-up approach, with all assumptions being derived from a local area perspective. The drivers of the forecasts are predominantly based on levels of new residential development and local demographic assumptions, such as in and out migration rates for each local area.

The diagram below describes the various factors that contribute to the modelling process.



The population forecasts are based on a combination of three statistical models. They include a cohort component model, a housing unit model and a household propensity model. Each of the models has a series of inputs, which when linked to the other models provides the forecast outputs.

Details of each of the three statistical models can be found on the council web links provided in the table above.

3. Modelling

In addition, some further residential housing demand modelling has been undertaken by Wellington City Council for each of the other participating councils to analyse the impact of a high growth population scenario (Stats NZ high growth population forecast) on the number of households and dwellings in each council area. The high growth population forecasts have been applied to individual council area models based on the .id geographical areas, and assumptions around average household size and dwelling occupancy rates. The models generate a series of annual household and dwelling forecast outputs at a small area level (sub-council area) based on the high growth population forecast series.

The modelling work includes forecasts of dwellings by type (separate dwellings, townhouses, other private dwellings) for each council area. These forecasts breakdown the total annual dwelling figures generated by .id into estimates of different property types. The property type estimates are based on property type numbers by census area unit area from the 2013 census. Councils have adjusted their property type estimates over the forecast period where more recent information is available that would influence the growth rate of the different property types.

To comply with NPS-UDC requirements, population and dwelling forecasts have been extended from 2043 to 2047 with year 0 being 2017 in the various council residential housing demand models developed by WCC.

The outputs from this work have been combined for each council area to provide a range of estimates of dwelling and property type demand.

A classification or grouping of geographical areas into larger aggregate housing activity areas has been undertaken for a number of councils where housing typologies are similar across smaller area units. The classification allows for different types of projected growth to be identified and monitored. Typical housing activity areas capture a consistent form of development such as low density residential, future urban areas etc.

A summary of the number of forecast.id and the housing activity areas is summarised below:

Council Area	Informed Decisions Areas	Housing Activity Areas
Hutt City Council	28	6
Kapiti Coast District Council	14	14
Porirua City Council	14	6
Upper Hutt City Council	15	15
Wellington City Council	30	6
Total	**101**	**47**

4. Results

The results from the council residential housing demand models provide outputs at a high level (council wide level and by housing activity area) and by small areas over a thirty year period from 2017 (year 0) to 2047 (year 30). Model outputs include annual household and dwelling numbers for total dwellings (private occupied and vacant) from forecast.id and estimates of households, households by type and dwellings based on a high population growth series from Statistics New Zealand. Annual household and dwelling figures for the purposes of this report have been grouped into short term (2017 – 2020), medium term (2020 – 2027) and long-term (2027 – 2047).

Appendix 1.3

Wellington Region Residential Infill and Redevelopment Capacity Modelling – Methodology

Overview

The purpose of this document is to outline the process used to model the District Plan enabled residential development capacity allowed under the following Council's District Plans:

- Wellington City Council (WCC)
- Hutt City Council (HCC)
- Upper Hutt City Council (UHCC).
- Porirua City Council (PCC)
- Kāpiti Coast District Council (KCDC)

The modelling was undertaken as an input into the preparation of the Housing and Business Capacity Assessment (HBA) prepared to fulfil the requirements of the National Policy Statement for Urban Development Capacity (NPS).

WCC, with assistance provided by Eagle Technology, has taken the regional lead on modelling the residential capacity of the region to inform the HBA, producing the District Plan enabled development capacity on behalf of each of the Councils. The economic feasibility modelling was co-ordinated by WCC and completed by Property Economics, with specific construction cost inputs provided by Rider Levett Bucknall.

The capacity modelling has been undertaken on a parcel by parcel basis. On each parcel, multiple development types have been tested. These are

- Two types of development – infill or comprehensive redevelopment.
- Three housing types – standalone, terraces, or apartments; and
- three sizes for each type – small, medium, and large, based on a localised average for that type.

The capacity model 'builds' each outcome. The economic feasibility modelling then sets about estimating the construction costs and the sales revenue. The feasible outcome is then the yield from the development that is deemed most profitable.

Process

The residential capacity modelling is completed in four stages:

1. Data Preparation – the underlying data is prepared in ArcMap.
2. Procedural 3D Modelling – the data is imported into CityEngine for application of District Plan rules through 3D modelling.
3. ArcGIS Analysis – additional modelling of District Plan rules which cannot be modelled in CityEngine.
4. Economic Feasibility Analysis – Economic tests are applied in Excel to determine commercial feasibility and realisation. Further sensitivities are also applied here. More information is available in the Property Economics Report.

The following discussion provides more detail on each of these steps.

Data Preparation

GIS layers and associated data tables were created for each Council in ArcMap. This was completed by the respective Council and supplied to WCC.

The source data was land parcel GIS layers, supplied to each Council by Land Information New Zealand. Additional land based, rating database, and geospatial information was added. This includes:

- District Plan information – such as land use zoning, heritage buildings, and designations.
- Rating information – such as capital value, land value, improvement value, and improvement ratio.
- Geospatial information –cardinal direction of the street from the front boundary, direction of adjacent residential zones for centre type zones, and site coverage.

All data was aggregated into a GIS layer and associated table. The data was then cleaned and quality checked. Where a specific attribute had no data this was left blank.

Once the layers and associated tables are created, these need to be split into two, to test the two different scenarios; comprehensive redevelopment and infill. The redevelopment layer contains all the required District Plan, rating, and geospatial information. The spatial element of this data is the raw land parcels. The infill layer contains the same information but has the existing buildings on every site cut out. This excludes buildings which have less floorspace than $50m^2$; these buildings are often sheds or small garages which are considered expendable. Figure 1 below provides an example of the difference between the two layers.

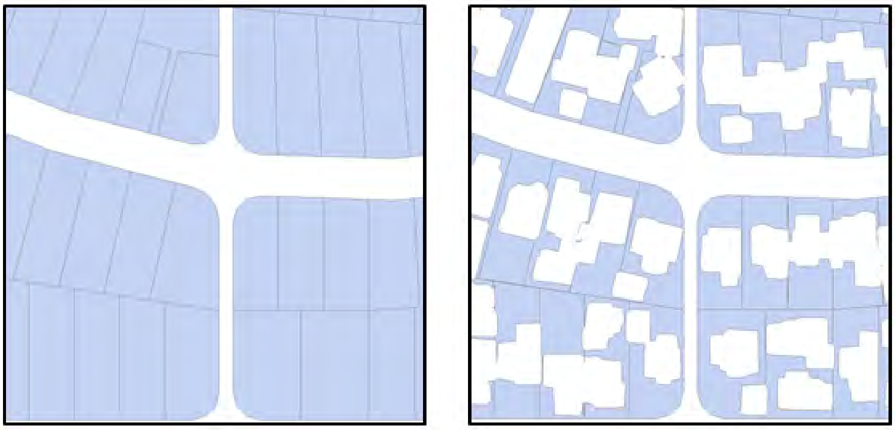


Figure 1 - Comprehensive Redevelopment (left) and Infill (right) GIS Layers

Procedural 3D Modelling

The data is imported into CityEngine for the purposes of 3D procedural modelling. Procedural modelling is a method which uses a customised rule file to undertake a series of tasks on any number of inputs. A key benefit of this method is that the parameters are alterable. The rule file for the capacity modelling was designed so that the District Plan provisions could be changed at any time; this is particularly useful for scenario testing beyond the HBA required by the NPS.

WCC developed the CityEngine rule file which is used to model the development capacity for each Council. The rule file is approximately 1800 lines of code and begins by setting all of the key parameters (District Plan rules, etc.) and then applying these, through a range of tests and geometric calculations, to develop a realistic 3D model of what could be built on a specific parcel. The rule file was designed to enable easy alteration and to report on the key statistics that provide the necessary information for the capacity modelling.

At a high level, the procedural modelling involves 5 steps:

1. Import the underlying GIS layers and align to terrain.
2. Apply the user set parameters (District Plan zone, rules, etc.).
3. Run a range of tests and geometric operations.
4. Produce models of what can be built.
5. Produce reports on key statistics.

The first step is to import the comprehensive redevelopment and infill layers that were prepared in the Data Preparation stage of the process. The rule file draws many of the parameters straight from these layers and the modelling is performed over all individual parcels. These 2D layers also need to be aligned to the relevant terrain data. Once this is done the data becomes 3D and the slope on each site can be factored into the modelling. An example of the terrain data applied to the parcels can be seen in Figure 2.

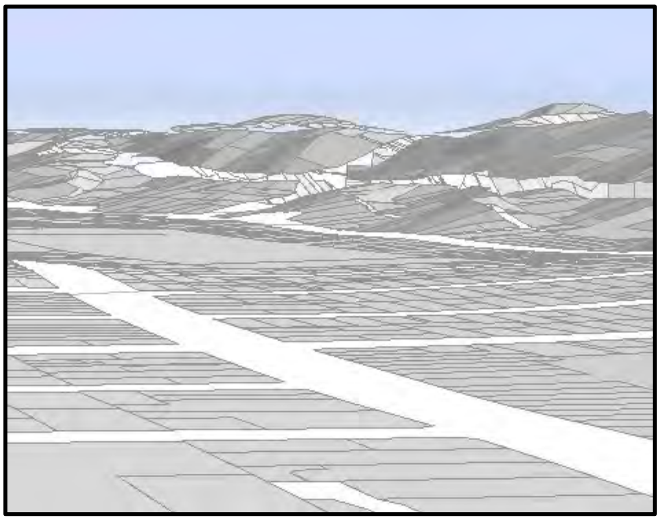


Figure 2 - Terrain Data Applied to Parcels in Miramar, Wellington City.

The next step is to apply the user set parameters, specific to each Council. These have been written into the custom rule file in a way that enables each Council's parameters to be separate of the others. The parameters that were included are the respective Council's District Plan rules which include height limits, building recession plane requirements, site coverage limits, and yard requirements. It is within these parameters that the buildings are modelled on each site.

Once the user set parameters have been entered, these are applied to all parcels within a Council area. This is done through a series of custom tests and operations that look at the specific parameter and place limitations on how the 3D modelled development will be extruded on each site. The model completely maximises the development potential of each site, however it is not possible for a development to exceed the limitations placed on it through the set parameters. Once all user set parameters are entered and appropriately tested, the entire city can be modelled, parcel by parcel, at once. A small example of what this looks like is shown in Figure 3.

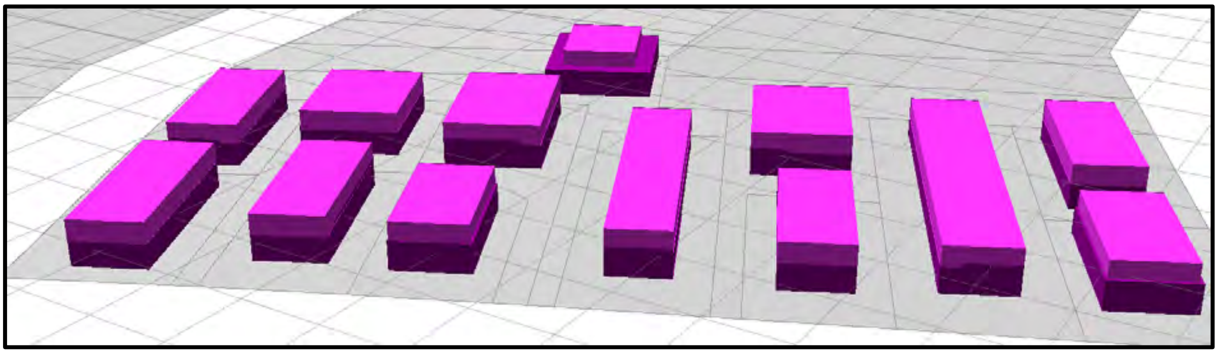


Figure 3 - Example of the comprehensive redevelopment 3D output, Miramar, Wellington City.

The final step of the procedural modelling stage is to collect the key statistics that have been generated through the modelling process. This includes information such as the number of dwellings and floorspace areas. Once all parcels for the comprehensive redevelopment and infill scenario have been modelled, the data is exported from CityEngine as two individual multipatches. These multipatches contain associated tables that hold the key development statistics.

ArcGIS Analysis

The next stage in the process was initially built and run using ArcMap's Model Builder. It has since been converted to a series of ArcPy and Visual Basic scripts. The ArcGIS analysis stage has 4 broad steps.

1. Apply Development Contribution (DC) areas and rates.
2. Apply open space and car parking requirements.
3. Maximise the development and split the result into multiple development types.
4. Apply minimum lot size rules.

This process requires four inputs; the spatial DC areas, the multipatch from CityEngine, the original parcel layer, and a layer which contains the roads for the relevant Council. Once these inputs are ready, the script runs through the above process in the above order.

DC fees are based on where in a city a house is being built. Each Council has a spatial DC layer which splits the city up into areas; each area has a particular chargeable fee. To incorporate this into the modelling, the DC layer is referenced by the script and a field is created in the multipatch layer to determine which DC area each property is located in. This then determines how much each development will be charged for the DC.

The open space and car parking requirements are modelled through a similar process to one another. The process uses the multipatches to cut the modelled shape of the new dwelling/s out of the underlying parcel Polygons are then created in the remaining area which represent the car parks and open space. Calculations are made to determine how many car parks and how much open space can fit on the remaining area of the site. For car parks, this is done by dividing the areas up by the adequate car park size and then counting how many spaces for carparks there are. For open space, this is done by calculating the area of the polygons that have been created to represent open space. Car parks differ in that they also have to be connected to a driveway. To determine if this is possible on a site, another polygon is created that must be 2.5m wide and must touch both the road layer and the parking space. If it is determined that the modelled development does not allow the required amount of car parks or open space then the development fails these tests. However, there is another chance to meet these requirements in the maximisation stage. An example of the car parking output can be seen in Figure 4.

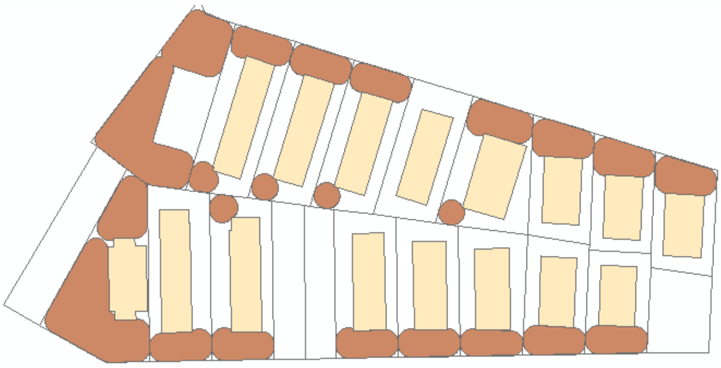


Figure 4 - Example of Car Parking Output. The light colour is the modelled buildings; the dark is the car parking space.

Following the car parking and open space tests, the model then maximises the development on the site by reducing the building space and assigning that space to car parks and open space until the required amount of car parking and open space is met. This is done through a recursive test that keeps processing until the district plan requirements are met or until there is no more building space.

Once this is done, the single modelled development for both the comprehensive redevelopment and infill scenario is split into 3 different types, where those types are possible; standalone, terrace, and apartment. These types are also split into three different sizes which deviate from the average dwelling size in a particular suburb; small, medium, and large. At this point, there are up to 18 development types over every modelled parcel.

Some Councils have a minimum lot size rule. This rule requires a minimum site area after subdivision or a notional net site area per dwelling, if no subdivision were to occur. To model this rule the process applies a calculation which determines how many individual lots are possible from the subdivision of one site. This number is used as the maximum amount of dwellings that can be achieved on that site. If the modelled development exceeds this number then the development is scaled back to the maximum. If the modelled development does not exceed this number then the modelled figure is used as the total yield. The output at this stage is the plan enabled capacity and this can now be tested for economic feasibility.

Economic Analysis

The final stage of the process is the economic feasibility analysis over the modelled developments in order to determine which are economically feasible to develop, i.e. which developments will return a suitable profit for a hypothetical developer. WCC has co-ordinated this analysis and Property Economics has completed it, with specific construction cost input from Rider Levett Bucknall.

At a high level, the economic analysis is done by incorporating all the costs of a development, incorporating a realistic sale price, and then determining if the development is profitable. The types of costs included are the initial purchase price, professional fees, civil works fees, network provider fees, and the construction cost from building to painting. Where necessary, these costs change based on the type of development being modelled and where in the city the development is.

This analysis is performed across all of the scenarios on one site. The final capacity number is based on the most profitable scenario.

For a more detailed discussion on the economic feasibility modelling, see the relevant Property Economics report, appended elsewhere in this HBA.

Key Assumptions

The key assumptions that have gone into the modelling process are listed below.

- The residential modelling has taken place on parcels below 5 hectares. Anything above 5 hectares is modelled using the Wellington Region Greenfield Model. For details of this, see the MRCagney report.
- The floor height used in the modelling is 3m. This accounts for stud heights of 2.4-2.7m with space for services.
- To avoid unrealistic development the model uses the below dimensions:
    - Minimum width of 6m.
    - Minimum ground floor area of 50m^2.
    - Minimum total floor area of 50m^2
- A standalone development type is classified as a single dwelling.
- A multi-unit type is classified as multiple dwellings up to 3 storeys.
- An apartment is classified as any development that reaches 4 storeys or higher.
- An analysis of average building sizes for both standalone houses and multi-unit houses was undertaken for every suburb in every Council area. These figures were used as the average building sizes. This figure ranges from 55m^2 for an apartment in Wellington Central to 290m^2 for a standalone house in Waikanae Park, Kāpiti.
- Although the model does not specifically subdivide a property, it does generate multiple dwellings on one site. To incorporate the required subdivision it is assumed that every dwelling on a site has an equal share of the land. For example if a site was 600m^2 and 2 dwellings were generated, each dwelling would have 300m^2 of land.
- In mixed-use areas, as well as incorporating district plan rules around the requirements for retail on ground floor, mixed use proportions were used to determine how much of a

development will be residential vs. commercial. These were based on an analysis of each Councils rating database and, in some cases, building consent plans. For the purposes of economic modelling, each development is initially modelled at 100% residential but is then scaled back after the economic modelling. This is to ensure the entire development is being tested for feasibility. The leftover floorspace is then used for determining business capacity in the respective zones. The residential proportions of the mixed use floorspace for each Council are shown in Table 1.

Table 1- Proportion of residential in Mixed Use Zones

Council	Zone & Suburb	Proportion
Wellington City Council	Centre	10%
	Central Area	50%
	Central Area & Suburb = Wellington Central	33%
	Central Area & Suburb = Te Aro, Pipitea, Mount Victoria, Count Cook, Thorndon	67%
	Business 1	10%
Porirua City Council	City Centre	10%
	Suburban Shopping Centre Policy Area	25%
Kāpiti Coast District Council	Town Centre	20%
	Town Centre & Suburb = Ōtaki	12%
	Town Centre & Suburb = Paraparaumu Beach North and Paraparaumu Beach South	40%
	Town Centre & Suburb = Waikanae Beach	20%
	Town Centre & Suburb = Waikanae East	20%
	Town Centre & Suburb = Waikanae Park	20%
	Town Centre & Suburb = Waikanae West	20%
	Town Centre & Suburb = Raumati Beach	40%
	Local Centre	10%
	Local Centre & Suburb = Paekakariki	50%
	Outer Business Centre	10%
	District Centre	15%
Hutt City Council	Suburban Commercial	10%
	Central Commercial	20%
	Petone Commercial Area 1	30%
	Petone Commercial Area 2	10%
Upper Hutt City Council	Business Commercial	20%

Limitations

The modelling has taken many factors into account to produce realistic development. However, due to the many unpredictable factors, there are limitations. These are listed below.

- Land owner desire to develop – not every person that has development potential on their property is going to develop, even after taking into account realisation rates (see the relevant Property Economics report).
- The model maximises development on every site. In reality, the maximum development potential is not always realised due to many factors, including developer preferences.

- Amalgamation of properties – The model does not take into account the amalgamation of adjoining properties. This is due to the complexities of knowing where and when this will occur.
- Data quality issues – there are some instances where the underlying data is incorrect or is missing.
- Activity status – under the relevant District Plan, not including Wellington City, only the permitted activity status has been modelled. The model has not incorporated what could be achieved through a resource consent process.
    - For Wellington City, the restricted discretionary status for multi-unit residential development was modelled. This is because there is sufficient evidence that multi-units will be granted consent, in most cases.

Appendix 1.4

Wellington greenfield development feasibility modelling

Final Report

Prepared for: Wellington City Council

Prepared by: MRCagney Pty Ltd, Auckland, New Zealand, in partnership with Colliers International

Document Information

Project Name	Wellington greenfield development feasibility modelling
Status	Final Report
Client	Wellington City Council
Client Reference	
MRC Reference	NZ2342
File Name	/Users/peternunns/Documents/6 MRCagney - work/4 Projects/WCC/Wellington greenfield models/Final issue/Wellington greenfield feasibility modelling tech report FINAL REPORT.docx

MRCagney Pty Ltd
Level 4, 12 O'Connell Street, Auckland, 1010
PO Box 3696, Shortland Street, Auckland, 1140
New Zealand

t: +64 9 377 5590
f: +64 9 377 5591
e: auckland@mrcagney.com
www.mrcagney.com

Quality Assurance Register

Issue	Description	Prepared by	Reviewed by	Authorised by	Date
1	Draft Technical Note	Peter Nunns		Peter Nunns	2 August 2018
2	Draft Report	Peter Nunns	Danielle Gatland	Peter Nunns	5 October 2018
3	Final Report	Danielle Gatland / Phil Donovan	Peter Nunns	Peter Nunns	14 December 2018

MRCagney Pty Ltd
Level 4, 12 O'Connell Street
Auckland, 1010
PO Box 3696, Shortland Street
Auckland, 1140
New Zealand

t: +64 9 377 5590
f: +64 9 377 5591
e: auckland@mrcagney.com
www.mrcagney.com
NZBN 1317981

Contents

1 Introduction

This technical report presents the Wellington greenfield land development feasibility model that MRCagney and Colliers developed for five Wellington territorial authorities, and describes key inputs, assumptions, and findings from analysis.

In this report, we use the term 'greenfield development' to refer to the conversion of rural land to urban uses, in particular residential subdivisions. However, this model could equally well be applied to any large parcel of undeveloped or lightly-developed land ranging from a golf course to a major industrial site that has been cleared for redevelopment.

The model described in this report estimates the commercial feasibility of developing new residential subdivisions in the Wellington region, based on information available in mid/late 2018, taking into account:

- The quantity of land that is available for development, which was estimated based on Wellington's GIS-based development capacity model
- The cost of acquiring greenfield sites for development, which is based on site valuations updated to current (2018) values
- The cost to undertake site works, provide infrastructure, and subdivide sites, which are based on unit cost rates supplemented with other case study and market data
- Sale prices for residential sections with a given size, location, and characteristics such as slope and view, which are estimated based on statistical analysis of recent property sales in the Wellington region.

This model extends the greenfield development feasibility model published by the Ministry of Business, Innovation and Employment to assist councils in assessing development feasibility. While the basic setup and workings of the model have not changed, we have:

- Extended the model to address an arbitrarily large number of greenfield sites, rather than a single 'representative' site
- Comprehensively reviewed the default unit cost parameters in the MBIE model and amended these values where there is evidence that costs are likely to be different in the Wellington context
- Adjusted how the model calculates earthworks requirements and road reserve area to account for the impact of Wellington's hilly topography
- Developed location-specific and site-specific estimates of section sale prices based on a statistical analysis of five to ten years of residential property sales, supplemented with market insights from Colliers.

1.1 Concept of feasibility analysis

'Feasibility analysis' refers to analysis of whether expected revenues from developing a piece of land exceed the costs of development, including a profit margin to cover the effort and risk involved in the development process. Somebody who is considering subdividing land for residential use will typically begin by asking whether current prices for residential sections are likely to cover the cost to buy a site, survey and plan it, undertake earthworks, provide roads and pipes, and market new sections. If the answer is 'no', then the development is unlikely to proceed.

Feasibility analysis focuses on the commercial calculations of a profit-seeking developer, rather than broader economic, social, or environmental considerations that may affect whether a development is beneficial for society. For instance, a site may be profitable to develop even though it has large negative impacts on biodiversity or high costs to service with publicly-funded infrastructure. In such a case, it may be desirable to limit development to avoid those impacts.

While council decision-making about where to enable growth through district plans and infrastructure provision should also respond to factors other than commercial feasibility, there are several reasons why it is important for councils to undertake feasibility analysis, especially of housing development capacity.

First, because feasibility is a prerequisite for most development to occur, it should inform councils' expectations for what will happen as a result of district plan and infrastructure decisions. Developments that are feasible are more likely to occur, while developments that are not feasible are less likely to occur, at least until market conditions change.

When councils have a choice about whether to enable additional development capacity in one location or another, it is preferable to choose the location that is more feasible to develop. This can help to ensure that planning provides appropriate opportunities for people to be housed and to reduce the risk of investing in 'stranded' infrastructure assets.

Second, councils have an important role in regulating and facilitating new development, and analysing feasibility can improve their ability to understand development processes. Identifying factors that exert the strongest influence on whether a development is feasible or not can assist in designing policies that shape the form of urban development. It can also help in understanding which 'pain points' are most important to overcome to unlock development in desirable locations.

1.2 Limits of feasibility analysis

Feasibility analysis is not a forecast of exactly what will happen 'on the ground'. While a development that is more feasible is more *likely* to occur than one that is less feasible, there are a number of reasons why a feasible development may not occur, or an infeasible development may occur. These include the following:

Landowner intentions
Some landowners may not be interested in developing land (or selling their site to a developer) even if they could profit by doing so, because they prefer to retain existing uses. For instance, somebody who owns a family farm on the edge of an expanding urban area may prefer to continue farming until they retire, or even leave the farm to their children as a going concern.

Conversely, some landowners may be willing to supply land at a discount relative to its market value to achieve their preferred development outcome. For instance, a public or community housing provider may develop land at a financial loss in order to meet its goal of supplying affordable housing for low-income people.

Changing market conditions
Feasibility analysis presents a snapshot of the profitability of developing at a given point in time. If market conditions change significantly, it may affect the price to buy greenfield land for development, the cost of inputs to land development, or the sale price for development-ready sections. These will in turn affect the profitability of greenfield development.

Changing market conditions can have several impacts:

- Region-wide changes in costs or prices can affect the overall quantity of development that is feasible – a 'rising tide lifts all boats' effect.
- Localised changes in prices can affect the spatial distribution of feasible development – for instance, if prices are rising in one suburb and falling in another, then development will become more attractive in the first location and less in the second.

In this report, we do not attempt to predict future market conditions. However, we note that market conditions *have* changed significantly in recent years. As shown in the following chart, MBIE's residential land value index has risen significantly since 2015 throughout the Wellington region. We have used mid-2018 prices and costs in this analysis, noting that feasibility outcomes may have been different in the recent past.

Figure 1: MBIE residential land value index for Wellington territorial authorities

Moreover, there are some signs that the spatial structure of prices is changing in the Wellington region. The following table summarises change in MBIE's residential land value index over the 1998-2018 period.

Over the full period, Kāpiti Coast has experienced the largest percentage increase in residential land values, while Wellington City has experienced the lowest increases. However, in the recent period of price growth (2015-2018), Lower Hutt and Upper Hutt have experienced the highest percentage increases. While there are more similarities than differences in rates of increase, this may indicate that development in the Hutt Valley is becoming more feasible relative to development elsewhere in the region.

Table 1: Changes in residential land values in the Wellington region

TA	MBIE residential land value index				Percentage change	
	Jun-98	Jun-08	Jun-15	Jun-18	1998 to 2018	2015 to 2018
Wellington City	1.712	3.846	4.047	5.678	232%	40%
Lower Hutt City	1.357	3.470	3.446	5.089	275%	48%

Upper Hutt City	1.090	2.836	2.757	4.019	269%	46%
Porirua City	1.133	3.006	2.969	4.261	276%	44%
Kāpiti Coast District	1.315	2.652	3.572	5.098	288%	43%

Note: These values show nominal price increases that have not been adjusted to account for general price inflation.

Local factors affecting costs or prices

We have endeavoured to ensure that inputs to feasibility modelling are reasonable, and that cost and revenue inputs vary appropriately based on the observed characteristics of particular sites. However, the model we have developed will not necessarily capture all local factors that may affect costs or prices, and hence influence the profitability of developing sites.

For example, some sites may have geotechnical constraints, flooding issues, or constraints around cultural heritage or biodiversity that may be difficult to detect without an in-depth site assessment. These may affect subdivision design or costs to develop the site. Conversely, some sites may have features that make them unusually attractive places to live, such as outstanding scenic views or good sunlight and exposure, and which may not be fully captured in section price estimates.

In general, it pays to take a conservative view about costs as they seldom go down upon further investigation. We have incorporated cost contingencies into the model as a 'buffer' for unexpected costs, but further sensitivity testing may be wise.

1.3 Overview of this report

This report is structured as follows:

- Section 2 presents an overview of feasibility model workings, highlights key user inputs and outputs, and explains how users can update the model to include additional sites or to reflect changes in development costs and prices in future years
- Section 3 explains input assumptions for land development costs, including sources for key assumptions and estimates
- Section 4 explains how we have estimated prices for new residential sections throughout the Wellington region
- Section 5 applies this model to Wellington greenfield sites, discusses implications of this analysis, and highlights areas where further work may be useful.

Technical appendices provide supplementary information where needed.

2 Overview of model workings

To begin, we describe the model dashboard. This is the key point of interface for most users. It provides a summary of model outputs, and sensitivity toggles and scenarios for testing the most likely variables to impact feasibility. This review is in Section 2.1.

The rest of Section 2 describes the detail in more model, including the raw site inputs, pre-processing steps, model calculations, key outputs, and how to update the model for future relevance.

The model is implemented in Excel to ensure that it is accessible to a range of users. All calculations have been implemented using base Excel spreadsheet functions – there is no need to use Visual Basic macros or Excel's data analysis tools. At the time of reporting, the model was less than 3 MB in size, meaning that it can easily be circulated via email.

2.1 User interface, model dashboard

The "Summary dashboard" sheet summarises outputs from the model and allows users to sensitivity test the results. Most users will only need to interact with the dashboard, as it presents key outputs and enables basic sensitivity tests. Figure 2 shows the key elements of the dashboard.

Figure 2: Feasibility model: summary dashboard

MRCagney

Wellington Greenfield Development Model

Summary Dashboard

Note: This sheet contains summary metrics to understand the feasible greenfield development capacity from the input sites.
Users can select values in the green-highlighted cells to affect outcomes.

Scenario selection

TA being assessed	Porirua City	
Scenario	**Option**	**Notes**
Time to develop subdivisions (mo	18	Base assumption is 18 months; suggested sensitivity tests of 24 or 30 months
Feasibility scenario	Maximise number of lots	Options: Maximise number of lots, maximise gross profit, maximise profit margin
Minimum *net* density	10	Minimum net density (sites per hectare)
Maximum *net* density	30	Maximum net density (sites per hectare)
Price and cost sensitivity tests		
Section pricing model	Model 1	Options: Model 1, Model 4
Civil works contingency sensitivit	25%	Base: 25%. Sensitivity: 30%
Fees and charges contingency se	10%	Base: 10%. Sensitivity: 15%
Price scenario	Base	Options: Low, Medium, High, Manual (NOTE: If you select manual, please enter price/cost sensitivities below)
Sale price sensitivities	0%	This raises or lowers dwelling sales prices relative to their baseline (2018) values.
Cost sensitivities	0%	This raises or lowers development costs relative to their baseline (2018) values.
Land purchase price sensitivities	0%	This raises or lowers land purchase prices relative to their baseline (2018) values. To exclude the cost of purchasing a site from the analysis, set this to -100%.
Apply Upper Hutt Reserve Fund	Yes	Options: Yes, No (note that if this is yes, but the TA being assessed is not Upper Hutt, then the reserve fund is not applied)
Gross margin sensitivity tests		
Gross margin required for a development to be feasible	20%	Base assumption is 20% gross profit margin requirement; suggested sensitivity tests range from 15% to 30%

Key	
(green)	User inputs
(yellow)	Calculations (do not change)

Output summaries

Zone	Site attributes & plan enabled capacity				Feasibility of council capacity estimates			Feasibility outputs for other density options (sensitivity tests)		
	Number of sites	Total land area (hectares)	Total developable	Number of plan enabled	Number of feasible sites	Feasible area to develop	Number of added	Number of feasible sites	Feasible area to develop	Number of added sections
PCC - Suburban Zone, Rural Zone	6	76.2	74.1	948	6	74.1	948	6	74.1	1493
PCC - Suburban Zone	1	4.4	4.4	56	1	4.4	56	1	4.4	88
PCC - Rural Zone, Judgeford Hills Zor	1	127.3	111.5	1447	1	111.5	1447	1	111.5	2273
PCC - Judgeford Hills Zone	1	4.7	4.7	59	1	4.7	59	1	4.7	94
PCC - Rural Zone	1	141.5	128.0	1660	1	128.0	1660	1	128.0	2597
PCC - Suburban Zone, Open Spaces Z	2	51.7	51.7	668	2	51.7	668	2	51.7	1047
	0	0.0	0.0	0	0	0.0	0	0	0.0	0
Totals	**12**	**405.9**	**374.5**	**4838**	**12**	**374.5**	**4838**	**12**	**374.5**	**7592**

Area Unit	Site attributes & plan enabled capacity				Feasibility of council capacity estimates			Feasibility outputs for other density options (sensitivity tests)		
	Number of sites	Total land area (hectares)	Total developable	Number of plan enabled	Number of feasible sites	Feasible area to develop	Number of added	Number of feasible sites	Feasible area to develop	Number of added sections
Pukerua Bay	2	35.2	35.2	454	2	35.2	454	2	35.2	712
Mana-Camborne	1	24.9	24.1	311	1	24.1	311	1	24.1	488
Adventure	1	4.4	4.4	56	1	4.4	56	1	4.4	88
Resolution	2	132.0	116.2	1506	2	116.2	1506	2	116.2	2367
Paekakariki Hill	1	141.5	128.0	1660	1	128.0	1660	1	128.0	2597
Plimmerton	0	0.0	0.0	0	0	0.0	0	0	0.0	0
Ranui Heights	2	5.7	5.1	60	2	5.1	60	2	5.1	98
Porirua Central	1	10.3	9.7	123	1	9.7	123	1	9.7	195
Titahi Bay North	2	51.7	51.7	668	2	51.7	668	2	51.7	1047
	0	0.0	0.0	0	0	0.0	0	0	0.0	0
Totals	**12**	**405.9**	**374.5**	**4838**	**12**	**374.5**	**4838**	**12**	**374.5**	**7592**

At the top of the dashboard there are a set of options for user-selected sensitivity tests. These sensitivity tests are described in Table 2. See the "User Guide" sheet in the spreadsheet model for assistance in understanding what impact each variable has on the feasibility of developments. Note that for some variables, large changes in their value may not cause significant changes to the feasibility outputs.

Table 2: Options for sensitivity tests and inputs

Group	Variable	Recommended value	Description
TA being assessed			Select the TA for the sites to assess.
Scenario options	Time to develop	18 months	Time to develop greenfield sites. Suggested sensitivity tests are 24 or 30 months.
	Feasibility scenario	Maximise number of lots	Options: Maximise number of lots, maximise gross profit, maximise profit margin
	Minimum *net* density	10	Range of net density values to sensitivity test the input greenfield capacity estimates. The images on page 12 give examples of different dwelling densities.
	Maximum *net* density	30	
Price and cost sensitivities	Section pricing model	Model 1	Options to apply alternative statistical models of section prices: Model 1 (linear model), Model 4 (log model)
	Civil works contingency sensitivity	25%	Contingency of civil works costs, as proportion of total civil works costs
	Fees and charges contingency sensitivity	10%	Contingency of fees and charges, as proportion of total fees and charges
	Price scenario	Base	Options: Base, low, high, manual. For manual, each of the sales price, cost, and land purchase price sensitivities can be specified individually. To sensitivity test the case where developers purchased land in the past at a negligible price and held it for future development, set the land purchase price sensitivity to -100%.
	Apply Upper Hutt Reserve Fund	Yes	The Upper Hutt Reserve Fund (4% of market value of lots) will only apply if Upper Hutt is selected as the TA
Gross margin sensitivity tests	Gross margin required for feasibility	20%	Gross profit margin required for a development to be considered feasible

The output summary tables have three main aspects, which are displayed in three groups of columns. The summary aims to communicate information regarding:

- Site attributes and plan enabled capacity (number of sites, total area of sites including un-developable area, total developable area of sites, number of plan enabled sections)
- Feasibility of council capacity estimates (number of feasible parcels, total area of feasible developments, number of added subdivided lots)
- Feasibility of alternative densities (number of feasible parcels, total area of feasible developments, number of subdivided lots)

Dwelling density examples

16 dwellings per hectare.
Montrose Grove, Churton Park, Wellington

21 dwellings per hectare.
Rimu Road, Kelburn, Wellington

33 dwellings per hectare. Somerset Avenue, Newtown, Wellington

2.2 Greenfield development capacity data

The greenfield feasibility model is designed to use outputs from Wellington City's GIS-based development capacity model with some additional pre-processing. The development capacity model identifies large greenfield parcels that have been zoned for urban development or identified as future urban zones.

The spreadsheet model is designed to accept development capacity model outputs in spreadsheet form. The following attributes are required for each greenfield site:

- **Unique_Parcel_ID**: This is a field that identifies each distinct parcel. There can be multiple input sites with the same "Unique_Parcel_ID", in which case they will be aggregated within the spreadsheet model.
- **zone**: This is the district plan zoning currently applied to the site. This is used to summarise model outputs.
- **Parcel_area_m2**: This identifies the total area of the parcel (in square metres), including area that is undevelopable.
- **DevelopableSpace_ha**: This identifies the total developable area (in hectares) estimated in the development capacity model.
- **capital_value**: This is the assessed value of the site, based on the most recent ratings valuation.[1] This is used to estimate the cost to purchase the site for development.
- **DwellingCount**: This identifies the number of existing dwellings on the site, if any. The final output refers to the "net added lots", so the existing dwelling count is subtracted from the total number of sites.
- **GreenfieldDwellingCapacity**: This is an estimate (from the development capacity model) of the total number of dwellings that could be developed on the site under district plan rules. This has been calculated based on assumed gross density per dwelling.
- **Constraint_Total**: This is an indicator of the degree to which each individual parcel (or parcel sliver) is available for development based on geographic and infrastructure constraints. A value of 0 indicates that the site has no development potential, whilst a value of 1 indicates that the whole site is available for development.
    - The constraint scores are inherited directly from councils' capacity estimates, and can split parcels up into multiple slivers, based on overlays that intersect only part of the parcels.
    - This process split up individual greenfield parcels into multiple slivers.

We conducted some additional pre-processing and manual inspection of sites to join several additional variables that were not included in outputs from the Wellington development capacity model. The additional variables that are recommended to be included are:

- **Levy_Area** (recommended): The zone/area for development contributions. We used GIS shapefiles of DC charging areas (supplied by Wellington TAs) to identify which charging area each greenfield site falls into.
- **DevelopmentContribution** (required): The value of the development contribution owing for each new site. We joined data on development contributions per dwelling for each of the DC charging areas.

[1] At the time that this report was written, the most recent valuations were as follows: Wellington City, Upper Hutt City: 2015; Porirua City: 2016; Lower Hutt City, Kāpiti Coast District: 2017.

- **AU2013_NAM** (required): Census area unit names. We matched each greenfield site to a 2013 Census area unit using the parcel centroids. This is used for estimating section revenues for each site.
- **SlopeClass** (required): From data provided by Wellington City Council, each input site was classified as relatively flat, moderate slope, or steep slope. This field details how each site has been classified.
- **Share_View_Water**[2] (recommended): What proportion of the new sites are expected to have a view of the water.
- **Share_View_Land**[2] (recommended): What proportion of the new sites are expected to have a view of land.

2.3 Description of model workings

The feasibility spreadsheet is used to apply costs to the identified sites and estimate the feasibility of greenfield developments. The inputs include the greenfield sites, development cost estimates, and other development inputs. The feasibility of development is estimated, and the results are then summarised. Figure 3 illustrates the general model workflow.

To use the model to estimate the feasibility of developing new residential sections on greenfield sites, users must provide data on the greenfield sites in question, including their size, net developable area (accounting for constraints), estimated dwelling capacity, capital value, location (identified using 2013 Census area units), and development contribution charging area.

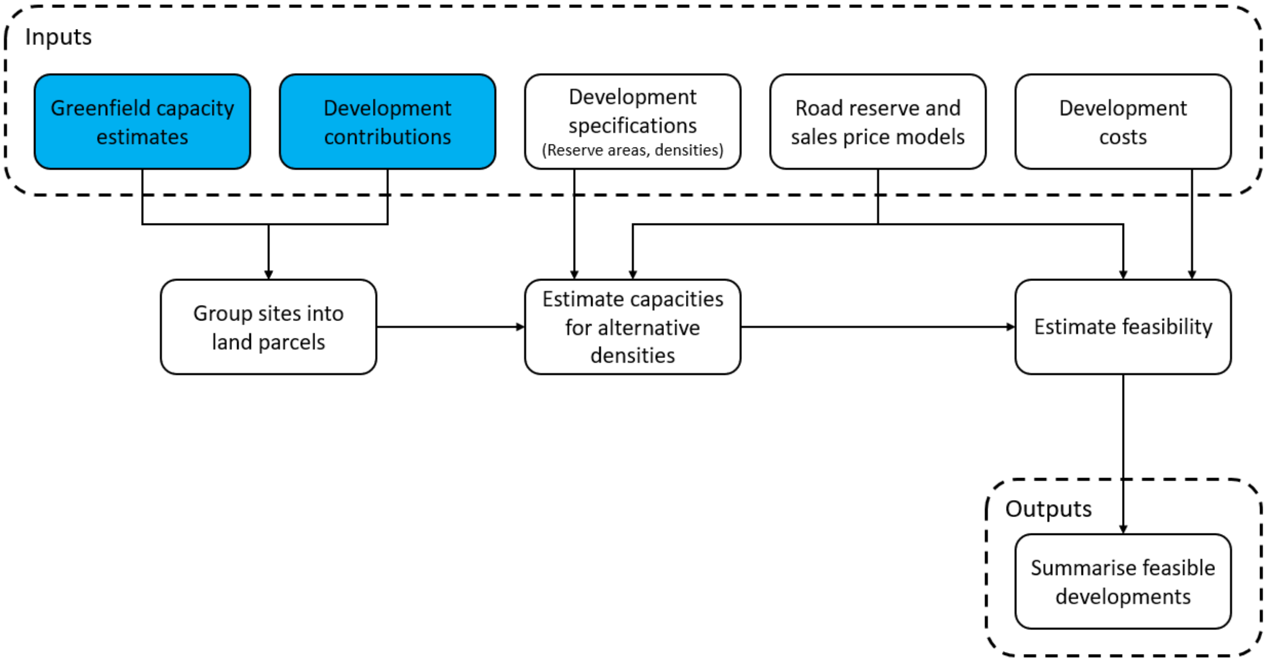
Other model inputs include functions to estimate road reserve requirements and residential section prices for greenfield sites in different locations and with different characteristics and parameters to estimate development costs.

The model then calculates the estimated cost to develop new sections on each site and the expected revenue from development. In addition to the estimated dwelling capacity, the model sensitivity tests a range of alternative dwelling densities. It then identifies whether any of these development options are commercially feasible, which is defined as delivering a gross profit margin above a selected threshold. (A default threshold of 20% is used in the model.)

The model dashboard summarises outcomes for total plan-enabled capacity and feasible capacity by district plan zone type and Census area unit. It also allows users to sensitivity test alternative assumptions for costs, revenues, and feasibility thresholds.

[2] The views of water and of land can be estimated using a manual assessment from online maps. These variables range from 0 (no views) to 1 (all sites have views), and the Share_View_Water and Share_View_Land should sum to 1 or less (ie a site should not be considered to have a view of land and water). These inputs affect the section pricing estimates. MRCagney performed this manual assessment on the original sites that were provided for Porirua, however no assessment has been made for subsequent data provided to MRCagney as capacity model outputs changed significantly near the end of the project. We sensitivity tested the impact of adding view attributes for sites that were not feasible, finding that they had little impact on the outcomes.

Figure 3: Greenfield feasibility model workflow



2.3.1 Model inputs

The necessary inputs for estimating the feasibility of greenfield developments are as follows:

Greenfield sites: For each territorial authority included in the model, there is an input sheet containing the pre-processed data described above.

- Unique Parcel ID
- Constraint_Total
- Developable space (hectares)
- Estimated greenfield dwelling capacity
- Zone
- Suburb
- Capital value
- Existing dwelling count
- Total parcel area (m^2)
- Development contribution charging area and DC per dwelling (spatially joined in the pre-processing)
- Census area unit (spatially joined in the pre-processing)
- Slope attribute (Relatively flat, Moderate slope, or Steep slope)
- Share of site with views of water or views of land

Costs: Unit cost rates for land development are standard across all territorial authorities.

- Civil works costs (site preparation, earthworks, subdivision, roading, infrastructure)
- Fees and charges (resource consent fees, project management, legal fees, sales and marketing)

Other inputs: These inputs are used to update capital values and estimate the quantity of earthworks, reserve areas, and roads

- SPAR index (sales-price to appraisal ratio) for dwelling sales in the year of valuation and the most recent SPAR index (to estimate the inflation in dwelling sales prices since the ratings valuations)
- Earthworks requirements: average volume of earthworks per site area for sites of varying steepness
- Reserve areas (proportion of sites reserved for eg wastewater, stormwater, landscape reserves)
- Road reserve coefficients: coefficients for the road reserve model. See Section 6 for more

Inputs for each district: Each territorial authority has a separate section pricing model. The coefficients for each territorial authority are input on the relevant sheet.

- Section sales price coefficients: For estimating the average section sales price of developments. See Section 4 for more

2.3.2 Model calculations

The methodology for the feasibility calculations is as follows.

"Sites" sheet: This sheet groups together greenfield parcel slivers based on the Unique_Parcel_ID variable and organises them in a form that is suitable for feasibility calculations.

- The raw input sites are grouped according to the field specified in cell B3 on this sheet.
- The following attributes are summed for each unique parcel: existing dwelling counts, developable space, total parcel area, and estimated greenfield dwelling capacity.
- The following attributes are averaged for each unique parcel: capital value (as this is estimated for the whole parcel before the sites are disaggregated, so all slivers should have the same capital value).
- The maximum value for any individual site within the unique parcel is selected for: development contributions.
- The following attributes are simply inherited from the first instance of each site within the raw input sheet: district plan zone, Census area unit, and proportion with views of land or water.
- The proportion of the parcel with varying levels of steepness is calculated by weighting the degree of steepness of each site within the parcel by the developable area of each site.

Workings sheets (entitled "Density1" - "Density5", and "InputDensityOpt"): These sheets calculate development costs, revenues, feasibility, and dwelling yields for a range of alternative net density options. To do so, they:

- Estimate the amount of area devoted to roads and landscape/water reserve
- Update the 'developable area' attribute to subtract road and reserve areas calculated above
- Estimate site-specific costs of construction, fees and other charges, and the purchase cost of sites, taking into account price movements since the most recent ratings valuations. These costs are GST-exclusive.
- Estimate section sales prices and total revenue for the proposed subdivision density. Sale prices include GST, and hence the total revenue calculation subtracts off GST.
- Estimate the profit and profit margin of developments

"Greenfield calcs": This sheet summarises the results from the model workings in a form that can be output to the dashboard. It

- Summarises for each density of development: feasibility status, number of feasible lots, feasible profit and profit margins
- Summarises the necessary density of development to meet each of the possible development objectives included.

2.3.3 Model outputs

The "Summary Dashboard" sheet in the feasibility model provides the key outputs of the model. There are two summary tables – one to summarise by the district zones and the other to summarise by Census area units. The summary tables provide three key groups of information:

- Site attributes and plan enabled capacity: how many sites there are, what the area of those sites are, and what the plan enabled number of sections is (ie the outputs of the council development capacity estimates).
- Feasibility of council capacity estimates: number of feasible sites, area of those sites and the number of feasible sections that could be developed.
- Feasibility of other density options: same as the previous point, but for a range of net dwelling density tests, based on the user input toggles on the same sheet.

2.4 Updating the model over time

The spreadsheet feasibility model has been set up to make it easy for users to update it to include additional greenfield sites. Section 2.3.1 above describes key variables that must be included for any new greenfield sites included in the model. Users should enter these in the "Sites" sheets described above.

Users may also seek or to 'rebase' the model to reflect changes in prices and development costs over a short (three to five year) time horizon. Sections 3 and 4 describe the cost and revenue inputs to the model, which are complex and require specialist input to review and update.

In our view, it would be impractical and unnecessary to update these assumptions on an annual basis. As a result, if users are seeking to update the model from, for instance, 2018 costs and prices to 2019 costs and prices, we suggest adjusting the cost and price sensitivity tests on the 'Summary dashboard' sheet to reflect observed year-on-year price changes.

The following table provides suggested sources for updating cost and price assumptions.

Table 3: Suggested approach for updating costs and prices over a short time horizon

Cost and price sensitivity	Suggested source

Sale price sensitivities	Use the change in the MBIE residential land value index ("Dwelling land price – SPAR index") for each TA from mid-2018 to the update year. This is available online at the MBIE interactive house price dashboard.[3] For instance, if the Wellington City land value index rises from its June 2018 value of 5.678 to (say) 5.962, this would be a 5% increase in prices. Users would then set the sale price sensitivity test to 5%.
Cost sensitivities	Use the change in Statistics New Zealand's Business Price Index for Civil Construction or Land Improvements from mid-2018 to the update year. This is available online on Statistics New Zealand's website.[4] For instance, if the Land Improvements price index rose from its June 2018 value of 1994 to (say) 2053, this would be a 3% increase in development costs. Users would then set the cost sensitivity test to 3%.
Land price sensitivities	Use the change in the MBIE residential land value index ("Dwelling land price – SPAR index") for each TA from mid-2018 to the update year. This is available online at the MBIE interactive house price dashboard.[3] This assumes that unimproved land values rise at around the same rate as section prices. An alternative would be to assume that greenfield land values rise at a faster rate.

Over the longer term, ie beyond a three to five year time horizon, it would be desirable to review input assumptions in more detail. Over a longer period, there may be more meaningful changes to:

- The structure of prices, ie which suburbs have relatively high or low prices
- Standards for infrastructure development for new subdivisions, which affect dwelling yield and development costs
- Costs for different types of land development inputs.

[3] https://mbienz.shinyapps.io/urban-development-capacity/
[4] https://www.stats.govt.nz/topics/price-indexes

3 Development cost inputs

The greenfield feasibility model includes all major categories of costs associated with developing and subdividing greenfield sites. For each site in the model, development costs are calculated based on:

- Unit cost rates excluding goods and services tax (GST), eg cost per cubic metre of earthworks
- Multiplied by the estimated quantities of work required on that specific site, eg total quantity of earth that must be cut and filled on the site.

The following table summarises the key categories of costs included in the model and explains how these categories of costs are estimated for individual sites. It also indicates how large each category of costs is likely to be in the context of a typical development. This suggests that the feasibility of developing new greenfield sections will be most strongly affected by the magnitude of costs for:

- Site purchase (10-20% of costs)
- Earthworks (5-15% of total costs)
- Roading and infrastructure supply (20-25%)
- Development contributions (5-15%)
- Financing, which is in turn affected by the length of the development process (8-15%).

In this section, we outline key parameters and input assumptions used to estimate development costs and explain the basis for these estimates.

Table 4: Overview of greenfield development costs included in model

Development cost category	**How costs were estimated**	**Indicative share of development costs***
Site purchase	Most recent capital value of the site, updated to mid-2018 values using MBIE land price index	10-20%
Civil works		
Site clearance	Apply unit cost rates to site area	2-5%
Landscape stabilisation	Apply unit cost rates to site area	<1%
Earthworks and site preparation	Estimate quantity of cut/fill required based on site slope; apply unit cost rates for quantity of earthworks	5-15%
Water supply	Estimate linear metres of pipe and apply unit cost rates	1-2%
Wastewater	Estimate linear metres of pipe and apply unit cost rates	1-2%
Subdivision costs	Apply unit cost rate per new lot	<1%
Roading	Estimate share of site devoted to roads based on	20-25%

	section density and site slope; apply unit cost rate to road area	
Landscape and stormwater reserves	Estimate share of site set aside for reserves; apply unit cost rate for developing reserves	3%
Civil works contingency	Estimate as a proportion of total civil works costs	5-15%
Fees and charges		
Development contributions	Identify which development contribution charging area the site falls into; calculate total DCs based on number of lots created	5-15%
Resource consent fees / resource consent compliance certification	Estimate based on council resource consent fees policy	<1%
Site / project management	Calculate as a proportion of civil works costs	2-3%
Consultant fees (planning, engineering, geotech, surveying, etc)	Calculate as a proportion of civil works costs	4-7%
Legal	Estimate as a share of revenues from selling sections	1-2%
Sales and marketing	Estimate as a share of revenues from selling sections	2-3%
Fees and charges contingency	Estimate as a proportion of total fees and charges costs	2-4%
Financing costs	Identify when costs are incurred within the overall project timeframe and estimate holding costs over the remaining period	8-15%

** Note: This indicative breakdown is based on modelled sites in Porirua City. Values are not intended to add to 100%.*

3.1 Benchmarking land development costs

As background for this analysis, we reviewed land development costs for 18 subdivisions around New Zealand, mostly outside of Wellington, over the last decade. The following table summarises this data, with costs rebased to 2018 New Zealand dollars using Statistics New Zealand's *Capital Goods Price Index* for land development.

These costs exclude site purchase costs but include most other land development costs. They exclude GST and, in some cases, exclude financing costs. This data indicates that land development costs may range from just under $70,000 to over $400,000 per section. The lower end of this range generally consists of subdivisions that are already serviced by infrastructure, while the upper end reflects low-density developments in Queenstown, which is a very sensitive landscape.

In most cases, land development costs tend to range from $90,000 to $140,000 per section. Costs may be higher if extensive earthworks and infrastructure provision are required. The cost estimates in the Wellington greenfield feasibility model fall within this range. Discussions with Colliers indicates that more recent developments in Wellington are also consistent with these figures.

Table 5: Land development costs for 18 case study subdivisions

Location	**Description**	**Dwellings**	**Average site area (m2)**	**Land development costs ($/section)**
Auckland - North Shore (1)	Urban, spec housing	24	2152	$118,435
Auckland - North Shore (2)	Urban, mixed housing	22	230	$103,046
Auckland - Pukekohe (3)	Urban, spec housing	41	1000	$129,264
Auckland - Pukekohe (3)	Urban, spec housing	33	1000	$135,959
Hawkes Bay (1)	Urban, mixed use	149	500	$77,450
Hawkes Bay (1)	Urban, mixed use	128	500	$68,599
Hawkes Bay (2)	Urban, mixed housing	26	338	$78,903
Northland (1)	Rural, spec housing	56	761	$66,140
Queenstown (1)	Rural, spec housing	89	900	$155,179
Queenstown (1)	Rural, spec housing	15	1400	$279,414
Queenstown (1)	Rural, spec housing	18	2500	$298,390
Queenstown (1)	Rural, spec housing	10	1200	$402,521
Queenstown (1)	Urban, spec housing	95	800	$92,736
Southland (1)	Urban, spec housing	70	800	$69,918
Tauranga - Te Tumu (4)	Urban, spec housing	3930	660	$121,472
Waikato - Tuakau (3)	Urban, spec housing	21	650	$99,499
Waikato (2)	Urban, mixed housing	71	162	$79,078
Wellington (1)	Urban, mixed use	170	500	$66,540
Weighted average			*667*	*$116,440*

Notes: (1) Page, I. 2008. New house price modelling. BRANZ Study Report 196(2008); (2) Page, I. and Curtis, M. 2013. New house price model update at April 2013. BRANZ Project Report E626; (3) The Surveying Company. 2016. Personal communication with John Gasson. 1 August 2016.; (4) Tauranga City Council. 2016. Assessment of Residential Development Feasibility for the Te Tumu Urban Growth Area.

3.2 Site purchase costs

The model assumes that greenfield development sites are purchased for development at current (mid-2018) market prices.

In order to estimate current prices, we start with the site's most recent rating valuation. Valuations are conducted on a three-yearly basis, meaning that they may under-estimate current market prices. We therefore adjust them upwards using the land value index published by MBIE for territorial authorities, which is shown in Figure 1.

For instance, the most recent valuation for Porirua City was conducted in the September quarter of 2016. Since then, residential land prices have risen by around 27%. Hence a greenfield site that was valued at $1 million at that date is likely to have a current price of around $1.27 million.

The assumption that development sites are purchased at current prices is likely to be conservative. Some developers may have purchased land in the past at a lower price and held it for future development. These developers may be able to access land at a considerably lower price than current market values.

In doing so, they incur some holding costs (from interest charges on bank loans or foregone return on equity) and may earn revenues from existing agricultural uses, eg pastoral farming. Overall, this is likely to lower land costs and thus increase feasibility for somebody developing in the current period. However, it is difficult to assess because the date of purchase may be unknown.

To address this possibility, we recommend sensitivity testing alternative values for land purchase prices in the spreadsheet model. To do so, users should select the "Manual" option for price sensitivity, and then set the "Land price sensitivity" parameter to -100%.

Alternatively, a 'low cost' scenario could be estimated by deflating site value to previous years' prices using the residential land price index published by MBIE. An adjustment for financing costs could also be added in, unless the site has some economic use that is likely to cover those holding costs. For instance, if the landowner is known to have originally purchased the site at a point when land prices were 80% lower than at present, the "Land price sensitivity" parameter could be set to -80%.

3.3 Roads and landscape / stormwater reserves

The model estimates the proportion of each site that must be devoted to roads and landscape / stormwater reserves. This has two impacts on feasibility outcomes:

- First, there are financial costs associated with developing roads and reserves, which are accounted for in civil works costs
- Second, setting aside a larger proportion of the site for roads and reserves means less space left over to construct new dwellings.

Areas set aside for roads and reserves are additional to areas that have been excluded from the developable area due to identifiable constraints such as excessive slope or the presence of transmission lines.

For a typical subdivision, roads and reserves may account for around one-third of the developable area of a site. The following table summarises the assumptions used in modelling. To estimate road area, we undertook a statistical analysis of the determinants of the share of land devoted to roads in all existing Wellington suburban neighbourhoods. This analysis is described in Section 6.

Table 6: Road and landscape / stormwater reserves

Category	Share of developable area
Road area	Typical range: 14-22% • A relatively flat site with 20 dwellings per net hectare would have around 22% of its area devoted to roads • Higher-density sites devote a larger share of land area to roads • Sloping sites tend to have a smaller share of roads
Landscape / stormwater reserves	10% of area

3.4 Civil works costs

This section sets out the unit cost rates we have used to estimate civil works costs and explains how we have applied these costs.

We extended the MBIE model's treatment of earthworks costs and road infrastructure requirements to account for the impact of the Wellington region's hilly topology. Steep sites may require more earthworks to enable residential construction and they may face different requirements for road networks. We have addressed these issues based on data on actual development outcomes in the Wellington region. We see this as an important feature of the model given the significance of earthworks and road infrastructure costs in overall land development costs.

3.4.1 Civil works unit cost rates

The following table summarises the cost input parameters we have used to estimate civil works costs in this analysis.

For civil works cost rates, we have started with the base cost estimates in the MBIE greenfield model, and incorporated Wellington-specific data from QV Costbuilder, which provides detailed data on construction unit cost rates at a regional level. Where appropriate, we have aligned these unit costs with the requirements set out in Wellington's Code of Practice for Subdivision, for instance, to identify the required diameter of water mains in new subdivisions. After developing base cost estimates, we worked with Colliers to 'ground truth' these based on discussions with developers in the area and data on recent subdivisions.

A key feature of the MBIE model, which we have inherited in this modelling, is that costs are staged throughout the lifespan of the development to calculate financing costs for the development. We have reviewed some timing parameters and adjusted them slightly based on discussions with Colliers.

Table 7: Civil works cost rates

Item	Timing	Unit cost	Source / notes

Site clearance: Strip top soil, deposit on temporary stockpile on site	20%	\$5 / m^2 site area	QV Costbuilder: Site Preparation Table. This suggests a range of \$2.20/m2 (for 50mm cut) to \$6.70/m2 (for 150mm avg cut). \$5/m2 is used as a typical value
Earthworks and site preparation	25%	\$15 / m^3 cut	QV Costbuilder suggests: \$3.70/m3 balanced cut to fill over site, plus \$9.5/m3 excavate to reduce levels for sand / light soil and \$10.8/m3 for clay, plus \$1.3/m2 for trim excavation/filling to batter. Colliers advice is that a typical range would be \$12-15/m3 assuming cut-fill balance.
Landscape stabilisation	25%	\$1 / m^2 site area	Colliers advises that \$1/m2 is typical of recent developments. QV Costbuilder implies a higher cost rate.
Water supply	35%	\$235 / m pipe	QV Costbuilder suggests that the average cost for principal mains of 100mm-150mm nominal diameter is \$220/m, and the average cost for excavating a trench for this diameter pipe with average depth 1m is \$15/m, with higher/lower figures depending on soil. This aligns with Wellington COP Table 6.5 (allowable pipe diameter) and Table 6.7 (minimum cover to pipes) Total costs are estimated assuming around 125m pipe per ha.
Wastewater	35%	\$225 / m pipe	QV Costbuilder cost estimate for concrete sewers; averaged across multiple size categories for Class 2 (X) and Class 4 (Z) pipe. Total costs are estimated assuming around 125m pipe per ha.
Subdivision costs	35%	\$1,000 / lot	Checked against land development cost benchmarks summarised in Table 5.
Road reserves	35%	\$200 / m^2 road reserve	Cost rate included in the MBIE model, checked against QV Costbuilder and Colliers. This cost includes 1.8m footpaths. Note that in some cases costs may be higher depending upon material supply. This cost aligns with Wellington COP requirement for NRB M4 basecourse, 300mm thick, with chip seal paving, kerb and channel, and footpaths.
Landscape & stormwater reserves	50%	\$60 / m^2 reserve	These costs vary greatly per project and can be as low as \$3/m2. This is likely to be a pessimistic figure.

Civil works contingency	55%	25%	Contingency was based on a review of ex-ante feasibility analyses from other regions. Cost contingencies tend to be higher for civil works due to the increased risk of encountering geotechnical issues or other holdups. Sensitivity test 30%.

3.4.2 Estimating earthworks requirements

The following table summarises the parameters that we have used to estimate bulk earthwork requirements. We estimated these based on selected case studies of recent earthworks and subdivision consents in the Wellington regions. They vary depending upon the slope of the site, which has been identified qualitatively. We have ground-truthed these estimates with inputs from Colliers on recent developments in the area.

This data suggests that earthworks requirements vary considerably between subdivisions, depending upon the slope of the land. Earthworks can be a significant contributor to overall development costs, which can have a fundamental impact on feasibility for some sites.

Due to the limited number of sites analysed, we have not investigated whether earthworks costs vary based on section size – ie steep sites may require less earth to be moved if the site is being developed to a lower density. This may represent an area for further model refinement, based on an analysis of a larger sample of earthworks consents.

Table 8: Estimated bulk earthwork requirements for Wellington subdivisions

Site type	Earthwork requirements	Notes
Steeply sloping sites	3 m^3 of cut per m^2	Based on Newlands subdivision in Wellington City
Moderately sloping sites	1.3 m^3 of cut per m^2	Based on Brooksite Park and Kenepuru case studies in Porirua
Relatively flat sites	0.3 m^3 of cut per m^2	Based on Wainuiomata subdivision in Lower Hutt, Wallaceville and Riverstone subdivisions in Upper Hutt, and Waikanae and Otaki subdivisions in Kāpiti Coast

The following table summarises the details of the case studies of consents for bulk earthworks undertaken as part of new subdivisions in the Wellington region. These illustrate variations in the quantity of earth that may have to be moved in different types of places.

Table 9: Case studies of bulk earthwork requirements for subdivisions in Wellington region

Site	Land area	Volume of earthworks	Quantity of fill (m3) per land area (m2)	Notes

Site	Land area	Volume of earthworks	Quantity of fill (m3) per land area (m2)	Notes
Porirua City, Brookside Park	105,200 m2	143,440 m3	1.36 m3	148 lot subdivision Maximum cut height 4.5m, maximum fill height 3.5m
Wellington City, Newlands	18,750 m2	62,000 m3	3.31 m3	60 lot subdivision of four existing lots Will lower the level of land; approximately 6900 heavy vehicle movements Maximum cut height of 10.6m
Wellington City, Crofton Downs		Not outlined in consent		138 lot subdivision Cut and fill batters used; buildings set back 5-10 metres to avoid stability issues Earthwork quantities are in the Geotechnical Management Plan and Earthworks Specification (Engeo), dated 18 May 2016
Porirua City, Kenepuru	367,000 m2	480,000 m3	1.31 m3	145 lot subdivision Maximum fill depth of 9m; maximum cut depth of 13m Stockpile 10,000 m3 of topsoil and unsuitable material on site, and remove 10,000 m3 from site Stage 2 (26.4ha) taking place over 3 earthworks seasons
Lower Hutt City, Wainuiomata	13,200 m2	2,900 m3	0.22 m3	20 lot subdivision, Papakāinga development Maximum fill height 0.8m; cuts will be minor
Upper Hutt City, Wallaceville	156,900 m2 Cut area: 69,900m2 Fill area: 86,940m2	55,700 m3	0.36 m3	Generally flat site; pasture Maximum cut 1.8m; maximum fill 2.3m All cut material used on site

Site	Land area	Volume of earthworks	Quantity of fill (m3) per land area (m2)	Notes
Upper Hutt, Riverstone Stage 8	107,000 m2 earthworks area Total site area 12.6ha	Not quantified in consent; plans indicate minor earthworks limited to less than 1/10th of the site	Assuming an average cut of ~1m, this implies a ratio of around 0.1m3	79 lot subdivision, ranging in net size from 419m2 to 2755m2 Road details provided in application. Two lots (totalling ~2ha) designated as reserves Cut and fill depth ranges from 0.5m to 2.0m All cut material used on site Previous (2007) resource consent included some earthworks to support this stage
Kāpiti Coast, Waikanae (SH1)	429,400 m2	112,430 m3 cut	0.26 m3	162 lot subdivision, ranging in size from 551m2 to 8102m2 Consent implies that some cut will be removed from the site.
Kāpiti Coast, Otaki (Moana St)	34,200 m2	10,800m3 cut	0.32 m3	39 lot subdivision, ranging in size from 470m2 to 895m2 Maximum cut depth of 5m
Kāpiti Coast, Waikanae (Winara Ave)	77000 m2 earthworks area Total site area 12.7ha	12,000m3 cut	0.16 m3	75 lot subdivision, ranging in size from 450m2 to 6759m2 Maximum cut depth of 3m

3.5 Fees and charges costs

This section sets out the unit cost rates we have used to estimate fees and charges and explains how we have applied these costs.

3.5.1 Fees and charges unit cost rates

The following table summarises the cost input parameters we have used for fees and charges. Once again, we have started with the default values in the MBIE model, updated them with Wellington-specific data on resource consent lodgement fees and development contribution fees published by councils, and validated costs against the case studies summarised in Table 5.

As for the civil works costs, we have reviewed some of the timing parameters used to calculate financing costs with Colliers.

Table 10: Fees and charges cost rates

Item	Timing	Unit cost	Source / notes
Development contributions	90%	Site-specific inputs	Council development contribution fee estimates
Resource Consent Fees	10%	See Table 11	Council consent fee tables
Certification of compliance with RC conditions	95%	See Table 11	Council consent fee tables
Site/Project Management	50%	3% of civil costs	Checked against subdivision cost benchmarks – see below
Consultant fees (planning, engineering, geotech, surveying, etc)	20%	10% of civil costs	Checked against subdivision cost benchmarks – see below
Legal	60%	2% of sales price	Checked against subdivision cost benchmarks
Sales and Marketing	75%	3% of sales price	Checked against subdivision cost benchmarks
Fees and charges costs contingency	75%	10%	Contingency was based on a review of ex-ante feasibility analyses from other regions. A lower cost contingency was used for fees and charges as there is usually more certainty about these costs.

3.5.2 Development contributions

Development contributions are site-specific, and hence we have estimated development contributions in the pre-processing stage based on the location of sites. The sources for the development contribution estimates are listed below:

- Wellington City: a shapefile of development contribution zones (and fees for each zone) was provided by Wellington City Council. The "Residential_1" fees have been applied.
- Lower Hutt City: the spatial extent of the development contribution zones were provided by Lower Hutt City Council, and the development contribution amounts were sourced online.[5]
- Upper Hutt City: the development contribution zones and charges were provided by Upper Hutt City Council. The base and water and wastewater contributions are summed for the Mangaroa area.
- Porirua City: shapefile of development contribution zones and fees for each zone were provided by Porirua City Council.
- Kāpiti Coast District: the development contributions at a parcel level were provided by Kāpiti Coast District Council and applied to the greenfield parcels. The development contributions applied range from $4,142 to $26,587 per additional lot.

[5] http://iportal.huttcity.govt.nz/Record/ReadOnly?Tab=3&Uri=4958139, 1 November 2018

Whilst most development contributions are estimated and joined to each site in the pre-processing steps (before the data is input into the spreadsheet model), the Reserve Fund contribution for Upper Hutt is incorporated within the spreadsheet model. The Reserve Fund contribution is estimated as 4% of the market value (excluding GST) for each section. This proportion can be updated in the "Other inputs" sheet of the spreadsheet, or this functionality can be turned off entirely from the Summary Dashboard sheet.

3.5.3 Resource consent fees

The following table summarises estimated resource consent fees for each TA. We assume, following a review of selected subdivision and earthworks consents, that applicants will lodge a single consent (or pair of consents) for subdivision and land use, including earthworks and civil works on site. However, we note that some developers may 'stage' projects instead.

Unless otherwise indicated, we have used published fees for notified consents. In some cases, this may be a pessimistic assumption, as there may be a path to consent subdivisions without notification. However, in cases where a site is not currently zoned for residential use, a plan change may be required to develop. In these cases, developers are likely to incur additional fees.

We note that assumptions about resource consent fees can be amended in the "Costs" tab in the spreadsheet model. We tested alternative assumptions about resource consent fees, finding that they did not greatly affect the results. For instance, in Upper Hutt City, including costs for fully notified consents did not affect the number of sites that were feasible.

Table 11: Resource consent fees

Council	**Consent fees**	**Notes**
Wellington City	$16,000 per subdivision Plus $900 for certification (s224(c)) at end of process	Assumes a fully notified subdivision and land use consent https://wellington.govt.nz/services/consents-and-licences/resource-consents/fees
Porirua City	$9,800 per subdivision Plus $816 for certification at end of process	Assumes fully notified subdivision and land use consents https://poriruacity.govt.nz/services/building-consents/resource-consents/#notified-resource-consent
Lower Hutt City	$16,640 per subdivision Plus $960 for certification at end of process	Assumes fully notified subdivision and land use consents http://iportal.huttcity.govt.nz/Record/ReadOnly?Uri=4934255
Upper Hutt City	$2,130 per subdivision Plus $765 for s224(c) certification at end of process	Assumes separate non-notified subdivision and land use consents, based on advice from Upper Hutt City https://upperhuttcity.com/wp-content/uploads/2015/06/Schedule-of-Fees-and-Charges-2018-2019.pdf
Kāpiti Coast District	$4,590 per subdivision Plus $1,224 for s224(c) certification at end of process	Assumes a fully notified land use consent and a non-notified subdivision consent for 20+ sections. According to Kāpiti Coast District Council, developers are typically only charged one fee for both consents, rather than being charged separately for each. https://www.Kāpiticoast.govt.nz/services/A---Z-Council-Services-and-Facilities/Fees-and-Charges/Resource-Management-Fees/

3.5.4 Professional fees

Professional fees include the costs of site and project management, consultant fees for planning, engineering, geotech, surveying, etc, legal advice, and sales and marketing. These costs can be difficult to estimate as sources such as QV Costbuilder do not report unit cost rates for professional fees.

To benchmark these fees, we have drawn upon the case studies summarised in Table 5. These case studies provide detailed information on professional fee costs, including site / project management; consultant fees for design, architecture, and resource consent preparation; legal, accounting, and surveying; and sales and marketing.

The following table summarises findings from 19 case studies, some of which are excluded from Table 5 as they were rural, low-density developments. While there is variation between sites, professional fees make up 14.5% of overall land development costs, excluding site purchase costs. If we exclude Queenstown and Central Otago, which often have unusually high professional fee costs due to the risk of lengthy consenting processes and litigation, it gives a weighted average of 12.8% of total land development costs.

This is similar to the cost estimates used in the MBIE model, which add up to around 10-14% of total development costs excluding site purchase costs. We have therefore retained the MBIE estimates of professional fees, with some minor simplifications and adjustments. However, in doing so we note that the wide range of outcomes observed in the table below indicates that there will be 'overs' and 'unders' at a site level.

Table 12: Professional fees as a share of total costs.

Location	Description	Professional fees as share of total cost
Auckland - North Shore (1)	Urban greenfield	11.1%
Auckland - North Shore (2)	Urban, mixed housing	3.2%
Auckland - Pukekohe (3)	Urban, spec housing	8.4%
Auckland - Pukekohe (3)	Urban, spec housing	4.4%
Central Otago (1)	Rural	18.8%
Hawkes Bay (2)	Urban mixed housing	7.3%
Northland (1)	Rural greenfield	11.9%
Queenstown (1)	Rural	12.3%
Queenstown (1)	Rural greenfield	35.7%
Queenstown (1)	Rural greenfield	13.3%
Queenstown (1)	Urban greenfield	13.1%
Queenstown (1)	Rural	20.7%
Queenstown (1)	Rural	16.4%
Queenstown (1)	Rural	28.1%
Southland (1)	Urban	8.4%
Tauranga - Te Tumu (4)	Urban, spec housing	17.3%
Waikato - Tuakau (3)	Urban, spec housing	11.0%
Waikato (2)	Urban mixed housing	11.5%
Wellington (1)	Rural	12.7%
Weighted average		*14.5%*
Weighted average excl Queenstown and Central Otago		*12.8%*

Notes: (1) Page (2008); (2) Page and Curtis (2013); (3) The Surveying Company (2016); (4) Tauranga City Council (2016)

3.6 Financing costs and feasibility threshold

Finally, we briefly summarise assumptions used to calculate financing costs, and the gross profit margin used to determine whether a development is feasible or infeasible.

The MBIE model calculates financing costs for individual project components based on:

- A weighted average cost of capital parameter, which reflects either the direct financial cost to service debt or the indirect opportunity costs associated with equity contributions to the project
- The overall development timeframe – developments that take longer to complete – have larger financing costs due to the need to hold debt for a longer period
- The timing of individual expenditures – costs that are incurred at the start of the development process, such as land purchase, must be financed for longer than costs that occur near the end, such as development contributions.

Based on discussions with Colliers and a review of data on weighted average cost of capital for listed companies in New Zealand and interest rates on business loans, we have incorporated the following assumptions about cost of capital, average project timeframes, and minimum gross profit threshold required for a development to be considered feasible.

Table 13: Financial assumptions

Parameter	**Parameter**	**Notes**
Weighted average cost of capital	10%	Default value used in the MBIE model. This is close to PwC's estimated weighted average cost of capital for listed firms in the building and construction industry (10.5%).[6] It is slightly higher than the current bank overdraft rate for small to medium size enterprises (9.4%).[7]
Average development timeframe	18 months	Based on discussions with Colliers. Sensitivity tests of 24 months or 30 months could also be applied.
Gross profit threshold	20%	Default value in the MBIE model. Sensitivity tests of 25% or 30% could also be applied.

[6] See https://www.pwc.co.nz/pdfs/pdf-pwc-appreciating-value-nz-edition-6-march-2015-deal-activity-ipo-listed-share-price-performance.pdf
[7] See RBNZ data: https://www.rbnz.govt.nz/statistics/b3

4 Residential section price inputs

Residential section prices are an essential input to feasibility modelling, as they are used to estimate revenues from developing new subdivisions. Outcomes for feasibility correspond closely to section prices: setting other factors equal, a location where section prices are 10% higher will have a gross profit margin that is 10% higher.

In this section, we describe how we estimated current (early/mid 2018) residential section prices for all locations covered by the greenfield feasibility model including consideration of different characteristics, such as section size, slope, and views.

Our approach is flexible and allows prices to be estimated for a wide variety of sites based on a relatively simple set of inputs. In collaboration with Colliers, we undertook a statistical analysis of Wellington property sales over the last five to ten years in order to:

- Identify the key factors that positively or negatively affect prices for residential sections
- Identify variation in prices for similar sections between different suburbs throughout the entire Wellington region.

The resulting section price estimates were ground-truthed by Colliers based on their on-the-ground knowledge of the Wellington market. Here, we briefly describe our approach and illustrate the results.

The development cost estimates described in the previous section exclude GST, while section price estimates are GST-inclusive. We have therefore subtracted GST from section prices before calculating feasibility outcomes.

4.1 Overview of methodology

Here, we provide a brief, semi-technical explanation of the approach we have used to estimate section prices, and how it compares with simpler methods that are commonly used in feasibility analysis.

A simple approach for estimating prices is to calculate the average section prices (or house prices) in different locations as an estimate of the market price in different locations. A hypothetical example is provided in the following table.

Table 14: Hypothetical example of section price estimates

Location	**500-1,000 m^2 section**	**1,000-2,000 m^2 section**	**2,000-5,000 m^2 section**
North	$200,000	$300,000	$400,000
South	$180,000	$260,000	$350,000
West	$190,000	$280,000	$360,000
East	$140,000	$220,000	$290,000

In mathematical terms, what this is doing is estimating the *average sale price conditional on location and section size*, ie:

$$E[Price|Location, Size]$$

For instance, in the above example:

$$E[Price|Location = West, Size = 1{,}000 - 2{,}000m2] = \$280{,}000$$

This approach has several limitations that make it difficult to apply across a large urban area with sections that vary across several characteristics:

- First, if there is a small number of section sales in some locations, it may not be possible to make an estimate of the average price. Typically, this is addressed by extrapolating or interpolating values from other locations, but there are no firm rules about how to do so, which means that the outcomes may be somewhat arbitrary.
- Second, the characteristics of sections may vary within areas, making it difficult to pin down a price for a typical section. In some cases, this may make it difficult to accurately estimate prices. For instance, a hilly site within a largely flat area may be assigned an erroneously high price under the assumption that sections on that site will be priced similarly to the average section sold in that area.

To address these issues, we used a simple statistical method, ordinary least squares (OLS) regression, that is commonly used to analyse determinants of property values.[8] This is often called 'hedonic regression' or 'hedonic analysis'. This approach is preferred as it allows us to control for a wider set of property attributes that may affect prices, rather than limiting ourselves to a small number of characteristics.

OLS regression can be thought of as an extension of the conventional approach of averaging sale prices. In effect, rather than estimating the average value of section prices conditional on a small number of characteristics, such as location and size, OLS allows us to estimate average section prices conditional on a broader set of variables, denoted X:

$$E[Price|X]$$

X could include variables such as:

- Location
- Section size
- Views from the property
- Section slope / gradient
- Natural hazards, eg flood risk
- Availability of infrastructure

It would be cumbersome to cross-tabulate all attributes into a table like the one shown above. This would require us to slice the data up increasingly finely. In addition, some variables may be 'continuous' rather than 'discrete' – ie they may take on a range of values rather than falling into a few broad bands.

[8] We have previously applied this approach to analyse property values in Auckland. See Nunns, Allpress, and Balderston. 2016. How do Aucklanders value their parks? Auckland Council Technical Report 2016/031. This report also tested more sophisticated statistical models that addressed spatial autocorrelation in the data, but these models exhibited few meaningful differences from OLS.

OLS regression is a computationally efficient way to extend the conditional expectation approach to address more variables. It 'explains' the value of an outcome variable, in this case section sale price, as a linear combination of various explanatory variables. A basic example of OLS regression is as follows:

$$Price_i = \beta_0 + \beta_1 South_i + \beta_2 West_i + \beta_3 East_i + \beta_4 Size_i + \beta_5 Size_i^2 + \varepsilon_i$$

This model explains section prices ($Price_i$) as a function of location (coded by indicator variables for $South_i$, $West_i$, and $East_i$ – if all three indicators are false then the property must be in the North location) and section size ($Size_i$). To allow section size to have a 'nonlinear' effect on prices – ie another square metre of land is worth less for a large property than a small property – the model includes a quadratic term for section size ($Size_i^2$).

This model must be estimated on individual property sales – with the subscript 'i' used to denote the sale ID. The β coefficients are estimated by OLS regression – these are parameters that indicate the relative impact of different attributes on sale price.

The term ε_i reflects the residual variation in sale prices that cannot be 'explained' by the measurable variables. Typically, it will be possible to 'explain' between 50% and 80% of the variation in property sale prices based on their measurable characteristics. Other unmeasured attributes, such as landscaping, interior fit-out, site layout and dimensions, etc, account for the rest.

After estimating this model, the resulting beta coefficients can be used to 'predict' the expected sale price for different types of sections. For instance, if we wanted to predict the average price for a 600m2 section in the West location, we could do so as follows:

$$E[Price|Location = West, Size = 600m2] = \beta_0 + \beta_2 + \beta_4 * 600 + \beta_5 * 600^2$$

Similarly, if we wanted to predict the average price for a 1200m2 section in the North location, we could do so as follows:

$$E[Price|Location = North, Size = 1200m2] = \beta_0 + \beta_4 * 1200 + \beta_5 * 1200^2$$

These results should be identical to (or at least very similar to) the values in the table above.

A more general formulation of OLS regression, that allows for consideration of a larger number of variables, is as follows:[9]

$$Price_i = \beta X_i + \varepsilon_i$$

Where X_i is a vector of explanatory variables (including a constant term) and β is a vector of coefficients to be estimated by the model.

4.2 Key steps in analysis

We used the following process to develop our analysis of residential section prices:

[9] There are two practical limitations to the number of variables that can be included in a regression model. First, we must have fewer variables than observations – ie if we have 100 sales observations and 100 variables, we will get nowhere. Second, we cannot have perfect correlations between any of the explanatory variables (or any groups of variables).

- First, we cleaned the data to exclude:
  - Non-residential sites;
  - Sites with zero land area, which are likely to represent data entry errors or cross-lease sites;
  - Large sites (over 2000m2) that are likely to represent lifestyle blocks or large-lot residential sections rather than suburban residential sections; and
  - Multi-unit dwellings.
  - We also removed the top 1% and bottom 1% of the distribution of land prices per square metre, as inspection of the data showed that high or low prices often reflect data entry errors.10
  - However, we retained both vacant sections and sections with a single dwelling (excluding cross-leased sections and multi-unit sections) in the analysis – a choice we discuss further below.
- Second, in collaboration with Colliers we identified a set of variables to explore that may influence section prices. In addition to location and section size, these included driveway access, slope, access to views, and year of sale. Statistical testing showed that all variables had a meaningful impact on section prices.
- Third, we used OLS regression to estimate four alternative statistical models of section prices. These models, which we explain below, incorporate different assumptions about how the size and other attributes of a section affect its price.
- Fourth, we identified a preferred model that best fit the data and provides the most realistic picture of section prices in Wellington. To do so, we considered both statistical evidence (eg how well the models 'fit' the data and whether they resulted in over- or under-predictions for certain segments of the market) and ground-truthing by Colliers.
- Finally, we incorporated the coefficients from our preferred model into the greenfield feasibility spreadsheet and used them to predict section prices for individual greenfield sites.

We estimated a separate statistical model for each individual territorial authority. This allows section characteristics to have a different effect on prices in different locations. For instance, on average, adding another ten square metres of land is 'worth' more in Wellington City than in Porirua.

4.2.1 Inclusion of vacant sections and standalone houses

Most of the residential property sales are of completed dwellings, rather than vacant lots. We therefore include data on standalone house sales to expand the sample size and fill gaps in the section sales data. Sale prices for standalone houses include the value of the dwelling, while sale prices for vacant sections only include the value of the land. We therefore estimate the price for the land underneath standalone houses by subtracting the improvement value from the most recent rates assessment from the sale prices. We define a new variable as follows:

$$LandPrice_i = SalePrice_i - IV_i$$

For vacant sites, the LandPrice variable is simply equal to SalePrice, while for sites with a house on them, LandPrice should be equal to the value of the section, excluding the house. However, some development costs (eg the cost to obtain resource consent or building consent) may not be counted in the improvement value, which may lead to a biased estimate of prices for these properties. We therefore include an indicator variable

[10] For instance, one 450m^2 site in Wellington City was recorded as having a sale price of $95 million. We suspect that extra zeroes have been added to the sale price.

for standalone house sales in our regression models to control for other development costs that are not included in improvement value.

The following data shows the composition of the cleaned datasets we used to estimate OLS models of section prices. On average, prices are highest in Wellington City and lowest in the Kāpiti Coast and Porirua City. There are relatively few vacant sections in the dataset, which highlights the importance of including standalone home sales to develop a richer picture of location- and site-specific features that affect sale prices. In Section 7, we show that the inclusion of standalone home sales has not caused any bias in section price estimates.

Table 15: Summary statistics for property sales datasets

Location	**Sales Period**	**Number**	**Vacant Sections (%)**	**Standalone Homes (%)**	**Average Land Price ($/m^2)**	**Average Section Size (m^2)**
Wellington City	Jan 2008 - Jul 2018	25,399	4.6%	95.4%	$569	601
Porirua	Jul 2013 - Jun 2018	4,567	19.9%	80.1%	$316	721
Lower Hutt	Jul 2013 - Jun 2018	7,225	3.3%	96.7%	$409	675
Upper Hutt	Jul 2013 - Jun 2018	3,419	5.7%	94.3%	$319	722
Kāpiti Coast	Jan 2013 - May 2018	6,309	11.2%	88.8%	$288	808

4.2.2 Model variables and model specification

For each territorial authority, we use the datasets described above to estimate four alternative OLS regression models that included the following explanatory variables:

- Location: Measured by indicator variables for each suburb. The coefficient on each suburb indicator variable represents the value of being in that location, reflecting its access to jobs, retail, and amenities, school zoning, climate, etc.[11]
- Section size: Measured in terms of land area. This is a ‘continuous’ variable.
- Slope: This is measured using indicator variables for whether the section is relatively flat, moderately sloping, or steeply sloping.
- View: This is measured using indicator variables for whether the section has a view of land, view of water, or no view.
- An indicator variable for whether the property has driveway access.
- An indicator variable for whether the property is a standalone home as opposed to a vacant lot.

Different models reflect different assumptions about how section prices ‘respond’ to different property characteristics.

[11] An alternative, which we have used in previous analysis, is include direct measures of how close properties are to various attractive things, eg distance to the CBD, distance to the nearest beach, presence within a desirable school zone, etc. This is more computationally intensive, and it and less flexible than the suburb-level indicator variables used in this analysis.

The first model specification is given by:

Equation 1: Model 1 specification

$$lp_i = a_i + a_i^2 + v_i + c_i + dv_i + y_i + au_i + h_i$$

where:

- i represents an individual property sale record;
- lp_i represents the land price, in dollars;
- a_i is the land area of the property, in square metres;
- ${a_i}^2$ is the land area squared of the property;
- v_i is the view from the property, which is coded into three categories (no view; view of land; view of water);
- c_i is the contour of the property (coded into flat, gently sloping, steeply sloping);
- dv_i is an indicator of whether or not the property has a driveway;
- y_i is an indicator for the year that the property was sold;
- au_i is an indicator variable for which Census area unit (ie suburb) the property is located in; and
- h_i is an indicator variable for whether or not the property has a dwelling on it, or whether it is a vacant section.

In Model 2, the dependent variable (lp_i) from Model 1 and the area of the property (a_i) are transformed using the natural logarithm, while ${a_i}^2$ is dropped.

Equation 2: Model 2 specification

$$log(lp_i) = log(a_i) + v_i + c_i + dv_i + y_i + au_i + h_i$$

Model 3 is the same as Model 1 except the dependent variable is changed from lp_i to lpm_i which is land price per metre.

Equation 3: Model 3 specification

$$lpm_i = a_i + a_i^2 + v_i + c_i + dv_i + y_i + au_i + h_i$$

Finally, Model 4 is the same as Model 2 except for the change in dependent variable from lp to lpm as well.

Equation 4: Model 4 specification

$$log(lpm_i) = log(a_i) + v_i + c_i + dv_i + y_i + au_i + h_i$$

An analysis of model residuals found that Models 1 and 4 appear to perform best in terms of their ‘fit’ to the data. Colliers suggests that Model 1 results in predicted section prices that are more plausible in the Wellington context.

We have included section price estimates based on both Model 1 and Model 4 in the spreadsheet model. We suggest that Model 1 results should be as a basis for analysis, while Model 4 results could be used as a sensitivity test.

4.3 Summary of section price models

The following table summarises key coefficients from Model 1 for each of the five Wellington TAs. The model’s constant term, in the second-to-last row, incorporates the impact of sale year (2018) and the assumption that all sections have driveway access. The constant term varies across area units, resulting in higher prices in some locations and lower prices in others, and hence we have reported an unweighted average to highlight broad differences in prices between TAs.

We highlight a few key features of these section price models:

- First, the large positive coefficients on the section size variable show that larger sections are worth more, but that this effect diminishes for larger sections, as shown by the negative coefficients on the section size squared variable.
- Second, steeply sloping sites are worth less than moderately sloping sites, which are in turn worth less than flat sites. These effects are qualitatively consistent across all five TAs that have slope data recorded for property sales.
- Third, views of water increase section values more than views of land in Wellington City, Lower Hutt, Porirua, and Kāpiti Coast. The coefficient on views of water was negative but statistically insignificant in Upper Hutt. We suspect that this reflects the impact of an omitted variable – any Upper Hutt sites with water views are likely to be up steep hills – and hence we have excluded the view variables from the Upper Hutt model.
- Fourth, the constant term (which reflects the 'baseline' value of a section in the average area unit) is highest in Wellington City and lowest in Porirua City, which aligns with expectations.
- Lastly, the R^2 parameters show that these statistical models explained a large amount of the property-to-property variation in residential section prices within each city.[12] The share of overall variation explained by these models ranges from 49% in Kāpiti Coast to 71% in Lower Hutt.

Section 7 presents a full set of model coefficients and statistics, including constant terms for individual area units and tests of the statistical significance of individual model variables.

Table 16: Key coefficients from section price models for each TA, early-mid 2018

Attribute	Wellington City	Lower Hutt	Upper Hutt	Porirua	Kāpiti Coast
Section size	241	300	156	71	99
Section size squared	-0.030	-0.115	-0.040	-0.010	0.009[13]
View of land	-3,244	-7,942	NA	-986	-2,444
View of water	31,990	4,922	NA	40,855	119,419
Gentle slope	-27,755	-14,587	-8,579	-12,856	-10,669
Steep slope	-88,161	-69,298	-39,371	-40,312	-26,986
Constant for vacant sections with driveway,	335,632	126,782	221,815	282,233	180,487

[12] There are many idiosyncratic factors that affect property prices, and it is not possible to measure all of these attributes in detail. In our experience, it would be unusual to achieve an R^2 value higher than 70-80% when undertaking a statistical analysis of property prices. Studies that achieve values in this range usually include a much larger number of explanatory variables, or transform section prices to reduce the amount of variability (eg by taking the natural logarithm). As a result, there will always be some 'unders' and 'overs' for price estimates. In Section 7, we demonstrate that there is no systematic bias in the pattern of errors resulting from these models.

[13] The coefficient for section size squared for Kapiti is positive, which is assumed to be reflecting the preference for larger, 'lifestyle' like properties in the Kāpiti area compared with the other relatively more 'urban' areas.

averaged across all area units[14]					
R^2 (goodness of fit)	53%	71%	61%	53%	49%

4.4 Predicted section prices by location

In addition to variation in average section prices *between* different territorial authorities, there are also significant variations *within* territorial authorities.

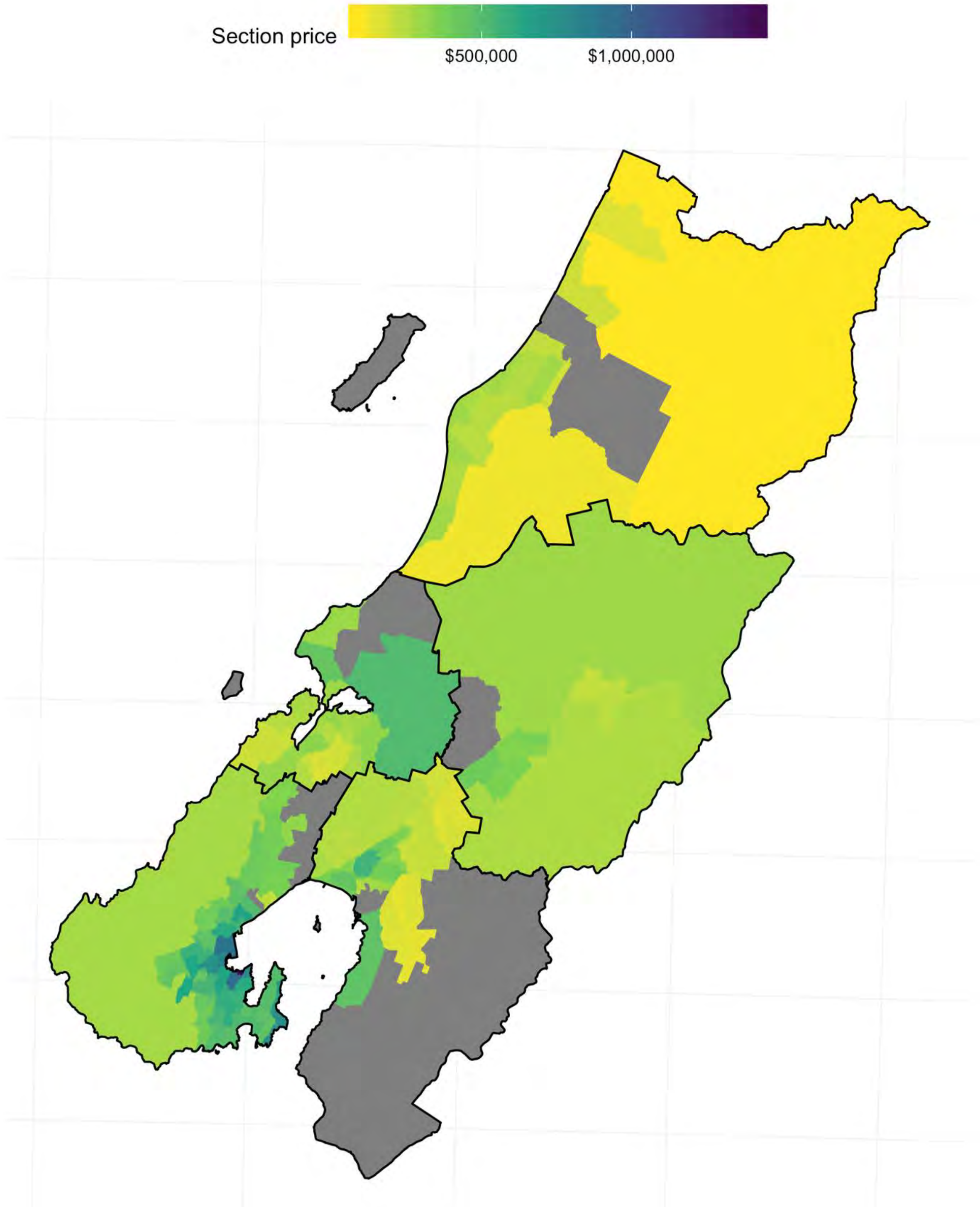
The following map shows estimated section prices for a representative 500m^2 flat section with no view for each area unit in the region.[15] Yellow and green colours indicate lower prices, while blue prices indicate high prices. Grey areas indicate area units with no observed sales – where necessary we have estimated prices based on prices in adjacent suburbs.

A few patterns stand out in this data. The first is the value of accessibility: prices drop off rapidly with distance from the Wellington city centre. Outside of central areas, prices tend to be highest in locations that are more accessible to major transport infrastructure. The second pattern is around geography and natural amenities: Coastal properties in Porirua City and the Kāpiti Coast are generally higher-price than inland properties, while hillier parts of the Hutt Valley tend to have lower prices. Third, there are some localised pockets of low prices, such as Cannons Creek in Porirua.

This map includes predictions for section prices in parts of the city that do not currently have identified greenfield development sites. This highlights the fact that this model can easily be extended to address new greenfield areas throughout the region, potentially including major brownfield sites within existing urban areas. For area units where there were no residential property sales, we made predictions based on prices in the most relevant adjacent area units, and validated these predictions with Colliers.

[14] This sums together the constant term in the regression, the coefficient for the vacant section sales, the coefficient for sales that occurred in 2018, the coefficient for properties with a driveway, and the average coefficients for individual area units, weighted by the share of vacant section sales in each area unit.
[15] A small number of area units had no residential property sales, and hence no predicted constant term. In these cases, we worked with Colliers to interpolate values from adjacent area units.

Figure 4: Estimated 2018 section prices by Census area unit for a representative section



5 Application to Wellington region greenfield sites

To conclude, we summarise key results from our application of this model to greenfield development sites in the Wellington region. These results are based on the development capacity model outputs available at the time of reporting (December 2018).

5.1 Overview of input sites

The following table summarises the greenfield sites that were included in the model. The development capacity model has identified a total of 1,700 hectares of greenfield land across 136 sites in Wellington City, Porirua City, Kāpiti Coast, Lower Hutt, and Upper Hutt. It estimates that around 1,480 hectares of this land is developable, taking into account geographic and infrastructure constraints. This would yield a theoretical maximum of 15,000 new dwellings.

Rating valuation data suggests that these sites are currently valued at an average of around $7 to $28 per square metre, which is typical for unimproved sites with rural zoning. However, there are some sites with significantly higher capital values. This can affect feasibility in some cases.

Table 17: Summary of greenfield sites included in modelling

Territorial authority	**Number of greenfield sites (unique parcel IDs)**	**Total land area (ha)**	**Developable land area excluding constraints (ha)**	**Estimated development capacity (net added dwellings)**	**Weighted average capital value per m2 of developable land**
Wellington City	19	271.1	206.3	2,662	$24
Lower Hutt City	50	529.4	430.7	2,210	$7
Upper Hutt City	22	330.9	261.7	2,931	$9
Porirua City	12	405.9	374.5	4,838	$9
Kāpiti Coast District	33	239.8	215.8	2,800	$28
Regional total	**136**	**1,777**	**1,489**	**15,441**	

5.2 Summary of key results

Table 18 summarises estimated feasible dwelling capacity for each territorial authority, based on the gross dwelling densities output from the Wellington development capacity model. These results are drawn directly from the “Summary dashboard” in the feasibility model.

They reflect development sites that have been identified as of December 2018, and hence exclude any future urban development areas that have yet to be identified in plans.

We highlight the following findings:

- In Wellington City, 17 of the 19 greenfield sites are feasible to develop. Detailed analysis reported in the "Greenfield calcs" sheet shows that most of these sites have gross profit margins well in excess of the 20% threshold. These sites are estimated to yield 2,628 additional dwellings.
- In Lower Hutt City, 20 of the 50 greenfield sites are feasible to develop. These sites account for 111.3 hectares of developable land, which is around 26% of the total developable land in Lower Hutt, and are expected to yield 1,316 additional dwellings. However, a number of sites were *close* to feasible, with profit margins in the range of 14-18%. Sensitivity testing suggests that these sites may be more feasible under alternative assumptions about section density.
- In Upper Hutt City 21 of 22 greenfield sites are feasible to develop. These sites have a total developable area of 224.6 hectares and are expected to yield 2,818 additional dwellings.
- In Porirua City, all 12 greenfield sites are feasible to develop. These sites represent 374.5 hectares of developable land and are estimated to yield 4,838 additional dwellings.
- In Kāpiti Coast District, only 20 of 33 greenfield sites are feasible to develop. These sites account for 75% of total developable land area and dwelling capacity. They are estimated to yield 2,106 additional dwellings on 163.8 hectares of developable land.[16]

Table 18: Summary of greenfield feasibility model results based on density from development capacity model

Territorial authority	**Number of greenfield sites that are feasible to develop**	**Developable land area (ha)**	**Estimated feasible dwellings**
Wellington City	17	203.5	2,628
Lower Hutt City	20	111.3	1,316
Upper Hutt City	21	224.6	2,818
Porirua City	12	374.5	4,838
Kāpiti Coast District	20	163.8	2,106
Regional total	**90**	**1,077**	**13,706**

The feasibility model also enables sensitivity testing of key assumptions, including:

- Development timeframes
- Alternative net density assumptions for subdivision
- Gross profit margins
- Price and cost assumptions

The following table summarises the results of selected sensitivity tests. This analysis shows that:

[16] According to feedback from Kāpiti Coast District Council, estimated dwelling yields are based on current residential densities as a proxy until subdivision standards are established through a structure plan for the area. In addition, despite having structure plan provisions, the Ngarara and the remaining part of the Waikanae North development have been modelled using the same residential development densities as a proxy to provide consistency for greenfield modelling across Kāpiti.

- Results are not too sensitive to either a higher gross profit threshold or a longer development timeframe. In particular, the sites in Wellington saw no change in feasibility under these tests, and the sites in Porirua saw only very small reductions in feasibility.
- Applying alternative assumptions about net densities for new subdivisions (ie permitting developments up to 30 dwellings per net hectare) increases the number of feasible dwellings across all districts.[17] This reflects the fact that, within this range of densities, reducing section size seems to increase revenues more than it increases costs. This finding in turn suggests that there may be value in investigating whether alternative density rules may deliver an increase in feasible dwellings.
- Applying alternative section price estimates generally results in a reduction in feasible dwellings, reflecting the fact that this model is slightly more conservative about prices for certain types of dwellings. The negative effects of this model are most apparent in Lower Hutt with about a 65% reduction in net added dwellings, whilst all other districts had no more than a 15% reduction in net added dwellings when the alternative section pricing model was applied.

Table 19: Sensitivity tests for total feasible dwelling capacity

Scenario	**Baseline model**	**30% gross profit margin threshold *(1)***	**Alternative net density assumptions *(2)***	**Alternative section price estimates *(3)***	**Longer development timeframe *(4)***
Expected impact	*N/A*	*Reduce feasible capacity*	*Increase feasible capacity*	*Can have positive or negative effects*	*Reduce feasible capacity*
Wellington City	2,628	2,628	4,024	2,515	2,628
Lower Hutt City	1,316	884	8,324	452	1,038
Upper Hutt City	2,818	2,726	5,291	2,620	2,818
Porirua City	4,838	4,782	7,592	4,782	4,782
Kāpiti Coast District	2,106	1,970	3,773	1,936	2,038
Regional total	**13,706**	**12,990**	**29,004**	**12,305**	**13,304**

Notes:
(1) The baseline threshold for feasibility is a 20% gross profit margin;
(2) This sensitivity test identifies the most feasible option (ie maximising gross profit) for net density ranging from 10 to 30 dwellings per net hectare;
(3) This is based on application of Model 4 to estimate section prices, rather than Model 1 as in the baseline;
(4) Development timeframe extended from 18 to 30 months

5.3 Detailed results for selected territorial authorities

[17] The effect is particularly large in Lower Hutt, which appears to reflect the fact that there are three sites where the WCC capacity model assumes extremely low densities of less than one dwelling per hectare. Hence testing alternative densities results in as a ten- to thirty-fold increase in the number of dwellings on these sites. This may bear further investigation.

Detailed results are available in the feasibility model spreadsheet. Here, we highlight spatial variation in feasibility outcomes within Lower Hutt and Kāpiti Coast District.

The following table summarises Lower Hutt results by Census area unit. This shows that areas that are most feasible are those with higher-priced suburbs like Eastbourne, Kelson, Naenae North and Normandale, while other locations have a split of feasibility and non-feasibility. Feasible sites in lower-priced suburbs are expected to have lower prices for greenfield land, or less challenging geography and therefore lower development costs.

Table 20: Lower Hutt feasibility outcomes by Census area unit

Area unit	**Total sites**	**Number of additional plan-enabled sections**	**Number of feasible sites**	**Number of feasible sections**	**Benchmark section price *(1)***
Arakura	15	702	4	360	$144,700
Delaney	1	47	0	0	$151,600
Eastbourne	1	38	1	38	$455,800
Glendale	22	739	10	518	$167,600
Homedale East	3	261	1	122	$142,800
Kelson	2	213	2	213	$239,400
Manuka	1	20	0	0	$180,600
Naenae North	1	27	1	27	$214,300
Normandale	1	38	1	38	$229,000
Pencarrow	2	104	0	0	$167,600
Tirohanga	1	21	0	0	$243,500
Totals	**50**	**2,210**	**20**	**1,316**	

Notes: (1) This is the estimated price for a 500m2 flat section with no view in each suburb.

The following table summarises Kāpiti Coast results by Census area unit. Similar to Lower Hutt, areas with higher prices are seen to have a high proportion of feasible development (Raumati South, Waikanae Park, Waikanae West), whilst lower priced areas are less feasible, or not feasible at all (Otaki, Otaki Forks).

Table 21: Kāpiti Coast District feasibility outcomes by Census area unit

Area unit	**Total sites**	**Number of plan-enabled sections**	**Number of feasible sites**	**Number of feasible sections**	**Benchmark section price *(1)***
Otaki	7	811	3	461	$170,051
Otaki Forks	2	228	0	0	$150,142
Paraparaumu Beach South	1	0	0	0	$272,682
Paraparaumu Central	1	0	0	0	$229,127
Raumati South	3	174	3	174	$263,202
Waikanae East	1	86	0	0	$242,011
Waikanae Park	17	1,469	13	1,439	$254,499
Waikanae West	1	32	1	32	$262,824
Totals	**33**	**2,800**	**20**	**2,106**	

Note: (1) This is the estimated price for a 500m2 flat section with no view in each suburb.

5.4 Residual land value and implications for infrastructure funding

In addition to calculating the expected profit margin from development, we calculate residual land values for each site. In effect, this inverts the feasibility calculation used in the above analysis.[18]

Residual value analysis estimates the 'fundamental' value of land or development sites based on:

- the expected revenues from developing those sites (ie the sale price of new sections)
- minus the expected costs to develop new buildings on those sites, including a profit margin to cover the developer's effort and risk.

Developers often use residual value calculations when deciding how much to offer for a development site. Residual value from development can be less than zero in some cases, indicating that development revenues are not sufficient to cover development costs let alone provide a return to the landowner.

Even if residual value is positive, it may be less than the site's current valuation, in which case may owners would prefer to 'hold out' rather than sell to a developer. However, if residual value is greater than the site's current valuation, then landowners may prefer to sell or develop.

The following table summarises residual value estimates for Porirua greenfield sites, most of which are feasible. Residual value estimates range from a low of $29/m^2$ in Adventure to a high of $146/m^2$ in Resolution. The weighted average residual value across all Porirua sites is $128/m^2$.

[18] More specifically, it is calculated as $(total\ revenue)/(1 + profit\ margin) - (development\ costs\ excluding\ land\ purchase)$

High residual values represent a 'windfall gain' that accrues to landowners and/or developers when land is rezoned from rural to urban uses and serviced with urban infrastructure, at least in desirable areas. These windfall gains do not exist in all locations. For instance, in areas with extremely low prices, residual value can be *negative*, reflecting the fact that section prices are too low to cover development costs.

However, where significant residual value does exist, there may be opportunities to use 'value capture' techniques, such as targeted rates or infrastructure funding agreements, to help fund new infrastructure required to enable development. These mechanisms allow infrastructure providers and landowners/developers to 'split' the excess profits from developing land.

Value capture can be both fair and efficient. It helps ensure that the costs of unlocking development are aligned with the financial benefits of development. In doing so, it eases the financial constraints that infrastructure providers are facing, allowing them to better respond to growth and invest in improved quality of life for existing residents.

There are various technical and political challenges to implementing effective value capture mechanisms, and a full discussion is significantly beyond the scope of this report. However, we highlight that feasibility analysis can assist in understanding where there may (or may not) be opportunities to use value capture.

Table 22: Current land values and residual value estimates for Porirua greenfield sites

Parcel ID	Area Unit	Developable area (ha)	Current land value ($/m^2 developable area)	Residual value ($/m^2)	Difference
38	Pukerua Bay	12.5	$27	$123	$96
49	Pukerua Bay	22.8	$26	$126	$100
1535	Mana-Camborne	24.1	$13	$123	$110
3535	Adventure	4.4	$27	$29	$3
4535	Resolution	111.5	$2	$146	$144
4536	Resolution	4.7	$9	$145	$135
4826	Paekakariki Hill	128.0	$9	$127	$118
14034	Ranui Heights	3.3	$11	$82	$71
14240	Ranui Heights	1.7	$59	$82	$23
14699	Porirua Central	9.7	$10	$130	$120
17142	Titahi Bay North	36.2	$13	$106	$93
18101	Titahi Bay North	15.5	$5	$106	$101

6 Appendix 1: Calculating road requirements

Understanding the amount of land consumed by road space is important when predicting the number of future dwellings in new developments. Land dedicated to roads is land not available for dwellings. This can have a large impact on development profitability and therefore development uptake in an urban area. A further challenge caused by Wellington's hilly terrain is significant challenges for designing road networks, which may in turn affect the amount of land that must be set aside for them.

We estimated road requirements by analysing geospatial data on road network provision, topography, and development density in the Wellington region. The following table shows some basic results, illustrating the average share of land (excluding reserves) devoted to roads in each of the five Wellington councils.

Table 23: Average amount of land devoted to roads

Territorial Authority	Total land (hectares)	Total road land (hectares)	Road land (%)
Kāpiti Coast District	893	146	16
Lower Hutt City	2327	426	18
Porirua City	1204	191	16
Upper Hutt City	892	150	17
Wellington City	3531	715	20

6.1 Creating the data set

Creating the data set began with the LINZ primary parcel data set[19]. The first step was to join the slope of each parcel to the LINZ parcels by parcel id. The slope data was sourced from 8m elevation data and was represented as the average slope within each parcel. The slope data was then categorised into the following four categories:

1. **Flat:** Ranging from 0 to 10% slope,
2. **Sloping:** Ranging from 10 to 20%,
3. **Steep:** Ranging from 20% to 30%, and
4. **Very steep:** above 30% slope.

Next, an intersection[20] was performed between the parcel properties and the NZ meshblocks. This (a) cut the parcels up where they crossed over meshblock boundaries and (b) assigned a meshblock number to each parcel. Then the data was aggregated up into the meshblock level. Two key statistics were calculated for each meshblock were:

1. Total parcel area within the meshbock,
2. Total road parcel area within the meshblock,
3. Total flat parcel area within the meshblock,
4. Total sloping parcel area within the meshblock,

[19] This data set can be found online at the LINZ data source under "NZ Primary Parcels".
[20] An intersection is GIS operation where two layers a crossed over each other, creating a new layer where they intersect. See: http://wiki.gis.com/wiki/index.php/Intersect.

5. Total steep parcel area within the meshblock,
6. Total very steep parcel area within the meshblock.

Several other meshblock statistics were also joined to the data in this process:

1. Number of occupied private dwellings and,
2. The total number of people employed in this meshblock (workplace address).

From the total number of employed people, a meshblock was then defined as commercial by setting a cutoff of 75 employed people in the meshblock. All commercial meshblocks where then excluded from the analysis as we are interested in residential development.

The next step was to define the urbanised areas of the Wellington region.

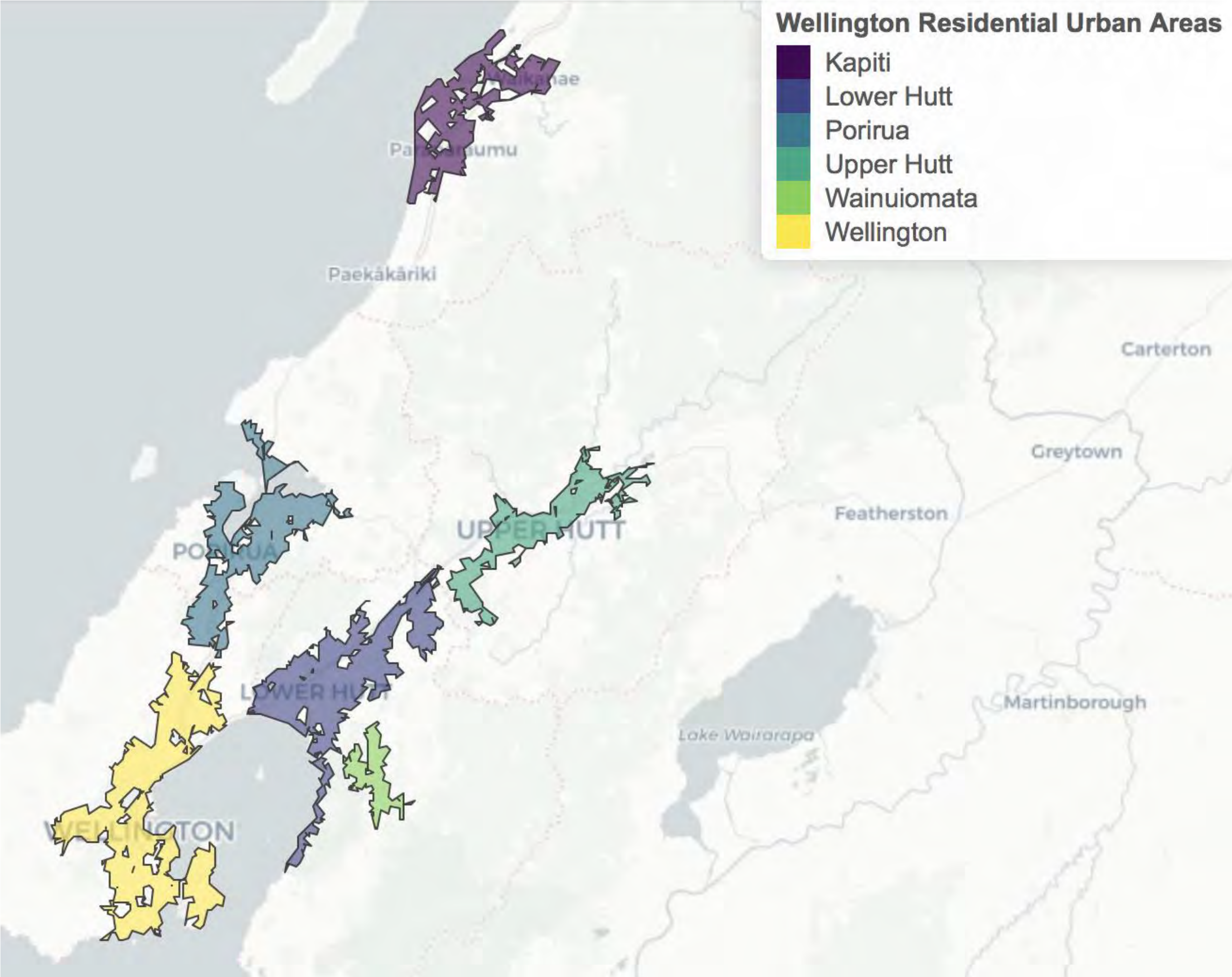
6.2 Defining urbanised areas

To define the contiguous urbanised area, as opposed to reserves, a neighbourhood analysis at the parcel level was conducted. This involved:

1. Converting parcel polygons to points,
2. Finding the top 10 nearest neighbours,
3. Averaging their distance from the parcel point, and
4. Filtering the parcels where the average distance was less than 150 metres.

The map below demonstrates the areas that were created from this analysis.

Figure 5: Urbanised areas in the Wellington region



Once these urban parcels had been selected, they were then dissolved to create a contiguous urbanised area. From this contiguous urban area, only the meshblocks that were fully contained within the urban area we used in the analysis.

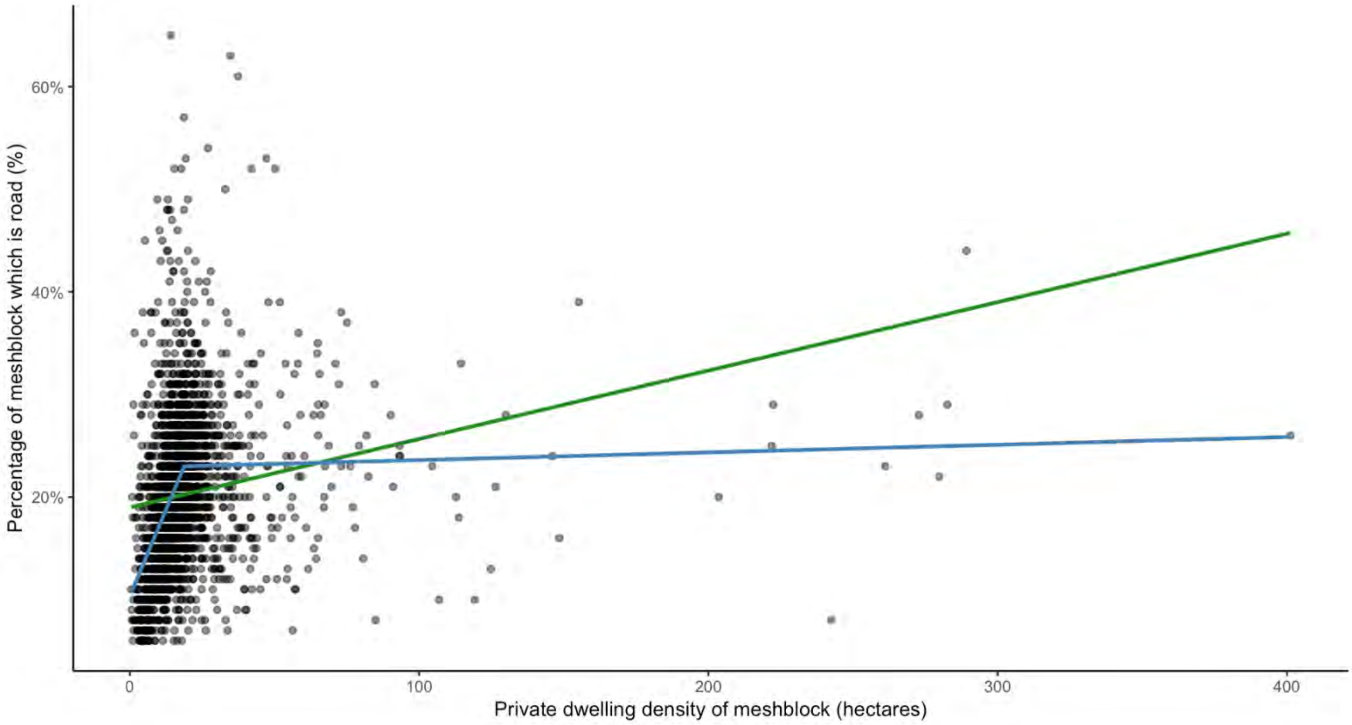
6.3 Exploratory data analysis

We started by exploring the data, focusing on the relationship between the share of urbanised land in each meshblock that is devoted to road space and average density of dwellings within that meshblock. Higher-density suburbs tend to require more land devoted to roads, as they need more accessways and space for transport access.

Figure 6 presents the relationship between net dwelling density and the amount of land dedicated to road in each meshblock. There is a positive relationship between density and road requirements, as expected. However, there is wide variation in road density in the data.

The green line represents a simple linear model, while the blue line represents two linear models; one for properties with a net dwelling density below 19 dwellings per hectares and ones above 19. The split model provides a better representation of the data. This relationship can be explained by the fact that the share of road space reaches a 'maximum' general level when traded up against dwelling density, as the total space allocated to roads *and* dwellings cannot exceed 100%.

Figure 6: The relationship between net dwelling density and the share of meshblocks used as road space



The nature of this relationship, and its 'split' behaviour is an important feature of the data that we consider when defining the model of road requirements.

6.4 Estimating the determinants of the amount of land dedicated to road use

We used this data to estimate the drivers of road requirements for residential suburbs. We considered four basic factors:

- The density of dwellings in the suburb
- Whether there is a 'nonlinearity' in the effect of dwelling density on road density
- The average slope of the suburb
- Which territorial authority the suburb is in.

We used ordinary least squares regression to test four different model formulations at both the meshbock and the area unit level. Trying these models at the different geographical scales meant we could test for the modifiable area unit problem (MAUP). Fortunately, no extreme differences were found between the levels and the model outputs. The four different model formulations tried were:

Equation 5: Road space Model 1 specification

$$r_i = o_i$$

where i represents the meshblock, r represents percentage of road space and o represents the density of private occupied dwellings. However, as noted in the preceding section, the relationship between dwelling density and road space is, strictly speaking, not a linear one. Because of this, the next model specification includes an interaction term between dwelling density and an indicator variable (p) indicating whether that meshblock is above 19 private dwellings per hectare or not (Yes or No). The second formulation is specified as

Equation 6: Road space Model 2 specification

$$r_i = o_i * p_i$$

the third specification adds in a slope variable (s) as

Equation 7: Road space Model 3 specification

$$r_i = o_i * p_i + s_i$$

The final formulation was:

Equation 8: Road space Model 4 specification

$$r_i = o_i * p_i + s_i + ta_i$$

where *ta* represents the territorial authority of the parcel. The 'flat' slope variable was excluded from the analysis to avoid collinearity with other slope indicators. This means that any reading of the model output is based on the inclusion of the 'flat' variable, and the direction of the variables is in relation to that 'flat' variable.

The results of these models are presented in the following Section 3.

6.5 Results of statistical analysis

Models 1, 2, 3 and 4 represent the meshblock level models with the four formulations, and Models 5, 6, 7 and 8 represent the area unit level models (ie using an area unit indicator instead of a meshblock indicator). The results of this analysis for all 8 formulations are presented in the Table below.

The dependent variable (share of suburb devoted to roads) expresses percentages as a decimal, eg 10% equates to 0.1. Model coefficients are listed to the right of the variable name, while standard errors are below in brackets.

Table 24: Road density regression results

Dependent variable:	Road space (%)							
Level of aggregation	Census meshblocks				Census area units			
Model specification	1	2	3	4	1	2	3	4
Private dwelling density (ha)	0.001***	0.007***	0.007***	0.006***	0.004***	0.008***	0.007***	0.006***
	(0.0001)	(0.0004)	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
Private dwelling density (ha) (Yes)		0.125***	0.122***	0.113***		0.221***	0.207***	0.196***
		(0.006)	(0.006)	(0.006)		(0.036)	(0.036)	(0.036)
Percentage of land that is 'sloping'			-0.017***	-0.028***			-0.067**	-0.103***
			(0.006)	(0.007)			(0.027)	(0.034)
Percentage of land that is 'steep'			-0.017*	-0.027***			0.097**	0.078
			(0.009)	(0.009)			(0.048)	(0.048)
Percentage of land that is 'very steep'			0.023**	0.010			-0.010	-0.025
			(0.010)	(0.011)			(0.054)	(0.055)
Kāpiti Coast DIstrict				0				0
				(0)				(0)
Lower Hutt City				0.007				0.008
				(0.006)				(0.016)
Porirua City				0.001				0.010
				(0.006)				(0.018)
Upper Hutt City				-0.008				-0.011
				(0.007)				(0.016)
Wellington City				0.018***				0.024
				(0.006)				(0.019)
Private dwelling density (ha): Private dwelling density (ha) (Yes)		-0.007***	-0.007***	-0.006***		-0.011***	-0.010***	-0.010***
		(0.0004)	(0.0004)	(0.0004)		(0.002)	(0.002)	(0.002)
Constant	0.190***	0.103***	0.109***	0.108***	0.140***	0.089***	0.101***	0.111***
	(0.002)	(0.005)	(0.005)	(0.007)	(0.010)	(0.012)	(0.014)	(0.017)
Observations	2,628	2,628	2,628	2,628	119	119	119	119
R^2	0.036	0.172	0.177	0.187	0.215	0.442	0.477	0.507
F Statistic	98.223*** (df = 1; 2626)	181.193*** (df = 3; 2624)	94.072*** (df = 6; 2621)	60.287*** (df = 10; 2617)	32.060*** (df = 1; 117)	30.421*** (df = 3; 115)	17.024*** (df = 6; 112)	11.106*** (df = 10; 108)
Note:	*p**p***p<0.01							

Immediately, one can see the improvement by including the interaction variable in the model specification with the R values increasing from 0.036 to 0.172 from Model 1 to Model 2. Furthermore, the coefficients are significant and make sense with dwelling density effectively not adding any increase to road percentages in meshblocks with a private dwelling density greater than 19 dwellings per net hectare.

Overall, the magnitude, direction and significance of the variables are relatively consistent. All variables except for the very steep variable are significant in the meshblock model. However, several variables become insignificant in the model at the area unit level. The constants of the model are higher in the meshblock models, and lower in the area unit models. In both models, Model Formulation 4 has the lowest constant as more of the variance is explained in the additional variables. The magnitude of these variables does however relate quite closely to the summary statistics presented earlier and appear reasonable.

In terms of the slope variables, the behaviour is mixed and not always significant. In terms of the territorial authorities, these all seem reasonable with the Wellington City TA having the largest impact of the amount of land dedicated to roads, followed by Lower Hutt and Porirua and, then finally, Kāpiti.

We use the results from model 4 to predict the quantity of land that will be used for roads in new subdivisions, taking into account the net density of sections in the subdivision and the gradient of these sites.

7 Appendix 2: Statistical analysis of section prices

In this section, we provide detailed results from our statistical analysis of section prices for each of the five Wellington region territorial authorities.

7.1 Wellington City

The following table summarises Wellington City model coefficients for Models 1 and 4, estimated using data over the 2008-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Table 25: Wellington City: Model 1 and Model 4 results

	Model 1		**Model 4**	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Constant	230,789	22,262	10.560	0.07
Section size	241	13		
Section size squared	-0.03	0.007		
Log section area			-0.650	0.01
Section	-22,974	4,719	-0.080	0.01
View of land	-3,244	2,264	-0.010	0.01
View of water	31,990	3,083	0.080	0.01
Gentle slope	-27,755	2,180	-0.080	0.01
Steep slope	-88,161	2,930	-0.250	0.01
Driveway	17,362	2,161	0.030	0.01
Sale year 2009	3,892	3,938	0.020	0.01
Sale year 2010	8,266	4,024	0.050	0.01
Sale year 2011	-1,604	4,073	0.020	0.01
Sale year 2012	7,676	3,961	0.050	0.01
Sale year 2013	16,754	3,940	0.100	0.01
Sale year 2014	24,393	4,005	0.130	0.01
Sale year 2015	43,147	3,958	0.190	0.01
Sale year 2016	129,342	3,960	0.460	0.01
Sale year 2017	205,539	4,159	0.670	0.01
Sale year 2018	243,504	5,902	0.760	0.02
Area unit constants?	Yes		Yes	

R2	0.53	NA	0.687	NA

7.2 Lower Hutt City

The following table summarises Lower Hutt City model coefficients for Models 1 and 4, estimated using data over the 2013-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Table 26: Lower Hutt City: Model 1 and Model 4 results

	Model 1		**Model 4**	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Constant	126,862	9,411	10.690	0.08
Section size	300	15		
Section size squared	-0.11	0.008		
Log section area			-0.740	0.01
Section	-32,720	7,493	-0.260	0.03
View of land	-7,942	3,197	-0.040	0.01
View of water	4,922	4,258	0.020	0.02
Gentle slope	-14,587	3,029	-0.070	0.01
Steep slope	-69,298	4,392	-0.280	0.02
Driveway	9,935	2,886	0.040	0.01
Sale year 2014	-4,137	3,717	-0.010	0.01
Sale year 2015	3,067	3,594	0.030	0.01
Sale year 2016	57,101	3,585	0.280	0.01
Sale year 2017	87,879	3,643	0.420	0.01
Sale year 2018	114,407	4,417	0.540	0.02
Area unit constants?	Yes		Yes	
R2	0.71		0.803	

7.3 Upper Hutt City

The following table summarises Upper Hutt City model coefficients for Models 1 and 4, estimated using data over the 2013-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Note that, following model testing, view variables were excluded from this model.

Table 27: Upper Hutt City: Model 1 and Model 4 results

	Model 1		**Model 4**	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Constant	-19,197	11,914	9.690	0.10
Section size	156	15		
Section size squared	-0.04	0.00		
Log section area			-0.740	0.01
Section	38,826	7,135	0.190	0.03
Gentle slope	-8,579	3,141	-0.060	0.01
Steep slope	-39,371	5,580	-0.210	0.03
Driveway	11,656	4,713	0.060	0.02
Sale year 2014	-6,587	3,954	-0.030	0.02
Sale year 2015	-624	3,818	0.000	0.02
Sale year 2016	47,788	3,791	0.250	0.02
Sale year 2017	88,557	3,870	0.430	0.02
Sale year 2018	122,688	4,687	0.580	0.02
Area unit constants?	Yes		Yes	
R2	0.61		0.748	

7.4 Porirua City

The following table summarises Porirua City model coefficients for Models 1 and 4, estimated using data over the 2013-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Table 28: Porirua City: Model 1 and Model 4 results

	Model 1		Model 4	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Constant	106,241	11,296	10.780	0.11
Section size	71	19		
Section size squared	-0.01	0.01		
Log section area			-0.830	0.02
Section	17,376	5,225	0.080	0.02
View of land	-986	2,987	-0.010	0.01
View of water	40,855	3,036	0.150	0.01
Gentle slope	-12,856	2,484	-0.060	0.01
Steep slope	-40,312	4,419	-0.170	0.02
Driveway	7,631	3,289	0.030	0.01
Sale year 2014	-8,436	4,214	-0.030	0.02
Sale year 2015	-53	4,079	0.020	0.02
Sale year 2016	45,392	4,036	0.240	0.02
Sale year 2017	74,696	4,273	0.360	0.02
Sale year 2018	97,823	5,193	0.490	0.02
Area unit constants?	Yes		Yes	
R2	0.53		0.684	

7.5 Kāpiti Coast District

The following table summarises Kāpiti Coast District model coefficients for Models 1 and 4, estimated using data over the 2013-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Note that we have not included variables for views, slope, or presence of a driveway in the Kāpiti Coast model as the sales data did not include information on these property attributes.

Table 29: Kāpiti Coast District: Model 1 and Model 4 results

	Model 1		**Model 4**	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Intersect	-46,622	59,579	9.140	0.28
Section size	99	17	NA	NA
Section size squared	0.01	0.01	NA	NA
Log section area	NA	NA	-0.630	0.02
Section	1,424	4,659	0.050	0.02
View of land	-2,444	3,484	-0.010	0.02
View of water	119,419	3,758	0.380	0.02
Gentle slope	-10,669	3,026	-0.040	0.01
Steep slope	-26,986	6,270	-0.090	0.03
Driveway	821	3,099	0.030	0.01
Sale year 2014	6,376	3,475	0.040	0.02
Sale year 2015	16,991	3,415	0.060	0.01
Sale year 2016	73,929	3,414	0.340	0.01
Sale year 2017	118,378	3,560	0.530	0.02
Sale year 2018	115,075	5,400	0.520	0.02
Area unit constants?	Yes		Yes	
R2	0.49		0.543	

7.6 Analysis of model residuals

To help identify an appropriate statistical model, we examined residual plots for vacant section sales, excluding standalone home sales. The 'residual' for a specific sale is the difference between the actual sale price and the price that is predicted by the statistical model. A positive residual indicates that the model has under-estimated the price for a specific property, and a negative residual indicates an over-estimate.

The following charts show the pattern of residuals relative to section size. Because Models 1 and 4 use different dependent variables, the vertical axes on these charts have a significantly different scale.

We observe several reassuring features in the residuals. First, residuals for vacant section sales are generally clustered around zero – while there are overs and unders, they are roughly evenly distributed. This means that including sales of standalone homes is unlikely to result in any significant 'bias' in our estimates of section prices.

Second, there is no clear pattern in the overs and unders. Our statistical models does not appear to systematically over- or under-predict prices for sections of a certain size. This means that they are likely to capture the underlying relationship between section size and price, controlling for location and site characteristics.

As a result, we are confident that these models will produce reliable estimates of average prices for different types of sections sold in different locations.

Figure 7: Model 1 residual plots

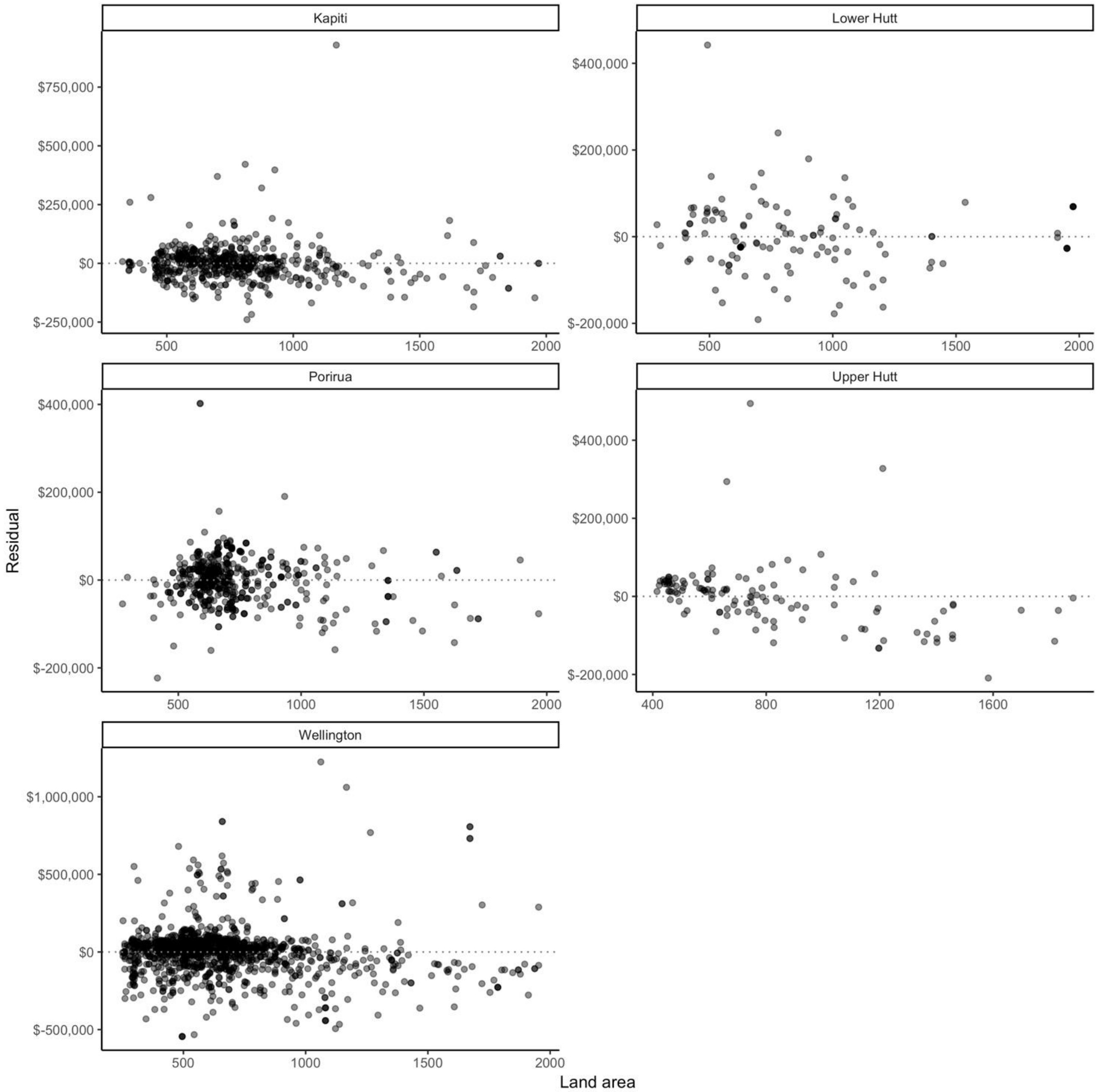
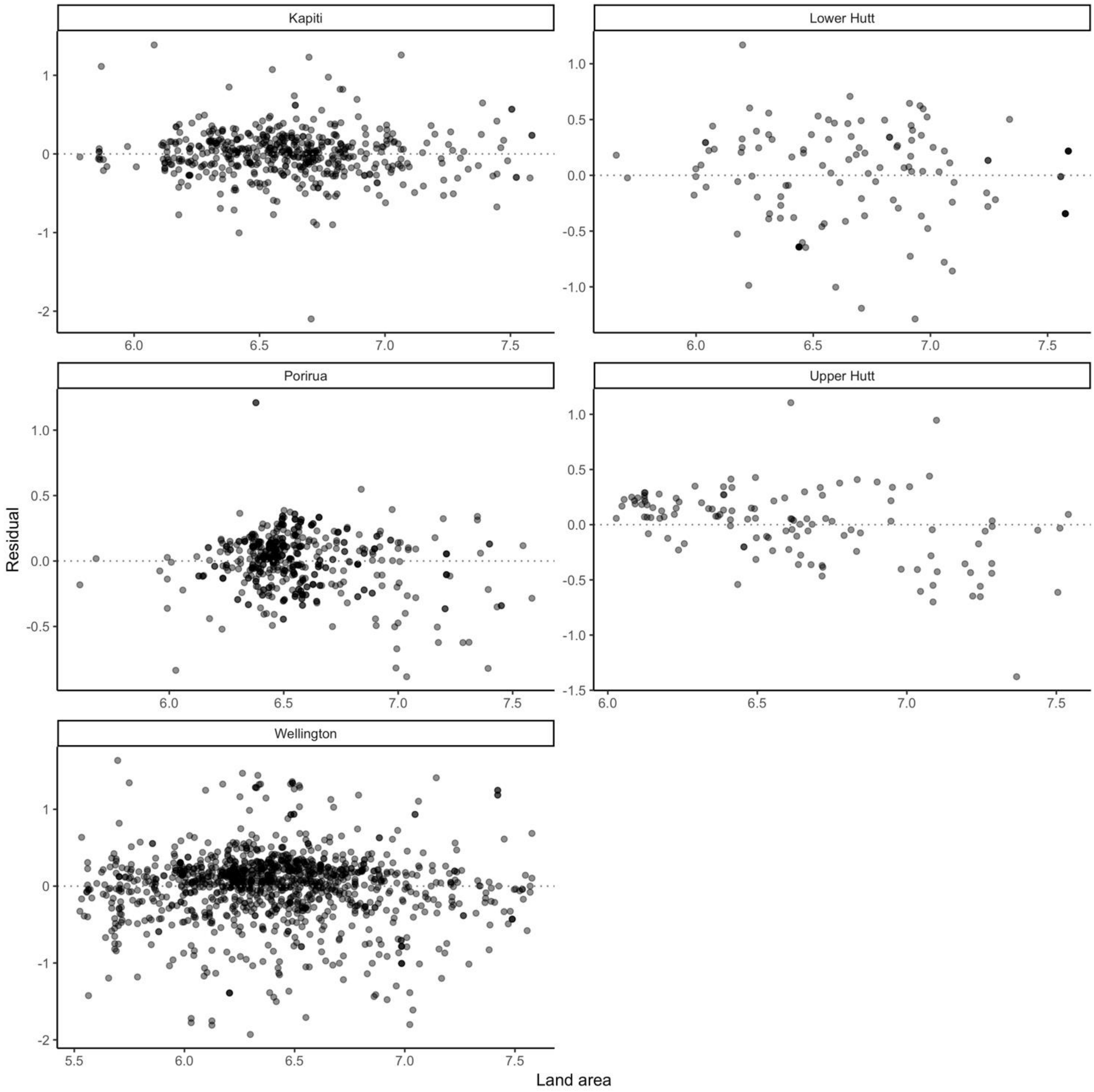


Figure 8: Model 4 residual plots



Appendix 1.5

Demand for business land in the Wellington region

From today's economy to future needs

May 2018

SENSE PARTNERS
DATA LOGIC ACTION

Key points

The region needs to plan for land demand growth…

The Wellington region needs to plan for continued growth in demand for business land

- Despite changes to the structure of the local economy, the Wellington region will demand extra business land over the next 3, 10 and 30 years
- Our baseline estimates suggests demand for land grows 3.9 percent in Wellington City, 4.8 percent in Kapiti and Upper Hutt grows 10.5 percent by 2047
- We expect demand for Lower Hutt business land to fall due to a continued shift from industrial to services activity and intensification of industrial land use activity

Demographic assumptions drive the extent to which additional land is required

- Our central estimates use Statistics New Zealand's median population projections
- There is merit in adopting Statistics New Zealand's 'High' projection as a scenario. Under a high population scenario, additional demand lifts 14 percent by 2047
- Regional business land requirements from a forecast.id population projection are not much different to our baseline but there are local differences (see figure 1)

Transport infrastructure improvements lift demand, but demographics matter more

- Many related transport infrastructure projects are reducing travel times and the costs of shifting people and freight across the region
- These projects impact on the location and magnitude of demand for business land
- But the scale of transport impacts is limited – reasonable assumptions on population growth rates matter more for the aggregate outlook (see figure 1 for comparison)

…and factors, such as increased utilisation of floorspace, also reduce demand

- Based on trends in sectoral activity we expect industries to moderately intensify floorspace utilisation over coming years
- This includes is a shift from heavy industry, to lighter industries which use less land
- These factors moderate the demand for business land assumptions across the region – our estimates are contingent on both assumptions

Floorspace demand and our floor-to-land assumption drives the business land demand

- To forecast business land demand, we need to make assumptions on how floorspace is accommodated across the region
- Assessing the ratio of floorspace of land is not straightforward – we make local assessments at a sector level and suggest sensitivities for future robustness work

FIGURE 1: MOST COUNCILS SHOW MODEST GROWTH (%) IN BUSINESS LAND DEMAND

Change in total business land demand by local council, percent relative to 2017

	Kapiti Coast		Lower Hutt		Upper Hutt		Wellington City	
Horizon	10-yr	30-yr	10-yr	30-yr	10-yr	30-yr	10-yr	30-yr
Baseline	0.82	4.78	-4.77	-12.07	8.86	10.51	3.32	3.89
forecast.id	1.31	14.24	-6.83	-7.12	5.81	15.56	2.87	3.87
High projection	7.16	21.15	1.39	2.98	16.32	31.95	8.89	17.40
Transport links	1.73	7.63	-4.46	-11.23	9.16	11.45	3.70	5.03

…understanding industry and local nuances is critical

…disaggregating demand by economic sector matters for planning purposes

- Our projections suggest industrial activity will be flat at best, and is likely to decline, across a 30-year period, consistent with a shift away from manufacturing to a services-led economy
- Industrial land use is also intensifying, as the mix changes away from heavy manufacturing activity towards logistics, printing and food manufacturing
- At the same time, current business land requirements for industrial uses are moving, as firms seek to mitigate risks from earthquakes and sea-level rise. Councils need to assess the current state before planning for the next 3, 10 and 30 years

Local councils' experiences differ: expect demand in Wellington City to grow modestly

- Wellington City's exposure to the Government and Commercial sectors sets the tone for the region posting modest growth in business land demand over the next 30 years
- Government is expected to grow as a fraction of the local economy and commercial services and health, education and training workers also sustain growth in the city
- The population growth rate in future years and our assumption of a modest rate of intensification in floorspace used are key risks to the outlook for Wellington City

…how the industrial sector unfolds determines business land demand in Lower Hutt

- Our baseline estimates suggest a shift away from industrial activity will reduce demand for industrial activity in Lower Hutt
- This reduced demand is partially offset by growth in demand for land to accommodate more commercial, retail and health, education and training activity

…business land demand in Upper Hutt is also contingent on industrial activity

- Demand for business land in Upper Hutt swings on the outlook for industrial activity that our model suggests is weaker by 2047 than the current state of activity
- Since industrial activity is not particularly intensive, small changes in activity could lead to relatively large changes in demand for industrial business land in Upper Hutt
- Right now, demand for business land in Upper Hutt is increasing. This is driven by 3 factors:
    - Stronger than expected population growth across the Wellington region
    - An improvement in the outlook for logistics, food manufacturing and other light industrial activities
    - A relative shift towards industrial land in Upper Hutt that has lower earthquake and sea-level rise risks than some other locations in the region

…Kapiti Coast firms are set to demand more land across a range of sectors

- The outlook for Kapiti is for modest growth across commercial, retail, industrial and even government. The health and education sector is particularly strong
- Kapiti is also likely to benefit more than others from the development of a set of transport infrastructure projects on Wellington's northern corridor
- Our estimates show these projects lift demand 2.5 percent by 2047, but there is uncertainty. Baseline population growth has a large impact on demand relative to the impacts of transport projects

…the current and future economy shapes demand

Economic activity set to grow in the Wellington region

- Economic activity will continue to grow across the Wellington region over the next 3-, 10- and 30-year periods.
- Employment has recovered from the GFC. Strong population growth boosts activity.
- Expect employment growth to moderate from the current pace over future periods.

Wellington is unusual among New Zealand regions.

- The Wellington region is a very complex economy. It is a large and diversified economy, that specialises in many industries. This specialisation help determine demand for floorspace and hence business land.
- Auckland is the only other comparator – most regions in New Zealand tend to be highly specialised in only a few things

Wellington City exhibits some typical pull factors of large urban centres

- Wellington benefits from its size, as seat of government, as a place with significant concentration of highly skilled and entrepreneurial people.
- We anticipate the Government sector will grow at a rate close to or a little below the national economy. That means the Government sector grows at a slightly faster rate than the Wellington economy and increases as a share of the region's employment.
- While these are the visible engines of growth, there is a wide array of businesses that service these industries and the wider economy

Wellington sub-regions are different but complementary.

- Most government sector jobs are in Wellington and Upper Hutt.
- But domestic services, which are complementary and necessary to smooth functioning of the regional economy, are in neighbouring territorial authorities.
- Health, education and aged care are more prominent in outside of Wellington city.

Local impacts vary across the region

- To help understand the spatial demand for business land, we forecast employment growth by industry for each of the districts within our study.
- Industry composition makes for significant differences at the district level, we expect:
  - Growth in Lower Hutt to be a little lower than elsewhere because of exposure to industrial activity and manufacturing
  - Government increases Upper Hutt employment moderated by other sectors.
  - Kapiti benefits from an increasing share of employment in Health, Education and Training and related industries
  - Expect Wellington City to benefit from strong Government and Commercial growth.

The region's success is tied to some structurally growing industries

- These include skilled services, government, health, education, finance and tourism.
- These structurally growing industries account for 60% of jobs in the study area and will lead to increasing demand in commercial and government space.
- There are also structurally declining industries like manufacturing, wholesale trade, distribution and media. This is likely to reduce demand for industrial space.

Contents

Context

This report helps councils think about the outlook for the regional economy, assesses demand for business land 3, 10 and 30 years from today and responds to the requirements of the National Policy Statement on Urban Development Capacity (NPS-UDC). It is intended to help four councils across the Wellington region – Kapiti Coast, Lower Hutt, Upper Hutt and Wellington city – plan.

The report begins by highlighting the economic drivers of current activity within the Wellington region before modelling future economic activity. Then the report translates projections of economic activity to demand for floor area and land use for each of the four local councils that form the study area. In addition to the quantum of land area and floor area, we consider scenarios with stronger population growth and with the impact of transport infrastructure improvements to the Northern corridor.

As part of informing and testing our modelling and interpretation of results, we met with many companies, developers and firms active in the construction sector, including: Kapiti Airport, Coastlands, Richard Burrell, Malcolm Gillies, Victoria University of Wellington, Naylor Love, the Government Property Group, the New Zealand Property Council (Wellington Branch) and Master Builders. We thank MR Cagney for assistance with the report.

Figures

Key Points

Overview

The current economy

The future economy

Business land demand

Appendices

1.Overview

The prime purpose of this report is to quantify demand for business land for four councils – Kapiti, Lower Hutt, Upper Hutt and Wellington City – within the Wellington region.

To quantify business land demand, we first focus on firms and the local business environment, setting out the key local economic drivers in section 2 of the report. We highlight local trends and the complexity of the local economy. These factors are critical for understanding the future shape of the Wellington economy and the intensity of land demand per worker.

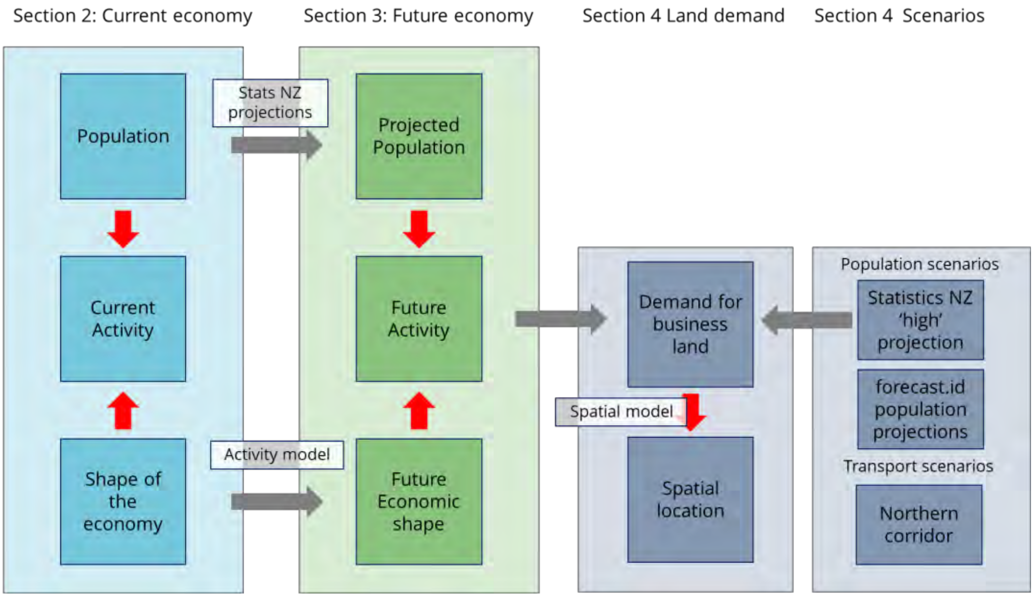
In section 3 of the report, we introduce an economic model use to forecast the future economic activity in terms of the number of workers in each council across 6 different industries: Commercial, Government, Retail, Industrial, Health and Education and a catch-all 'Other' group.

Section 4 first translates our projections of economic activity into demand for floor area based on assumptions on the floorspace each worker will require in the future. Then we use local floor-to-area ratios for each local industry and council to project future demand for business land.

In addition to our baseline case, section 4 also explores scenarios that relate to population growth and the impact of improvements to local roading infrastructure. These scenarios show the range of possible outcomes. As far as possible, councils should consider these alternative outcomes when planning for future growth. We make some concluding remarks along these lines in section 5.

FIGURE 2: WE TAKE A STAGED APPROACH TO ASSESSING BUSINESS LAND DEMAND

Report roadmap



Source: Sense Partners

2. The current economy

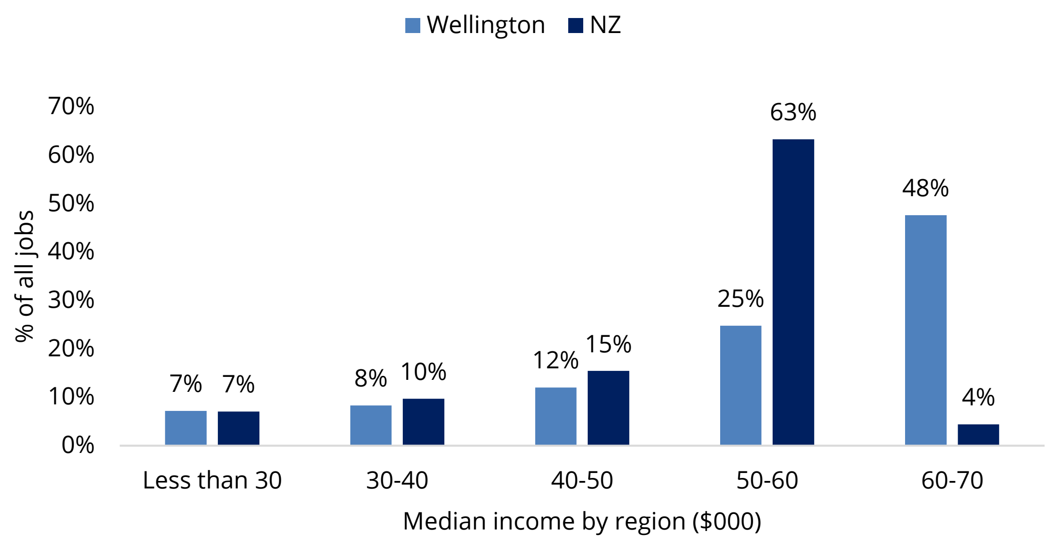
2.1 Drivers of growth

2.1.1 The Wellington region is different

Incomes are much higher in Wellington

Wellington's high incomes stand-out as a key difference relative to the rest of the country. Almost half of all jobs in the Wellington region land at $60,000 or more. That makes for a significant wage premium compared to the rest of New Zealand. Figure 3 shows most jobs peak out at $50,000-$60,000 in the rest of the country.

FIGURE 3: WELLINGTON HAS MORE HIGH PAYING JOBS COMPARED TO ELSEWHERE
Employment by income band, Wellington Region vs New Zealand



Source: Statistics New Zealand, Sense Partners

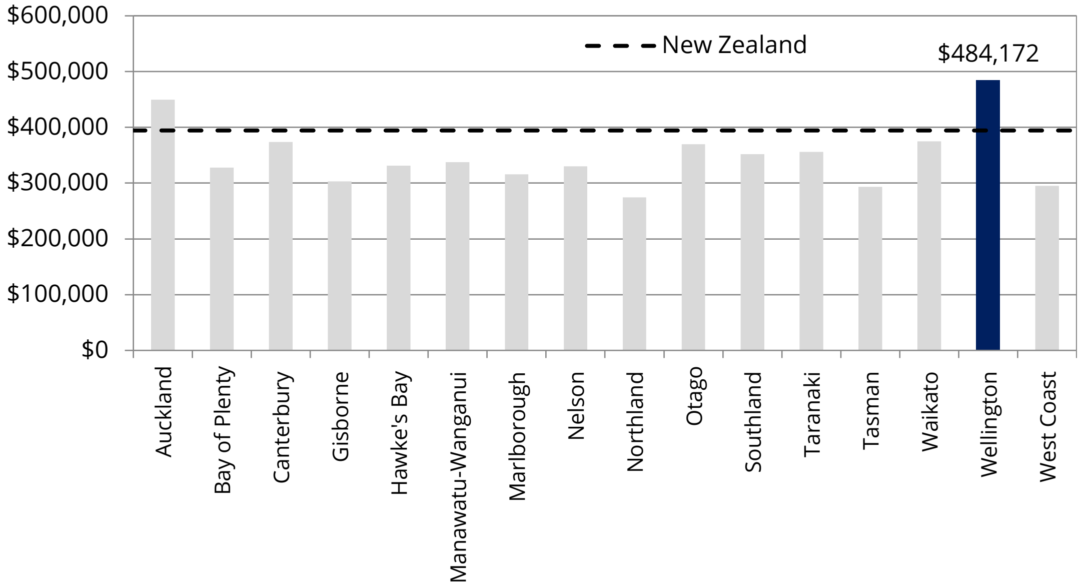
Part of the high-income story reflects a highly educated workforce. The average worker is more likely to have a tertiary qualification and more likely to have a higher degree than the rest of New Zealand. That improves estimates of human capital within the region (see Figure 4) that in turn generate higher wages.

Higher wages also attract workers to the region. Wellington is also New Zealand's second-most populous region. Put together with Wellington's highly skilled labour force, Wellington's labour market is *deep* – there are potentially many people that can do specialised roles (such as environmental engineering, cross-border taxation lawyers and designing graphics for the gaming industry). For firms operating in industries that drive the local economy, there are simply more finance, government and IT workers in Wellington than most other regions. We expect these trends to continue and drive future demand for business land.

Deep labour markets help match firms and workers to jobs. With many jobs and workers in the labour market it also easier to shift jobs. When highly educated workers shift jobs, knowledge is shared and transferred to other workers, lifting productivity compared with other regions without such deep, highly connected labour markets.

FIGURE 4: HUMAN CAPITAL IS MUCH HIGHER IN THE CAPITAL REGION THAN OUTSIDE

Regional estimates of human capital



Source: Statistics New Zealand, Sense Partners

Firms in the Wellington region operate in complex industries

Deep labour markets help the Wellington region specialise and compete in complex industries. This helps determine the economic performance of the region. Regions have a suite of industries they compete in. Some regions exhibit a high degree of specialisation, operating in only a small chunk of the make-up of the national economy. Other regions are general and are composed of a little bit of the economic composition of the national economy.

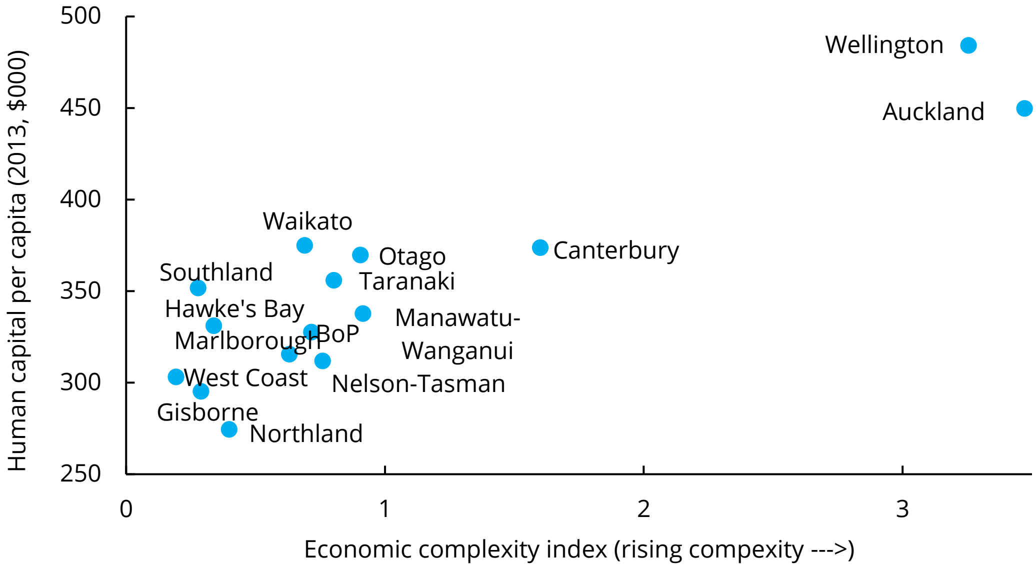
Specialisation is an important component of a region's economic *complexity*, that is, the extent that a region provides a unique set of goods and services provided by no other region.[1] Complexity can help lift incomes since it helps provide a productivity premium relative to regions that produce similar goods and services to elsewhere. This helps lift the potential within a region, but the experience of Auckland and the Wellington region shows that while complexity can explain regions where incomes are high (see Figure 5), it is not necessarily a good predictor of which regions might be expected to grow strongly. Economic complexity can

[1] See Appendix 1 for details on how we calculate complexity.

change over time. But our estimates show that the differences between Auckland and the Wellington region and the rest of New Zealand have persisted over many years (see Figure 6). Expect this trend to continue and help determine future business land demand.

FIGURE 5: ECONOMIC COMPLEXITY CAN HELP EXPLAIN WHERE INCOMES ARE HIGH

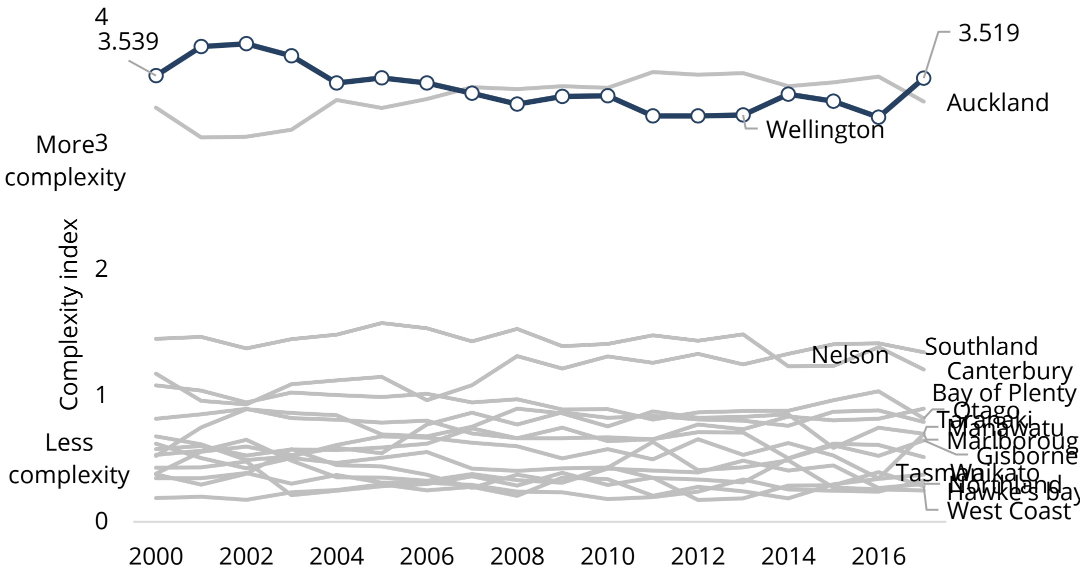
Economic complexity (2016) against human capital per capita (2013 census)



Source: Statistics New Zealand, Sense Partners

FIGURE 6: DIFFERENCES IN ECONOMIC COMPLEXITY PERSIST

Regional complexity estimates, 2000-2017

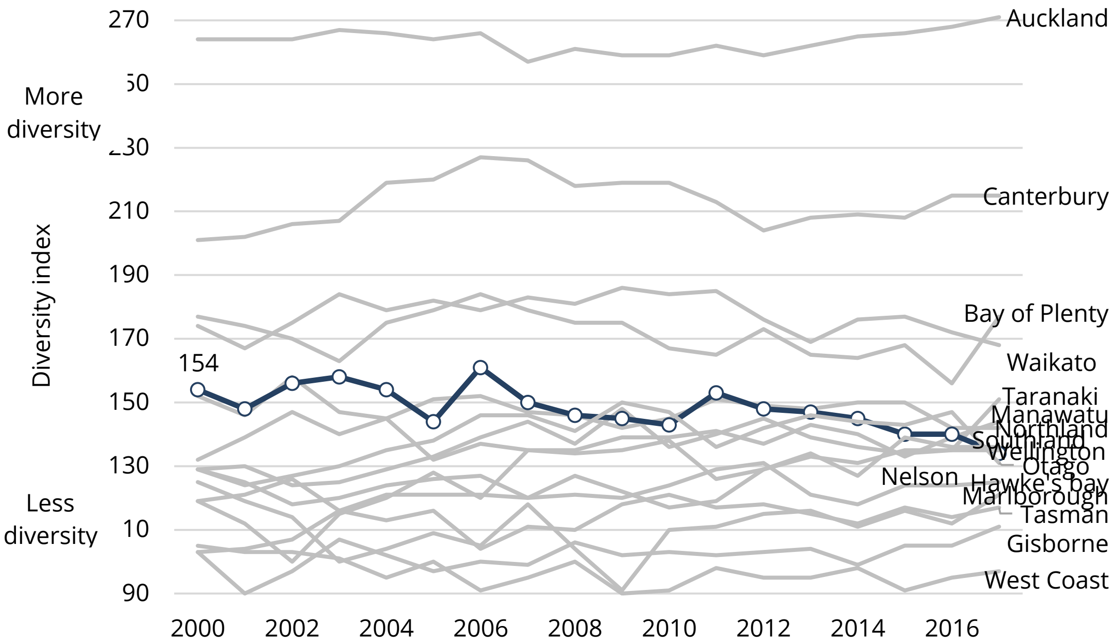


Source: Statistics New Zealand, Sense Partners

Our complexity measures are derived from employees counts that compare the number of sub-industries that exhibit specialisation, where the proportion of employees involved in that industry is higher than the national average, and ubiquity measures that compare specialisation across regions. Figure 7 and Figure 8 compare diversity and ubiquity across New Zealand (See Appendix 1 on how we measure diversity and ubiquity).

FIGURE 7: AUCKLAND'S PRODUCTIVE BASE IS MORE DIVERSE THAN OTHER REGIONS

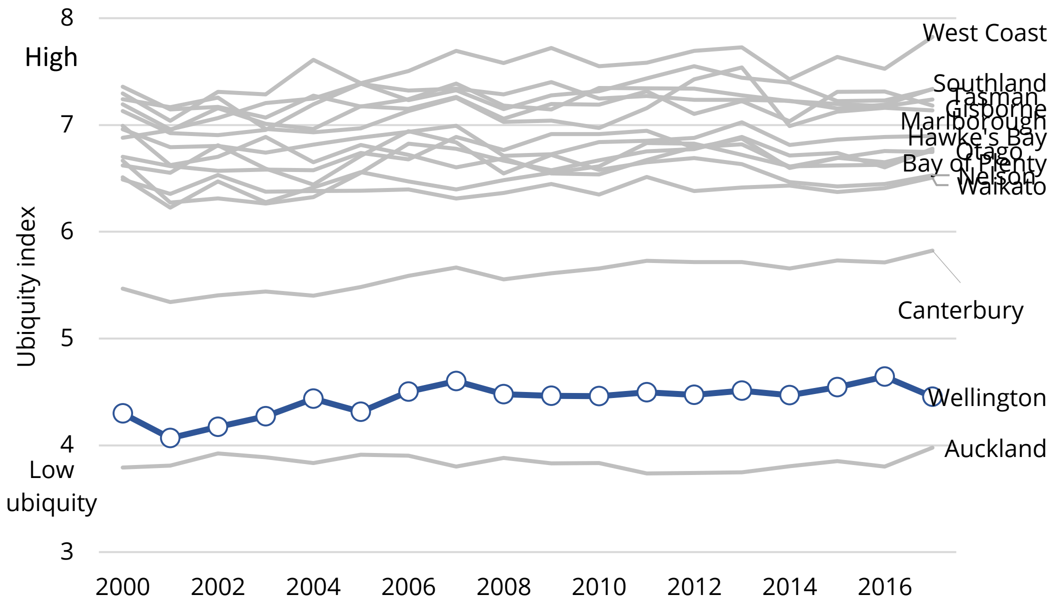
Diversity measures, based on 6-digit ANZSIC industry employee counts



Source: Statistics New Zealand, Sense Partners

FIGURE 8: WELLINGTON AND AUCKLAND SPECIALISE IN MANY NICHE INDUSTRIES

Ubiquity measures, based on 6-digit ANZSIC industry employee counts



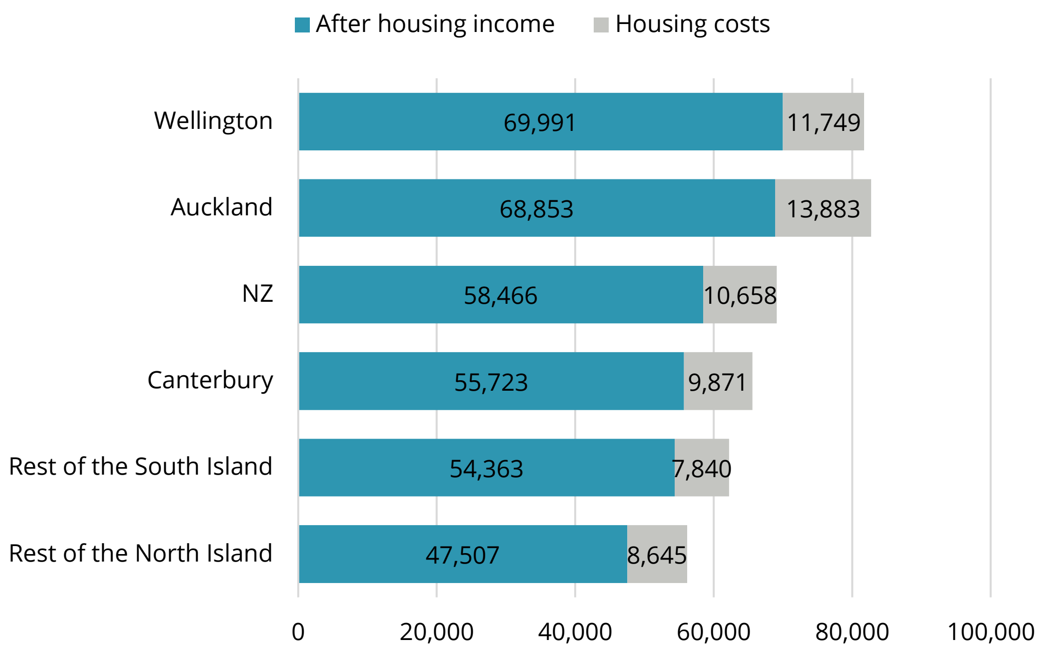
Source: Statistics New Zealand, Sense Partners

2.1.2 There is a competitive advantage but underperformance

Competitive advantage

Wellington's labour markets produce a competitive advantage for firms that locate within the region. Access to a deep pool of labour with high human capital helps provide an edge relative to businesses that operate from other regions. Workers are attracted by high incomes and housing costs that are more moderate than Auckland (see Figure 9), that make for high disposable income. This makes it easier for many service sector employers to access the labour they need and support the shift towards services across the region.

FIGURE 9: WELLINGTON HAS HIGH INCOMES AND MODERATE HOUSING COSTS
Income pre- and post-housing costs

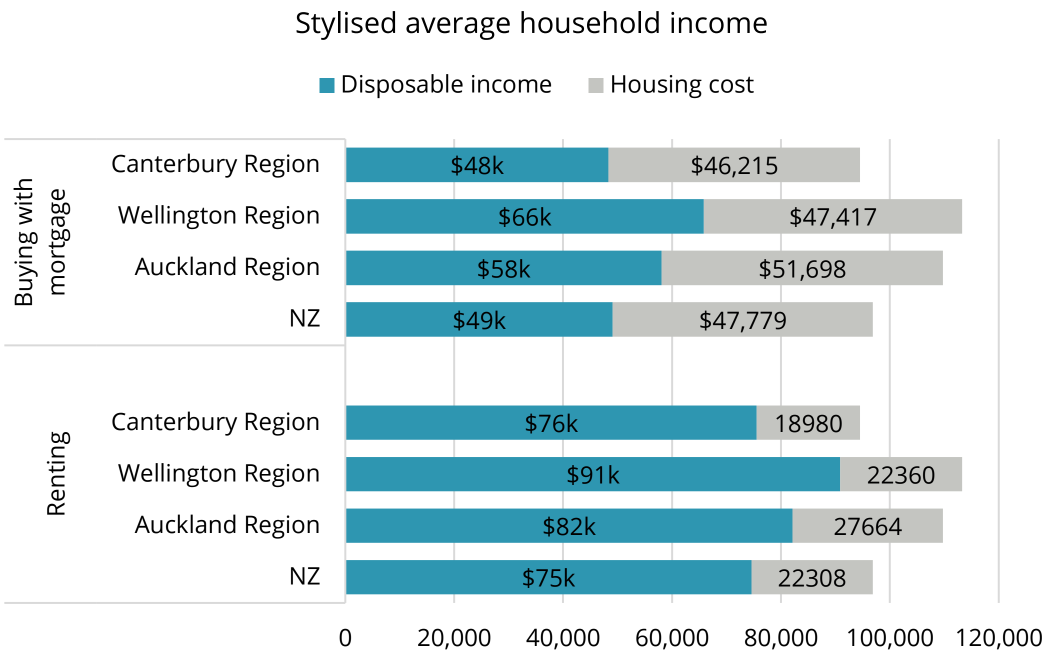


Source: Statistics New Zealand, Sense Partners

Figure 9 shows the powerful influence housing costs can have on a region's competitiveness. Housing costs reduce disposable incomes, eating away to the competitive advantage that can entice workers to a region. For Wellington, to maintain an edge, it is critical to keep housing costs lower than the Auckland region. This helps support the future population growth that drives demand for business land.

Housing costs are broader than the cost of purchasing a home. For many at the key age cohorts that support migration between New Zealand's regions, rental costs are critical. The cost and access to rental accommodation can be a key driver of attraction to locate within region. Figure 10 omits many important elements of decisions over housing (including quality, the cost of housing and the time cost, of travel) but at least for now, the cost of renting in the Wellington region is lower than in Auckland.

FIGURE 10: LOWER RENTS HELP WELLINGTON MAINTAIN AN EDGE OVER AUCKLAND
Household incomes, buying with mortgage compared to renting accommodation



Source: Statistics New Zealand, Sense Partners

Relative underperformance

While the region has a competitive advantage, growth has been lower than expected. To benchmark expectations, we decompose the average rate of economic growth for each council into three parts:

(i) what we might expect if the territorial authority grew at the average rate of economic growth observed (*the national growth rate*)

(ii) the growth rate based on the *industry specialisation* of each territory authority (expect rapid growth for regions with fast-growing industries)

(iii) a *competitiveness* effect, the residual that reconciles the local growth rate to the national growth rate adjusted for industry composition.

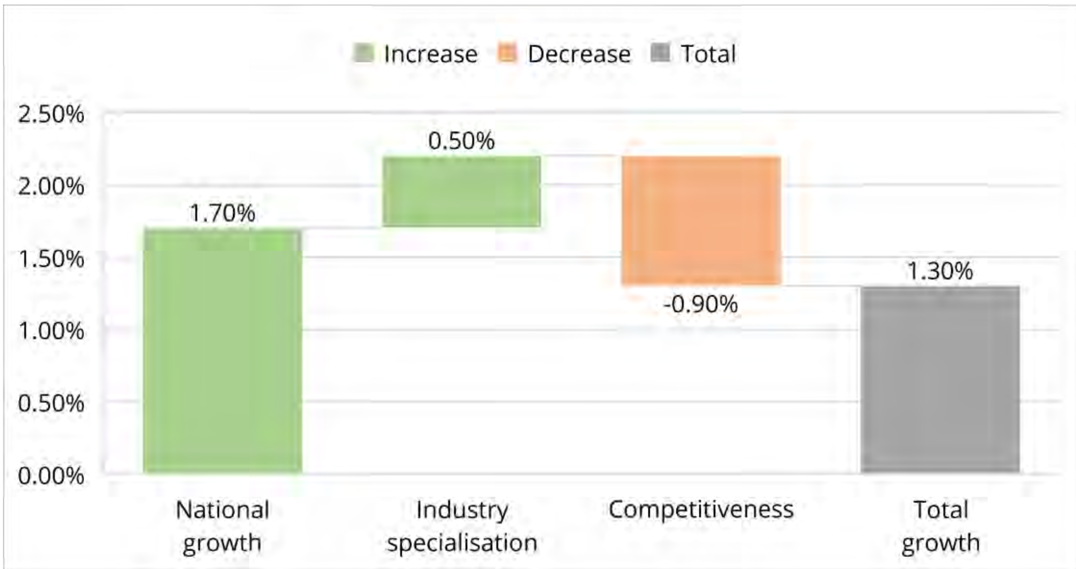
We use shift-share analysis to decompose growth in employment for each council into the three parts. Our results show that the region has tended to underperform.

Employment in Wellington City has grown at 1.3 percent each year since 2000.[2] Employment nationally grew 1.7 percent over the same period (see Figure 11). Moreover, Wellington city is comprised of subindustries that tend to grow faster than elsewhere, so we should expect Wellington city to grow 0.5 percent more each year than the national average. Wellington city's

[2] Wellington city had just under 150,000 jobs in 2016 according to the Statistics New Zealand business demography database we use for our shift-share analysis.

poor performance implies that local competitiveness effects dragged half a percentage point from growth each year over the relevant period.

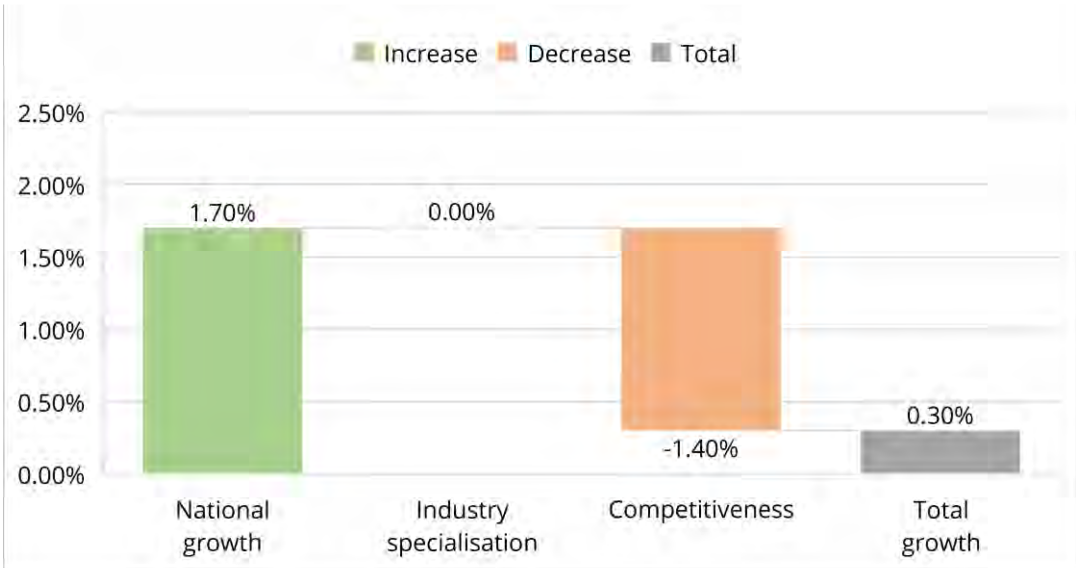
FIGURE 11: WELLINGTON CITY HAS UNDERPERFORMED
Wellington City, Shift-share analysis, employment totals, 2000-2016



Source: Statistics New Zealand, Sense Partners

Figure 12 shows that Lower Hutt employment grew relatively slowly at 0.3 percent a year (adding 1,930 jobs between 2000 and 2016). The industry composition of the local economy was not particularly exposed or underrepresented by fast-growing industries. So, our analysis attributes the relatively slow rate of employment growth to local competitiveness factors likely to dampen future demand for business land.

FIGURE 12: LOWER HUTT HAS DECLINED FROM A LACK OF COMPETITIVENESS
Lower Hutt, Shift-share analysis, employment totals, 2000-2016

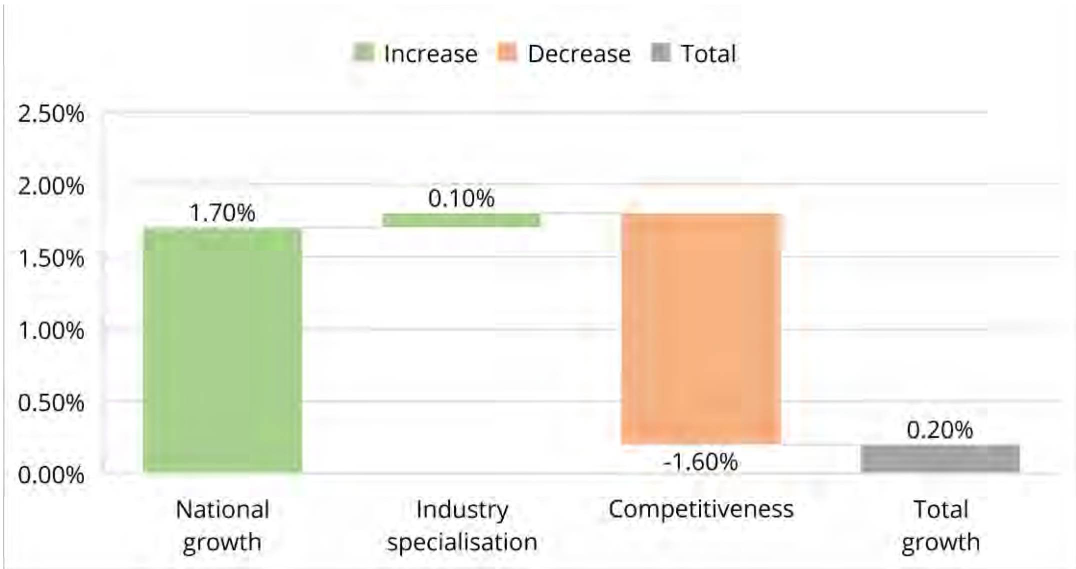


Source: Statistics New Zealand, Sense Partners

Upper Hutt shows similar performance to Lower Hutt, growing only 0.20% a year between 2000 and 2016 – much weaker than the average national growth rate. Upper Hutt's industry composition is not particularly relevant for thinking about employment growth and we attribute the weak rate of growth to local underperformance.

FIGURE 13: EMPLOYMENT IN UPPER HUTT EXPANDS ONLY SLIGHTLY

Upper Hutt, Shift-share analysis, employment totals, 2000-2016

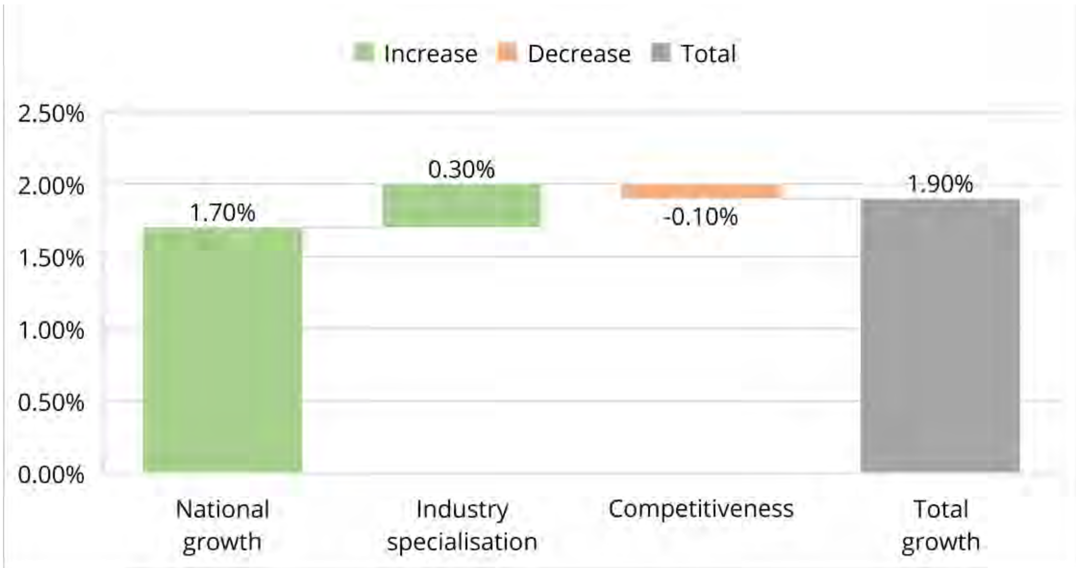


Source: Statistics New Zealand, Sense Partners

Kapiti Coast's employment grew over the period, slightly outperforming the national average and posting 1.9 percent average growth over the period (see Figure 14). supporting future business activity and demand for land.

FIGURE 14: KAPITI POSTED SOLID EMPLOYMENT GROWTH

Kapiti Coast, Shift-share analysis, employment totals, 2000-2016



Source: Statistics New Zealand, Sense Partners

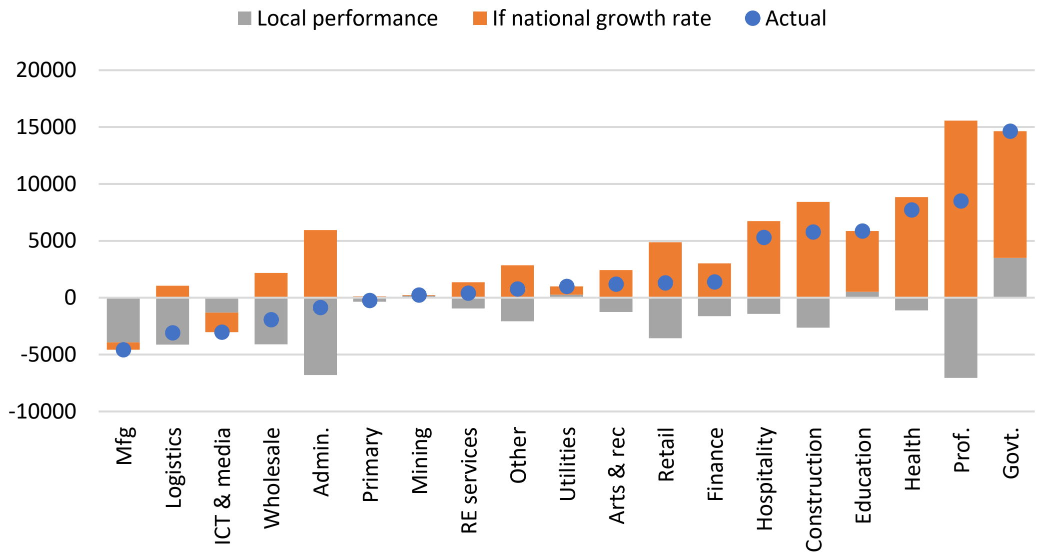
Kapiti Coast's industries are also slanted towards the faster growing industries, an effect we expect to grow employment by 0.3 percent each year. That impact implies that local competitiveness recorded for the Kapiti Coast pulled employment growth down a little (by 0.1 percent) over the period.

But across the region, performance was poor. Kapiti's average performance was more than offset by the weaker performance for Lower Hutt, Upper Hutt and Wellington City – that provides the lion's share of employment. We can also decompose this poor performance on an industry basis. Figure 15 shows that almost every industry, aside from government, contributed to lower growth than expected at a national level.

FIGURE 15: DECLINE ACROSS ALMOST ALL NON-GOVERNMENT INDUSTRIES

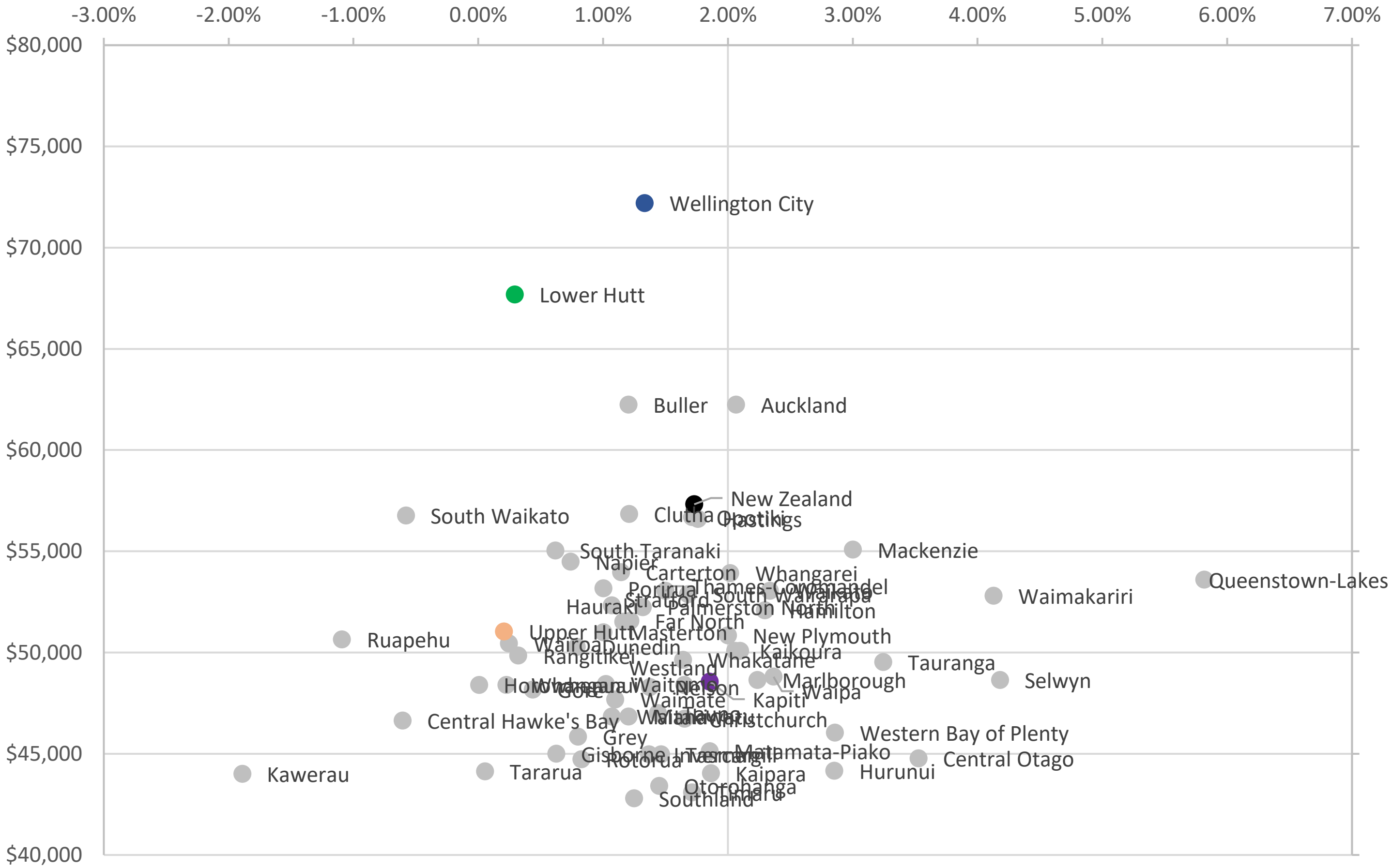
Additional jobs created due to regional performance premium, 2000-2017

Study area's employment growth decomposition



Source: Statistics New Zealand, Sense Partners

FIGURE 16: HIGH INCOMES RATHER THAN STRONG EMPLOYMENT GROWTH MAKE WELLINGTON STAND OUT

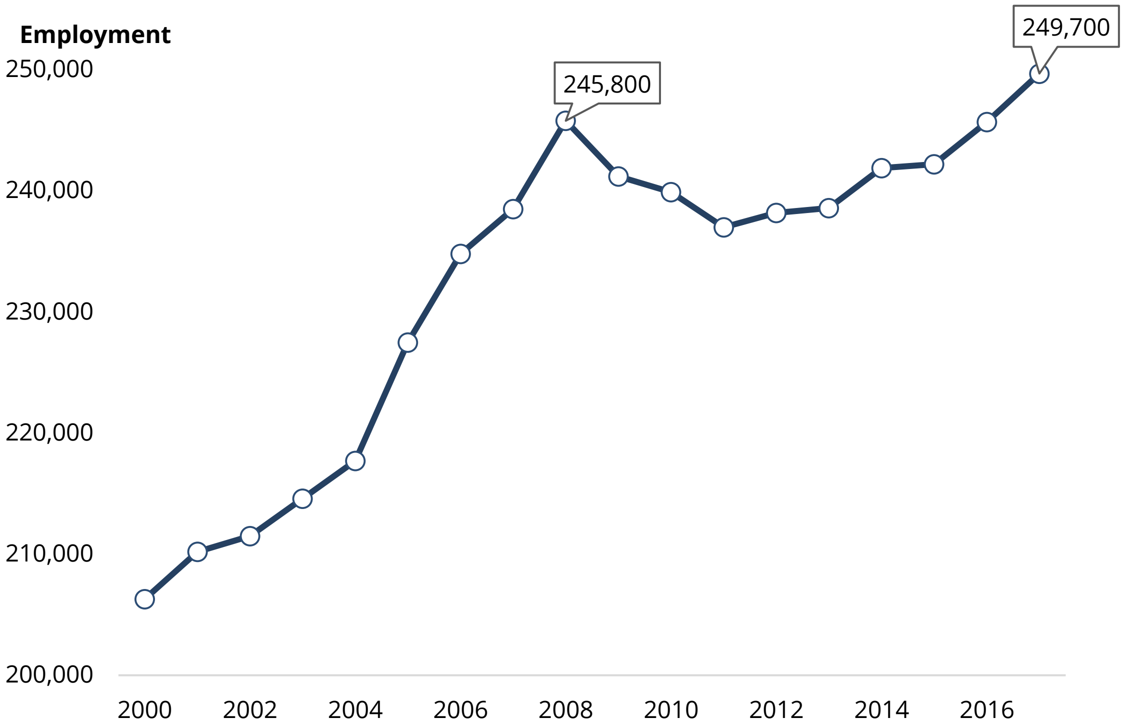


Source: Statistics New Zealand, Sense Partners

The GFC cast a long shadow

One of the defining features of the past 10 years is the impact of the Global Financial Crisis on local labour markets. The crisis had a severe impact on most advanced economies. New Zealand was not immune, and many regions experienced long periods of elevated unemployment rates. Figure 17 shows that for the Wellington region the GFC had a marked effect – only in 2017 did the level of employment return to its pre-GFC peak.

FIGURE 17: EMPLOYMENT HAS ONLY JUST REACHED THE PRE-GFC PEAK
Wellington region, Employee Count, Business Demography Database

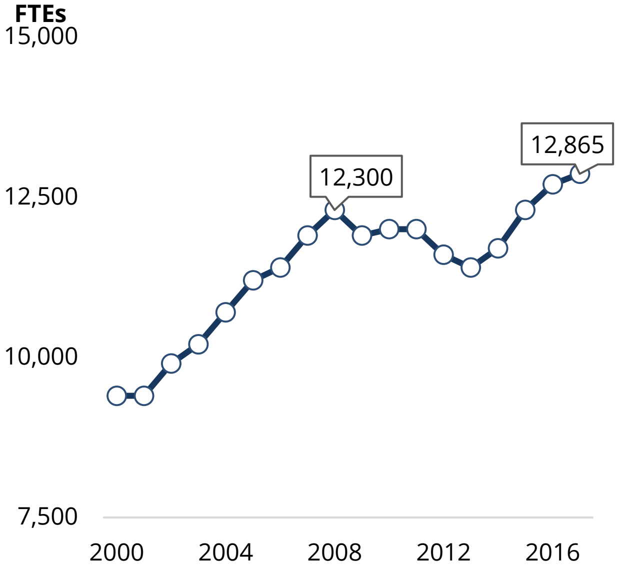


Source: Statistics New Zealand

Lower Hutt and Upper Hutt were hit particularly hard – neither region has seen employment return to the pre-GFC peak (see Figure 19 and Figure 20). In contrast, Wellington city shows only a modest fall in employment that is offset by job growth by 2014. Kapiti Coast was also a little less effected by the GFC. These trends help shape the demand for floorspace.

FIGURE 18: EMPLOYMENT: KAPITI COAST

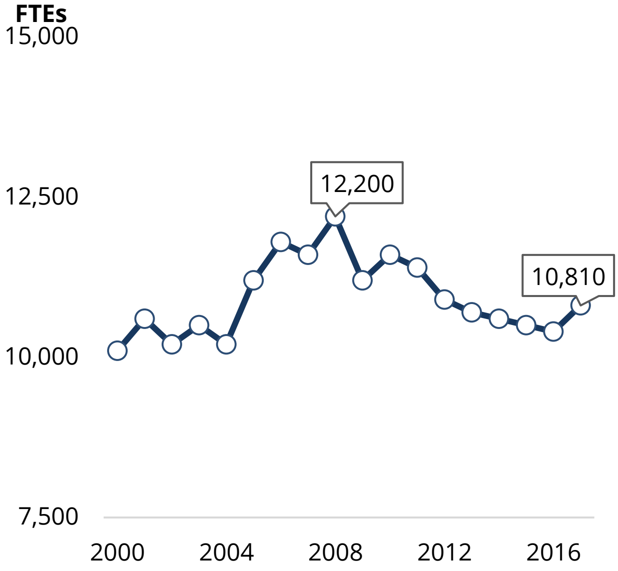
Kapiti Coast Employees, SNZ Business Demography



Source: Statistics New Zealand

FIGURE 19: EMPLOYMENT: UPPER HUTT

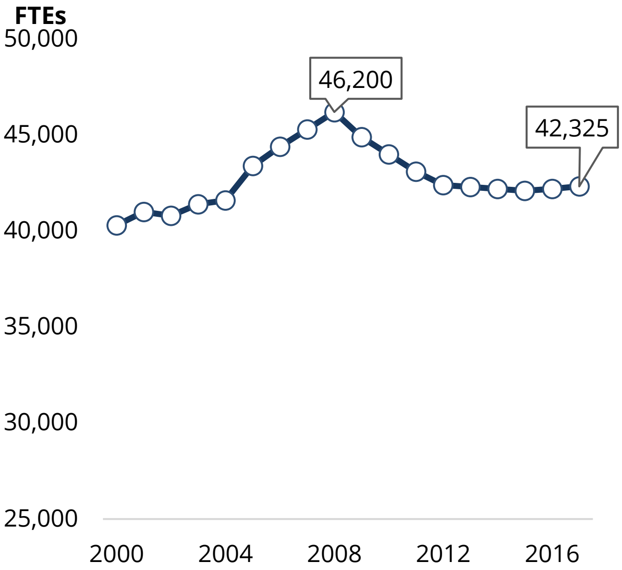
Upper Hutt Employees, SNZ Business Demography



Source: Statistics New Zealand

FIGURE 20: EMPLOYMENT: LOWER HUTT

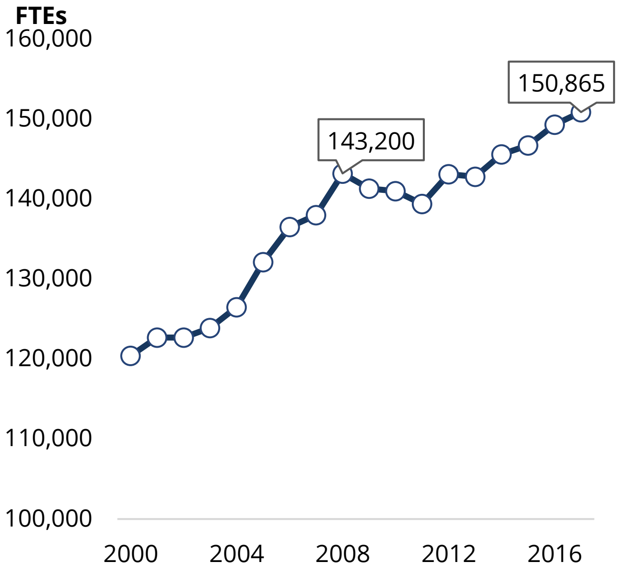
Lower Hutt Employees, SNZ Business Demography



Source: Statistics New Zealand

FIGURE 21: EMPLOYMENT: WELLINGTON CITY

Wellington City Employees, SNZ Business Demography



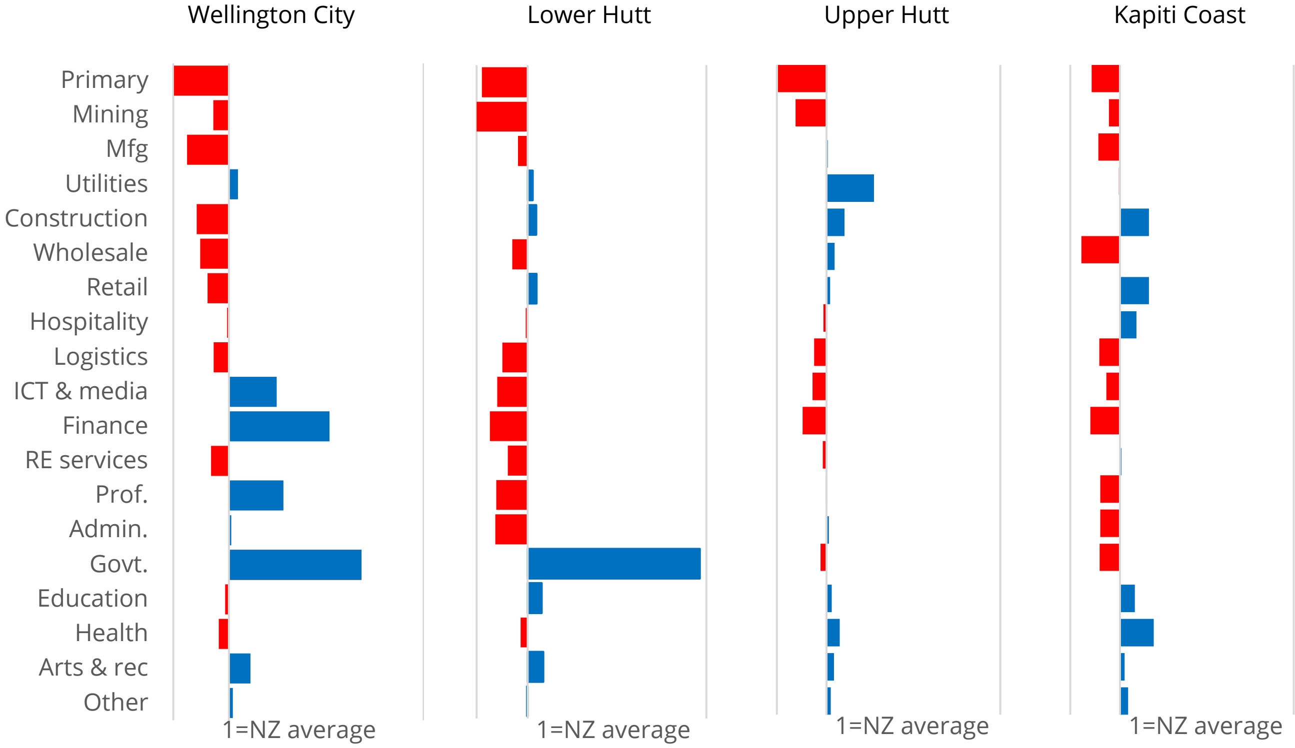
Source: Statistics New Zealand

2.1.3 Expect the Government sector to grow

At least part of the relative strength of the recovery from the GFC in Wellington city relates to the role of the Government sector. Without exposure to the manufacturing industries that characterise both Lower Hutt and Upper Hutt employment (see Figure 22), employment fell only modestly. Figure 22 shows starkly just how important the government is for the local economy – almost all industries show decline except for government roles.

FIGURE 22: GOVERNMENT IS CRITICAL FOR THE REGION

Performance of local industry, 2000-2017, additional jobs created relative to NZ average



Source: Statistics New Zealand, Sense Partners

2.1.4 Local complementarities exist

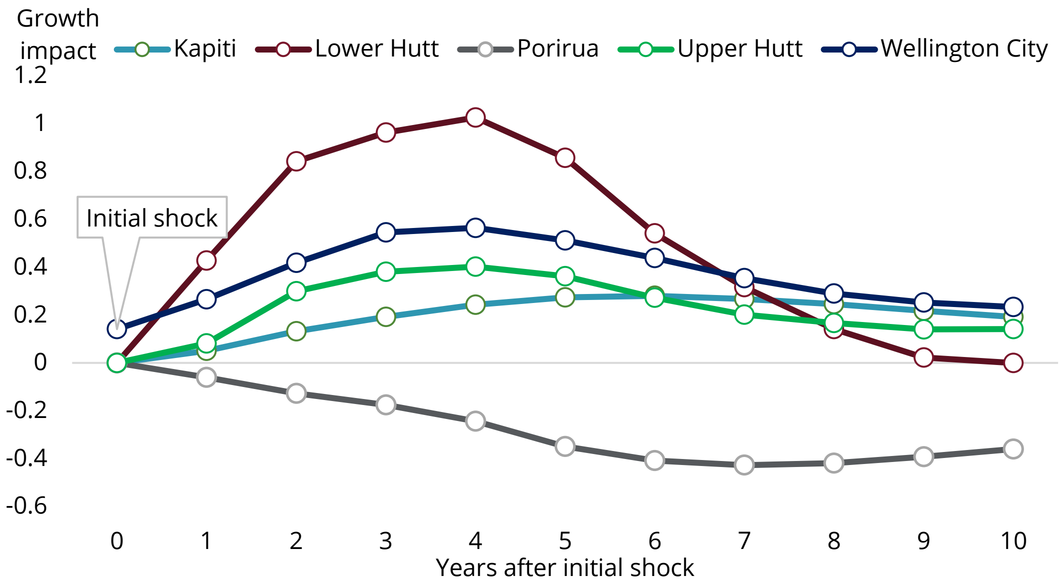
Outside of the role of the government sector, one of the key drivers of activity at the local level are the interactions across the territory authorities. When activity lifts in one part of the region, other territory authorities are brought along for the ride. Conversely, when activity falters, expect spill-overs to other areas to slow economic growth.

To show some of these interactions, we developed a simple model of economic activity within the Wellington region based on employment growth in five local territory authorities (Wellington City, Lower Hutt, Upper Hutt, Kapiti Coast and Porirua City).

Our model maps the growth interactions across the five local authorities from 2000 to 2017. In Figure 23 we show how a shock to economic growth in Wellington City resonates through Wellington City and the other authorities. The shock peaks four years after the initial shock.

FIGURE 23: SOME BUT NOT ALL LOCAL AUTHORITIES ARE TIED TO WELLINGTON CITY

One standard deviation shock to employment growth in Wellington City



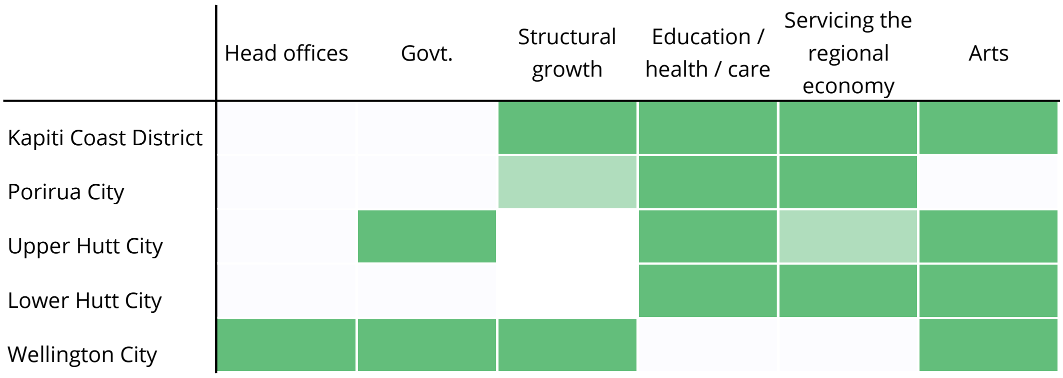
Source: Statistics New Zealand, Sense Partners

Lower Hutt appears closely tied to Wellington and lifts significantly in response to the initial shock – responding even more strongly than the local Wellington City economy. Upper Hutt is strongly tied to Wellington City and the Kapiti Coast also lifts in response to stronger activity in Wellington City. Porirua moves in the opposite direction – employment declines in response to stronger growth in Wellington City.[3] This suggests bundling Wellington City, Lower Hutt, Upper Hutt and Kapiti Coast together captures the central dynamic at play within the region.

The spill-overs shows complementarities across the local councils. These complementarities have their origins in how local firms interact to produce goods and services. Each district has their own specialisations. For example, the government sector locates in Wellington City and Upper Hutt with health, education and aged-care tending to be based in local authorities outside Wellington City. Figure 24 shows a stylised representation of the complementarities.

[3] Porirua has different demographics compared with Wellington city, has ties to economic activity to the north and will have its own growth drivers (including property development).

FIGURE 24: COMPLENTARITIES EXIST ACROSS THE LOCAL ECONOMY
Stylised representation



Source: Statistics New Zealand, Sense Partners

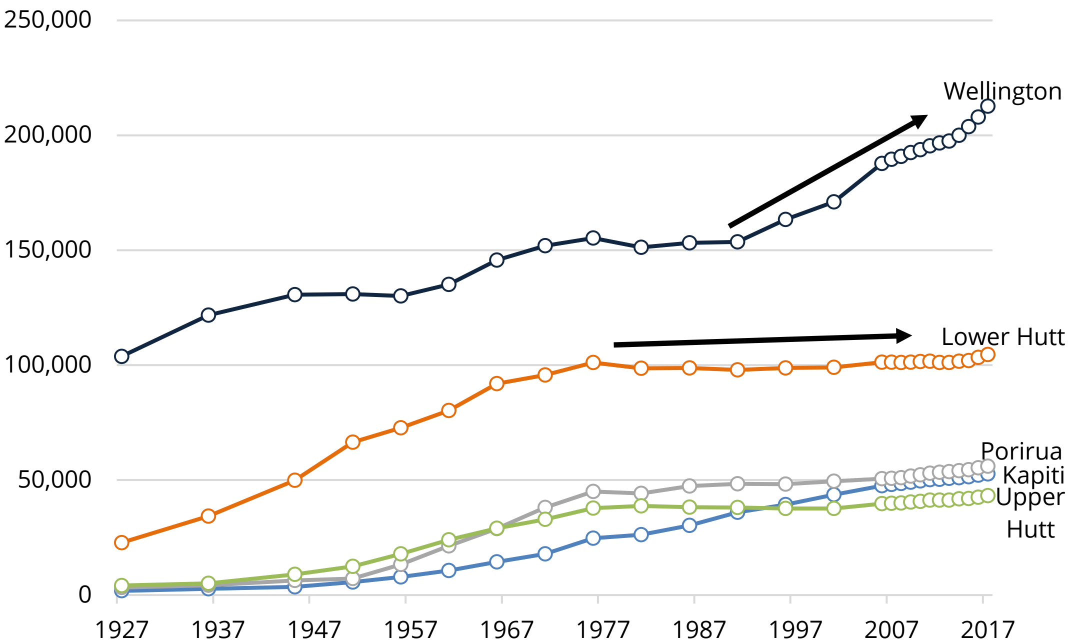
2.2 Demographics

2.2.1 Population is the key driver of local demand

Population growth, and demographic trends more broadly, are crucial for determining activity in local economies. Demographic trends will influence demand trends and growth potential, especially via life-cycle effects. But population growth is key for driving economic growth.

Figure 25 shows the populations of the local region over a 90-year time frame

FIGURE 25: SUB-REGIONS SHOW PERIODS OF GROWTH AND PERIODS OF STAGNATION
Population, 1927-2017



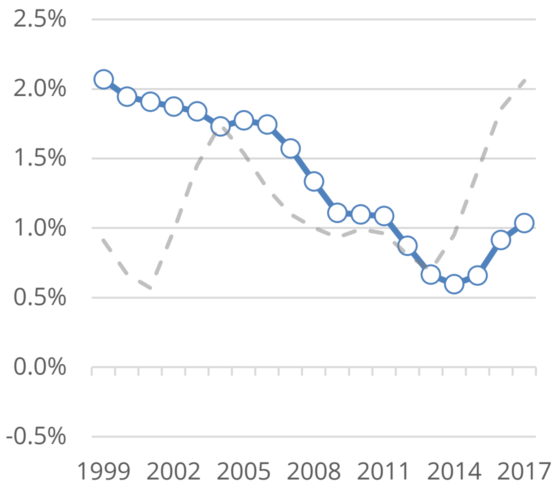
Source: Statistics New Zealand

Lower Hutt, Upper Hutt and Porirua grew rapidly prior to the 1970s but have moved sideways over more recent decades. Growth in Wellington City accelerated from the early 1990s. The Kapiti Coast continues to grow at a persistent rate off a low base population.

Knowing how local populations have developed relative to national trends is informative for thinking about future activity growth. Figure 26 to Figure 29 show that recent population increases in Wellington city tightly reflect national population growth while growth rates for Lower Hutt and Upper Hutt have been well below national population growth. Population growth in Kapiti has moderated relative to the pace of population growth at the national level.

FIGURE 26: KAPITI COAST DECLINING TREND

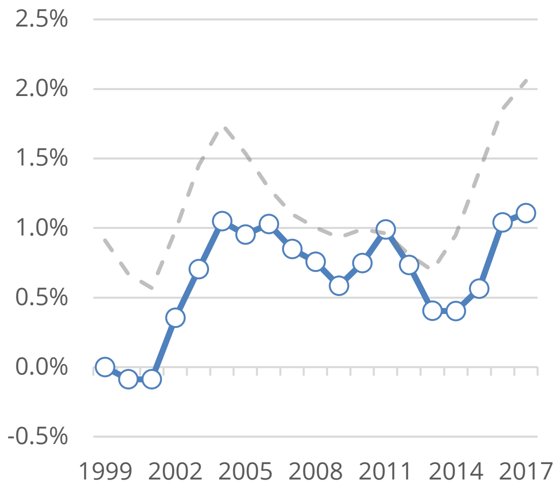
Kapiti Coast relative to New Zealand



Source: Statistics New Zealand

FIGURE 27: UPPER HUTT BELOW AVERAGE

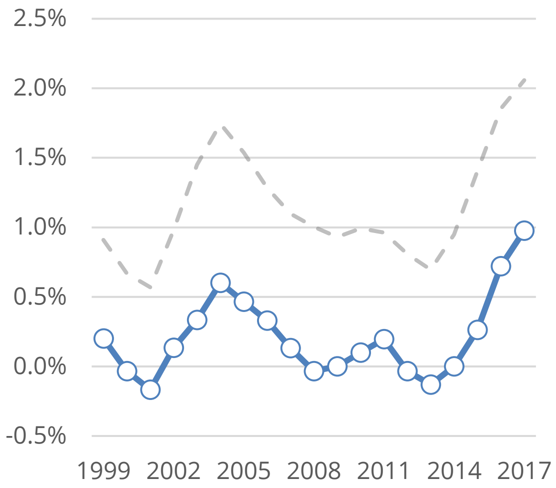
Upper Hutt relative to New Zealand



Source: Statistics New Zealand

FIGURE 28: LOWER HUTT BELOW AVERAGE

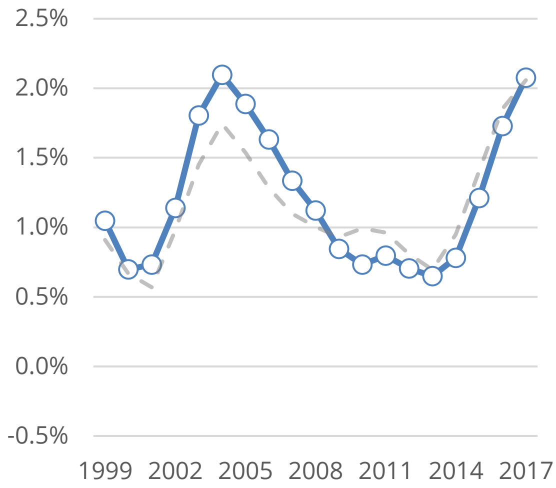
Lower Hutt relative to New Zealand



Source: Statistics New Zealand

FIGURE 29: WELLINGTON CITY LIKE NZ GROWTH

Wellington City relative to New Zealand



Source: Statistics New Zealand

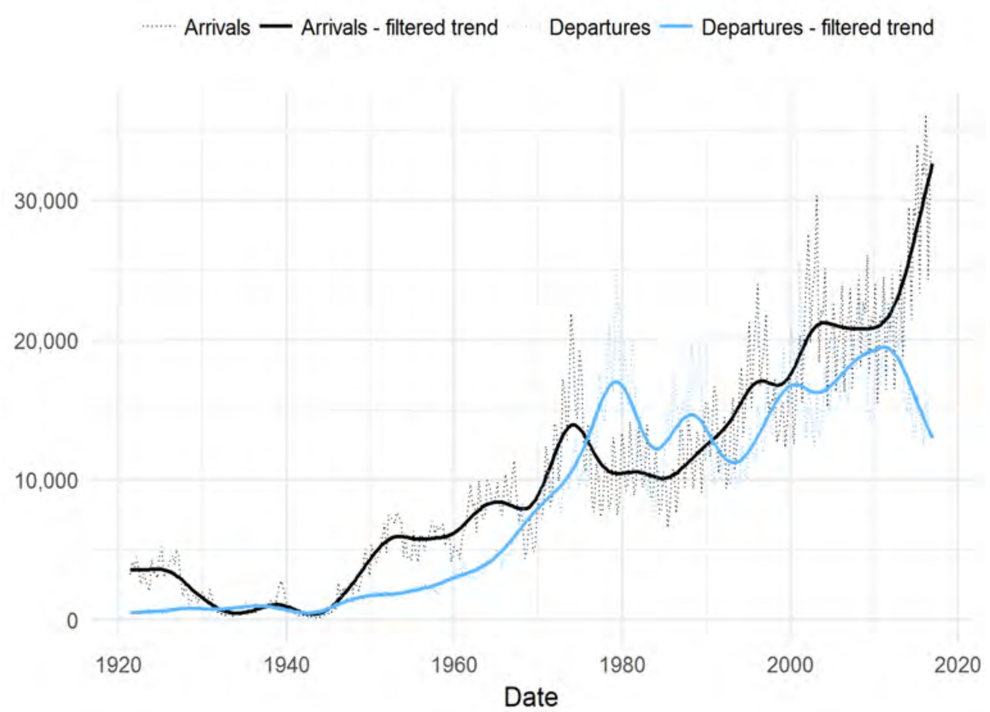
So, knowing what might happen with population growth at the national level can help inform the population growth we could expect for Wellington city. For other districts we might expect slightly more moderate population growth.

At a national level, it turns out there are very good reasons to expect strong population growth to persist. Figure 30 shows trends for both arrivals and departures. Rather than settling at a number of immigrants per year, arrivals shows a clear upward trend that dates back to the second world war.

FIGURE 30: EXPECT STRONG MIGRATION-BASED POPULATION GROWTH TO CONTINUE

Performance of local industry, 2000-2017

Additional jobs created due to regional performance premium



Source: Statistics New Zealand, Sense Partners

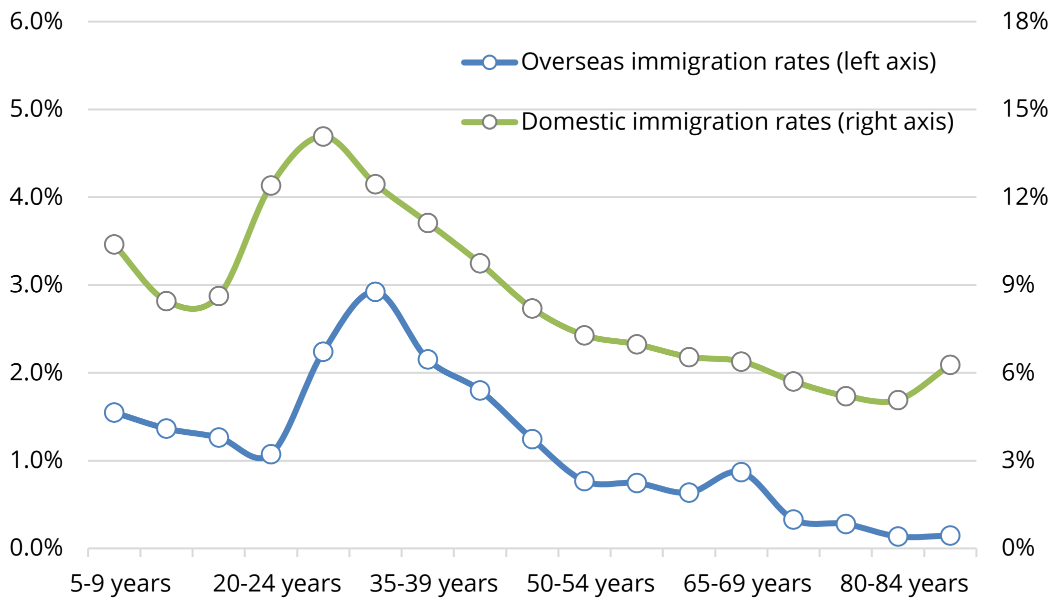
This upward trend is supported by a global population that is growing more quickly than the domestic population and an urbanisation process that means the pool of potential migrants, with the economic capital to move to New Zealand, continues to grow. Future arrivals are closely tied to the propensity of the growing pool of potential migrants rather than a fixed number of arrivals per year.

Figure 30 shows that departures from New Zealand have declined over recent years, exacerbating the increase in migration led population growth. The decline in departures is related to factors that include: (i) the reduced demand for labour in Australia after the moderation in the commodity boom; (ii) tightening of immigration policies in countries with traditional ties to New Zealand such as the UK; and (iii) the relative strength of the domestic economy in recent years. We expect the strength of some of these factors to wane, but migration is still likely to be supportive of robust population growth in the next ten years.

The life-cycle can also help determine local migration impacts. Figure 31 to Figure 34 show how migrants at different points in the life cycle can be attracted to particular regions. Older domestic migrants are more attracted to the Kapiti Coast than Wellington City while Wellington City attracts younger cohorts from both domestic and international locations.

FIGURE 31: KAPITI ATTRACTS OLDER DOMESTIC MIGRANTS

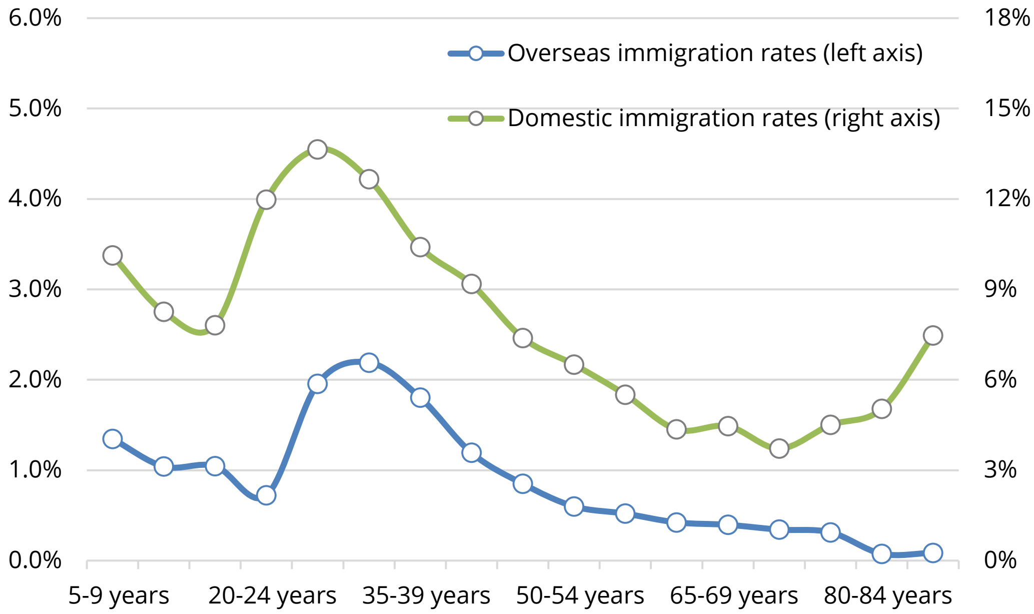
Rates of migration by age, Kapiti Coast, average across 2001,2006 and 2013 census



Source: Statistics New Zealand, Sense Partners

FIGURE 32: UPPER HUTT ALSO ATTRACTS OLDER DOMESTIC MIGRANTS

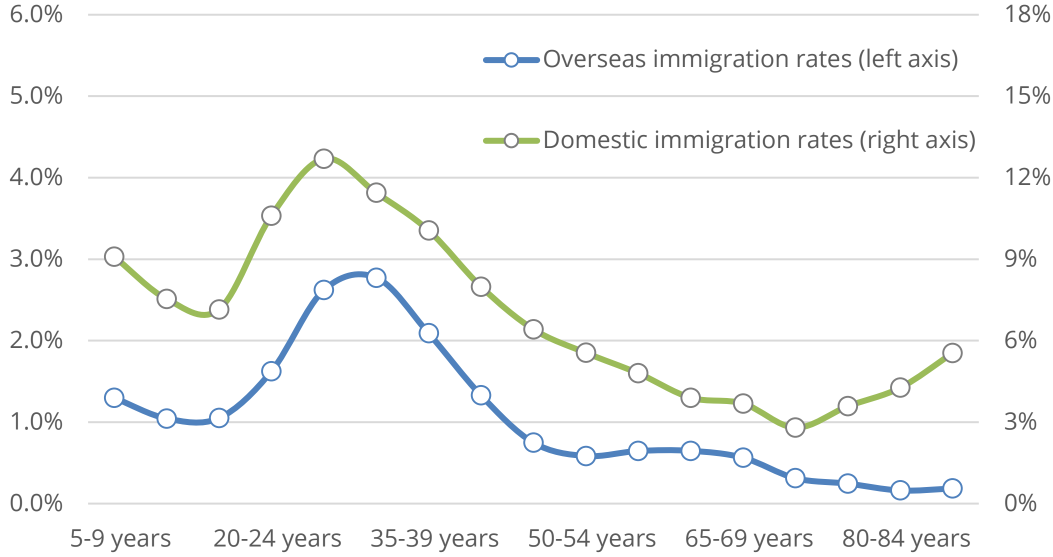
Rates of migration by age, Upper Hutt, average across 2001,2006 and 2013 census



Source: Statistics New Zealand, Sense Partners

FIGURE 33: MIGRATION: TO LOWER HUTT HAS A RELATIVE BROAD AGE BASE

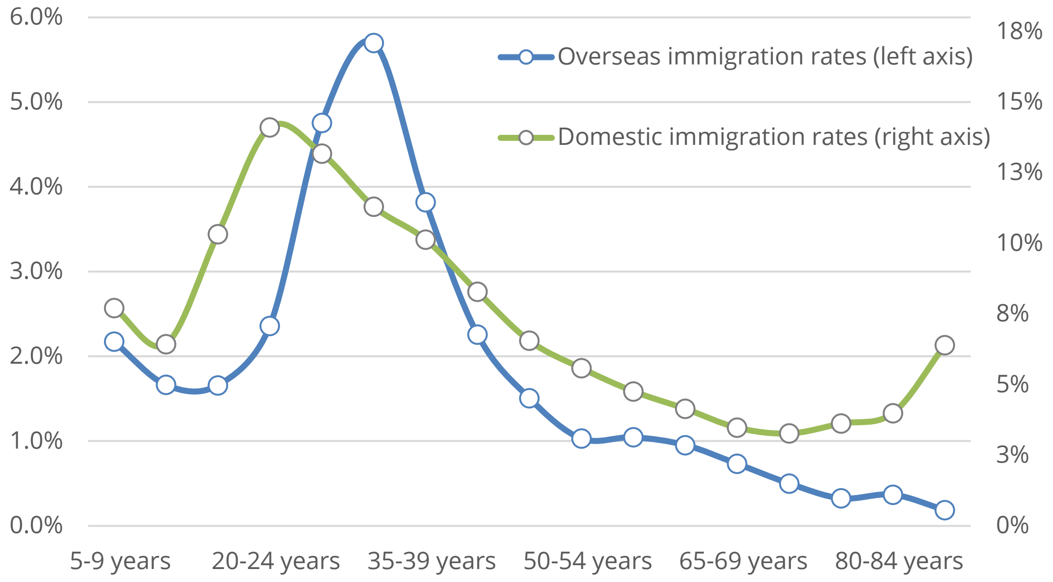
Rates of migration by age, Lower Hutt, average across 2001,2006 and 2013 census



Source: Statistics New Zealand, Sense Partners

FIGURE 34: WELLINGTON CITY ATTRACTS YOUNGER COHORTS

Rates of migration by age, Wellington city, average across 2001,2006 and 2013 census



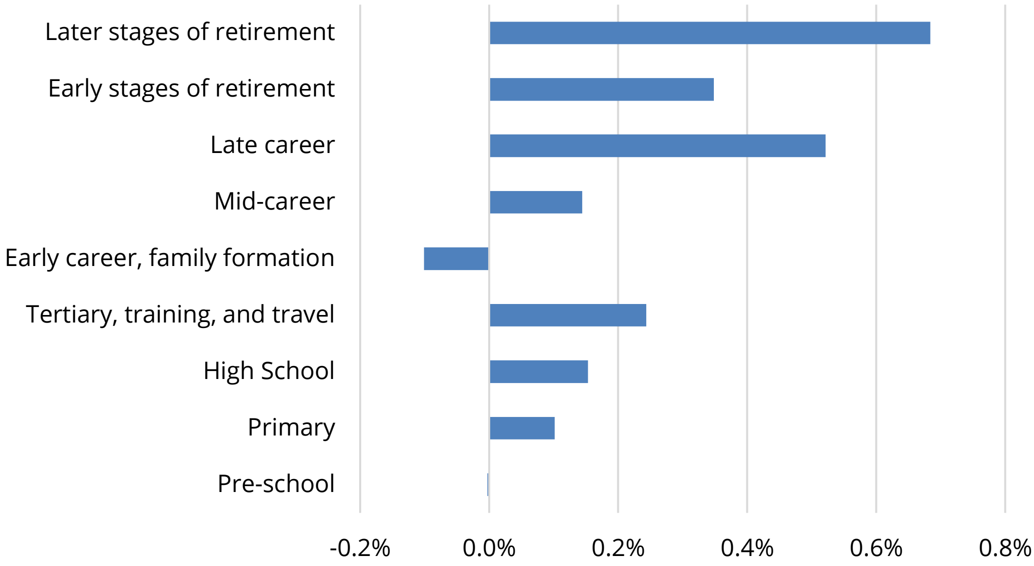
Source: Statistics New Zealand, Sense Partners

2.2.2 The life-cycle also helps determine local effects

The stage of the life-cycle can determine population growth within local areas. Figure 35 shows that population growth on the Kapiti Coast is driven by strong growth in the late career and retirement stage of the life cycle. For Lower Hutt, growth in these older cohorts offsets population decline in younger cohorts.

FIGURE 35: RETIREMENT EFFECTS BOOST THE KAPITI COAST POPULATION

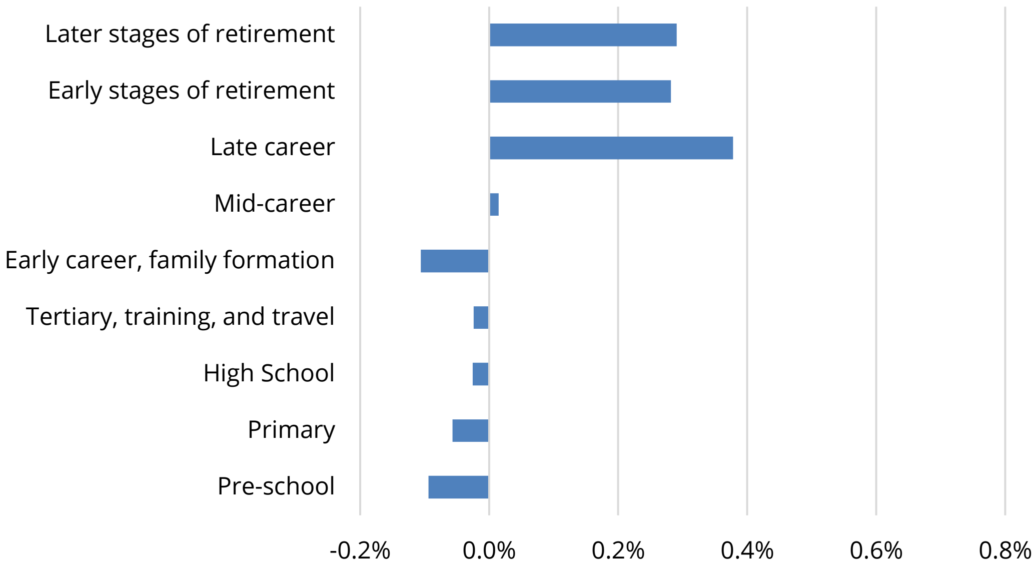
Life-cycle stages, Kapiti Coast, % contribution to growth, average of 2001, 2006, 2013 censuses



Source: Statistics New Zealand, Sense Partners

FIGURE 36: RETIREMENT OFFSETS DECLINING YOUNGER COHORTS FOR LOWER HUTT

Life-cycle stages, Lower Hutt, % contribution to growth, average of 2001, 2006, 2013 censuses

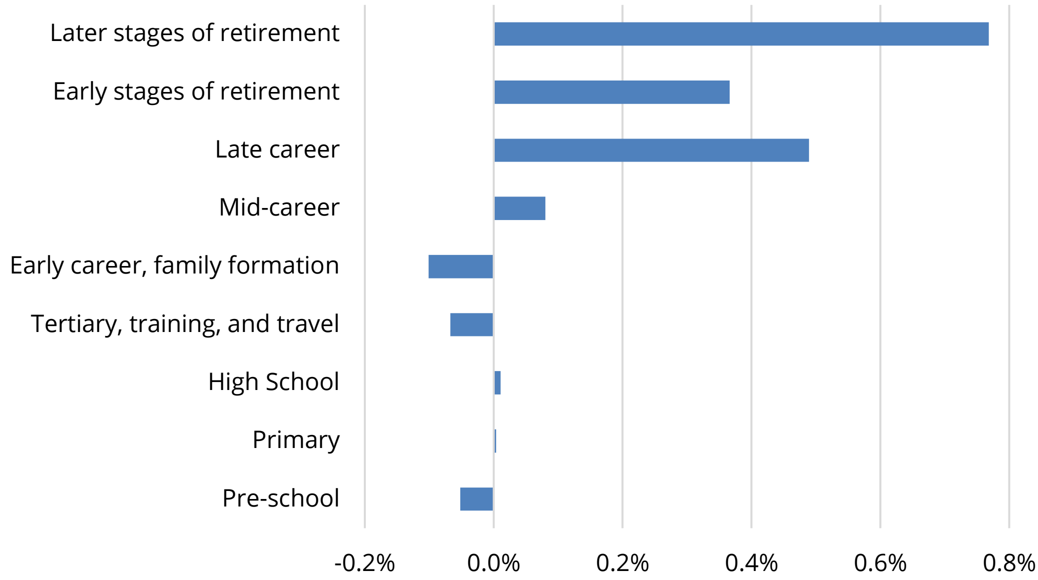


Source: Statistics New Zealand, Sense Partners

The retirement stage also helps boost the population in Upper Hutt. Population growth in Wellington City is much more broad-based, attracting growth in almost all the adult life-stages.

FIGURE 37: AGEING COHORTS DRIVE UPPER HUTT POPULATION DYNAMICS

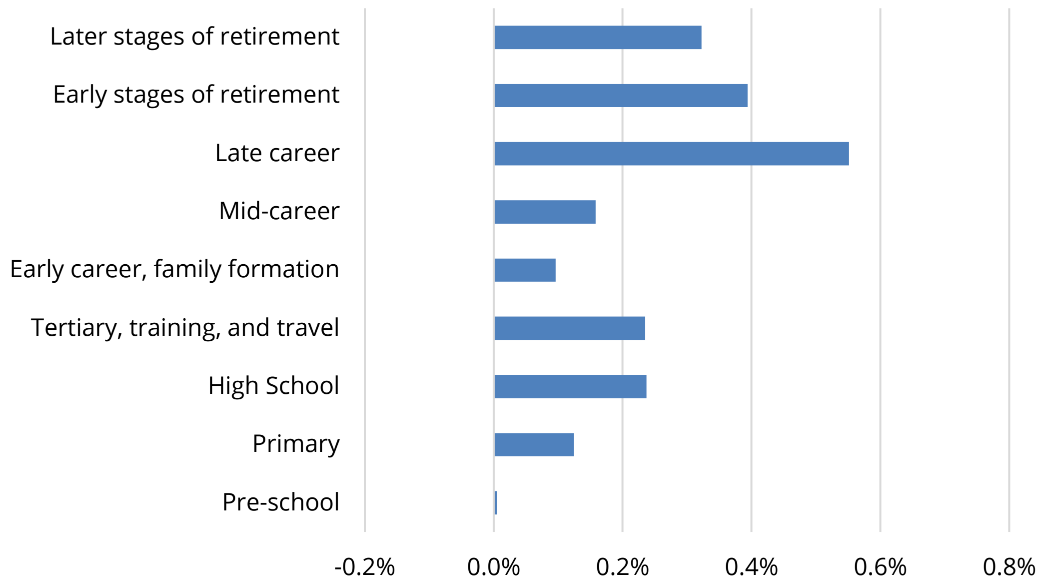
Life-cycle stages, Upper Hutt, % contribution to growth, average of 2001, 2006, 2013 censuses



Source: Statistics New Zealand, Sense Partners

FIGURE 38: WELLINGTON CITY'S POPULATION GROWTH IS BROAD-BASED

Life-cycle stages, Wellington City, % contribution to growth, ave. of 2001, 2006, 2013 censuses

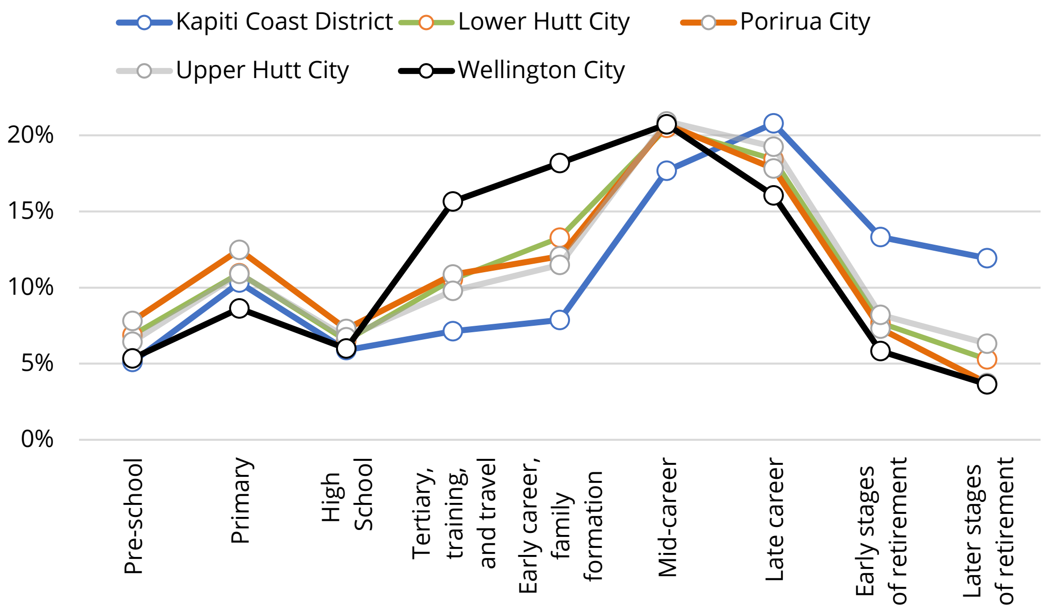


Source: Statistics New Zealand, Sense Partners

These life-style effects also drive the interdependencies across the region (see Figure 39).

FIGURE 39: POPULATION SHARES BY AGE REFLECT COMPLEMENTARITIES

Additional jobs created due to regional performance premium

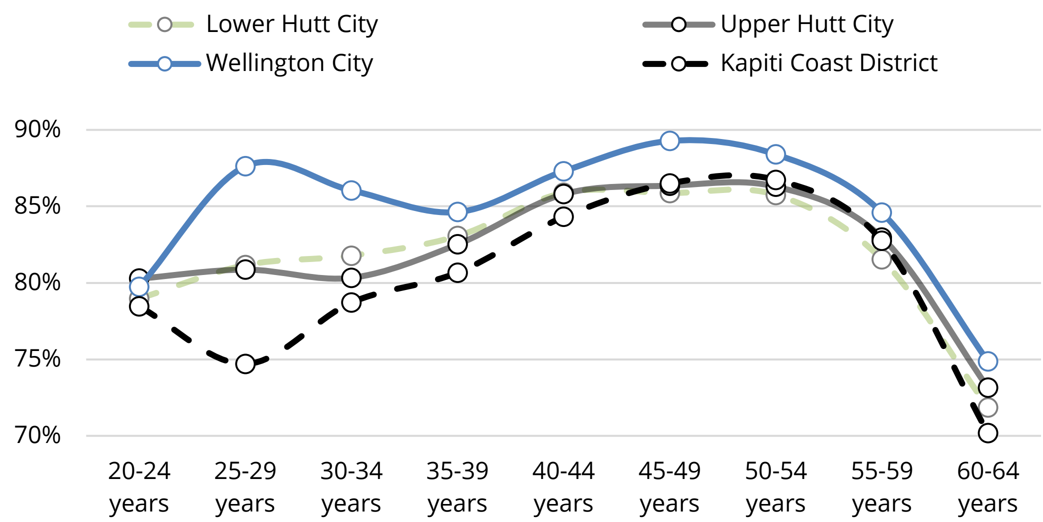


Source: Statistics New Zealand, Sense Partners

But care must be taken when interpreting the relationship between economic activity and population growth. If we expect productive workers to choose to locate in areas most likely to support higher wages, then economic activity can be driven higher by the sorting of high productivity workers into regions rather than any local growth dynamics. Wellington city's high labour force participation in prime working ages is consistent with high productivity workers moving in to the area (Figure 40).

FIGURE 40: SORTING EFFECTS DRIVE WELLINGTON CITY'S HIGH LABOUR FORCE PARTICIPATION RATE WITH MANY PRODUCTIVE WORKERS MOVING TO THE CITY

Labour Force Participation by age and Territory Authority

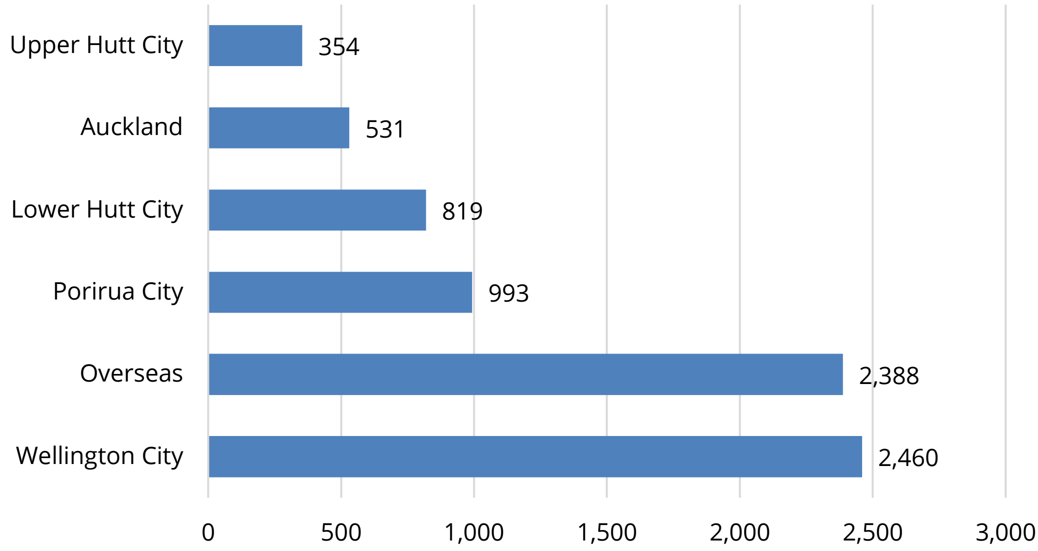


Source: Statistics New Zealand, Sense Partners

2.2.3 Wellington city has important push-pull impacts

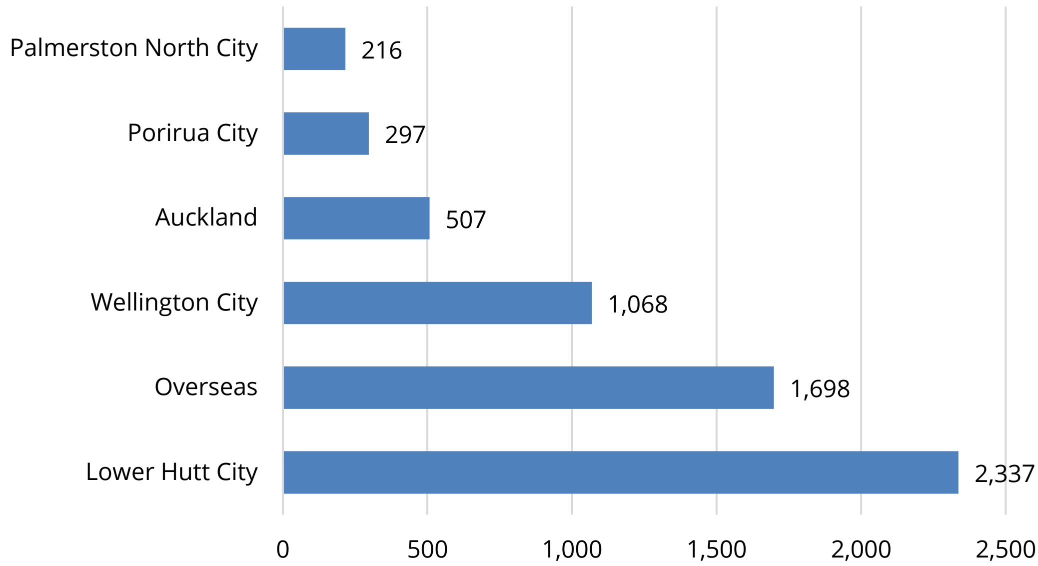
Wellington's urban base plays a strong role as the core of the region with other territorial authorities acting in the periphery of a core-periphery dynamic. Wellington city is the source of much of the migration growth for the periphery including the Kapiti Coast (see Figure 41), Upper Hutt (see Figure 42), and Lower Hutt (Figure 43). Wellington city in turn draws international migrants to the region.

FIGURE 41: KAPITI DRAWS MANY MIGRANTS FROM WELLINGTON CITY
Kapiti Coast migration sources, 2013 Census, 5-year period



Source: Statistics New Zealand

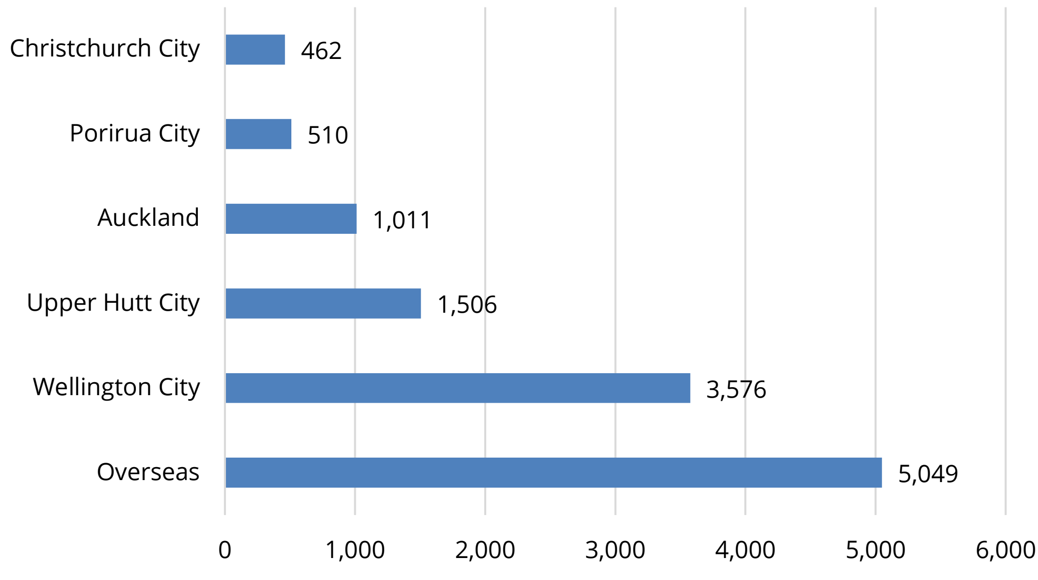
FIGURE 42: UPPER HUTT ALSO ATTRACTS MIGRANTS FROM WELLINGTON CITY
Upper Hutt migration sources, 2013 Census, 5-year period



Source: Statistics New Zealand, Sense Partners

FIGURE 43: WELLINGTON CITY PROVIDES LOWER HUTT WITH MIGRANTS

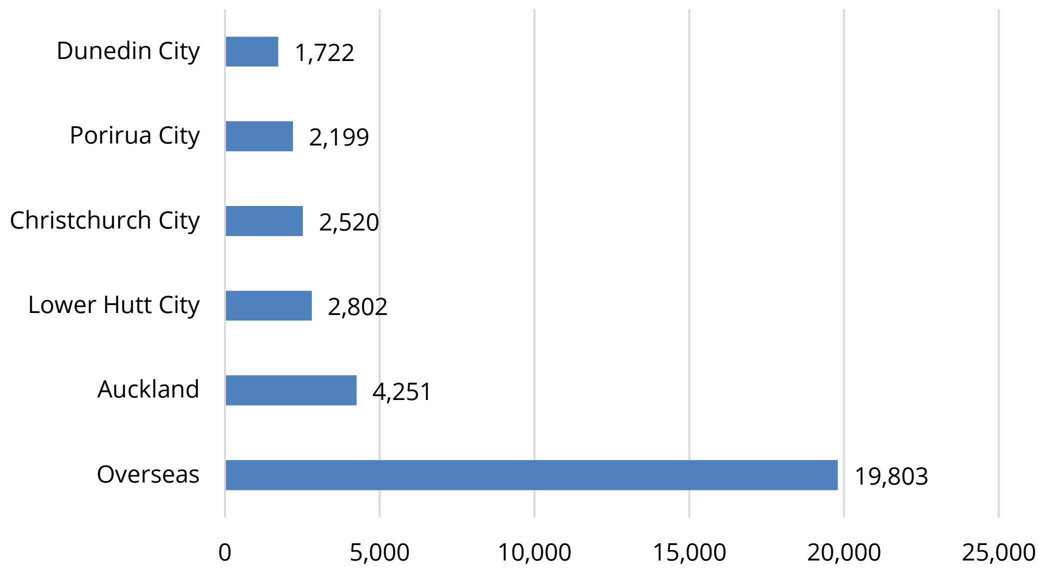
Lower Hutt migration sources, 2013 Census, 5-year period



Source: Statistics New Zealand, Sense Partners

FIGURE 44: WELLINGTON CITY ATTRACTS INTERNATIONAL MIGRANTS

Wellington City migration sources, 2013 Census, 5-year period



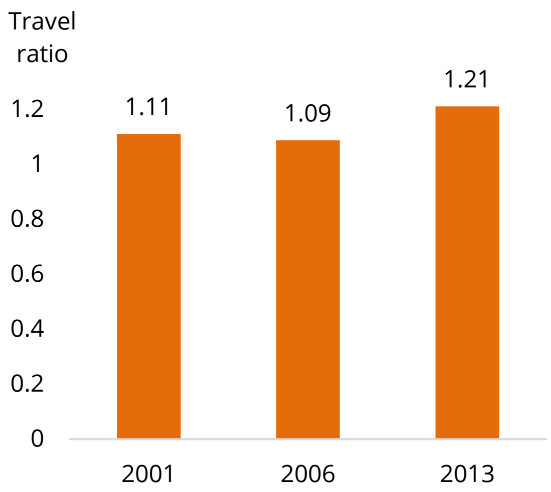
Source: Statistics New Zealand, Sense Partners

Part of the attraction of Wellington city is the compactness of the urban area. Relative to the rest of New Zealand, there are more jobs than workers in Wellington city (see Figure 45) than most other territorial authorities. There are relatively few jobs for each worker in the periphery territorial authorities of Upper Hutt (Figure 46), Lower Hutt (Figure 47) and the Kapiti Coast (Figure 48).

The core-periphery dynamic, with workers commuting daily from the periphery to the core, is stronger in the Wellington region than other regions. Each figure below shows the ratio of the number of workers in each local council over residents in each local council relative to New Zealand averages. Appendix 2 provides additional details on local labour markets.

FIGURE 45: DAILY WORKER INFLOW RATE: WELLINGTON CITY

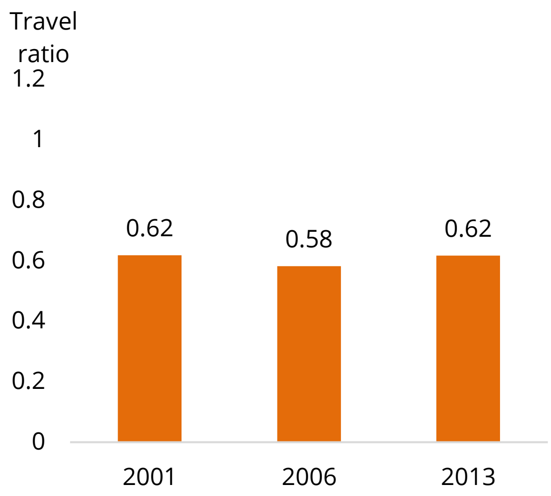
Workers/residents ratio relative to New Zealand



Source: Statistics New Zealand

FIGURE 46: DAILY WORKER INFLOW RATE: UPPER HUTT

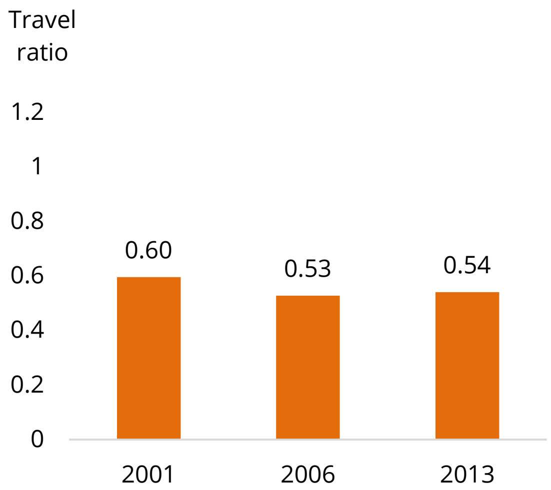
Workers/residents ratio relative to New Zealand



Source: Statistics New Zealand

FIGURE 47: DAILY WORKER INFLOW RATE: LOWER HUTT

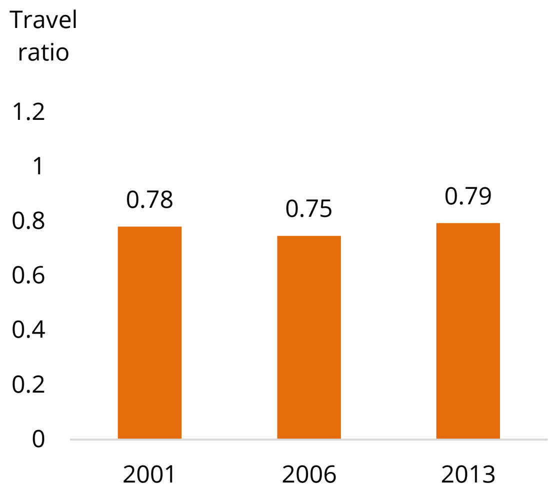
Workers/residents ratio relative to New Zealand



Source: Statistics New Zealand

FIGURE 48: DAILY WORKER INFLOW RATE: KAPITI COAST:

Workers/residents ratio relative to New Zealand



Source: Statistics New Zealand

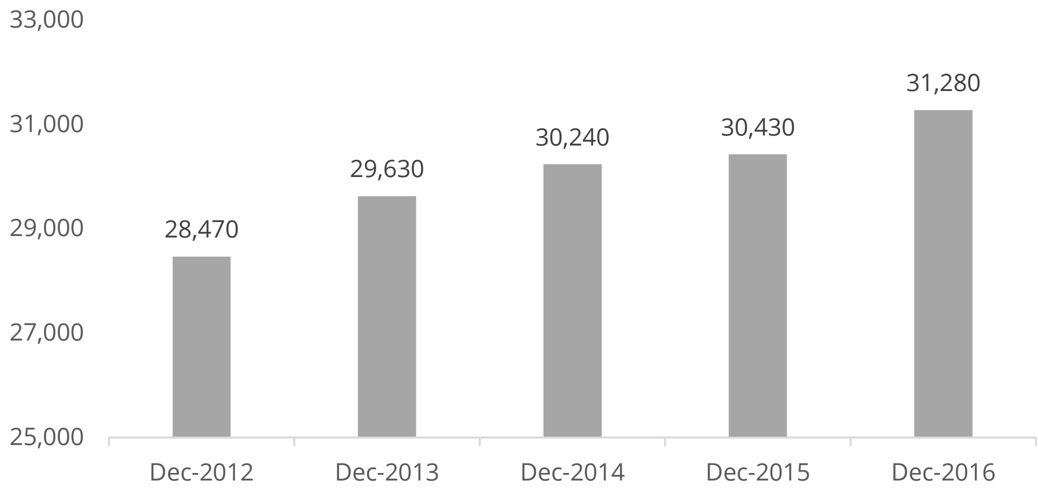
2.3 Sectoral composition

2.3.1 Government will be a larger share of the economy

The government workforce has been increased in recent years (see Figure 49).

FIGURE 49: THE GOVERNMENT SECTOR WORKFORCE IS INCREASING

Wellington region, LEED database

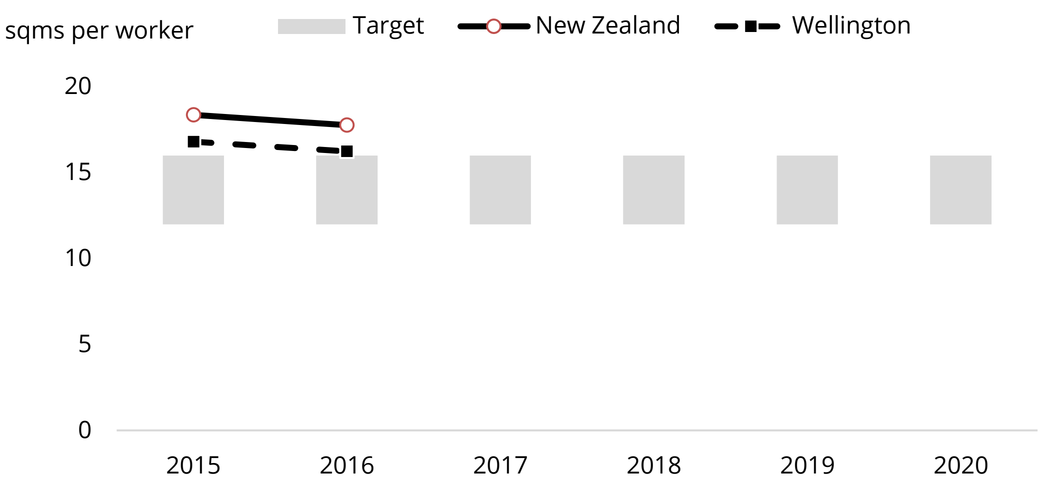


Source: Statistics New Zealand

Although a modestly growing government sector helps determine the outlook for employment, other pressures are reducing the footprint for each office worker (see Figure 50). An increasing workforce does not necessarily translate to increasing demand for land, a point we return to in section 3.

FIGURE 50: OFFICE SPACE PER GOVERNMENT WORKER IS FALLING

Wellington region office space per worker



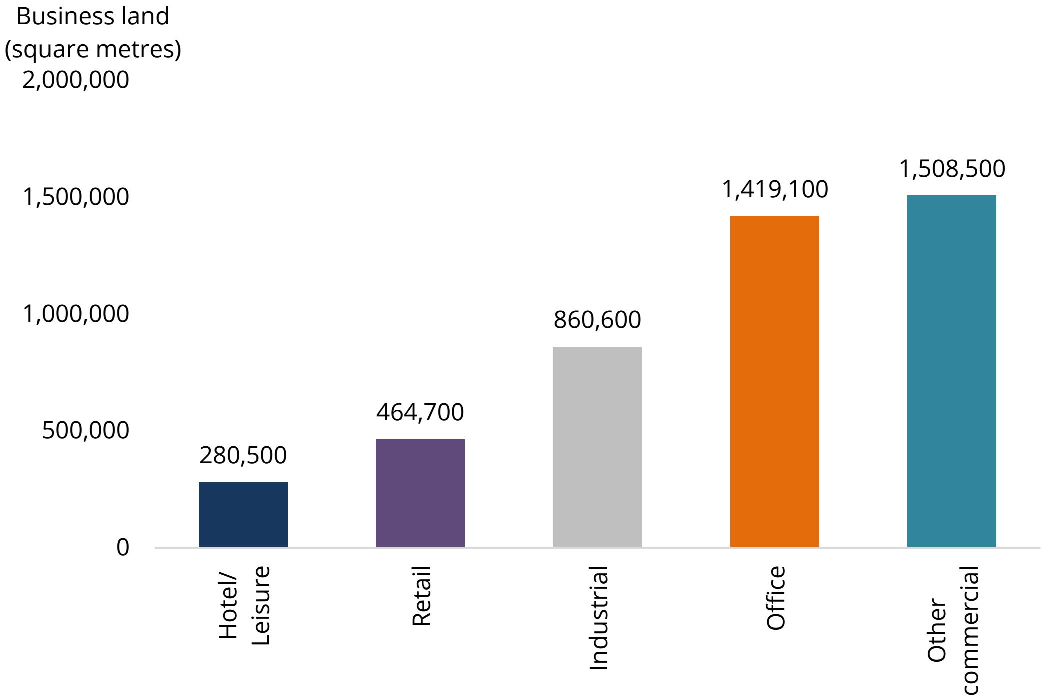
Source: Government Property Group

2.3.2 Tourism has upside potential

The past five years has seen New Zealand benefit from the rapidly growing tourism sector. International visitor arrivals have posted double-digit growth for several years. Initially this growth was fuelled by rapidly growing visitor numbers from China. But more recently, traditional markets have grown too – the sector is firing on all cylinders.

But while growth is particularly rapid, Figure 51 shows the hotel/leisure footprint is much smaller than industrial, commercial, industrial and retails spaces across the region. While tourism helps support retail, right now the impact on business land is at the margin rather than fuelling large changes in aggregate demand. Figure 52 to Figure 55 show a similar story emerges for each local authority.

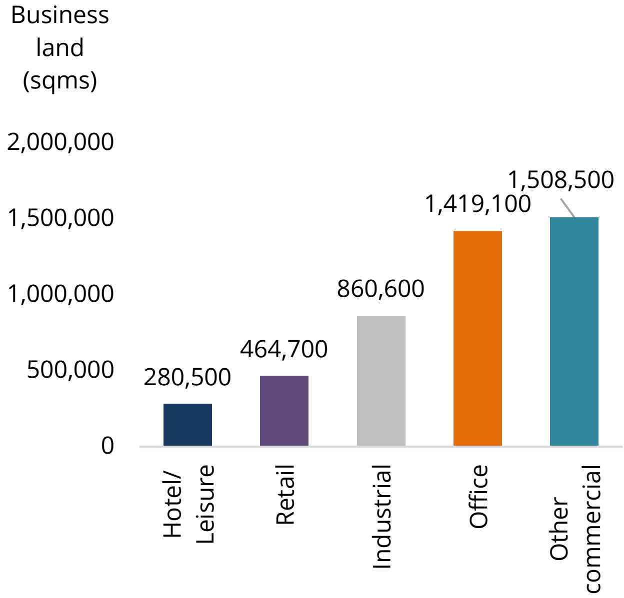
FIGURE 51: TOURISM CAPTURES HEADLINES BUT NOT FOOTPRINT
Wellington region



Source: Urban Economics (2016)

FIGURE 52: HOTELS A LITTLE SLICE OF THE CITY

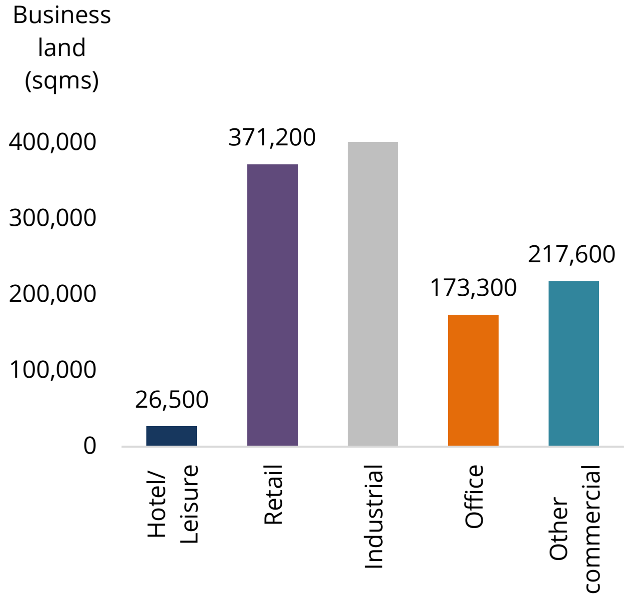
Business land by type, Wellington City, 2016



Source: Urban Economics (2016)

FIGURE 53: INDISTRUAL DOMINATES LOWER HUTT

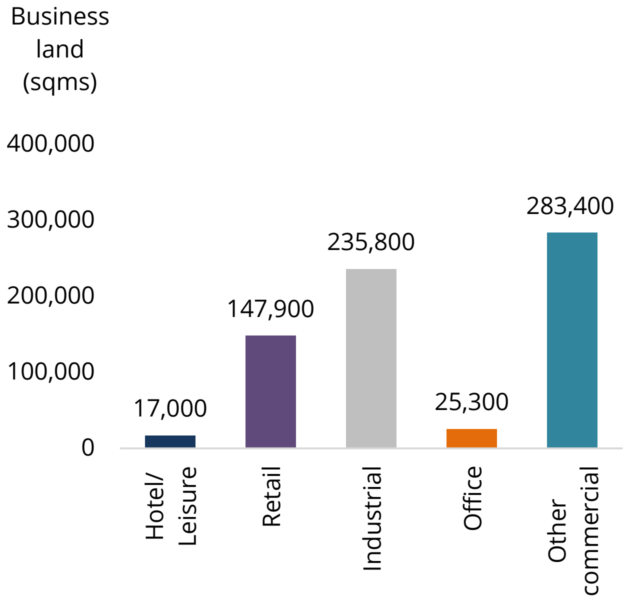
Business land by type, Lower Hutt, 2016



Source: Urban Economics (2016)

FIGURE 54: KAPITI: INDUSTRIAL AND COMMERCIAL

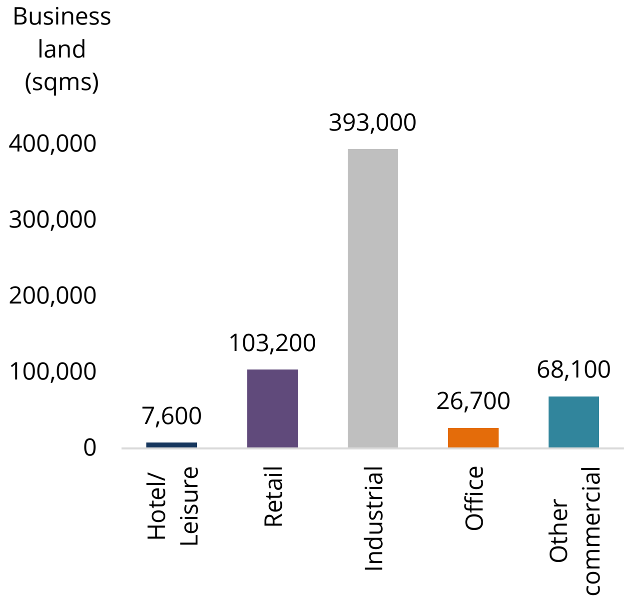
Business land by type, Kapiti Coast, 2016



Source: Urban Economics (2016)

FIGURE 55: UPPER HUTT: MOSTLY INDUSTRIAL

Business land by type, Upper Hutt, 2016

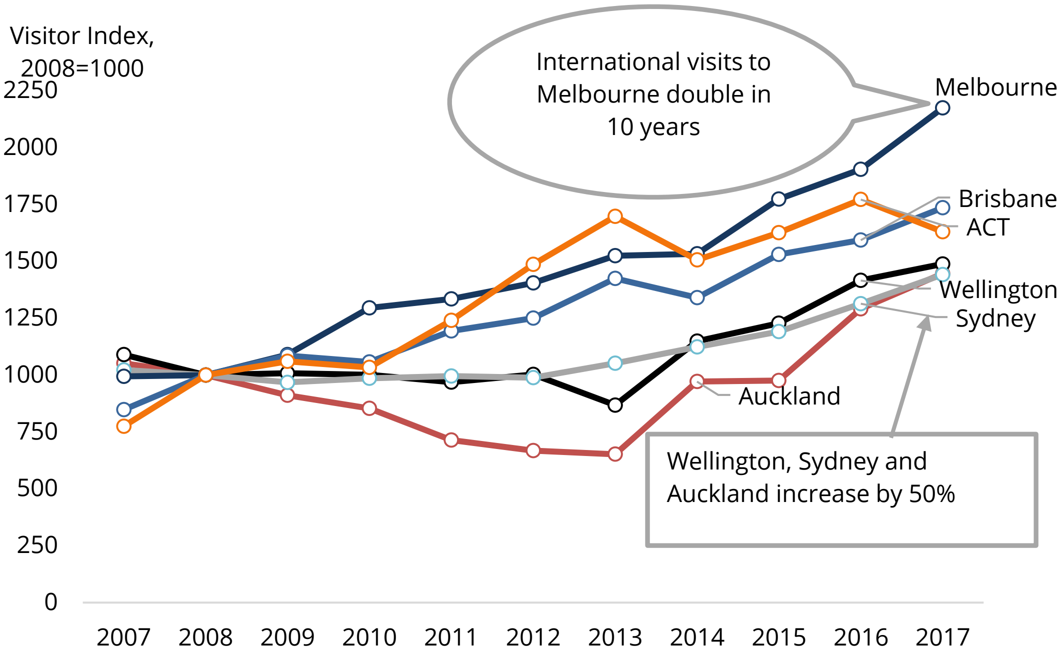


Source: Urban Economics (2016)

But urban tourism markets can change rapidly. Figure 56 shows a group of Australasian cities (including Auckland, Sydney and Wellington) that grew international visits by 50 percent in the 10 years to 2017. Melbourne led the pack, doubling growth across the same 10-year period. If sustained across a 30-year period, such a growth rate would require a substantial increase in business land.

FIGURE 56: CITY VISITS CAN SPUR RAPID TOURISM GROWTH

Growth in international visits, selected cities

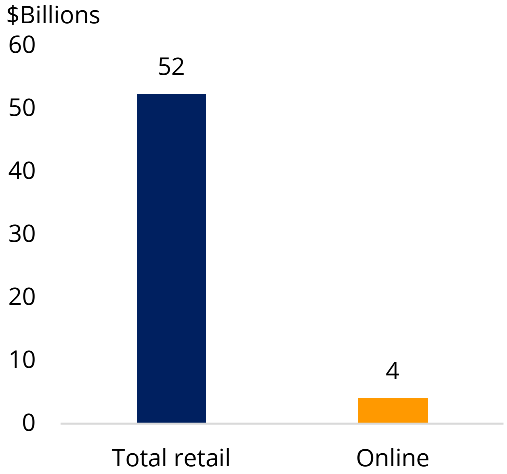


Source: Statistics New Zealand, Australian Bureau of Statistics

2.3.3 Retail under pressure right now

Demand for retail takes up a large footprint across the Wellington region. But many factors, including convenience, access to a wider range of products, the ease of comparing prices and improved logistics, have placed within store shopping under pressure from on-line options. On-line shopping is a small fraction of total retails (see Figure 57) but is growing particularly quickly (see Figure 58). Growth in on-line might be expected to limit marginal growth in the retail sector, reducing overall demand for business land and transforming the type of land required, towards logistics and away from retail space *per se*.

FIGURE 57: ON-LINE IS RELATIVELY SMALL
New Zealand, 2017



Source: Statistics New Zealand

FIGURE 58: BUT ON-LINE GROWING RAPIDLY
New Zealand, 2017

Source: Statistics New Zealand

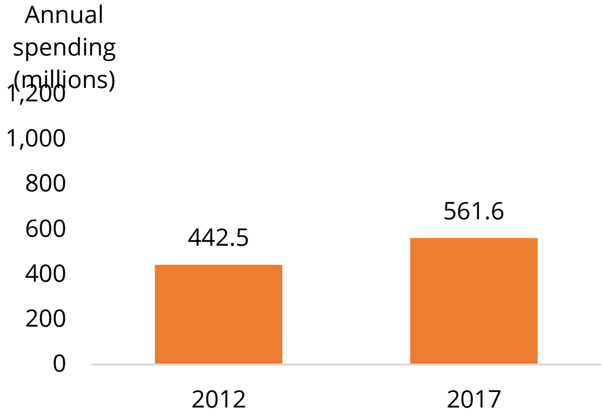
Growth in on-line might be expected to limit marginal growth in the retail sector, reducing overall demand for business land.

Local experiences will differ. Retail spending grew 16.3 percent across the region as a whole in the five years to October 2017 (see Figure 63).[4] Figure 59 and Figure 60 show differences in the growth experience of local councils over the past five years. Spend in Kapiti Coast and Wellington City has grown at a faster rate than Lower Hutt. Spend grew 27 percent in Kapiti, 17 percent in Wellington City, 17 percent in Upper Hutt and 10 percent in Lower Hutt. Total spend in the region grew 16 percent while transaction grew 24 percent.

[4] The number of transactions grew at an even faster clip – 23 percent in five years.

FIGURE 59: KAPITI COAST RETAIL SPENDING

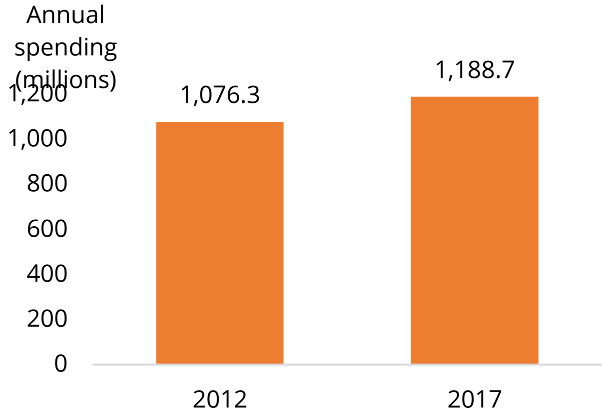
Kapiti Coast, year to Oct 2012 and year to Oct 2017



Source: Marketview

FIGURE 60: LOWER HUTT RETAIL SPENDING

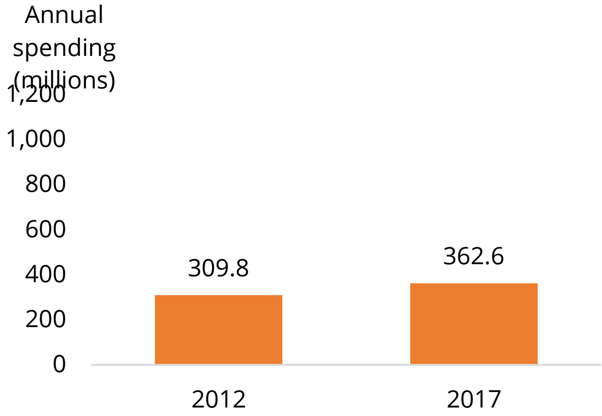
Lower Hutt, year to Oct 2012 and year to Oct 2017



Source: Marketview

FIGURE 61: UPPER HUTT RETAIL SPENDING

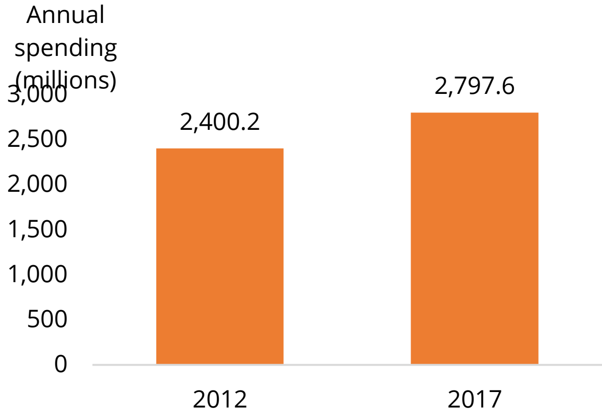
Upper Hutt, year to Oct 2012 and year to Oct 2017



Source: Marketview

FIGURE 62: WELLINGTON CITY RETAIL SPENDING

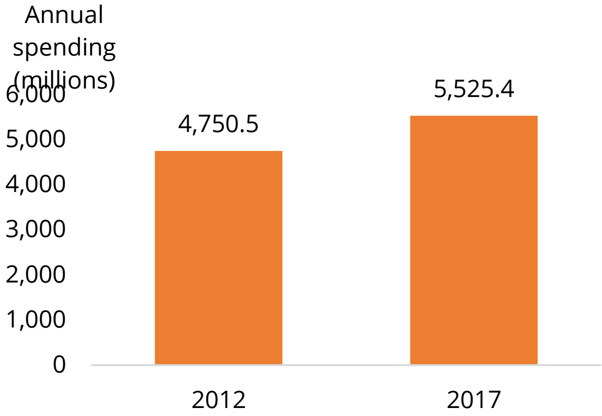
Wellington City year to Oct 2012 and year to Oct 2017



Source: Marketview

FIGURE 63: WELLINGTON REGION RETAIL SPEND

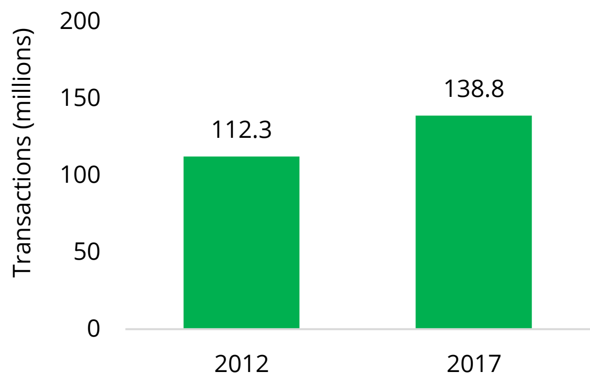
Wellington region, year to Oct 2012 and year to Oct '17



Source: Marketview

FIGURE 64: WELLINGTON REGION: TRANSACTIONS

Wellington region, year to Oct 2012 and year to Oct '17

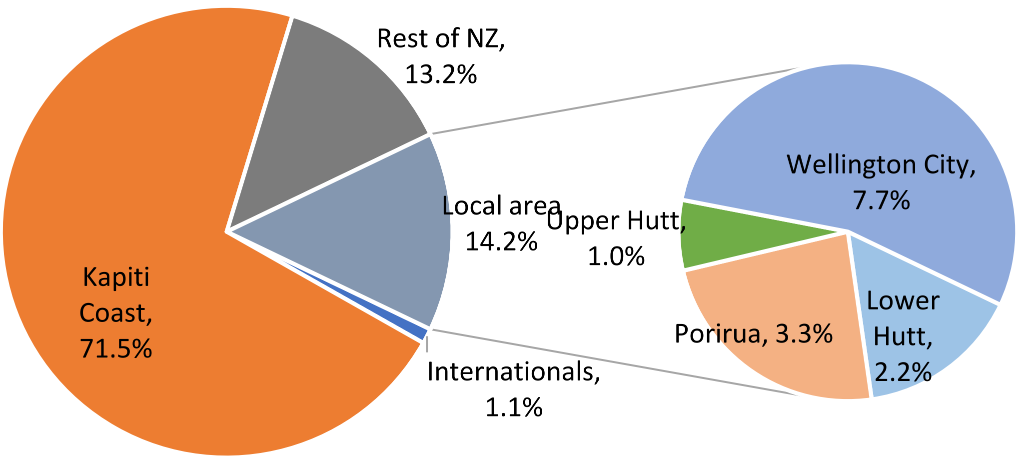


Source: Marketview

This faster growth rate is underpinned by the growth in the relevant consumer markets. Typically, local consumers provide the bulk of the activity in the local economy. For example, Figure 65 shows the split for retail in Kapiti. Residents comprise the largest share of sales. Residents from Wellington city help support retail spending in Lower Hutt but almost two-thirds of spending is by residents.

FIGURE 65: LOCAL RESIDENTS PROVIDE THE LION'S SHARE OF KAPITI RETAIL SPEND

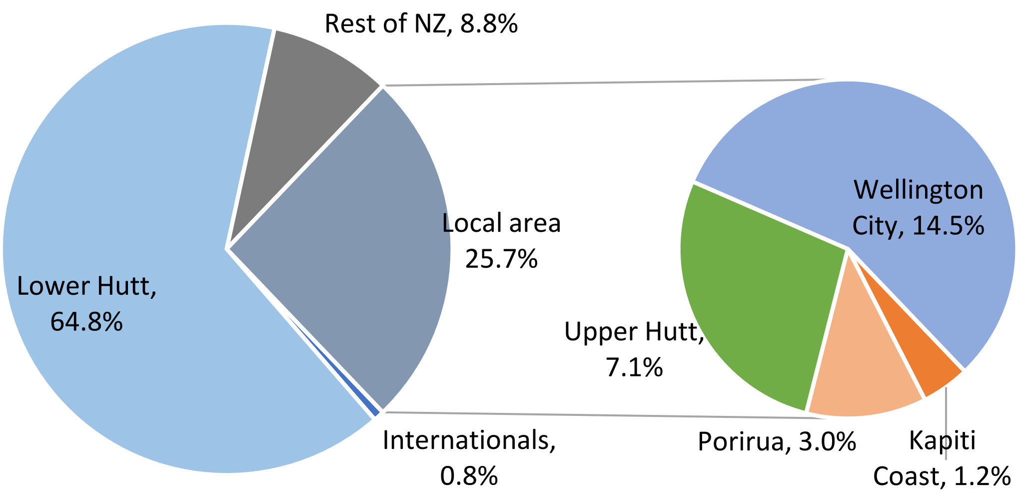
Origin of retail spending, Kapiti Coast, year to October 2017



Source: Statistics New Zealand, Sense Partners

FIGURE 66: LOCAL RESIDENTS AND WELLNGTON CITY DRIVE RETAIL IN LOWER HUTT

Origin of retail spending, Lower Hutt, year to October 2017

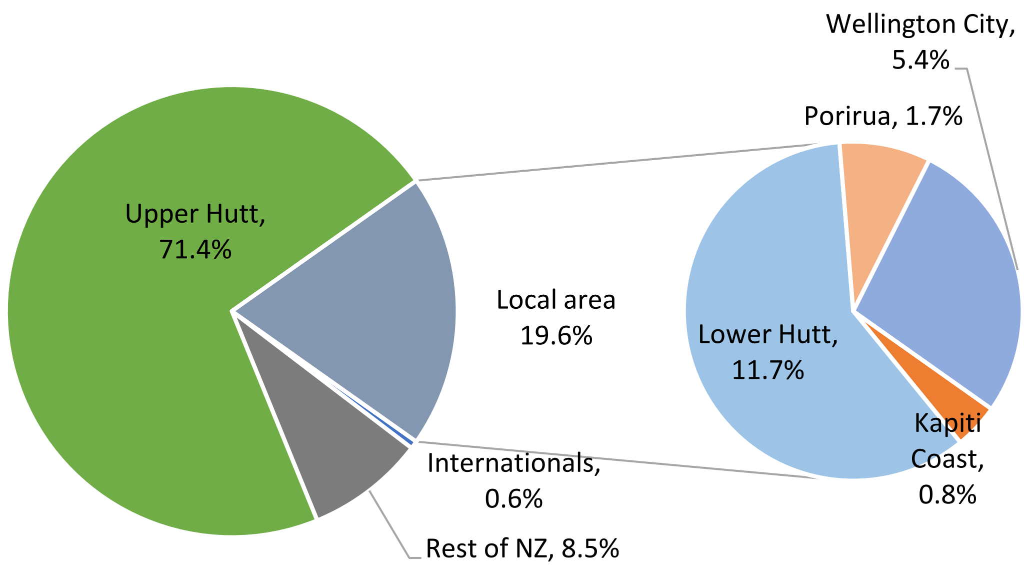


Source: Statistics New Zealand, Sense Partners

Spending by local residents is 71 percent of spending in the Upper Hutt area and spending by other residents across the region comprises almost 20 percent of retail (see Figure 67). Retail activity in Wellington attracts residents from a variety of sources, including international visitors who make up 4.5 percent of retail spending (see Figure 68).

FIGURE 67: RESIDENTS OF UPPER HUTT DRIVE RETAIL IN UPPER HUTT

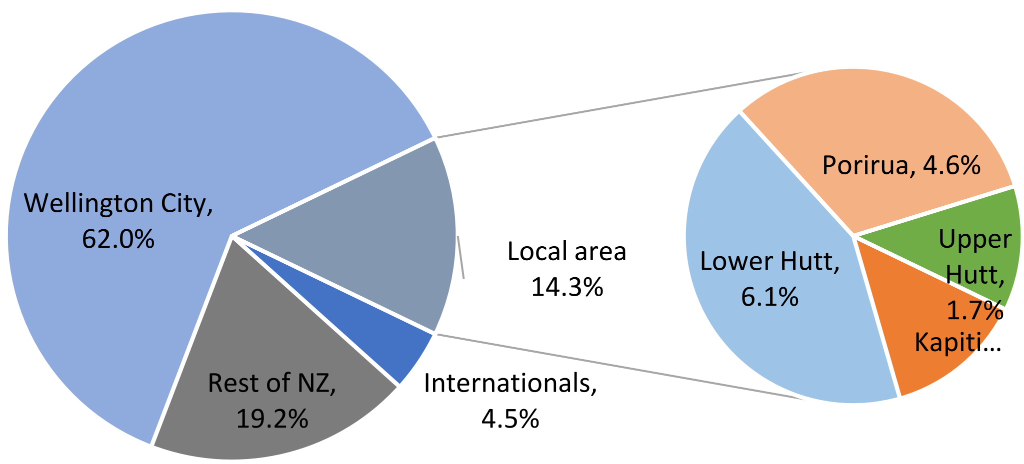
Origin of retail spending, Upper Hutt, year to October 2017



Source: Statistics New Zealand, Sense Partners

FIGURE 68: VISITORS GENERATE A QUARTER OF WELLINGTON RETAIL SPENDING

Origin of retail spending, Wellington City, year to October 2017



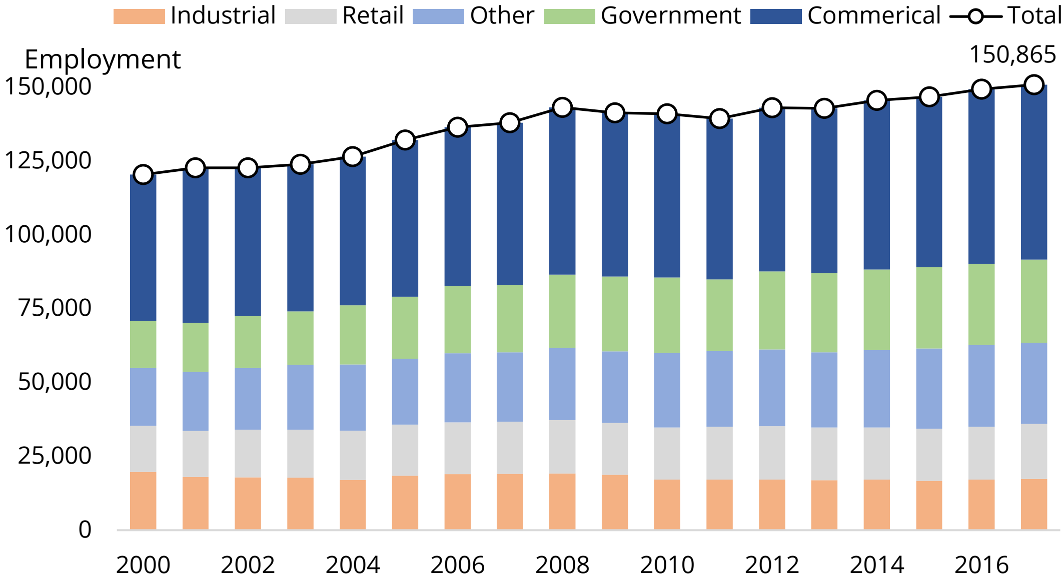
Source: Statistics New Zealand, Sense Partners

2.3.4 A granular look reveals sub-industry growth

Looking a little below the surface of headline job numbers reveals the industry dynamics within local areas. Wellington's employment base swings on the government sector, increasing 76 percent since 2000. Fewer industrial jobs has hit Upper Hutt hard. In the period since the peak of industrial jobs in 2006, industrial employment has fallen by almost 45 percent.

FIGURE 69: GOVERNMENT FUELLED WELLINGTON'S JOB GROWTH SINCE 2000

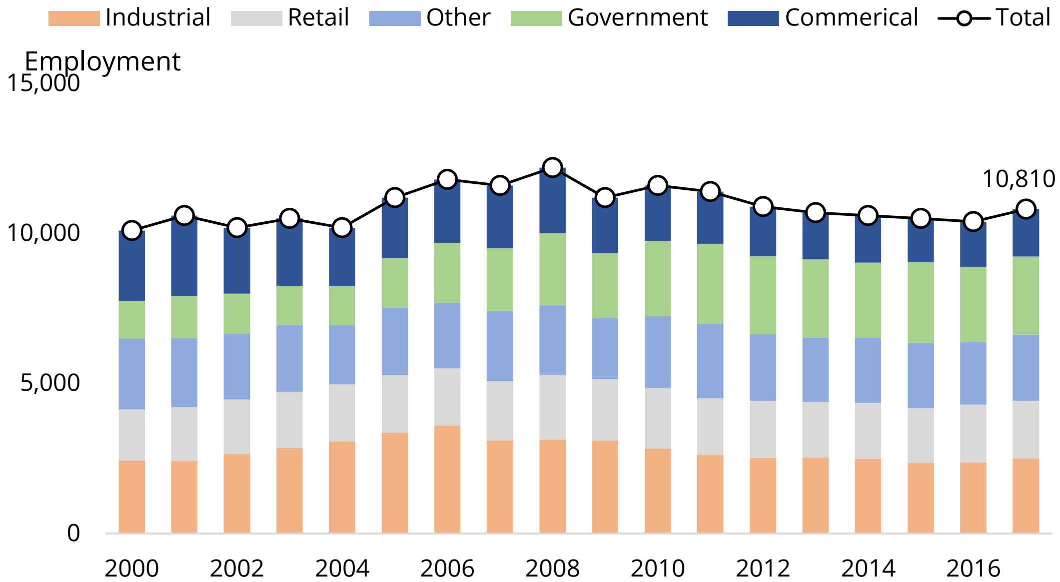
Wellington city employment by industrial sub-classification, 2000-2017



Source: Statistics New Zealand, Sense Partners

FIGURE 70: INDUSTRIAL DECLINE HITS UPPER HUTT EMPLOYMENT NUMBERS

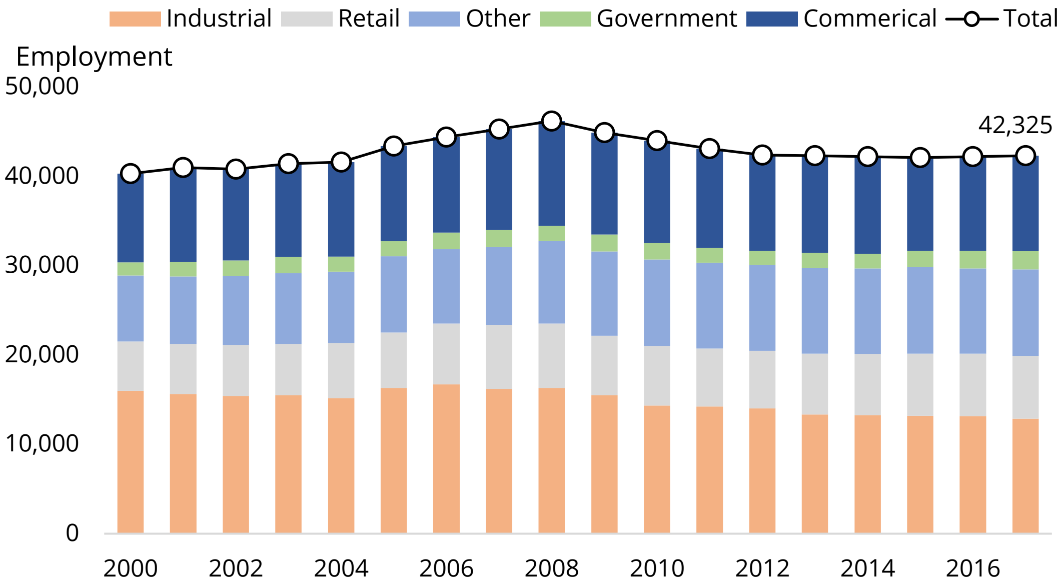
Upper Hutt employment by industrial sub-classification, 2000-2017



Source: Statistics New Zealand, Sense Partners

FIGURE 71: FEWER COMMERICAL AND INDUSTRIAL JOBS IN LOWER HUTT

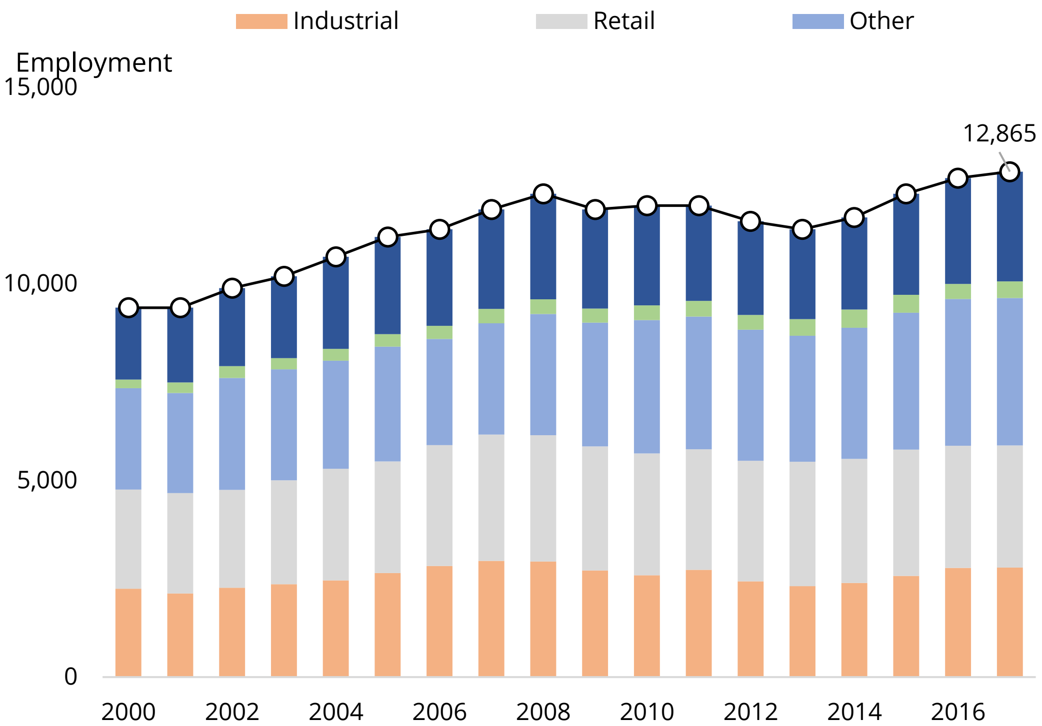
Lower Hutt employment by industrial sub-classification, 2000-2017



Source: Statistics New Zealand, Sense Partners

FIGURE 72: INCREASING EMPLOYMENT ON THE KAPITI COAST IS BROAD-BASED

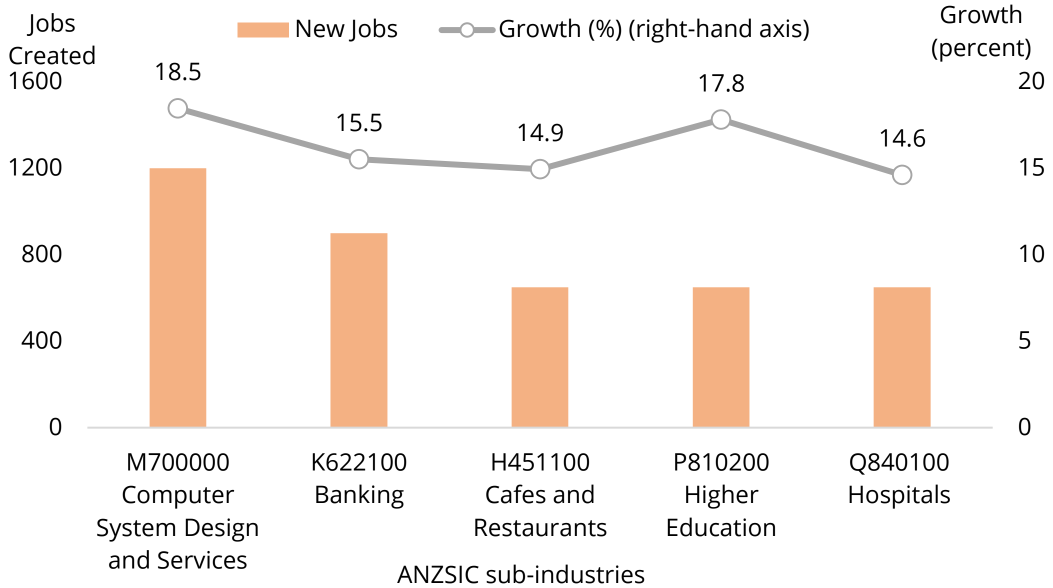
Kapiti Coast employment by industrial sub-classification, 2000-2017



Source: Statistics New Zealand, Sense Partners

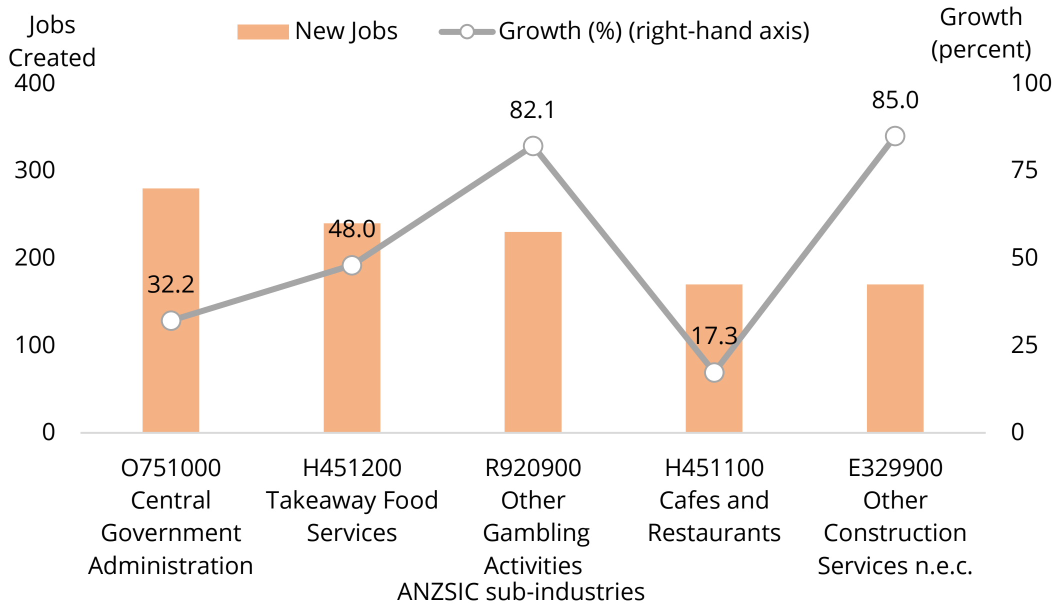
But taking a more refined approach can reveal where the industries of the future lie. We first compute the five most sub-industries responsible for the largest increase in job numbers for each of the local authorities at the ANZSIC 6-digit level (a classification with over 800 subindustries). This shows some niche industries are posting exponential growth rates and have the potential to become dominant employers over the next 30 years (see Figure 73, Figure 74, Figure 75, Figure 76),

FIGURE 73: WELLINGTON CITY HAS RAPIDLY-GROWING NICHE INDUSTRIES
Wellington City, Job Creation 2015 -2017



Source: Statistics New Zealand, Sense Partners

FIGURE 74: LOWER HUTT POSTED STRONG GROWTH IN SOME SUB-INDUSTRIES
Lower Hutt, Job Creation 2015 -2017

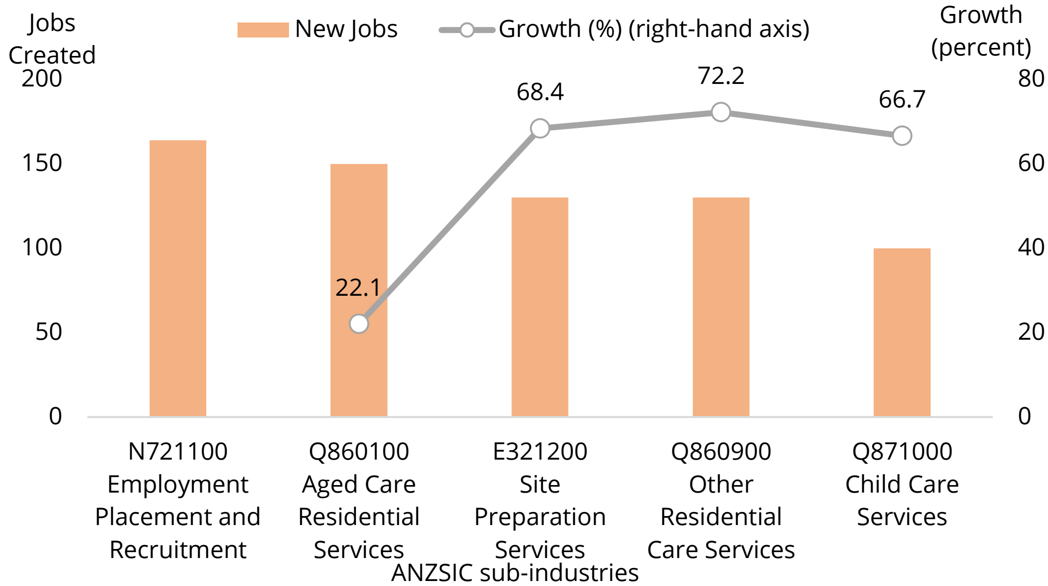


Source: Statistics New Zealand, Sense Partners

Wellington City's computer design industry added 1,200 jobs in the three years to 2017 and holds the possibility of providing many more future employment opportunities. Other niche employers include Banking, Higher Education and Hospital workers. Opportunities for other councils include aged care and a broader base of sub-industries. Some of the job growth in Kapiti is likely to relate to the development of the expressway.

FIGURE 75: AGED CARE AND CHILD CARE SPARK GROWTH ON THE KAPITI COAST

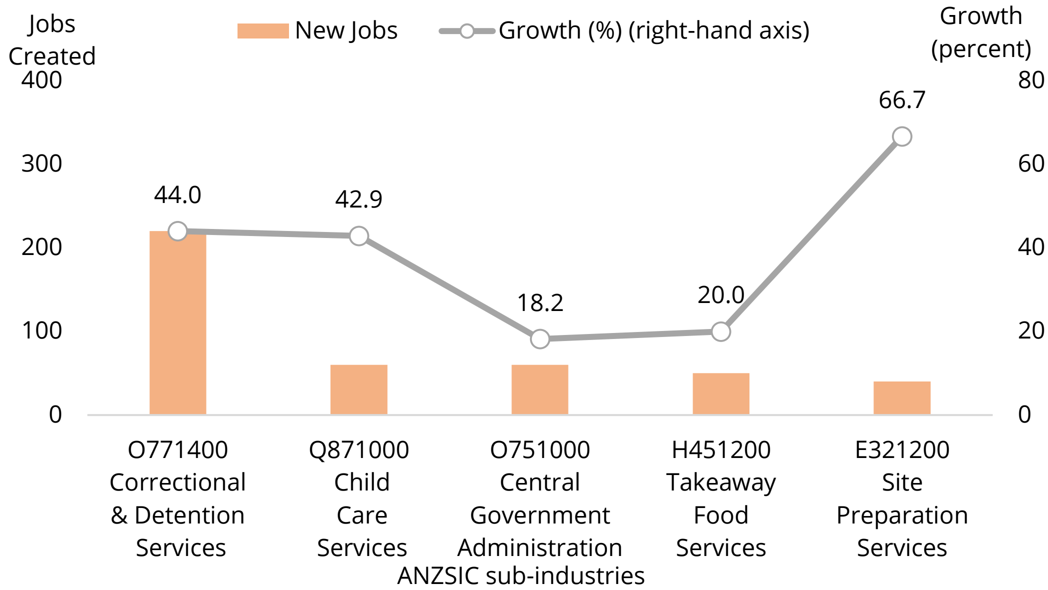
Kapiti Coast, Job Creation 2015 -2017



Source: Statistics New Zealand, Sense Partners

FIGURE 76: UPPER HUTT HAS A VARIETY OF FAST-GROWING SUB-INDUSTRIES

Upper Hutt, Job Creation 2015 -2017



Source: Statistics New Zealand, Sense Partners

3. The future economy

3.1 Our modelling approach

3.1.1 Overview

To understand future demand for business land, section 2 highlighted we first need to project economic activity across the region. Rather than work with aggregate economic activity, we prefer to use employees demand as the relevant metric to allocate business land. We then develop estimates of business land demand from future employment estimates in section 4.

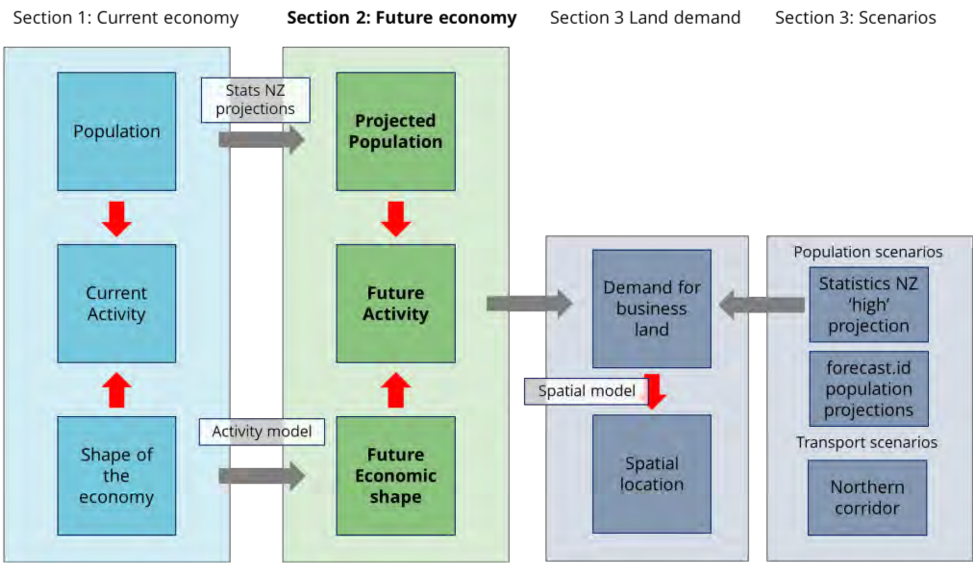
Since demand for business land differs across industries, we need to project the economic shape of the regional economy. We also want to allocate where business land locates across the region. So we need a projection that allows activity to move across districts. We also need a projection that can be mapped back to Statistics New Zealand's projections for population growth rate as a benchmark. These requirements suggest a staged process:

- Step one: Use Statistics New Zealand's medium growth projection to set the overall growth rate for the region's labour force.
- Step two: Combine with a forecast of the industrial shape of the regional economy to obtain future employment activity.
- Step three: Allocate economic activity across the local districts.

Figure 77 shows a stylised representation of how we combine Statistics New Zealand's population projections with our model of the shape of the local economy to obtain future activity in this section of our report. We make high-level allocations of activity to local districts.

FIGURE 77: WE USE POPULATION AND INDUSTRY SHAPE TO FORECAST ACTIVITY

Stylised approach to forecasting activity in stage two



Source: Sense Partners

3.2 Population projections

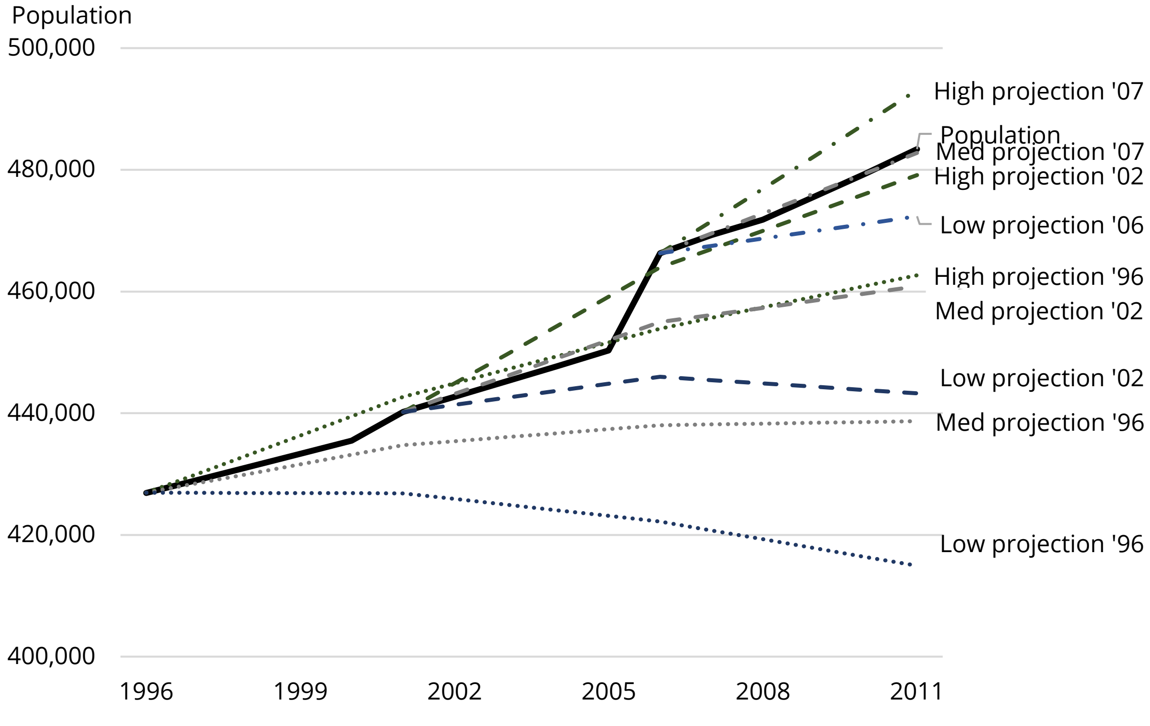
Our projections need to align with the population projections produced by Statistics New Zealand. But rather than using the future population growth rate to inform business land demand, we first obtain a projection for the future labour force in the region. We achieve this by applying national, age-specific labour force participation rates to the local population.

Statistics New Zealand's medium-term population projections have tended to under-predict the national population in recent years. Among other factors, Statistics New Zealand's population projections miss a structural trend in inward migration that suggests Statistics New Zealand will continue to under-predict the population.

Statistics New Zealand have underpredicted growth in the region (see Figure 78). Given the importance of the population forecasts for predicting future activity, in addition to working with Statistics New Zealand's medium projection we also use results based on the high projection and projections from forecast.id.

FIGURE 78: STATISTICS NEW ZEALAND PROJECTIONS FOR THE WELLINGTON REGION TEND TO UNDERSHOOT POPULATION GROWTH

Statistics New Zealand population estimates and subnational projections for Wellington region



Source: Statistics New Zealand

3.3 Future economic activity

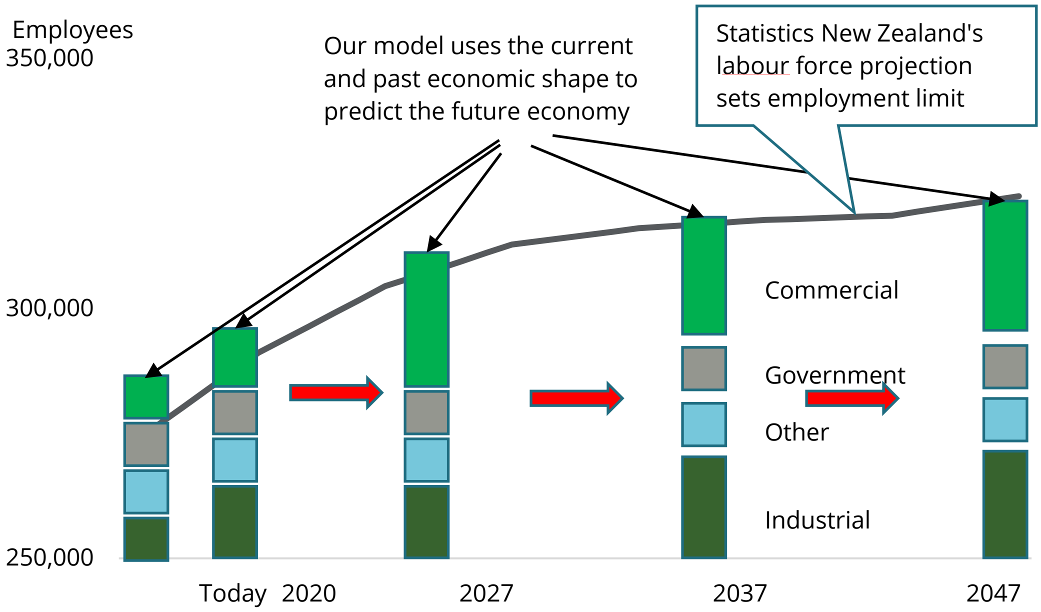
To model future economic activity, we use a VAR or Vector Auto-Regressive model of the shape of the economy. VAR models are a useful economic model for a variety of purposes including explaining economic data, making predictions about the future, generating scenarios and providing policy advice.

VAR models have a long history in economics.[5] So we are using a tool that is well understood and has been deployed across many applications. VAR models can address several questions, including for example, thinking about how changes in interest rates might impact on house prices, or how immigration might impact on economic growth.

Our focus is to forecast the shape of the Wellington economy in 3-, 10- and 30-years' time. To ensure the shape of the economy is useful to think about the demand for business land, we first corral Statistics New Zealand's counts of employees into bins (such as industrial, commercial, government and other activity) that provide insight to demand for business land.

To move from the outlook for the Wellington region to the local outlook for each district, we need to allocate expected employment activity by industry throughout the region to specific districts. We allow the shares of each district to change over time by building simple single equation models of the industry share of each district. This allows the district share of employment by industry to change over time (see Figure 81 for a stylised view).

FIGURE 79: VAR MODEL PROJECTS THE INDUSTRY SHAPE OF WELLINGTON ECONOMY



Source: Statistics New Zealand, Sense Partners

[5] For example, the use of VARs for regional forecasting in Anderson (1979) and the importance of VARs in macroeconomic literature in Sims (1980).

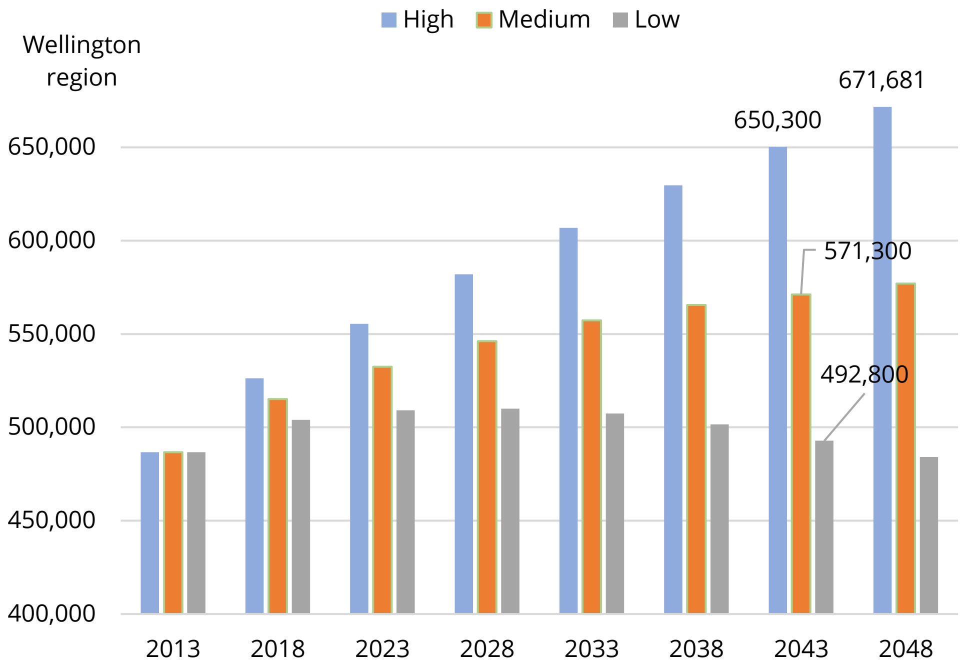
3.3.1 Projecting labour force growth

Population growth, and demographic trends more broadly, are crucial for determining activity in local economies. Demographic trends will influence demand trends and growth potential, especially via life-cycle effects. But population growth is key for driving economic growth.

But knowing how local populations have developed relative to national trends is informative for thinking about future activity growth. Figure 80 shows three sets of population projections for the Wellington region: (i) Low; (ii) Medium; and (iii) High.

We use the medium projection as our baseline. While we carry over both the low and high projections through some of our analysis, the weight of evidence suggests adopting the high projection as a scenario and generally omit the low scenario from stage three analysis. In stage 3, we also construct a scenario that uses population forecasts from population.id. These forecasts take a similar approach to Statistics New Zealand but are more up-to-date.

FIGURE 80: WE USE STATISTICS NEW ZEALAND'S MEDIUM PROJECTION AS BASELINE
Population projections, Wellington region 2013-2048



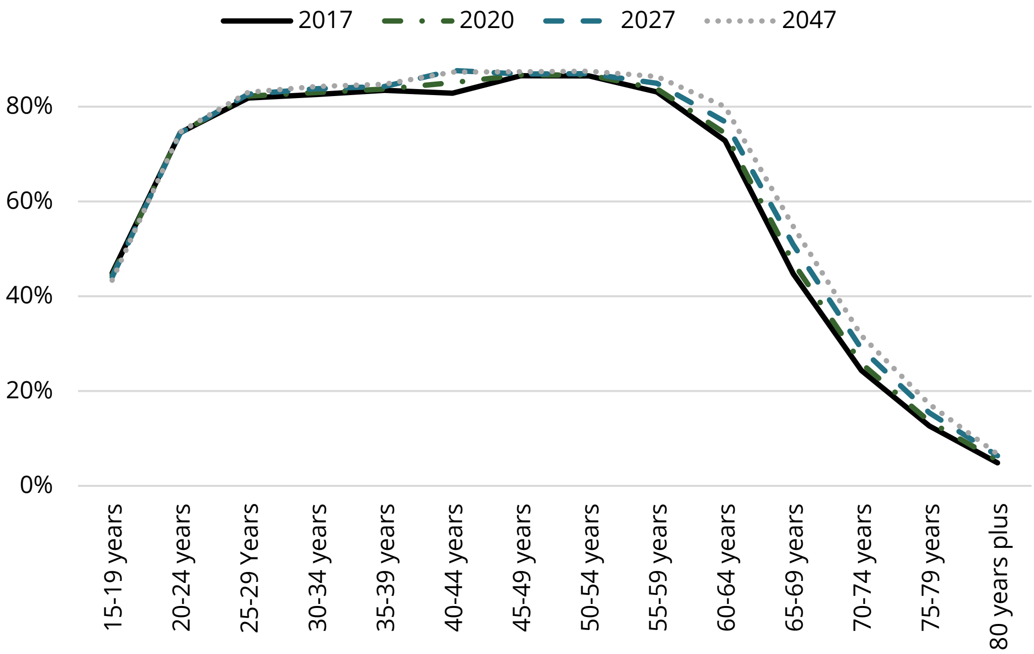
Source: Statistics New Zealand

Since Statistics New Zealand do not produce subnational labour force projections, we use national labour force participation rates to map from the regional population projections to workforce projections. The national labour force projections (see Figure 81) are age-specific.

We then apply the age-specific labour force participation rates to age-specific regional population forecasts to obtain our projection for the regional labour force (see Figure 82). This projection effectively sets the pace of employment activity within the region.

FIGURE 81: WE APPLY NATIONAL LABOUR FORCE PARTICIPATION RATES BY AGE TO OBTAIN REGIONAL WORKFORCE PROJECTIONS FOR WELLINGTON

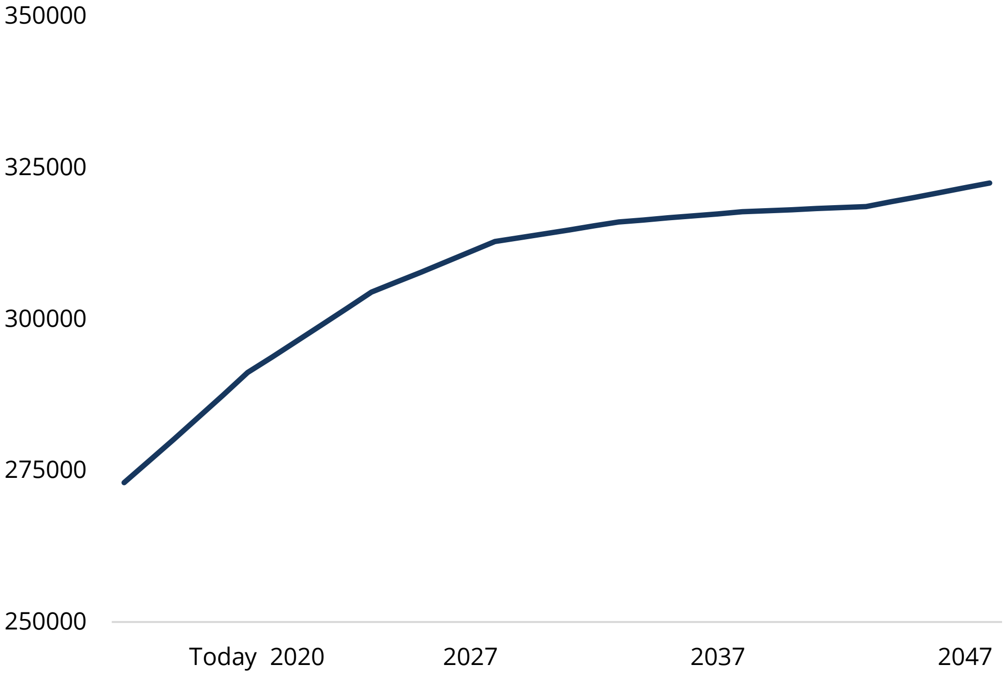
Labour force participation rates, by age, New Zealand projection, 2017-2047



Source: Statistics New Zealand

FIGURE 82: OUR LABOUR FORCE PROJECTION SETS THE PACE OF ACTIVITY GROWTH

Labour force participation, Wellington, 2017-2047



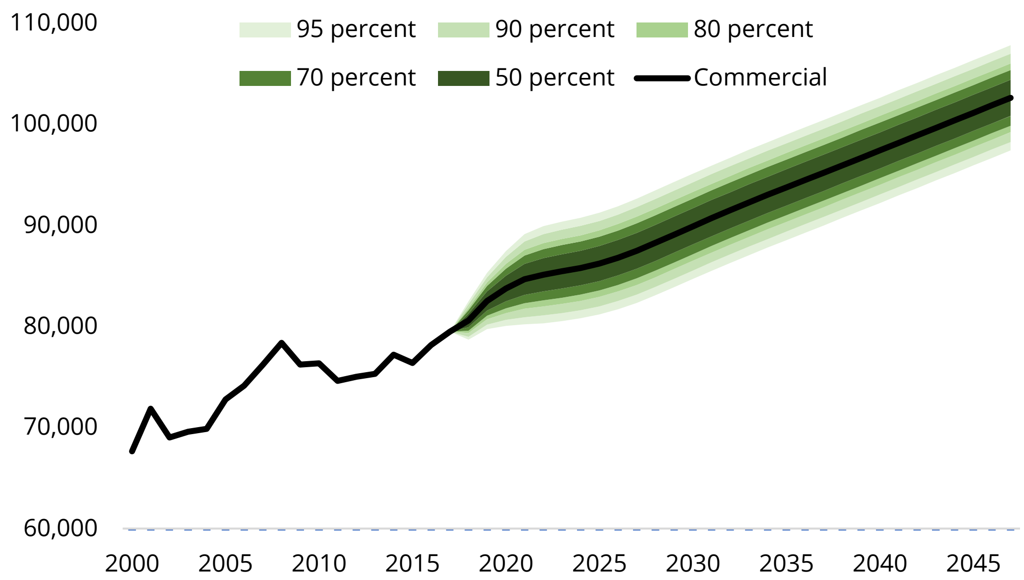
Source: Statistics New Zealand, Sense Partners

3.3.2 Projecting economic activity

Our projections combine our VAR model (Appendix 1 for additional detail) of the industry shape of the economy with the regional labour force derived by Statistics New Zealand's medium population projection and age-specific national labour force participation rate. Figure 83 and Figure 84 show commercial and retail are expected to perform well.

FIGURE 83: COMMERCIAL EMPLOYMENT SET TO FLOURISH TO 2047

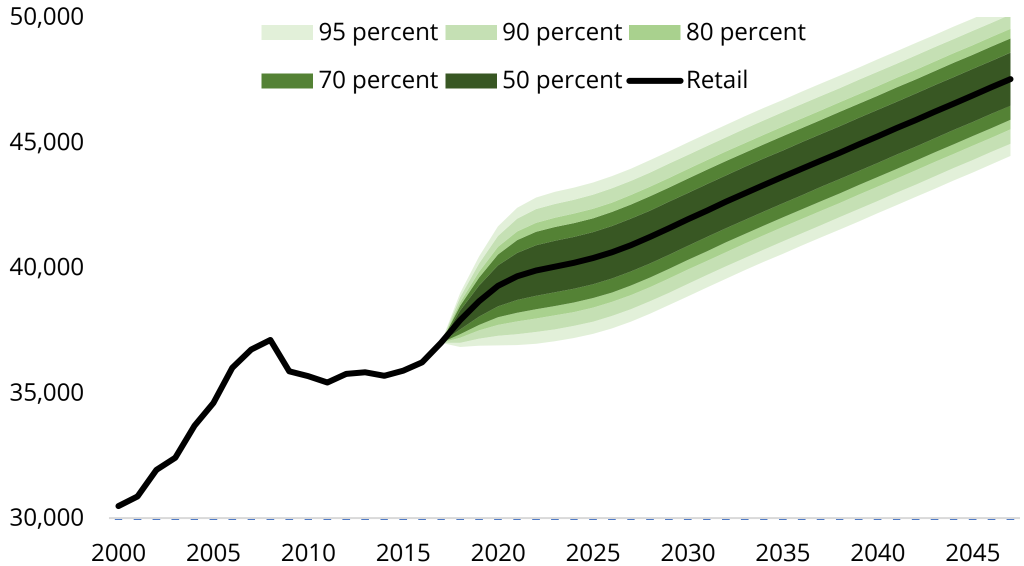
Wellington Region, Employees by industry, 2000-2047, Commercial



Source: Statistics New Zealand, Sense Partners

FIGURE 84: HISTORY SUGGESTS RETAIL WILL RETURN TO STRONG GROWTH RATES

Wellington Region, Employees by industry, 2000-2047, Retail

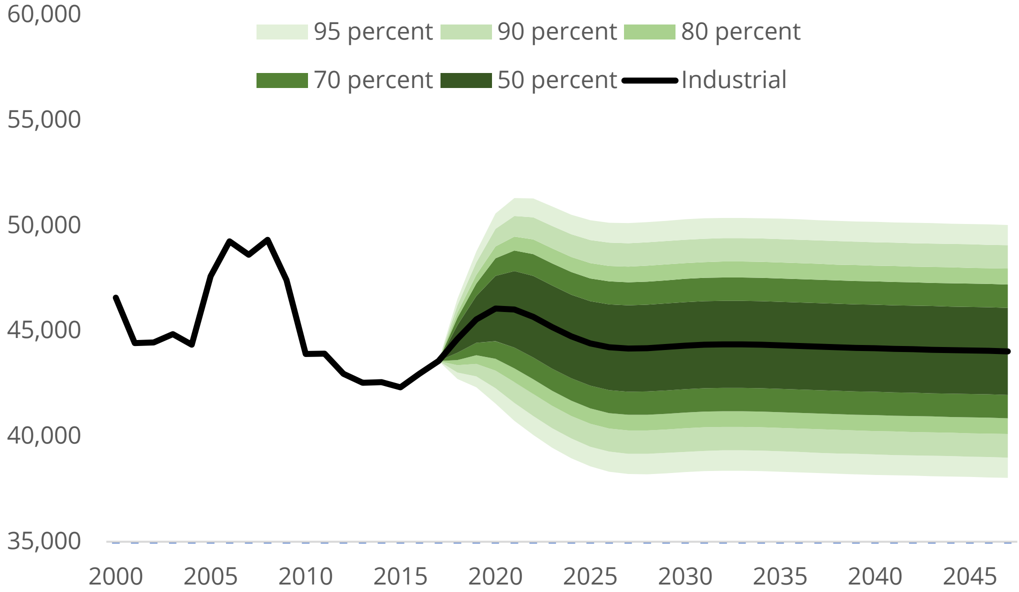


Source: Statistics New Zealand, Sense Partners

The outlook for industrial employment is more mixed. The slump in industrial employment after the GFC implies a weak growth outlook although the precise numbers are very uncertain.

FIGURE 85: OUTLOOK FOR INDUSTRIAL ACTIVITY UNCERTAIN

Wellington Region, Employees by industry, 2000-2047, "Industrial"

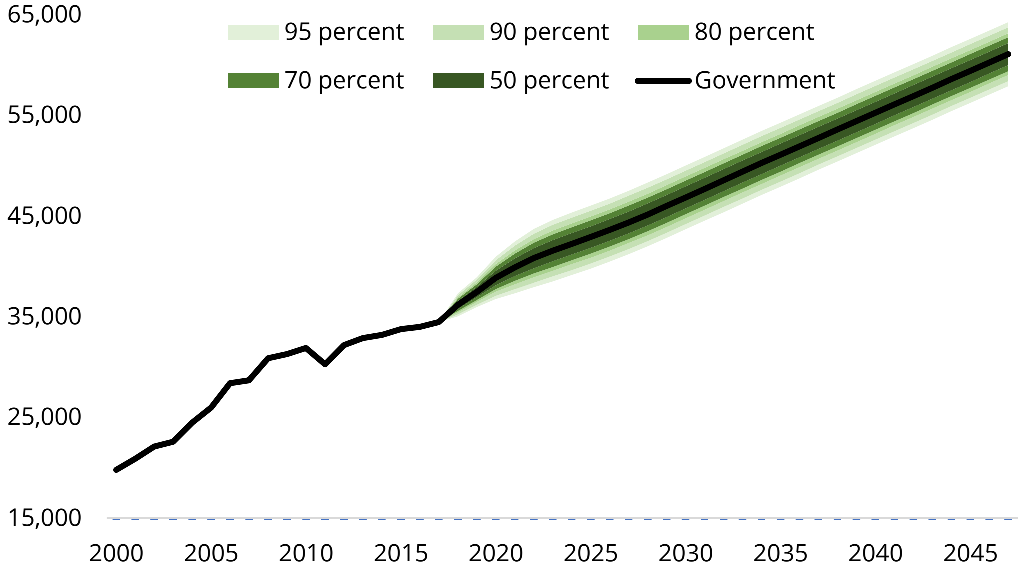


Source: Statistics New Zealand, Sense Partners

In contract, growth in the government sector is predicted to continue steadily. Our numbers suggest government activity decreases as a share of the national economy but increases a little as a share of the regional Wellington economy.

FIGURE 86: EXPECT EMPLOYMENT IN THE GOVERNMENT TO GROW STRONGLY

Wellington Region, Employees by industry, 2000-2047, Government

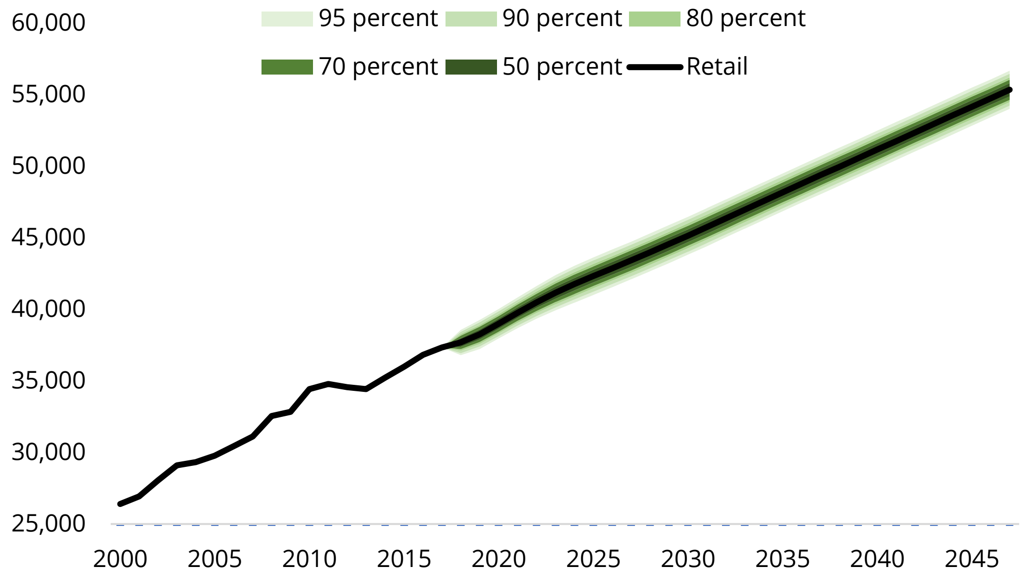


Source: Statistics New Zealand, Sense Partners

We choose to also forecast health, education and training (see Figure 87) as an industry that relies on large but infrequent infrastructure projects to support activity. The past twenty years implies strong growth to 2047. Employment in a "grab bag" of other industries is predicted to lift more slowly in the future (see Figure 88).

FIGURE 87: HEALTH, EDUCATION AND TRAINING ANTIPICATED TO GROW

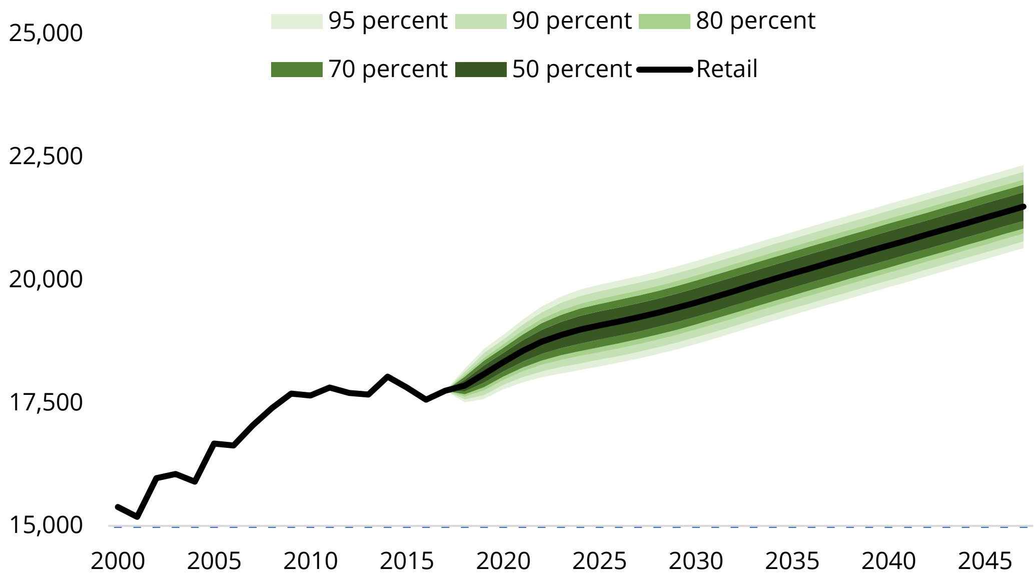
Wellington Region, Employees by industry, 2000-2047, "Health, Education and Training"



Source: Statistics New Zealand, Sense Partners

FIGURE 88: MIX OF OTHER INDUSTRIES EXPECTED TO POST MODEST GROWTH RATES

Wellington Region, Employees by industry, 2000-2047, "Other"



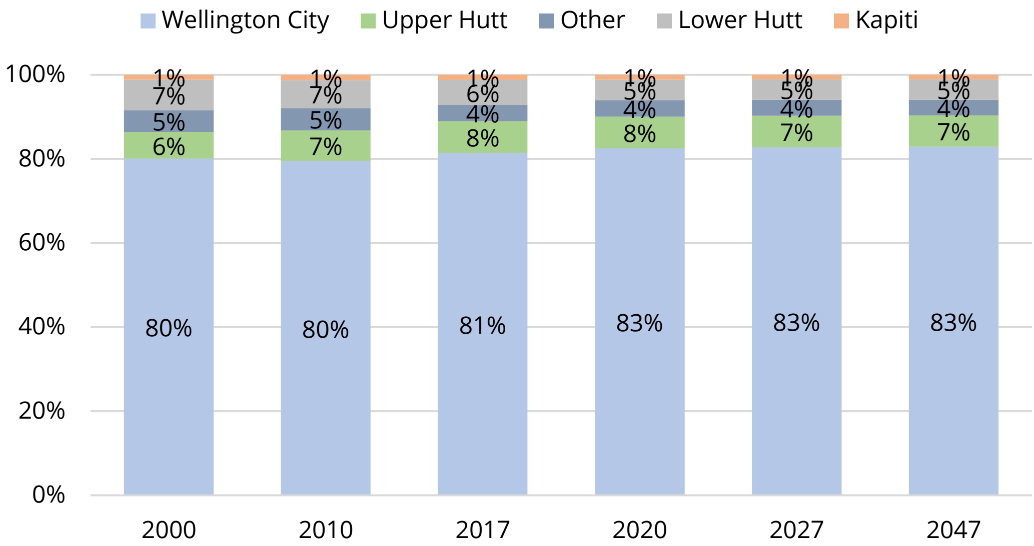
Source: Statistics New Zealand, Sense Partners

3.4 The local activity outlook

We use the share of each district's industry employment to allocate future activity across the region. Figure 89 shows that Wellington City has, retains, and grows the lion's share of government workers across the region. We include workers from other parts of the Wellington region – that is, Porirua, Masterton, Carterton and South Wairarapa – in the 'Other' category.

FIGURE 89: WELLINGTON CITY TO GROW THE SHARE OF GOVERNMENT WORKERS

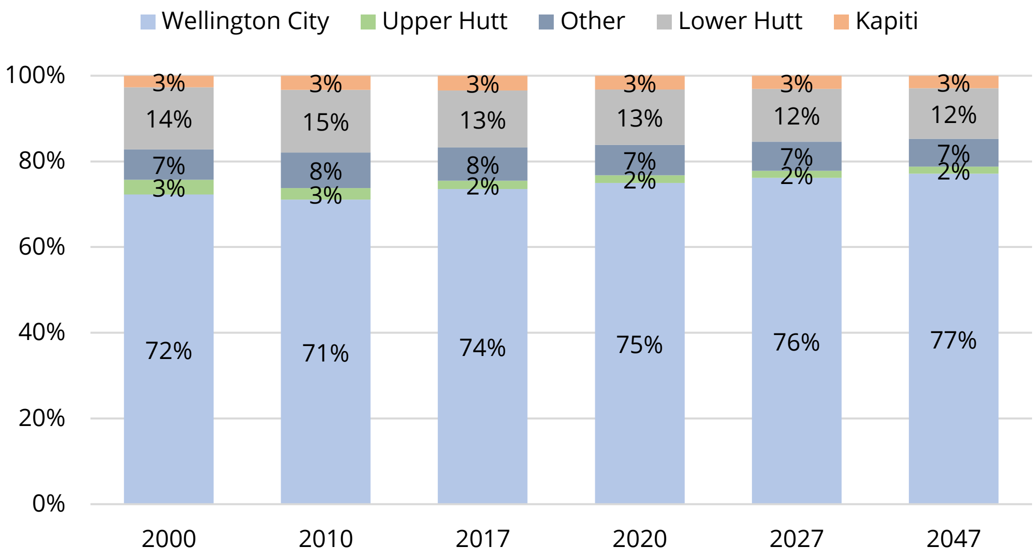
Share of Government employment in Wellington region, selected years



Source: Statistics New Zealand, Sense Partners

FIGURE 90: COMMERCIAL EMPLOYMENT IN WELLINGTON CITY ALSO A LITTLE LARGER

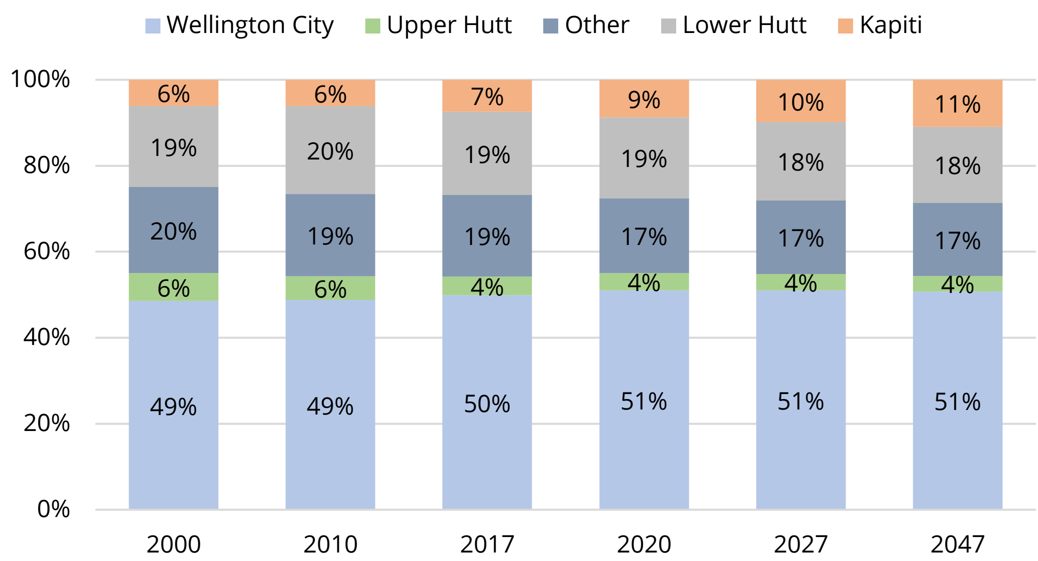
Share of Commercial employment in Wellington region, selected years



Source: Statistics New Zealand, Sense Partners

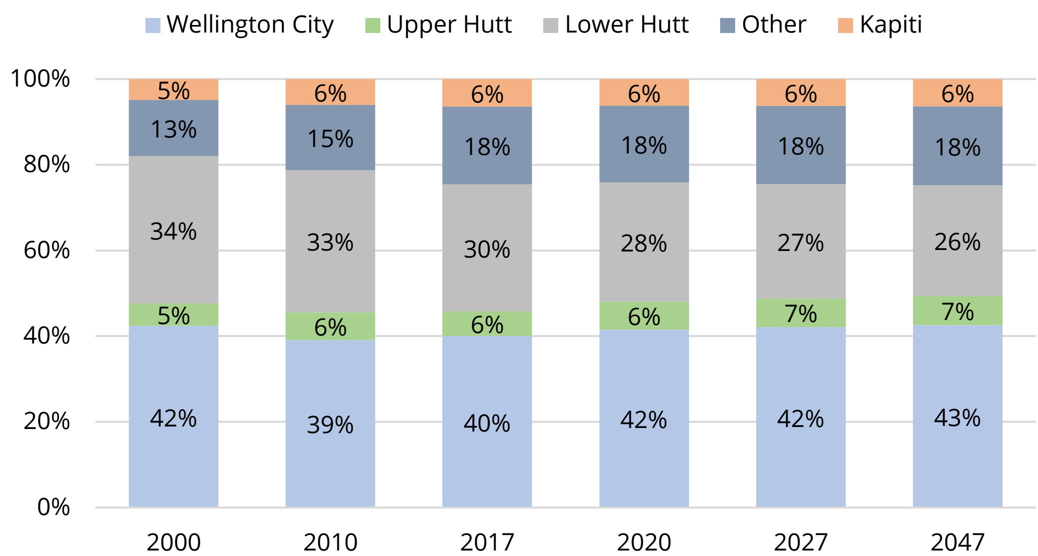
Figure 91 shows Kapiti increases its share of workers in health, education and training a little by 2047. Wellington City accounts for about half of employment in the sector over time. Kapiti also has many self-employed workers that leave the average firms size at 2.5 – unchanged from 2000 and much lower than the national average of 3.8. Industrial employment across the region is flat or declining over the forecast horizon to 2047. Figure 92 shows to expect outright declines in Lower Hutt where the share of industrial employment declines over time.

FIGURE 91: KAPITI INCREASES HEALTH, EDUCATION AND TRAINING EMPLOYMENT
Share of Health, Education and Training employment in Wellington region, selected years



Source: Statistics New Zealand, Sense Partners

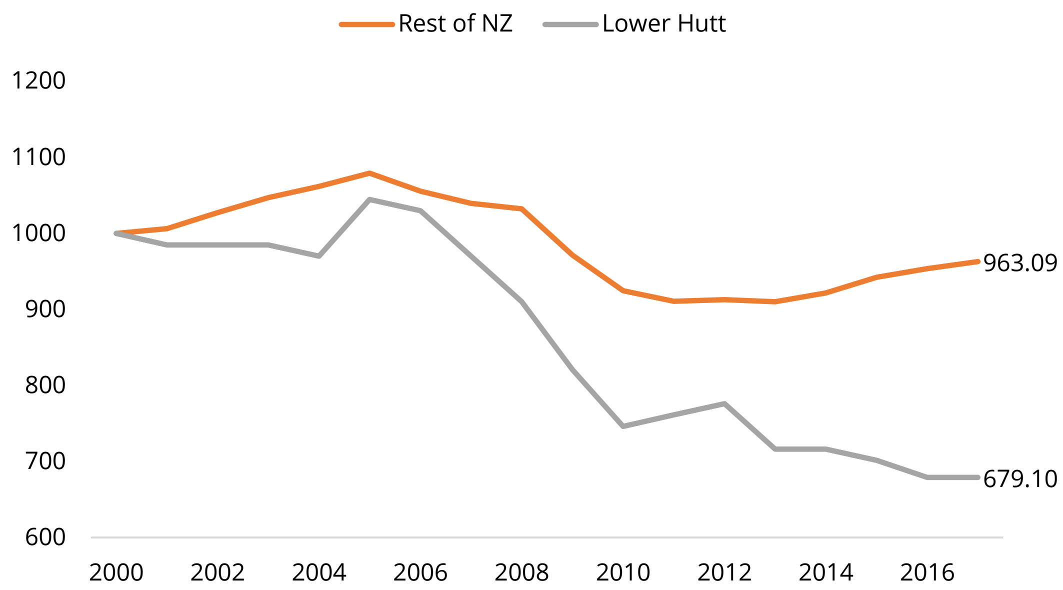
FIGURE 92: LOWER HUTT'S SHARE OF INDUSTRIAL EMPLOYMENT DECLINES
Share of Industrial employment in Wellington region, selected years



Source: Statistics New Zealand, Sense Partners

This decline stems from Lower Hutt's exposure to a declining manufacturing sector. The other growing components of industrial activity lift the relative shares of other districts. But for Lower Hutt, a persistent decline in manufacturing eats away at employment over the forecast period. Figure 93 provides an index of manufacturing employment that shows this exposure clearly. Manufacturing employment in the rest of New Zealand falls rapidly after the GFC but has stabilised and lifted in recent years. In contract manufacturing employment in Lower Hutt falls dramatically and fades away rather than stabilising in recent times.

FIGURE 93: MANUFACTURING EMPLOYMENT IN LOWER HUTT HAS NOT STABILISED
Index of manufacturing employment, year 2000=1000, Lower Hutt vs rest of New Zealand



Source: Statistics New Zealand, Sense Partners

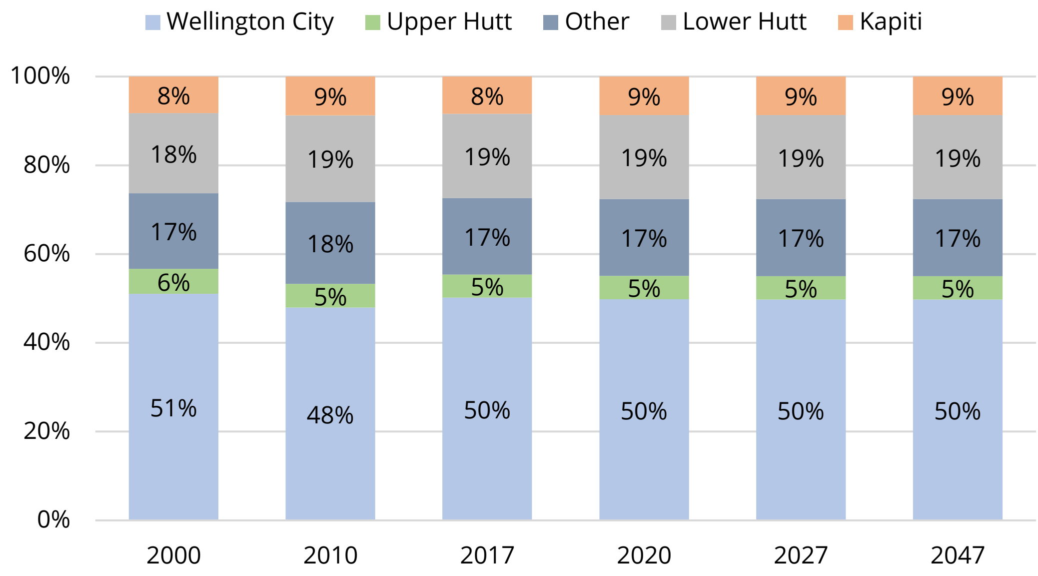
Our baseline forecast for retail activity shows stable shares of activity across the region (see Figure 94). Wellington City accounts for half of employment in the sector. Employment in the "Other" category (Porirua, Carterton, Masterson and South Wairarapa) comprises an 18% share with Lower Hutt and Kapiti also posting a share of employment.

The outlook for the retail sector is likely to be contingent on the impact on online shopping that is growing rapidly, albeit from a low base. We will return to this point in stage 3, when we consider the land requirements for different types of retail activity.

Figure 95 show the outlook for "other" industry employment in terms of share by district. "Other" industries make up 7 percent of total employment in 2017. The shares by district are relatively constant across the forecast horizon.

FIGURE 94: RETAIL EMPLOYMENT IS RELATIVELY STABLE ACROSS THE DISTRICTS

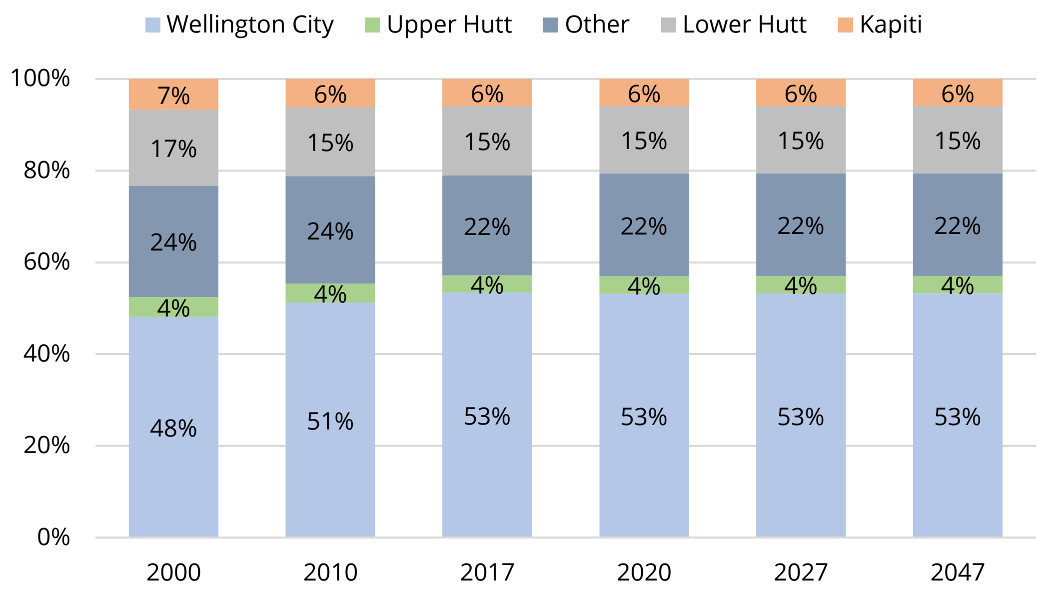
Share of Retail employment in Wellington region, selected years



Source: Statistics New Zealand, Sense Partners

FIGURE 95: DISTRICT SHARES OF "OTHER" INDUSTRY EMPLOYMENT ARE CONSTANT

Share of "Other" employment in Wellington region, selected years

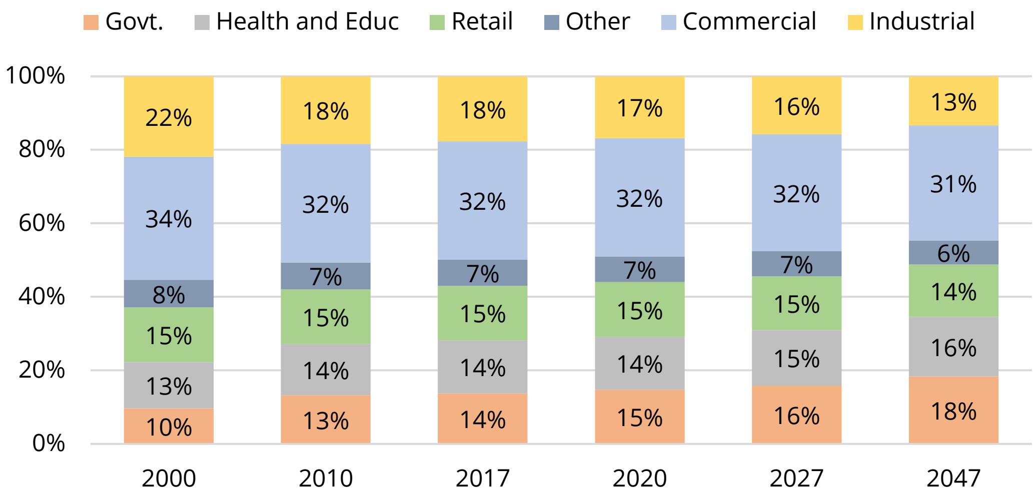


Source: Statistics New Zealand, Sense Partners

Figure 154 to Figure 177 in Appendix 2 show allocations of employment across the region. Understanding the share of employment by industry across the region provides insights into the types of movements in Figure 154 to Figure 177. While many of the shares are relatively constant (commercial and retail for example) Figure 96 shows that the industrial sector declines over the forecast period and is almost 50 percent smaller in thirty years times.

FIGURE 96: GOVERNMENT INCREASES BUT INDUSTRIAL SHARE OF REGION DECLINES

Share of employment in Wellington region, by industry type, selected years

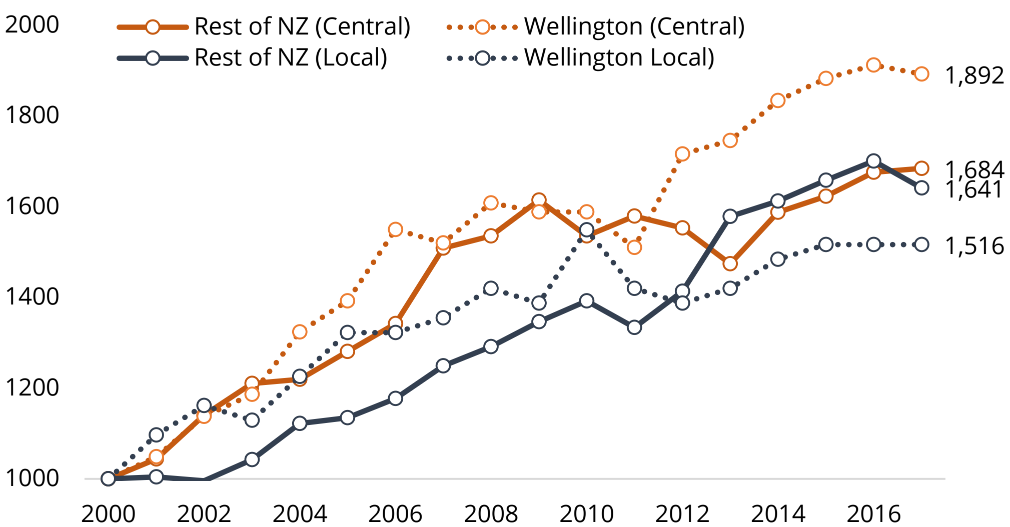


Source: Statistics New Zealand, Sense Partners

In contrast, the government sector increases over time and is a materially larger share of the economy in 30-years' time. Government sector employment is measured here by Public Administration workers which includes local government. Figure 97 takes a closer look at an index of the relative growth of central and local government employment. Central government employment within the Wellington region grows at a faster pace than local government

FIGURE 97: GOVERNMENT INCREASES BUT INDUSTRIAL SHARE OF REGION DECLINES

Index of government employment, year 2000=1000, Wellington region vs rest of New Zealand



Source: Statistics New Zealand, Sense Partners

Our local employment estimates have implications for overall economic activity. We prefer to retain employment to map to business land demand, but we can use productivity assumptions to show how economic activity, as measured by GDP, is likely to develop (see Box A).

Box A: Estimating local output by council

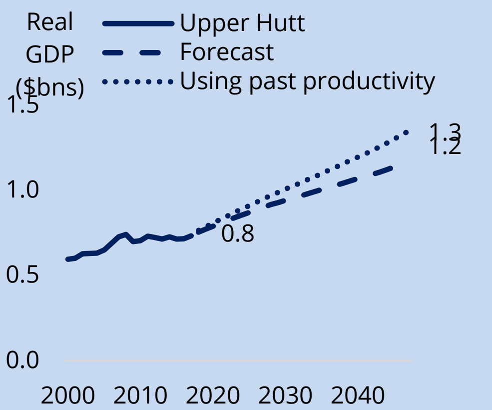
We use MBIE's Modelled Territory Authority GDP (MTAGDP) to obtain GDP estimates that account for initial differences in average earnings across each of the districts. These estimates adjust for commuting movements in and out of the district such that the GDP estimates represent value created in each district rather than value created by residents in each district.

Each council's GDP forecast is from historic local rates of productivity and a forecast where productivity grows at 1%, a little more conservative than Treasury's standard assumption of national productivity growth of 1.5 percent that has been hard to attain recently.

Our estimates show: (i) economic output in Upper Hutt is expected to hit $1 billion by 2035 (see Figure 98); (ii) economic activity in Lower Hutt is expected to increase by $1.1 billion over a 30-year period (see Figure 99); (iii) Kapiti requires a lift in productivity to substantially boost activity (see Figure 100); and (iv) Figure 101 shows that activity within Wellington City is expected to increase by a little over 50 percent over time next thirty years.

FIGURE 98: UPPER HUTT ACTIVITY HITS $1 BILLION BY 2035

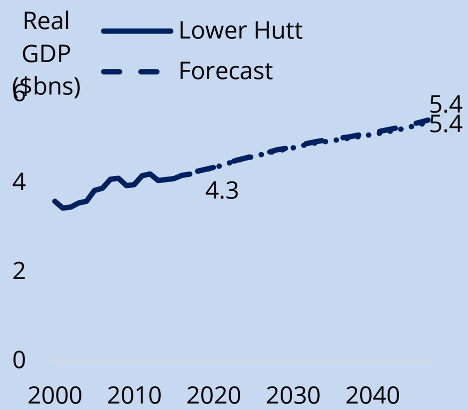
Outlook for real GDP, Upper Hutt



Source: SNZ, Sense Partners

FIGURE 99: EXPECT LOWER HUTT'S FOOTPRINT TO LIFT BY $1.1 BILLION

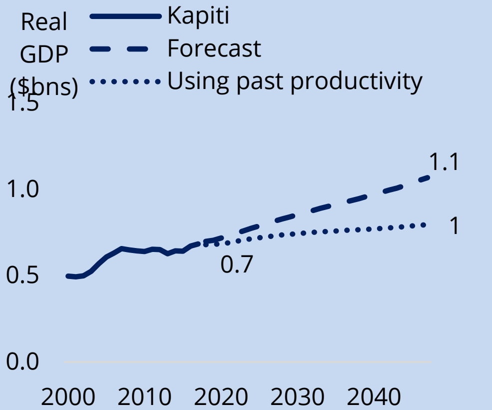
Outlook for real GDP, Lower Hutt



Source: SNZ, Sense Partners

FIGURE 100: TO GROW ACTIVITY KAPITI NEEDS PRODUCTIVITY BOOST

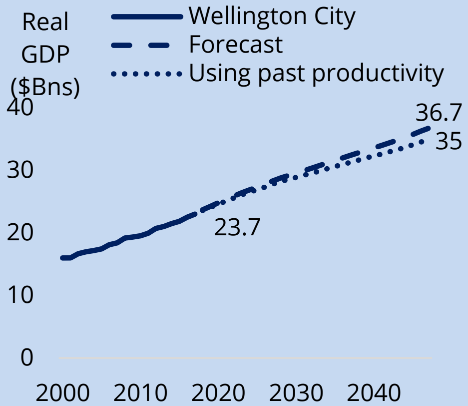
Outlook for real GDP, Kapiti



Source: SNZ, Sense Partners

FIGURE 101: WELLINGTON CITY SET TO LIFT ACTIVITY BY 50 PERCENT

Outlook for real GDP, Wellington City



Source: SNZ, Sense Partners

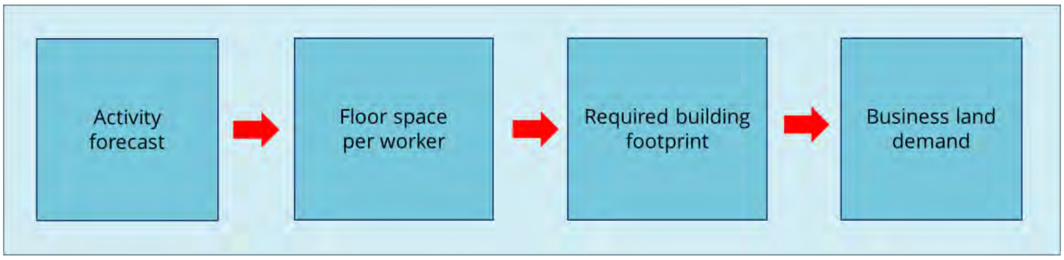
4. Business land demand

4.1 Our approach

4.1.1 The general overview

To understand future demand for business land, we use our projections of economic activity developed in section 3 to first map business demand to floorspace area. Then we turn the demand for floorspace, via an assumed building footprint, into an estimate of demand for business land. Figure 102 provides an overview of these steps.

FIGURE 102: WE USE A STAGED APPROACH TO FORECAST BUSINESS LAND DEMAND
Stylised approach to forecasting activity in section four



Source: Sense Partners

We assess demand at the regional level. We start from the premise that firms can and do switch locations within the region, so any assessment of demand needs to be made at an aggregate level. Once we have quantified demand for floorspace and land, we then allocate floorspace and land demand across each of the local councils. This is based on a simple model where firms respond to different demand and supply signals, calibrated to the existing spatial location of firms across the region.

As use of business land differs across industries, we need to project the economic shape of the regional economy. We also want to model where businesses would locate across the region. So we need a projection that allows activity to move across districts. We also need a projection that can be mapped back to Statistics New Zealand's projections for population growth rate as a benchmark.

There are considerable uncertainties when considering the economic conditions that guide firms' location choices over the next 3, 10 and 30 years. To tease out the more likely developments, we pursue two sets of scenarios, designed to address the more substantive issues. These include:

1. Stronger population growth than envisaged by Statistics New Zealand (see section 4.4)
2. Improved access to the region from the Northern corridor (see section 4.5).

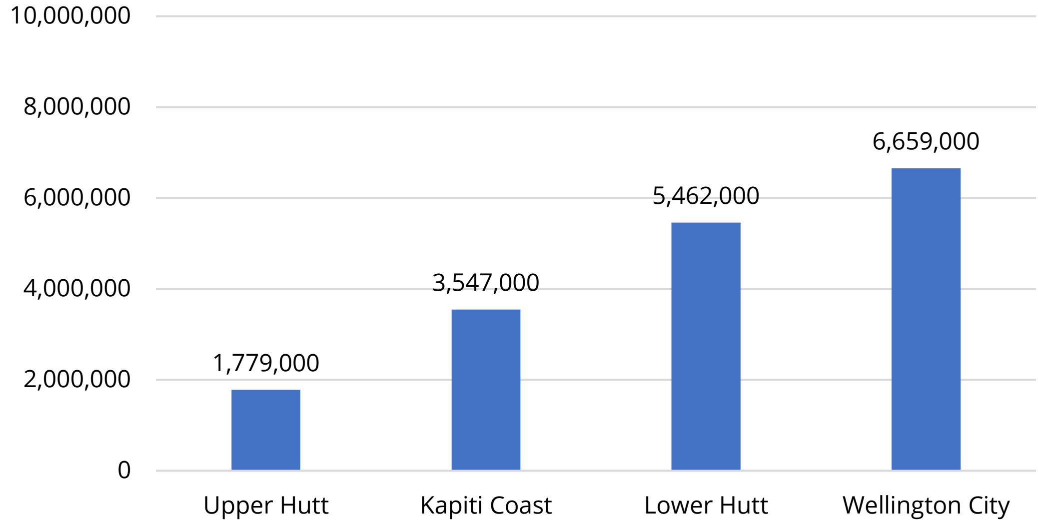
4.1.2 The current state

Business land and floorspace

Business land is dispersed across the Wellington region. Commercial and office activity dominates Wellington City, while industrial land is concentrated in Lower Hutt and Upper Hutt. Kapiti Coast contains a mix of activity. Retail activity is spread across all four councils. Lower Hutt and Wellington City contain the most business land (see Figure 103).

FIGURE 103: LOWER HUTT AND WELLINGTON CITY HOLD THE MOST BUSINESS LAND

Business land across the Wellington region by local councils in the study area



Source: Sense Partners and MR Cagney estimates

Activity type matters a lot. MBIE and the Ministry for the Environment (see the National Policy Statement on Urban Development Capacity 2017) suggests allowing for the following business space per worker:

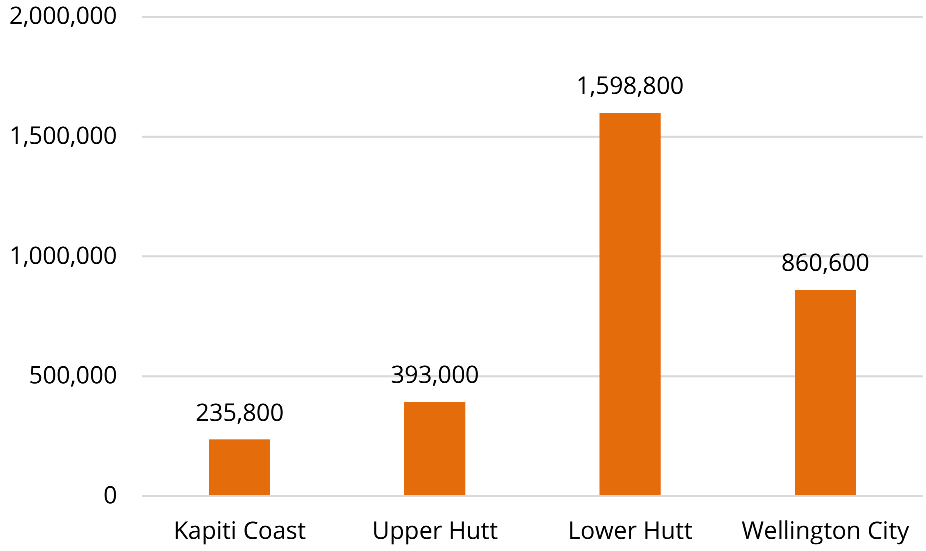
- Office: 15-20 square metres
- Retail: 30-50 square metres
- Industrial: 100-170 square metres

In addition, different business activity impacts on the building footprint, in terms of floorspace (i.e. floors) per square meter of business land. Lower Hutt has a greater share of industrial land than Wellington City (see Figure 105). But industrial land is of lower intensity, in terms of area per worker and floors to land, than commercial office space or retail activity.[6] By comparison the intensity of business floor area to business land ratios and intensity of workers to business floor area, make the Wellington CBD one of the most intensely populated business districts in New Zealand. The Lambton Quay area accommodates almost 60,000 workers, or about 2 workers for every 3 square metres of business land.

[6] Retail workers require only a third as much floorspace as industrial workers.

FIGURE 104: INDUSTRIAL ACTIVITY USES SUBSTANTIAL LAND

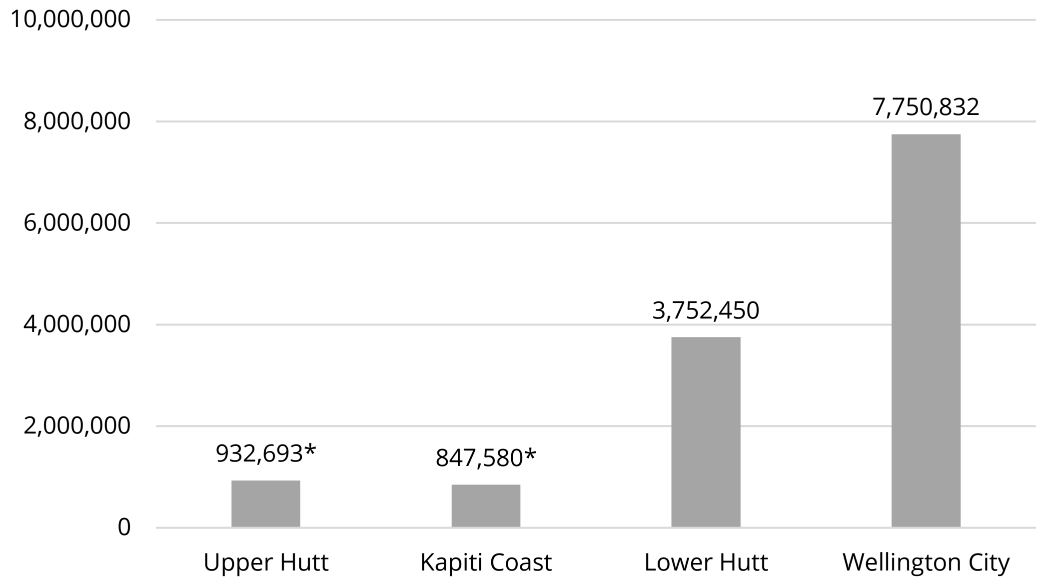
Industrial land by local council within study area



Source: Urban Economics (2016)

FIGURE 105: WELLINGTON CITY CONTAINS THE MOST FLOOR SPACE IN THE REGION

Total floor space by local area, all business land types



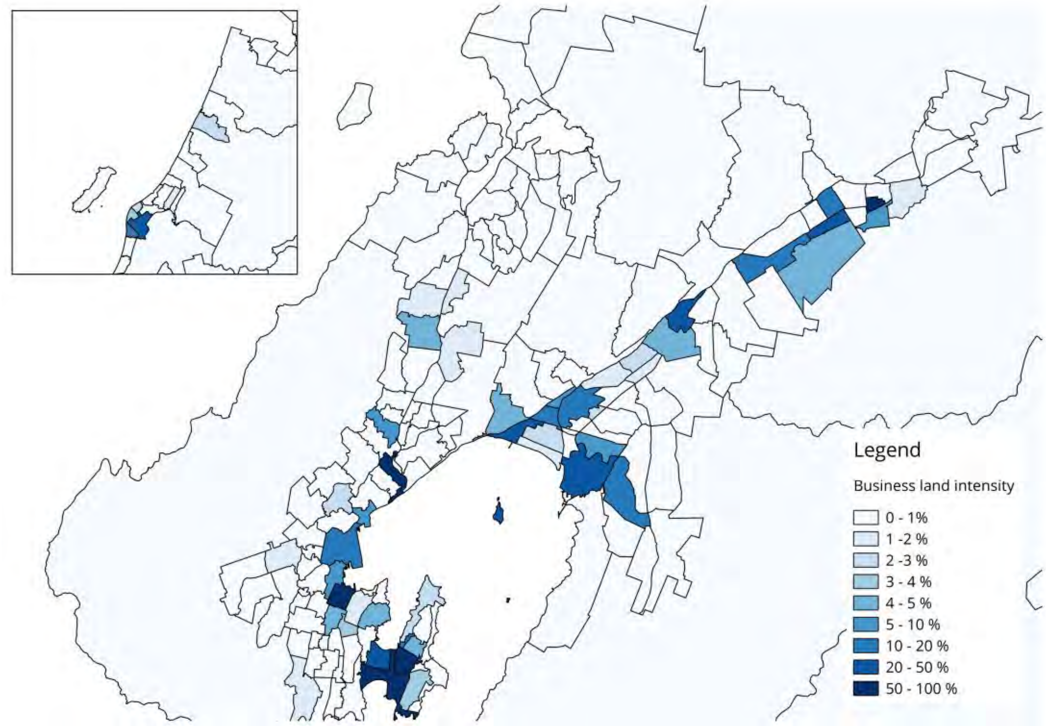
NB. * Denotes estimates based on LIDAR data rather than floorspace area records.

Source: Sense Partners and MR Cagney estimates

Zoning

To show the location of business land across the region, we map the fraction of business land by suburb using Statistics New Zealand's area unit as a definition of the suburb. The map in Figure 106 shows that business land is currently in a handful of locations and that Wellington's CDB is an extremely dense location of business activity.

FIGURE 106: WELLINGTON'S CBD IS AN INTENSE AGGLOMERATION OF WORKERS



Source: Statistics New Zealand, Sense Partners

Council zoning rules impact on the location of business land and what type of business can locate there.

While some zoning aims to avoid or minimise spill-overs from activities (such as by separating heavy industrial use from residential use), in other cases zoning allows both certain business use and residential use.

Thus zoning needs to be taken into account in our projections. Each council has its own zoning rules, which complicate the modelling. See Figure 182 in the Appendix for a detailed list.

4.2 Mapping Activity to Floorspace

4.2.1 Approach

To project future business demand for land, we need to connect our activity projections to business land use. As an intermediate step, we first map activity back to estimates of floor space demand and then map floor space demand to land demand.

Mapping economic activity to floor space demand means taking our forecasts of employment for the region and applying a forecast for the footprint, or floorspace, per worker. Since there is no consistent time series for footprint per worker, we use information from many sources to calibrate our projection. These include:

- over a specific period, the ratio of consents, by activity in the Wellington region, to the growth of employees – a signal of the capacity required to house additional workers
- explicit guidance on likely bounds from the National Policy Statement on Urban Development Capacity. These are expectations rather than standards.
- sector reports, for example the Government Property Group's Crown Office Estate Report and local commercial real estate reports
- sense checking estimates against trends, where we do have consistent data over time, such as international trends in office space per worker
- one-on-one discussions with business representatives
- discussion in a group setting with councils to test thinking.

Since there is limited data on footprint per worker, the assumptions we work with contain some uncertainty. However, the estimates are better than relying on the ranges supplied by the NPS-UDC, as these ranges miss local factors and trends over time.

4.2.2 Calibrating the footprint of economic activity

We work with six categories of economic activity – government, commercial, retail, industrial, HET (Health, Education and Training), and a catch-all 'other'. While the *economic* drivers of these categories are different, similarities in footprint per worker exist for some of the categories. For example, we expect broad similarities between the office space required per worker for government employees and the private sector, which we confirmed with international estimates and the estimates provided by the Government Property Group.

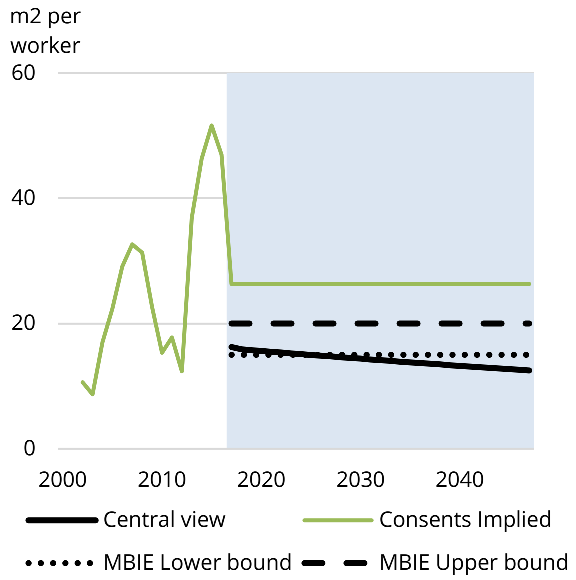
Government and commercial

Since we have no lengthy time series data on office space per worker, we use several data sources to calibrate our assumptions. We first look at the history of consented office floor space. We compare consented floorspace in the sector to additional workers in the sector as a guide to the floorspace needed to accommodate additional workers in the future.

Figure 107 and Figure 108 show that the 5-year average of consented floor space per workers is reasonably volatile. In any year, consented activity will not match realised floorspace one-for-one. But over a sufficiently long period, the average provides a reasonable guide.

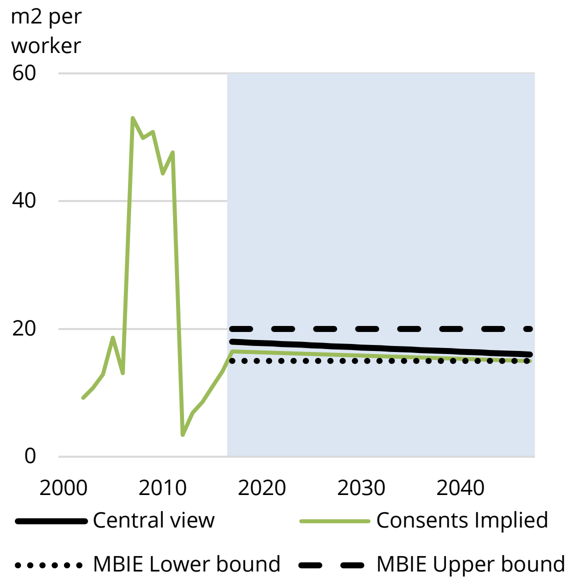
The Government Property Group provides an estimate of office space per government worker as a target range of 12-16 square metres. That range is a little higher than international comparisons for major cities where space is at a premium, so the central view we use slowly reduces office space per government worker from the current point of 17 square metres per employee to 14 square metres, the midpoint of the government target, in 30-years' time.

FIGURE 107: WORKER SPACE: GOVERNMENT



NB. Consent history is a 5-year moving average

FIGURE 108: WORKER SPACE: COMMERCIAL



NB. Consent history is a 5-year moving average

In comparison, private sector office space per worker is, at 16.5 square metres, slightly higher than the public sector at present. We reduce the rate of intensification more slowly, running office space per worker to 15 square metres, the bottom of the NPS-UDC guidance by the end of the forecast period.

While the increase in intensity looks small in absolute terms, our assumption represents a 10 percent reduction in space requirements over the 30-year period. This flows directly in our projection for business land demand. If office space per worker does not intensify at the rates we suggest, then additional business land would be required.

Mild increases in the intensity of the use of office space is entirely consistent with international experience in the past 2-3 years and the impact of technology. With desk occupancy around 30-40 percent, hot-desking is increasingly in focus with more demand for shared spaces. Expect these technology trends to continue.

Retail and Industrial

Retail workers require more space than office workers and trends in consents per additional retail worker, and the NPS-UDC guidance that suggests 30-50 square metres, guide us here.

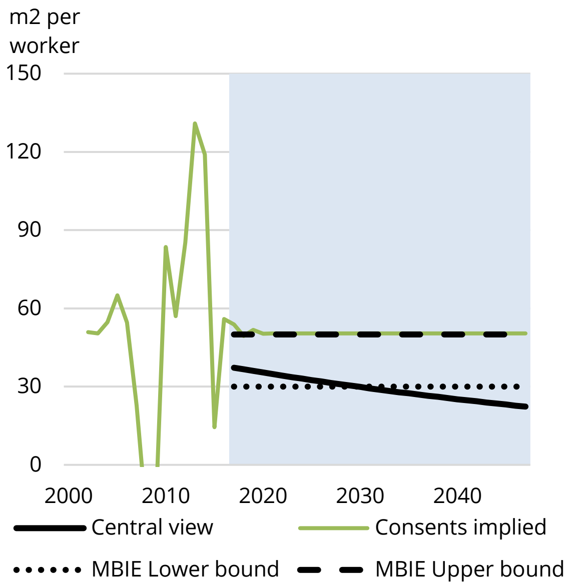
The nature of retail is changing. Increasing demand, over past decades, means Increased demand for online-shopping makes for direct competition now large format retail now competes with. While US retail space is focussed on densifying existing spaces with little new investment, the starting point for US retail space per household is many multiples higher for the US than New Zealand (see JLL 2017).

Rather than a decline, we expect demand for retail floorspace to grow more slowly in future than it has in the past. Improvements in logistics are likely to reduce, rather than increase floorspace required, as storage is increasingly pushed to shared warehouses or rapid delivery models. While the rate of decline from the current retail space per worker, from 37 to 25 square metres per worker may appear steep, the decline is approximately one percent per annum. Figure 109 shows our assumption for retail floorspace required per worker.

Industrial land carries the largest footprint per worker. While the industrial sector is relatively small in the Wellington region, the space requirements have a large impact on land needs. Consented floorspace per worker provides little guidance, with the average significantly greater than the NPS-UDC range.

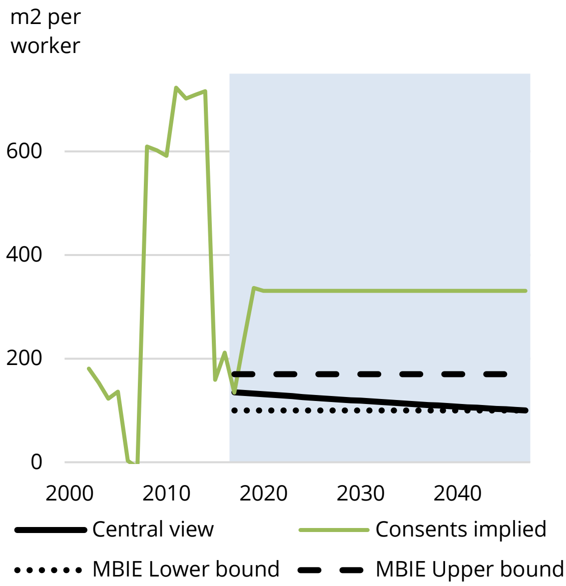
Increasingly, new uses of industrial land in the Wellington region tend to be associated with logistics and light manufacturing such as digital printing and food manufacturing. These activities do not have the same space requirements as heavy industrial activity and we gradually increase the intensity of industrial activity within our forecast (see Figure 110). Although this reduction from the current industrial floorspace per worker or 150 square metres to 100 square metres occurs only gradually, the impact on total land is substantial.

FIGURE 109: WORKER SPACE: RETAIL



NB. Consent history is a 5-year moving average

FIGURE 110: WORKER SPACE: INDUSTRIAL



NB. Consent history is a 5-year moving average

Health, Education and Training and Other

Health, education and training workers form a substantive part of the Wellington regional economy. Understanding the floorspace requirements for this sector is important for business space requirements across the region.

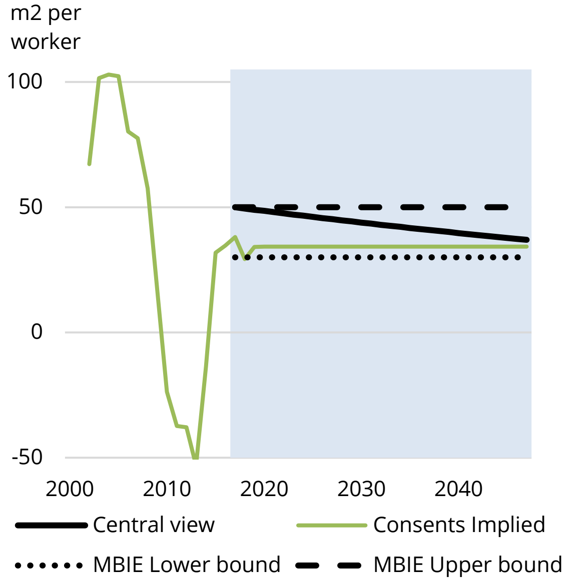
The sector is diverse and includes a tertiary sector located in both office and single storey buildings, primary and secondary schools managed by central government, and health care providers that will become increasingly important as the region ages.

Consenting activity provides little guidance for this sector. Consenting tends to be very lumpy with substantive projects interspersed with small projects.

The consented average footprint for the sector is close to retail. We consider the bounds provided by the NPS-UDC for retail as having some information content for this sector. We expose the sector to modest intensification over the forecast period and hit 100 square metres per worker by 2047.

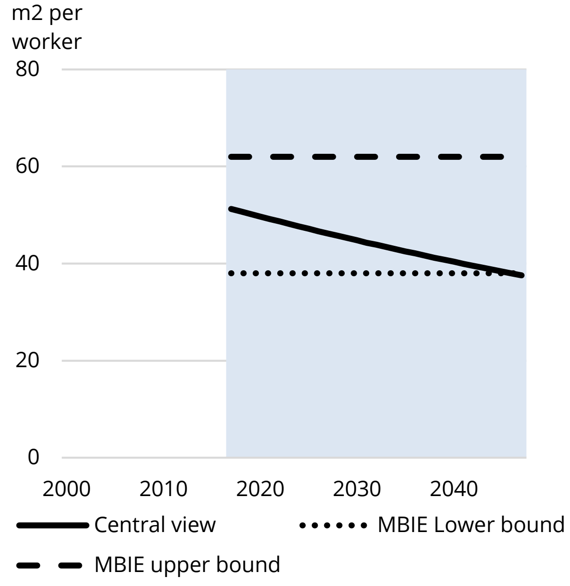
We also require an assumption for other workers that span a variety of industries. We assume a modest decline in land required for each worker. The sector intensifies from approximately 50 square metres per worker to 38 square metres by the end of the forecast period. This is the average of our assumptions across the other sectors.

FIGURE 111: WORKER SPACE: HET



NB. Consent history is a 5-year moving average

FIGURE 112: WORKER SPACE: OTHER



NB. Consent history is a 5-year moving average

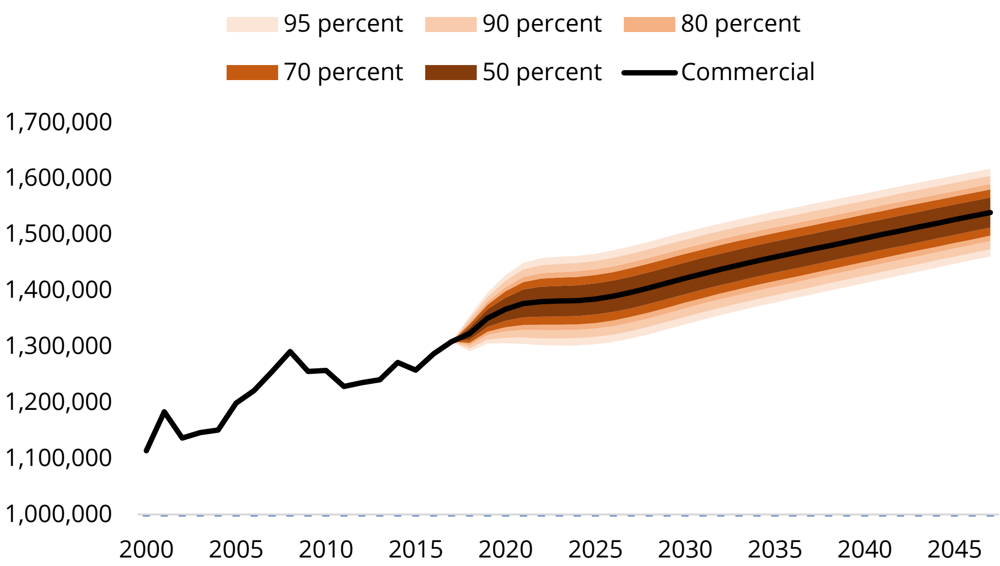
4.2.3 Demand for floorspace

Combining our forecasts of economic activity across the region with our assumptions for the floorspace required for each worker gives our forecast for total floorspace. Initially, we ignore businesses decisions about where to locate within the region and work with a regional floorspace forecast.

Commercial

Figure 113 shows our forecast for how demand for commercial floorspace evolves. From an estimated 1.3 million square metres in 2016, we expect demand to hit 1.55 million square metres in 2047.

FIGURE 113: COMMERCIAL FLOORSPACE DEMAND GROWS DESPITE INTENSIFICATION
Wellington Region, Demand for floorspace, 2000-2047, Commercial



Growth is stronger in the next five years – about 1.4 percent per annum – before slowing to about 0.5 percent per annum by 2047. The slowing of the rate of growth is driven by slow population growth in later periods, based on the Statistics New Zealand medium population projections.

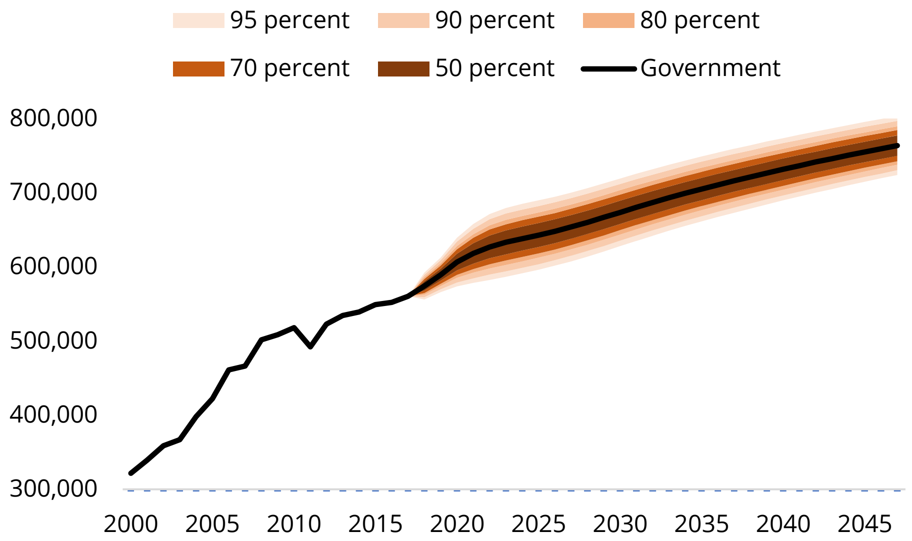
Our forecasts for economic activity from our economic model capture uncertainty about how the regional economy will evolve. We allow that uncertainty to carry through and impact on our floorspace forecast.

But there are many other factors that impact on the outlook. These include the interplay between supply and price, increasing costs of building up, and difficulties with earthquake remediation. These factors drive additional uncertainties that can change demand for business land. Councils will need to update estimates when these factors present.

Government

Figure 114 shows our projection for floorspace demand for the Government sector. This includes central and local government. From an estimate of about 400,000 square metres in 2016 the Government sector is set to grow to 550,000 square metres by 2047.

FIGURE 114: EXPECT GOVERNMENT TO REQUIRE MORE FLOORSPACE
Wellington Region, Demand for floorspace, 2000-2047, Government



Assumptions on the space required per worker have a marked effect on the outlook. If we keep the footprint per worker static at the current requirement, then the sector requires 720,000 square metres by 2047 – an increase of 72 percent.

Implicitly, our forecast assumes no change in how government chooses to situate activity. While our forecast has stronger growth in the next few years, it also focuses on averages rather than trying to pick cycles in government spending. So councils should plan on the basis of the range of outcomes rather than the precision implied by our central forecast.

Retail

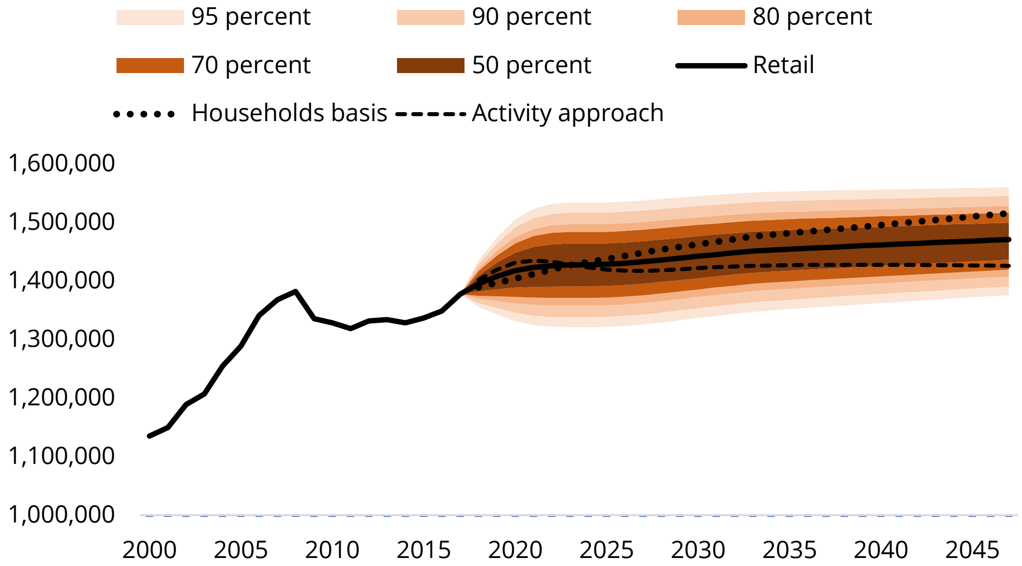
The outlook for retail is complicated by a change in technology that promotes on-line shopping and next-day delivery over traditional retailing. However, tt is easy to overstate the impacts. Right now, traditional retailing dominates online spending that accounts for about $4.4 billion or around 5% of total retail sales (see BNZ Online Retail Sales, 15 January 2018).

To help triangulate our assumptions, we augment our assessment of retail with a forecast based on the number of households in the region. The guidance on the National Policy Statement on Urban Development Capacity suggests a benchmark of 7 square metres of retail floorspace per household. So, we also construct a projection of retail floorspace on a per household basis, based on Statistics New Zealand's forecast of the number of households in the region.

Figure 115 shows the forecast based on households (dotted line) is a little stronger than our forecast based on the economic activity (dashed line). We calculate the average of the two approaches and this informs our central view on retail activity. This average implies retail space would hit 1.47 million square metres by 2047. That represents a ten percent increase in floorspace over the entire period.

FIGURE 115: DEMAND FOR RETAIL FLOORSPACE GROWS MODESTLY

Wellington Region, Demand for floorspace, 2000-2047, Retail



More material impacts of online activity on traditional retail would switch demand from retail towards industrial spaces that could be used for warehousing and logistics.

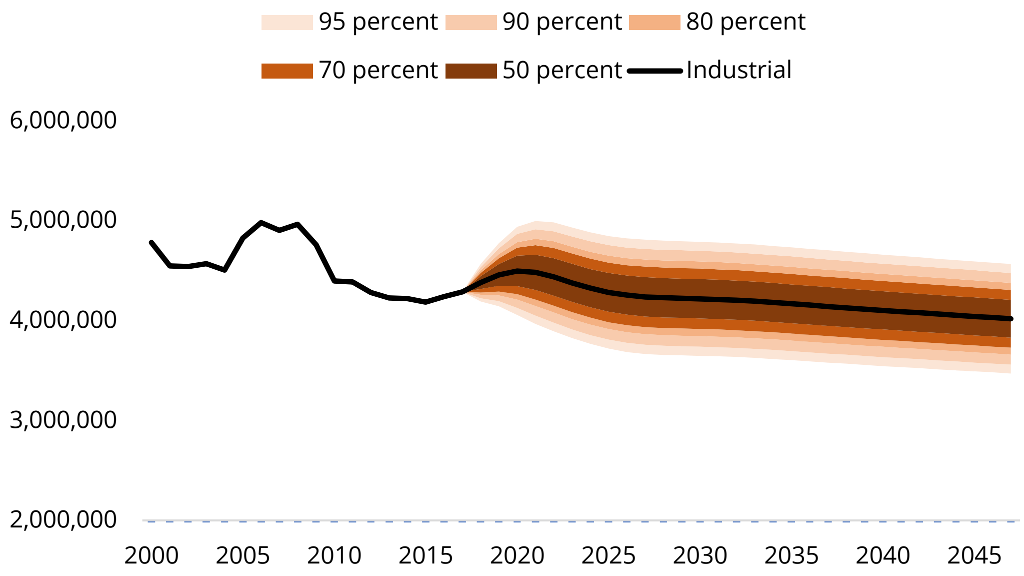
Councils will need to monitor how retail demand develops to ensure planning is appropriate for this sector and the wider community.

Industrial

In the near-term industrial land demand grows a little, reflecting a recent lift in activity. But over the long-term, the shift from industrial activity towards services, and our assumption that the floorspace required for each industrial worker declines, produces a mild decline in the demand for industrial floorspace.

Our projection for demand for industrial land is shown in Figure 116.

FIGURE 116: A CONTINUED SLOW DECLINE IN DEMAND FOR INDUSTRIAL LAND SPACE
Wellington Region, Demand for floorspace, 2000-2047, Industrial



There are upside risks to our projection. Recent activity in the sector around logistics and food manufacturing show the potential for growth within the industrial sector that has lifted a little since the trough in activity in 2014.

Resilience to earthquakes and sea-level rise are also changing the landscape for industrial land across the region. Anecdotal evidence suggests international investors are increasingly wary of locations exposed to geotechnical risks. These factors are rapidly changing the price of industrial land in different locations as firms choose different locations within the region.

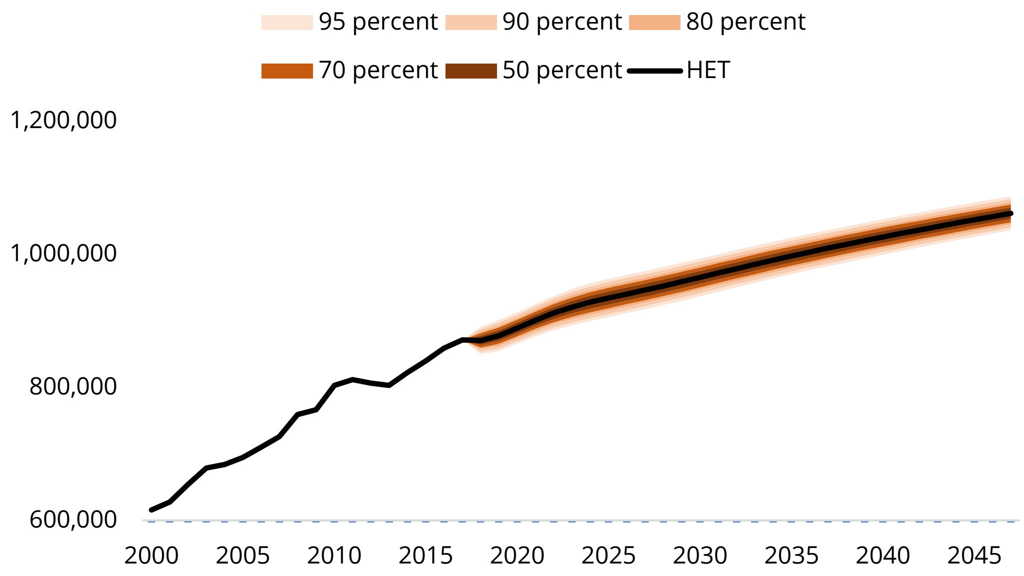
Health, Education and Training

Our projection for demand for land in the Health, Education and Training sector is relatively strong compared with other sectors. Our projection for economic activity suggests many more workers in this sector as the population ages and increased incomes lift consumption of health services. We expect activity in the education sector to continue to be buoyant, supported by growth in the tertiary sector over the forecast period.

Changes in floorspace for health, education and training tends to move in large chunky increases when infrastructure projects for hospitals or expansions of tertiary institutions are put in place. When assessing capacity, councils may well want to assess the current state of health and education facilities relative to our assessment of needs.

Over the projection horizon, we expect demand for floorspace to grow by 216,000 square metres, comprising a 25 percent increase over 30 years.

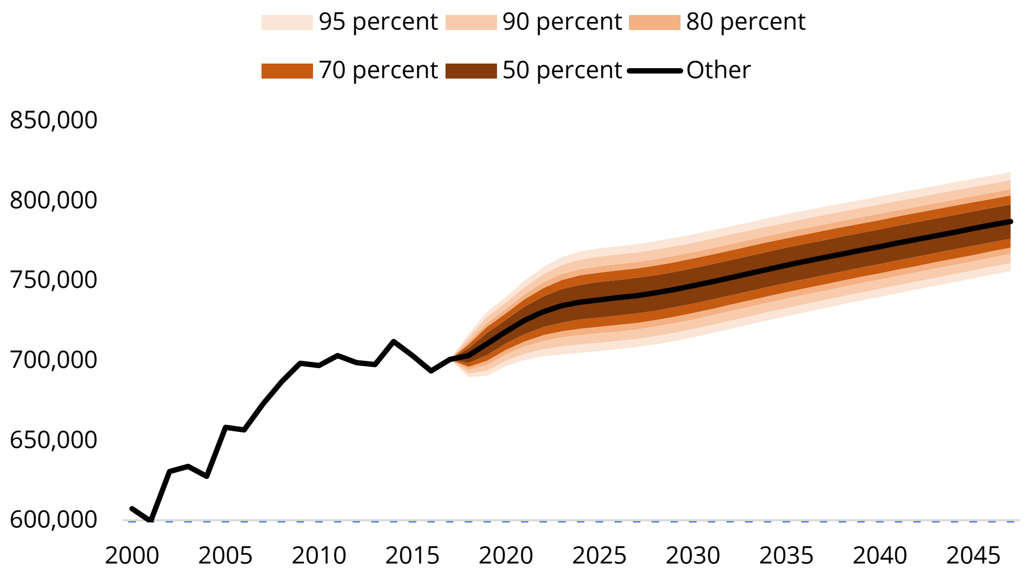
FIGURE 117: EXPECT STRONG HEALTH, EDUCATION & TRAINING FLOORSPACE DEMAND
Wellington Region, Demand for floorspace, 2000-2047, Health, Education and Training (HET)



Other

Our catch-all "other" category suggests 12 percent growth in floorspace in demand over the next 30 years, requiring an additional 86,000 square metres by 2047. We assume modest increases in the intensity of the use of space that are average increases in intensity of our regular categories.

FIGURE 118: MODEST FLOORSPACE DEMAND GROWTH FROM OTHER FIRMS IS LIKELY
Wellington Region, Demand for floorspace, 2000-2047, Other



4.3 From floorspace to land

4.3.1 Approach

To move from floorspace to demand for business land, we need to use a FAR (floor-to-area ratio) to convert floorspace to demand for land. In addition, to understand how much additional land might be required, we first need to know the existing stock of business land.[7] With a floor-to-area ratio in hand, we can then use our floorspace projections to quantify demand for business land across the region.

4.3.2 Data and methodology

Our analysis relies upon 4 key sources of data, provided by councils in GIS shapefile format:

- Land Information New Zealand (LINZ) data was used to identify the location and shape of parcels, as well as the number of property titles associated with each parcel
- Council zoning maps, as at late 2017, were used to identify the zoning of each individual parcel and hence to identify sites that are zoned for business use
- LIDAR (light detection and ranging) data on building footprints identify the area covered by buildings, and (for Wellington and Lower Hutt) the height of buildings
- Ratings database information provided additional information on property values and (for Wellington,Lower Hutt and Kapiti) the amount of floorspace on each site.

Figure 119 summarises the data sources we used to identify the level of development on business-zoned sites, and (to some degree) the allocation of uses within buildings. Some GIS data required extensive checking and cleaning prior to use (see Appendix 3).

FIGURE 119: DATA SOURCES TO EVALUATE BUSINESS ZONED LAND DEVELOPMENT

Data source	Wellington City	Lower Hutt	Upper Hutt	Kapiti Coast[8]
Site area	Yes	Yes	Yes	Yes
Zoning	Yes	Yes	Yes	Yes
Building footprints	Yes	Yes	Yes	Yes
Building height	Yes	Yes		
Number of titles	Yes	Yes	Yes	Yes
Land relative to capital values	Yes	Yes	Yes	Yes
Total floorspace	Yes	Yes		Yes

Source: Local councils

[7] The charts in section 3 combine activity with our floorspace requirements per worker to estimate current floorspace use by our industrial groupings.
[8]Kapiti also provided further property and GIS information to support analysis of measures and fill gaps from sources identified above.

4.3.3 Stock of zoned land in each council

Before moving to estimating demand for business land we need to first understand the existing stock of business land, including:

- the average degree of development on existing sites
- the development level of sites in different locations, (using ratings valuation data)
- building footprints (using LIDAR data).

Figure 120 breaks down land according to the current level of development. Land to Capital values, the LV/CV ratios, categorise sites according to how 'developed' they are. A low LV/CV ratio indicates improvement values make up most site valuations. A high LV/CV ratio indicates a site is vacant or home to small or low-value developments. This indicates:

- Wellington City's business-zoned sites are more likely to have low LV/CV ratios – 6% of sites have ratios under 0.2 (where buildings make up more than 80% of the value of the site), and another 31% have ratios under 0.4.
- However, 19% of business-zoned land in Wellington City has a ratio over 0.8, indicating that land makes up the majority of site value.
- Lower Hutt has less land with a low LV/CV ratio and more with a high ratio – 27% of land has a LV/CV ratio over 0.8.
- Business land in Upper Hutt is more likely to have a low level of development – 37% of land has an LV/CV ratio over 0.8
- For Kapiti, a third of business land by area is over 0.8 but a third of land is between 0.6-0.7, which comes from town centre and industrial uses.

Figure 121 summarises the total quantity of zoned land, by council area. We exclude sites under 200 square metres since these sites appear to be 'slivers' of undevelopable land like berms.[9]

LIDAR data also provides information on site coverage ratios and floor area ratios.

In general:

- Site coverage ratios (SCR) are higher in Wellington City and Lower Hutt than in Kapiti Coast or Upper Hutt. (Wellington's average SCR is 0.39, excluding the large Airport zone.) This suggests either:
    a. there is more undeveloped land in the latter councils, or
    b. development intensity is generally higher in inner areas.

[9] There were around 2,200 sites under 200m2, comprising 29% of the total business-zoned sites in the dataset. However, they only accounted for 1.3% of the total land area and hence their exclusion is immaterial to the results.

- Estimated building heights are generally higher in Wellington City than in Lower Hutt. In Lower Hutt, average building heights are two storeys or less in most zones.
- Average lot sizes are generally larger in industrial zones than in commercial or centre zones. This reflects demand for larger floorplates for industrial activities.

These results provide a guide to the quantity of business-zoned land and the level of existing development in different locations. These results can be filtered further to drill further into the characteristics of business-zoned land.

FIGURE 120: LV/CV RATIOS VARY SPATIALLY ACROSS THE REGION

Distribution of LV/CV ratios for business land in Wellington councils

TA / zone	LV/CV ratio						Total land
	0.0 - 0.2	0.2 -0.4	0.4 -0.6	0.6 -0.8	0.8 -1.0	Missing	
Kapiti Coast District	**2%**	**19%**	**29%**	**20%**	**26%**	**3%**	**362**
Airport Zone	0%	20%	20%	20%	0%	40%	127
District Centre	6%	20%	26%	18%	24%	6%	69
Industrial	2%	22%	25%	19%	30%	2%	115
Local Centre	9%	22%	39%	26%	4%	0%	5
Outer Business Zone	1%	12%	36%	21%	29%	1%	26
Town Centre	1%	19%	32%	22%	22%	3%	20
Lower Hutt City	**1%**	**15%**	**28%**	**24%**	**27%**	**4%**	**546**
Avalon Business	0%	41%	6%	44%	9%	0%	10
Central Commercial	14%	20%	31%	16%	17%	2%	37
General Business	0%	11%	30%	19%	36%	3%	294
Petone Comm. - Area 1	3%	23%	26%	37%	10%	1%	6
Petone Comm. - Area 2	0%	18%	38%	20%	22%	2%	29
Special Business	1%	16%	23%	37%	16%	7%	149
Special Commercial	0%	0%	10%	14%	76%	0%	1
Suburban Commercial	3%	26%	43%	19%	8%	2%	21
Upper Hutt City	**6%**	**21%**	**16%**	**14%**	**37%**	**6%**	**178**
Business Commercial	6%	37%	15%	15%	26%	2%	45
Business Industrial	6%	16%	16%	14%	41%	7%	133
Wellington City	**6%**	**31%**	**18%**	**19%**	**19%**	**7%**	**666**
Airport	3%	67%	2%	26%	2%	0%	146
Business 1	7%	21%	22%	17%	33%	1%	67
Business 2	8%	28%	28%	4%	32%	0%	148
Central Area	8%	17%	16%	24%	17%	19%	233
Centre	1%	20%	33%	20%	25%	1%	71
Curtis St Business	0%	0%	0%	0%	100%	0%	1
Grand total							**1752**

Source: Local councils

Lastly, we use LIDAR data to show how intensity of development varies within the largest zones in each council. This illustrates variation in development outcomes in each area.

FIGURE 121: SUMMARY OF BUSINESS-ZONED LAND BY COUNCIL AND BUSINESS ZONE

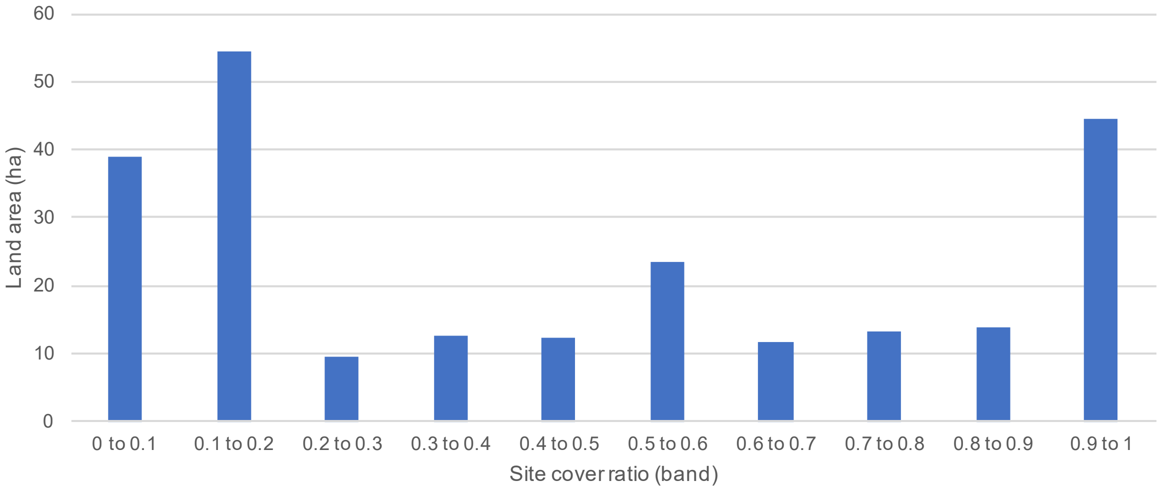
TA / zone	Number of parcels	Total land area (ha)	Total floor area (LIDAR estimate)	Total building footprint (LIDAR)	Average parcel size (m2)	FAR-LIDAR	SCR-LIDAR	Implied average building height
Kapiti Coast District	**946**	**354.7**	**489,731**	**451,079**	**3,750**	**0.13**	**0.13**	
Airport Zone	12	126.6	29,493	30,279	105,504	0.02	0.02	
District Centre	58	68.7	88,854	77,704	11,852	0.12	0.11	
Industrial	422	102.0	205,560	205,336	2,416	0.18	0.20	
Local Centre	25	5.0	10,000	8,162	1,981	0.20	0.16	
Outer Business Centre Zone	133	32.0	42,873	47,809	2,408	0.16	0.15	
Town Centre	296	20.4	112,951	81,788	690	0.55	0.40	
Lower Hutt City	**2,475**	**546.2**	**3,752,450**	**1,997,040**	**2,207**	**0.69**	**0.37**	**1.9**
Avalon Business	48	9.5	133,846	26,224	1,988	1.40	0.27	5.1
Central Commercial	386	36.6	503,565	228,024	949	1.37	0.62	2.2
General Business	1,119	294.1	1,657,323	910,536	2,628	0.56	0.31	1.8
Petone Commercial - Area 1	145	6.1	67,654	39,082	421	1.11	0.64	1.7
Petone Commercial - Area 2	249	28.5	296,648	154,302	1,145	1.04	0.54	1.9
Special Business	224	148.7	999,166	535,330	6,639	0.67	0.36	1.9
Special Commercial	3	1.2	5,475	5,475	3,912	0.47	0.47	1.0
Suburban Commercial	301	21.5	88,775	98,066	714	0.41	0.46	0.9
Upper Hutt City	**841**	**177.9**		**496,376**	**2,116**		**0.28**	
Business Commercial	492	45.3		180,326	920		0.40	
Business Industrial	349	132.6		316,050	3,801		0.24	
Wellington City	**3,305**	**665.9**	**7,750,832**	**2,138,473**	**2,015**	**1.16**	**0.32**	**3.6**
Airport	50	146.1	347,683	102,313	29,218	0.24	0.07	3.4
Business 1	315	66.9	546,022	275,456	2,122	0.82	0.41	2.0
Business 2	230	148.1	670,205	320,140	6,439	0.45	0.22	2.1
Central Area	1,691	233.1	5,634,178	1,068,155	1,378	2.42	0.46	5.3
Centre	1,012	70.7	552,744	372,410	699	0.78	0.53	1.5
Curtis St Business	7	1.1	0	0	1,559		0.00	
Grand total	**7,567**	**1,745**		**5,082,968**	**2,306**		**0.29**	

Source: Local councils

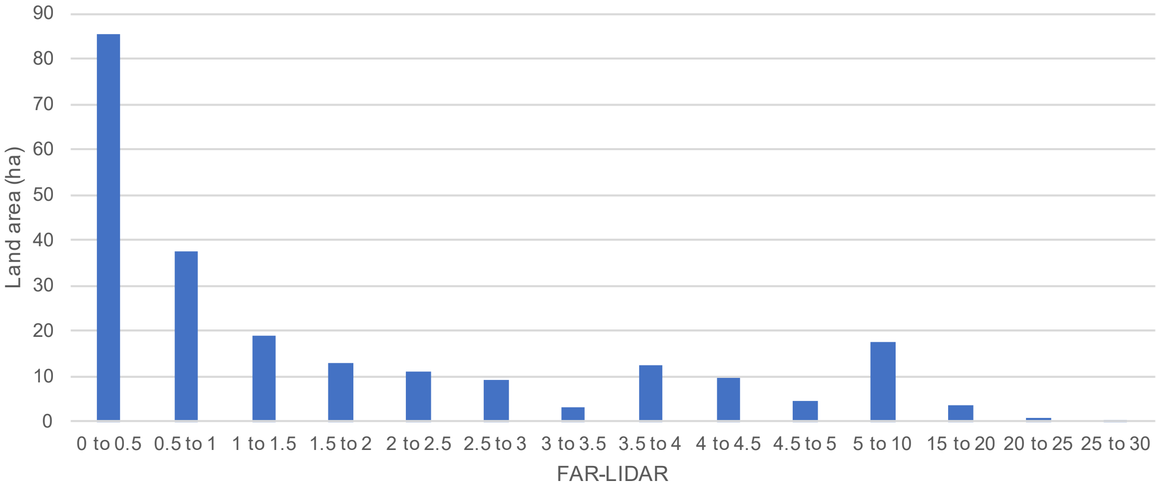
Figure 122 shows the distribution of the site-cover ratio and the FAR-LIDAR measure for Wellington's Central Area. Note that, even in this highly developed area, there are many sites with low FARs, and low site coverage. This may reflect vacant sites in the area, or some errors with the underlying data, that we have not been able to identify.

FIGURE 122: DISTRIBUTIONS OF BUSINESS LV/CV RATIOS FOR WELLINGTON CITY

Panel A: Distribution of site cover ratio



Panel B: Distribution of FAR-LIDAR



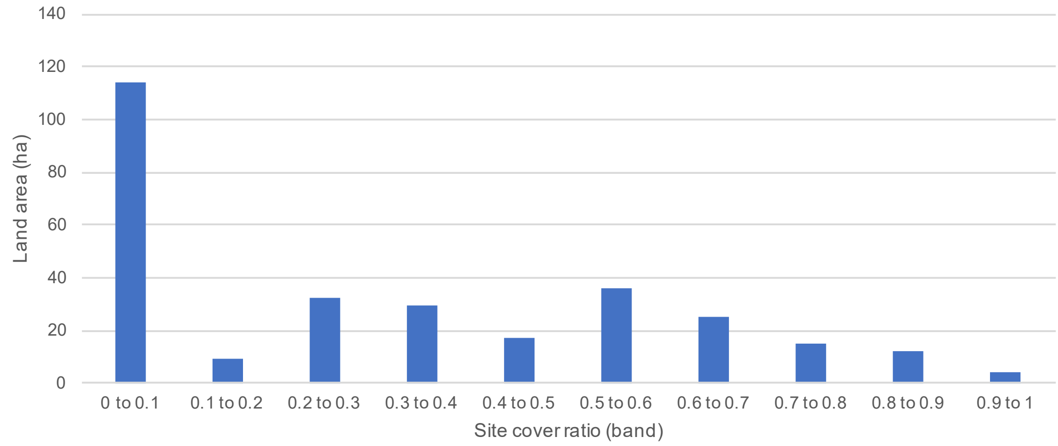
Source: Local councils, MRCagney

Figure 123 shows the distribution of these measures in Lower Hutt's General Business zone, which accounts for over half of the business-zoned land in this area.

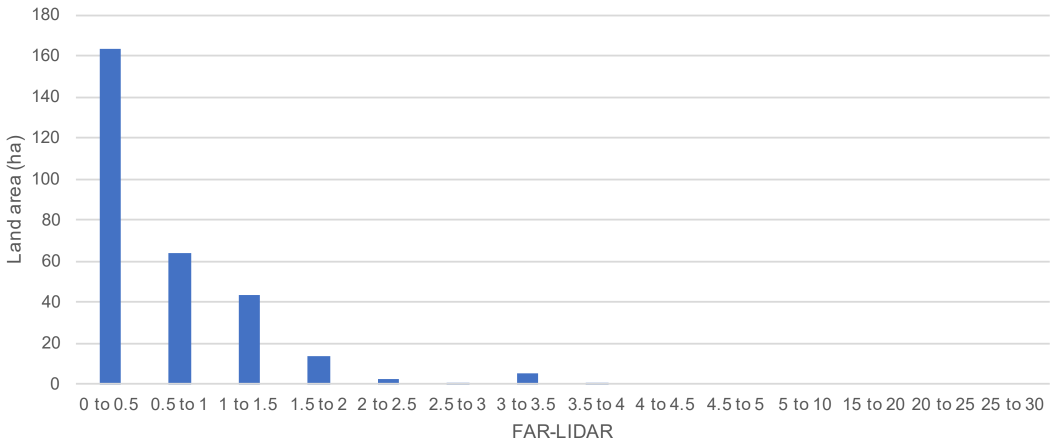
This shows a markedly different pattern: (i) fewer highly-developed sites; and (ii) no FARs above 5. Excluding many sites with very low site coverage, the median SCR is about 0.5-0.6.

FIGURE 123: DISTRIBUTION OF FAR-LIDAR AND SCR-LIDAR IN LOWER HUTT'S ZONES

Panel A: Distribution of site cover ratio



Panel B: Distribution of FAR-LIDAR



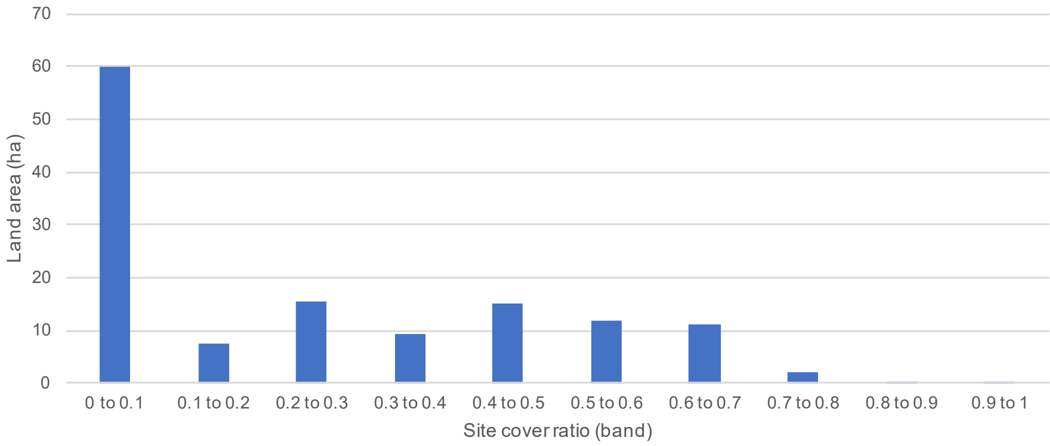
Source: Local councils, MRCagney

Figure 124 shows the distribution of SCRs in Upper Hutt's industrial and commercial zones.

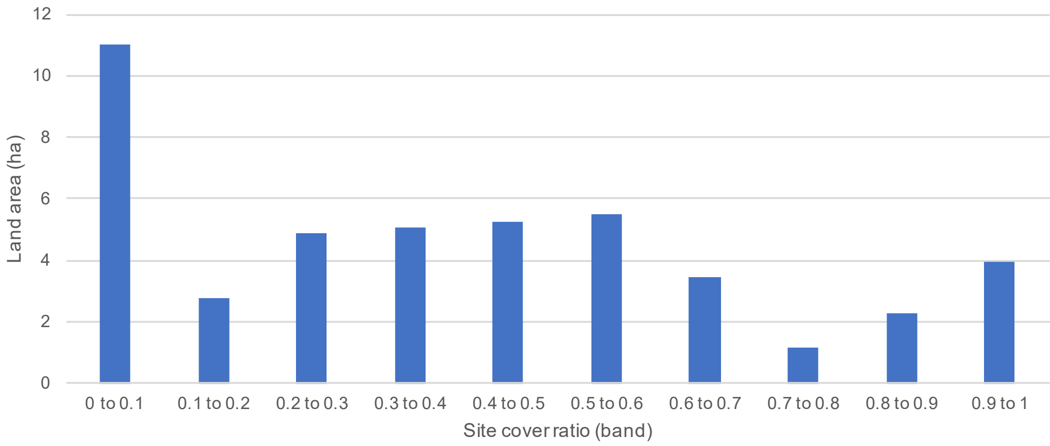
The first panel shows a very similar distribution to Lower Hutt's General Business zone, while the second panel shows greater variation in SCRs, including some sites that are nearly fully built out on the ground level.

FIGURE 124: DISTRIBUTION OF FAR-LIDAR AND SCR-LIDAR IN UPPER HUTT'S ZONES

Panel A: Distribution of site cover ratio



Panel B: Distribution of FAR-LIDAR

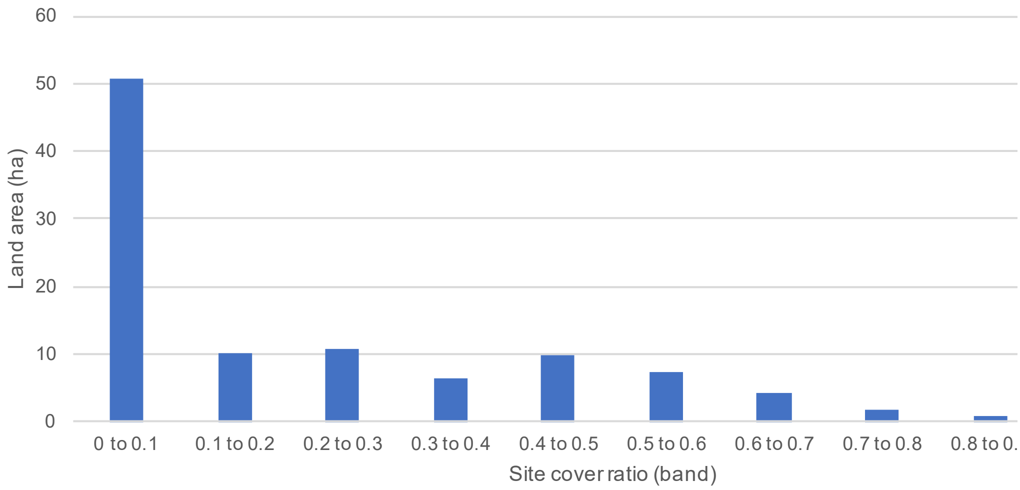


Source: Local councils, MRCagney

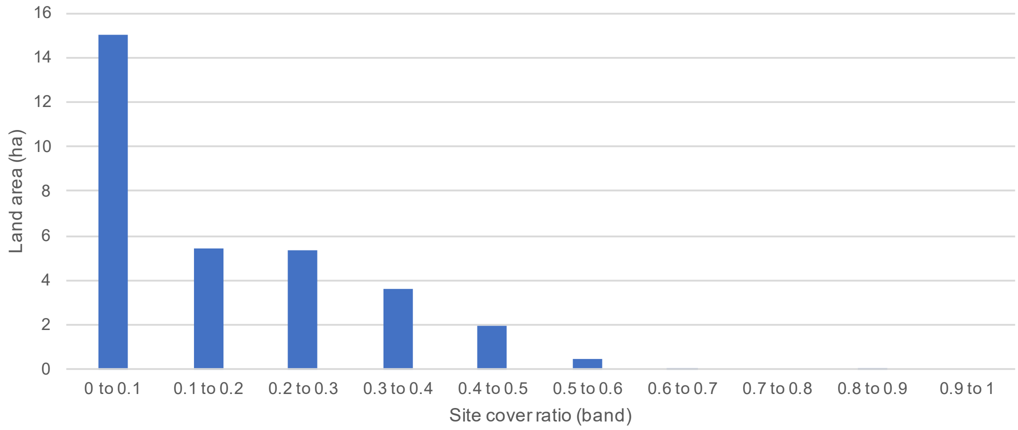
Finally, the following diagram shows the distribution of SCRs in selected industrial and commercial zones in Kapiti Coast. The first panel shows a very similar distribution to other industrial zones, while the second panel shows generally lower SCRs in the Outer Business Centre zone, reflecting its role as a 'big box' retail area.

FIGURE 125: DISTRIBUTION OF SCR-LIDAR IN SELECTED KAPITI BUSINESS ZONES

Panel A: Distribution of site cover ratio in industrial zone



Panel B: Distribution of SCR-LIDAR in Outer Business Centre zone



Source: Local councils, MRCagney

4.3.4 Floor area ratios by council and activity type

To account for variation in FARs, we suggest a set of summary-FARs for 3 broad business activities – industry, retail, and office-based businesses (including government services) – in each of the council areas. Figure 126 summarises these FARs and explains how they are derived. There are some caveats on the application of these values:

1. They reflect averages, and the distribution of outcomes on individual sites is likely to differ. Sites largely undeveloped to any significant extent are excluded.

2. Office activities in some areas are likely to build up, and as a result may take place on the same sites as retail activities or rental activities. So, in central areas, demand for office floorspace (the vertical dimension) will also matter in addition to land needs.

3. We recommend sensitivity tests (using the values Figure 126), to reflect uncertainty about the distribution of outcomes in practice or the underlying quality of data.

FIGURE 126: ESTIMATED FARS FOR BUSINESS ACTIVITIES IN WELLINGTON COUNCILS

Activity	Estimated FAR	Derivation
		Wellington City
Industry	0.4 (Sensitivity: 0.5)	Industrial activities are likely to predominantly occur on the ground floor, rather than in multi-storey buildings. Excluding sites with an SCR under 0.1, the average SCR-LIDAR in Wellington's Business 1 and 2 zones is 0.39. The SCR in the Business 1 zone is slightly higher (0.5) and could be used as a baseline.
Retail	0.75 (Sensitivity: 1.0)	Excluding sites with an SCR under 0.1, the average FAR-LIDAR in centre zones (where many retail activities are concentrated) is 0.86. Adjusting for overestimates due to use of LIDAR data, this indicates a FAR of around 0.75. City centre retail may have a larger FAR due to the propensity to use up a larger share of the ground storey.
Office-based businesses	5.0 (Sensitivity: 2.5)	Excluding sites with an SCR under 0.1, the average FAR-LIDAR in the central area is 2.88. Adjusting for overestimates, this indicates a FAR of around 2.5. However, the distribution of FARs in the city centre has a local peak in the 5-10 range. This suggests that buildings of this size are typical for office purposes. Consequently, a higher value should be used as a baseline.
		Lower Hutt City
Industry	0.4 (Sensitivity: 0.5)	Industrial activities are likely to predominantly occur on the ground floor, rather than in multi-storey buildings. Excluding sites with an SCR under 0.1, the average SCR-LIDAR in Lower Hutt's General Business zone (which enables industrial activities as well as non-industrial activities) zone is 0.50. The average SCR in the Special Business zone, which enables hazardous industrial activities at Seaview, is slightly lower at 0.44.
Retail	0.7 (Sensitivity: 0.5)	Outside central areas, retail activities are likely to predominantly occur on the ground floor, rather than in multiple storeys. Excluding sites with an SCR under 0.1, the average SCR-LIDAR in Lower Hutt's Central Commercial zone is 0.69. They are lower in the Special Commercial and Suburban Commercial zones (0.48).
Office-based businesses	1.3 (Sensitivity 2.5)	Excluding sites with an SCR under 0.1, the average FAR-LIDAR in Lower Hutt's Central Commercial zone is 1.53. This is used as a proxy for the density of office buildings outside central Wellington. Adjusting for overestimates, this indicates a FAR of around 1.3.

		Upper Hutt City
Industry	0.4 (Sensitivity: 0.5)	Industrial activities are likely to predominantly occur on the ground floor, rather than in multi-storey buildings. Excluding sites with an SCR under 0.1, the average SCR-LIDAR in Upper Hutt's Business – Industrial zone is 0.42.
Retail	0.5 (Sensitivity: 0.7)	Outside central areas, retail activities are likely to predominantly occur on the ground floor, rather than in multiple storeys. Excluding sites with an SCR under 0.1, the average SCR-LIDAR in Upper Hutt's Business – Commercial zone is 0.52. (The sensitivity test is drawn from Lower Hutt data.)
Office-based businesses	1.0 (Sensitivity: 1.3-2.0)	Excluding sites with an SCR under 0.1, the average improvement value per square metre of land in Upper Hutt's Central Commercial zone is $2410/m2. Based on the average relationship indicated in our analysis this suggests that there is roughly 1 square metre of floorspace per square metre of land. This is used as a proxy for the density of office buildings in Upper Hutt.
		Kapiti Coast District
Industry	0.4 (Sensitivity: 0.5)	Industrial activities are likely to predominantly occur on the ground floor, rather than in multi-storey buildings. Excluding sites with an SCR under 0.1, the average SCR-LIDAR in Kapiti Coast's Industrial zone is 0.38.
Retail	0.5 (Sensitivity: 0.35 to 0.5)	Outside central areas, retail activities are likely to predominantly occur on the ground floor, rather than in multiple storeys. Excluding sites with an SCR under 0.1, the average SCR-LIDAR in Kapiti Coast's District Centre, Local Centre, and Town Centre zones is 0.4. Ratios are slightly lower in the District Centre and Local Centre (0.35).
Office-based businesses	0.7 (Sensitivity: 1.0)	In Lower and Upper Hutt, average FARs in commercial zones are estimated to be 50% to 100% higher than average site coverage. This indicates a trend towards a mix of one and two storey buildings. If a similar relationship applies in Kapiti Coast, it would indicate FARs for office-based activities that are in the range of 0.7 to 1.0.

Source: MRCagney

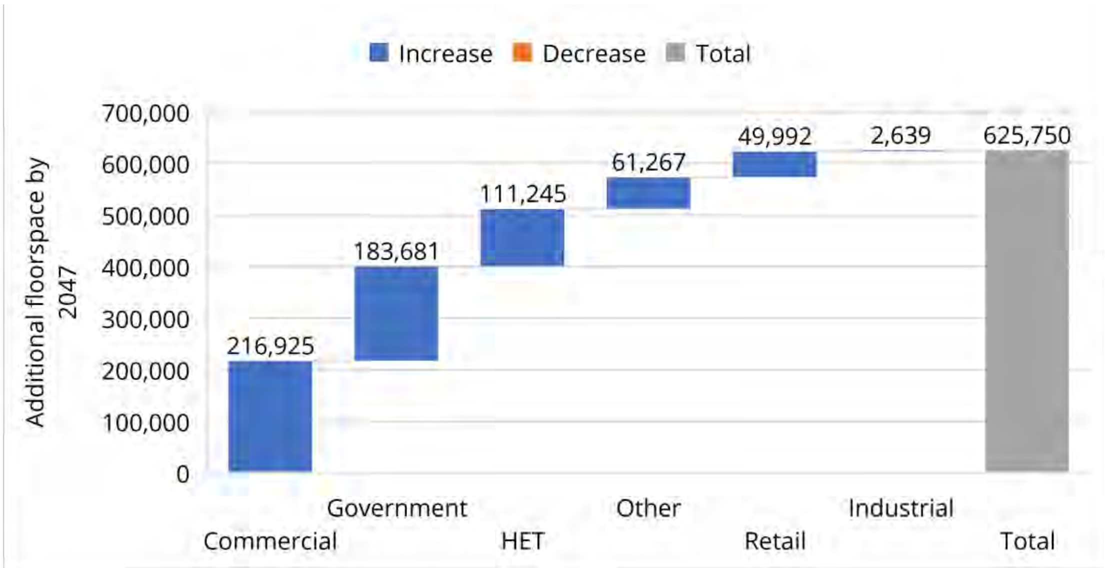
4.3.5 Demand for business land

Floorspace

To project land demand, we use our local council activity estimates from the stage 2 report, to allocate floorspace demand to local councils, and then use our FAR estimates to construct business land demand. We summarise space demand in Figure 127 to Figure 130. A range of industries lift total floorspace demand in Wellington City by 625,750 square metres or about 11 percent. Less demand for industrial space reduces total demand for Lower Hutt.

FIGURE 127: WELLINGTON CITY REQUIRES AN ADDITIONAL 625,750 SQUARE METRES

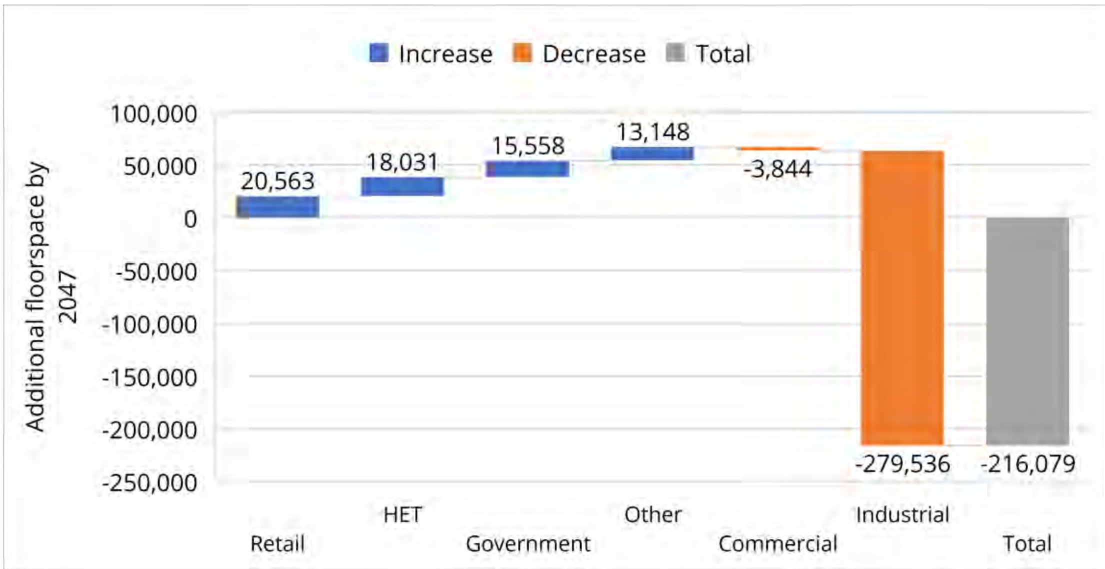
Wellington City, Demand for floorspace, 2000-2047



Source: Sense Partners

FIGURE 128: LOWER HUTT EXPECTED TO HAVE LESS DEMAND FOR INDUSTRIAL SPACE

Lower Hutt, Demand for floorspace, 2000-2047



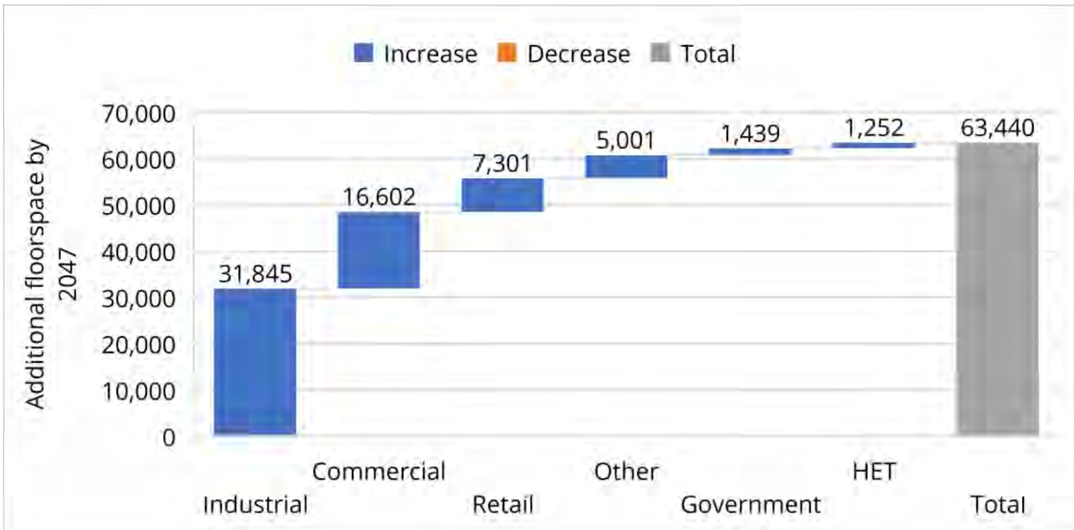
Source: Sense Partners

Although total demand for business land falls across for Lower Hutt, councils will need to be mindful of assessing opportunities to substitute industrial land to other uses. Industrial land has specific characteristics including locating specific employment opportunities in a region. Fulsome cost-benefit assessment is required before substituting industrial land to other uses.

Industrial land demand holds up for Upper Hutt. We expect Upper Hutt to continue to increase its share of industrial employment in the region. Partly this reflects an expected continuation of recent trends towards firms seeking to reduce earthquake risks with some locations in Upper Hutt offering more stable land (see Box B).

FIGURE 129: OUR METHODS SHOW MODEST RISE IN UPPER HUTT FLOORSPACE

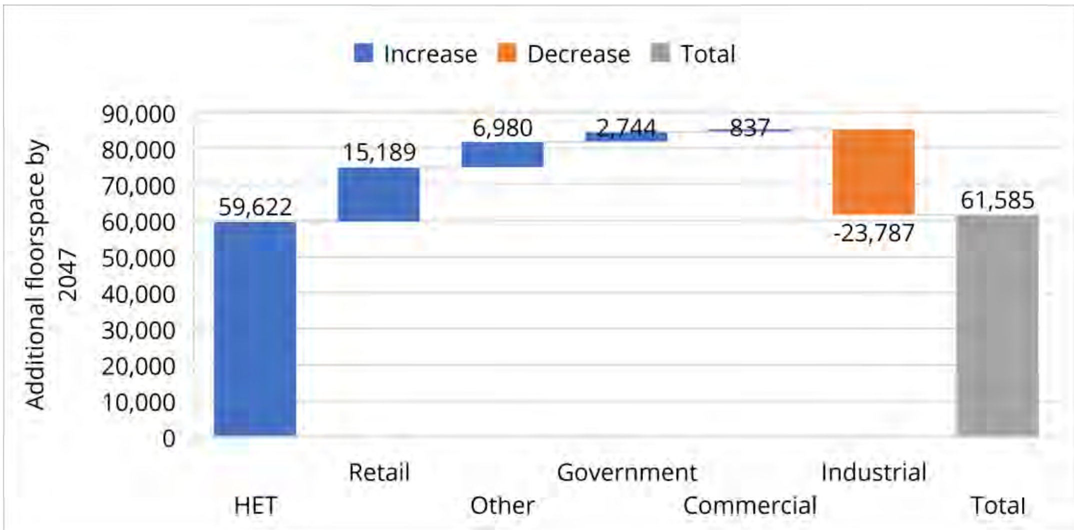
Upper Hutt, Demand for floorspace, 2000-2047



Source: Sense Partners

FIGURE 130: KAPITI COAST SHOWS STRONG DEMAND FOR HET FLOORSPACE

Kapiti Coast, Demand for floorspace, 2000-2047



Source: Sense Partners

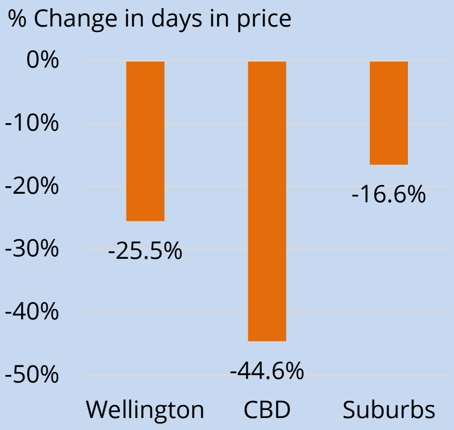
By 2047, we expect many more health and education workers are needed in the Kapiti Coast and this boosts demand for business land in the Kapiti Coast. Industrial demand falls a little.

Box B: Earthquake & sea-level rise change market dynamics

Increased attention to earthquake risk (following the Christchurch earthquakes on Sept 4 2010 and Feb 11 2011, and the Kaikoura earthquake, Nov 14, 2016) is reshaping the market for business land in the Wellington region. Our business contacts report the risk of sea-level rise affects firms' location choices, including the large plots of industrial land in the Seaview area. Anecdotally, premises with high building code standards are pre-requisites for both domestic and international investors to invest in local firms within the regime.

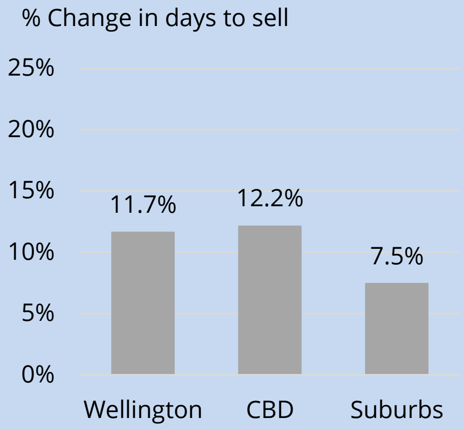
Seismic activity shifts the value of commercial property. A recent study by Motu, conducted in the year prior to the Kaikoura earthquake, finds that the price of earthquake-prone buildings in Wellington fell substantially after the Christchurch earthquakes (see Figure 131) and took longer to sell (see Figure 132).

FIGURE 131: EARTHQUAKE-PRONE BUILDINGS TAKE A PRICE-HIT



Source: Motu (2015) study

FIGURE 132: EARTHQUAKE-PRONE BUILDINGS TAKE LONGER TO SELL



Source: Motu (2015) study

These impacts change demand for land within the Wellington region in at least two ways:

1. Speeding up the building cycle as buildings become too costly to repair to code and quickly depreciate to end-of-life. This creates opportunity to build up in the CBD.
2. Increasing the relative price of sound business land to appreciate relative to land with substantial geotechnical issues.

Together, these features are changing the landscape of the city right now. Earthquake strengthening is supporting construction activity, already booming from rapid population growth.

Additional earthquakes are likely to incentivise further strengthening of the building code, so we see current seismic strengthening as part of an ongoing process that will underpin construction activity for some time. Our forecasts embed a moderation in population growth, which would moderate the current pace of activity over time.

Business Land

Our estimates suggest Wellington City needs more business land over the next thirty years. Additional land is required across all sectors, particularly retail, health and education, the commercial and government sector but also some for the industrial sector.

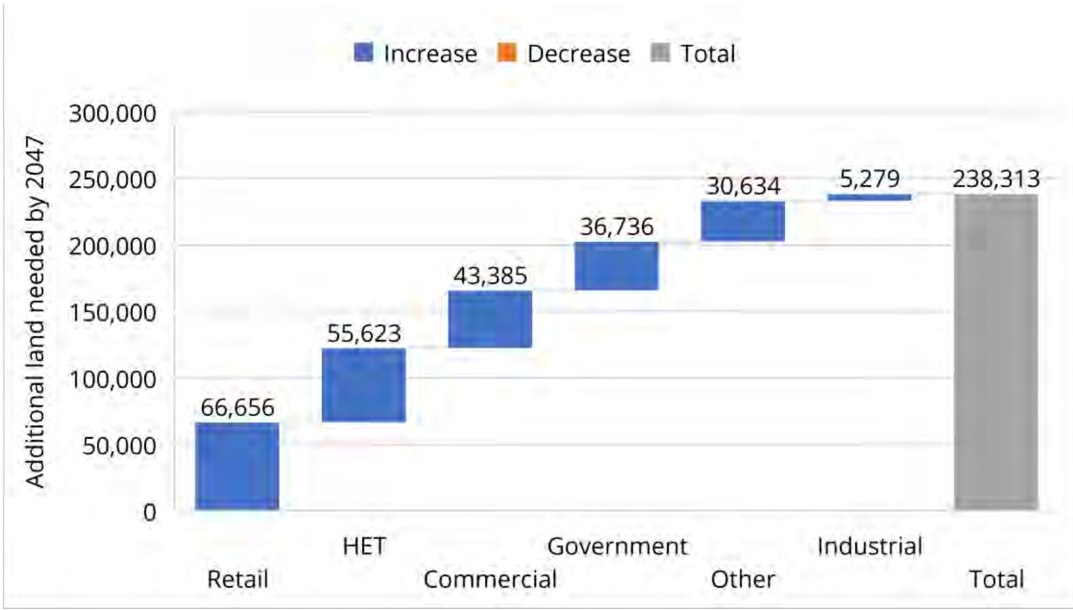
The demand sums to 238,313 square metres of business land (equivalent to perhaps 100 supermarkets) or a 4 percent increase in business land. This is much weaker than population growth of about 20 percent over that period. Many factors help hold down land demand:

(i) workforce growth is weaker than population growth

(ii) activity continues to shift away from floorspace intensive activities like industrial towards services that use land more intensively

(iii) each industry intensifies its use of space (for example, government office workers requiring less floorspace).

FIGURE 133: WELLINGTON CITY REQUIRES SUBSTANTIVE ADDITIONAL BUSINESS LAND
Wellington City, Demand for business land, 2000-2047



Source: Sense Partners

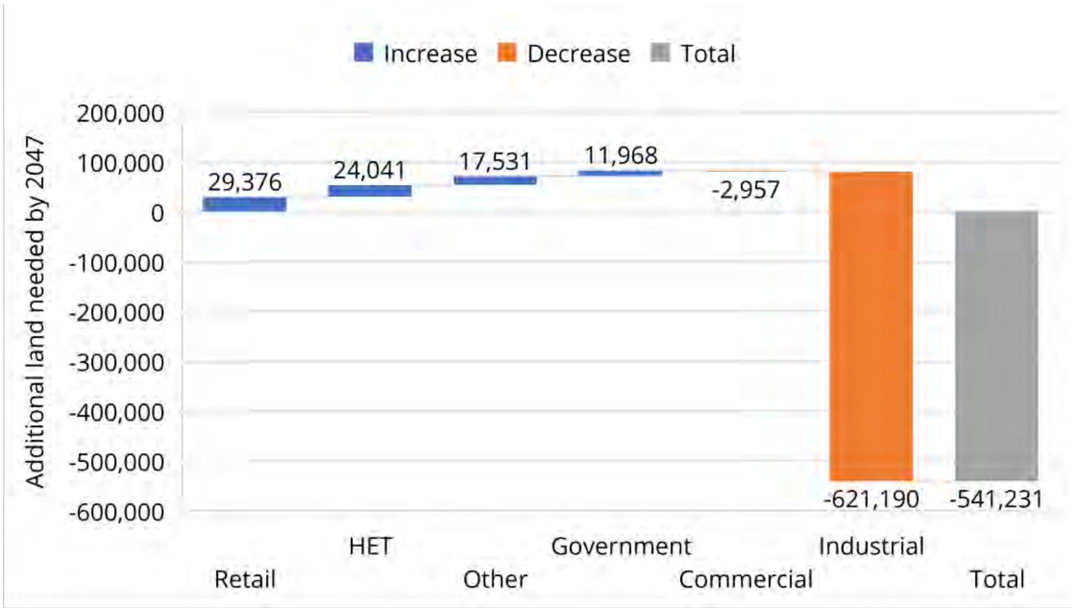
Demand of land in Lower Hutt is expected to decline over the next 30 years.

Lower Hutt has a substantial area of industrial land. We expect a mild decline in industrial activity across the region. Lower Hutt is also losing its share of industrial activity, exacerbating the overall decline. Moreover, we expect the floorspace required for industrial activity to decline a little over time as heavy industrial activities are replaced by industrial activities that are slightly less land intensive. These factors all sum to a material 40 percent decline in the demand for business land in Lower Hutt.

Several points are important in our analysis. First, our projections are conditional on the types of movements we have seen in activity over the past 20 years. Technology and policy can influence outcomes and our forecasts are no fait accompli. Moreover, our forecasts are conditional on Statistics New Zealand's medium population projection. There is likely some upside risk to these projections (downside risks are possible but less likely) that could boost the outlook, a point we explore in section 4.

Nevertheless, any decline in the need for business land might provide councils with an opportunity to promote other uses. Councils will need to think through the costs and benefits of alternative uses for industrial land in Lower Hutt.

FIGURE 134: DEMAND FOR INDUSTRIAL LAND IN LOWER HUTT MUCH LOWER BY 2047
Lower Hutt, Demand for business land, 2000-2047



Source: Sense Partners

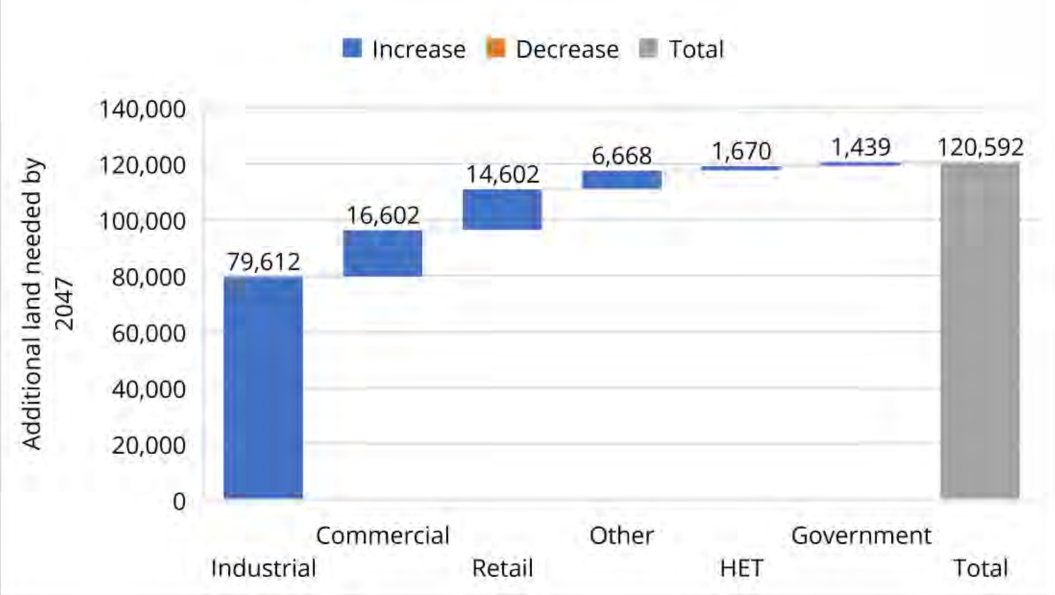
Demand for business land in Upper Hutt is expected to grow over the 30 years to 2047 (see Figure 135. Increasing market share for industrial land is sufficient to generate an increase in land requirements even though industrial requirements overall are declining across the region.

Mild increases in commercial and retail activity also boost the outlook. Government activity only provides a small lift in terms of land requirements but further safety concerns over seismic stability of land in the Wellington region could boost demand for land in Upper Hutt.

Our estimates suggest the Health, Education and Training sector is the primary driver of business land demand on the Kapiti Coast (see Figure 136). An ageing population is likely to continue to increase the strong demand for services in the region that has grown rapidly in recent years.

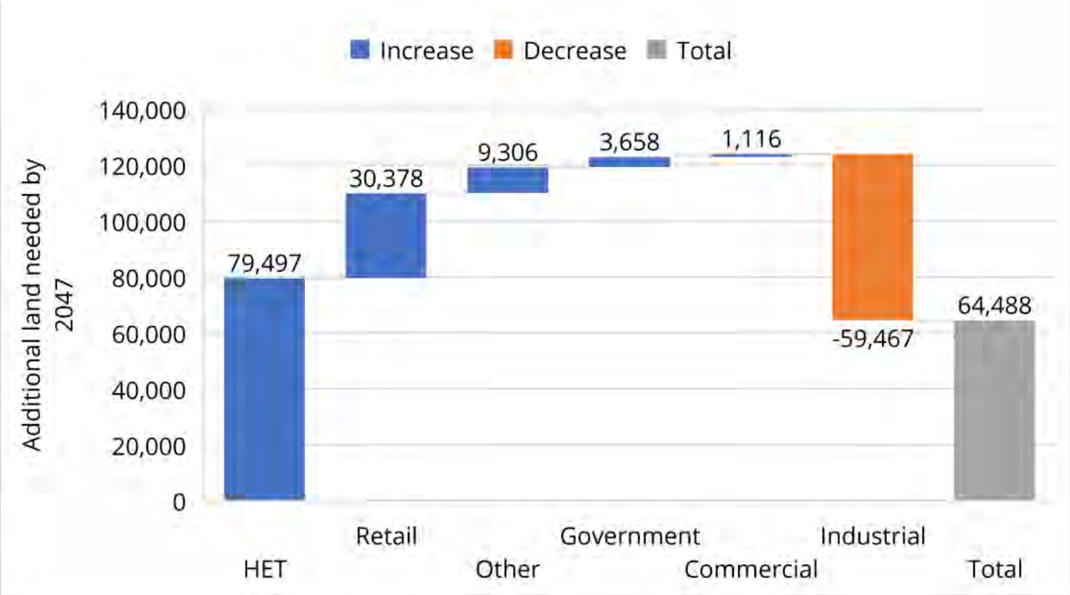
Population growth is also expected to generate some additional retail activity which impacts demand for land, although the region is relatively well serviced. Like elsewhere, a mild decline in industrial activity reduces land demand overall.

FIGURE 135: EXPECT MODEST GROWTH IN DEMAND FOR UPPER HUTT BUSINESS LAND
Upper Hutt, Business land demand, 2000-2047



Source: Sense Partners

FIGURE 136: HEALTH AND EDUCATION WORKERS DRIVE LAND DEMAND IN KAPITI
Kapiti Coast, Business land demand, 2000-2047



Source: Sense Partners

4.4 Alternative demographic assumptions

4.4.1 Demographics

Demographics can have a material impact on the structure of the economy. This occurs through several channels, including the consumer side, with additional demand for schools, community services and retail.

Demographics also impact on production. With population growth comes growth in the workforce, but an ageing population is likely to be part of the labour force attachment. The age profile of the local population can also help determine business land demand.

To test the impact of alternative demographic assumptions on the demand for business land, we take two alternative forecasts of the local population: (i) Statistics New Zealand's high forecast; and (ii) forecast.id's population forecast for the Wellington region.[10]

Over recent years, population growth has consistently outstripped Statistics New Zealand's medium population forecast. So we experiment with a stronger population projection, and do not advocate using Statistics New Zealand's low population forecast.

4.4.2 The population scenarios

Figure 137 shows the forecast.id population forecast for the Wellington region vs Statistics New Zealand's medium population projection. The forecasts have similar regional profiles. Differences relate to the weak growth Statistics New Zealand suggests for the final projection years of one percent over 5 years – when current growth is almost two percent each year.

Statistics New Zealand produce what they consider 'high' and 'low' population forecasts to complement their 'medium' projection we use for our baseline forecast.

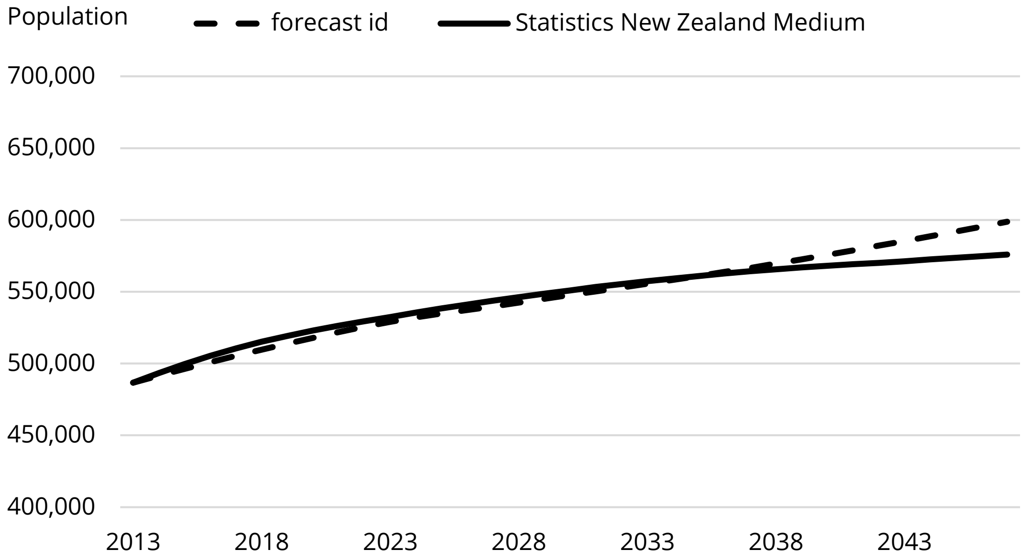
For many years, national population growth has exceeded Statistics New Zealand's population forecasts. For example, Statistics New Zealand's 2014 forecast for New Zealand's population growth in 2017 predicted growth of 0.9 percent but the population grew 2.1 percent.

The difference in outcomes is almost entirely driven by migration – a basic assumption rather than a nuanced model in Statistics New Zealand's methodology. Our own work on migration forecasting indicates migration is likely to continue to be stronger than Statistics New Zealand assumes. So, to think through the impacts on business land of stronger population growth, we conduct a scenario using Statistics New Zealand's high population forecast. By the end of the

[10] The company forecast.id provide population forecasts to some local councils in Australia and New Zealand.

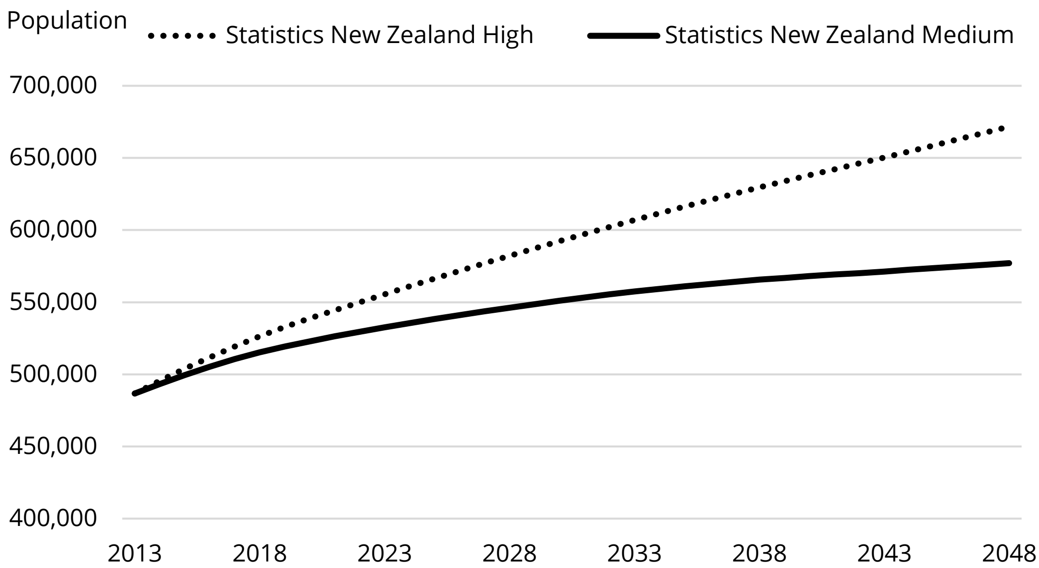
forecast period, the Statistics New Zealand high population forecasts is 14 percent higher than the medium- projection.[11]

FIGURE 137: FORECAST.ID'S FORECAST IS SIMILAR TO STATISTICS NEW ZEALAND'S
Expected Population, Wellington region



Source: Statistics New Zealand and forecast.id

FIGURE 138: WE MAKE A SCENARIO WITH STATISTICS NEW ZEALAND 'HIGH' FORECAST
Alternative Statistics New Zealand population forecasts for the Wellington region



Source: Statistics New Zealand and forecast.id

[11] Since we need a forecast to 2047, we use the growth rate at the end of each Statistics New Zealand forecast to rate the forecast forward to 2047.

4.4.3 Impacts on business land demand

Figure 139 compares the impacts of the population scenarios relative to percentage increase in land demand in our baseline case. Appendix 4 shows additional charts for each council.

FIGURE 139: SUMMARY OF POPULATION SCENARIOS: % CHANGE IN LAND DEMAND

	Kapiti			Lower Hutt			Upper Hutt			Wellington City		
	3-yr	10-yr	30-yr	3-yr	10-yr	30-yr	3-yr	10-yr	30-yr	3-yr	10-yr	30-yr
Total												
Baseline	1.47	0.82	4.78	2.28	-4.77	-12.1	8.09	8.86	10.51	5.63	3.32	3.89
forecast.id	0.97	1.31	14.24	0.15	-6.83	-7.12	4.98	5.81	15.56	5.30	2.87	3.87
High projection	4.63	7.16	21.15	5.51	1.39	2.98	11.63	16.32	31.95	8.52	8.89	17.40
Commercial												
Baseline	1.22	-1.20	5.05	-7.71	-10.6	-4.75	4.83	6.53	16.18	5.30	8.11	19.56
forecast.id	0.73	-0.72	14.53	-9.63	-12.54	0.61	1.81	3.54	21.49	4.98	7.64	19.54
High projection	4.37	5.02	21.46	-4.79	-4.83	11.56	8.26	13.83	38.72	8.19	13.94	35.11
Government												
Baseline	4.94	7.37	13.00	8.06	12.71	19.30	3.65	6.49	12.12	8.57	18.15	41.11
forecast.id	4.42	7.89	23.19	5.81	10.26	26.01	0.67	3.50	17.24	8.24	17.63	41.08
High projection	8.20	14.12	30.65	11.47	19.99	39.72	7.05	13.78	33.88	11.55	24.52	59.46
Retail												
Baseline	4.54	7.34	10.85	2.81	3.82	6.52	3.87	5.54	8.43	2.57	3.34	5.98
forecast.id	4.03	7.86	20.85	0.68	1.57	12.51	0.88	2.58	13.38	2.25	2.89	5.96
High projection	7.79	14.09	28.16	6.06	10.53	24.75	7.27	12.77	29.46	5.38	8.91	19.76
Industrial												
Baseline	-0.73	-5.02	-7.08	2.48	-7.22	-18.0	10.61	10.80	10.57	6.79	2.23	0.13
forecast.id	-1.22	-4.55	1.30	0.35	-9.24	-13.4	7.43	7.70	15.62	6.47	1.79	0.11
High projection	2.36	0.96	7.44	5.71	-1.23	-3.97	14.24	18.39	32.02	9.72	7.75	13.14
Health and Education												
Baseline	6.50	24.33	74.26	0.75	3.81	8.67	-2.67	-0.99	2.73	2.30	8.95	20.72
forecast.id	5.98	24.93	89.97	-1.34	1.56	14.79	-5.47	-3.77	7.42	1.98	8.47	20.70
High projection	9.81	32.15	101.5	3.93	10.52	27.28	0.53	5.79	22.66	5.10	14.82	36.42
Other												
Baseline	6.54	6.82	13.23	0.91	3.55	9.69	5.41	8.41	14.91	2.29	6.02	12.80
forecast.id	6.02	7.34	23.44	-1.18	1.30	15.86	2.38	5.37	20.16	1.98	5.56	12.78
High projection	9.86	13.54	30.91	4.10	10.24	28.47	8.87	15.83	37.21	5.10	11.74	27.47

Source: Sense Partners

Business land demand under the forecast.id population forecast
The table includes the outlook for Wellington City conditional on the forecast.id population forecast.[12] Outcomes are very similar to our baseline that uses the Statistics New Zealand medium-term projection to show Wellington City additional business land demand. The forecast for total business land demand is slightly lower than the baseline because forecast.id allocates a slightly lower share of population growth in the region to Wellington City compared to Statistics New Zealand. The figures in Appendix 4 provide additional details.

Since the outlook for Lower Hutt is driven by the industrial sector that has large land requirements per worker, small population movements impact total business land demand. The table also shows the large decline in the demand for land in the industrial sector that characterised the outlook for Lower Hutt when using the Statistics New Zealand medium-term projection.

Upper Hutt exhibits higher business land demand under the forecast.id population forecast than the Statistics New Zealand forecast. By the end of the period, population growth in Upper Hutt is sufficient to generate extra demand for industrial land in particular (161,000 extra square metres across 30 years) that lifts demand higher.

The forecast.id projection for the Kapiti is more optimistic than Statistics New Zealand. Forecast.id expect population growth of 20 percent (almost an additional 6,000 people) between 2018 and 2043 and this helps lift demand for business land see Appendix 4).

Business land demand under Statistics New Zealand's 'High' population assumption
Under the high population scenario, Wellington City requires substantially more business land – a little over 1,000,000 extra square metres over the thirty years to 2047, an increase of about 17 percent (and to give a sense of forecast risk, the additional demand is almost 70% more than under the median projection.) Figure 197 in Appendix 4 provides details.

Although the industrial sector is declining across the region, Wellington City has been slightly increasing the share of activity – up 6 percent over the last ten years. Industrial activity takes substantive amounts of floorspace and the specific floor-to-area ratio we use for Wellington City is 0.5, so any increase in floorspace requirements doubles land requirements. As the city grows some intensification is likely to occur in the industrial sector, reducing space requirements, but quantifying the extent to which this is occurs is a question about capacity.

More modest increases in land requirements for retail, health and education and our 'other' sector also increase demand for land. While the increases in demand for commercial and government land are relatively small, this reflects the high floor-to-area ratio we use for these sectors in Wellington City.

---

[12] Figure 193 to Source: Sense Partners

Figure 196 show additional detail on the impact of the forecast.id population projection on a council-by-council basis.

These are businesses located inside the CBD where land is at a premium. Although the land requirements are relatively small, securing additional land is likely to be very difficult but again, this is a question about capacity.

In aggregate, higher regional population growth approximately offsets the decline in industrial land demand in Lower Hutt (see table). Demand for land increases substantially across most sectors. Demand for retail land increases by almost 25 percent and health and education also increases substantially.

But industrial land is not likely to be easily turned to other uses. Accommodating marked increases in land demand in some sectors is likely to require careful planning decisions.

The table also shows the outlook for Upper Hutt under the high population growth scenario. The industrial sector requires substantial land to accommodate the new population track. Upper Hutt is increasing market share of the industrial sector and then must also accommodate additional population growth so additional demand for land is material.

This highlights some of the uncertainties that need to be considered for planning purposes. While the medium population growth scenario produces only modest land requirements, the high population scenario suggests much more is required.

This presents a risk to councils – who will need to pick a way to manage this. Whether to initially plan on high or medium population growth depends in part on the costs and benefits of each approach, including how easy it is to change later.

Population growth a has large influence on demand for business land in the Kapiti Coast. Additional workers are predominantly employed in the Health and Education sector with additional workers in retail and the industrial sector.

The retail sector has expanded substantially in Kapiti in recent years with many new retail suppliers entering the market. Right now, the region appears well-served and current providers may even accommodate some additional growth before additional land is required.

These sectors require substantive amounts of floorspace. Our assumptions for the floor-to-area ratios for each sector mean additional land is required to accommodate floorspace demands. A little over 20 percent more business land could be required.

4.5 The impact of transport linkages

4.5.1 Regional transport improvements and economic activity

Most investments in transport infrastructure lift economic activity through two distinct channels, as they effectively bring in more people to the region:

i. **Deepening local markets** including thickening local labour markets that enable more productive matches between firms and workers, increasing firms' access to intermediate suppliers that can also increase specialisation, and promoting agglomeration effects (gains from information sharing when workers locate close together).

ii. **Broadening the local markets** by increasing the number of consumers in the geographic range of the market. This can enable new investment opportunities as existing firms can scale up and specialise their product and services.

The two channels change the underlying structure of the economy, promoting some industries while other industries fade. Over enough time, households also change where they want to live, changing the spatial distribution of the economy.

Often, large and dense cities benefit more from infrastructure spend that unlocks constraints on resources, resulting in a larger and more productive economy. But equally, economies that start from a low population base can experience large effects when population growth occurs after decades of low or stagnant growth.

Investment in transport reduces travel times both to the core or larger city as well as away from the core city. Firms may choose to reap the benefit of lower transport costs and service the city from cheaper locations outside the city. Alternatively, some firms may choose to locate within the city and service the region from a central location with reduced travel costs. Over time, the relative price of land adjusts to where firms are indifferent about location.

Households respond positively to employment opportunities and amenity value (sometimes facilitated by increased density). The cost of housing and increased transport times are negative factors. The combination of positive and negative factors bound the size of cities with positive benefits pulling additional people into the city (and negative factors pushing them out) until increased transport and housing costs equate inflows with outflows.

4.5.2 Modelling the impact of improved linkages

Modelling the impact of transport infrastructure on economic activity and location choice can be difficult. Not only does the impact of infrastructure on activity need to be modelled but the spatial location of activity needs to be modelled. Moreover, models of economic activity need to account for the second-round impacts on activity from the changes in prices of inputs to production that can occur when location of people and firms changes.

Two recent NZTA research reports provide guidance on how to gauge likely impacts for New Zealand.[13] These are detailed studies that develop, build and estimate activity and spatial models to quantify impacts based on transport infrastructure projects in the Golden Triangle – the region that spans Auckland, Hamilton and Tauranga.

Rather than reinvent these studies we use their parameter estimates to gauge the likely effects of the transport improvements associated with improvements in the Northern Corridor before turning to the improvements associated with *Let's Get Wellington Moving*. Since we do not re-estimate the models, our approach should be considered as indicative of the direction and broad scale of the impacts.

These studies use a Gross Value Add model to measure impacts on economic productivity. Then a spatial general equilibrium model is used to understand the location of activity and the impact on land use.

One of the key variables within the approach is to identify improvements in access – both a deepening of local markets and a broadening of the consumer markets. Byett et al. (2015, 2017) experiment with variables that leverage access to ports and airports and the population mass of the local area. Two of their variables relate directly to deepening and broadening of local markets:

(i) Proxy of population within a 40-minute drive of the location. This measure is the 80th percentile of US commute times and might be expected to define a local labour market. We calculate this measure based on the centre of each suburb (Statistics New Zealand area units) to each location, in our case, the CBD of each local council.

(ii) Proxy of population within a 120-minute drive of the location. This measures approximately same-day delivery areas, as a proxy for the local consumer market. We calculate this measure based on the centre of each suburb to the CBD of each local council.

We compare these access variables before and after the improvements to the Northern corridor. Then we apply the elasticities from the Byett et al. (2017) model that translate accessibility improvements to productivity, applying MBIE's modelling nominal GDP estimates since these measures are available at detailed sub-industry level. Then we assume that over enough time productivity improvements translate to wage growth that attracts population growth to the region one-for-one. Finally, we use these population scenarios to update our business land projection.

Richer approaches might test the robustness of our estimates to alternative access variables. Additional sensitivity tests might be usefully conducted on a range of travel time improvements. But this would require a specific transport study – beyond the scope of this current project. Our goals are simpler – identify the likely scale of impacts and the regions that are likely to experience the largest changes.

---

[13] See Byett et al. (2015, 2017)

4.5.3 Transport improvements to the Northern corridor

From an economic activity perspective, Wellington's major transport infrastructure are associated with improvements to the Northern corridor. These projects split into two types: (i) infrastructure improvements that improve flows into and out of the city; (ii) improvements that improve flows around the city. The first suite of improvements that help improve flows into and out of the city include:

- **The Smart Motorway** – applied to the flows between Johnsonville and Wellington, the region's busiest flows.
- **Transmission Gully** – the largest infrastructure project in the region (the 27 kilometre motorway from Mackays Crossing to Linden, with associated link roads and interchanges) impacts the councils in this study, as well Porirua and Horowhenua.
- **Mackays to Peka Peka** – the completed 18 kilometre four-way expressway that separates local and highway traffic along the Kapiti Coast, with impacts on activity already materialising.
- **The Peka Peka to Otaki Expressway** – the Ōtaki bypass increases flows between Wellington and the logistics and other industries in central New Zealand, including Horowhenua and Palmerston North.
- **Otaki to North of Levin** – the northernmost section of the corridor that links the northern part of the Kapiti Coast to Horowhenua and central New Zealand.

NZTA also highlight a second suite of three projects located in Wellington city:

- **The Mt. Victoria tunnel duplication**
- **Tunnel to tunnel inner-city transport improvements**
- **Terrace tunnel duplication**

The overall project is forecast to deliver travel time savings of between 23 and 33 minutes between Levin and the airport in the peak period and between 17 and 20 minutes during the day in 2026. We allocate improvements across the transport projects based on a 22-minute improvement in the travel time between Wellington CBD and Levin.

Figure 140 and Figure 141 documents the travel-times pre- and post-implementation.[14] Figure 142 shows the change in market deepening and broadening.

[14] We preserve the second-suite of projects to the Let's Get Wellington moving analysis. Our 22-minutes is an average of the peak period and during the day estimates. Horowhenua and Palmerston North are included for comparison only.

FIGURE 140: APPROXIMATE TRAVEL TIMES PRE-CORRIDOR IMPROVEMENTS

Current	Horowhenua	Kapiti Coast	Upper Hutt	Lower Hutt	Wellington City	Palmerston North
Horowhenua	0	36 mins	78 mins	73 mins	77 mins	43 mins
Kapiti Coast	36 mins	0	45 mins	47 mins	45 mins	75 mins
Upper Hutt	78 mins	45 mins	0	19 mins	31 mins	117 mins
Lower Hutt	73 mins	47 mins	19 mins	0	19 mins	116 mins
Wellington City	77 mins	45 mins	31 mins	19 mins	0	120 mins
Palmerston North	43 mins	75 mins	117 mins	116 mins	120 mins	0

Source: Various

Several points are worth noting with regard to Figure 141 that shows improved times in bold and changes bracketed below:

- the northern corridor affects almost all nodes except for links between Lower Hutt, Upper Hutt and Wellington city and the link between Palmerston North
- the assumed transport time improvement between the Kapiti Coast and Wellington CBD is substantive. Expect smaller economic impacts for lower travel time savings
- travel time savings to and from the largest population centres – Wellington in particular – drive impacts.[15]

FIGURE 141: APPROXIMATE TRAVEL TIMES POST-CORRIDOR IMPROVEMENTS

Current	Horowhenua	Kapiti Coast	Upper Hutt	Lower Hutt	Wellington City	Palmerston North
Horowhenua	0	**29 mins (7 mins)**	**68 mins (7 mins)**	**63 mins (10 mins)**	**55 mins (22 mins)**	43 mins
Kapiti Coast	**29 mins (7 mins)**	0	**35 mins (10 mins)**	**37 mins (10 mins)**	**30 mins (15 mins)**	**68 mins (7 mins)**
Upper Hutt	**68 mins (10 mins)**	**35 mins (10 mins)**	0	19 mins	31 mins	**100 mins (17 mins)**
Lower Hutt	**63 mins (10 mins)**	**37 mins (10 mins)**	19 mins	0	19 mins	**99 mins (17 mins)**
Wellington City	**55 mins (22 mins)**	**30 mins (15 mins)**	31 mins	19 mins	0	**98 mins (22 mins)**
Palmerston North	43 mins	**65 mins (10 mins)**	**92 mins (25 mins)**	**91 mins (25 mins)**	**98 mins (22 mins)**	0

Source: Sense Partners

[15] Porirua's population base is included in the calculation of the access variables.

We then translate travel time savings to access variables, computing populations within 40- and 120-minutes of each local council before and after the improvements (see Figure 142).

FIGURE 142: DEEPENING AND BROADENING OF MARKETS AFTER TRANSPORT IMPROVEMENTS

Current	Wellington city	Kapiti Coast	Upper Hutt	Lower Hutt	Horowhenua	Palmerston North
Pre 40-min pop.	418,030	326,020	390,210	418,030	157,860	136,950
Post 40 min pop.	458,160	496,150	413,730	454,800	159,680	136,950
Deepening (%)	**9.6%**	**52.2%**	**6.0%**	**8.8%**	**1.2%**	**0%**
Pre 120-min pop.	543,830	734,450	665,420	547,190	756,480	604,490
Post 120-min pop.	592,420	736,080	679,630	595,780	756,480	661340
Broadening (%)	**8.9%**	**0.2%**	**8.9%**	**8.8%**	**0%**	**9.4%**

NB. Pre 40-minute population documents the population in suburbs within a 40-minute drive of the Wellington CBD before transport improvements while the post-40 minute population shows the population within a 40 minute drive after the transport improvement. Similarly, for the 120-minute pre- and post- populations.

Source: Sense Partners

With the access variables in hand, we then multiply the deepening and broadening of each market by the impact parameters in Byett et al. (2017) on an industry basis to obtain the impact on productivity. We work with nominal GDP to exploit the detailed subindustry parameters reported in Figure 143.

FIGURE 143: DEEPENING AND BROADENING AFTER TRANSPORT IMPROVEMENTS BY INDUSTRY

Industry	Access coefficient		Change in Nominal GDP			
	40-min	120-min	Kapiti	Hutt	Upper Hutt	WCC
Accommodation and Food Services	0.056	0.056	435.1	761.8	360.7	1,882.9
Administrative and Support Services	0.051	0.087	150.8	746.0	141.9	2,134.9
Agriculture, Forestry & Fishing Support Services and Hunting	-0.087	0.032	16.1	6.5	31.5	4.9
Arts and Recreation Services	0.089	0.053	348.7	805.1	673.5	2,769.7
Auxiliary Finance and Insurance Services	0.07	0.087	60.7	420.2	51.0	2,256.3
Basic Chemical and Chemical Product Manufacturing	0.061	0.068	104.1	110.0	302.3	64.2
Beverage and Tobacco Product Manufacturing	0.032	0.032	329.4	1,417.2	164.1	166.9
Building Construction	0.056	0.056	230.1	592.0	406.4	812.8
Central Government Admin, Defence & Public Safety	0.081	0.081	182.7	1,294.6	4,184.6	15,189.1
Construction Services	0.056	0.056	1,060.4	2,285.5	763.7	1,303.2
Dairy Cattle Farming	-0.078	0.032	59.4	0.0	8.9	4.5
Dairy Product Manufacturing	0.032	0.032	77.7	443.8	14.5	526.4
Education and Training	0.076	0.026	893.6	1,988.9	1,006.5	4,106.9
Electricity and Gas Supply	0.035	0.035	215.4	547.2	0.0	5,073.9
Fabricated Metal Product Manufacturing	0.061	0.063	108.9	489.0	207.8	116.7
Finance	0.065	0.087	293.4	999.5	203.3	8,819.1
Fishing and Aquaculture	0.032	0.032	6.2	5.0	0.0	31.5
Forestry and Logging	0.032	0.032	32.2	6.5	84.2	0.0
Fruit, Oil, Cereal and Other Food Product Manufacturing	0.032	0.048	190.4	447.6	119.0	398.5
Furniture and Other Manufacturing	0.061	0.061	32.2	163.2	45.4	99.4

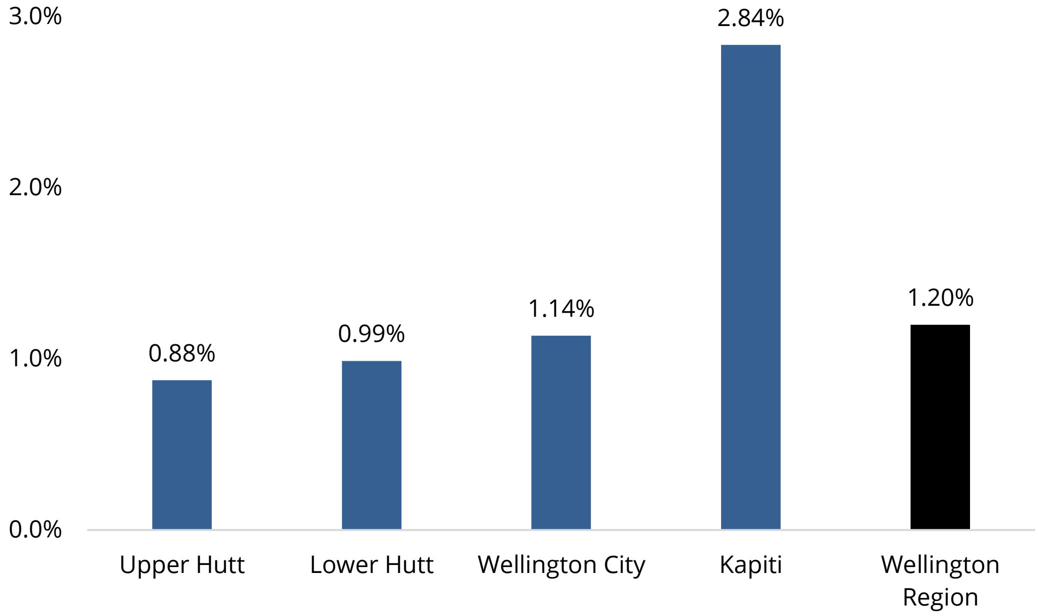
Industry	Access coefficient		Change in Nominal GDP			
	40-min	120-min	Kapiti	Hutt	Upper Hutt	WCC
Health Care and Social Assistance	0.083	0.043	1,178.5	3,758.7	826.5	5,380.2
Heavy and Civil Engineering Construction	0.056	0.056	224.9	1,015.9	246.4	334.2
Horticulture and Fruit Growing	-0.07	0.032	125.2	4.7	0.0	5.5
Information Media Services	0.077	0.068	87.8	218.5	22.1	1,390.4
Insurance and Superannuation Funds	0.077	0.087	0.0	70.8	0.0	2,935.9
Local Government Administration	0.056	0.087	205.0	211.0	137.3	394.0
Machinery and Other Equipment Manufacturing	0.061	0.067	65.9	485.3	514.1	139.6
Meat and Meat Product Manufacturing	-0.061	0.032	0.0	0.0	0.0	576.8
Mining	0.035	0.032	7.4	13.9	0.0	175.2
Motor Vehicle and Motor Vehicle Parts and Fuel Retailing	0.028	0.021	123.1	374.2	137.2	316.2
Non-Metallic Mineral Product Manufacturing	0.061	0.068	144.2	79.9	15.9	129.7
Other Services	0.096	0.069	346.9	1,010.3	329.5	2,000.2
Other Store-Based Retailing and Non Store Retailing	0.029	0.019	648.8	1,248.7	539.4	1,405.1
Owner-Occupied Property Operation (National Accounts)	0.079	0.079	793.2	2,519.2	1,147.5	6,447.4
Petroleum and Coal Product Manufacturing	0.061	0.061	0.0	180.1	0.0	4,147.5
Polymer Product and Rubber Product Manufacturing	0.061	0.061	16.2	669.8	197.7	54.7
Postal, Courier Transport Support, & Warehousing	0.057	-0.033	208.5	1,232.4	170.8	1,854.4
Poultry, Deer and Other Livestock Farming	0.032	0.032	22.8	14.4	0.0	1.3

Industry	Access coefficient		Change in Nominal GDP			
	40-min	120-min	Kapiti	Hutt	Upper Hutt	WCC
Primary Metal and Metal Product Manufacturing	0.061	0.061	11.3	156.7	25.4	26.8
Printing	0.061	0.058	52.5	402.9	13.3	253.8
Professional, Scientific and Technical Services	0.061	0.087	797.3	3,571.1	507.3	15,702.9
Property Operators and Real Estate Services	0.079	0.079	1,250.4	2,681.6	850.5	4,686.9
Pulp, Paper and Converted Paper Product Manufacturing	0.061	0.061	0.0	193.6	0.0	0.0
Rail, Water, Air and Other Transport	-0.038	0.057	129.1	20.1	151.3	2,674.0
Rental and Hiring Services (except Real Estate)	0.079	0.079	79.1	325.4	73.1	538.5
Road Transport	-0.044	0.057	258.2	1,122.1	321.4	704.8
Seafood Processing	0.032	0.032	0.0	0.0	0.0	14.3
Sheep, Beef Cattle and Grain Farming	-0.085	0.032	26.3	3.2	0.0	6.0
Supermarket, Grocery Stores and Specialised Food Retailing	0.031	0.018	404.1	547.2	380.1	771.0
Telecommunications, Internet and Library Services	0.107	0.068	156.4	433.0	168.1	4,972.5
Textile, Leather, Clothing and Footwear Manufacturing	0.061	0.061	14.0	179.3	8.6	14.7
Transport Equipment Manufacturing	0.061	0.068	8.6	198.5	9.0	46.8
Water, Sewerage, Drainage etc	0.085	0.035	160.1	1,192.7	308.3	192.7
Wholesale Trade	0.087	0.086	249.6	3,331.1	865.1	2,938.4
Wood Product Manufacturing	0.052	0.032	54.2	116.6	119.0	18.3

Source: Sense Partners

Summing up the impact across each sub-industry yields the increase in activity in each of the local councils that we display in Figure 144.

FIGURE 144: TRANSPORT IMPROVEMENTS SUGGEST MILD ACTIVTY INCREASES



Source: Sense Partners

Kapiti reaps the largest return from the improved transport links. The reduction in travel times from 45 minutes to 30 minutes pulls people and firms into the district deepening the labour market and improving local productivity. This might manifest in local offices developing rather than situating within Wellington City. The region also benefits from a broadening of the consumer market to the North of Wellington, connecting more consumers to Kapiti firms. Wellington City also benefits from the improved infrastructure links. But since the local labour market is already deep, the impacts of improved links are more muted than for Kapiti.

Our analysis suggests that Lower Hutt and Upper Hutt both benefit from the transport improvements, but the impacts are modest since the improvements are largely improvements to traffic flow along the Wellington-Kapiti-Levin route. In aggregate, our analysis suggests productivity in the Wellington region lifts by 1.2 percent.

Some points are worth closer attention. First, to model the impact on business land, we assume that increases in productivity will increase real wages and population in the long-run one-for-one. While the improvement in productivity for Kapiti is substantial and important for growth, the region's population is projected to rise by 12 percent over our thirty-year time horizon. So the impact of the transport improvements on the region are uneven, but as a whole are an order of magnitude smaller than the increasing population.

Second, our travel time estimates are based on official sources. With a staged project, travel times might be expected to change as firms respond to the types of incentives we document. Future work could detail the sensitivity of estimates to travel time assumptions.

4.5.4 Impact on business land demand

Figure 145 shows the impact of the improvements in transport infrastructure on business land demand for each of the local councils.

FIGURE 145: COMPARISON OF LAND DEMAND UNDER TRANSPORT IMPROVEMENTS

	Kapiti			Lower Hutt			Upper Hutt			Wellington City		
	3-yr	10-yr	30-yr	3-yr	10-yr	30-yr	3-yr	10-yr	30-yr	3-yr	10-yr	30-yr
Total												
Baseline	1.47	0.82	4.78	2.28	-4.77	-12.1	8.09	8.86	10.51	5.63	3.32	3.89
Transport	1.74	1.73	7.63	2.37	-4.46	-11.2	8.18	9.16	11.45	5.74	3.70	5.03
Commercial												
Baseline	1.22	-1.20	5.05	-7.71	-10.6	-4.75	4.83	6.53	16.18	5.30	8.11	19.56
Transport	1.50	-0.31	7.90	-7.62	-10.3	-3.84	3.74	6.79	13.07	5.42	8.51	20.88
Government												
Baseline	4.94	7.37	13.00	8.06	12.71	19.30	3.65	6.49	12.12	8.57	18.15	41.11
Transport	5.22	8.34	16.06	8.16	13.07	20.44	3.74	6.79	13.07	8.69	18.58	42.66
Retail												
Baseline	4.54	7.34	10.85	2.81	3.82	6.52	3.87	5.54	8.43	2.57	3.34	5.98
Transport	4.82	8.31	13.86	2.91	4.15	7.53	3.95	5.83	9.35	2.68	3.72	7.15
Industrial												
Baseline	-0.73	-5.02	-7.08	2.48	-7.22	-18.0	10.61	10.80	10.57	6.79	2.23	0.13
Transport	-0.46	-4.16	-4.56	2.57	-6.93	-17.2	10.70	11.12	11.50	6.91	2.61	1.22
Health and Education												
Baseline	6.50	24.33	74.26	0.75	3.81	8.67	-2.67	-0.99	2.73	2.30	8.95	20.72
Transport	6.79	25.45	78.98	0.84	4.14	9.71	-2.58	-0.71	3.60	2.41	9.34	22.05
Other												
Baseline	6.54	6.82	13.23	0.91	3.55	9.69	5.41	8.41	14.91	2.29	6.02	12.80
Transport	6.83	7.79	16.30	1.01	3.88	10.73	5.50	8.71	15.89	2.41	6.41	14.04

Source: Sense Partners

Demand for business land in Kapiti increases off the back of the transport infrastructure improvements and is up 7.64 percent by the end of 2047. Health, education and training demand increases by about 6.8 percent. The extra people brought in to the region partly offsets the decline in demand for industrial land.

After the transport improvements, demand for business land in Lower Hutt improves but the decline in demand for industrial land remains substantial, as in the baseline case. Total demand is up after 3 years but ultimately falls 11 percent by 2047 from the combination of a weaker outlook for industrial land and our assumption that the average industrial worker requires a smaller footprint in the future. Relative to others, Lower Hutt misses the lift in access the improvements in transport infrastructure provides.

Demand for business land in Upper Hutt is little changed by the transport infrastructure improvements. The improvement in access for Upper Hutt is even smaller than Lower Hutt –so the impacts on business land demand that we show in the table are small and up only a little on our baseline projection.

Finally, the table shows the impact of the improvements in travel infrastructure on business land demand for Wellington City. Demand is up a little across each of the industrial categories. Business demand for Wellington City now hits a little over 300,000 square metres by 2047.

5. Concluding remarks

The Wellington region will need to continue to plan how to accommodate extra demand for business land over the next 3-, 10- and 30-years. While population is expected to grow materially higher over the timeframes that matter for planning perspective, there are many factors at play that suggest demand for business land will be more modest relative to population growth.

Economic activity continues to shift away from industrial manufacturing that has traditionally required large amounts of land relative to complex commercial services that require smaller amounts of floorspace and business land. This shift has been occurring for decades but will continue to shape the economic landscape.

Changes in activity types are also happening within sector classifications. These changes are likely to further reduce the need for business land a little. For example, food manufacturing and logistics are replacing heavier industrial activity mitigating future needs for floorspace and land.

But councils need to be wary. Business needs can be localised and not easily shifted across the region. Our forecasts show strong demand for some types of business land in specific locations. This can include preferences for reducing risks associated with land subject to earthquake risk and sea-level rise. Shifts in preferences will challenge councils to meet challenges while making the most of opportunities.

Transport infrastructure also shapes the quantity and location of business land required. We show a sequence of transport infrastructure projects that improve access and travel times along the region's Northern corridor, increase but also shift where business land is likely to be needed.

There are many uncertainties, but the key uncertainty for the outlook for business land is how many people choose to live and work within the Wellington region. Our baseline forecast for business land uses Statistics New Zealand's medium population projection but there are sound reasons to consider planning to manage stronger population flows. To this end we show that demand for business land is substantially larger under Statistics New Zealand's high population projection.

Accommodating extra people has greater impacts on demand for business land than the transport infrastructure projects we consider. Councils will need to think through the costs and benefits of planning to accommodate higher population inflows. Assessing the capacity of the region to accommodate demand will help in this regard.

References

Anderson, Paul A. (1979), "Help for the regional economic forecaster: vector autoregression," *Quarterly Review*, Federal Reserve Bank of Minneapolis, vol 3(3)

Bank of New Zealand (2018), New Zealand Online Retail Sales, November and provisional December 2017 spending

Byett, A, A Stroombergen, J Laird and R Paling (2017) The economic impacts of connectivity. NZ Transport, Agency research report 608. 158pp.

Byett, A, J Laird, A Stroombergen and S Trodd (2015) Assessing new approaches to estimating the, economic impact of transport interventions using the gross value added approach. NZ Transport, Agency research report 566. 131pp.

Canova, Fabio (2007), "Methods for Applied Macroeconomic Research", Princeton University Press.

Grimes, A, E Apatov, L Lutchman and A Robinson (2014) Infrastructure's long-lived impact on urban development: theory and empirics. Motu working paper 14–11.

Grimes, A & C Young, (2013) "Spatial effects of urban rail upgrades", Journal of Transport Geography 30(6): 1-6.

Grimes, Arthur and Yun Liang, (2010) "Bridge to Somewhere: Valuing Auckland's Northern Motorway Extensions", Journal of Transport Economics & Policy 44(3): 287-315

Hamilton, J. D. (1994) "Time series analysis", Princeton, N.J.: Princeton University Press.

Hausmann, R. and B. Klinger (2006) 'Structural Transformation and Patterns of Comparative Advantage in the Product Space', CID Working Paper

Hidalgo, C. and R. Hausmann (2009) 'The building blocks of economic complexity', PNAS 2009 106 (26) 10570-10575.

JLL (2017), US Retail Investment Outlook, Quarter 4 2017.

Maré, DC and DJ Graham (2009) Agglomeration elasticities in New Zealand. Motu working paper 09–06. 128pp.

Property Economics (2017), Porirua City Industrial and Business land demand supply analysis (draft), September 2017. 1

Sims, Christopher, (1980), "Macroeconomics and Reality", *Econometrica*, 48, issue 1, p. 1-48.

Statistics New Zealand (2016). How accurate are population estimates and projections? An evaluation of Statistics New Zealand population estimates and projections, 1996–2013. Retrieved from www.stats.govt.nz.

Timar, Levente, Arthur Grimes and Richard Fabling (2015), "Before a Fall: Impacts of Earthquake Regulation and Building Codes on the Commercial Building Market" Motu Working Paper 15-19 Motu Economic and Public Policy Research October 2015

Statistics New Zealand (2016). How accurate are population estimates and projections? An evaluation of Statistics New Zealand population estimates and projections, 1996–2013. Retrieved from www.stats.govt.nz.

Urban Economics (2016), "Economics significance of the Property Industry to the Wellington Economy", Report prepared for Property Council New Zealand

Wellington City Council (2006), Long-term plan, 2006-2016, Wellington City Council, available at: https://wellington.govt.nz/your-council/plans-policies-and-bylaws/plans-and-reports/long-term-plan/long-term-plan-2006-16

Wellington City Council (2009), Long-term council community plan, 2009-2019, Wellington City Council, available at: https://wellington.govt.nz/your-council/plans-policies-and-bylaws/plans-and-reports/long-term-plan/long-term-council-community-plan-2009-19

Wellington City Council (2012), Long-term plan, 2012-2022, Wellington City Council, available at: https://wellington.govt.nz/your-council/plans-policies-and-bylaws/plans-and-reports/long-term-plan/long-term-plan-2012-22

Wellington City Council (2015), Long-term plan, 2015-2025, Wellington City Council, available at: https://wellington.govt.nz/your-council/plans-policies-and-bylaws/plans-and-reports/long-term-plan/long-term-plan-2015-25

Appendix 1: Ubiquity, diversity and complexity

Economic complexity indices measure the capability of an economy or regional economy. Economic complexity indices bring together information on the scope, or diversity of economic production and the degree to which the economy produces goods and services that are made nowhere else.

Measuring both diversity of production and the extent to which that production is unique first requires a measure of whether production is specialised. To do this, for each region we count the number of sub-industries where employment forms a higher fraction of the employment base than the national average Essentially, we count up industries that are overweight at the local level, or more formally:

$$S_{r,i} = \frac{\frac{e_{r,i}}{\sum_i e_{r,i}}}{\frac{\sum_r e_{r,i}}{\sum_{r,i} e_{r,i}}}$$

where $S_{r,i}$represents the degree of specialisation and is bounded between 0 and 1.[16]

Then, the scope or diversity of a region is the sum of all the industries where the region shows specialisation, that is:

$$d_r = \sum_i s_{r,i}$$

where d_r is the diversity index for the region. The scope or uniqueness of an industry is then:

$$u_i = \sum_r s_{r,i}$$

But then we need to move beyond the relative position of a region versus all regions (and an industry versus all industries) to compare similar and dissimilar regions. To quantify this joint analysis we iterate over the joint distribution of diversity and ubiquity, evaluating the average diversity and ubiquity score for each region for every iteration. Ultimately, successive iterations mix differences between ubiquity and diversity and leave the complexity index. More technically, the complexity index, E_r, is given by:

$$E_r = 1 + \frac{\left(d_{r,k=20} - \frac{\sum_r d_{r,k=20}}{R}\right)}{\sqrt{\frac{\sum_r \left(d_{r,k=20} - \frac{\sum_r d_{r,k=20}}{R}\right)^2}{R}}}$$

[16] For example, Wellington exhibits specialisation in book publishing (J541300), data processing and web-hosting services (J592100), management advice and related consulting services (M696200), aged care residential services (Q860100) and corporate head office management services (M696100), among other activities.

where

$$d_{r,k} - (u_{k-1,i}. SP'_r).\frac{1}{d_{r,k=0}}$$

is the diversity process at the k-th iteration and:

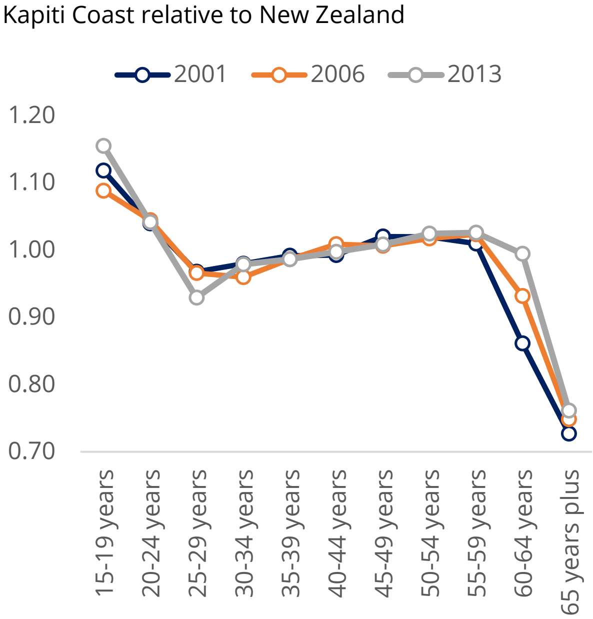
$$u_{k,i} = (SP'_i. d_{r,k-1}).\frac{1}{u_{k=0,i}}$$

gives the ubiquity measure at the k-th iteration.

We use counts of employees across 490 industries and across 16 regions to construct our time series estimates of complexity from 2000 top 2017, first converting our employee count data in specialisation measures before constructing the diversity and ubiquity measures specified above.

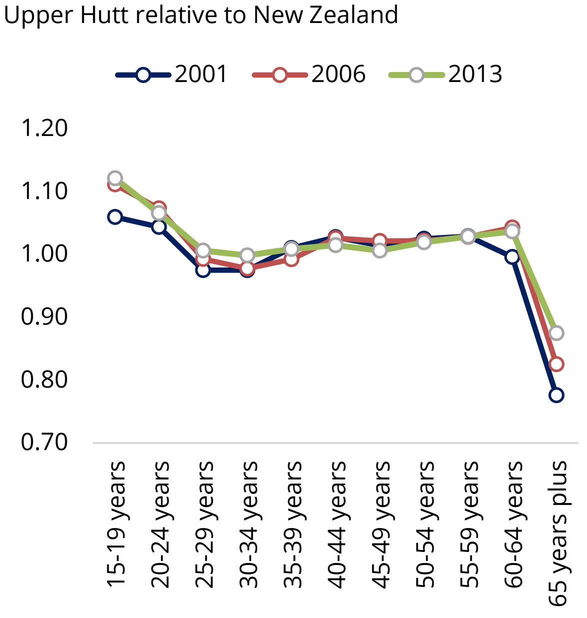
Appendix 2: Local labour markets

FIGURE 146: LABOUR FORCE PARTICIPATION: BY AGE, KAPITI COAST RELATIVE TO NEW ZEALAND



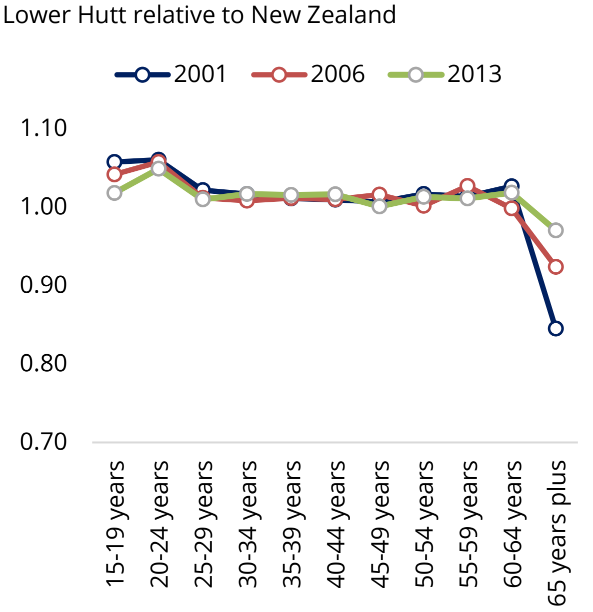
Source: Statistics New Zealand

FIGURE 147: LABOUR FORCE PARTICIPATION:BY AGE, UPPER HUTT RELATIVE TO NEW ZEALAND



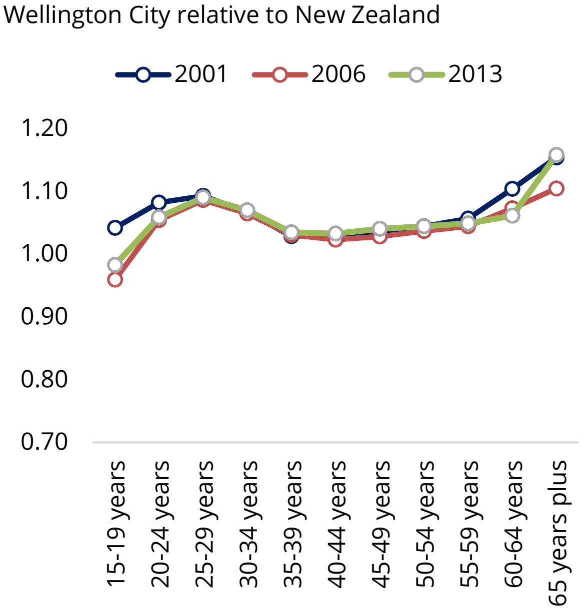
Source: Statistics New Zealand

FIGURE 148: LABOUR FORCE PARTICIPATION: BY AGE LOWER HUTT RELATIVE TO NEW ZEALAND



Source: Statistics New Zealand

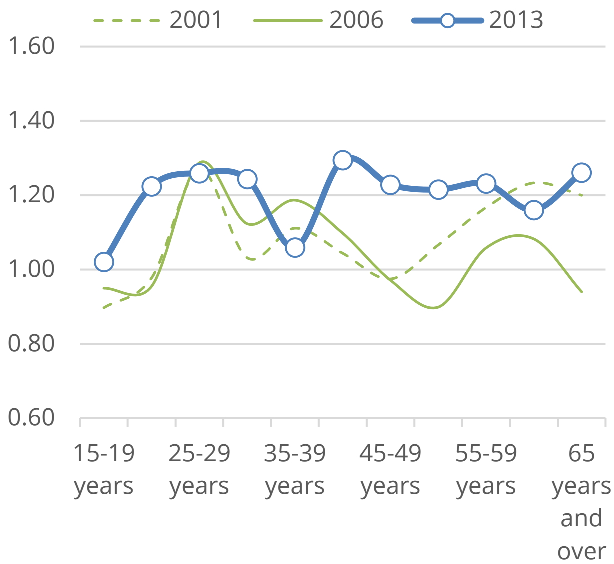
FIGURE 149: LABOUR FORCE PARTICIPATION BY AGE WELLINGTON RELATIVE TO NEW ZEALAND



Source: Statistics New Zealand

FIGURE 150: UNEMPLOYMENT BY AGE: KAPITI COAST

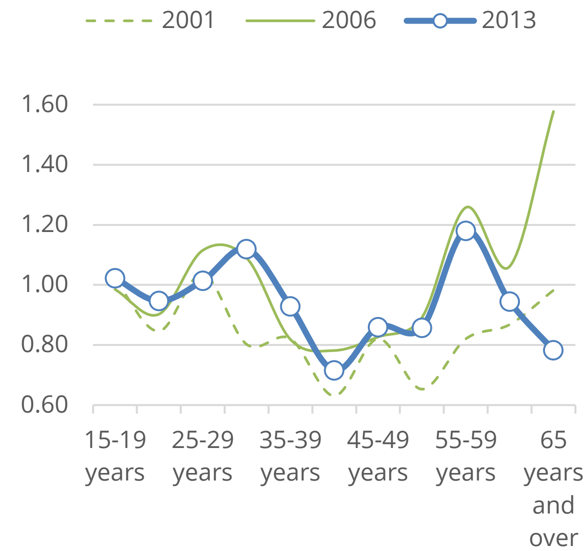
Kapiti Coast relative to New Zealand



Source: Statistics New Zealand

FIGURE 151: UNEMPLOYMENT BY AGE: UPPER HUTT

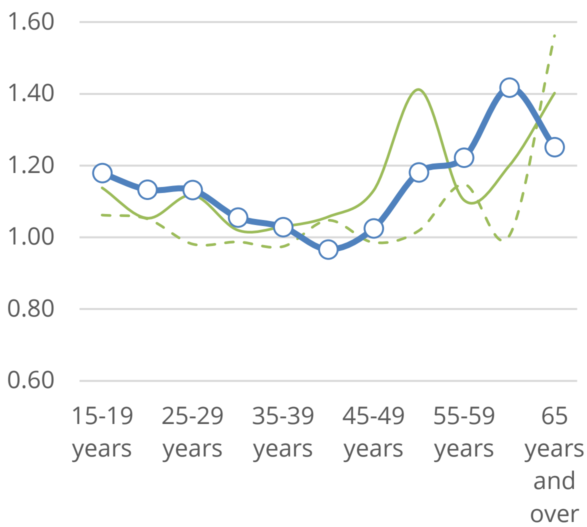
Upper Hutt relative to New Zealand



Source: Statistics New Zealand

FIGURE 152: UNEMPLOYMENT BY AGE: LOWER HUTT

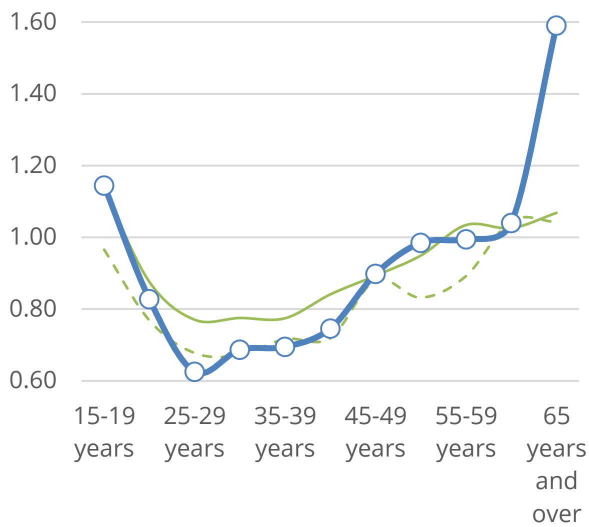
Lower Hutt relative to New Zealand



Source: Statistics New Zealand

FIGURE 153: UNEMPLOYMENT BY AGE: WELLINGTON CITY

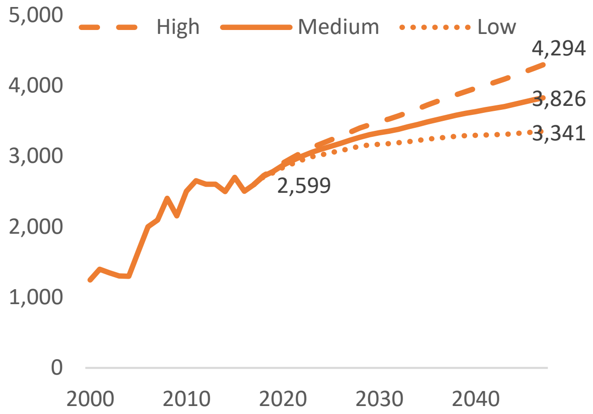
Wellington City relative to New Zealand



Source: Statistics New Zealand

FIGURE 154: UPPER HUTT: GOVERNMENT

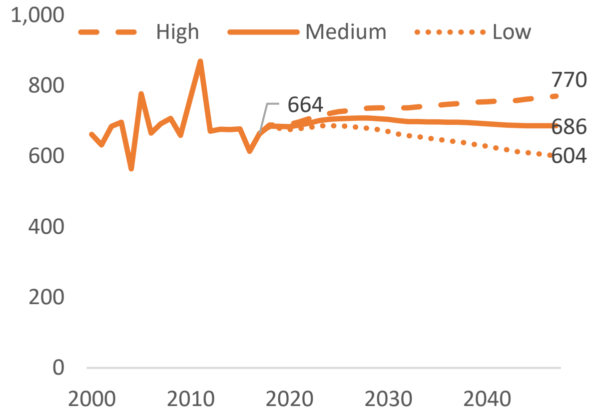
Upper Hutt, Government employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 155: UPPER HUTT OTHER

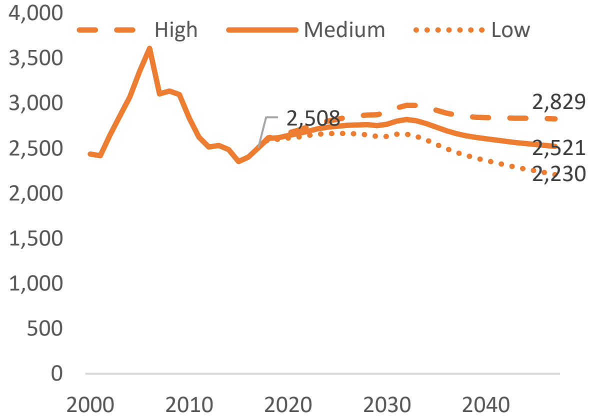
Upper Hutt, "Other" employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 156: UPPER HUTT INDUSTRIAL

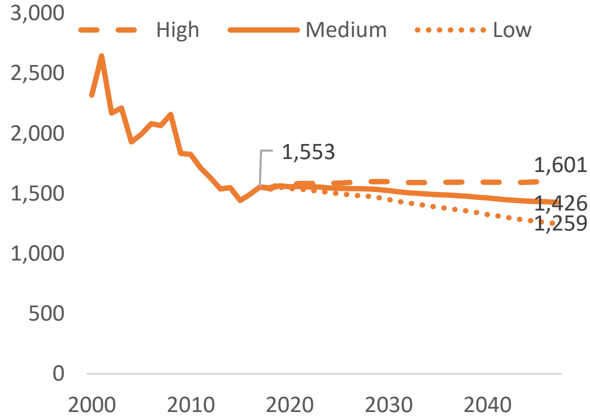
Upper Hutt, Industrial employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 157: UPPER HUTT: COMMERCIAL

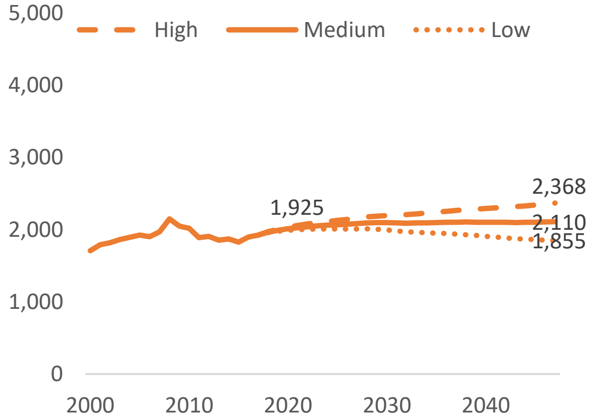
Upper Hutt, Commercial employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 158: UPPER HUTT RETAIL

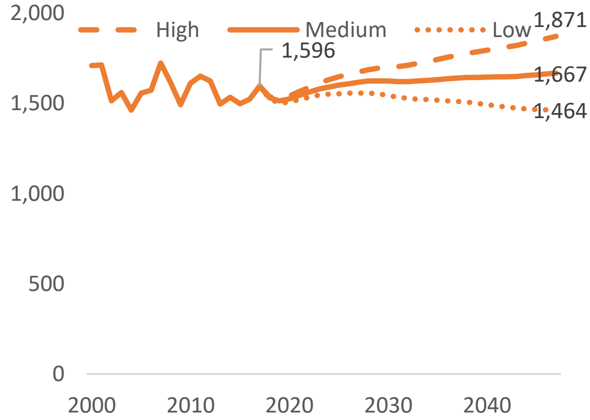
Upper Hutt, Retail employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 159: UPPER HUTT: HEALTH-EDUCATION

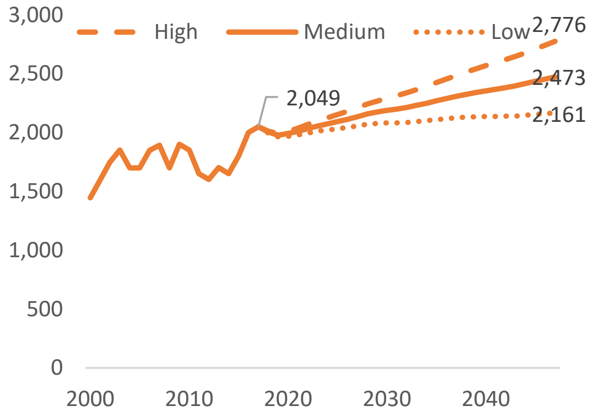
Upper Hutt, Health Educ.& training, employees 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 160: LOWER HUTT: GOVERNMENT

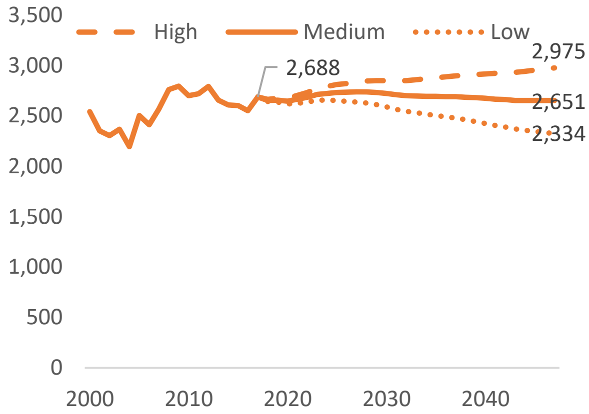
Lower Hutt, Government employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 161: LOWER HUTT OTHER

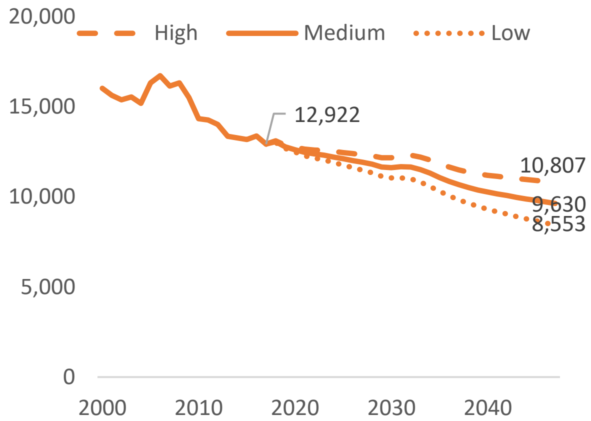
Lower Hutt, "Other" employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 162: LOWER HUTT INDUSTRIAL

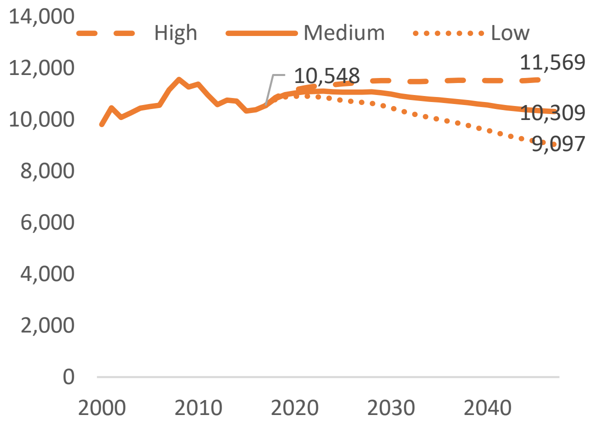
Lower Hutt, Industrial employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 163: LOWER HUTT: COMMERCIAL

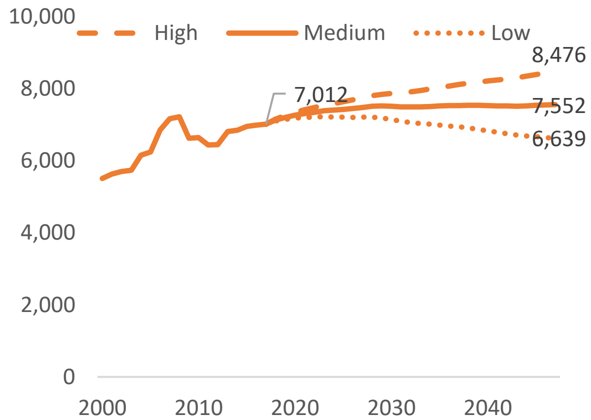
Lower Hutt, Commercial employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 164: LOWER HUTT RETAIL

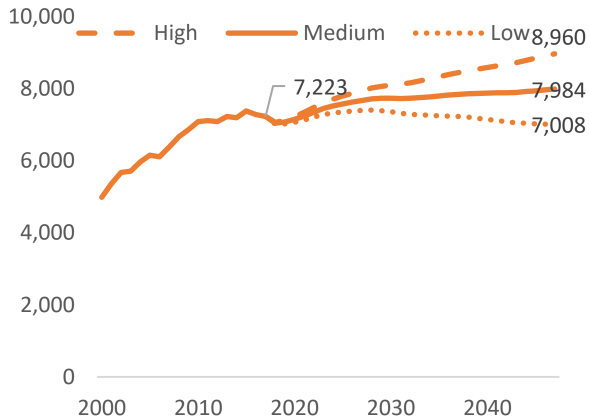
Lower Hutt, Retail employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 165: LOWER HUTT: HEALTH-EDUCATION

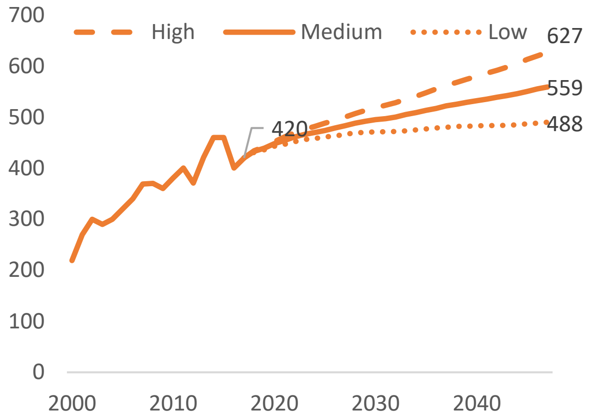
Lower Hutt, Health Educ.& training, employees 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 166: KAPITI: GOVERNMENT

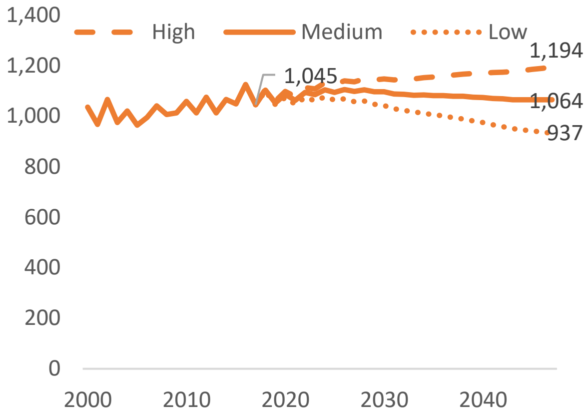
Kapiti, Government employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 167: KAPITI OTHER

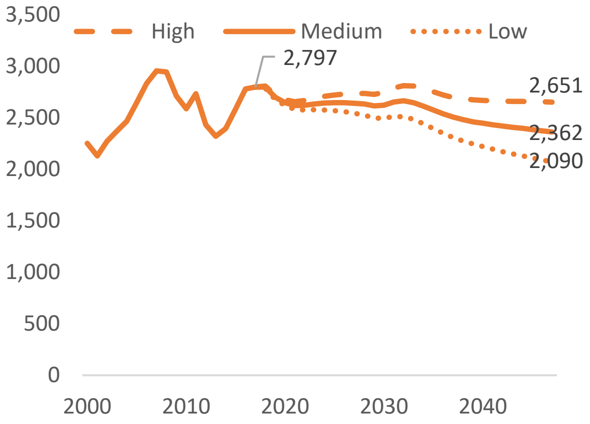
Kapiti, "Other" employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 168: KAPITI INDUSTRIAL

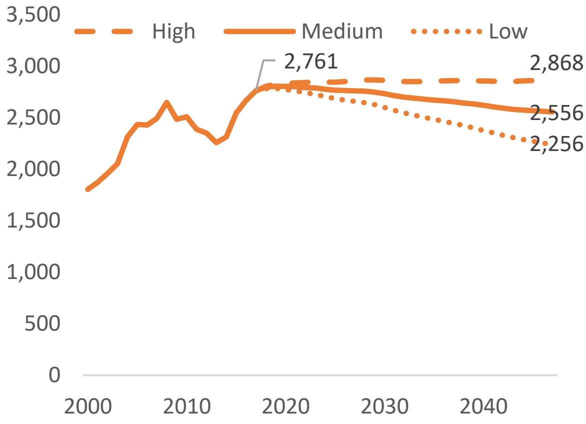
Kapiti, Industrial employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 169: KAPITI: COMMERCIAL

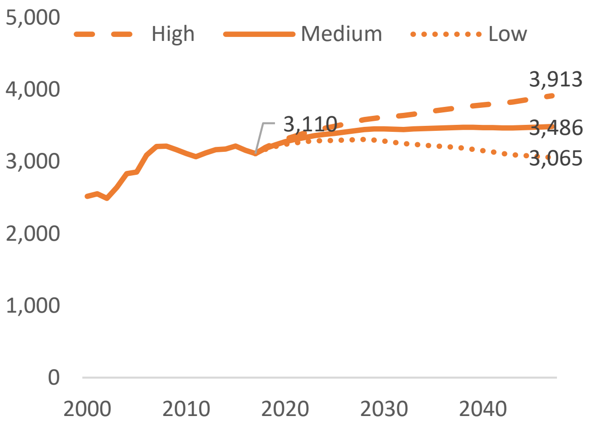
Kapiti, Commercial employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 170: KAPITI RETAIL

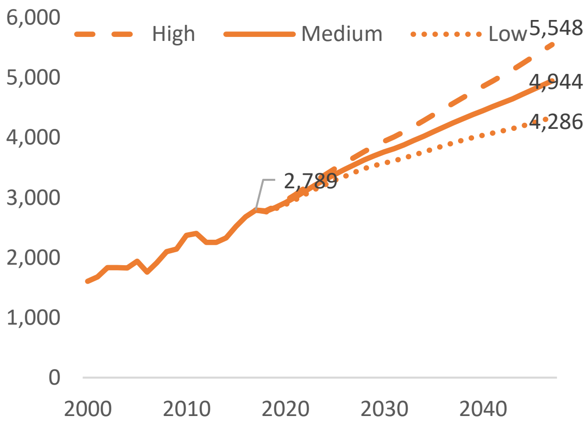
Kapiti, Retail employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 171: KAPITI: HEALTH-EDUCATION

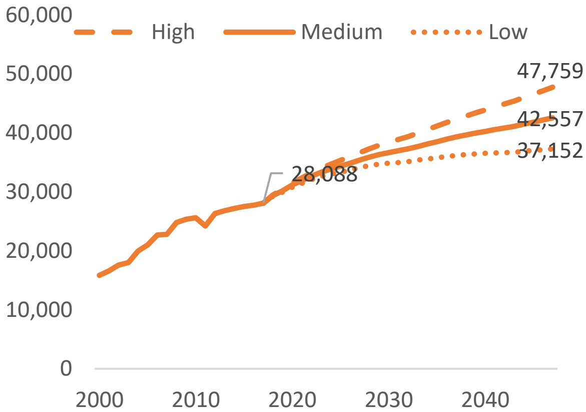
Kapiti, Health Educ.& training, employees 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 172: WELLINGTON CITY: GOVERNMENT

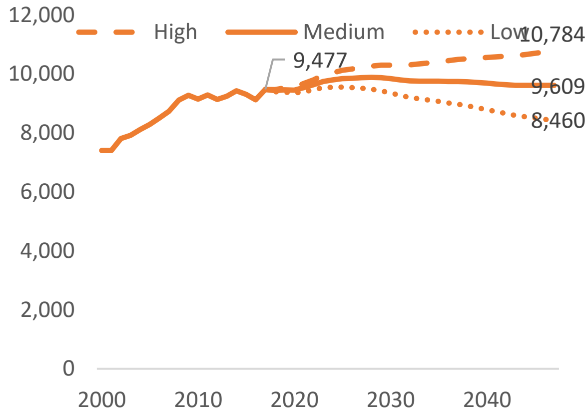
Wellington City, Government employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 173: WELLINGTON CITY OTHER

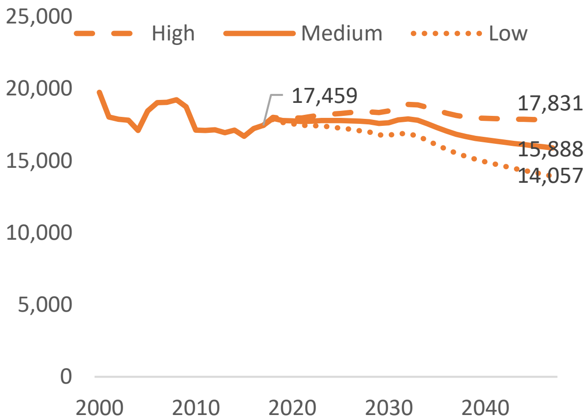
Wellington City, "Other" employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 174: WELLINGTON CITY INDUSTRIAL

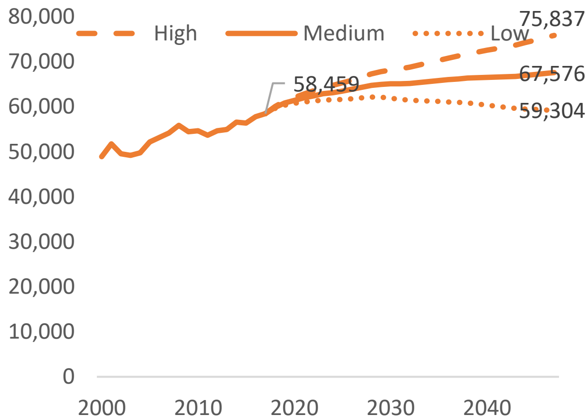
Wellington City, Industrial employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 175: WELLINGTON CITY: COMMERCIAL

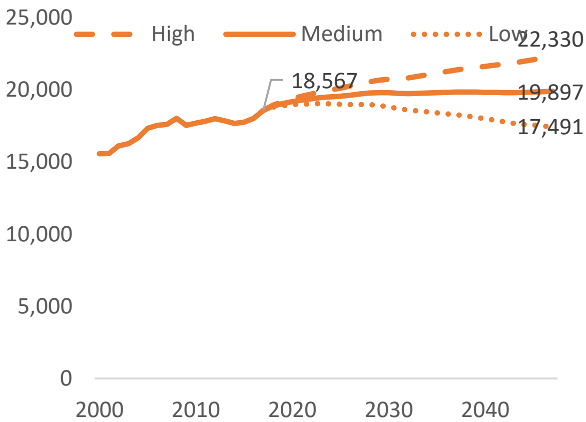
Wellington City, Commercial employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 176: WELLINGTON CITY RETAIL

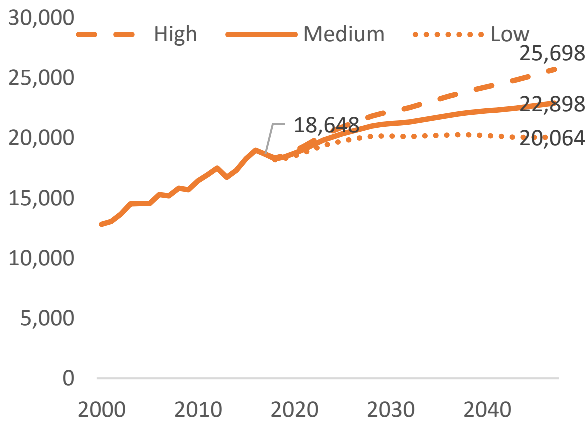
Wellington City, Retail employees, 2000-47



Source: Statistics New Zealand, Sense Partners

FIGURE 177: WELLINGTON CITY: HEALTH ETC

Wellington City, HET, employees 2000-47



Source: Statistics New Zealand, Sense Partners

Appendix 3: The Vector-auto-regressive model

VAR models are a standard economic model that typically work with a small number of variables to uncover the structure of the economy and to produce forecasts of key variables.

One of the key benefits of how we will use our VAR model is there is no need to impose restrictions on the model. Aside from assuming linear interactions, the dynamic interactions across variables are left unrestricted. More technically, we can represent the VAR as:

$$x_t = F_{x_{t-1}} + u_t$$

where x_t is a vector of industry share data derived from yearly employment count data from Statistics New Zealand's business demography database, so the t subscript represents a year.

More precisely, we bundle together health, education and training employment and then construct industrial, commercial, government, and retail categories, grouping all remaining employment into an "other" category. Figure 181 shows the map from ANZSIC categories to our industry groupings. So for our VAR model, x_t includes the following variables:

$$x_t = [h_t, i_t, c_t, g_t, r_t, o_t]$$

where h_t is health, education and training, i_t is industrial employment, c_t is commercial, g_t is government employment, r_t is retail employment and o_t is "other" employment.

In principle, x_t could be expanded to include lags of our employment variables such that our industry employment variables could be related to not just last year's values but values from two years ago. When we test the fit of using additional lags, we find that a model with a single lag provides the best trade-off between matching the data and overfitting the data. Moreover, we include a constant and a trend in our model.

Before including the variables in the model, we test the order of integration of each series to check the variables are stationary using Augmented Dickey-Fuller statistics. Alongside the F-statistics that report the overall fit of each variable in the VAR, we report the results of these tests that show each of the variables are stationary (see Figure 178).

FIGURE 178:THE MODEL FITS THE STATIONARITY DATA VERY WELL

ADF-test results for stationarity and model fit statistics

Test	Health	Industrial	Commercial	Government	Retail	Other
ADF-stat	-2.136	-2.276	-2.727	-1.186	-2.704	0.675
p-value	(0.480)	(0.533)	(0.705)	(0.118)	(0.696)	(0.010)
F-test	114.00	13.2	22.6	134.3	23.31	54.73
p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Source: Sense Partners

We use the Akaike-Information Criteria to evaluate the fit of our model. In addition, we test that the residuals from the VAR model are well-behaved, the results of which we present in Figure 53.

FIGURE 179: RESIDUALS FROM THE VAR MODEL ARE NORMAL

Tests for well-behaved residuals

Test	Skewness	Kurtosis	Normality
Test-stat	7.964	5.045	13.009
p-value	(0.241)	(0.538)	(0.368)

Source: Sense Partners

One of the key benefits of our model framework is that we allow for dynamic interactions across the industry shares.

Figure 180 shows the impact on each variable in our VAR from each industry share variable. The figure shows that the Health, Education and Training sector is primarily driven by activity in its own sector (46%). Government sector employment today has only as a small impact (6%) on employment in Health, Education and Training ten years in the future.

FIGURE 180: THE MODEL ALLOWS DYNAMIC INTERACTIONS ACROSS INDUSTRY SHARES

Outlook for economic activity, real GDP, Wellington City

	Driver after ten years					
Variable	Health	Industrial	Commercial	Government	Retail	Other
Health	46%	7%	20%	6%	13%	8%
Industrial	10%	26%	10%	10%	23%	20%
Commercial	8%	22%	24%	10%	18%	18%
Government	11%	14%	10%	20%	32%	13%
Retail	16%	18%	9%	8%	33%	16%
Other	10%	13%	7%	18%	29%	23%

Source: Sense Partners

FIGURE 181: MAP FROM ANZSIC 2006 TO OUR INDUSTRY CATEGORIES

Industry	Commercial	Govt.	Health & Education	Other	Industrial	Retail	Employees June, 2017
A Agriculture, Forestry and Fishing				0.9	0.1		565
B Mining				0.9	0.1		335
C Manufacturing					1		11,130
D Electricity, Gas, Water and Waste Services				0.7	0.3		2055
E Construction					1		13,430
F Wholesale Trade					1		7,320
G Retail Trade						1	19,100
H Accommodation and Food Services	0.15					0.85	17,240
I Transport, Postal and Warehousing					1		6,890
J Information Media and Telecommunications	1						5,685
K Financial and Insurance Services	1						11,450
L Rental, Hiring and Real Estate Services	1						2,600
M Professional Scientific and Technical Services	1						29,640
N Administrative and Support Services	1						11,770
O Public Administration and Safety		1					34,010
P Education and Training	0.25		0.75				20,900
Q Health Care and Social Assistance	0.25		0.75				25,090
R Arts and Recreation Services	0.25			0.75			5,700
S Other Services				1			8,210

Source: Statistics New Zealand, Sense Partners

Appendix 4: Allowable business activities by zone

FIGURE 182: EACH COUNCIL IN THE REGION ALLOWS A DIVERSE SET OF BUSINESS ACTIVITIES, BUT UNDER DIFFERENT BUSINESS ZONING DEFINITIONS

Council	Zoning area	Local Council Description	Area
Kapiti coast	Industrial	The district allows a range of industrial activities including manufacturing, light industry, fabricating, processing and servicing and repair of goods. The great majority of these are within the land zoned industrial/service.	114.8
	District Centre	The Paraparaumu District Centre is intended to serve as a focal point for the district. Integration of retail and commercial activities with community (cultural and recreational), civic amenities and facilities and residential activities in a district core.	68.5
	Outer Business Zone	Provides for compatible commercial activities and some retail activities on the periphery of the district centre.	26.2
	Town Centre	Enables retail activities that provide 'convenience' goods and a range of 'comparison' goods to serve the major weekly household shopping needs of the local community, as well as a range of other business, cultural and community facilities and services.	20.7
	Local Centre	To provide a mix of limited local retail activities, other business activities, facilities and services which serve the daily convenience needs of local communities, generally within a walkable distance.	4.9
Lower Hutt	General Business	A range of industrial and commercial activities are accommodated. Certain retailing activities are permitted outside the main commercial centres, due to their nature and character. For example, kit set garages, caravans, trailers and boats. Natural materials are included where they are sold in bulk, such as gravel, shingle, rock, concrete, coal, fire wood and timber	294.1
	Special Business	To protect the community and the receiving environment from the risk associated with the location and operation of hazardous facilities in Seaview/Gracefield	148.7
	Central Commercial		36.6
	Petone Commercial 2	To provide for a mixed-use activity area within Petone which caters for a range of complementary commercial, small-scale or low intensity light industrial, business & service activities, residential & large format retail activities.	28.5
	Avalon Business	The principal activity has been television production and broadcasting, as well as a range of media and communication activities. A mix of activities not necessarily associated with television and film production and broadcasting activities, but consistent with their effects, is appropriate. Includes: telecommunications, office,	9.5

122

Council	Zoning area	Local Council Description	Area
		industrial activities related to TV and broadcasting, service industry, cottage industry, research, warehousing, recreation, education, emergency facilities.	
	Petone Commercial 1	Small scale activities are permitted on Jackson Street generally between Victoria and Cuba Streets so that there is no likelihood of encroachment into adjoining residential activity areas and adverse effects, such as adverse traffic effects, are managed.	6.1
	Suburban commercial	Provides for a range of retail and commercial activity to meet the needs of residents, activities which provide a community focus, light industrial activities of a workshop nature where an associated retailing activity is maintained at the front of the shop.	21.5
Upper Hutt	Business Industrial	The Commercial Sub-zone focuses on retail and service functions which support the local community. Within this sub-zone, the CBD accommodates a variety of activities in a compact, convenient layout which is characterised by pedestrian-orientated traffic. Commercial activities are also provided for in Silverstream and other suburban areas. These areas provide for a limited range of shopping and business needs. The smaller neighbourhood shops, including dairies, provide for day-to-day convenience shopping.	132.6
	Business Commercial	The Industrial Sub-zone incorporates land which is used for a range of larger scale industrial, warehousing, storage and commercial activities which are vehicle rather than pedestrian orientated. There are limited retail activities within these areas and the environmental standards are less stringent than those within Commercial .	45.3
Wellington City	Business Two	Traditional business areas where a range of industrial activities including warehousing, manufacturing and commercial services can occur. Because of the industrial nature of the activities in such areas, lower levels of amenity are acceptable compared with other areas. Residential and some retail activities are restricted.	148.1
	Central Area	It is a vibrant mix of inner-city living, entertainment, and commercial activity. It attracts arts, cultural and recreational events of local, national and international repute. Major infrastructure and facilities that contribute to the city's economic base are located within the Central Area.	233.1
	Business One	Contain a range of uses including: employment activities, light industrial, commercial and business services, recreational, residential and entertainment uses, and local community services. In some cases, retail activities are also appropriate.	66.9
	Centre	Centres range from large shopping centres to small clusters of shops. They have multiple functions and activities, but their core is providing localised shopping and services that complement the Central Area.	70.7
	Curtis St Business	Specifically provide for and encourage a range of commercial activities in the Curtis Business Street Area. Control the establishment of large integrated retail developments and large supermarkets.	1.1

123

Appendix 5: Using consent data

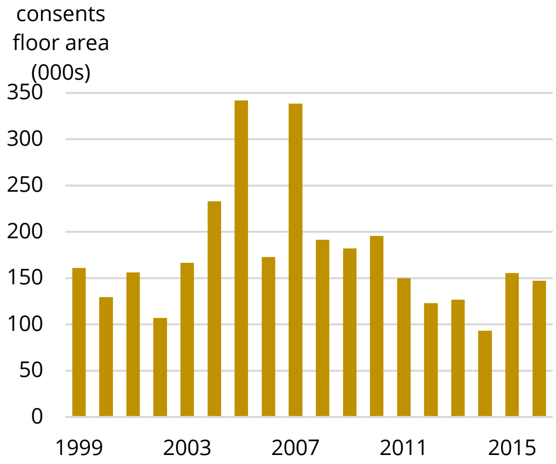
FIGURE 183: MAP FROM CONSENT DATA CATEGORIES TO OUR INDUSTRY CATEGORIES

Industry	Commercial	Govt.	Health & Education	Other	Industrial	Retail	Consented area 2016
Hotels	0.15					0.85	19,475
Health			1				2,250
Education			1				8,140
Social				1			8,316
Shops						1	17,479
Office	0.5	0.5					49,457
Storage					1		7,521
Factories					1		23,164
Farms				1			18,632

Source: Statistics New Zealand, Sense Partners

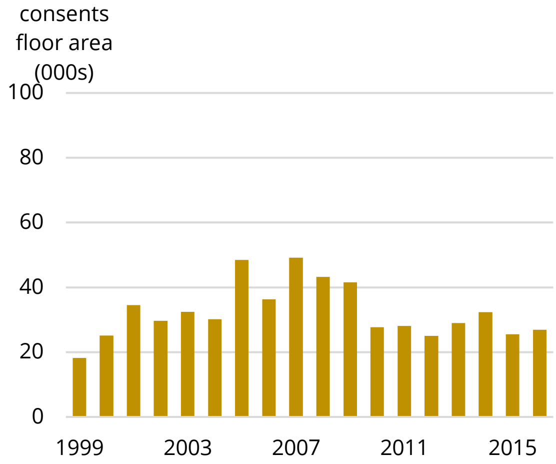
Figure 184 to Figure 189 show the history of consent data according to these categories.

FIGURE 184: COMMERCIAL CONSENTS



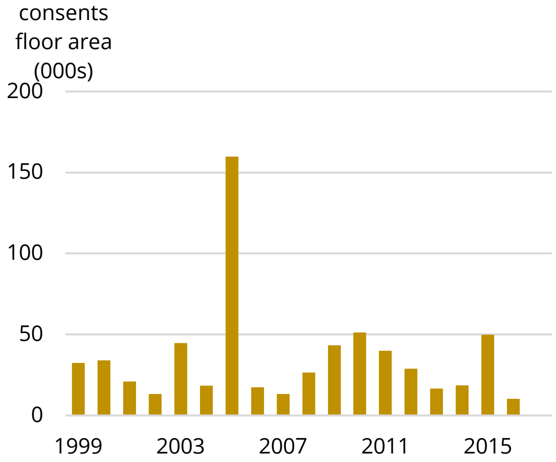
Source: Statistics New Zealand

FIGURE 185: OTHER CONSENTS



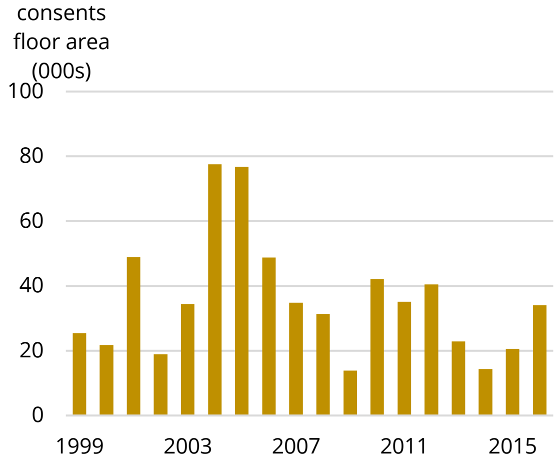
Source: Statistics New Zealand

FIGURE 186: HEALTH & EDUCATION CONSENTS



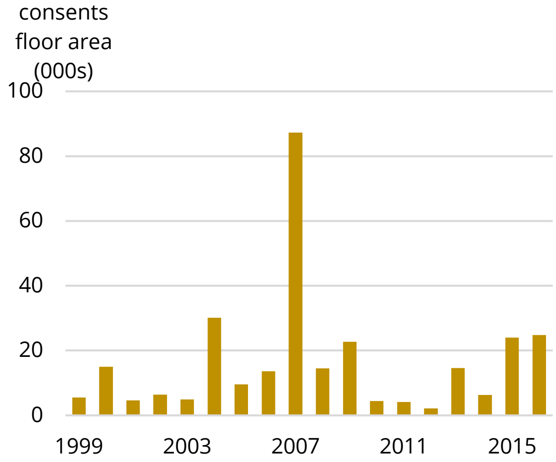
Source: Statistics New Zealand

FIGURE 187: RETAIL CONSENTS



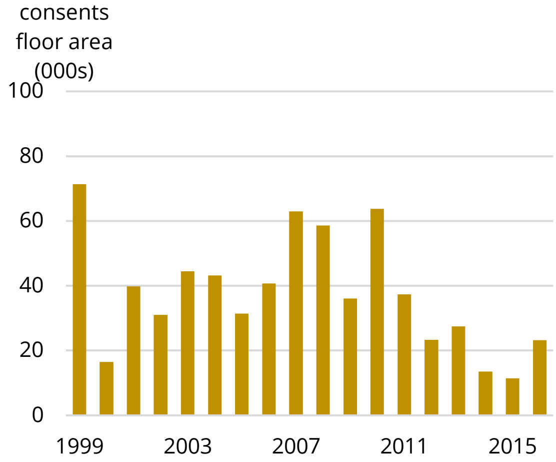
Source: Statistics New Zealand

FIGURE 188: GOVERNMENT CONSENTS



Source: Statistics New Zealand

FIGURE 189: INDUSTRIAL CONSENTS



Source: Statistics New Zealand

Appendix 6: GIS analysis

We undertook the following steps to transform the data and, in some cases, correct errors in the underlying data:

1. Discard roads and water bodies from the LINZ parcel database. In some cases, 'slivers' of land near road reserves remained in the LINZ dataset.
2. Match ratings information to LINZ parcels. If 90% of parcels fall in one zoning area, the entire parcel is coded to that zone. Otherwise, the parcel is split between zones.
3. Match LIDAR building footprint / building height data to LINZ parcels and calculate the area of building footprint within each parcel. If a building footprint crosses over two parcels, it is split between them.
4. Match ratings data on capital and land values and existing building floorspace to LINZ parcels. As there is a 'many to many' relationship between ratings units and parcels, this entailed:
    - proportionately allocating ratings unit data to parcels based on share of land area in cases where ratings units overlapped multiple parcels,
    - summing up values for all ratings units to the underlying parcel where multiple ratings units were present on a single parcel.

      There were cases where the format of the underlying data resulted in errors. For instance, each tenancy in an office building may have the entire building area recorded against it, rather than the area of the individual tenancy.

      In these cases, the summed values were divided by the number of ratings units, which often (but not always) resulted in a plausible result.
5. Many additional variables were created using the underlying data. This included:
    - An estimated floor area ratio using ratings database information on floor area (FAR-ratings)
    - An estimated site coverage ratio using LIDAR building footprints (SCR-LIDAR)
    - An estimated floor area using LIDAR data on building footprints and building heights (FAR-LIDAR) by dividing building height in metres by an average ratio. To estimate total floor area per building we use 3.4 metres per storey to estimate building storeys and then multiply by building footprint
    - The ratio of land value to capital value based on ratings data (LV/CV ratio). This is measure the building investment that has occurred on each site.
    - The estimated value of improvements on sites (IV), that is, CV minus LV.
6. Several filters were also created to exclude sites with erroneous ratings information or sites that are likely to be too small to be developable.

Relationships between these measures

Several sources of data on existing buildings are incomplete. To estimate FARs by activity and zone, we need to extrapolate FARs for sites in Upper Hutt.

To that end, we analyse correlations between ratings valuations, ratings database information on building area, and LIDAR data on building footprints and height.

Kapiti also provided additional information on its business areas to support analysis of measures, including FARs. This information was based on property ownership and includes aggregated data on LINZ parcels. This enabled rating information and additional GIS information to be used to complement and fill gaps in analysing measures.

Ratings data versus LIDAR data

First, we consider the correlation between two measures of FARs at the site level – FAR-ratings and FAR-LIDAR. The following diagram shows this correlation for Wellington City and Lower Hutt City, excluding several sites where there appeared to be large errors in the ratings database estimates of building area that could not be resolved with GIS analysis.

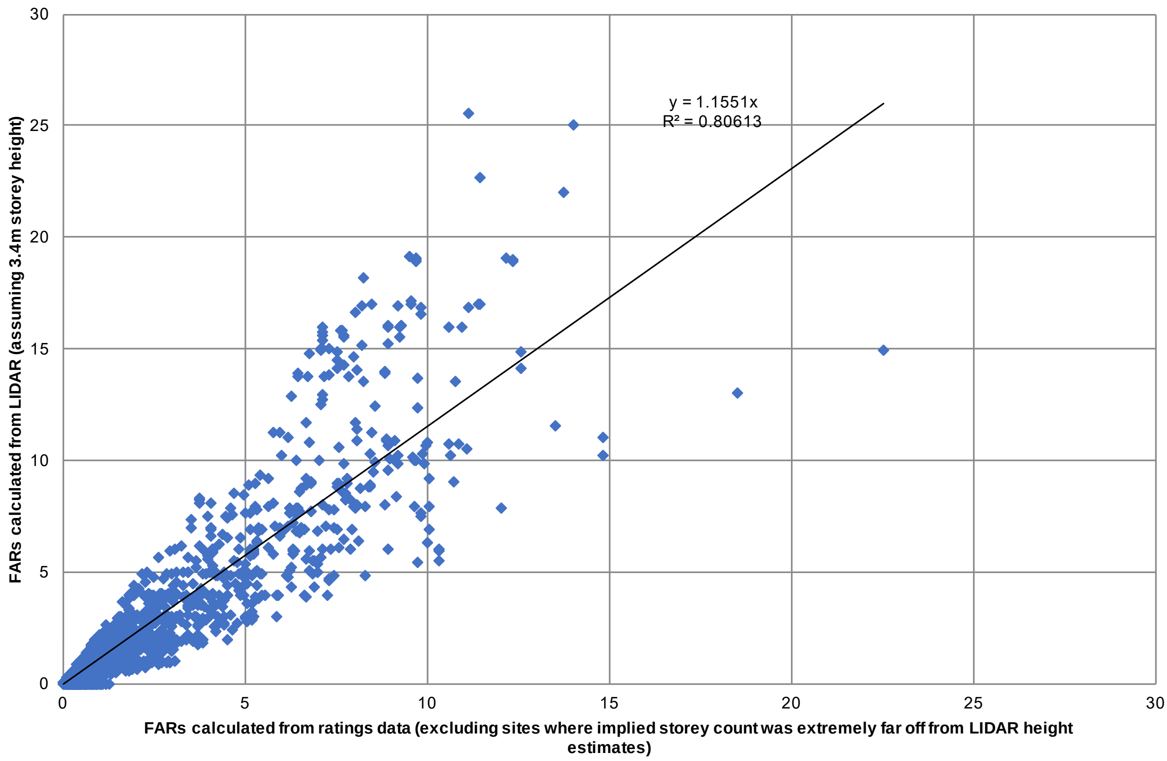
Figure 190 show there is a strong positive correlation between these measures, albeit with heteroscedasticity. However, this data indicates that there is likely to be upward bias in estimates of floor area derived from LIDAR data. This may reflect:

(a) upper levels of buildings that are smaller than lower levels, and

(b) storey heights that vary between buildings.

FIGURE 190: OUR 2 MEASURES OF BUSINESS LAND FARS ARE CORRELATED

Relationship between 2 measures for business land in Wellington City and Lower Hutt City

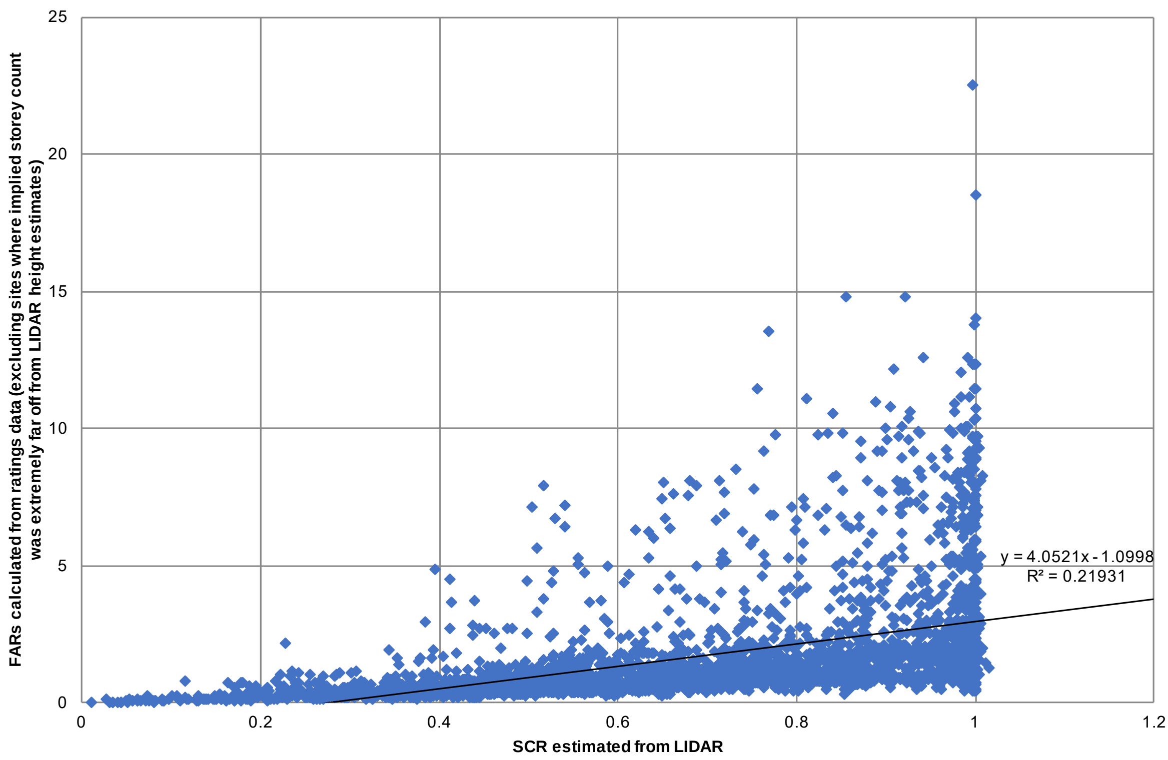


Source: MR Cagney

Second, we considered the correlation between FARs and site cover ratios. In general, we would expect some correlation between these measures, as FARs are roughly equal to SCRs multiplied by building height, but not a very strong relationship. Figure 121 shows that this is as expected. We therefore suggest that SCRs cannot be used as a close proxy for FARs, except in limited situations where there are no buildings over one storey in height.

FIGURE 191: SCRS CAN ONLY BE A CLOSE PROXY IN LIMITED SITUATIONS

FAR ratings and SCR-LIDAR for business land in Wellington City and Lower Hutt City



Source: MR Cagney

So, for our analysis:

- LIDAR data can be used as a substitute for ratings valuation data on floor area, but needs to rescaled using the trend line in Figure 191.
- Unless development is predominantly single-storey, such as in industrial zones or large format retail, site cover ratios cannot be used as a proxy to estimate FARs

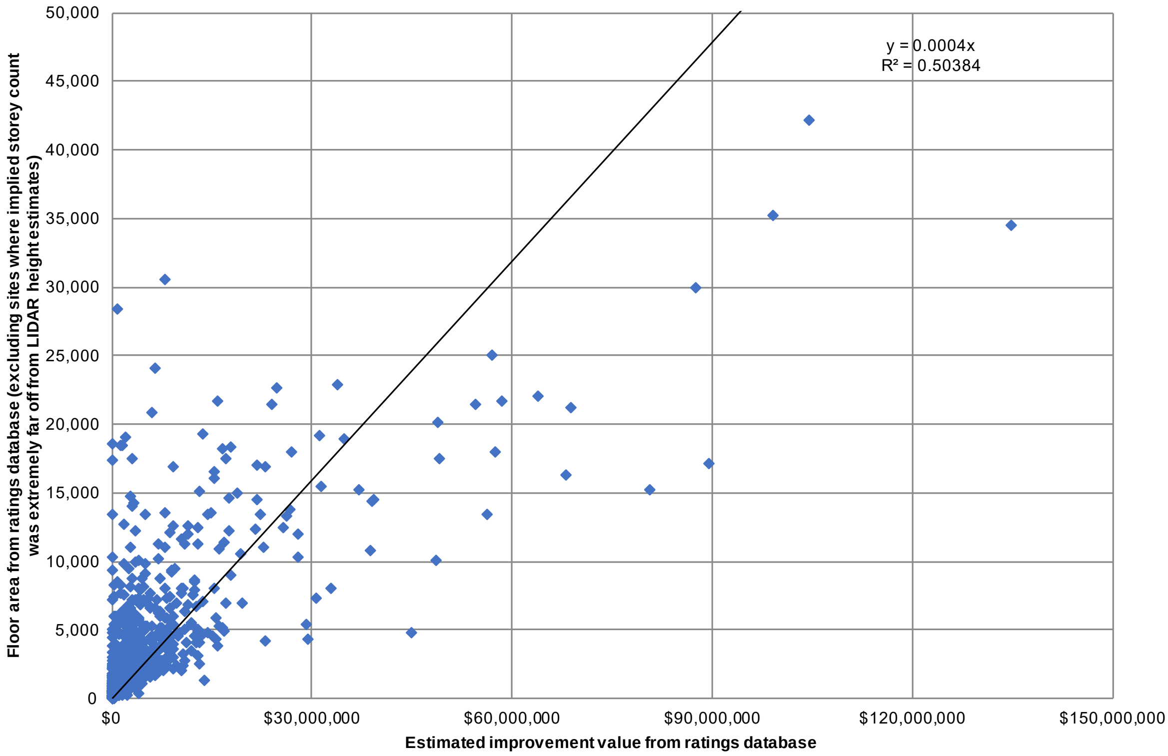
FARs and ratings valuations

Next, we test if ratings valuations can be a proxy for FARs. Figure 192 shows the two measures have the expected positive correlation, with good fit, albeit with some heteroskedasticity.[17] The trend-line shows each additional square metre of floorspace has an additional $2500 of improvement value. This is intuitively sensible – close to the average cost to build floorspace.

[17] Here, heteroskedasticity is likely to reflect buildings that are run-down and have less value.

FIGURE 192: RATING VALUATION CAN PROXY FOR FARS

Floor area and improvement value for business land in Wellington City and Lower Hutt City



Source: MR Cagney

To make an estimate of the quantity of floorspace on sites in Upper Hutt City, we:

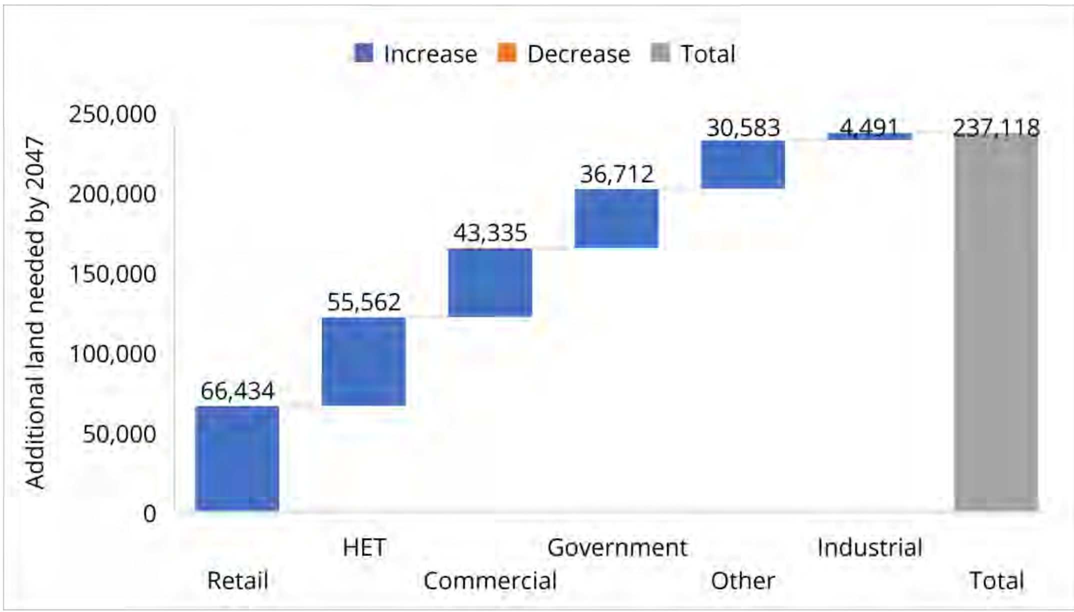
- use ratings valuations to estimate the value of improvements on sites
- exclude sites with 'implausible' ratings valuations, likely to reflect data coding errors
- convert valuations to estimated floorspace using the ratio of $2500 per square metre.

Our estimates of floorspace are likely to be imprecise one a site-by-site basis since they under-estimate floorspace for sites with older buildings that are relatively more dilapidated. However, the line of best fit shows our relationship captures a large share of variation in the data.

Appendix 7: Land demand by council

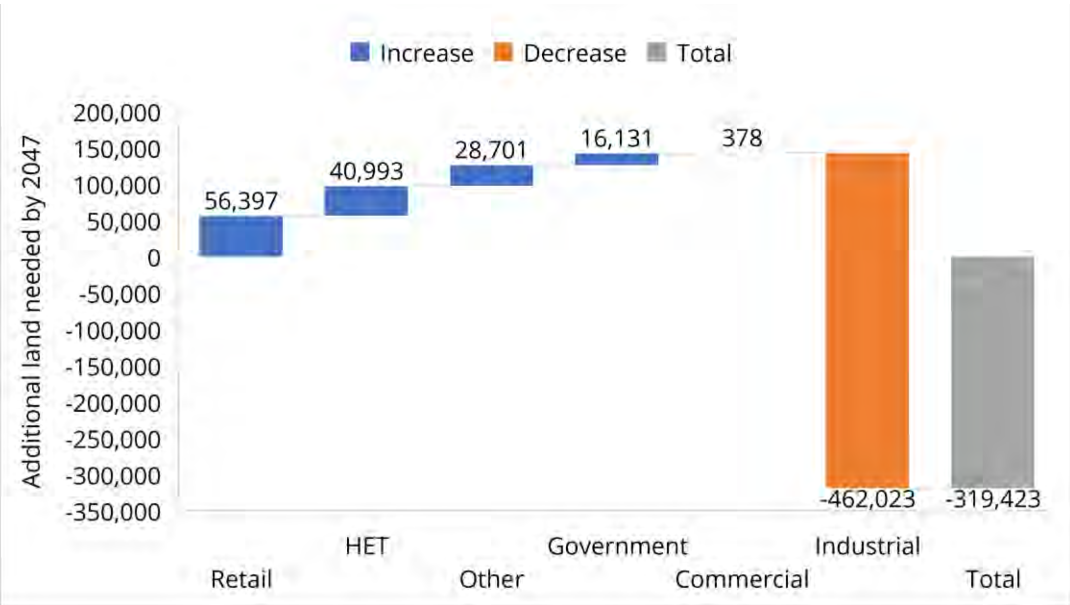
forecast.id population scenario

FIGURE 193: FORECAST.ID NUMBERS SUGGEST SIMILAR BUSINESS LAND DEMAND
Wellington City, Growth in demand for business land, 2000-2047, forecast.id scenario



Source: Sense Partners

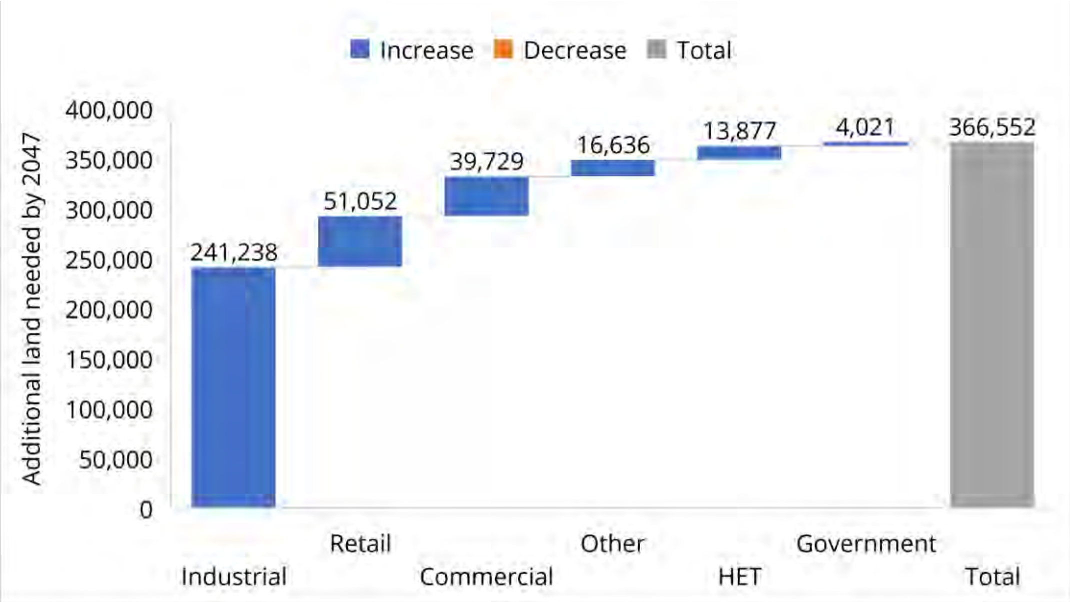
FIGURE 194: MORE PEOPLE LIFTS DEMAND FOR INDUSTRIAL LAND IN LOWER HUTT
Lower Hutt, Growth in demand for business land, 2000-2047, forecast.id scenario



Source: Sense Partners

FIGURE 195: INDUSTRIAL LAND REQUIREMENTS SHAPE UPPER HUTT OUTLOOK

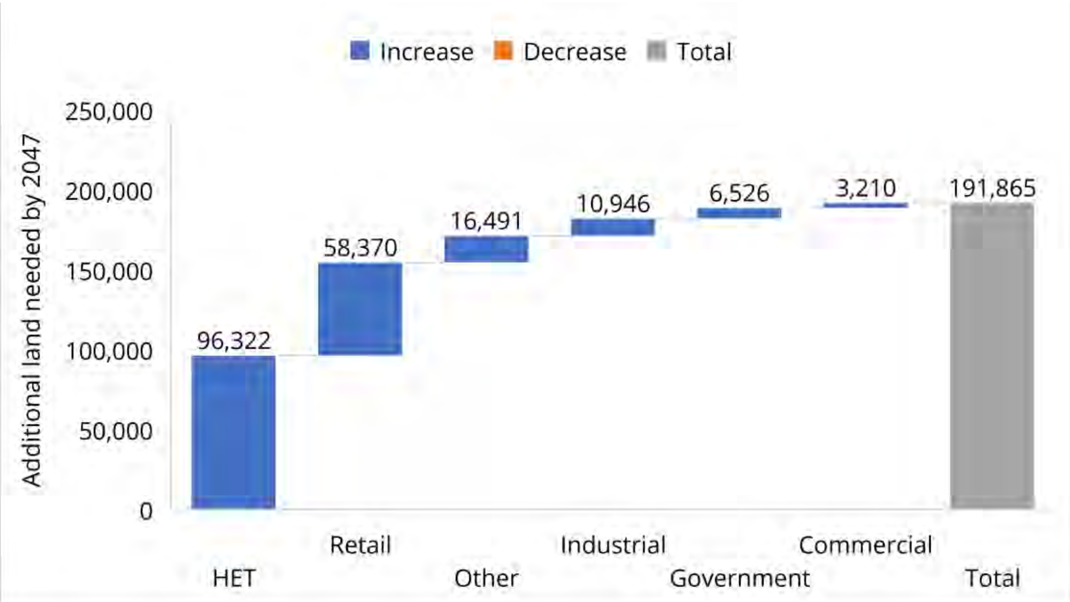
Upper Hutt, Growth in demand for business land, 2000-2047, forecast.id scenario



Source: Sense Partners

FIGURE 196: FORECAST.ID EXPECTS MORE PEOPLE TO HIT KAPITI LIFTING DEMAND

Kapiti Coast, Growth in demand for business land, 2000-2047, forecast.id scenario

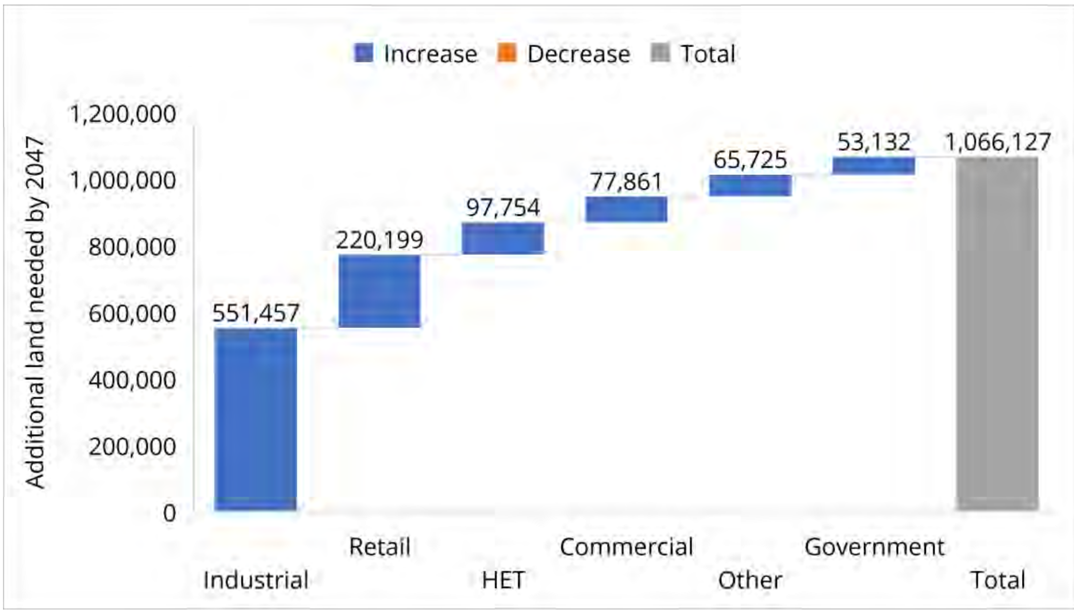


Source: Sense Partners

Statistics New Zealand high population scenario

FIGURE 197: HIGHER POPULATION GROWTH WOULD SIGNIFICANTLY LIFT DEMAND FOR BUSINESS LAND IN WELLINGTON CITY

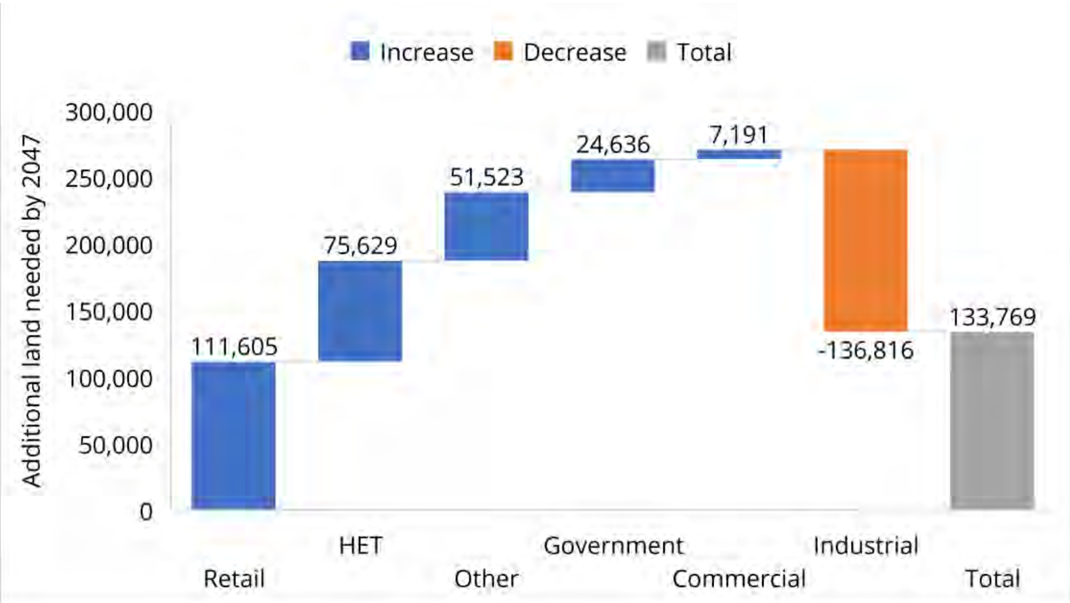
Wellington City, Demand for business land, 2000-2047, High population scenario



Source: Sense Partners

FIGURE 198: POPULATION GROWTH OFFESTS LOWER HUTT'S INDUSTRIAL DECLINE

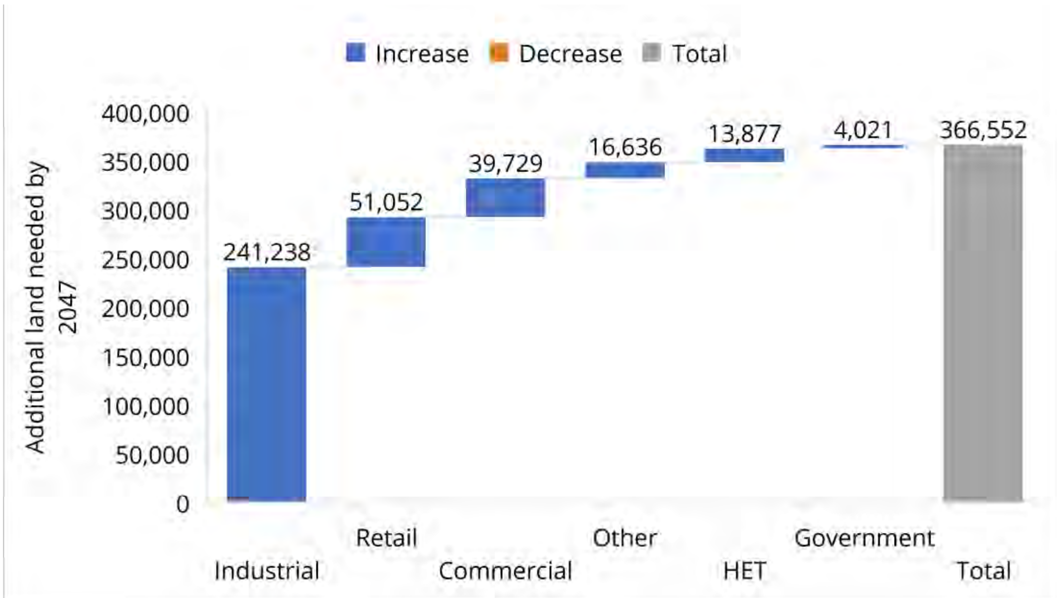
Lower Hutt, Demand for business land, 2000-2047, High population scenario



Source: Sense Partners

FIGURE 199: A GROWING POPULATION PRESSURES DEMAND HIGHER IN UPPER HUTT

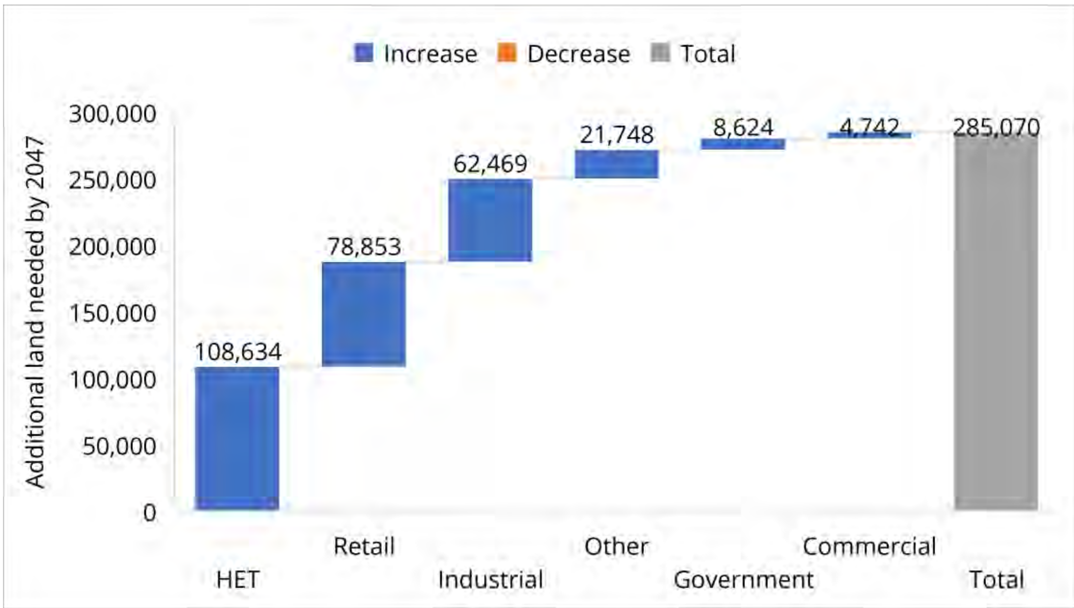
Upper Hutt, Demand for business land, 2000-2047, High population scenario



Source: Sense Partners

FIGURE 200: STRONG KAPITI POPULATION GROWTH LIFTS BUSINESS LAND DEMAND

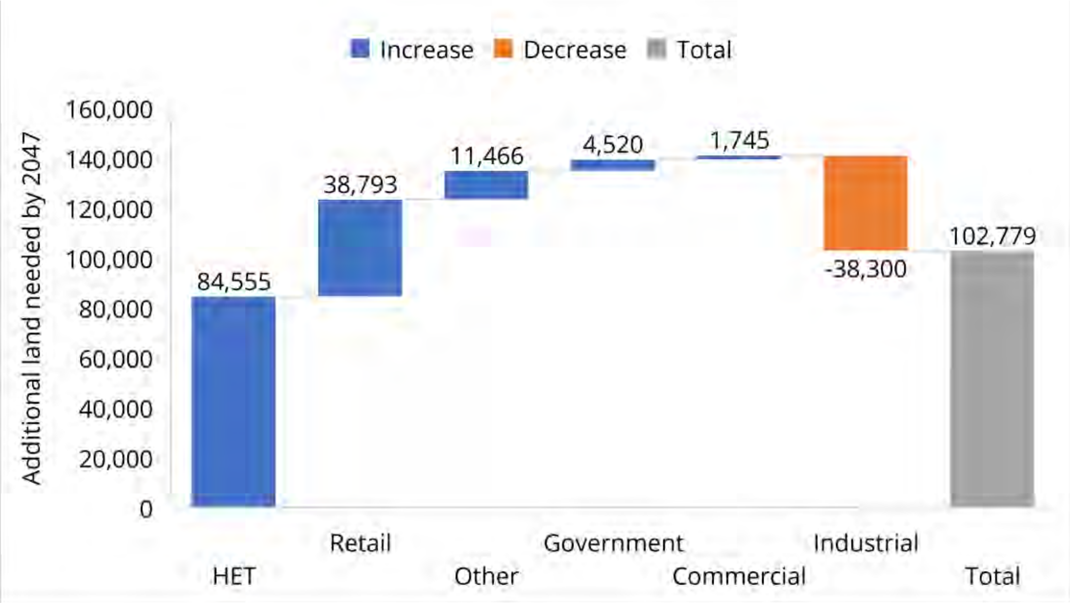
Kapiti Coast, Business land demand, 2000-2047, High population scenario



Source: Sense Partners

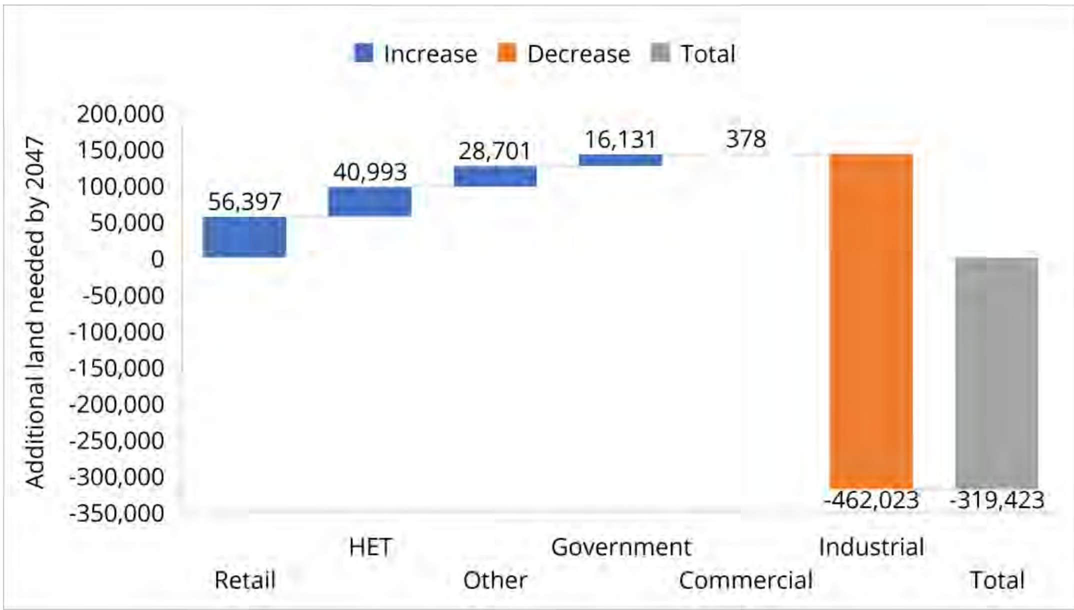
Improved transport scenario

FIGURE 201: ADDITIONAL POPULATION GROWTH RAMP UPS BUSINESS LAND NEEDS
Kapiti Coast, Demand for business land, 2000-2047, improved transport scenario



Source: Sense Partners

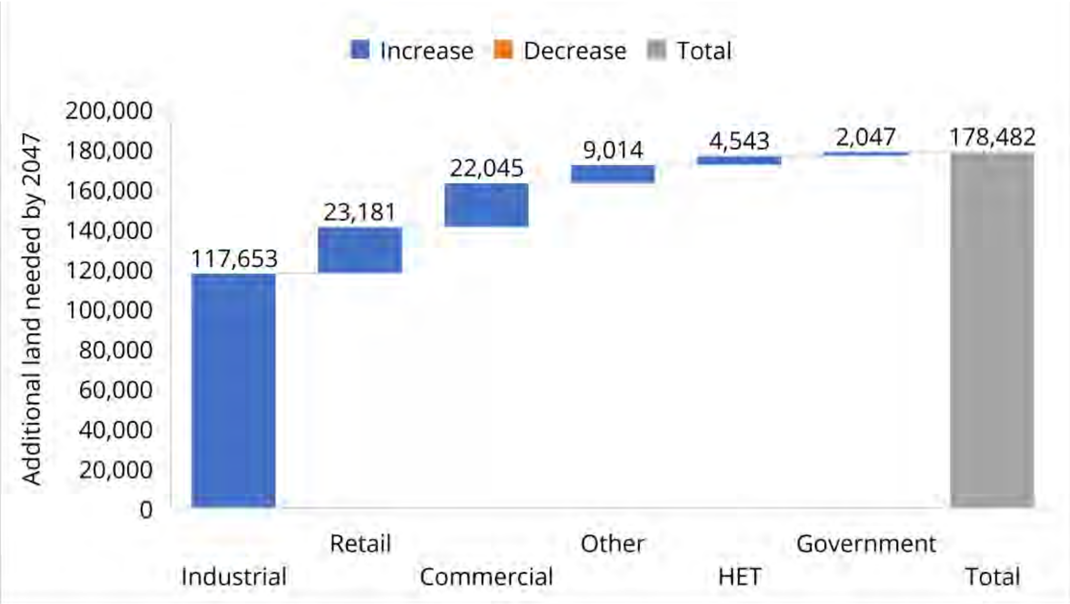
FIGURE 202: DEMAND FOR INDUSTRIAL LAND IN LOWER HUTT IS NOT AS LOW
Lower Hutt, Demand for business land, 2000-2047, improved transport scenario



Source: Sense Partners

FIGURE 203: INDUSTRIAL LAND REQUIREMENTS CHANGE IN UPPER HUTT

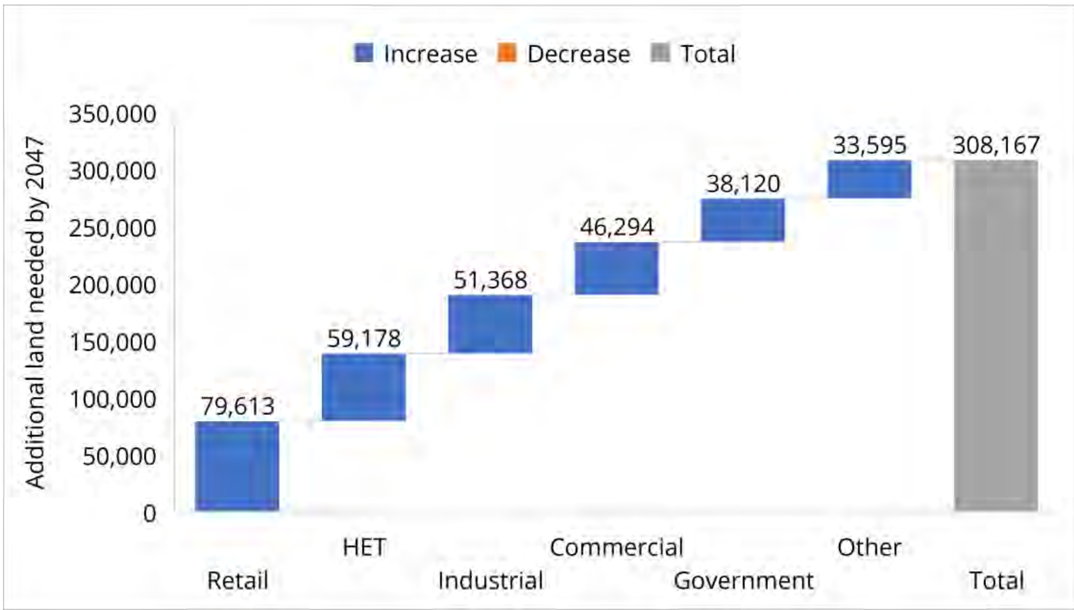
Upper Hutt, Demand for business land, 2000-2047, improved transport scenario



Source: Sense Partners

FIGURE 204: EXPECT MODEST FLOORSPACE DEMAND GROWTH FROM OTHER FIRMS

Wellington City, Demand for business land, 2000-2047, improved transport scenario



Source: Sense Partners

Appendix 1.6

Memorandum

To	Mitch Lewandowski (Wellington City Council); Ike Kleynbos (Upper Hutt City Council); Joe Jeffries (Hutt City Council); Hamish McGillivray (Kapiti Coast District Council); Alisha Karan (Porirua City Council).
From	Andrew Macleod (The Property Group)
Subject	National Policy Statement – Urban Development Capacity – Multi-Criteria Analysis for Business Land in the Wellington Metropolitan Area

Purpose

The purpose of this memorandum is to provide a concise summary of the methodology and outcomes of workshops convened by Wellington City Council (WCC), Kapiti Coast District Council (KCDC), Porirua City Council (PCC), Upper Hutt City Council (UHCC) and Hutt City Council (HCC) in late 2018 and early 2019 to help fulfil statutory requirements under the National Policy Statement – Urban Development Capacity (NPS-UDC) in relation to business land in the Wellington metropolitan area.

NPS-UDC

The NPS-UDC places a statutory responsibility on territorial local authorities to continuously monitor the supply of urban land and to release additional land as required to ensure a minimum forward supply of land is available for future development. The current exercise was directed towards the supply of all types of business land, specifically whether existing zoned areas of land represent an effective supply and is feasible to develop in an economic sense.

A "multi-criteria analysis" (MCA) process was utilised, as further described below, in order to determine the relative feasibility of business land areas within the jurisdiction of the five participating local authorities.

Methodology

The Wellington metropolitan territorial local authorities – being WCC, KCDC, PCC, UHCC and HCC – recognised that business does not necessarily respect jurisdictional boundaries and therefore agreed to work together with a consistent methodology. Aside from this the following were the key elements of the methodology employed:

- A scoring system of 0 (low score) to 5 (high score) was adopted and applied to 14 criteria across 57 different business zoned areas across metropolitan Wellington.

- The criteria were independently developed and addressed a full range of relevant considerations including infrastructure servicing, access to consumers and labour force, ease of development, resilience to hazards and planning constraints.

- The scoring system was applied in five separate group workshops (one for each council) facilitated by myself and with the groups comprising one council staff member and external stakeholders active in the local marketplaces (e.g. property developers, commercial agents, consultants, business group representatives) – the groups ranged in size from 4 – 7 members.

- The methodology was consistently applied in the five workshops but due to the varying membership of the five groups it is not intended to rank the areas across the whole metropolitan area, however ranking within each council jurisdiction has occurred.

This MCA methodology has been used by other territorial local authorities, notably Queenstown Lakes District Council, and is encouraged by government as one of the tools that should be used to fulfil information gathering under the NPS-UDC. This is detailed in the NPS-UDC guidance document *"National Policy Statement on Urban Development Capacity: Guide on Evidence and Monitoring"*.

Outcomes and discussion

All the workshops were enthusiastically attended by the external stakeholders and through my involvement as facilitator I make the following observations:

- External stakeholders across all workshops demonstrated excellent knowledge of local business land markets and were able to also bring nuanced understanding of individual areas based on their professional expertise or direct experience of areas.

- In turn the Council officers were able to offer excellent advice about the planning and hazard constraints affecting areas and were able to reinforce their advice through use of visual information (GIS information across a range of different spatial data sets was available at each workshop).

- Across all the areas assessed the maximum score was 63 and lowest score 29, as against a total achievable score of 70 and lowest possible score of 0 (results for all councils have been tabulated and provided separately).

- We would advise that within each council area the areas can be safely ranked but the quirks of each group means that across the broader suite of areas (i.e. across the whole metropolitan area) the scoring lacks relativity and a separate moderation exercise would be required if the councils wanted the ability to accurately rank the full list of areas.

- More generally the workshops represented an excellent and good spirited "coming together" of the councils and external stakeholders – there was some useful sharing of ideas and knowledge that all parties seemed to appreciate and benefit from.

Finally, thank you to the constituent councils for engaging us to complete this piece of work.

ANDREW MACLEOD
Director - Planning
04 470 6141 / 021 598 511
amacleod@propertygroup.co.nz

Appendix 1.7

Business Land Development Capacity – Modelling Methodology

Purpose: To outline the methodology used to model the development capacity of business land across the Wellington region. Mixed-use business capacity is calculated separately in the residential capacity modelling

Introduction

The Business Capacity component of this HBA seeks to understand the capacity of business zoned land (commercial and industrial) throughout the Wellington region. The assessment calculates the total land area and floor area[1] (m^2) of business development which is able to be provided under the present District Plan settings of the five Councils party to this HBA.

The assessment has calculated the potential of both infill development around existing buildings, and the area that could be made available by complete re-development of existing business zoned sites. In addition the development potential of sites that are currently vacant has been calculated.

Four questions answered through this process are:

- What is the existing amount of development of business zoned land?
- What is the potential capacity of business zoned land if each site was re-developed?
- What is the infill capacity of business zoned land if the development potential of each site was maximised around existing buildings?
- What is the capacity of business zoned land that is currently deemed vacant?

1. Data preparation

Property parcel datasets provided by each council were used as a starting point for the base data. This contained property data such as District Plan zones, existing building footprints and floor space area, as well as other key attributes.

A selection query was applied to only show parcels that were zoned for commercial or industrial purposes and were also located in the business areas selected for this HBA as described in the Multi Criteria Analysis process detailed in Appendix 1.6. These business areas were identified as 'hubs' of commercial or industrial activity and were used in workshops with key stakeholders to evaluate the market feasibility of development in these areas.

Further selection queries identified whether or not a site was designated (e.g. school, NZTA) or if it had a heritage feature on it. Sites that had designations or heritage features were omitted from the analysis. Rules for maximum building heights, setbacks and site coverage along with vacancy status were also joined to the dataset. This built the foundation layer of data for the business sites to be assessed.

Vacant business zoned sites were identified by reviewing the improvement values and existing building footprints of business sites. Business sites with no improvement values meant that land value and capital value were the same – and hence were vacant. In addition, a desktop analysis using the most current satellite imagery was carried out, as well as field visits to visually ground-truth and confirm the vacant status of sites.

[1] For the purposes of this report and the HBA, floor area is expressed as Gross Floor Area.

2. Current Capacity of Business Zoned Land

Objective: Calculate the existing land area and floor area of buildings on business zoned sites for each council.

Existing floor area was included within each council's land parcel datasets. However, there were a number of sites missing data for existing building footprints or existing floor area. Where possible these were calculated manually using imagery and measuring tools in GIS software.

Table 1: Existing business zoned land area and floor space by Council

Council	Total land area (m2)	Existing building floor space (m2)	Number of sites
WCC	2,316,068	628,823	439
PCC	1,623,565	597,090	510
HCC	4,318,272	2,175,016	1805
UHCC	1,471,328	511,653	509
KCDC	2,578,988	451,401	773

3. Redevelopment capacity of business zoned land

Objective: Calculate the potential of business zoned land if sites were completely re-developed – e.g. clear any existing building on a site and rebuild to the District Plan standards.

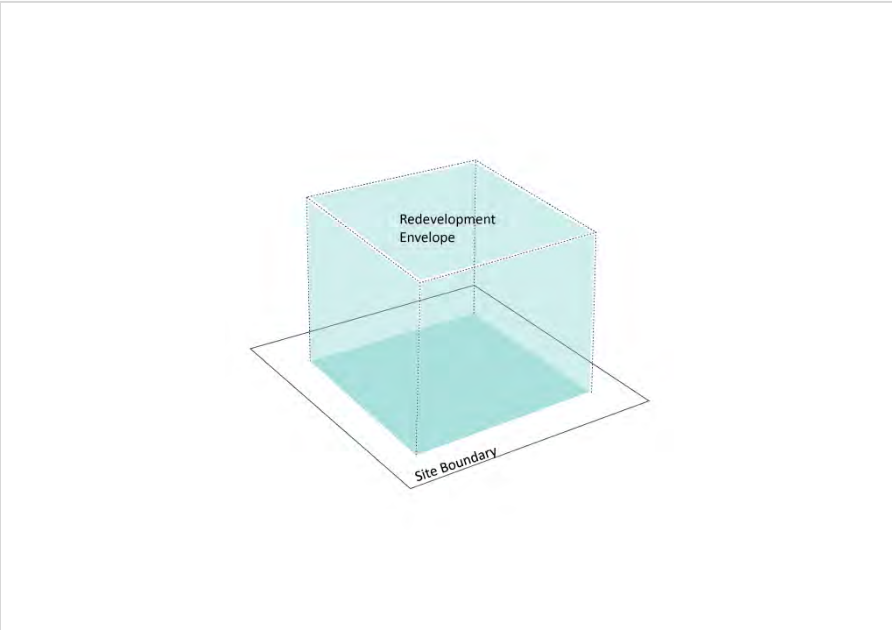


Figure 2: Re-developable area

This scenario assumes that any existing building is removed from the site. To obtain the re-developable floor area, the District Plan zone related rules such as boundary setbacks and site coverage ratios were applied to the parcel area. This created a reduced site area that was then multiplied by the plan enabled number of floors from the previous step.

Boundary setbacks applied depended on the business zone/sub zone, and whether the sites were located next to a residentially zoned site, open space area or major road/rail corridors as dictated by the relevant District Plan. For example, in Wellington City a 3 metre setback is required for all business sites, but those sites that are adjacent to residential areas require a 5 metre setback. Setbacks were applied by creating setback buffers around specific areas or corridors and then erasing the buffered area from the business zoned parcels.

As most councils have complicated and bespoke setback and recession planes rules, site coverage controls and carpark requirements, it was decided that a site coverage ratio (SCR), specific to each business zone, would be applied to sites in order to calculate the available re-developable area. This was important from a regional perspective as it meant that each council had a consistent method applied to encompass differing complexities of their business zones rules.

For WCC, UHCC and HCC the SCR from the Sense Partners business demand report[2] was added to the dataset for each business site (commercial and industrial). An average site coverage calculation, based on existing District Plan zone site coverages was calculated and applied to KCDC and PCC sites. In some cases manual adjustments were applied based on local knowledge to get more representative site coverages.

The re-developable floor area was multiplied by the SCR to obtain a more realistic value regarding floor area of a fully redeveloped site.

Table 2: Re-developable business capacity by Council

Council	Existing building floor space area (m2)	Total re-developable area (m2)	Number of sites
WCC	628,823	2,439,369	439
PCC	597,090	1,409,522	510
HCC	2,156,475	6,644,989	1,787
UHCC	511,653	1,385,061	509
KCDC	451,401	2,620,771	773

4. Maximised Building Envelope

Objective**:** Calculate the potential floor space area of development on a site that remains above the existing building up to the District Plan allowed height – e.g. add more floors to existing buildings. This step is also required for the infill area to be calculated as detailed in Section 5 which follows.

[2] See Appendix 1.5.

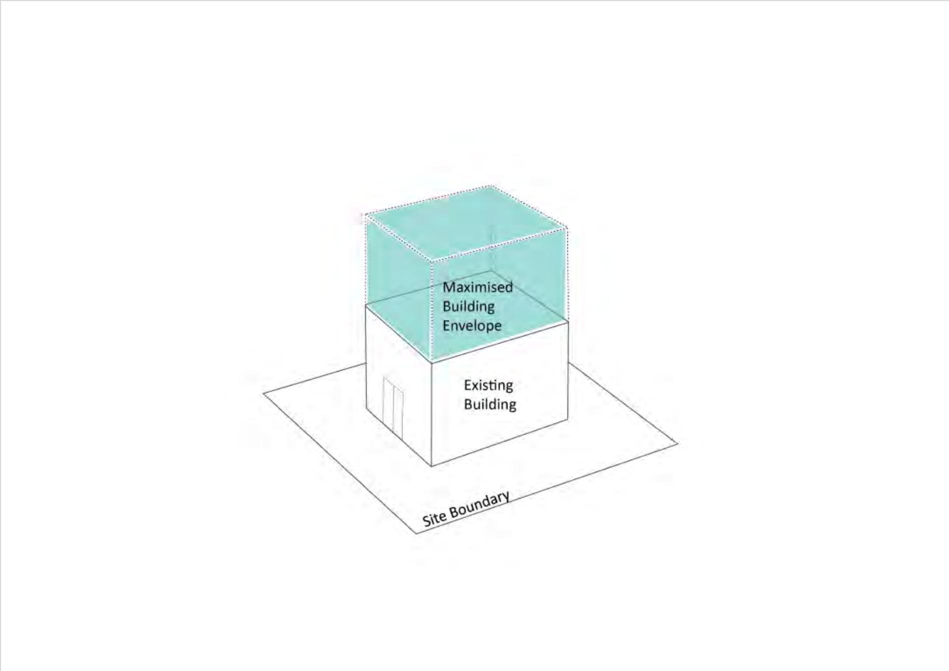


Figure 1: Plan enabled floor area to maximum height

The plan enabled scenario assumes that floor area could be increased based on the building height controls in councils' district plans (e.g. increase the existing building in height by adding additional floors). The plan enabled number of floors is calculated by dividing the maximum allowed height limit by an average floor height based on business zone norms. These average floor heights for business zones were agreed and set at 3.5 metres for commercial business sites and a maximum of 1 story for industrial business sites. The existing building footprint was then multiplied by the plan enabled number of floors to obtain the redevelopment envelope of the existing footprint.

5. Infill capacity of business zoned land

Objective: Calculate the infill capacity of business zoned land – extending existing buildings outwards to maximise the full capacity of the site.

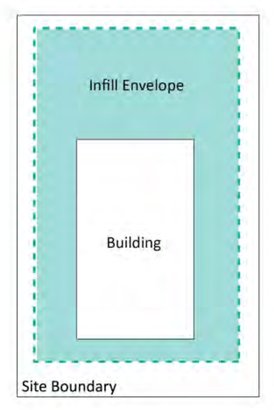


Figure 3: Infill area

Infill capacity was calculated by subtracting the Maximised Building Envelope and existing building floor space from the re-developable floor area (adjusted by the SCR). This provides the additional floor space available outside of the existing building footprint (the donut). Any values that were negative (e.g. where the plan enabled area was larger than the re-developable area) were excluded from the calculations (changed to zero) as they represent no additional capacity.

Table 3: Infill business capacity by Council

Council	Existing building floor space area (m2)	Total infill area (m2)	Number of sites
WCC	628,823	1,414,238	439
PCC	597,090	384,881	510
HCC	2,156,475	1,711,565	1,787
UHCC	511,653	431,645	509
KCDC	451,401	1,796,057	773

6. Vacant business zoned sites

Objective: Calculate the re-developable capacity of Business zoned land that was identified as currently vacant.

Vacant business zoned sites were previously identified via the following thresholds.

Sites either had:

- An improvement ratio of between 0 and 0.1; or
- An improvement ratio of between 0.1 and 0.3 (to highlight possible re-developable land); or

- The existing building footprint was less than or equal to 50smq GFA

For a site to be classified as vacant it had to meet the following conditions;

- If the site contains an unformed car park on the premise but the use of the site for vehicle parking is likely to be a temporary.
- If a building consent or resource consent has been issued, but no CCC or 223/224 certification as been granted (this layer is not available on the web map and will need to be checked manually by each council)
- If the site contains a building under construction (only once completed is a site considered not vacant).

Table 4: Vacant business capacity by Council

Council	Total re-developable Area (m2)	Number of vacant sites
WCC	800,711	10
PCC	26,649	19
LHCC	223,946	71
UHCC	223,334	78
KCDC	630,922	71

7. Mixed-use business capacity

A separate modelling process for residential capacity modelling was also carried out as part of the NPS-UDC process. Any mixed use zones (combination of residential and business zones) were captured in the residential capacity modelling. The business capacity results were cross checked with the residential capacity results for any overlap of sites modelled in both. Where there was an overlap of areas, business related capacity from the residential model replaced the results from the business capacity modelling. Upper Hutt City Council have provided specific further information relating to their methodology.

8. Multi Criteria Analysis and business land demand

In parallel with the completion of the business capacity assessment, the feasibility of development opportunities in these business areas was considered through a Multi Criteria Analysis. The final output from this determined the likely feasibility of development occurring in each of these areas. Final capacity results were adjusted to remove certain sites where future redevelopment was deemed unlikely to happen.

Appendix 1.8

Content from NZ Transport Agency into NPS-UDC Housing and Business Capacity Assessment Report for the Wellington region

WCC is coordinating a combined regional report that presents summary regional information and separate chapters from WCC; HCC; UHCC; PCC and KCDC.

WCC has requested the Agency provide a 'high-level view of the capacity constraints on the state highway network'.

--

Introduction

This section provides an overview of the role of the Wellington state highway network and identifies both key issues and/or capacity constraints on the network, and planned activities to address these issues. Like public transport, the state highway network acts as a connector, facilitating travel within and between urban areas of the region for commuting and access to education, health, and social facilities. It also enables the inter-regional movement of people and goods between Wellington region and the rest of the country.

Responding to the Government priorities and expectations set out in the Government Policy Statement on Land Transport 2018 (GPS) requires the Transport Agency to ensure that all transport modes, and alternatives, have been considered when planning and investing in land transport, and decisions are based on the ability to deliver positive social and economic and environmental outcomes. This means that decisions about the preferred location of future development should consider not only the 'capacity of the state highway network' but how the transport system overall can support land use and seek to encourage growth in areas that can be well-serviced by public transport and increased use of active modes.

Increasing housing supply in areas that are able to be connected by public and active transport provides an opportunity to reduce reliance on private vehicles and support mode shift. This enables us to utilise land in our cities more efficiently and reduce the dominance of vehicles on our streets.

Issues on the existing state highway network

The concentration of Wellington regional employment in Wellington City, and the dominance of the knowledge-based sector working conventional hours means that a large number of people want to travel into and out of the City at the same time – this creates a significant and concentrated peak demand on road and public transport networks.

This significant and concentrated commuter peak, limited east-west connectivity, and capacity constraints on key parts of the network, are all significant factors contributing to congestion on the state highway network. This creates significant travel time delays and unreliable journey times for freight, private vehicles and bus services. For people travelling from the north, high demand for travel during the peak is placing significant pressure on capacity.

Key congestion and/or pinch points during the peak include:

- SH1 Ōtaki (particularly during holiday periods)
- SH1 Pukerua Bay to Paekākāriki
- SH1 Paremata roundabout
- SH1 Tawa to Ngauranga
- SH2 Intersections including Dowse, Melling, Kennedy Good
- SH2 Ngauranga to Petone
- SH1 Ngauranga to Wellington CBD to Airport

Congestion and travel time delays are impacting all forms of transport travelling through the Wellington CBD, including bus services through the central city. Traffic re-routing to avoid queues is then impacting on amenity and safety on local road routes, such as Oriental Bay to Evans Bay. These issues have been part of the impetus for the Let's Get Wellington Moving partnership between NZTA, Wellington City Council, and Greater Wellington Regional Council.

Resilience is also a significant issue given the vulnerability of the region to a range of natural hazards. Resiliency of transport infrastructure is an important consideration for the location of new growth areas and/or areas for intensification.

Space constraints on road corridors and limited alternative routes means that the transport system has poor resilience to unplanned events (whether they are caused by natural hazards or network incidents such as crashes). Close proximity of road and rail corridors exacerbates resilience risks as unplanned events can impact the operation of both road and rail, with significant impacts for commuters.

Key sections of the state highway network have been assessed as being extremely, highly, or very highly vulnerable to earthquake, tsunami, or storm risk. Sections of note include Petone to Ngauranga, SH1 corridor, particularly the coastal sections, Johnsonville bypass, and Ngauranga Gorge, and sections of SH2 that are vulnerable to flooding/storms and earthquakes. Increasing resilience and safety interventions will be key to improving the capacity of these routes.

Planned improvements to the state highway network

As the region's population increases, there will be increased demand for travel. The degree to which the state highway network performance will be affected will be dependent on the amount and spatial distribution of growth. Projects that are planned for or currently underway along the network will create changes to capacity and performance. For example, the completion of Transmission Gully will create significant capacity increases between Porirua and Wellington along SH1. However, this may induce demand quickly taking up the new capacity. As new sections of the network are completed, decisions will be made on which parts of the existing state highway will be revocated to the relevant council, whilst ensuring overall system resilience that is enabled through the use of alternative routes.

A number of significant state highway activities are either in construction, committed for implementation funding, or in various stages of planning. These are outlined in Table 1 below.

Table 1: Significant state highway activities in short, medium, long term

The table below provides an indication of some of the significant activities that are either in construction or likely to be (column 1), proposed for within 10 years (column 2), or potential longer-term improvements (column 3). This is not an exhaustive list, and will be change through the upcoming Regional Land Transport Plan process.

Years 1-3 (2018-2020)	Years 4-10 (2021-2028)	Years 11-30 (2029-2048)
Transmission Gully	Ngauranga to Petone cycleway	Let's Get Wellington Moving programme improvements
Let's Get Wellington Moving programme early improvements (subject to decisions in 2019	Let's Get Wellington Moving programme improvements	Petone to Grenada
State Highway 58 safety Improvements	Access to the Port and proposed new ferry terminal	
PekaPeka to Ōtaki	Ōtaki to North of Levin	
	State Highway 1 Optimisation measures	
	Melling Interchange (subject to re-evaluation decision)	

Appendix 1.9

Material for NPS for urban development capacity: role of public transport in responding to population growth.

1. Introduction

The Metlink public transport network is crucial for providing our growing population with access to economic and social opportunities in the Wellington region. Public transport is an efficient way to move large numbers of people at peak times, particularly on corridors where travel demand is high and capacity is constrained. It provides an important travel option for many people and reduces traffic demand and congestion on the road network.

Ongoing investment in the region's public transport network is a critical factor in responding to population growth.

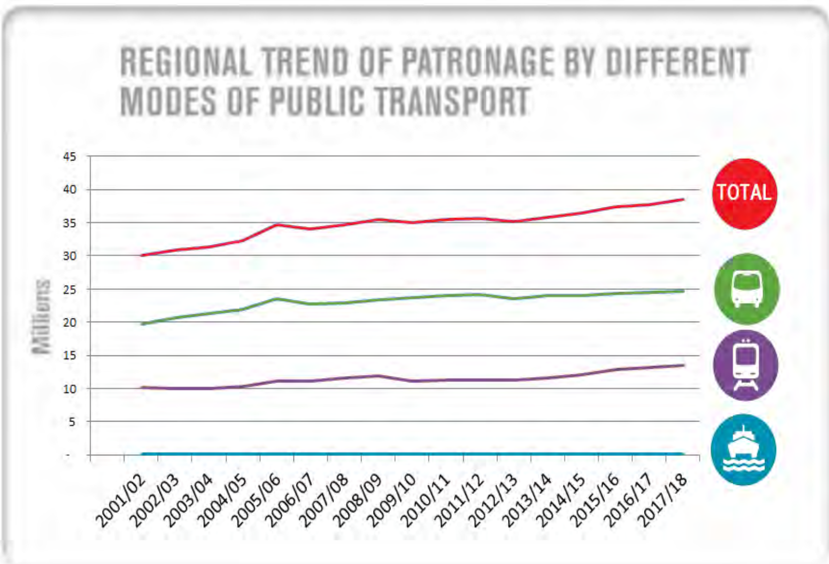
Rail plays a significant role in providing for access to the regional CBD and growth to the north. Rail is a very efficient way to move large numbers of people over longer distances and we will continue to build on the region's established rail network which links communities to the north of the Wellington City CBD. The priority is to improve rail's reliability, capacity and frequency, and over the longer term the aim is to further improve journey times and reach.

Bus also plays a critical role in moving significant numbers of people (particularly within Wellington City) and for providing access to centres and the core rail network in other parts of the region. On some key corridors in Wellington City bus is reaching capacity limits. Significant investment in infrastructure, including mass transit and increased bus priority is necessary to enable continued growth in public transport within these parts of Wellington City. A key part of this is the investigation of mass transit through the Let's Get Wellington Moving project. The project is a joint initiative between Wellington City Council, Greater Wellington Regional Council and NZTA- to agree a programme of transport system improvements and associated urban development opportunities in the area from Ngauranga Gorge to the airport, including the Wellington Urban Motorway and connections to the central city, hospital, and the eastern and southern suburbs.

Strategic Context

The Wellington region has a strong culture of public transport use with 38.5 million passenger trips being taken on the Metlink public transport network during 2017/18, equating to 74 per capita – the highest per capita public transport use in the country.

Wellington has particularly high use of public transport for commuting to and from Wellington City CBD.



Approximately 40% of people entering Wellington's CBD in the morning peak come on public transport, compared to 32% via cars and 15% active modes. Public transport share has increased steadily over the last decade and is , unusually high amongst Australasian cities.

Public transport patronage has increased in recent years following a period of relatively low growth. Rail patronage has increased significantly over the last 5 years stimulated by investment in infrastructure and services. While growth on bus has been slower, in places this reflected the need for further investment in services and infrastructure to increase capacity.

The Metlink network is based on a layered hierarchy of services: core routes, local routes and targeted services identified in the Regional Public Transport Plan (PT Plan).

Wellington Region's Public Transport Network

The Wellington region's public transport network consists of three layers:

- **Core routes** are the urban rail network and frequent bus services that form the network's backbone, linking areas of high demand with high-capacity, direct services with extensive operating hours.
    - **Core rail routes** provide high-capacity, long-distance, time-competitive commuter services connecting key urban areas across the region. Their primary functions are to reduce severe road congestion on State Highways 1 and 2 and meet the demand for travel from key suburban and town centres to the Wellington CBD during peak periods.
    - **Core bus routes** provide high-capacity, frequent, all day services within urban areas, reducing congestion on the major transport corridors and meeting the all-day travel demand. They operate at least every 15 minutes during the day, and often more frequently during busy periods.
- **Local routes** include all-day medium to low frequency services connecting town and activity centres along the lower-demand corridors, providing local access to town and activity centres within the suburban areas. These routes complement the core network by covering areas it does not serve and by collecting and distributing passengers to and from it.
- Additional **Targeted services** are provided to meet demand, including peak-only services, school services, night bus services, and community services that provide access to areas or link destinations where there is not enough demand to justify core or local routes.

The Wellington region's layered network is shown in Appendix 1. The layered network concept is critical for understanding our plan for developing public transport to accommodate population and employment growth, and address congestion and other problems.

In particular, a key focus is developing the core network so it can deliver high quality, high capacity public transport services that provide journey times that are competitive with car travel, and deliver a high quality customer experience. Part of this includes improvements to information, ticketing and technology systems that support public transport.

Regional transport context

The RLTP 2018 update identifies a number of transport problems facing the region where public transport has an important role to play and which may affect the feasibility of urban development.

The 2018 update forms part of the RLTP 2015, public transport is one of the key objectives in the RLTP. More information can be found here[1].

- ***Population growth -***The region's population is forecast to grow at least 20% over the next 30 years, faster than previously expected. A significant proportion of this growth is expected to be in central Wellington City and to the north in Kāpiti and Porirua. Public transport can play an important role to accommodate this growth in a safe and sustainable way.
- ***Traffic congestion on constrained corridors*** - Increasing travel demand is leading to congested conditions on the road network occurring over longer periods. Congestion particularly affects key routes to and from and across Wellington CBD. Traffic congestion is increasing at peak times on State highways 1 and 2 coming into Wellington City from the North, and is starting earlier and finishing later. Population growth is increasing pressure on our transport network, including parts of our public transport network, which is at or near capacity at peak times. A high quality public transport system has an important role to play in providing choices for people to opt out of congestion; however public transport can also be impacted by traffic congestion (as discussed below).
- ***Climate change*** - public transport has an important role in transitioning to a low carbon transport future – though mode shift to low emission transport modes such as public transport, walking and cycling, better integration of transport and land use planning, and transitioning to a low carbon electric fleet.
- ***Resilience*** - Public transport, including passenger rail can improve our resilience to natural events (such as earthquakes and severe weather events, climate change impacts such as sea level rise, and day to day incidents) by providing a high quality transport option. Improving the resilience of public transport network itself is also important in this regard.
- ***New technologies and ways of providing services –*** the impact of new technologies and service types (e.g. autonomous vehicles, electric vehicles, ride-sharing services, Mobility as a Service (MaaS) platforms, E-bikes and scooters) is still uncertain but these are likely to provide significant challenges and opportunities for public transport. For example opportunities for using ride sharing services to provide first and last mile transport solutions or transport options for locations where conventional public transport is uneconomic to operate.
- ***Changing lifestyles and travel preferences -*** such as more inner city living, changing attitudes to driving amongst young people, and demographic changes (an aging population) – these factors will all impact on travel requirements, while the trend for younger people is away from reliance on travel by private car.

Challenges for public transport

There are also key challenges for public transport in responding to these issues:

Public transport capacity

- There is difficulty in providing additional public transport capacity to respond to growth in Wellington City. Most public transport in Wellington City is mixing with increasingly

[1] http://www.gw.govt.nz/assets/Transport/Regional-transport/Wgtn-RLTP-2015.pdf

congested traffic affecting reliability and constraining capacity by limiting the services we can operate on core routes. We are already facing issues at key pinch points.

- On some routes, e.g. Karori, there is limited ability to add more services without increased priority measures. To address these capacity constraints significant investment in mass transit and increased bus priority is required before capacity for future growth can be delivered. We need to plan now for measures that give priority to public transport services, such as bus lanes and traffic signal priority.

- Patronage growth on the rail network has been much higher than anticipated. While there is scope for increasing capacity on the rail network there is a need for ongoing investment to enable continued growth. Funding has recently been committed for some upgrades to the track assets to enable increased services, but further investment will be needed to enable future growth, including investment in new rolling stock. This is being looked at as part of improving rail connections between Wellington CBD and the lower north island (Palmerston North and Wairarapa).

Land use and transport planning

- The capacity of the bus network is not currently an issue outside Wellington City, but there is poor utilisation of existing services. This is due to a number of factors including: low density and dispersed urban form in the outer districts; geography; employment location and general cultural reliance on the car for mobility.

- It is important to consider when developing new greenfield sites how these could be served by public transport. Suburbs with single roads in or out and large numbers of cul de sacs are much harder to serve with public transport that a more connected road network. High quality pedestrian environments also support greater use of public transport, particularly in and around public transport hubs.

- Further intensification of existing urban areas will help improve the viability of public transport in the region (particularly bus services). Where possible intensification should be delivered where there is already high quality public transport, e.g. within 500m of an existing railway station or core bus route. New growth areas need to be designed and located in a 'smart' way to ensure they consolidate the urban footprint, have a focus on centres and generally increase density.

Customer expectations

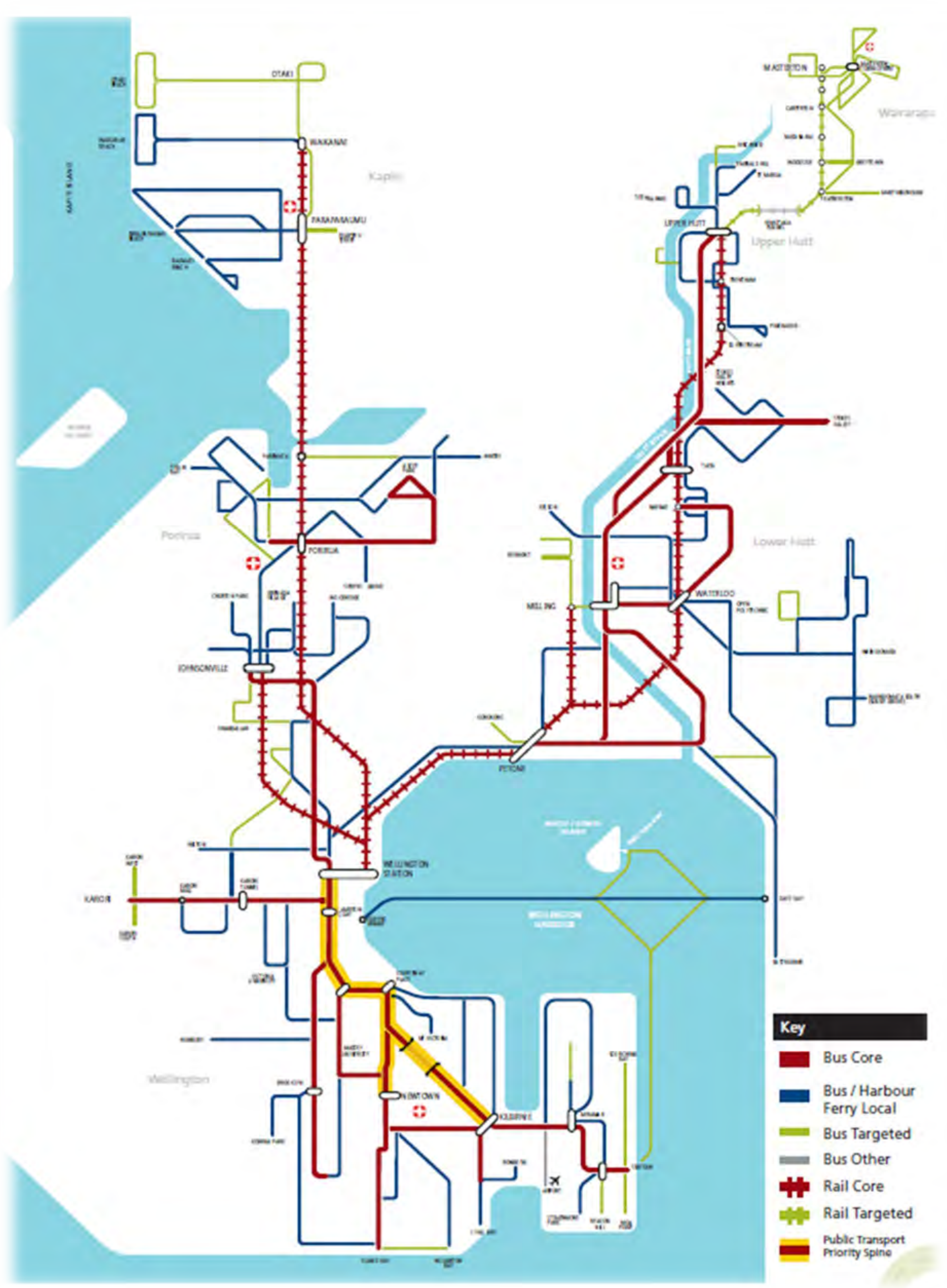
- Customer expectations for public transport are changing, it is not enough to ensure that there is just capacity. Public transport must also be high quality, accessible, affordable, reliable and frequent for people to use it as there preferred choice.

- Part of this challenge is delivering improvements to services while maintaining affordability. There is increasingly demand for better quality real time information, improved ticketing and modern comfortable vehicles that are accessible to all people. All of this comes at a cost. Delivering the capacity on public transport to enable growth needs to be complemented by investment in a high quality customer experience.

Changes to technology

- Changes to transport technology and travel behaviour such as e-bikes and scooters, ride sharing and MaaS for the first mile/last mile connections to railway stations will likely affect demand for public transport. There is a greater need to develop key railway stations as mobility hubs to enable access to core public transport network for new modes of mobility. This may impact on the viability of some bus feeder services.

Appendix 1: Metlink Public Transport Network



Source: Wellington Regional Land Transport Plan 2015, pg 77

Appendix 2: Extract from the Regional Land Transport Plan 2015

A high quality, reliable public transport network

A high quality (frequent, comfortable, safe, and easy to use) and reliable peak period public transport network will provide an efficient method for moving large numbers of people at peak times (with associated de-congestion benefits) along corridors here the transport network is in high demand and capacity is an issue. Continuing to improve off-peak accessibility will ensure that the public transport network provides a good base level of service for community accessibility purposes.

Ongoing investment in the region's rail network is an important part of this strategy. Rail is a very efficient way to move large numbers of people over longer distances and we will continue to build on the region's established rail network which links many communities within the region along several key corridors to the north of the Wellington City CBD. The priority is to improve rail's reliability, capacity and frequency, and over the longer term the aim is to further improve journey times and reach.

Buses play an important role in the region's transport network and will continue to do so in future. They support the rail network with connecting feeder services and provide core public transport services in many areas. Bus Rapid Transit (high quality, high capacity buses running in dedicated lanes) along the public transport priority spine in central Wellington and beyond will provide fast and reliable journeys through the Golden Mile/CBD and to the southern and eastern suburbs.

Key improvement areas for public transport include:

- Continued modernising of public transport vehicles
- Measures to improve journey times and service reliability
- Enhancing the quality of stations, stops and interchanges
- Improving pedestrian access to public transport stops and stations
- Improving public transport fare, information and ticketing systems
- Improving the design of public transport networks to be more effective and efficient
- Ensuring value for money through new performance based operating contracts
- Maintaining and enhancing park and ride facilities
- Using customer feedback to improve the network
- Promoting public transport use

7.3 THE NEED FOR INVESTMENT

It is not always affordable or desirable to continually increase the capacity of the road network in response to congestion and travel demand. Public transport is far more efficient at moving large numbers of people over long distances within the urban area than any other travel mode. It will therefore play an important role in providing for future travel demand. An effective and efficient public transport network will support future access to employment and markets with less impact in terms of land required for parking, and will be reasonably robust in the context of uncertainty over fuel costs, and other demographic and social changes. Investment in the region's public transport system complements investment in the roading network by providing an alternative to car travel on congested motorways and arterial roads, freeing up space for freight and commercial use and for other trips that cannot be made by public transport.

To achieve this, the Wellington public transport network needs to be attractive to users, both in terms of the convenience of the service that is offered and the relative cost to users compared to the alternatives available.

Key factors that are commonly identified in public transport perceptions surveys as reasons that people do not use public transport more often include:

- longer journey times and poor reliability
- fare cost
- frequency of services
- comfort of stops/stations and vehicles

Investment in the day-to-day operation of the existing public transport network is crucial to ensure that it operates efficiently and effectively. For example, a lack of prior investment in Wellington's rail network up until around 2005 led to significant reliability issues, crowding, poor asset management, inadequate service frequency, and an uncomfortable travel experience for passengers. Significant catch-up investment in the rail network over more recent years has been focused on addressing these issues.

Results from perception surveys suggest that just over half of users believe that bus services are reliable. There has been a gradual decline in bus reliability over the six-year period to 2013. Buses use the road network and are affected by traffic congestion which impacts negatively on journey times and reliability. Investment in bus priority measures, particularly through congested urban streets, is crucial for improved bus journey times. Investment in a modern bus fleet, together with high quality stops and interchanges, is needed to provide comfortable and attractive public transport journeys.

A cost effective public transport system will help to keep public transport fares affordable and improve their competitiveness with the relative cost of car trips. Investing in network efficiency and integration improvements will be crucial to achieve this.

7.4 BENEFITS OF INVESTMENT

Public transport services are an essential part of Wellington's transport network, and contribute significantly to the region's liveability and economic productivity, primarily by:

- decreasing severe traffic congestion, particularly in the morning and afternoon peak periods, which in turn makes journey time reliable for other transport network users
- providing transport choices, including during off-peak periods
- contributing to reduction of CO2 emissions from transport
- enabling efficient land use and a compact, well designed and sustainable urban environment
- improving health and safety

Compared with single-occupant private car journeys, public transport trips are generally more energy efficient, generate fewer emissions and result in less congestion, particularly when the trips are well patronised and the public transport vehicles are well maintained. Public transport also has safety advantages over private cars, and provides health benefits by contributing to a more active lifestyle.

7.5 STRATEGIC RESPONSE

The long-term approach is to provide a modern, effective and efficient integrated public transport network that contributes to sustainable economic growth and increased productivity while also providing for the social needs of the community. This will require continued investment in and improvement of the Metlink public transport network so that services:

- go where people want to go, at the times they want to travel
- provide competitive journey times
- provide value for money
- are easy to understand and use
- are safe, comfortable and reliable
- provide flexibility, allowing people to change their plans.

In addition, investment is required to maintain the coverage of local and targeted services and in improving the accessibility of public transport by providing information, facilities and services that are available to all members of the public.

7.6 KEY NETWORK PRIORITIES

Figure 21. The key priorities for the public transport network are as follows:

Area	Priorities	Timing	Explanation
Rail network	Rail scenario 1	Medium term	Improving the efficiency of the metro rail system by redesigning service patterns so that capacity and frequency are provided to match peak demand, improving the utilisation of rolling stock and other resources. This will be achieved by: • A new regularised (clock face) timetable with an enhanced morning peak-hour service • A new service pattern based on an inner-metro-style service originating from Porirua, Waterloo and Johnsonville stations, and an outer suburban-style service originating from Waikanae, Upper Hutt and Masterton • Network hubs at the busiest stations – Waterloo and Porirua – and more metro services starting from these hubs (up to five trains per hour) during the morning peak period. More trains with fewer carriages in the peak period will give people more flexible travel options • More express trains from stations on the outer network
	Expand the Matangi fleet	Medium term	35 new Matangi trains will be purchased following the decommissioning and sale of the Ganz Mavag trains in 2016. This will provide a more modern, flexible and integrated electric rail fleet for the Wellington region.
	Expand park and ride facilities and improve stations	Ongoing	Expanding park and ride facilities for the train network will enable growth in rail patronage and extend the reach of the rail network. Short term priorities include park and ride expansion at Tawa, Porirua, Petone, Paraparaumu and Waikanae stations. An ongoing programme of railway station renewal and development will ensure that station facilities increasingly contribute to a better overall journey experience for people using the rail network. Short term priorities include a third platform at Porirua and station improvements at Waterloo and Upper Hutt stations
	Future rail upgrades	Long term	Once Rail Scenario 1 is complete, the preferred option is to proceed to Rail Scenario 2 (increasing supply), then Rail Scenario A (improving journey times),

			followed by Rail Scenario B (network extensions). However, a different order for these different scenarios may be appropriate depending on levels of demand and future patronage forecasts
Bus network	Wellington City bus network	Short to medium term	Implementing the outcomes of the Wellington City Bus Review will provide a simpler network with more frequent services available to more people, with less service duplication and fewer buses on the Golden Mile. This should lead to increased patronage and improved cost effectiveness. New routes are expected to operate from 2017.
	Bus Rapid Transit (BRT)	Medium term	Implementation of a BRT network for Wellington City will be facilitated by the implementation of priority measures and high quality infrastructure along a public transport priority spine through central Wellington City (from Wellington railway station to Newtown and to Kilbirnie). It will also involve vehicle improvements. This will enable fast and reliable journey times for public transport users on core routes, particularly through the Golden Mile and to the southern and eastern suburbs, with the goal of these trips becoming increasingly competitive with the same journeys by car. The BRT network will be progressively introduced through: • The construction of dedicated bus lanes and priority measures, starting with the public transport priority spine • The introduction of a new bus network for Wellington City bus services (see above) • The rollout of a new fleet of bus vehicles that are modern, low emission, and high-capacity to meet future demand.
	Signage, bus stops and interchanges	Ongoing	Implementation of a programme of renewal and development for network signage, bus stops and interchanges. A medium term priority will be improving key interchange nodes (Wellington railway station, Newtown and Kilbirnie) associated with the new BRT system along the Wellington City public transport priority spine.
	Area based bus service reviews	Ongoing	• Rolling bus service reviews across the region will be ongoing to ensure that

			networks and services respond to changing needs over time.
	Network Operating Framework	Ongoing	The application of a Network Operating Framework to local road networks in all regional and sub-regional centres will enable the role and priority of transport modes, including buses, within the urban road network to be assigned. This will help to clarify the role of different routes, and will also assist with the consideration of trade-offs where re-allocation of road space for bus priority lanes or facilities is required.
Fares and ticketing	Integrated ticketing	Short to medium term	Implementation of integrated fares and ticketing to provide an integrated way to pay across the whole Metlink network, allowing travellers to use the same payment system to buy single or multiple trips, or a journey using a number services. A simplified fare structure and new fare products will encourage more frequent use of public transport. The system will provide better information about the journeys people take, allowing better planning to meet travellers' actual needs. Network efficiency will be improved by better planning, faster boarding times, and the introduction of free transfers between services.
Service procurement	Implement the 'Public Transport Operating Model' (PTOM)	Short to medium	Implementation of a new approach to procurement of services that make up the Metlink bus and rail network through performance-based partnering contracts. This is expected to create an environment where goals and objectives are aligned through collaborative planning, joint investment, performance incentives, and shared risks and rewards.

Appendix 1.10

Material for NPS for urban development capacity assessment: overview of regional open space

Regional open space managed by Greater Wellington comprises 33,000 hectares of parks and forests. Other additional areas of open space include river corridors managed for flood protection and recreation purposes, such as the Hutt, Waikanae, Ruamāhanga and Ōtaki Rivers. Commercial forestry plantations in the Wairarapa on land owned by Greater Wellington are in general not open to public use and not considered to be part of the public open space network.

In terms of a quantum (supply) of regional park open space, the current park and forest network is considered to be adequate overall to meet the recreation needs of the community. However there are a number of key recreation and biodiversity corridor gaps. There are also opportunities to improve the quality of public open space for both human health and wellbeing and natural heritage value. Feedback about community needs, issues and opportunities received during initial consultation for reviewing the regional parks network management plan in 2018 also identified a number of issues and opportunities for regional open space.
These include:

Landscapes and visitor experience

Overall having a diversity of landscape settings in regional parks and forests is highly valued by residents of the region and should be maintained. However there are opportunities to improve visitor experiences of parks and forests through facility and service provision, for example public toilets, heritage interpretation and nature play opportunities.

Access to and within parks

At present public transport links to most parks are poor and there are gaps in provision of trails and links across the network. There are opportunities for a range of improvements to provide access points aligned to public transport for example to address a commuter link gap between Porirua and the Hutt Valley via Belmont Park and trail links to address issues such as a trail gap between Kaitoke Regional Park and the Remutaka Rail Trail and a Remutaka Cycle Trail opportunity for extension from the Orongorongo River to the Pencarrow Coast Road. Within parks and forests there are further opportunities to improve trail gradients, signage and connections. Further improvements in access to and within the regional public open space areas will occur as facilities are improved, and as areas closed to the public for private grazing purposes are opened to achieve full access and restored to native bushland or wetland.

Recreational needs

There are some unmet recreation activity needs in some parts of the region, for example the need for a trail bike (motorised) track and club facility for teenagers and children was identified by community stakeholder in the Kapiti area.

Ecological integrity

Open space serves as important ecological connections to maintain and restore biodiversity in the region. Ecological corridor gaps for wildlife and fish passage blockages exist in a number of places which provides an opportunity for work with private and public land owners to make improvements.

Summary of Regional Open Space

Name	Territorial Authority	Area
Akatarawa Forest	Upper Hutt City Council; Kapiti Coast District Council	15,500 hectares
Battle Hill Farm Forest Park	Porirua City Council	500 hectares
Belmont Regional Park	Wellington City Council; Porirua City Council; Lower Hutt City Council	3500 hectares
East Harbour Regional Park	Lower Hutt City Council	2000 hectares
Kaitoke Regional Park	Upper Hutt City Council	2860 hectares
Pakuratahi Forest	Upper Hutt City Council	8000 hectares
Queen Elizabeth Regional Park	Kapiti Coast District Council	638 hectares
Wainuiomata Regional Park	Lower Hutt City Council	340 hectares

Appendix 1.11

School roll information capture (2019)

Purpose

This document sets out roll information for schools in the Wellington region. This information is correct as at 30 January 2019.

We have included state-integrated schools in this information. State-integrated schools have a special character (usually Anglican/Catholic etc.) and the buildings are owned by a private entity and are capped by a “maximum roll.” The Ministry of Education does provide some maintenance funding for buildings, as well as setting or altering the maximum roll. We have used the maximum roll for state-integrated schools, rather than the onsite capacity.

It should be noted that although state integrated schools are part of the education network, these schools have a special character which may not appeal to all families. This means that population growth will not necessarily result in an increase in enrolments or available maximum roll at these schools being utilised.

We have used 2018 rolls for all schools, as the most update roll information. We have used March rolls for all intermediate and secondary schools; and October rolls for primary schools. Primary and intermediate schools have been grouped together as primary schools in this report.

Roll Information

Wellington Central and South

- There are 17 state primary schools in the Wellington Central network. Of these 17, four are state-integrated schools. There is space for approximately 250 students at the four primary state-integrated schools. The remaining state schools are at or over capacity. This area has been identified as one of our three growth areas and is a key focus for us over the next ten years. Some of these schools have been identified as candidates for roll growth over the next four years, though this is subject to securing funding through a national prioritisation process. Almost all of these schools operate enrolment schemes (zones).
- There are four secondary schools (St Mary’s College; Wellington Girls’ College; Wellington High School and Wellington College) servicing the Wellington Central area. St Mary’s College is a state-integrated school. The other three schools operate enrolment schemes and are at or over capacity. We note that all three colleges enrol students from outside their respective zones which although are counted for capacity purposes are not included when considering new property.

Wellington West

- There are 11 state and three state-integrated primary schools in this network around the Karori/Khandallah/Wadestown and surrounding areas. There is space for 182 students in the state schools and 384 in the state-integrated schools.
- There is no secondary school in Wellington West. Students here are in-zone for Wellington Girls' High School; Wellington College; Wellington High School and Onslow College

Wellington East

- There are 10 state and four state-integrated primary schools in this area. There is space for approximately 400 students in the state network and approximately 300 spare student spaces in the state-integrated schools.
- There are four secondary schools servicing this network (St Patrick's College, St Catherine's College, Wellington East Girls' College and Rongotai College). All four of these schools are single sex schools. There is space for 150 students in the state schools (Wellington East Girls' College and Rongotai College). There is space for 100 students in the state-integrated schools (St Patrick's College and St Catherine's College).

Northern Suburbs Wellington

- There are 16 state and two state-integrated primary schools in this network. There is capacity for 475 students in the state network and 50 spaces in the state-integrated network.
- There are three state secondary schools (Newlands College, Onslow College and Tawa College) servicing this area. These schools are all at or above capacity. However, Tawa College has 533 students enrolled from outside of its home zone, who are predominantly from Porirua.

Porirua West

- There are five state primary schools and two state-integrated schools in this network. There is space for 250 students in the state schools and 150 students in the state-integrated schools. Only one of these schools currently operates an enrolment scheme (Titahi Bay School).
- There are two secondary schools in Porirua West; Mana College and Bishop Viard College. Bishop Viard College currently has space for approximately 450 students. The Government has recently announced a $15 million redevelopment for Mana College. When completed, Mana College will have final capacity for 600 students. Mana College currently has space for 150 students.

Eastern Porirua

- In November 2018, the Government announced a $1.5 billion revitalisation of Porirua, mainly concentrating on the east. This will see a redevelopment of around 2,000 existing state homes and around 2,000 new affordable homes. This will be over the next 25 years.
- There are 10 state primary schools and one state-integrated school in this network. There is currently space for 780 students in the state primary network, and around 60 spaces in the state-integrated school.
- There is one secondary school in this network, Porirua College. This school currently has space for 200 students.

Porirua North

- There are nine state primary schools and one state-integrated school in this network. There is space for 150 students in the state network and space for 10 students in the state-integrated school.
- There is one secondary network, Aotea College can accommodate an additional 100 students.

Kapiti North

- This is another key area of our ten year growth plan. We plan to closely monitor this area and invest in additional capacity.
- There are five state primary schools in this network and one state-integrated school. There is space for 20 students in the state network and 110 student in the state-integrated school.
- There is one secondary school in this network. There is space for around 170 students at this school.

Kapiti South

- There are seven primary schools and two state-integrated schools in this network. There is space for 180 students in the state network and 140 students in the state-integrated school.
- There are two secondary schools in this network. Both these schools are co-educational and are at or over capacity. Although one College takes around 300 students from outside its zone.

Lower Hutt
Wainuiomata

- There are six state primary schools and one state-integrated schools in this network. There is space for 600 students in the state schools network and space for 80 students in the state-integrated network.
- There is one secondary school in Wainuiomata which currently has space for 270 students. The government recently announced a redevelopment for this school. This area is a focus for Hutt City Council who have a number of housing developments planned here.

Lower Hutt Western/South

- There are 15 primary schools and five state-integrated schools in this network. There is space for 470 students in the state network and 90 students in the state-integrated network. We have seen some growth in this area in the Western Hills of Lower Hutt, mainly in the suburb of Maungaraki.
- There is one state secondary school (Hutt Valley High School) and four state-integrated schools. Hutt Valley High School is at capacity, although it has around 250 students from outside their home zone. There is space for 50 students in the state-integrated network.

Lower Hutt Eastern/North

- There are 12 primary schools and two state-integrated primary. The state schools have space for around 1,000 students, and the state-integrated schools have space for around 300 students.
- There are two secondary schools in this network. They have space for around 400 students.
- There is one state-integrated composite school Wa Ora Montessori School. It has space for around 70 students.

Upper Hutt

- There are 13 state primary schools with space for 530 students and two state-integrated primary school which has space for 160 students.
- There are two state secondary schools with space for 150 students and two state-integrated school which is at or over capacity.

School roll information capture (2019)

Summary Table of capacity information and available space:

Area	Primary (state-integrated)	Primary (state)	Secondary (state-integrated	Secondary (state)
Wellington Central and South	250	At capacity	n/a	At capacity
Wellington West	384	182	n/a	At capacity
Wellington East	300	400	100	150
Northern Suburbs Wellington	475	50	n/a	At capacity
Porirua West	150	250	450	150
Porirua East	60	780	n/a	200
Porirua North	10	150	n/a	100
Kapiti North	110	20	n/a	170
Kapiti South	140	180	n/a	At capacity
Wainuiomata	80	600	n/a	270
Lower Hutt Western/South	90	470	50	At capacity
Lower Hutt Eastern/North	300	1,000	70	400
Upper Hutt	160	530	At capacity	150

Appendix 2.1

PROPERTY ECONOMICS

WELLINGTON CITY

COMMERCIALLY FEASIBLE RESIDENTIAL CAPACITY ASSESSMENT

Client: Wellington City Council

Project No: 51743

Date: May 2019

SCHEDULE

Code	Date	Information / Comments	Project Leader
51743.4	May 2019	Report	Tim Heath / Phil Osborne

DISCLAIMER

This document has been completed, and services rendered at the request of, and for the purposes of Wellington City Council only.

Property Economics has taken every care to ensure the correctness and reliability of all the information, forecasts and opinions contained in this report. All data utilised in this report has been obtained by what Property Economics consider to be credible sources, and Property Economics has no reason to doubt its accuracy. Property Economics shall not be liable for any adverse consequences of the client's decisions made in reliance of any report by Property Economics. It is the responsibility of all parties acting on information contained in this report to make their own enquiries to verify correctness.

1. INTRODUCTION

Property Economics has been engaged by Wellington City Council (**WCC**), as part of a wider region residential capacity project team, to undertake an assessment of the commercially feasible residential capacity (supply) of the Wellington City District within the context of Council's obligations under the National Policy Statement on Urban Development Capacity (**NPS UDC**).

The purpose of this report is to provide WCC with robust market intelligence to assist in making more informed and economically justified decisions in regard to the design and implementation of a residential policy framework for the District Plan and other long-term planning documents.

This report discusses the work undertaken by both Property Economics and Wellington City Council in analysing the existing theoretical residential capacity of the City and developing a capacity model for calculating the level of feasible development within the District. This will inform policy makers on the feasible level of housing supply, and which areas are able to accommodate future residential development based on current zonings, policy settings and market parameters

2. THEORETICAL CAPACITY

Property Economics have been provided with GIS layers containing the sites within Wellington that provided for infill, or comprehensive redevelopment. Theoretical residential capacity was calculated by WCC utilising current theoretical District Plan policy settings algorithmic, GIS and 3D modelling. The information contained several different scenarios, based on housing typology and quantum, that were identified as theoretically viable to develop.

Table 1 below outlines the theoretical capacity output by the model provided to Property Economics by WCC by suburb.

TABLE 1 – WELLINGTON THEORETICAL RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB

Suburbs	Theoretical Capacity	Suburbs	Theoretical Capacity
Aro Valley	451	Mornington	309
Berhampore	1,206	Mount Cook	3,585
Breaker Bay	36	Mount Victoria	1,043
Broadmeadows	268	Newlands	4,544
Brooklyn	2,127	Newtown	3,031
Churton Park	1,712	Ngaio	2,410
Crofton Downs	486	Ngauranga	44
Glenside	148	Northland	857
Grenada North	2,661	Oriental Bay	57
Grenada Village	1,442	Owhiro Bay	284
Hataitai	939	Paparangi	1,491
Highbury	68	Pipitea	3,533
Houghton Bay	186	Rongotai	182
Island Bay	2,970	Roseneath	81
Johnsonville	7,192	Seatoun	760
Kaiwharawhara	23	Southgate	376
Karaka Bays	125	Strathmore Park	1,989
Karori	6,774	Tawa	10,323
Kelburn	584	Te Aro	15,631
Khandallah	2,604	Thorndon	2,900
Kilbirnie	3,415	Vogeltown	271
Kingston	248	Wadestown	748
Lyall Bay	1,039	Wellington Central	6,624
Maupuia	333	Wilton	658
Melrose	215	Woodridge	738
Miramar	4,062	Grand Total	103,783

Source: Property Economics, WCC

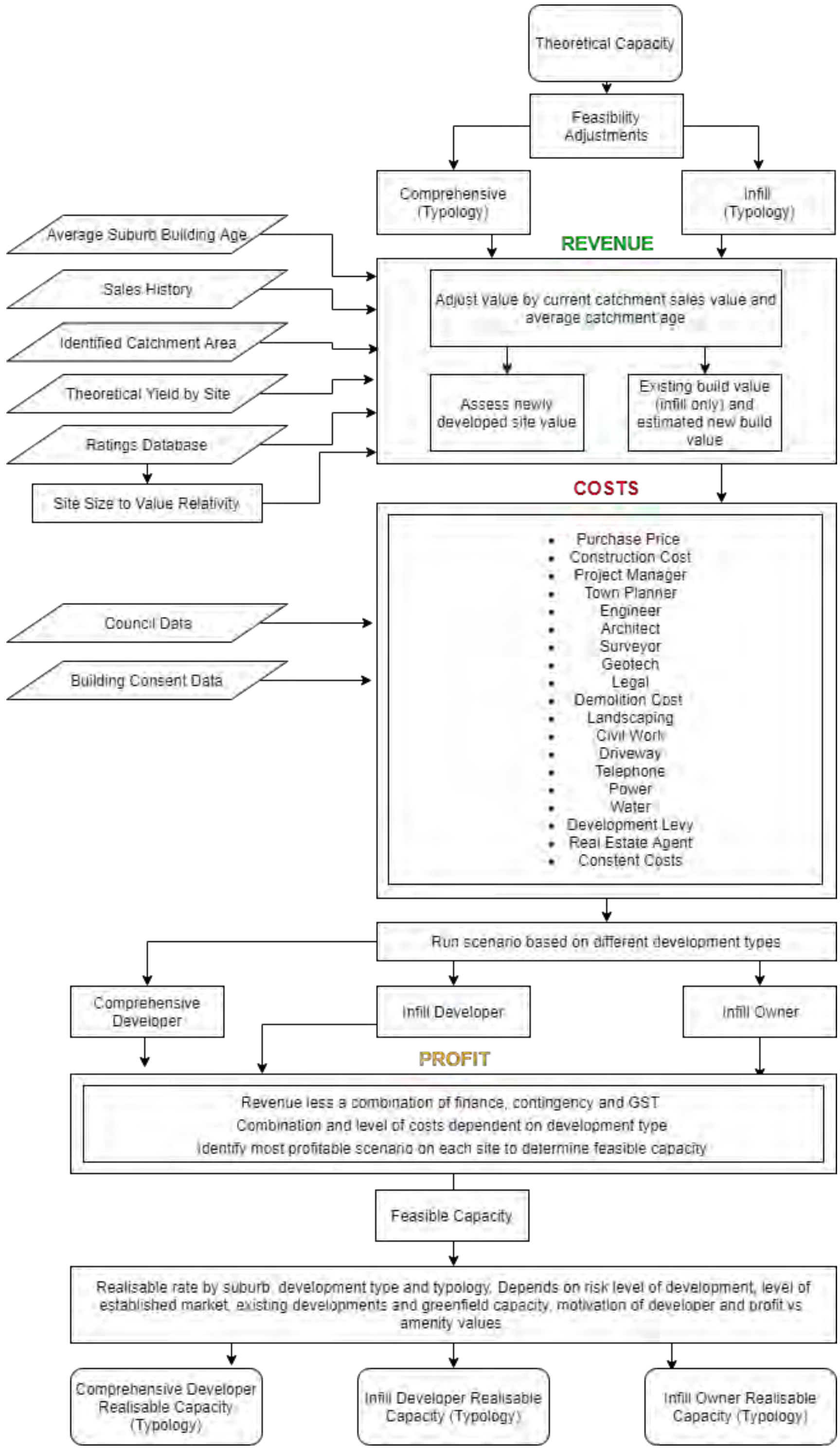
Table 1 shows there is theoretical capacity within Wellington for around 103,800 new dwellings (rounded). The suburbs of Te Aro and Tawa have the highest level of theoretical capacity at 15,631 and 10,323 respectively, while the suburb of Kaiwharawhara has the lowest level of theoretical capacity at an estimated 23 dwellings.

It is important to note that Table 1 represents the sum of the maximum attainable yield attainable yield of any typology on an individual site basis. The theoretical model outputs passed to Property Economics by WCC contained several different development scenarios on each site, therefore the theoretical yield represents the scenarios on each site where the development potential is the highest.

3. FEASIBLE CAPACITY MODELLING

A high-level overview of the model utilised by Property Economics in determining the feasible residential capacity for Wellington is outlined in the flow chart in Figure 1 below, with detailed descriptions of each stage of the process given following.

FIGURE 1: PROPERTY ECONOMICS RESIDENTIAL FEASIBILITY MODEL OVERVIEW



Source: Property Economics

Due to the large number of areas within Wellington, it has been considered appropriate to group them by a comparative 'suburb rating', with 1 being lower value and 5 higher value. All model inputs have been broken down and summarised by this suburb grouping. Table 2 below shows the allocation of suburbs to suburb groups.

TABLE 2 – WELLINGTON SUBURB GROUPS

Suburb	Suburb Rating	Suburb	Suburb Rating
Aro Valley	3	Mornington	3
Berhampore	2	Mount Cook	3
Breaker Bay	4	Mount Victoria	4
Broadmeadows	5	Newlands	3
Brooklyn	3	Newtown	3
Churton Park	3	Ngaio	4
Crofton Downs	4	Ngauranga	2
Glenside	3	Northland	3
Grenada North	1	Oriental Bay	5
Grenada Village	3	Owhiro Bay	2
Hataitai	4	Paparangi	2
Highbury	3	Pipitea	4
Houghton Bay	2	Rongotai	3
Island Bay	3	Roseneath	5
Johnsonville	3	Seatoun	4
Kaiwharawhara	4	Southgate	2
Karaka Bays	2	Strathmore Park	3
Karori	4	Tawa	3
Kelburn	4	Te Aro	4
Khandallah	5	Thorndon	4
Kilbirnie	3	Vogeltown	3
Kingston	3	Wadestown	4
Lyall Bay	3	Wellington Central	4
Maupuia	4	Wilton	3
Melrose	2	Woodridge	3
Miramar	3		

Source: Property Economics, WCC

Land and Improvement Value per SQM

Using the ratings database provided by Wellington City Council, the land value per sqm and improvement value per sqm is calculated. This is then summarised by suburb, size and typology to give the average per sqm value for various types of dwellings.

By splitting the valuation into land and improvement value, it accounts for variations of both sizes e.g. a large dwelling on a small piece of land compared to the same size dwelling on a larger piece of land.

Values are not the same across each suburb (due to differing structures and quality), and thus it is required to give the per sqm value for each suburb individually. Also, the per sqm rate for land and improvement value are shown not to be consistent across all sizes. For example, a larger dwelling has on average a lower per sqm improvement value than a smaller one. This inverse relationship between size and per sqm value is the same for both land value per sqm and building value per sqm.

Tables 3-4 below show the build value per sqm utilised in the commercially feasible capacity modelling for varying building sizes for standalone and terraced typologies.

TABLE 3 – WELLINGTON STANDALONE BUILD VALUE / SQM BY SUBURB RATING

Standalone	50	100	150	200	250	300
1	$ 3,300	$ 2,543	$ 2,010	$ 1,804	$ -	$ -
2	$ 4,044	$ 3,191	$ 2,763	$ 2,642	$ 2,492	$ 2,518
3	$ 3,727	$ 3,285	$ 2,881	$ 2,596	$ 2,372	$ 2,386
4	$ 3,706	$ 3,867	$ 3,485	$ 3,332	$ 3,343	$ 3,412
5	$ 4,317	$ 4,003	$ 3,787	$ 3,759	$ 3,722	$ 3,684

Source: Property Economics, WCC

TABLE 4 – WELLINGTON TERRACED BUILD VALUE / SQM BY SUBURB

Terraced	50	100	150	200	250	300
1	$ 2,874	$ 2,215	$ 1,720	$ 1,571	$ -	$ -
2	$ 3,303	$ 2,607	$ 2,279	$ 2,188	$ 2,070	$ 2,147
3	$ 3,160	$ 2,719	$ 2,372	$ 2,158	$ 1,989	$ 1,991
4	$ 3,441	$ 3,319	$ 2,969	$ 2,821	$ 2,845	$ 2,877
5	$ 4,092	$ 3,463	$ 3,230	$ 3,273	$ 3,219	$ 3,209

Source: Property Economics, WCC

Due to limited availability of ratings data for apartment typologies, nominal values were used for a range of apartment sizes, with capital value determined by interpolating between these points, and scaling based on the average rating data across a suburb.

TABLE 5 – WELLINGTON NOMINAL APARTMENT VALUES

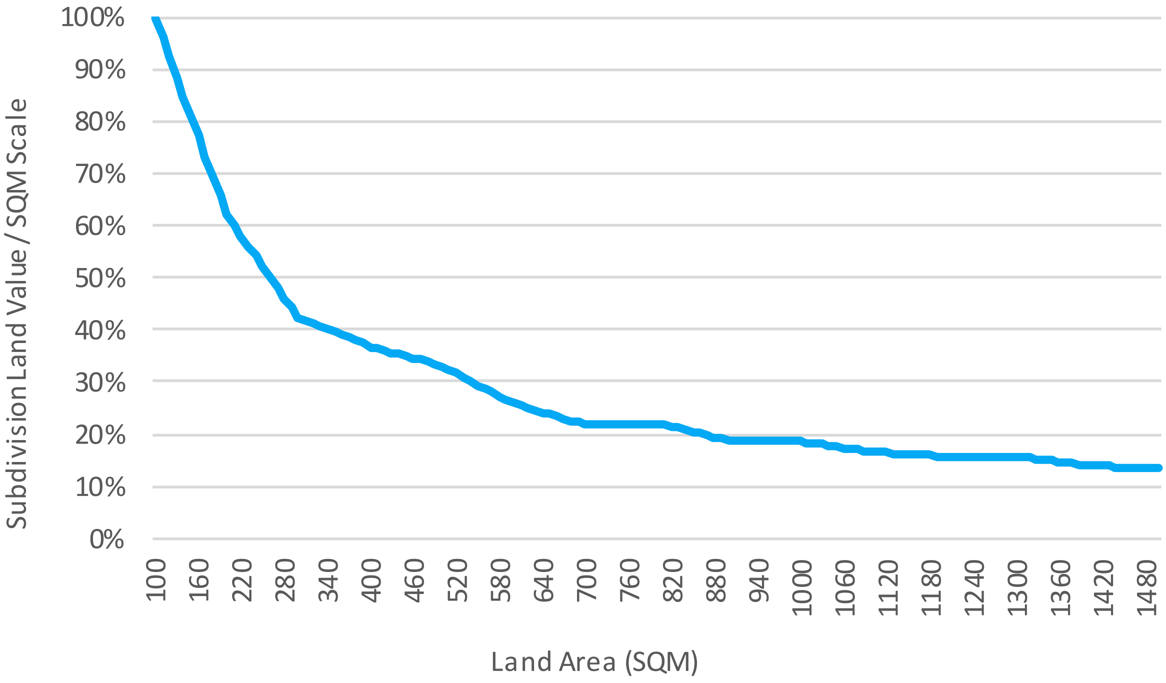
Apartment	25	50	75	100	125	150
3	$ 316,819	$ 391,061	$ 490,050	$ 644,408	$ 763,196	$ 873,668
4	$ 369,023	$ 455,499	$ 570,800	$ 750,592	$ 888,953	$ 1,017,629
5	$ 405,926	$ 501,049	$ 643,991	$ 825,652	$ 977,849	$ 1,119,392

Apartment	175	200	225	250	275	300
3	$ 976,407	$ 1,071,955	$ 1,160,814	$ 1,243,453	$ 1,320,308	$ 1,391,782
4	$ 1,137,297	$ 1,248,589	$ 1,352,090	$ 1,448,346	$ 1,537,864	$ 1,621,116
5	$ 1,251,027	$ 1,373,448	$ 1,487,299	$ 1,593,181	$ 1,691,651	$ 1,783,228

Source: Property Economics, WCC

Figure 2 below shows the land value per sqm subdivision scale utilised in the commercially feasible capacity modelling for varying land sizes. This was utilised for both standalone and terraced typologies, however as described above apartments were modelled using nominal capital values. Figure 2 is indexed against a site size of 100sqm (representing a scale of 100%). At 1,000sqm the index is 20%, indicating that the average 1,000sqm site has a land value per sqm around 1/5th of that of a 100sqm site.

FIGURE 2 – WELLINGTON LAND VALUE / SQM SCALE



Source: Property Economics, WCC

A limitation identified during the modelling process was that by applying a percentage increase on the site-specific land value through the process of subdivision, meant that sites with a proportionally high underlying land value resulted in an impractical subdivided land value on a per sqm basis. This was identified as a specific problem for sites with underlying commercial land values.

As a solution, the maximum residentially zoned land value per sqm identified within the ratings database was used as a maximum limit for the land value per sqm after subdivision. This removed the impact of sites with underlying commercial land values resulting in impractically high profitability, and thus feasible yield.

Average Suburb Age

Using the same ratings database, the average age of dwellings is determined for each suburb. This is undertaken in order to adjust the building value for each suburb based on values of houses from each decade. The data shows that there is a relationship between the age of a building and its per sqm improvement value. Therefore, finding the average age and distribution (of the built product) in a suburb allows the building values outlined above in Tables 2 and 3 to be appropriately adjusted. Note, this adjustment was performed in 'bands', with decades updated accordingly, rather than applying an average across the suburb. This step is important due to the fact that the application of sales data is based on a significant proportion of older stock and does not, therefore, appropriately value new builds.

Sales vs Capital Value (CV)

A statistically significant sample dataset of recent sales in Wellington was used to find the difference between the average sales price and the most recent valuation. This is to ensure the capacity modelling utilises the most up to date values data critical to the determination of current day feasible capacity.

Given the nominal level of sales over this period of time in Wellington, it was deemed appropriate to supplement this dataset with site-specific updated valuation samples for each suburb. Based on a representative sample from each suburb in Wellington, the average increase of sales price over the recent valuation is then determined. There exists a relationship between the suburb and this average increase, and thus the percentage increase is expressed per suburb. This average increase of sales over CV is then applied in the model to update the valuations (Tables 3 and 4) to reflect current market value.

Table 6 below shows the average Sales / CV percentage utilised in the model.

TABLE 6 – WELLINGTON AVERAGE SALES / CV BY SUBURB RATING

Suburb Rating	Sales / CV
1	115%
2	112%
3	114%
4	117%
5	109%

Source: Property Economics, WCC

Construction Costs

Suburb based differentials between constructions costs for new dwellings were found by analysing the value of recent building consents granted within Wellington. The historical building consent data shows that the average value of building consents varies across suburb within Wellington, indicating the variety of product quality that is built.

Because of this, a table of average building consent per sqm by suburb was extracted from the building consent data in order to represent the average construction costs in a suburb. This is then used in the model as the construction costs of building a new dwelling. Note, this is only used for standalone and terraced dwellings, as apartments have been modelled using nominal capital values. Due to data restrictions some suburbs were grouped by quality for this purpose. This, once again, neutralises suburb based sales data where these average sales are based on higher quality (and therefore more expensive) builds.

Tables 7, 8 and 9 below show the average build cost by suburb rating for standalone, terraced and apartment typology types.

TABLE 7 – WELLINGTON STANDALONE BUILD COST BY SUBURB RATING

STANDALONE	50	75	100	125	150	175	200	225	250	275	280
1	$ 2,807	$ 2,265	$ 1,723	$ 1,557	$ 1,297	$ 1,277	$ 1,202	$ 1,146	$ -	$ -	$ -
2	$ 3,440	$ 2,776	$ 2,162	$ 1,953	$ 1,783	$ 1,755	$ 1,761	$ 1,680	$ 1,664	$ 1,606	$ 1,595
3	$ 3,338	$ 2,693	$ 2,342	$ 2,116	$ 1,957	$ 1,926	$ 1,821	$ 1,737	$ 1,667	$ 1,609	$ 1,598
4	$ 3,153	$ 2,544	$ 2,620	$ 2,367	$ 2,249	$ 2,213	$ 2,221	$ 2,118	$ 2,233	$ 2,155	$ 2,140
5	$ 3,673	$ 2,964	$ 2,712	$ 2,450	$ 2,445	$ 2,406	$ 2,505	$ 2,389	$ 2,486	$ 2,399	$ 2,383

Source: Property Economics

TABLE 8 – WELLINGTON TERRACED BUILD COST BY SUBURB RATING

TERRACED	50	75	100	125	150	175	200	225	250	275	280
1	$ 2,655	$ 2,108	$ 1,588	$ 1,426	$ 1,182	$ 1,165	$ 1,094	$ 1,041	$ -	$ -	$ -
2	$ 3,253	$ 2,583	$ 1,992	$ 1,789	$ 1,625	$ 1,602	$ 1,602	$ 1,525	$ 1,509	$ 1,454	$ 1,444
3	$ 3,157	$ 2,506	$ 2,158	$ 1,938	$ 1,783	$ 1,758	$ 1,657	$ 1,577	$ 1,511	$ 1,456	$ 1,446
4	$ 2,982	$ 2,368	$ 2,414	$ 2,168	$ 2,049	$ 2,020	$ 2,021	$ 1,923	$ 2,024	$ 1,950	$ 1,937
5	$ 3,473	$ 2,758	$ 2,499	$ 2,244	$ 2,227	$ 2,196	$ 2,279	$ 2,169	$ 2,253	$ 2,171	$ 2,156

Source: Property Economics

TABLE 9 – WELLINGTON APARTMENT BUILD COST BY SUBURB

APARTMENT	50	75	100	125	150	175	200	225	250	275	280
1	$ 3,521	$ 2,979	$ 2,348	$ 2,182	$ 1,861	$ 1,843	$ 1,766	$ 1,711	$ -	$ -	$ -
2	$ 4,315	$ 3,650	$ 2,946	$ 2,738	$ 2,558	$ 2,534	$ 2,588	$ 2,506	$ 2,519	$ 2,460	$ 2,450
3	$ 4,187	$ 3,542	$ 3,192	$ 2,966	$ 2,807	$ 2,781	$ 2,676	$ 2,592	$ 2,523	$ 2,464	$ 2,454
4	$ 3,955	$ 3,346	$ 3,570	$ 3,318	$ 3,226	$ 3,196	$ 3,263	$ 3,161	$ 3,379	$ 3,300	$ 3,287
5	$ 4,607	$ 3,897	$ 3,695	$ 3,434	$ 3,506	$ 3,474	$ 3,681	$ 3,566	$ 3,762	$ 3,674	$ 3,659

Source: Property Economics

Other Development Costs

As well as construction costs, a number of other costs have been incorporated in to the feasibility model on a per dwelling basis. Some of the key costs are outlined below in Table 10. Other costs are identified in Figure 1 but also include commercial interest at 8% p.a. and a 10% contingency on total costs (risk).

TABLE 10 – WELLINGTON PER DWELLING DEVELOPMENT COSTS

COMPREHENSIVE COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ 100	$ 100	$ 100
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

INFILL COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ -	$ -	$ -
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

Source: Property Economics, WCC

4. FEASIBILITY MODELLING OUTPUTS

4.1. FEASIBLE CAPACITY OUTPUTS

Property Economics has assessed the variables outlined above in the Wellington market and run feasible capacity models across the range of locations, land values, improvement values, and land value changes. A key component of the market's willingness to develop infill is the relationship between a site's land value, fixed subdivision costs and the identifiable 'uptake' in value (sqm) through subdivision.

Table 11 below outlines a summary of the number of potential sections on sites where the ratios meet a profit level suitable to meet market expectations (20% for the purpose of this analysis).

Table 11 represents the subdivision undertaken by either an owner occupier or a developer, with the capacity representing the most profitable. This is an important difference as motivations and capital outlay are often different. These figures have removed all 'double ups' i.e. where multiple instances were tested on a specific site and represent the most profitable scenario for that site.

TABLE 11 – WELLINGTON FEASIBLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB – OWNER AND DEVELOPER

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aro Valley	451	6	61	89	156	35%
Berhampore	1206	-	242	112	354	29%
Breaker Bay	36	-	8	15	23	64%
Broadmeadows	268	-	26	-	26	10%
Brooklyn	2127	6	345	221	572	27%
Churton Park	1712	-	94	27	121	7%
Crofton Downs	486	-	46	24	70	14%
Glenside	148	-	1	16	17	11%
Grenada North	2661	-	3	59	62	2%
Grenada Village	1442	-	175	83	258	18%
Hataitai	939	-	248	268	516	55%
Highbury	68	-	23	8	31	46%
Houghton Bay	186	-	31	16	47	25%
Island Bay	2970	18	402	306	726	24%
Johnsonville	7192	997	383	446	1,826	25%
Kaiwharawhara	23	-	7	2	9	39%
Karaka Bays	125	-	23	25	48	38%
Karori	6774	-	784	1,761	2,545	38%
Kelburn	584	-	158	194	352	60%
Khandallah	2604	59	262	758	1,079	41%
Kilbirnie	3415	586	224	104	914	27%
Kingston	248	-	17	6	23	9%
Lyall Bay	1039	3	123	192	318	31%
Maupuia	333	-	43	64	107	32%
Melrose	215	-	65	30	95	44%
Miramar	4062	-	524	272	796	20%
Mornington	309	-	43	21	64	21%
Mount Cook	3585	1,511	74	130	1,715	48%
Mount Victoria	1043	8	89	167	264	25%
Newlands	4544	-	275	176	451	10%
Newtown	3031	863	288	239	1,390	46%
Ngaio	2410		322	440	762	32%
Ngauranga	44	-	-	-	-	0%
Northland	857	25	182	137	344	40%
Oriental Bay	57	-	10	23	33	58%
Owhiro Bay	284	-	30	30	60	21%
Paparangi	1491	-	97	40	137	9%
Pipitea	3533	446	1	-	447	13%
Rongotai	182	-	67	17	84	46%
Roseneath	81	-	33	17	50	62%
Seatoun	760	-	98	284	382	50%
Southgate	376	-	59	46	105	28%
Strathmore Park	1989	-	212	245	457	23%
Tawa	10323	-	332	563	895	9%
Te Aro	15631	2,817	20	31	2,868	18%
Thorndon	2900	718	90	212	1,020	35%
Vogeltown	271	-	44	31	75	28%
Wadestown	748	-	162	232	394	53%
Wellington Central	6624	1,922	1	-	1,923	29%
Wilton	658	-	88	52	140	21%
Woodridge	738	-	61	114	175	24%
Grand Total	103,783	9,985	6,996	8,345	25,326	24%

Source: Property Economics, WCC

If developments were to be undertaken by either a developer or owner occupier, there is potential for 25,326 additional units within the Wellington market. As all development options have been considered in Table 11, this represents the total feasible capacity in the market. This level of feasible capacity represents a 24% feasibility rate on the theoretical capacity.

4.2. SENSITIVITY ANALYSIS

As an extension to the feasibility modelling outlined above, scenarios testing the sensitivity of the feasibility model have also been undertaken. This has been done to test the robustness of the model, and see the practical implications due to small changes in the input variables.

The following scenarios have been tested in this sensitivity analysis:

- **Increasing the build value across all typologies by 15%.** This in essence represents a greater per sqm profit margin on any new built product. Tables 3 and 4 above show the build value per sqm utilised in the feasibility model for standalone and terraced developments. Under this sensitivity, the build values in this table were increased by 15%. Since nominal apartment values were used in the analysis, the average split between land value and improvement value was found on a suburb by suburb basis, with the 15% increase applied based on this proportional split i.e. applying only to build value. Within the model the relative difference between the build value of a development and the build cost is an important driver of profitability, and as such this sensitivity was run to investigate the impact on overall feasibility when this difference is greater.

- **Increasing the savings incurred due to Economies of Scale (EoS).** In the normal model, the maximum savings that could occur due to larger scale developments was savings of around 15% on relevant costs. This has been scaled to a maximum of around 50%, with the savings increased as the scale of the development increases. For example, a subdivision of one standalone dwelling will incur the same costs and thus profit level as the normal model, however an comprehensive apartment development of 50 units will incur significantly less costs than under the normal model. This sensitivity was included to investigate the effect of higher profitability drivers for large developments only.

- **Increasing the maximum attainable land value in the model by 10%**. This represents the possibility of the highest per sqm land value increasing by 10% in the future. Outlined in the process above, a maximum land value per sqm was applied on a suburb by suburb basis to remove the impact of scaling commercially valued land to inappropriately high per sqm land values. Increasing this maximum by 10% is expected to increase the feasibility of several sites as the profit made on the subdivision of the land would increase. This maximum was found by identifying the current highest residential land value per sqm within the suburb. The 10% increase as a sensitivity simply tests to see the relative impact of changing this imposed maximum.

- **Decreasing the maximum attainable land value in the model by 10%.** This represents the possibility of the highest per sqm land value increasing by 10% in the future. Similar to the sensitivity above, this represents a change in the imposed maximum land value achievable through subdivision, however, decreases this value by 10% rather than increasing. Again, this is to test the relative impact of changing this imposed maximum.

Each scenario has been tested independently of the other in order to isolate the sensitivity of the model to this specific scenario.

A summary of the feasible capacity under each of the four scenarios, compared against the original feasible capacity is given following in Table 12. A full breakdown of feasible capacity under each sensitivity scenario is given in Appendix 1.

TABLE 12 – FEASIBLE CAPACITY SENSITIVITY ANALYSIS

Scenario	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Normal Model	103,783	9,985	6,996	8,345	25,326	24%
Increased Economies of Scale	103,783	12,398	8,687	10,362	31,447	30%
Increased Build Value	103,783	13,524	9,475	11,303	34,302	33%
Increased Land Value (10%)	103,783	12,001	8,409	10,030	30,440	29%
Decreased Land Value (10%)	103,783	8,185	5,735	6,841	20,760	20%

Source: Property Economics, WCC

The series of sensitivities show that the modelling process is most sensitive to the increased build value, increasing feasible capacity to around 34,300, a feasibility rate of 33%.

4.3. REALISABLE CAPACITY OUTPUTS

On top of the feasible capacity modelling, practical considerations must be taken into account as to what is likely to be developed in the real world. While this section is separated from the sensitivities above the realisation rates essentially provide for 'development chance' given the propensity for development variances.

These considerations are based on:

- Dwelling typology
- Development option
- Greenfield competition

The identification of these variables not only provides for sensitivities but also addresses the relativity between typologies. While all three typologies may be feasible the development model identifies the site scenario with the highest profit margin. However, practically while the model assesses the standard 20% profit margin, there is greater risk in some typologies. The assessment below endeavours to consider these risks and motivation differentials.

The capacity for greenfield development within Wellington has been provided to Property Economics, and this has been cross referenced against future residential demand to give an indication of the proportion of demand that can be satisfied by greenfield development. Forecast demand for residential product has been based on Statistics NZ medium population and household projections. Table 13 outlines greenfield capacity and future residential demand:

TABLE 13 – WELLINGTON GREENFIELD DEVELOPMENT CAPACITY

	Greenfield Capacity	30-Year Demand	Greenfield % of Demand	Required Brownfield
Wellington City	2,628	24,900	11%	22,272

Source: Property Economics, WCC, SNZ

Over the 30-year forecast period from 2018-2048, Wellington is forecast to require an additional 24,900 dwellings. Greenfield modelling provided by WCC has indicated that the City has capacity for 2,628 greenfield dwellings, making up 11% of 30-year demand. This is deemed a relatively low proportion of 30-year demand that is able to be fulfilled by greenfield capacity (the lowest of any TA within the Wellington Region). As such, the relative risk of brownfield development is lower than in any other TA as this form of development is evidently required within the market.

On top of greenfield consideration, the relative risk of each development type must be considered in quantifying what will practically be developed by the market. The risk is not homogenous across typology or development type, and thus a matrix of 'risk factors' have been applied across each combination of typology and development type.

Risk has been accounted for developments undertaking by developers by increasing the required profit level for a development to be classified as 'realisable', on top of being feasible.

Table 14 below shows the profit levels required for each combination of typology and development option to be considered realisable by the model.

TABLE 14 – DEVELOPER REALISABLE PROFIT RATES

	Comprehensive Developer	Infill Developer	Infill Owner
Standalone	**20%**	**17%**	**25%**
Terraced	**23%**	**20%**	**28%**
Apartment	**32%**	**28%**	**39%**

Source: Property Economics, WCC, SNZ

This reflects the market practicality that developments taken on by a developer have relatively lower risk if they are an infill development, rather than a comprehensive development. It also shows the increasing risk of development as the typology increases in scale from standalone dwellings, through to terraced product, and finally apartments.

For an owner occupier the model considers the profit level of the development relative to the capital value of the existing dwelling(s). This is because motivations for an owner to subdivide their property are inherently linked with the relative profit they can achieve against the value of their own home e.g. a $100,000 profit on a $1,000,000 site will be less likely to be developed by the owner, compared to a $100,000 profit on a $500,000 site, assuming similar fixed costs. Therefore, as a methodology for this, the model considers that the lowest quartile of feasible infill developments in terms of the relative profit / CV ratio will not be realised by the market.

Taking these market practicalities into consideration, Table 15 represents the realisable capacity within Wellington.

TABLE 15 – WELLINGTON REALISABLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
Aro Valley	451	3	75	50	128	28%
Berhampore	1206	-	297	63	361	30%
Breaker Bay	36	-	10	9	18	51%
Broadmeadows	268	-	32	-	32	12%
Brooklyn	2127	3	424	125	552	26%
Churton Park	1712	-	115	15	131	8%
Crofton Downs	486	-	56	14	70	14%
Glenside	148	-	1	9	10	7%
Grenada North	2661	-	4	33	37	1%
Grenada Village	1442	-	215	47	262	18%
Hataitai	939	-	305	152	456	49%
Highbury	68	-	28	5	33	48%
Houghton Bay	186	-	38	9	47	25%
Island Bay	2970	8	494	173	675	23%
Johnsonville	7192	434	470	253	1,157	16%
Kaiwharawhara	23	-	9	1	10	42%
Karaka Bays	125	-	28	14	42	34%
Karori	6774	-	963	998	1,961	29%
Kelburn	584	-	194	110	304	52%
Khandallah	2604	26	322	430	777	30%
Kilbirnie	3415	255	275	59	589	17%
Kingston	248	-	21	3	24	10%
Lyall Bay	1039	1	151	109	261	25%
Maupuia	333	-	53	36	89	27%
Melrose	215	-	80	17	97	45%
Miramar	4062	-	644	154	798	20%
Mornington	309	-	53	12	65	21%
Mount Cook	3585	657	91	74	822	23%
Mount Victoria	1043	3	109	95	207	20%
Newlands	4544	-	338	100	437	10%
Newtown	3031	375	354	135	864	29%
Ngaio	2410	-	395	249	645	27%
Ngauranga	44	-	-	-	-	0%
Northland	857	11	224	78	312	36%
Oriental Bay	57	-	12	13	25	44%
Owhiro Bay	284	-	37	17	54	19%
Paparangi	1491	-	119	23	142	10%
Pipitea	3533	194	1	-	195	6%
Rongotai	182	-	82	10	92	51%
Roseneath	81	-	41	10	50	62%
Seatoun	760	-	120	161	281	37%
Southgate	376	-	72	26	99	26%
Strathmore Park	1989	-	260	139	399	20%
Tawa	10323	-	408	319	727	7%
Te Aro	15631	1,225	25	18	1,267	8%
Thorndon	2900	312	111	120	543	19%
Vogeltown	271	-	54	18	72	26%
Wadestown	748	-	199	131	330	44%
Wellington Central	6624	836	1	-	837	13%
Wilton	658	-	108	29	138	21%
Woodridge	738	-	75	65	140	19%
Grand Total	103,783	4,342	8,592	4,729	17,663	17%

Source: Property Economics, WCC

Table 15 shows that the realisable capacity across Wellington is just over 17,650 new dwellings, representing a 17% realisation rate across the City. In essence, this represents a 70% realisation rate of the already calculated feasible capacity outlined in Table 11 above.

As expected, the realisation on standalone developments is higher than other typologies, with realisable capacity for standalones outweighing the feasible capacity 23%. In contrast, realisable apartment capacity is 43% of feasible capacity, and terraced being 57%.

APPENDIX 1 – SENSITIVITY ANALYSIS TABLES

EOS Scale (50%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aro Valley	451	7	76	111	194	43%
Berhampore	1206	-	300	139	440	36%
Breaker Bay	36	-	10	19	29	79%
Broadmeadows	268	-	32	-	32	12%
Brooklyn	2127	7	428	274	710	33%
Churton Park	1712	-	117	34	150	9%
Crofton Downs	486	-	57	30	87	18%
Glenside	148	-	1	20	21	14%
Grenada North	2661	-	4	73	77	3%
Grenada Village	1442	-	217	103	320	22%
Hataitai	939	-	308	333	641	68%
Highbury	68	-	29	10	38	57%
Houghton Bay	186	-	38	20	58	31%
Island Bay	2970	22	499	380	901	30%
Johnsonville	7192	1,238	476	554	2,267	32%
Kaiwharawhara	23	-	9	2	11	49%
Karaka Bays	125	-	29	31	60	48%
Karori	6774	-	973	2,187	3,160	47%
Kelburn	584	-	196	241	437	75%
Khandallah	2604	73	325	941	1,340	51%
Kilbirnie	3415	728	278	129	1,135	33%
Kingston	248	-	21	7	29	12%
Lyall Bay	1039	4	153	238	395	38%
Maupuia	333	-	53	79	133	40%
Melrose	215	-	81	37	118	55%
Miramar	4062	-	651	338	988	24%
Mornington	309	-	53	26	79	26%
Mount Cook	3585	1,876	92	161	2,130	59%
Mount Victoria	1043	10	111	207	328	31%
Newlands	4544	-	341	219	560	12%
Newtown	3031	1,072	358	297	1,726	57%
Ngaio	2410	-	400	546	946	39%
Ngauranga	44	-	-	-	-	0%
Northland	857	31	226	170	427	50%
Oriental Bay	57	-	12	29	41	72%
Owhiro Bay	284	-	37	37	75	26%
Paparangi	1491	-	120	50	170	11%
Pipitea	3533	554	1	-	555	16%
Rongotai	182	-	83	21	104	57%
Roseneath	81	-	41	21	62	77%
Seatoun	760	-	122	353	474	62%
Southgate	376	-	73	57	130	35%
Strathmore Park	1989	-	263	304	567	29%
Tawa	10323	-	412	699	1,111	11%
Te Aro	15631	3,498	25	38	3,561	23%
Thorndon	2900	892	112	263	1,267	44%
Vogeltown	271	-	55	38	93	34%
Wadestown	748	-	201	288	489	65%
Wellington Central	6624	2,387	1	-	2,388	36%
Wilton	658	-	109	65	174	26%
Woodridge	738	-	76	142	217	29%
Grand Total	103,783	12,398	8,687	10,362	31,447	30%

Build Value Increase (15%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aro Valley	451	8	83	121	211	47%
Berhampore	1206	-	328	152	479	40%
Breaker Bay	36	-	11	20	31	87%
Broadmeadows	268	-	35	-	35	13%
Brooklyn	2127	8	467	299	775	36%
Churton Park	1712	-	127	37	164	10%
Crofton Downs	486	-	62	33	95	20%
Glenside	148	-	1	22	23	16%
Grenada North	2661	-	4	80	84	3%
Grenada Village	1442	-	237	112	349	24%
Hataitai	939	-	336	363	699	74%
Highbury	68	-	31	11	42	62%
Houghton Bay	186	-	42	22	64	34%
Island Bay	2970	24	544	414	983	33%
Johnsonville	7192	1,350	519	604	2,473	34%
Kaiwharawhara	23	-	9	3	12	53%
Karaka Bays	125	-	31	34	65	52%
Karori	6774	-	1,062	2,385	3,447	51%
Kelburn	584	-	214	263	477	82%
Khandallah	2604	80	355	1,027	1,461	56%
Kilbirnie	3415	794	303	141	1,238	36%
Kingston	248	-	23	8	31	13%
Lyall Bay	1039	4	167	260	431	41%
Maupuia	333	-	58	87	145	44%
Melrose	215	-	88	41	129	60%
Miramar	4062	-	710	368	1,078	27%
Mornington	309	-	58	28	87	28%
Mount Cook	3585	2,047	100	176	2,323	65%
Mount Victoria	1043	11	121	226	358	34%
Newlands	4544	-	372	238	611	13%
Newtown	3031	1,169	390	324	1,883	62%
Ngaio	2410	-	436	596	1,032	43%
Ngauranga	44	-	-	-	-	0%
Northland	857	34	247	186	466	54%
Oriental Bay	57	-	14	31	45	78%
Owhiro Bay	284	-	41	41	81	29%
Paparangi	1491	-	131	54	186	12%
Pipitea	3533	604	1	-	605	17%
Rongotai	182	-	91	23	114	63%
Roseneath	81	-	45	23	68	84%
Seatoun	760	-	133	385	517	68%
Southgate	376	-	80	62	142	38%
Strathmore Park	1989	-	287	332	619	31%
Tawa	10323	-	450	763	1,212	12%
Te Aro	15631	3,815	27	42	3,884	25%
Thorndon	2900	972	122	287	1,381	48%
Vogeltown	271	-	60	42	102	37%
Wadestown	748	-	219	314	534	71%
Wellington Central	6624	2,603	1	-	2,605	39%
Wilton	658	-	119	70	190	29%
Woodridge	738	-	83	154	237	32%
Grand Total	103,783	13,524	9,475	11,303	34,302	33%

Land Value Increase (10%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aro Valley	451	7	73	107	188	42%
Berhampore	1206	-	291	135	425	35%
Breaker Bay	36	-	10	18	28	77%
Broadmeadows	268	-	31	-	31	12%
Brooklyn	2127	7	415	266	688	32%
Churton Park	1712	-	113	32	145	8%
Crofton Downs	486	-	55	29	84	17%
Glenside	148	-	1	19	20	14%
Grenada North	2661	-	4	71	75	3%
Grenada Village	1442	-	210	100	310	22%
Hataitai	939	-	298	322	620	66%
Highbury	68	-	28	10	37	55%
Houghton Bay	186	-	37	19	56	30%
Island Bay	2970	22	483	368	873	29%
Johnsonville	7192	1,198	460	536	2,195	31%
Kaiwharawhara	23	-	8	2	11	47%
Karaka Bays	125	-	28	30	58	46%
Karori	6774	-	942	2,117	3,059	45%
Kelburn	584	-	190	233	423	72%
Khandallah	2604	71	315	911	1,297	50%
Kilbirnie	3415	704	269	125	1,099	32%
Kingston	248	-	20	7	28	11%
Lyall Bay	1039	4	148	231	382	37%
Maupuia	333	-	52	77	129	39%
Melrose	215	-	78	36	114	53%
Miramar	4062	-	630	327	957	24%
Mornington	309	-	52	25	77	25%
Mount Cook	3585	1,816	89	156	2,061	57%
Mount Victoria	1043	10	107	201	317	30%
Newlands	4544	-	331	212	542	12%
Newtown	3031	1,037	346	287	1,671	55%
Ngaio	2410	-	387	529	916	38%
Ngauranga	44	-	-	-	-	0%
Northland	857	30	219	165	413	48%
Oriental Bay	57	-	12	28	40	70%
Owhiro Bay	284	-	36	36	72	25%
Paparangi	1491	-	117	48	165	11%
Pipitea	3533	536	1	-	537	15%
Rongotai	182	-	81	20	101	55%
Roseneath	81	-	40	20	60	74%
Seatoun	760	-	118	341	459	60%
Southgate	376	-	71	55	126	34%
Strathmore Park	1989	-	255	294	549	28%
Tawa	10323	-	399	677	1,076	10%
Te Aro	15631	3,386	24	37	3,447	22%
Thorndon	2900	863	108	255	1,226	42%
Vogeltown	271	-	53	37	90	33%
Wadestown	748	-	195	279	474	63%
Wellington Central	6624	2,310	1	-	2,311	35%
Wilton	658	-	106	63	168	26%
Woodridge	738	-	73	137	210	29%
Grand Total	103,783	12,001	8,409	10,030	30,440	29%

Land Value Decrease (10%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aro Valley	451	5	50	73	128	28%
Berhampore	1206	-	198	92	290	24%
Breaker Bay	36	-	7	12	19	52%
Broadmeadows	268	-	21	-	21	8%
Brooklyn	2127	5	283	181	469	22%
Churton Park	1712	-	77	22	99	6%
Crofton Downs	486	-	38	20	57	12%
Glenside	148	-	1	13	14	9%
Grenada North	2661	-	2	48	51	2%
Grenada Village	1442	-	143	68	211	15%
Hataitai	939	-	203	220	423	45%
Highbury	68	-	19	7	25	37%
Houghton Bay	186	-	25	13	39	21%
Island Bay	2970	15	330	251	595	20%
Johnsonville	7192	817	314	366	1,497	21%
Kaiwharawhara	23	-	6	2	7	32%
Karaka Bays	125	-	19	20	39	31%
Karori	6774	-	643	1,444	2,086	31%
Kelburn	584	-	130	159	289	49%
Khandallah	2604	48	215	621	884	34%
Kilbirnie	3415	480	184	85	749	22%
Kingston	248	-	14	5	19	8%
Lyall Bay	1039	2	101	157	261	25%
Maupuia	333	-	35	52	88	26%
Melrose	215	-	53	25	78	36%
Miramar	4062	-	430	223	653	16%
Mornington	309	-	35	17	52	17%
Mount Cook	3585	1,239	61	107	1,406	39%
Mount Victoria	1043	7	73	137	216	21%
Newlands	4544	-	225	144	370	8%
Newtown	3031	707	236	196	1,139	38%
Ngaio	2410	-	264	361	625	26%
Ngauranga	44	-	-	-	-	0%
Northland	857	20	149	112	282	33%
Oriental Bay	57	-	8	19	27	47%
Owhiro Bay	284	-	25	25	49	17%
Paparangi	1491	-	80	33	112	8%
Pipitea	3533	366	1	-	366	10%
Rongotai	182	-	55	14	69	38%
Roseneath	81	-	27	14	41	51%
Seatoun	760	-	80	233	313	41%
Southgate	376	-	48	38	86	23%
Strathmore Park	1989	-	174	201	375	19%
Tawa	10323	-	272	462	734	7%
Te Aro	15631	2,309	16	25	2,351	15%
Thorndon	2900	589	74	174	836	29%
Vogeltown	271	-	36	25	61	23%
Wadestown	748	-	133	190	323	43%
Wellington Central	6624	1,576	1	-	1,576	24%
Wilton	658	-	72	43	115	17%
Woodridge	738	-	50	93	143	19%
Grand Total	103,783	8,185	5,735	6,841	20,760	20%

Appendix 2.2

Wellington Water

NPS-UDC Three Waters Infrastructure Enabled Development Capacity

Wellington City Council

Our water, our future.

Version	Date	Author	Amendment Summary
1.0	14 December 2018	Emily Greenberg Nadia Nitsche	Revised wastewater and water supply mapped results.
2.0	29/03/19	Emily Greenberg	Minor edits
2.1	29/03/19	Emily Greenberg	Minor edits
2.2	15/05/19	Emily Greenberg	revised definition of short-term, infrastructure enabled development capacity on page 3

Contents

Executive Summary

The purpose of this report is to meet the National Policy Statement on Urban Development Capacity (NPS-UDC) requirements in terms of reporting on the infrastructure enabled capacity to support growth.

This report assesses where projected areas for urban growth in Wellington City Council (WCC) can be serviced with existing or planned water supply, wastewater systems and protection from stormwater flooding. We refer to these services as the three waters.

Hydraulic models were combined with projected population estimates in the short-term (next three years), medium-term (three to ten years) and the long-term (ten- 30 years).

The results are presented by catchment as either, yes the catchment is enabled for water supply, wastewater or stormwater protection, or no the catchment is not enabled.

The adequacy of the existing or planned water supply to support projected urban growth is limited in 76 percent of the water supply catchments in Wellington due to either inadequate water pressure or insufficient reservoir storage volumes to support a growing population. These results do not consider the opportunity to reconfigure the network to accommodate site-specific growth or new reservoirs that typically accompany new growth areas.

The adequacy of the existing or planned wastewater network is limited in most catchments for the medium-term population projections and in all of the catchments for the long-term projections. This is due to insufficient pumping station capacities and undersized main trunk diameters combined with high inflow of rainwater and infiltration of groundwater during wet weather, which leads to overflows of untreated wastewater at several locations throughout the city. Similar to the model results for water supply, these results do not consider opportunities for proposed developments to implement site-specific mitigations.

Stormwater can limit growth by creating a flooding risk to life and property. As stormwater pipes are designed to safely carry away only nuisance flooding from low to medium intensity rain events, most stormwater protection must result from planning restrictions on where and how development occurs. For example, the hydraulic models for this report assume that all new development in Wellington is managed so that flooding is not increased up to and including the 1 in 100-year rainfall event and that buildings do not impede overland flow paths or areas of ponding.

In addition to flooding risks, stormwater, including stormwater contaminated with wastewater, from existing urban areas and from future developments will need to be managed to protect the water quality of the streams and coastal waters to meet the new requirements in the Proposed Natural Resource Management Plan for the Wellington Region, the recommendations from Te Whanganui-a-Tara Whaitua Committee and the aspirations of the wider Wellington community.

1. Purpose

This report assesses where projected areas for urban growth in Wellington City Council (WCC) can be serviced with existing or planned water supply, wastewater systems and protection from stormwater flooding. We refer to these services as the three waters.

This assessment is provided to WCC as a technical report to support their evidence and monitoring requirements under the National Policy Statement for Urban Development Capacity (NPS-UDC) 2016.

The flowchart below (Figure 1) is from the NPS-UDC *Guide on Evidence and Monitoring* (2017) that indicates how the evidence on infrastructure is used to assess feasible development capacity.

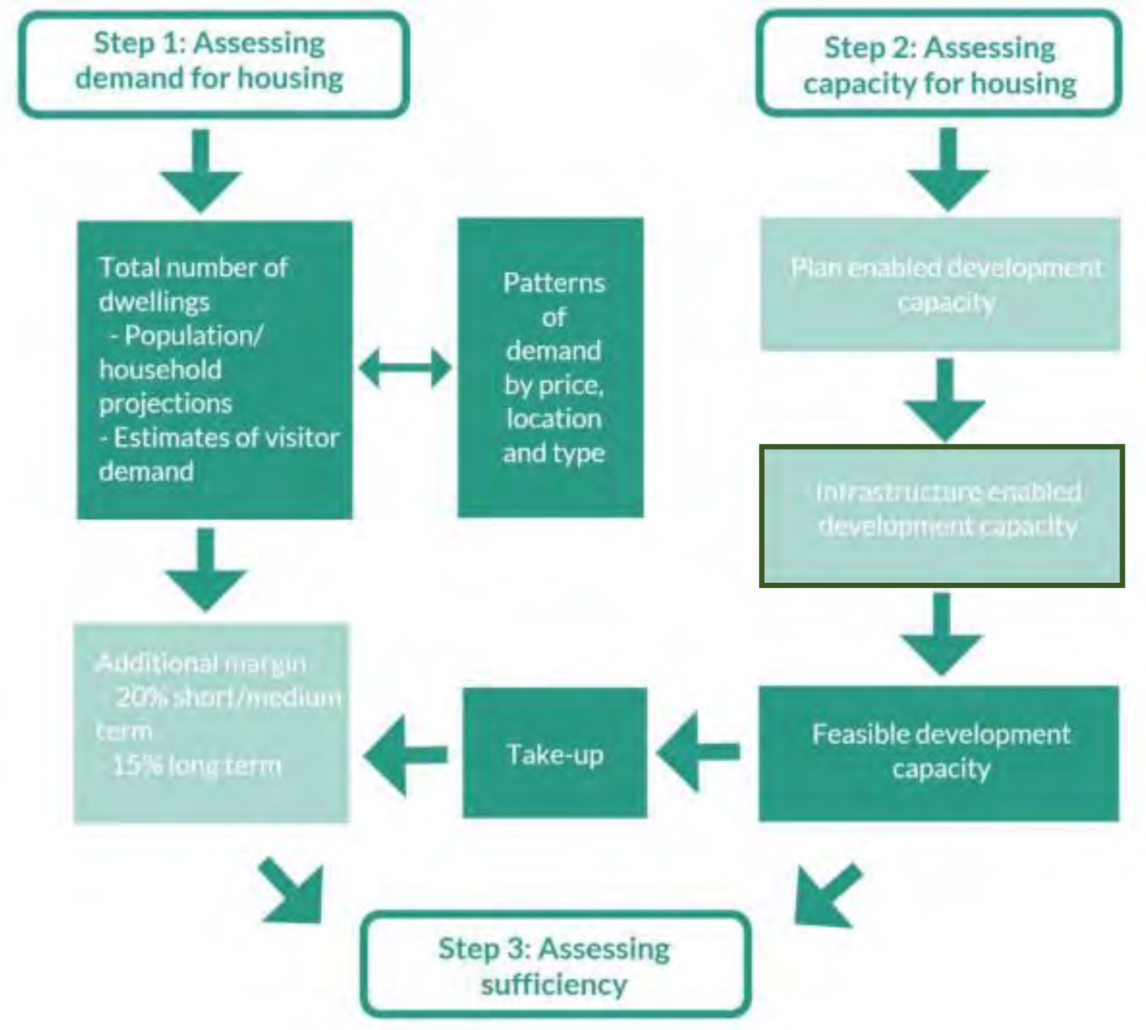


Figure 1: Housing Assessment Methodology overview Flow Chart. WWL's role is shown under Step 2, Infrastructure enabled development capacity.

2. Assessing Infrastructure Enabled Development Capacity

The NPS-UDC guidance document on evidence and monitoring acknowledges that it does not provide a method for assessing the amount of development capacity enabled by infrastructure (page 36 of the guidance document). However, the definition of "development capacity" in the NPS-UDC includes "the provision of adequate development infrastructure to support the development of the land".

The NPS-UDC defines "feasible" as "development that is commercially viable, taking into account the current likely costs, revenue and yield of developing". In addition, the guidance is clear that the term "feasible" does not include the cost to the local authority of providing infrastructure.

Therefore, for this report infrastructure enabled development capacity is assessed as areas that are adequately serviced by existing three waters infrastructure or areas that will be serviced by infrastructure identified in the LTP or Infrastructure Strategy.

Areas that are currently zoned for residential or business development but which are not serviced or planned to be serviced are therefore not identified as infrastructure enabled for this report.

Similarly, areas that are currently zoned for development but where additional development cannot be guaranteed an adequate level of service are therefore also not infrastructure enabled. The adequate level of service for stormwater includes the protection from flooding through the use of land use restrictions as well as pipes and drains. The adequate level of service for wastewater includes that additional connections do not create or contribute to surcharges of untreated overflows; and for water supply the adequate level of service is based on minimum water pressure and storage volumes.

The levels of service are defined in Section 4.1, Level of Service.

For the three waters, infrastructure enabled development capacity is assessed

a) in the **short-term** as areas that are serviced by existing infrastructure with adequate capacity

b) in the **medium-term** as areas that are serviced (either existing or planned in the LTP to be in place within the next ten years) with adequate infrastructure

c) in the **long-term** as areas that are serviced (either existing or identified in the Infrastructure Strategy to be in place within the next 30 years) with adequate infrastructure.

Adequate is based on levels of service defined for hydraulic modelling.

Where water supply or wastewater service is not adequate to support a proposed development, it is common for the developer to install mitigations, such as a new reservoir or a larger wastewater pipe. Depending on a number of factors, the need for mitigation can make or break the commercially viable (or feasibility) of a proposed development.

For the purposes of this report, the results of the assessment of infrastructure enabled development capacity are provided in mapped and tabular format (Section 5, Results). If the three waters infrastructure is adequate to support predicted development, it is identified as a "Yes". If the existing or planned infrastructure is inadequate, or mitigation is required, capacity for development is identified as a "No".

2.1 Where mitigation can enable

We acknowledge that mitigation for stormwater, water supply or wastewater could alternatively be assessed as a cost within the equation that determines "feasibility", or profitability. As this cost would vary by location and size of the required mitigation, the determination of mitigation cost is out of scope for the level of evidence provided in this report (see Section 4.6, Mitigation Options).

3. Wellington Model Availability for Three Waters

The catchments that are modelled for water supply and wastewater are defined by the operation of their separate infrastructure networks. Therefore the water supply and wastewater catchments are different from each other. The stormwater catchments are defined by topography and are thus also different from the water supply and wastewater networks.

3.1 Water supply

A safe and reliable water supply is essential to public health and the social and economic development of a city. The water that is delivered to Wellington is sourced from the headwaters of the Hutt River, The Wainuiomata and Orongorongo catchments and the Waiwhetu aquifer. It is delivered via a bulk water system that supplies water regionally to Wellington, Hutt, Upper Hutt and Porirua cities.

The bulk water is treated and delivered to local reservoirs that are positioned at elevations that can provide adequate water pressure for an uninterrupted reticulated supply for drinking water, domestic and commercial use, fire-fighting and emergency storage.

The capacity of the water supply to accommodate future growth was assessed based on storage availability and network capacity as described for the level of service outlined in Section 4.1.1.

For this assessment for the NPS-UDC, Wellington was defined by 46 Water Storage Areas (WSA). WSAs are defined as a water supply network comprising of at least one reservoir, which can be expected to operate independently if the supply is interrupted.

The WSA can contain one or several District Metered Areas (DMA) – which is a section of water supply network bounded by flow meters of closed valves. The water supply storage areas modelled for this report are shown in Figures 2 to 5 below. The methods and results for this water storage assessment are documented in two reports (Stantec 2018a and 2018b).

For WCC, six of the water supply catchments were assessed using an existing calibrated model. For four of these catchments, water supply models have been calibrated for the current and future peak day demand in Zone Management Plan studies, based on future growth that is allocated as accurately as possible. For these six model catchments, listed below which cover 28 WSAs, the model results on network performance are considered to be more accurate:

1. Aro/Bell Road Model (ZMP)
2. Brooklyn Model (ZMP)
3. Island Bay Model (Calibrated)
4. Johnsonville Model (ZMP)
5. Wellington Low Level Model (Calibrated)
6. Tawa Model (ZMP)

For the other 18 Wellington WSAs, water supply capacity was modelled using a simple network model that is assessed under current peak day demand. If critical areas exist under current peak demand with a pressure below 27m, the WSA was considered to have reached its network capacity and any additional growth would worsen an already non-conforming situation. If there are no critical areas, the model was rerun with future demand at the catchment-scale.

Figure 2: Water Storage Areas in Wellington, map 1 of 4

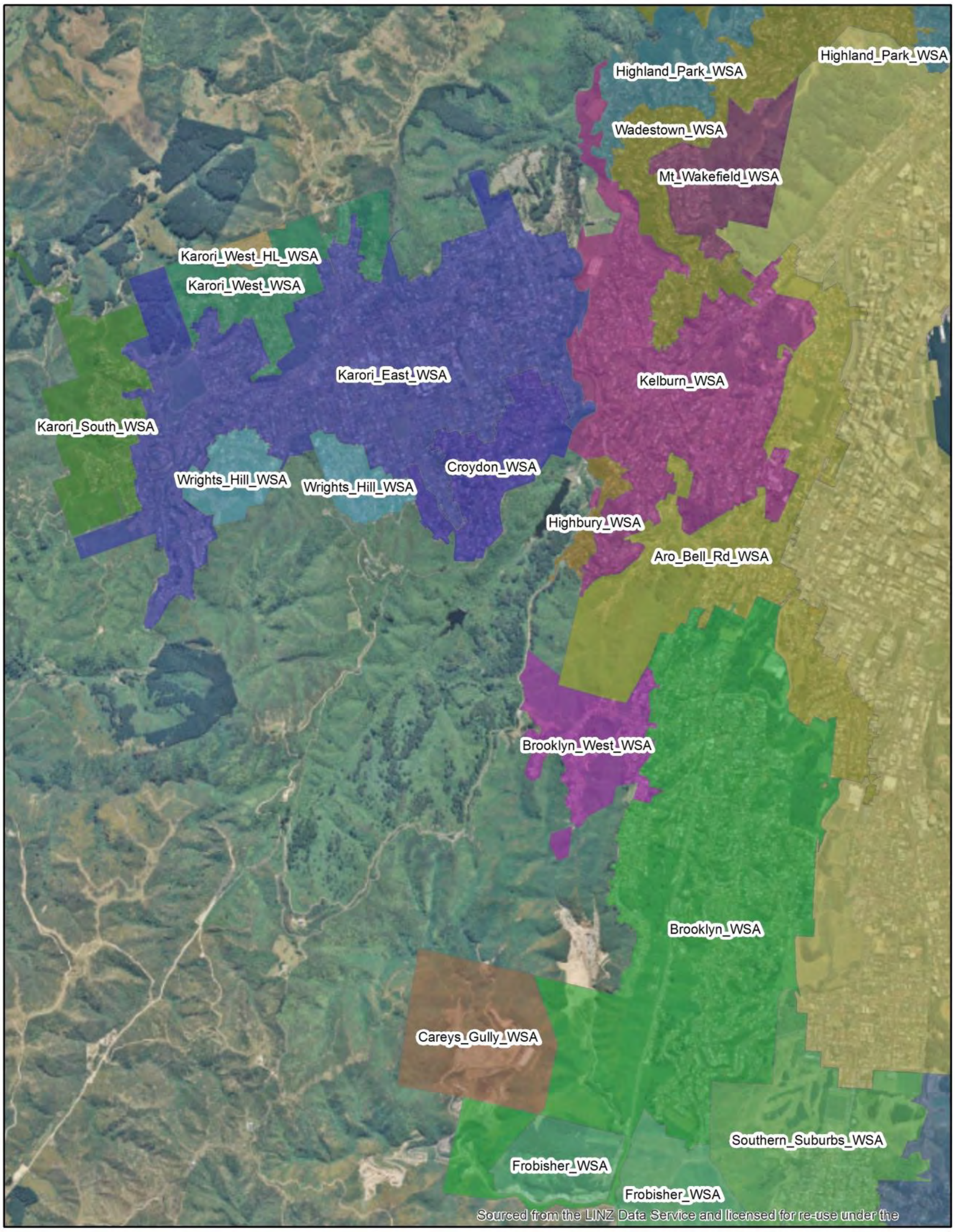


Figure 3: Water Storage Areas in Wellington, map 2 of 4

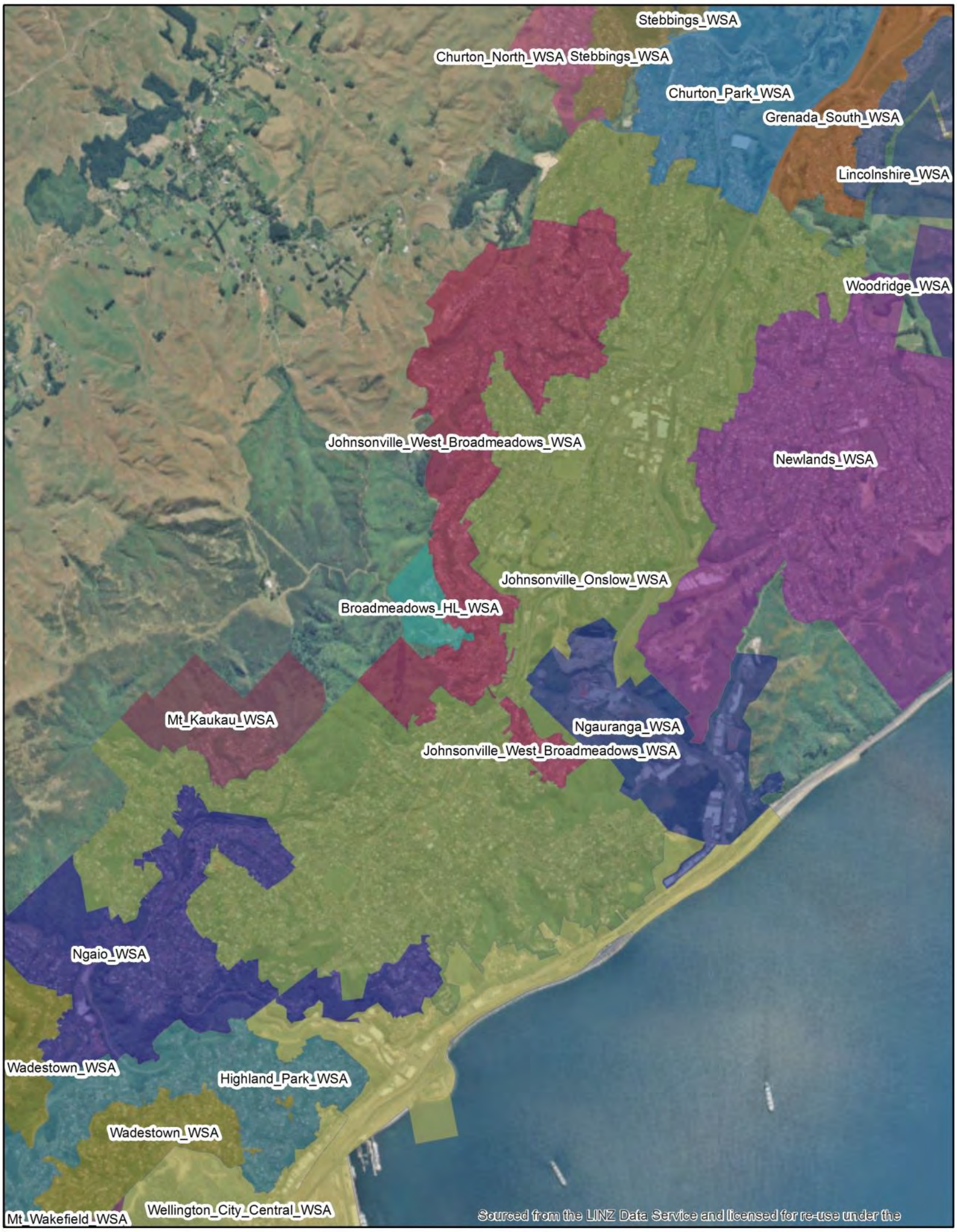


Figure 4: Water Storage Areas in Wellington, map 3 of 4

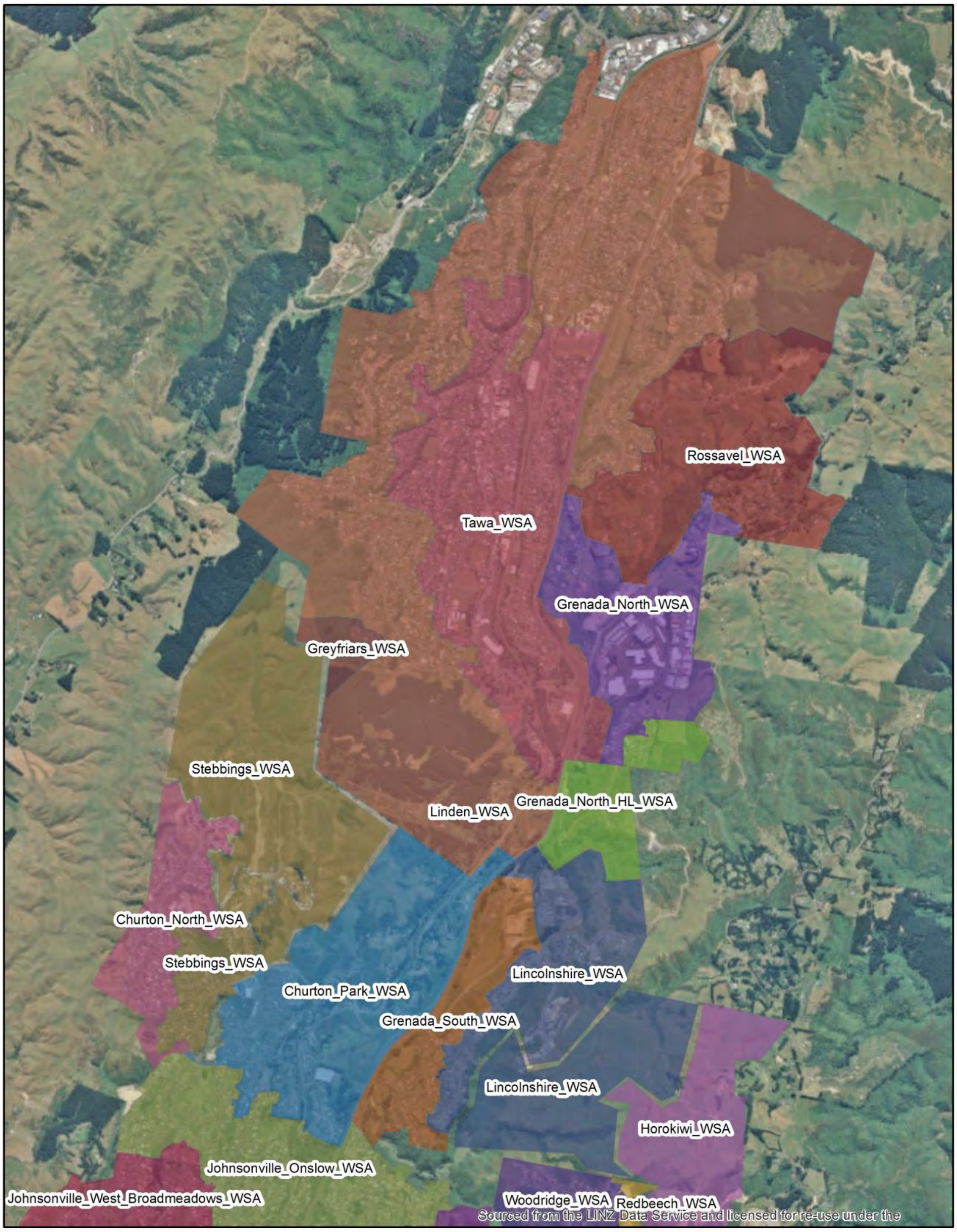


Figure 5: Water Storage Areas in Wellington, map 4 of 4

3.2 Wastewater

After the water delivered to houses and businesses has been used, it becomes wastewater[1]. This wastewater needs to be safely conveyed through reticulated networks to the wastewater treatment plant where it is treated and disposed of in an appropriate way to minimise risks to human and environmental health.

During heavy rain events, stormwater, groundwater, and even seawater can enter the wastewater network resulting in overloading the capacity of the wastewater networks and overflow to the environment. These overflows are exacerbated by cross connections where stormwater downpipes are incorrectly connected into the wastewater system.

The pipes that make up the wastewater network are aging and prone to leaking and overflowing of untreated wastewater. Network capacity constraints and declining condition, coupled with increased rainfall and rising water tables may result in increased overflows and potential contamination of receiving waters and risk to public health. The level of service for the wastewater network, which is based on managing overflows during rain events rather than preventing leaks during dry weather, may not be sufficient for achieving the desired water quality in Wellington's streams and harbour.

Wastewater in Wellington is treated at one of three treatment plants – Moa Point Wastewater Treatment Plant (WWTP), Western WWTP or the Porirua WWTP. Six hydraulic models for wastewater were developed and calibrated, including the models for the four catchments that flow to and are treated at the Moa Point WWTP - Evans Bay (including Miramar), Central Business District (CBD) (including Newtown), Island Bay and Wellington Western Hills. The Karori catchment is treated at the Western WWTP and the Tawa catchment is treated at the Porirua WWTP. The Tawa catchment includes a portion of Johnsonville and all of Churton Park and Tawa.

The Porirua /Tawa model was calibrated against physical data for the performance and capacity of the trunk sewers.

The other five models, Evans Bay, CBD, Island Bay, Wellington Western Hills and Karori were calibrated using flow gauges on the local sewers and are therefore more detailed, catchment planning models.

Nonetheless, for each of these models additional monitoring is required. This monitoring is needed to confirm the location and frequency of modelled constructed overflow locations and confirm in the field the location of manholes that the model indicates are overflowing.

The level of service for the wastewater system to accommodate future growth was assessed based on the hydraulic capacity of the sewer mains during a 1-year rainfall event, as discussed in Section 4.1.2.

For the purposes of this assessment the above models are used to examine the overall hydraulic performance of the complete catchment. The catchment boundaries modelled for wastewater are shown in Figure 6 below.

[1] If plumbed correctly, the greywater component of used water may be able to be collected and disposed of on-site. Greywater can be collected from baths, sinks and washing machines and must not contain discharge from toilets or contain human waste.

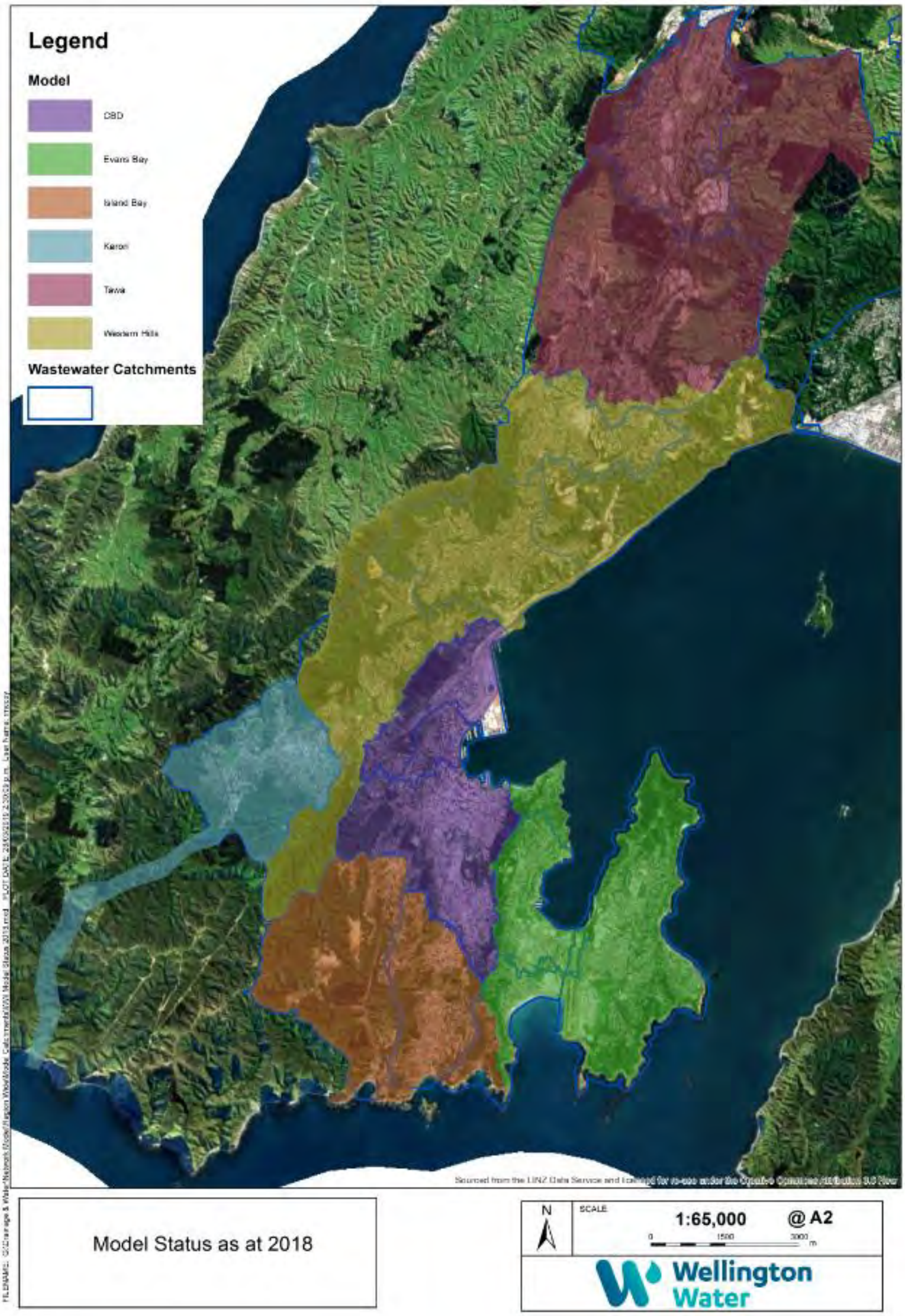


Figure 6: The six modelled wastewater catchments for Wellington City

3.3 Stormwater

Stormwater services are essential to the protection of public health impacts and property damage as rainfall needs to be drained away to prevent damp ground and the various illnesses that can develop affecting people and property.

Stormwater pipe networks historically were designed to carry away only the low to medium intensity rainfall events. When the storm intensity exceeds this pipe design capacity then water flows overland and residences and businesses can be at risk of flooding.

The region's stormwater networks comprise both built assets such as pipes and intakes, as well as natural assets, such as overland flowpaths and watercourses. These networks discharge stormwater into streams, the harbour and the ocean at many locations across the region. Land use and building restrictions that protect overland flowpaths from being built over or blocked are also important for protecting people and property.

As stormwater picks up sediment, contaminants, petrochemicals and heavy metals such as zinc, copper and lead, it can result in harmful water quality where it discharges to streams or coastal waters. Stormwater from greenfield development in particular, can result in excessive discharges of sediment.

Wellington Water has modelled the stormwater flood risk during a 1 in 100 year event plus climate change in Wellington City within eight catchments: Tawa, Johnsonville, Karori, Southern CBD, Miramar, Haitaitai, Island Bay and Lyall Bay. Where available, the stormwater models were validated against historical flood events. The models are being used to quantify and prioritise stormwater flooding risks and inform the assessment for the NPS-UDC. The model results have not been included in this report as it is our intention to share them first with the community and potentially affected owners and occupiers prior to publishing them. The results are therefore provided in Table 5 and the text in subsection 5.2.3.

The stormwater models for the Churton Park, Horokiwi, Ngaio and Wilton catchments are still in development and were not available at the time of this report.

The catchment boundaries for the stormwater hydraulic models are shown in Figure 7 below.

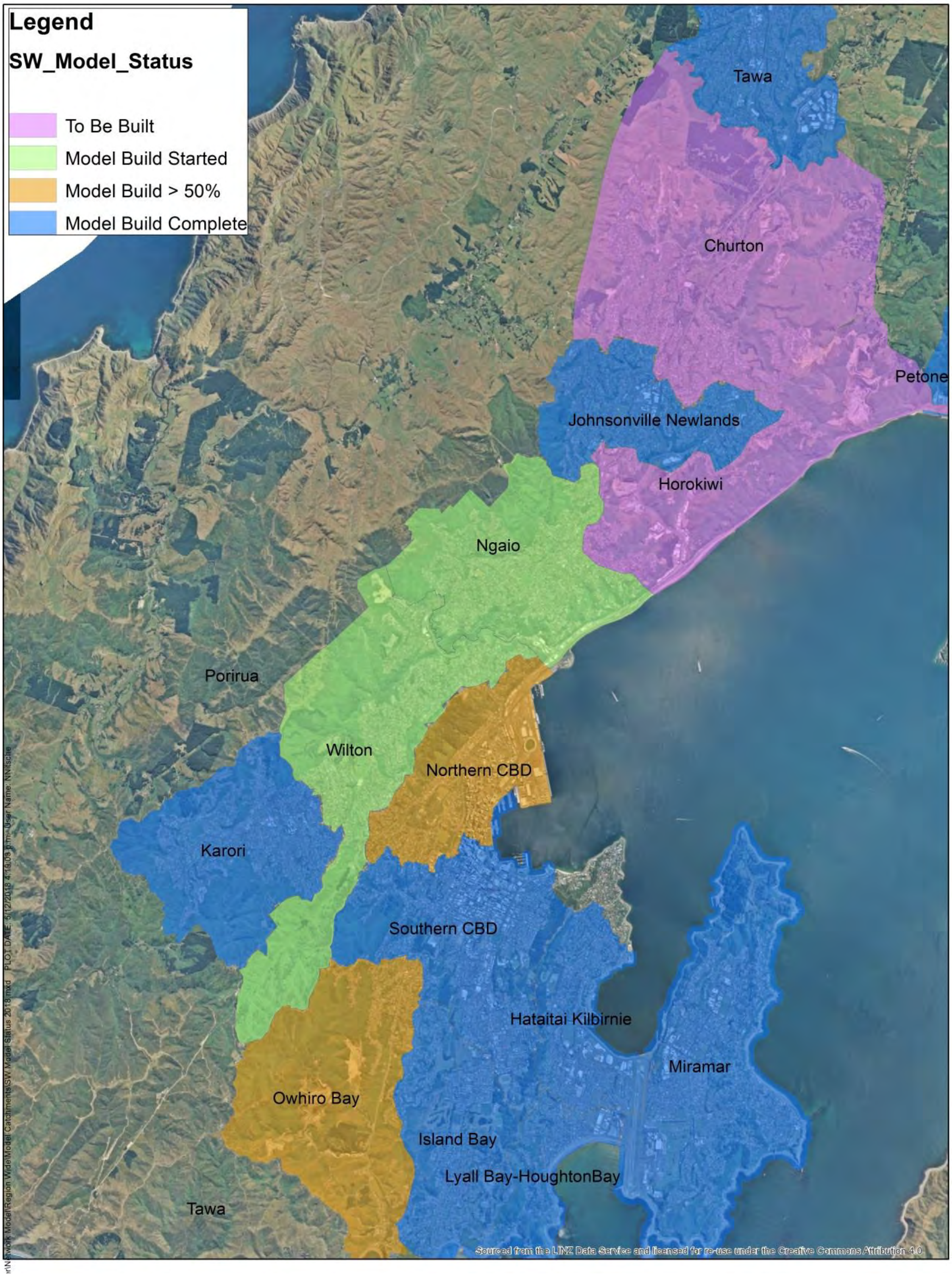


Figure 7: Eight modelled stormwater catchments in Wellington city.

4. Criteria and Assumptions

The main criteria and assumptions that were used in the assessment of infrastructure enabled development capacity are described in this section.

4.1 Level of service

As noted in Section 2 above, the assessment of infrastructure enabled development capacity relies on the ability to identify infrastructure that provides an adequate level of service (LOS) to new development. In particular, the LOS needs to be adequate for the assessment of feasible development capacity over the short-term (the next three years) and meaningful for the identification of funding for development infrastructure required to service capacity in the medium- and long-term.

The LOS and associated criteria in the Regional Standard for Water Services (RSWS) are target LOS for new assets and are therefore not a useful or consistent framework for assessing existing infrastructure's suitability for enabling development capacity as required under the NPS-UDC.

Although some criteria in the RSWS are relevant to this assessment, the design codes in the RSWS are not specific to identifying capacity constraints in the primary systems for new developments (brownfield or greenfield) or specific to identifying upgrades and extensions needed to service projected growth in the medium- and long-term.

Therefore to fulfil the evidence needs under the NPS-UDC, the LOS and associated criteria for water supply, wastewater and stormwater capacity have been consulted on with our Client Councils and are defined in the following subsections.

4.1.1 Water supply level of service

Wellington Water has defined the LOS for water supply for the assessment of infrastructure enabled development capacity as:

The provision of safe and healthy water based on:

a. Minimum pressure of 25m at the point of supply

b. Reservoir Storage requirements at the maximum of either:

1. 700 L/person storage requirements where existing demand are unknown (e.g., new development area)

   2 x Average Day Demand (ADD*) plus firefighting storage requirements when existing demand is available

   OR

2. Peak day demand (PDD*) plus 20% for operational storage plus firefighting storage requirements as outlined in SNZ PAS 4509 "Code of practice for firefighting water supplies"

   OR

3. Storage for seismic resilience – required storage to provide minimum levels of service after a significant earthquake based on:

Days 1 to 7 – Emergency State - People and businesses will be self-sufficient, relying on their own stored water supplies, their communities, and Civil Defence centres.
Days 8 to 30 – Survival & Stability - Residents collect up to 20 litres per person per day from Distribution Points while Critical Customers begin to receive water to their boundary.
From Day 30 – Restoration & Recovery - The region moves toward restoration of normal service through provision of reliable reticulated supplies.

This LOS is referred to as Network LOS based on water pressure or a Storage LOS based on either Operational storage LOS or the Seismic LOS.

A key component of constraints in the water supply network is the storage capacity of the reservoirs that supply each zone. The criteria for reservoir storage to achieve the level of service for water supply is based on a combination of firefighting storage requirements as well as population. Therefore there is a direct correlation between reservoir storage and population.

Reconfiguring the water supply network, such as expanding or reducing the area supplied by a specific reservoir, is a common method used to service site-specific growth. Nonetheless, Wellington Water's assessment of infrastructure enabled development capacity does not consider this option for the evidence provided for the NPS-UDC, as this method is only relevant to proposals for site-specific developments.

In addition, the assessment assumes that there are no changes to the bulk water supply network. If needed, further detailed studies could be considered on the flow capacity of the bulk water distribution system to supply projected peak day demand. It is of value to note that this level of service is also dependent on the volume of water used (demand). Currently there are relatively few restrictions on the volume of water used (demand management). As noted in subsection 4.4, Consenting Requirements, further restrictions on the ability to take additional volumes of water from our rivers and aquifers are likely in the near future.

4.1.2 Wastewater level of service

Wellington Water defined the LOS for the wastewater network for the assessment of infrastructure enabled development capacity as:

> Peak wet weather flow capacity and overflows at the 1-year Average Recurrence Interval (ARI) shall not be made worse (volume or frequency).

It is important to note that the LOS above is different than the LOS used in the Interim Guideline for New Wastewater Connections, which considers overflows only at unconstructed overflows (such as manholes and gully traps). This is because the LOS for new wastewater connections is project specific, whereas the LOS for the assessments under the NPS-UDC needs to consider the capacity of the entire network to support growth over the medium- and long-term.

Where capacity is limited, the LOS for the NPS-UDC needs to help identify infrastructure needs for funding in a LTP or Infrastructure Strategy.

4.1.3 Stormwater level of service

The capacity for new development with an adequate level of stormwater protection is a combination of built assets such as pipes and natural assets such as overland flow paths. The level of service for stormwater protection is determined based on risk, and the impacts of the development on stormwater risk are influenced by site-specific considerations and how the development is undertaken.

Wellington Water defined the LOS for stormwater capacity and constraints for the assessment of infrastructure enabled development as:

1. Safe access to and protection from flooding of habitable floors in the 100 year flood event that includes the predicted impacts of climate change.

2. Safe access to and protection of flooding for Commercial/Business in the 10 year flood event

This LOS can be achieved using the following criteria in new developments:

a. Development in a ponding area is only allowed if there is safe access at the time of flooding and no loss of storage. Ponding[2] of 300mm or greater is considered to preclude safe access.

b. New developments do not impede flood flows in open channel – in the absence of detailed assessment of appropriate setbacks, as a minimum all new buildings are constructed at least 5m horizontal from the top of bank of any stream or drain. [3]

c. New habitable floor levels are set at above the level of the flood hazard expected in a 100 year rainfall event that includes the predicted impacts of climate change (20%[4] increase in rainfall intensities and 1m of sea level rise).

d. The provision of drainage to protect commercial/business floor levels in a 10 year flood event.

e. Overland flow paths remain unimpeded.

f. New development is hydraulically neutral and does not increase flooding risk in the catchment. In practice we measure this in a 10 year rainfall event and a 100 year rainfall event[5].

---

[2] Ponding for an assessment of access does not include freeboard.

[3] The minimum setback of 5m allows a corridor for the conveyance of flood flows, the erosion of the stream banks and maintenance access to the watercourse.

[4] 20% is consistent with the Regional Asset Management Plan investment performance measure and is proposed to be incorporated in to the revised RSWS.

This LOS for stormwater protection does not assume that these standards are in place in the RSWS or the relevant district plan. Nonetheless to achieve this LOS which was defined to assess capacity, Wellington Water strongly recommends that Councils implement planning controls for overflow paths, hydraulic neutrality and protection of streams. Without these controls the risk of flooding will limit growth and also exacerbate flooding risks elsewhere in the catchments.

Where councils incorporate into their district plans rules to manage flood hazards then new developments typically can avoid flood hazards and downstream impacts through elevated floor levels, protection of watercourses and overland flow paths and hydraulic neutrality. If these controls are embedded in district plans the stormwater network is not considered to be a restriction on development enabled capacity for this report.

We point out that for this report on infrastructure enabled development capacity only criteria a) and b) contain absolute constraints to development – development is not recommended if there is no safe access during flooding and development cannot occur close to a stream or drain.

In other areas, development could occur if the development is designed to meet the criteria (eg, floors built above the flood hazard, designs that do not impede overland flow paths and development which is hydraulically neutral). We acknowledge, however, that in some locations the costs of these design solutions could be high and therefore development would be economically unfeasible due to flood risks. These assumptions are reiterated in Section 4.6, Mitigation Options.

4.2 Population and dwelling growth estimates

For the water supply models, projected increases in dwellings over the short-term, medium-term and long-term scenarios were based on growth and location data from Forecast.id (forecast.idnz.co.nz). The totals within each Forecast.id area were adjusted as needed to reflect the catchment boundaries specific to the water supply areas used in the hydraulic models.

For the wastewater models, projected population growth over the short-term, medium-term and long-term scenarios were based on high growth Stats NZ population forecasts provided by Wellington City Council which were then distributed equally between the growth areas from Forecast.id.

The higher growth forecasts were not able to be incorporated into the water supply models due to timing constraints. Therefore the modelled water supply results reflect the infrastructure capacity for a lower predicted growth than WCC’s dwelling model results. Section 5.2.1 addresses this in more detail.

---

[5] An assessment at both events is needed to assess hydraulic neutrality along the range of events. Depending on topography and design of mitigation structures, an assessment of only a 1 in 100-year event does not necessarily assess neutrality at a lesser event.

Table 1: Projected population and dwellings for Wellington used in the hydraulic models.

Forecast ID	Short Term (2017 – 2020) Pop'n/Dwelling	Medium Term (2020 – 2027) Pop'n/Dwelling	Long Term (2027 – 2047) Pop'n/Dwelling
Aro Valley - Highbury	3829/1488	3951/1538	4163/1640
Berhampore	3975/1573	4360/1668	4880/1929
Brooklyn	7002/2744	7281/2906	7555/3068
Churton Park - Glenside	7989/2739	9486/3292	10055/3642
Grenada Village - Paparangi - Woodridge - Horokiwi	6462/2264	7749/2688	10099/3539
Hataitai	6863/2643	6907/2686	6911/2758
Island Bay - Owhiro Bay	9196/3393	9333/3524	9353/3652
Johnsonville	11603/4138	12093/4337	13558/4913
Kaiwharawhara - Khandallah - Broadmeadows	10835/4018	10824/4137	10785/4304
Karori	15678/5651	15839/5772	16405/6089
Kelburn	4732/1496	4930/1563	5034/1665
Kilbirnie - Rongotai - Moa Point	5352/2141	5382/2235	6794/2810
Kingston - Mornington - Vogeltown	3218/1308	3268/1334	3396/1385
Lyall Bay	2833/1125	2865/1142	2950/1173
Miramar - Maupuia	11774/4384	11808/4506	12772/4888
Mt Cook	7907/2941	8444/3093	9784/3625
Mt Victoria	5743/2320	5885/2373	6207/2515
Newlands - Ngauranga	8398/2902	8813/3128	8958/3273
Newtown	9905/3531	10854/3846	12890/4655
Ngaio - Crofton Downs	8149/2960	8416/3081	8328/3193
Northland - Wilton	5759/2349	5763/2382	5815/2427
Ohariu - Makara - Makara Beach	823/318	836/335	914/370

Forecast ID	Short Term (2017 – 2020) Pop'n/Dwelling	Medium Term (2020 – 2027) Pop'n/Dwelling	Long Term (2027 – 2047) Pop'n/Dwelling
Roseneath - Oriental Bay	3466/1549	3632/1626	3818/1685
Seatoun - Karaka Bays - Breaker Bay	4043/1516	4037/1568	4042/1645
Southgate - Houghton Bay - Melrose	4225/1617	4243/1673	4329/1745
Strathmore Park	4094/1439	4145/1478	4159/1529
Tawa - Grenada North - Takapu Valley	15474/5316	15932/5540	18632/6432
Te Aro	13594/5441	16294/6602	19416/8373
Thorndon - Pipitea	4829/2219	5171/2378	5967/2810
Wadestown	3866/1531	3880/1619	4034/1761
Wellington Central	4283/1374	6117/2134	8037/3042
TOTAL	215,899/80,428	228,538/86,184	250,040/96,535

4.3 Modelling assumptions and limitations

The assumptions and limitations of the modelling needs to be considered when interpreting and using the results. The key assumptions and limitations are shown in the table below:

Table 2: Modelling assumptions and limitations

Model	Assumption/Limitation
Water supply	Reconfiguring the water supply network, such as expanding or reducing the area supplied by a specific reservoir, is a common method used to service site-specific growth. This assessment of infrastructure enabled development capacity for the NPS-UDC does not consider this option. The bulk water supply system has not been analysed in the capacity assessment. The modelling does not consider future efficiency of the network (leak prevention) and customer use (demand management). The same existing commercial water consumption is assumed for commercial users in future horizons. No additional commercial growth has been assessed in this work. There are often multiple solutions possible to meet the fire-fighting

	requirements and therefore this criteria is not used for the purpose of identifying infrastructure enabled development capacity. Site-specific development within a larger water supply zone are not assessed as site-specific developments require a more detailed assessment. This is because the LOS for minimum pressure is dependent on the infrastructure required to service the new development.
Wastewater	Some results on wet weather overflows can be due to errors in the asset data or model confidence (if located far from the calibration point). A 1-year design rainfall event with 2-hour duration (Cardno 2018) was used to assess pipe capacity and wet weather overflows. Some known overflow locations do not discharge until it rains for a longer period of time. For example, the Murphy Street overflow does not spill until a 1-year rainfall event is greater than six-hours in duration. Additional monitoring is required to confirm the frequency of modelled constructed overflows and confirm in the field the location of manholes that the model indicates are overflowing at the 1-year ARI. The model does not consider future reduction of overflows from renewals and upgrades that reduce inflow and infiltration. Dry weather performance, such as leaks and areas of blockage, is not included in the level of service for the hydraulic modelling.
Stormwater	New development is assumed to achieve hydraulic neutrality in all flood events up to and including the 1 in 100-year event. This means that new development would be designed so flooding is not increased. For this assessment, the water quality effects from stormwater are not considered in the level of service. However, the management of stormwater to achieve improved water quality will be needed to meet the new requirements in the Proposed Natural Resource Management Plan for the Wellington Region, the future recommendations from the Te Whanganui-a-Tara Whaitua Committee and the aspirations of the wider community.

4.4 Consenting requirements

The operation of our infrastructure networks need to respond to consenting requirements, which in some cases may constrain our ability to provide the adequate level of services.

Water supply – Wellington, along with Upper Hutt, Hutt and Porirua city councils, purchase their water in bulk from Greater Wellington Regional Council. This water is delivered to the community via a network of reservoirs, pump stations and water mains. With the current level of regional demand, a new water supply source will be required in approximately 2040. However, provisions in the Proposed Natural Resource Management Plan restrict the ability to take additional volumes of water from our rivers and aquifers.

Wastewater – The wastewater network requires resource consents for its discharges of treated wastewater from the treatment plants to the marine environment. The current consent conditions include limits on the rate and volume of discharge and bypass events.

In Wellington there are 102 constructed overflows of untreated wastewater at locations that were built sometime in the past to relieve pressure on the network. The location and monitoring of all of these overflows is a new programme that has resulted, in part, from our better understanding of the condition of the wastewater network as we complete our hydraulic models. Many of these locations overflow into the stormwater network before discharging to fresh or coastal water. Unconstructed overflows are manholes that surcharge due to excessive flows or operational issues such as partial blockages.

Overflow locations are obvious risks to human health and safety and are the focus of renewal and upgrades. Wellington Water now has a short-term resource consent (WGN180027 expires 30 November 2023) for the majority of the constructed overflows that go to the stormwater network. This consent requires monitoring and reporting, the management of acute effects on human health, and the development of a stormwater management strategy to guide a longer-term consent. This management strategy will likely include the need for progressive reduction or elimination of overflow events during most rainfall events.

The costs to Council for the required renewal and upgrades for elimination of unconstructed overflows and progressive reduction or elimination of constructed overflows may be significant.

Stormwater – The new Wellington regional plan (Proposed Natural Resource Management Plan) has introduced new and more stringent provisions for the protection of water quality, including the requirement to have a consent for stormwater discharges, including discharges of stormwater contaminated with wastewater.

Water sensitive urban design and planning and designing for stormwater runoff and its discharge to fresh and coastal water are relatively new disciplines in the Wellington Region and regulatory tools requiring their use for land use and subdivision are still in progress. Achieving these new objectives will require significant investment. While the water quality limits have yet to be set it is anticipated that new development will be required to meet increasingly higher levels of water quality outcomes.

It is strongly recommended that Council implements planning controls for overflow paths, hydraulic neutrality and protection of streams as well as water quality outcomes. Without these controls stormwater will limit growth and the risk of flooding will increase.

4.5 Greenfield development

For this report infrastructure enabled development capacity is assessed only in areas that are currently serviced by infrastructure and areas where future infrastructure is funded in the LTP or identified in the Infrastructure Strategy. This includes greenfield areas that are enabled by District Plan zoning provisions and where development in the area could connect to and be serviced by the existing sewer system and water supply.

Where infrastructure upgrades are funded in the LTP or identified in the Infrastructure Strategy, the indicated timing of the upgrade determines if the new infrastructure for greenfield development is considered for short- or medium-term development capacity.

4.6 Mitigation options

As noted in Section 2.1, if development were to require mitigation to overcome a constraint in the existing infrastructure, we have assessed that area/development as not having infrastructure enabled development capacity.

An alternative assessment could include providing a cost for mitigation that could be included in the assessment of feasibility.

4.7 Resilience

The need for resilience of the network to a major earthquake are not factored into the LOS, other than storage requirements for water supply.

5. Results

This section provides a series of maps and tables to describe where infrastructure enabled development capacity exists and where it does not exist based on the results of hydraulic modelling.

5.1 Mapped Results

Maps are provided for the model results for water supply and wastewater. Maps are not included for stormwater as the flood extent is still being validated against historic records.

5.1.1 Water supply mapped results

The Wellington water supply network was mapped as 46 discrete WSAs and each comprises at least one reservoir. The reservoirs are refilled from the Greater Wellington bulk supply network, which is in turn fed from a number of sources in the Hutt Valley and Wainuiomata. As noted in Section 4.3, the model results do not take into account the ability to reconfigure the water supply network, such as expanding or reducing the area supplied by a specific reservoir, to enable site-specific growth.

The modelling results in Figure 8 to Figure 10 indicate the water supply capacity that exists currently (2017) and what is projected in the short-term (2020), medium-term (2027) and long-term (2047) for the network, storage and overall assessment.

The results show WSA catchments that have no constraints (green), constraints from under capacity in the LOS for either network or storage (orange) or whether the constraints are due to under capacity in the LOS for both network and storage (red). Greenfield areas that have projected growth but no existing network were not assessed for network capacity (green with hash lines).

On a catchment scale, the ability of the water supply network to support projected population growth in the short-, medium- and long-terms and meet the defined LOS is best described in Table 3 in subsection 5.2.1.

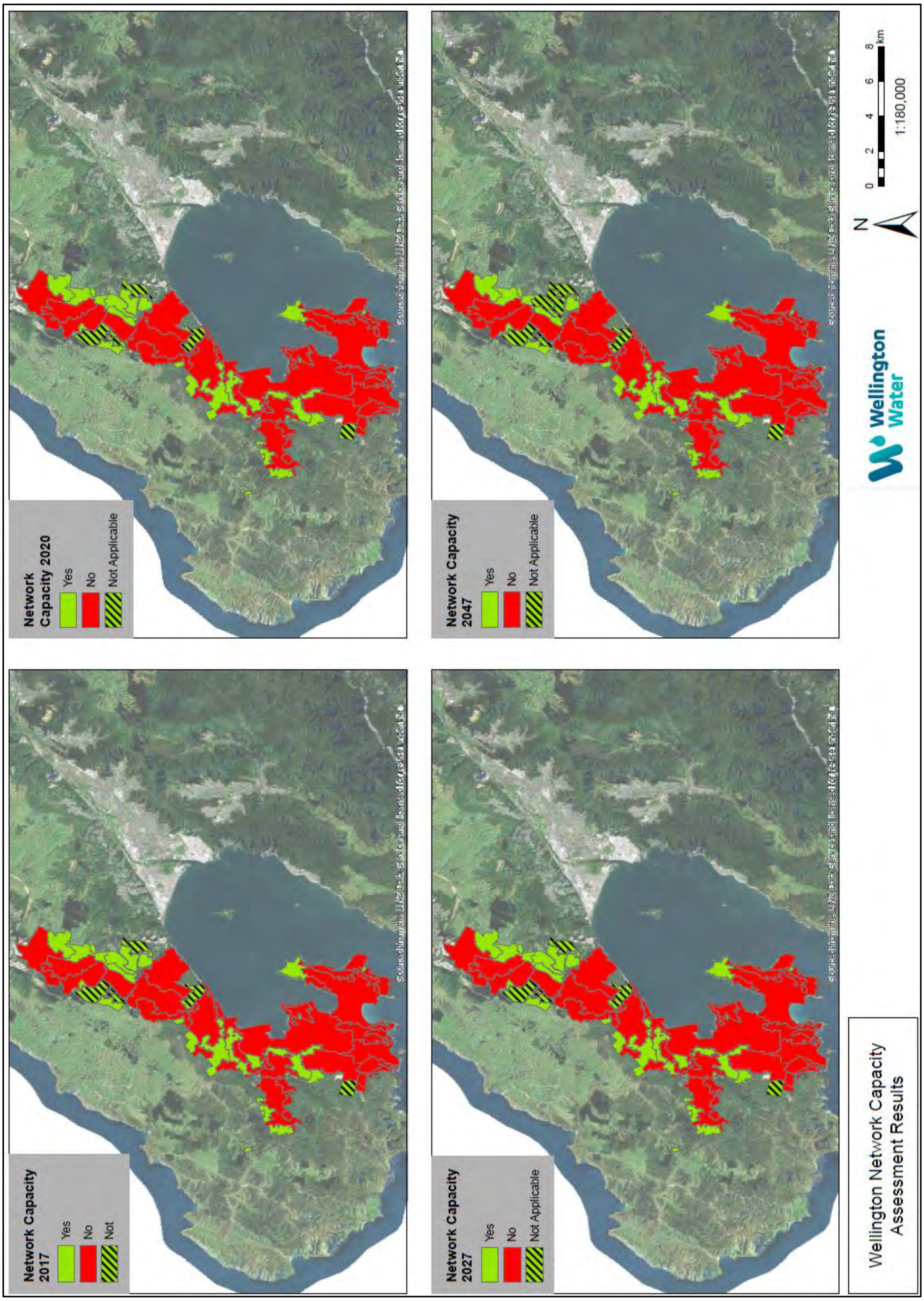


Figure 8: Water supply assessment of the network capacity for Wellington at 2017, 2020, 2027 and 2047.

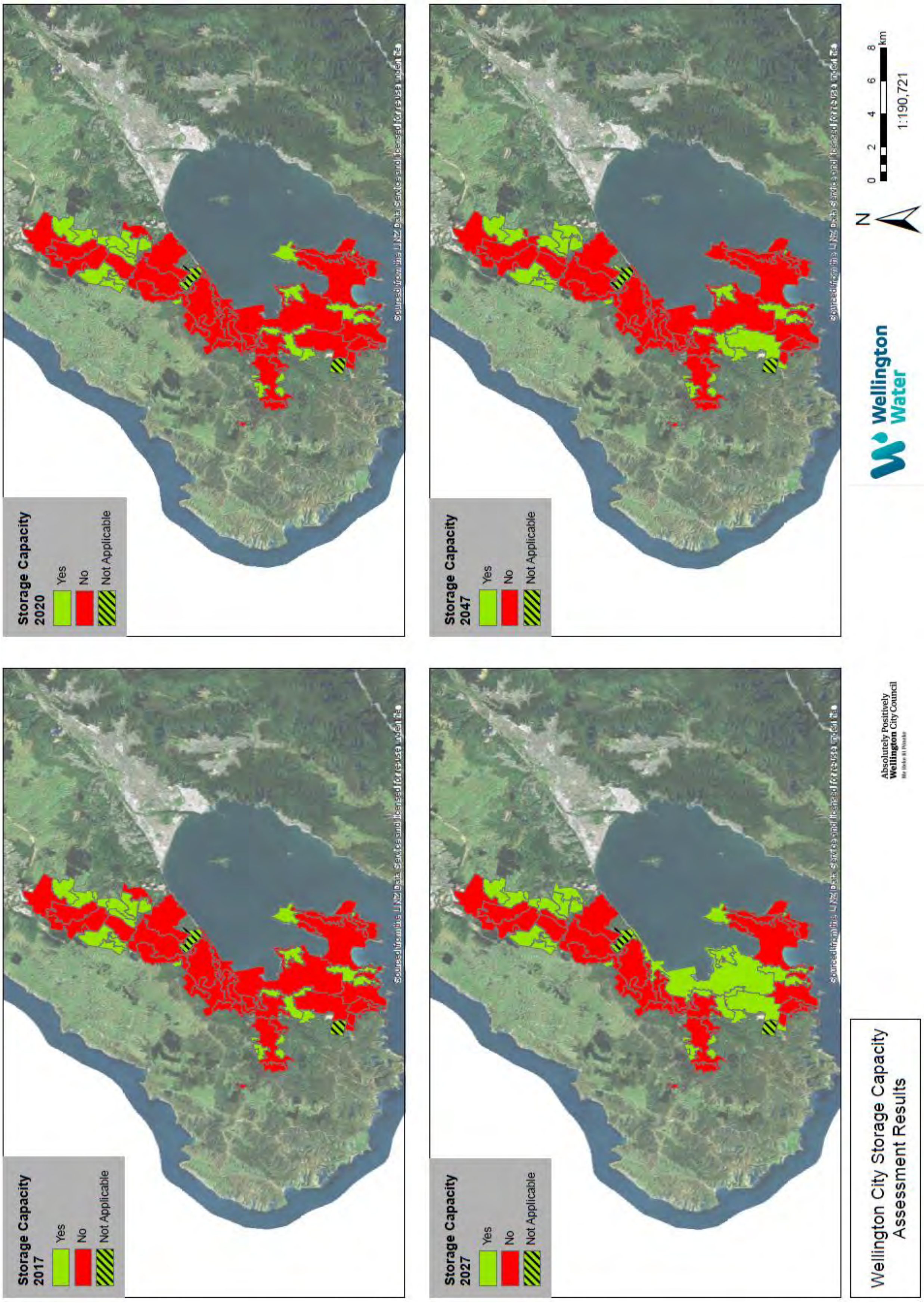


Figure 9: Water supply assessment of the storage capacity for Wellington at 2017, 2020, 2027 and 2047

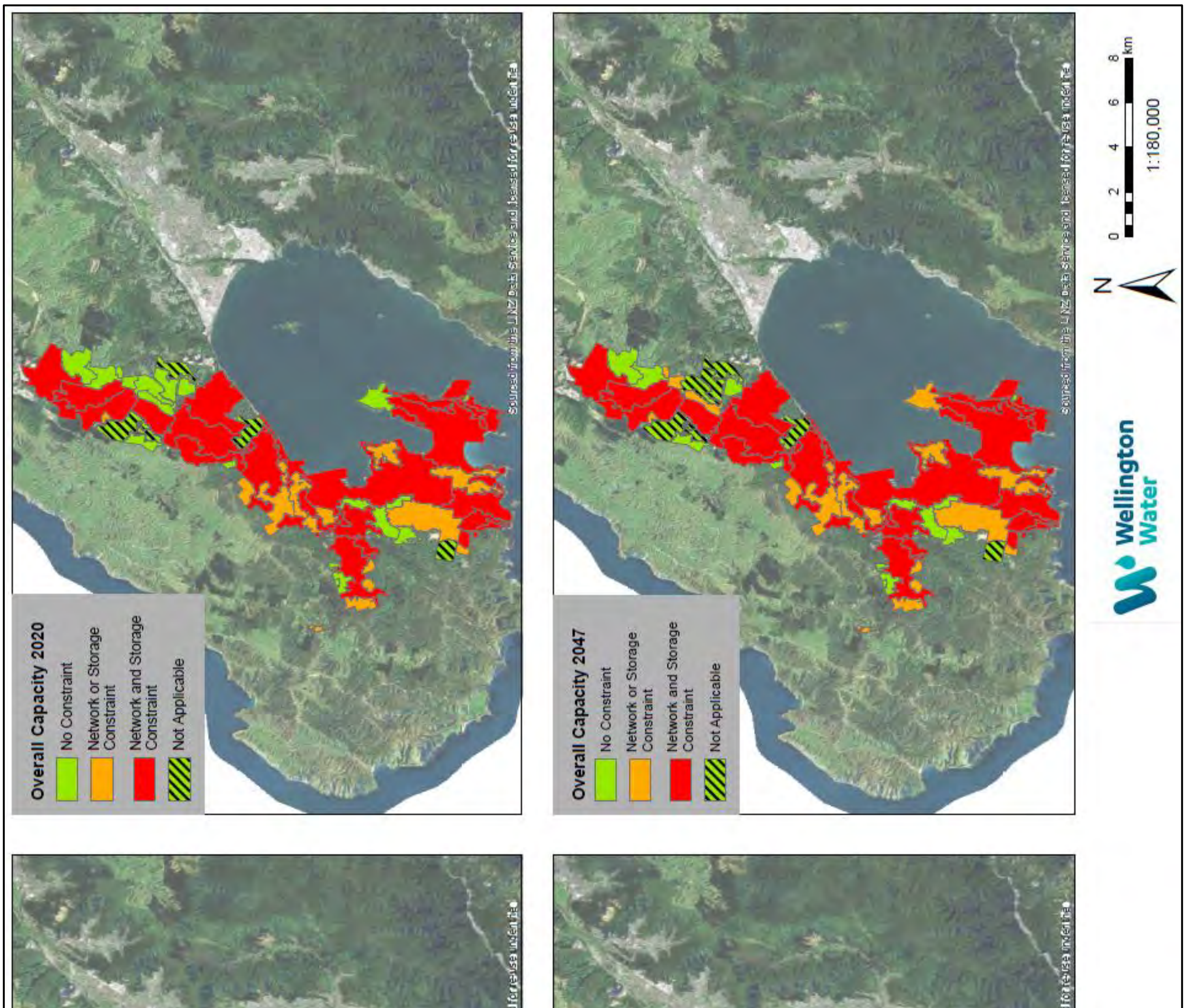


Figure 10: Overall water supply capacity assessment for Wellington at 2017, 2020, 2027 and 2047.

5.1.2 Wastewater mapped results

The wastewater modelling was based on six catchments, Evans Bay, CBD, Island Bay, Wellington Western Hills, Karori and Tawa.

The results in Figure 11 to Figure 15 show the capacity assessment for the long-term projected population at year 2047. Sewer pipes that are under capacity are shown in red and locations of untreated wastewater overflows are indicated with coloured circles, with red circles indicating overflow locations with the largest volume.

On a catchment scale, the ability of the wastewater network to accommodate additional flows from projected population growth in the short-, medium- and long-terms and meet the defined LOS is best described in Table 4 in subsection 5.2.2.

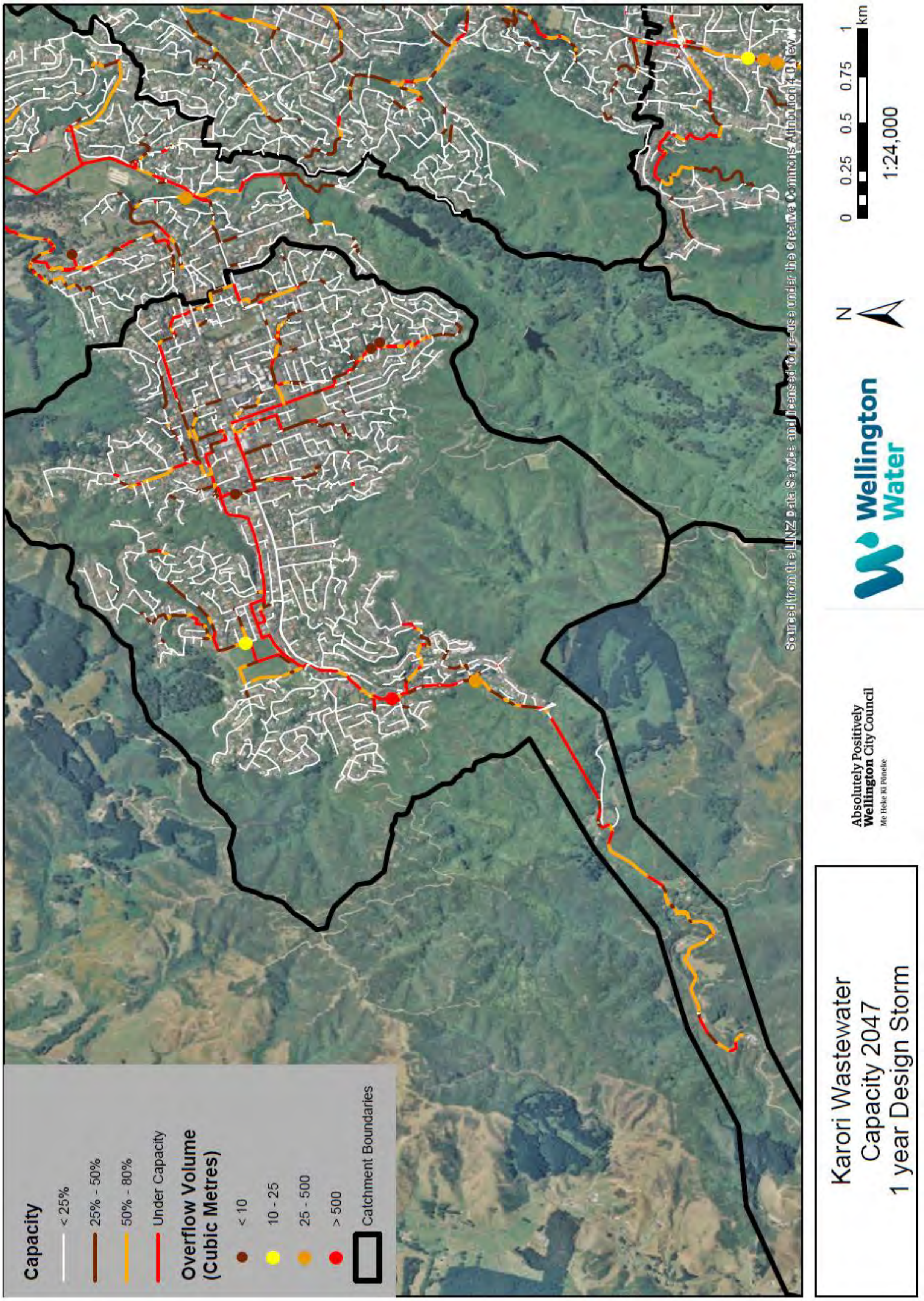


Figure 11: Future population (2047) - Wellington wastewater capacity assessment - Karori

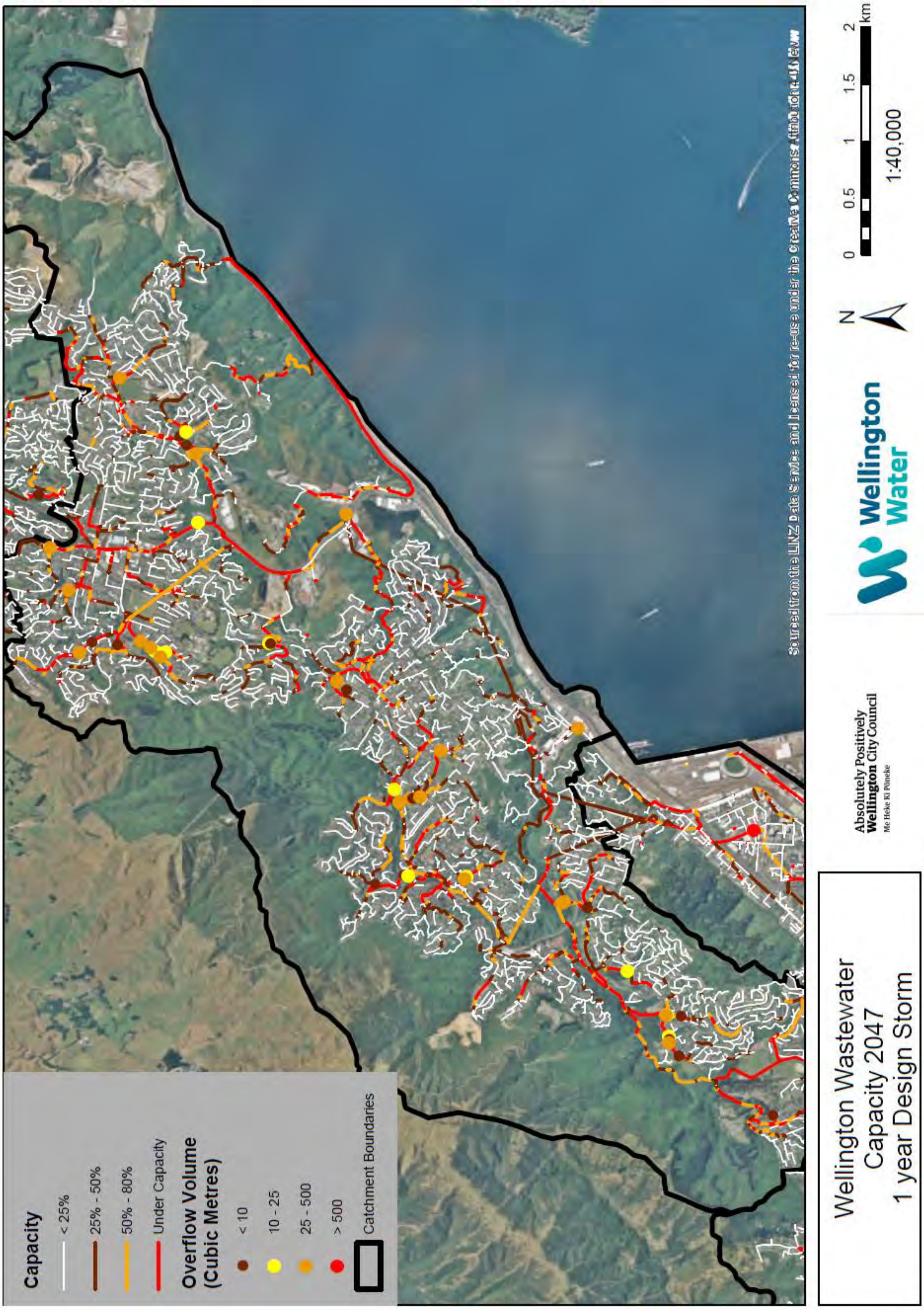


Figure 12: Future population (2047) - Wellington wastewater capacity assessment - Wellington Western Hills (in part)

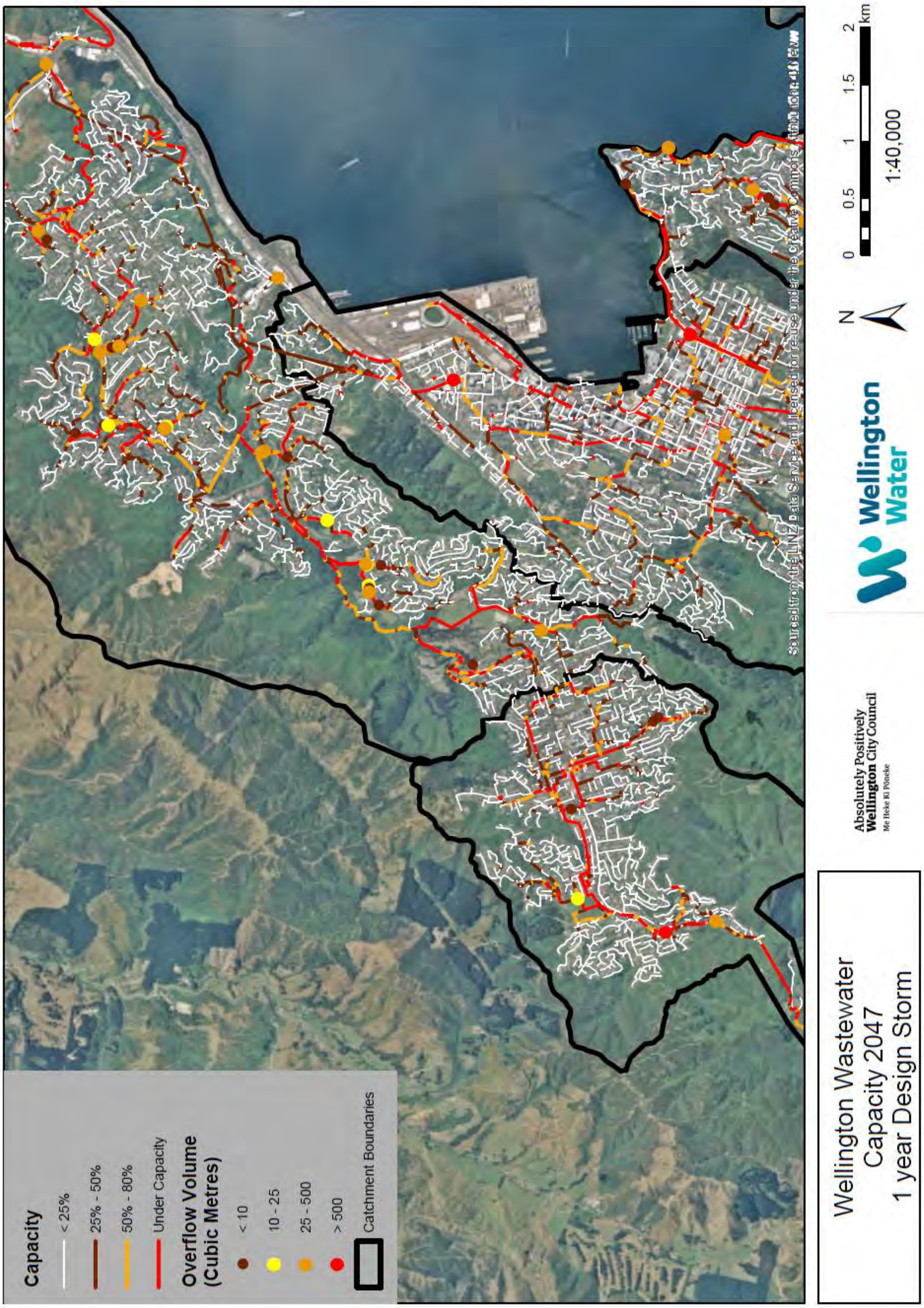


Figure 13: Future population (2047) - Wellington wastewater capacity assessment - Wellington Western Hills (in part) and CBD (in part).

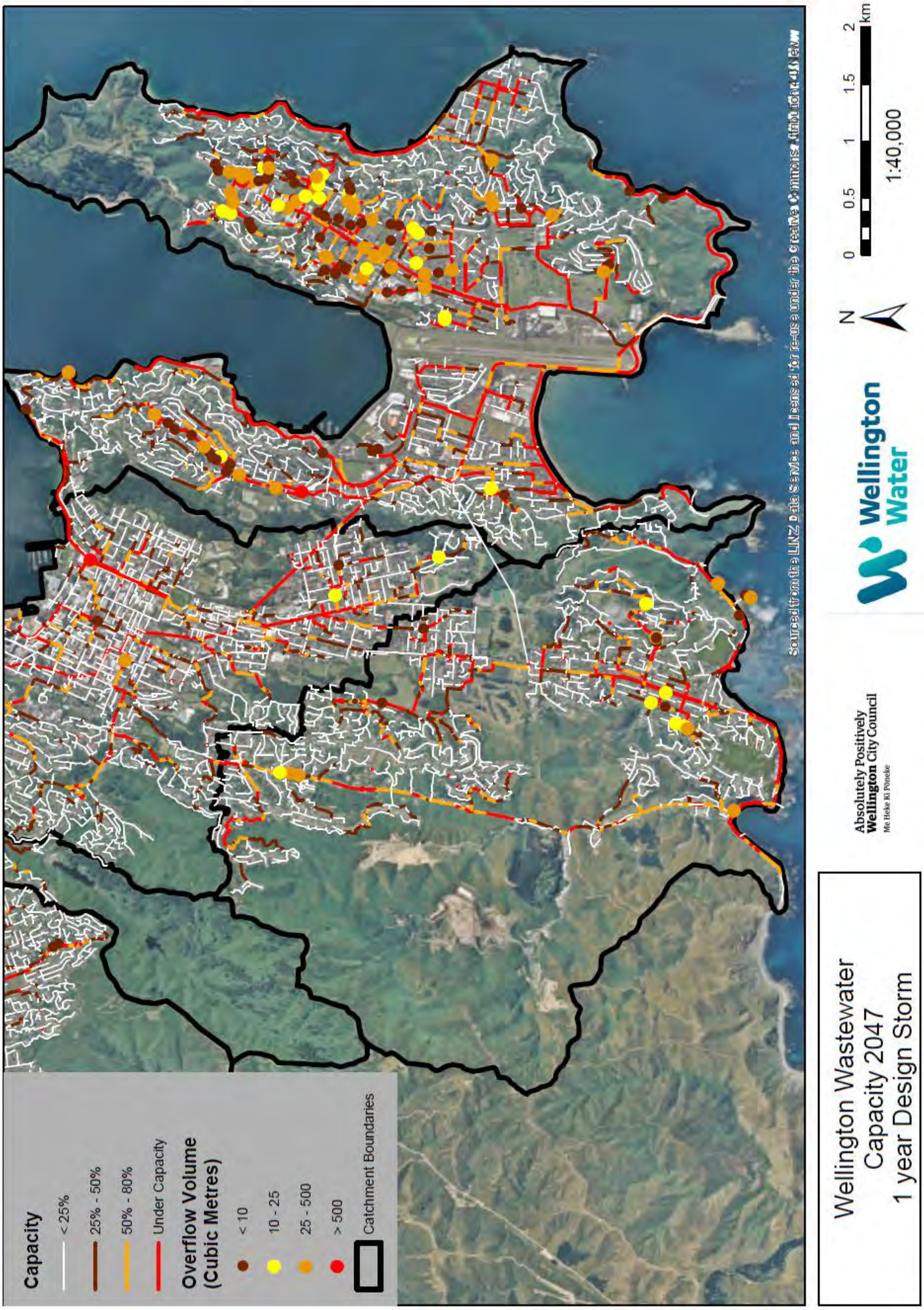


Figure 14: Future population (2047) Wellington wastewater capacity assessment – CBD (in part), Evans Bay and Island Bay.

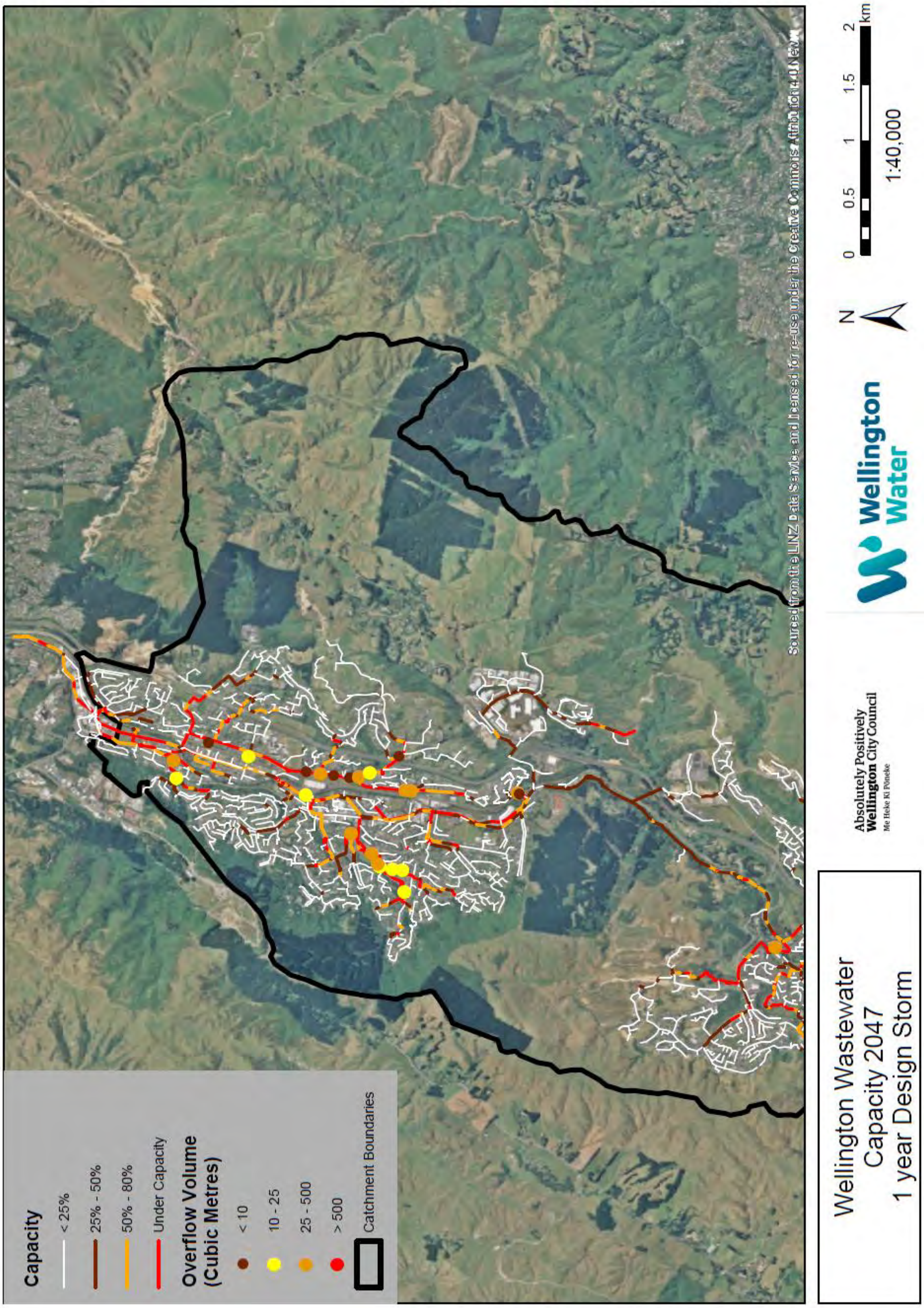


Figure 14: Future population (2047) - Wellington wastewater capacity assessment – Tawa (North)

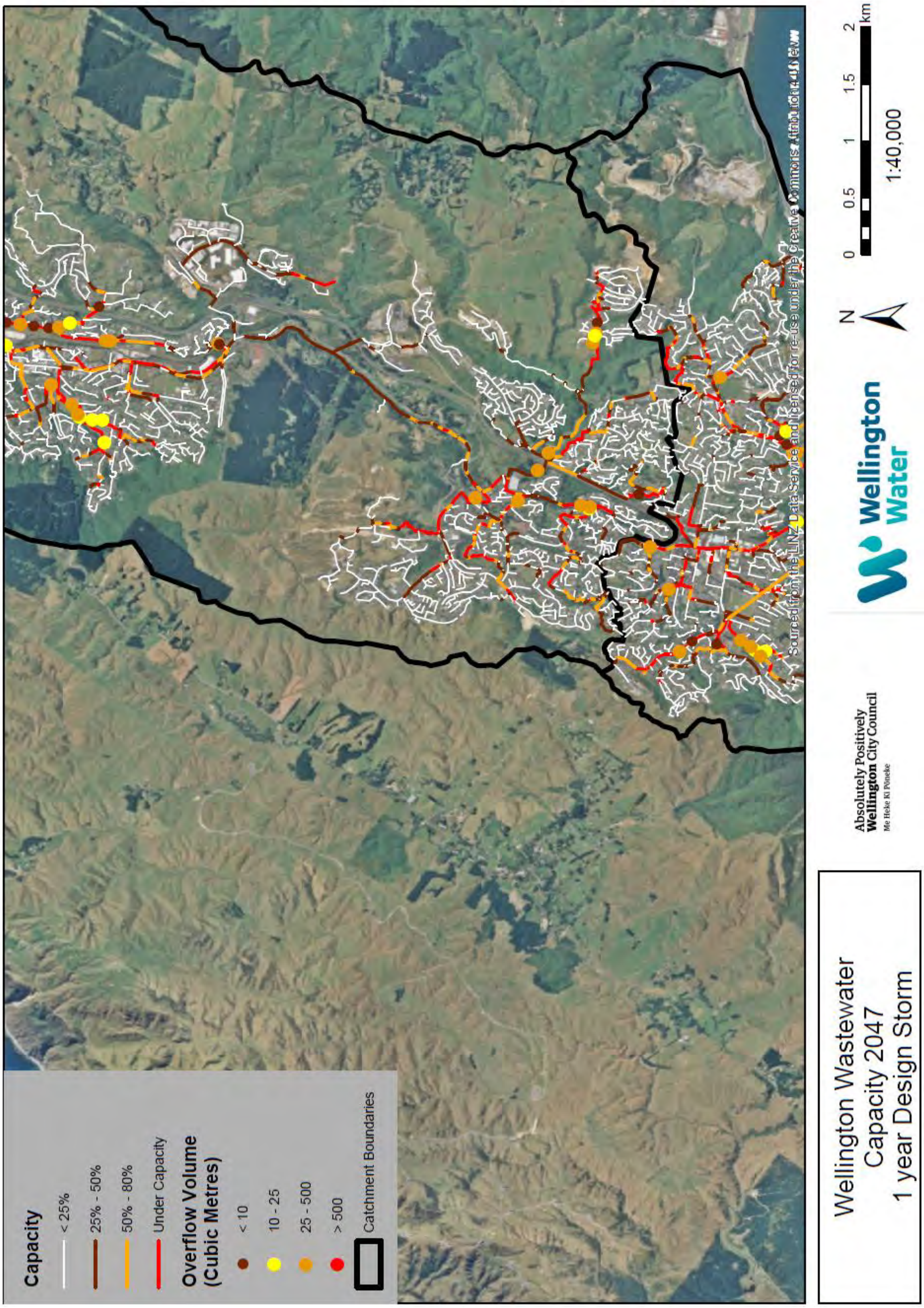


Figure 15: Future population (2047) - Wellington wastewater capacity assessment – Tawa (South)

5.1.3 Stormwater mapped results

As discussed above in subsection 3.3, the mapped stormwater results are not included in this report. Results are summarised in tables and text in subsection 5.2.3.

5.2 Tabled results

Tables of the model results are provided for water supply, wastewater and stormwater.

5.2.1 Water supply tabled results

Table 3 below indicates the constraints in infrastructure enabled capacity for each of the modelled WSAs in the short-term, medium-term and long term. Similar to the maps, the results for each WSA indicate the capacity in the water supply using the LOS based on network pressure (N), storage volumes (S) and both network and storage (O for Overall).

Where appropriate, the table provides additional information on whether the results for the storage LOS are relevant to the LOS of for operational storage or seismic resilience.

Where pressure in the network is modelled to be lower than the level of service, small network modifications or upgrades would eliminate these deficiencies in most cases, enabling urban growth from a network capacity point of view. Alternatively, it is possible that in some locations, localised substandard pressure could be acceptable.

It is unknown how the model results would differ if the more up-to-date WCC population predictions were used. It can be assumed, however, that if increased predicted populations were located within WSAs with modelled storage constraints that the extent of these constraints would also be increased.

Table 3: Water supply enabled development capacity by Water Storage Area (N: network LOS, S: storage LOS, O: Overall LOS)

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Aro/Bell Road	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: There are currently some areas of moderately low pressure in the zone, which are not significantly affected by the projected growth.
Brooklyn	N: No S: No O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: High elevated properties in Mitchell Street have already low pressures which creates a constraint in this WSA. However the water pressure will only drop by 0.5m with projected additional demand. Storage: The planned additional storage

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
				eliminates the existing shortfall.
Brooklyn West	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: There are already some high elevated properties in Ashton Fitchett Drive with moderately low pressure in the zone, which are not significantly affected by the projected growth. Storage: There is enough storage available to accommodate the growth.
Careys Gully	N: NA S: NA O: NA	N: NA S: NA O: NA	N: NA S: NA O: NA	As the area consists of a single commercial user, the hydraulic model is not relevant for the purpose of the NPS-UDC.
Churton Park	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There are already high elevated properties with low pressure in the zone, which will be affected by the projected growth. Storage: There is storage short fall in both operational and seismic criteria.
Churton North	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	The model indicates that there is enough network and storage capacity to accommodate forecasted growth.
Stebbings	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: NA S: Yes O: NA	Network: The projected dwellings for Stebbings includes a large area currently zoned rural. Because this area does not have a reticulated network, the future network capacity in the Stebbings model was not assessed for the long-term population. Storage: The storage is sufficient for the dwellings predicted for 2047.
Grenada South	N: Yes S: Yes O: Yes	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that network can accommodate forecasted growth. Storage: There is a storage shortfall for the seismic criterion starting between 2020 and

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
				2027.
Lincolnshire	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: NA S: Yes O: NA	Network: The projected dwellings for Lincolnshire includes a large area currently zoned rural. Because this area does not have a reticulated network, the future network capacity was not assessed for the long-term scenario. Storage: The storage is sufficient for the dwellings predicted for 2047.
Horokiwi	N: NA S: No O: NA	N: NA S: Yes O: NA	N: NA S: Yes O: NA	Network: Because this area does not have a reticulated network, the future network capacity has not been assessed. Storage: LTP includes funding for a future reservoir
Frobisher	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There is no capacity in the network of the Frobisher WSA Storage: There is a shortfall for both the operational and seismic criteria
Southern Suburbs	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There is no spare capacity in the network of Southern Suburbs Storage: There is a shortfall for both the operational and seismic criteria
Broadmeadows HL	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: The WSA is very small with short lengths of pipe sized for firefighting. Water network capacity is not a constraint. Storage is sufficient.
Highland Park	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: There are already some areas of moderately low pressure in the zone, which are not significantly affected by the projected growth. Storage: There is an existing shortfall for the seismic criteria, with a shortfall for the

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
				operational criteria predicted between the 2027 and 2047 horizons.
Johnsonville Onslow	N: No S: No O: No	N: No S: No O: No	N. No S: No O: No	Network: There is no spare capacity. Storage: There is an existing shortfall for the seismic criteria, with a shortfall for the operational criteria predicted between the 2020 and 2027 horizons.
Johnsonville West Broadmeadows	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There is no spare capacity in the network. Storage: There is a shortfall for both the operational and seismic criteria.
Mount Kaukau	N: Yes S: No O: No	N: Yes S: No O: No	N:Yes S: No O: No	Network: There are already a number of high elevation properties (estimated at 10) with low pressure in the zone, which are not affected by the projected growth. Storage: There is a shortfall for both the operational and seismic criteria
Mount Wakefield	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The network indicates that there is enough capacity to accommodate the growth. Storage: There is a shortfall for both the operational and seismic criteria.
Ngaio	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The network indicates that there is enough capacity to accommodate the growth. Storage: There is a marginal shortfall for the seismic criteria.
Wadestown	N: No S: No O: No	N: No S: No O: No	N: No S. No O: No	Network: There may be a possibility of rezoning high-elevation low-pressure properties along Orangi Kaupapa Road into the higher-HGL Mount Wakefield zone. Storage: There is a shortfall for both the operational and seismic criteria.

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Croydon	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There is no spare capacity in the network of Croydon WSA. Storage: There is an existing shortfall for both the operational and seismic criteria.
Karori East	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There is no spare capacity in the network of Karori East WSA. Storage: There is an existing shortfall for the seismic criterion.
Karori South	N: Yes S: No O: No	.: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that there is enough network capacity to accommodate the growth. Storage: There is an existing marginal shortfall for both the operational and seismic criteria. However it is within the margin of error of this assessment
Karori West HL	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: The WSA is very small with short lengths of pipe sized for firefighting. Water network capacity is not a constraint.
Karori West	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	There is enough network and storage capacity to accommodate growth.
Wrights Hill	N: No S: Yes O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: There is no spare capacity in the network of Wrights Hill WSA. Storage: There is enough storage available to accommodate the growth.
Kelburn	N.: No S.: No O: No	N.: No S.: No O: No	N.: No S.: No O: No	Network: There is no spare capacity in the network of Kelburn WSA. Storage: There is an existing storage shortfall for both the operational and seismic criteria.

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Highbury	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: The model indicates that there is enough network capacity to accommodate the growth. Storage: Considering the very small tank in the Highbury WSA (0.13 ML), the calculated marginal shortfall considered to be within the margin of error of this assessment.
Alexandra Road WSA	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The WSA is very small with short lengths of pipe sized for firefighting. Water network capacity is not a constraint. Storage: There is a storage shortfall for both the operational and seismic criteria.
Beacon Hill HL WSA	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: The WSA is very small with short lengths of pipe sized for firefighting. Water network capacity is not a constraint.
Mount Crawford	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: No O: No	Network: The WSA is very small with short lengths of pipe sized for firefighting. Water network capacity is not a constraint. Storage: The storage is sufficient until some point between 2027 and 2047, where the operational criterion is no longer met.
Miramar Aramoana	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There are few high-elevation low-pressure properties in Seatoun which create constraint for this WSA. It may be possible to rezone those few properties from Miramar Aramoana WSA into the adjacent higher-HGL Maupuia WSA. Storage: There is an existing shortfall for both the operational and seismic criteria. However the Maupuia and Mt Crawford reservoirs could potentially assist the WSA, and so could the Carmichael and Macalister reservoirs for operational purposes.

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Roseneath	N. No S: Yes O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: Adjustments to PRV settings are likely to address low pressures and allow further development. Storage: There is enough storage available to accommodate the growth.
Maupuia	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There is a localised nature of low pressure areas. There may be a possibility of installing booster pumps for the larger low-pressure pockets in cul-de-sacs, and accepting lower pressure in certain isolated areas. Storage: There is an existing shortfall for the seismic criterion.
Wellington City Central	N: No S: No O: No	N: No S: Yes O: No	N: No S: No O: No	Network: There are high-elevation low-pressure properties at varies locations which create constraint for this WSA. There is a ZMP project in progress to address these deficiencies through rezoning, operational changes and pipe upgrades. Storage: Storage shortfall is alleviated with a new reservoir that supplies the medium-term population growth.
Melrose	N. No S: Yes O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: There is no spare capacity in the existing network. Storage: There is sufficient storage available.
Ngauranga	N: NA S: NA O: NA	N: NA S: NA O: NA	N: NA S: NA O: NA	The zone is almost exclusively commercial and the commercial growth has not been analysed.
Newlands	N: No S: No O: No	N: No S: No O: No	N: No S. No O: No	Network: There is no spare capacity in the network of Newlands WSA. Storage: There is an existing shortfall for the operational criterion. This may need to be confirmed with further investigation.

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Red Beech	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: The WSA is very small with short lengths of pipe sized for firefighting. Water network capacity is not a constraint. Previous studies have identified that the constraint to growth is the relation with the Woodridge Reservoir (Stantec 2017.) Storage: The existing storage is expected to be abandoned when the Horokiwi Reservoir is built, around 2027.
Woodridge	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: There are already number of high elevation properties with low pressure in the zone, which are not affected by the projected growth. Storage: The "Woodridge development – Hydraulic assessment Rev. 4" report concluded that, the replenishment of Woodridge Reservoir was acceptable, although below Wellington Water's target.
Grenada North HL WSA	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: No O: No	Network: The WSA is very small with short lengths of pipe sized for firefighting. Water network capacity is not a constraint. Storage: The marginal storage shortfall calculated for 2047 is considered to be well within the margin of error of this assessment.
Grenada North WSA	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Storage: the demand in Grenada North is essentially commercial and therefore the storage calculations based on projected dwelling increase are not particularly relevant to this WSA.
Greyfriars WSA	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The WSA is very small with short lengths of pipe sized for firefighting. Water network capacity is not a constraint. Storage: There is already an existing marginal shortfall for the operational criteria.

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Linden WSA	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: Rezoning of the low pressure properties at Chastudon Place into the adjacent Broken-Hill-Porirua WSA is feasible. The rezoning of the low pressure properties at Duval Grove may be possible into a potential new high-level water zone considered in the Tawa Zone Management Plan Project (work in progress). Storage: The calculated storage shortfall is associated with the seismic criterion.
Rossaveel	N: Yes S: Yes O: Yes	N. Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	The model indicates that there is enough network and storage capacity to accommodate the projected growth.
Tawa	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There is an opportunity to rezone Lyndhurst Road properties into the adjacent Chester DMA. Pipe upgrades may be considered for low pressure properties in Bartlett Grove. Storage: There is an existing shortfall for both the operational and seismic criteria.

5.2.2 Wastewater

There are many locations in the Moa Point, Western and Porirua (Tawa) wastewater networks that have insufficient capacity to enable growth. The hydraulic modelling indicates that the sewer pipes in the hills surrounding the harbours typically have sufficient capacity and are unlikely to be stressed with further intensification. However a number of the main sewer pipes are unable to convey the current flows and these pipes regularly discharge untreated wastewater through constructed overflows and surcharging manholes during wet weather. Where this occurs the modelling results indicate that the wastewater infrastructure does not enable growth on a catchment scale.

Due to the age of some of the network, including the laterals that connect to the network from private residences, the inflow of rainwater and infiltration of groundwater (I&I) into the wastewater network is a significant factor contributing to the insufficient capacity of the system. Overflows can also be caused by insufficient pump rates and operational issues such as partial blockages. The key network factors causing modelled sewer overflows are insufficient pipe diameters and pumping rate combined with high I&I.

The hydraulic wastewater models show that projected population growth can result in untreated wastewater surcharging from up to 231 manholes and from 23 constructed overflows during a 1-year ARI with the projected long-term population at year 2047.

Table 4: Wastewater enabled development capacity by catchment

Wastewater	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Evans Bay (including Miramar)	No	No	No	There are a total of 30 constructed overflows in this catchment. The majority of the pipes in the Miramar catchment are under capacity due to both downstream constraints and pipe capacity. The downstream constraints are the pump station and rising main. The Evans Bay catchment is very flat and has high groundwater levels which result in high I&I volumes which exacerbate the under capacity in the pipes. Short-term: Increased overflow volumes at 8 existing constructed overflow locations and the 72 manholes. There are 2 additional manhole locations overflowing. Medium term: Increased overflow volumes at 8 existing constructed overflow locations and at 80 manholes. Long-term: Increased overflow volumes at 8 existing constructed overflow locations and at 105 manholes.
Island Bay	Yes	Yes	No	The wastewater system in Island Bay does not have many capacity issues. There are 4 constructed overflows. The main capacity constraints are around the Island Bay trunk sewer. Long term: The level of service is not met as there are additional overflow volumes at 16 manholes and at 4 constructed overflow locations.

Wastewater	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Tawa	No	No	No	Short term: Modelled results show increased overflow volumes at 25 existing manhole overflow locations. Medium term: Increased overflow volumes at 25 existing manhole overflow locations, and additional overflows at 2 new manhole locations. Long term: Increased overflow volumes at 27 existing manhole overflow locations, and overflows at 8 new manhole locations and 1 constructed overflow location.
Wellington Western Hills	No	No	No	Short term: Modelled results show increased overflow volumes at 3 constructed overflows and at 27 existing manhole overflow locations. Medium term: Increased overflows at 3 constructed overflows and at 30 existing manhole overflow locations. Long term: Increased overflows at 4 constructed overflows, and 45 manhole locations.
Karori	Yes	No	No	The Karori catchment has 11 constructed overflows and 2 of these overflow at the 1 - year ARI with the current population. The main trunk running through the middle of the catchment is under capacity for the future population. Medium term: Increased overflow volume at 6 constructed overflows and 1 manhole location Long term: Increased overflow volumes at 2 constructed overflows and 4 manhole locations.
CBD (including	Yes	No	No	There are a total of 36 constructed overflows in this catchment. There are concerns about

Wastewater	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Newtown)				the age of the network and the effect of so many constructed overflows on the quality of the receiving waters and bathing beaches. Medium term: Modelled results show increased overflow volumes at 2 constructed overflows Long term: Modelled results show increased overflow volumes at 4 constructed overflows and at 3 manholes.

5.2.3 Stormwater

One of the modelling assumptions is that planning and building restrictions will require new development to achieve hydraulic neutrality in all rainfall events up to and including the 1 in 100-year rainfall event including the predicted impacts of climate change. If this policy were implemented, stormwater risks would not be increased by increased population and its associated development. With this assumption the stormwater modelling results are relevant for today as well as for 2047.

At the top of the catchments, there generally is less risk of surface ponding where the terrain is steeper. However, in steeper areas overland flowpaths can be a threat to life due to the high velocities. It is therefore critical that overland flowpaths remain unobstructed to reduce the flood risk to people and property. In addition, deep ponding in some locations can preclude safe access.

It is also important to maintain the capacity of the waterways not just during low flow but also when they are in flood.

Specific locations in each catchment are described below where development must be specifically designed to avoid impeding overland flowpaths or flood storage areas, or where the depth of ponding precludes safe access.

Tawa:

Significant flood events occurred in the Tawa catchment in February 2013 and May 2015. The valley is drained by many overland flow paths and streams that have been restricted by development. Much of the pipe networks and culverts in the valley are not able to convey even a 10-year rainfall event. Furthermore, high water levels in the Porirua Stream can contribute to upstream flooding by restricting the ability of the stormwater pipes to discharge into the stream.

On the valley slopes there are many locations of overland flows damaging property. The flooding spreads and deepens when it reaches the valley floor including around the central commercial properties between Lincoln Avenue and Lyndhurst Rd.

Johnsonville:

Following the 1976 flood, a major stormwater construction project created a tunnel to intercept flood flows down Broderick Road and convey them to Ngauranga Gorge. For many years this tunnel has provided a reasonable base level of protection to the low-lying valley floor surrounding the Johnsonville shopping and business area. However development on the surrounding hillsides have reduced the effectiveness of the tunnel and moderate flooding now is expected to occur in a 1 in 10-year rainfall event. In a 1 in 100-year rainfall event, extensive flooding of the commercial area would be expected.

Karori:

Much of the Karori stormwater network does not have capacity to carry the 10-year flood flow. The catchment has a history of surface flooding associated with overland flow paths and the Karori Stream. Of particular note is the large flood-prone area along Ranelagh St/Ranelagh Terrace. There is also overland flow along South Karori Road and Allington Road which contributes to extensive flooding in Hildreth Street, Fernlea Avenue and Ranelagh Street.

CBD:

The hydraulic models have identified the CBD to have the highest flood risk in Wellington. Runoff from the large and heavily developed catchments that extend up to the Wellington Zoo in Newtown flows through constrained pipe networks under the low lying CBD before discharging into the harbour. Exacerbating the flooding is the reclaimed land bordering the harbour which is at a higher elevation than the inland area surrounding Wakefield Street. The flooding is likely to be compounded by high tides and sea level rise.

Flooding has been reported in many parts of the catchment. The most affected areas are Aro Valley, Mt Cook, the Basin Reserve, Kent Terrace, Cambridge Street, Wakefield Street and Adelaide Road in Newtown.

There were 60 reports of flooding within the catchment in the May 2015 event, including multiple reports relating to flooding at the eastern end of Aro Street in Aro Valley, Papawai Terrace in Mount Cook and Wakefield Street in Te Aro. The event occurred two weeks after the 28 April 2015 event which also had extensive flooding within the catchment. These resulted from less than 10-year rainfall events.

The hydraulic models have been combined with a depth damage analysis that predicts well over $100M in direct flood damages in the CBD if a 1 in 100-year rainfall event were to occur.

Miramar:

The Miramar peninsula is bowl-shaped with rainfall that lands on the hills passing overland or through the stormwater pipe networks and eventually discharging through a one pipe outlet to Evans Bay. The southern and central areas of Miramar are low-lying and prone to flooding in heavy rain.

There are many records of historical flooding within the catchment and several flood mitigation options have been considered. The main flooding incidents occurred during two major events that occurred during 1994 and 1995. The areas of concern are Miramar Avenue, Park Road and Polo Ground, Northern Ira Street, Broadway, Weka and Glamis Street as well as Darlington to Monorgan Road.

Haitaitai/Kilbirnie:

Localised flooding has occurred on numerous occasions within the Kilbirnie Catchment.

Between 2009 and the start of 2014 approximately 170 complaints have been made in relation to localised flooding, ponding, or water flowing out of the stormwater network in the Kilbirnie catchment. The most recent flooding of note in the catchment occurred in May 2013 in which multiple residential and commercial properties were flooded along Kilbirnie Crescent, Bay Road, Tully Street, and Duncan Terrace. There are existing projects in Kilbirnie to address the flooding.

Island Bay:

There are low-lying areas in the Island Bay catchment that can be inundated with deep flooding if a heavy rainfall coincides with a high tide. These areas are at the southern end of The Parade, between Mersey and Humber Street as well as the low -lying areas of Reef and Trent Streets. Parts of this area exceed the stormwater level of service for safe access of depths greater than 300mm. There are a number of overland flow paths that should be protected from new development. These are found near Melrose Rd and Mersey St, Severn St, Avon St and at the back of properties along Jackson Street.

Lyall Bay:

Flooding occurs in the low-lying areas of the Lyall Bay catchment during heavy rainfall. This flooding is likely to be compounded by high tide and sea level rise. During the 12 May 2015 event flooding was recorded at the intersection of Toru Street. The model indicates overland flowpaths along Onepu Road, Puru Crescent and Queens Drive.

Table 5: Stormwater protection enabled development capacity by catchment

Stormwater	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Tawa	Yes	Yes	Yes	The modelled catchments show that development can occur in combination with adequate planning provisions. For example, development must be hydraulically neutral so that flooding isn't increased, and development should be restricted in areas where deep flooding can preclude safe access.
Johnsonville	Yes	Yes	Yes	
Karori	Yes	Yes	Yes	
Southern CBD	Yes	Yes	Yes	
Miramar	Yes	Yes	Yes	
Haitaitai/Kilbirnie	Yes	Yes	Yes	
Island Bay	Yes	Yes	Yes	
Lyall Bay	Yes	Yes	Yes	
Churton Park, Horokiwi, Ngaio and Wilton catchments	Not modelled			

6. Conclusion

The results of hydraulic modelling for water supply and wastewater have identified significant limitations to the infrastructure enabled development capacity for Wellington City in the short-, medium- and long-term.

None of the six catchments modelled for wastewater have sufficient capacity to enable long-term projected population growth.

Of the 46 catchments modelled for water supply, only 11 catchments have sufficient pressure and storage to support the projected long-term population growth.

For stormwater, the network has a limited ability to control flooding and was primarily designed to carry away surface water during the low to medium-intensity rain events. However, historic development, loss or restriction of overland flow paths and reclamation of low-lying areas have contributed to regular flooding in some areas during the 10-year flood events. The hydraulic models used for this report, assume that planning and building restrictions will require new development to achieve hydraulic neutrality in all rainfall events up to and including the 1 in 100-year rainfall event. This means that limitations identified for development capacity from stormwater are only within the areas that are close to streams and drains and locations where significant ponding would limit safe access.

The results provided in this report reflect defined levels of service and identified limitations and assumptions. As such this is considered to be a high level assessment which does not consider the opportunities for site-specific mitigation to enable development.

The next steps are to assess the possible options to rectify the constraints in infrastructure enabled development capacity and then include the best options in the WCC LTP and Infrastructure Strategy.

7. References

Cardno. 2018. Rainfall input files for wastewater modelling. Prepared for Wellington Water Ltd October 2018.

Stantec. 2018a. NPSUDC – Regional water supply capacity assessment: Methodology and summary. Prepared for Wellington Water Ltd. October 2018. 58 pages

Stantec. 2018b. NPSUDC – Regional water supply capacity assessment: Detailed assessments - Wellington. Prepared for Wellington Water Ltd. October 2018.

Stantec. 2017. Woodridge development hydraulic model assessment. Prepared for Wellington Water Ltd. August 2017.

Appendix 2.3

Absolutely Positively
Wellington City Council
Me Heke Ki Pōneke

Assessment of Wellington City Road Network

Under National Policy Statement on Urban Development Capacity 2016

Prepared to inform and support the Housing and Business Capacity Assessment for Wellington City Council under the National Policy Statement on Urban Development Capacity.

February 2019

Version Control

Version	Date	Notes
Draft 1.0	4/12/2018	First draft.
Draft 2.0	8/02/2019	Incorporating feedback and GWRC modelling assessments.
Draft 3.0	13/02/2019	Incorporating feedback from TS team.
Final 4.0	19/02/2019	Incorporating feedback from PP team.

Contents

Summary

This paper presents an assessment of Wellington City Council's transport network's ability to meet the requirements of the National Policy Statement on Urban Development Capacity 2016 (NPS-UDC).

The Council provides 970 kilometres of footpaths and accessways, 697 kilometres of roads, and 2.4 kilometres of bridges and tunnels. This infrastructure enables over 200,000 residents to move around the city every day. The Council's transport infrastructure has a replacement cost of $1.4 billion. Our transport infrastructure is in good condition overall, our current levels of service are largely meeting the needs of the city, and the service levels are considered to be sustainable and affordable. There will always be an ongoing requirement to invest in infrastructure maintenance, renewal and upgrades to improve network quality, accommodate population growth, and enhance the effectiveness of the transport network as a whole.

Between 2017 - 2047 the city's population is forecast to grow by 46,500 – 74,500 residents, one third of which is expected to be in the central city, and over 20,000 jobs, which are expected to be largely in the central city.

This growth will add to existing strains on the transport network and significant investment will be required to maintain acceptable levels of accessibility to support economic, social and recreational activities. The Council is working with Greater wellington Regional Council and the NZ Transport Agency to develop a transport investment package under the Let's Get Wellington Moving project. This is expected to provide for growth for the north, central, southern and eastern suburbs. The local share of funding to support this package is not yet identified and therefore not fully provided for in the current Long-term Plan. No projects are yet identified, nor funded, to support growth in the western suburbs (e.g. Karori).

Purpose

This paper presents an assessment of Wellington City Council's road network's ability to meet the requirements of the National Policy Statement on Urban Development Capacity 2016 (NPS-UDC). The NPS-UDC requires an assessment of:

- whether development capacity is serviced with infrastructure; and
- whether development infrastructure required to service development is identified in the Council's Long-term Plan, or Infrastructure Strategy.

The assessment is not contingent on the location of development capacity, but assesses the infrastructure as it currently stands, and its potential to absorb further growth over the period 2017 - 2047.

For the purpose of this paper the scope of the transport network includes facilities for walking, cycling, public transport and motorised traffic.

Wellington Context

Wellington City is expected to add 46,500 – 74,500 residents, one third of which is expected to be in the central city, and over 20,000 jobs over the period 2017 - 2047. As the city grows, there is an increasing need to make best use of limited space.

In order to accommodate growth while retaining and enhancing the qualities that attract people to Wellington, decisions around the allocation of public space are going to be critical. Decisions must support the aspirations of Wellingtonians around becoming a more people-centred, connected, eco city with a dynamic central city. It is also set in the context of Our City Tomorrow and Let's Get Wellington Moving.

The Regional Land Transport Programme, Let's Get Wellington Moving conversation, WCC's Urban Growth Plan, Low Carbon Capital Plan, Our City Tomorrow and the Long-term Plan set the strategic direction for our transport network development, which is to encourage walking, cycling and public transport over other modes of transport.

The sustainable transport hierarchy adopted in the Urban Growth Plan 2015 places emphasis on encouraging greater use of walking, cycling and public transport.

Figure 1 Sustainable Transport Hierarchy

Overview of the Local Road Network

The Council's draft Transport Activity Management Plan (December 2017) provides a comprehensive summary of the state and performance of the city's transport network. The Plan states:

More than 150 years of investment in the physical infrastructure of Wellington City has contributed to our connectivity regionally, nationally and internationally. Our transport network facilitates access to seven percent of New Zealand's total jobs which are located in the city, and allows nearly 100,000 people to commute to the central city for work. This connectivity has increased the city's attractiveness to business, talent, and further investment.

Wellington City Council maintains 970 kilometres of footpaths and accessways, 697 kilometres of roads, and 2.4 kilometres of bridges and tunnels that enable over 200,000 residents to move around the city every day. The Council's transport infrastructure has a replacement cost of $1.4 billion.

Our transport infrastructure is in good condition overall, our levels of service are largely meeting the needs of the city, and the service levels are considered to be sustainable and affordable. There will always be an ongoing requirement to invest in infrastructure maintenance, renewal and upgrades to improve network quality, accommodate population growth, and enhance the effectiveness of the transport network as a whole. We still have challenges and these are outlined in this plan.

The following map summarises and shows the extent of Wellington city's transport network.

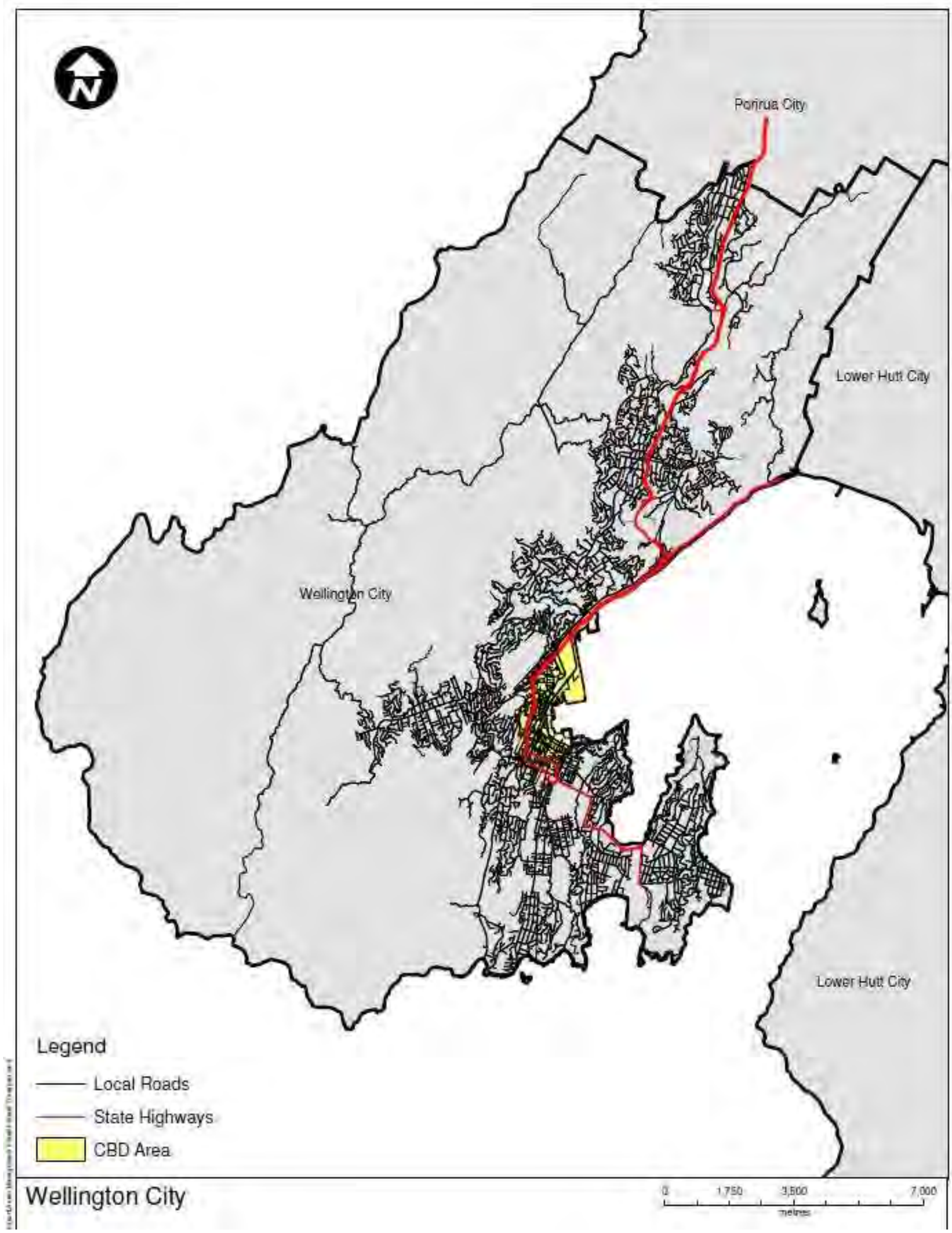


Figure 2 Extent of Wellington City's Transport Network

The following table summarises city owned transport assets.

Table 1 Summary Inventory of Transport Network Assets

Asset	Asset Components	Quantity	Units
Pedestrian Network	Footpaths	893	km
	Malls	5330	m^2
	Access Paths	77	km
	Half Cost Paths	14	km
	Street Furniture (seats, bollards, bins, pedestrian shelters, plaques)	3127	
	Accessway Walls	511	
	Pedestrian structures (Structural steps, boardwalks, tunnels, bridges)	82	
Cycleway Network	Cycleways (included in other assets)	31	km
	Cycle Racks (street furniture asset)	428	
Passenger Transport Network	Bus Stops	1323	
	Shelters	455	
	Railway Station Bus Interchange	1	
Vehicle Network	Tunnels	4	
	Road Bridges (60 owned by WCC + 16 we maintain components of for NZTA which are not valued)	76	
	Retaining Walls, Sea Walls	2687	
	Road Formation and Pavements	697	km
	Shared Driveways (Tawa only)	3.5	km
Roads Open Space	Managed Open Space	68	ha
Surface Water Management	Kerbs and channels	1234	km
	Sumps and Leads	15,200	
	Culverts	547	
Network Control and Management	Street lights	18,324	
	Street Light Poles	5871	
	Traffic signals	118	
	Traffic signs	25,332	
	Sign Posts	15,092	
	Road markings, Line marking	985	km
	Road markings, Text	929	
	Road markings, cross hatching	94,620	m2
	Road markings, symbols e.g. turning arrows	9093	
	Raised pedestrian crossings & refuge, raised pavements	61	
	Roundabouts	52	
	Traffic Islands	1298	
	Speed Humps	298	
Safety	Fences, handrails and guardrails	127	km

The Council's transport assets have a total optimised replacement cost of $1.4 billion (2017 valuation).

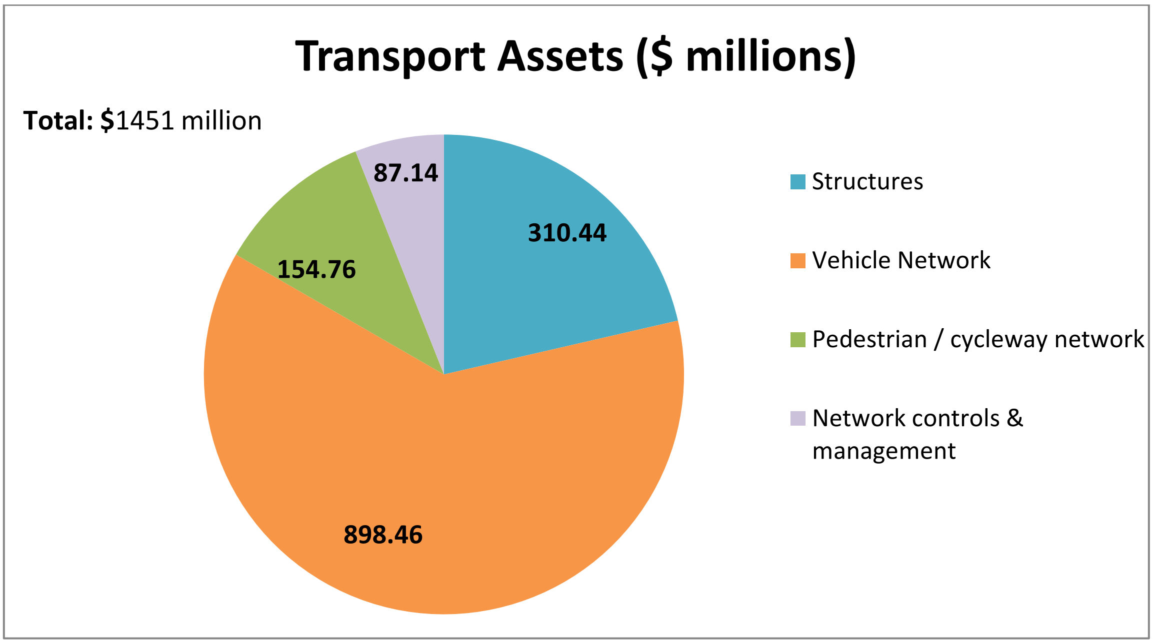


Figure 3 Replacement Value of Wellington City's Transport Assets

Performance Monitoring

The Council monitors the performance of the network in many ways, including:

- conducting regular condition assessments of assets
- monitoring of vehicle travel times on key routes
- monitoring of travel patterns by mode
- monitoring of road safety outcomes
- recording public feedback and complaints
- surveying residents' opinions annually
- reporting on financial performance in quarterly and annual reports
- reporting on a number of non-financial key performance indicators.

Physical condition

The Council's transport assets are regularly inspected and condition is recorded in various management systems, primarily the Road Asset Maintenance Management system (RAMM). Maintenance and renewal programmes are undertaken to ensure assets provide an acceptable level of service throughout their service lives.

The majority of the Council's transport network assets are in good condition with maintenance and renewal programmes being adequately funded. Eight percent of the transport network retaining walls- are in poor or very poor condition. Renewal funding has been increased in the current long term plan to address this situation.

Another issue identified in recent years is the seismic risk associated with tunnels in the city. Three of the city's four road tunnels have been strengthened for seismic performance. Strengthening work on the last tunnel is planned to commence in 2019.

Average travel times and speeds

Average trip times can give an indication of the combined impact of trip distances and trip speeds on the time spent travelling. This is important as it gives an indication of how the transport network enables people to get from place to place. Figure 4 shows the average length of time for trips in the Wellington region by travel mode from 2004/5 to 2016/17. Average trip times for pedestrians and car drivers have stayed constant over that time period. Walking trips are on average the quickest trips, and are 10 minutes long on average. Car trips are on average about 12 minutes long. Public transport trips take the longest time on average, at 23 minutes in 2016/17.

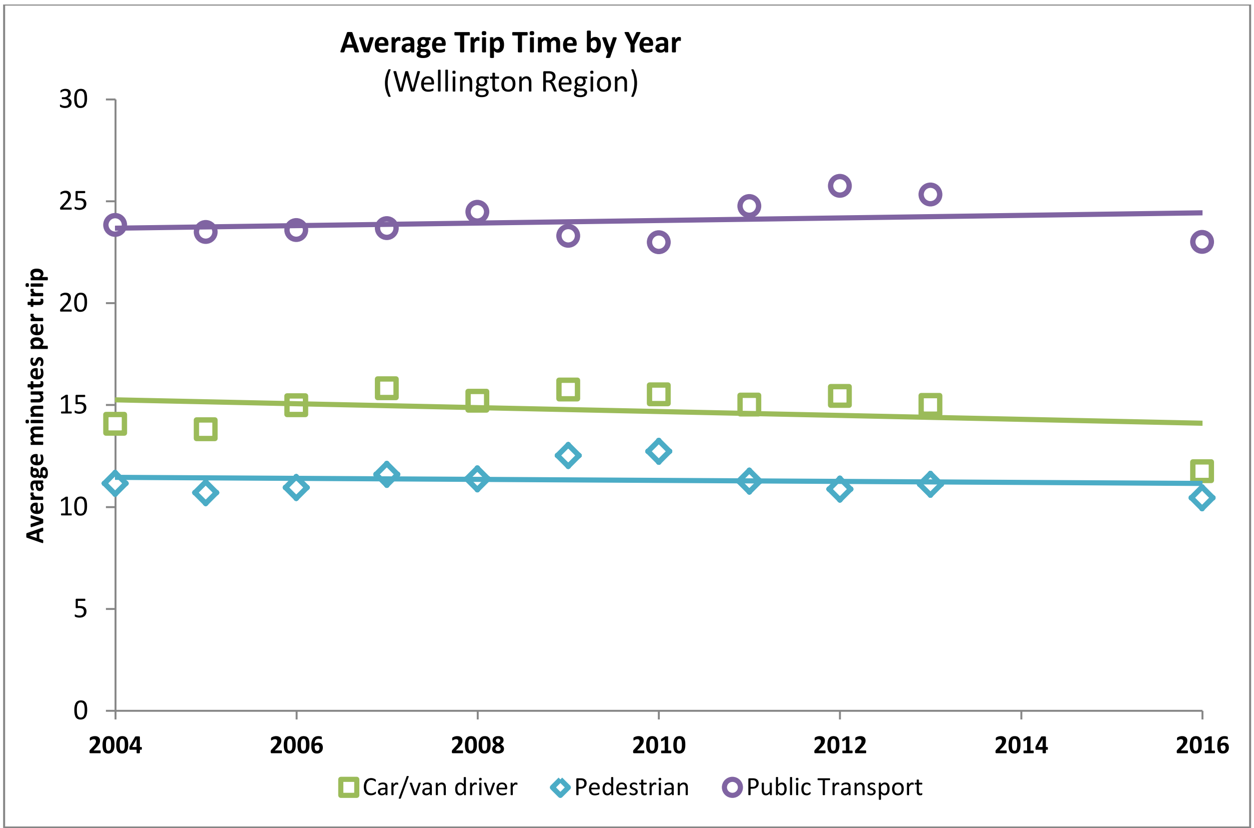


Figure 4 Average Trip Times by Modes (NZ Household Travel Survey)

Average travel speeds provide another indication of the level of service and accessibility that the transport network provides. It can also give an indication of the impacts recent travel trends have had on the functioning of the transport network. Figure 5 shows average travel speed, in kilometres per hour, of trips in the Wellington region from 2004 to 2016. Travel speeds for all modes appear to have remained constant from 2004 to 2016. Car journeys on average have the fastest speed, at 37 kilometres per hour on average, followed by public transport journeys at 27 kilometres per hour on average. Taken together, Figures 4 and 5 suggest that journeys in the Wellington region have stayed constant and have not become significantly longer or more congested on average over the past decade. Although trip times and speeds in the region may have remained constant on average, there may be isolated locations where journeys have become longer or more unreliable.

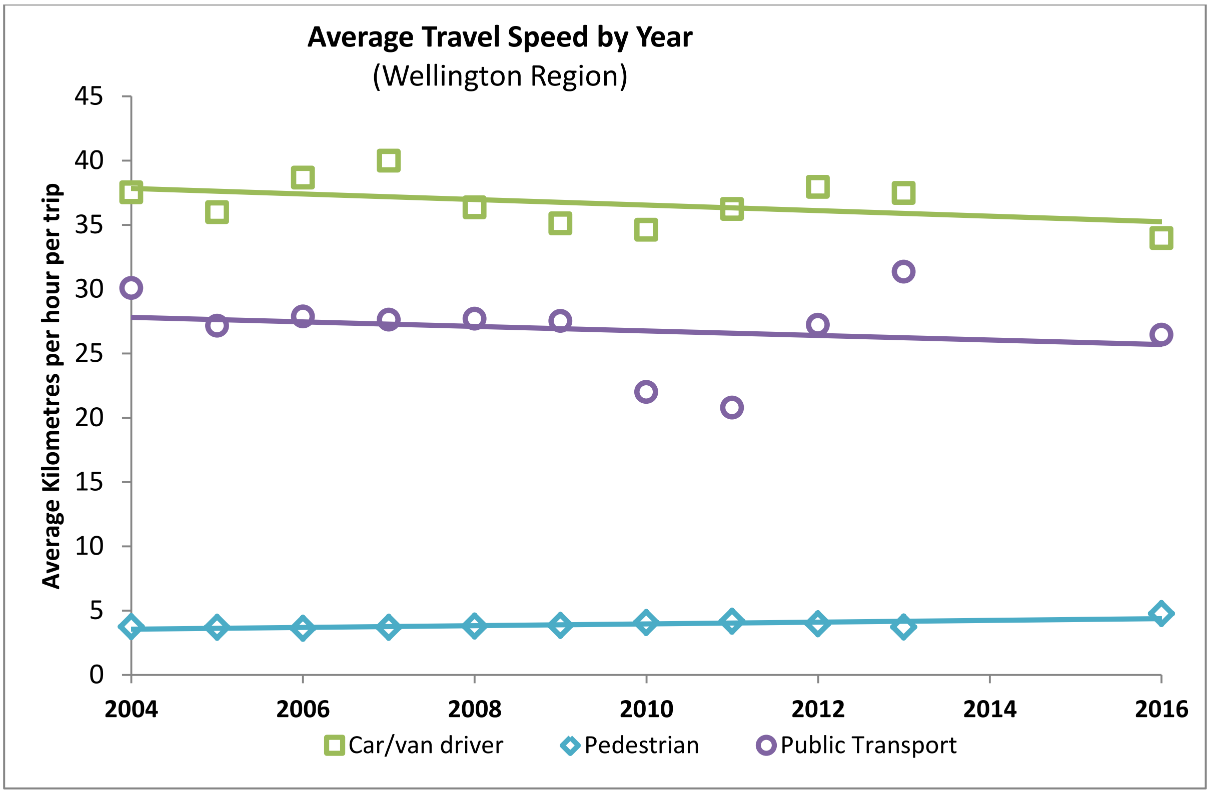
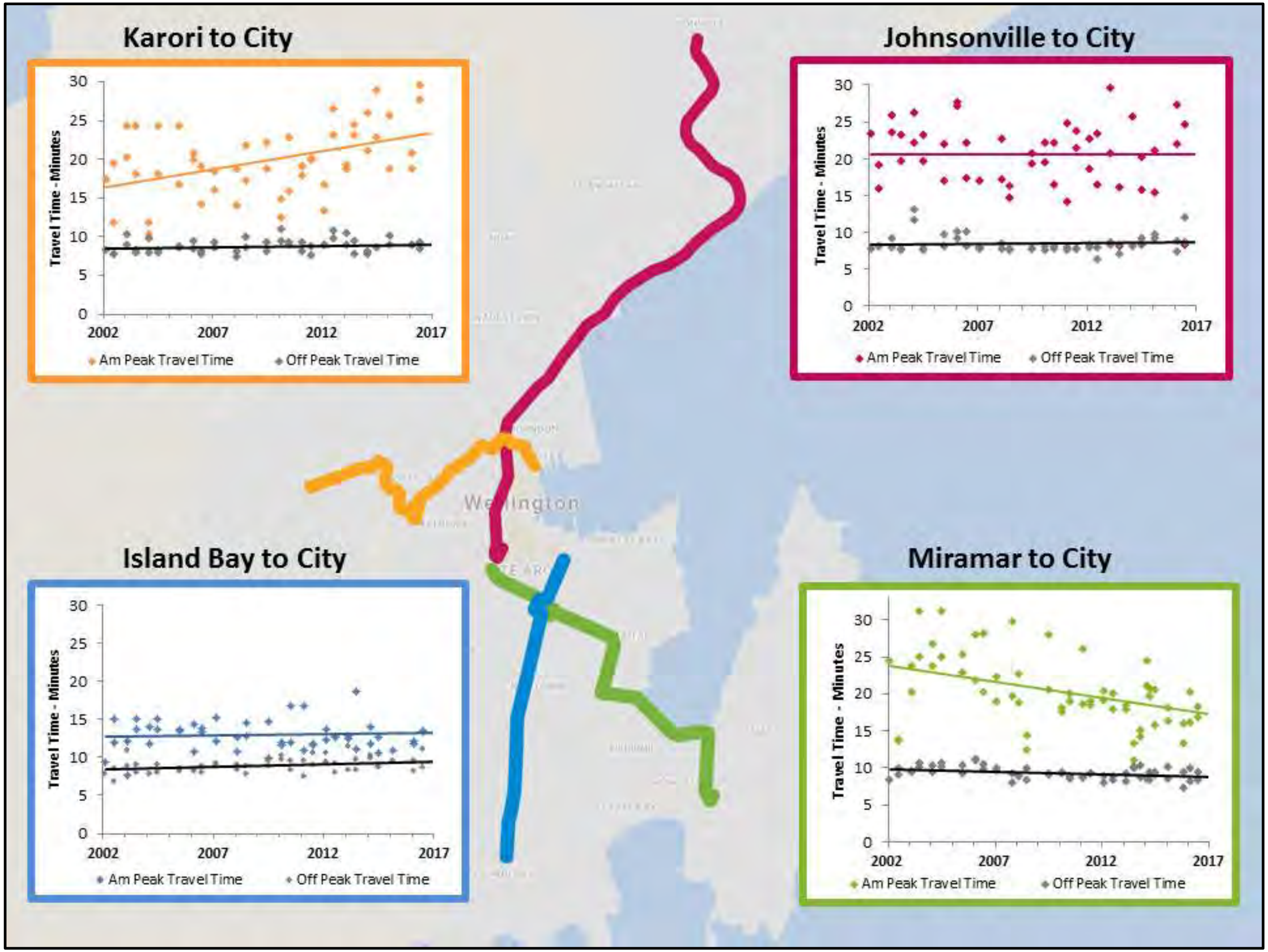


Figure 5 Average Travel Speed by Year (NZ Household Travel Survey)

Wellington City Council monitors travel times on four key routes to the central city using floating car surveys[1]. AM peak travel times are generally worse than the PM peak. Results are shown in Figure 6 on the next page. Since 2002, AM peak journey times from Karori to the central city have increased from 16 minutes to 23 minutes on average, while AM peak journey times from Miramar to the central city have decreased by around the same proportion. Journey times from Johnsonville and Island Bay to the central city have remained constant.

[1] A method to determine the travel times and speeds on selected routes. Travel time information is collected from vehicles that are being driven in a normal stream of traffic.

Figure 6 Vehicle Travel Times on Key Routes



Travel modes

Three primary sources are used to monitor mode share trends. First is the Ministry of Transport's Household Travel Survey. This looks at travel for all purposes, but is only available at a regional level. It shows that the number of trips per person per year by mode have remained constant in the region over the past decade.

The second source is the Census. This is conducted every five years. Data for the 2018 Census is not currently available so we are still relying on the 2013 results until new data is published. Census data on travel choices are only for people's journeys to work. This is available for small areas. At the city level for commuting, Census data shows a trend away from car travel toward walking, cycling and public transport.

Figures 7 and 8 show the changing prevalence of commute modes for Wellington City residents from 2001 to 2013[2]. The percentage of people driving or carpooling to work has decreased while the percentage of people walking or cycling to work has increased significantly. The commute mode that saw the largest increase was walking. There were just under 6,000 additional walking commuters between 2001 and 2013 and the percentage of people walking to work rose from 16% to 20% over that time. Commutes by bike have become much more common, having risen from 2.5% of commutes in 2001 to 4.1% of commutes in 2013. Motorcycle commutes have also become much more common, having doubled between 2001 and 2013. Public transport trips have risen slightly, from 18.5% of commutes to 19.5% of commutes in 2013. In contrast, the frequency of car commuting has dropped significantly, from 50.5% of commutes in 2001 to 43.7% of commutes in 2013. Car commuting accounted for just 4% of new commute trips between 2001 and 2013. These local trends differ substantially from national trends[3]. This is likely to be influenced by perceived and real difficulties in commuting by car with increased congestion and limited parking options, particularly following the November 2016 earthquake which resulted in the closure of three major car parking buildings. The region's investment in new commuter trains and related infrastructure and services since 2005 has resulted in increasing use of rail network.

Figure 7 shows the magnitude and mode of new commutes by suburbs in Wellington from 2001 to 2013. For the central city and inner suburbs, most of the growth has been in walking and cycling. In contrast, growth in the northern suburbs is serviced by private vehicles and public transport.

[2] New Zealand Census, 2001, 2006, and 2013

[3] At a national level, car commuting accounted for 77% of new commute trips and the percentage of people driving to work has risen over the time period.

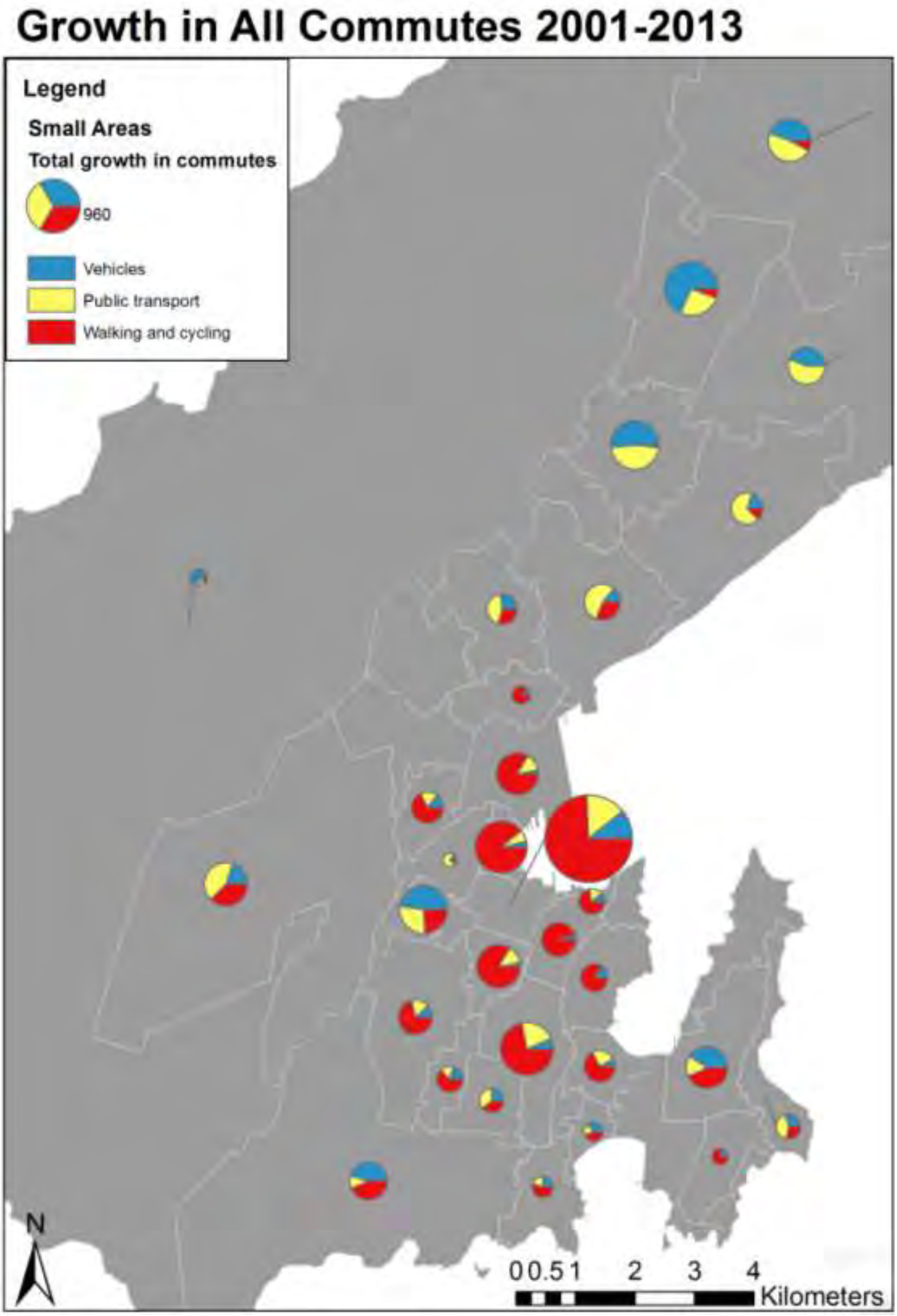


Figure 7 Growth in All Commutes 2001-2013

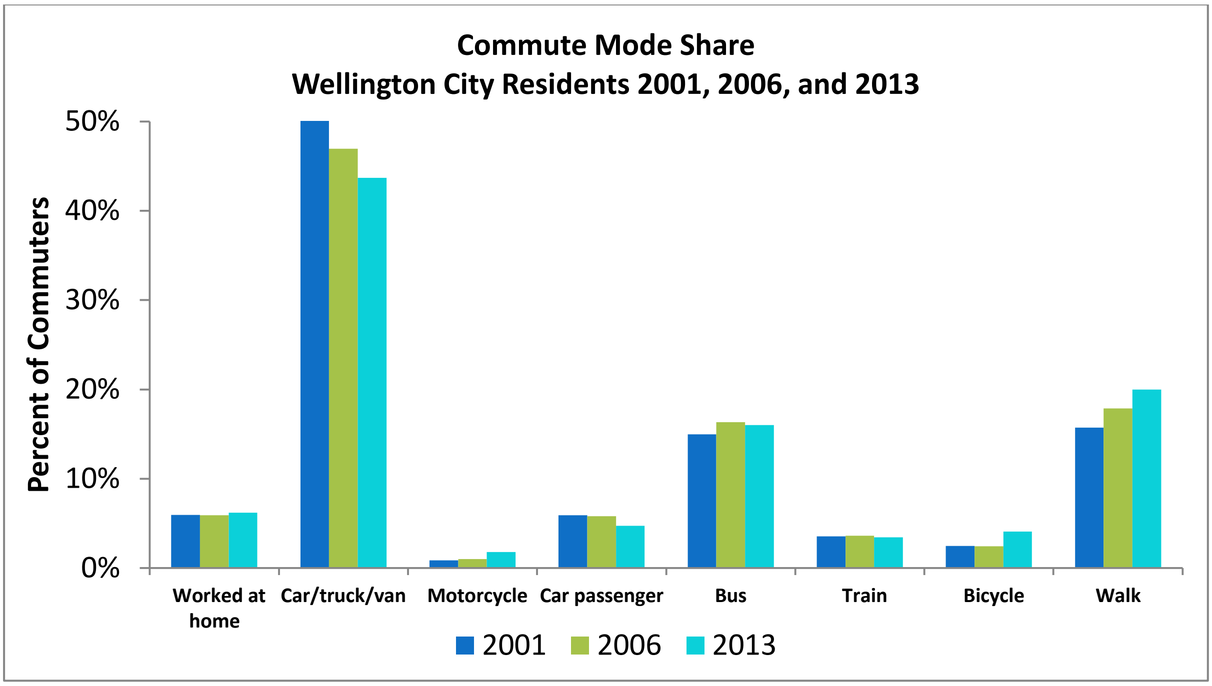


Figure 8 Commute Mode Share

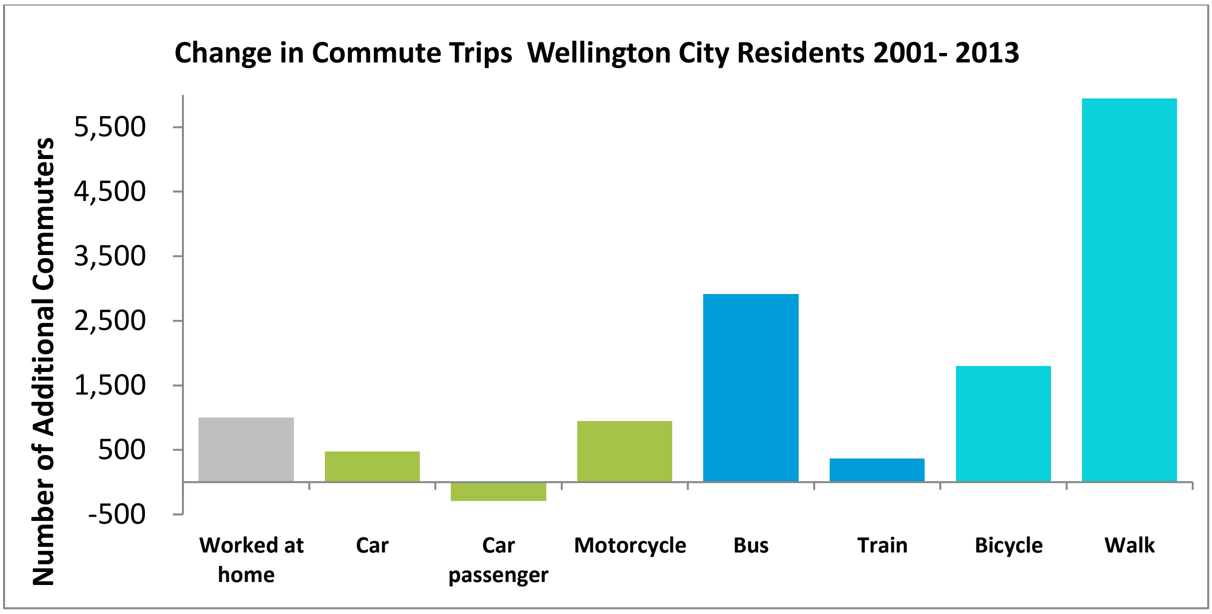


Figure 9 Change in Commute Trips

The central city has experienced sustained growth in its residential population and as the region's key employment centre. From 2001 to 2013, there was a growth of around 16,000 daily commuters travelling to the CBD and a growth in residential population of around 9000 residents. Figure 10 shows the change in travel modes for all commutes to the CBD from 2001 to 2013. This figure includes residents of both Wellington City and the wider region who work in the central city. The commute mode with the largest growth was public transport; 37% of new commutes to the CBD were by this mode and an additional 6402 commuters took public transport in 2013 relative to 2001. Walking and cycling also saw strong growth. From 2001 to 2013, 29% of new commutes to the CBD were by walking and 9% were by cycling. Driving in contrast, saw very slow growth relative to the overall percent of people driving to work each day; driving accounted for only 8.5% of new commutes to the CBD from 2001 to 2013. This may change significantly, however, with the completion of Transmission Gully in 2020.

The inner suburbs of Wellington grew by 4566 residents from 2001 to 2013. This growth has been particularly concentrated in Mt Cook, which saw a 58% increase in its population over that time period. The outer suburbs of Wellington accommodated the majority of the city's growth from 2001 to 2013 and grew by 16,149 residents over the same time period. The outer suburbs that have seen the largest growth are Churton Park, Johnsonville, and Woodridge, which grew by 2670, 2145, and 936 residents, respectively. From 2001 to 2013 there was a growth of over 25,000 jobs in the city. Of these jobs , 66% were located in the central city, 10% were located in the inner suburbs (primarily in Kelburn and Newtown), 19% were located in the outer suburbs (primarily in Ngauranga and Miramar), and 5% were people who worked from home throughout the city.

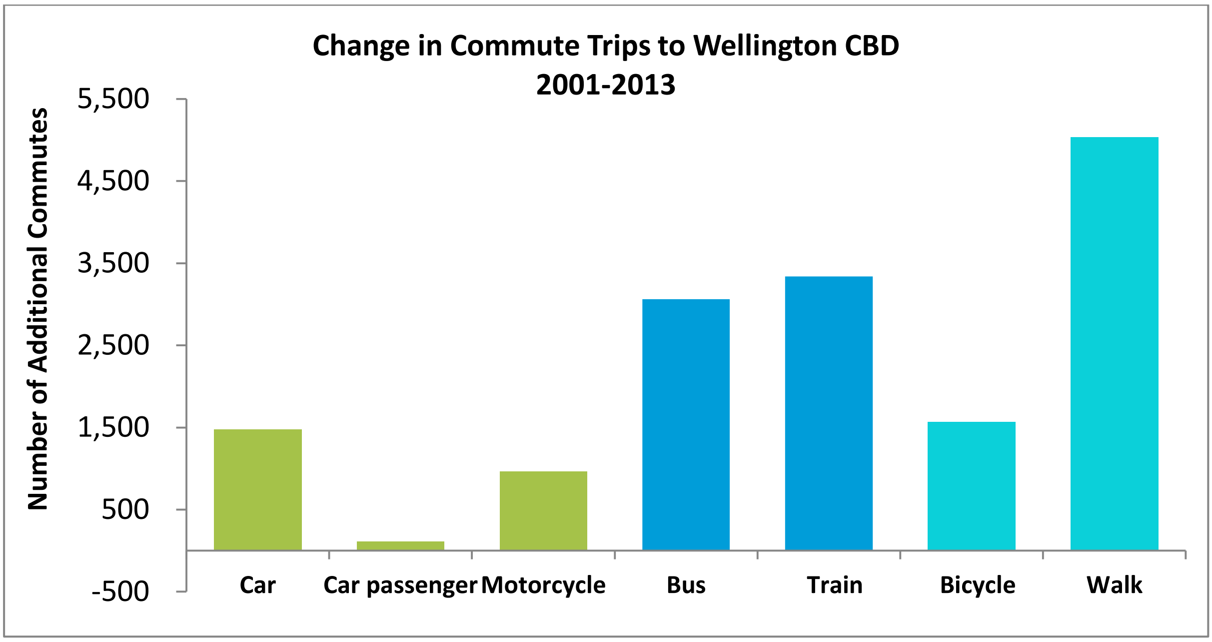


Figure 10 Change in Commute Trips to Wellington CBD (from city and region)

The third source of data is the Council's annual travel surveys which records the number of people travelling across a cordon around the city centre during the 7am to 9am period. Figure 11 shows a clear trend away from car travel toward walking, cycling and public transport. Whereas in 1999 people in private vehicles comprised 60% of cordon crossings, by 2018 they were only 44% of cordon crossings. In addition, the central city population grew by 9000 from 2001 to 2013. Although they are not captured in cordon data because they generally do not cross the cordon, Census results show over three quarters of people walk to work.

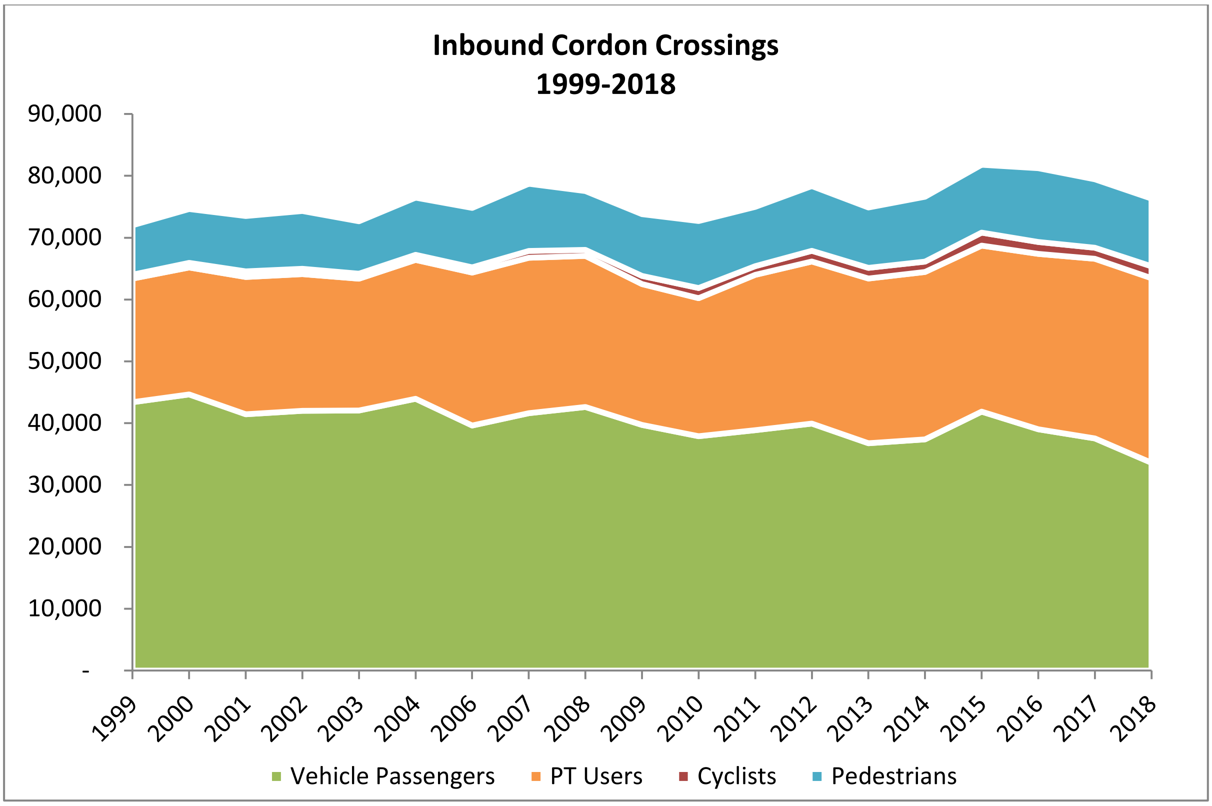


Figure 11 Inbound CBD Cordon Crossings since 1999

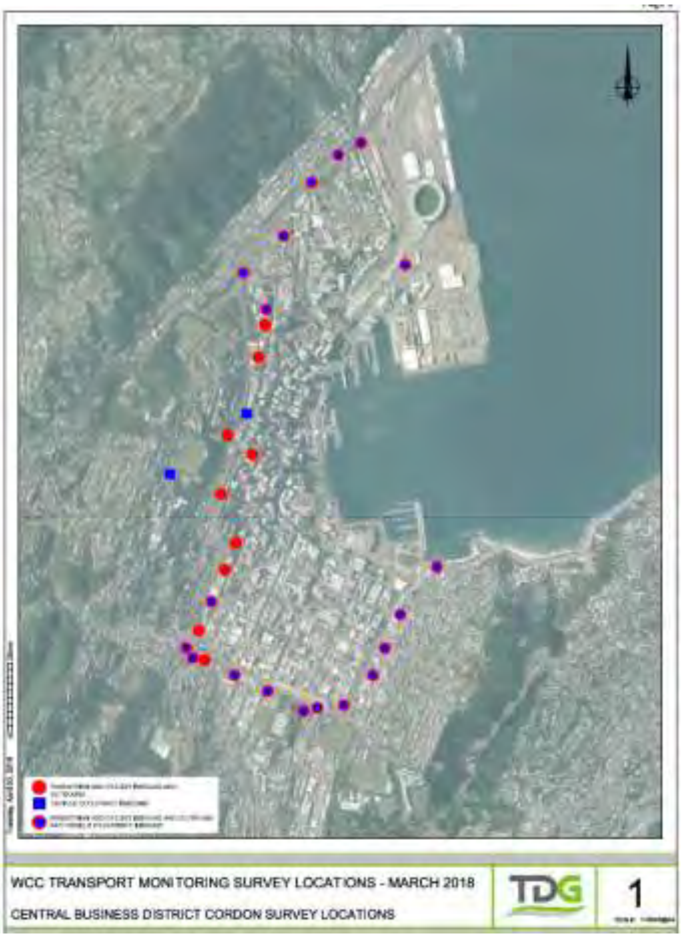


Figure 12 Cordon survey locations

Road safety outcomes

The NZ Transport Agency (NZTA) maintains a record of all crashes in New Zealand, referred to as the Crash Analysis System, which allows analysis of crash trends. The following chart (Figure 13) shows the number of serious injuries and fatalities among road users on all Wellington City roads. In an average year, there are over 70 crashes causing a death or serious injury on the transport network in Wellington City. On average, 16 are pedestrians, 14 are cyclists, 39 are vehicle occupants, and 2 are other/multiple users. Although the number of deaths and serious injuries fluctuates from year to year, the average number has remained stubbornly flat over the last 15 years.

Over the past decade, there have been 40 transport fatalities in Wellington City, 4 per year on average.

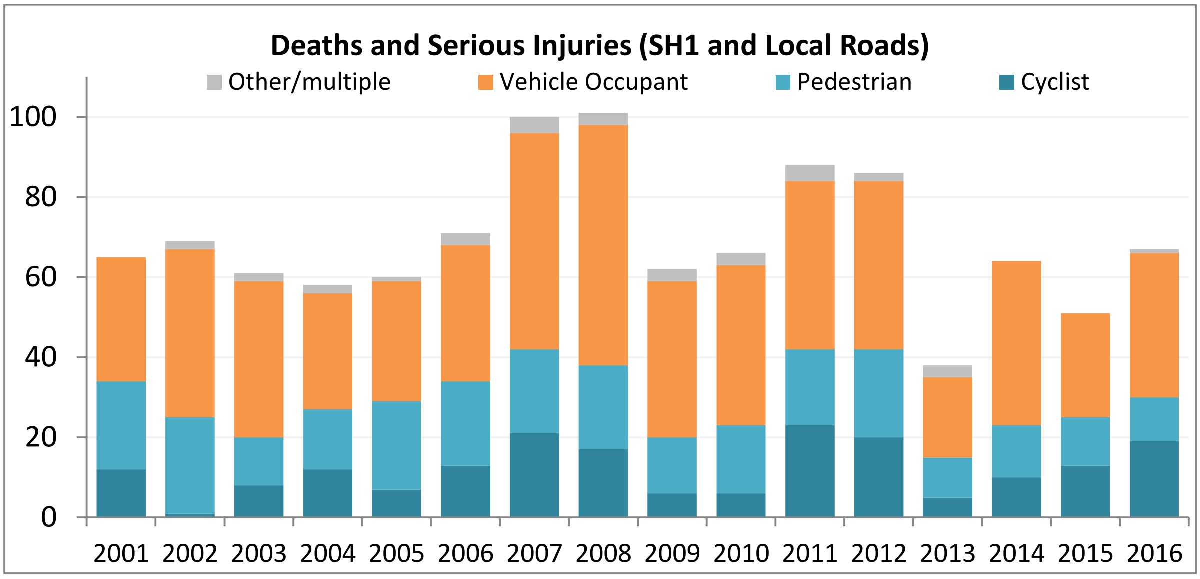


Figure 13 Deaths and Serious Injury Crashes 2001-2016

In an average year, there are around 1500 crashes on the transport network in Wellington City. Around 1350 of these crashes are between motor vehicles, and only 150 involve pedestrians or cyclists. The vast majority (98%) of crashes between motor vehicles do not result in a death or serious injury.

For injury crashes from 2007 to 2016, 81% of the crashes resulted in minor injuries, 18% in serious injuries and 1% in fatalities. These crashes harmed 3317 people and had a social cost of $728 million. The 2016 total of 264 crashes, while low compared to the outcomes seen in the first half of the decade, now appears to be part of a fairly static trend although serious injuries are creeping up again from a low of 27 in 2013 to 54 in 2016.

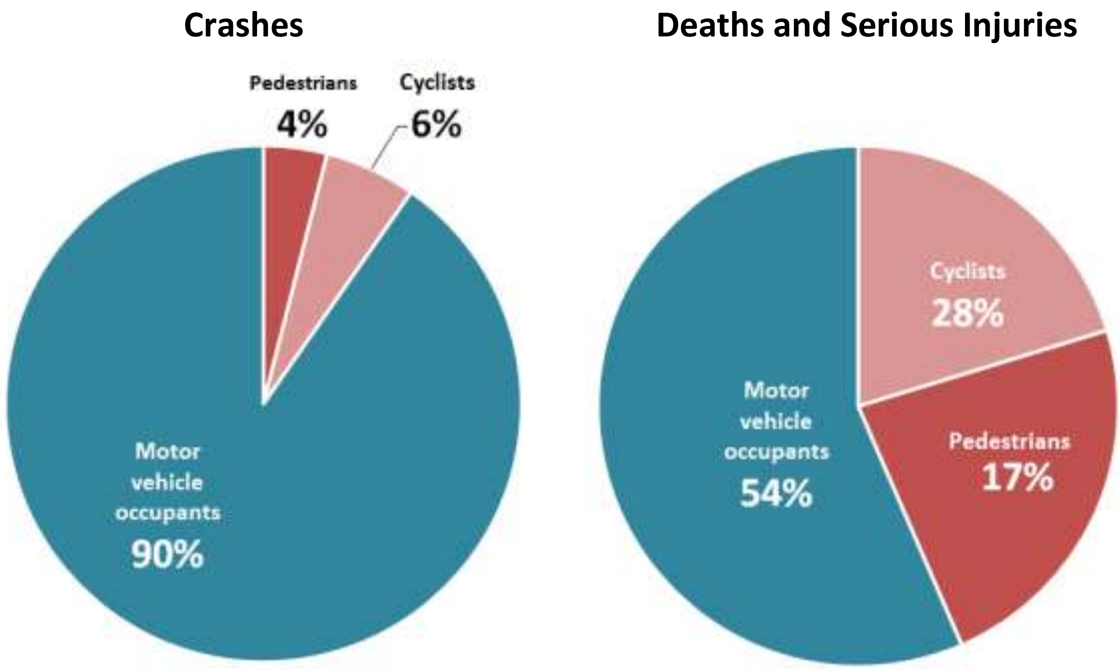


Figure 14 Crashes Involving Pedestrians and Cyclists

Although pedestrians and cyclists represent a small proportion of both distance travelled and total crashes, they account for almost half of transport-related deaths and serious injuries (Figure 14). For pedestrians, most crashes are concentrated in the central city. For cyclists, most crashes occur in the central city and on major arterial roads throughout the city. People on bikes represent 28% of all deaths and serious injuries in the city and pedestrians represent 17% of all deaths and serious injuries in the city.

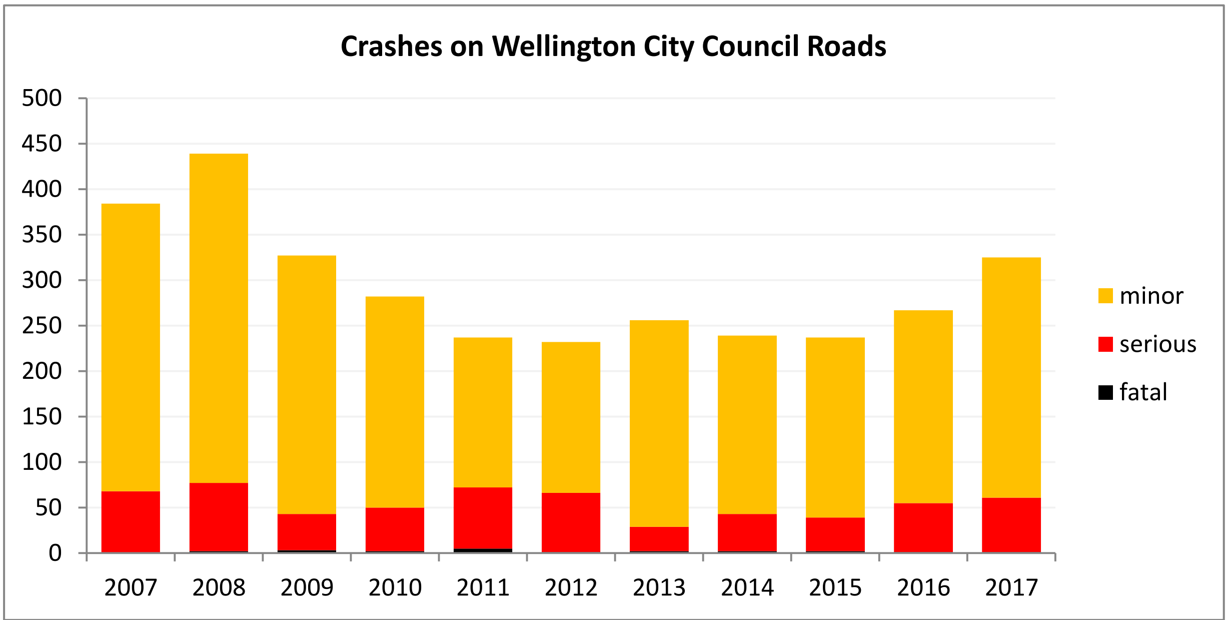


Figure 15 Annual Crashes on Wellington City Council Roads

Public feedback and complaints

During a typical year there are at least 22,000 requests to the Council for service across the transport network. These requests are prioritised according to the risk to the public or property with urgent tasks responded to within two hours.

Residents' opinions

Every year the Council surveys a sample of residents to gauge their satisfaction across the range of city services. The following charts present key transport results from 2013 to 2018. There is strong and consistent agreement the city's transport system allows easy access to the city (Figure 16).

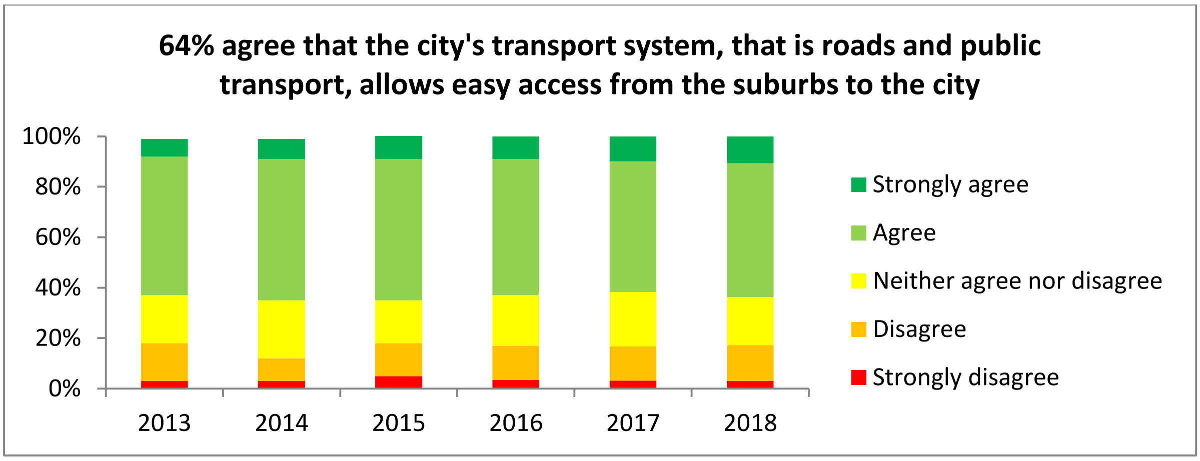


Figure 16 Agreement that the Transport System Allows Easy Access

People say it is easy to walk around and footpath assets are in good condition.

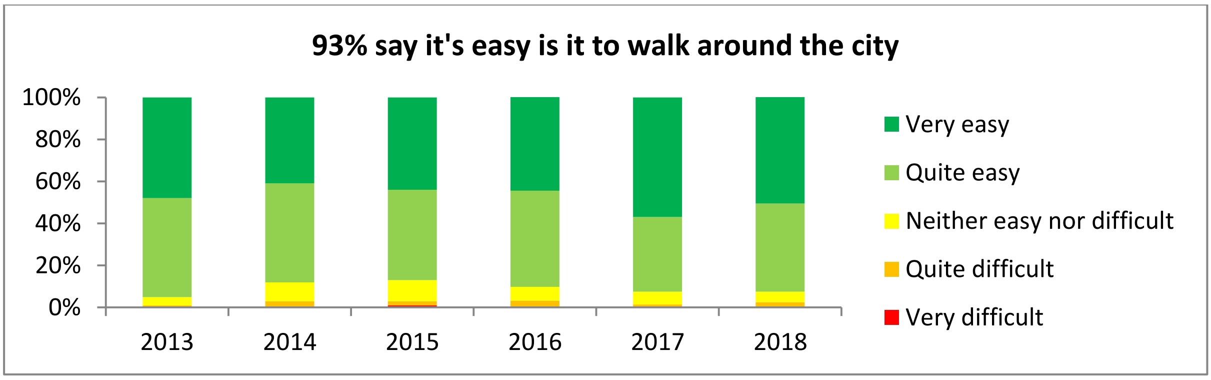


Figure 17 Agreement that it's Easy to Walk Around the City

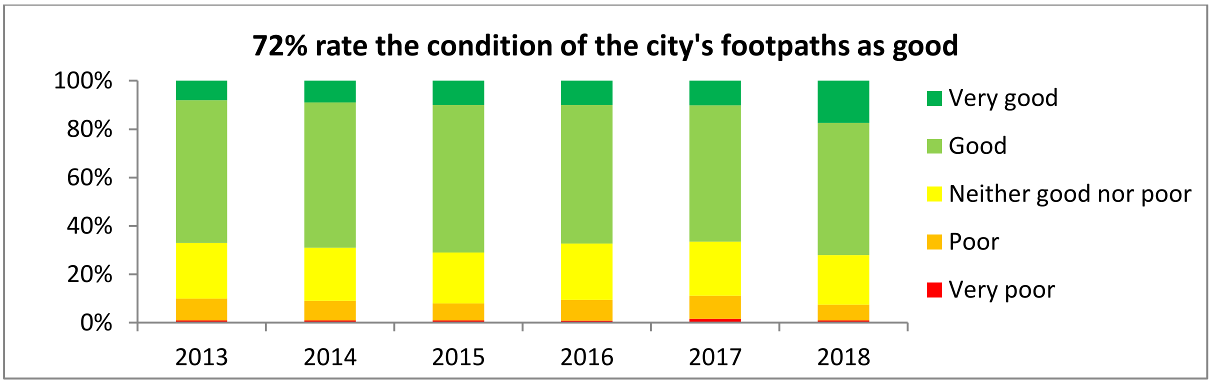


Figure 18 Agreement that Footpaths are in Good Condition

In contrast, people say it is difficult to cycle around, most are dissatisfied with the safety of cycleways, or lack thereof.

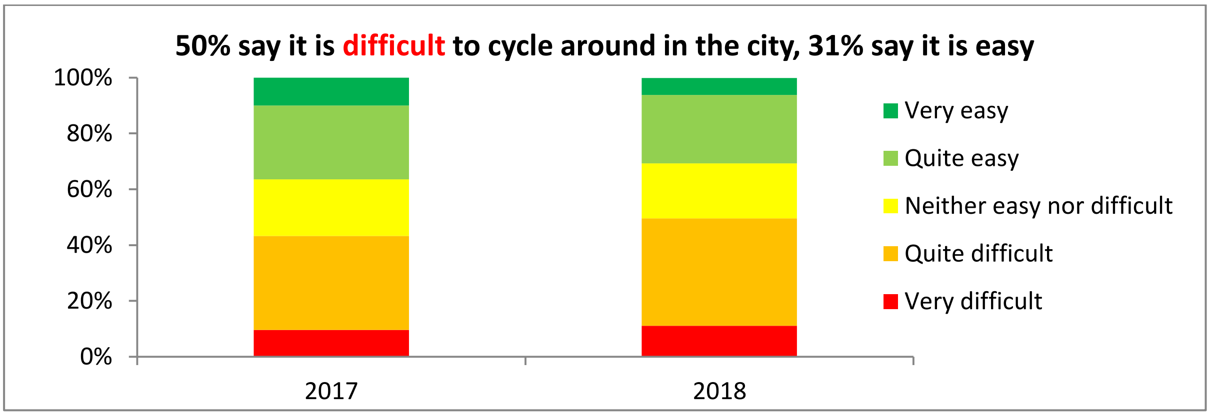


Figure 19 Agreement that it's Easy to Cycle Around the City

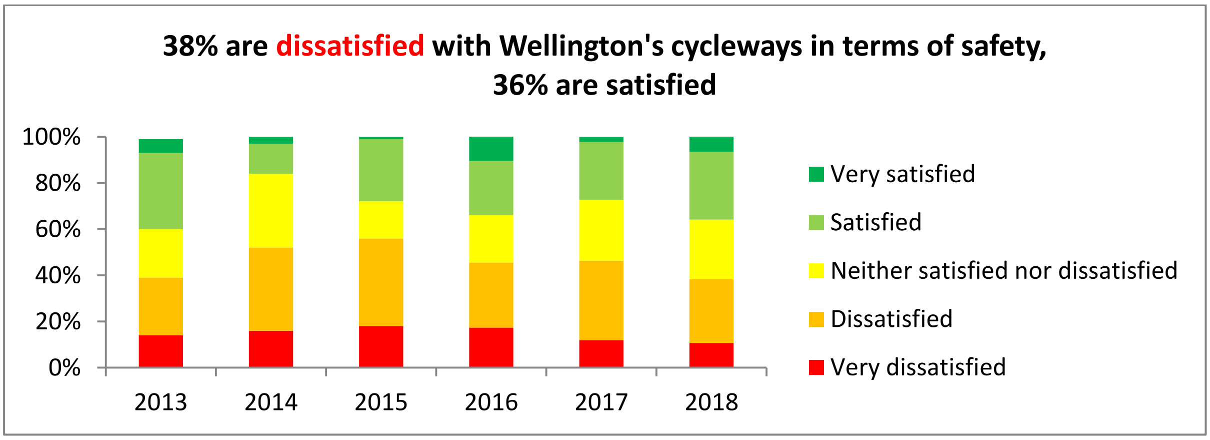


Figure 20 Satisfaction with Safety of Cycleways

Most are happy with the convenience of public transport.

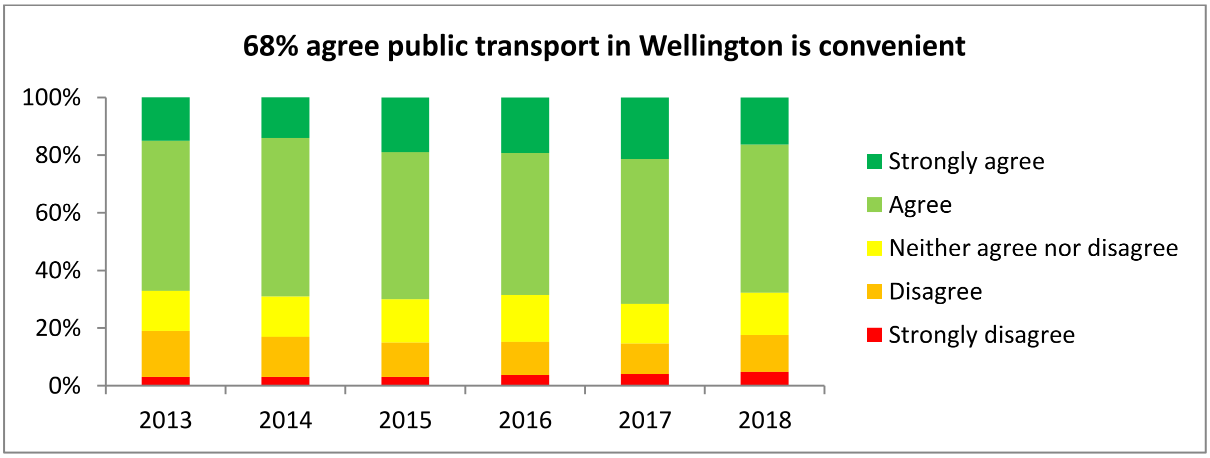


Figure 21 Agreement that Public Transport is Convenient

A slight majority say it's easy to drive around the city, but people are finding traffic volumes increasingly unacceptable, and report difficulties finding a convenient car park. The condition of the city's roads is considered good.

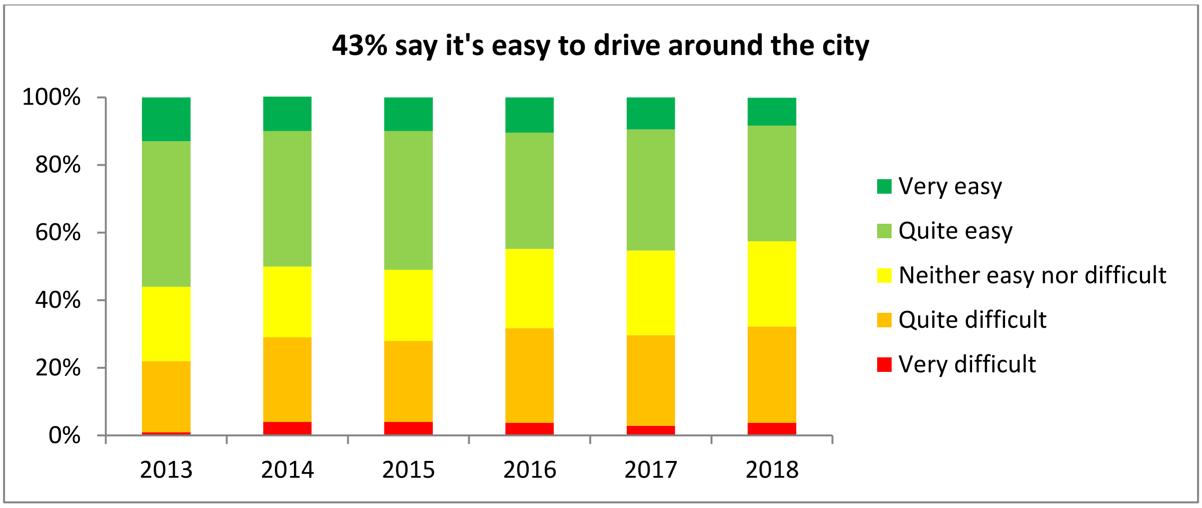


Figure 22 Agreement that it's Easy to Drive Around the City

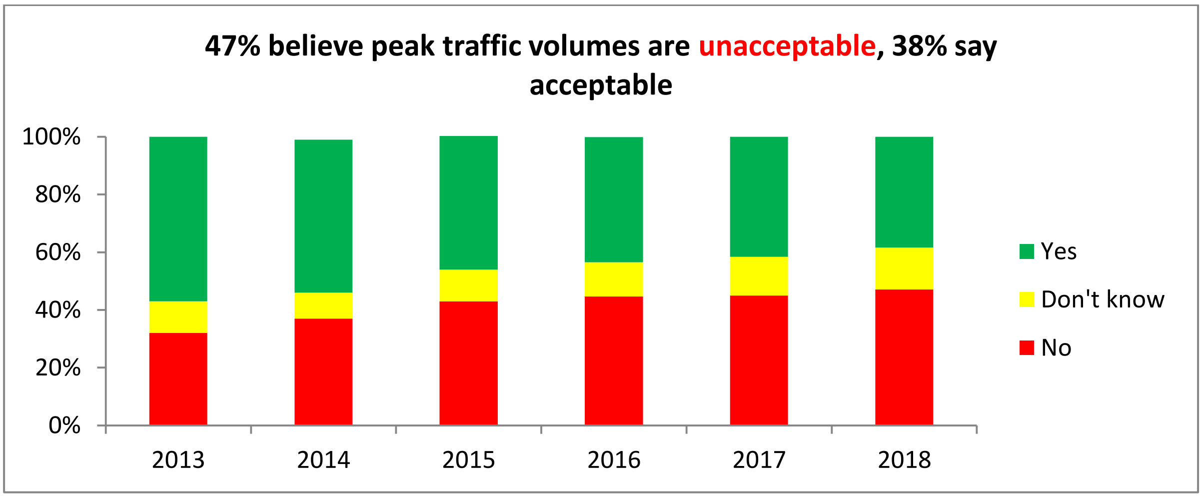


Figure 23 Agreement that Peak Traffic Volumes are Acceptable

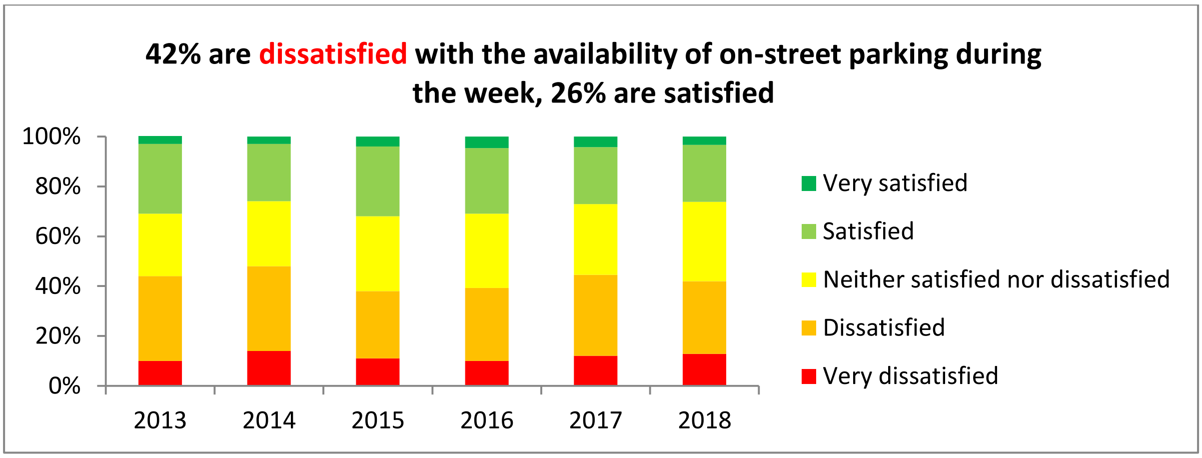


Figure 24 Agreement that On-Street Parking is Available

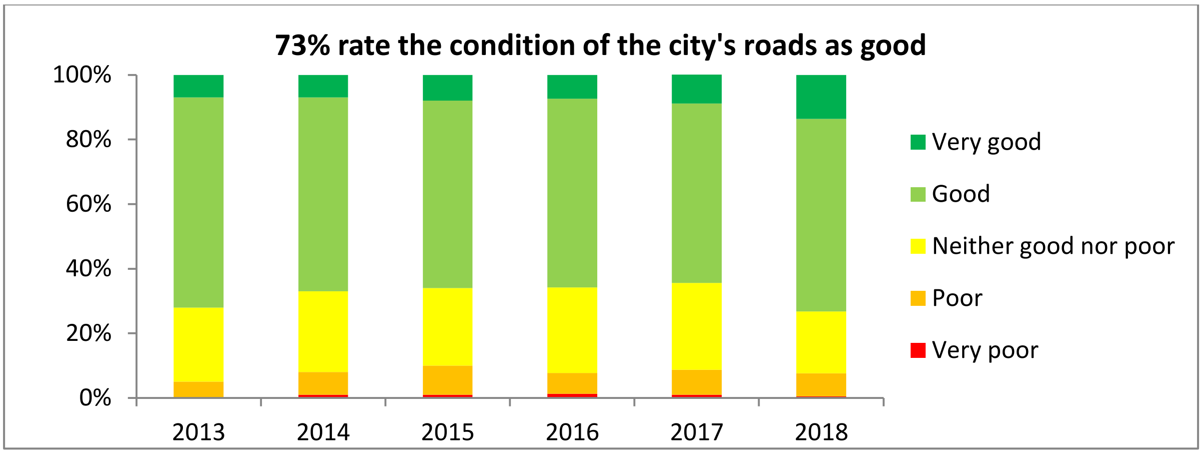


Figure 25 Agreement that the City's Road Condition is Good

Financial performance and non-financial performance

Results of financial performance and performance against key performance indicators are published in the Council's annual reports. For 2017/18 total operating expenditure on transport was $55.2 million, $2.5 million over budget. This was primarily due to higher storm clean-up costs and depreciation expenditure above budget. Capital expenditure (renewals and developments) was $55.2 million, $7.4 million underspent due to inability to deliver projects within projected timelines.

The following table is a summary of performance against the agreed outcome indicators and key performance measures for transport.

	OUTCOME INDICATOR TRENDS	KPI COMPARED TO TARGET	KPI COMPARED TO LAST YEAR
Positive result	3	7	5
Within 5% or no change	5	3	9
Not met or decreased	5	5	1
Not measured or not comparable	-	2	2

Response to Constraints and Issues

Impacts on the transport network

Trends since 2000 show a decrease in driving per person and an increase in levels of commuting by walking, cycling, and public transport. Although Wellington's population and employment levels have been increasing, the total amount of car travel, average journey times, and average travel speeds have remained relatively constant over the past decade. If recent trends continued until 2043, total car travel demand would only increase by 9% relative to 2001 and by 2% relative to 2013 levels. This is consistent with the recent plateauing of total car travel demand across the country. Following recent trends, we can also expect continued increases in levels of walking and cycling for transport in Wellington.

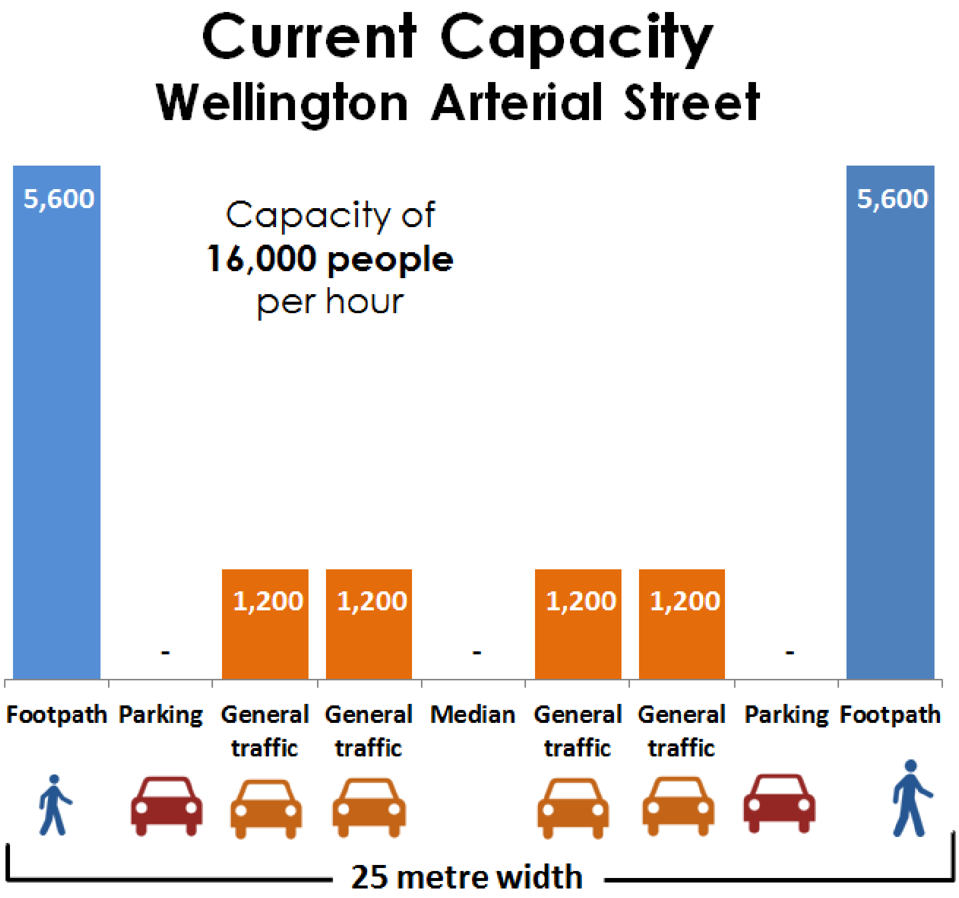
Although future overall traffic volume is uncertain, certain key corridors are becoming more heavily used. Increased volumes and vehicle loading create additional stress upon the road pavement structure, accelerating pavement defects such as cracking, rutting, shoving and reducing the asset life of both the pavement surface and structure. This is particularly a challenge given the large expected increases in heavy vehicles and public transport traffic volumes as heavy vehicles cause increased wear on roads.

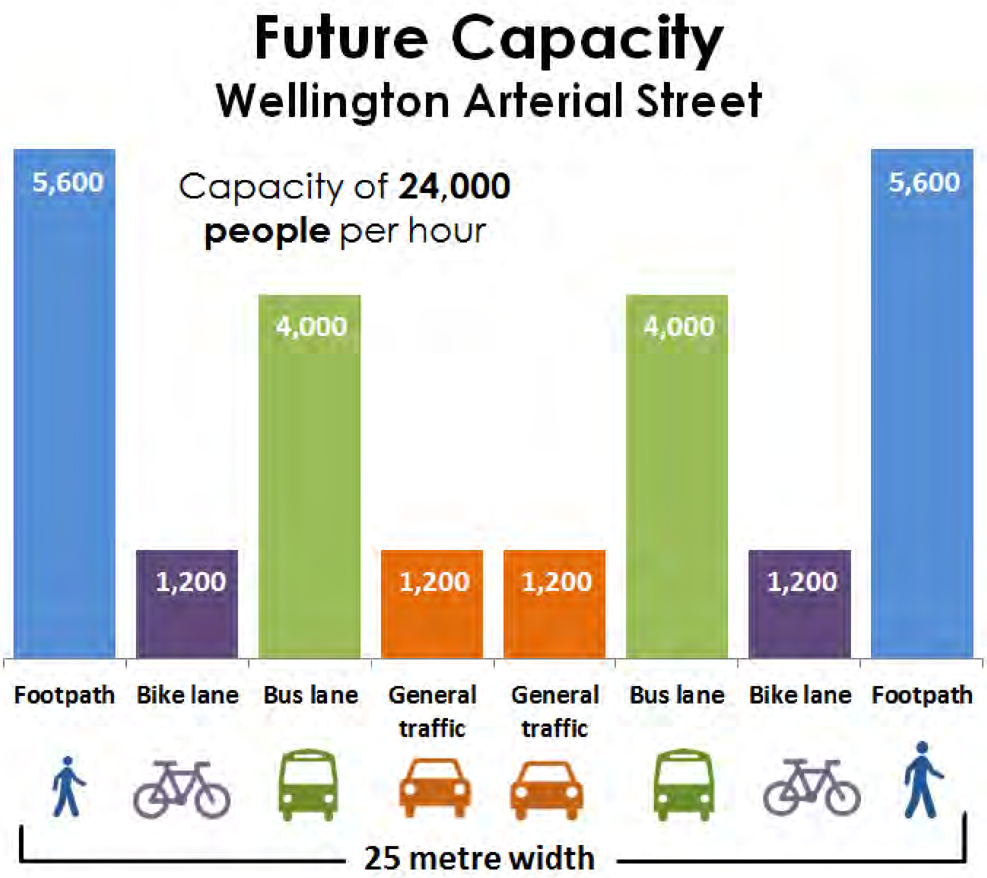
For roads that are expected to experience significant increases in traffic volumes, road reconstruction takes increased demand into account during the design process. There is also a risk that maintenance and renewal requirements will increase due to the increased demand. These factors will be considered in the life cycle asset management processes.

Growth and demand strategic responses

Options for increasing capacity for private vehicles are limited by constrained corridors that must accommodate a variety of transport modes. For example, traffic moving between the central city and southern suburbs such as Newtown and Island Bay has only two options, Taranaki Street via Wallace Street or Adelaide Road, both of which have capacity issues already. Increasing demand for walking and cycling presents a growing challenge to provide safety and amenity for these modes. As a result, limited road space must be shared between transport modes. Future investments need to take into account the constrained nature of the network and strike a balance between several transport modes.

Our strategic response is to reallocate space away from relatively inefficient general traffic and parking lanes to higher capacity transit modes. Moving more people by public transport, walking, and cycling, will allow us to move more people through constrained road corridors. The following diagrams illustrate this principle, showing that the capacity of a 25 metre wide arterial street can increase from 16,000 to 24,000 people per hour. Such a change will also provide health and sustainability benefits.


Current Capacity
Wellington Arterial Street
Capacity of
16,000 people
per hour
5,600
-
1,200
1,200
-
1,200
1,200
-
5,600
Footpath
Parking
General traffic
General traffic
Median
General traffic
General traffic
Parking
Footpath
25 metre width


Future Capacity
Wellington Arterial Street
Capacity of 24,000 people per hour
5,600
1,200
4,000
1,200
1,200
4,000
1,200
5,600
Footpath
Bike lane
Bus lane
General traffic
General traffic
Bus lane
Bike lane
Footpath
25 metre width

Increased traffic volumes are associated with a range of negative outcomes, including increased traffic congestion, increased travelling times, increased vehicle emissions, and increased costs for maintenance, renewal, and capital expenditure for the transport network. As a result, we will accommodate growth and demand through a variety of measures aimed at minimising these adverse outcomes. These measures include: development contributions, compact development policy, maintenance of the transport network, and pedestrian, cycling, and public transport improvements that encourage modal shift away from car travel and towards these modes.

Compact development policy

The Council's Urban Growth Plan and the Towards 2040 Strategy establish a future framework for the land use and the city's urban form. Both documents encourage urban containment and intensification, particularly medium and higher density dwelling housing developments around key suburban centres and on key transport routes. This approach will mean that development is focused in areas that are near shops and other destinations, thus minimising trip distances, and are in areas that are transit oriented and facilitate walking, cycling and public transport rather than car travel. The sustainable transport hierarchy introduced in the Urban Growth Plan places pedestrians as the highest priority in the transport system. Implementing this hierarchy in the decision-making process will increase walking and cycling levels while decreasing the negative external impacts of private vehicle travel.

Creating a dynamic central city is an essential part of a smart and green future for Wellington. The central city is the economic engine and cultural heart of the region. The Central City Framework gives a strategic direction for the growth and enhancement of Wellington's central city over the next 30 years. The aim is to create the physical environment to support a 'dynamic central city' - one that's built for people. A city that's attractive and green, with high quality buildings, parks and squares. This approach will enable more people to live in the central city, where car travel demand is lowest and walking rates are the highest. This will both reduce travel demand on the transport network and ensure that our city is liveable and vibrant.

Let's Get Wellington Moving

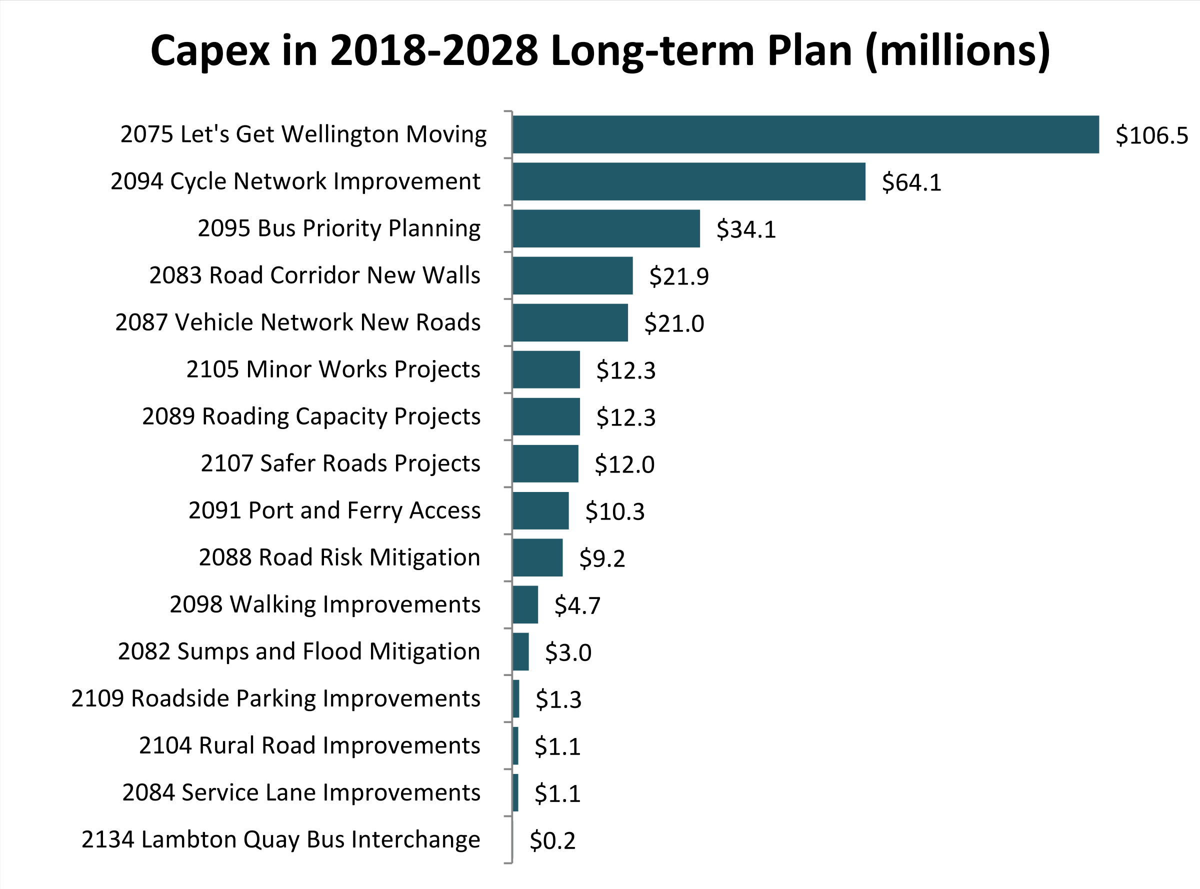
The Council is working with NZTA and Greater Wellington Regional Council on the *Let's Get Welly Moving* project to develop a strategic response to transport issues between Ngauranga and the airport. The Let's Get Wellington Moving programme is about improving the outcomes of liveability, economic growth and productivity, safety and resilience. It is taking a whole of system approach to examining transport between Ngauranga and the airport, and its interaction with land use. An implementation plan is being developed with significant community input and is anticipated to become clear in early 2019.

Planned and/or Budgeted Improvements

The Council implements its capital works programme to respond to growth and demand and to contribute to achieving its strategic priorities. These priorities have been identified by taking into account strategic priorities set out in the Government Policy on Land Transport, the Council's Long-term Plan, and the Council's Urban Growth Plan.

Specific programmes are discussed below.

Transport improvements over the next 10-years are focussed on addressing priority resilience and safety shortcomings. The following capital investment (CAPEX) in transport upgrade projects has been included in the 2018-2028 Long-term Plan. The total investment is $315 million over 10 years.



This investment is summarised in the following table and chart.

Upgrade Budget ($)	Actual		Forecast Investment			
	2016/17	2017/18	2018/19	2019/20	2020/21	7 years to 2027-28
Recommended AMP			29,113,032	25,761,553	14,406,510	245,574,768
Approved LTP	7,408,525	23,761,279	29,113,032	25,761,553	14,406,510	245,574,768
Funding gap	-	-	-	-	-	-

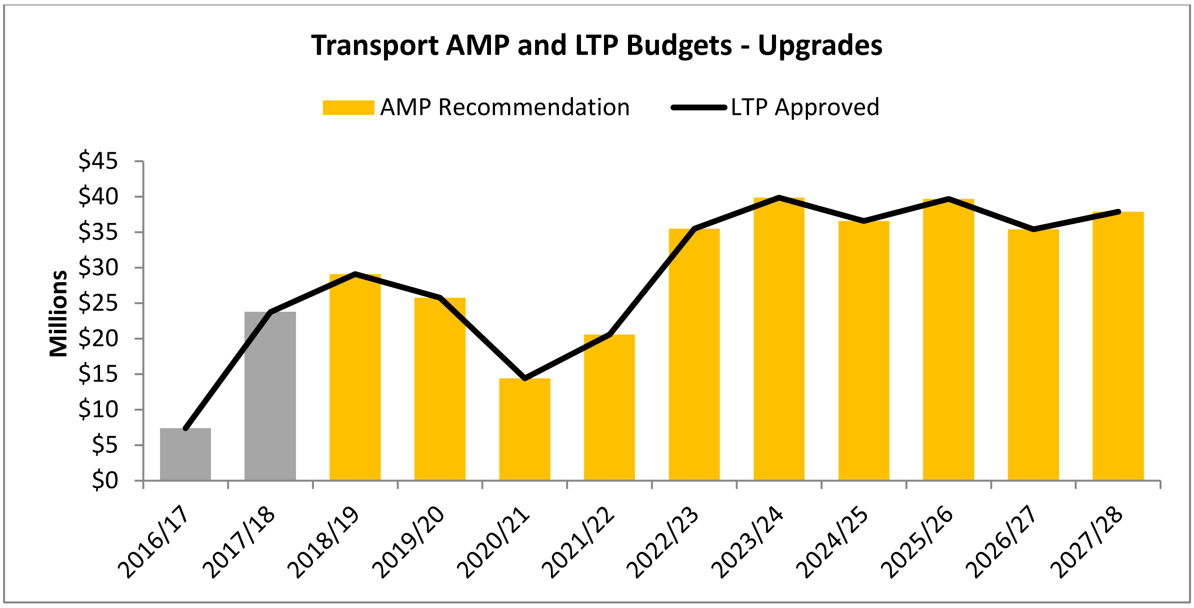


Figure 26 AMP and LTP Budgets - Upgrades

The current long-term plan provides sufficient funding for current demands and identified transport upgrade projects, so there is no funding gap. If growth planning identifies future transport pressures in corridors not addressed by the current programmes (e.g. Karori), funding will need to be sought through future Long-term Plan processes.

Let's Get Wellington Moving

Only nominal funding has so far been provided in the current long-term plan as the recommended programme of investment and the share to be met by Wellington City Council is still being determined. Clarity is anticipated in early 2019.

Walking and cycling improvements

As the city grows, there will be increasing numbers of people on bikes and an increasing number of pedestrians. There is evidence[4] that there is an unmet demand for walking and cycling in the city, so service improvements in these areas can potentially decrease demand for driving as more people are able to walk and cycle for their transport needs. Meeting this demand for walking and cycling is a cost effective response to increasing travel demand, as travel by these modes is significantly less resource intensive than car travel. Given limited space, we need to manage and balance the needs of different users of the road corridor to maximise benefits while minimising costs. We are in the process of implementing a significant cycleways programme that will provide connections between the suburbs and the central city, and will thus allow more people to bike to work and reduce reliance on car travel.

Public transport

The Council will continue to work with Greater Wellington Regional Council, as the city's public transport provider, to provide more frequent, reliable, connected, and affordable public transport services, including at weekends, with integrated fare options to enable a modal change to help reduce congestion.

[4] Cycling Demand Analysis 2014.

We plan to create bus priority lanes over the next 10 years if this approach is endorsed by the Let's Get Wellington Moving project. New priority bus lanes and measures have been identified for the following areas and will continue to be implemented as resources allow.

Potential focus areas include:

- Thorndon Quay and Hutt Road
- The Golden Mile between the Wellington Railway Station and Courtenay Place
- Kent and Cambridge terraces
- Adelaide Road
- Victoria Street
- Willis Street
- Karori route
- Taranaki Street

The Long-Term Plan also includes some funding to assist in the development of Wellington Bus Interchanges in Kilbirnie, Miramar, Karori, Johnsonville, Brooklyn, Newtown, and Island Bay.

Resilience improvements

The Council has, for many years, had an ongoing programme to improve the resilience of key routes and critical assets. Three of the city's four road tunnels have been seismically strengthened and the last one is planned to be strengthened in the current financial year. A programme to strengthen walls supporting the road in Ngaio Gorge is nearly complete with one wall remaining. A new programme is being developed to improve the resilience of critical routes for emergency response, under the umbrella of the Regional Transport Resilience Programme, and the Earthquake-Prone Priority Buildings Programme.

Linkages to State Highway Developments

There are currently no significant State Highway developments proposed within the Wellington City boundary. The completion of Transmission Gully is scheduled for 2020 but capacity constraints south of Porirua will limit traffic growth south of the project, and planned investments in cycleways, a new bus network, and rail upgrades will provide additional capacity for travel to and from Wellington.

The Council is working in partnership with Greater Wellington Regional Council and the New Zealand Transport Agency to identify an integrated improvement programme for the corridor between Ngauranga and Wellington airport. Clarity is anticipated in early 2019.

The Council strongly supports the development of a new strategic route linking Petone to Grenada. The east/west corridor is proposed to increase resilience of the roading network, and increase connectivity between Porirua and the Hutt Valley. The Transport Agency is reviewing the project to ensure that it will deliver on the Government's objectives, and address the severe resilience risk of isolation faced by people in parts of Wellington and the Hutt Valley. This route is considered vital to support critical access needs. It will also open up opportunities for employment and higher intensity land use development in the Lincolnshire Farm area.

The Council is working with CentrePort, KiwiRail, Greater Wellington Regional Council and the New Zealand Transport Agency to identify improvements to the port access and resilience. It is not yet clear what the scope, form or timing of improvements will take.

Assessment of Existing and Anticipated Constraints

The large amount of activity on the city's constrained transport system is starting to impact on Wellington's liveability, and its economic growth and productivity.

Wellington's transport problems include:

- Growing traffic congestion and unreliable journey times
- Poor and declining levels of service
- Safety issues, especially for cycling and walking
- Vulnerability to disruption from unplanned events

The very constrained nature of most of the city's main transport corridors means that in general corridor widening to expand capacity is unrealistic.

Greater Wellington Regional Council has reviewed outputs from the Wellington Transport Strategic Model (WTSM) and provided a high level summary of a 2036 High Growth future scenario to inform this analysis[5] (refer Attachment 1). The model indicates morning peak transport demands increasing by 21 percent for car trips and 41 percent for public transport trips overall, and for trips to the CBD car trips increasing by 15 percent and public transport trips by 58 percent.

The analysis examined forecast demands on key corridors. It showed:

- at an aggregate level there is forecast to be a 20 percent increase in persons using key corridors into Wellington City on a daily basis between 2013 and 2036 under a high growth scenario
- public transport passenger volumes on the selected corridors are forecast to increase by over 40 percent (inbound) compared to a 16 percent forecast increase in persons in cars, a function of:
    - the forecast assumptions (continuation of recent trend with growth in trips to CBD accommodated by public transport and active modes)
    - a constrained road network (particularly at peak times)
    - parking capacity constraint in Wellington CBD
- public transport growth is forecast to be particularly strong from the north, with 40 percent growth in bus passenger along Hutt Road and a 50 percent increase in rail passengers heading into the CBD

These forecast transport demands have been taken into account by the Let's Get Wellington Moving project. The strategic response to growth pressures is to focus on moving more people with fewer vehicles and encouraging urban development alongside transport investment. Before doing anything else we will:

- Find ways to get more out of the existing transport system and make it safer to use
- Encourage people to walk, use public transport, and cycle for more trips, and make fewer trips by car

We will do this by delivering on our strategic interventions:

- Encourage mode shift to walking, cycling, and public transport

[5] Wellington City NPS Analysis, Greater Wellington Regional Council.

- Enable mode shift with key changes to walking, cycling and public transport infrastructure, and land use policies
- Create dedicated/priority routes to support key changes
- Reduce road space for general traffic on dedicated/priority routes
- Manage the network to limit increases in general traffic and operate the network safely and efficiently
- Relocate general traffic away from the central city to an improved bypass route

Assessment of whether development capacity is serviced with transport infrastructure

Let's Get Wellington Moving is focused on the corridor from Ngauranga to Wellington airport. Depending on the investment package, growth in transport demands from the north, centre, south and east will be provided for to varying degrees. Growth in the west is not provided for. Growth in the Lincolnshire and Stebbings areas is partially provided for with GWRC's planned investment in rail improvements but is likely to require improvements to local roads and intersections, and enhanced public transport connections to the bus and rail networks.

Assessment of whether development infrastructure required to service development is identified in the Council's Long-term Plan, or Infrastructure Strategy

Business as usual transport programmes, including some capital development projects, are provided for in the Long-term Plan (see roading improvements above), and Infrastructure Strategy. However, the large scale investment likely to be necessary to support Wellington City Council's share of the Let's Get Wellington Moving Recommended Programme of Investment is yet to be determined and fully provided for. Investment to improve the corridors to the western suburbs (e.g. Karori) has not yet been identified or provided for.

Attachments

1. Wellington City NPS Analysis, GWRC, 29 January 2019

FILE NOTE

DATE 29th January 2019

AUTHOR Andrew Ford

SUBJECT Wellington City NPS Analysis

Overview

Wellington City Council (WCC) are developing inputs to the National Policy Statement (NPS) on Urban Development Capacity (UDC).

One component of this assessment is future forecasts of vehicle traffic and public transport patronage on local roads, to be used to inform the development of the NPS on UDC and identify constraints that may justify further investigation and possible future investment.

This note provides a high level summary of a 2036 High Growth future scenario to inform the analysis

Background and assumptions

The modelling work has been undertaken using the following scenarios:

- WTSM and WPTM 2013 – base model
- WTSM and WPTM 2036 - trend future, high population growth

At a high level, the forecast assumptions are as follows:

- **Trend future** – Model parameters and outcomes reflect a continuation of recent trend growth with reference to commuter trips to Wellington CBD in the AM peak (all future growth in peak hour trips to Wellington CBD assigned to active modes or PT)
- **High population and employment growth** – As summarised in Table 1, assumes a 35% increase in population within Wellington City and 32% increase in employment:
    - 100% growth in population within CBD (~25,000 additional residents)
    - Over 20,000 additional residents in northern Wellington, with 10,000 to 15,000 additional residents in Wellington's southern and eastern suburbs
- **No additional highway infrastructure** (compared to base year) apart from Mackays to Peka Peka Expressway and Transmission Gully
- **Bus network** assumed to be current 2018 bus network (as implemented in July 2018)
- **Rail network** assumed to be current 2018 rail network and frequencies

Table 2 Population and employment growth – high growth-redistributed scenario

	Population		Employment	
	Base	**2036**	**Base**	**2036**
WCC – CBD	26,500	50,000	93,500	124,000
WCC - Northern suburbs	62,500	85,000	15,500	18,500
WCC - Southern suburbs	40,500	55,500	11,000	14,000
WCC - Eastern suburbs	40,000	50,500	11,500	16,000
WCC - Western suburbs	31,000	33,500	5,000	6,500
Wellington City Total	**200,500**	**274,500**	**136,500**	**179,000**
Kapiti	50,500	63,000	14,000	16,500
Porirua	53,500	67,500	15,000	17,500
Lower Hutt	101,000	107,000	40,500	42,500
Upper Hutt	41,500	50,000	11,500	13,000
Wairarapa	42,500	44,000	17,500	17,000
Total	**489,500**	**606,000**	**235,000**	**285,500**

Model limitations

There are a number of limitations that should be borne in mind when interpreting the model outputs:

- All forecasts contain an inherent level of uncertainty, and are dependent on the eventuation of a series of assumptions and relationships made at one point in time; outputs should therefore be interpreted as being indicative of a range within which the outcome might sit, with the range increasing the farther into that future that you are forecasting
- WTSM does not model and account for capacity constraints on public transport; therefore additional analysis is recommended to understand whether the public transport network (as modelled) has the capacity to carry the forecast demand
- WTSM has a very coarse representation of active modes (walking and cycling) and it is recommended that simplified analysis outside of WTSM be used to develop estimates of future walking and cycling numbers
- WTSM models a 2hr period and has a relatively simplistic method of modelling intersection delays; as a result, WTSM will probably underestimate the level of congestion and increase in delays generated by the forecast increases in traffic volumes, particularly during the peak of the peak
- WTSM and WPTM are strategic models, calibrated and validated in 2013 to a level that is appropriate for their given strategic purpose; at an individual link level, observed car and PT passenger volumes might not exactly reflect reality, therefore it is recommended that when interpreting outputs the focus should be the relative difference between base / option as opposed to absolute numbers or absolute differences
- Both WTSM and WPTM have a 2013 base year; between 2013 and 2018, there has been rapid population growth and increases in traffic and PT volumes (particularly rail), therefore it is recommended that this recent growth should again be borne in mind when interpreting model forecasts
- The underlying relationships upon which WTSM is based are 17 years old, with an update planning for the next couple of years; therefore WTSM outputs should be interpreted with caution, particularly in relation to the following observation:

- WTSM over-estimates base and forecast growth in car trips within Wellington CBD (and indeed shorter distance car trips in general), with these trips assigned by the model as car trips whereas in reality they are more likely to be walking trips

Model results

This section presents results from the modelling work as follows:

- High level metrics covering Wellington region
- More detailed corridor analysis (daily figures, in persons)

High level metrics

Table 2 below summarises the high level metrics extracted from WTSM for the model runs in question. The table presents the following for the AM peak and annually respectively:

- car trips (vehicles), PT trips (passengers), car and PT mode share
- car trips to CBD (vehicles), PT trips to CBD (passengers), car and PT mode share to CBD

For the car and PT trips, the percentage increase is the forecast change (growth) between base 2013 and 2036 (high growth). For car and PT mode share, the percentage increase reflects the percentage point change between 2013 and 2036 forecast (i.e. car mode share decreasing from 93.2% to 92.6% is a 0.6 percentage point decrease).

Table 3 High level summary – WTSM outputs, 2013 and 2036 (High)

	AM peak				Annual (000s)		
	Base 2013	2036 High	% increase		Base 2013	2036 High	% increase
	90801	70100	70100		90801	70100	70100
Car Trips	164,528	198,999	21%		397,198	497,504	25%
PT Trips	31,954	45,042	41%		29,102	39,728	37%
Car Mode Share	83.7%	81.5%	-2.2%		93.2%	92.6%	-0.6%
PT Mode Share	16.3%	18.5%	2.2%		6.8%	7.4%	0.6%
Car Trips to CBD[6]	28,077	32,333	15%		53,089	70,455	33%
PT Trips to CBD	18,473	29,205	58%		8,490	13,219	56%
Car Mode Share to CBD	60.3%	52.5%	-7.8%		86.2%	84.2%	-2.0%
PT Mode Share to CBD	39.7%	47.5%	7.8%		13.8%	15.8%	2.0%
Car veh.km	1,421,839	1,645,662	16%		2,760,583	3,361,367	22%
Car veh.hr	32,811	39,841	21%		59,114	74,804	27%
PT pax.km	511,839	759,856	48%		407,490	605,018	48%

The model outputs show the following:

[6] Includes car trips within CBD; previous analysis has shown that WTSM overestimates car trips within the CBD (both in the base and future), therefore the increase in car trips to the CBD is likely to be lower than forecast by the model; this limitation should be borne in mind when interpreting this high level information, it is estimated that the forecast % increase in car trips to the CBD(excluding car trips where the origin is also in the CBD) would be around 15% between 2013 and 2036

- there is forecast to be a 25% increase in regional annual car trips and ~40% in regional annual PT trips between 2013 and 2036
- focussing on Wellington CBD in the AM peak, there is forecast to be a 15% (see Note 1) increase in car trips to the CBD and a 60% increase in PT trips to the CBD
- across the regional, car vehicle kilometres and car vehicle hours are forecast to increase by between 20% and 30% whilst PT passenger kilometres are forecast to increase by around 50%

High level metrics

Table 3 below provides an estimate of daily car and PT trips (in persons, by direction) along key corridors into Wellington City for the 2013 base and 2036 high growth scenario.

The estimates have been obtained from WTSM (car vehicles) and WPTM (PT passengers) and aggregated across all modes and expressed as persons (assumed vehicle occupancy in 2013 and 2036 of 1.35).

Table 4 Daily Car and PT volumes for key corridors in Wellington City, 2013 and 2036 high growth (persons, 000s)

		2013			2036 High			% change		
		Car vehicles (000s)	PT pax (000s)	Total persons (000s)	Car persons (000s)	PT pax (000s)	Total persons (000s)	Car persons	PT pax	Persons
SH1 @ Ngaio	IB	41.6	1.2	57.3	48.0	1.7	66.4	15%	42%	16%
	OB	38.2	0.9	52.4	46.9	1.0	64.3	23%	11%	23%
Rail @ Wellington Station	IB	0.0	14.9	14.9	0.0	22.2	22.2		49%	49%
	OB	0.0	11.7	11.7	0.0	15.6	15.6		33%	33%
Hutt Rd @ Ngaio Gorge	IB	13.7	4.2	22.8	15.2	6.0	26.6	11%	43%	17%
	OB	12.3	2.9	19.6	12.7	4.1	21.3	3%	41%	9%
Wadestown Rd @ Tinakori	IB	5.8	0.6	8.4	6.8	0.7	9.9	17%	17%	18%
	OB	5.3	0.3	7.5	6.3	0.4	8.9	19%	33%	19%
Glenmore @ Bowen	IB	9.6	2.0	15.0	11.0	2.7	17.6	15%	35%	17%
	OB	8.6	1.3	13.0	9.6	1.6	14.5	12%	23%	12%
Kelburn Parade @ Kelburn	IB	4.4	1.4	7.4	4.6	1.2	7.4	5%	-14%	0%
	OB	6.1	2.1	10.3	7.2	0.8	10.5	18%	-62%	2%
Brooklyn @ ICB	IB	3.0	0.9	4.9	3.3	1.7	6.2	10%	89%	27%
	OB	5.8	1.4	9.2	6.0	1.2	9.4	3%	-14%	2%
Wallace St @ Webb	IB	7.7	2.2	12.6	10.6	3.1	17.4	38%	41%	38%
	OB	14.1	1.7	20.7	16.1	2.3	24.0	14%	35%	16%
Adelaide Rd @ Basin	IB	13.9	3.9	22.6	17.6	4.0	27.8	27%	3%	23%
	OB	8.0	2.6	13.4	11.4	2.7	18.1	43%	4%	35%
Mt Vic Tunnel	IB	18.0	0.0	24.2	19.0	0.0	25.7	6%		6%
	OB	19.1	0.0	25.8	19.9	0.0	26.8	4%		4%
Bus Tunnel	IB	0.0	2.8	2.8	0.0	4.9	4.9		75%	75%
	OB	0.0	1.9	1.9	0.0	3.1	3.1		63%	63%
Oriental @ Chaffers	IB	6.3	0.5	9.0	7.3	0.7	10.5	16%	40%	17%
	OB	6.1	0.4	8.6	7.7	0.4	10.9	26%	0%	27%
	IB	**124.0**	**34.6**	**201.9**	**143.4**	**48.9**	**242.6**	**16%**	**41%**	**20%**
	OB	**123.6**	**27.2**	**194.1**	**143.8**	**33.2**	**227.4**	**16%**	**22%**	**17%**
Total		**247.6**	**61.8**	**396.0**	**287.2**	**82.1**	**470.0**	**16%**	**33%**	**19%**

In summary, the outputs show the following:

- at an aggregate level there is forecast to be a 20% increase in persons using the corridors in question on a daily basis between 2013 and 2036 under a high growth scenario

- PT passengers volumes on the selected corridors are forecast to increase by over 40% (inbound) compared to only a 16% forecast increase in persons in cars on the corridors in question, a function of
    - the forecast assumptions (continuation of recent trend with growth in trips to CBD accommodated by PT and active modes)
    - a constrained highway network (particularly at peak times)
    - parking capacity constraint in Wellington CBD
- PT growth is forecast to be particularly string from the north, with 40% growth in bus passenger along Hutt Road and a 50% increase in rail passengers heading into the CBD

Whilst the overall forecast growth in people crossing the cordon (~20%) is less than the forecast growth in population within Wellington City (~35%) there are a number of explanations for this:

- A significant proportion of population growth is forecast to occur within Wellington CBD, with the increase in trips (mainly walking) generated by this growth not captured by corridor volumes
- Population growth in areas outside of Wellington CBD will generate shorter distance local trips that do not impinge on the CBD

Whilst difficult to accurately estimate from WTSM, high level model metrics suggest a 25% to 30% increase in annual car trips and 45% to 50% increase in annual PT trips to / from and within Wellington City between 2013 and 2036 under a high growth scenario.

Appendix 2.4

National Policy Statement – Urban Development Capacity

Open Space and Recreation

27th February 2019

1 PURPOSE

This paper sets out the current issues and opportunities in planning for and delivery of parks, open space and recreation outcomes in Wellington City as the city considers spatial planning and how to accommodate population growth. The Council's assessment for the purposes of the National Policy Statement on Urban Development Capacity (NPS-UDC) requires consideration of open space and recreation facilities and assets as part of the infrastructure that will support urban development.

2 SETTING THE SCENE

2.1 Parks, Recreation and the Natural Environment in Wellington

Wellington City has a population of over 212,700 people (ERP 2017). The city has a strong natural environment setting underpinning the character of the city and the quality of life and identity of the people who live and work in Wellington.

There is over 4200ha of reserve land in Wellington City across a range of different types of open space with a broad range of associated values. Wellington has a 2500ha Outer Green Belt reserves network at its western edge and a harbour and coastal open space network, that coupled with the Wellington Town Belt and suburban and city parks, provide potential to support a growing city set in a natural environment.

The city is a "Natural Capital" due to the natural environment and the nature-driven attractions and is a national leader in natural environment management. Natural capital is the stock of natural assets, which includes biodiversity as well as earth, air, and water. Cities depend on a healthy natural environment that continuously provides a range of benefits, known as 'ecosystem services'. Healthy ecosystems are the foundation for sustainable cities, influencing and affecting human well-being and most economic activity. These include for example the provision of drinking water, air quality, carbon sequestration, stabilising land and water retention. They also include human health associated with interaction with the natural environment and opportunity to build community and sense of place.

Residents in Wellington consistently agree that Wellington's connection with nature improves residents' quality of life[1]. *Our Natural Capital* is Wellington's award winning biodiversity strategy that guides the ongoing protection and enhancement of the cities 'natural capital' so that it can thrive both for its own sake and continue to support the function of the city and the people and communities who live here. Wellington is well placed to build on the integration of natural environment systems into planning for change and growth across the city and take maximum advantage of an 'ecosystem services' approach to urban planning and the range of benefits that approach can provide.

The range of parks, open spaces and associated recreation facilities in Wellington and the proximity of people to this network contribute to making Wellington a unique place to live, work and play. The open space and recreation network in Wellington is a point of difference and will support the city in maintaining high measures of economic, environmental and social success.

[1] Annual WCC residents monitoring survey has respondents agree or disagree with this statement and levels of agreement are consistenly over 90%

It is important that the network of open space and recreation facilities grows and improves in response to the changing needs of the city. As the population increases there will be increased pressure on capacity of some sport and recreation facilities (for example sportsfields and neighbourhood parks).

Wellington City Council invests in open spaces and facilities because it is important to council's wider objectives. It contributes to a range of health, social, environmental and economic benefits, many of which are not measured or accounted for in considering this investment alongside other priorities.

The existing open space and recreation policy needs review and refinement to better address the key issues in Wellington today including population growth (spatially) and understanding which parts of the community are growing and what their particular needs are. For example there is proportionally higher growth predicted in the numbers of young adults (15-30yrs) and older adults (55 years plus). There is increasing investment and uptake in active transport, the city is considering how to respond to climate change and develop resilient three waters infrastructure.

2.2 'Four Capitals' as a measure of success and the role of Parks, Open Spaces and Sport and Recreation facilities

At a central government level The Treasury Living Standards Framework (LSF) sets the scene for a broader set of measures across four 'capitals' being used to understand long-term wellbeing alongside traditional, more narrowly focussed measures of economic success such as GPD for example.

There is ongoing interest in how the natural environment and parks and recreation areas fit with this framework and how outcomes can be measured given the existing and well understood contribution these spaces and places make to social, human, natural and financial/physical capital, as described in the LSF.

As the primary providers of significant areas of parks, open spaces and recreation and sports facilities and programmes, local authorities have potential for high impact in contributing to the long-term wellbeing of the country across the 'four capitals'.

2.3 Wellington City Council's strategic direction

In Wellington City, Wellington 2040, the Urban Growth Plan, the current Long Term Plan and the Lets Get Wellington Moving work all include multiple focus areas that capture Council's strategic direction.

A well located, high quality, multifunctional parks and open space network leads or contributes to success across all of these focus areas and will enable city growth that aligns with both national and local aspirations for 'long term wellbeing' in the broadest sense.

Wellington's strategic direction around parks and open spaces, recreation and the natural environment is set through *Our Capital Spaces* (the Open Spaces and Recreation Framework) and *Our Natural Capital* (Biodiversity Strategy). There are eight Reserve Management Plans, prepared as required by the Reserves Act 1977, that cover all the existing parks across the city. The management plans include objectives and policies around landscape, recreation, ecology and indigenous biodiversity, culture and history and community groups and partnerships as they relate to the parks. There is limited information around planning to respond to growth in any of the reserve management plans with the exception of the Northern Reserves Management Plan however this plan needs review being over ten years old[2].

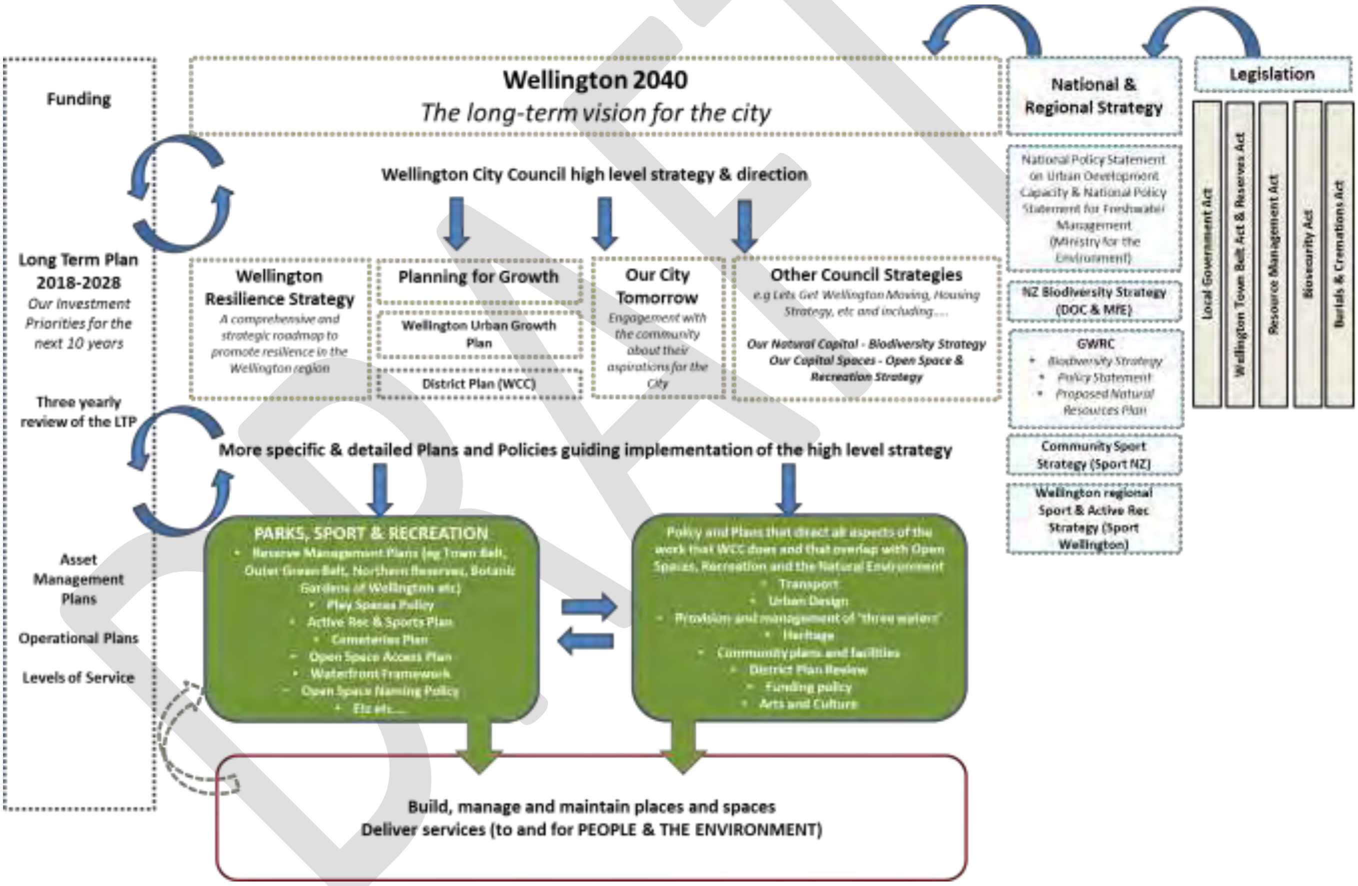
Our Natural Capital is Wellington's biodiversity strategy that guides the ongoing protection and enhancement of the cities 'natural capital' so that it can thrive both for its own sake and continue to support the function of the city and the people and communities who live here.

[2] The Reserevs Act 1977 suggests reserve management plans are reviewed at least every ten years.

The Councils Play Spaces Policy has a set of 'Priorities' that apply to all areas in the city and that will need consideration when planning for growth. The Open Space Access Plan is the tracks network plan. While it has a parks focus it needs to be integrated into walking and biking networks across the city.

There are other policies that determine how places and spaces are provided for, used and managed (eg the Community and Recreation Leases Policy) and Asset Management Plans that determine investment and funding and levels of service. The current strategic fit of open space and recreation planning is captured in the diagram below.

All of the plans and policies are under continuous rolling review. This can lead to plans becoming quickly out of date in times of rapid change or pace of development and city growth. A recent change to population growth predictions and a proposed District Plan review will require review of many of these plans and polices, in particular in the area of provision of open space and facilities and the response to growth across the different areas of the city (i.e inner city, suburban and greenfields areas). Funding policy will also need to change to respond to identified changes in level of service.



3 OPEN SPACE AND RECREATION PROVISION

3.1 Open Space

Wellington City currently has a network of over 4200ha of reserves and a total of 365km of tracks. Our Capital Spaces, the Open Space and Recreation Strategy for Wellington, has only one very basic measure of provision with a guide of *600m or 10 minutes' walk to one or more neighbourhood park, play space, or other outdoor recreation opportunity such as a track link*. This measure is set against an outcome that *open spaces and outdoor recreation opportunities are close to where people live.* Analysis of existing urban areas in Wellington shows the 73% of areas zoned for residential development meet this provision target[3]. New housing areas will require provision of open space as they develop and it is increasingly difficult to get quality open space through the subdivision and development process. This provision target does not consider population density.

The city wide park network provision mapping does not take account of open space quality. In considering provision there is a measure of geographic spread but the measures are not fine grained enough to capture the different types of open space and the quality of those. This is particularly important in areas of population growth as it would be possible to have met the current provision target but the provision being 'counted' is a small neighbourhood park that does not have capacity to provide a useful space for a higher population density or was never developed for neighbourhood park use or to service the current community.

There are national statistics for parks provision based on population[4]. Wellington City has 18.8ha of open space/1000 residents (national median 17.3ha) however the city has 2ha/1000 residents of actively maintained parks (national median 8.8ha) and 1.1 ha of sports parks/1000 residents (national median 2.3ha). These are not provision targets but provide useful national comparison.

Analysis of geographical spread and area per head of population reflects that while Wellington City has a good overall area of parks, a large portion of those are hillsides, gullies and other areas that while they have significant landscape and ecological values they often have limited use for recreation purposes. This is a unique characteristic of the Wellington parks network. It means that the neighbourhood and community park type spaces have to work very hard to provide for the recreation and amenity needs of residents and there is a high likelihood that as the city grows new parks and/or investment will be required to improve the quality of existing parks[5]. It also means the walking track network plays an important role in meeting the recreation needs of city residents and that the city is well placed to make the most of the high quality landscape and ecological function of the parks network.

As with provision measures based on geographic spread, population measures do not take account of the different types of reserves and the spectrum of values they provide across ecology, human health and wellbeing, economy and social and cultural outcomes. More work is required on provision of different types of open space and what these provide as a network of spaces with a range of values (eg nature for nature sake, ecosystem services to the city and people, recreation, human health and wellbeing, climate change resilience and economy). We don't have measures that determine what open space provision (either geographic spread measures or population based measures) would maximise the value of the parks network across the different parts of the city as it changes.

The graphic below (Figure 1 – Open Space by Category) shows the high proportion of the open space network that is in the 'nature' category. As described, this is a point of difference in Wellington and provides for the ongoing development of a city with a natural landscape setting and potential to capitalise on ecosystem services that these places provide. There is however an issue with the quantity and quality of flat useable open space for recreation. While the Outer Green Belt and the Wellington Town Belt provide a good foundation, the network of sports fields, community parks and neighbourhood parks is compromised by the quantity, location and current quality of many of those spaces. For example, a high number of the city's sports fields are located in gullies that have been filled by historic landfill and left a flat space that was turned into a park. Many of these have ongoing management, maintenance and capacity issues related to that history.

Many of the neighbourhood parks are the result of residential development over the years and provision of open space based on negotiations over development approval. They are not always well

[3] Network analysis that includes all Wellington Town Belt, neighbourhood and community parks but exludes track connection points as they are so variable in quality that including them would not provide an accurate assessment of actual provision of open space and recreation opportunity for the general population.
[4] Yardstick collects data from participating Local Authorities.
[5] Quality improvements can include for example purchase of land to increase the size and/or layout of the park, redesign, increase in facilities and increase in mainteance.

located or of a quality that can meet the needs of the neighbourhood as it grows and changes. Opportunities to improve city and suburban parks through purchase of additional land and/or redesign and higher maintenance requirements will need to be considered in response to growth scenarios.

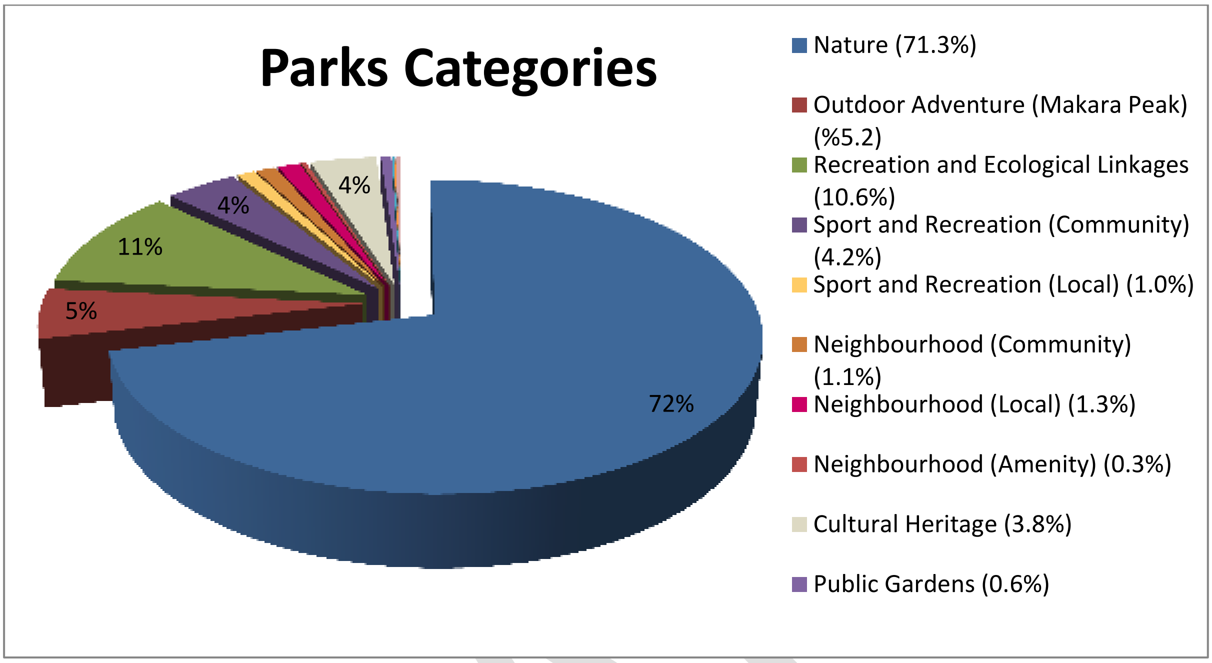


Figure 1 – Open Space by Category

Wellington City Council funds some redevelopment of parks and open spaces that will help meet the needs of population growth in specific areas. The current Long Term Plan includes two significant park redevelopments. There is however no ongoing funding for any other open space improvement projects associated with population growth or urban intensification[6]. This is because there is currently no clarity, as described above, about what the response needs to be to provide for population growth and no estimate of what that might cost over time. We do not currently know how many new parks are required and/or what improvements are needed to the existing parks network and where the focus areas should be across the city.

The parks provision and funding response associated with greenfields development will be different to suburban infill which in turn will be different again to inner city residential development. Planning to inform Development Contributions has not been completed to consider funding for parks purchase and development and/or increased maintenance costs across the city in response to population growth.

There is currently no clear policy direction in relation to what type of green open spaces the inner city needs, where and what the function of each might be. These spaces also generally need high levels of maintenance and renewal to ensure they can cope with high levels of use and meet expectations for the way the inner city parks look and function. There is a piece of research underway to help clarify the issues and opportunities for change for central city parks planning. Similar work is required to understand provision of sports and recreation spaces and places in the inner city in response to predicted residential population growth and the existing high (and growing) number of working commuters who spend their day in Wellington City but do not necessarily live there.

[6] There is significant funding for formal playground renewals, a portion of which will be used for general park improvements when each playground is renewed over time.

The development of the Suburban Reserves Management Plan in 2015 included a detailed analysis of park category and provision and identified gaps in the parks network. The planning did not include the northern growth areas of the city and did not anticipate the current population growth predictions. Geographical measures (as per Our Capital Spaces) were applied and not population measures. No additional funding was allocated for the purchase of new or redevelopment of existing reserves through that management plan process. Suburban Reserves provision and funding will need review across the city in response to growth scenarios and changes to the District Plan settings.

Wellington City Council purchases new reserve land as it becomes available subject to case by case assessment of the land and where purchase is supported by existing policy direction. For example, 32 hectares of land was purchased in 2018 for addition to the Outer Green Belt Reserves. Purchase of that land was supported by policy direction provided in the Outer Green Belt Management Plan. Purchase is funded through increased borrowing rather than through other mechanisms such as a reserve development and purchase fund for example.

Open space is also provided for through Structure Planning process. There has been allocation of future funding for the greenfield development area at Lincolnshire Farms for a community park and tracks network. The other northern growth areas at Woodridge and Stebbings Valley have Reserves Agreements in place that will see the reserves network vested to Council over time in partnership with the developer (and in lieu of development contributions payments for reserves).

The Parks, Sport and Recreation business unit at Wellington City Council manages the Wellington Cemeteries. There is an identified need to make provision for new cemetery space before 2038. More space is needed prior to that for certain denominations.

3.2 Recreation facilities

Community and recreation facilities in Wellington offer a wide mix of different type, scale and quality of facility providing for an increasingly diverse and rapidly changing mix of activities. Keeping up with community needs and recreation trends and provision of spaces, places and programmes that meet these needs is a challenge for Councils nationally as the key providers. This issue is compounded by the existing facilities network comprising often aging facilities that are not evenly spread throughout communities and that were not necessarily built to provide for mixed or changing use. There is a national issue with the equity of provision of recreation spaces and places and the funding of these. Schools play a key role in provision of community sports and recreation spaces and places.

People in the Wellington region are some of the most active in New Zealand with 77% participating in active recreation or sport weekly. Although participation is high, duration of time spent needs to improve to achieve the health benefits associated with participation (including physical and mental health measures).

Wellington city and region is well served by the range and quality of its sport and recreation facilities. There is over 4200ha of reserves and a network of 365km of tracks across the city with 74% of suburban area population located within a ten minute walk of a playground. Wellington has five indoor and two outdoor pools, five recreation centres, 44 natural and 10 artificial sportsfields. There are 35 basketball half courts and a range of world-class community facilities including the ASB Sports Centre, which attracts over 860,000 visitors per year.

There has been significant investment in major sport and recreation facilities in the last 10-15 years. This includes ASB Sports Centre, nine artificial sportsfields, Wellington Regional Aquatic Centre redevelopment, Keith Spry Pool redevelopment, Karori Park and pool redevelopments, Newtown Park redevelopment, Makara Peak Mountain Bike Park, and the walking/bike track network. Increased funding was recently approved to enable higher quality and more frequent playground renewal.

Wellington City Council has a Play Spaces Policy that outlines a network plan developed through analysis of provision of formal playgrounds. The network provides for 74% of the urban area being serviced by the proposed playgrounds network. School provision is in addition to this, with evidence to suggest that schools encourage community use of their grounds outside of school hours. As with open space, playground provision will need to increase if new areas of residential development are identified through any District Plan change or other central Government legislation changes to provide for housing outside of existing urban or zoned areas.

The Wellington Regional Sport and Active Recreation Strategy provides strategic direction for planning for spaces, places and programmes across the region. A Regional Spaces and Places Plan is currently being completed to provide regional direction on provision. In response, Wellington City Council will need to consider at a more local level what the current network of spaces and places provides and where to direct future investment to meet the needs of the community. This will include how to respond to population growth alongside changing trends in recreation participation and in the context of the existing network of spaces and places.

Planning a response to population growth for the Wellington City sport and recreation spaces and places is incredibly complex as the network of spaces and places must also respond to changing community needs and trends in participation. An increase of 50,000 people to Wellington does not necessarily equate to three more tennis courts for example as it might be that there is already an oversupply and/or that data shows that less and less people are playing tennis in the future. It also doesn’t account for the fact that there may be lots of tennis courts in the city but that they are not evenly spread across the city. It might also be the case that there are lots of courts but they are all in need of significant repair or renewal work that is currently not funded. This kind of analysis needs to occur across all of the different facilities and activities and yields different results for each.

There is a range of provision models for sport and recreation facilities from privately owned through to Council owned and managed. The Council also leases space to clubs where they have developed their own facilities for community use.

Intensification of the central city population will put additional pressure on Freyberg Pool, which is the main aquatic facility for the CBD. This facility is currently at functional capacity at daily peak periods. There is also minimal indoor provision of traditional recreation activity spaces in or near the CBD, and all are currently managed by the private sector (for example indoor football and netball). The private sector is also the key provider in the CBD of other recreation activities such as yoga, cross-fit and pilates for example. Access to the waterfront and Wellington Town Belt for recreation (both formal and informal) is a key part of provision for inner city residents, workers and visitors.

The regional strategy outlines a set of principles to consider when planning for recreation and sport spaces and places:

- Decision based on need and demand analysis
- Resilience to natural disaster
- Financial sustainability of each facility
- Multi use where appropriate
- Accessibility (income, age, gender, ethnicity, religion and ability)
- Partnership/Collaboration
- Adaptability/Functionality
- Community return on investment
- Avoiding overprovision/duplication
- Appropriate ongoing maintenance

The provision of community sport and recreation spaces requires alignment with planning for schools in green fields development areas. Schools are a significant provider of sport and recreation spaces, facilities and programmes and partnerships with local authorities are a very effective way of meeting community need.

There is a need to carry out more work to understand how best to manage the existing sport and recreation facilities and where to direct investment. Provision for city growth will need to be considered in that work.

4 OPPORTUNITIES

Wellington is in the enviable position of having a well-established open spaces network with high value across a range of measures. The Outer Green Belt reserves for example are valued by the people of Wellington, not separate from the city, but a vital part of it – a living, functioning, natural and cultural landscape providing a wide variety of tangible and intangible benefits for the city. These benefits include large areas required to support biodiversity, space for a range of recreation and leisure activities close to the city for residents and visitors, protection of the headwaters of many of the city’s streams, and the landscapes that are a key part of the character of Wellington and residents sense of place and identity.

Land use and spatial planning decisions necessary to guide city growth and development will weigh up the costs and benefits associated with various options. Comprehensive understanding of the value of parks and open spaces and the potential for overlap and integration into other city planning goals will set the scene for robust decision making.

A well planned and well managed network of open spaces will support multiple outcomes for city growth. They provide environmental protection, biodiversity, recreation and leisure, ‘lungs’ of the city, resilience (community/people & land & infrastructure), community resource, health, wellbeing and economic advantage, and sense of place and identity. In allocating land for various uses in any spatial planning exercise, open space provision often represents a high return on investment.

There needs to be a focus on ongoing protection of the natural environment in Wellington as a key part of what makes the city unique. In addition, there is a need to better plan for and fund improvements to the existing community and neighbourhood parks to ensure they can meet the needs of the community as it changes and grows over time.

The Regional Sport and Recreation Strategy has highlighted the need to do more work at a local level to understand the implications of population growth on the current network of spaces and places provided by the Council. This is a complex area of work across a huge range of spaces, places, and programmes and across a range of different sports codes and activities, each with different networks of facilities and changing participation trends.

4.1 Policy review and development to support planning for growth

- Open Space and Recreation Strategy (Our Capital Spaces) – review to guide decision making and funding requirements for provision (quantity and quality) in response to population and spatial growth.
- New Open Space Provision and Funding Policy – analysis of current network and gaps by park category including potential for acquisition policy and review of predicted need for increased funding for ongoing park redevelopment and increased maintenance costs. Align with Development Contributions policy review and updates.
- New central city and waterfront parks network plan
- Community facilities policy review – including opportunity to look at leases policy, and Councils role in funding
- New Recreation and Sport planning (in response to regional strategy and national facilities planning)
- New Green networks planning (walking and cycleway across the city and beyond)

- Road reserve use and management review across Council
- Asset Management Plans
- Infrastructure Strategy

Appendix 3.1

Wellington Water

NPS-UDC Three Waters Infrastructure Enabled Development Capacity

Hutt City Council

Our water, our future.

Version	Date	Author	Amendment Summary
1.0	21 December 2018	Emily Greenberg Nadia Nitsche	Revised maps included
1.12	10 January 2019	Emily Greenberg	Revised Executive summary
2.0	15/05/19	Emily Greenberg	Revised definition of short term, infrastructure enabled development capacity on page 3 and replaced Figure 1

Contents

Executive Summary

The purpose of this report is to meet the National Policy Statement on Urban Development Capacity requirements in terms of reporting on the infrastructure enabled capacity to support predicted urban growth in the short-term (three years), medium-term (next three to ten years) and long-term (next ten- 30 years).

This report assesses where projected areas for urban growth in Hutt City Council are supported with existing or planned water supply, wastewater systems and protection from stormwater flooding. We refer to these services as the three waters.

Council will combine the results in this report with an assessment of how much development capacity is enabled through zoning provisions in the District Plan.

The results of hydraulic modelling for water supply has identified significant limitations to the infrastructure enabled development capacity for Hutt City. However, for site-specific growth the assessment would need to consider options such as expanding or reducing the area supplied by a specific reservoir. Nonetheless, significant upgrades would be needed to support the anticipated population growth.

The wastewater results are limited as the hydraulic model for the majority of the Hutt City will not be finalised until the end of 2019. A calibrated model for the Wainuiomata catchment is available and the results from this model show capacity shortfalls for short-term growth as well as for growth in the medium and long-term.

The hydraulic modelling of stormwater in the Hutt CBD/Waiwhetu catchment is not complete and this limits the ability to assess constraints on development capacity. The stormwater modelling for the other three catchments is complete but still needs to be validated against historical events and observations. However a relatively large area in Petone is known to be low-lying and susceptible to increased flooding from predicted sea-level rise.

Stormwater can limit growth by creating a flooding risk to life and property. As stormwater pipes are designed to safely carry away only nuisance flooding from low to medium intensity rain events, most stormwater protection must result from planning restrictions on where and how development occurs. For example, the hydraulic models for this report assume that all new development is managed so that flooding is not increased up to and including the 1 in 100-year rainfall event and that buildings do not impede overland flow paths or areas of ponding.

Hydraulic models were used in this report to identify where the water supply, wastewater and stormwater protection systems would not provide an adequate level of service for an increasing population. The next step is to finalise the models that need to be calibrated and then to use the models to evaluate the various options for improving the systems to accommodate predicted population growth. The best options can then be considered for inclusion in the Long Term Plan and Infrastructure Strategy so that urban development is enabled in the short, medium and long-term.

1. Purpose

This report assesses where projected areas for urban growth in Hutt City Council (HCC) can be serviced with existing or planned water supply, wastewater systems and protection from stormwater flooding. We refer to these services as the three waters.

This assessment is provided to HCC as a technical report to support their evidence and monitoring requirements under the National Policy Statement for Urban Development Capacity (NPS-UDC) 2016.

The flowchart below (Figure 1) is from the NPS-UDC *Guide on Evidence and Monitoring* (2017) that indicates how the evidence on infrastructure is used to assess feasible development capacity.

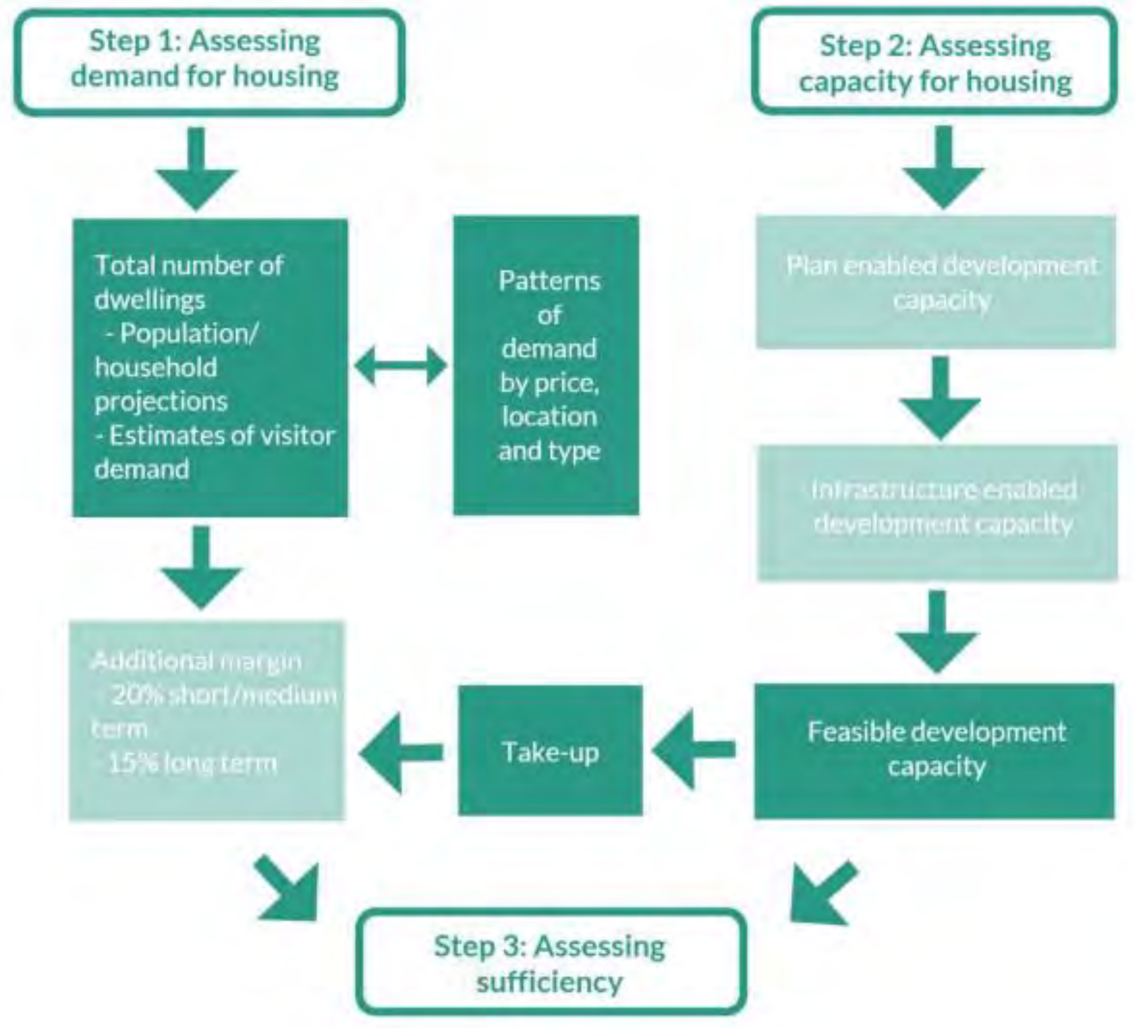


Figure 1: Housing Assessment Methodology overview Flow Chart. WWL's role is shown under Step 2, Infrastructure enabled development capacity.

2. Assessing Infrastructure Enabled Development Capacity

The NPS-UDC guidance document on evidence and monitoring acknowledges that it does not provide a method for assessing the amount of development capacity enabled by infrastructure (page 36 of the guidance document). However, the definition of "development capacity" in the NPS-UDC includes “the provision of adequate development infrastructure to support the development of the land”.

The NPS-UDC defines “feasible” as “development that is commercially viable, taking into account the current likely costs, revenue and yield of developing”. In addition, the guidance is clear that the term “feasible” does not include the cost to the local authority of providing infrastructure.

Therefore, for this report infrastructure enabled development capacity is assessed as areas that are adequately serviced by existing three waters infrastructure or areas that will be serviced by infrastructure identified in the LTP or Infrastructure Strategy.

Areas that are currently zoned for residential or business development but which are not serviced or planned to be serviced are therefore not identified as infrastructure enabled for this report.

Similarly, areas that are currently zoned for development but where additional development cannot be guaranteed an adequate level of service are therefore also not infrastructure enabled. The adequate level of service for stormwater includes the protection from flooding through the use of land use restrictions as well as pipes and drains. The adequate level of service for wastewater includes that additional connections do not create or contribute to surcharges of untreated overflows; and for water supply the adequate level of service is based on minimum water pressure and storage volumes.

The levels of service are defined in Section 4.1, Level of Service.

For the three waters, infrastructure enabled development capacity is assessed

a) in the **short-term** as areas that are serviced by existing infrastructure with adequate capacity

b) in the **medium-term** as areas that are serviced (either existing or planned in the LTP to be in place within the next ten years) with adequate infrastructure

c) in the **long-term** as areas that are serviced (either existing or identified in the Infrastructure Strategy to be in place within the next 30 years) with adequate infrastructure.

Adequate is based on levels of service defined for hydraulic modelling.

Where water supply or wastewater service is not adequate to support a proposed development, it is common for the developer to install mitigations, such as a new reservoir or a larger wastewater pipe. Depending on a number of factors, the need for mitigation can make or break the commercially viable (or feasibility) of a proposed development.

For the purposes of this report, the results of the assessment of infrastructure enabled development capacity are provided in mapped and tabular format (Section 5, Results). If the three waters infrastructure is adequate to support predicted development, it is identified as a “Yes”. If the existing or planned infrastructure is inadequate, or mitigation is required, capacity for development is identified as a “No”.

2.1 Where mitigation can enable

We acknowledge that mitigation for stormwater, water supply or wastewater could alternatively be assessed as a cost within the equation that determines "feasibility", or profitability. As this cost would vary by location and size of the required mitigation, the determination of mitigation cost is out of scope for the level of evidence provided in this report (see Section 4.6, Mitigation Options).

3. Hutt City Model Availability for Three Waters

The catchments that are modelled for water supply and wastewater are defined by the operation of their separate infrastructure networks. Therefore the catchment boundaries for water supply and wastewater are different from each other. The stormwater catchments are defined by topography and are thus also different from the catchments used for the water supply and wastewater hydraulic models.

3.1 Water supply

A safe and reliable water supply is essential to public health and the social and economic development of a city. The water that is delivered to Hutt City is sourced from the headwaters of the Te Awa Kairangi/Hutt River, the Wainuiomata and Orongorongo catchments and the Waiwhetu aquifer. It is delivered via a bulk water system that supplies water regionally to Wellington, Hutt, Upper Hutt and Porirua cities.

The bulk water is treated and delivered to local reservoirs that are positioned at elevations that can provide adequate water pressure for an uninterrupted reticulated supply for drinking water, domestic and commercial use, fire-fighting and emergency storage.

The capacity of the water supply to accommodate future growth was assessed based on storage availability and network capacity as described for the level of service outlined in Section 4.1.1.

For this assessment for the NPS-UDC, the Hutt was defined by 20 Water Storage Areas (WSA), as shown in Figure 2 below. WSAs are defined as a water supply network comprising of at least one reservoir, which can be expected to operate independently if the supply is interrupted.

The WSA can contain one or several District Metered Areas (DMA) – which is a section of water supply network bounded by flow meters of closed valves. The water supply storage areas modelled for this report are shown in Figure 2 below. The methods and results for this water storage assessment are documented in two reports (Stantec 2018a and 2018b).

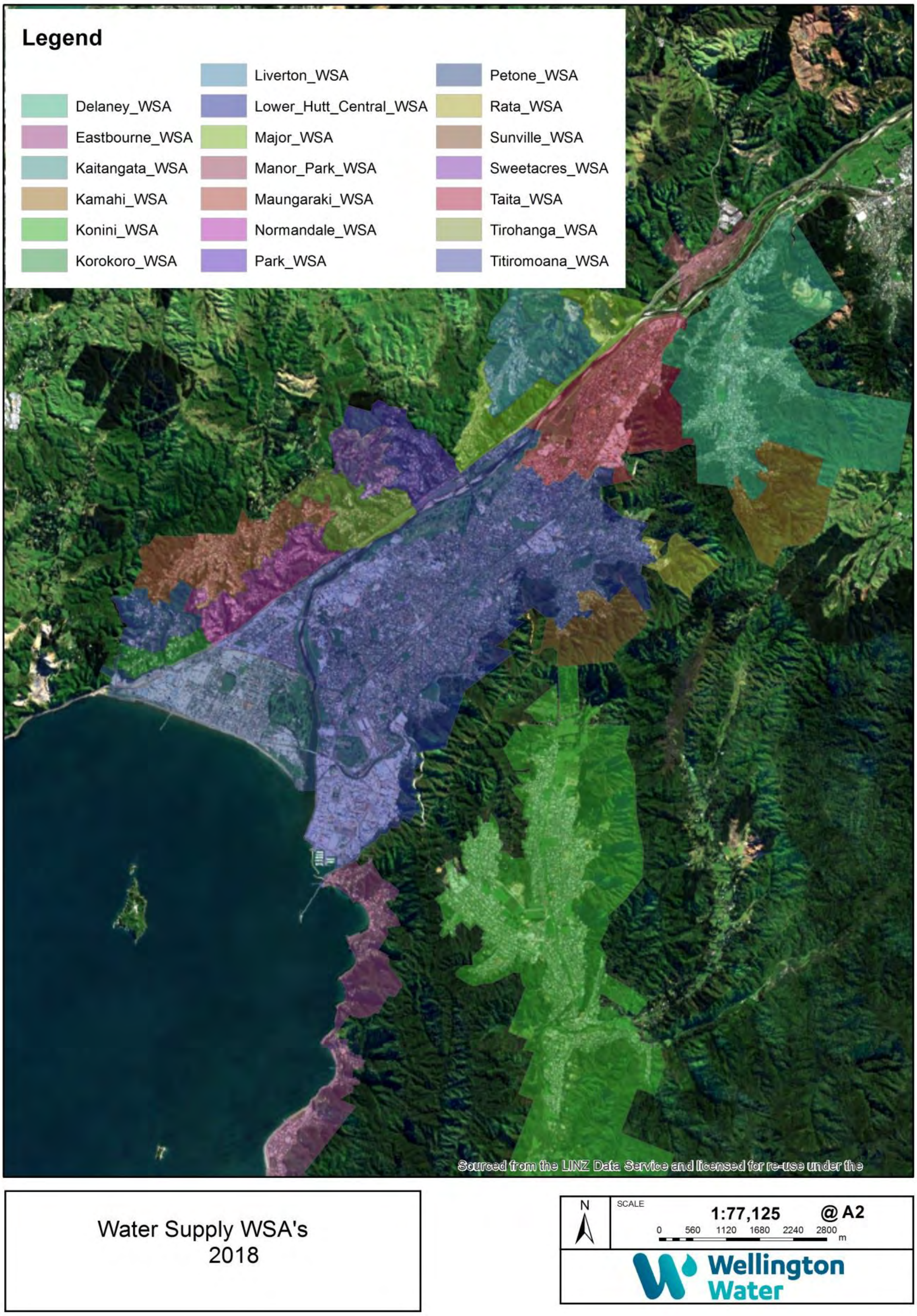


Figure 2: Locations of the 20 Water Storage Areas modelled for Hutt City

3.2 Wastewater

After the treated water delivered to houses and businesses has been used, it becomes wastewater[1]. This wastewater needs to be safely conveyed through reticulated networks to the wastewater treatment plant where it is treated and disposed of in an appropriate way to minimise risks to human and environmental health.

During heavy rain events, stormwater and groundwater can enter the wastewater network resulting in overloading the capacity of the wastewater networks. When this happens, untreated wastewater can overflow to the environment. These overflows are exacerbated by cross connections where stormwater downpipes are incorrectly connected into the wastewater system.

The pipes that make up the wastewater network are aging and prone to leaking and overflowing of untreated wastewater. Network capacity constraints and declining condition, coupled with increased rainfall and rising water tables may result in increased overflows and potential contamination of receiving waters and risks to public health. The level of service for the wastewater network, which is based on managing overflows during rain events rather than preventing leaks during dry weather, may not be sufficient for achieving the desired water quality in the region’s streams and harbour.

Wastewater from Hutt City is treated at the Seaview Wastewater Treatment Plant (WWTP).

For HCC, two catchments were used for the hydraulic wastewater models. The hydraulic model for the Wainuiomata wastewater catchment was developed and calibrated in 2012. It is anticipated that this model will be re-calibrated at the end of 2018 using data from recent flow gauging. The level of service for the wastewater system in the Wainuiomata catchment to accommodate future growth was assessed based on the hydraulic capacity of the sewer mains during a 1-year rainfall event, as discussed in Section 4.1.2.

The assessment for the Eastbourne and the Lower Hutt wastewater catchment is based on the design code and this model not been calibrated. Wellington Water will calibrate this model by the end of 2019. The design code provides an indication on whether the network has enough capacity for the theoretical flow based on projected populations.

For the purposes of this report, the above models were used to assess the overall hydraulic performance of each catchment. The two catchment boundaries modelled for wastewater are shown in Figure 3 below.

[1] If plumbed correctly, the greywater component of used water may be able to be collected and disposed of on-site. Greywater can be collected from baths, sinks and washing machines and must not contain discharge from toilets or contain human waste.

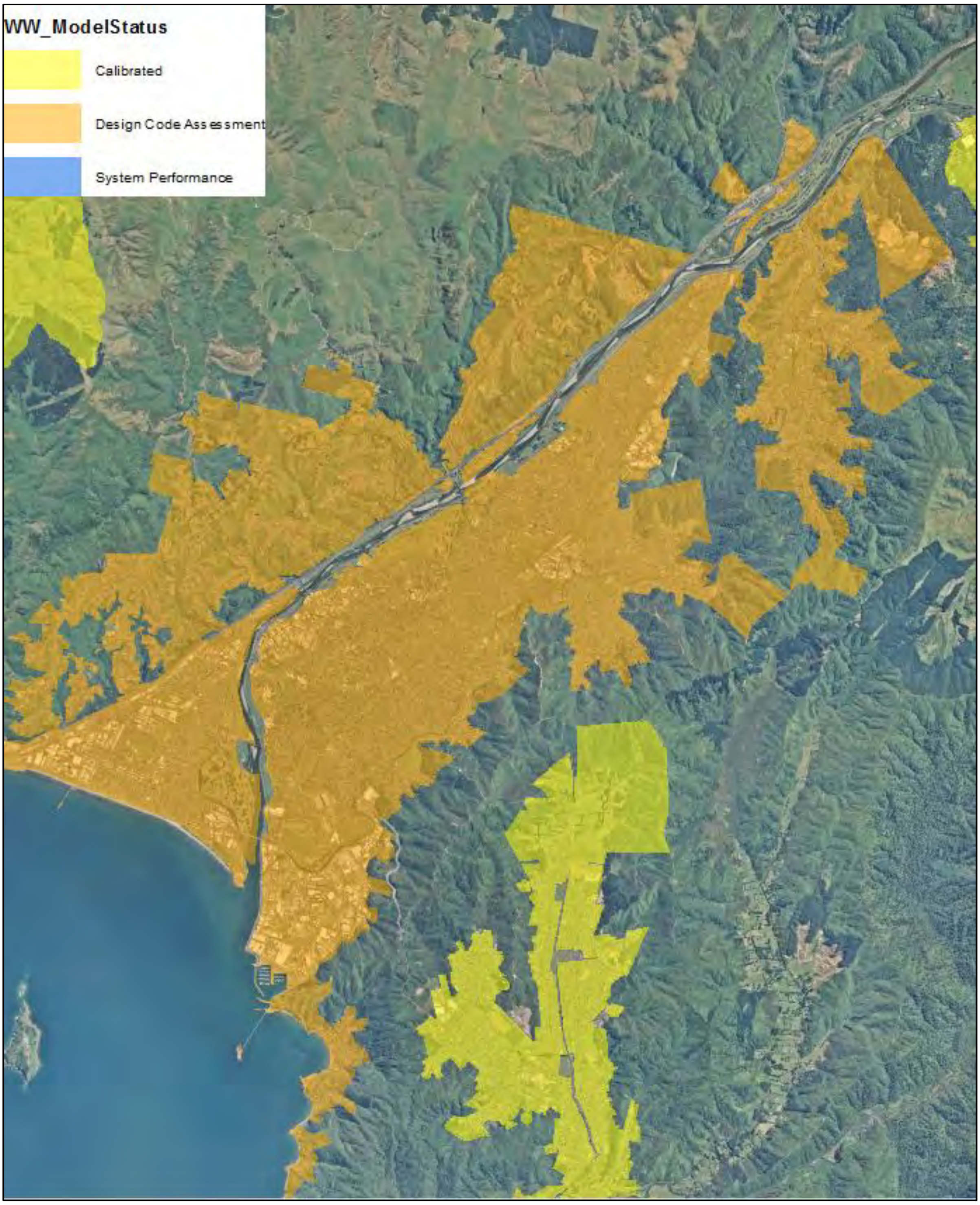


Figure 3: The two wastewater catchments modelled for Hutt City.

3.3 Stormwater

Stormwater services are essential to the protection of public health and property. Rainfall needs to be drained away to prevent damp ground and the various illnesses that can affect people and property.

Stormwater pipe networks historically were designed to carry away only the low to medium intensity rainfall events. When the storm intensity exceeds the capacity of this pipe design, water flows overland and residences and businesses can be at risk of flooding.

The region’s stormwater networks comprise both built assets such as pipes and intakes, as well as natural assets, such as overland flow paths and watercourses. These networks discharge stormwater into streams, the harbour and the ocean at many locations across the region. Land use and building restrictions that protect overland flow paths from being built over or blocked are also important for protecting people and property.

As stormwater picks up sediment, contaminants, petrochemicals and heavy metals such as zinc, copper and lead, it can result in harmful water quality where it discharges to streams or coastal waters. Stormwater from greenfield development in particular, can result in excessive discharges of sediment.

Wellington Water has a programme to model the urban stormwater flood risk within four catchments in Hutt City. The flood hazard has been assessed based on a 1 in 100-year flood event that includes the predicted impacts of climate change. Models for three of these catchments, Petone, Wainuiomata and Stokes Valley, have been built and the next step is to validate the results against observed historical events. The fourth model for the relatively large Hutt CBD/Waiwhetu catchment will be built by the end of 2019.

This report does not include the mapped results from the three stormwater models as it is our intention to validate and then share the maps first with the community and potentially affected owners and occupiers.

A large portion of Petone is built in a low-lying area that is susceptible to flooding and is vulnerable to arise in sea levels. A figure is provided in this report which indicates the low-lying areas of Petone that are is susceptible to flooding particularly if flooding were to coincide with high tides and elevated water levels in the Hutt River.

The catchment boundaries for the stormwater hydraulic models are shown in Figure 4 below.

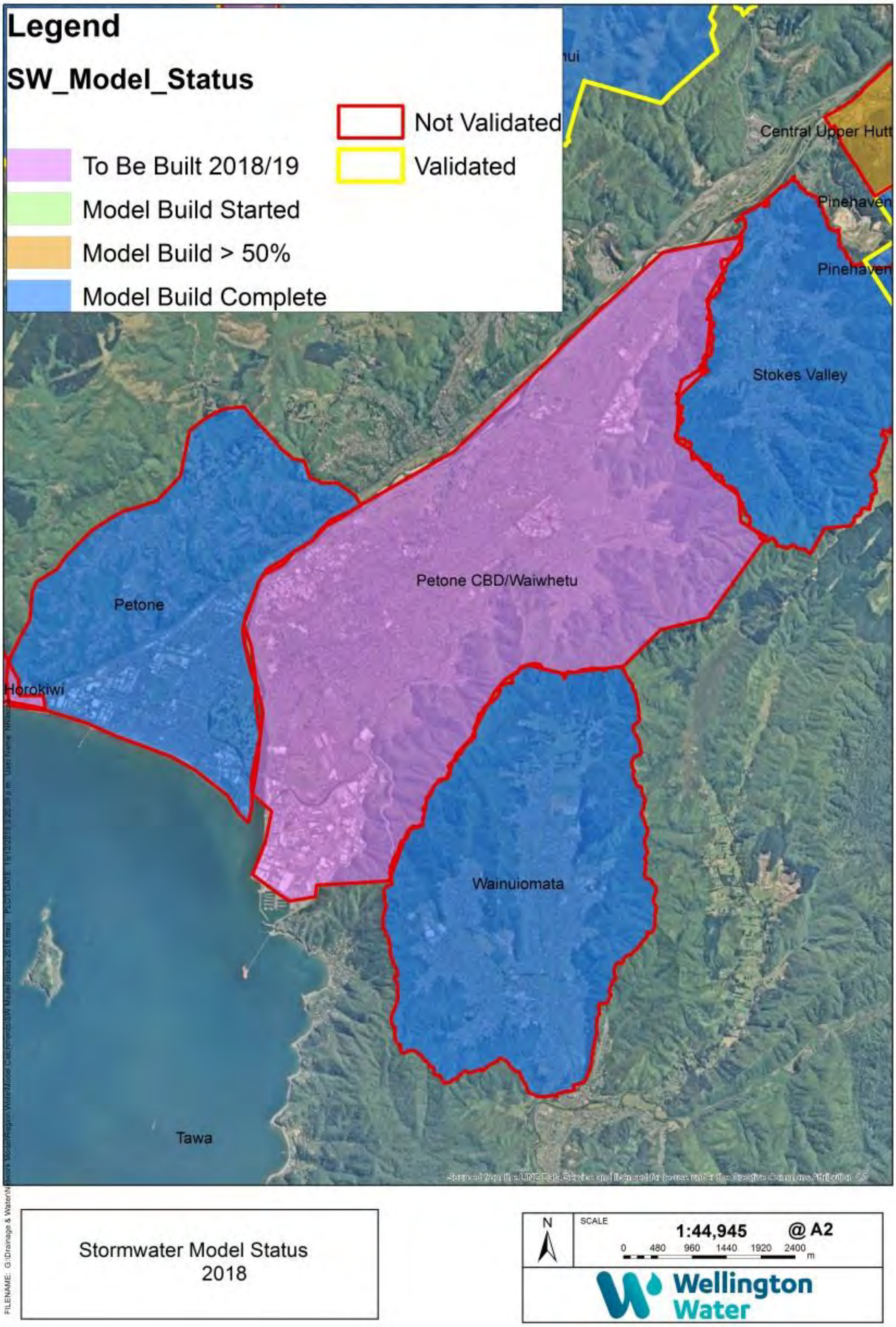


Figure 4: Four urban catchments for stormwater modelling in Hutt City.

4. Criteria and Assumptions

The main criteria and assumptions that were used in the assessment of infrastructure enabled development capacity are described in this section.

4.1 Level of service

As noted in Section 2 above, the assessment of infrastructure enabled development capacity relies on the ability to identify infrastructure that provides an adequate level of service (LOS) to new development. In particular, the LOS needs to be adequate for the assessment of feasible development capacity over the short-term (the next three years) and meaningful for the identification of funding for development infrastructure required to service capacity in the medium- and long-term.

The LOS and associated criteria in the Regional Standard for Water Services (RSWS) are target LOS for new assets and are therefore not a useful or consistent framework for assessing existing infrastructure's suitability for enabling development capacity as required under the NPS-UDC.

Although some criteria in the RSWS are relevant to this assessment, the design codes in the RSWS are not specific to identifying capacity constraints in the primary systems for new developments (brownfield or greenfield) or specific to identifying upgrades and extensions needed to service projected growth in the medium- and long-term.

Therefore to fulfil the evidence needs under the NPS-UDC, the LOS and associated criteria for water supply, wastewater and stormwater capacity have been consulted on with our Client Councils and are defined in the following subsections.

4.1.1 Water supply level of service

Wellington Water has defined the LOS for water supply for the assessment of infrastructure enabled development capacity as:

The provision of safe and healthy water based on:

a. Minimum pressure of 25m at the point of supply

b. Reservoir Storage requirements at the maximum of either:

1. 700 L/person storage requirements where existing demand are unknown (e.g., new development area)

   2 x Average Day Demand (ADD*) plus firefighting storage requirements when existing demand is available

   OR

2. Peak day demand (PDD*) plus 20% for operational storage plus firefighting storage requirements as outlined in SNZ PAS 4509 "Code of practice for firefighting water supplies"

   OR

3. Storage for seismic resilience – required storage to provide minimum levels of service after a significant earthquake based on:

   Days 1 to 7 – Emergency State - People and businesses will be self-sufficient, relying on their own stored water supplies, their communities, and Civil Defence centres.
   Days 8 to 30 – Survival & Stability - Residents collect up to 20 litres per person per day from Distribution Points while Critical Customers begin to receive water to their boundary.
   From Day 30 – Restoration & Recovery - The region moves toward restoration of normal service through provision of reliable reticulated supplies.

This LOS is referred to as Network LOS based on water pressure or a Storage LOS based on either Operational storage LOS or the Seismic LOS.

A key component of constraints in the water supply network is the storage capacity of the reservoirs that supply each zone. The criteria for reservoir storage to achieve the level of service for water supply is based on a combination of firefighting storage requirements as well as population. Therefore there is a direct correlation between reservoir storage and population.

Reconfiguring the water supply network, such as expanding or reducing the area supplied by a specific reservoir, is a common method used to service site-specific growth. Nonetheless, Wellington Water's assessment of infrastructure enabled development capacity does not consider this option for the evidence provided for the NPS-UDC, as this method is only relevant to proposals for site-specific developments.

In addition, the assessment assumes that there are no changes to the bulk water supply network. If needed, further detailed studies could be considered on the flow capacity of the bulk water distribution system to supply projected peak day demand. It is of value to note that this level of service is also dependent on the volume of water used (demand). Currently there are relatively few restrictions on the volume of water used. As noted in subsection 4.4, Consenting Requirements, the ability to take additional volumes of water from our rivers and aquifers will most likely be restricted in the near future.

4.1.2 Wastewater level of service

Wellington Water defined the LOS for the wastewater network for the assessment of infrastructure enabled development capacity as:

> Peak wet weather flow capacity and overflows at the 1-year Average Recurrence Interval (ARI) shall not be made worse (volume or frequency).

It is important to note that the LOS above is different than the LOS used in the Interim Guideline for New Wastewater Connections, which considers overflows only at unconstructed overflows (such as manholes and gully traps). This is because the LOS for new wastewater connections is project specific, whereas the LOS for the assessments under the NPS-UDC needs to consider the capacity of the entire network to support growth over the medium- and long-term.

Where capacity is limited, the LOS for the NPS-UDC needs to help identify infrastructure needs for funding in a LTP or Infrastructure Strategy.

4.1.3 Stormwater level of service

The capacity for new development with an adequate level of stormwater protection is a combination of built assets such as pipes and natural assets such as overland flow paths. The level of service for stormwater protection is determined based on risk, and the impacts of the development on stormwater risk are influenced by site-specific considerations and how the development is undertaken.

Wellington Water defined the LOS for stormwater capacity and constraints for the assessment of infrastructure enabled development as:

1. Safe access to and protection from flooding of habitable floors in the 100 year flood event that includes the predicted impacts of climate change.
2. Safe access to and protection of flooding for Commercial/Business in the 10 year flood event

This LOS can be achieved using the following criteria in new developments:

a. Development in a ponding area is only allowed if there is safe access at time of flooding and no loss of storage. Ponding[2] of 300mm or greater is considered to preclude safe access.

b. New developments do not impede flood flows in open channel – in the absence of detailed assessment of appropriate setbacks, as a minimum all new buildings are constructed at least 5m horizontal from the top of bank of any stream or drain. [3]

c. New habitable floor levels are set at above the level of the flood hazard expected in a 100 year rainfall event that includes the predicted impacts of climate change (20%[4] increase in rainfall intensities and 1m of sea level rise).

d. The provision of drainage to protect commercial/business floor levels in a 10 year flood event.

e. Overland flow paths remain unimpeded.

f. New development is hydraulically neutral and does not increase flooding risk in the catchment. In practice we measure this in a 10 year rainfall event and a 100 year rainfall event[5].

---

[2] Ponding for an assessment of access does not include freeboard.

[3] The minimum setback of 5m allows a corridor for the conveyance of flood flows, the erosion of the stream banks and maintenance access to the watercourse.

[4] 20% is consistent with the Regional Asset Management Plan investment performance measure and is proposed to be incorporated in to the revised RSWS.

It is strongly recommended that Councils implement planning controls for overflow paths, hydraulic neutrality and protection of streams. Without these controls the risk of flooding will limit growth and also exacerbate flooding risks elsewhere in the catchments.

Where councils incorporate into their district plans rules to manage flood hazards then new developments typically can avoid flood hazards and downstream impacts through elevated floor levels, protection of watercourses and overland flow paths and hydraulic neutrality. If these controls are embedded in district plans the stormwater network is not considered to be restrictions on development enabled capacity for this report.

We point out that for this report on infrastructure enabled development capacity only criteria a) and b) contain absolute constraints to development – development is not enabled in locations where there is no safe access during flooding and development is not enabled within 5m to a stream or drain.

In other areas, development could occur if the development is designed to meet the criteria (eg, floors built above the flood hazard, designs that do not impede overland flow paths and development which is hydraulically neutral). We acknowledge, however, that in some locations the costs of these design solutions could be high and therefore development would be economically unfeasible due to flood risks. These assumptions are reiterated in Section 4.6, Mitigation Options.

4.2 Population and dwelling growth estimates

For the water supply models, projected increases in dwellings over the short-term, medium-term and long-term scenarios were based on data from Forecast.id (forecast.idnz.co.nz). For the wastewater models, projected population growth over the short-term, medium-term and long-term scenarios were also based on a high growth dataset modified from Forecast.id and provided to Wellington Water from Wellington City Council.

The totals within each catchment used for population or dwelling projections within the hydraulic models were adjusted as needed to reflect the catchment boundaries specific to the water supply and wastewater network models.

Table 1: Projected growth in population and dwellings for Hutt City

Catchment	Short Term (2017 – 2020) Pop’n/Dwelling	Medium Term (2020 – 2027) Pop’n/Dwelling	Long Term (2027 – 2047) Pop’n/Dwelling
Alicetown - Melling	2,867/1,108	2,807/1,107	2,927/1,204
Arakura	2,734/968	2,893/1,035	2,994/1,104
Avalon	5,345/2,076	5,623/2,179	6,005/2,364

[5] An assessment at both events is needed to assess hydraulic neutrality along the range of events. Depending on topography and design of mitigation structures, an assessment of only a 100-year event does not necessarily assess neutrality at a lesser event.

Catchment	Short Term (2017 – 2020) Pop'n/Dwelling	Medium Term (2020 – 2027) Pop'n/Dwelling	Long Term (2027 – 2047) Pop'n/Dwelling
Belmont	2,952/1,085	3,077/1,168	3,455/1,345
Boulcott	2,838/1,043	3,313/1,214	3,548/1,341
Eastbourne	5,111/2,068	5,182/2,179	5,312/2,310
Epuni East	3,166/1,199	3,140/1,214	3,251/1,320
Epuni West	3,314/1,296	3,413/1,364	3,618/1,471
Esplanade	2,802/1,128	3,085/1,254	3,788/1,564
Fernlea	2,145/727	2,239/766	2,338/822
Glendale	4,369/1,376	4,812/1,526	5,670/1,841
Gracefield - Seaview - Waiwhetu	4,534/1,766	4,675/1,861	4,937/2,006
Haywards-Manor Park - Kelson	3,391/1,260	3,554/1,357	4,130/1,623
Homedale - Pencarrow	6,491/2,319	6,704/2,425	7,038/2,619
Hutt Central - Waterloo West	5,718/2,090	6,132/2,291	7,266/2,774
Hutt City	109,200/40,254	115,020/43,024	124,601/47,653
Korokoro - Petone Central - Wilford	6,826/2,581	7,291/2,785	7,982/3,104
Maungaraki	4,148/1,545	4,315/1,634	4,583/1,780
Moera - Woburn	3,514/1,376	3,573/1,439	3,757/1,526
Naenae North	5,098/1,734	5,173/1,824	5,481/1,988
Naenae South	3,891/1,341	4,015/1,397	4,124/1,460
Normandale - Tirohanga	3,536/1,258	3,645/1,328	4,061/1,499
Parkway	3,455/1,258	4,038/1,465	4,302/1,615
Stokes Valley East	5,531/2,023	5,709/2,122	6,057/2,276
Stokes Valley Northwest - Holborn	2,312/799	2,569/896	2,844/1,013
Stokes Valley West	2,735/918	2,909/987	3,176/1,099

Catchment	Short Term (2017 – 2020) Pop'n/Dwelling	Medium Term (2020 – 2027) Pop'n/Dwelling	Long Term (2027 – 2047) Pop'n/Dwelling
Taita North	3,225/1,060	3,343/1,124	3,448/1,213
Taita South	3,195/1,096	3,267/1,151	3,417/1,231
Waterloo East	4,663/1,816	4,808/1,931	5,175/2,142
TOTAL	**109,200/40,254**	**115,020/43,024**	**124,601/47,653**

4.3 Modelling assumptions and limitations

The assumptions and limitations of the modelling needs to be considered when interpreting and using the results. The key assumptions and limitations are shown in the table below:

Table 2: Modelling assumptions and limitations

Model	Assumption/Limitation
Water supply	Reconfiguring the water supply network, such as expanding or reducing the area supplied by a specific reservoir, is a common method used to service site-specific growth. This assessment of infrastructure enabled development capacity for the NPS-UDC does not consider this option. The bulk water supply system has not been analysed in the capacity assessment. The modelling does not consider future efficiency of the network (leak prevention) and customer use (demand management). The same existing commercial water consumption is assumed for commercial users in future horizons. There are often multiple solutions possible to meet the fire-fighting requirements and therefore this criteria is not used for the purpose of identifying infrastructure enabled development capacity. Site-specific development within a larger water supply zone are not assessed as site-specific developments require a more detailed assessment. This is because the LOS for minimum pressure is dependent on the infrastructure required to service the new development.
Wastewater	For the Wainuiomata model, a 1-year design rainfall event with a 2-hour duration was used to assess pipe capacity and wet weather overflows (Cardno 2018). Some known overflow locations do not discharge until it rains for a longer period of time. In general, overflows with larger incoming pipes will tend to discharge during longer period events. Some results on wet weather overflows can be due to errors in the asset data or model confidence (if

	located far from the calibration point). Additional monitoring is required to confirm the frequency of modelled constructed overflows and confirm in the field the location of manholes that the model indicates are overflowing at the 1-year ARI. A hydraulic model is not currently available for the larger Hutt City wastewater catchment. Results based on the design code are indicative only. The hydraulic model does not consider future reduction of overflows from renewals and upgrades that reduce inflow and infiltration. Dry weather performance, such as leaks and areas of blockage, is not included in the level of service for the hydraulic modelling.
Stormwater	New development is assumed to achieve hydraulic neutrality in all flood events up to and including the 1 in 100-year event. For this assessment, the water quality effects from stormwater are not considered in the level of service. However, the management of stormwater to achieve improved water quality will be needed to meet the new requirements in the Proposed Natural Resource Management Plan for the Wellington Region, the future recommendations from the Te Whanganui-a-Tara Whaitua Committee and the aspirations of the wider community. Flooding from Te Awa Kairangi/Hutt River, Waitwhetu Stream and the larger streams in HCC are managed by Greater Wellington Regional Council. The potential effects of these flood flows have not been incorporated into the stormwater models.

4.4 Consenting requirements

The operation of our infrastructure networks need to respond to consenting requirements, which in some cases may constrain our ability to provide the adequate level of services.

Water supply – Hutt City, along with Upper Hutt, Wellington and Porirua city councils, purchase their water in bulk from Greater Wellington Regional Council. This water is delivered to the community via a network of reservoirs, pump stations and water mains. With the current level of regional demand, a new water supply source will be required in approximately 2040. However, provisions in the Proposed Natural Resource Management Plan restrict the ability to take additional volumes of water from our rivers and aquifers.

Wastewater – The wastewater network requires resource consents for its discharges of treated wastewater from the treatment plants to the marine environment. The current consent conditions include limits on the rate and volume of discharge and bypass events.

In Hutt City there are a number of constructed overflows for untreated wastewater that were built sometime in the past to relieve pressure on the network. Many of these locations overflow into the stormwater network before discharging to fresh or coastal water. The identification and monitoring of these overflows will improve as the hydraulic models are completed for Hutt City. Unconstructed overflows are manholes that surcharge due to excessive flows or operational issues such as partial blockages.

Overflow locations are obvious risks to human health and safety and are the focus of renewal and upgrades. Wellington Water now has a short-term resource consent (WGN180027 expires 30 November 2023) for the majority of the constructed overflows that go to the stormwater network. This consent requires monitoring and reporting, the management of acute effects on human health, and the development of a stormwater management strategy to guide a longer-term consent. This management strategy will likely include the need for progressive reduction or elimination of overflow events during most rainfall events.

The costs to Council for the required renewal and upgrades for elimination of unconstructed overflows and progressive reduction or elimination of constructed overflows may be significant.

Stormwater – The new Wellington regional plan (Proposed Natural Resource Management Plan) has introduced new and more stringent provisions for the protection of water quality, including the requirement to have a consent for stormwater discharges, including discharges of stormwater contaminated with wastewater.

Water sensitive urban design and planning and designing for stormwater runoff and its discharge to fresh and coastal water are relatively new disciplines in the Wellington Region and regulatory tools requiring their use for land use and subdivision are still in progress. Achieving these new objectives will require significant investment. While the water quality limits have yet to be set it is anticipated that new development will be required to meet increasingly higher levels of water quality outcomes.

It is strongly recommended that Councils implement planning controls for overflow paths, hydraulic neutrality and protection of streams as well as water quality outcomes. Without the controls stormwater will limit growth and also increase the risk of flooding elsewhere in the catchments.

4.5 Greenfield development

For this report infrastructure enabled development capacity is assessed only in areas that are currently serviced by infrastructure and areas where future infrastructure is funded in the LTP or identified in the Infrastructure Strategy. This includes greenfield areas that are enabled by District Plan zoning provisions and where development in the area could connect to and be serviced by the existing sewer system and water supply.

Where infrastructure upgrades are funded in the LTP or identified in the Infrastructure Strategy, the indicated timing of the upgrade determines if the new infrastructure for greenfield development is considered for short- or medium-term development capacity.

4.6 Mitigation options

As noted in Section 2.1, if development were to require mitigation to overcome a constraint in the existing infrastructure, we have assessed that area/development as not having infrastructure enabled development capacity.

An alternative assessment could include providing a cost for mitigation that could be included in the assessment of feasibility.

4.7 Resilience

The need for resilience of the network to a major earthquake are not factored into the LOS, other than storage requirements for water supply.

5. Results

This section provides a series of maps and tables to describe where infrastructure enabled development capacity exists and where it does not exist based on the results of hydraulic modelling.

5.1 Mapped Results

Maps are provided for the model results for water supply and wastewater.

Maps are not included for stormwater as the flood extent is still being validated against historic records.

5.1.1 Water supply mapped results

The Hutt City water supply network was mapped as 20 discrete WSAs and each comprises at least one reservoir. The reservoirs are refilled from the Greater Wellington bulk supply network, which is in turn fed from a number of sources in the Hutt Valley and Wainuiomata. As noted in Section 4.3, the model results do not take into account the ability to reconfigure the water supply network, such as expanding or reducing the area supplied by a specific reservoir, to enable site-specific growth.

The modelling results in Figure 5 to Figure 7 indicate the water supply capacity that exists currently (2017) and what is projected in the short-term (2020), medium-term (2027) and long-term (2047) for the network, storage and overall assessment.

The results show WSA catchments that have no constraints (green), constraints from under capacity in the LOS for either network or storage (orange) or whether the constraints are due to under capacity in the LOS for both network and storage (red).

On a catchment scale, the ability of the water supply network to support projected population growth in the short-, medium- and long-terms and meet the defined LOS is best described in Table 3 in subsection 5.2.1.

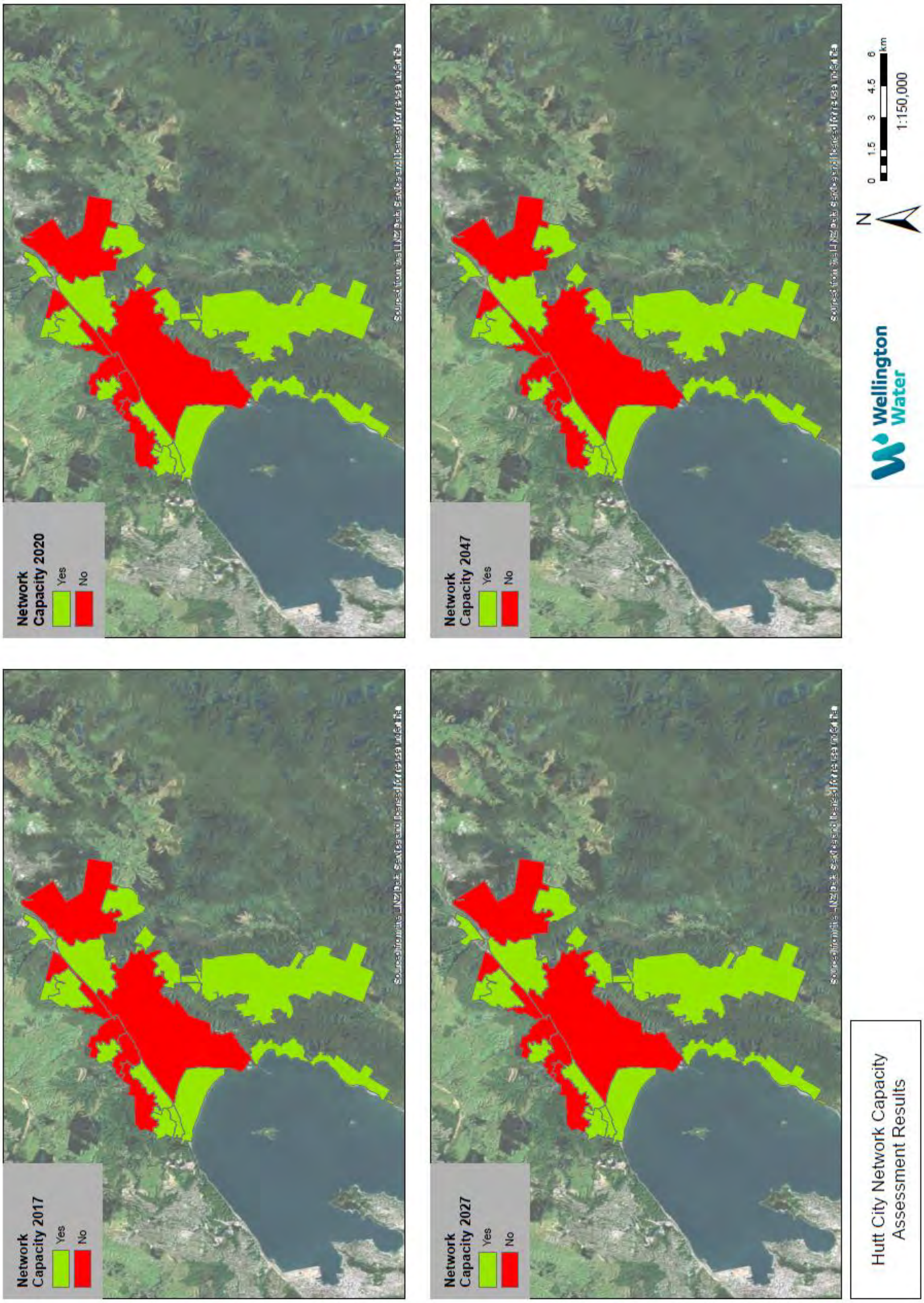


Figure 5: Water supply assessment of the network capacity for Hutt City at 2017, 2020, 2027 and 2047.

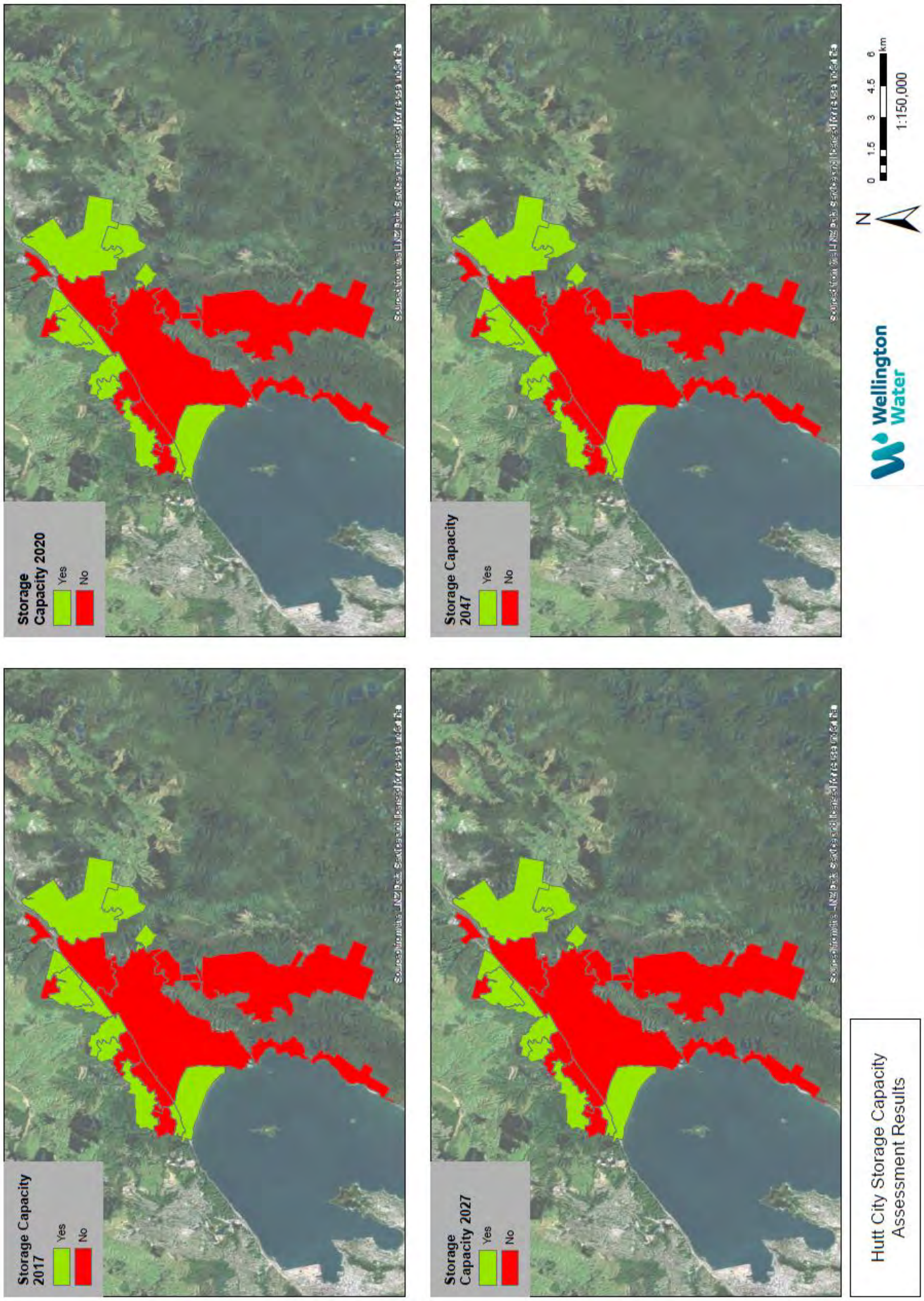


Figure 6: Water supply assessment of the storage capacity for Hutt City at 2017, 2020, 2027 and 2047.

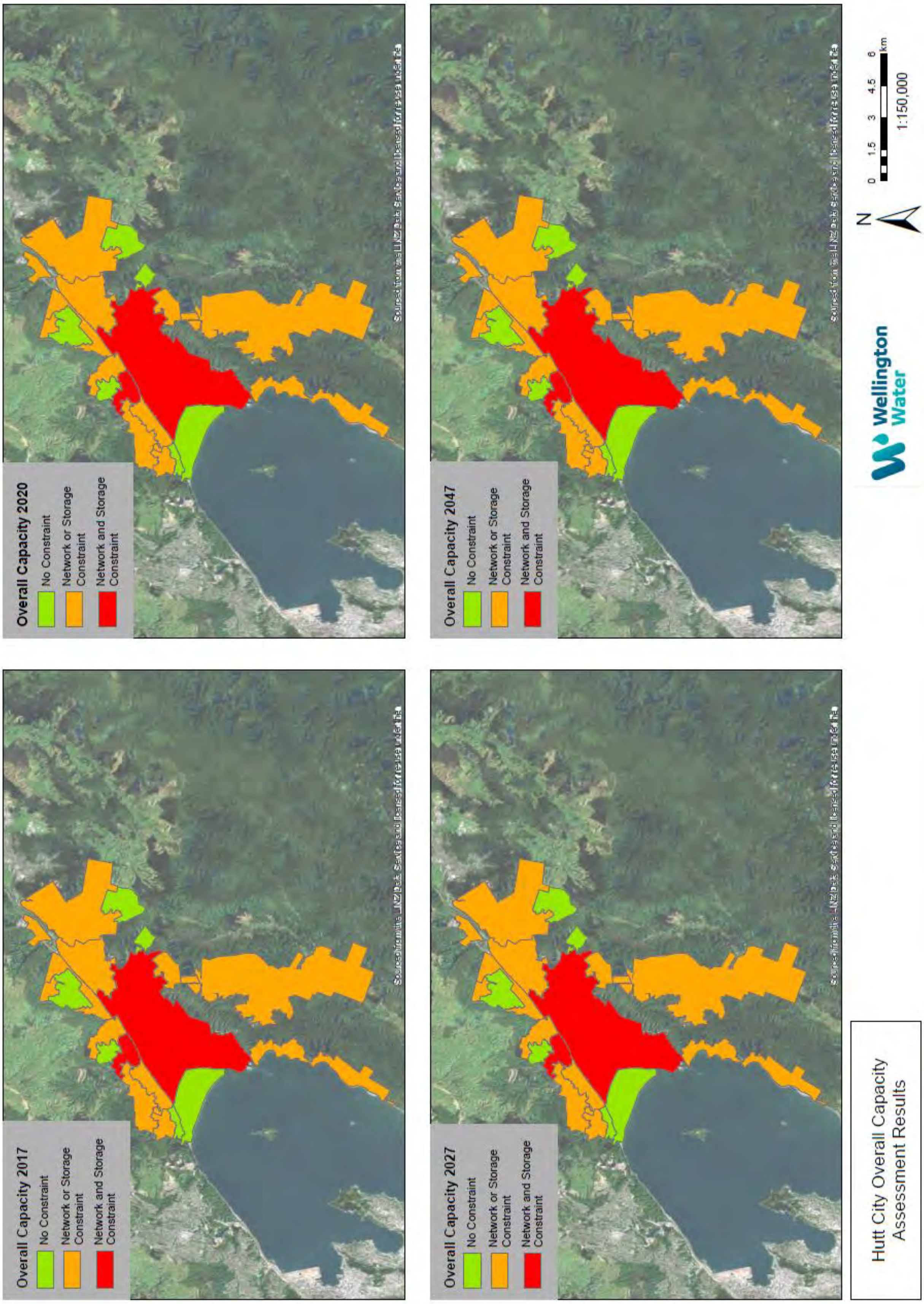


Figure 7: Water supply assessment of the overall capacity for Hutt City at 2017, 2020, 2027 and 2047.

5.1.2 Wastewater mapped results

The wastewater modelling was based on two catchments, Wainuiomata and Hutt City including Eastbourne.

The results in Figure 8 to Figure 11 show the capacity assessment for the long-term projected population at year 2047. Sewer pipes that are under capacity are shown in red.

For the Wainuiomata catchment, the results from the calibrated hydraulic model also predict the locations of untreated wastewater overflows during the 1-year ARI. For the projected population at year 2047, these overflow locations are indicated with coloured circles, with red circles indicating overflow locations with the largest volume.

On a catchment scale, the ability of the wastewater network to accommodate additional flows from projected population growth in the short-, medium- and long-terms and meet the defined LOS is best described in Table 4 in subsection 5.2.2.

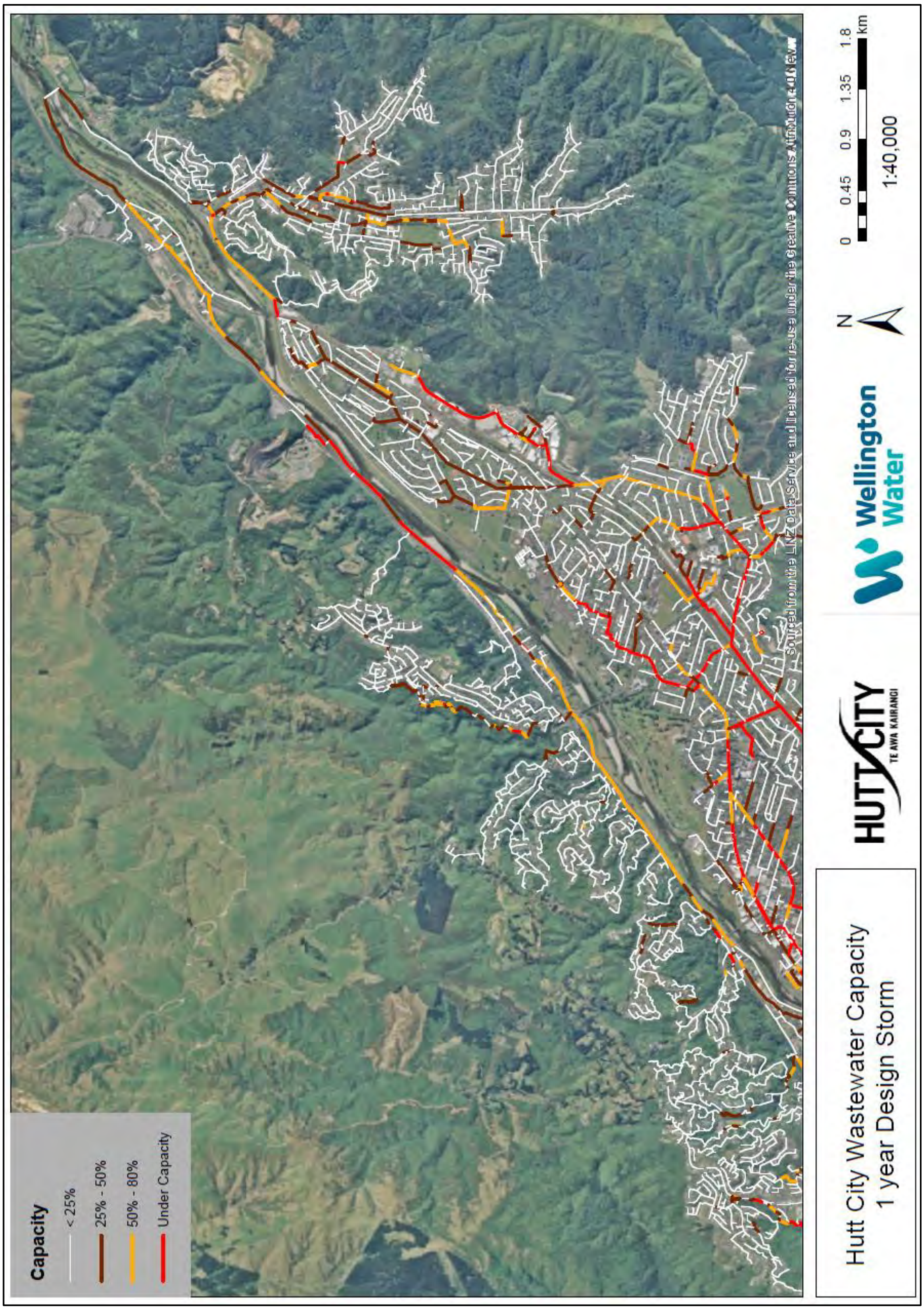


Figure 8: Future population (2047) – Hutt City wastewater capacity indicative assessment (map 1 of 3)

Figure 9: Future population (2047) – Hutt City wastewater capacity indicative assessment – Petone (map 2 of 3)

Figure 10: Future population (2047) – Hutt City wastewater capacity indicative assessment – Eastbourne (map 3 of 3)

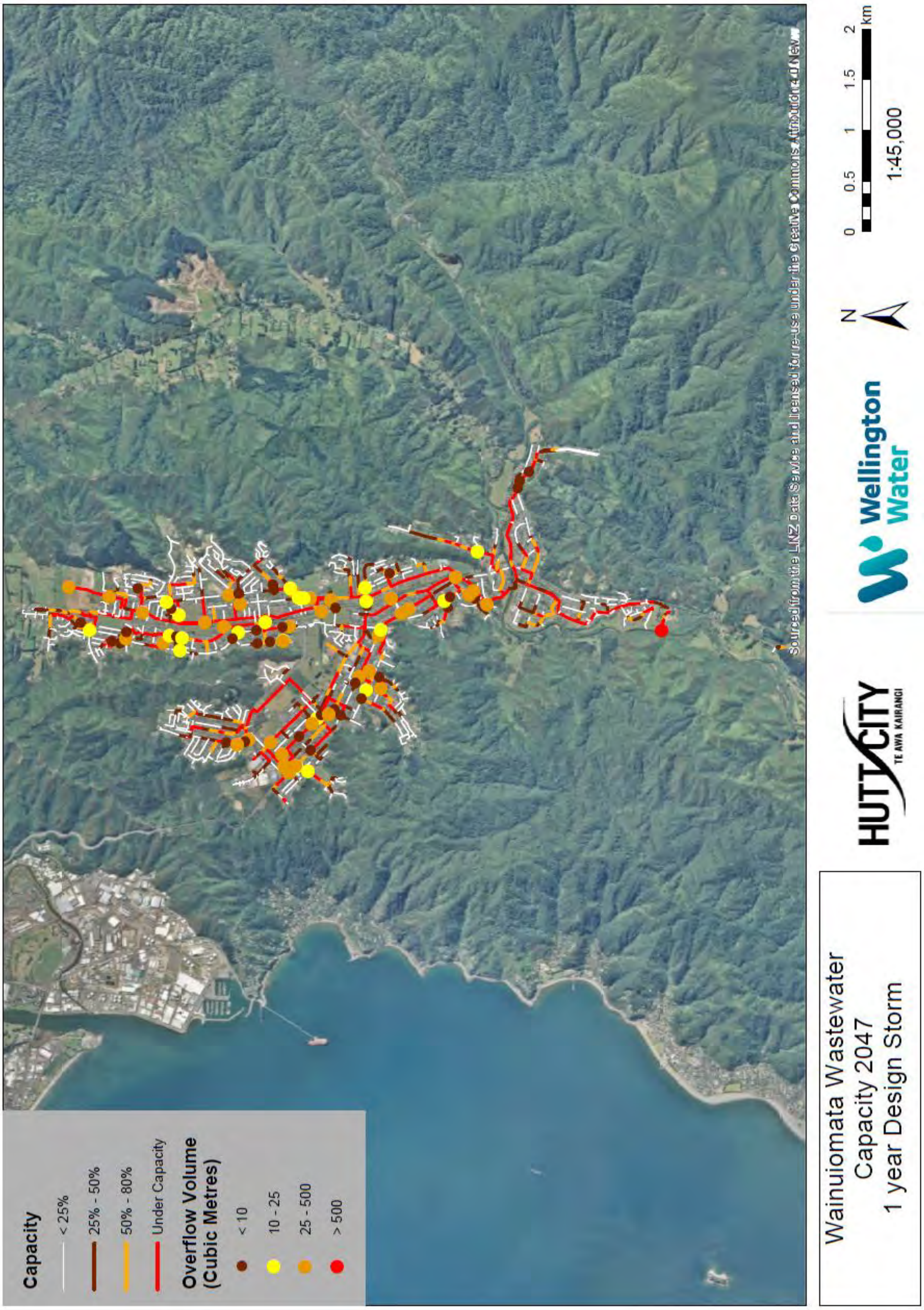


Figure 11: Future population (2047) – Hutt City wastewater capacity modelled results - Wainuiomata

5.1.3 Stormwater mapped results

As discussed above in subsection 3.3, the mapped stormwater results of the urban flood modelling are not included in this report.

A map showing the potential extent of flooding in Petone from predicted sea-level rise is shown in Figure 12.

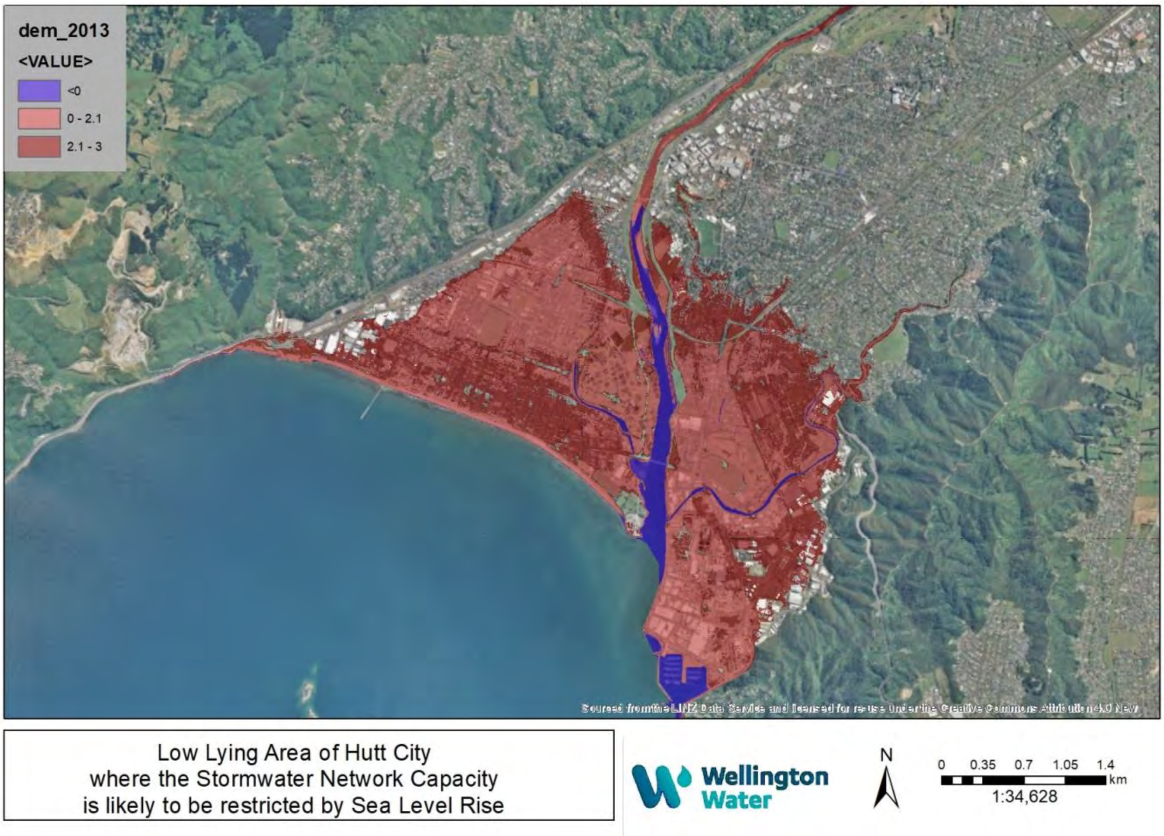


Figure 12: Low-lying areas that could be flooded by a predicted 2.1m sea-level rise.

5.2 Tabled Results

Tables are provided from the model results for water supply, wastewater and stormwater below.

5.2.1 Water supply tabled results

Table 3 below indicates the constraints in infrastructure enabled capacity for each of the modelled WSAs in the short-term, medium-term and long term. Similar to the maps, the results for each WSA indicate the capacity in the water supply using the LOS based on network pressure (N), storage volumes (S) and both network and storage (O for Overall).

Where appropriate, the table provides additional information on whether the results for the storage LOS are relevant to the LOS of for operational storage or seismic resilience.

Where pressure in the network is modelled to be lower than the level of service, small network modifications or upgrades would eliminate these deficiencies in most cases, enabling urban growth from a network capacity point of view. Alternatively, it is possible that in some locations, localised substandard pressure could be acceptable.

Table 3: Water supply enabled development capacity by Water Storage Area (N: network LOS, S: storage LOS, O: Overall LOS)

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Delaney	N: No S: Yes O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: There are current areas of critical low pressure in the zone and the network cannot accommodate projected growth. Storage: The storage is sufficient for the dwellings predicted for 2047.
Eastbourne	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that the network can accommodate forecasted growth. Storage: There are existing shortfalls for both the operational and seismic storage level of service.
Kaitangata	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that the network can accommodate forecasted growth. Storage: There is an existing shortfall for the operational storage level of service. However it is a very small area and calculated shortfall is well within the margin of error of this assessment.
Kamahi	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: The model indicates that the network can accommodate forecasted growth. Storage: The storage is sufficient for the dwellings predicted for 2047.
Konini	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that the network can accommodate forecasted growth. Storage: The storage is insufficient in both operational and seismic criteria.

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Korokoro	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	The model indicates that there is enough network and storage capacity to accommodate forecasted growth.
Liverton (upper Kelson)	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: There are current areas of low pressure in the zone but the network can accommodate projected growth as those existing low pressure properties are not significantly affected by growth. Storage: The storage is sufficient for the dwellings predicted for 2047.
Major	N: No S: Yes O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: There are current areas of critical low pressure in the zone and the network cannot accommodate projected growth. Storage: The storage is sufficient for the dwellings predicted for 2047.
Manor Park	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that the network can accommodate forecasted growth. Storage: The storage is insufficient in both operational and seismic criteria.
Lower Hutt Central	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There are localised low pressure areas in Rata and Sunville which only affect about 70 properties. Rezoning some properties in the adjacent higher-HGL zones may increase the network capacity to accommodate projected growth. Storage: The storage is insufficient in both operational and seismic criteria.
Maungaraki	N: No S: Yes O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: There are current areas of low pressure in the zone and the network cannot accommodate projected growth. Storage: The storage is sufficient for the dwellings predicted for 2047.

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Normandale	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: There are few properties with minimum predicted pressure marginally below LOS. However it considered acceptable for this study. Storage: There is a shortfall for both the operational and seismic criteria
Park	N: No S: Yes O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: There are current areas of low pressure in the Hill Road. The network cannot accommodate projected growth. Storage: The storage is sufficient for the dwellings predicted for 2047.
Petone	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: The model indicates that the network can accommodate forecasted growth. Storage: The storage is sufficient for the dwellings predicted for 2047.
Rata	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N. Yes S: No O: No	Network: The WSA is very small with short lengths of pipe, typical of small zones sized for firefighting. Network capacity is not a constraint. Storage: There is enough storage until 2047 when the operational criterion is not met.
Sunville	N: Yes S: No O: No	N: Yes S: No O: No	N. Yes S: No O: No	Network: The WSA is very small with short lengths of pipe, typical of small zones sized for firefighting. Network capacity is not a constraint. Storage: There is a shortfall for both the operational and seismic criteria.
Sweetacres	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N:Yes S: Yes O: Yes	Network: The model indicates that the network can accommodate forecasted growth. Storage: The storage is sufficient for the dwellings predicted for 2047.

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Taita	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that the network can accommodate forecasted growth. Storage: There is a shortfall for the operational criteria.
Tirohanga	N: No S: No O: No	N: No S: No O: No	N: No S: No O: No	Network: There are current areas of low pressure which will be impacted by projected growth. There is no spare capacity in the network. Storage: There is a shortfall for both the operational and seismic criteria.
Titiromoana	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S. No O: No	Network: The model indicates that the network can accommodate forecasted growth. Storage: There is a shortfall for both the operational and seismic criteria.

5.2.2 Wastewater

In the absence of detailed wastewater hydraulic model for the Hutt City catchment, a design flow capacity assessment was completed. This assessment compared an estimate of the peak wet weather flow based on the upstream contributing catchment against the theoretical pipe-full capacity using the asset data of slope and diameter of the pipe. This high level assessment has not been calibrated and therefore the results are indicative only.

The calibrated hydraulic wastewater model for Wainuiomata shows that with projected population growth at year 2047 there will be an increased frequency or volume of untreated wastewater surcharging from up to 48 manholes and from 16 constructed overflows.

Due to the age of some of the network, including the laterals that connect to the network from private residences, the inflow of rainwater and infiltration of groundwater (I&I) into the wastewater network is a significant factor contributing to the insufficient capacity of the system. Overflows can also be caused by insufficient pump rates and operational issues such as partial blockages. The key network factors causing modelled sewer overflows are insufficient pipe diameters and pumping rate combined with high I&I.

A major limitation for the Wainuiomata wastewater network to enable projected population growth is the insufficient capacity in the pump stations, trunk sewers and particularly the pipe that carries wastewater through the tunnel from Wainuiomata to the Hutt City catchment. Currently, the LTP and Infrastructure Strategy do not include funding or plans to upgrade this core infrastructure.

Table 4: Wastewater enabled development capacity by catchment

Wastewater	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Wainuiomata	No	No	No	Short-term: increased overflow volumes and frequency at 10 existing constructed overflow locations and 2 additional locations. There are 29 manholes with increased overflows at this scenario. Medium term: increased overflows at 10 existing constructed overflow locations and 3 additional constructed overflow locations. There are 32 manholes with increased overflows at this scenario. Long-term: increased overflows at 10 existing constructed overflow locations and 6 additional constructed overflow locations. There are 48 manholes with increased overflows at this scenario.
Hutt City	No	No	No	The design code analysis for Hutt City indicates capacity issues with the wastewater network, especially the trunk sewers.

5.2.3 Stormwater

One of the modelling assumptions is that planning and building restrictions will require new development to achieve hydraulic neutrality in all rainfall events up to and including the 1 in 100-year rainfall event including the predicted impacts of climate change. If this policy were implemented, stormwater risks would not be increased by increased population and its associated development. With this assumption the stormwater modelling results are relevant for today as well as for 2047.

At the top of the Hutt catchments, there generally is less risk of surface ponding where the terrain is steeper. However, in steeper areas overland flow paths can be a threat to life due to the high velocities. It is therefore critical that overland flow paths remain unobscured to reduce the flood risk to people and property. It is also important to maintain the capacity of the streams and drains not just during low flow but also when they are in flood. With these types of planning provisions, stormwater is not a constraint to development enabled capacity other than where ponding precludes safe access or within the buffer area of rivers, streams and drains.

Petone:

The Petone catchment is located close to the sea with a flat topography for the majority of the catchment. The catchment is vulnerable to flooding as a result of predicted sea level rise. An area of particular concern is around Udy Street which is at a lower elevation than the Esplanade near the coast. In May 2015 and November 2016 there was widespread flooding within the Petone catchment despite these being moderate rainfall events. Preliminary results from the hydraulic models indicate that the low-lying areas in Petone will be difficult to protect and in time may become unsuitable and unsafe for residential development.

Wainuiomata:

Over the last decade considerable effort and expense was put into increasing the capacity of Black Creek and the main water channels that flow through Wainuiomata. This has increased the base flood protection for much of the area. However in many areas the level of protection is still well below the targeted 1 in 100-year level. There is still surface flooding in the flatter areas adjacent to the main channels when the streams are full as the connected stormwater pipes cannot discharge.

Stokes Valley:

Stokes Valley has a history of flooding and a 2005 assessment of the stormwater pipe networks in Stokes Valley identified that many pipes lacked capacity and widespread upgrades are needed. The area has been the target of a programme of major improvements to increase the capacity of its drainage network. However, there are ongoing flooding issues in the valley.

Hutt CBD/Waiwhetu:

A hydraulic model of the urban stormwater flood risk is planned but has not been developed for the Hutt CBD/Waiwhetu catchment. Historical flooding has been recorded in the low-lying areas around Whites Line West and Hutt Valley High School as well as in a number of places in Melling and Alicetown. These areas are also predicted by Greater Wellington Regional Council to experience deep flooding in excess of 1m if the Te Awa Kairangi/Hutt River defences are breached. Even though it is likely to be only a rare event, these flood depths would be a threat to life.

After the 2004 flooding of the Waiwhetu Stream, the capacity of the lower reach of the Waiwhetu Stream was increased and now provides capacity to convey almost a 1 in 40-year flood event. However much of the surrounding area is low-lying and close to sea level. Therefore in extreme rainfall events these areas are still expected to flood as the connected stormwater network will not be able to discharge due to the elevated flood levels of the receiving water bodies where the pipes are located.

Table 5: Stormwater protection enabled development capacity by catchment

Stormwater	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Petone	NA	NA	NA	Development capacity in the Petone

Stormwater	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Wainuiomata	Yes	Yes	Yes	catchment needs to be validated but the modelling results indicate that there are likely significant limitations on development enabled capacity due to the low-lying nature of a large portion of the catchment. For other areas, development is not enabled in the flood hazard areas along the rivers and large streams. In general, however, for most areas development can occur in combination with adequate planning provisions. For example, development must be hydraulically neutral so that flooding isn't increased, and in areas at risk of flooding development must not impede overland flow paths and appropriate floor levels are required.
Stokes Valley	Yes	Yes	Yes	
Petone CBD/Waiwhetu	Not modelled			

6. Conclusion

The results of hydraulic modelling for water supply has identified significant limitations to the infrastructure enabled development capacity for Hutt City. However, for site-specific growth the assessment would need to consider options such as expanding or reducing the area supplied by a specific reservoir. Nonetheless, significant upgrades would be needed to support the anticipated population growth.

The wastewater results are limited as the hydraulic model for the majority of the Hutt City will not be finalised until the end of 2019. A calibrated model for the Wainuiomata catchment is available and the results from this model show capacity shortfalls for short-term growth as well as for growth in the medium and long-term.

The hydraulic modelling of stormwater in the Hutt CBD/Waiwhetu catchment is not complete and this limits the ability to assess constraints on development capacity. The stormwater modelling for the other three catchments is complete but still needs to be validated against historical events and observations. However a relatively large area in Petone is known to be low-lying and susceptible to increased flooding from predicted sea-level rise.

The stormwater network has a limited ability to control flooding and is only designed to carry away surface water from low to medium intensity rain events. Therefore limitations on development capacity from stormwater are identified only within the areas that are close to streams and drains and locations where significant ponding limits safe access. Additional limitations form flood hazards associated with the Te Awa Kairangi/Hutt River, the Waiwhetu Stream and other large streams are not included in this assessment.

The results provided in this report reflect defined levels of service and identified limitations and assumptions. As such this is considered to be a high level assessment which does not consider potential site-specific mitigations.

The next steps are to complete and validate all hydraulic models that are outstanding, assess the potential options to rectify the identified constraints and then recommend the best options for the next HCC LTP and Infrastructure Strategy.

7. References

Cardno. 2018. Rainfall input files for wastewater modelling. Prepared for Wellington Water Ltd October 2018.

Stantec. 2018a. NPSUDC – Regional water supply capacity assessment: Methodology and summary. Prepared for Wellington Water Ltd. October 2018. 58 pages.

Stantec. 2018b. NPSUDC – Regional water supply capacity assessment: Detailed assessments – Hutt City. Prepared for Wellington Water Ltd. October 2018.

Appendix 3.2

Hutt City Council
30 Laings Road
Private Bag 31912
Lower Hutt 5040
New Zealand
www.huttcity.govt.nz
T 04 570 6666
F 04 569 4290

Assessment of Hutt City Road Network

Under National Policy Statement on Urban Development Capacity 2016

March 2019

Version Control

Version	Date	Notes
Draft 1.0	9 January 2019	First Draft
Final	18 March 2019	

Purpose

This paper presents an assessment of Hutt City Council's road network to meet the requirements of the National Policy Statement on Urban Development Capacity 2016 (NPS-UDC). The NPS-UDC requires an assessment of;

- whether development capacity is serviced with infrastructure; and
- whether development infrastructure required to service development is identified in the Council's Long Term Plan, or Infrastructure Strategy.

The assessment is not contingent on the location of development capacity, but assesses the infrastructure as it currently stands, and its potential to absorb further growth over the next 30 years.

For the purpose of this paper the scope of the road network includes facilities for walking, cycling, public transport and motorised traffic.

Hutt City Context

The Hutt City Council 2012-2032 Urban Growth Strategy contains a target of increasing the population of Hutt City to at least 110,000 people by 2032 (an increase of approximately 12,000 persons from the 2013 census) with an associated target of increasing the number of new homes in the City by at least 6,000 over the same period. The Urban Growth Strategy sets out the intention to provide this level of population and housing growth through:

(i) residential intensification in existing urban areas including Waterloo, Epuni, residential areas adjacent to Lower Hutt CBD, Eastbourne, Petone and around suburban shopping centres;
(ii) new greenfield development in Kelson, Wainuiomata and Stokes Valley; and
(iii) additional residential development in rural areas.

District Plan Change 43 was recently proposed to facilitate this growth through providing for greater housing capacity and a wider range of options for housing styles and sizes at medium densities within the existing urban area in targeted locations.

The Regional Land Transport Programme, Hutt City's Infrastructure Strategy 2018 – 2048, Long Term Plan and Transport Activity Management Plan outline the strategic direction for our transport network development which includes the promotion of active modes and public transport.

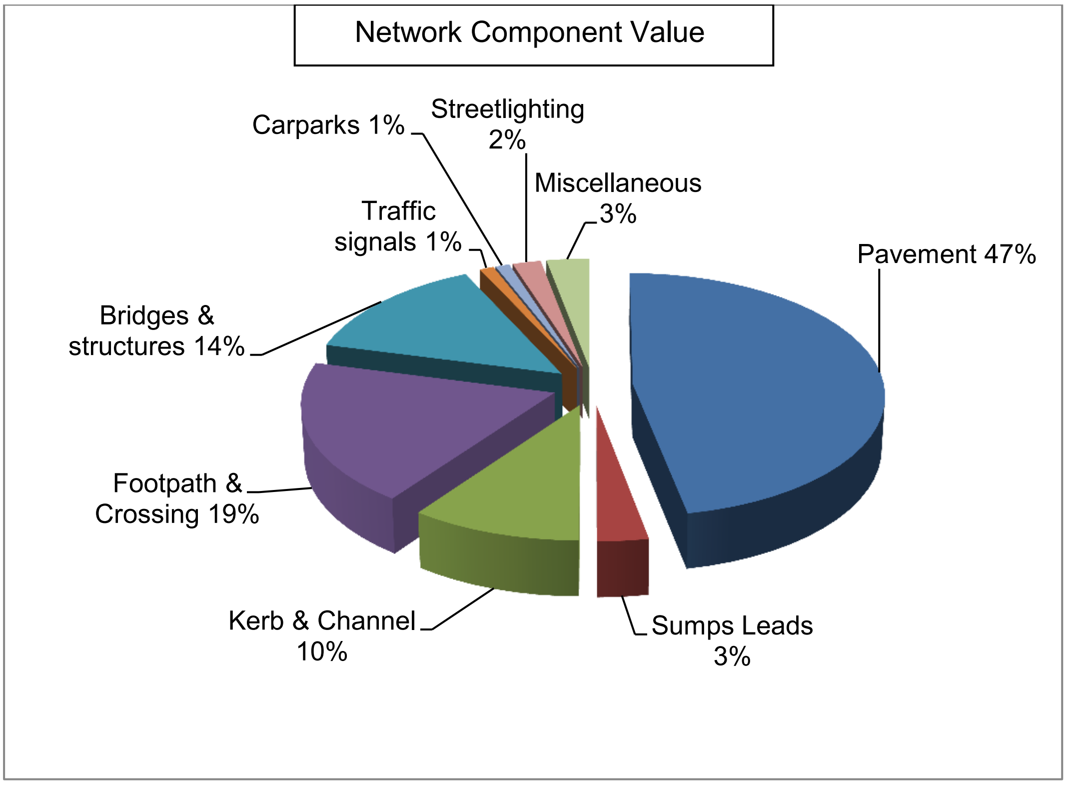
These documents and the analysis carried out when District Plan Change 43 was proposed form the basis of this assessment.

Overview of the Local Road Network

Hutt City Council's Transport Activity Management Plan provides a comprehensive summary of the condition and performance of the city's transport network and includes the following statements;

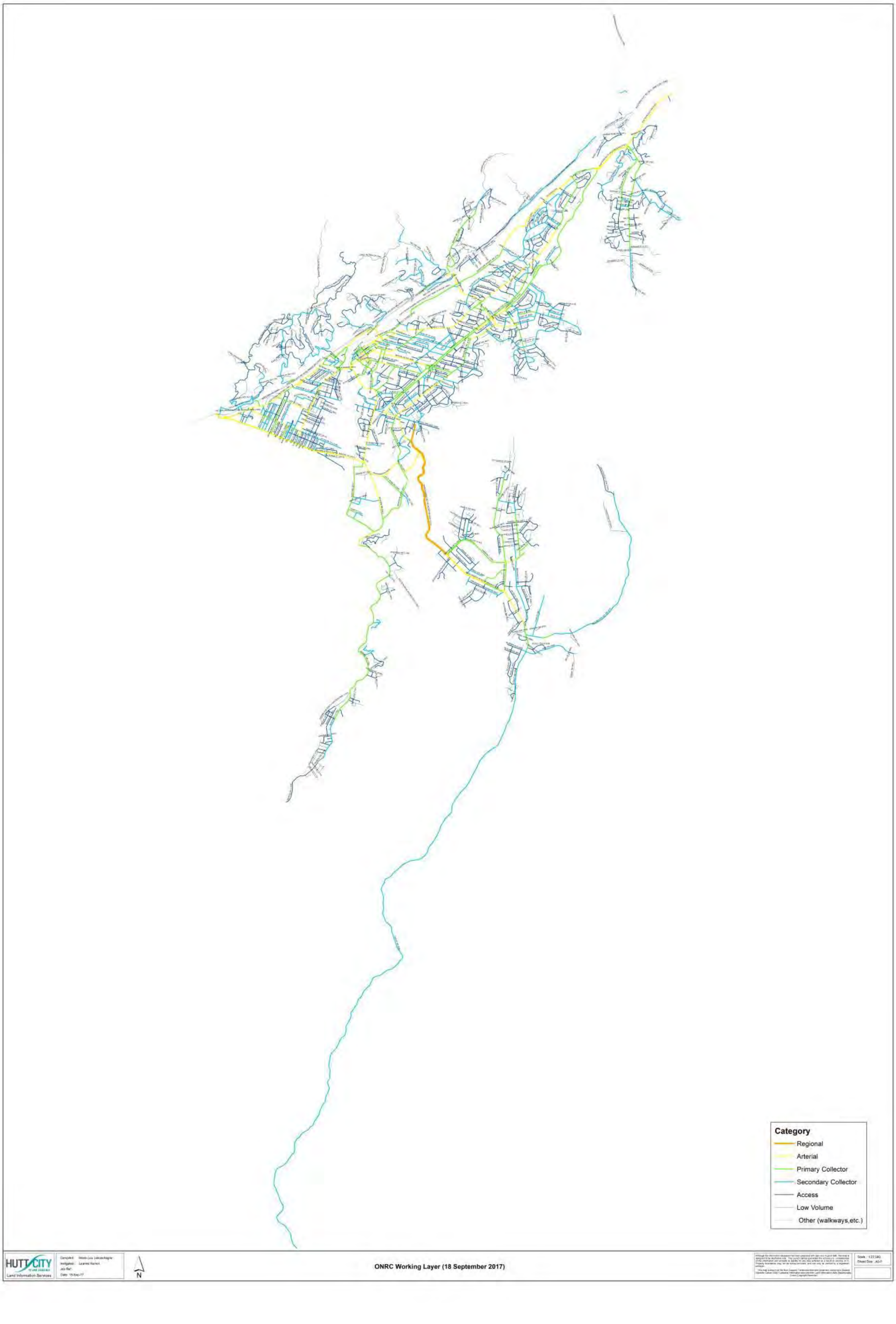
The city has an aspiration for economic and population growth and the strategies developed to support these goals are beginning to bear fruit. An aging demographic and social wellbeing objectives require the transport network to provide for alternatives modes of travel, as well as accommodating the demands imposed by growth.
The economic activities within the city rely heavily on customer access from within the city and beyond, while the industrial activities rely on access within the city to regional and national transport links. The Seaview/Gracefield industrial area is the largest industrial area within the region, with Hutt City accounting for 2.1% of the National GDP in 2016.
The urban area is elongated with outlying suburbs which results in just over 50% of the network being arterial and collector roads. The remainder is access and low volume roads. There are no unsealed roads and only 6% of the network is rural, predominantly secondary collector.
Effective, efficient and safe internal and external land transport is critical for an urban environment to function successfully and grow. The Hutt City transport system consists of multi modal networks linking the CBD, suburbs and surrounding cities.
HCC's Transport Activity supports the economic wellbeing of the city by responding to growth and development while promoting social and cultural wellbeing via our Road Safety Programme, Road Asset Maintenance and Renewal programme, and the Traffic Services Programme.
Our objectives are met through the operation and maintenance of a network that includes 484 kilometres of roadway, 686 kilometres of footpath and walkway, 71 bridges, 13,957 streetlights, 24 sets of traffic signals, 151 Pay & Display meters and 1,800 Pay & Display car-parks. The total replacement cost of the network is $902,803,000 as at December 2017.

Road Network Component Value – Chart



NZTA have recently introduced the One Network Road Classification (ONRC) system to enable operational and cultural change in road activity management. It facilitates a customer-focused, business case approach to budget bids for the National Land Transport Programme. Classification of New Zealand's roads using the ONRC was completed in 2013.

The following map illustrates the ONRC classification of the Hutt City roading network;



ONRC Working Layer (18 September 2017)

How Performance is Monitored

The Council monitors levels of service using seven measures:

- Resident satisfaction with seven aspects of the road assets and service –street lighting, litter, graffiti, traffic control, footpaths, roads, and parking
- Road condition index - measures quality of the road surface
- Smooth travel index – measure the quality of the ride
- Accident trend – for fatal and serious injury accidents measures safety
- Response to service requests – measures service delivery and promptness of reply
- Resurfacing achieved – shows whether the Council is doing adequate maintenance work to protect the assets
- Quality of footpaths – shows whether the footpaths are safe and meet the service standard for footpaths

We also receive performance feedback from various sources including;

- Feedback from consultative processes such as the LTP and the Annual Plan.
- Feedback from Council staff and the operations and maintenance contractor.
- The 2002 Peter Glen Research – Customer Satisfaction Survey (this work drilled more deeply than the Communitrak survey, and subsequent work is now more targeted)
- Management knowledge of existing asset performance.
- Direct operational feedback from customers, community groups, industry and Councillors.
- NZTA's 'Maintenance Guidelines for Local Roads' document.
- Cycleway consultation group.
- Pedestrian consultation group.
- Eastern Bays walkway consultation group.
- Disabled persons consultation group.

New Performance Measures have been developed as part of the ONRC regime and these will be important comparators with our peers in future. Councils are currently validating the data used in determining the new measures to ensure accurate and relevant comparisons are made.

How Constraints and Issues are Responded To

Drivers of Demand

The future demand for roading network services in Hutt City will be driven by:

- Social – future demographic trends and the need to service population growth in the city.

- Changing customer expectations and the need to upgrade services in the parts of the network where gaps exist between existing and specified level of service.
- Changes in travel preferences.
- Environmental trends and changing expectations about how the adverse effects of roading and parking activity are mitigated.
- Technological changes.
- Economic changes, considering growth and the economic strength of the city.
- Commercial trends.

Increasing standards and community expectations will have an influence on the nature and design of future transport facilities. Furthermore, environmental issues can be expected to be increasingly important in decisions about the mode and form of future transport infrastructure. These environmental and social issues are identified and addressed in the Network Operating Framework from which the Network Operating Plan will be developed.

Responses to Constraints/Issues

Responses to constraints and issues relating to roading condition are normally covered by our maintenance and renewals strategies.

Maintenance

Maintenance strategies are designed to enable existing assets to operate to their service potential over their useful life. This is necessary to meet service standards, achieve target standards and prevent premature asset failure or deterioration. There are three types of maintenance:

- Programmed (proactive) maintenance - A base level of maintenance carried out to a predetermined schedule. Its objective is to maintain the service potential of the asset system.
- Condition maintenance - Maintenance actioned as a result of condition or performance evaluations of components of the road network system (e.g. weed spraying, bridge repairs). Its objective is to avoid critical asset or system failure.
- Response maintenance - Maintenance carried out in response to reported problems or system defects (e.g. pothole repairs). Its objective is to maintain day-to-day levels of service.

Renewals

The purpose of the renewal plan and the associated draft financial programme is to provide for the progressive replacement of individual assets which have reached the end of their useful life at a rate which maintains the standard and value of the system of assets as a whole. This programme does not increase the standards of service able to be provided, but maintains these standards at current levels. This programme must be maintained at adequate levels to maintain standards of service, and the overall quality of assets.

Required levels of expenditure on the cyclic asset replacement programme will not be uniform but will vary from year to year and will reflect:

- the age profile of the system,
- the condition profile of the system,
- the ongoing maintenance demand, and
- the differing economic lives of individual assets which comprise the overall system of assets.

Failure to maintain an adequate cyclic asset replacement programme will be reflected in a decline in the overall standard of the system of assets. Thus Council aims to maintain this programme within a band of +/- 10% of the target programme on a cumulative basis. Where the actual programme falls below the cumulative budget target, the shortfall will be reflected in a reduction in the overall depreciated replacement cost value of the system. Age and condition profiles of roading network components will be used as reference points to determine forward renewal programmes. These programmes are intended to maintain the overall standard of the system.

Cyclic renewal works fall into two categories:

- Rehabilitation: Involves major work on an existing asset or asset component which is capitalised rather than expensed under maintenance. An example is pavement smoothing works to reinstate the quality of ride. Rehabilitation does not provide for a planned increase in the operating capacity or design loading. It is intended to enable the system to continue to be operated so as to meet the current standards of service.

- Renewal: Typically, complete replacement of an existing asset. Does not provide for a planned increase to the operating capacity or design loading. Some minor increase in capacity may result from the process of renewal, but a substantial improvement is needed before system development is considered to have occurred. An example is the renewal of kerbs and footpaths through the road reconstruction programme.

However, there are many response options to constraints and issues relating to network capacity. These include new assets, many of which are listed under the section on Planned and Budgeted Improvements, and works which upgrade or improve an existing asset beyond its existing capacity or performance in response to changes in traffic needs or customer expectations.

The capital works programme identifies two broad categories of projects planned:

Growth related – projects focused on meeting increased traffic or changes in traffic patterns

- Road widening
- Intersection upgrades including new traffic signals or controls
- New roads and bridges

Service level related – projects planned to improve the level of service

- Cycleway construction

- Bridge strengthening
- Neighbourhood street improvement works
- Footpath extensions
- Crash reduction projects

Planned and Budgeted Improvements

There are a number of transport infrastructure projects at various stages of planning from concept ideas through to funded and scheduled projects which may influence travel patterns and behaviour on the Hutt City road network. These projects include:

- Cross Valley Connection;
  $1m has been budgeted for Investigation and Design commencing this year with $250k approved by NZTA for the next stage of the Business Case process, the Programme Business Case. We have previously completed the first stage of the Business Case process and are about to start the PBC. We have $65m budgeted in our LTP in 2025-27 for construction.

- Melling Interchange Upgrade;
  This is an NZTA project being undertaken as part of the RiverLink project.

- Melling Bridge Replacement;
  As per the Melling Interchange Upgrade comments. HCC has $6.5m budgeted in our LTP in 2025-26 as a contribution to this initiative.

- Relocation of Melling train station;
  As per the Melling Interchange Upgrade comments. HCC has no budget for this initiative.

- CBD Eastern Access Route;
  This project has been incorporated into the local road changes associated with the RiverLink project. HCC has $3.5 budgeted for this work in 2020/21.

- Petone to Grenada Link;
  This is an NZTA project.

- Petone Interchange Upgrade;
  This project is expected to be part of the P2G project, dependent on final alignment.

- SH58/ SH2 Interchange Upgrade;
  This is an NZTA project. Project construction is complete.

- Petone to Ngauranga Cycleway;
  This is an NZTA project.

- Petone to Melling Cycleway;
  This is an NZTA project with a $1m unsubsidised contribution from HCC budgeted in 2018/19.

- Beltway Cycleway;
  The northern and central sections of this project are in the final stage of detailed design and construction is expected to commence this calendar year. This work is budgeted.

- New cycling/pedestrian bridge linking the CBD with Melling Station;
  This is part of the RiverLink project.

- Wainuiomata Hill Shared Path.
  This project is nearing completion with construction estimated to finish in May/June 2019. This work was budgeted.

- Eastern Bays Shared Path
  This project is in the final stages of the business case process and preparation of the resource consent application is underway. This work is budgeted.

Linkages to State Highways

State Highway 2 runs along the foot of the Western Hills and provides a roading connection between Upper Hutt, the Wairarapa and beyond, to Wellington. Along with State Highway 58 it provides a connection between Pauatahanui and the Kapiti Coast and the Hutt Valley. Connections onto State Highway 58 in Hutt City are limited to the State Highway 2 intersectionnd the nearby intersection with Hebden Crescent. Opportunities for Hutt City traffic to access or leave State Highway 2 exist at the following locations going from south to north:

- Petone interchange;
- Priests Avenue and McKenzie Avenue;
- Dowse interchange;
- Melling interchange including Block Road and Tirohanga Road;
- Pomare Road and Wairere Road;
- Grounsell Crescent;
- Kennedy Good interchange including Major Drive;
- Owen Street;
- Hebden Crescent; and
- Haywards Interchange including Manor Park Road.

Assessment of Existing Constraints

The intersections between the local road network and State Highway 2 all experience congestion during the morning and evening peaks. In particular Melling and Petone are under capacity and have poor safety records. The Melling Interchange Upgrade as part of the River link Project and the Petone Interchange Upgrade which should accompany the Cross Valley Connection and Petone to Grenada Project considerations are critical in improving vehicle movements through and around Hutt City.

There is significant traffic congestion on weekday mornings for southbound traffic heading towards Wellington as a result of the limited capacity of State Highway 2 to the south of Petone. Similar congestion occurs on weekday evenings as traffic exiting Wellington is joined by traffic from State Highway 1 at Ngauranga Gorge.

The local Hutt road network is relatively uncongested at peak times with little significant congestion detected. The key features of the Hutt City road network can be summarised as follows:

- there is no pattern of fatal or serious injury road crashes that indicates a particular safety issue with any one part of the Hutt City road network;
- traffic flows into and out of the Hutt CBD are distributed across at least 12 different routes;
- some queuing occurs on the approaches to the High Street intersection with Daysh Street and Fairway Drive during both the weekday morning and evening and Saturday midday peaks.
- some congestion occurs within the CBD on Saturday associated with traffic accessing Queensgate and the Riverbank Market
- some queuing of vehicles turning right into and out of Waiwhetu Road at the intersection with Whites Line East occurs during the weekday morning peak.
- Some queuing occurs during the evening peak for traffic accessing the Ewen Bridge, particularly from Queens Drive and High Street.

The improvement projects mentioned earlier are intended to address the most critical existing constraints.

It should be noted that Hutt City Council has developed a Network Operating Framework which assists in assessing service level gaps in the network for all travel modes. A recently developed traffic model will assist in validating the existing service levels and understanding the impact of various initiatives on future service levels.

Assessment of Anticipated Constraints

The existing constraints will compound if traffic volumes continue to grow with the expected population growth. Further, if the proposed improvement projects are not implemented then more of the roading network will come under pressure. The traffic model will assist in identifying these locations as the areas of growth are understood.

However, a significant investment in the Hutt City's active mode network coupled with an increased focus on the public transport offer could lead to a reduction in private vehicle use.

Technological advances are also an important consideration in assessing future traffic volumes and consequent network constraints. There is a variance of opinion on the impact of autonomous vehicles, some predicting higher traffic volumes as roading capacity is effectively increased through closer following distances while others see more shared vehicle usage reducing total vehicle numbers.

Summary

In summary, Hutt City has a number of existing constraints in its transport network and has identified improvement projects to address these. Concurrently, Hutt City is investing heavily in its active mode network to provide attractive mode choices for its growing population.

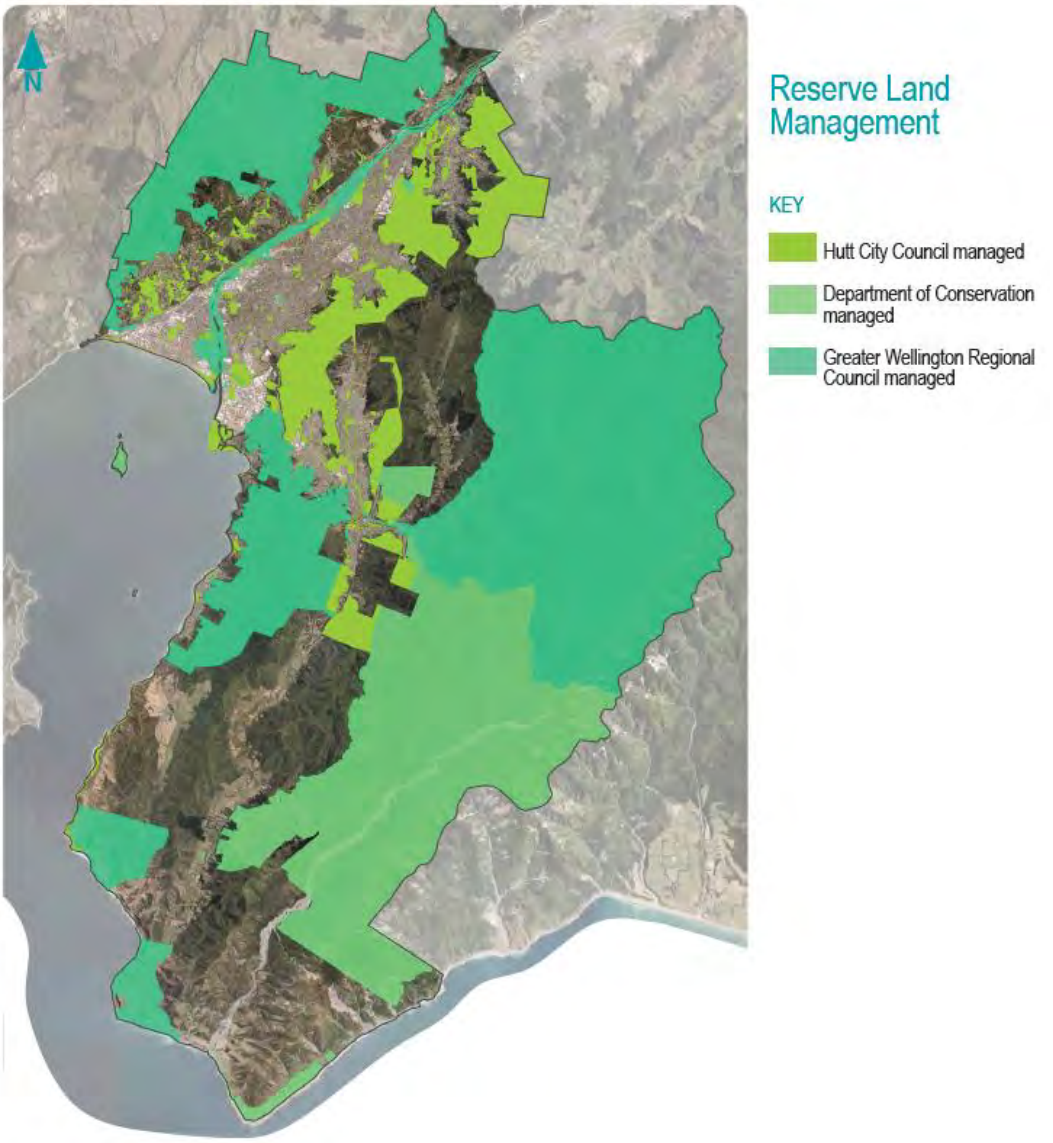
Appendix 3.3

Hutt City Open Space Network Assessment for NPS – UDC

Introduction

1. This brief document summarises the open space network owned and administered by the Hutt City Council. It draws information from the Reserves Strategy (Reserves Strategic Directions 2016 -2026) and from the Valley Floor Review, key documents in the strategic management of the City's open space network.

2. While the assessment covers only Hutt City Council owned land, it is noted that almost half (49.4%) of the entire City consists of public open space managed as reserve. Open Space managed by the Department of Conservation, the Greater Wellington Regional Council and Hutt City Council is shown in the aerial plan below, providing the wider context in which this assessment has been undertaken. From a user perspective, ownership of open space is less relevant than its presence and availability.



Hutt City Council Owned Network Overview

3. Hutt City Council manages 349 reserves comprising 2,781 hectares, most of which are classified and protected under the Reserves Act 1977. The table below breaks this down into different categories of reserve.

Reserve Category	Quantity	Hectares
Nature	67	2,074
Sports and Recreation	55	303
Ecological Corridor	88	271
Cultural and Heritage	9	83
Neighbourhood	83	35
Drainage	29	7
Civic Space	13	5
Public Garden	5	3
Total	**349**	**2,781**

4. Reserve categories are based on the New Zealand Recreation Association Parks Categories (with the exception of Drainage Reserves) and are applied according to a reserve's character and primary purpose. They are described more fully in Appendix 1.

5. Within these reserve spaces there are approximately 166 kilometres of walking and cycling tracks, mostly within the surrounding hills, (nature reserves) and 54 playgrounds mostly situated in neighbourhood reserves.

Network Sufficiency

6. Council, through its Reserves Strategy, includes a service standard which aims to have a reserve within an easy walking distance from residential housing within its urban areas. An easy walking distance is defined as being within 400 metres or an 8.5 minute walk, which is the time it generally takes an elderly person or young child to walk 400 metres.

7. A desktop exercise using GIS mapping tools indicates that over 98% of households in the urban area are within a 400 metre radius of open space. This result excludes the rural areas largely within Wainuiomata and the Western Hills. A plan showing areas of the City that do not meet this standard is attached as Appendix 2.

8. A review of the Wellington region's sports grounds undertaken in 2014 showed that Hutt City has sufficient reserve land to accommodate formal sport. This is unlikely to change in the foreseeable future given the overall participation trends for formal sports along with the development of artificial playing surfaces that have enabled more intensive use and thereby increasing overall capacity.

9. The Valley Floor Review, (a comprehensive review of reserve land on the most densely populated part of the City undertaken between 2013 and 2016) identified that the main two shortcomings of open space for the Valley floor were a lack of connectivity and reserve

development, suitable to meet the needs of local communities. Council has developed an action plan and funding in the Long Term Plan to address these two issues.

Network Gaps and Pressures

10. Council has identified some gaps within the open space network that would improve biodiversity. These are largely to improve ecological corridors such as the network of reserves on the Eastern Hills and in Wainuiomata. As opportunity arises such as subdivision, Council will consider purchase or other mechanisms to ensure ecological linkages can be maintained and protected.

11. A review of play spaces undertaken in 2012 (Go Outside and Play) identified a small number of gaps in the distribution of formal playgrounds in the City based on a play space being within 600 metres of residents (direct line). The main one was in the Epuni area for which Council has indicated that a new playground will be developed on reserve land adjacent to residential intensification in this part of the City. Council has 54 playgrounds in total.

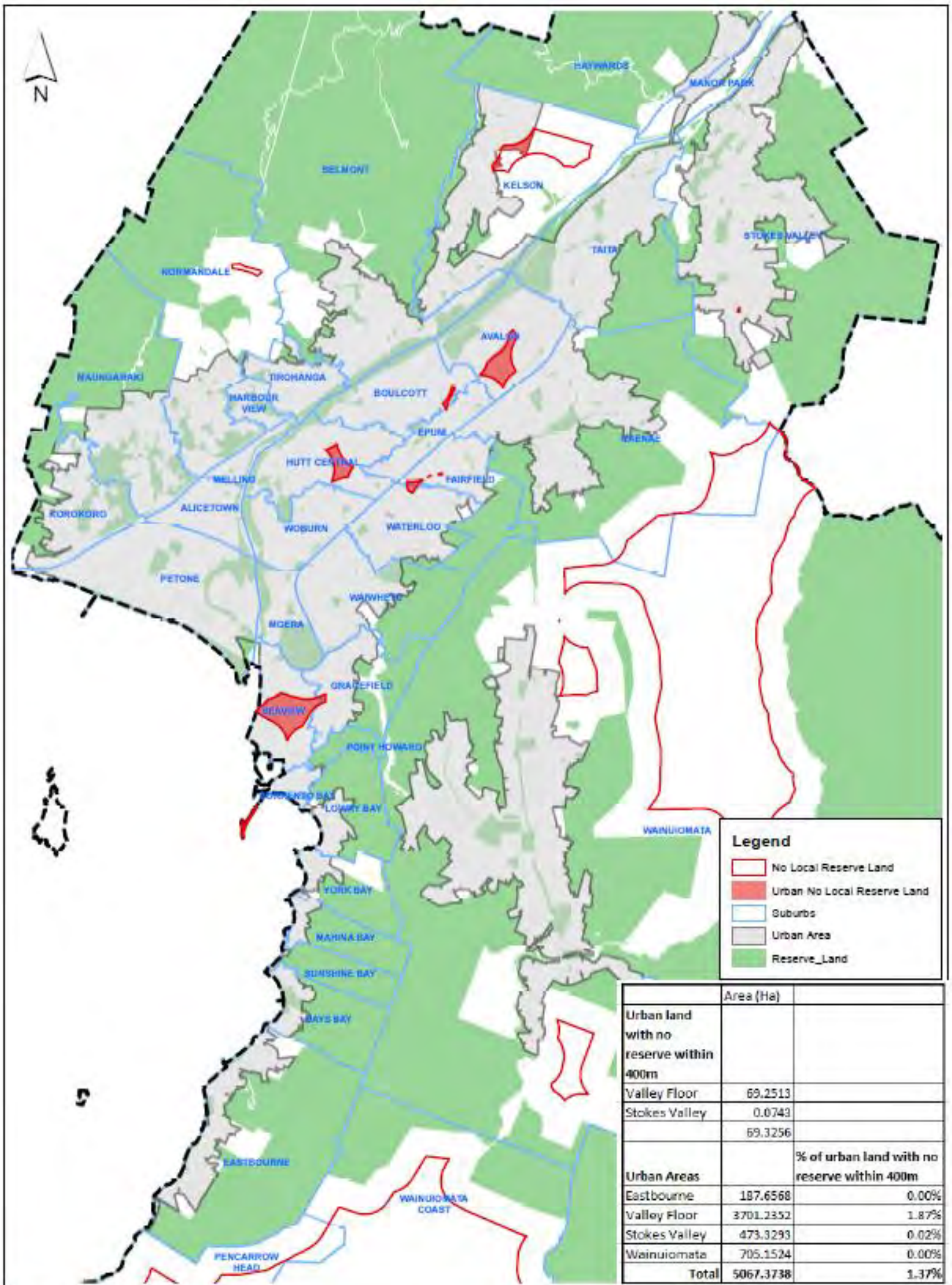
12. The redevelopment of the Avalon Park Playground has been a great success, that success resulting in very high usage and pressure on parks infrastructure such as parking.

Appendix 1

NZRA Parks Categories

Category	Description/Primary Purpose	Alternative Names
Sports and Recreation	Parks (often quite large areas) set aside and developed for organised sport and recreation activities, recreation facilities and buildings, often multiple use.	• Active • Sports
Neighbourhood	Parks developed and used for informal recreation and sporting activities, play and family based activities, and social and community activities.	• Local • Social Recreation • Community
Public Gardens	Parks and gardens developed to a very high horticultural standard with collections of plants and landscaping for relaxation, contemplation, appreciation, education, events, functions and amenity/intrinsic value.	• Botanic Gardens • Horticultural • Premier
Nature	Parks that offer the experience and/or protection of the natural environment, containing native bush, coastal margins, forestry, farm parks, wetlands, riparian areas and water bodies.	• Conservation • Bushland • Forest • Protected • Environmental
Cultural Heritage	Parks that protect the built cultural and historical environment, and/or provide for heritage conservation, education, commemoration, mourning and remembrance.	• Cemeteries • Cultural • Heritage
Outdoor Adventure	Parks developed and used for recreation and sporting activities and associated built facilities that require a large scale, forested, rural or peri-urban environment.	• Regional • Forest • Farm • All Terrain
Civic	Areas of open space often provided within or adjacent to central business districts, and developed to provide a space for social gatherings, meeting places, relaxation and enjoyment	• Plaza • Community Hub • Town Squares • Streetscape
Recreation and Ecological Linkages	Areas of open space that are often linear in nature that provide pedestrian and cycle linkages, wildlife corridors and access to water margins. May provide for environmental protection, and access to waterways.	• Linear • Walkways • Corridor • Green Corridors • Environmental Corridors • Esplanade • Linkage

Appendix 2



	Area (Ha)	
Urban land with no reserve within 400m		
Valley Floor	69.2513	
Stokes Valley	0.0743	
	69.3256	
Urban Areas		**% of urban land with no reserve within 400m**
Eastbourne	187.6568	0.00%
Valley Floor	3701.2352	1.87%
Stokes Valley	473.3293	0.02%
Wainuiomata	705.1524	0.00%
Total	**5067.3738**	1.37%

HUTT CITY
Land Information Services

Compiled: John Floyd
Instigated: Bruce Hodgins
Job Ref: 2018/19 P & G
Date: January 2019

LOWER HUTT
Urban Areas
Land with no Reserve Land within 400m

Scale: 1:50,000
Sheet Size: A3-P

Appendix 3.4

HUTT CITY

COMMERCIALLY FEASIBLE RESIDENTIAL CAPACITY ASSESSMENT

Client: Hutt City Council

Project No: 51743

Date: May 2019

SCHEDULE

Code	Date	Information / Comments	Project Leader
51743.4	May 2019	Report	Tim Heath / Phil Osborne

DISCLAIMER

This document has been completed, and services rendered at the request of, and for the purposes of Hutt City Council only.

Property Economics has taken every care to ensure the correctness and reliability of all the information, forecasts and opinions contained in this report. All data utilised in this report has been obtained by what Property Economics consider to be credible sources, and Property Economics has no reason to doubt its accuracy. Property Economics shall not be liable for any adverse consequences of the client's decisions made in reliance of any report by Property Economics. It is the responsibility of all parties acting on information contained in this report to make their own enquiries to verify correctness.

1. INTRODUCTION

Property Economics has been engaged by Wellington City Council, on behalf of Hutt City Council (**HCC**) as part of a wider region residential capacity project team, to undertake an assessment of the commercially feasible residential capacity (supply) of the Hutt City District within the context of Council's obligations under the National Policy Statement on Urban Development Capacity (**NPS UDC**).

The purpose of this report is to provide HCC with robust market intelligence to assist in making more informed and economically justified decisions in regard to the design and implementation of a residential policy framework for the District Plan and other long-term planning documents.

This report discusses the work undertaken by both Property Economics and Wellington City Council in analysing the existing theoretical residential capacity of Hutt City and developing a capacity model for calculating the level of feasible development within the District. This will inform policy makers on the feasible level of housing supply, and which areas are able to accommodate future residential development based on current zonings, policy settings and market parameters.

2. THEORETICAL CAPACITY

Property Economics have been provided with GIS layers containing the sites within Hutt City that provided for infill, or comprehensive redevelopment. Theoretical residential capacity was calculated by WCC utilising current theoretical District Plan policy settings and algorithmic, GIS and 3D modelling. The information contained several different scenarios, based on housing typology and quantum, that were identified as theoretically viable to develop.

Table 1 below outlines the theoretical capacity output by the model provided to Property Economics by WCC by suburb.

TABLE 1 – HUTT CITY THEORETICAL RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB

Suburbs	Theoretical Capacity
ALICETOWN	493
AVALON	1119
BELMONT	780
BOULCOTT	686
DAYS BAY	105
EASTBOURNE	419
EPUNI	709
FAIRFIELD	735
HARBOUR VIEW	279
HAYWARDS	73
HUTT CENTRAL	7988
KELSON	927
KOROKORO	181
LOWRY BAY	136
MAHINA BAY	19
MANOR PARK	110
MAUNGARAKI	836
MELLING	146
MOERA	436
NAENAE	2887
NORMANDALE	909
PETONE	2121
POINT HOWARD	50
SORRENTO BAY	2
STOKES VALLEY	4170
SUNSHINE BAY	8
TAITA	1971
TIROHANGA	268
WAINUIOMATA	7533
WAIWHETU	1016
WATERLOO	1246
WOBURN	622
YORK BAY	50
Grand Total	39,030

Source: Property Economics, WCC

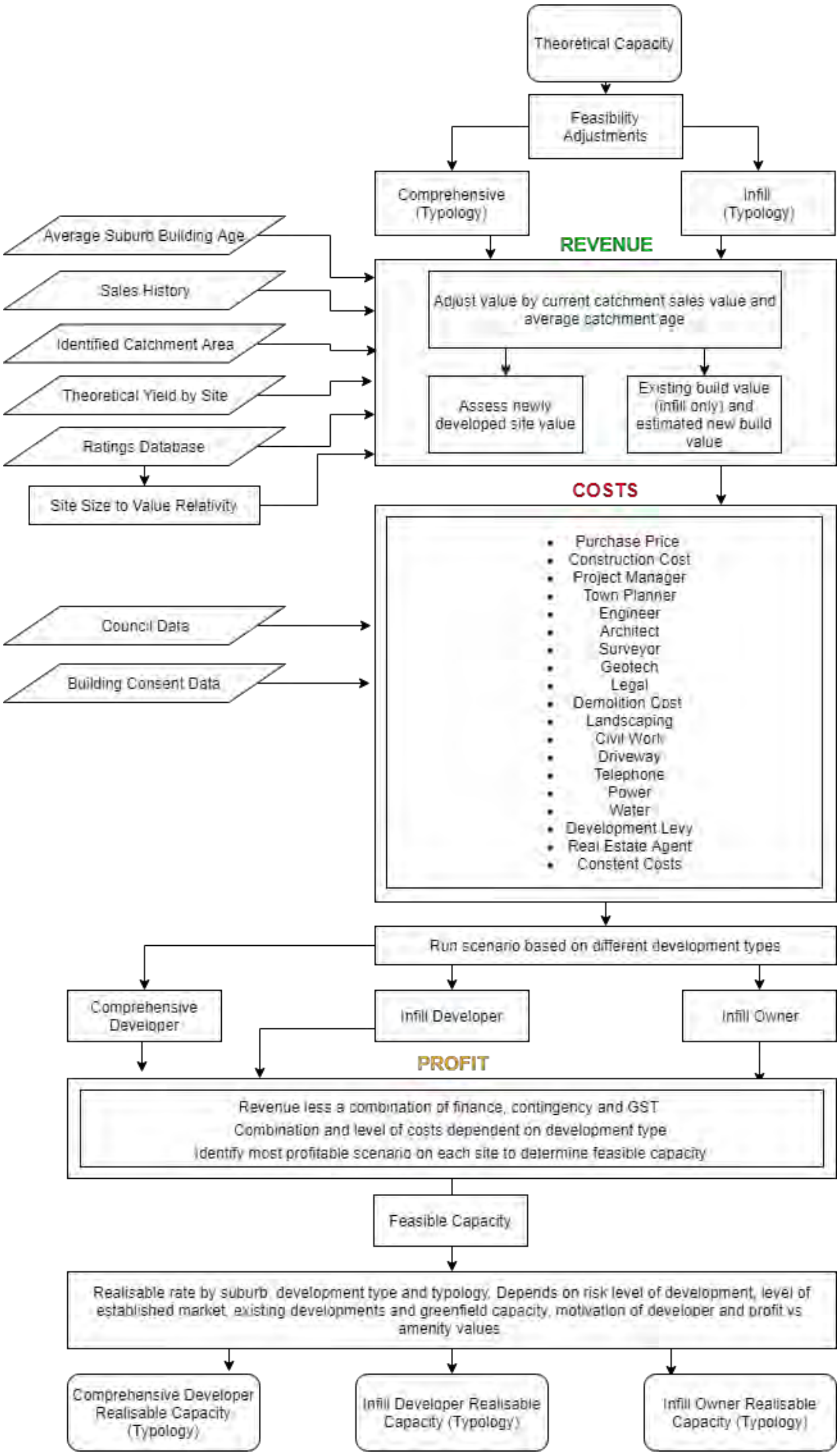
Table 1 shows there is theoretical capacity within Hutt City for around 39,030 new dwellings. The suburbs of Hutt Central and Wainuiomata have the highest level of theoretical capacity at 7,988 and 7,533 respectively, while the area of Sorrento Bay has the lowest level of theoretical capacity at only an estimated 2 dwellings.

It is important to note that Table 1 represents the sum of the maximum attainable yield of any typology on an individual site basis. The theoretical model outputs passed to Property Economics by WCC contained several different development scenarios on each site, therefore the theoretical yield represents the scenarios on each site where the development potential is the highest.

3. FEASIBLE CAPACITY MODELLING

A high-level overview of the model utilised by Property Economics in determining the feasible residential capacity for Hutt City is outlined in the flow chart in Figure 1 below, with detailed descriptions of each stage of the process given following.

FIGURE 1: PROPERTY ECONOMICS RESIDENTIAL FEASIBILITY MODEL OVERVIEW



Source: Property Economics

Land and Improvement Value per SQM

Using the ratings database provided by Hutt City Council, the land value per sqm and improvement value per sqm is calculated. This is then summarised by suburb, size and typology to give the average per sqm value for various types of dwellings.

By splitting the valuation into land and improvement value, it accounts for variations of both sizes e.g. a large dwelling on a small piece of land compared to the same size dwelling on a larger piece of land.

Values are not the same across each suburb (due to differing structures and quality), and thus it is required to give the per sqm value for each suburb individually. Also, the per sqm rate for land and improvement value are shown not to be consistent across all sizes. For example, a larger dwelling has on average a lower per sqm improvement value than a smaller one. This inverse relationship between size and per sqm value is the same for both land value per sqm and building value per sqm.

Tables 2-3 below show the build value per sqm utilised in the commercially feasible capacity modelling for varying building sizes for standalone and terraced typologies.

TABLE 2 – HUTT CITY STANDALONE BUILD VALUE / SQM BY SUBURB

STANDALONE	25	50	75	100	125	150	175	200	225	250	275	300	325	350
ALICETOWN	$3,927	$3,715	$3,541	$3,399	$3,276	$3,118	$3,017	$2,872	$2,768	$2,731	$2,671	$ 2,605	$ 2,583	$ 2,527
AVALON	$3,506	$3,318	$3,162	$3,036	$2,925	$2,784	$2,694	$2,565	$2,472	$2,438	$2,385	$ 2,327	$ 2,306	$ 2,257
BELMONT	$4,116	$3,894	$3,712	$3,563	$3,434	$3,268	$3,162	$3,011	$2,901	$2,862	$2,799	$ 2,731	$ 2,707	$ 2,649
BOULCOTT	$4,901	$4,637	$4,420	$4,243	$4,089	$3,892	$3,766	$3,585	$3,455	$3,408	$3,333	$ 3,252	$ 3,224	$ 3,155
DAYS BAY	$4,371	$4,135	$3,941	$3,784	$3,646	$3,471	$3,358	$3,197	$3,081	$3,039	$2,973	$ 2,900	$ 2,875	$ 2,813
EASTBOURNE	$4,371	$4,135	$3,941	$3,784	$3,646	$3,471	$3,358	$3,197	$3,081	$3,039	$2,973	$ 2,900	$ 2,875	$ 2,813
EPUNI	$4,901	$4,637	$4,420	$4,243	$4,089	$3,892	$3,766	$3,585	$3,455	$3,408	$3,333	$ 3,252	$ 3,224	$ 3,155
FAIRFIELD	$4,901	$4,637	$4,420	$4,243	$4,089	$3,892	$3,766	$3,585	$3,455	$3,408	$3,333	$ 3,252	$ 3,224	$ 3,155
GRACEFIELD	$4,524	$4,281	$4,080	$3,917	$3,774	$3,593	$3,476	$3,309	$3,189	$3,146	$3,077	$ 3,002	$ 2,976	$ 2,912
HARBOUR VIEW	$2,602	$2,462	$2,346	$2,252	$2,170	$2,066	$1,999	$1,903	$1,834	$1,809	$1,769	$ 1,726	$ 1,711	$ 1,674
HAYWARDS	$4,116	$3,894	$3,712	$3,563	$3,434	$3,268	$3,162	$3,011	$2,901	$2,862	$2,799	$ 2,731	$ 2,707	$ 2,649
HUTT CENTRAL	$4,901	$4,637	$4,420	$4,243	$4,089	$3,892	$3,766	$3,585	$3,455	$3,408	$3,333	$ 3,252	$ 3,224	$ 3,155
KELSON	$4,116	$3,894	$3,712	$3,563	$3,434	$3,268	$3,162	$3,011	$2,901	$2,862	$2,799	$ 2,731	$ 2,707	$ 2,649
KOROKORO	$4,681	$4,429	$4,222	$4,053	$3,905	$3,717	$3,597	$3,424	$3,300	$3,256	$3,184	$ 3,106	$ 3,079	$ 3,013
LOWRY BAY	$4,371	$4,135	$3,941	$3,784	$3,646	$3,471	$3,358	$3,197	$3,081	$3,039	$2,973	$ 2,900	$ 2,875	$ 2,813
MAHINA BAY	$4,371	$4,135	$3,941	$3,784	$3,646	$3,471	$3,358	$3,197	$3,081	$3,039	$2,973	$ 2,900	$ 2,875	$ 2,813
MANOR PARK	$4,116	$3,894	$3,712	$3,563	$3,434	$3,268	$3,162	$3,011	$2,901	$2,862	$2,799	$ 2,731	$ 2,707	$ 2,649
MAUNGARAKI	$3,421	$3,237	$3,085	$2,962	$2,854	$2,717	$2,629	$2,503	$2,412	$2,379	$2,327	$ 2,270	$ 2,250	$ 2,202
MELLING	$4,116	$3,894	$3,712	$3,563	$3,434	$3,268	$3,162	$3,011	$2,901	$2,862	$2,799	$ 2,731	$ 2,707	$ 2,649
MOERA	$4,522	$4,279	$4,078	$3,915	$3,773	$3,591	$3,475	$3,308	$3,188	$3,145	$3,076	$ 3,001	$ 2,974	$ 2,911
NAENAE	$4,735	$4,480	$4,270	$4,099	$3,950	$3,760	$3,638	$3,463	$3,338	$3,293	$3,220	$ 3,142	$ 3,114	$ 3,047
NORMANDALE	$3,976	$3,762	$3,586	$3,442	$3,317	$3,157	$3,055	$2,908	$2,803	$2,765	$2,704	$ 2,638	$ 2,615	$ 2,559
PENCARROW HEAD	$4,371	$4,135	$3,941	$3,784	$3,646	$3,471	$3,358	$3,197	$3,081	$3,039	$2,973	$ 2,900	$ 2,875	$ 2,813
PETONE	$4,522	$4,279	$4,078	$3,915	$3,773	$3,591	$3,475	$3,308	$3,188	$3,145	$3,076	$ 3,001	$ 2,974	$ 2,911
POINT HOWARD	$4,901	$4,637	$4,420	$4,243	$4,089	$3,892	$3,766	$3,585	$3,455	$3,408	$3,333	$ 3,252	$ 3,224	$ 3,155
REMUTAKA FOREST PAR	$2,860	$2,706	$2,579	$2,476	$2,386	$2,271	$2,197	$2,092	$2,016	$1,989	$1,945	$ 1,898	$ 1,881	$ 1,841
SEAVIEW	$4,901	$4,637	$4,420	$4,243	$4,089	$3,892	$3,766	$3,585	$3,455	$3,408	$3,333	$ 3,252	$ 3,224	$ 3,155
SORRENTO BAY	$4,371	$4,135	$3,941	$3,784	$3,646	$3,471	$3,358	$3,197	$3,081	$3,039	$2,973	$ 2,900	$ 2,875	$ 2,813
STOKES VALLEY	$2,602	$2,462	$2,346	$2,252	$2,170	$2,066	$1,999	$1,903	$1,834	$1,809	$1,769	$ 1,726	$ 1,711	$ 1,674
SUNSHINE BAY	$4,371	$4,135	$3,941	$3,784	$3,646	$3,471	$3,358	$3,197	$3,081	$3,039	$2,973	$ 2,900	$ 2,875	$ 2,813
TAITA	$2,860	$2,706	$2,579	$2,476	$2,386	$2,271	$2,197	$2,092	$2,016	$1,989	$1,945	$ 1,898	$ 1,881	$ 1,841
TIROHANGA	$2,602	$2,462	$2,346	$2,252	$2,170	$2,066	$1,999	$1,903	$1,834	$1,809	$1,769	$ 1,726	$ 1,711	$ 1,674
WAINUIOMATA	$2,860	$2,706	$2,579	$2,476	$2,386	$2,271	$2,197	$2,092	$2,016	$1,989	$1,945	$ 1,898	$ 1,881	$ 1,841
WAINUIOMATA COAST	$2,860	$2,706	$2,579	$2,476	$2,386	$2,271	$2,197	$2,092	$2,016	$1,989	$1,945	$ 1,898	$ 1,881	$ 1,841
WAIWHETU	$2,860	$2,706	$2,579	$2,476	$2,386	$2,271	$2,197	$2,092	$2,016	$1,989	$1,945	$ 1,898	$ 1,881	$ 1,841
WATERLOO	$3,098	$2,931	$2,794	$2,682	$2,585	$2,460	$2,381	$2,266	$2,184	$2,155	$2,107	$ 2,056	$ 2,038	$ 1,994
WOBURN	$3,098	$2,931	$2,794	$2,682	$2,585	$2,460	$2,381	$2,266	$2,184	$2,155	$2,107	$ 2,056	$ 2,038	$ 1,994
YORK BAY	$4,371	$4,135	$3,941	$3,784	$3,646	$3,471	$3,358	$3,197	$3,081	$3,039	$2,973	$ 2,900	$ 2,875	$ 2,813

Source: Property Economics, HCC, WCC

TABLE 3 – HUTT CITY TERRACED BUILD VALUE / SQM BY SUBURB

TERRACED	25	50	75	100	125	150	175	200	225	250	275	300	325	350
ALICETOWN	$4,241	$4,012	$3,824	$3,671	$3,538	$3,367	$3,258	$3,102	$2,989	$2,949	$2,884	$2,814	$2,789	$2,729
AVALON	$3,787	$3,583	$3,415	$3,279	$3,159	$3,007	$2,910	$2,770	$2,670	$2,634	$2,576	$2,513	$2,491	$2,437
BELMONT	$4,445	$4,206	$4,009	$3,848	$3,708	$3,530	$3,415	$3,251	$3,134	$3,091	$3,023	$2,949	$2,924	$2,861
BOULCOTT	$5,293	$5,008	$4,773	$4,583	$4,416	$4,203	$4,067	$3,872	$3,732	$3,681	$3,600	$3,512	$3,481	$3,407
DAYS BAY	$4,720	$4,466	$4,257	$4,087	$3,938	$3,748	$3,627	$3,453	$3,328	$3,283	$3,210	$3,132	$3,105	$3,038
EASTBOURNE	$4,720	$4,466	$4,257	$4,087	$3,938	$3,748	$3,627	$3,453	$3,328	$3,283	$3,210	$3,132	$3,105	$3,038
EPUNI	$5,293	$5,008	$4,773	$4,583	$4,416	$4,203	$4,067	$3,872	$3,732	$3,681	$3,600	$3,512	$3,481	$3,407
FAIRFIELD	$5,293	$5,008	$4,773	$4,583	$4,416	$4,203	$4,067	$3,872	$3,732	$3,681	$3,600	$3,512	$3,481	$3,407
GRACEFIELD	$4,886	$4,623	$4,406	$4,230	$4,076	$3,880	$3,754	$3,574	$3,445	$3,398	$3,323	$3,242	$3,214	$3,145
HARBOUR VIEW	$2,810	$2,658	$2,534	$2,433	$2,344	$2,231	$2,159	$2,055	$1,981	$1,954	$1,911	$1,864	$1,848	$1,808
HAYWARDS	$4,445	$4,206	$4,009	$3,848	$3,708	$3,530	$3,415	$3,251	$3,134	$3,091	$3,023	$2,949	$2,924	$2,861
HUTT CENTRAL	$5,293	$5,008	$4,773	$4,583	$4,416	$4,203	$4,067	$3,872	$3,732	$3,681	$3,600	$3,512	$3,481	$3,407
KELSON	$4,445	$4,206	$4,009	$3,848	$3,708	$3,530	$3,415	$3,251	$3,134	$3,091	$3,023	$2,949	$2,924	$2,861
KOROKORO	$5,056	$4,784	$4,559	$4,377	$4,218	$4,015	$3,885	$3,698	$3,564	$3,516	$3,439	$3,355	$3,325	$3,254
LOWRY BAY	$4,720	$4,466	$4,257	$4,087	$3,938	$3,748	$3,627	$3,453	$3,328	$3,283	$3,210	$3,132	$3,105	$3,038
MAHINA BAY	$4,720	$4,466	$4,257	$4,087	$3,938	$3,748	$3,627	$3,453	$3,328	$3,283	$3,210	$3,132	$3,105	$3,038
MANOR PARK	$4,445	$4,206	$4,009	$3,848	$3,708	$3,530	$3,415	$3,251	$3,134	$3,091	$3,023	$2,949	$2,924	$2,861
MAUNGARAKI	$3,695	$3,496	$3,332	$3,199	$3,082	$2,934	$2,839	$2,703	$2,605	$2,569	$2,513	$2,452	$2,430	$2,378
MELLING	$4,445	$4,206	$4,009	$3,848	$3,708	$3,530	$3,415	$3,251	$3,134	$3,091	$3,023	$2,949	$2,924	$2,861
MOERA	$4,884	$4,621	$4,404	$4,228	$4,075	$3,878	$3,753	$3,573	$3,443	$3,397	$3,322	$3,241	$3,212	$3,144
NAENAE	$5,114	$4,838	$4,611	$4,427	$4,266	$4,061	$3,929	$3,740	$3,605	$3,556	$3,478	$3,393	$3,363	$3,291
NORMANDALE	$4,294	$4,063	$3,872	$3,718	$3,582	$3,410	$3,299	$3,141	$3,027	$2,986	$2,920	$2,849	$2,824	$2,764
PENCARROW HEAD	$4,720	$4,466	$4,257	$4,087	$3,938	$3,748	$3,627	$3,453	$3,328	$3,283	$3,210	$3,132	$3,105	$3,038
PETONE	$4,884	$4,621	$4,404	$4,228	$4,075	$3,878	$3,753	$3,573	$3,443	$3,397	$3,322	$3,241	$3,212	$3,144
POINT HOWARD	$5,293	$5,008	$4,773	$4,583	$4,416	$4,203	$4,067	$3,872	$3,732	$3,681	$3,600	$3,512	$3,481	$3,407
REMUTAKA FOREST PARK	$3,089	$2,922	$2,785	$2,674	$2,577	$2,453	$2,373	$2,259	$2,177	$2,148	$2,101	$2,049	$2,031	$1,988
SEAVIEW	$5,293	$5,008	$4,773	$4,583	$4,416	$4,203	$4,067	$3,872	$3,732	$3,681	$3,600	$3,512	$3,481	$3,407
SORRENTO BAY	$4,720	$4,466	$4,257	$4,087	$3,938	$3,748	$3,627	$3,453	$3,328	$3,283	$3,210	$3,132	$3,105	$3,038
STOKES VALLEY	$2,810	$2,658	$2,534	$2,433	$2,344	$2,231	$2,159	$2,055	$1,981	$1,954	$1,911	$1,864	$1,848	$1,808
SUNSHINE BAY	$4,720	$4,466	$4,257	$4,087	$3,938	$3,748	$3,627	$3,453	$3,328	$3,283	$3,210	$3,132	$3,105	$3,038
TAITA	$3,089	$2,922	$2,785	$2,674	$2,577	$2,453	$2,373	$2,259	$2,177	$2,148	$2,101	$2,049	$2,031	$1,988
TIROHANGA	$2,810	$2,658	$2,534	$2,433	$2,344	$2,231	$2,159	$2,055	$1,981	$1,954	$1,911	$1,864	$1,848	$1,808
WAINUIOMATA	$3,089	$2,922	$2,785	$2,674	$2,577	$2,453	$2,373	$2,259	$2,177	$2,148	$2,101	$2,049	$2,031	$1,988
WAINUIOMATA COAST	$3,089	$2,922	$2,785	$2,674	$2,577	$2,453	$2,373	$2,259	$2,177	$2,148	$2,101	$2,049	$2,031	$1,988
WAIWHETU	$3,089	$2,922	$2,785	$2,674	$2,577	$2,453	$2,373	$2,259	$2,177	$2,148	$2,101	$2,049	$2,031	$1,988
WATERLOO	$3,346	$3,166	$3,017	$2,897	$2,791	$2,657	$2,571	$2,448	$2,359	$2,327	$2,276	$2,220	$2,201	$2,154
WOBURN	$3,346	$3,166	$3,017	$2,897	$2,791	$2,657	$2,571	$2,448	$2,359	$2,327	$2,276	$2,220	$2,201	$2,154
YORK BAY	$4,720	$4,466	$4,257	$4,087	$3,938	$3,748	$3,627	$3,453	$3,328	$3,283	$3,210	$3,132	$3,105	$3,038

Source: Property Economics, HCC, WCC

Due to limited availability of ratings data for apartment typologies, nominal values were used for a range of apartment sizes, with capital value determined by interpolating between these points, and scaling based on the average rating data across a suburb. Additionally, the relative value of site specific land value, per square metre, has been utilised to differentiate between values within suburbs.

TABLE 4 – HUTT CITY NOMINAL APARTMENT VALUES

Apartment	25	50	75	100	125	150
Average	$186,288	$229,942	$290,896	$378,908	$448,755	$513,712

Apartment	175	200	225	250	275	300
Average	$574,122	$630,303	$682,552	$731,143	$776,333	$818,360

Source: Property Economics, HCC, WCC

The land value per sqm utilised in the commercially feasible capacity modelling for varying land sizes. This was utilised for both standalone and terraced typologies, however as described above apartments were modelled using nominal capital values.

A limitation identified during the modelling process was that by applying a percentage increase on the site-specific land value through the process of subdivision, meant that sites with a proportionally high underlying land value resulted in an impractical subdivided land value on a per sqm basis. This was identified as a specific problem for sites with underlying commercial land values.

As a solution, the maximum residentially zoned land value per sqm identified within the ratings database was used as a maximum limit for the land value per sqm after subdivision. This removed the impact of sites with underlying commercial land values resulting in impractically high profitability, and thus feasible yield.

Average Suburb Age

Using the same ratings database, the average age of dwellings is determined for each suburb. This is undertaken in order to adjust the building value for each suburb based on values of houses from each decade. The data shows that there is a relationship between the age of a building and its per sqm improvement value. Therefore, finding the average age and distribution (of the built product) in a suburb allows the building values outlined above in Tables 2 and 3 to be appropriately adjusted. Note, this adjustment was performed in 'bands', with decades updated accordingly, rather than applying an average across the suburb. This step is important due to the fact that the application of sales data is based on a significant proportion of older stock and does not, therefore, appropriately value new builds.

Sales vs Capital Value (CV)

A statistically significant sample dataset of recent sales in Hutt City was used to find the difference between the average sales price and the most recent valuation. This is to ensure the capacity modelling utilises the most up to date values data critical to the determination of current day feasible capacity.

Given the nominal level of sales over this period of time in Hutt City, it was deemed appropriate to supplement this dataset with site-specific updated valuation samples for each suburb. Based on a representative sample from each suburb in Hutt City, the average increase of sales price over the recent valuation is then determined. There exists a relationship between the suburb and this average increase, and thus the percentage increase is expressed per suburb. This average increase of sales over CV is then applied in the model to update the valuations (Tables 2 and 3) to reflect current market value.

Table 5 shows the average Sales / CV percentage utilised in the model.

TABLE 5 – HUTT CITY AVERAGE SALES / CV BY SUBURB

Suburb	Sales / CV	Suburb	Sales / CV
ALICETOWN	110%	MOERA	110%
AVALON	107%	NAENAE	111%
BELMONT	107%	NORMANDALE	107%
BOULCOTT	108%	PENCARROW HEAD	104%
DAYS BAY	104%	PETONE	108%
EASTBOURNE	104%	POINT HOWARD	104%
EPUNI	108%	REMUTAKA FOREST PARK	112%
FAIRFIELD	109%	SEAVIEW	109%
GRACEFIELD	110%	SORRENTO BAY	104%
HARBOUR VIEW	107%	STOKES VALLEY	107%
HAYWARDS	107%	SUNSHINE BAY	104%
HUTT CENTRAL	107%	TAITA	112%
KELSON	107%	TIROHANGA	107%
KOROKORO	108%	WAINUIOMATA	112%
LOWRY BAY	104%	WAINUIOMATA COAST	112%
MAHINA BAY	104%	WAIWHETU	109%
MANOR PARK	107%	WATERLOO	109%
MAUNGARAKI	107%	WOBURN	105%
MELLING	110%	YORK BAY	104%

Source: Property Economics, HCC, WCC

Construction Costs

Suburb based differentials between constructions costs for new dwellings were found by analysing the value of recent building consents granted within Hutt City. The historical building consent data shows that the average value of building consents varies across suburb within Hutt City, indicating the variety of product quality that is built.

Because of this, a table of average building consent per sqm by suburb was extracted from the building consent data in order to represent the average construction costs in a suburb. This is then used in the model as the construction costs of building a new dwelling. Note, this is only used for standalone and terraced dwellings, as apartments have been modelled using nominal capital values. Due to data restrictions some suburbs were grouped by quality for this purpose. This, once again, neutralises suburb-based sales data where these average sales are based on higher quality (and therefore more expensive) builds.

Tables 6. 7. and 8 following show the average build cost by suburb for standalone, terraced and apartment typology types.

TABLE 6 – HUTT CITY STANDALONE BUILD COST BY SUBURB

STANDALONE	50	75	100	125	150	175	200	225	250	275	280
ALICETOWN	$3,476	$2,805	$2,439	$2,204	$2,038	$2,006	$1,897	$1,809	$1,736	$1,676	$1,664
AVALON	$3,211	$2,592	$2,254	$2,036	$1,883	$1,854	$1,752	$1,672	$1,604	$1,548	$1,538
BELMONT	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
BOULCOTT	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
DAYS BAY	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
EASTBOURNE	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
EPUNI	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
FAIRFIELD	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
GRACEFIELD	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
HARBOUR VIEW	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
HAYWARDS	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
HUTT CENTRAL	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
KELSON	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
KOROKORO	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
LOWRY BAY	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
MAHINA BAY	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
MANOR PARK	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
MAUNGARAKI	$3,444	$2,780	$2,417	$2,184	$2,020	$1,988	$1,880	$1,793	$1,721	$1,661	$1,649
MELLING	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
MOERA	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
NAENAE	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
NORMANDALE	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
PENCARROW HEAD	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
PETONE	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
POINT HOWARD	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
REMUTAKA FOREST PAR	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
SEAVIEW	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
SORRENTO BAY	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
STOKES VALLEY	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
SUNSHINE BAY	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783
TAITA	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
TIROHANGA	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
WAINUIOMATA	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
WAINUIOMATA COAST	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
WAIWHETU	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
WATERLOO	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
WOBURN	$2,752	$2,220	$1,931	$1,745	$1,614	$1,588	$1,501	$1,432	$1,375	$1,327	$1,318
YORK BAY	$3,723	$3,004	$2,613	$2,361	$2,183	$2,149	$2,031	$1,938	$1,860	$1,795	$1,783

Source: Property Economics

TABLE 7 – HUTT CITY TERRACED BUILD COST BY SUBURB

TERRACED	50	75	100	125	150	175	200	225	250	275	280
ALICETOWN	$3,667	$2,959	$2,573	$2,325	$2,150	$2,116	$2,001	$1,909	$1,832	$1,768	$1,756
AVALON	$3,388	$2,734	$2,378	$2,148	$1,987	$1,955	$1,849	$1,764	$1,693	$1,634	$1,622
BELMONT	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
BOULCOTT	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
DAYS BAY	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
EASTBOURNE	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
EPUNI	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
FAIRFIELD	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
GRACEFIELD	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
HARBOUR VIEW	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
HAYWARDS	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
HUTT CENTRAL	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
KELSON	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
KOROKORO	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
LOWRY BAY	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
MAHINA BAY	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
MANOR PARK	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
MAUNGARAKI	$3,634	$2,932	$2,550	$2,304	$2,131	$2,097	$1,983	$1,891	$1,815	$1,752	$1,740
MELLING	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
MOERA	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
NAENAE	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
NORMANDALE	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
PENCARROW HEAD	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
PETONE	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
POINT HOWARD	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
REMUTAKA FOREST PAR	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
SEAVIEW	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
SORRENTO BAY	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
STOKES VALLEY	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
SUNSHINE BAY	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881
TAITA	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
TIROHANGA	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
WAINUIOMATA	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
WAINUIOMATA COAST	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
WAIWHETU	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
WATERLOO	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
WOBURN	$2,903	$2,343	$2,037	$1,841	$1,702	$1,675	$1,584	$1,511	$1,450	$1,400	$1,390
YORK BAY	$3,927	$3,169	$2,756	$2,490	$2,303	$2,267	$2,143	$2,044	$1,962	$1,894	$1,881

Source: Property Economics

TABLE 8 – HUTT CITY APARTMENT BUILD COST BY SUBURB

APARTMENT	50	75	100	125	150	175	200	225	250	275	280
ALICETOWN	$ 4,188	$ 3,379	$ 2,939	$ 2,655	$ 2,456	$ 2,417	$ 2,285	$ 2,180	$ 2,092	$ 2,019	$ 2,005
AVALON	$ 3,869	$ 3,123	$ 2,716	$ 2,454	$ 2,269	$ 2,233	$ 2,112	$ 2,014	$ 1,933	$ 1,866	$ 1,853
BELMONT	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
BOULCOTT	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
DAYS BAY	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
EASTBOURNE	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
EPUNI	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
FAIRFIELD	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
GRACEFIELD	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
HARBOUR VIEW	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
HAYWARDS	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
HUTT CENTRAL	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
KELSON	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
KOROKORO	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
LOWRY BAY	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
MAHINA BAY	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
MANOR PARK	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
MAUNGARAKI	$ 4,150	$ 3,349	$ 2,913	$ 2,631	$ 2,434	$ 2,395	$ 2,265	$ 2,160	$ 2,073	$ 2,001	$ 1,987
MELLING	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
MOERA	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
NAENAE	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
NORMANDALE	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
PENCARROW HEAD	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
PETONE	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
POINT HOWARD	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
REMUTAKA FOREST PARK	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
SEAVIEW	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
SORRENTO BAY	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
STOKES VALLEY	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
SUNSHINE BAY	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148
TAITA	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
TIROHANGA	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
WAINUIOMATA	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
WAINUIOMATA COAST	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
WAIWHETU	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
WATERLOO	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
WOBURN	$ 3,315	$ 2,675	$ 2,327	$ 2,102	$ 1,944	$ 1,913	$ 1,809	$ 1,726	$ 1,656	$ 1,598	$ 1,588
YORK BAY	$ 4,485	$ 3,620	$ 3,148	$ 2,844	$ 2,630	$ 2,589	$ 2,448	$ 2,335	$ 2,241	$ 2,163	$ 2,148

Source: Property Economics

Other Development Costs

As well as construction costs, a number of other costs have been incorporated in to the feasibility model on a per dwelling basis. Some of the key costs are outlined below in Table 9. Other costs are identified in Figure 1 but also include commercial interest at 8% p.a. and a 10% contingency on total costs (risk).

TABLE 9 – HUTT CITY PER DWELLING DEVELOPMENT COSTS

COMPREHENSIVE COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ 100	$ 100	$ 100
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

INFILL COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ -	$ -	$ -
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

Source: Property Economics, WCC

4. FEASIBILITY MODELLING OUTPUTS

4.1. FEASIBLE CAPACITY OUTPUTS

Property Economics has assessed the variables outlined above in the Hutt City market and run feasible capacity models across the range of locations, land values, improvement values, and land value changes. A key component of the market's willingness to develop infill is the relationship between a site's land value, fixed subdivision costs and the identifiable 'uptake' in value (sqm) through subdivision.

Table 10 below outlines a summary of the number of potential sections on sites where the ratios meet a profit level suitable to meet market expectations (20% for the purpose of this analysis).

TABLE 10 – HUTT CITY FEASIBLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB – OWNER AND DEVELOPER

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
ALICETOWN	493		28	1	29	6%
AVALON	1119		95	7	102	9%
BELMONT	780		55	87	142	18%
BOULCOTT	686		121	121	242	35%
DAYS BAY	105		21	2	23	22%
EASTBOURNE	419		66	16	82	20%
EPUNI	709		66	17	83	12%
FAIRFIELD	735		67	62	129	18%
HARBOUR VIEW	279		20	10	30	11%
HAYWARDS	73				-	0%
HUTT CENTRAL	7988		100	276	376	5%
KELSON	927		57	47	104	11%
KOROKORO	181		18	80	98	54%
LOWRY BAY	136		38	16	54	40%
MAHINA BAY	19			2	2	11%
MANOR PARK	110			1	1	1%
MAUNGARAKI	836		55	30	85	10%
MELLING	146		27	3	30	21%
MOERA	436		16	29	45	10%
NAENAE	2887		158	578	736	25%
NORMANDALE	909		79	124	203	22%
PETONE	2121		102	69	171	8%
POINT HOWARD	50		9	21	30	60%
SORRENTO BAY	2		2		2	100%
STOKES VALLEY	4170		3		3	0%
SUNSHINE BAY	8				-	0%
TAITA	1971		88	132	220	11%
TIROHANGA	268		38		38	14%
WAINUIOMATA	7533		191	332	523	7%
WAIWHETU	1016		148	37	185	18%
WATERLOO	1246		200	27	227	18%
WOBURN	622		136	18	154	25%
YORK BAY	50		6	5	11	22%
Grand Total	39,030	-	2,010	2,150	4,160	11%

Source: Property Economics, WCC

Table 10 represents the subdivision undertaken by either an owner occupier or a developer, with the capacity representing the most profitable. This is an important difference as motivations and capital outlay are often different. These figures have removed all 'double ups' i.e. where multiple instances were tested on a specific site and represent the most profitable scenario for that site.

If developments were to be undertaken by either a developer or owner occupier, there is then potential for 4,160 additional units within the Hutt City market. As all development options have been considered in Table 10, this represents the total feasible capacity in the market. This level of feasible capacity represents an 11% feasibility rate on the theoretical capacity.

4.2. SENSITIVITY ANALYSIS

As an extension to the feasibility modelling outlined above, scenarios testing the sensitivity of the feasibility model have also been undertaken. This has been done to test the robustness of the model, and see the practical implications due to small changes in the input variables.

The following scenarios have been tested in this sensitivity analysis:

- **Increasing the build value across all typologies by 15%.** This in essence represents a greater per sqm profit margin on any new built product. Tables 3 and 4 above show the build value per sqm utilised in the feasibility model for standalone and terraced developments. Under this sensitivity, the build values in this table were increased by 15%. Since nominal apartment values were used in the analysis, the average split between land value and improvement value was found on a suburb by suburb basis, with the 15% increase applied based on this proportional split i.e. applying only to build value. Within the model the relative difference between the build value of a development and the build cost is an important driver of profitability, and as such this sensitivity was run to investigate the impact on overall feasibility when this difference is greater.

- **Increasing the savings incurred due to Economies of Scale (EoS).** In the normal model, the maximum savings that could occur due to larger scale developments was savings of around 15% on relevant costs. This has been scaled to a maximum of around 50%, with the savings increased as the scale of the development increases. For example, a subdivision of one standalone dwelling will incur the same costs and thus profit level as the normal model, however an comprehensive apartment development of 50 units will incur significantly less costs than under the normal model. This sensitivity was included to investigate the effect of higher profitability drivers for large developments only.

- **Increasing the maximum attainable land value in the model by 10%**. This represents the possibility of the highest per sqm land value increasing by 10% in the future. Outlined in the process above, a maximum land value per sqm was applied on a suburb by suburb basis to remove the impact of scaling commercially valued land to inappropriately high per sqm land values. Increasing this maximum by 10% is expected to increase the feasibility of several sites as the profit made on the subdivision of the land would increase. This maximum was found by identifying the current highest residential land value per sqm within the suburb. The 10% increase as a sensitivity simply tests to see the relative impact of changing this imposed maximum.

- **Decreasing the maximum attainable land value in the model by 10%.** This represents the possibility of the highest per sqm land value increasing by 10% in the future. Similar to the sensitivity above, this represents a change in the imposed maximum land value achievable through subdivision, however, decreases this value by 10% rather than increasing. Again, this is to test the relative impact of changing this imposed maximum.

Each scenario has been tested independently of the other in order to isolate the sensitivity of the model to this specific scenario.

A summary of the feasible capacity under each of the four scenarios, compared against the original feasible capacity is given below in Table 11. A full breakdown of feasible capacity under each sensitivity scenario is given in Appendix 1.

TABLE 11 – FEASIBLE CAPACITY SENSITIVITY ANALYSIS

Scenario	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Normal Model	39,030	-	2,010	2,150	4,160	11%
Increased Economies of Scale	39,030	-	2,086	2,455	4,541	12%
Increased Build Value	39,030	-	2,691	4,618	7,309	19%
Increased Land Value (10%)	39,030	-	2,159	2,255	4,414	11%
Decreased Land Value (10%)	39,030	-	1,979	2,107	4,086	10%

Source: Property Economics, WCC

The series of sensitivities show that the modelling process is most sensitive to the increased build value, increasing feasible capacity to just over 7,300, a feasibility rate of 19%.

4.3. REALISABLE CAPACITY OUTPUTS

On top of the feasible capacity modelling, practical considerations must be taken into account as to what is likely to be developed in the real world. While this section is separated from the sensitivities above the realisation rates essentially provide for 'development chance' given the propensity for development variances.

These considerations are based on:

- Dwelling typology
- Development option
- Greenfield competition

The identification of these variables not only provides for sensitivities but also addresses the relativity between typologies. While all three typologies may be feasible the development model identifies the site scenario with the highest profit margin. However, practically while the model assesses the standard 20% profit margin, there is greater risk in some typologies. The assessment below endeavours to consider these risks, and motivation, differentials.

The capacity for greenfield development within Hutt City has been provided to Property Economics, and this has been cross referenced against future residential demand to give an indication of the proportion of demand that can be satisfied by greenfield development. Forecast demand for residential product has been based on Statistics NZ medium population and household projections.

Table 12 outlines greenfield capacity and future residential demand:

TABLE 12 – HUTT CITY GREENFIELD DEVELOPMENT CAPACITY

	Greenfield Capacity	30-Year Demand	Greenfield % of Demand	Required Brownfield
Lower Hutt City	1,316	6,300	21%	4,984

Source: Property Economics, WCC, SNZ

Over the 30-year forecast period from 2018-2048, Hutt City is forecast to require an additional 6,300 dwellings. Greenfield modelling provided by WCC has indicated that the District has capacity for 1,316 greenfield dwellings, making up 21% of 30-year demand. This is a comparatively low proportion of 30-year demand able to be satisfied by greenfield capacity, relative to other TA's in the Wellington Region. As such, the relative risk of brownfield development is low due to the low competition of greenfield options.

On top of greenfield consideration, the relative risk of each development type must be considered in quantifying what will practically be developed by the market. The risk is not homogenous across typology or development type, and thus a matrix of 'risk factors' have been applied across each combination of typology and development type.

Risk has been accounted for developments undertaking by developers by increasing the required profit level for a development to be classified as 'realisable', on top of being feasible.

Table 13 below shows the profit levels required for each combination of typology and development option to be considered realisable by the model.

TABLE 13 – DEVELOPER REALISABLE PROFIT RATES

	Comprehensive Developer	Infill Developer	Infill Owner
Standalone	20%	17%	25%
Terraced	23%	20%	28%
Apartment	32%	28%	39%

Source: Property Economics, WCC, SNZ

This reflects the market practicality that developments taken on by a developer have relatively lower risk if they are an infill development, rather than a comprehensive development. It also shows the increasing risk of development as the typology increases in scale from standalone dwellings, through to terraced product, and finally apartments.

For an owner occupier the model considers the profit level of the development relative to the capital value of the existing dwelling(s). This is because motivations for an owner to subdivide their property are inherently linked with the relative profit they can achieve against the value of their own home e.g. a $100,000 profit on a $1,000,000 site will be less likely to be developed by the owner, compared to a $100,000 profit on a $500,000 site, assuming similar fixed costs. Therefore, as a methodology for this, the model considers that the lowest quartile of feasible infill developments in terms of the relative profit / CV ratio will not be realised by the market.

Taking these market practicalities into consideration, Table 14 represents the realisable capacity within Hutt City:

TABLE 14 – HUTT CITY REALISABLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
ALICETOWN	493		17		17	2%
AVALON	1119		86		86	7%
BELMONT	780		88		88	7%
BOULCOTT	686		241		241	34%
DAYS BAY	105		23		23	22%
EASTBOURNE	419		78		78	16%
EPUNI	709		79		79	10%
FAIRFIELD	735		121		121	15%
HARBOUR VIEW	279		11		11	0%
HAYWARDS	73				-	0%
HUTT CENTRAL	7988		252		252	2%
KELSON	927		71		71	2%
KOROKORO	181		42		42	19%
LOWRY BAY	136		54		54	36%
MAHINA BAY	19		2		2	11%
MANOR PARK	110				-	0%
MAUNGARAKI	836		57		57	2%
MELLING	146		29		29	18%
MOERA	436		29		29	4%
NAENAE	2887		552		552	13%
NORMANDALE	909		90		90	3%
PETONE	2121		337	84	421	12%
POINT HOWARD	50		20		20	34%
SORRENTO BAY	2		2		2	100%
STOKES VALLEY	4170				-	0%
SUNSHINE BAY	8				-	0%
TAITA	1971		147		147	5%
TIROHANGA	268		30		30	5%
WAINUIOMATA	7533		78		78	0%
WAIWHETU	1016		152		152	13%
WATERLOO	1246		222		222	16%
WOBURN	622		154		154	23%
YORK BAY	50		9		9	16%
Grand Total	39,030	-	3,073	84	3,157	8%

Source: Property Economics, WCC

Table 14 shows that the realisable capacity across Hutt City is just over 3,150 new dwellings, representing an 8% realisation rate across the District. In essence, this represents a 76% realisation rate of the already calculated feasible capacity outlined in Table 10 above.

As expected, the realisation on standalone developments is higher than terraced, with realisable capacity for standalone developments higher than feasible capacity, due to the higher 'margin' of profit levels over the realisable profit rate. Standalone capacity increases by 53% over and above feasible capacity, as it has higher realisable profit margins than more feasible terraced developments. Realisation rates for terraced dwellings show that around 4% of feasible capacity is realised, with the overwhelming majority switching to standalone.

APPENDIX 1 – SENSITIVITY ANALYSIS TABLES

EOS Scale (50%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
ALICETOWN	493		28	1	29	6%
AVALON	1119		95	7	102	9%
BELMONT	780		55	115	170	22%
BOULCOTT	686		121	121	242	35%
DAYS BAY	105		21	2	23	22%
EASTBOURNE	419		69	19	88	21%
EPUNI	709		67	24	91	13%
FAIRFIELD	735		67	67	134	18%
HARBOUR VIEW	279		20	10	30	11%
HAYWARDS	73				0	0%
HUTT CENTRAL	7988		80	424	504	6%
KELSON	927		57	53	110	12%
KOROKORO	181		18	94	112	62%
LOWRY BAY	136		38	16	54	40%
MAHINA BAY	19			2	2	11%
MANOR PARK	110			18	18	16%
MAUNGARAKI	836		55	31	86	10%
MELLING	146		27	4	31	21%
MOERA	436		16	29	45	10%
NAENAE	2887		158	578	736	25%
NORMANDALE	909		79	141	220	24%
PETONE	2121		194	69	263	12%
POINT HOWARD	50		9	24	33	66%
SORRENTO BAY	2		2		2	100%
STOKES VALLEY	4170		3		3	0%
SUNSHINE BAY	8				0	0%
TAITA	1971		88	132	220	11%
TIROHANGA	268		38	0	38	14%
WAINUIOMATA	7533		191	349	540	7%
WAIWHETU	1016		148	75	223	22%
WATERLOO	1246		200	27	227	18%
WOBURN	622		136	18	154	25%
YORK BAY	50		6	5	11	22%
Grand Total	39,030	-	2,086	2,455	4,541	12%

Build Value Increase (15%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
ALICETOWN	493		34	1	35	7%
AVALON	1119		108	14	122	11%
BELMONT	780		60	280	340	44%
BOULCOTT	686		105	143	248	36%
DAYS BAY	105		17	26	43	41%
EASTBOURNE	419		66	32	98	23%
EPUNI	709		72	33	105	15%
FAIRFIELD	735		70	77	147	20%
HARBOUR VIEW	279		18	45	63	23%
HAYWARDS	73		2	13	15	21%
HUTT CENTRAL	7988		94	531	625	8%
KELSON	927		69	73	142	15%
KOROKORO	181		19	101	120	66%
LOWRY BAY	136		33	31	64	47%
MAHINA BAY	19			12	12	63%
MANOR PARK	110		2	18	20	18%
MAUNGARAKI	836		63	98	161	19%
MELLING	146		13	18	31	21%
MOERA	436		51	29	80	18%
NAENAE	2887		372	644	1016	35%
NORMANDALE	909		96	226	322	35%
PETONE	2121		193	84	277	13%
POINT HOWARD	50		9	24	33	66%
SORRENTO BAY	2		2		2	100%
STOKES VALLEY	4170		95	190	285	7%
SUNSHINE BAY	8			2	2	25%
TAITA	1971		130	294	424	22%
TIROHANGA	268		44	21	65	24%
WAINUIOMATA	7533		374	1373	1747	23%
WAIWHETU	1016		162	83	245	24%
WATERLOO	1246		193	34	227	18%
WOBURN	622		119	37	156	25%
YORK BAY	50		6	31	37	74%
Grand Total	39,030	-	2,691	4,618	7,309	19%

Land Value Increase (10%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
ALICETOWN	493		29	1	30	6%
AVALON	1119		96	7	103	9%
BELMONT	780		55	87	142	18%
BOULCOTT	686		124	126	250	36%
DAYS BAY	105		21	2	23	22%
EASTBOURNE	419		66	16	82	20%
EPUNI	709		67	17	84	12%
FAIRFIELD	735		69	64	133	18%
HARBOUR VIEW	279		30	10	40	14%
HAYWARDS	73				0	0%
HUTT CENTRAL	7988		101	355	456	6%
KELSON	927		57	49	106	11%
KOROKORO	181		18	80	98	54%
LOWRY BAY	136		38	18	56	41%
MAHINA BAY	19			2	2	11%
MANOR PARK	110		1	1	2	2%
MAUNGARAKI	836		55	30	85	10%
MELLING	146		30		30	21%
MOERA	436		23	28	51	12%
NAENAE	2887		158	578	736	25%
NORMANDALE	909		80	136	216	24%
PETONE	2121		204	66	270	13%
POINT HOWARD	50		9	21	30	60%
SORRENTO BAY	2		2	0	2	100%
STOKES VALLEY	4170		9	2	11	0%
SUNSHINE BAY	8				0	0%
TAITA	1971		90	132	222	11%
TIROHANGA	268		39		39	15%
WAINUIOMATA	7533		191	332	523	7%
WAIWHETU	1016		149	42	191	19%
WATERLOO	1246		204	27	231	19%
WOBURN	622		137	22	159	26%
YORK BAY	50		7	4	11	22%
Grand Total	39,030	-	2,159	2,255	4,414	11%

Land Value Decrease (10%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
ALICETOWN	493		17	1	18	4%
AVALON	1119		94	7	101	9%
BELMONT	780		49	87	136	17%
BOULCOTT	686		121	113	234	34%
DAYS BAY	105		20	2	22	21%
EASTBOURNE	419		65	16	81	19%
EPUNI	709		64	17	81	11%
FAIRFIELD	735		65	55	120	16%
HARBOUR VIEW	279		13	3	16	6%
HAYWARDS	73				0	0%
HUTT CENTRAL	7988		94	273	367	5%
KELSON	927		53	43	96	10%
KOROKORO	181		18	80	98	54%
LOWRY BAY	136		36	18	54	40%
MAHINA BAY	19			2	2	11%
MANOR PARK	110				0	0%
MAUNGARAKI	836		39	40	79	9%
MELLING	146		12	14	26	18%
MOERA	436		7	26	33	8%
NAENAE	2887		158	578	736	25%
NORMANDALE	909		77	97	174	19%
PETONE	2121		183	63	246	12%
POINT HOWARD	50		9	21	30	60%
SORRENTO BAY	2		2		2	100%
STOKES VALLEY	4170		1		1	0%
SUNSHINE BAY	8				0	0%
TAITA	1971		88	132	220	11%
TIROHANGA	268		36	0	36	13%
WAINUIOMATA	7533		191	332	523	7%
WAIWHETU	1016		140	35	175	17%
WATERLOO	1246		189	32	221	18%
WOBURN	622		132	15	147	24%
YORK BAY	50		6	5	11	22%
Grand Total	39,030	-	1,979	2,107	4,086	10%

Appendix 4.1

PROPERTY ECONOMICS

PORIRUA COMMERCIALLY FEASIBLE RESIDENTIAL CAPACITY ASSESSMENT

Client: Porirua City Council

Project No: 51670

Date: May 2019

SCHEDULE

Code	Date	Information / Comments	Project Leader
51670.7	May 2019	Report	Tim Heath / Phil Osborne

DISCLAIMER

This document has been completed, and services rendered at the request of, and for the purposes of Porirua City Council only.

Property Economics has taken every care to ensure the correctness and reliability of all the information, forecasts and opinions contained in this report. All data utilised in this report has been obtained by what Property Economics consider to be credible sources, and Property Economics has no reason to doubt its accuracy. Property Economics shall not be liable for any adverse consequences of the client's decisions made in reliance of any report by Property Economics. It is the responsibility of all parties acting on information contained in this report to make their own enquiries to verify correctness.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Property Economics has been engaged by Porirua City Council (**PCC**) to undertake an assessment of the commercially feasible residential capacity (supply) of Porirua City within the context of PCC's obligations under the National Policy Statement on Urban Development Capacity (**NPS UDC**) to determine feasible capacity and the shifting demographics within the market and subsequent residential dwelling demand over the next 20-30 years to assist with Proposed (Porirua) District Plan (**PDP**) policy development.

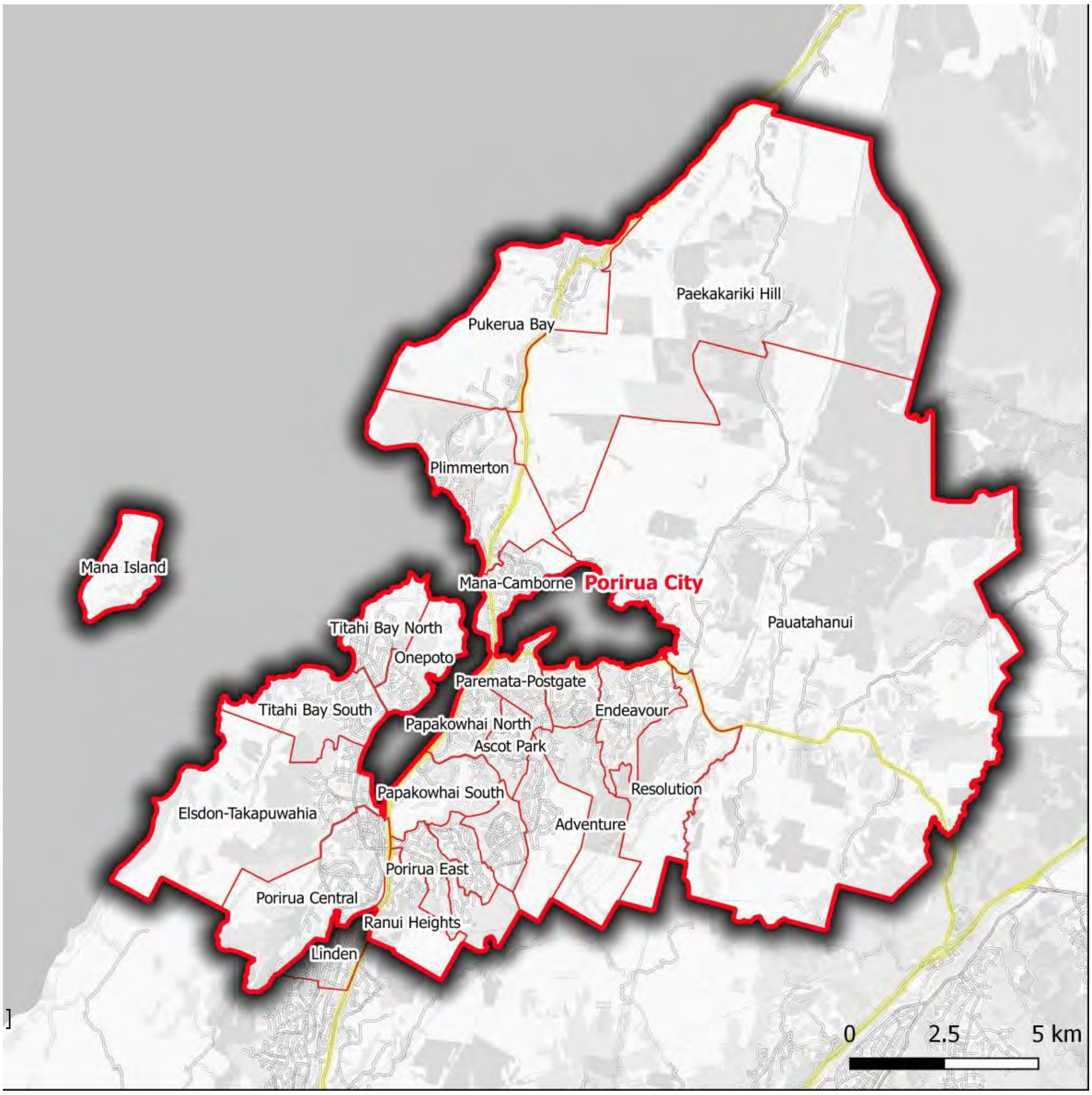
The purpose of this report is to provide PCC with robust market intelligence to assist in making more informed and economically justified decisions in regard to the design and implementation of residential components for the Porirua District Plan. This report will contextualise the growth potential of the area in respect of residential demand, outline the buyers in the area are (currently and future) by household type, and provide information on the state of the residential market, trends and house price sales overview.

The base population forecast data utilised in this assessment have been derived from the estimates generated by Forecast id for PCC. Property Economics has not tested the veracity or underlying assumptions of the Forecast id projections but utilised them for the purpose of demand modelling to be consistent with the source projection data utilised by Council's other long-term planning documents.

The relevant NPS timeframes applied in this assessment utilise 2018 as the base year, 2021 (3-year short term period), 2028 (medium term 10-year period), and 2048 (long term 30-year period).

The base geospatial extent of the study area for this assessment is the Porirua District given this is the area the District Plan (and Council) has jurisdiction over. This may not represent the full geospatial extent of influences on Porirua's residential market however for the purposes of PDP policy development and NPS UDC capacity obligations represents the most appropriate study area for this analysis. Figure 1 shows the geospatial extent of the District.

FIGURE 1: PORIRUA DISTRICT GEOSPATIAL EXTENT



Source: Property Economics, Google Maps

1.1. KEY RESEARCH OBJECTIVES

The core objectives of this report are to:

- Fully profile the existing residential market and identify housing market and sale trends. This will include a review of the proportional market 'shift' towards higher density residential product, as well as identifying emerging markets and opportunities.
- Project household growth and structure, by delineating the different residential sub-markets across the district, determining the relationship between the household structure composition and dwelling types within Porirua.
- Assess the different household typology currently in the identified sub-markets and determine, in proportional terms, what the respective housing type preferences are, and disaggregate the market by dwelling type.
- Assess the recent dwelling price sale trends across the different housing typologies and sub-markets to show the extent of the recent market movements by house type, this includes 'new' vs 'old' homes.
- Undertake high level analysis of visitor demand through tourism night growth at a trended level and implications for residential capacity.
- Leveraging the geographic information available in previous phases to provide a clear picture of the key wider surrounding markets property data.
- Quantifying the theoretical capacity in the District Plan, and then cross referencing with growth / demand to quantify any rezonings or additional land requirements.
- Development of the residential feasibility model. Taking the theoretical capacity data as inputs, commercial feasibility on a suburb level will be given, broken down by typology.

2.1 INFORMATION & DATA SOURCES

Information has been obtained from a variety of what Property Economics consider to be reputable and reliable data sources and publications, including:

- Census of Population and Dwellings 2013 - Statistics NZ (extrapolated to 2018 by Property Economics)
- Household and Population Projections – Statistics NZ
- Population Projections – Forecast id
- Dwelling Sales Volume – MBIE
- Residential Sales Price Data - MBIE
- Residential Consent Data – Statistics NZ
- District Plan Residential Zones – PCC
- Theoretical Capacity Modelling Outputs – WCC
- Relevant Rating Database Data – WCC
- Relevant Development Cost Data - WCC

2. EXECUTIVE SUMMARY

ECONOMIC PROFILING AND FORECASTING

Porirua City has a current population base of around 56,900 people and approximately 18,300 households (rounded) under the Forecast id population forecasts. Under the SNZ Medium growth scenario, population is forecast to grow by 7% over the next 30 years to around 60,400 people by 2048. Under the Forecast id growth scenario, population is forecast to grow by 50% over the same 30-year period to around 85,400 people. In respect of nominal net growth, the Forecast id projections are 650% higher than the SNZ Medium growth projections.

Demographic profiling for the District shows that annual household income levels in Porirua City (on average) are higher compared to both the Wellington Region and NZ average, with a higher proportion of individuals earning over $100,000 per year. Porirua also has a rather youthful population, with 32% of its population from 0-19, compared to 27% nationwide. Porirua is an ethnically diverse City, with only 54% of its population derived from European ethnic groups compared to the wider Wellington Region and NZ averages which are closer to 70%. Conversely, Porirua has a higher proportion of Maori (18%) and Pacific Peoples (22%) relative to the wider Wellington Region and NZ markets. Overall, many of the demographic attributes of Porirua are similar to those of the wider Wellington Region. The demographics of Porirua are more centred towards higher income family oriented and ethnically diverse population with both parents working to provide for multiple children households.

Two Parent Families forecast to be the largest household growth sector within Porirua City over the next 30-years, in the order of 3,080 new households by 2048. Households with Couples (Without Children) are forecast to comprise 29% of Porirua by 2048, increasing from its current 26% representation, similarly Single households are forecast to increase proportionally from 18% of the market to nearly 20% over the forecast period. These changes contrast the shrinking proportion of Single Parents and Family based households which are forecast to shrink proportionally by 2-3% over the forecast period. These trends highlight the shrinking person per household ratios experienced in New Zealand and add to the growing (albeit slowly growing) preference for higher density living.

Porirua's housing composition currently stands at 80% standalone, 13% terraced housing and 6% apartments. The changes in the make-up of households in regard to household structure within Porirua are not expected to be at a scale that would significantly change market demand for high density residential product over the foreseeable future.

Relative to the Greater Wellington, Porirua City residential house prices have historically sold at levels just below the regional average. The uptick in resident sale prices over the last two years has seen Porirua residential median sale prices surge from around $425,000 to nearly $500,000 or around 17% within 6-quarters.

FEASIBLE RESIDENTIAL CAPACITY

Overall there is theoretical capacity within Porirua City for 36,084 new residential dwellings based on WCC's theoretical capacity modelling. Standalone dwellings represent 49.4% of the theoretical capacity, with terraced dwellings being 47.6%, and apartments 2.9%.

Based on feasible capacity modelling undertaken by Property Economics, there is potential for 4,315 additional units within the Porirua market. All sites that return a profit from an owner occupier also return a profit for a developer, and therefore this number represents the total feasible capacity in the market – where both scenarios are tested.

This level of feasible capacity represents a 12% feasibility rate on the theoretical capacity. 75% of feasible capacity comes from terraced dwellings, with 25% from standalone dwellings.

On top of the feasible capacity modelling, practical considerations have been taken into account as to what is likely to be developed in the real world, based on, dwelling typology, development options and greenfield competition. Based on these factors, realisable capacity across Porirua City is just around 2,150 new dwellings, representing a 6% realisation rate across the District. In essence, this represents a 50% realisable rate of the feasible capacity.

3. POPULATION AND HOUSEHOLD FORECASTS

The Statistics NZ medium and high, as well as Forecast id population and household growth projections[1] within Porirua City under are presented in Table 1 and graphically illustrated on Figure 2.

For the purpose of this table, 2018 has been classified as the current base year (shaded blue), year 2021 as short term (shaded in yellow), year 2028 has been classified as medium term (shaded green) and the years 2033 to 2048 have been classified as long term (shaded red). The black shaded figures represent the net change over the assessed period.

TABLE 1 - PORIRUA CITY POPULATION AND HOUSEHOLD PROJECTIONS

	Scenario	2018	2021	2028	2033	2038	2043	2048	Net # Growth 2018-2048	Net % Growth 2018-2048
Population	High	57,800	59,660	63,700	66,200	68,300	70,200	72,100	14,300	25%
	Medium	56,600	57,620	59,500	60,300	60,600	60,500	60,400	3,800	7%
	.id	56,900	59,960	68,700	75,500	80,200	82,800	85,400	28,500	50%
Households	High	19,700	20,600	22,400	23,700	24,800	25,800	26,900	7,200	37%
	Medium	19,300	19,900	21,100	21,700	22,200	22,600	23,000	3,700	19%
	.id	18,300	19,380	22,400	24,700	26,500	27,600	28,700	10,400	57%
Houshold Size	High	2.93	2.90	2.84	2.79	2.75	2.72	2.68	-0.25	-9%
	Medium	2.93	2.90	2.82	2.78	2.73	2.68	2.63	-0.31	-10%
	.id	3.11	3.09	3.07	3.06	3.03	3.00	2.98	-0.13	-4%
Population growth (p.a.)	High	-	1.07%	0.92%	0.78%	0.63%	0.56%	0.54%	-	-
	Medium	-	0.60%	0.41%	0.27%	0.10%	-0.03%	-0.03%	-	-
	.id		1.79%	2.16%	1.98%	1.25%	0.65%	0.63%		
Household growth (p.a.)	High	-	1.52%	1.13%	1.16%	0.93%	0.81%	0.85%	-	-
	Medium	-	1.04%	0.79%	0.57%	0.46%	0.36%	0.35%	-	-
	.id		1.97%	2.29%	2.05%	1.46%	0.83%	0.80%		

Source: Property Economics, Statistics NZ, Forecast id

The current population base for Porirua City is estimated to be around 56,600 residents and 19,300 households applying the medium growth, with an increase of around 2% for the high growth scenario. Currently under the Forecast id scenario Porirua has around 56,900 residents and 18,300 households. To provide a wider perspective, the current Porirua population base makes up approximately 11% of the wider Wellington Region's total population.

---

[1] *The Statistics NZ and Forecast id population and household projections are only available up to the year 2043 for population figures and 2038 for household numbers and as such have been extrapolated out to 2048 by Property Economics.*

The medium growth scenario forecasts Porirua experiencing moderate growth of 7% (3,800) residents and 19% (3,700) households between 2018 and 2048. The Statistics NZ high growth scenario forecasts growth with the population increasing by 25% (14,300 residents) and households by 37% (7,200 households) by 2048. This will see the population base increasing to 72,100 residents and 26,900 households over the next 30 years under this scenario.

PCC's request to be consistent with other growth strategies utilising more specific growth projections for the District, Property Economics has performed the analysis within this report based on the population forecasts provided by Forecast id. These population projections show the current (2018) population at around similar, albeit slightly larger of a population base compared to the Statistics NZ medium projections, and a significantly smaller household base. However, the Forecast id population figures are projected to grow at rate much higher than the Statistics NZ medium and high scenarios.

According to Forecast id, Porirua City's population base is expected to grow by around 28,500 residents (50%) to a total of around 85,400 residents by 2048.

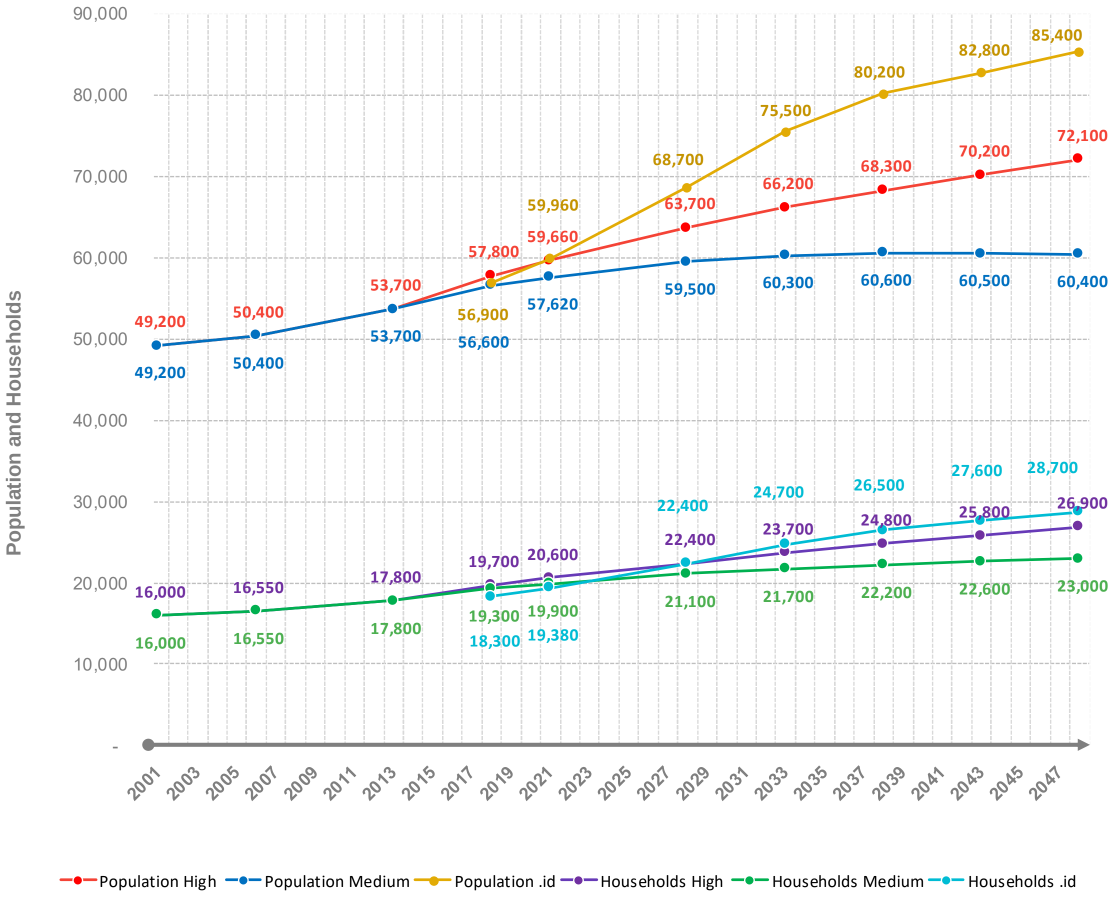
The Forecast id projections also show a relatively higher population per household ratio than the Statistics NZ projections, but the overall trend of expected decreasing population household ratios for the projected future hold true across the board. In terms of household figures, Forecast id project the number of households to increase from 18,300 in 2018 to 28,700 in 2048, representing a 57% increase over the next 30 years.

Thus in effect the Forecast id projections represent a growth profile of the City's population base above even the Stats NZ high scenario. The comparative analysis with Statistics medium growth scenario is important as this projection series represents the NPS UDC base requirement.

Table 1 indicates that the number of households is to increase at a faster rate than the population due to a projected fall in the person per dwelling ratio over the forecast period. This is not isolated to the study area but a trend projected to occur across the whole country due to an aging population, smaller families and a higher proportion of 'split' or single parent households.

Figure 2 represents a graphical representation of the growth projection in Table 1 to illustrate the different growth profiles of the different projections series. Also shown is the actual usual resident population and household base for the city from the last three censuses (2001, 2006 & 2013) for context.

FIGURE 2 PORIRUA CITY POPULATION AND HOUSEHOLD PROJECTIONS



Source: Property Economics, Statistics NZ, Forecast id

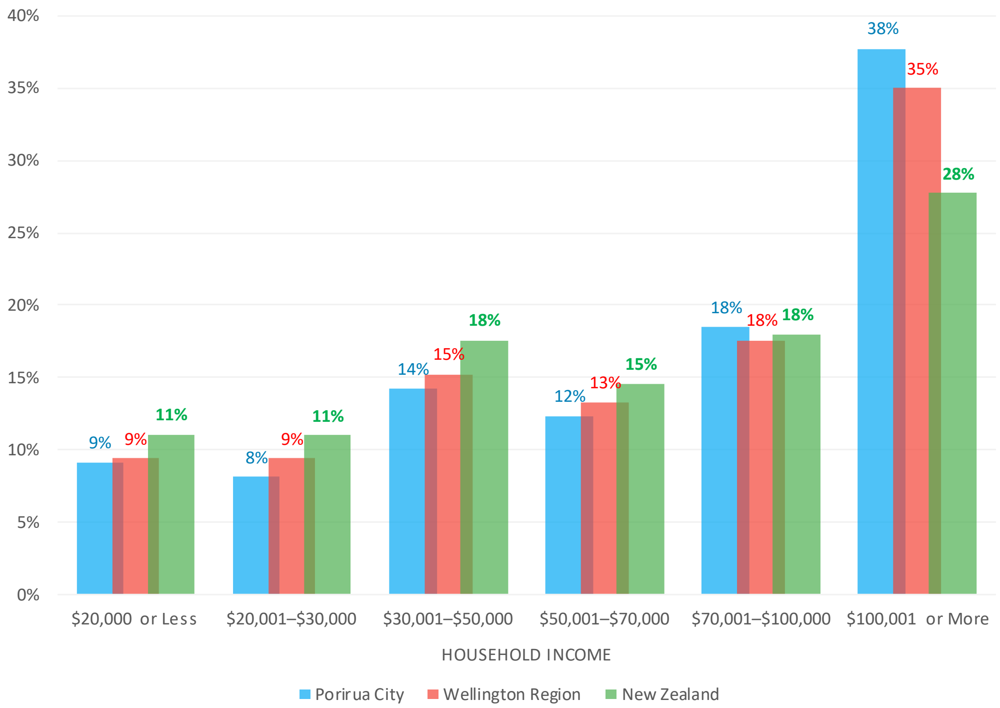
Applying the Forecast id projected scenario, the bulk of the City's 2048 population base is already residing in the Porirua, with the 2018 population base representing 67% of the projected 2048 population base. This indicates higher levels of local economic growth within Porirua over the assessed period is likely to be better achieved if driven from innovation, improved productivity and efficiency in the existing market rather than population driven growth.

This provides some broad parameters for Council in their thinking. With that said, we consider it important for the District to plan for a sensible level of growth to place the District in the best position possible to capture in future years, and mitigate potential risks. Within this report, we have applied the Forecast id growth projections as the main projection suite as requested by Council (28,500 people and 10,400 households rounded).

4. DEMOGRAPHIC PROFILING

Economic and social demographic profiling has been carried out for Porirua City, Wellington Region and New Zealand averages, which allows for comparisons to be made on a regional and national basis to provide a wider context. This will assist in understanding the consumer and business composition of the localised markets and their key economic and social variables. A full breakdown of the demographic profiles has been provided in Appendix 1.

FIGURE 3: ANNUAL HOUSEHOLD INCOME DEMOGRAPHIC PROFILE



Source: Property Economics, Statistics NZ

Some of the key findings from the demographic profiling include:

- Annual household income levels in Porirua City (on average) are higher compared to both the Wellington Region and NZ average. This is a positive sign for ability to generate retail expenditure. Interestingly, while Porirua has a higher percentage of households earning over $100k per year relative to the Wellington Region (38% vs 35%), Porirua has a smaller proportion of individuals earning over $50K per year (31% vs 33%). This indicates that households within Porirua are more likely to have two parent incomes (or two household income streams) which adds to the income of the household as a whole. This complements the higher proportion of two parent families in the District comparatively, which facilitates the higher household income levels, and highlights Porirua as having a population with a strong family structure.

- In terms of the sources of income, 76% of Porirua residents gain income from wages, salary, commissions and bonuses, which is 3% higher than those in the Wellington Region. Whereas, the Wellington Region has a 3% higher proportion of people who are self-employed or business owners, and 7% higher of people gaining income from interest, dividends, rent, other investments. This indicates a higher proportion of Porirua residents are company employees / workers rather than company owners and entrepreneurs compared to the wider market.
- Children and Teenagers (0-19 years of age) make up almost a third of Porirua City's population base at 32%, which is relatively high when compared to the wider Wellington Region and NZ average of 27% each. Subsequently, Porirua has a smaller proportion of its population comprising of over 65 years at only 10% compared to 13% for the Wellington Region and 14% for NZ. This indicates that Porirua has a strong ability focus on the 'next generation' and can be viewed as a city for families.
- Porirua City is also highly ethnically diverse with only 54% of its population derived from European ethnic groups compared to the wider Wellington Region and NZ averages which are closer to 70%. Conversely, Porirua has a higher proportion of Maori (18%) and Pacific Peoples (22%) relative to the wider Wellington Region and NZ markets. This indicates Porirua has a strong multi-cultural base focused around the Pacific Island and Maori peoples, and less on Asian ethnic groups.
- The local age demographics for Porirua, in turn, are tied to the higher proportion of Single and Two Parent Family households. Porirua City itself has 54% of households within these two categories, whereas the Wellington Region and NZ have significantly lower levels at 41% and 43%, respectively.

Overall, many of the demographic attributes of Porirua are similar to those of the wider Wellington Region. The demographics of Porirua are more centred towards higher income family oriented and ethnically diverse population with both parents working to provide for multiple children households. These District averages may not paint the complete picture of diversity within the District, as the demographics signal a potential underling division in the demographics between eastern and western suburbs of Porirua if the profiling was undertaken at a finer grain level.

5. PROJECTED HOUSING TYPE DEMAND

This section of the report forecasts the housing demand for Porirua City for the 2018 - 2048 period according to household and dwelling types. These projections have been based on the projected changes in household types as part of the Forecast.id suite of projections for Porirua City.

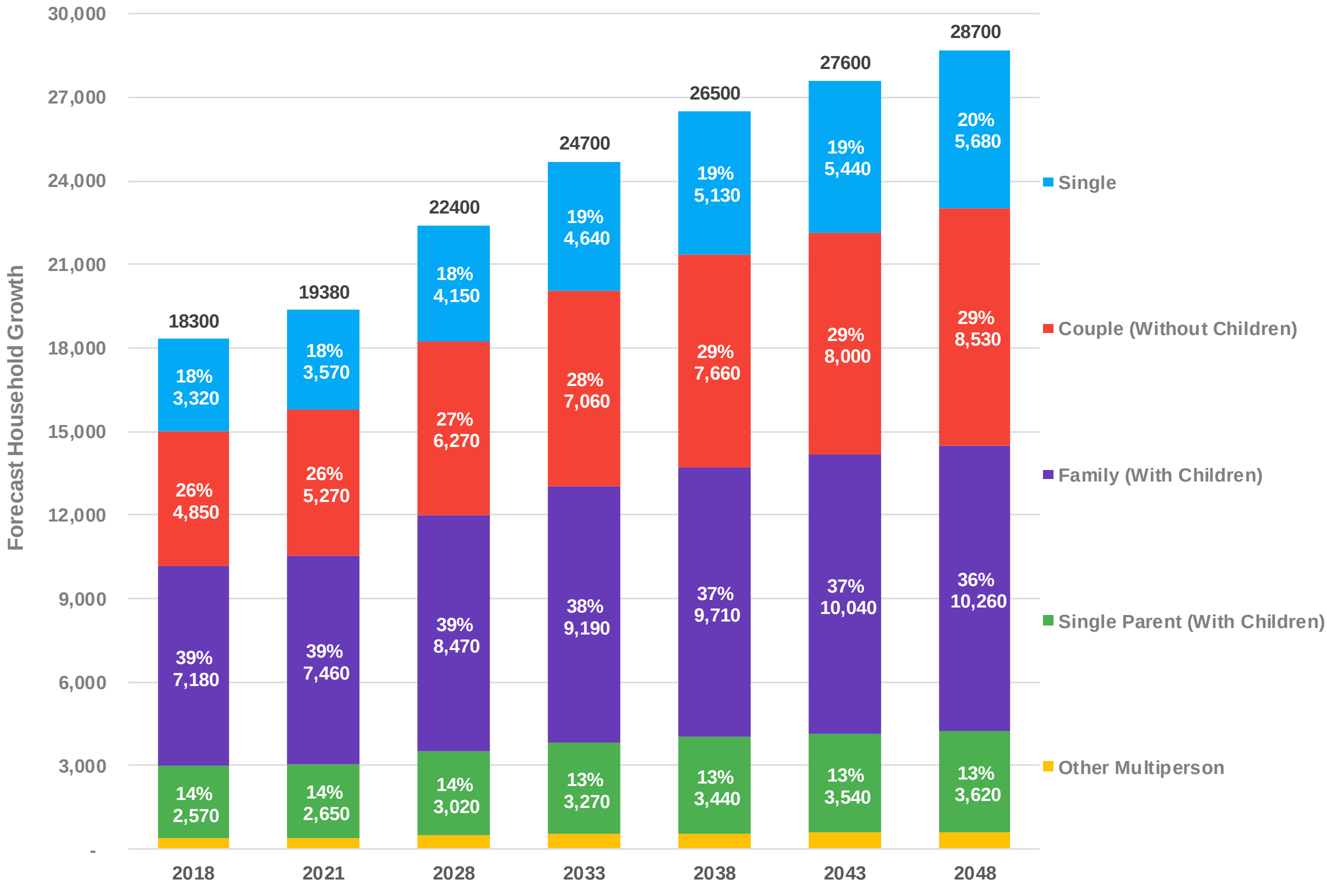
Dwelling type (Apartment, Standalone and Terraced) preferences have been based on the Statistics NZ Census 2001, 2006 and 2013 data, by cross referencing the historic trends between household structure and dwelling type and projecting these trends out by the household growth forecasts utilised earlier in this report and applying them to the aforementioned household projections.

Under this methodology forecast demand for each dwelling type is intrinsically linked to supply side trends for dwelling types and is a representation of the interplay between the demand and supply for residential dwelling types. Basing forecast demand on the historic composition of differing dwelling types undercuts the actual demand preferences of households in favour for more realistic estimates of the future residential landscape of Porirua.

In this regard, this approach is likely to provide conservative estimates for the demand for higher density housing as more intensively developed residential product is likely to accelerate in growth (both nominally and proportionally) with the trend of new residential developments focusing on higher density product over the foreseeable future. This correlates with decreases in person per household counts at a rate that is not yet reflected in the dwelling preferences of past years driving up housing demand in higher density form factors.

Figure 4 following shows the forecast household structure composition of Porirua City over the period of 2018 – 2048.

FIGURE 4: PORIRUA CITY HOUSEHOLD STRUCTURE COMPOSITION FORECAST 2018 – 2048



Source: Property Economics, PDC

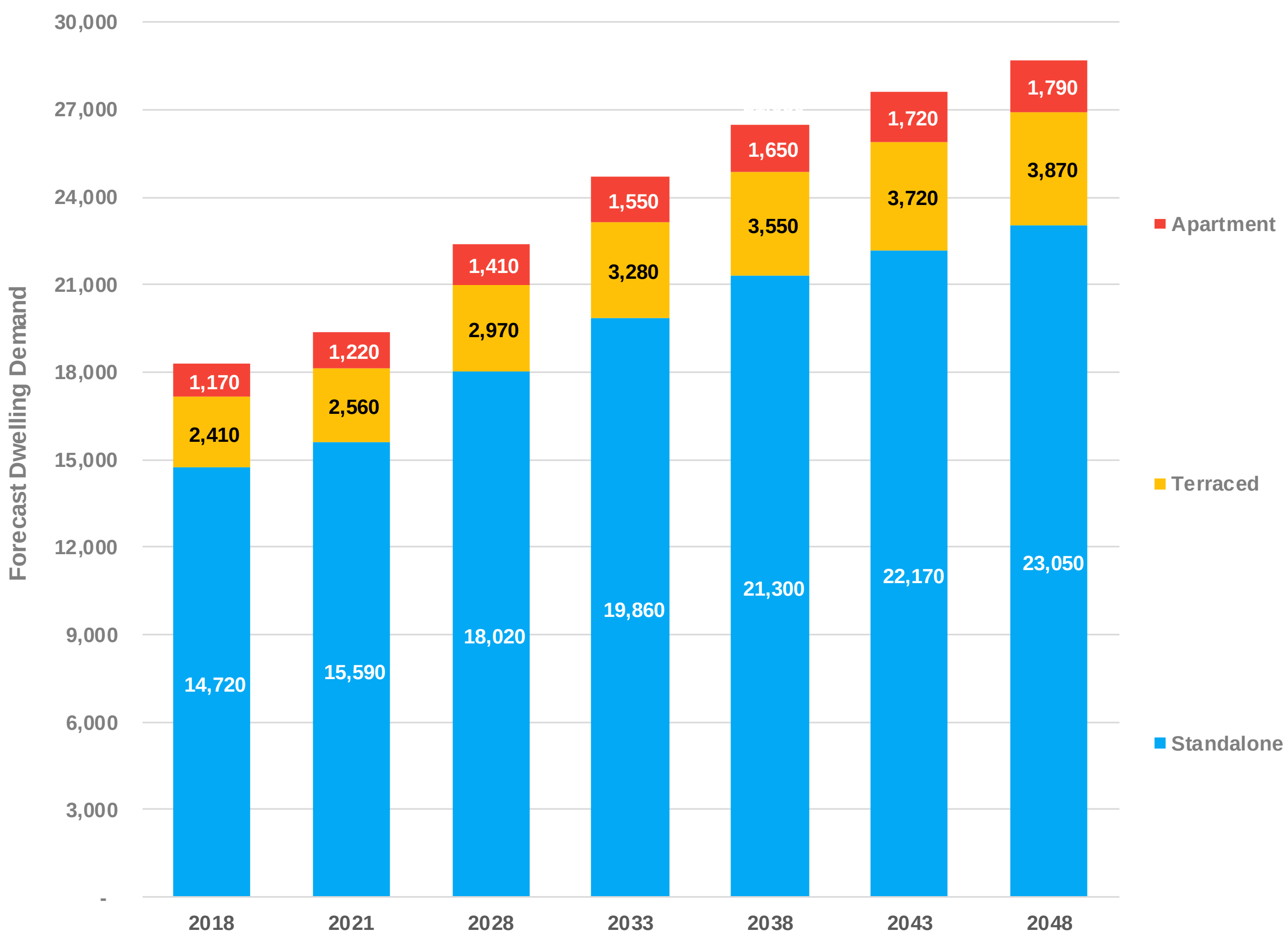
There are expected to be on-going structural changes in household types over the next 30 years, albeit gradual in effect. These structures (or household types) are often linked to the type of house generally preferred by a particular household structure (i.e. house preferences).

Currently the volume of households within Porirua is around 18,300, with Two Parent Families forecast to be the largest growth sector within Porirua City over the next 30-years, in the order of 3,080 new households by 2048.

Households with Couples (Without Children) are forecast to comprise 29% of Porirua by 2048, increasing from its current 26% representation, similarly Single households are forecast to increase proportionally from 18% of the market to nearly 20% over the forecast period. These changes contrast the shrinking proportion of Single Parents and Family based households which are forecast to shrink proportionally by 2-3% over the forecast period. These trends highlight the shrinking person per household ratios experienced in New Zealand and add to the growing (albeit slowly growing) preference for higher density living.

Figure 5 translates household structure forecasts to dwelling type based on the historic trends of the type of dwelling types that different household structures reside within Porirua City.

FIGURE 5: PORIRUA CITY GROWTH 2018 - 2048 BY HOUSEHOLD STRUCTURE



Source: Statistics NZ, Property Economics

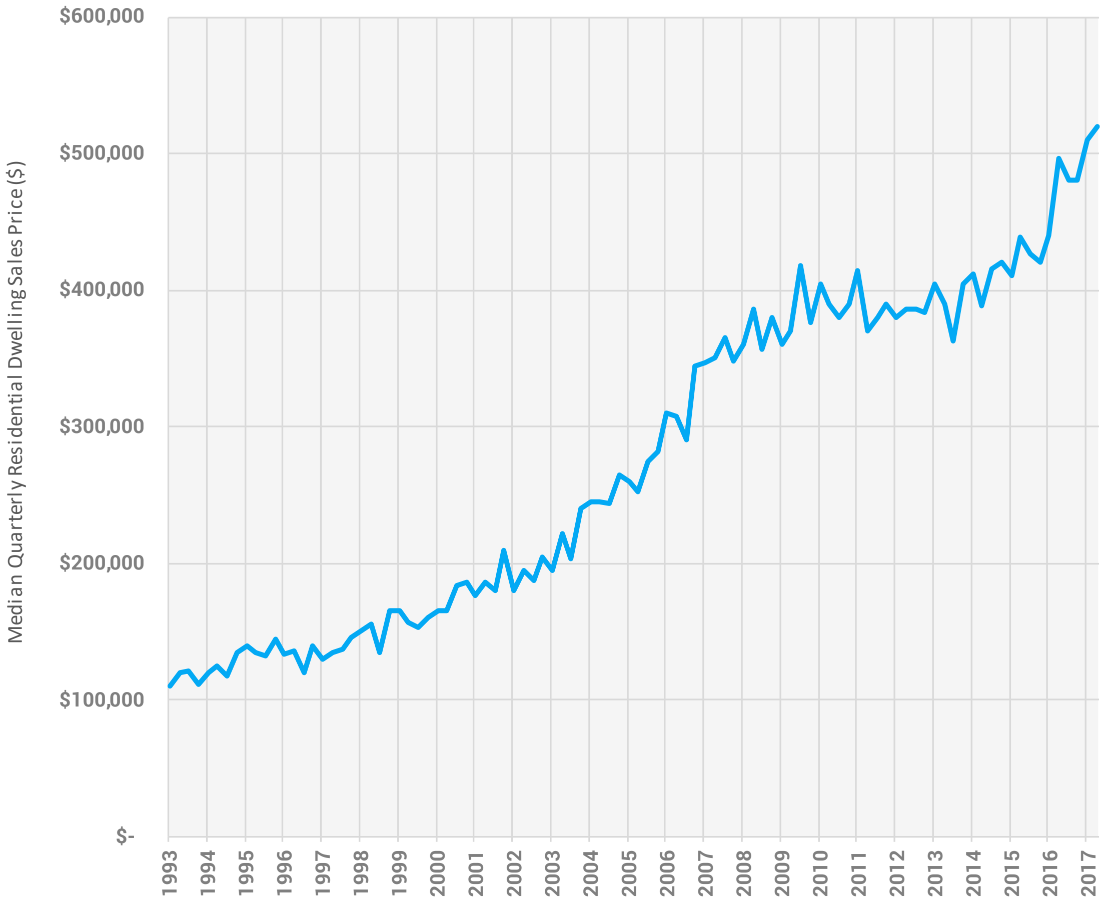
The current composition of residential housing within Porirua is estimated to comprise of around 80% standalone, 13% terraced housing and 6% apartment offer. The changes in the make-up of households in regard to household structure within Porirua are not expected to be at a scale that would significantly change market demand for high density residential product over the foreseeable future. Subsequently, this means that standalone homes will remain the dominant house product sought over the forecast period.

6. RESIDENTIAL SALES SYNOPSIS

6.1. SALES PRICE POINT ANALYSIS

Figure 6 illustrates the quarterly median sale prices for residential dwellings across Porirua City over the last 25 years (period of 1993 – 2017). Note, only sales for the first two quarters of 2017 have been assessed

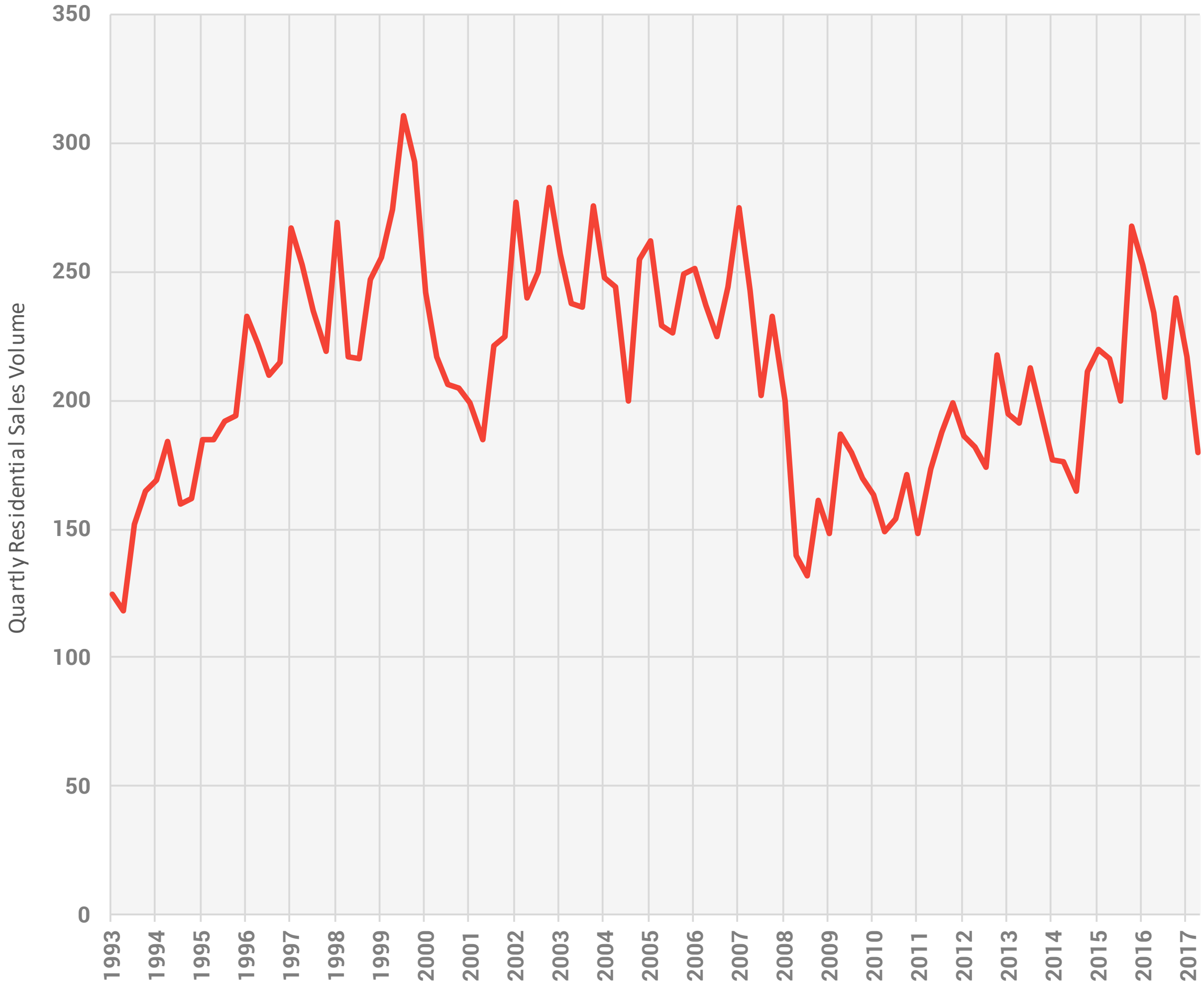
FIGURE 6: MEDIAN QUARTERLY RESIDENTIAL HOUSE SALE PRICE TRENDS 2000 – 2016



Source: Property Economics, Core Logic

Figure 6 highlights the impact of the economic boom of the early 2000s, the 2008 Global Financial Crisis (GFC), and the post-GFC economic recovery. However, median sale price data has shown that prices generally have only fallen a few percent (if at all). These periods of market correction have historically lead to a period of stagnation in house prices. The trends across the last 3-years show a promising transition from the price slump experienced over the 2007 – 2014 period, with a surge in prices over four years or 2013 – 2017 period.

FIGURE 7: PORIRUA RESDIENTIAL SALES VOLUME



Source: Property Economics, Core Logic

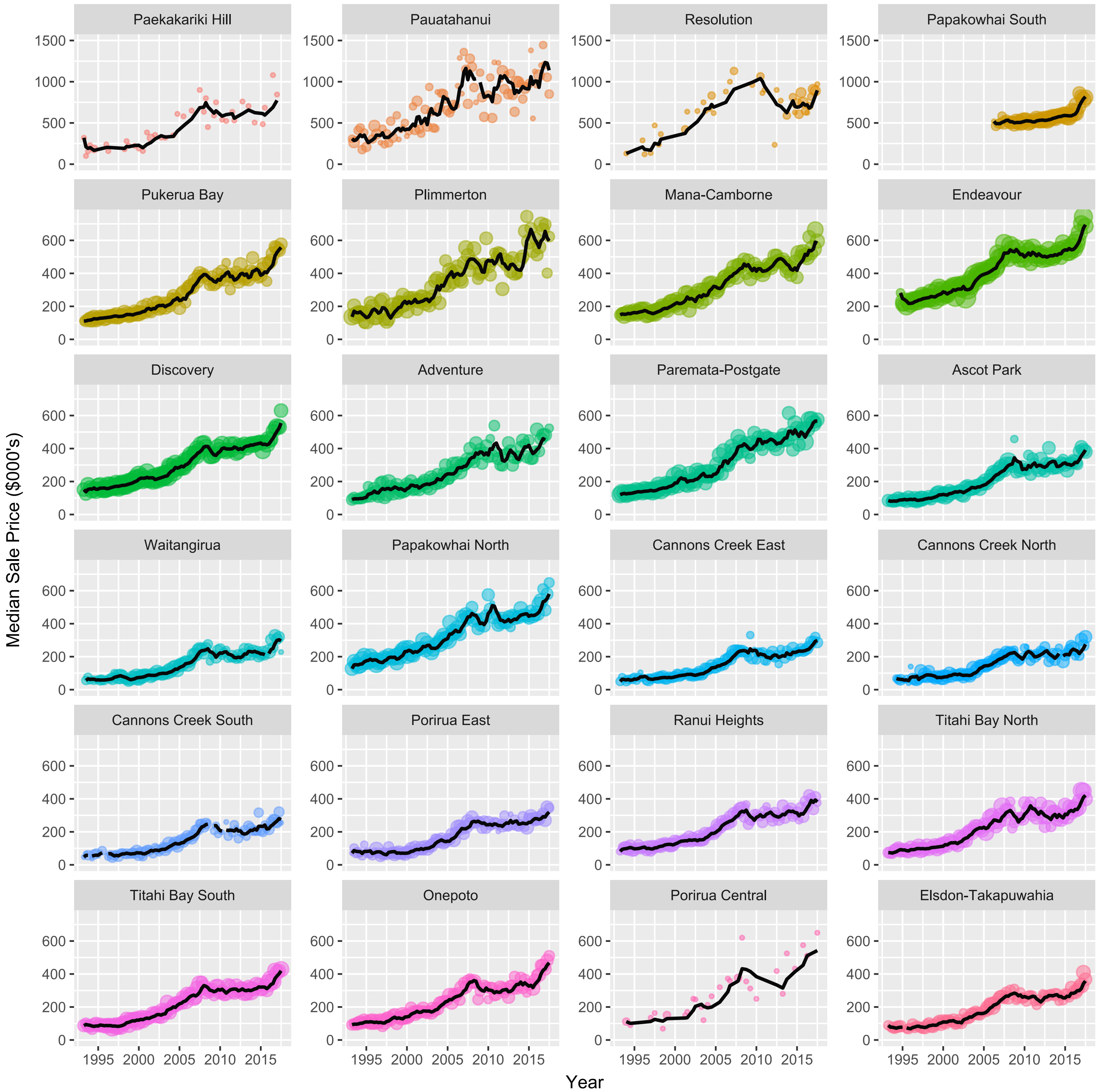
For Porirua, the overall 2008-2016 temporal period trends can be split into three distinct stages, with the years of 2008 to 2011 basically representing a period of economic / market correction due to the fallout from the Global Financial Crisis (GFC). The 2008 year represented the start of the '*fallout*' from the collapse of the financial mortgage markets. This resulted in a period of a sustained slowdown (a '*bust*' period). As a result of the GFC, in 2008, residential dwelling price growth slowed dramatically across New Zealand and dropped in certain markets. Porirua had a small fall before the market stabilised over the 2009 / 10 years.

2011 can be considered the year the market '*bottomed out*' and started to recover with the GFC '*hangover*' dissipating with housing prices once against starting to increase at moderate rates. This was primarily due a lack of additional supply being developed in the preceding years.

By 2016 Porirua City median property prices increased by 23% (2011 – 2016) to around $480,000 by the fourth quarter.

Figure 8 shows the quarterly residential median prices points for Porirua by Census Area Unit (CAU) over the 1993 – 2017 time period. For the purpose of analysis, the size of each points represents the relative quantity of sales, in addition to the 12-month price trend denoted by the black trend line. It should also be noted that the top row of areas in Figure 8 have a wider price scale to other identified other CAUs due to their higher median price points.

FIGURE 8: PORIRUA CITY MEDIAN RESIDENTIAL SALES 1993 – 2017



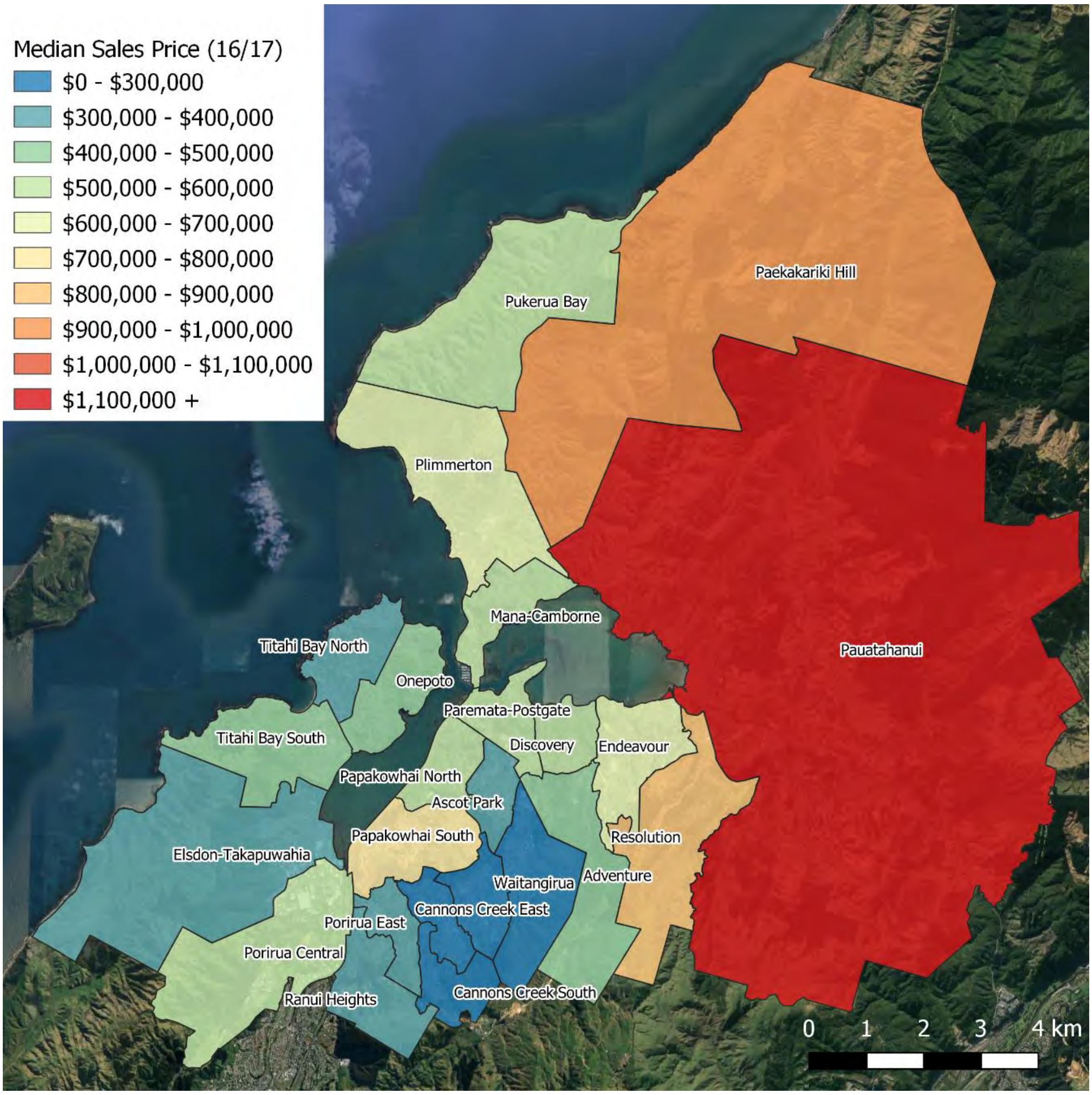
Source: Property Economics, Core Logic

Across the individual area units within Porirua the overarching district trend can be observed at varying degrees of intensity. The same economic boom period of the early 2000s leading up to the GFC in 2008 with some area units falling in price, stagnating or slowing down significantly before a uptick in price points at the tail end of the assessment period over the last four years.

Some notable outliers include Resolution which experienced a significant drop in prices following the GFC, however appears to have had a significant level of new development in recent years. Similarly, residential dwelling sales in Papakowhai South only appears in 2005 indicating a lack of development before this period.

Figure 9 maps the median sales price by CAU over 2016/17 to give a geospatial view of the distribution of residential sales prices over the last two years.

FIGURE 9: PORIRUA CAU 2016/17 MEDIAN SALES PRICE



Source: Property Economics, MBIE

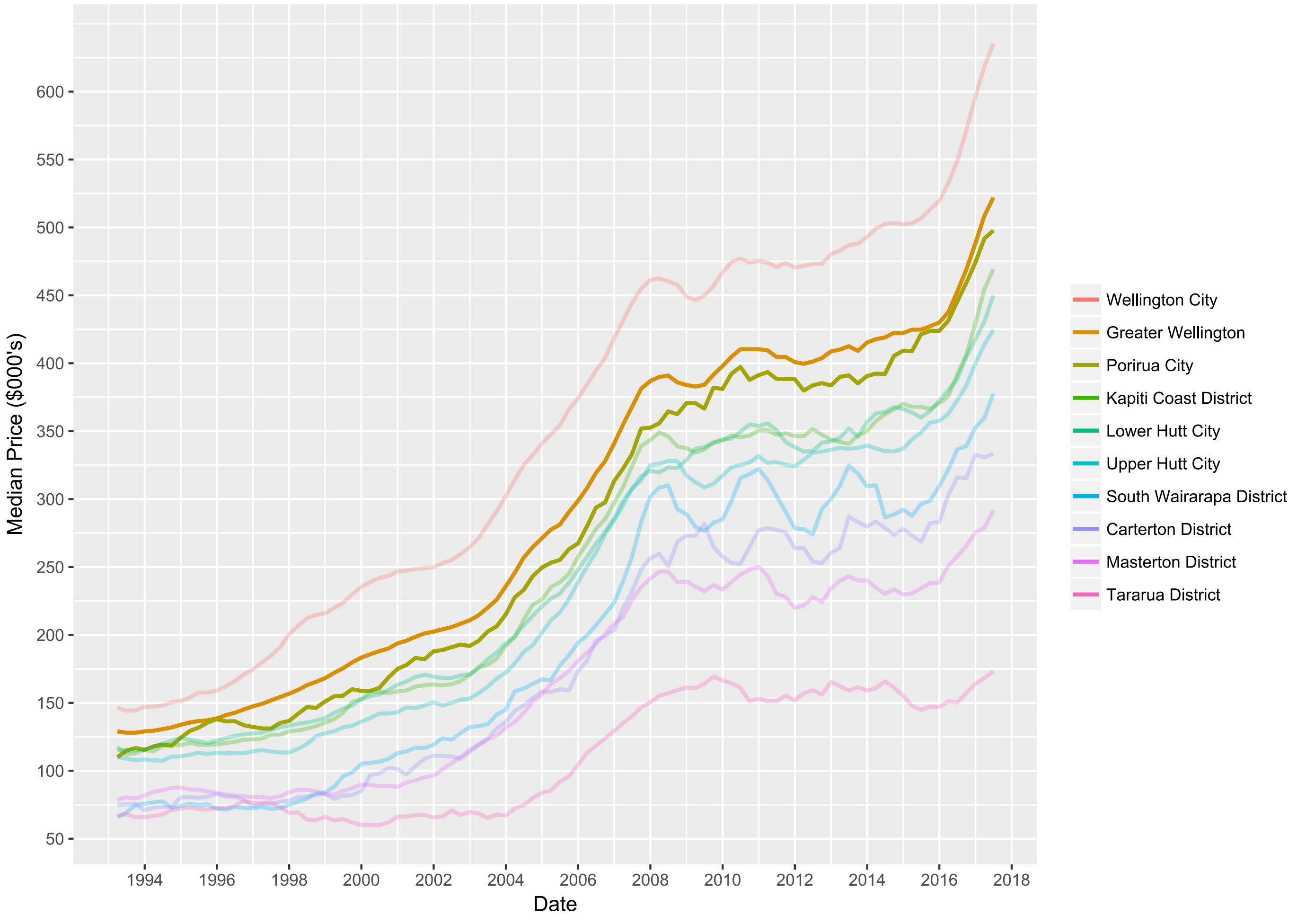
Sales prices are on average higher in the more rural areas within Porirua. This is to be expected due to larger land sizes and lifestyle blocks. This is evident as the CAU's with the three highest median sales prices over the last two years are Pauatahanui, Paekakariki Hill and Resolution, which are all located toward the eastern side of Porirua in more rural/fringe areas.

Areas with new development also have a higher price point, indicating better build quality and higher improvement value of the dwelling. For example, Papakowhai South has the fourth highest median sales price, and is located quite central within Porirua. This area has experienced significant new residential development over the last ~10 years, indicated in Figure 8 as new sales only start around 2007.

6.2. REGIONAL COMPARISON OF SALES DATA

Figure 10 compared the median residential sale prices across the territorial authorities that lie within the Wellington Region. Note, the legend has been order based on the descending order of median prices across the identified territorial authorities

FIGURE 10: WELLINGTON REGION MEDIAN RESIDENTIAL SALES 1993 – 2017



Source: Property Economics, MBIE

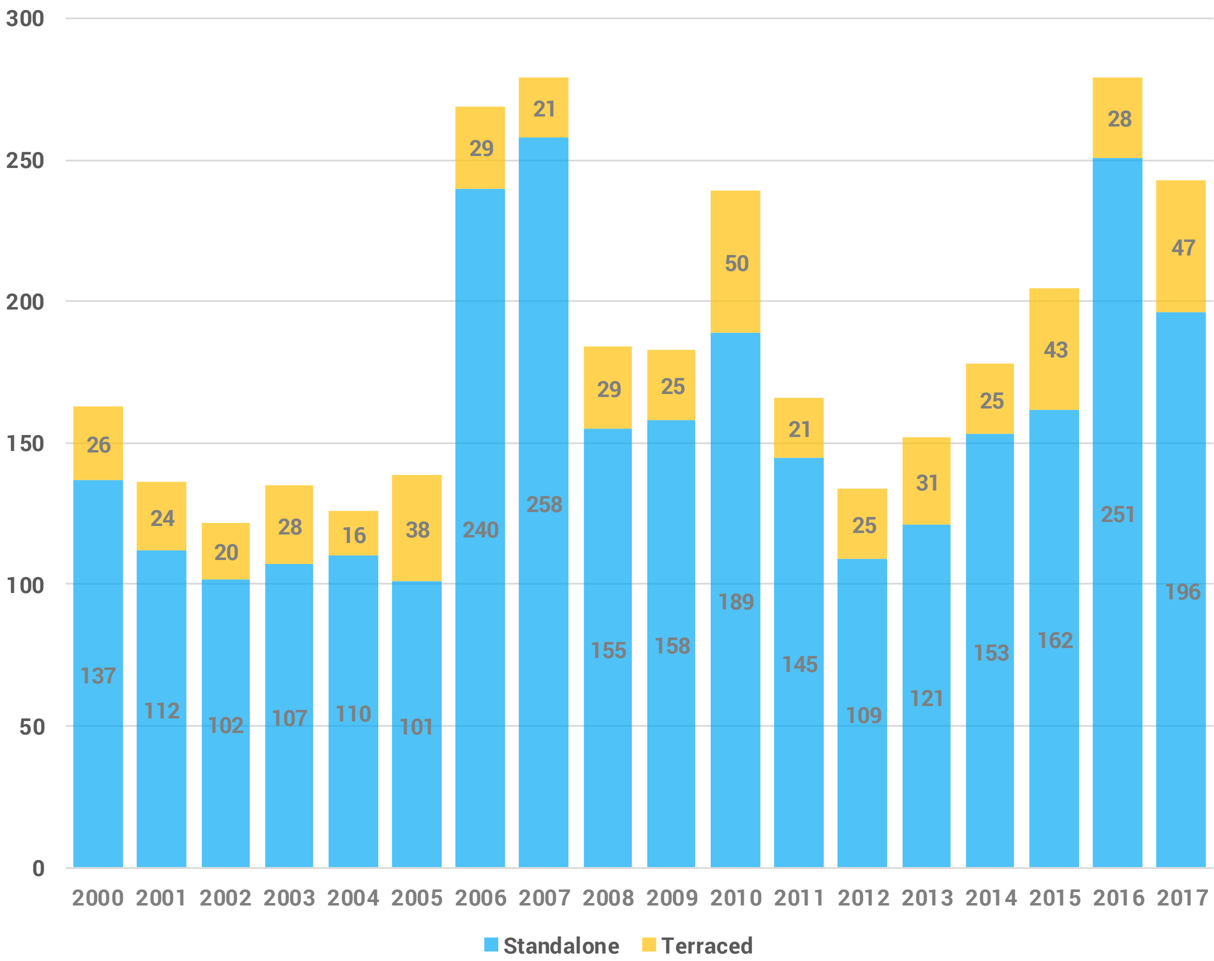
Relative to the Greater Wellington, Porirua City residential house prices have historically sold at levels just below the regional average. Compared to other territorial authorities within the region Porirua commands the second highest price points, second only to Wellington City. Over the 1993 – 2017 period, residential prices within Porirua have had a variance relative to the region in the order of $0 – $35,000, compared to Wellington City however, the gap has been growing (albeit with great volatility) a price differential of just $20,000 in 1996 which has since grown to nearly $140,000 in the most recent observed period.

The uptick in resident sale prices over the last two years has seen Porirua residential median sale prices surge from around $425,000 to nearly $500,000 or around 17% within 6-quarters.

7. RESIDENTIAL BUILDING CONSENTS

This section of the report assesses the trend of housing development that has occurred within the delineated markets over the last decade. Figure 11 shows the history of new residential building consents over 2000 – 2017 period. This not only provides an overview of when development in the assessed markets occurred and in what dwelling types, but also the market confidence in residential investment over key development periods.

FIGURE 11: PORIRUA CITY NEW RESIDENTIAL BUILDING CONSENTS 2000 - 2017



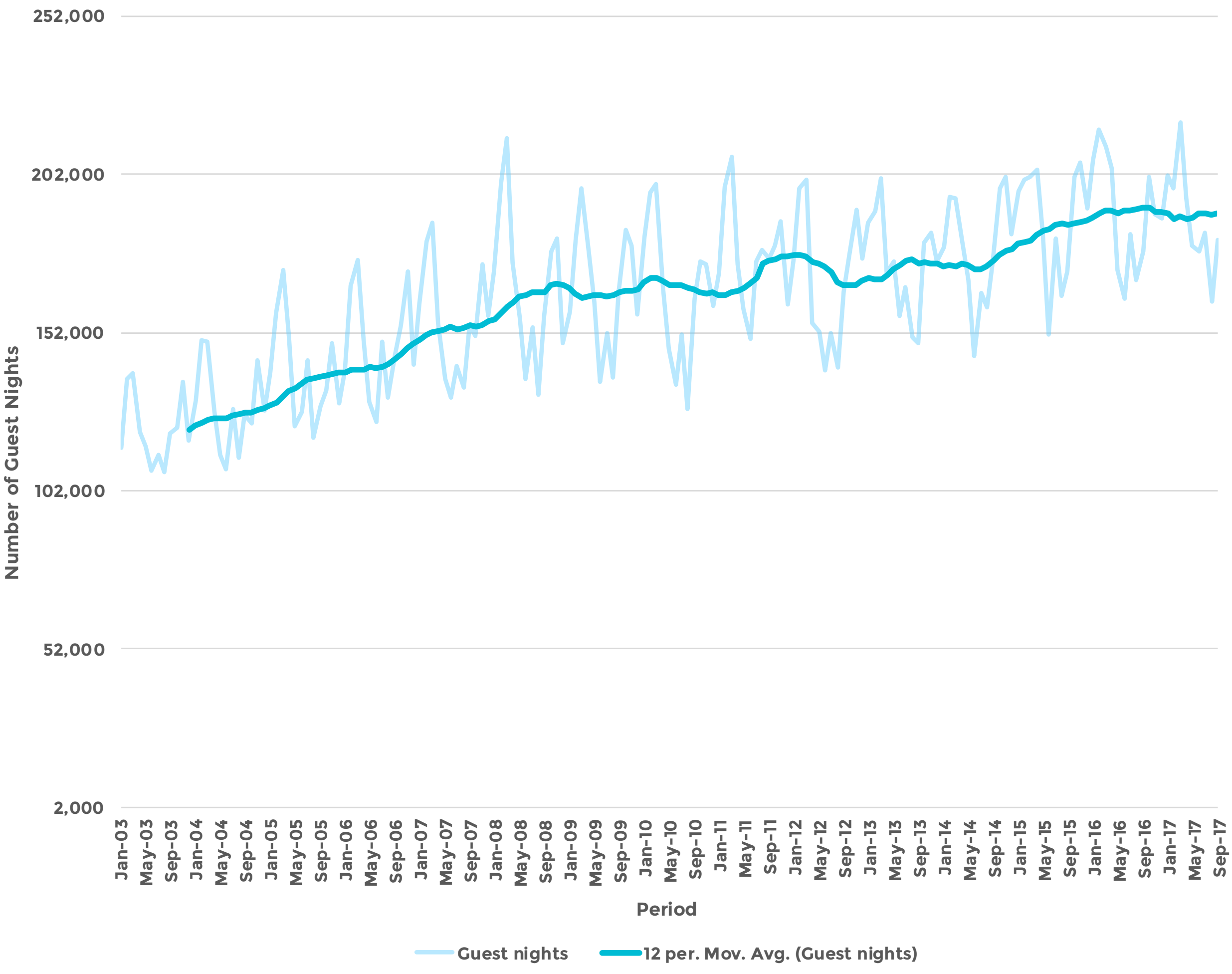
Source: Property Economics, Statistics NZ

Figure 11 shows a spike in the 2006 and 2007 periods with more than double the development of standalone residential dwellings compared to previous years. Unfortunately this was not continue as it is immediately followed by the GFC in 2008, while development slowed over the period of 2008 – 2012. Like much of Wellington Region, growth in Porirua City has bounced back with a positive residential consent trend starting from 2012.

8. VISITOR DEMAND

This section of the report assesses the tourism trends within Porirua City and its relationship to residential demand. Figure 12 illustrates the monthly stay guest nights or number the number of nights visitors are staying in commercial accommodation within Porirua per month. For the purpose of analysis, the 12-month moving mean has also been determined highlighting overall visitor trends within the city.

FIGURE 12: PORIRUA CITY MONTHLY GUEST NIGHTS (2003 – 2017)

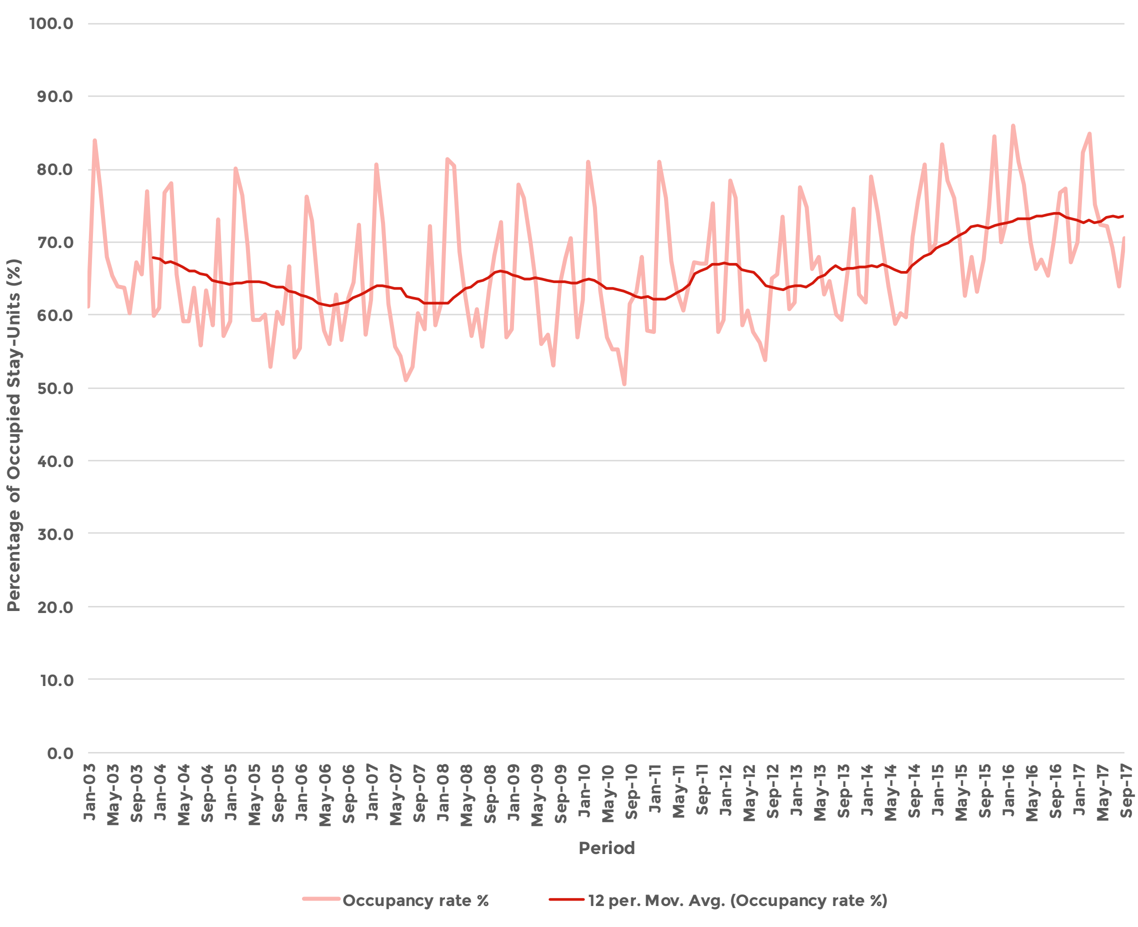


Source: Property Economics, Stats NZ

Overall Figure 12 shows a relatively steady growth of visitors staying in Porirua with indications of a slow down during the GFC and a slight pickup occurring from 2014 onwards. These trends are consistent with the overall economic trajectory observed in earlier section of this report. Current monthly guest nights for the last observed 12-month period has been in the order of 190,000 stays.

Figure 13 shows the monthly occupancy rate for Porirua City as well as the 12-month mean to illustrate the overall trend holding season variations constant.

FIGURE 13: PORIRUA CITY MONTHLY OCCUPANCY RATE (2003 – 2017)



Source: Property Economics, Stats NZ

The 12-month trend for occupancy rates within Porirua have generally hovered around the 60 – 70% mark, with the recent economic upsurge pushing this proportion beyond 70%. The increase in occupancy levels is solely due to an increase in visitors into Porirua but also due to a decrease in available stay units within the city, coincidently correlating with 2014 upwards trend of guests visiting Porirua City.

9. UNOCCUPIED DWELLINGS

While Section 3 assess the level of household growth forecast within Porirua City it is important to note that there is a natural level of unoccupied dwellings. These dwellings are unoccupied for a variety of reasons such as dwellings being held for investment purposes, holiday homes or a natural number of dwellings in transition between owners i.e. for sale or awaiting settlement.

Empty Dwellings in Table 2 shows the number of usually occupied and empty dwellings within Porirua City as last reflected by the 2013 Census.

TABLE 2 - USUALLY OCCUPIED AND EMPTY DWELLINGS – 2013 CENSUS

Area Unit	Usually Occupied Dwellings	Empty Dwellings	Total Dwellings	% Empty Dwellings
Adventure	492	3	495	1%
Ascot Park	822	18	840	2%
Cannons Creek East	948	54	1,002	5%
Cannons Creek North	909	72	981	7%
Cannons Creek South	426	21	447	5%
Discovery	948	9	957	1%
Elsdon-Takapuwahia	765	30	795	4%
Endeavour	1,251	21	1,272	2%
Inlet-Porirua Harbour	21	-	21	0%
Mana Island	-	-	-	-
Mana-Camborne	1,008	21	1,029	2%
Onepoto	627	12	639	2%
Paekakariki Hill	51	-	51	0%
Papakowhai North	795	12	807	1%
Papakowhai South	834	18	852	2%
Paremata-Postgate	969	18	987	2%
Pauatahanui	360	18	378	5%
Plimmerton	864	42	906	5%
Porirua Central	66	6	72	8%
Porirua East	672	39	711	5%
Pukerua Bay	702	33	735	4%
Ranui Heights	492	6	498	1%
Resolution	48	3	51	6%
Titahi Bay North	981	57	1,038	5%
Titahi Bay South	1,284	42	1,326	3%
Waitangirua	1,044	42	1,086	4%
Total	17,379	597	17,976	3%

Source: Property Economics, Stats NZ

Currently 3% of dwellings within Porirua City are currently empty, historical occupancy rates are relatively similar, with Empty Dwellings comprising around 3 – 4% of Porirua City dwellings in 2001 and 2006.

10. RESIDENTIAL FEASIBILITY MODELLING

This section of the report discusses the work undertaken by both Property Economics, and Wellington City Council (WCC), on behalf of Porirua City Council as part of a wider region residential capacity project team, to undertake an assessment of the commercially feasible residential capacity (supply) of the Porirua District within the context of Council's obligations under the National Policy Statement on Urban Development Capacity (**NPS UDC**).

This section discusses the work undertaken by both Property Economics and Wellington City Council in analysing the existing theoretical residential capacity of Porirua City and developing a capacity model for calculating the level of feasible development within the District. This will inform policy makers on the feasible level of housing supply, and which areas are able to accommodate future residential development based on current zonings, policy settings and market parameters.

10.1. THEORETICAL CAPACITY

Property Economics have been provided with GIS layers containing the sites within Porirua City that provided for infill, or comprehensive redevelopment. Theoretical residential capacity was calculated by WCC utilising current theoretical District Plan policy settings and algorithmic, GIS and 3D modelling. The information contained several different scenarios, based on housing typology and quantum, that were identified as theoretically viable to develop.

Table 3 below outlines the theoretical capacity output by the model provided to Property Economics by WCC by suburb.

TABLE 3 – PORIRUA THEORETICAL RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB

Suburbs	Theoretical Capacity
Aotea	3038
Ascot Park	1974
Camborne	1015
Cannons Creek	4584
Elsdon	620
Hongoeka	150
Kenepuru	86
Papakowhai	1714
Paremata	1028
Plimmerton	739
Porirua City Centre	684
Pukerua Bay	1677
Ranui	2929
Takapuwahia	1395
Titahi Bay	6234
Waitangirua	2403
Whitby	5814
Grand Total	36,084

Source: Property Economics, WCC, PCC

Table 3 shows there is theoretical capacity within Porirua for around 36,080 new dwellings (rounded). The suburbs of Titahi Bay and Whitby have the highest level of theoretical capacity at 6,324 and 5,814 respectively, while the suburb of Kenepuru has the lowest level of theoretical capacity at an estimated 86 dwellings. This excludes Keneperu plan changes which allows for significant capacity of around 700+ dwellings as it is Property Economics understanding this has been factored into the Greenfield model.

It is important to note that Table 3 represents the sum of the maximum attainable yield on an individual site basis. The theoretical model outputs passed to Property Economics by WCC contained several different development scenarios on each site, therefore the theoretical yield represents the scenarios on each site where the development potential is the highest.

10.2. FEASIBLE CAPACITY MODELLING

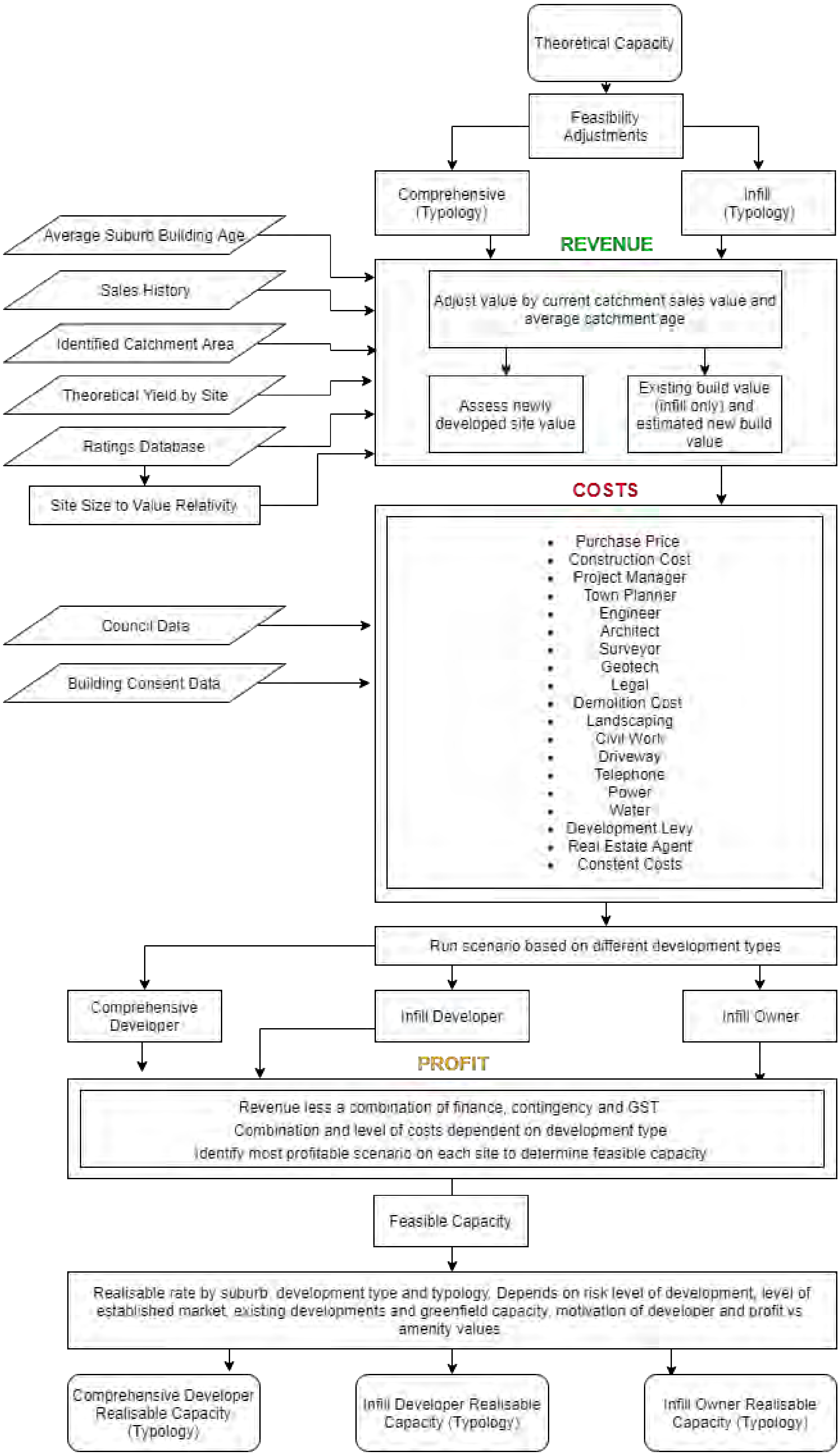
Economic feasibility modelling methodology utilised by PCC was passed to Property Economics alongside the theoretical outputs. However, there were several limitations of this feasibility modelling that Property Economics considered fundamental to the process. Originally, the model relied on the sqm size of the dwelling and placed an overall value (by dwelling with no typology differentiation) on this by suburb. This provided a total site value based on per sqm value tables per suburb.

A summary of the limitations of this method identified by Property Economics are outlined below:

1. The approach did not address land value or size.
2. The approach applied the same sqm value to existing dwellings resulting in a significant number of properties that were worth several multiples of their original, non-subdivided values.
3. The approach did not differentiate between areas within identified suburbs.
4. While sales value was identified by suburb as an average value build costs were only delineated by dwelling size and typology (the average quality of the build in each suburb will play a part in sales value and therefore impact upon build cost).
5. The increase in property 'values' to expected purchase price was based on a Citywide increase of 30%
6. The model only considered a scenario where the 'risk' associated with expected return included the purchase of the whole property (often with data that identified multiple property owner sites as 1 site, therefore requiring a large purchase in order to subdivide off one additional unit), this reduced the potential feasible quantum significantly.

A more comprehensive model that improved upon these limitations was developed by Property Economics. A high-level overview of this model is outlined in the flow chart in Figure 14 below, with detailed descriptions of each stage of the process given following.

FIGURE 14: PROPERTY ECONOMICS RESIDENTIAL FEASIBILITY MODEL OVERVIEW



Source: Property Economics

Land and Improvement Value per SQM

Using the ratings database provided by Porirua City Council, the land value per sqm and improvement value per sqm is calculated. This is then summarised by suburb, size and typology to give the average per sqm value for various types of dwellings.

By splitting the valuation in to land and improvement value, it accounts for variations of both sizes e.g. a large dwelling on a small piece of land compared to the same size dwelling on a larger piece of land.

Values are not the same across each suburb, and thus it is required to give the per sqm value for each suburb individually. Also, the per sqm rate for land and improvement value are shown not to be consistent across all sizes. For example, a larger dwelling has on average a lower per sqm improvement value than a smaller one. This inverse relationship between size and per sqm value is the same for both land value per sqm and building value per sqm.

Tables 4-6 below show the build value per sqm utilised in the commercially feasible capacity modelling for varying building sizes for standalone, terraced and apartment typologies.

TABLE 4 – PORIRUA STANDALONE BUILD VALUE / SQM BY SUBURB

STANDALONE	50	100	150	200	250	300
Aotea	$ 3,497	$ 2,873	$ 2,827	$ 2,760	$ 2,593	$ 2,557
Ascot Park	$ 3,898	$ 3,203	$ 3,151	$ 3,077	$ 2,891	$ 2,850
Camborne	$ 3,939	$ 3,237	$ 3,184	$ 3,110	$ 2,921	$ 2,880
Cannons Creek	$ 3,936	$ 3,234	$ 3,182	$ 3,107	$ 2,919	$ 2,878
Elsdon	$ 4,071	$ 3,345	$ 3,291	$ 3,214	$ 3,019	$ 2,977
Hongoeka	$ 3,853	$ 3,166	$ 3,115	$ 3,042	$ 2,857	$ 2,817
Kenepuru	$ 3,464	$ 2,846	$ 2,800	$ 2,735	$ 2,569	$ 2,533
Onepoto	$ 3,542	$ 2,911	$ 2,863	$ 2,796	$ 2,627	$ 2,590
Papakowhai	$ 3,483	$ 2,862	$ 2,815	$ 2,749	$ 2,583	$ 2,547
Paremata	$ 4,475	$ 3,677	$ 3,617	$ 3,533	$ 3,319	$ 3,272
Plimmerton	$ 4,212	$ 3,461	$ 3,405	$ 3,325	$ 3,124	$ 3,080
Porirua	$ 5,295	$ 4,351	$ 4,280	$ 4,180	$ 3,927	$ 3,872
Porirua City Centre	$ 3,141	$ 2,581	$ 2,539	$ 2,480	$ 2,330	$ 2,297
Pukerua Bay	$ 4,358	$ 3,581	$ 3,523	$ 3,441	$ 3,232	$ 3,187
Ranui	$ 3,795	$ 3,119	$ 3,068	$ 2,996	$ 2,815	$ 2,775
Takapuwahia	$ 3,567	$ 2,931	$ 2,883	$ 2,816	$ 2,645	$ 2,608
Titahi Bay	$ 3,962	$ 3,255	$ 3,203	$ 3,127	$ 2,938	$ 2,897
Waitangirua	$ 3,372	$ 2,771	$ 2,726	$ 2,662	$ 2,501	$ 2,465
Whitby	$ 3,626	$ 2,979	$ 2,931	$ 2,862	$ 2,689	$ 2,651

Source: Property Economics, WCC, PCC

TABLE 5 – PORIRUA TERRACED BUILD VALUE / SQM BY SUBURB

TERRACED	50	100	150	200	250	300
Aotea	$ 3,322	$ 2,730	$ 2,685	$ 2,622	$ 2,464	$ 2,429
Ascot Park	$ 3,703	$ 3,043	$ 2,993	$ 2,923	$ 2,746	$ 2,708
Camborne	$ 3,742	$ 3,075	$ 3,025	$ 2,954	$ 2,775	$ 2,736
Cannons Creek	$ 3,739	$ 3,072	$ 3,023	$ 2,952	$ 2,773	$ 2,734
Elsdon	$ 3,867	$ 3,178	$ 3,126	$ 3,053	$ 2,868	$ 2,828
Hongoeka	$ 3,660	$ 3,008	$ 2,959	$ 2,890	$ 2,715	$ 2,676
Kenepuru	$ 3,291	$ 2,704	$ 2,660	$ 2,598	$ 2,441	$ 2,406
Onepoto	$ 3,365	$ 2,765	$ 2,720	$ 2,656	$ 2,496	$ 2,460
Papakowhai	$ 3,309	$ 2,719	$ 2,675	$ 2,612	$ 2,454	$ 2,419
Paremata	$ 4,251	$ 3,493	$ 3,437	$ 3,356	$ 3,153	$ 3,108
Plimmerton	$ 4,001	$ 3,288	$ 3,235	$ 3,159	$ 2,968	$ 2,926
Porirua	$ 5,030	$ 4,133	$ 4,066	$ 3,971	$ 3,731	$ 3,678
Porirua City Centre	$ 2,984	$ 2,452	$ 2,412	$ 2,356	$ 2,213	$ 2,182
Pukerua Bay	$ 4,140	$ 3,402	$ 3,347	$ 3,269	$ 3,071	$ 3,028
Ranui	$ 3,606	$ 2,963	$ 2,915	$ 2,846	$ 2,674	$ 2,636
Takapuwahia	$ 3,388	$ 2,784	$ 2,739	$ 2,675	$ 2,513	$ 2,478
Titahi Bay	$ 3,763	$ 3,092	$ 3,042	$ 2,971	$ 2,791	$ 2,752
Waitangirua	$ 3,203	$ 2,632	$ 2,589	$ 2,529	$ 2,376	$ 2,342
Whitby	$ 3,444	$ 2,830	$ 2,784	$ 2,719	$ 2,554	$ 2,518

Source: Property Economics, WCC, PCC

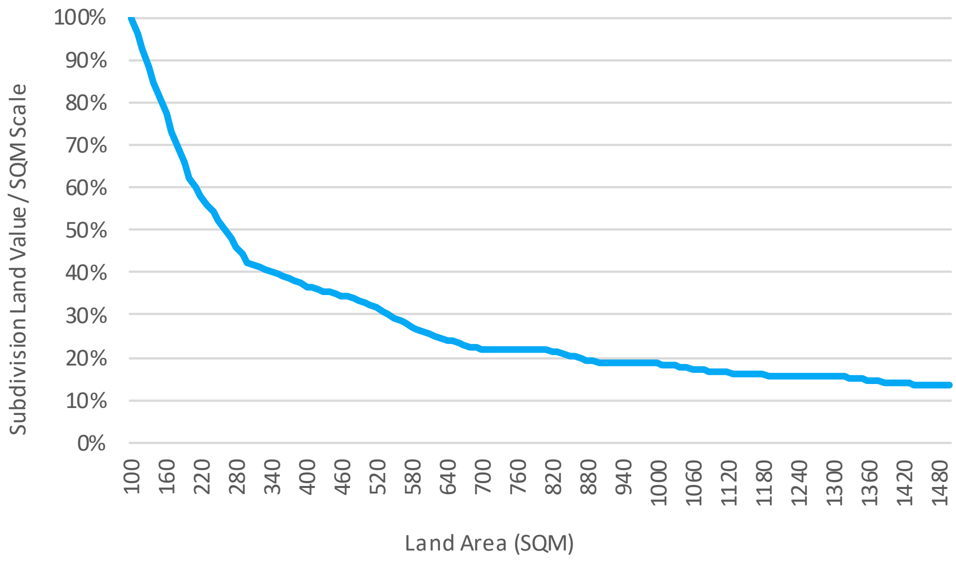
TABLE 6 – PORIRUA APARTMENT BUILD VALUE / SQM BY SUBURB

APARTMENT	50	100	150	200	250	300
Aotea	$ 3,776	$ 3,103	$ 3,053	$ 2,981	$ 2,801	$ 2,761
Ascot Park	$ 4,210	$ 3,459	$ 3,403	$ 3,323	$ 3,122	$ 3,078
Camborne	$ 4,254	$ 3,496	$ 3,439	$ 3,358	$ 3,155	$ 3,111
Cannons Creek	$ 4,251	$ 3,493	$ 3,436	$ 3,356	$ 3,153	$ 3,108
Elsdon	$ 4,397	$ 3,613	$ 3,554	$ 3,471	$ 3,261	$ 3,215
Hongoeka	$ 4,161	$ 3,419	$ 3,364	$ 3,285	$ 3,086	$ 3,043
Kenepuru	$ 3,741	$ 3,074	$ 3,024	$ 2,953	$ 2,775	$ 2,736
Onepoto	$ 3,825	$ 3,143	$ 3,092	$ 3,020	$ 2,837	$ 2,797
Papakowhai	$ 3,761	$ 3,091	$ 3,041	$ 2,969	$ 2,790	$ 2,750
Paremata	$ 4,833	$ 3,971	$ 3,907	$ 3,815	$ 3,584	$ 3,534
Plimmerton	$ 4,549	$ 3,738	$ 3,677	$ 3,591	$ 3,374	$ 3,326
Porirua	$ 5,719	$ 4,699	$ 4,623	$ 4,514	$ 4,241	$ 4,181
Porirua City Centre	$ 3,392	$ 2,788	$ 2,742	$ 2,678	$ 2,516	$ 2,481
Pukerua Bay	$ 4,707	$ 3,868	$ 3,805	$ 3,716	$ 3,491	$ 3,442
Ranui	$ 4,099	$ 3,368	$ 3,314	$ 3,236	$ 3,040	$ 2,997
Takapuwahia	$ 3,852	$ 3,165	$ 3,114	$ 3,041	$ 2,857	$ 2,817
Titahi Bay	$ 4,278	$ 3,516	$ 3,459	$ 3,378	$ 3,173	$ 3,128
Waitangirua	$ 3,642	$ 2,992	$ 2,944	$ 2,875	$ 2,701	$ 2,663
Whitby	$ 3,916	$ 3,217	$ 3,165	$ 3,091	$ 2,904	$ 2,863

Source: Property Economics, WCC, PCC

Figure 15 below shows the land value per sqm subdivision scale utilised in the commercially feasible capacity modelling for varying land sizes. This was utilised for all typologies. Figure 15 is indexed against a site size of 100sqm (representing a scale of 100%). At 1000sqm the index is 20%, indicating that the average 1000sqm site has a land value per sqm around 1/5th of that of a 100sqm site.

FIGURE 15 – PORIRUA LAND VALUE / SQM SCALE



Source: Property Economics, WCC, PCC

A limitation identified during the modelling process was that by applying a percentage increase on the site-specific land value through the process of subdivision, meant that sites with a proportionally high underlying land value resulted in an impractical subdivided land value on a per sqm basis. This was identified as a specific problem for sites with underlying commercial land values.

As a solution, the maximum residentially zoned land value per sqm identified within the ratings database was used as a maximum limit for the land value per sqm after subdivision. This removed the impact of sites with underlying commercial land values resulting in impractically high profitability, and thus feasible yield.

Average Suburb Age

Using the same ratings database, the average age of dwellings is found for each suburb. This is done in order to adjust the building value for each suburb based on values of houses from each decade. The data shows that there is a relationship between the age of a building and it's per sqm improvement value. Therefore, finding the average age in a suburb allows the building value to be adjusted appropriately.

Sales vs Capital Value (CV)

A statistically significant sample dataset of recent sales in Porirua was used to find the difference between the average sales price and the most recent valuation. This is to ensure the capacity modelling utilises the most up to date values data critical to the determination of current day feasible capacity.

Given the nominal level of sales over this period of time in Porirua, it was deemed appropriate to supplement this dataset with site-specific updated valuation samples for each suburb. Based on a representative sample from each suburb in Porirua, the average increase of sales price over the recent valuation is then determined. There exists a relationship between the suburb and this average increase, and thus the percentage increase is expressed per suburb. This average increase of sales over CV is then applied in the model to update the valuations (Tables 4,5 and 6) to reflect current market value.

Table 7 below shows the average Sales / CV percentage utilised in the model.

TABLE 7 – PORIRUA AVERAGE SALES / CV BY SUBURB

Suburb	Sales / CV
Aotea	115%
Ascot Park	124%
Camborne	120%
Cannons Creek	142%
Elsdon	132%
Hongoeka	118%
Kenepuru	121%
Onepoto	117%
Papakowhai	115%
Paremata	120%
Plimmerton	118%
Porirua	121%
Porirua City Centre	121%
Pukerua Bay	116%
Ranui	121%
Takapuwahia	132%
Titahi Bay	122%
Waitangirua	121%
Whitby	114%

Source: Property Economics, WCC, PCC

Construction Costs

Constructions costs for new dwellings were found by analysing the value of recent building consents granted within Porirua. The historical building consent data shows that the average value of building consents varies across suburb within Porirua, indicating the variety of product quality that is built.

Because of this, a table of average building consent per sqm by suburb was extracted from the building consent data in order to represent the average construction costs in a suburb. This is then used in the model as the construction costs of building a new dwelling.

Tables 8, 9 and 10 below show the average build cost by suburb for standalone, terraced and apartment typology types.

TABLE 8 – PORIRUA STANDALONE BUILD COST BY SUBURB

STANDALONE	50	75	100	125	150	175	200	225	250	275	300
Aotea	$ 3,171	$ 2,559	$ 2,226	$ 2,011	$ 1,860	$ 1,830	$ 1,731	$ 1,651	$ 1,584	$ 1,529	$ 1,481
Ascot Park	$ 3,378	$ 2,726	$ 2,371	$ 2,142	$ 1,981	$ 1,950	$ 1,843	$ 1,758	$ 1,687	$ 1,629	$ 1,577
Camborne	$ 3,312	$ 2,673	$ 2,325	$ 2,100	$ 1,942	$ 1,912	$ 1,807	$ 1,724	$ 1,655	$ 1,597	$ 1,546
Cannons Creek	$ 3,449	$ 2,784	$ 2,421	$ 2,187	$ 2,023	$ 1,991	$ 1,882	$ 1,795	$ 1,723	$ 1,663	$ 1,610
Elsdon	$ 3,454	$ 2,787	$ 2,424	$ 2,190	$ 2,026	$ 1,994	$ 1,885	$ 1,798	$ 1,725	$ 1,665	$ 1,613
Hongoeka	$ 3,358	$ 2,710	$ 2,357	$ 2,130	$ 1,970	$ 1,938	$ 1,833	$ 1,748	$ 1,678	$ 1,619	$ 1,568
Kenepuru	$ 3,203	$ 2,585	$ 2,248	$ 2,031	$ 1,879	$ 1,849	$ 1,748	$ 1,668	$ 1,600	$ 1,545	$ 1,496
Onepoto	$ 3,254	$ 2,626	$ 2,284	$ 2,064	$ 1,909	$ 1,878	$ 1,776	$ 1,694	$ 1,626	$ 1,569	$ 1,519
Papakowhai	$ 3,122	$ 2,519	$ 2,191	$ 1,980	$ 1,831	$ 1,802	$ 1,704	$ 1,625	$ 1,560	$ 1,505	$ 1,458
Paremata	$ 3,500	$ 2,825	$ 2,457	$ 2,220	$ 2,053	$ 2,020	$ 1,910	$ 1,822	$ 1,749	$ 1,688	$ 1,634
Plimmerton	$ 3,516	$ 2,837	$ 2,467	$ 2,229	$ 2,062	$ 2,029	$ 1,919	$ 1,830	$ 1,756	$ 1,695	$ 1,641
Porirua	$ 3,991	$ 3,221	$ 2,801	$ 2,531	$ 2,340	$ 2,303	$ 2,178	$ 2,077	$ 1,994	$ 1,924	$ 1,863
Porirua City Centre	$ 2,967	$ 2,394	$ 2,082	$ 1,881	$ 1,740	$ 1,712	$ 1,619	$ 1,544	$ 1,482	$ 1,430	$ 1,385
Pukerua Bay	$ 3,505	$ 2,829	$ 2,460	$ 2,223	$ 2,056	$ 2,023	$ 1,913	$ 1,824	$ 1,751	$ 1,690	$ 1,636
Ranui	$ 3,350	$ 2,704	$ 2,351	$ 2,124	$ 1,965	$ 1,934	$ 1,828	$ 1,744	$ 1,674	$ 1,615	$ 1,564
Takapuwahia	$ 3,217	$ 2,596	$ 2,258	$ 2,040	$ 1,887	$ 1,857	$ 1,756	$ 1,675	$ 1,607	$ 1,551	$ 1,502
Titahi Bay	$ 3,338	$ 2,694	$ 2,343	$ 2,117	$ 1,958	$ 1,927	$ 1,821	$ 1,737	$ 1,667	$ 1,609	$ 1,558
Waitangirua	$ 3,089	$ 2,493	$ 2,168	$ 1,959	$ 1,812	$ 1,783	$ 1,686	$ 1,608	$ 1,543	$ 1,490	$ 1,442
Whitby	$ 3,237	$ 2,612	$ 2,272	$ 2,053	$ 1,898	$ 1,868	$ 1,766	$ 1,685	$ 1,617	$ 1,561	$ 1,511

Source: Property Economics

TABLE 9 – PORIRUA TERRACED BUILD COST BY SUBURB

TERRACED	50	75	100	125	150	175	200	225	250	275	300
Aotea	$ 2,999	$ 2,382	$ 2,051	$ 1,842	$ 1,695	$ 1,671	$ 1,575	$ 1,499	$ 1,436	$ 1,384	$ 1,338
Ascot Park	$ 3,195	$ 2,537	$ 2,185	$ 1,962	$ 1,805	$ 1,780	$ 1,677	$ 1,596	$ 1,530	$ 1,474	$ 1,425
Camborne	$ 3,133	$ 2,487	$ 2,142	$ 1,924	$ 1,770	$ 1,745	$ 1,645	$ 1,565	$ 1,500	$ 1,445	$ 1,398
Cannons Creek	$ 3,262	$ 2,590	$ 2,231	$ 2,003	$ 1,843	$ 1,817	$ 1,713	$ 1,630	$ 1,562	$ 1,505	$ 1,455
Elsdon	$ 3,267	$ 2,594	$ 2,234	$ 2,006	$ 1,846	$ 1,820	$ 1,715	$ 1,632	$ 1,564	$ 1,507	$ 1,457
Hongoeka	$ 3,176	$ 2,522	$ 2,172	$ 1,950	$ 1,794	$ 1,769	$ 1,668	$ 1,587	$ 1,521	$ 1,465	$ 1,417
Kenepuru	$ 3,030	$ 2,406	$ 2,072	$ 1,860	$ 1,712	$ 1,688	$ 1,591	$ 1,514	$ 1,451	$ 1,398	$ 1,352
Onepoto	$ 3,078	$ 2,444	$ 2,105	$ 1,890	$ 1,739	$ 1,714	$ 1,616	$ 1,538	$ 1,474	$ 1,420	$ 1,373
Papakowhai	$ 2,953	$ 2,344	$ 2,019	$ 1,813	$ 1,668	$ 1,645	$ 1,550	$ 1,475	$ 1,414	$ 1,362	$ 1,317
Paremata	$ 3,310	$ 2,629	$ 2,264	$ 2,033	$ 1,870	$ 1,844	$ 1,738	$ 1,654	$ 1,585	$ 1,527	$ 1,477
Plimmerton	$ 3,325	$ 2,640	$ 2,274	$ 2,042	$ 1,879	$ 1,852	$ 1,746	$ 1,661	$ 1,592	$ 1,534	$ 1,483
Porirua	$ 3,774	$ 2,997	$ 2,581	$ 2,318	$ 2,132	$ 2,102	$ 1,982	$ 1,886	$ 1,807	$ 1,741	$ 1,684
Porirua City Centre	$ 2,806	$ 2,228	$ 1,919	$ 1,723	$ 1,585	$ 1,563	$ 1,473	$ 1,402	$ 1,343	$ 1,294	$ 1,252
Pukerua Bay	$ 3,315	$ 2,632	$ 2,267	$ 2,036	$ 1,873	$ 1,847	$ 1,740	$ 1,656	$ 1,587	$ 1,529	$ 1,479
Ranui	$ 3,169	$ 2,516	$ 2,167	$ 1,946	$ 1,790	$ 1,765	$ 1,664	$ 1,583	$ 1,517	$ 1,462	$ 1,414
Takapuwahia	$ 3,043	$ 2,416	$ 2,080	$ 1,868	$ 1,719	$ 1,695	$ 1,597	$ 1,520	$ 1,457	$ 1,404	$ 1,357
Titahi Bay	$ 3,157	$ 2,507	$ 2,159	$ 1,939	$ 1,783	$ 1,758	$ 1,657	$ 1,577	$ 1,511	$ 1,456	$ 1,408
Waitangirua	$ 2,922	$ 2,320	$ 1,998	$ 1,794	$ 1,651	$ 1,628	$ 1,534	$ 1,460	$ 1,399	$ 1,348	$ 1,304
Whitby	$ 3,061	$ 2,431	$ 2,093	$ 1,880	$ 1,730	$ 1,705	$ 1,607	$ 1,530	$ 1,466	$ 1,412	$ 1,366

Source: Property Economics

TABLE 10 – PORIRUA APARTMENT BUILD COST BY SUBURB

APARTMENT	50	75	100	125	150	175	200	225	250	275	300
Aotea	$ 3,978	$ 3,365	$ 3,033	$ 2,819	$ 2,668	$ 2,643	$ 2,543	$ 2,463	$ 2,398	$ 2,342	$ 2,294
Ascot Park	$ 4,237	$ 3,585	$ 3,230	$ 3,002	$ 2,841	$ 2,815	$ 2,709	$ 2,624	$ 2,554	$ 2,494	$ 2,444
Camborne	$ 4,155	$ 3,515	$ 3,167	$ 2,944	$ 2,786	$ 2,760	$ 2,656	$ 2,573	$ 2,504	$ 2,446	$ 2,396
Cannons Creek	$ 4,327	$ 3,660	$ 3,298	$ 3,066	$ 2,901	$ 2,875	$ 2,766	$ 2,679	$ 2,608	$ 2,547	$ 2,495
Elsdon	$ 4,333	$ 3,665	$ 3,303	$ 3,070	$ 2,905	$ 2,879	$ 2,770	$ 2,683	$ 2,611	$ 2,550	$ 2,499
Hongoeka	$ 4,213	$ 3,564	$ 3,211	$ 2,985	$ 2,825	$ 2,799	$ 2,693	$ 2,609	$ 2,539	$ 2,480	$ 2,429
Kenepuru	$ 4,019	$ 3,399	$ 3,063	$ 2,847	$ 2,695	$ 2,670	$ 2,569	$ 2,488	$ 2,422	$ 2,365	$ 2,317
Onepoto	$ 4,082	$ 3,453	$ 3,112	$ 2,893	$ 2,737	$ 2,712	$ 2,610	$ 2,528	$ 2,461	$ 2,403	$ 2,354
Papakowhai	$ 3,916	$ 3,313	$ 2,985	$ 2,775	$ 2,626	$ 2,602	$ 2,503	$ 2,425	$ 2,360	$ 2,305	$ 2,258
Paremata	$ 4,391	$ 3,714	$ 3,347	$ 3,111	$ 2,944	$ 2,917	$ 2,807	$ 2,719	$ 2,646	$ 2,585	$ 2,532
Plimmerton	$ 4,410	$ 3,731	$ 3,362	$ 3,125	$ 2,957	$ 2,930	$ 2,819	$ 2,731	$ 2,658	$ 2,596	$ 2,543
Porirua	$ 5,006	$ 4,235	$ 3,816	$ 3,547	$ 3,357	$ 3,326	$ 3,200	$ 3,100	$ 3,017	$ 2,947	$ 2,887
Porirua City Centre	$ 3,721	$ 3,148	$ 2,837	$ 2,637	$ 2,496	$ 2,472	$ 2,379	$ 2,304	$ 2,243	$ 2,191	$ 2,146
Pukerua Bay	$ 4,397	$ 3,719	$ 3,352	$ 3,115	$ 2,948	$ 2,921	$ 2,811	$ 2,723	$ 2,650	$ 2,588	$ 2,536
Ranui	$ 4,203	$ 3,555	$ 3,204	$ 2,978	$ 2,818	$ 2,792	$ 2,687	$ 2,602	$ 2,533	$ 2,474	$ 2,424
Takapuwahia	$ 4,035	$ 3,414	$ 3,076	$ 2,859	$ 2,706	$ 2,681	$ 2,580	$ 2,499	$ 2,432	$ 2,375	$ 2,327
Titahi Bay	$ 4,187	$ 3,542	$ 3,192	$ 2,967	$ 2,808	$ 2,782	$ 2,677	$ 2,593	$ 2,524	$ 2,465	$ 2,415
Waitangirua	$ 3,875	$ 3,278	$ 2,954	$ 2,746	$ 2,599	$ 2,575	$ 2,477	$ 2,400	$ 2,336	$ 2,281	$ 2,235
Whitby	$ 4,061	$ 3,435	$ 3,095	$ 2,877	$ 2,723	$ 2,698	$ 2,596	$ 2,514	$ 2,447	$ 2,390	$ 2,342

Source: Property Economics

Other Development Costs

As well as construction costs, a number of other costs have been incorporated into the feasibility model on a per dwelling basis. Some of the key costs are outlined below in Table 11. Other costs are identified in Figure 1 but also include commercial interest at 8% p.a. and a 10% contingency on total costs (risk).

TABLE 11 – PORIRUA PER DWELLING DEVELOPMENT COSTS

COMPREHENSIVE COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ 100	$ 100	$ 100
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

INFILL COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ -	$ -	$ -
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

Source: Property Economics, WCC, PCC

10.3. FEASIBLE CAPACITY OUTPUTS

Property Economics has assessed the variables outlined above in the Porirua market and run feasible capacity models across the range of locations, land values, improvement values, and land value changes. A key component of the market's willingness to develop infill is the relationship between a site's land value, fixed subdivision costs and the identifiable 'uptake' in value (sqm) through subdivision.

Tables 12 below outlines a summary of the number of potential sections on sites where the ratios meet a profit level suitable to meet market expectations (20% for the purpose of this analysis).

Table 12 represents the subdivision undertaken by either an owner occupier or a developer, with the capacity representing the most profitable. This is an important difference as motivations and capital outlay are often different. These figures have removed all 'double ups' i.e. where multiple instances were tested on a specific site and represent the most profitable scenario for that site.

TABLE 12 – PORIRUA FEASIBLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB – OWNER AND DEVELOPER

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aotea	3038		9	83	92	3%
Ascot Park	1974		28	30	58	3%
Camborne	1015		50	22	72	7%
Cannons Creek	4584		181	770	951	21%
Elsdon	620		30	55	85	14%
Hongoeka	150		4	28	32	21%
Kenepuru	86			2	2	2%
Papakowhai	1714		11	29	40	2%
Paremata	1028		73	147	220	21%
Plimmerton	739		50	52	102	14%
Porirua City Centre	684			30	30	4%
Pukerua Bay	1677		128	278	406	24%
Ranui	2929		48	124	172	6%
Takapuwahia	1395		23	132	155	11%
Titahi Bay	6234		234	1263	1,497	24%
Waitangirua	2403		9	67	76	3%
Whitby	5814		182	143	325	6%
Grand Total	36,084	-	1,060	3,255	4,315	12%

Source: Property Economics, WCC, PCC

If developments were to be undertaken by either a developer or owner occupier, there is then potential for 4,315 additional units within the Porirua market. As all development options have been considered in Table 12, this represents the total feasible capacity in the market. This level of feasible capacity represents a 12% feasibility rate on the theoretical capacity, 9% above the feasible capacity by developers alone. 75% of feasible capacity comes from terraced dwellings, with the remaining 25% from standalone dwellings.

10.4. REALISABLE CAPACITY OUTPUTS

On top of the feasible capacity modelling, practical considerations must be taken into account as to what is likely to be developed in the real world. While this section is separated from the sensitivities above the realisation rates essentially provide for 'development chance' given the propensity for development variances.

These considerations are based on:

- Dwelling typology
- Development option
- Greenfield competition

The identification of these variables not only provides for sensitivities but also addresses the relativity between typologies. While all three typologies may be feasible the development model identifies the site scenario with the highest profit margin. However, practically while the model assesses the standard 20% profit margin, there is greater risk in some typologies. The assessment below endeavours to consider these risks, and motivation, differentials.

The capacity for greenfield development within Porirua has been provided to Property Economics, and this has been cross referenced against future residential demand to give an indication of the proportion of demand that can be satisfied by greenfield development. Forecast demand for residential product has been based on the Forecast ID projection utilised in previous chapters.

Table 13 outlines greenfield capacity and future residential demand:

TABLE 13 – PORIRUA GREENFIELD DEVELOPMENT CAPACITY

	Greenfield Capacity	30-Year Demand	Greenfield % of Demand	Required Brownfield
Porirua City	5,961	10,400	57%	4,439

Source: Property Economics, WCC, PCC

Over the 30-year forecast period from 2018-2048, Porirua is forecast to require an additional 10,400 dwellings. Greenfield modelling provided by WCC has indicated that the District has capacity for 5,961 greenfield dwellings, making up 57% of 30-year demand.

On top of greenfield consideration, the relative risk of each development type must be considered in quantifying what will practically be developed by the market. The risk is not homogenous across typology or development type, and thus a matrix of 'risk factors' have been applied across each combination of typology and development type.

Risk has been accounted for developments undertaking by developers by increasing the required profit level for a development to be classified as 'realisable', on top of being feasible. Table 14 below shows the profit levels required for each combination of typology and development option to be considered realisable by the model.

TABLE 14 – DEVELOPER REALISABLE PROFIT RATES

	Comprehensive Developer	Infill Developer	Infill Owner
Standalone	**20%**	**17%**	**25%**
Terraced	**23%**	**20%**	**28%**
Apartment	**32%**	**28%**	**39%**

Source: Property Economics, WCC, PCC, Forecast ID

This reflects the market practicality that developments taken on by a developer have relatively lower risk if they are an infill development, rather than a comprehensive development. It also shows the increasing risk of development as the typology increases in scale from standalone dwellings, through to terraced product, and finally apartments.

For an owner occupier the model considers the profit level of the development relative to the capital value of the existing dwelling(s). This is because motivations for an owner to subdivide their property are inherently linked with the relative profit they can achieve against the value of their own home e.g. a $100,000 profit on a $1,000,000 site will be less likely to be developed by the owner, compared to a $100,000 profit on a $500,000 site, assuming similar fixed costs. Therefore, as a methodology for this, the model considers that the lowest quartile of feasible infill developments in terms of the relative profit / CV ratio will not be realised by the market.

Taking these market practicalities into consideration, Table 15 represents the realisable capacity within Porirua.

TABLE 15 – PORIRUA REALISABLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
Aotea	3038			11	11	0%
Ascot Park	1974		5	7	12	1%
Camborne	1015		20	11	31	3%
Cannons Creek	4584		38	483	521	11%
Elsdon	620		3	20	23	4%
Hongoeka	150		2	14	16	11%
Kenepuru	86				-	0%
Papakowhai	1714			3	3	0%
Paremata	1028		48	129	177	17%
Plimmerton	739		40	48	88	12%
Porirua City Centre	684			24	24	4%
Pukerua Bay	1677		77	199	276	16%
Ranui	2929		2	9	11	0%
Takapuwahia	1395		22	42	64	5%
Titahi Bay	6234		85	723	808	13%
Waitangirua	2403			17	17	1%
Whitby	5814		19	49	68	1%
Grand Total	36,084	-	361	1,789	2,150	6%

Source: Property Economics, WCC, PCC

Table 15 shows that the realisable capacity across Porirua is just around 2,150 new dwellings, representing a 6% realisation rate across the District. In essence, this represents a 50% realisation rate of the already calculated feasible capacity outlined in Table 12 above.

10.5. SENSITIVITY ANALYSIS

As an extension to the feasibility modelling outlined above, scenarios testing the sensitivity of the feasibility model have also been undertaken. This has been done to test the robustness of the model, and see the practical implications due to small changes in the input variables.

The following scenarios have been tested in this sensitivity analysis:

- Increasing the build value across all typologies by 15%. This in essence represents a greater per sqm profit margin on any new built product.

- Increasing the savings incurred due to Economies of Scale (**EoS**). In the normal model, the maximum savings that could occur due to larger scale developments was savings of around 15% on relevant costs. This has been scaled to a maximum of around 50%, with the savings increased as the scale of the development increases.

- Increasing the maximum attainable land value in the model by 10%. This represents the possibility of the highest per sqm land value increasing by 10% in the future.

- Decreasing the maximum attainable land value in the model by 10%. This represents the possibility of the highest per sqm land value increasing by 10% in the future.

Each scenario has been tested independently of the other in order to isolate the sensitivity of the model to this specific scenario.

A summary of the feasible capacity under each of the four scenarios, compared against the original feasible capacity is given below in Table 16, with Table 17 showing the realisable capacity under each sensitivity. A full breakdown of feasible and realisable capacity under each sensitivity scenario is given in Appendix 2.

TABLE 16 – FEASIBLE CAPACITY SENSITIVITY ANALYSIS

Scenario	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Normal Model	36,084	-	1,060	3,255	4,315	12%
Increased Economies of Scale	36,084	-	1,241	4,119	5,360	15%
Increased Build Value	36,084	11	1,691	5,276	6,978	19%
Increased Land Value (10%)	36,084	-	2,563	554	3,117	9%
Decreased Land Value (10%)	36,084	-	1,141	4,073	5,214	14%

Source: Property Economics, WCC, PCC

TABLE 17 – REALISABLE CAPACITY SENSITIVITY ANALYSIS

Scenario	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
Normal Model	36,084	-	361	1,789	2,150	6%
Increased Economies of Scale	36,084	-	553	2,478	3,031	8%
Increased Build Value	36,084	-	1,078	4,428	5,506	15%
Increased Land Value (10%)	36,084	-	1,807	248	2,055	6%
Decreased Land Value (10%)	36,084	-	476	2,442	2,918	8%

Source: Property Economics, WCC, PCC

The series of sensitivities show that the modelling process is most sensitive to the increased build value, increasing feasible capacity to almost 7,000, a feasibility rate of 19%.

It is important to note the reason for the increased and decreased land value maximum having an inverse effect on the feasible capacity. This is because as the maximum land value increases, Tables 16 and 17 show that the profitability of standalone sites increases relative to terraced sites, with standalone now becoming comparatively the most profitable on each site. However, standalone developments on average have a lower yield, thus effectively reducing the feasible capacity.

APPENDIX 1: DEMOGRAPHIC PROFILING

Section		Porirua City	Wellington Region	New Zealand
GENERAL	Population	55,350	501,950	4,677,550
	Households	18,750	193,600	1,755,150
	Person Per Dwelling Ratio	2.95	2.59	2.67
AGE PROFILE	0–4 Years	9%	7%	7%
	5–9 Years	8%	6%	7%
	10–14 Years	8%	6%	7%
	15–19 Years	7%	7%	7%
	20–24 Years	6%	7%	7%
	25–29 Years	5%	6%	6%
	30–34 Years	6%	7%	6%
	35–39 Years	7%	7%	6%
	40–44 Years	8%	8%	7%
	45–49 Years	7%	7%	7%
	50–54 Years	7%	7%	7%
	55–59 Years	6%	6%	6%
	60–64 Years	5%	5%	5%
	65 years and Over	10%	13%	14%
HOUSEHOLD INCOME	$20,000 or Less	9%	9%	11%
	$20,001–$30,000	8%	9%	11%
	$30,001–$50,000	14%	15%	18%
	$50,001–$70,000	12%	13%	15%
	$70,001–$100,000	18%	18%	18%
	$100,001 or More	38%	35%	28%
PERSONAL INCOME	$5,000 or Less	15%	14%	15%
	$5,001–$10,000	6%	5%	5%
	$10,001–$20,000	15%	16%	18%
	$20,001–$30,000	12%	12%	14%
	$30,001–$50,000	20%	20%	21%
	$50,001 or More	31%	33%	27%
ETHNICITY	European Ethnic Groups	54%	69%	67%
	Māori Ethnic Group	18%	12%	13%
	Pacific Peoples' Ethnic Groups	22%	7%	7%
	Asian Ethnic Groups	5%	9%	11%
	MELAA Ethnic Groups	1%	1%	1%
	Other Ethnic Groups	1%	2%	2%
QUALIFICATION ATTAINMENT	No Qualification	21%	16%	21%
	Level 1 Certificate	13%	11%	13%
	Level 2 Certificate	12%	11%	11%
	Level 3 Certificate	10%	11%	10%
	Level 4 Certificate	9%	9%	10%
	Level 5 or Level 6 Diploma	9%	9%	9%
	Bachelor Degree and Level 7 Qualifications	14%	18%	14%
	Postgraduate and Honours Degrees	3%	5%	3%
	Masters Degree	3%	5%	3%
	Doctorate Degree	0%	1%	1%
	Overseas Secondary School Qualification	5%	6%	7%

		Porirua City	Wellington Region	New Zealand
EMPLOYMENT	Employed - Full Time	50%	51%	48%
	Employed - Part Time	13%	14%	14%
	Unemployed	6%	5%	5%
	Not in Labour Force	30%	30%	33%
EMPLOYMENT CLASSIFICATION	Managers	18%	18%	19%
	Professionals	26%	30%	23%
	Technicians and Trades Workers	10%	10%	12%
	Community and Personal Service Workers	10%	9%	9%
	Clerical and Administrative Workers	14%	14%	12%
	Sales Workers	9%	9%	9%
	Machinery Operators and Drivers	5%	4%	5%
	Labourers	9%	7%	11%
STUDENT RATIO	Full Time	11%	12%	11%
	Part Time	5%	4%	4%
	Full-time and Part-time Study	0%	0%	0%
	Not Studying	84%	84%	85%
HOUSEHOLD INCOME SOURCES	Wages, Salary, Commissions, Bonuses etc	76%	73%	69%
	Self-employment or Business	18%	21%	22%
	Interest, Dividends, Rent, Other Invest.	25%	32%	27%
	Payments from a Work Accident Insurer	1%	1%	2%
	NZ Superannuation or Veterans Pension	16%	20%	22%
	Other Super., Pensions, Annuities	4%	5%	4%
	Unemployment Benefit	5%	4%	4%
	Sickness Benefit	3%	3%	3%
	Domestic Purposes Benefit	5%	3%	4%
	Invalids Benefit	2%	3%	3%
	Student Allowance	3%	4%	4%
	Other Govt Benefits, Payments or Pension	6%	6%	6%
	Other Sources of Income	2%	3%	3%
	No Source of Income During That Time	0%	0%	1%
INDUSTRY OF EMPLOYMENT	Agriculture, Forestry and Fishing	1%	2%	7%
	Mining	0%	0%	0%
	Manufacturing	6%	5%	10%
	Electricity, Gas, Water and Waste Services	1%	1%	1%
	Construction	8%	6%	8%
	Wholesale Trade	3%	3%	5%
	Retail Trade	9%	9%	10%
	Accommodation and Food Services	4%	6%	6%
	Transport, Postal and Warehousing	4%	3%	4%
	Information Media and Telecommunications	2%	3%	2%
	Financial and Insurance Services	5%	5%	4%
	Rental, Hiring and Real Estate Services	2%	2%	2%
	Professional, Scientific and Technical Services	11%	14%	9%
	Administrative and Support Services	4%	3%	3%
	Public Administration and Safety	12%	13%	5%
	Education and Training	11%	9%	8%
	Health Care and Social Assistance	12%	10%	10%
	Arts and Recreation Services	2%	2%	2%
	Other Services	4%	4%	4%

		Porirua City	Wellington Region	New Zealand
HOUSEHOLDS	Single	17%	25%	23%
	Couple	26%	29%	29%
	Single Parent With Children	18%	12%	13%
	Two Parent Family	36%	29%	30%
	Other Multi-person	3%	6%	5%
NUMBER OF RESIDENTS	1 Residents	18%	24%	23%
	2 Residents	31%	34%	34%
	3 Residents	18%	17%	16%
	4 Residents	17%	15%	15%
	5 Residents	8%	6%	7%
	6 Residents	4%	2%	3%
	7 Residents	2%	1%	1%
	8 Plus Residents	2%	1%	1%
HOME OWNERSHIP	Dwelling Owned or Partly Owned	51%	52%	50%
	Dwelling Not Owned and Not Held in a Family Trust	36%	35%	35%
	Dwelling Held in a Family Trust	12%	13%	15%
YEARS AT RESIDENCE	0 Years	18%	22%	22%
	1–4 Years	30%	29%	30%
	5–9 Years	21%	20%	21%
	10–14 Years	12%	12%	11%
	15–29 Years	14%	12%	11%
	30 Years or More	5%	5%	5%
NUMBER OF BEDROOMS	One Bedroom	3%	7%	6%
	Two Bedrooms	13%	21%	19%
	Three Bedrooms	49%	43%	45%
	Four Bedrooms	28%	22%	23%
	Five Bedrooms	6%	5%	6%
	Six Bedrooms	1%	1%	1%
	Seven Bedrooms	0%	0%	0%
	Eight or More Bedrooms	0%	0%	0%
WEEKLY RENT PAID	Under $100	25%	8%	9%
	$100–$149	12%	6%	7%
	$150–$199	7%	7%	8%
	$200–$249	11%	10%	10%
	$250–$299	13%	12%	13%
	$300–$349	12%	11%	14%
	$350 and Over	21%	46%	39%

APPENDIX 2: SENSITIVITY ANALYSIS TABLES

EOS Scale (50%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aotea	3038		4	126	130	4%
Ascot Park	1974		25	51	76	4%
Camborne	1015		32	83	115	11%
Cannons Creek	4584		177	811	988	22%
Elsdon	620		42	110	152	25%
Hongoeka	150		2	39	41	27%
Kenepuru	86		12	7	19	22%
Papakowhai	1714		8	78	86	5%
Paremata	1028		67	175	242	24%
Plimmerton	739		39	79	118	16%
Porirua City Centre	684		184	38	222	32%
Pukerua Bay	1677		143	345	488	29%
Ranui	2929		59	248	307	10%
Takapuwahia	1395		74	176	250	18%
Titahi Bay	6234		215	1381	1596	26%
Waitangirua	2403		10	89	99	4%
Whitby	5814		148	283	431	7%
Grand Total	36,084	-	1,241	4,119	5,360	15%

EOS Scale (50%) - Realisable Capacity

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
Aotea	3038			52	52	2%
Ascot Park	1974		5	22	27	1%
Camborne	1015		15	76	91	9%
Cannons Creek	4584		32	498	530	12%
Elsdon	620		4	80	84	14%
Hongoeka	150		1	22	23	15%
Kenepuru	86		12	3	15	17%
Papakowhai	1714			22	22	1%
Paremata	1028		46	167	213	21%
Plimmerton	739		27	75	102	14%
Porirua City Centre	684		184	38	222	32%
Pukerua Bay	1677		56	321	377	22%
Ranui	2929		24	23	47	2%
Takapuwahia	1395		60	109	169	12%
Titahi Bay	6234		74	814	888	14%
Waitangirua	2403		1	17	18	1%
Whitby	5814		12	139	151	3%
Grand Total	36,084	-	553	2,478	3,031	8%

Build Value Increase (15%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aotea	3038		13	124	137	5%
Ascot Park	1974		45	153	198	10%
Camborne	1015		41	72	113	11%
Cannons Creek	4584	1	211	1132	1344	29%
Elsdon	620	1	52	134	187	30%
Hongoeka	150		18	39	57	38%
Kenepuru	86		12	10	22	26%
Papakowhai	1714		21	85	106	6%
Paremata	1028	3	73	206	282	27%
Plimmerton	739		45	94	139	19%
Porirua City Centre	684		184	42	226	33%
Pukerua Bay	1677		132	428	560	33%
Ranui	2929		179	362	541	18%
Takapuwahia	1395		53	231	284	20%
Titahi Bay	6234	6	308	1646	1960	31%
Waitangirua	2403		39	237	276	11%
Whitby	5814		265	281	546	9%
Grand Total	36,084	11	1,691	5,276	6,978	19%

Build Value Increase (15%) - Realisable Capacity

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
Aotea	3038			98	98	3%
Ascot Park	1974		13	99	112	6%
Camborne	1015		33	70	103	10%
Cannons Creek	4584		168	1041	1209	26%
Elsdon	620		37	128	165	27%
Hongoeka	150		18	35	53	35%
Kenepuru	86		12	7	19	22%
Papakowhai	1714		4	56	60	4%
Paremata	1028		68	192	260	25%
Plimmerton	739		39	91	130	18%
Porirua City Centre	684		184	38	222	32%
Pukerua Bay	1677		125	396	521	31%
Ranui	2929		28	128	156	5%
Takapuwahia	1395		70	181	251	18%
Titahi Bay	6234		175	1535	1710	27%
Waitangirua	2403		10	74	84	3%
Whitby	5814		94	259	353	6%
Grand Total	36,084	-	1,078	4,428	5,506	15%

Land Value Increase (10%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aotea	3038		27		27	1%
Ascot Park	1974		41	6	47	2%
Camborne	1015		73	1	74	7%
Cannons Creek	4584		286	358	644	14%
Elsdon	620		67	11	78	13%
Hongoeka	150		33	2	35	23%
Kenepuru	86		19		19	22%
Papakowhai	1714		17		17	1%
Paremata	1028		130	30	160	16%
Plimmerton	739		71	8	79	11%
Porirua City Centre	684		229		229	33%
Pukerua Bay	1677		278	18	296	18%
Ranui	2929		97	2	99	3%
Takapuwahia	1395		134	16	150	11%
Titahi Bay	6234		746	98	844	14%
Waitangirua	2403		41	1	42	2%
Whitby	5814		274	3	277	5%
Grand Total	36,084	-	2,563	554	3,117	9%

Land Value Increase (10%) - Realisable Capacity

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
Aotea	3038		2		2	0%
Ascot Park	1974		16	3	19	1%
Camborne	1015		60	1	61	6%
Cannons Creek	4584		184	127	311	7%
Elsdon	620		51	9	60	10%
Hongoeka	150		12	2	14	9%
Kenepuru	86		19		19	22%
Papakowhai	1714		6		6	0%
Paremata	1028		124	22	146	14%
Plimmerton	739		66	4	70	9%
Porirua City Centre	684		229		229	33%
Pukerua Bay	1677		245	13	258	15%
Ranui	2929		42	2	44	2%
Takapuwahia	1395		85	8	93	7%
Titahi Bay	6234		505	53	558	9%
Waitangirua	2403		24	1	25	1%
Whitby	5814		137	3	140	2%
Grand Total	36,084	-	1,807	248	2,055	6%

Land Value Decrease (10%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Aotea	3038		4	124	128	4%
Ascot Park	1974		26	48	74	4%
Camborne	1015		32	81	113	11%
Cannons Creek	4584		178	796	974	21%
Elsdon	620		42	108	150	24%
Hongoeka	150		3	36	39	26%
Kenepuru	86		12	7	19	22%
Papakowhai	1714		8	75	83	5%
Paremata	1028		67	173	240	23%
Plimmerton	739		39	75	114	15%
Porirua City Centre	684		184	38	222	32%
Pukerua Bay	1677		105	349	454	27%
Ranui	2929		48	248	296	10%
Takapuwahia	1395		33	185	218	16%
Titahi Bay	6234		207	1360	1567	25%
Waitangirua	2403		10	89	99	4%
Whitby	5814		143	281	424	7%
Grand Total	36,084	-	1,141	4,073	5,214	14%

Land Value Decrease (10%) - Realisable Capacity

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
Aotea	3038			52	52	2%
Ascot Park	1974		5	22	27	1%
Camborne	1015		15	74	89	9%
Cannons Creek	4584		32	490	522	11%
Elsdon	620		4	80	84	14%
Hongoeka	150		2	19	21	14%
Kenepuru	86		12	3	15	17%
Papakowhai	1714			19	19	1%
Paremata	1028		46	166	212	21%
Plimmerton	739		27	70	97	13%
Porirua City Centre	684		176	38	214	31%
Pukerua Bay	1677		67	320	387	23%
Ranui	2929		2	26	28	1%
Takapuwahia	1395		21	111	132	9%
Titahi Bay	6234		59	799	858	14%
Waitangirua	2403		1	17	18	1%
Whitby	5814		7	136	143	2%
Grand Total	36,084	-	476	2,442	2,918	8%

Appendix 4.2

Wellington greenfield development feasibility modelling

Final Report

Prepared for: Wellington City Council

Prepared by: MRCagney Pty Ltd, Auckland, New Zealand, in partnership with Colliers International

Document Information

Project Name	Wellington greenfield development feasibility modelling
Status	Final Report
Client	Wellington City Council
Client Reference	
MRC Reference	NZ2342
File Name	/Users/peternunns/Documents/6 MRCagney - work/4 Projects/WCC/Wellington greenfield models/Final issue/Wellington greenfield feasibility modelling tech report FINAL REPORT.docx

MRCagney Pty Ltd
Level 4, 12 O'Connell Street, Auckland, 1010
PO Box 3696, Shortland Street, Auckland, 1140
New Zealand

t: +64 9 377 5590
f: +64 9 377 5591
e: auckland@mrcagney.com
www.mrcagney.com

Quality Assurance Register

Issue	Description	Prepared by	Reviewed by	Authorised by	Date
1	Draft Technical Note	Peter Nunns		Peter Nunns	2 August 2018
2	Draft Report	Peter Nunns	Danielle Gatland	Peter Nunns	5 October 2018
3	Final Report	Danielle Gatland / Phil Donovan	Peter Nunns	Peter Nunns	14 December 2018

MRCagney Pty Ltd
Level 4, 12 O'Connell Street
Auckland, 1010
PO Box 3696, Shortland Street
Auckland, 1140
New Zealand

t: +64 9 377 5590
f: +64 9 377 5591
e: auckland@mrcagney.com
www.mrcagney.com
NZBN 1317981

BETTER TRANSPORT • BETTER PLACES • BETTER CHOICES

Contents

1 Introduction

This technical report presents the Wellington greenfield land development feasibility model that MRCagney and Colliers developed for five Wellington territorial authorities, and describes key inputs, assumptions, and findings from analysis.

In this report, we use the term 'greenfield development' to refer to the conversion of rural land to urban uses, in particular residential subdivisions. However, this model could equally well be applied to any large parcel of undeveloped or lightly-developed land ranging from a golf course to a major industrial site that has been cleared for redevelopment.

The model described in this report estimates the commercial feasibility of developing new residential subdivisions in the Wellington region, based on information available in mid/late 2018, taking into account:

- The quantity of land that is available for development, which was estimated based on Wellington's GIS-based development capacity model
- The cost of acquiring greenfield sites for development, which is based on site valuations updated to current (2018) values
- The cost to undertake site works, provide infrastructure, and subdivide sites, which are based on unit cost rates supplemented with other case study and market data
- Sale prices for residential sections with a given size, location, and characteristics such as slope and view, which are estimated based on statistical analysis of recent property sales in the Wellington region.

This model extends the greenfield development feasibility model published by the Ministry of Business, Innovation and Employment to assist councils in assessing development feasibility. While the basic setup and workings of the model have not changed, we have:

- Extended the model to address an arbitrarily large number of greenfield sites, rather than a single 'representative' site
- Comprehensively reviewed the default unit cost parameters in the MBIE model and amended these values where there is evidence that costs are likely to be different in the Wellington context
- Adjusted how the model calculates earthworks requirements and road reserve area to account for the impact of Wellington's hilly topography
- Developed location-specific and site-specific estimates of section sale prices based on a statistical analysis of five to ten years of residential property sales, supplemented with market insights from Colliers.

1.1 Concept of feasibility analysis

'Feasibility analysis' refers to analysis of whether expected revenues from developing a piece of land exceed the costs of development, including a profit margin to cover the effort and risk involved in the development process. Somebody who is considering subdividing land for residential use will typically begin by asking whether current prices for residential sections are likely to cover the cost to buy a site, survey and plan it, undertake earthworks, provide roads and pipes, and market new sections. If the answer is 'no', then the development is unlikely to proceed.

Feasibility analysis focuses on the commercial calculations of a profit-seeking developer, rather than broader economic, social, or environmental considerations that may affect whether a development is beneficial for society. For instance, a site may be profitable to develop even though it has large negative impacts on biodiversity or high costs to service with publicly-funded infrastructure. In such a case, it may be desirable to limit development to avoid those impacts.

While council decision-making about where to enable growth through district plans and infrastructure provision should also respond to factors other than commercial feasibility, there are several reasons why it is important for councils to undertake feasibility analysis, especially of housing development capacity.

First, because feasibility is a prerequisite for most development to occur, it should inform councils' expectations for what will happen as a result of district plan and infrastructure decisions. Developments that are feasible are more likely to occur, while developments that are not feasible are less likely to occur, at least until market conditions change.

When councils have a choice about whether to enable additional development capacity in one location or another, it is preferable to choose the location that is more feasible to develop. This can help to ensure that planning provides appropriate opportunities for people to be housed and to reduce the risk of investing in 'stranded' infrastructure assets.

Second, councils have an important role in regulating and facilitating new development, and analysing feasibility can improve their ability to understand development processes. Identifying factors that exert the strongest influence on whether a development is feasible or not can assist in designing policies that shape the form of urban development. It can also help in understanding which 'pain points' are most important to overcome to unlock development in desirable locations.

1.2 Limits of feasibility analysis

Feasibility analysis is not a forecast of exactly what will happen 'on the ground'. While a development that is more feasible is more *likely* to occur than one that is less feasible, there are a number of reasons why a feasible development may not occur, or an infeasible development may occur. These include the following:

Landowner intentions
Some landowners may not be interested in developing land (or selling their site to a developer) even if they could profit by doing so, because they prefer to retain existing uses. For instance, somebody who owns a family farm on the edge of an expanding urban area may prefer to continue farming until they retire, or even leave the farm to their children as a going concern.

Conversely, some landowners may be willing to supply land at a discount relative to its market value to achieve their preferred development outcome. For instance, a public or community housing provider may develop land at a financial loss in order to meet its goal of supplying affordable housing for low-income people.

Changing market conditions
Feasibility analysis presents a snapshot of the profitability of developing at a given point in time. If market conditions change significantly, it may affect the price to buy greenfield land for development, the cost of inputs to land development, or the sale price for development-ready sections. These will in turn affect the profitability of greenfield development.

Changing market conditions can have several impacts:

- Region-wide changes in costs or prices can affect the overall quantity of development that is feasible – a 'rising tide lifts all boats' effect.
- Localised changes in prices can affect the spatial distribution of feasible development – for instance, if prices are rising in one suburb and falling in another, then development will become more attractive in the first location and less in the second.

In this report, we do not attempt to predict future market conditions. However, we note that market conditions *have* changed significantly in recent years. As shown in the following chart, MBIE's residential land value index has risen significantly since 2015 throughout the Wellington region. We have used mid-2018 prices and costs in this analysis, noting that feasibility outcomes may have been different in the recent past.

Figure 1: MBIE residential land value index for Wellington territorial authorities

Moreover, there are some signs that the spatial structure of prices is changing in the Wellington region. The following table summarises change in MBIE's residential land value index over the 1998-2018 period.

Over the full period, Kāpiti Coast has experienced the largest percentage increase in residential land values, while Wellington City has experienced the lowest increases. However, in the recent period of price growth (2015-2018), Lower Hutt and Upper Hutt have experienced the highest percentage increases. While there are more similarities than differences in rates of increase, this may indicate that development in the Hutt Valley is becoming more feasible relative to development elsewhere in the region.

Table 1: Changes in residential land values in the Wellington region

TA	MBIE residential land value index				Percentage change	
	Jun-98	Jun-08	Jun-15	Jun-18	1998 to 2018	2015 to 2018
Wellington City	1.712	3.846	4.047	5.678	232%	40%
Lower Hutt City	1.357	3.470	3.446	5.089	275%	48%

Upper Hutt City	1.090	2.836	2.757	4.019	269%	46%
Porirua City	1.133	3.006	2.969	4.261	276%	44%
Kāpiti Coast District	1.315	2.652	3.572	5.098	288%	43%

Note: These values show nominal price increases that have not been adjusted to account for general price inflation.

Local factors affecting costs or prices
We have endeavoured to ensure that inputs to feasibility modelling are reasonable, and that cost and revenue inputs vary appropriately based on the observed characteristics of particular sites. However, the model we have developed will not necessarily capture all local factors that may affect costs or prices, and hence influence the profitability of developing sites.

For example, some sites may have geotechnical constraints, flooding issues, or constraints around cultural heritage or biodiversity that may be difficult to detect without an in-depth site assessment. These may affect subdivision design or costs to develop the site. Conversely, some sites may have features that make them unusually attractive places to live, such as outstanding scenic views or good sunlight and exposure, and which may not be fully captured in section price estimates.

In general, it pays to take a conservative view about costs as they seldom go down upon further investigation. We have incorporated cost contingencies into the model as a 'buffer' for unexpected costs, but further sensitivity testing may be wise.

1.3 Overview of this report

This report is structured as follows:

- Section 2 presents an overview of feasibility model workings, highlights key user inputs and outputs, and explains how users can update the model to include additional sites or to reflect changes in development costs and prices in future years
- Section 3 explains input assumptions for land development costs, including sources for key assumptions and estimates
- Section 4 explains how we have estimated prices for new residential sections throughout the Wellington region
- Section 5 applies this model to Wellington greenfield sites, discusses implications of this analysis, and highlights areas where further work may be useful.

Technical appendices provide supplementary information where needed.

2 Overview of model workings

To begin, we describe the model dashboard. This is the key point of interface for most users. It provides a summary of model outputs, and sensitivity toggles and scenarios for testing the most likely variables to impact feasibility. This review is in Section 2.1.

The rest of Section 2 describes the detail in more model, including the raw site inputs, pre-processing steps, model calculations, key outputs, and how to update the model for future relevance.

The model is implemented in Excel to ensure that it is accessible to a range of users. All calculations have been implemented using base Excel spreadsheet functions – there is no need to use Visual Basic macros or Excel's data analysis tools. At the time of reporting, the model was less than 3 MB in size, meaning that it can easily be circulated via email.

2.1 User interface, model dashboard

The "Summary dashboard" sheet summarises outputs from the model and allows users to sensitivity test the results. Most users will only need to interact with the dashboard, as it presents key outputs and enables basic sensitivity tests. Figure 2 shows the key elements of the dashboard.

Figure 2: Feasibility model: summary dashboard

MRCagney

Wellington Greenfield Development Model

Summary Dashboard

Note: This sheet contains summary metrics to understand the feasible greenfield development capacity from the input sites.
Users can select values in the green-highlighted cells to affect outcomes.

Scenario selection

TA being assessed: **Porirua City**

Scenario	Option	Notes
Time to develop subdivisions (mo	18	Base assumption is 18 months; suggested sensitivity tests of 24 or 30 months
Feasibility scenario	Maximise number of lots	Options: Maximise number of lots, maximise gross profit, maximise profit margin
Minimum *net* density	10	Minimum net density (sites per hectare)
Maximum *net* density	30	Maximum net density (sites per hectare)
Price and cost sensitivity tests		
Section pricing model	Model 1	Options: Model 1, Model 4
Civil works contingency sensitivit	25%	Base: 25%. Sensitivity: 30%
Fees and charges contingency se	10%	Base: 10%. Sensitivity: 15%
Price scenario	Base	Options: Low, Medium, High, Manual (NOTE: If you select manual, please enter price/cost sensitivities below)
Sale price sensitivities	0%	This raises or lowers dwelling sales prices relative to their baseline (2018) values.
Cost sensitivities	0%	This raises or lowers development costs relative to their baseline (2018) values.
Land purchase price sensitivities	0%	This raises or lowers land purchase prices relative to their baseline (2018) values. To exclude the cost of purchasing a site from the analysis, set this to -100%.
Apply Upper Hutt Reserve Fund	Yes	Options: Yes, No (note that if this is yes, but the TA being assessed is not Upper Hutt, then the reserve fund is not applied)
Gross margin sensitivity tests		
Gross margin required for a development to be feasible	20%	Base assumption is 20% gross profit margin requirement; suggested sensitivity tests range from 15% to 30%

Key	
(green)	User inputs
(yellow)	Calculations (do not change)

Output summaries

Zone	Site attributes & plan enabled capacity				Feasibility of council capacity estimates			Feasibility outputs for other density options (sensitivity tests)		
	Number of sites	Total land area (hectares)	Total developable	Number of plan enabled	Number of feasible sites	Feasible area to develop	Number of added	Number of feasible sites	Feasible area to develop	Number of added sections
PCC - Suburban Zone, Rural Zone	6	76.2	74.1	948	6	74.1	948	6	74.1	1493
PCC - Suburban Zone	1	4.4	4.4	56	1	4.4	56	1	4.4	88
PCC - Rural Zone, Judgeford Hills Zor	1	127.3	111.5	1447	1	111.5	1447	1	111.5	2273
PCC - Judgeford Hills Zone	1	4.7	4.7	59	1	4.7	59	1	4.7	94
PCC - Rural Zone	1	141.5	128.0	1660	1	128.0	1660	1	128.0	2597
PCC - Suburban Zone, Open Spaces Z	2	51.7	51.7	668	2	51.7	668	2	51.7	1047
	0	0.0	0.0	0	0	0.0	0	0	0.0	0
Totals	**12**	**405.9**	**374.5**	**4838**	**12**	**374.5**	**4838**	**12**	**374.5**	**7592**

Area Unit	Site attributes & plan enabled capacity				Feasibility of council capacity estimates			Feasibility outputs for other density options (sensitivity tests)		
	Number of sites	Total land area (hectares)	Total developable	Number of plan enabled	Number of feasible sites	Feasible area to develop	Number of added	Number of feasible sites	Feasible area to develop	Number of added sections
Pukerua Bay	2	35.2	35.2	454	2	35.2	454	2	35.2	712
Mana-Camborne	1	24.9	24.1	311	1	24.1	311	1	24.1	488
Adventure	1	4.4	4.4	56	1	4.4	56	1	4.4	88
Resolution	2	132.0	116.2	1506	2	116.2	1506	2	116.2	2367
Paekakariki Hill	1	141.5	128.0	1660	1	128.0	1660	1	128.0	2597
Plimmerton	0	0.0	0.0	0	0	0.0	0	0	0.0	0
Ranui Heights	2	5.7	5.1	60	2	5.1	60	2	5.1	98
Porirua Central	1	10.3	9.7	123	1	9.7	123	1	9.7	195
Titahi Bay North	2	51.7	51.7	668	2	51.7	668	2	51.7	1047
	0	0.0	0.0	0	0	0.0	0	0	0.0	0
Totals	**12**	**405.9**	**374.5**	**4838**	**12**	**374.5**	**4838**	**12**	**374.5**	**7592**

At the top of the dashboard there are a set of options for user-selected sensitivity tests. These sensitivity tests are described in Table 2. See the "User Guide" sheet in the spreadsheet model for assistance in understanding what impact each variable has on the feasibility of developments. Note that for some variables, large changes in their value may not cause significant changes to the feasibility outputs.

Table 2: Options for sensitivity tests and inputs

Group	Variable	Recommended value	Description
TA being assessed			Select the TA for the sites to assess.
Scenario options	Time to develop	18 months	Time to develop greenfield sites. Suggested sensitivity tests are 24 or 30 months.
	Feasibility scenario	Maximise number of lots	Options: Maximise number of lots, maximise gross profit, maximise profit margin
	Minimum *net* density	10	Range of net density values to sensitivity test the input greenfield capacity estimates. The images on page 12 give examples of different dwelling densities.
	Maximum *net* density	30	
Price and cost sensitivities	Section pricing model	Model 1	Options to apply alternative statistical models of section prices: Model 1 (linear model), Model 4 (log model)
	Civil works contingency sensitivity	25%	Contingency of civil works costs, as proportion of total civil works costs
	Fees and charges contingency sensitivity	10%	Contingency of fees and charges, as proportion of total fees and charges
	Price scenario	Base	Options: Base, low, high, manual. For manual, each of the sales price, cost, and land purchase price sensitivities can be specified individually. To sensitivity test the case where developers purchased land in the past at a negligible price and held it for future development, set the land purchase price sensitivity to -100%.
	Apply Upper Hutt Reserve Fund	Yes	The Upper Hutt Reserve Fund (4% of market value of lots) will only apply if Upper Hutt is selected as the TA
Gross margin sensitivity tests	Gross margin required for feasibility	20%	Gross profit margin required for a development to be considered feasible

The output summary tables have three main aspects, which are displayed in three groups of columns. The summary aims to communicate information regarding:

- Site attributes and plan enabled capacity (number of sites, total area of sites including un-developable area, total developable area of sites, number of plan enabled sections)
- Feasibility of council capacity estimates (number of feasible parcels, total area of feasible developments, number of added subdivided lots)
- Feasibility of alternative densities (number of feasible parcels, total area of feasible developments, number of subdivided lots)

Dwelling density examples

16 dwellings per hectare.
Montrose Grove, Churton Park, Wellington

21 dwellings per hectare.
Rimu Road, Kelburn, Wellington

33 dwellings per hectare. Somerset Avenue, Newtown, Wellington

2.2 Greenfield development capacity data

The greenfield feasibility model is designed to use outputs from Wellington City's GIS-based development capacity model with some additional pre-processing. The development capacity model identifies large greenfield parcels that have been zoned for urban development or identified as future urban zones.

The spreadsheet model is designed to accept development capacity model outputs in spreadsheet form. The following attributes are required for each greenfield site:

- **Unique_Parcel_ID**: This is a field that identifies each distinct parcel. There can be multiple input sites with the same "Unique_Parcel_ID", in which case they will be aggregated within the spreadsheet model.
- **zone**: This is the district plan zoning currently applied to the site. This is used to summarise model outputs.
- **Parcel_area_m2**: This identifies the total area of the parcel (in square metres), including area that is undevelopable.
- **DevelopableSpace_ha**: This identifies the total developable area (in hectares) estimated in the development capacity model.
- **capital_value**: This is the assessed value of the site, based on the most recent ratings valuation.[1] This is used to estimate the cost to purchase the site for development.
- **DwellingCount**: This identifies the number of existing dwellings on the site, if any. The final output refers to the "net added lots", so the existing dwelling count is subtracted from the total number of sites.
- **GreenfieldDwellingCapacity**: This is an estimate (from the development capacity model) of the total number of dwellings that could be developed on the site under district plan rules. This has been calculated based on assumed gross density per dwelling.
- **Constraint_Total**: This is an indicator of the degree to which each individual parcel (or parcel sliver) is available for development based on geographic and infrastructure constraints. A value of 0 indicates that the site has no development potential, whilst a value of 1 indicates that the whole site is available for development.
  - The constraint scores are inherited directly from councils' capacity estimates, and can split parcels up into multiple slivers, based on overlays that intersect only part of the parcels.
  - This process split up individual greenfield parcels into multiple slivers.

We conducted some additional pre-processing and manual inspection of sites to join several additional variables that were not included in outputs from the Wellington development capacity model. The additional variables that are recommended to be included are:

- **Levy_Area** (recommended): The zone/area for development contributions. We used GIS shapefiles of DC charging areas (supplied by Wellington TAs) to identify which charging area each greenfield site falls into.
- **DevelopmentContribution** (required): The value of the development contribution owing for each new site. We joined data on development contributions per dwelling for each of the DC charging areas.

[1] At the time that this report was written, the most recent valuations were as follows: Wellington City, Upper Hutt City: 2015; Porirua City: 2016; Lower Hutt City, Kāpiti Coast District: 2017.

- **AU2013_NAM** (required): Census area unit names. We matched each greenfield site to a 2013 Census area unit using the parcel centroids. This is used for estimating section revenues for each site.
- **SlopeClass** (required): From data provided by Wellington City Council, each input site was classified as relatively flat, moderate slope, or steep slope. This field details how each site has been classified.
- **Share_View_Water**[2] (recommended): What proportion of the new sites are expected to have a view of the water.
- **Share_View_Land**[2] (recommended): What proportion of the new sites are expected to have a view of land.

2.3 Description of model workings

The feasibility spreadsheet is used to apply costs to the identified sites and estimate the feasibility of greenfield developments. The inputs include the greenfield sites, development cost estimates, and other development inputs. The feasibility of development is estimated, and the results are then summarised. Figure 3 illustrates the general model workflow.

To use the model to estimate the feasibility of developing new residential sections on greenfield sites, users must provide data on the greenfield sites in question, including their size, net developable area (accounting for constraints), estimated dwelling capacity, capital value, location (identified using 2013 Census area units), and development contribution charging area.

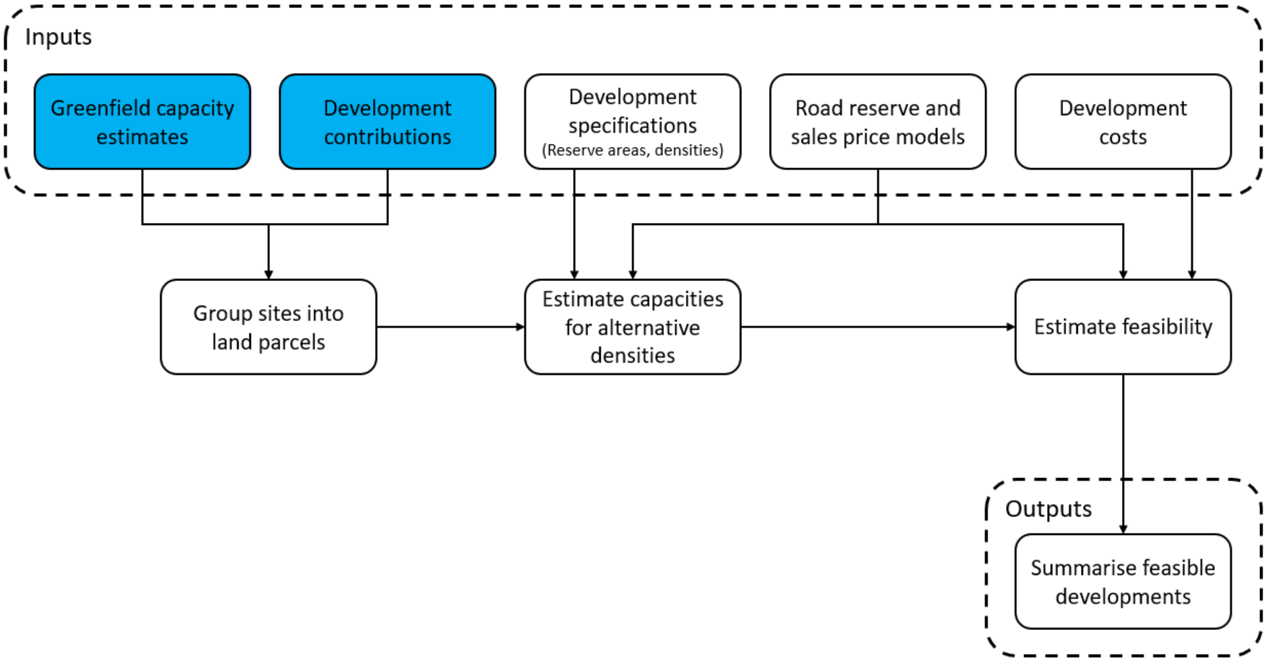
Other model inputs include functions to estimate road reserve requirements and residential section prices for greenfield sites in different locations and with different characteristics and parameters to estimate development costs.

The model then calculates the estimated cost to develop new sections on each site and the expected revenue from development. In addition to the estimated dwelling capacity, the model sensitivity tests a range of alternative dwelling densities. It then identifies whether any of these development options are commercially feasible, which is defined as delivering a gross profit margin above a selected threshold. (A default threshold of 20% is used in the model.)

The model dashboard summarises outcomes for total plan-enabled capacity and feasible capacity by district plan zone type and Census area unit. It also allows users to sensitivity test alternative assumptions for costs, revenues, and feasibility thresholds.

[2] The views of water and of land can be estimated using a manual assessment from online maps. These variables range from 0 (no views) to 1 (all sites have views), and the Share_View_Water and Share_View_Land should sum to 1 or less (ie a site should not be considered to have a view of land and water). These inputs affect the section pricing estimates. MRCagney performed this manual assessment on the original sites that were provided for Porirua, however no assessment has been made for subsequent data provided to MRCagney as capacity model outputs changed significantly near the end of the project. We sensitivity tested the impact of adding view attributes for sites that were not feasible, finding that they had little impact on the outcomes.

Figure 3: Greenfield feasibility model workflow



2.3.1 Model inputs

The necessary inputs for estimating the feasibility of greenfield developments are as follows:

Greenfield sites: For each territorial authority included in the model, there is an input sheet containing the pre-processed data described above.

- Unique Parcel ID
- Constraint_Total
- Developable space (hectares)
- Estimated greenfield dwelling capacity
- Zone
- Suburb
- Capital value
- Existing dwelling count
- Total parcel area (m^2)
- Development contribution charging area and DC per dwelling (spatially joined in the pre-processing)
- Census area unit (spatially joined in the pre-processing)
- Slope attribute (Relatively flat, Moderate slope, or Steep slope)
- Share of site with views of water or views of land

Costs: Unit cost rates for land development are standard across all territorial authorities.

- Civil works costs (site preparation, earthworks, subdivision, roading, infrastructure)
- Fees and charges (resource consent fees, project management, legal fees, sales and marketing)

Other inputs: These inputs are used to update capital values and estimate the quantity of earthworks, reserve areas, and roads

- SPAR index (sales-price to appraisal ratio) for dwelling sales in the year of valuation and the most recent SPAR index (to estimate the inflation in dwelling sales prices since the ratings valuations)
- Earthworks requirements: average volume of earthworks per site area for sites of varying steepness
- Reserve areas (proportion of sites reserved for eg wastewater, stormwater, landscape reserves)
- Road reserve coefficients: coefficients for the road reserve model. See Section 6 for more

Inputs for each district: Each territorial authority has a separate section pricing model. The coefficients for each territorial authority are input on the relevant sheet.

- Section sales price coefficients: For estimating the average section sales price of developments. See Section 4 for more

2.3.2 Model calculations

The methodology for the feasibility calculations is as follows.

"Sites" sheet: This sheet groups together greenfield parcel slivers based on the Unique_Parcel_ID variable and organises them in a form that is suitable for feasibility calculations.

- The raw input sites are grouped according to the field specified in cell B3 on this sheet.
- The following attributes are summed for each unique parcel: existing dwelling counts, developable space, total parcel area, and estimated greenfield dwelling capacity.
- The following attributes are averaged for each unique parcel: capital value (as this is estimated for the whole parcel before the sites are disaggregated, so all slivers should have the same capital value).
- The maximum value for any individual site within the unique parcel is selected for: development contributions.
- The following attributes are simply inherited from the first instance of each site within the raw input sheet: district plan zone, Census area unit, and proportion with views of land or water.
- The proportion of the parcel with varying levels of steepness is calculated by weighting the degree of steepness of each site within the parcel by the developable area of each site.

Workings sheets (entitled "Density1" - "Density5", and "InputDensityOpt"): These sheets calculate development costs, revenues, feasibility, and dwelling yields for a range of alternative net density options. To do so, they:

- Estimate the amount of area devoted to roads and landscape/water reserve
- Update the 'developable area' attribute to subtract road and reserve areas calculated above
- Estimate site-specific costs of construction, fees and other charges, and the purchase cost of sites, taking into account price movements since the most recent ratings valuations. These costs are GST-exclusive.
- Estimate section sales prices and total revenue for the proposed subdivision density. Sale prices include GST, and hence the total revenue calculation subtracts off GST.
- Estimate the profit and profit margin of developments

"Greenfield calcs": This sheet summarises the results from the model workings in a form that can be output to the dashboard. It

- Summarises for each density of development: feasibility status, number of feasible lots, feasible profit and profit margins
- Summarises the necessary density of development to meet each of the possible development objectives included.

2.3.3 Model outputs

The "Summary Dashboard" sheet in the feasibility model provides the key outputs of the model. There are two summary tables – one to summarise by the district zones and the other to summarise by Census area units. The summary tables provide three key groups of information:

- Site attributes and plan enabled capacity: how many sites there are, what the area of those sites are, and what the plan enabled number of sections is (ie the outputs of the council development capacity estimates).
- Feasibility of council capacity estimates: number of feasible sites, area of those sites and the number of feasible sections that could be developed.
- Feasibility of other density options: same as the previous point, but for a range of net dwelling density tests, based on the user input toggles on the same sheet.

2.4 Updating the model over time

The spreadsheet feasibility model has been set up to make it easy for users to update it to include additional greenfield sites. Section 2.3.1 above describes key variables that must be included for any new greenfield sites included in the model. Users should enter these in the "Sites" sheets described above.

Users may also seek or to 'rebase' the model to reflect changes in prices and development costs over a short (three to five year) time horizon. Sections 3 and 4 describe the cost and revenue inputs to the model, which are complex and require specialist input to review and update.

In our view, it would be impractical and unnecessary to update these assumptions on an annual basis. As a result, if users are seeking to update the model from, for instance, 2018 costs and prices to 2019 costs and prices, we suggest adjusting the cost and price sensitivity tests on the 'Summary dashboard' sheet to reflect observed year-on-year price changes.

The following table provides suggested sources for updating cost and price assumptions.

Table 3: Suggested approach for updating costs and prices over a short time horizon

Cost and price sensitivity	Suggested source

Sale price sensitivities	Use the change in the MBIE residential land value index ("Dwelling land price – SPAR index") for each TA from mid-2018 to the update year. This is available online at the MBIE interactive house price dashboard.[3] For instance, if the Wellington City land value index rises from its June 2018 value of 5.678 to (say) 5.962, this would be a 5% increase in prices. Users would then set the sale price sensitivity test to 5%.
Cost sensitivities	Use the change in Statistics New Zealand's Business Price Index for Civil Construction or Land Improvements from mid-2018 to the update year. This is available online on Statistics New Zealand's website.[4] For instance, if the Land Improvements price index rose from its June 2018 value of 1994 to (say) 2053, this would be a 3% increase in development costs. Users would then set the cost sensitivity test to 3%.
Land price sensitivities	Use the change in the MBIE residential land value index ("Dwelling land price – SPAR index") for each TA from mid-2018 to the update year. This is available online at the MBIE interactive house price dashboard.[3] This assumes that unimproved land values rise at around the same rate as section prices. An alternative would be to assume that greenfield land values rise at a faster rate.

Over the longer term, ie beyond a three to five year time horizon, it would be desirable to review input assumptions in more detail. Over a longer period, there may be more meaningful changes to:

- The structure of prices, ie which suburbs have relatively high or low prices
- Standards for infrastructure development for new subdivisions, which affect dwelling yield and development costs
- Costs for different types of land development inputs.

[3] https://mbienz.shinyapps.io/urban-development-capacity/
[4] https://www.stats.govt.nz/topics/price-indexes

3 Development cost inputs

The greenfield feasibility model includes all major categories of costs associated with developing and subdividing greenfield sites. For each site in the model, development costs are calculated based on:

- Unit cost rates excluding goods and services tax (GST), eg cost per cubic metre of earthworks
- Multiplied by the estimated quantities of work required on that specific site, eg total quantity of earth that must be cut and filled on the site.

The following table summarises the key categories of costs included in the model and explains how these categories of costs are estimated for individual sites. It also indicates how large each category of costs is likely to be in the context of a typical development. This suggests that the feasibility of developing new greenfield sections will be most strongly affected by the magnitude of costs for:

- Site purchase (10-20% of costs)
- Earthworks (5-15% of total costs)
- Roading and infrastructure supply (20-25%)
- Development contributions (5-15%)
- Financing, which is in turn affected by the length of the development process (8-15%).

In this section, we outline key parameters and input assumptions used to estimate development costs and explain the basis for these estimates.

Table 4: Overview of greenfield development costs included in model

Development cost category	**How costs were estimated**	**Indicative share of development costs***
Site purchase	Most recent capital value of the site, updated to mid-2018 values using MBIE land price index	10-20%
Civil works		
Site clearance	Apply unit cost rates to site area	2-5%
Landscape stabilisation	Apply unit cost rates to site area	<1%
Earthworks and site preparation	Estimate quantity of cut/fill required based on site slope; apply unit cost rates for quantity of earthworks	5-15%
Water supply	Estimate linear metres of pipe and apply unit cost rates	1-2%
Wastewater	Estimate linear metres of pipe and apply unit cost rates	1-2%
Subdivision costs	Apply unit cost rate per new lot	<1%
Roading	Estimate share of site devoted to roads based on	20-25%

	section density and site slope; apply unit cost rate to road area	
Landscape and stormwater reserves	Estimate share of site set aside for reserves; apply unit cost rate for developing reserves	3%
Civil works contingency	Estimate as a proportion of total civil works costs	5-15%
Fees and charges		
Development contributions	Identify which development contribution charging area the site falls into; calculate total DCs based on number of lots created	5-15%
Resource consent fees / resource consent compliance certification	Estimate based on council resource consent fees policy	<1%
Site / project management	Calculate as a proportion of civil works costs	2-3%
Consultant fees (planning, engineering, geotech, surveying, etc)	Calculate as a proportion of civil works costs	4-7%
Legal	Estimate as a share of revenues from selling sections	1-2%
Sales and marketing	Estimate as a share of revenues from selling sections	2-3%
Fees and charges contingency	Estimate as a proportion of total fees and charges costs	2-4%
Financing costs	Identify when costs are incurred within the overall project timeframe and estimate holding costs over the remaining period	8-15%

** Note: This indicative breakdown is based on modelled sites in Porirua City. Values are not intended to add to 100%.*

3.1 Benchmarking land development costs

As background for this analysis, we reviewed land development costs for 18 subdivisions around New Zealand, mostly outside of Wellington, over the last decade. The following table summarises this data, with costs rebased to 2018 New Zealand dollars using Statistics New Zealand's *Capital Goods Price Index* for land development.

These costs exclude site purchase costs but include most other land development costs. They exclude GST and, in some cases, exclude financing costs. This data indicates that land development costs may range from just under $70,000 to over $400,000 per section. The lower end of this range generally consists of subdivisions that are already serviced by infrastructure, while the upper end reflects low-density developments in Queenstown, which is a very sensitive landscape.

In most cases, land development costs tend to range from $90,000 to $140,000 per section. Costs may be higher if extensive earthworks and infrastructure provision are required. The cost estimates in the Wellington greenfield feasibility model fall within this range. Discussions with Colliers indicates that more recent developments in Wellington are also consistent with these figures.

Table 5: Land development costs for 18 case study subdivisions

Location	**Description**	**Dwellings**	**Average site area (m2)**	**Land development costs ($/section)**
Auckland - North Shore (1)	Urban, spec housing	24	2152	$118,435
Auckland - North Shore (2)	Urban, mixed housing	22	230	$103,046
Auckland - Pukekohe (3)	Urban, spec housing	41	1000	$129,264
Auckland - Pukekohe (3)	Urban, spec housing	33	1000	$135,959
Hawkes Bay (1)	Urban, mixed use	149	500	$77,450
Hawkes Bay (1)	Urban, mixed use	128	500	$68,599
Hawkes Bay (2)	Urban, mixed housing	26	338	$78,903
Northland (1)	Rural, spec housing	56	761	$66,140
Queenstown (1)	Rural, spec housing	89	900	$155,179
Queenstown (1)	Rural, spec housing	15	1400	$279,414
Queenstown (1)	Rural, spec housing	18	2500	$298,390
Queenstown (1)	Rural, spec housing	10	1200	$402,521
Queenstown (1)	Urban, spec housing	95	800	$92,736
Southland (1)	Urban, spec housing	70	800	$69,918
Tauranga - Te Tumu (4)	Urban, spec housing	3930	660	$121,472
Waikato - Tuakau (3)	Urban, spec housing	21	650	$99,499
Waikato (2)	Urban, mixed housing	71	162	$79,078
Wellington (1)	Urban, mixed use	170	500	$66,540
Weighted average			*667*	*$116,440*

Notes: (1) Page, I. 2008. New house price modelling. BRANZ Study Report 196(2008); (2) Page, I. and Curtis, M. 2013. New house price model update at April 2013. BRANZ Project Report E626; (3) The Surveying Company. 2016. Personal communication with John Gasson. 1 August 2016.; (4) Tauranga City Council. 2016. Assessment of Residential Development Feasibility for the Te Tumu Urban Growth Area.

3.2 Site purchase costs

The model assumes that greenfield development sites are purchased for development at current (mid-2018) market prices.

In order to estimate current prices, we start with the site's most recent rating valuation. Valuations are conducted on a three-yearly basis, meaning that they may under-estimate current market prices. We therefore adjust them upwards using the land value index published by MBIE for territorial authorities, which is shown in Figure 1.

For instance, the most recent valuation for Porirua City was conducted in the September quarter of 2016. Since then, residential land prices have risen by around 27%. Hence a greenfield site that was valued at $1 million at that date is likely to have a current price of around $1.27 million.

The assumption that development sites are purchased at current prices is likely to be conservative. Some developers may have purchased land in the past at a lower price and held it for future development. These developers may be able to access land at a considerably lower price than current market values.

In doing so, they incur some holding costs (from interest charges on bank loans or foregone return on equity) and may earn revenues from existing agricultural uses, eg pastoral farming. Overall, this is likely to lower land costs and thus increase feasibility for somebody developing in the current period. However, it is difficult to assess because the date of purchase may be unknown.

To address this possibility, we recommend sensitivity testing alternative values for land purchase prices in the spreadsheet model. To do so, users should select the "Manual" option for price sensitivity, and then set the "Land price sensitivity" parameter to -100%.

Alternatively, a 'low cost' scenario could be estimated by deflating site value to previous years' prices using the residential land price index published by MBIE. An adjustment for financing costs could also be added in, unless the site has some economic use that is likely to cover those holding costs. For instance, if the landowner is known to have originally purchased the site at a point when land prices were 80% lower than at present, the "Land price sensitivity" parameter could be set to -80%.

3.3 Roads and landscape / stormwater reserves

The model estimates the proportion of each site that must be devoted to roads and landscape / stormwater reserves. This has two impacts on feasibility outcomes:

- First, there are financial costs associated with developing roads and reserves, which are accounted for in civil works costs
- Second, setting aside a larger proportion of the site for roads and reserves means less space left over to construct new dwellings.

Areas set aside for roads and reserves are additional to areas that have been excluded from the developable area due to identifiable constraints such as excessive slope or the presence of transmission lines.

For a typical subdivision, roads and reserves may account for around one-third of the developable area of a site. The following table summarises the assumptions used in modelling. To estimate road area, we undertook a statistical analysis of the determinants of the share of land devoted to roads in all existing Wellington suburban neighbourhoods. This analysis is described in Section 6.

Table 6: Road and landscape / stormwater reserves

Category	**Share of developable area**
Road area	Typical range: 14-22% • A relatively flat site with 20 dwellings per net hectare would have around 22% of its area devoted to roads • Higher-density sites devote a larger share of land area to roads • Sloping sites tend to have a smaller share of roads
Landscape / stormwater reserves	10% of area

3.4 Civil works costs

This section sets out the unit cost rates we have used to estimate civil works costs and explains how we have applied these costs.

We extended the MBIE model's treatment of earthworks costs and road infrastructure requirements to account for the impact of the Wellington region's hilly topology. Steep sites may require more earthworks to enable residential construction and they may face different requirements for road networks. We have addressed these issues based on data on actual development outcomes in the Wellington region. We see this as an important feature of the model given the significance of earthworks and road infrastructure costs in overall land development costs.

3.4.1 Civil works unit cost rates

The following table summarises the cost input parameters we have used to estimate civil works costs in this analysis.

For civil works cost rates, we have started with the base cost estimates in the MBIE greenfield model, and incorporated Wellington-specific data from QV Costbuilder, which provides detailed data on construction unit cost rates at a regional level. Where appropriate, we have aligned these unit costs with the requirements set out in Wellington's Code of Practice for Subdivision, for instance, to identify the required diameter of water mains in new subdivisions. After developing base cost estimates, we worked with Colliers to 'ground truth' these based on discussions with developers in the area and data on recent subdivisions.

A key feature of the MBIE model, which we have inherited in this modelling, is that costs are staged throughout the lifespan of the development to calculate financing costs for the development. We have reviewed some timing parameters and adjusted them slightly based on discussions with Colliers.

Table 7: Civil works cost rates

Item	**Timing**	**Unit cost**	**Source / notes**

Site clearance: Strip top soil, deposit on temporary stockpile on site	20%	\$5 / m^2 site area	QV Costbuilder: Site Preparation Table. This suggests a range of \$2.20/m2 (for 50mm cut) to \$6.70/m2 (for 150mm avg cut). \$5/m2 is used as a typical value
Earthworks and site preparation	25%	\$15 / m^3 cut	QV Costbuilder suggests: \$3.70/m3 balanced cut to fill over site, plus \$9.5/m3 excavate to reduce levels for sand / light soil and \$10.8/m3 for clay, plus \$1.3/m2 for trim excavation/filling to batter. Colliers advice is that a typical range would be \$12-15/m3 assuming cut-fill balance.
Landscape stabilisation	25%	\$1 / m^2 site area	Colliers advises that \$1/m2 is typical of recent developments. QV Costbuilder implies a higher cost rate.
Water supply	35%	\$235 / m pipe	QV Costbuilder suggests that the average cost for principal mains of 100mm-150mm nominal diameter is \$220/m, and the average cost for excavating a trench for this diameter pipe with average depth 1m is \$15/m, with higher/lower figures depending on soil. This aligns with Wellington COP Table 6.5 (allowable pipe diameter) and Table 6.7 (minimum cover to pipes) Total costs are estimated assuming around 125m pipe per ha.
Wastewater	35%	\$225 / m pipe	QV Costbuilder cost estimate for concrete sewers; averaged across multiple size categories for Class 2 (X) and Class 4 (Z) pipe. Total costs are estimated assuming around 125m pipe per ha.
Subdivision costs	35%	\$1,000 / lot	Checked against land development cost benchmarks summarised in Table 5.
Road reserves	35%	\$200 / m^2 road reserve	Cost rate included in the MBIE model, checked against QV Costbuilder and Colliers. This cost includes 1.8m footpaths. Note that in some cases costs may be higher depending upon material supply. This cost aligns with Wellington COP requirement for NRB M4 basecourse, 300mm thick, with chip seal paving, kerb and channel, and footpaths.
Landscape & stormwater reserves	50%	\$60 / m^2 reserve	These costs vary greatly per project and can be as low as \$3/m2. This is likely to be a pessimistic figure.

Civil works contingency	55%	25%	Contingency was based on a review of ex-ante feasibility analyses from other regions. Cost contingencies tend to be higher for civil works due to the increased risk of encountering geotechnical issues or other holdups. Sensitivity test 30%.

3.4.2 Estimating earthworks requirements

The following table summarises the parameters that we have used to estimate bulk earthwork requirements. We estimated these based on selected case studies of recent earthworks and subdivision consents in the Wellington regions. They vary depending upon the slope of the site, which has been identified qualitatively. We have ground-truthed these estimates with inputs from Colliers on recent developments in the area.

This data suggests that earthworks requirements vary considerably between subdivisions, depending upon the slope of the land. Earthworks can be a significant contributor to overall development costs, which can have a fundamental impact on feasibility for some sites.

Due to the limited number of sites analysed, we have not investigated whether earthworks costs vary based on section size – ie steep sites may require less earth to be moved if the site is being developed to a lower density. This may represent an area for further model refinement, based on an analysis of a larger sample of earthworks consents.

Table 8: Estimated bulk earthwork requirements for Wellington subdivisions

Site type	**Earthwork requirements**	**Notes**
Steeply sloping sites	3 m^3 of cut per m^2	Based on Newlands subdivision in Wellington City
Moderately sloping sites	1.3 m^3 of cut per m^2	Based on Brooksite Park and Kenepuru case studies in Porirua
Relatively flat sites	0.3 m^3 of cut per m^2	Based on Wainuiomata subdivision in Lower Hutt, Wallaceville and Riverstone subdivisions in Upper Hutt, and Waikanae and Otaki subdivisions in Kāpiti Coast

The following table summarises the details of the case studies of consents for bulk earthworks undertaken as part of new subdivisions in the Wellington region. These illustrate variations in the quantity of earth that may have to be moved in different types of places.

Table 9: Case studies of bulk earthwork requirements for subdivisions in Wellington region

Site	**Land area**	**Volume of earthworks**	**Quantity of fill (m3) per land area (m2)**	**Notes**

Site	Land area	Volume of earthworks	Quantity of fill (m3) per land area (m2)	Notes
Porirua City, Brookside Park	105,200 m2	143,440 m3	1.36 m3	148 lot subdivision Maximum cut height 4.5m, maximum fill height 3.5m
Wellington City, Newlands	18,750 m2	62,000 m3	3.31 m3	60 lot subdivision of four existing lots Will lower the level of land; approximately 6900 heavy vehicle movements Maximum cut height of 10.6m
Wellington City, Crofton Downs		Not outlined in consent		138 lot subdivision Cut and fill batters used; buildings set back 5-10 metres to avoid stability issues Earthwork quantities are in the Geotechnical Management Plan and Earthworks Specification (Engeo), dated 18 May 2016
Porirua City, Kenepuru	367,000 m2	480,000 m3	1.31 m3	145 lot subdivision Maximum fill depth of 9m; maximum cut depth of 13m Stockpile 10,000 m3 of topsoil and unsuitable material on site, and remove 10,000 m3 from site Stage 2 (26.4ha) taking place over 3 earthworks seasons
Lower Hutt City, Wainuiomata	13,200 m2	2,900 m3	0.22 m3	20 lot subdivision, Papakāinga development Maximum fill height 0.8m; cuts will be minor
Upper Hutt City, Wallaceville	156,900 m2 Cut area: 69,900m2 Fill area: 86,940m2	55,700 m3	0.36 m3	Generally flat site; pasture Maximum cut 1.8m; maximum fill 2.3m All cut material used on site

Site	Land area	Volume of earthworks	Quantity of fill (m3) per land area (m2)	Notes
Upper Hutt, Riverstone Stage 8	107,000 m2 earthworks area Total site area 12.6ha	Not quantified in consent; plans indicate minor earthworks limited to less than 1/10th of the site	Assuming an average cut of ~1m, this implies a ratio of around 0.1m3	79 lot subdivision, ranging in net size from 419m2 to 2755m2 Road details provided in application. Two lots (totalling ~2ha) designated as reserves Cut and fill depth ranges from 0.5m to 2.0m All cut material used on site Previous (2007) resource consent included some earthworks to support this stage
Kāpiti Coast, Waikanae (SH1)	429,400 m2	112,430 m3 cut	0.26 m3	162 lot subdivision, ranging in size from 551m2 to 8102m2 Consent implies that some cut will be removed from the site.
Kāpiti Coast, Otaki (Moana St)	34,200 m2	10,800m3 cut	0.32 m3	39 lot subdivision, ranging in size from 470m2 to 895m2 Maximum cut depth of 5m
Kāpiti Coast, Waikanae (Winara Ave)	77000 m2 earthworks area Total site area 12.7ha	12,000m3 cut	0.16 m3	75 lot subdivision, ranging in size from 450m2 to 6759m2 Maximum cut depth of 3m

3.5 Fees and charges costs

This section sets out the unit cost rates we have used to estimate fees and charges and explains how we have applied these costs.

3.5.1 Fees and charges unit cost rates

The following table summarises the cost input parameters we have used for fees and charges. Once again, we have started with the default values in the MBIE model, updated them with Wellington-specific data on resource consent lodgement fees and development contribution fees published by councils, and validated costs against the case studies summarised in Table 5.

As for the civil works costs, we have reviewed some of the timing parameters used to calculate financing costs with Colliers.

Table 10: Fees and charges cost rates

Item	Timing	Unit cost	Source / notes
Development contributions	90%	Site-specific inputs	Council development contribution fee estimates
Resource Consent Fees	10%	See Table 11	Council consent fee tables
Certification of compliance with RC conditions	95%	See Table 11	Council consent fee tables
Site/Project Management	50%	3% of civil costs	Checked against subdivision cost benchmarks – see below
Consultant fees (planning, engineering, geotech, surveying, etc)	20%	10% of civil costs	Checked against subdivision cost benchmarks – see below
Legal	60%	2% of sales price	Checked against subdivision cost benchmarks
Sales and Marketing	75%	3% of sales price	Checked against subdivision cost benchmarks
Fees and charges costs contingency	75%	10%	Contingency was based on a review of ex-ante feasibility analyses from other regions. A lower cost contingency was used for fees and charges as there is usually more certainty about these costs.

3.5.2 Development contributions

Development contributions are site-specific, and hence we have estimated development contributions in the pre-processing stage based on the location of sites. The sources for the development contribution estimates are listed below:

- Wellington City: a shapefile of development contribution zones (and fees for each zone) was provided by Wellington City Council. The "Residential_1" fees have been applied.
- Lower Hutt City: the spatial extent of the development contribution zones were provided by Lower Hutt City Council, and the development contribution amounts were sourced online.[5]
- Upper Hutt City: the development contribution zones and charges were provided by Upper Hutt City Council. The base and water and wastewater contributions are summed for the Mangaroa area.
- Porirua City: shapefile of development contribution zones and fees for each zone were provided by Porirua City Council.
- Kāpiti Coast District: the development contributions at a parcel level were provided by Kāpiti Coast District Council and applied to the greenfield parcels. The development contributions applied range from $4,142 to $26,587 per additional lot.

[5] http://iportal.huttcity.govt.nz/Record/ReadOnly?Tab=3&Uri=4958139, 1 November 2018

Whilst most development contributions are estimated and joined to each site in the pre-processing steps (before the data is input into the spreadsheet model), the Reserve Fund contribution for Upper Hutt is incorporated within the spreadsheet model. The Reserve Fund contribution is estimated as 4% of the market value (excluding GST) for each section. This proportion can be updated in the "Other inputs" sheet of the spreadsheet, or this functionality can be turned off entirely from the Summary Dashboard sheet.

3.5.3 Resource consent fees

The following table summarises estimated resource consent fees for each TA. We assume, following a review of selected subdivision and earthworks consents, that applicants will lodge a single consent (or pair of consents) for subdivision and land use, including earthworks and civil works on site. However, we note that some developers may 'stage' projects instead.

Unless otherwise indicated, we have used published fees for notified consents. In some cases, this may be a pessimistic assumption, as there may be a path to consent subdivisions without notification. However, in cases where a site is not currently zoned for residential use, a plan change may be required to develop. In these cases, developers are likely to incur additional fees.

We note that assumptions about resource consent fees can be amended in the "Costs" tab in the spreadsheet model. We tested alternative assumptions about resource consent fees, finding that they did not greatly affect the results. For instance, in Upper Hutt City, including costs for fully notified consents did not affect the number of sites that were feasible.

Table 11: Resource consent fees

Council	**Consent fees**	**Notes**
Wellington City	$16,000 per subdivision Plus $900 for certification (s224(c)) at end of process	Assumes a fully notified subdivision and land use consent https://wellington.govt.nz/services/consents-and-licences/resource-consents/fees
Porirua City	$9,800 per subdivision Plus $816 for certification at end of process	Assumes fully notified subdivision and land use consents https://poriruacity.govt.nz/services/building-consents/resource-consents/#notified-resource-consent
Lower Hutt City	$16,640 per subdivision Plus $960 for certification at end of process	Assumes fully notified subdivision and land use consents http://iportal.huttcity.govt.nz/Record/ReadOnly?Uri=4934255
Upper Hutt City	$2,130 per subdivision Plus $765 for s224(c) certification at end of process	Assumes separate non-notified subdivision and land use consents, based on advice from Upper Hutt City https://upperhuttcity.com/wp-content/uploads/2015/06/Schedule-of-Fees-and-Charges-2018-2019.pdf
Kāpiti Coast District	$4,590 per subdivision Plus $1,224 for s224(c) certification at end of process	Assumes a fully notified land use consent and a non-notified subdivision consent for 20+ sections. According to Kāpiti Coast District Council, developers are typically only charged one fee for both consents, rather than being charged separately for each. https://www.Kāpiticoast.govt.nz/services/A---Z-Council-Services-and-Facilities/Fees-and-Charges/Resource-Management-Fees/

3.5.4 Professional fees

Professional fees include the costs of site and project management, consultant fees for planning, engineering, geotech, surveying, etc, legal advice, and sales and marketing. These costs can be difficult to estimate as sources such as QV Costbuilder do not report unit cost rates for professional fees.

To benchmark these fees, we have drawn upon the case studies summarised in Table 5. These case studies provide detailed information on professional fee costs, including site / project management; consultant fees for design, architecture, and resource consent preparation; legal, accounting, and surveying; and sales and marketing.

The following table summarises findings from 19 case studies, some of which are excluded from Table 5 as they were rural, low-density developments. While there is variation between sites, professional fees make up 14.5% of overall land development costs, excluding site purchase costs. If we exclude Queenstown and Central Otago, which often have unusually high professional fee costs due to the risk of lengthy consenting processes and litigation, it gives a weighted average of 12.8% of total land development costs.

This is similar to the cost estimates used in the MBIE model, which add up to around 10-14% of total development costs excluding site purchase costs. We have therefore retained the MBIE estimates of professional fees, with some minor simplifications and adjustments. However, in doing so we note that the wide range of outcomes observed in the table below indicates that there will be 'overs' and 'unders' at a site level.

Table 12: Professional fees as a share of total costs.

Location	Description	Professional fees as share of total cost
Auckland - North Shore (1)	Urban greenfield	11.1%
Auckland - North Shore (2)	Urban, mixed housing	3.2%
Auckland - Pukekohe (3)	Urban, spec housing	8.4%
Auckland - Pukekohe (3)	Urban, spec housing	4.4%
Central Otago (1)	Rural	18.8%
Hawkes Bay (2)	Urban mixed housing	7.3%
Northland (1)	Rural greenfield	11.9%
Queenstown (1)	Rural	12.3%
Queenstown (1)	Rural greenfield	35.7%
Queenstown (1)	Rural greenfield	13.3%
Queenstown (1)	Urban greenfield	13.1%
Queenstown (1)	Rural	20.7%
Queenstown (1)	Rural	16.4%
Queenstown (1)	Rural	28.1%
Southland (1)	Urban	8.4%
Tauranga - Te Tumu (4)	Urban, spec housing	17.3%
Waikato - Tuakau (3)	Urban, spec housing	11.0%
Waikato (2)	Urban mixed housing	11.5%
Wellington (1)	Rural	12.7%
Weighted average		*14.5%*
Weighted average excl Queenstown and Central Otago		*12.8%*

Notes: (1) Page (2008); (2) Page and Curtis (2013); (3) The Surveying Company (2016); (4) Tauranga City Council (2016)

3.6 Financing costs and feasibility threshold

Finally, we briefly summarise assumptions used to calculate financing costs, and the gross profit margin used to determine whether a development is feasible or infeasible.

The MBIE model calculates financing costs for individual project components based on:

- A weighted average cost of capital parameter, which reflects either the direct financial cost to service debt or the indirect opportunity costs associated with equity contributions to the project
- The overall development timeframe – developments that take longer to complete – have larger financing costs due to the need to hold debt for a longer period
- The timing of individual expenditures – costs that are incurred at the start of the development process, such as land purchase, must be financed for longer than costs that occur near the end, such as development contributions.

Based on discussions with Colliers and a review of data on weighted average cost of capital for listed companies in New Zealand and interest rates on business loans, we have incorporated the following assumptions about cost of capital, average project timeframes, and minimum gross profit threshold required for a development to be considered feasible.

Table 13: Financial assumptions

Parameter	**Parameter**	**Notes**
Weighted average cost of capital	10%	Default value used in the MBIE model. This is close to PwC's estimated weighted average cost of capital for listed firms in the building and construction industry (10.5%).[6] It is slightly higher than the current bank overdraft rate for small to medium size enterprises (9.4%).[7]
Average development timeframe	18 months	Based on discussions with Colliers. Sensitivity tests of 24 months or 30 months could also be applied.
Gross profit threshold	20%	Default value in the MBIE model. Sensitivity tests of 25% or 30% could also be applied.

[6] See https://www.pwc.co.nz/pdfs/pdf-pwc-appreciating-value-nz-edition-6-march-2015-deal-activity-ipo-listed-share-price-performance.pdf
[7] See RBNZ data: https://www.rbnz.govt.nz/statistics/b3

4 Residential section price inputs

Residential section prices are an essential input to feasibility modelling, as they are used to estimate revenues from developing new subdivisions. Outcomes for feasibility correspond closely to section prices: setting other factors equal, a location where section prices are 10% higher will have a gross profit margin that is 10% higher.

In this section, we describe how we estimated current (early/mid 2018) residential section prices for all locations covered by the greenfield feasibility model including consideration of different characteristics, such as section size, slope, and views.

Our approach is flexible and allows prices to be estimated for a wide variety of sites based on a relatively simple set of inputs. In collaboration with Colliers, we undertook a statistical analysis of Wellington property sales over the last five to ten years in order to:

- Identify the key factors that positively or negatively affect prices for residential sections
- Identify variation in prices for similar sections between different suburbs throughout the entire Wellington region.

The resulting section price estimates were ground-truthed by Colliers based on their on-the-ground knowledge of the Wellington market. Here, we briefly describe our approach and illustrate the results.

The development cost estimates described in the previous section exclude GST, while section price estimates are GST-inclusive. We have therefore subtracted GST from section prices before calculating feasibility outcomes.

4.1 Overview of methodology

Here, we provide a brief, semi-technical explanation of the approach we have used to estimate section prices, and how it compares with simpler methods that are commonly used in feasibility analysis.

A simple approach for estimating prices is to calculate the average section prices (or house prices) in different locations as an estimate of the market price in different locations. A hypothetical example is provided in the following table.

Table 14: Hypothetical example of section price estimates

Location	500-1,000 m^2 section	1,000-2,000 m^2 section	2,000-5,000 m^2 section
North	$200,000	$300,000	$400,000
South	$180,000	$260,000	$350,000
West	$190,000	$280,000	$360,000
East	$140,000	$220,000	$290,000

In mathematical terms, what this is doing is estimating the *average sale price conditional on location and section size*, ie:

$$E[Price|Location, Size]$$

For instance, in the above example:

$$E[Price|Location = West, Size = 1{,}000 - 2{,}000m2] = \$280{,}000$$

This approach has several limitations that make it difficult to apply across a large urban area with sections that vary across several characteristics:

- First, if there is a small number of section sales in some locations, it may not be possible to make an estimate of the average price. Typically, this is addressed by extrapolating or interpolating values from other locations, but there are no firm rules about how to do so, which means that the outcomes may be somewhat arbitrary.
- Second, the characteristics of sections may vary within areas, making it difficult to pin down a price for a typical section. In some cases, this may make it difficult to accurately estimate prices. For instance, a hilly site within a largely flat area may be assigned an erroneously high price under the assumption that sections on that site will be priced similarly to the average section sold in that area.

To address these issues, we used a simple statistical method, ordinary least squares (OLS) regression, that is commonly used to analyse determinants of property values.[8] This is often called 'hedonic regression' or 'hedonic analysis'. This approach is preferred as it allows us to control for a wider set of property attributes that may affect prices, rather than limiting ourselves to a small number of characteristics.

OLS regression can be thought of as an extension of the conventional approach of averaging sale prices. In effect, rather than estimating the average value of section prices conditional on a small number of characteristics, such as location and size, OLS allows us to estimate average section prices conditional on a broader set of variables, denoted X:

$$E[Price|X]$$

X could include variables such as:

- Location
- Section size
- Views from the property
- Section slope / gradient
- Natural hazards, eg flood risk
- Availability of infrastructure

It would be cumbersome to cross-tabulate all attributes into a table like the one shown above. This would require us to slice the data up increasingly finely. In addition, some variables may be 'continuous' rather than 'discrete' – ie they may take on a range of values rather than falling into a few broad bands.

[8] We have previously applied this approach to analyse property values in Auckland. See Nunns, Allpress, and Balderston. 2016. How do Aucklanders value their parks? Auckland Council Technical Report 2016/031. This report also tested more sophisticated statistical models that addressed spatial autocorrelation in the data, but these models exhibited few meaningful differences from OLS.

OLS regression is a computationally efficient way to extend the conditional expectation approach to address more variables. It 'explains' the value of an outcome variable, in this case section sale price, as a linear combination of various explanatory variables. A basic example of OLS regression is as follows:

$$Price_i = \beta_0 + \beta_1 South_i + \beta_2 West_i + \beta_3 East_i + \beta_4 Size_i + \beta_5 Size_i^2 + \varepsilon_i$$

This model explains section prices ($Price_i$) as a function of location (coded by indicator variables for $South_i$, $West_i$, and $East_i$ – if all three indicators are false then the property must be in the North location) and section size ($Size_i$). To allow section size to have a 'nonlinear' effect on prices – ie another square metre of land is worth less for a large property than a small property – the model includes a quadratic term for section size ($Size_i^2$).

This model must be estimated on individual property sales – with the subscript 'i' used to denote the sale ID. The β coefficients are estimated by OLS regression – these are parameters that indicate the relative impact of different attributes on sale price.

The term ε_i reflects the residual variation in sale prices that cannot be 'explained' by the measurable variables. Typically, it will be possible to 'explain' between 50% and 80% of the variation in property sale prices based on their measurable characteristics. Other unmeasured attributes, such as landscaping, interior fit-out, site layout and dimensions, etc, account for the rest.

After estimating this model, the resulting beta coefficients can be used to 'predict' the expected sale price for different types of sections. For instance, if we wanted to predict the average price for a 600m2 section in the West location, we could do so as follows:

$$E[Price|Location = West, Size = 600m2] = \beta_0 + \beta_2 + \beta_4 * 600 + \beta_5 * 600^2$$

Similarly, if we wanted to predict the average price for a 1200m2 section in the North location, we could do so as follows:

$$E[Price|Location = North, Size = 1200m2] = \beta_0 + \beta_4 * 1200 + \beta_5 * 1200^2$$

These results should be identical to (or at least very similar to) the values in the table above.

A more general formulation of OLS regression, that allows for consideration of a larger number of variables, is as follows:[9]

$$Price_i = \beta X_i + \varepsilon_i$$

Where X_i is a vector of explanatory variables (including a constant term) and β is a vector of coefficients to be estimated by the model.

4.2 Key steps in analysis

We used the following process to develop our analysis of residential section prices:

[9] There are two practical limitations to the number of variables that can be included in a regression model. First, we must have fewer variables than observations – ie if we have 100 sales observations and 100 variables, we will get nowhere. Second, we cannot have perfect correlations between any of the explanatory variables (or any groups of variables).

- First, we cleaned the data to exclude:
  - Non-residential sites;
  - Sites with zero land area, which are likely to represent data entry errors or cross-lease sites;
  - Large sites (over 2000m2) that are likely to represent lifestyle blocks or large-lot residential sections rather than suburban residential sections; and
  - Multi-unit dwellings.
  - We also removed the top 1% and bottom 1% of the distribution of land prices per square metre, as inspection of the data showed that high or low prices often reflect data entry errors.10
  - However, we retained both vacant sections and sections with a single dwelling (excluding cross-leased sections and multi-unit sections) in the analysis – a choice we discuss further below.
- Second, in collaboration with Colliers we identified a set of variables to explore that may influence section prices. In addition to location and section size, these included driveway access, slope, access to views, and year of sale. Statistical testing showed that all variables had a meaningful impact on section prices.
- Third, we used OLS regression to estimate four alternative statistical models of section prices. These models, which we explain below, incorporate different assumptions about how the size and other attributes of a section affect its price.
- Fourth, we identified a preferred model that best fit the data and provides the most realistic picture of section prices in Wellington. To do so, we considered both statistical evidence (eg how well the models 'fit' the data and whether they resulted in over- or under-predictions for certain segments of the market) and ground-truthing by Colliers.
- Finally, we incorporated the coefficients from our preferred model into the greenfield feasibility spreadsheet and used them to predict section prices for individual greenfield sites.

We estimated a separate statistical model for each individual territorial authority. This allows section characteristics to have a different effect on prices in different locations. For instance, on average, adding another ten square metres of land is 'worth' more in Wellington City than in Porirua.

4.2.1 Inclusion of vacant sections and standalone houses

Most of the residential property sales are of completed dwellings, rather than vacant lots. We therefore include data on standalone house sales to expand the sample size and fill gaps in the section sales data. Sale prices for standalone houses include the value of the dwelling, while sale prices for vacant sections only include the value of the land. We therefore estimate the price for the land underneath standalone houses by subtracting the improvement value from the most recent rates assessment from the sale prices. We define a new variable as follows:

$$LandPrice_i = SalePrice_i - IV_i$$

For vacant sites, the LandPrice variable is simply equal to SalePrice, while for sites with a house on them, LandPrice should be equal to the value of the section, excluding the house. However, some development costs (eg the cost to obtain resource consent or building consent) may not be counted in the improvement value, which may lead to a biased estimate of prices for these properties. We therefore include an indicator variable

[10] For instance, one 450m^2 site in Wellington City was recorded as having a sale price of $95 million. We suspect that extra zeroes have been added to the sale price.

for standalone house sales in our regression models to control for other development costs that are not included in improvement value.

The following data shows the composition of the cleaned datasets we used to estimate OLS models of section prices. On average, prices are highest in Wellington City and lowest in the Kāpiti Coast and Porirua City. There are relatively few vacant sections in the dataset, which highlights the importance of including standalone home sales to develop a richer picture of location- and site-specific features that affect sale prices. In Section 7, we show that the inclusion of standalone home sales has not caused any bias in section price estimates.

Table 15: Summary statistics for property sales datasets

Location	**Sales Period**	**Number**	**Vacant Sections (%)**	**Standalone Homes (%)**	**Average Land Price ($/m^2)**	**Average Section Size (m^2)**
Wellington City	Jan 2008 - Jul 2018	25,399	4.6%	95.4%	$569	601
Porirua	Jul 2013 - Jun 2018	4,567	19.9%	80.1%	$316	721
Lower Hutt	Jul 2013 - Jun 2018	7,225	3.3%	96.7%	$409	675
Upper Hutt	Jul 2013 - Jun 2018	3,419	5.7%	94.3%	$319	722
Kāpiti Coast	Jan 2013 - May 2018	6,309	11.2%	88.8%	$288	808

4.2.2 Model variables and model specification

For each territorial authority, we use the datasets described above to estimate four alternative OLS regression models that included the following explanatory variables:

- Location: Measured by indicator variables for each suburb. The coefficient on each suburb indicator variable represents the value of being in that location, reflecting its access to jobs, retail, and amenities, school zoning, climate, etc.[11]
- Section size: Measured in terms of land area. This is a 'continuous' variable.
- Slope: This is measured using indicator variables for whether the section is relatively flat, moderately sloping, or steeply sloping.
- View: This is measured using indicator variables for whether the section has a view of land, view of water, or no view.
- An indicator variable for whether the property has driveway access.
- An indicator variable for whether the property is a standalone home as opposed to a vacant lot.

Different models reflect different assumptions about how section prices 'respond' to different property characteristics.

[11] An alternative, which we have used in previous analysis, is include direct measures of how close properties are to various attractive things, eg distance to the CBD, distance to the nearest beach, presence within a desirable school zone, etc. This is more computationally intensive, and it and less flexible than the suburb-level indicator variables used in this analysis.

The first model specification is given by:

Equation 1: Model 1 specification

$$lp_i = a_i + a_i^2 + v_i + c_i + dv_i + y_i + au_i + h_i$$

where:

- i represents an individual property sale record;
- lp_i represents the land price, in dollars;
- a_i is the land area of the property, in square metres;
- ${a_i}^2$ is the land area squared of the property;
- v_i is the view from the property, which is coded into three categories (no view; view of land; view of water);
- c_i is the contour of the property (coded into flat, gently sloping, steeply sloping);
- dv_i is an indicator of whether or not the property has a driveway;
- y_i is an indicator for the year that the property was sold;
- au_i is an indicator variable for which Census area unit (ie suburb) the property is located in; and
- h_i is an indicator variable for whether or not the property has a dwelling on it, or whether it is a vacant section.

In Model 2, the dependent variable (lp_i) from Model 1 and the area of the property (a_i) are transformed using the natural logarithm, while ${a_i}^2$ is dropped.

Equation 2: Model 2 specification

$$log(lp_i) = log(a_i) + v_i + c_i + dv_i + y_i + au_i + h_i$$

Model 3 is the same as Model 1 except the dependent variable is changed from lp_i to lpm_i which is land price per metre.

Equation 3: Model 3 specification

$$lpm_i = a_i + a_i^2 + v_i + c_i + dv_i + y_i + au_i + h_i$$

Finally, Model 4 is the same as Model 2 except for the change in dependent variable from lp to lpm as well.

Equation 4: Model 4 specification

$$log(lpm_i) = log(a_i) + v_i + c_i + dv_i + y_i + au_i + h_i$$

An analysis of model residuals found that Models 1 and 4 appear to perform best in terms of their 'fit' to the data. Colliers suggests that Model 1 results in predicted section prices that are more plausible in the Wellington context.

We have included section price estimates based on both Model 1 and Model 4 in the spreadsheet model. We suggest that Model 1 results should be as a basis for analysis, while Model 4 results could be used as a sensitivity test.

4.3 Summary of section price models

The following table summarises key coefficients from Model 1 for each of the five Wellington TAs. The model's constant term, in the second-to-last row, incorporates the impact of sale year (2018) and the assumption that all sections have driveway access. The constant term varies across area units, resulting in higher prices in some locations and lower prices in others, and hence we have reported an unweighted average to highlight broad differences in prices between TAs.

We highlight a few key features of these section price models:

- First, the large positive coefficients on the section size variable show that larger sections are worth more, but that this effect diminishes for larger sections, as shown by the negative coefficients on the section size squared variable.
- Second, steeply sloping sites are worth less than moderately sloping sites, which are in turn worth less than flat sites. These effects are qualitatively consistent across all five TAs that have slope data recorded for property sales.
- Third, views of water increase section values more than views of land in Wellington City, Lower Hutt, Porirua, and Kāpiti Coast. The coefficient on views of water was negative but statistically insignificant in Upper Hutt. We suspect that this reflects the impact of an omitted variable – any Upper Hutt sites with water views are likely to be up steep hills – and hence we have excluded the view variables from the Upper Hutt model.
- Fourth, the constant term (which reflects the 'baseline' value of a section in the average area unit) is highest in Wellington City and lowest in Porirua City, which aligns with expectations.
- Lastly, the R^2 parameters show that these statistical models explained a large amount of the property-to-property variation in residential section prices within each city.[12] The share of overall variation explained by these models ranges from 49% in Kāpiti Coast to 71% in Lower Hutt.

Section 7 presents a full set of model coefficients and statistics, including constant terms for individual area units and tests of the statistical significance of individual model variables.

Table 16: Key coefficients from section price models for each TA, early-mid 2018

Attribute	Wellington City	Lower Hutt	Upper Hutt	Porirua	Kāpiti Coast
Section size	241	300	156	71	99
Section size squared	-0.030	-0.115	-0.040	-0.010	0.009[13]
View of land	-3,244	-7,942	NA	-986	-2,444
View of water	31,990	4,922	NA	40,855	119,419
Gentle slope	-27,755	-14,587	-8,579	-12,856	-10,669
Steep slope	-88,161	-69,298	-39,371	-40,312	-26,986
Constant for vacant sections with driveway,	335,632	126,782	221,815	282,233	180,487

[12] There are many idiosyncratic factors that affect property prices, and it is not possible to measure all of these attributes in detail. In our experience, it would be unusual to achieve an R^2 value higher than 70-80% when undertaking a statistical analysis of property prices. Studies that achieve values in this range usually include a much larger number of explanatory variables, or transform section prices to reduce the amount of variability (eg by taking the natural logarithm). As a result, there will always be some 'unders' and 'overs' for price estimates. In Section 7, we demonstrate that there is no systematic bias in the pattern of errors resulting from these models.

[13] The coefficient for section size squared for Kapiti is positive, which is assumed to be reflecting the preference for larger, 'lifestyle' like properties in the Kāpiti area compared with the other relatively more 'urban' areas.

averaged across all area units[14]					
R^2 (goodness of fit)	53%	71%	61%	53%	49%

4.4 Predicted section prices by location

In addition to variation in average section prices *between* different territorial authorities, there are also significant variations *within* territorial authorities.

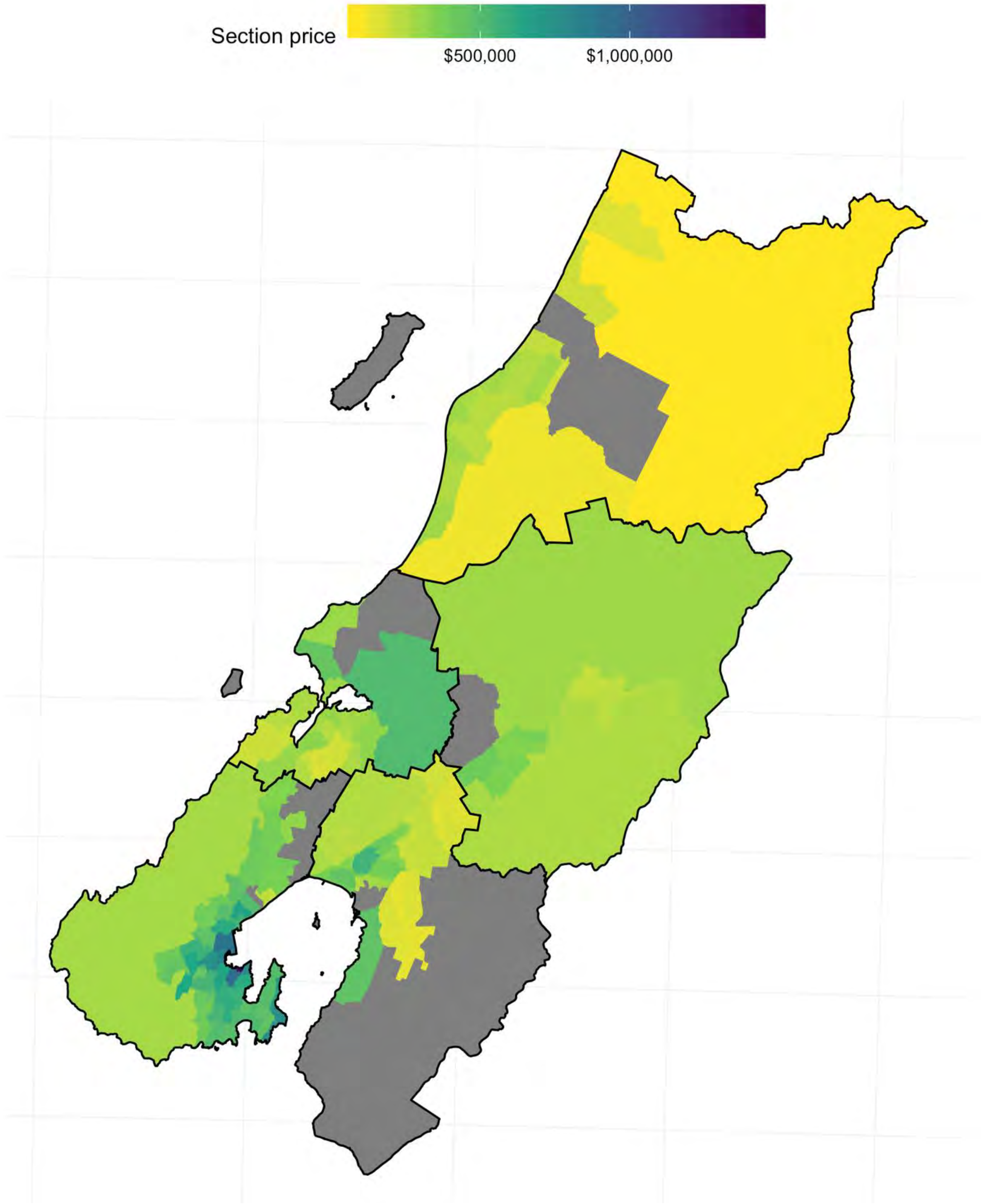
The following map shows estimated section prices for a representative 500m^2 flat section with no view for each area unit in the region.[15] Yellow and green colours indicate lower prices, while blue prices indicate high prices. Grey areas indicate area units with no observed sales – where necessary we have estimated prices based on prices in adjacent suburbs.

A few patterns stand out in this data. The first is the value of accessibility: prices drop off rapidly with distance from the Wellington city centre. Outside of central areas, prices tend to be highest in locations that are more accessible to major transport infrastructure. The second pattern is around geography and natural amenities: Coastal properties in Porirua City and the Kāpiti Coast are generally higher-price than inland properties, while hillier parts of the Hutt Valley tend to have lower prices. Third, there are some localised pockets of low prices, such as Cannons Creek in Porirua.

This map includes predictions for section prices in parts of the city that do not currently have identified greenfield development sites. This highlights the fact that this model can easily be extended to address new greenfield areas throughout the region, potentially including major brownfield sites within existing urban areas. For area units where there were no residential property sales, we made predictions based on prices in the most relevant adjacent area units, and validated these predictions with Colliers.

[14] This sums together the constant term in the regression, the coefficient for the vacant section sales, the coefficient for sales that occurred in 2018, the coefficient for properties with a driveway, and the average coefficients for individual area units, weighted by the share of vacant section sales in each area unit.
[15] A small number of area units had no residential property sales, and hence no predicted constant term. In these cases, we worked with Colliers to interpolate values from adjacent area units.

Figure 4: Estimated 2018 section prices by Census area unit for a representative section



5 Application to Wellington region greenfield sites

To conclude, we summarise key results from our application of this model to greenfield development sites in the Wellington region. These results are based on the development capacity model outputs available at the time of reporting (December 2018).

5.1 Overview of input sites

The following table summarises the greenfield sites that were included in the model. The development capacity model has identified a total of 1,700 hectares of greenfield land across 136 sites in Wellington City, Porirua City, Kāpiti Coast, Lower Hutt, and Upper Hutt. It estimates that around 1,480 hectares of this land is developable, taking into account geographic and infrastructure constraints. This would yield a theoretical maximum of 15,000 new dwellings.

Rating valuation data suggests that these sites are currently valued at an average of around $7 to $28 per square metre, which is typical for unimproved sites with rural zoning. However, there are some sites with significantly higher capital values. This can affect feasibility in some cases.

Table 17: Summary of greenfield sites included in modelling

Territorial authority	Number of greenfield sites (unique parcel IDs)	Total land area (ha)	Developable land area excluding constraints (ha)	Estimated development capacity (net added dwellings)	Weighted average capital value per m2 of developable land
Wellington City	19	271.1	206.3	2,662	$24
Lower Hutt City	50	529.4	430.7	2,210	$7
Upper Hutt City	22	330.9	261.7	2,931	$9
Porirua City	12	405.9	374.5	4,838	$9
Kāpiti Coast District	33	239.8	215.8	2,800	$28
Regional total	**136**	**1,777**	**1,489**	**15,441**	

5.2 Summary of key results

Table 18 summarises estimated feasible dwelling capacity for each territorial authority, based on the gross dwelling densities output from the Wellington development capacity model. These results are drawn directly from the “Summary dashboard” in the feasibility model.

They reflect development sites that have been identified as of December 2018, and hence exclude any future urban development areas that have yet to be identified in plans.

We highlight the following findings:

- In Wellington City, 17 of the 19 greenfield sites are feasible to develop. Detailed analysis reported in the "Greenfield calcs" sheet shows that most of these sites have gross profit margins well in excess of the 20% threshold. These sites are estimated to yield 2,628 additional dwellings.
- In Lower Hutt City, 20 of the 50 greenfield sites are feasible to develop. These sites account for 111.3 hectares of developable land, which is around 26% of the total developable land in Lower Hutt, and are expected to yield 1,316 additional dwellings. However, a number of sites were *close* to feasible, with profit margins in the range of 14-18%. Sensitivity testing suggests that these sites may be more feasible under alternative assumptions about section density.
- In Upper Hutt City 21 of 22 greenfield sites are feasible to develop. These sites have a total developable area of 224.6 hectares and are expected to yield 2,818 additional dwellings.
- In Porirua City, all 12 greenfield sites are feasible to develop. These sites represent 374.5 hectares of developable land and are estimated to yield 4,838 additional dwellings.
- In Kāpiti Coast District, only 20 of 33 greenfield sites are feasible to develop. These sites account for 75% of total developable land area and dwelling capacity. They are estimated to yield 2,106 additional dwellings on 163.8 hectares of developable land.[16]

Table 18: Summary of greenfield feasibility model results based on density from development capacity model

Territorial authority	**Number of greenfield sites that are feasible to develop**	**Developable land area (ha)**	**Estimated feasible dwellings**
Wellington City	17	203.5	2,628
Lower Hutt City	20	111.3	1,316
Upper Hutt City	21	224.6	2,818
Porirua City	12	374.5	4,838
Kāpiti Coast District	20	163.8	2,106
Regional total	**90**	**1,077**	**13,706**

The feasibility model also enables sensitivity testing of key assumptions, including:

- Development timeframes
- Alternative net density assumptions for subdivision
- Gross profit margins
- Price and cost assumptions

The following table summarises the results of selected sensitivity tests. This analysis shows that:

[16] According to feedback from Kāpiti Coast District Council, estimated dwelling yields are based on current residential densities as a proxy until subdivision standards are established through a structure plan for the area. In addition, despite having structure plan provisions, the Ngarara and the remaining part of the Waikanae North development have been modelled using the same residential development densities as a proxy to provide consistency for greenfield modelling across Kāpiti.

- Results are not too sensitive to either a higher gross profit threshold or a longer development timeframe. In particular, the sites in Wellington saw no change in feasibility under these tests, and the sites in Porirua saw only very small reductions in feasibility.
- Applying alternative assumptions about net densities for new subdivisions (ie permitting developments up to 30 dwellings per net hectare) increases the number of feasible dwellings across all districts.[17] This reflects the fact that, within this range of densities, reducing section size seems to increase revenues more than it increases costs. This finding in turn suggests that there may be value in investigating whether alternative density rules may deliver an increase in feasible dwellings.
- Applying alternative section price estimates generally results in a reduction in feasible dwellings, reflecting the fact that this model is slightly more conservative about prices for certain types of dwellings. The negative effects of this model are most apparent in Lower Hutt with about a 65% reduction in net added dwellings, whilst all other districts had no more than a 15% reduction in net added dwellings when the alternative section pricing model was applied.

Table 19: Sensitivity tests for total feasible dwelling capacity

Scenario	**Baseline model**	**30% gross profit margin threshold *(1)***	**Alternative net density assumptions *(2)***	**Alternative section price estimates *(3)***	**Longer development timeframe *(4)***
Expected impact	*N/A*	*Reduce feasible capacity*	*Increase feasible capacity*	*Can have positive or negative effects*	*Reduce feasible capacity*
Wellington City	2,628	2,628	4,024	2,515	2,628
Lower Hutt City	1,316	884	8,324	452	1,038
Upper Hutt City	2,818	2,726	5,291	2,620	2,818
Porirua City	4,838	4,782	7,592	4,782	4,782
Kāpiti Coast District	2,106	1,970	3,773	1,936	2,038
Regional total	**13,706**	**12,990**	**29,004**	**12,305**	**13,304**

Notes:
(1) The baseline threshold for feasibility is a 20% gross profit margin;
(2) This sensitivity test identifies the most feasible option (ie maximising gross profit) for net density ranging from 10 to 30 dwellings per net hectare;
(3) This is based on application of Model 4 to estimate section prices, rather than Model 1 as in the baseline;
(4) Development timeframe extended from 18 to 30 months

5.3 Detailed results for selected territorial authorities

[17] The effect is particularly large in Lower Hutt, which appears to reflect the fact that there are three sites where the WCC capacity model assumes extremely low densities of less than one dwelling per hectare. Hence testing alternative densities results in as a ten- to thirty-fold increase in the number of dwellings on these sites. This may bear further investigation.

Detailed results are available in the feasibility model spreadsheet. Here, we highlight spatial variation in feasibility outcomes within Lower Hutt and Kāpiti Coast District.

The following table summarises Lower Hutt results by Census area unit. This shows that areas that are most feasible are those with higher-priced suburbs like Eastbourne, Kelson, Naenae North and Normandale, while other locations have a split of feasibility and non-feasibility. Feasible sites in lower-priced suburbs are expected to have lower prices for greenfield land, or less challenging geography and therefore lower development costs.

Table 20: Lower Hutt feasibility outcomes by Census area unit

Area unit	**Total sites**	**Number of additional plan-enabled sections**	**Number of feasible sites**	**Number of feasible sections**	**Benchmark section price *(1)***
Arakura	15	702	4	360	$144,700
Delaney	1	47	0	0	$151,600
Eastbourne	1	38	1	38	$455,800
Glendale	22	739	10	518	$167,600
Homedale East	3	261	1	122	$142,800
Kelson	2	213	2	213	$239,400
Manuka	1	20	0	0	$180,600
Naenae North	1	27	1	27	$214,300
Normandale	1	38	1	38	$229,000
Pencarrow	2	104	0	0	$167,600
Tirohanga	1	21	0	0	$243,500
Totals	**50**	**2,210**	**20**	**1,316**	

Notes: (1) This is the estimated price for a 500m2 flat section with no view in each suburb.

The following table summarises Kāpiti Coast results by Census area unit. Similar to Lower Hutt, areas with higher prices are seen to have a high proportion of feasible development (Raumati South, Waikanae Park, Waikanae West), whilst lower priced areas are less feasible, or not feasible at all (Otaki, Otaki Forks).

Table 21: Kāpiti Coast District feasibility outcomes by Census area unit

Area unit	**Total sites**	**Number of plan-enabled sections**	**Number of feasible sites**	**Number of feasible sections**	**Benchmark section price *(1)***
Otaki	7	811	3	461	$170,051
Otaki Forks	2	228	0	0	$150,142
Paraparaumu Beach South	1	0	0	0	$272,682
Paraparaumu Central	1	0	0	0	$229,127
Raumati South	3	174	3	174	$263,202
Waikanae East	1	86	0	0	$242,011
Waikanae Park	17	1,469	13	1,439	$254,499
Waikanae West	1	32	1	32	$262,824
Totals	**33**	**2,800**	**20**	**2,106**	

Note: (1) This is the estimated price for a 500m2 flat section with no view in each suburb.

5.4 Residual land value and implications for infrastructure funding

In addition to calculating the expected profit margin from development, we calculate residual land values for each site. In effect, this inverts the feasibility calculation used in the above analysis.[18]

Residual value analysis estimates the 'fundamental' value of land or development sites based on:

- the expected revenues from developing those sites (ie the sale price of new sections)
- minus the expected costs to develop new buildings on those sites, including a profit margin to cover the developer's effort and risk.

Developers often use residual value calculations when deciding how much to offer for a development site. Residual value from development can be less than zero in some cases, indicating that development revenues are not sufficient to cover development costs let alone provide a return to the landowner.

Even if residual value is positive, it may be less than the site's current valuation, in which case may owners would prefer to 'hold out' rather than sell to a developer. However, if residual value is greater than the site's current valuation, then landowners may prefer to sell or develop.

The following table summarises residual value estimates for Porirua greenfield sites, most of which are feasible. Residual value estimates range from a low of $29/m^2 in Adventure to a high of $146/m^2 in Resolution. The weighted average residual value across all Porirua sites is $128/m^2.

[18] More specifically, it is calculated as $(total\ revenue)/(1 + profit\ margin) - (development\ costs\ excluding\ land\ purchase)$

High residual values represent a 'windfall gain' that accrues to landowners and/or developers when land is rezoned from rural to urban uses and serviced with urban infrastructure, at least in desirable areas. These windfall gains do not exist in all locations. For instance, in areas with extremely low prices, residual value can be *negative*, reflecting the fact that section prices are too low to cover development costs.

However, where significant residual value does exist, there may be opportunities to use 'value capture' techniques, such as targeted rates or infrastructure funding agreements, to help fund new infrastructure required to enable development. These mechanisms allow infrastructure providers and landowners/developers to 'split' the excess profits from developing land.

Value capture can be both fair and efficient. It helps ensure that the costs of unlocking development are aligned with the financial benefits of development. In doing so, it eases the financial constraints that infrastructure providers are facing, allowing them to better respond to growth and invest in improved quality of life for existing residents.

There are various technical and political challenges to implementing effective value capture mechanisms, and a full discussion is significantly beyond the scope of this report. However, we highlight that feasibility analysis can assist in understanding where there may (or may not) be opportunities to use value capture.

Table 22: Current land values and residual value estimates for Porirua greenfield sites

Parcel ID	Area Unit	Developable area (ha)	Current land value ($/m^2 developable area)	Residual value ($/m^2)	Difference
38	Pukerua Bay	12.5	$27	$123	$96
49	Pukerua Bay	22.8	$26	$126	$100
1535	Mana-Camborne	24.1	$13	$123	$110
3535	Adventure	4.4	$27	$29	$3
4535	Resolution	111.5	$2	$146	$144
4536	Resolution	4.7	$9	$145	$135
4826	Paekakariki Hill	128.0	$9	$127	$118
14034	Ranui Heights	3.3	$11	$82	$71
14240	Ranui Heights	1.7	$59	$82	$23
14699	Porirua Central	9.7	$10	$130	$120
17142	Titahi Bay North	36.2	$13	$106	$93
18101	Titahi Bay North	15.5	$5	$106	$101

6 Appendix 1: Calculating road requirements

Understanding the amount of land consumed by road space is important when predicting the number of future dwellings in new developments. Land dedicated to roads is land not available for dwellings. This can have a large impact on development profitability and therefore development uptake in an urban area. A further challenge caused by Wellington's hilly terrain is significant challenges for designing road networks, which may in turn affect the amount of land that must be set aside for them.

We estimated road requirements by analysing geospatial data on road network provision, topography, and development density in the Wellington region. The following table shows some basic results, illustrating the average share of land (excluding reserves) devoted to roads in each of the five Wellington councils.

Table 23: Average amount of land devoted to roads

Territorial Authority	Total land (hectares)	Total road land (hectares)	Road land (%)
Kāpiti Coast District	893	146	16
Lower Hutt City	2327	426	18
Porirua City	1204	191	16
Upper Hutt City	892	150	17
Wellington City	3531	715	20

6.1 Creating the data set

Creating the data set began with the LINZ primary parcel data set[19]. The first step was to join the slope of each parcel to the LINZ parcels by parcel id. The slope data was sourced from 8m elevation data and was represented as the average slope within each parcel. The slope data was then categorised into the following four categories:

1. **Flat:** Ranging from 0 to 10% slope,
2. **Sloping:** Ranging from 10 to 20%,
3. **Steep:** Ranging from 20% to 30%, and
4. **Very steep:** above 30% slope.

Next, an intersection[20] was performed between the parcel properties and the NZ meshblocks. This (a) cut the parcels up where they crossed over meshblock boundaries and (b) assigned a meshblock number to each parcel. Then the data was aggregated up into the meshblock level. Two key statistics were calculated for each meshblock were:

1. Total parcel area within the meshbock,
2. Total road parcel area within the meshblock,
3. Total flat parcel area within the meshblock,
4. Total sloping parcel area within the meshblock,

[19] This data set can be found online at the LINZ data source under "NZ Primary Parcels".
[20] An intersection is GIS operation where two layers a crossed over each other, creating a new layer where they intersect. See: http://wiki.gis.com/wiki/index.php/Intersect.

5. Total steep parcel area within the meshblock,
6. Total very steep parcel area within the meshblock.

Several other meshblock statistics were also joined to the data in this process:

1. Number of occupied private dwellings and,
2. The total number of people employed in this meshblock (workplace address).

From the total number of employed people, a meshblock was then defined as commercial by setting a cutoff of 75 employed people in the meshblock. All commercial meshblocks where then excluded from the analysis as we are interested in residential development.

The next step was to define the urbanised areas of the Wellington region.

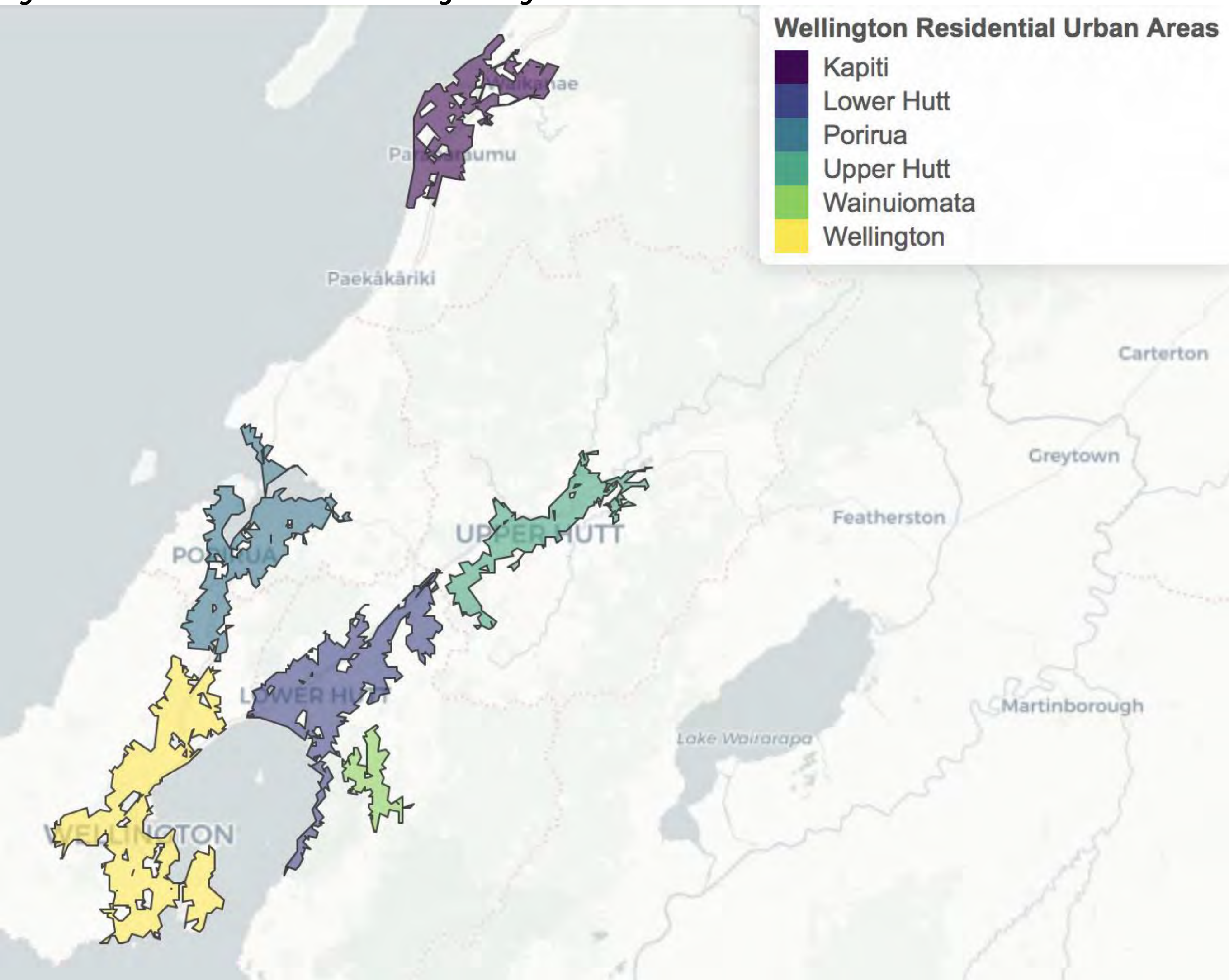
6.2 Defining urbanised areas

To define the contiguous urbanised area, as opposed to reserves, a neighbourhood analysis at the parcel level was conducted. This involved:

1. Converting parcel polygons to points,
2. Finding the top 10 nearest neighbours,
3. Averaging their distance from the parcel point, and
4. Filtering the parcels where the average distance was less than 150 metres.

The map below demonstrates the areas that were created from this analysis.

Figure 5: Urbanised areas in the Wellington region



Once these urban parcels had been selected, they were then dissolved to create a contiguous urbanised area. From this contiguous urban area, only the meshblocks that were fully contained within the urban area we used in the analysis.

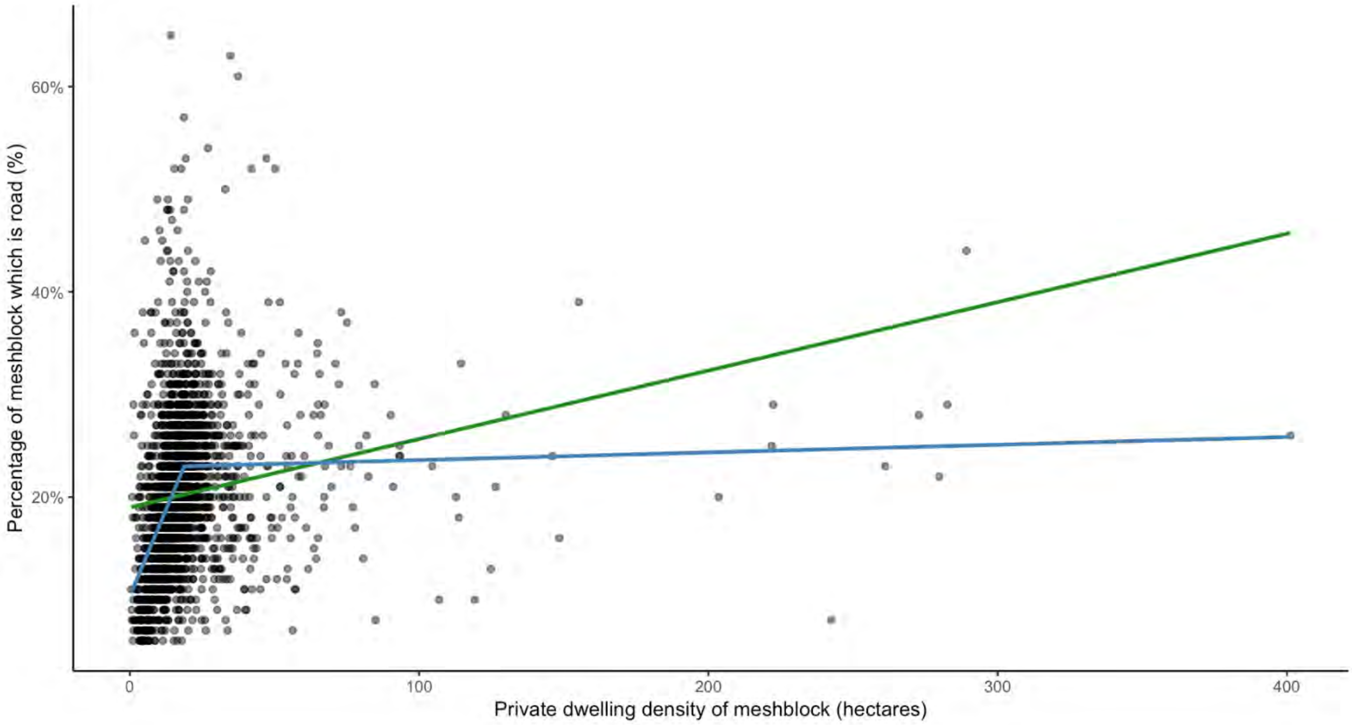
6.3 Exploratory data analysis

We started by exploring the data, focusing on the relationship between the share of urbanised land in each meshblock that is devoted to road space and average density of dwellings within that meshblock. Higher-density suburbs tend to require more land devoted to roads, as they need more accessways and space for transport access.

Figure 6 presents the relationship between net dwelling density and the amount of land dedicated to road in each meshblock. There is a positive relationship between density and road requirements, as expected. However, there is wide variation in road density in the data.

The green line represents a simple linear model, while the blue line represents two linear models; one for properties with a net dwelling density below 19 dwellings per hectares and ones above 19. The split model provides a better representation of the data. This relationship can be explained by the fact that the share of road space reaches a 'maximum' general level when traded up against dwelling density, as the total space allocated to roads *and* dwellings cannot exceed 100%.

Figure 6: The relationship between net dwelling density and the share of meshblocks used as road space



The nature of this relationship, and its 'split' behaviour is an important feature of the data that we consider when defining the model of road requirements.

6.4 Estimating the determinants of the amount of land dedicated to road use

We used this data to estimate the drivers of road requirements for residential suburbs. We considered four basic factors:

- The density of dwellings in the suburb
- Whether there is a 'nonlinearity' in the effect of dwelling density on road density
- The average slope of the suburb
- Which territorial authority the suburb is in.

We used ordinary least squares regression to test four different model formulations at both the meshbock and the area unit level. Trying these models at the different geographical scales meant we could test for the modifiable area unit problem (MAUP). Fortunately, no extreme differences were found between the levels and the model outputs. The four different model formulations tried were:

Equation 5: Road space Model 1 specification

$$r_i = o_i$$

where *i* represents the meshblock, *r* represents percentage of road space and *o* represents the density of private occupied dwellings. However, as noted in the preceding section, the relationship between dwelling density and road space is, strictly speaking, not a linear one. Because of this, the next model specification includes an interaction term between dwelling density and an indicator variable (*p*) indicating whether that meshblock is above 19 private dwellings per hectare or not (Yes or No). The second formulation is specified as

Equation 6: Road space Model 2 specification

$$r_i = o_i * p_i$$

the third specification adds in a slope variable (*s*) as

Equation 7: Road space Model 3 specification

$$r_i = o_i * p_i + s_i$$

The final formulation was:

Equation 8: Road space Model 4 specification

$$r_i = o_i * p_i + s_i + ta_i$$

where *ta* represents the territorial authority of the parcel. The 'flat' slope variable was excluded from the analysis to avoid collinearity with other slope indicators. This means that any reading of the model output is based on the inclusion of the 'flat' variable, and the direction of the variables is in relation to that 'flat' variable.

The results of these models are presented in the following Section 3.

6.5 Results of statistical analysis

Models 1, 2, 3 and 4 represent the meshblock level models with the four formulations, and Models 5, 6, 7 and 8 represent the area unit level models (ie using an area unit indicator instead of a meshblock indicator). The results of this analysis for all 8 formulations are presented in the Table below.

The dependent variable (share of suburb devoted to roads) expresses percentages as a decimal, eg 10% equates to 0.1. Model coefficients are listed to the right of the variable name, while standard errors are below in brackets.

Table 24: Road density regression results

Dependent variable:	Road space (%)							
Level of aggregation	Census meshblocks				Census area units			
Model specification	1	2	3	4	1	2	3	4
Private dwelling density (ha)	0.001***	0.007***	0.007***	0.006***	0.004***	0.008***	0.007***	0.006***
	(0.0001)	(0.0004)	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
Private dwelling density (ha) (Yes)		0.125***	0.122***	0.113***		0.221***	0.207***	0.196***
		(0.006)	(0.006)	(0.006)		(0.036)	(0.036)	(0.036)
Percentage of land that is 'sloping'			-0.017***	-0.028***			-0.067**	-0.103***
			(0.006)	(0.007)			(0.027)	(0.034)
Percentage of land that is 'steep'			-0.017*	-0.027***			0.097**	0.078
			(0.009)	(0.009)			(0.048)	(0.048)
Percentage of land that is 'very steep'			0.023**	0.010			-0.010	-0.025
			(0.010)	(0.011)			(0.054)	(0.055)
Kāpiti Coast DIstrict				0				0
				(0)				(0)
Lower Hutt City				0.007				0.008
				(0.006)				(0.016)
Porirua City				0.001				0.010
				(0.006)				(0.018)
Upper Hutt City				-0.008				-0.011
				(0.007)				(0.016)
Wellington City				0.018***				0.024
				(0.006)				(0.019)
Private dwelling density (ha): Private dwelling density (ha) (Yes)		-0.007***	-0.007***	-0.006***		-0.011***	-0.010***	-0.010***
		(0.0004)	(0.0004)	(0.0004)		(0.002)	(0.002)	(0.002)
Constant	0.190***	0.103***	0.109***	0.108***	0.140***	0.089***	0.101***	0.111***
	(0.002)	(0.005)	(0.005)	(0.007)	(0.010)	(0.012)	(0.014)	(0.017)
Observations	2,628	2,628	2,628	2,628	119	119	119	119
R^2	0.036	0.172	0.177	0.187	0.215	0.442	0.477	0.507
F Statistic	98.223*** (df = 1; 2626)	181.193*** (df = 3; 2624)	94.072*** (df = 6; 2621)	60.287*** (df = 10; 2617)	32.060*** (df = 1; 117)	30.421*** (df = 3; 115)	17.024*** (df = 6; 112)	11.106*** (df = 10; 108)
Note:	*p**p***p<0.01							

Immediately, one can see the improvement by including the interaction variable in the model specification with the R values increasing from 0.036 to 0.172 from Model 1 to Model 2. Furthermore, the coefficients are significant and make sense with dwelling density effectively not adding any increase to road percentages in meshblocks with a private dwelling density greater than 19 dwellings per net hectare.

Overall, the magnitude, direction and significance of the variables are relatively consistent. All variables except for the very steep variable are significant in the meshblock model. However, several variables become insignificant in the model at the area unit level. The constants of the model are higher in the meshblock models, and lower in the area unit models. In both models, Model Formulation 4 has the lowest constant as more of the variance is explained in the additional variables. The magnitude of these variables does however relate quite closely to the summary statistics presented earlier and appear reasonable.

In terms of the slope variables, the behaviour is mixed and not always significant. In terms of the territorial authorities, these all seem reasonable with the Wellington City TA having the largest impact of the amount of land dedicated to roads, followed by Lower Hutt and Porirua and, then finally, Kāpiti.

We use the results from model 4 to predict the quantity of land that will be used for roads in new subdivisions, taking into account the net density of sections in the subdivision and the gradient of these sites.

7 Appendix 2: Statistical analysis of section prices

In this section, we provide detailed results from our statistical analysis of section prices for each of the five Wellington region territorial authorities.

7.1 Wellington City

The following table summarises Wellington City model coefficients for Models 1 and 4, estimated using data over the 2008-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Table 25: Wellington City: Model 1 and Model 4 results

	Model 1		**Model 4**	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Constant	230,789	22,262	10.560	0.07
Section size	241	13		
Section size squared	-0.03	0.007		
Log section area			-0.650	0.01
Section	-22,974	4,719	-0.080	0.01
View of land	-3,244	2,264	-0.010	0.01
View of water	31,990	3,083	0.080	0.01
Gentle slope	-27,755	2,180	-0.080	0.01
Steep slope	-88,161	2,930	-0.250	0.01
Driveway	17,362	2,161	0.030	0.01
Sale year 2009	3,892	3,938	0.020	0.01
Sale year 2010	8,266	4,024	0.050	0.01
Sale year 2011	-1,604	4,073	0.020	0.01
Sale year 2012	7,676	3,961	0.050	0.01
Sale year 2013	16,754	3,940	0.100	0.01
Sale year 2014	24,393	4,005	0.130	0.01
Sale year 2015	43,147	3,958	0.190	0.01
Sale year 2016	129,342	3,960	0.460	0.01
Sale year 2017	205,539	4,159	0.670	0.01
Sale year 2018	243,504	5,902	0.760	0.02
Area unit constants?	Yes		Yes	

R2	0.53	NA	0.687	NA

7.2 Lower Hutt City

The following table summarises Lower Hutt City model coefficients for Models 1 and 4, estimated using data over the 2013-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Table 26: Lower Hutt City: Model 1 and Model 4 results

	Model 1		**Model 4**	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Constant	126,862	9,411	10.690	0.08
Section size	300	15		
Section size squared	-0.11	0.008		
Log section area			-0.740	0.01
Section	-32,720	7,493	-0.260	0.03
View of land	-7,942	3,197	-0.040	0.01
View of water	4,922	4,258	0.020	0.02
Gentle slope	-14,587	3,029	-0.070	0.01
Steep slope	-69,298	4,392	-0.280	0.02
Driveway	9,935	2,886	0.040	0.01
Sale year 2014	-4,137	3,717	-0.010	0.01
Sale year 2015	3,067	3,594	0.030	0.01
Sale year 2016	57,101	3,585	0.280	0.01
Sale year 2017	87,879	3,643	0.420	0.01
Sale year 2018	114,407	4,417	0.540	0.02
Area unit constants?	Yes		Yes	
R2	0.71		0.803	

7.3 Upper Hutt City

The following table summarises Upper Hutt City model coefficients for Models 1 and 4, estimated using data over the 2013-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Note that, following model testing, view variables were excluded from this model.

Table 27: Upper Hutt City: Model 1 and Model 4 results

	Model 1		Model 4	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Constant	-19,197	11,914	9.690	0.10
Section size	156	15		
Section size squared	-0.04	0.00		
Log section area			-0.740	0.01
Section	38,826	7,135	0.190	0.03
Gentle slope	-8,579	3,141	-0.060	0.01
Steep slope	-39,371	5,580	-0.210	0.03
Driveway	11,656	4,713	0.060	0.02
Sale year 2014	-6,587	3,954	-0.030	0.02
Sale year 2015	-624	3,818	0.000	0.02
Sale year 2016	47,788	3,791	0.250	0.02
Sale year 2017	88,557	3,870	0.430	0.02
Sale year 2018	122,688	4,687	0.580	0.02
Area unit constants?	Yes		Yes	
R2	0.61		0.748	

7.4 Porirua City

The following table summarises Porirua City model coefficients for Models 1 and 4, estimated using data over the 2013-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Table 28: Porirua City: Model 1 and Model 4 results

	Model 1		Model 4	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Constant	106,241	11,296	10.780	0.11
Section size	71	19		
Section size squared	-0.01	0.01		
Log section area			-0.830	0.02
Section	17,376	5,225	0.080	0.02
View of land	-986	2,987	-0.010	0.01
View of water	40,855	3,036	0.150	0.01
Gentle slope	-12,856	2,484	-0.060	0.01
Steep slope	-40,312	4,419	-0.170	0.02
Driveway	7,631	3,289	0.030	0.01
Sale year 2014	-8,436	4,214	-0.030	0.02
Sale year 2015	-53	4,079	0.020	0.02
Sale year 2016	45,392	4,036	0.240	0.02
Sale year 2017	74,696	4,273	0.360	0.02
Sale year 2018	97,823	5,193	0.490	0.02
Area unit constants?	Yes		Yes	
R2	0.53		0.684	

7.5 Kāpiti Coast District

The following table summarises Kāpiti Coast District model coefficients for Models 1 and 4, estimated using data over the 2013-2018 period. We have used these to estimate section prices by location throughout this territorial authority. Area unit constants are excluded to simplify the table.

Note that we have not included variables for views, slope, or presence of a driveway in the Kāpiti Coast model as the sales data did not include information on these property attributes.

Table 29: Kāpiti Coast District: Model 1 and Model 4 results

	Model 1		**Model 4**	
Dependent variable	**Section price ($)**		**Log section price per square metre**	
Attribute	**Coeff**	**Std err**	**Coeff**	**Std err**
Intersect	-46,622	59,579	9.140	0.28
Section size	99	17	NA	NA
Section size squared	0.01	0.01	NA	NA
Log section area	NA	NA	-0.630	0.02
Section	1,424	4,659	0.050	0.02
View of land	-2,444	3,484	-0.010	0.02
View of water	119,419	3,758	0.380	0.02
Gentle slope	-10,669	3,026	-0.040	0.01
Steep slope	-26,986	6,270	-0.090	0.03
Driveway	821	3,099	0.030	0.01
Sale year 2014	6,376	3,475	0.040	0.02
Sale year 2015	16,991	3,415	0.060	0.01
Sale year 2016	73,929	3,414	0.340	0.01
Sale year 2017	118,378	3,560	0.530	0.02
Sale year 2018	115,075	5,400	0.520	0.02
Area unit constants?	Yes		Yes	
R2	0.49		0.543	

7.6 Analysis of model residuals

To help identify an appropriate statistical model, we examined residual plots for vacant section sales, excluding standalone home sales. The 'residual' for a specific sale is the difference between the actual sale price and the price that is predicted by the statistical model. A positive residual indicates that the model has under-estimated the price for a specific property, and a negative residual indicates an over-estimate.

The following charts show the pattern of residuals relative to section size. Because Models 1 and 4 use different dependent variables, the vertical axes on these charts have a significantly different scale.

We observe several reassuring features in the residuals. First, residuals for vacant section sales are generally clustered around zero – while there are overs and unders, they are roughly evenly distributed. This means that including sales of standalone homes is unlikely to result in any significant 'bias' in our estimates of section prices.

Second, there is no clear pattern in the overs and unders. Our statistical models does not appear to systematically over- or under-predict prices for sections of a certain size. This means that they are likely to capture the underlying relationship between section size and price, controlling for location and site characteristics.

As a result, we are confident that these models will produce reliable estimates of average prices for different types of sections sold in different locations.

Figure 7: Model 1 residual plots

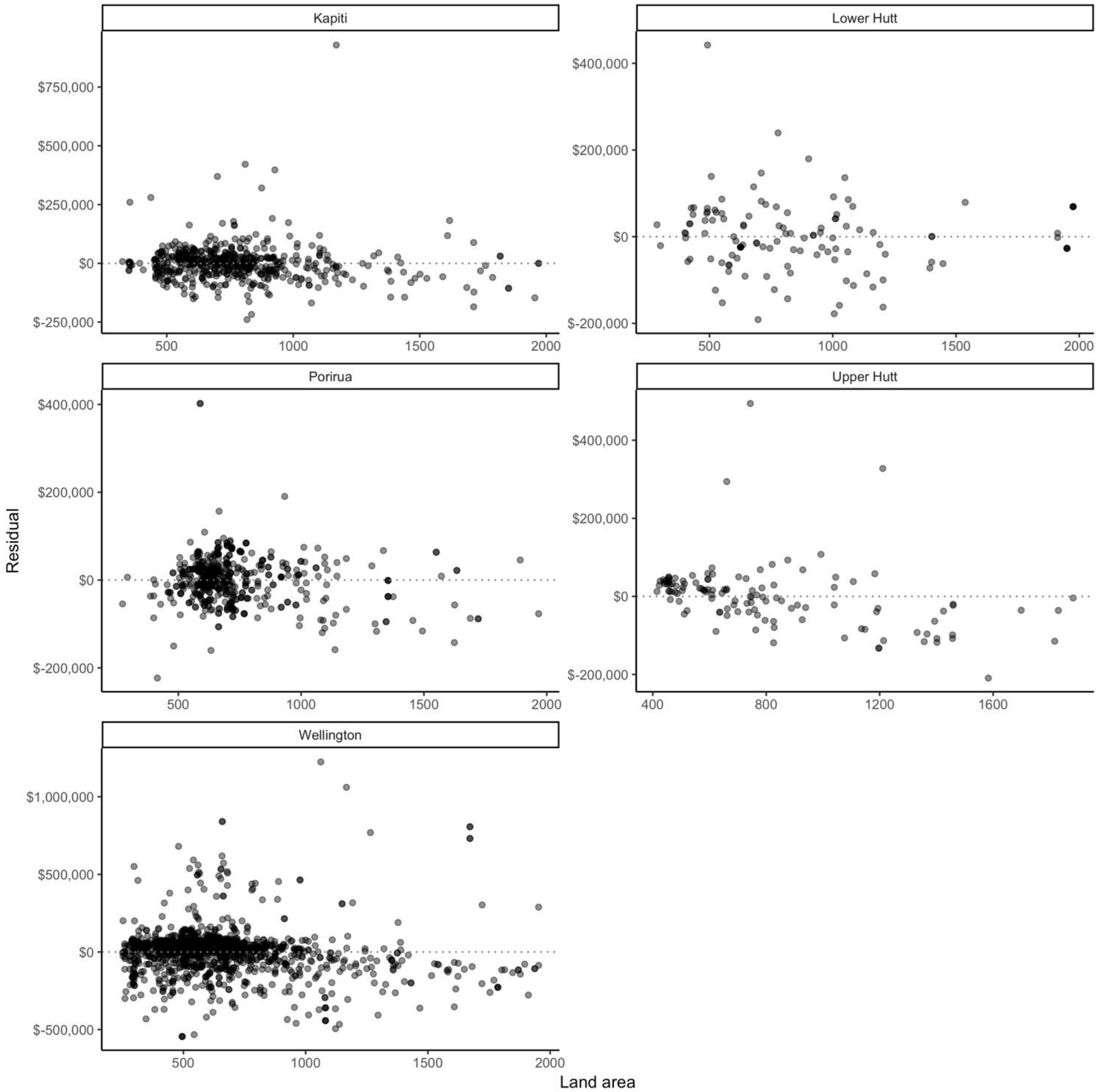
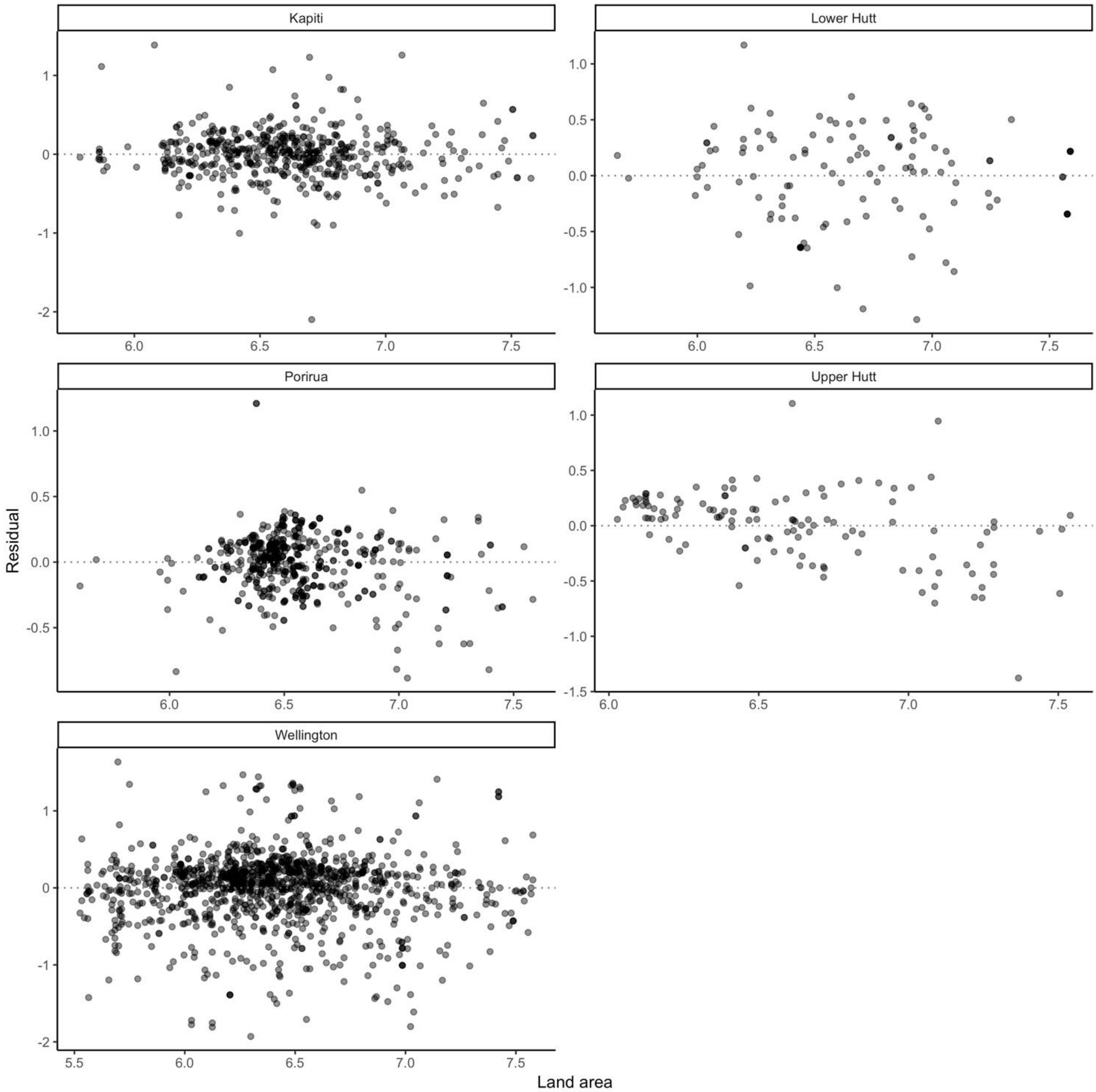


Figure 8: Model 4 residual plots



Appendix 4.3

PROPERTY ECONOMICS

PORIRUA CITY BUSINESS LAND DEMAND AND SUPPLY ASSESSMENT

Project No: 51669

Date: November 2017

Client: Porirua City Council

SCHEDULE

Code	Date	Information / Comments	Project Leader
51669.5	Nov 2017	Report	Tim Heath / Phil Osborne

DISCLAIMER

This document has been completed, and services rendered at the request of, and for the purposes of Porirua City Council only.

Property Economics has taken every care to ensure the correctness and reliability of all the information, forecasts and opinions contained in this report. All data utilised in this report has been obtained by what Property Economics consider to be credible sources, and Property Economics has no reason to doubt its accuracy. Property Economics shall not be liable for any adverse consequences of the client's decisions made in reliance of any report by Property Economics. It is the responsibility of all parties acting on information contained in this report to make their own enquiries to verify correctness.

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Property Economics has been engaged by Porirua City Council (**PCC**) to undertake an economic assessment on Business Land Capacity by determining the future business land requirements of the district over the next 30-years factoring in the current business zone provisions, capacity and implications of NPS-UDC PC1[1] directive.

To assist in the understanding and consumption of this assessment, the report will be split into two sections - Retail / Commercial Service and Commercial Office / Industrial markets, given the different methodologies applied to each to determine future demand (and therefore land requirements). The methodologies required to determine the future land requirements of retail and supporting commercial service activities, and other office and industrial business activity are different. Increased retail GFA and land demand is considered more appropriately based on the level of annualised retail expenditure the market can generate and sustain, while office and industrial activities has a more widespread catchment and is more appropriately based on employment sector growth forecasts. While the sectors will be assessed separately, it is acknowledged these sectors are intrinsically linked and 'feed off' each other in a commercial context.

[1] *National Policy Statement on Urban Development Capacity*

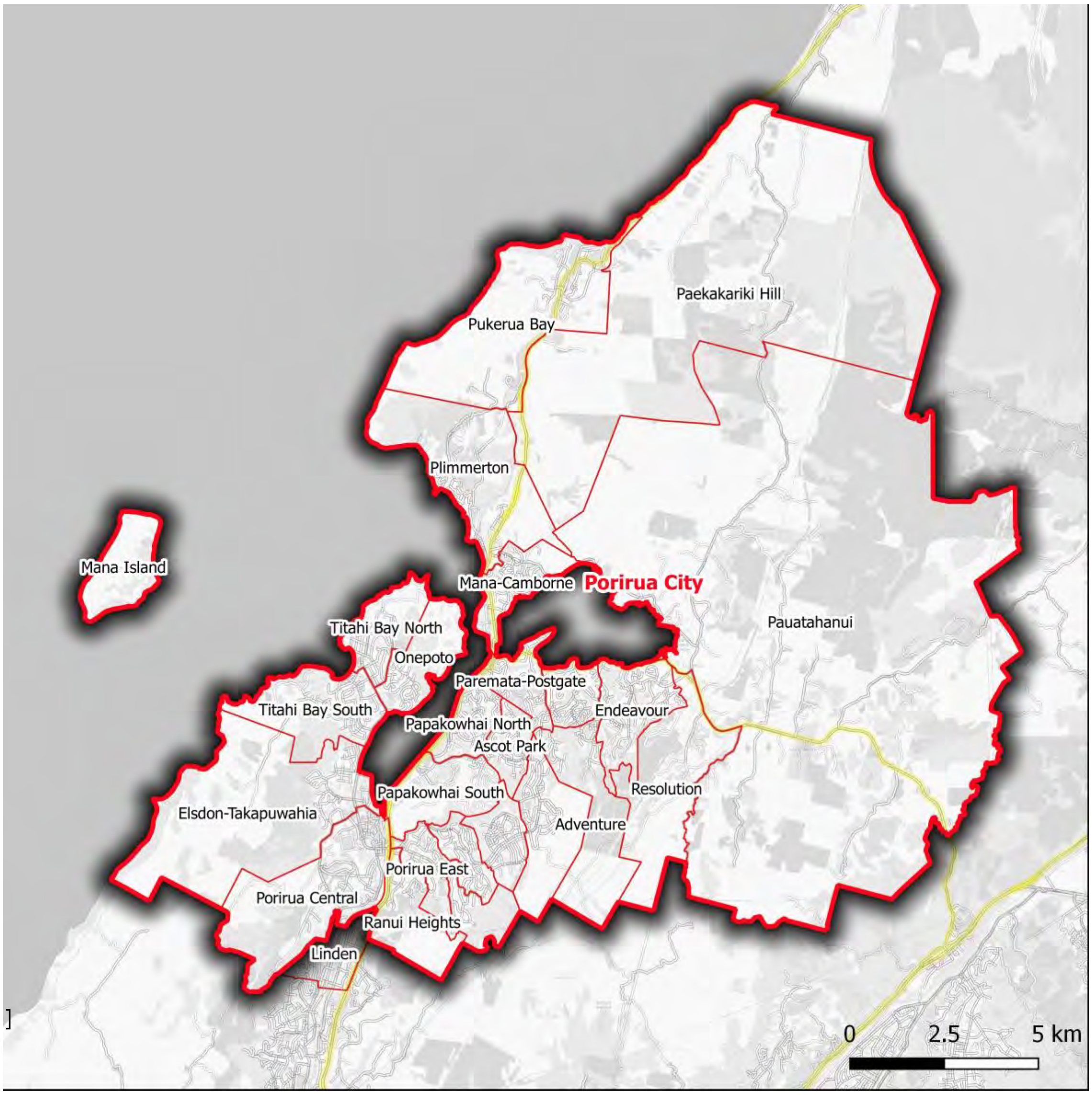
The base population forecast data utilised in this assessment have been derived from the estimates generated by Forecast id for PCC. Property Economics has not tested the veracity or underlying assumptions of the Forecast id projections, but utilised them for the purpose of demand modelling to be consistent with the source projection data utilised by Council's other long-term planning documents.

The primary purpose of this report is to provide a sound economic foundation for PCC to assist their decision making relating to policy development for the provision of business land within the city by assessing the current industrial and commercial markets and determining the net additional business land requirements to meet future market needs, to satisfy Council's NPS-UDC obligations.

The relevant NPS timeframes applied in this assessment utilise 2018 as the base year, 2021 (3-year short term period), 2028 (medium term 10-year period), and 2048 (long term 30-year period).

The base geospatial extent of the study area for this assessment is the Porirua District given this is the area the District Plan (and Council) has jurisdiction over. This may not represent the full extent of Porirua's trade catchment for individual markets (i.e. retail market), however where practical cross territorial boundary influences have been factored into the analysis and methodology applied. Figure 1 shows the geospatial extent of the District.

FIGURE 1: PORIRUA DISTRICT GEOSPATIAL EXTENT



Source: Property Economics, Google Maps

1.1. KEY RESEARCH OBJECTIVES

The core objectives of this report are to:

- Fully profile the existing industrial and business activity within Porirua City by ANZSIC sector, employment base (by sector) and each identified business node geospatially.
- Analyse business composition trends on a temporal basis over the last 16 years by sector, employment and geospatial distribution, and compares this to the wider national economy (business growth, employment growth) to identify the recent performance of Porirua by sector against national and regional trends.
- Identify the existing vacancy rates for each business area in respect of existing built form and vacant land as both in effect represent available capacity to accommodate future growth.
- Determine future commercial and industrial business land requirements for the District over the long term 30-year period.
- Develop a Geospatial Economic Model for business and industrial employment projections for the District over the 30-year period to 2048.
- Develop a Retail Expenditure Model for the District to forecast the retail and commercial service sector demand over the 30-year period.
- Analysis retail spending patterns / shopping behaviour in the District utilising MarketView retail transaction data and determine a net retail expenditure position for the District on an annualised basis.
- Undertake an audit of centre retail activity in the District to accurately quantify current centre retail provision, composition and 'health' of the centre network.
- Quantify the current differential between sustainable retail supply and retail demand (including long term demand) to highlight any future requirements and opportunities.
- Determine future net additional business land requirements in the context of current supply / capacity and future demand (growth), and where geospatially within the District these land requirements can be more efficiently delivered.

1.2. INFORMATION SOURCES

Information and data has been obtained from a variety of sources and publications available to Property Economics, including:

- Existing Porirua Industrial and Business Land Supply – PCC
- Business Demographic Data – Statistics NZ
- Census of Population and Dwellings 2013 – Statistics NZ,
- Population Projections - Forecast id
- Building Consent Data – Statistics NZ
- District Plan Business Zones and GIS Datasets – PCC
- Current Vacant Industrial and Business Zoned Land – PCC
- GDP Data – MBIE
- Retail Transaction Data – MarketView
- Household Economic Survey - Statistics NZ
- Retail Trade Survey - Statistics NZ
- NZ Shopping Centre Directory 2016 Edition – Property Council NZ
- NZ Roading Network GIS Dataset – NZTA
- Porirua Centre Retail Audit – Property Economics

2. EXECUTIVE SUMMARY

Over the long term 30-year period, Porirua is likely to experience significant changes in its market in relation to the way goods and services are sourced, accessed and distributed. Transmission Gully will be a major infrastructural addition that will not only stimulate change, but also provide an opportunity for the District to drive higher levels of economic activity and growth. Without strategic planning and taking advantage of the opportunities Transmission Gully will offer Porirua, a more subdued growth profile for the District is likely.

Porirua City is currently estimated to have around 200ha of business zoned land, with approximately 29ha of which is considered to be vacant. Breaking down Porirua's business land provision shows that there is currently 150ha of industrial zoned land (of which 26ha is vacant), and around 50ha of commercial zoned land (of which just under 3ha is vacant).

The economic research undertaken in this assessment assesses two growth scenarios. The Trended Scenario which is in essence 'more of the same' or business as usual approach, whereas the Transmission Gully scenario assesses the likely growth profile for business land in the district based on the opportunity provided by Transmission Gully. This latter scenario does not necessarily represent what the District is likely to achieve naturally, but what the District could potentially achieve with some well positioned and competitively priced industrial zone land resource.

Under the Trended Scenario the long term (30-year) business land requirements for the District is estimated at around 36ha based on projected growth. The crucial industrial component of this was 26ha, which can largely be offset by existing vacant supply. However, this vacant supply is not well positioned to take advantage of Transmission Gully, so is unlikely to reap the potential benefits available to the District.

The Transmission Gully scenario had an estimated 30-year business land requirement of 74ha based on projected growth. A significant 63ha of this was industrial zoned land, and is only likely to be realised if a large zoned provision was provided beside a Transmission Gully interchange.

The highest demand projection for commercial office space was 10ha under the Transmission Gully scenario. This can comfortably be absorbed in the underdeveloped existing Central City commercial zone with more efficient vertical development. This would add vibrancy and vitality to the central area of Porirua and spark reinvestment in the Central City area.

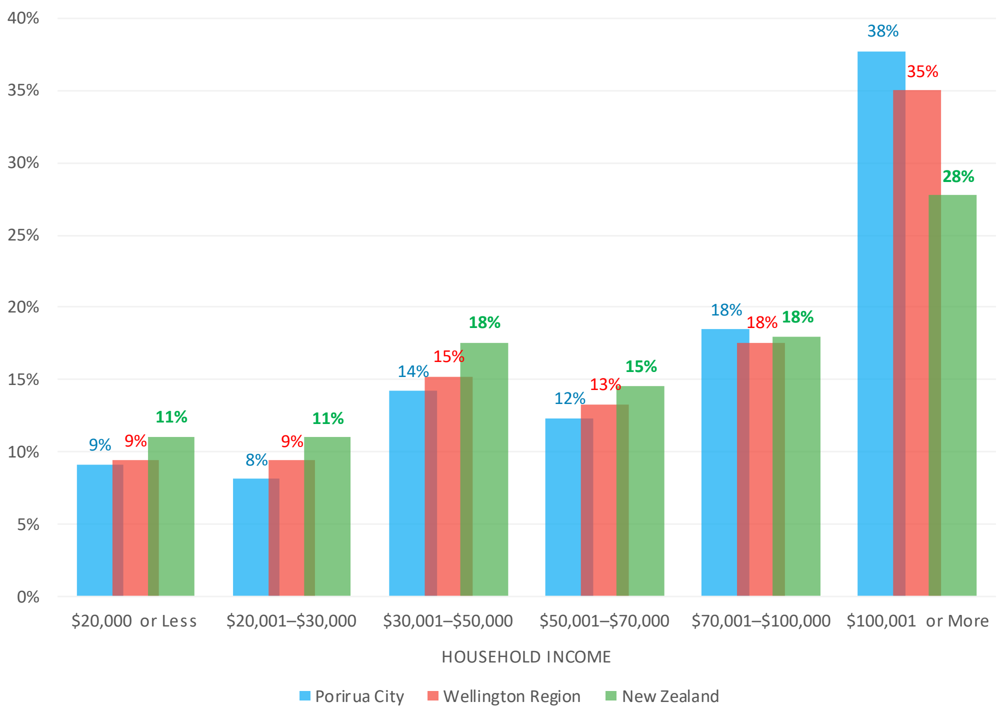
From a retail perspective, the sustainable level of GFA as at 2048 already exists in the market. This is reflected in the abundance of low performance stores in a significant proportion of the existing retail offer, which has a detrimental effect on the quality of the retail environment, amenity and shopping experience. Improving the quality of offer in the current zoned provision should be the focus, rather than developing more GFA as the market is not large enough to support additional retail GFA / zoned land for the foreseeable future.

For there to be meaningful economic advancement in the growth profile of Porirua (retail growth, business growth, employment growth), Property Economics recommend zoning additional industrial land resource beside a Transmission Gully interchange. This better places Porirua to accommodate overflow demand from Wellington (particularly industrial demand), and have and industrial land resource on New Zealand's major transport route (SH1). From an industrial business location perspective, this is a vital criterion when selecting locations to locate businesses and make often substantial capital investment decisions. This is particularly relevant to high growth industrial sectors of logistics, warehousing and distribution.

3. DEMOGRAPHIC PROFILING

Economic and social demographic profiling has been carried out for Porirua City, Wellington Region and New Zealand averages, which allows for comparisons to be made on a regional and national basis to provide a wider context. This will assist in understanding the consumer and business composition of the localised markets and their key economic and social variables. A full breakdown of the demographic profiles has been provided in Appendix 1.

FIGURE 2: ANNUAL HOUSEHOLD INCOME DEMOGRAPHIC PROFILE



Source: Property Economics, Statistics NZ

Some of the key findings from the demographic profiling include:

- Annual household income levels in Porirua City (on average) are higher compared to both the Wellington Region and NZ average. This is a positive sign for ability to generate retail expenditure. Interestingly, while Porirua has a higher percentage of households earning over $100k per year relative to the Wellington Region (38% vs 35%), Porirua has a smaller proportion of individuals earning over $50K per year (31% vs 33%). This indicates that households within Porirua are more likely to have two parent incomes (or two household income streams) which adds to the income of the household as a whole. This complements the higher proportion of two parent families in the District comparatively, which facilitates the higher household income levels, and highlights Porirua as having a population with a strong family structure.

- In terms of the sources of income, 76% of Porirua residents gain income from wages, salary, commissions and bonuses, which is 3% higher than those in the Wellington Region. Whereas, the Wellington Region has a 3% higher proportion of people who are self-employed or business owners, and 7% higher of people gaining income from interest, dividends, rent, other investments. This indicates a higher proportion of Porirua residents are company employees / workers rather than company owners and entrepreneurs compared to the wider market.

- Children and Teenagers (0-19 years of age) make up almost a third of Porirua City's population base at 32%, which is relatively high when compared to the wider Wellington Region and NZ average of 27% each. Subsequently, Porirua has a smaller proportion of its population comprising of over 65 years at only 10% compared to 13% for the Wellington Region and 14% for NZ. This indicates that Porirua has a strong ability focus on the 'next generation' and can be viewed as a city for families.

- Porirua City is also highly ethnically diverse with only 54% of its population derived from European ethnic groups compared to the wider Wellington Region and NZ averages which are closer to 70%. Conversely, Porirua has a higher proportion of Maori (18%) and Pacific Peoples (22%) relative to the wider Wellington Region and NZ markets. This indicates Porirua has a strong multi-cultural base focused around the Pacific Island and Maori peoples, and less on Asian ethnic groups.

- The local age demographics for Porirua, in turn, are tied to the higher proportion of Single and Two Parent Family households. Porirua City itself has 54% of households within these two categories, whereas the Wellington Region and NZ have significantly lower levels at 41% and 43%, respectively.

Overall, many of the demographic attributes of Porirua are similar to those of the wider Wellington Region. The demographics of Porirua are more centred towards higher income family oriented and ethnically diverse population with both parents working to provide for multiple children households. These District averages may not paint the complete picture of diversity within the District, as the demographics signal a potential underling division in the demographics between eastern and western suburbs of Porirua if the profiling was undertaken at a finer grain level.

4. POPULATION AND HOUSEHOLD FORECASTS

The Statistics NZ and Forecast id population and household growth projections[2] within Porirua City under medium and high growth scenarios are presented in Table 1 and graphically illustrated on Figure 3.

For the purpose of this table, 2018 has been classified as the current base year (shaded blue), year 2023 as short term (shaded in yellow), year 2028 has been classified as medium term (shaded green) and the years 2033 to 2048 have been classified as long term (shaded red). The black shaded figures represent the net change over the assessed period.

TABLE 1 PORIRUA CITY POPULATION AND HOUSEHOLD PROJECTIONS

	Scenario	2018	2023	2028	2033	2038	2043	2048	Net # Growth 2018-2048	Net % Growth 2018-2048
Population	High	57,800	60,900	63,700	66,200	68,300	70,200	72,100	14,300	25%
	Medium	56,600	58,300	59,500	60,300	60,600	60,500	60,400	3,800	7%
	Forecast .id	55,624	57,998	59,627	61,488	63,194	64,843	66,492	10,868	20%
Households	High	19,700	21,200	22,400	23,700	24,800	25,800	26,900	7,200	37%
	Medium	19,300	20,300	21,100	21,700	22,200	22,600	23,000	3,700	19%
	Forecast .id	18,286	19,360	20,200	21,115	21,948	22,689	23,430	5,144	28%
Houshold Size	High	2.93	2.87	2.84	2.79	2.75	2.72	2.68	-0.25	-9%
	Medium	2.93	2.87	2.82	2.78	2.73	2.68	2.63	-0.31	-10%
	Forecast .id	3.04	3.00	2.95	2.91	2.88	2.86	2.84	-0.20	-7%
Population growth (p.a.)	High	-	1.05%	0.90%	0.77%	0.63%	0.55%	0.54%	-	-
	Medium	-	0.59%	0.41%	0.27%	0.10%	-0.03%	-0.03%	-	-
	Forecast .id		0.84%	0.56%	0.62%	0.55%	0.52%	0.50%		
Household growth (p.a.)	High	-	1.48%	1.11%	1.13%	0.91%	0.79%	0.84%	-	-
	Medium	-	1.02%	0.78%	0.56%	0.46%	0.36%	0.35%	-	-
	Forecast .id		1.15%	0.85%	0.89%	0.78%	0.67%	0.64%		

Source: Property Economics, Statistics NZ, Forecast id

The current population base for Porirua City is estimated to be around 56,600 residents and 19,300 households applying the medium growth and Forecast id scenarios, with an increase of

[2] *The Statistics NZ and Forecast id population and household projections are only available up to the year 2043 for population figures and 2038 for household numbers and as such have been extrapolated out to 2048 by Property Economics.*

around 2% for the high growth scenario. To provide a wider perspective, the current Porirua population base makes up approximately 11% of the wider Wellington Region's total population.

The medium growth scenario forecasts Porirua experiencing moderate growth of 7% (3,800) residents and 19% (3,700) households between 2018 and 2048. The Statistics NZ high growth scenario forecasts growth with the population increasing by 25% (14,300 residents) and households by 37% (7,200 households) by 2048. This will see the population base increasing to 72,100 residents and 26,900 households over the next 30 years under this scenario.

PCC's request to be consistent with other growth strategies utilising more specific growth projections for the District, Property Economics has performed the analysis within this report based on the population forecasts provided by Forecast id. These population projections show the current (2018) population at around similar, albeit slightly smaller of a population base compared to the Statistics NZ medium projections. However, the Forecast id population figures are projected to grow at rate higher than the Statistics NZ medium scenario and lower than the Statistics NZ high scenario.

According to Forecast id, Porirua City's population base is expected to grow by just under 10,700 residents (20%) to a total of around 66,500 residents by 2048.

The Forecast id projections also show a relatively higher population per household ratio than the Statistics NZ projections, but the overall trend of expected decreasing population household ratios for the projected future hold true across the board. In terms of household figures, Forecast id project the number of households to increase from 18,300 in 2018 to 23,400 in 2048. Which is a 28% increase over the next 30 years.

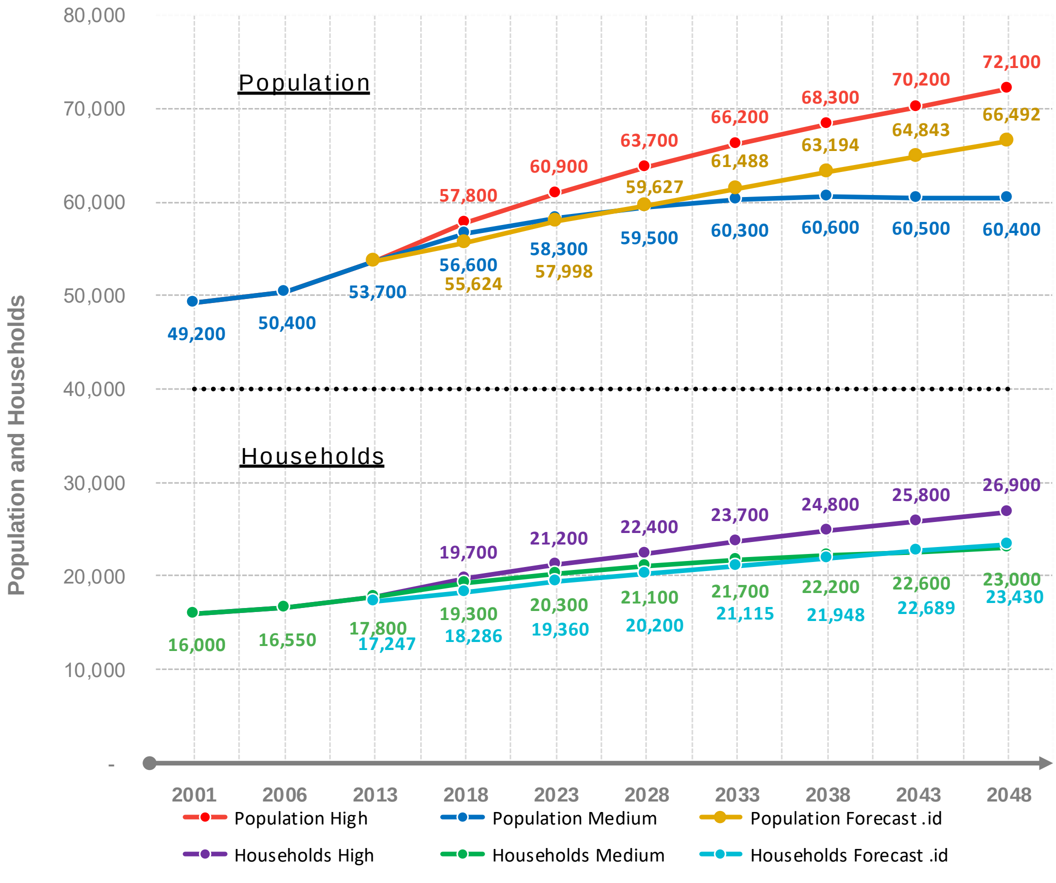
The Forecast id growth projections fall in between Statistics NZ Medium and High projections for population, but are almost the same as Statistics NZ Medium projection for households as at 2048, the change being Forecast id utilise a slightly higher person average per dwelling ratio than Stats NZ. The table and graph in this section show the various projections and differences for ease of reference.

This in effect the Forecast id projections represent a growth profile of the City's population base in between the Statistics NZ medium and high growth scenarios. The comparative analysis with Statistics medium growth scenario is important as this projection series represents the NPS UDC base requirement.

Table 1 indicates that the number of households is to increase at a faster rate than the population due to a projected fall in the person per dwelling ratio over the forecast period. This is not isolated to the study area but a trend projected to occur across the whole country due to an aging population, smaller families and a higher proportion of 'split' or single parent households.

Figure 3 represents a graphical representation of the growth projection in Table 1 to illustrate the different growth profiles of the different projections series. Also shown is the actual usual resident population and household base for the city from the last three censuses (2001, 2006 & 2013) for context.

FIGURE 3 PORIRUA CITY POPULATION AND HOUSEHOLD PROJECTIONS



Source: Property Economics, Statistics NZ, Forecast id

Applying the Forecast id projected scenario, the bulk of the City's 2048 population base is already residing in the Porirua, with the 2018 population base representing 84% of the projected 2048 population base. This indicates higher levels of local economic growth within Porirua over the assessed period is likely to be better achieved if driven from innovation, improved productivity and efficiency in the existing market rather than population driven growth.

For context, applying a standard deviation to the figures, there is only a 10% chance the Statistics NZ High 2048 population projections will be exceeded. There is a 30% chance the Forecast id 2048 population projection will be exceeded, and 50% chance the Statistics NZ 2048 population projection will be exceeded.

This provides some broad parameters for Council in their thinking. With that said, we consider it important for the District to plan for a sensible level of growth to place the District in the best position possible to capture in future years, and mitigate potential risks. Within this report, we have applied the Forecast id growth projections as the main projection suite as requested by Council (10,800 people and 5,100 households rounded).

5. PORIRUA CITY VS REGIONAL GDP TRENDS

This section distils at a high level the economic trends and performance of Porirua City and compares it against the performance of other districts in the Wellington Region over the 2000-2016. This helps contextualise how Porirua City is performing relative to competing economies.

The regional territorial authorities included in this analysis are shown in the map below. This includes part of the Tararua District.

FIGURE 4: WELLINGTON REGION TERRITORIAL AUTHORITIES

Table 2 displays the real GDP figures (adjusted for 2016 prices) for each of the territorial authorities within the Wellington Region.

Overall, the Wellington Region has experienced a 50% increase in real GDP between the 2000 and 2016 years with a net annual increased output of $11.7b. Porirua City, in particular, experienced a net output increase of $571m or 5% towards the total growth of the Wellington Region GDP over the period. Porirua was also the 2nd fastest growing territorial authority within the Wellington Region over the last 16 years, indicating that Porirua is an increasingly relevant place for businesses to operate and grow within the region.

In terms of the largest territorial authorities within the Wellington Region, Porirua is the 3rd largest economy, generating $1,484m in real GDP output in 2016. Porirua is succeeded by Lower Hutt City and Wellington City as larger economies within the Region, generating around $4,865m and $25,467m in real GDP in 2016 respectively.

Wellington City accounted for 73% of the region's GDP in 2016, and is clearly the economic hub of the region.

TABLE 2: WELLINGTON REGION REAL GDP BY TERRITORIAL AUTHORITY ($M)

Territorial Authority	2000	2002	2004	2006	2008	2010	2012	2014	2016	Net $ Growth	Net % Growth
Carterton District	$165	$177	$234	$224	$209	$281	$292	$303	$404	$239	145%
Kapiti Coast District	$516	$519	$591	$655	$675	$665	$676	$668	$760	$244	47%
Lower Hutt City	$3,717	$3,583	$3,720	$4,030	$4,259	$4,112	$4,359	$4,232	$4,865	$1,148	31%
Masterton District	$645	$730	$798	$799	$785	$759	$796	$814	$998	$353	55%
Porirua City	$913	$984	$1,015	$1,102	$1,225	$1,228	$1,245	$1,298	$1,484	$571	63%
South Wairarapa District	$203	$222	$243	$264	$217	$221	$233	$236	$277	$74	36%
Tararua District	$8	$9	$10	$10	$9	$9	$9	$10	$11	$3	38%
Upper Hutt City	$618	$652	$654	$713	$769	$731	$752	$756	$823	$206	33%
Wellington City	$16,601	$17,304	$17,855	$18,772	$19,920	$20,289	$21,521	$22,295	$25,467	$8,867	53%
Wellington Region	$23,386	$24,181	$25,120	$26,570	$28,068	$28,295	$29,881	$30,612	$35,090	$11,703	50%

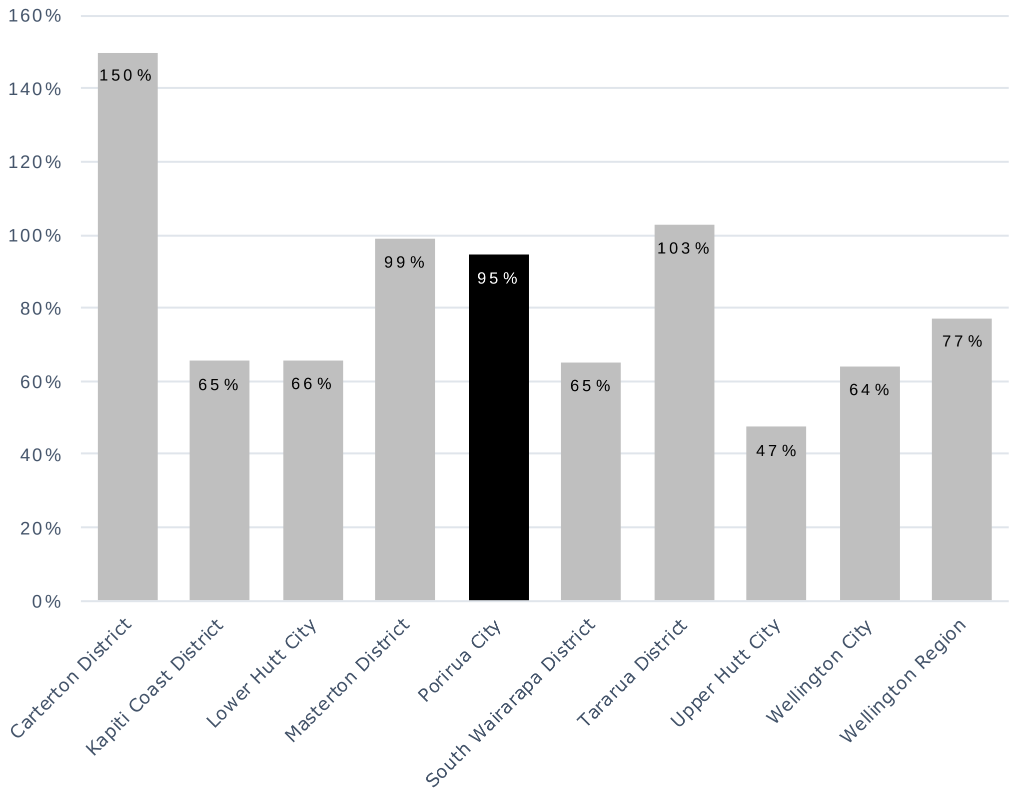
Source: Property Economics, MBIE

Figure 5 provides the real net annual GDP per capita growth rates of each territorial authorities within the Wellington Region between the 2000 and 2016 years and adjusted for 2016 prices.

Porirua City economy grew faster rate than most of the Wellington Region with regards to real GDP per capita, with around 95% growth since 2000 (and higher the regional average of 77%), indicating that the City's economy has become comparatively more productive.

This indicates that Porirua City's growth has been keeping pace with other territorial authorities on a proportional basis and is taking advantage of opportunities in a Regional context.

FIGURE 5 WELLINGTON REGION REAL GDP PER CAPITA GROWTH 2000-2016



Source: Property Economics, MBIE

5.1. PORIRUA CITY REAL GDP BY SECTOR 2001-2015

Table 3 breaks down the Porirua's real GDP (adjusted to 2016 prices) figures between 2001-2015 by sector. Note that Table 3 excludes the real GDP derived from GST on Production, Import Duties and Other Taxes, which potentially adds another 9% (on average) to the Porirua's total real GDP, and the 2015 figures are provisional.

TABLE 3 PORIRUA CITY REAL GDP FIGURES BY SECTOR

PORIRUA CITY	2001	2003	2005	2007	2009	2011	2013	2015	Net $ Growth	Net % Growth
Accommodation and Food Services	$20	$23	$23	$27	$18	$19	$21	$26	$6	30%
Administrative and Support Services	$11	$7	$10	$15	$12	$12	$16	$19	$8	73%
Agriculture	$5	$4	$6	$6	$4	$3	$5	$6	$1	30%
Construction	$64	$68	$84	$108	$120	$149	$158	$174	$110	172%
Education and Training	$106	$137	$129	$112	$124	$131	$117	$112	$6	6%
Financial and Insurance Services	$26	$29	$29	$27	$24	$30	$23	$29	$3	9%
Forestry, Fishing, Mining, Electricity, Gas, Water and Waste Services	$12	$17	$10	$12	$8	$12	$17	$16	$4	38%
Health Care and Social Assistance	$107	$84	$99	$122	$164	$138	$175	$132	$25	23%
Information Media, Telecommunications and Other Services	$74	$76	$71	$64	$65	$65	$71	$76	$2	3%
Manufacturing	$98	$85	$92	$115	$91	$87	$72	$90	-$8	-9%
Owner-Occupied Property Operation	$53	$55	$56	$65	$69	$75	$76	$77	$24	46%
Professional, Scientific and Technical Services	$75	$93	$80	$90	$71	$69	$66	$70	-$5	-7%
Public Administration and Safety	$39	$48	$52	$71	$73	$71	$57	$69	$30	76%
Rental, Hiring and Real Estate Services	$43	$57	$62	$92	$91	$85	$70	$82	$38	89%
Retail Trade	$63	$74	$82	$95	$91	$90	$87	$103	$39	62%
Transport, Postal and Warehousing	$21	$21	$22	$30	$35	$48	$35	$36	$15	71%
Wholesale Trade	$58	$42	$45	$41	$51	$54	$53	$64	$6	11%
Total	$875	$921	$950	$1,090	$1,113	$1,138	$1,119	$1,181	$306	35%

Source: Property Economics, MBIE

The Construction sector has experienced the most significant growth over the 14-year period, climbing up from being the 6th most productive sector in 2001 to the 1st in 2015. Construction has also had the highest net growth at $110m (or 172%) in real GDP, and contributing 36% towards the total growth of Porirua's economy.

Most of Porirua's economic growth has come from *'service sectors'* such as Rental, Hiring and Real Estate Services, Public Administration and Safety, and Retail Trade with these three sectors contributed 36% towards Porirua's 2001-2015 growth. However, this has caused Porirua's economy to become less diversified as the service sector takes up more significance away from the core productive base sectors.

Table 4 compares the growth of the various sectors within Porirua against that of the wider Wellington Region. The cells highlighted in blue indicate which respective economy had higher growth within the 2001-2015 period.

TABLE 4 PORIRUA CITY VS WELLINGTON REGION REAL GDP SECTOR GROWTH RATES

Sector Growth 2001-2015	Porirua City	Wellington Region
Accommodation and Food Services	30%	33%
Administrative and Support Services	73%	-8%
Agriculture	30%	-17%
Construction	172%	41%
Education and Training	6%	9%
Financial and Insurance Services	9%	23%
Forestry, Fishing, Mining, Electricity, Gas, Water and Waste Services	38%	48%
Health Care and Social Assistance	23%	65%
Information Media, Telecommunications and Other Services	3%	23%
Manufacturing	-9%	-9%
Owner-Occupied Property Operation	46%	41%
Professional, Scientific and Technical Services	-7%	35%
Public Administration and Safety	76%	86%
Rental, Hiring and Real Estate Services	89%	40%
Retail Trade	62%	43%
Transport, Postal and Warehousing	71%	56%
Wholesale Trade	11%	-3%
Total	38%	33%

Source: Property Economics, MBIE

Overall, Porirua City's economy has grown at a faster rate than that of the wider Wellington Region, indicating that the City has become more relevant within the region over the 14-year period. However, a lot of this growth has come from service / support sectors rather than any significant increases in the core productive base.

This is compounded with high-quality job sectors such as Financial and Insurance Services having experienced relatively low growth (9% compared to 23% for Wellington Region) and Professional, Scientific and Technical Services decreasing by 7%, while increasing by 35% for the Wellington Region. This tends to indicate the while professional service sectors (office dominated activities) are growing, Porirua is not attractive to them as a business location. This reflects the level of amenity and quality of environment (actual or perceived) offered within the Porirua City Centre, with the low growth levels relative to the wider market suggesting improvement is required.

This issue will become a recurring theme throughout this assessment. That is the quality of the Porirua central city area is stifling the growth potential of the city across a range of sectors. Porirua Central City is suffering from a quality issue not a quantity issue.

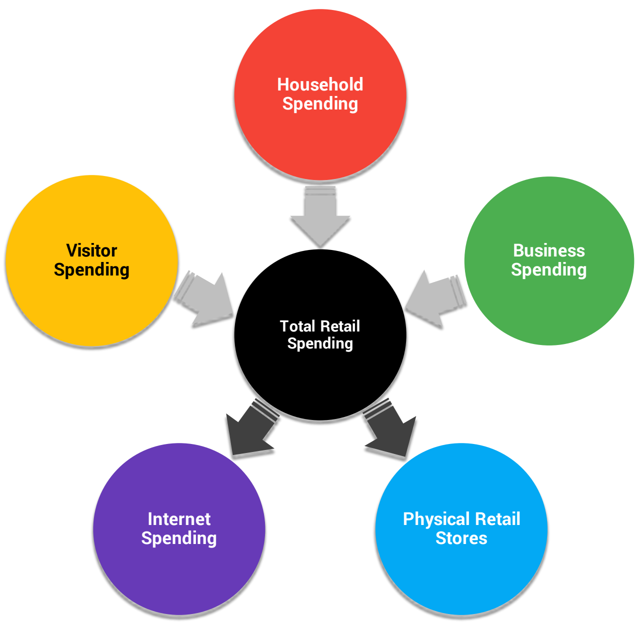
6. RETAIL EXPENDITURE AND SUSTAINABLE GFA

This section sets out the projected retail expenditure generated and sustainable GFA forecasts on an annualised basis for the Porirua City district. The forecasts have been based on the aforementioned population and household growth projections and have been prepared using Property Economics' Retail Expenditure Model.

6.1. RETAIL EXPENDITURE MODEL

A more detailed breakdown of the model and its inputs is set out in Appendix 2.

The following flow chart provides a graphical representation of the Property Economics Retail Expenditure Model to assist PCC in better understanding the methodology, key inputs utilised and assist in interpreting outputs.



GROWTH IN REAL RETAIL EXPENDITURE

For the purposes of projecting retail expenditure, growth in real retail spend has been incorporated into the model at an average rate of 1% per annum over the forecast period. This 1% rate is based on the level of debt retail spending, interest rates and changes in disposable income levels, and is the average inflation adjusted increase in spend per household over the assessed period.

LAYERED RETAIL CATCHMENTS

It is important to note that the retail expenditure generated in the identified market does not necessarily equate to the sales within that particular area. Residents can freely travel in and out of the area, and they will typically choose the centres with their preferred range of stores, products, brands, proximity, accessibility and price points. A good quality offering will attract customers from beyond its core market, whereas a low-quality offering is likely to experience retail expenditure leakage out of its core market.

For that reason, it is appropriate for modern retail markets to be assessed on the basis of "layered catchments". This is where consumers spread their retail spending across a wider spectrum of centres, with the majority of their "higher order" spend going to "higher order"' centres (predominantly large scale regional or main metropolitan shopping destinations). Meanwhile, convenience spend tends to remain more localised, triggering a layering of centre catchments across the city. In other words, a consumer could be in the primary catchment of numerous centres, not just one.

Therefore, the retail expenditure generated in an area represents the sales centres or retail stores within that area could potentially achieve and is the key influence on what the market can potentially sustain. This should not be interpreted as a negative, but simply represents normal commercial market mechanisms (competition) and is a consideration that needs to be appropriately accounted for in any retail analysis.

EXCLUDED ACTIVITIES

The retail expenditure figures below are in 2017 NZ dollars and exclude the following retail activities, as categorised under the ANZSIC categorisation system:

- Accommodation (hotels, motels, backpackers, etc.)
- Vehicle and marine sales & services (petrol stations, car yards, boat shops, caravan sales, and stores such as Repco, Super Cheap Autos, tyre stores, panel beating, auto electrical and mechanical repairs, etc.)
- Hardware, home improvement, building and garden supplies retailing (e.g. Mitre 10, Hammer Hardware, Bunnings, PlaceMakers, ITM, Kings Plant Barn, Palmers Garden Centres, etc.)

The above activities classified as retail by ANZSIC have been excluded because they are not considered to be core retail expenditure, nor fundamental retail centre activities in terms of visibility, location, viability or functionality. Modern retail centres do not rely on these types of stores to be viable or retain their role and function in the market as such stores have the potential to generate only consequential trade competition effects rather than flow-on retail distribution effects. Therefore, the retail centre network's economic wellbeing and social amenity cannot be unduly compromised.

The latter two bullet points contain activity types that generally have great difficulty establishing new stores in centres for land economic and site constraint reasons, i.e. the commercial reality is that for most of these activity types it would be unviable to establish new stores in centres given their modern store footprint requirements and untenable to remain located within them for an extended period of time (beyond an initial lease term) in successful centres due to property economic considerations such as rent, operating expenses, land value and site sizes.

Trade orientated activities such as kitchen showrooms, plumbing stores, electrical stores and paint stores are also excluded from the model for similar reasons. This is not to imply that these activity types are not situated in centres, as in many instances some of these stores types remain operating in centres as a historical overhang. However, in the future, it is increasingly difficult from a retail economic perspective to see these store types establishing in centres (new or redeveloped), albeit they likely have equal planning opportunity to do so. As such, demand for these store types is additional to the retail demand assessed in this analysis.

SUSTAINABLE GFA

This analysis uses a sustainable footprint approach to assess retail demand. Sustainable floorspace in this context refers to the level of floor space proportionate to an area's retainable retail expenditure that is likely to result in an appropriate quality and offer in the retail environment. This does not necessarily represent the 'break even' point, but a level of sales productivity ($/sqm) that allows retail stores to trade profitably and provide a good quality retail environment, and thus economic well-being and amenity.

It is necessary to separate the Gross Floor Area into:

- Net retail floorspace (Sustainable Floorspace); and
- Back office floorspace that does not generate any retail spend (**Back Office Floorspace**).

A store's net retail floor area only includes the area which displays the goods and services sold and represents the area to which the general public has access. By contrast, the Gross Floor Area typically represents the total area leased by a retailer. Back Office Floorspace in a retail store is the area used for storage, warehousing, staff facilities, admin functions or toilets and other 'back office' uses.

These activities typically occupy around 25-30% of a store's GFA. It is important to separate out such back office floorspace from sustainable floorspace because back office floorspace does not generate any retail spend. For the purposes of this analysis a 30% ratio has been applied.

6.2. ANNUALISED RETAIL EXPENDITURE AND SUSTAINABLE GFA

Table 5 forecasts the total level of retail expenditure generated by the Porirua City market on an annualised basis from the years 2018 to 2048, as well as the levels of sustainable retail GFA that can be supported by the generated spend within the catchment on an annualised basis under Forecast id growth projections.

TABLE 5: RETAIL EXPENDITURE AND SUSTAINABLE GFA FORECASTS BY ANZSIC SECTOR

TOTAL RETAIL SPEND	2018	2023	2028	2033	2038	2043	2048	Net # Growth	Net % Growth
Food retailing	$192	$211	$228	$248	$271	$295	$320	$129	67%
Clothing, footwear and personal accessories retailing	$33	$36	$39	$42	$46	$51	$55	$23	69%
Furniture, floor coverings, houseware and textile goods retailing	$18	$20	$22	$23	$25	$28	$30	$11	61%
Electrical and electronic goods retailing	$25	$27	$29	$31	$34	$37	$40	$15	61%
Pharmaceutical and personal care goods retailing	$18	$20	$22	$24	$26	$28	$31	$12	65%
Department stores	$39	$43	$46	$50	$54	$59	$64	$25	66%
Recreational goods retailing	$20	$23	$24	$26	$29	$32	$34	$14	69%
Other goods retailing	$31	$35	$38	$41	$46	$50	$55	$23	74%
Food and beverage services	$87	$97	$105	$115	$127	$140	$153	$66	75%
Total	$464	$511	$553	$601	$658	$719	$782	$318	69%

TOTAL RETAIL GFA	2018	2023	2028	2033	2038	2043	2048	Net # Growth	Net % Growth
Food retailing	23,650	26,050	28,150	30,500	33,350	36,400	39,500	15,850	67%
Clothing, footwear and personal accessories retailing	5,700	6,300	6,800	7,400	8,100	8,850	9,650	3,950	69%
Furniture, floor coverings, houseware and textile goods retailing	6,400	7,000	7,500	8,100	8,800	9,500	10,300	3,900	61%
Electrical and electronic goods retailing	6,200	6,800	7,350	7,900	8,550	9,300	10,050	3,850	62%
Pharmaceutical and personal care goods retailing	2,650	2,900	3,150	3,400	3,700	4,000	4,350	1,700	64%
Department stores	13,800	15,200	16,400	17,750	19,350	21,100	22,850	9,050	66%
Recreational goods retailing	5,450	6,000	6,500	7,050	7,750	8,450	9,200	3,750	69%
Other goods retailing	7,150	7,900	8,600	9,400	10,350	11,400	12,450	5,300	74%
Food and beverage services	13,850	15,350	16,700	18,250	20,150	22,150	24,250	10,400	75%
Total	84,850	93,500	101,150	109,750	120,100	131,150	142,600	57,750	68%

Source: Property Economics, Forecast id

Porirua City is currently estimated to generate around $464m of retail expenditure per annum with this forecast to increase by 69% to $782m per annum by 2048, which is a net increase of around $318m by 2048 above the current base year.

For comparison purposes, under the Statistics NZ growth projections, by 2048, Porirua City's generated retail expenditure is expected to be at around $710m under a Medium scenario (around 14% lower than when applying the Forecast id growth scenario), and $848m under a High scenario (around 3% higher than when applying the Forecast id growth scenario).

The Food Retailing sector is the most significant retail sector within Porirua City, comprising of around 41% of total retail expenditure and is forecast to increase by a net $129m or 67% by 2048. This sector is dominated by supermarket retailing and sales, which typically accounts for around 75% of household spend in this sector. This is followed by the Food and Beverage Service sector. Both of these retail sectors combined around 60% of the total retail growth within Porirua City, making both these sectors significant 'players' within the city's economic market and future retail provision.

Currently, the total sustainable GFA within the city equates to around 85,000sqm (rounded) and is expected to grow to 142,600sqm by 2048. It is important to note that this is not the total retail GFA currently being supplied by the market, but rather the amount of GFA that can be sustained by Porirua City's generated spend irrespective of where retail supply is located, or if this total generated retail expenditure was internalised within Porirua City.

The retail expenditure and GFA forecasts for Porirua City are expected to grow at similar rates of 69% and 68% respectively over the next 30 years. The additional $318m generated by residents in Porirua City translates to an additional 58,000sqm (rounded) of retail GFA able to be sustained by Porirua City residents.

Under the Statistics NZ growth projections, by 2048, Porirua City's sustainable GFA is expected to be at around 129,500sqm under a Medium scenario and 154,600 under a High scenario.

It is important to note that the retail expenditure generated does not equate to the sales of retail stores within the catchment. Residents can travel in and out of the catchment freely, and they will typically choose the centres with their preferred range of stores, proximity and accessibility. A good quality / high performing centre will attract customers from beyond its catchment, whereas a low quality / low performing centre will have retail expenditure leakage out of its catchment. Therefore, the retail expenditure generated in a catchment represents the sales a centre or retail stores within the catchment could potentially achieve.

7. RETAIL SPENDING PATTERNS

Retail expenditure patterns have been assessed using retail transaction data sourced from MarketView - a service provided by the Bank of New Zealand (**BNZ**). BNZ MarketView data is based on the spending and retail transactions of BNZ credit and debit (EFTPOS) cardholders[3]. The MarketView data has been collected from a range of stores across the spectrum of assessed retailers in Porirua City, from national chains to small independent stores.

As a guide, BNZ currently holds approximately 20% market share of the electronic card market in NZ, while electronic card transactions accounts for approximately 60% of retail spending within NZ. The retail transactional data sources for Porirua City are based on the most recently available calendar year period of June 2016 – May 2017. This discreet period has been chosen as it is an annualised period thereby removing any seasonal variations, allows analysis of the most up to date data available, and is considered the best proxy for quantifying the current spending patterns of the markets.

Given the large sample size of BNZ card holders and prolific use of EFTPOS within NZ, MarketView data is considered to provide a robust and accurate depiction of the destination and origin of retail spending flows in and out of the Porirua City district, and hence has been used as a basis for this assessment.

MarketView data for the purpose of this report has been assessed in two ways to help gauge the level of retail expenditure '**outflow**' from each of the regions (i.e. 'destination' of Porirua City resident spending), and the level of retail expenditure '**inflow**' ('origin' of Porirua City spending).

For the purposes of analysis, at a high-level internet retailing has been excluded from the MarketView datasets in order to gauge a more accurate one-the-ground movement of retail dollars within the market. As Internet retailing is excluded from the Property Economics Retail Expenditure Model later analysis in this report can be matched with analysis in this report to form an estimate of net on-the-ground retail expenditure in an area.

Firstly, Property Economics take a helicopter view of Porirua City and reviews the retail spending patterns of the total assessed market. Secondly, the spending patterns of the City are assessed in order to understand how the market is currently operating, and the extent of the spending flow interactions.

---

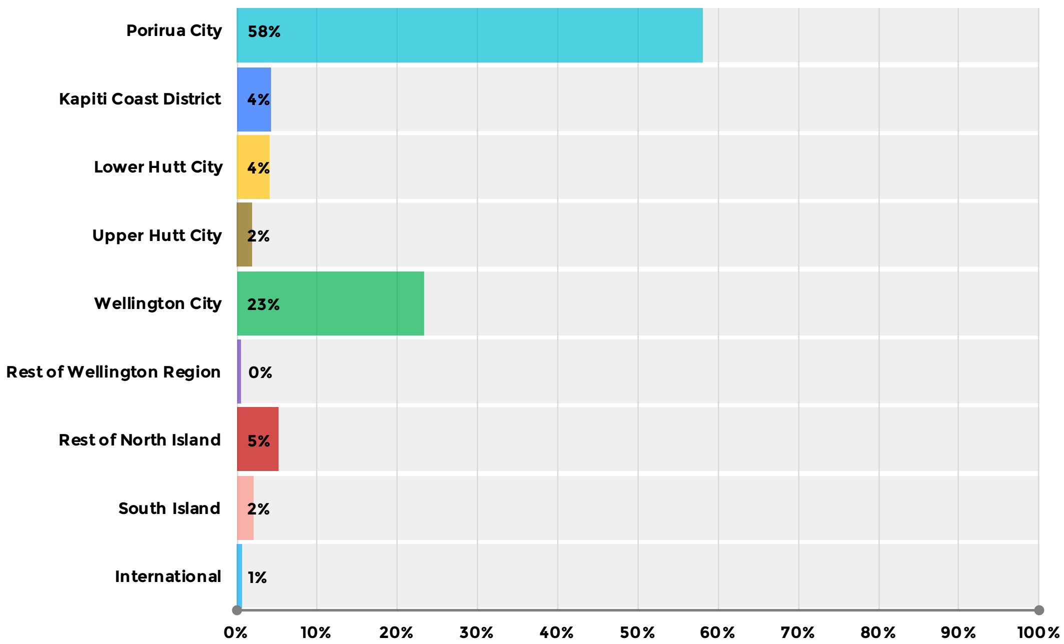
[3] *Market View data excludes business and corporate cards. The transaction values include GST, but exclude cash out with purchases. BNZ Market View does not pick up hire purchase, direct debit/credit payments or cash based spending.*

7.1. ORIGIN OF RETAIL SPEND

'Origin of retail spending' represents where retail spend within Porirua City is derived. In other words the areas where retail shoppers in Porirua City usually reside. This enables the quantification of the 'inflow' of retail dollars into Porirua City, and the origin composition of that inflow.

Figure 6 illustrates the origin of retail expenditure within Porirua City. For example, 58% of total retail expenditure spent within retail stores within Porirua City originate from Porirua City residents. While this may appear as a positive, indicating a moderate level of retention and inflow of retail expenditure, the Destination of Spending (assessed in the subsection following) shows a similar level of outflow to these other areas. Suggesting a more neutral net position in terms of the proportion of retail expenditure both comes into and goes out of Porirua City.

FIGURE 6: PORIRUA CITY ORIGIN OF SPEND



Source: Property Economics, MarketView

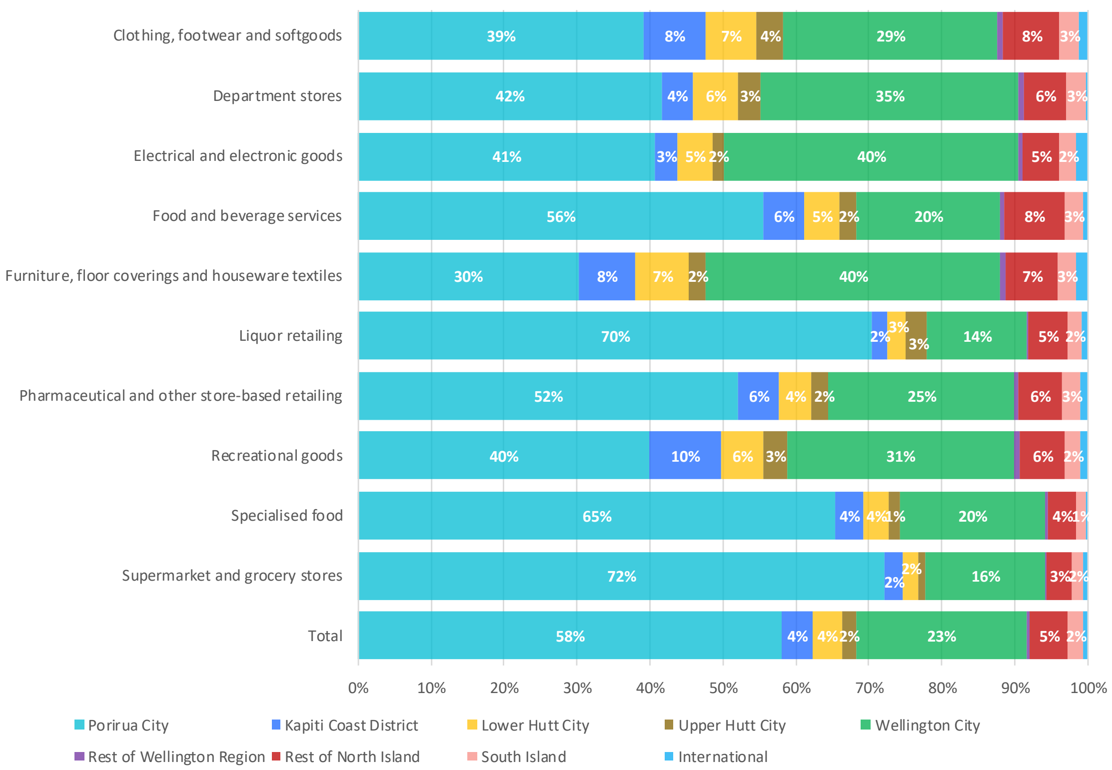
The retail spending pattern data shows a moderate 42% of retail sales within Porirua City originates from shoppers who reside outside of the localised area, with 23% originating from the neighbouring Wellington City and a further 10% originating from other districts within the Wellington Region. This high level of retail inflow from Wellington comes with associated risk to Porirua's market as future retail development in Wellington (i.e. proposed redevelopment of Johnsonville Mall) may attract some of this 'inflow' back to Wellington.

The relatively high inflow from the wider Wellington Region can be explained through a couple of reasons. First, that there are a significant number of Wellington City residents who work in Porirua City and as such increase the proportion of spending through 'drive-by traffic'. Second, it suggests that Porirua City may possess retail offers which attract retail customers to the area. A key sector group is large format retailing in Porirua, which is not well supplied in Wellington giving Porirua an advantage which Wellington finds difficult to counter with limited opportunities available for such development.

The 42% of spend within Porirua City that is derived from visitors outside the City represents a significant *'additional'* market for Porirua and, while not directly a part of Porirua's core economic market, indicates that Porirua has some ability to draw from areas outside of the localised market.

Figure 7 expands on Figure 6 by breaking down the origin of spend by retail sector, illustrating the demand for each Porirua's retail sectors respective of the district or region which it originates from. This is utilised to determine the retail sectors which attract the most demand from outside of Porirua City, as well as the retail sectors with less appeal.

FIGURE 7: PORIRUA CITY ORIGIN OF SPEND BY SECTOR



Source: Property Economics, MarketView

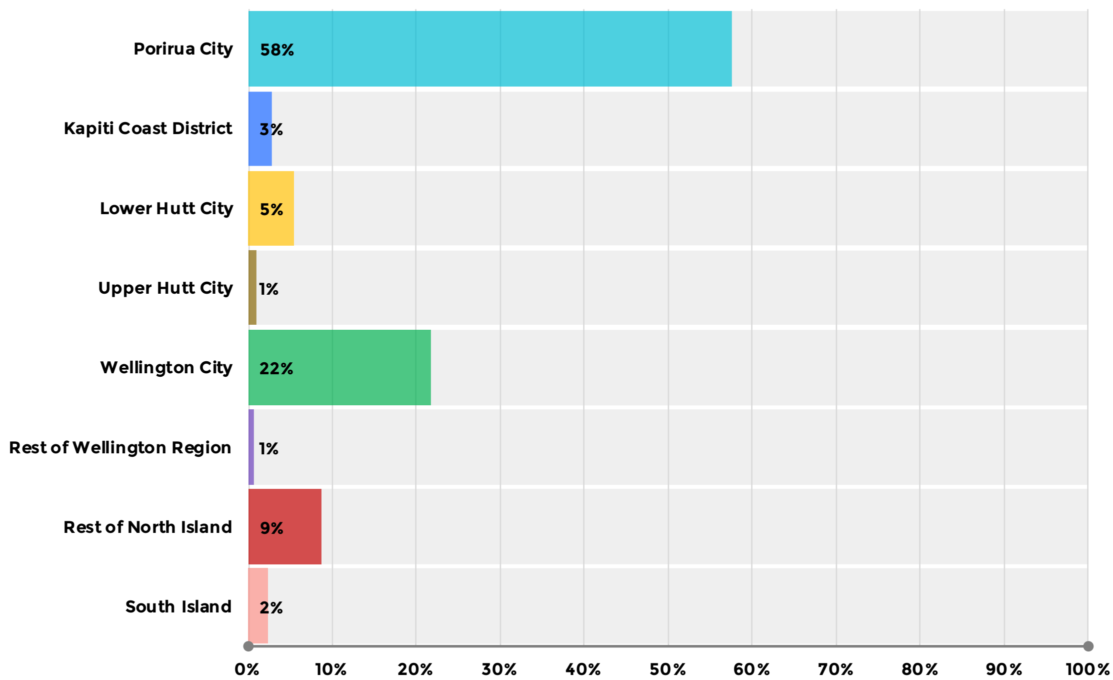
The retail sectors which attract the highest proportion of retail expenditure from outside of Porirua City (origin) include Furniture, floor coverings and houseware textiles (70%), Clothing, footwear and softgoods (61%), Recreational goods (60%), Electrical and electronic goods (59%) and Department stores (58%). These sectors, in particular, attract a higher proportion of retail expenditure from outside the catchment relative to the proportion that is generated by Porirua residents.

Porirua has a large enclosed mall, an environment Wellington City does not provide at this point, which is an attractive proposition for Wellington shoppers in the colder and wet winter months. Porirua's North City Mall also contains some key national banner anchor tenants that further enhance the attraction of Porirua including the Farmers and Kmart department stores.

7.2. DESTINATION OF SPEND

Destination retail spending is derived from identifying the locations where Porirua City residents spend their money on retail goods and services. This quantifies the 'outflow' of retail spend (retail leakage) from the Porirua City.

FIGURE 8: PORIRUA CITY DESTINATION OF SPEND



Source: Property Economics, MarketView

Figure 8 illustrates the proportional composition of retail patterns from Porirua City. In total, Porirua City currently captures a reasonably high 58% of retail spend generated within its core market. In real *'dollar'* terms, the Primary Catchment captures around $270m of the total $464m in retail expenditure that it generates per annum.

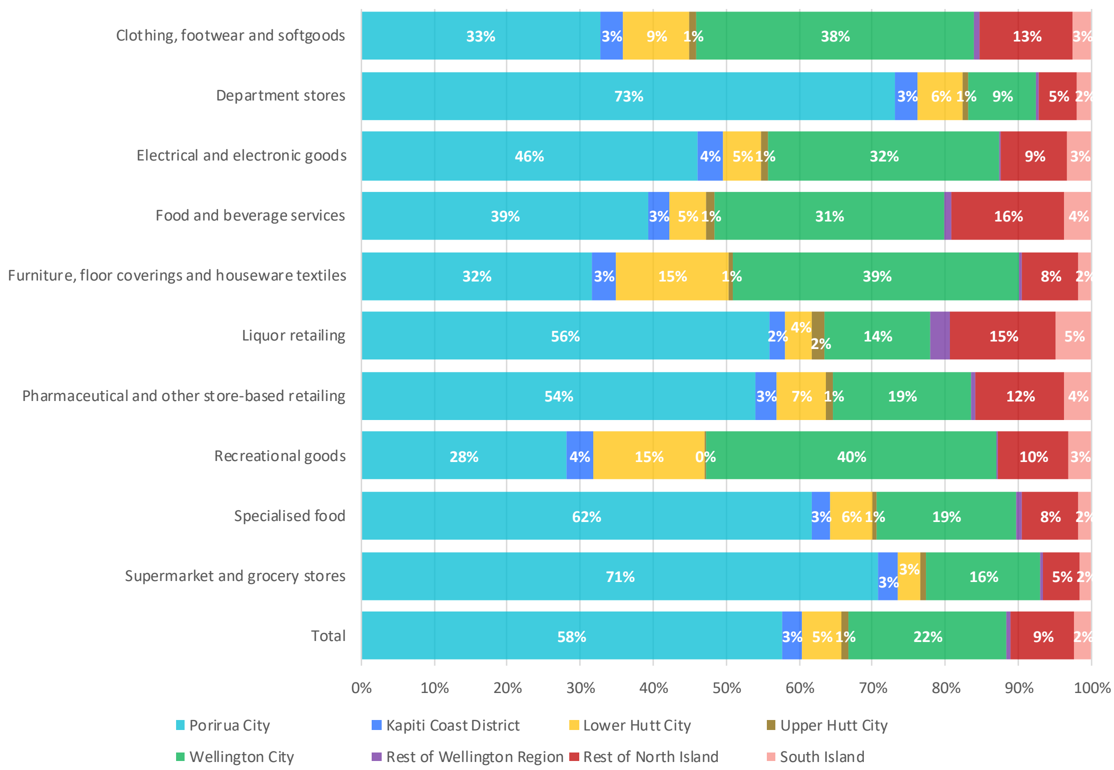
The largest competitor for Porirua City is Wellington City, as 22% of all retail dollars spent by Porirua residents are spent within Wellington City. However, this may be attributable to Porirua residents working in Wellington City and as such spend their income at centres close to their place of work.

The higher proportion of destination spend to the rest of the North Island and South Island compared to the origin spend (11% vs 9%, respectively) indicates that, while Porirua City is attracting some domestic tourism spend from around the country, there is a higher proportion of Porirua City residents choosing to travel to other parts of the country than people choosing to visit Porirua City.

Overall, Porirua City shows a net neutral position in regard to the proportion of retail expenditure that leaves and enters the localised market. While this is not necessarily a bad position to be in, the opportunity then arises for Porirua City to increase the amount of retail expenditure flowing into Porirua from other areas, by providing a more enticing, better quality built form, offer and environment that elevates the current retail shopping experience – a more retail oriented destination that encourages people to travel, stay longer and socialise, and return more frequently.

Figure 9 expands on Figure 8 by breaking down the destination of spend by retail sector, illustrating the demand generated by Porirua's retail sectors respective of the destination of the spend. This is utilised to determine the retail sectors which attract the most demand from Porirua City.

FIGURE 9: PORIRUA CITY DESTINATION OF SPEND BY SECTOR



Source: Property Economics, MarketView

From Figure 9 we can assess the level of internalisation[4] of each of the retail sectors within Porirua. The sectors which have a high proportion of internalisation indicates that these sectors are effectively and efficiently providing a retail provision in which Porirua residents want to shop. The opposite is also true in the sense that the higher the proportion of destination expenditure spent outside of Porirua City, the less competitive that sector is and shoppers find more enticing retail environment / provisions outside of the city.

Department stores have a strong internalised position within Porirua City as the sector has the lowest leakage comparatively at 27%, with 9% leaking to Wellington City and 6% leaking to Lower Hutt City. Department stores and other high retention sectors (such as Supermarkets and grocery stores, Furniture, floor coverings and houseware textiles, Clothing, footwear and softgoods and Food and beverage services) represent retail sectors which are highly competitive and service the retail needs of Porirua's residents effectively.

[4] *Retail expenditure generated in Porirua City and spent within Porirua City.*

The overall level of leakage indicates there is an opportunity for Porirua to grow retail sales and performance locally with an improvement in the quality of the offering, and not necessarily and increase in the quantity of the offering. This again is a reflection of the quality vs quantity position Porirua needs to focus on over the short to medium term. Porirua does not require 'more of the same' with an increased provision, but a step change improvement in the quality of the provision it already has.

District Plan policy development should be focused on *'looking after what you've got'* and improving the Porirua Central City provision and environment rather than enabling additional provision that would compete and potentially undermine the city centre further in terms of performance and investment.

Porirua City Centre (and surrounding commercial area) is one of the community's largest assets and is a critical economic engine of the City. District Plan policy needs to encourage reinvestment and redevelopment of the city centre, and Council facilitate development that advances the economic and social interests of the area and community. This investment required will be from both public and private sector interests, and is required to improve the competitiveness and attractiveness of Porirua as a business location.

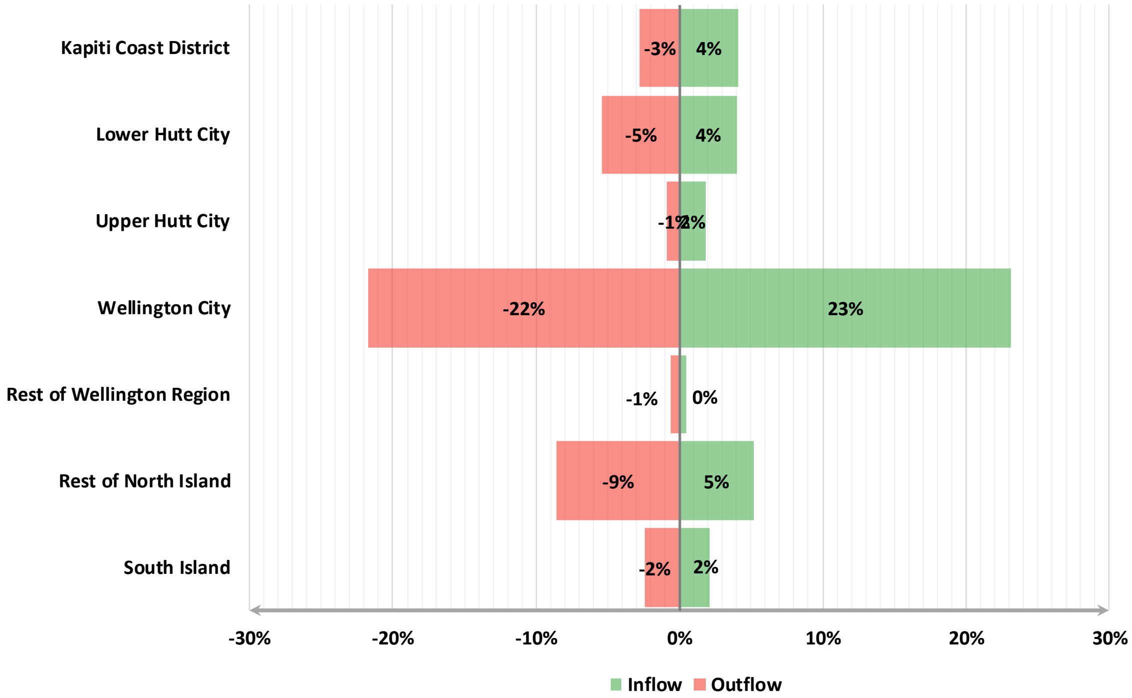
7.3. NET RETAIL FLOW POSITION

Assessing the proportional level of leakage or out flow of retail spend against the proportional inflow of retail spend entering the market quantifies the net flow position for the market as a whole. The net flow position for a market essentially represents the inflow combined with the retention that Porirua City currently achieves as a proportion of the total resident generated spend. This helps in identifying market potential and opportunities for Porirua City, and builds on the analysis in the previous two sections.

For the purpose of this analysis, this report compares retail inflow and retail outflow as a proportion of total spending or retail expenditure generated within Porirua City. This means that the outflow percentages represent spending as a proportion of what the Porirua generates, whereas inflows represent spending at retailers within Porirua City as a proportion of what the Porirua generates.

Figure 10 assesses the proportionally high level of inflow / outflow of retail dollars entering / exiting the Porirua City market geographically.

FIGURE 10: NET FLOWS FOR PORIRUA CITY BY MARKET



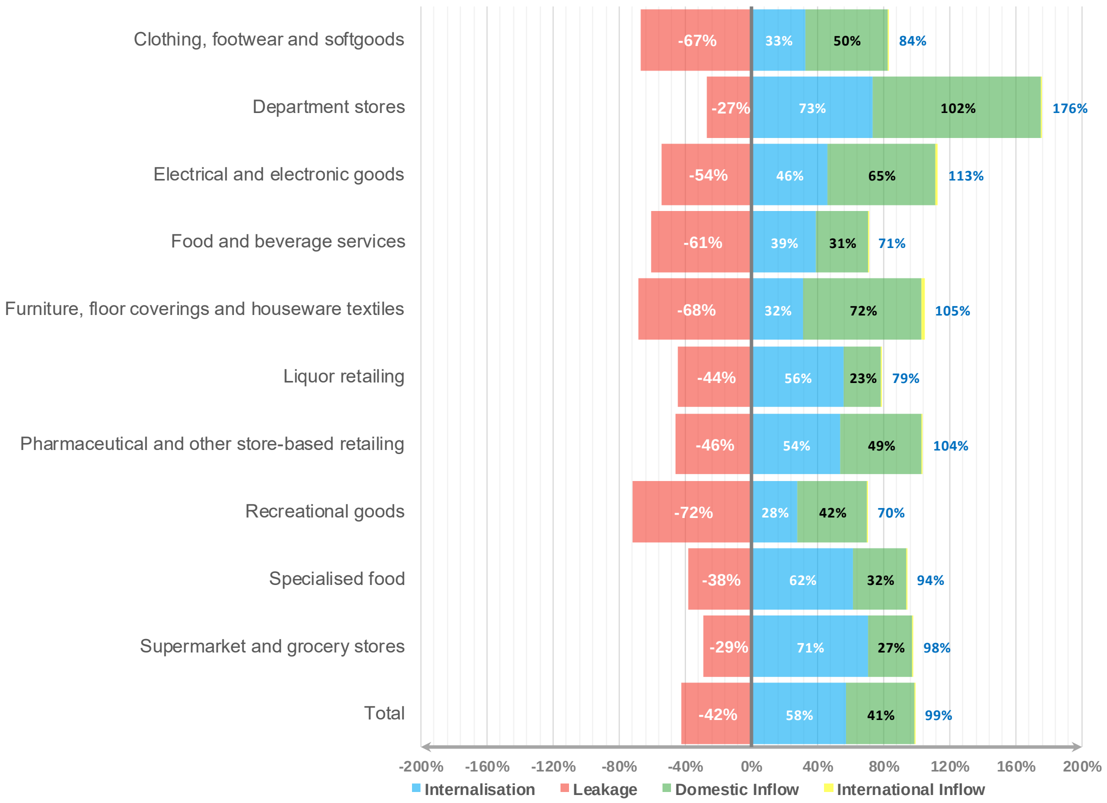
Source: Property Economics, MarketView

Similar to the previous section and as anticipated, the highest level of outflow is to Wellington City at 22%. However, this is offset by an inflow of 23%, indicating that, on average, Porirua has a net 1% inflow from Wellington City. This is also similar for the Kapiti Coast District.

The net flows for Porirua City results in a neutral net flow position against the regions displayed. However, the level of outflow indicates a strong market opportunity to better satisfy the local market. There will always be a proportion of outflow to Wellington, but the key is to keep this to a minimum to maximise the opportunity and benefit for Porirua.

Figure 11 further breaks down the net retail flows for Porirua City to illustrate the proportional level of leakage, internalisation, domestic and international inflow by sector.

FIGURE 11: NET FLOWS FOR PORIRUA CITY



Source: Property Economics, MarketView

To provide some context into the net flows:

- Internalisation is the proportion of Porirua City resident retail expenditure spent within Porirua City.
- Leakage is the proportion of Porirua City resident retail expenditure spent outside of Porirua City.
- Domestic Inflow is the proportion of retail expenditure spent within Porirua City from residents who's place of residence is outside of Porirua, relative to the total retail expenditure generated by Porirua residents.
- International Inflow is the proportion of retail expenditure spent within Porirua City from international tourists, relative to the total retail expenditure generated by Porirua residents.

There are several groupings of retailing activity that can be identified. First, convenience retail sectors such as Supermarkets and grocery stores, Specialised food and Liquor retailing are sectors where stores provide an almost homogenous product from shopper's perspective. Due to this spending within these sectors is more localised as shoppers have no material reason to travel further than their most convenient and accessible store / centre. Which is the reason why these sectors have a high internalisation rates for Porirua City.

Recreational goods and Clothing, footwear and softgoods, are comparison retailing items, which cater to specific tastes of the individual consumer. This means shoppers have a higher propensity to 'search' for the ideal product for their individual needs. This translates to a wider spread of where shoppers are spending their retail dollars, as shoppers are more willing to travel further afield for specific shops, brands and products.

While there is a high proportion of leakage within the Recreational goods and Clothing, footwear and softgoods sectors, the moderate level of domestic inflow suggest that these sectors provide aspects of retailing that shoppers outside of Porirua City find enticing enough to travel for.

Food and beverage services is both a convenience and a comparison product sector. As these activities can be considered both a necessity and luxury depending on price point, e.g. cafes, bars, restaurants and takeaways cater for casual through to fine dining. This sector has a net position of 71% within Porirua, indicating that Porirua earns a total of $71 for every $100 Porirua's residents spend on Food and Beverage services. While this is not necessarily an adverse position for the sector, measures should be made to decrease the level of leakage outside of Porirua with a better quality offer and dining experiences.

Retail sectors which have a net position of greater than 100% bring in a greater amount retail expenditure to Porirua City than what is being spent be residents outside Porirua City, such as Department stores, Electrical and electronic goods, Furniture, floor coverings and houseware textiles, and Pharmaceutical and other store-based retailing. For example, Department stores within Porirua earn $176 for every $100 of Department store retail expenditure generated by Porirua residents. Therefore, these sectors are highly competitive and provide a retail environment at a level higher than that being presented outside of the City.

Overall, the MarketView data indicates that Porirua City has a total net position of 99% of spend maintained, with 58% internalisation from its local residents spend. This represent a relatively neutral net position. To put these figures into perspective, out of every $100 that Porirua residents spend on retailing, $58 is spent within Porirua and $42 is spent outside of Porirua. Additionally, Porirua receives $41 from visitors from outside of the City, therefore, increasing the amount spent within the City to $99 for every $100 spent by Porirua residents.

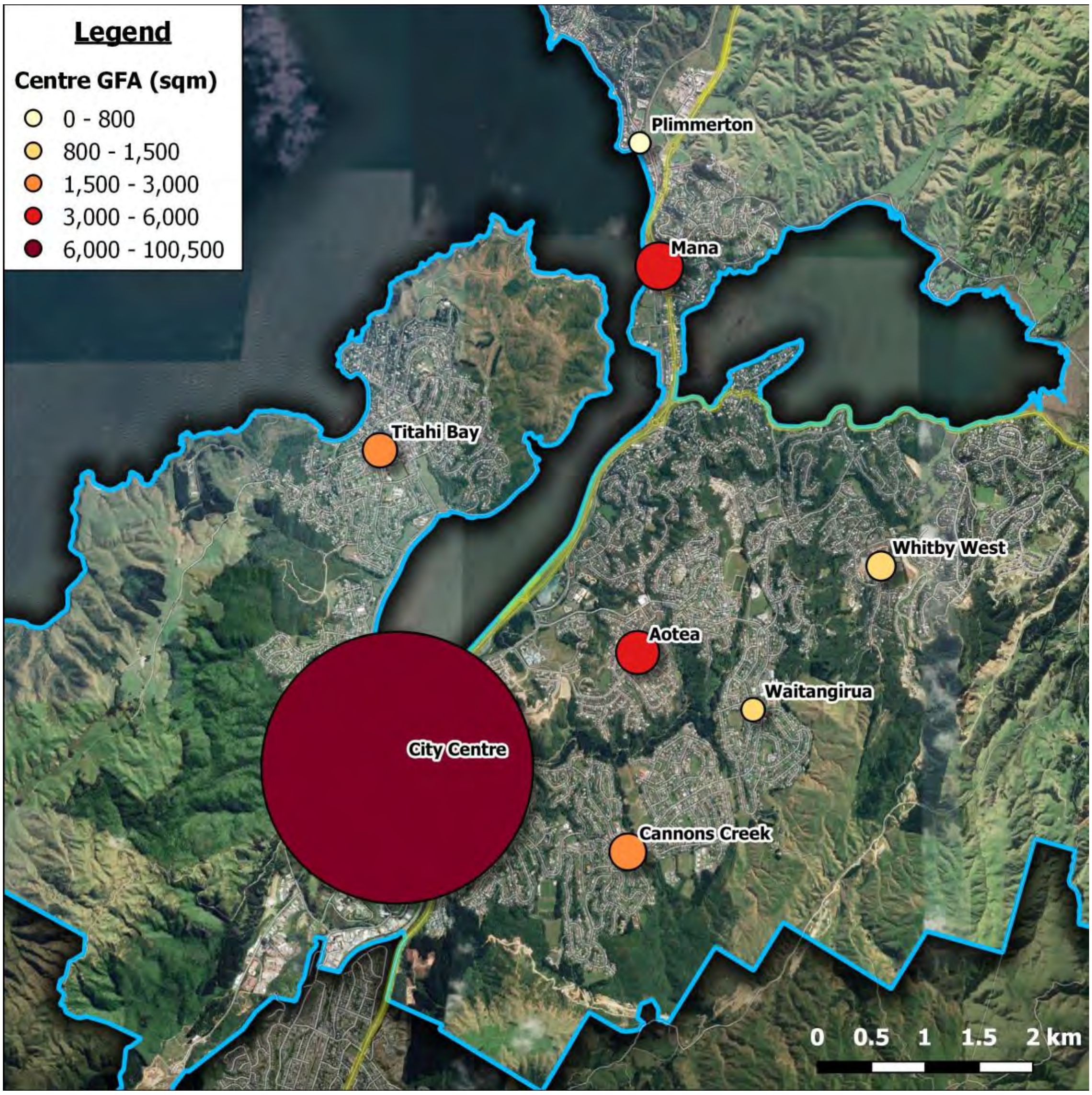
The key opportunity within Porirua City is then to assess the retail needs that aren't currently being met and providing a better-quality retail environment / provision which reduces the amount of local leakage to other areas. Which has the compounding potential to also increase the level of inflow to Porirua City.

8. EXISTING RETAIL SUPPLY

In July 2017, Property Economics undertook a retail audit of the Porirua retail centres in order to assess the current level of retail provision that exists within the City.

Within Porirua City, there are currently 309 retail stores within centres encompassing an estimated 121,500sqm GFA (rounded). Figure 12 shows the locations of the retail / commercial centres located in Porirua and their retail GFAs size bracket for context. This gives an indication of the proportional distribution of retail activity in the district, dominated by the Central City.

FIGURE 12: PORIRUA CITY RETAIL CENTRE DISTRIBUTION



Source: Property Economics, Google Maps

Table 6 shows the total nominal retail store count and GFA within Porirua, and the proportion of retail supply within each sector and splits retail stores and their GFA into three size brackets for each sector (0-499sqm, 500-999sqm and 1000sqm plus). This assists in a more in-depth analysis of the structure of the current retail supply within Porirua City by allowing a differentiation between Speciality and LFR store types. The results are displayed in terms of nominal store count and GFA of all retail tenancies within the centre by sector.

It is worth noting that the following survey information represents a 'snapshot' in time and retail stores are constantly opening, closing and relocating due to a variety of individual store and owner circumstances. In this regard, the retail market is dynamic and undergoing constant change.

TABLE 6: PORIRUA CITY RETAIL CENTRE SUPPLY BY SECTOR

ANZSIC06 RETAIL CLASSIFICAITONS	GFA (sqm)				Store Count			
	0-499	500-999	1000+	Total	0-499	500-999	1000+	Total
Supermarket			17,230	17,230			5	5
Other Food retailing	6,650	2,770	1,020	10,440	45	4	1	50
Clothing, footwear and personal accessories retailing	7,390	980		8,370	34	1		35
Furniture, floor coverings, houseware and textile goods retailing	2,070	2,540	5,330	9,940	11	4	2	17
Electrical and electronic goods retailing	390		3,860	4,250	1		2	3
Pharmaceutical and personal care goods retailing	1,270			1,270	8			8
Department stores			31,150	31,150			6	6
Recreational goods retailing	1,120	600	1,720	3,440	7	1	1	9
Other goods retailing	4,630	1,900	2,380	8,910	33	3	2	38
Food and beverage services	13,300	1,260	1,430	15,990	107	2	1	110
Vacant	5,230	850	4,430	10,510	25	1	2	28
Total	42,050	10,900	68,550	121,500	271	16	22	309
Total %	35%	9%	56%	100%	88%	5%	7%	100%

Source: Property Economics

In terms of proportional supply of retail GFA to the Porirua market, the Department Store retailing sector represent the largest proportion of market supply nominally accounting for just over a quarter (26%) of the total retail market at 31,150sqm. This is followed by Supermarket retailing at around 14% (17,230sqm) of the total retail GFA.

The Food and Beverage and Other Food Retailing sectors comprise of just over a half (52%) of the total number of stores within Porirua City combined. Additionally, these stores usually do not occupy relatively large amounts of GFA and mostly fall within the 0-499sqm per store category.

Clothing, Footwear and Personal Accessories Retailing is an important indicator for a centre's 'health' as a high order comparison good sector, a well-functioning centre will typically have a competitive number of Fashion stores that compete against higher order centres elsewhere. At 7% of the total retail GFA and 11% of Porirua's retail store composition, this is considered a slightly under an optimal provision but suggests that this sector is adequately represented within Porirua's retail environment. Again, the issue is not the level of provision, but ensuring the quality of the provision, environment and brands are satisfying market requirements.

There is a sizeable proportion of currently vacant retail stores identified by the retail audit. In total, vacant stores make up approximately 10,500sqm of retail GFA, representing 9% of total retail GFA and 9% of the total number of stores within Porirua. This suggests that Porirua City is struggling to some degree as close to a tenth of the total retail GFA and number of stores are not able to be sustained. Additional to this are the stores that are currently trading, but operating at low sales productivity levels which affects the quality of the offer and experience.

Specialty stores represent the core of Porirua's retail offer and are crucial for the City moving forward if its retail provision is to continue to play (and improve) its role and function successfully. At present a substantial 88% of the retail stores in the district are small (below 500sqm) specialty / finer grain retailers. However, these 'boutique' and often 'one off' stores only represent 35% of Porirua's total retail GFA.

Table 7 displays the current retail GFA and store count composition by centre within Porirua City. This allows for better understanding of the relative composition of retail supply and allocation along with the type of retail stores

TABLE 7: PORIRUA CITY RETAIL SUPPLY BY CENTRE

ANZSIC06 RETAIL CLASSIFICAITONS	GFA (sqm)				Store Count			
	0-499	500-999	1000+	Total	0-499	500-999	1000+	Total
Porirua City Centre	26,600	9400.00	64,400	100,400	146	14	20	180
Mana	2,550		1,350	3,900	18		1	19
Aotea	450		2,800	3,250	3		1	4
Cannons Shopping Centre	2,350			2,350	15			15
Whitby	1,450	900		2,350	10	1		11
Titahi Bay	1,450	600		2,050	13	1		14
Waitangirua	900			900	8			8
Plimmerton	730			730	10			10
Other Dispersed Retail	5,570			5,570	48			48
Total	42,050	10,900	68,550	121,500	271	16	22	309
Total %	35%	9%	56%	100%	88%	5%	7%	100%

Source: Property Economics

For Porirua, the City Centre is a clear dominant centre within the district accounting for 83% of the total centre retail GFA and 58% of the total number of stores. The most significant contributor to Porirua City Centre's GFA are LFR stores situated particularly at the northern end of the centre. Altogether, LFR within the City Centre contributes nearly two thirds (64%) of its total retail GFA. The Porirua City Centre is clearly Porirua's flagship centre, and the centre that in effect represents Porirua to the wider market.

In order to provide a more complete picture of Porirua City's retail environment, retail activity residing outside of the identified centres in Table 8 has been estimated based on the retail employment distribution within Porirua. With acknowledgment that retailing outside of centres typically have a lower employee to floorspace ratio due to lower site densities, a 25sqm per employee has been adopted to approximate the scale of out-of-centre retailing activity with in Porirua.

TABLE 8: PORIRUA CITY TOTAL ESTIMATED RETAIL GFA

	Estimated Retail ECs	Estimated Retail GFA
In Centre	2,209	121,500
Out of Centre	971	24,275
Total	3,180	145,775

Source: Property Economics

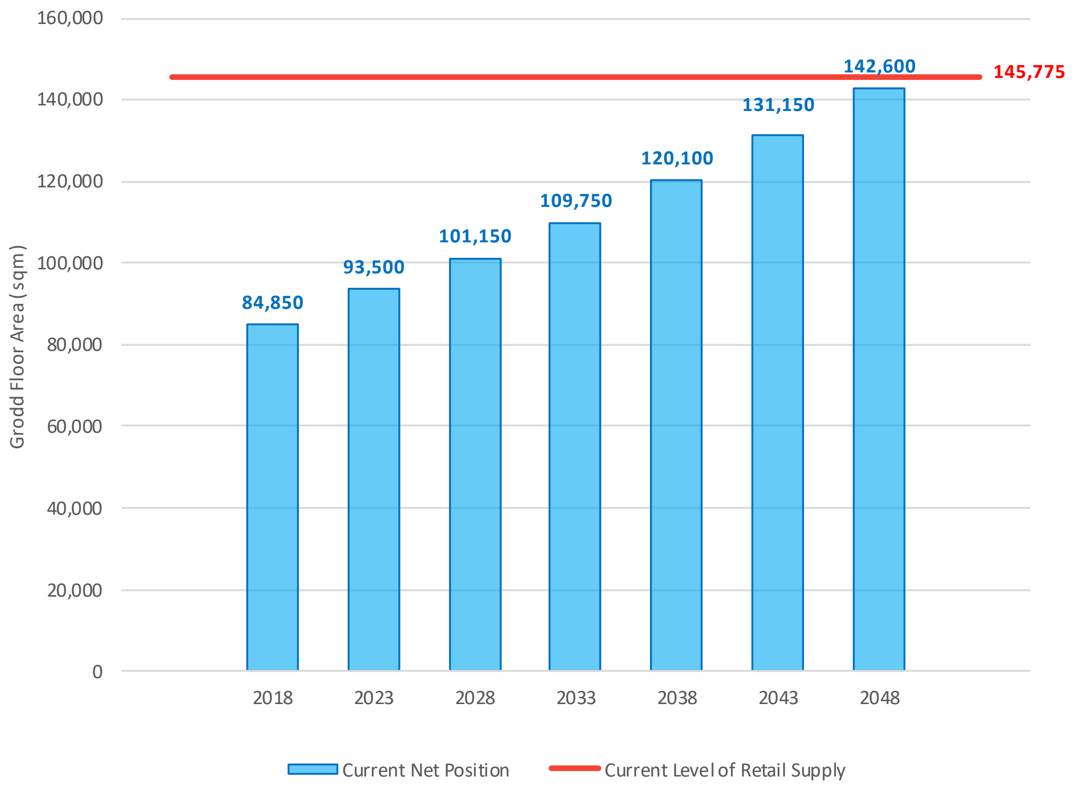
Adding measured in-centre supply to estimated out-of-centre supply provides an estimated total retail GFA provision for all retail activity within the district, and totals just under 146,000sqm GFA. This indicates that around 17% of all retail GFA supply is currently located in out-of-centre locations.

9. RETAIL SUPPLY AND DEMAND DIFFERENTIAL

To provide an overview of the current retail supply versus demand dynamics of the Porirua City market, this section compares the total existing Porirua retail provision outlined in earlier sections.

Figure 13 illustrates the total existing retailing supply versus the retail requirement (GFA) forecasted under the Property Economics REM growth scenario to satisfy future demand in the sectors within Porirua City to 2048.

FIGURE 13: RETAIL SUPPLY AND DEMAND DIFFERENTIAL 2017-2048



Source: Property Economics

The sustainable retail supply and demand differential indicates that there is currently an oversupply of around 61,000sqm of retail GFA within Porirua City. This surplus is not expected to meet demand levels until sometime around 2048. This confirms there is a large retail provision in Porirua not performing at good levels, with productivity levels that mean they are more surviving rather than thriving. This typically generates a higher level of retailer churn in a market.

There is currently 72% more retail GFA supplied to the Porirua City market than what is currently sustainable, indicating that the large number of retail stores are underperforming. This usually translates to lower quality retail environments, shopper experiences and low levels of investment in the built form and shop fitouts, and this lower quality environment comparatively is reflected on the ground in some parts of the Porirua City Centre in particular.

Porirua City has historically benefitted from low levels of competition, especially considering the high inflows within certain retail sectors and limited retail supply in Wellington City (versus demand generated). However, this low level of competition, coupled with the underperformance of many retail stores, sources a level of vulnerability if other areas outside of Porirua develop a better-quality retail proposition. For Porirua City Centre to be more competitive and reduce future expenditure leakage risk from new retail developments elsewhere (which would have a material effect on the local economy) reinvestment is required.

Therefore, the opportunity and strategy for Porirua City is to focus on quality over quantity in order to provide a better functioning, accessible and vibrant city centre with better quality retail and office provisions, retail store types / brands, centre environments and shopping experiences that leads to a transformational shift in the market's perception on the centre. This would result in a more efficient market (with less potential for local residents to travel elsewhere to undertake convenience shopping) and improve the social amenity and economic wellbeing of the overall City to the local communities it's designed to service.

10. NET RETAIL AND COMMERCIAL SERVICE GROWTH

This section assesses the influence of the spending patterns on the total future market opportunity / potential within Porirua City. Table 9 provides a breakdown of the additional retail and commercial service land requirement for the next 30 years including NPS buffer requirements. In order to determine net additional requirements over the NPS periods, nominal sustainable retail GFA levels with NPS margins applied to future demand, have been compared against existing retail supply (GFA) to determine net additional land requirements.

When translating this GFA requirement into land area, the 'at-grade' land requirements assumes that 90% the additional retail land requirement will be developed 'at-grade' and the balance (10%) will be 1st level space.

It is also important to 'factor in' the non-retail commercial functions of centres in any assessment of future potential as most centres are more than simply retail centres. They typically contain a variety of localised commercial services as outlined in Appendix 3. These activities can potentially comprise around 50% of successful centres when assessed at an individual centre basis, but at a wider city level account for approximately a third. For this reason, a 2:1 ratio for retail floorspace to commercial service has been adopted in this analysis, it has also been assumed that only 50% of commercial service activities will locate on at-grade premises. This means in terms of land requirements Commercial Service is estimated to be half of what is required to meet retail land requirements.

Table 9 presents the implications of net additional growth in respect of land requirements when assessed against sustainable retail and commercial service supply over the next 30 years. It is important to note that Porirua currently has a noteworthy oversupply of retail GFA when assessed against sustainable supply, resulting in no additional retail land being required until towards the end of the 30-year period, when demand catches up to the existing level of supply.

TABLE 9: PORIRUA CITY NET ADDITIONAL RETAIL AND COMMERCIAL DEMAND GROWTH

Retail GFA (sqm) - Nominal Requirement	3 Years	10 Years	30 Years
Current Supply	145,775	145,775	145,775
Sustainable Retail	93,500	101,150	142,600
Sustainable Retail Incl NPS Buffer	95,200	104,400	151,300
Sustainable Retail (incl NPS Buffer) vs Supply Differential	-50,575	-41,375	5,525
Land Requirements (ha) - Net Additional	**3 Years**	**10 Years**	**30 Years**
Retail	-	-	1.1
Commercial Service (50% At-Grade)	-	-	0.3
Retail & Commercial Service Total	-	-	1.4

Source: Property Economics

The analysis indicates that Porirua City has enough retail and commercial land to meet the projected growth in demand for at least the next 10-years. In the long-run, as market growth continues, this demand is expected to catch up to current supply in the long-term period taking into account the NPS-UDC buffer requirements. It is estimated that Porirua City may require an additional 1.4ha of retail / commercial zoned land in order to meet long-term demand including the NPS obligations. The appropriate location for a significant portion of is in the new growth cells that will occur within Porirua over the next 30 years to ensure convenience demand is appropriately satisfied, rather than a larger Central City area.

11. INDUSTRIAL AND COMMERCIAL SECTOR ANALYSIS

This chapter of the report assesses Porirua City's commercial and industrial markets, and evaluates the trends, size, distribution and composition of the different industrial and commercial ANZSIC[5] sectors that comprise the City's industrial and commercial economy.

This analysis will be used to forecast Porirua's future demand and business land requirements over the period to 2048 to guide PCC's long-term business land strategic planning processes.

11.1. EXISTING ZONED LAND CAPACITY

This section assesses the current quantum of zoned business land across Porirua as according to the District Plan, with Vacant land supply estimated based on unimproved parcels recorded in the Porirua Ratings Database provided by Council. It is Property Economics understand that commercial activity within Porirua is distributed across both commercial zoning areas with additional supported policy area overlays that overlap non-commercial zoned areas. For this reason, Table 10 shows both dedicated zoning areas and policy areas that comprise the overall commercial capacity of Porirua City.

For the purpose of analysis and maintaining consistency with the ratings database, the estimated land areas in Table 10 relate to rateable units only and subsequently exclude any roading that is represent within the business zone of which they relate. Due to this, some parking lots land areas have been omitted from the figures. Property Economics estimates that these omissions equate to around 1.2ha of vacant land available if the carparks within the Central City were to be redeveloped. Similarly, there is around 1.0ha of land utilised for car parking or undeveloped within Cannons Creek within the Suburban Shopping Centre Area that has also been omitted from Table 10 for the aforementioned reasons.

Australia New Zealand Standard Industrial Classification

TABLE 10: PORIRUA CITY BUSINESS LAND SUPPLY

Commercial Zones	Developed	Vacant	Total
Aotea Supermarket Zone	0.7	-	0.7
City Centre	38.5	1.4	39.8
Commercial Zone Total	**39.2**	**1.4**	**40.6**
Commercial Policy Areas	**Developed**	**Vacant**	**Total**
Suburban Shopping Centre	8.4	0.9	9.3
Aotea Mixed Use Policy Area*	-	0.5	0.5
Commercial Policy Area Total	**8.4**	**1.4**	**9.8**
Commercial Total	**47.6**	**2.8**	**50.4**
Industrial Zone	**123.7**	**26.1**	**149.8**

Source: Property Economics, PCC

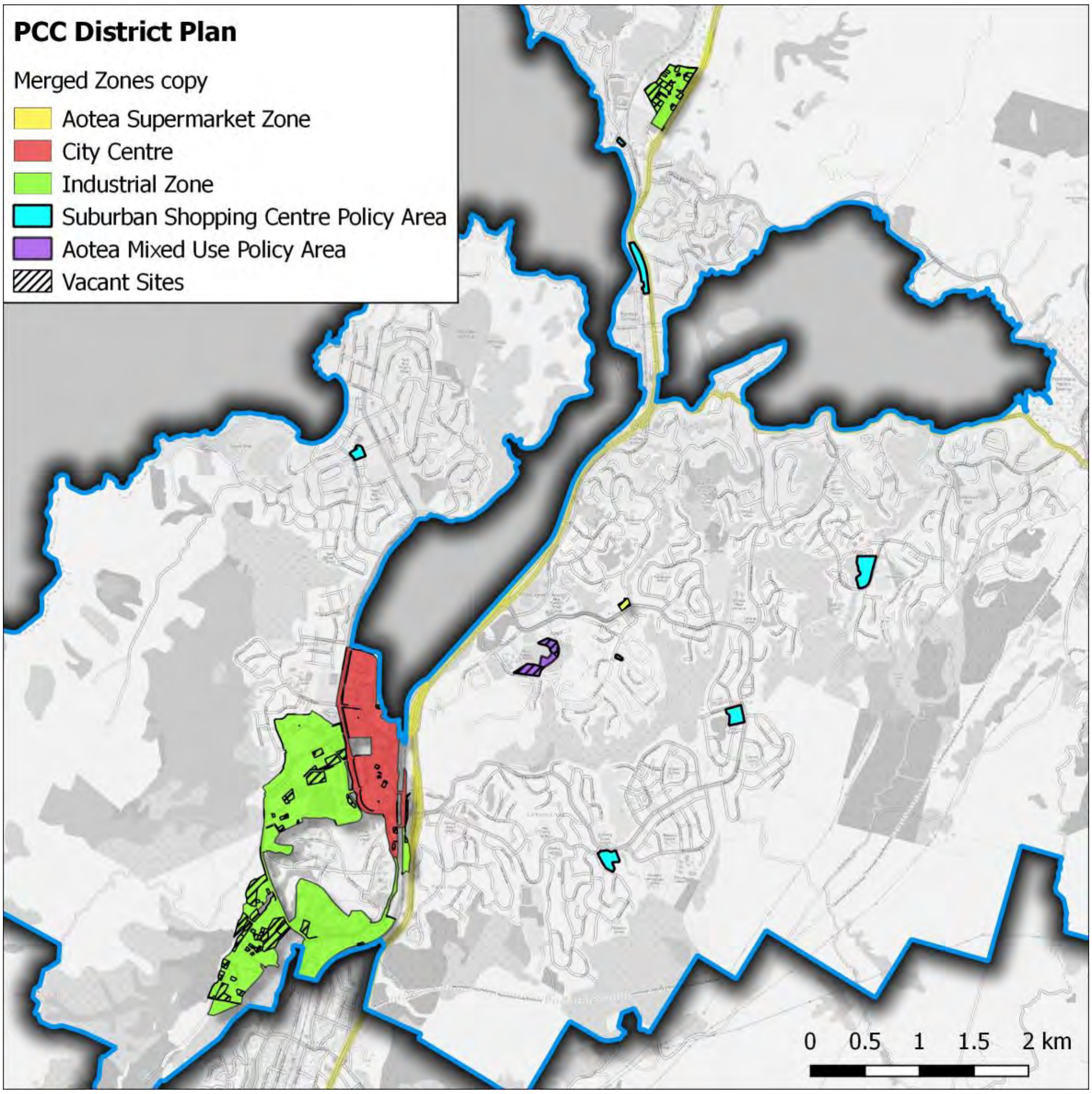
** Aotea Mixed Use Policy figures are based on post plan-change land figures*

At the time of writing this report Porirua City has 200ha of business zoned land, with vacancy level in the order of 15% or just over 29ha in total. The majority of vacant land is located on industrial zoned land which typically accommodates more land intensive activities. Table 10 indicates that over a fifth of industrial zoned land within Porirua City is currently vacant, or 26.1ha nominally.

Across Porirua City's commercial zones / areas, current vacancy levels are just over 50%, albeit this is largely due to the presence of the Commercial Recreation Policy Area (Baxter's Knob), which is designated for both a mix of commercial and residential activity with the intention to also preserve its natural attributes. In this regard, it is expected that while this area does facilitate commercial activity development, only a small portion of the area is planned to be utilised for commercial activity. It should also be noted that any inefficient land use or redevelopment opportunities on zoned land areas has not been accounted for in this report.

Figure 14 illustrates the distribution of zoned commercial land area show in Table 10 geospatially, with vacant sites also identified.

FIGURE 14: PORIRUA CITY COMMERCIAL LAND DISTRIBUTION



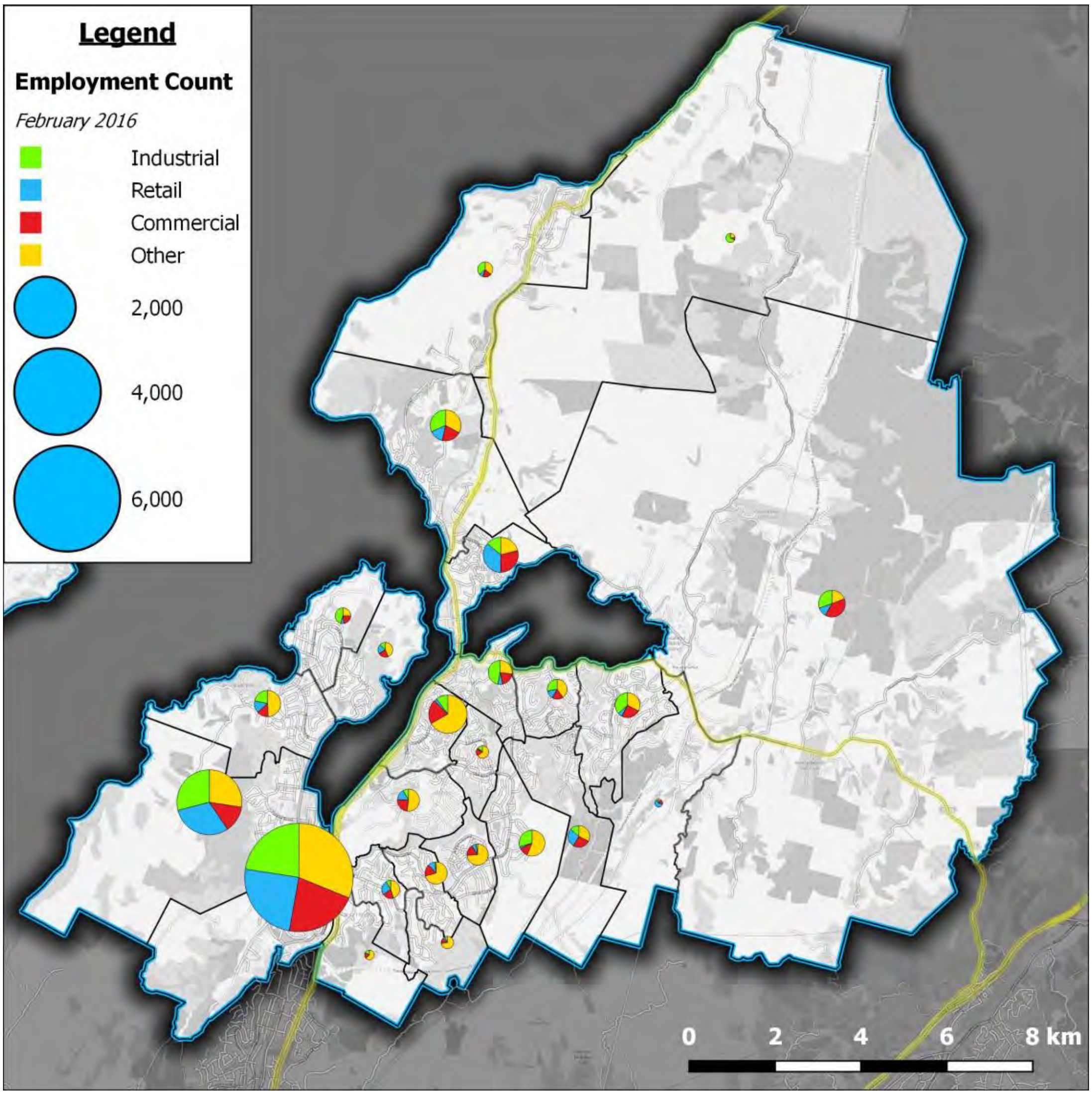
Source: Property Economics, Statistics NZ

11.2. GEOSPATIAL EMPLOYMENT DISTRIBUTION

Figure 15 illustrates the distribution of employment within Porirua City based on the most recent Statistics NZ business demographic counts, aggregated to a Census Area Unit level. This shows the concentration and composition of business activity within Porirua City, with the City Centre accommodating a range of Industrial, Retail, Commercial and Other services.

It is important to note that the figures utilised in Figure 15 include home offices and businesses that may be registered to a single location but predominately operate offsite or have no client facing premises. This leads to the wide distribution of employment located outside of the business zones identified areas.

FIGURE 15: PORIRUA CITY COMMERCIAL LAND DISTRIBUTION



Source: Property Economics, Statistics NZ

11.3. EMPLOYMENT COMPOSITION AND TEMPORAL TRENDS

Analysing the temporal employment trends within Porirua's different market sectors over the last 16-years is valuable as it shows trends over the whole property and economic cycle with three distinct periods - an economic 'boom' period, a market correction and period of economic recovery.

Property Economics utilise the most up-to-date version of Statistics New Zealand's Business Frame Data, Employment Counts with businesses assigned an industry sector according to their ANZSIC 2006 classification. For the purposes of this report classifications have been grouped into Industrial, Commercial, Other and Retail sectors that reflect the typical composition of employment on business zones. 'Other' employees refer to those working in businesses or organisations that would not typically be located on business zoned land. These include hospitals, schools, fire stations, community facilities, parks and recreation, etc.

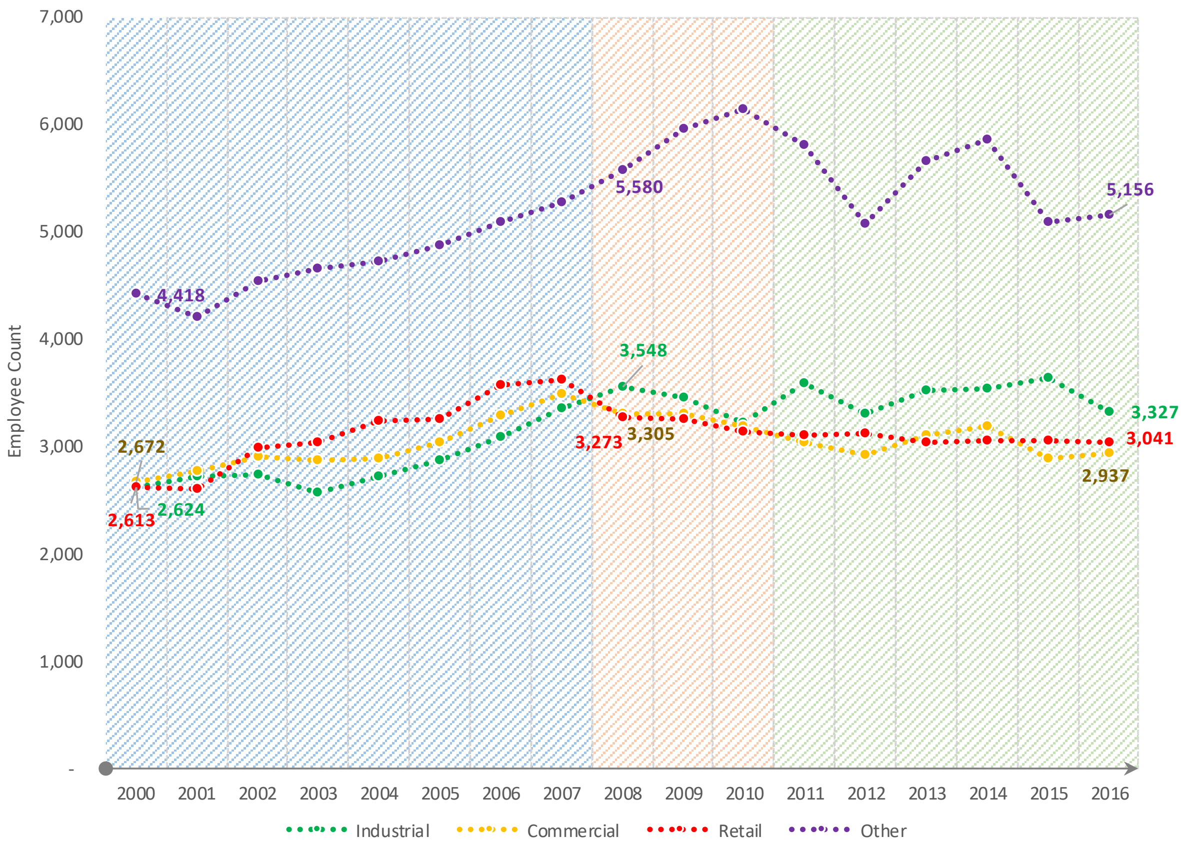
The ratios adopted for categorising the ANZSIC sectors into industrial, commercial, retail, etc., have been based on industrial sectors and have been compiled based on empirical data such as regional rating databases. These ratios can be found in Appendix 4, whereas Table 11 displays Porirua's temporal employment trends over the 2000-2016 period. These trends are subsequently displayed in Figure 16, which serves as a graphical representation of Table 11.

TABLE 11 PORIRUA TEMPORAL NET EMPLOYMENT TRENDS 2000-2016

Year	Industrial	Retail	Commercial	Other	Total
2000	2,624	2,613	2,672	4,418	12,327
2001	2,714	2,596	2,765	4,211	12,286
2002	2,730	2,990	2,902	4,542	13,164
2003	2,561	3,041	2,864	4,665	13,130
2004	2,714	3,243	2,892	4,717	13,565
2005	2,867	3,258	3,043	4,868	14,035
2006	3,085	3,578	3,285	5,089	15,035
2007	3,359	3,628	3,492	5,272	15,750
2008	3,548	3,273	3,305	5,580	15,705
2009	3,446	3,255	3,308	5,952	15,960
2010	3,227	3,139	3,186	6,149	15,700
2011	3,588	3,097	3,029	5,802	15,515
2012	3,310	3,114	2,919	5,067	14,410
2013	3,514	3,031	3,097	5,664	15,305
2014	3,541	3,048	3,186	5,851	15,625
2015	3,633	3,049	2,884	5,094	14,660
2016	3,327	3,041	2,937	5,156	14,460
Net # Growth (2000-2016)	703	428	265	738	2,133
Net % Growth (2000-2016)	27%	16%	10%	17%	17%

Source: Property Economics, Statistics NZ

FIGURE 16 PORIRUA TEMPORAL EMPLOYMENT TRENDS (2000-2016)



Source: Property Economics, Statistics NZ

Overall, Porirua City has experienced a net increase of 2,133 employees, equivalent to a net percentage increase of 17% above the City's 2000 employment base (i.e. 12,327 to 14,460 respectively). Most of this growth is derived from the Industrial and Other sectors, with each sector contributing 33% and 35% respectively to the City's Total employment growth. The Commercial sector contributed the least towards this growth at 12%, while the remaining 20% was contributed by the Retail sector. The proportion of Total employment growth provided by each of the sectors further exemplify the increasing importance of the Industrial sector to the Porirua economy as well as the continued dominance of the Other sector.

The 2000 – 2007 period represented a period of sustained economic growth or '*boom*' period within the global and national economy, which saw employment in Porirua experience a net increase of just over 3,400 employees, equating to 28% net employment growth over this 8-year period. Albeit, it appears the Porirua employment market is relatively isolated from the national economy to some degree e, given its comparatively low population and employment bases, employment trends are far more distinct from the national and global markets.

The 2008 – 2010 period highlights the economic downturn or 'bust' period driven by the economic fallout from the GFC[6] became embedded. While the Industrial, Retail and Commercial sectors saw decreases in employment numbers as businesses retrenched and cost cutting measures were implemented, the Other sector experienced a net increase by around 570 employees, continuing its growth from the previous period. Analysing the sub-sectors which make up the Other sector shows that this growth had been derived from Health Care and Social Assistance (a net increase of just over 410 employees).

The 2011 – 2016 period is a reflection of the business markets readjusting to the *'new post-GFC normal'* with employment movements fluctuating over the period, which is not unusual when markets are in the recovery stages from an economic downturn such as the GFC. While the Industrial, Retail and Commercial sectors remained at relatively similar levels in terms of their respective employment base, the Other sector dropped in employment numbers by around 650 employees or around 11%. This largely influenced the drop in the Porirua's Total employment base which decreased by around 1,050 employees (7%), most of which occurred within the last couple of years.

While the Total employment base has increased by a net 17% over the 2000-2016 period, Porirua has experienced a slight shift in its employment focus. The Industrial sector comprised of 21% of total employment in 2000, which has increased by a net 2% to 23% in 2016. Conversely, the commercial sector decreased by a net 2% over this period. Falling from 22% of total employment in 2000 to 20% in 2016. Suggesting an increase in importance of the Industrial sector to the Porirua economy and a decrease in importance for the Commercial sector. The Retail and Other sectors have remained stable at 21% and 36% of total employment.

A breakdown of Porirua's employment composition by industry is provided in Table 12.

Table 12 identifies the Education and Training, Health Care and Social Assistance, Retail Trade and Construction sectors as the most significant sectors within Porirua in 2016. Education and Training is the most dominant sector comprising of 18% of the total employment base, followed closely by the Retail Trade and Health Care and Social Assistance sectors, comprising of 16% and 15% respectively. The Construction sector adds a further 12% to Porirua's total employment base.

[6] Global Financial Crisis

TABLE 12 PORIRUA EMPLOYMENT TRENDS BY SECTOR 2000-2016

ANZSIC Sector	2000	2002	2004	2006	2008	2010	2012	2014	2016	Net # Growth	Net % Growth
A Agriculture, Forestry and Fishing	70	45	60	70	55	65	65	55	50	-20	-29%
B Mining	6	9	-	-	-	-	-	-	-	-6	-100%
C Manufacturing	1,250	1,200	1,050	1,050	990	980	860	870	980	-270	-22%
D Electricity, Gas, Water and Waste Services	21	50	25	25	40	35	45	50	40	19	90%
E Construction	620	780	880	1,150	1,600	1,450	1,500	1,800	1,450	830	134%
F Wholesale Trade	410	450	490	470	540	450	550	560	550	140	34%
G Retail Trade	1,950	2,250	2,350	2,600	2,550	2,450	2,400	2,300	2,250	300	15%
H Accommodation and Food Services	780	870	1,050	1,150	850	810	840	880	930	150	19%
I Transport, Postal and Warehousing	330	280	280	400	400	330	380	290	330	-	0%
J Information Media and Telecommunications	180	200	180	180	140	130	160	140	120	-60	-33%
K Financial and Insurance Services	120	150	170	180	180	140	180	120	140	20	17%
L Rental, Hiring and Real Estate Services	140	150	150	200	220	150	160	140	140	-	0%
M Professional, Scientific and Technical Services	700	940	880	970	770	770	710	750	680	-20	-3%
N Administrative and Support Services	340	210	200	280	440	320	340	400	450	110	32%
O Public Administration and Safety	550	640	720	970	1,050	940	780	860	820	270	49%
P Education and Training	2,250	2,300	2,550	2,500	2,800	2,950	2,550	2,700	2,550	300	13%
Q Health Care and Social Assistance	1,950	2,000	1,850	2,150	2,250	2,800	2,050	2,900	2,150	200	10%
R Arts and Recreation Services	230	210	230	200	310	330	300	290	240	10	4%
S Other Services	430	430	450	490	520	600	540	520	590	160	37%
Total All Industries	12,327	13,164	13,565	15,035	15,705	15,700	14,410	15,625	14,460	2,133	17%

Source: Property Economics, Statistics NZ

As well as being a significant contributor to Porirua's total employment base, the Construction sector experienced the strongest net growth as net employment numbers increased by 830 employees (134%) between 2000 and 2016. Subsequently, the Retail Trade and Education and Training sectors each increased by net 300 employees within the last 16-years, with Retail Trade growing by a slightly higher proportion (15% compared to 13% respectively).

The Manufacturing sector experienced the largest drop in net employment figures for the 2000-2016 period, with a decrease of 270 employees. This has resulted in a decrease in significance for Manufacturing in Porirua as it dropped from the 4th largest employer in 2000 to the 5th largest in 2016. However, the sector has seen increases in employment within the last couple of years, suggesting that there is a possibility of the sector reclaiming its former position in the future.

The net increase of 150 employees (19%) indicate that visitor numbers are increasing within Porirua City as the local, regional and national economies recover further from the last GFC and move into the new post-GFC normal phase.

The data trends presented in Table 12 indicate that Porirua City has experienced shifts in its employment demographics as the main Industrial, Retail, Commercial and Other sectors have seen increases and decreases in their respective sub-sectors over the last 16 years. Employment growth overall has been largely driven by support/service sectors. This can also indicate the shift in demand for these types of goods/services within Porirua City.

Table 13 provides a comparison of employment growth within Porirua City, Wellington Region and New Zealand on a percentage basis to enable the evaluation of the City's performance across different industry sectors over last 16 years relative to the wider Regional and National economies.

TABLE 13 COMPARATIVE EMPLOYMENT GROWTH

Employment Growth (%)	Porirua	Wellington	New Zealand
A Agriculture, Forestry and Fishing	-29%	-3%	18%
B Mining	-100%	143%	49%
C Manufacturing	-22%	-28%	-5%
D Electricity, Gas, Water and Waste Services	90%	82%	64%
E Construction	134%	59%	96%
F Wholesale Trade	34%	-17%	20%
G Retail Trade	15%	7%	24%
H Accommodation and Food Services	19%	39%	46%
I Transport, Postal and Warehousing	0%	-24%	7%
J Information Media and Telecommunications	-33%	-31%	-22%
K Financial and Insurance Services	17%	17%	36%
L Rental, Hiring and Real Estate Services	0%	11%	49%
M Professional, Scientific and Technical Servic	-3%	40%	68%
N Administrative and Support Services	32%	-9%	40%
O Public Administration and Safety	49%	70%	57%
P Education and Training	13%	36%	32%
Q Health Care and Social Assistance	10%	42%	48%
R Arts and Recreation Services	4%	19%	51%
S Other Services	37%	10%	33%
Total All Industries	17%	19%	32%

Source: Property Economics, Statistics NZ

Most noteworthy are the sectors that have grown within Porirua and decreased in the Wellington Region, such as Wholesale Trade and Administrative and Support Services. While these industries have moved out of Wellington and into other areas of NZ, Porirua has manged to capture a portion of this movement by offering enticing environments that these industries were not abundantly available elsewhere within the Wellington Region.

Additionally, the sectors in which have grown at a greater rate within Porirua compared to Wellington and NZ indicate that Porirua is one of the drivers of the regional and national growth. This includes industries such as Electricity, Gas, Water and Waste Services, Construction, Wholesale Trade and Other Services.

Wholesale Trade is particularly noteworthy due to the sector losing relevancy in the Wellington Region (decreasing by 17%), while increasing by 34% for Porirua and 20% for NZ as a whole. Suggesting that, while Wholesale Trade has lost relevancy in the wider Wellington Region, the sector has been a strong performer within Porirua compared to regional and national levels. This is similar for Administrative and Support Service, albeit the sector has not grown as fast as the national average.

Although Health Care and Social Assistance has been a pivotal driver of growth within Porirua and it's 3rd largest employer in 2016, the sector has not grown as fast as that in the Wellington region and NZ. Meaning that the sector within Porirua has been unable to capitalise on growing market and missed opportunities and potential which other areas in the Wellington region and NZ have secured.

One of the lowest performing sectors within Porirua is the Professional, Scientific and Technical Services sector which has decreased by 3%, but grown by 40% for the Wellington Region and 68% for NZ. Meaning that while this sector has experienced strong growth within the Wellington Region and more so on a national level, this sector has not found an environment in which it can grow in Porirua.

Despite the few sectors mentioned which have had positive growth, over the last 16-years, Porirua has lost relevance with respect to the wider Wellington Region and NZ as a whole and misses market opportunities and potential that other areas of New Zealand have secured. Porirua has seen 2% less potential growth (net) than the wider Wellington Region and 15% less than the New Zealand economy. Indicating the importance of, when looking forward from this point in time, ensuring that enough business land supply exists to facilitate future growth in these industries and enable the opportunity for Porirua City's core productive base and economy to expand and increase in relevance.

12. FUTURE INDUSTRIAL AND BUSINESS GROWTH

12.1. EMPLOYMENT AND BUSINESS SECTOR EMPLOYMENT FORECAST (2016-2048)

For the purpose of this analysis the employment growth (and subsequently land demand) is estimated under two different scenarios – trended and with a positive impact from the development of Transmission Gully. These scenarios will be based on the ability for Porirua to attract specific businesses based on their locational criteria. These will, in part, be based on:

- Labour Force projections (skilled / unskilled)
- Regional and local ability to accommodate growth, especially the potential relocation of business activity from the wider area.
- Porirua's relative business land supply and prices within the localised and national market
- Trended growth from at least the past 16 years at a Census Area Unit level
- Economic development directions
- Locational criteria by sector
- National / Regional and local supply of inputted goods and location of market
- Business sector analysis
- Changing working age

The resulting high-level output is set out in Section 11.2, providing two scenarios at a City level that will identify the total employment projections for a 3, 10 and 30-year (2021, 2028 and 2048) period within Porirua for each of the ANZSIC categories excluding Retail. Retail is assessed separately in this report through the Property Economics Retail Model.

The trended growth scenario for employment is estimated under Forecast id. population trends, estimated labour participation rates and a current trend of national significance. Trended scenario growth is estimated with a weighting towards current trends, in terms of retention and sector type, labour force participation rates and population. The Transmission Gully growth scenario is estimated under the assumption increasing Regional retention rates as well as increased inward accessibility and an increasing trend in national significance.

12.2. EMPLOYMENT PROJECTIONS

The projections in this section are based on the employment count for the Porirua City reported by Statistics New Zealand. Property Economics is aware that up to 30% of employees in any given area do not register the location of their job and therefore are not covered by this statistic. Additionally, sole traders often fall outside these statistics and have been considered in the following ratios. The ratios applied within this report are based on that shortfall and compensate for it in terms of relevant demand.

Table 14 outlines the employment growth forecasts for the City based on the past 16 years trends and national sector changes. This table indicates that total employment will grow by 3,100 EC's by 2048. This represents total growth of just over 20% over this period, with industrial employment growing at 3% and commercial office growing over 35% during the same period.

TABLE 14: TRENDED PORIRUA EMPLOYMENT PROJECTIONS TO 2048 BY SECTOR

	2000	2006	2013	2014	2015	2016	2018	2021	2028	2048
A Agriculture, Forestry and Fishing	70	70	70	55	65	50	55	55	50	50
B Mining	6	0	0	0	0	0	0	0	0	0
C Manufacturing	1,250	1,050	850	870	960	980	980	1,020	960	940
D Electricity, Gas, Water and Waste Services	21	25	55	50	55	40	40	50	55	60
E Construction	620	1,150	1,800	1,800	1,800	1,450	1,550	1,520	1,450	1,500
F Wholesale Trade	410	470	510	560	540	550	545	575	610	685
G Retail Trade	1,950	2,600	2,300	2,300	2,250	2,250	2,200	2,150	2,150	2,650
H Accommodation and Food Services	780	1,150	860	880	940	930	900	860	925	1,035
I Transport, Postal and Warehousing	330	400	330	290	310	330	340	320	285	285
J Information Media and Telecommunications	180	180	160	140	150	120	130	125	130	130
K Financial and Insurance Services	120	180	140	120	140	140	160	185	215	300
L Rental, Hiring and Real Estate Services	140	200	140	140	130	140	140	140	140	125
M Professional, Scientific and Technical Services	700	970	730	750	660	680	720	720	785	825
N Administrative and Support Services	340	280	350	400	410	450	460	495	515	615
O Public Administration and Safety	550	970	800	860	830	820	835	845	905	1,035
P Education and Training	2,250	2,500	2,550	2,700	2,500	2,550	2,500	2,450	2,600	3,150
Q Health Care and Social Assistance	1,950	2,150	2,850	2,900	2,150	2,150	2,185	2,255	2,450	3,585
R Arts and Recreation Services	230	200	290	290	200	240	235	230	235	285
S Other Services	430	490	520	520	570	590	610	595	655	625
Total All Industries	12,327	15,035	15,305	15,625	14,660	14,460	14,852	14,992	15,682	17,953

Source: Property Economics

Manufacturing is forecast to continue its overall fall in employment numbers while still representing a significant proportion of the City's economic output. Manufacturing diversification and product innovation are the *'buzz phrases'* at the moment seen to be the drivers of a growing manufacturing upskilling and capital utilisation.

Table 15 following outlines the projected employment base for Porirua under a Transmission Gully scenario which attracts an increasing proportion of activity from the wider region. It is important to highlight the significance of this is also included in the residential forecast provided by Forecast id.

This projection illustrates little change to the City's economy over the short term, but an increasing influence over the medium to long term with over 2,000 additional employees primarily in the industrial sectors.

TABLE 15: POTENTIAL (TRANSMISSION GULLY) PORIRUA EMPLOYMENT PROJECTIONS TO 2048 BY SECTOR

	2000	2006	2013	2014	2015	2016	2018	2021	2028	2048
A Agriculture, Forestry and Fishing	70	70	70	55	65	50	55	55	50	50
B Mining	6	0	0	0	0	0	0	0	0	0
C Manufacturing	1,250	1,050	850	870	960	980	980	1,020	1,094	1,166
D Electricity, Gas, Water and Waste Services	21	25	55	50	55	40	40	50	55	60
E Construction	620	1,150	1,800	1,800	1,800	1,450	1,550	1,520	1,581	1,980
F Wholesale Trade	410	470	510	560	540	550	545	575	665	904
G Retail Trade	1,950	2,600	2,300	2,300	2,250	2,250	2,200	2,150	2,279	3,048
H Accommodation and Food Services	780	1,150	860	880	940	930	900	860	925	1,035
I Transport, Postal and Warehousing	330	400	330	290	310	330	340	320	328	385
J Information Media and Telecommunications	180	180	160	140	150	120	130	125	130	130
K Financial and Insurance Services	120	180	140	120	140	140	160	185	215	300
L Rental, Hiring and Real Estate Services	140	200	140	140	130	140	140	140	140	125
M Professional, Scientific and Technical Services	700	970	730	750	660	680	720	720	785	865
N Administrative and Support Services	340	280	350	400	410	450	460	495	525	685
O Public Administration and Safety	550	970	800	860	830	820	835	845	905	1,035
P Education and Training	2,250	2,500	2,550	2,700	2,500	2,550	2,500	2,450	2,704	3,339
Q Health Care and Social Assistance	1,950	2,150	2,850	2,900	2,150	2,150	2,185	2,255	2,499	3,908
R Arts and Recreation Services	230	200	290	290	200	240	235	230	242	308
S Other Services	430	490	520	520	570	590	610	595	707	713
Total All Industries	12,327	15,035	15,305	15,625	14,660	14,460	14,585	14,590	15,829	20,034

Source: Property Economics

Under the trended scenario growth in Porirua City's employment was expected to be around 20% over the 30-year period, however the second scenario shows total growth of 37% for this period.

As stated the key growth sectors are in industrial activities with a growth rate of 3% climbing to 34% under this scenario.

The different results that are generated under the two scenarios highlights the sensitivity that Porirua City employment distribution experiences in relation to accessibility.

Commercial

The Commercial sector is forecast to have an employment base ranging between 3,953 and 4,174 by 2048. Historically, the commercial sector has remained constant in terms of its overall proportion of business activity over the last 16 years.

This is not unexpected as the commercial industry within Porirua has moved consistently with local growth based on population rather than Regional significance. As the population continues to increase as does age there is an increasing need for commercial businesses and professional services to service the population such as lawyers, accountants, and medical practitioners (in particular).

Industrial

The Industrial sector's employment base has seen particular shifts over the past 16 years. While its significance has increased the proportion of manufacturing has fallen while construction and construction services has seen healthy increases. While this sector is unlikely to see these sort of growth levels moving forward the industry itself is likely to see higher than average growth rates due to the increased accessibility and proportionally cheaper land supply.

13. BUSINESS LAND ESTIMATES

This section translates the employment forecasts (by category based on 2nd level ANZSIC categories) into land requirements based on dynamic employment to land ratios in line with the NPS UDC guidelines.

13.1. DEMAND ASSUMPTIONS

The following assumptions have been identified, regarding the preceding projections, to arrive at the total commercial, industrial and retail land demand requirements to 2048 for the Porirua catchment.

- Estimation of average business size and distribution through trended analysis
- A degree (sensitivity tested) of flexibility exists between the sectors undergoing decreases and those increasing within the boarder categories
- Structural changes underlying the employment projections will not fundamentally change the dynamic nature and trends associated with future employment to land ratios
- Current and expected supply of business land has been considered in the distribution and competitive levels associated with catchments (Districts) and sub-
- Current business land differentials have been considered in the distribution and competitive levels associated with catchments (Districts)
- Suitability and infrastructure requirements regarding business land have also been considered in the distribution of this distribution and growth.

The process undertaken by Property Economics, in assessing the potential spatial requirements for business activity, relies inherently on these EC projections.

The key component in translating these figures is the employment to floorspace/land ratios. Property Economics have developed these ratios based on national trends, both in terms of the current average ratio by sector and the dynamic trends that have occurred in terms of changes to these ratios through time. These ratios have been assessed against the Porirua activities specifically to arrive at an average floorspace and land requirement by sector.

The Property Economics ratios encapsulate the proportion of total homebased and 'out of zone' trends within the overall ratios, isolating the total amount of zoned land required to meet the projected level of activity.

Several of the industries have, and are expected to, seen significant shifts in floorspace to employee ratios. Several industrial sectors have seen growth in capital formation leading to more floorspace per employee, while commercial sectors have typically tending towards greater floorspace efficiencies.

Industrial Activity

Demand for industrial land originates from a number of changes in the Porirua economy. These include:

- Changes in economic composition
- Growth in industrial sectors
- Decline in industrial sectors
- Changes in land requirements by product and employee
- Changes in industry practice
- Price of industrial land (Quantity demanded)
- Competing uses.

A key aspect of the influence of declining and growing industrial sectors is their ability to utilise either underutilised or vacant premises. This is when an industrial sector declines in activity the ability for growing sectors to utilise potentially vacant premises. This flexibility 'factor' plays a significant role in the level of additional industrial land required. Over time it is expected that this flexibility becomes 'perfect' with either new industrial activity utilising the space or viable commercial/other activities occupying and redeveloping the space. However, this flexibility only tends to perfect with less flexibility over the short term (with new business having to potentially demolish old premises with existing greenfield or vacant options this is less likely in the short run).

A further consideration in the industrial land requirements is the NPS UDC PC1 requirements allowing for a 'buffer' between demand and supply so that the market can operate efficiently. PC2 of the NPS identifies that there may be occasions to increase this buffer given indicators in the market. Property Economics do not believe that the business market in Porirua represents a unique situation that would warrant consideration of a buffer greater than the 20% short to medium term and 15% long term outlined in the NPS.

Additionally, consideration of a position that does not require the complete flexibility of declining sector space considers a low opportunity for redevelopment and repurposing.

Historical uptake rates are illustrated through building consents for both industrial and commercial floorspace.

Table 16 shows the aggregated building consent data by nominal consents, consent floorspace (in square metres) and the value of these consents for Porirua City over the 2000 – 2016 period[7]. This provides an overview of on-the-ground development that has occurred over the last 16 years with insight into the scale, scope and regional distribution of activity in terms of new business development.

During the 2000 to 2016 period, Porirua consented a total 363 building non-residential building consents totalling 157,600sqm at a value of $114.3m. On average, 21 non-residential building consents were granted for each year, equalling to an average of 9,300sqm to the value of $6.7m. The Industrial sector contributed the largest relative proportion of new building consents, totalling $62.8m and 87,100sqm over 146 individual consents.

TABLE 16 PORIRUA CITY TOTAL BUILDING CONSENTS 2000-2016

	Number of Buiding Consents					Building Consents Floorspace (sqm)				
Year	Commercial Office	Industrial	Other Non-Residential	Retail and Commercial Service	Total	Commercial Office	Industrial	Other Non-Residential	Retail and Commercial Service	Total
2000	2	8	8	6	24	1,193	2,018	1,322	2,731	7,264
2001	2	9	5	5	21	122	6,076	573	12,405	19,176
2002	-	9	9	4	22	-	3,580	901	952	5,433
2003	3	5	10	5	23	1,845	1,842	1,234	3,110	8,031
2004	5	5	7	6	23	793	2,963	1,247	6,247	11,250
2005	3	11	3	6	23	735	5,268	718	1,294	8,015
2006	1	12	13	8	34	83	9,072	2,244	443	11,842
2007	1	11	15	1	28	95	7,413	2,077	126	9,711
2008	1	16	8	3	28	334	15,697	1,794	900	18,725
2009	-	7	6	4	17	-	9,448	804	420	10,672
2010	1	15	6	1	23	12	10,949	603	116	11,680
2011	2	6	6	3	17	3,363	4,672	774	877	9,686
2012	2	6	3	7	18	465	1,996	149	2,466	5,076
2013	-	5	11	4	20	-	733	2,601	8,638	11,972
2014	-	2	4	1	7	-	1,087	572	154	1,813
2015	2	12	3	3	20	137	2,424	478	706	3,745
2016	2	7	5	1	15	628	1,904	892	70	3,494
Average	2	9	7	4	21	577	5,126	1,117	2,450	9,270
Total	27	146	122	68	363	9,805	87,142	18,983	41,655	157,585

Source: Property Economics, Statistics NZ

[7] *Provides data on new consents only, and does not include expansions.*

TABLE 17 PORIRUA CITY TOTAL BUILDING CONSENTS 2000-2016 ($)

Year	Value of Building Consents				
	Commercial Office	Industrial	Other Non-Residential	Retail and Commercial Service	Total
2000	$1,175,000	$764,269	$136,489	$2,817,000	$4,892,758
2001	$66,000	$2,117,500	$176,393	$9,425,000	$11,784,893
2002	$0	$1,010,000	$123,100	$608,900	$1,742,000
2003	$1,612,000	$541,000	$314,000	$1,320,000	$3,787,000
2004	$683,000	$1,215,000	$212,820	$5,665,000	$7,775,820
2005	$545,000	$3,055,250	$110,000	$1,071,000	$4,781,250
2006	$80,000	$7,596,390	$436,250	$369,999	$8,482,639
2007	$100,000	$4,304,000	$480,050	$120,000	$5,004,050
2008	$360,000	$10,330,820	$405,550	$1,610,000	$12,706,370
2009	$0	$4,634,952	$197,713	$483,000	$5,315,665
2010	$15,000	$16,526,185	$149,162	$120,000	$16,810,347
2011	$5,000,000	$3,304,527	$168,000	$1,425,000	$9,897,527
2012	$850,000	$1,555,675	$34,600	$2,646,000	$5,086,275
2013	$0	$664,921	$640,120	$6,430,000	$7,735,041
2014	$0	$662,000	$149,946	$190,000	$1,001,946
2015	$300,000	$2,708,000	$109,500	$900,000	$4,017,500
2016	$1,326,950	$1,830,000	$257,000	$100,000	$3,513,950
Average	$712,526	$3,695,323	$241,217	$2,076,523	$6,725,590
Total	$12,112,950	$62,820,489	$4,100,693	$35,300,899	$114,335,031

Source: Property Economics, Statistics NZ

LAND REQUIREMENT

For the purposes of this report Tables 18 and 19 outline the two growth scenarios and the positions of land requirement. Table 18 shows the total land requirement necessary to accommodate all new growth. It illustrates minimal nominal growth over this period (this does not mean no industrial growth but that the productivity rates are likely to result in decreased demand for employees in these sectors). However, given the changes in land requirements the total land area to 2048 for Porirua is expected to be 26 hectares.

It is important to note, while considering the flexibility of this space, that much of the land area and to a degree floorspace utilised for this transitory activity is likely to be flexible.

TABLE 18: TRENDED INDUSTRIAL LAND REQUIREMENTS (2048)

Trended		
Employment	*Current*	3,433
	Trended	3,445
Employment Growth	*3-Year Growth*	23
	10-Year Growth	-106
	30-Year Growth	13
Floorspace Requirements	*3-Year Growth*	5,500
	10-Year Growth	16,000
	30-Year Growth	60,000
Land Requirements (Ha)	*3-Year Growth*	1
	10-Year Growth	5
	30-Year Growth	18
Infrastructure Requirements (Ha)	*3-Year Growth*	1
	10-Year Growth	6
	30-Year Growth	23
NPS REQUIREMENT (Ha)	*3-Year Growth*	1
	10-Year Growth	7
	30-Year Growth	26

Source: Property Economics

Table 19 shows a similar output while considering the potential effect of Transmission Gully on the level of business activity attracted to Porirua City. This shows industrial employment growth of just over 1,000 additional employees requiring some 63 hectares to accommodate the growth and change in these industries.

TABLE 19: TRANSMISSION GULLY INDUSTRIAL LAND REQUIREMENTS (2048)

Transmission Gully		
Employment	*Current*	3,433
	Positive	4,458
Employment Growth	*3-Year Growth*	23
	10-Year Growth	257
	30-Year Growth	1,025
Floorspace Requirements	*3-Year Growth*	5,500
	10-Year Growth	42,500
	30-Year Growth	146,700
Land Requirements (Ha)	*3-Year Growth*	2
	10-Year Growth	12
	30-Year Growth	42
Infrastructure Requirements (Ha)	*3-Year Growth*	2
	10-Year Growth	16
	30-Year Growth	54
NPS REQUIREMENT	*3-Year Growth*	2
	10-Year Growth	19
	30-Year Growth	63

Source: Property Economics

By 2048 the employment projections expect industrial activity to be approximately the same as the current levels. However, three factors have the potential to influence land demand beyond these changes. As alluded to above there are expected to be compositional changes within the industrial sector that will change the land requirements, both in terms of quantum and in terms of locational attributes. Additionally, land requirements per employee have, and are expected to, change over time, with commensurate changes in flexibility.

The resulting industrial land requirements for Porirua City component is likely to be between 1 and 3 hectares in the short term, extending to between 26 and 63 hectares by 2048 (including both an infrastructure requirement and the 15% NPS buffer).

COMMERCIAL OFFICE ACTIVITY

The Porirua commercial sector has grown in relation to its population over the past 16 years. With sectors such as public administration and healthcare growing at a greater rate than the typical commercial office sector. However, employment growth projections would suggest that over all commercial office will grow faster (by employment) than most other sectors in the next 30 years.

Once again, the distribution of commercial office activity is predicated on both the amenity within commercial zones (along with profile) and the appropriate supply and pricing of commercial land and premises.

Unlike industrial space however there is a much greater uniformity to the properties occupied by commercial office activities and so the level of flexibility within the industry both between businesses and the ability for premises to be 'divided' is significantly greater than that within industrial activities.

A key variance between floorspace requirement and land requirement is the number of storeys associated with a given area. For the purposes of this report estimates on building footprint to building floor area has been used, on average. Additionally, this activity can locate above ground floor retail or commercial services, as such a component of commercial office land demand has been accounted for with regard to the demand for other 'commercial' activities.

Table 20 illustrates the total demand for commercial office floorspace and associated land area at a gross, or 'at grade' level. This shows growth in the commercial office sectors of nearly 1,000 EC's over the long term 30-year period. This translates to a total land requirement of 8 hectares of 'at grade' land including infrastructure and the NPS 15% buffer.

TABLE 20: TRENDED OFFICE LAND REQUIREMENT (2048)

Employment	*Current*	3,017
	Trended	3,953
Employment Growth	*3-Year Growth*	61
	10-Year Growth	285
	30-Year Growth	935
Floorspace Requirements	*3-Year Growth*	1,500
	10-Year Growth	7,500
	30-Year Growth	28,000
Land Requirements (Ha)	*3-Year Growth*	0
	10-Year Growth	2
	30-Year Growth	6
Infrastructure Requirements (Ha)	*3-Year Growth*	0
	10-Year Growth	2
	30-Year Growth	7
NPS REQUIREMENT (Ha)	*3-Year Growth*	1
	10-Year Growth	2
	30-Year Growth	8

Source: Property Economics

A further consideration, with regard to commercial office space, is the fact that often development of this space will occur above either ground floor retail or commercial services. In assessing, therefore, the total demand for commercial space it is important not to double count this demand as the commercial office component has the potential to add vertical floorspace to the existing footprint rather than adding additional commercial land demand. The final tables below assess the total expected commercial land demand based on both a higher average building and the potential for 40% of all commercial office floorspace to be accommodated within buildings with a retail or commercial service activity on the ground floor.

Currently an average of 2.1 storeys can be expected within the commercial zones within Porirua. This results in an additional demand of 2.3 hectares of commercial land required to accommodate commercial office growth.

NB: It is important to note that this has not included the level of currently vacant commercial office space.

Table 21 summarises the commercial land requirement under the Transmission Gully scenario with growth of nearly 1,200 employees it results in a land demand of 10 hectares

TABLE 21: TRANSMISSION GULLY COMMERCIAL LAND REQUIREMENT (2048)

Employment	*Current*	3,017
	Positive	4,177
Employment Growth	*3-Year Growth*	61
	10-Year Growth	263
	30-Year Growth	1,160
Floorspace Requirements	*3-Year Growth*	1,600
	10-Year Growth	9,000
	30-Year Growth	34,000
Land Requirements (Ha)	*3-Year Growth*	0
	10-Year Growth	2
	30-Year Growth	8
Infrastructure Requirements (Ha)	*3-Year Growth*	0
	10-Year Growth	2
	30-Year Growth	9
NPS REQUIREMENT	*3-Year Growth*	1
	10-Year Growth	3
	30-Year Growth	10

Source: Property Economics

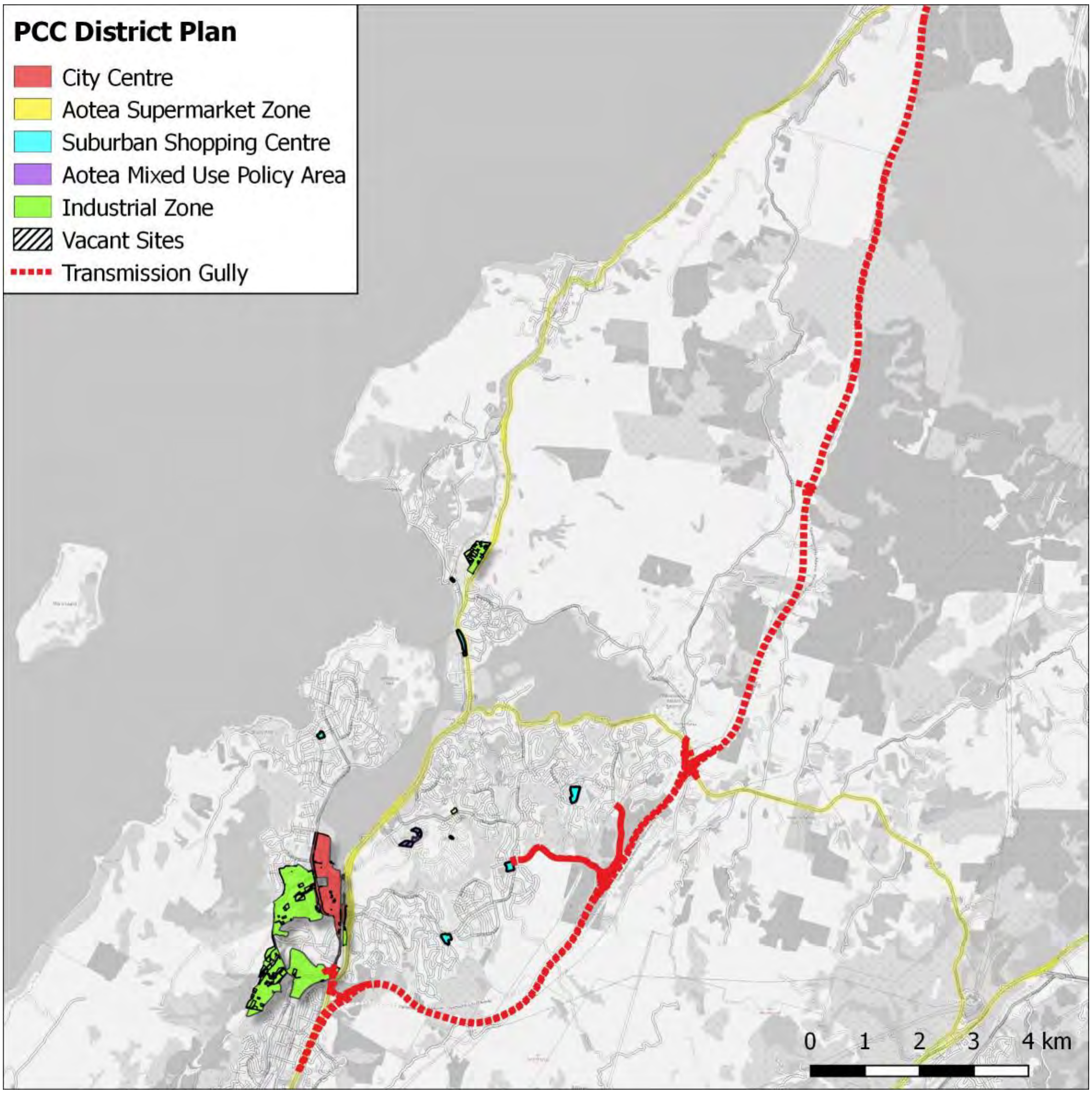
This final iteration results in a commercial office land demand of 1 hectare over the short to medium terms, and a total of between 2.3 and 3 hectares over the long term for Porirua City.

14. TRANSMISSION GULLY

Construction on the Transmission Gully Motorway (TGM) officially began on 8 September 2014 and completion is scheduled for 2020. The TGM spans 27 km and will consist of four-lane motorway, complementing the current Stats Highway 1 along the coast road between the Kapiti Coast, Pukerua Bay and Porirua.

Figure 17 shows the geospatial extent of the TGM relative to select zones in the PCC District Plan.

FIGURE 17: TRANSMISSION GULLY MOTORWAY RELATIVE TO PORIRUA CITY ZONES



Source: PCC, Property Economics.

The $850 million TGM is being delivered as a Public Private Partnership (PPP) by Wellington Gateway Partnership in partnership with the New Zealand government. A key part of the Wellington Northern Corridor 'roads of national significance', the project is one of the most significant single pieces of new road construction in the lower North Island.

Three intermediate interchanges are included in the project. The first interchange is with State Highway 58 at Pauatahanui, providing access to the Hutt Valley. The second interchange will link via new local roads to James Cook Drive in Whitby and the Warspite Avenue-Niagara Street intersection in Waitangirua. The third interchange will link via a new local road to Kenepuru Drive south of the Porirua city centre.

The TGM is set to generate benefits to the Wellington region by means of:

- Providing an alternative strategic link for the Wellington region, which will improve regional road network security.
- Assisting to remedy the safety concerns and projected capacity problems on the existing State Highway 1 by providing a safe and reliable route between Mackays Crossing and Linden in an environmentally responsive manner.
- Assisting in enabling wider economic development by providing a cost-optimised route that better provides for the through-movement of freight and people.
- Assisting in the integration of New Zealand's land transport system by enabling the existing State Highway 1 route to be developed into a safe multi-functional alternative to the TGM.

PORIRUA OPPRTUNITIES

The key opportunities for Porirua, as a result of TGM, lie in Property Economics view around the industrial market potential and the ability for Porirua to attract business activity the city that otherwise would not locate in Porirua. This can only realistically be '*tapped into'* with a single industrial zoning of land around a TGM interchange in the city of a size similar to the Transmission Gully growth scenario.

This will provide profile for Porirua and provide the platform for increase business, and subsequent, employment growth in the city. This could yield a growth profile for Porirua materially higher than the Trended / Business as Usual scenario.

Wellington City struggles to supply industrial land with its geographic constraints, and this issue is likely to be more pronounced in the future. Porirua, being the next territorial authority up SH1, is strategically placed to accommodate some of Wellington's industrial demand in a location that remains efficient to service the Wellington market. This places Porirua in a competitive and strategic position relative to alternative industrial location options up the SH1 corridor.

15. SUMMARY

Summarising the economic research and analysis conducted in this report, Table 22 consolidates the estimated additional zoned land requirements across each key property sector inclusive of infrastructure and NPS UDC buffer requirements. This in effect is the additional land generated as a result of projected growth.

TABLE 22: PORIRUA ADDITIONAL LAND REQUIREMENT SUMMARY

	Trended Growth			Transmission Gully Scenario		
Additional Land Requirements (ha)	3-Year Growth	10-Year Growth	30-Year Growth	3-Year Growth	10-Year Growth	30-Year Growth
Industrial	1.0	7.0	26.0	2.0	19.0	63.0
Commercial Office	1.0	2.0	8.0	1.0	3.0	10.0
Retail and Commercial Service			1.4			1.4
Total	2.0	9.0	35.4	3.0	22.0	74.4

Source: Property Economics.

Under the Trended Scenario an additional 36ha (rounded up) of land demand is generated at the 30-year timeframe as a result of projected growth. This is similar to adopting the status quo / business as usual approach to business growth in the local economy. The majority of this land demand is in the industrial sector (26ha or 73%).

Under the Transmission Gully Scenario an additional 75ha (rounded up) of land demand is generated at the 30-year timeframe, primarily as a result of providing a greater opportunity to '*tap into*' the industrial demand resulting from Transmission Gully's development through the District. Industrial land demand represents 85% of the total business land demand projected, and in Property Economics opinion the majority of this projected requirement needs to be positioned around a Transmission Gully interchange to give Porirua the best opportunity to attract this growth.

With Wellington City struggling to provide enough industrial zoned land to satisfy its generated industrial demand (currently and with the issue likely to be more pronounced in the future), Porirua, being the next territorial authority up SH1, is strategically placed on a comparative basis to capture industrial demand overflow from Wellington, and is in close enough proximity to be able to efficiently service the Wellington market as well as its own growing population base.

Vacant industrial land of 26ha reduces the net industrial land requirement from a straight mathematics perspective and would typically offset the 63ha requirement under the Transmission Gully Scenario. However, much of this land is not well located to maximise the opportunity Transmission Gully provides the District, and vacant industrial zoned land needs to be provided around the Transmission Gully interchange. The larger the vacant industrial zoning around the Transmission Gully interchange, the larger the opportunity, economic growth potential and economic efficiencies can be generated.

Faster growth through well located industrial zoned land can build on itself and flow through to faster economic growth of the local economy with a potentially higher rate of business and employment growth than projected.

The commercial office and retail / commercial service land demand is similar under both scenarios, with the Transmission Gully Scenario estimated at 11.4ha in total (2ha more than the Trended Scenario). Given the closeness of the land demand under the two growth scenarios, Property Economic consider it prudent to plan for the higher Transmission Gully scenario of 11.4ha to be consistent with the industrial approach, and it ensures Porirua has enough commercial land available and the best opportunity to fulfil the growth potential fuelled by that development.

However, with an underutilised Central City area, much of this land demand can be comfortably accommodated in the existing Central City zoned commercial provision by improving its development efficiency, land utilisation and quality of development. This should form part of a wider comprehensive redevelopment strategy for the Central City area in Porirua to ensure the central area can meet the aspirations of the residential and business community it serves, and is better placed to attract investment, growth and opportunities generated from Transmission Gully.

Long term retail requirements (GFA) already exist in the market, and is currently well above sustainable levels. This has given rise to a significant proportion of under performing retail GFA, especially in the Central City area. The mantra for the Porirua retail market should not be driven by providing more retail GFA, but improving the quality and performance of the GFA already in the market.

In respect of commercial office, if this estimated demand can be developed to a higher average than 2.1 storeys, the estimated land requirement would drop commensurately, i.e. if an average of 4.2 storeys for commercial office development was achieved, then the commercial office land required would halve and drop to 5ha. There is significant scope to develop vertically in Porirua's Central City, and over the first half of this century this should be encouraged to ensure efficient development of the Central City land resource.

Any growth in commercial zones in the suburban environs are likely to be required mostly to accommodate convenience retail and commercial service activities in the new residential growth cells of the District to meet growing requirements at the localised level. These are anticipated to be small convenience centres whose size will be dependent on the size of the local market.

APPENDIX 1: DEMOGRAPHIC PROFILING

Section		Porirua City	Wellington Region	New Zealand
GENERAL	Population	55,350	501,950	4,677,550
	Households	18,750	193,600	1,755,150
	Person Per Dwelling Ratio	2.95	2.59	2.67
AGE PROFILE	0–4 Years	9%	7%	7%
	5–9 Years	8%	6%	7%
	10–14 Years	8%	6%	7%
	15–19 Years	7%	7%	7%
	20–24 Years	6%	7%	7%
	25–29 Years	5%	6%	6%
	30–34 Years	6%	7%	6%
	35–39 Years	7%	7%	6%
	40–44 Years	8%	8%	7%
	45–49 Years	7%	7%	7%
	50–54 Years	7%	7%	7%
	55–59 Years	6%	6%	6%
	60–64 Years	5%	5%	5%
	65 years and Over	10%	13%	14%
HOUSEHOLD INCOME	$20,000 or Less	9%	9%	11%
	$20,001–$30,000	8%	9%	11%
	$30,001–$50,000	14%	15%	18%
	$50,001–$70,000	12%	13%	15%
	$70,001–$100,000	18%	18%	18%
	$100,001 or More	38%	35%	28%
PERSONAL INCOME	$5,000 or Less	15%	14%	15%
	$5,001–$10,000	6%	5%	5%
	$10,001–$20,000	15%	16%	18%
	$20,001–$30,000	12%	12%	14%
	$30,001–$50,000	20%	20%	21%
	$50,001 or More	31%	33%	27%
ETHNICITY	European Ethnic Groups	54%	69%	67%
	Māori Ethnic Group	18%	12%	13%
	Pacific Peoples' Ethnic Groups	22%	7%	7%
	Asian Ethnic Groups	5%	9%	11%
	MELAA Ethnic Groups	1%	1%	1%
	Other Ethnic Groups	1%	2%	2%
QUALIFICATION ATTAINMENT	No Qualification	21%	16%	21%
	Level 1 Certificate	13%	11%	13%
	Level 2 Certificate	12%	11%	11%
	Level 3 Certificate	10%	11%	10%
	Level 4 Certificate	9%	9%	10%
	Level 5 or Level 6 Diploma	9%	9%	9%
	Bachelor Degree and Level 7 Qualifications	14%	18%	14%
	Postgraduate and Honours Degrees	3%	5%	3%
	Masters Degree	3%	5%	3%
	Doctorate Degree	0%	1%	1%
	Overseas Secondary School Qualification	5%	6%	7%

		Porirua City	Wellington Region	New Zealand
EMPLOYMENT	Employed - Full Time	50%	51%	48%
	Employed - Part Time	13%	14%	14%
	Unemployed	6%	5%	5%
	Not in Labour Force	30%	30%	33%
EMPLOYMENT CLASSIFICATION	Managers	18%	18%	19%
	Professionals	26%	30%	23%
	Technicians and Trades Workers	10%	10%	12%
	Community and Personal Service Workers	10%	9%	9%
	Clerical and Administrative Workers	14%	14%	12%
	Sales Workers	9%	9%	9%
	Machinery Operators and Drivers	5%	4%	5%
	Labourers	9%	7%	11%
STUDENT RATIO	Full Time	11%	12%	11%
	Part Time	5%	4%	4%
	Full-time and Part-time Study	0%	0%	0%
	Not Studying	84%	84%	85%
HOUSEHOLD INCOME SOURCES	Wages, Salary, Commissions, Bonuses etc	76%	73%	69%
	Self-employment or Business	18%	21%	22%
	Interest, Dividends, Rent, Other Invest.	25%	32%	27%
	Payments from a Work Accident Insurer	1%	1%	2%
	NZ Superannuation or Veterans Pension	16%	20%	22%
	Other Super., Pensions, Annuities	4%	5%	4%
	Unemployment Benefit	5%	4%	4%
	Sickness Benefit	3%	3%	3%
	Domestic Purposes Benefit	5%	3%	4%
	Invalids Benefit	2%	3%	3%
	Student Allowance	3%	4%	4%
	Other Govt Benefits, Payments or Pension	6%	6%	6%
	Other Sources of Income	2%	3%	3%
	No Source of Income During That Time	0%	0%	1%
INDUSTRY OF EMPLOYMENT	Agriculture, Forestry and Fishing	1%	2%	7%
	Mining	0%	0%	0%
	Manufacturing	6%	5%	10%
	Electricity, Gas, Water and Waste Services	1%	1%	1%
	Construction	8%	6%	8%
	Wholesale Trade	3%	3%	5%
	Retail Trade	9%	9%	10%
	Accommodation and Food Services	4%	6%	6%
	Transport, Postal and Warehousing	4%	3%	4%
	Information Media and Telecommunications	2%	3%	2%
	Financial and Insurance Services	5%	5%	4%
	Rental, Hiring and Real Estate Services	2%	2%	2%
	Professional, Scientific and Technical Services	11%	14%	9%
	Administrative and Support Services	4%	3%	3%
	Public Administration and Safety	12%	13%	5%
	Education and Training	11%	9%	8%
	Health Care and Social Assistance	12%	10%	10%
	Arts and Recreation Services	2%	2%	2%
	Other Services	4%	4%	4%

		Porirua City	Wellington Region	New Zealand
HOUSEHOLDS	Single	17%	25%	23%
	Couple	26%	29%	29%
	Single Parent With Children	18%	12%	13%
	Two Parent Family	36%	29%	30%
	Other Multi-person	3%	6%	5%
NUMBER OF RESIDENTS	1 Residents	18%	24%	23%
	2 Residents	31%	34%	34%
	3 Residents	18%	17%	16%
	4 Residents	17%	15%	15%
	5 Residents	8%	6%	7%
	6 Residents	4%	2%	3%
	7 Residents	2%	1%	1%
	8 Plus Residents	2%	1%	1%
HOME OWNERSHIP	Dwelling Owned or Partly Owned	51%	52%	50%
	Dwelling Not Owned and Not Held in a Family Trust	36%	35%	35%
	Dwelling Held in a Family Trust	12%	13%	15%
YEARS AT RESIDENCE	0 Years	18%	22%	22%
	1–4 Years	30%	29%	30%
	5–9 Years	21%	20%	21%
	10–14 Years	12%	12%	11%
	15–29 Years	14%	12%	11%
	30 Years or More	5%	5%	5%
NUMBER OF BEDROOMS	One Bedroom	3%	7%	6%
	Two Bedrooms	13%	21%	19%
	Three Bedrooms	49%	43%	45%
	Four Bedrooms	28%	22%	23%
	Five Bedrooms	6%	5%	6%
	Six Bedrooms	1%	1%	1%
	Seven Bedrooms	0%	0%	0%
	Eight or More Bedrooms	0%	0%	0%
WEEKLY RENT PAID	Under $100	25%	8%	9%
	$100–$149	12%	6%	7%
	$150–$199	7%	7%	8%
	$200–$249	11%	10%	10%
	$250–$299	13%	12%	13%
	$300–$349	12%	11%	14%
	$350 and Over	21%	46%	39%

APPENDIX 2: PROPERTY ECONOMICS RETAIL MODEL

This overview outlines the methodology that has been used to estimate retail spend generated at Census Area Unit (CAU) level for the identified catchment out to 2033.

CAU 2013 Boundaries

All analysis has been based on Census Area Unit 2013 boundaries, the most recent available.

Permanent Private Households (PPH) 2013

These are the total Occupied Households as determined by the Census 2013. PPHs are the primary basis of retail spend generation and account for approximately 71% of all retail sales. PPHs have regard for (exclude) the proportion of dwellings that are vacant at any one time in a locality, which can vary significantly, and in this respect account for the movement of some domestic tourists.

Permanent Private Occupied Household Forecasts 2006-2048

These are based on Rationale Area Unit (CAU) Medium Series Population Growth Projections, with this extrapolated to the year of concern.

International Tourist Spend

The total international tourism retail spend has been derived from the Ministry of Business, Innovation and Employment (MBIE) estimates nationally and cross referenced through Statistics NZ. This has been distributed regionally on a 'spend per employee' basis, using regional spend estimates prepared by the MEDTSG. Domestic and business based tourism spend is incorporated in the employee and PPH estimates. Employees are the preferred basis for distributing regional spend geo-spatially as tourists tend to gravitate toward areas of commercial activity, however they are very mobile.

Total Tourist Spend Forecast

Growth is conservatively forecast in the model at 3% per annum for assessed period.

2016-2048 PPH Average Household Retail Spend

This has been determined by analysing the national relationship between PPH average household income (by income bracket) as determined by the 2013 Census, and the average PPH expenditure of retail goods (by income bracket) as determined by the Household Economic Survey (HES) prepared by Statistics NZ.

While there are variables other than household income that will affect retail spending levels, such as wealth, access to retail, population age, household types and cultural preferences, the effects of these are not able to be assessed given data limitations, and have been excluded from these estimates.

Real Retail Spend Growth (excl. trade based retailing)

Real retail spend growth has been factored in at 1% per annum. This accounts for the increasing wealth of the population and the subsequent increase in retail spend. The following explanation has been provided.

Retail Spend is an important factor in determining the level of retail activity and hence the 'sustainable amount 'of retail floorspace for a given catchment. For the purposes of this outline 'retail' is defined by the following categories:

- Food Retailing
- Footwear
- Clothing and Softgoods
- Furniture and Floor coverings
- Appliance Retailing
- Chemist
- Department Stores
- Recreational Goods
- Cafes, Restaurants and Takeaways
- Personal and Household Services
- Other Stores.

These are the retail categories as currently defined by the ANZSIC codes (Australia New Zealand Standard Industry Classification).

Assessing the level and growth of retail spend is fundamental in planning for retail networking and land use within a regional network.

Internet Retail Spend Growth

Internet retailing within New Zealand has seen significant growth over the last few decades. This growth has led to an increasing variety of business structures and retailing methods including; internet auctions, just-in-time retailing, online ordering, virtual stores etc.

As some of internet spend is being made to on-the-ground stores, a proportion of internet expenditure is being represented in the Statistics NZ Retail Trade Survey (RTS) while a large majority remains unrecorded. At the same time this expenditure is being recorded under the Household Economic Survey (HES) as a part of household retail spending, making the two datasets incompatible. For this reason, Property Economics has assumed a flat 5% adjustment percentage on HES retail expenditure, representing internet retailing that was never recorded within the RTS.

Additionally, growth of internet retailing for virtual stores, auctions and overseas stores is leading to a decrease in on-the-ground spend and floor space demand. In order to account for this, a non-linear percentage decrease of 5% in 2016 growing to 15% by 2048 has been applied to retail expenditure encompassing all retail categories in our retail model. These losses represent the retail diversion from on-the-ground stores to internet based retailing that will no longer contribute to retail floor space demand.

Retail Spend Determinants

Retail Spend for a given area is determined by: the population, number of households, size and composition of households, income levels, available retail offer and real retail growth. Changes in any of these factors can have a significant impact on the available amount of retail spend generated by the area. The coefficient that determines the level of 'retail spend' that eventuates from these factors is the MPC (Marginal Propensity to Consume). This is how much people will spend of their income on retail items. The MPC is influenced by the amount of disposable and discretionary income people are able to access.

Retail Spend Economic Variables

Income levels and household MPC are directly influenced by several macroeconomic variables that will alter the amount of spend. Real retail growth does not rely on the base determinants changing but a change in the financial and economic environment under which these determinants operate. These variables include:

Interest Rates: Changing interest rates has a direct impact upon households' discretionary income as a greater proportion of income is needed to finance debt and typically lowers general domestic business activity. Higher interest rates typically lower real retail growth.

Government Policy (Spending): Both Monetary and Fiscal Policy play a part in domestic retail spending. Fiscal policy, regarding government spending, has played a big part recently with government policy being blamed for inflationary spending. Higher government spending (targeting on consumer goods, direct and indirectly) typically increases the amount of nominal retail spend. Much of this spend does not, however, translate into floor space since it is inflationary and only serves to drive up prices.

Wealth/Equity/Debt: This in the early-mid 2000s had a dramatic impact on the level of retail spending nationally. The increase in property prices has increased home owners' unrealised equity in their properties. This has led to a significant increase in debt funded spending, with residents borrowing against this equity to fund consumable spending. This debt spending is a growth facet of New Zealand retail. In 1960 households saved 14.6% of their income, while households currently spend 14% more than their household income.

Inflation: As discussed above, this factor may increase the amount spent by consumers but typically does not dramatically influence the level of sustainable retail floor space. This is the reason that productivity levels are not adjusted but similarly inflation is factored out of retail spend assessments.

Exchange Rate: Apart from having a general influence over the national balance of payments accounts, the exchange rate directly influences retail spending. A change in the $NZ influences the price of imports and therefore their quantity and the level of spend.

General consumer confidence: This indicator is important as consumers consider the future and the level of security/finances they will require over the coming year.

Economic/Income growth: Income growth has a similar impact to confidence. Although a large proportion of this growth may not impact upon households' MPC (rather just increasing the income determinant) it does impact upon households' discretionary spending and therefore likely retail spend.

Mandatory Expenses: The cost of goods and services that are necessary has an impact on the level of discretionary income that is available from a household's disposal income. Important factors include housing costs and oil prices. As these increase the level of household discretionary income drops reducing the likely real retail growth rate.

Current and Future Conditions

Retail spend has experienced a significant real increase in the early-mid 2000s. This was due in large part to the increasing housing market. Although retail growth is tempered or crowded out in some part by the increased cost of housing it showed significant gains as home owners, prematurely, access their potential equity gains.

This resulted in strong growth in debt / equity spending as residents borrow against capital gains to fund retail spending on consumption goods. A seemingly strong economy also influenced these recent spending trends, with decreased employment and greater job security producing an environment where households were more willing to accept debt.

Over the last 8 years this has now reversed with the worldwide GFC recession causing a significant adjustment in consumer behaviour. As such, the economic environment has undergone rapid transformation. The national market is currently experiencing low interest rates (although expected to increase over this coming year) and a highly inflated $NZ (increasing importing however disproportionately).

Now emerging is a rebound in the property market and an increase in general business confidence as the economy starts to recover from the post-GFC hangover. These factors will continue to influence retail spending throughout the next 5 or so years. Given the previous years' (pre-2008) substantial growth and high levels of debt repayment likely to be experienced by New Zealand households it is expected that real retail growth rates will continue to be subdued for the short term.

Impacts of Changing Retail Spend

At this point in time a 1% real retail growth rate is being applied by Property Economics over the longer term 20-year period. This rate is highly volatile however and is likely to be in the order of

0.5% to 1% over the next 5 – 10 years rising to 1% - 2% over the more medium term as the economy stabilises and experiences cyclical growth. This would mean that it would be prudent in the shorter term to be conservative with regard to the level of sustainable retail floor space within given centres.

Business Spend

This is the total retail spend generated by businesses. This has been determined by subtracting PPH retail spend and Tourist retail spend from the Total Retail Sales as determined by the Retail Trade Survey (RTS) which is prepared by Statistics NZ. All categories are included with the exception of accommodation and automotive related spend. In total, Business Spend accounts for 26% of all retail sales in NZ. Business spend is distributed based on the location of employees in each Census Area Unit and the national average retail spend per employee.

Business Spend Forecast 2013-2048

Business spend has been forecasted at the same rate of growth estimated to be achieved by PPH retail sales in the absence reliable information on business retail spend trends. It is noted that while working age population may be decreasing as a proportion of total population, employees are likely to become more productive over time and therefore offset the relative decrease in the size of the total workforce.

APPENDIX 3: COMMERCIAL SERVICE STORE TYPES

Note this is not intended to represent an exhaustive list of appropriate store types

EXAMPLES OF CONVENIENCE COMMERCIAL / PROFESSIONAL SERVICES AND OFFICE ACTIVITIES

- Camera / Photography Shop
- Optometrist
- Locksmith
- Hairdresser
- Drycleaners
- Doctors
- Accountants
- Physiotherapists
- Medical practitioners
- Dentists
- Child care facilities
- Gym
- Lawyers

APPENDIX 4: BUSINESS CLASSIFICATIONS

Property Economics utilises the 2006 Australian and New Zealand Standard Industrial Classification (ANZSIC) as guidance, whereby businesses are assigned an industry according to their predominant economic activity.

A proportion of employees coded within industrial categories work within other more commercial (office) arms of a business in other locations, i.e. employees in the sales branch of electrical companies are coded in the electricity, gas, water and waste services. Despite being in the industrial industry, these employees are technically not industrial employees, and as such are not included in the proportions utilised for classifying industrial activities.

For planning purposes commercial and industrial employees are those working on zoned business land corresponding their respective sector. Often this is not the case, whereby activities such as hospitals, schools, police services and etc. are classified under commercial services focused sectors but are typically not zoned as such. For this reason, Property Economics has divided these classifications into industrial, commercial, retail and other sectors. These sectors correspond to the zoning of industrial, commercial, retail and special land zonings by the local authorities.

Industrial activities in general refer to land extensive activities, it includes part of the primary sector, largely raw material extraction industries such as mining and farming; the secondary sector, involving refining, construction, and manufacturing; and part of the tertiary sector, which involves distribution of manufactured goods. The employees work for the following sectors are considered an industrial sector employee:

- 10% of Agriculture, Forestry and Fishing
- 10% of Mining
- Transport, Postal and Warehousing
- Manufacturing
- 30% Electricity, Gas, Water and Waste Services
- Construction
- Wholesale Trade

Commercial activities generally refer to land intensive activities. It includes a large proportion of the tertiary sector of an economy, which deals with services; and the quaternary sector, focusing on technological research, design and development. The employees work for the following sectors are considered a commercial sector employee:

- 15% of Accommodation and Food Services
- Information Media and Telecommunications

- Financial and Insurance Services
- Rental, Hiring and Real Estate Services
- Professional, Scientific and Technical Services
- Administrative and Support Services
- 35% Public Administration and Safety
- 15% Education and Training
- 25% Health Care and Social Assistance
- 25% Arts and Recreation Services

Retail Activities generally refer to units mainly engaged in the purchase and on-selling of goods, without significant transformation, to the general public. Retail units generally operate from premises located and designed to attract a high volume of walk-in customers, have an extensive display of goods, and/or use mass media advertising designed to attract customers.

Cafes bars and Restaurants have also been included as part of Retail Activities and includes units mainly engaged in providing food and beverage serving services for consumption on the premises. Customers generally order and are served while seated (i.e. waiter/waitress service) and pay after eating. The employees work for the following sectors are considered a commercial sector employee:

- 85% of Accommodation and Food Services
- Retail Trade

Other Activities constitutes the balance of total employment within an area, and is not defined by any particular business sector. It encompasses community activities such as Museum Operations, Universities, Hospitals, Schools, Sports grounds and other activities not typically located on commercial or industrial land.

Appendix 5.1

Note: Modelling for Kāpiti Coast initially included a number of the rural zones to account for capacity relating to lifestyle housing options. However, a number of errors relating to modelling inputs for rural areas were identified late in the assessment process. As a result, information from rural areas (with the exception of Rural Residential areas) has been excluded from the analysis of Kapiti Coast's development capacity. Remodelling and assessment of rural zones will be undertaken to support future assessments. This is also noted in section 3.4.3 of Chapter 5 of the report.

KAPITI COAST

COMMERCIALLY FEASIBLE

RESIDENTIAL CAPACITY

ASSESSMENT

Client: Kapiti Coast DC

Project No: 51743

Date: May 2019

SCHEDULE

Code	Date	Information / Comments	Project Leader
51743.4	May 2019	Report	Tim Heath / Phil Osborne

DISCLAIMER

This document has been completed, and services rendered at the request of, and for the purposes of Kapiti Coast District Council only.

Property Economics has taken every care to ensure the correctness and reliability of all the information, forecasts and opinions contained in this report. All data utilised in this report has been obtained by what Property Economics consider to be credible sources, and Property Economics has no reason to doubt its accuracy. Property Economics shall not be liable for any adverse consequences of the client's decisions made in reliance of any report by Property Economics. It is the responsibility of all parties acting on information contained in this report to make their own enquiries to verify correctness.

1. INTRODUCTION

Property Economics has been engaged by Wellington City Council, on behalf of Kapiti Coast District Council (**KCDC**) as part of a wider region residential capacity project team, to undertake an assessment of the commercially feasible residential capacity (supply) of the Kapiti Coast District within the context of Council's obligations under the National Policy Statement on Urban Development Capacity (**NPS UDC**).

The purpose of this report is to provide KCDC with robust market intelligence to assist in making more informed and economically justified decisions in regard to the design and implementation of a residential policy framework for the District Plan and other long-term planning documents.

This report discusses the work undertaken by both Property Economics and Wellington City Council in analysing the existing theoretical residential capacity of Kapiti Coast and developing a capacity model for calculating the level of feasible development within the District. This will inform policy makers on the feasible level of housing supply, and which areas are able to accommodate future residential development based on current zonings, policy settings and market parameters.

2. THEORETICAL CAPACITY

Property Economics have been provided with GIS layers containing the sites within Kapiti Coast that provided for infill, or comprehensive redevelopment. Theoretical residential capacity was calculated by WCC utilising current theoretical District Plan policy settings and algorithmic, GIS and 3D modelling. The information contained several different scenarios, based on housing typology and quantum, that were identified as theoretically viable to develop.

Table 1 below outlines the theoretical capacity output by the model provided to Property Economics by WCC by suburb. At the request of Kapiti District Council, this is split between Rural and Urban zones.

TABLE 1 – KAPITI COAST THEORETICAL RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB

Rural Suburbs	Theoretical Capacity
Kaitawa	194
Maungakotukutuku	372
Otaihanga	202
Otaki	34
Otaki Forks	580
Paraparaumu Central	130
Peka Peka	232
Te Horo	81
Waikanae East	204
Waikanae Park	2,122
Rural Grand Total	4,151

Urban Suburbs	Theoretical Capacity
Maungakotukutuku	463
Otaihanga	474
Otaki	4,214
Paekakariki	284
Paraparaumu Beach North	853
Paraparaumu Beach South	1,168
Paraparaumu Central	4,110
Peka Peka	165
Raumati Beach	1,656
Raumati South	1,193
Te Horo	49
Waikanae Beach	1,475
Waikanae East	1,027
Waikanae Park	893
Waikanae West	1,483
Urban Grand Total	19,507

Source: Property Economics, WCC, KCDC

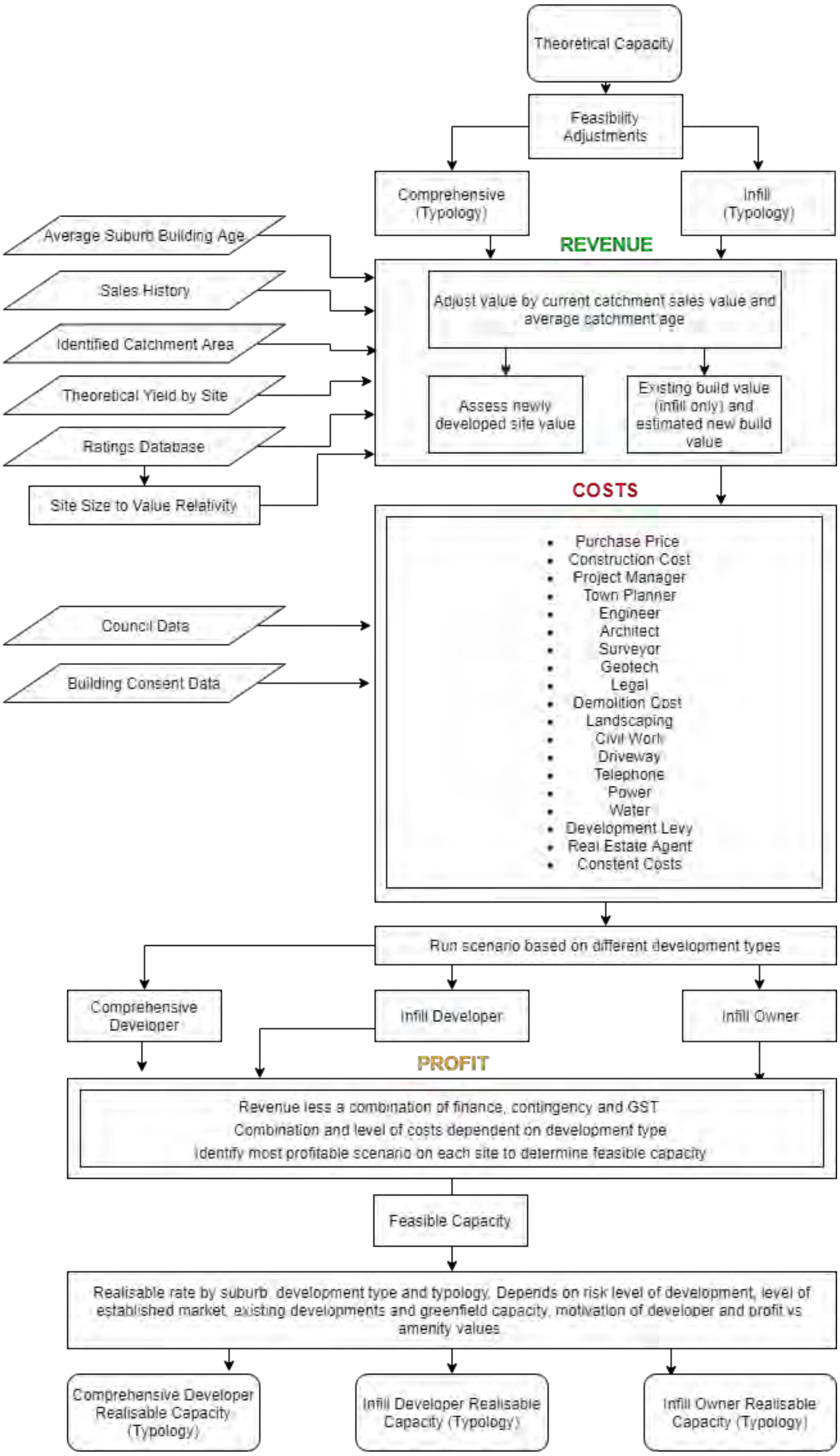
Table 1 shows there is theoretical capacity within Kapiti Coast for around 23,660 new dwellings (rounded), with 19,500 in urban areas and 4,150 in rural areas. The suburbs of Otaki and Paraparaumu Central have the highest level of theoretical capacity at 4,248 and 4,240 respectively, while the area of Te Horo has the lowest level of theoretical capacity at an estimated 130 dwellings.

It is important to note that Table 1 represents the sum of the maximum attainable yield on an individual site basis. The theoretical model outputs passed to Property Economics by WCC contained several different development scenarios on each site, therefore the theoretical yield represents the scenarios on each site where the development potential is the highest.

3. FEASIBLE CAPACITY MODELLING

A high-level overview of the model utilised by Property Economics in determining the feasible residential capacity for Kapiti Coast is outlined in the flow chart in Figure 1 below, with detailed descriptions of each stage of the process given following.

FIGURE 1: PROPERTY ECONOMICS RESIDENTIAL FEASIBILITY MODEL OVERVIEW



Source: Property Economics

Land and Improvement Value per SQM

Using the ratings database provided by Kapiti Coast District Council, the land value per sqm and improvement value per sqm is calculated. This is then summarised by suburb, size and typology to give the average per sqm value for various types of dwellings.

By splitting the valuation into land and improvement value, it accounts for variations of both sizes e.g. a large dwelling on a small piece of land compared to the same size dwelling on a larger piece of land.

Values are not the same across each suburb (due to differing structures and quality), and thus it is required to give the per sqm value for each suburb individually. Also, the per sqm rate for land and improvement value are shown not to be consistent across all sizes. For example, a larger dwelling has on average a lower per sqm improvement value than a smaller one. This inverse relationship between size and per sqm value is the same for both land value per sqm and building value per sqm.

Tables 2-3 below show the build value per sqm utilised in the commercially feasible capacity modelling for varying building sizes for standalone and terraced typologies.

TABLE 2 – KAPITI COAST STANDALONE BUILD VALUE / SQM BY SUBURB

STANDALONE	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350
Kaitawa	$-	$3,126	$2,958	$2,819	$2,706	$2,608	$2,482	$2,402	$2,287	$2,204	$2,174	$2,126	$2,074	$2,056	$2,012
Kapiti Island	$-	$2,476	$2,343	$2,233	$2,144	$2,066	$1,966	$1,903	$1,811	$1,746	$1,722	$1,684	$1,643	$1,629	$1,594
Maungakotukutuku	$-	$3,685	$3,487	$3,323	$3,191	$3,075	$2,926	$2,832	$2,696	$2,598	$2,563	$2,507	$2,445	$2,424	$2,372
Otaihanga	$-	$3,399	$3,216	$3,065	$2,942	$2,835	$2,699	$2,611	$2,486	$2,396	$2,363	$2,311	$2,255	$2,235	$2,187
Otaki	$-	$3,505	$3,316	$3,161	$3,034	$2,924	$2,783	$2,693	$2,564	$2,471	$2,437	$2,384	$2,326	$2,305	$2,256
Otaki Forks	$-	$3,940	$3,728	$3,553	$3,411	$3,287	$3,128	$3,027	$2,882	$2,777	$2,740	$2,680	$2,614	$2,591	$2,536
Paekakariki	$-	$3,724	$3,523	$3,358	$3,224	$3,106	$2,957	$2,861	$2,724	$2,625	$2,589	$2,532	$2,471	$2,449	$2,397
Paraparaumu Beach North	$-	$3,342	$3,162	$3,014	$2,893	$2,788	$2,654	$2,568	$2,445	$2,356	$2,324	$2,273	$2,217	$2,198	$2,151
Paraparaumu Beach South	$-	$3,246	$3,071	$2,927	$2,810	$2,708	$2,577	$2,494	$2,374	$2,288	$2,257	$2,207	$2,153	$2,135	$2,089
Paraparaumu Central	$-	$3,515	$3,326	$3,170	$3,043	$2,932	$2,791	$2,701	$2,571	$2,478	$2,444	$2,390	$2,332	$2,312	$2,262
Peka Peka	$-	$3,660	$3,463	$3,301	$3,169	$3,054	$2,906	$2,812	$2,677	$2,580	$2,545	$2,489	$2,429	$2,407	$2,356
Raumati Beach	$-	$3,611	$3,417	$3,257	$3,126	$3,013	$2,868	$2,775	$2,642	$2,546	$2,511	$2,456	$2,396	$2,375	$2,324
Raumati South	$-	$4,023	$3,807	$3,628	$3,483	$3,356	$3,195	$3,091	$2,943	$2,836	$2,798	$2,736	$2,669	$2,646	$2,589
Te Horo	$-	$3,612	$3,417	$3,257	$3,127	$3,013	$2,868	$2,775	$2,642	$2,546	$2,512	$2,456	$2,397	$2,376	$2,325
Waikanae Beach	$-	$3,614	$3,419	$3,259	$3,129	$3,015	$2,870	$2,777	$2,643	$2,548	$2,513	$2,458	$2,398	$2,377	$2,326
Waikanae East	$-	$3,405	$3,221	$3,070	$2,948	$2,840	$2,703	$2,616	$2,490	$2,400	$2,368	$2,315	$2,259	$2,239	$2,191
Waikanae Park	$-	$3,313	$3,135	$2,988	$2,869	$2,764	$2,631	$2,546	$2,424	$2,336	$2,304	$2,254	$2,199	$2,179	$2,133
Waikanae West	$-	$3,095	$2,928	$2,791	$2,680	$2,582	$2,458	$2,378	$2,264	$2,182	$2,152	$2,105	$2,054	$2,036	$1,992

Source: Property Economics, WCC, KCDC

TABLE 3 – KAPITI COAST TERRACED BUILD VALUE / SQM BY SUBURB

TERRACED	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350
Kaitawa	$-	$3,361	$3,180	$3,031	$2,910	$2,804	$2,669	$2,583	$2,459	$2,370	$2,338	$2,286	$2,230	$2,211	$2,163
Kapiti Island	$-	$2,663	$2,519	$2,401	$2,305	$2,221	$2,114	$2,046	$1,948	$1,877	$1,852	$1,811	$1,767	$1,751	$1,714
Maungakotukutuku	$-	$3,963	$3,749	$3,574	$3,431	$3,306	$3,147	$3,045	$2,899	$2,794	$2,756	$2,695	$2,629	$2,606	$2,551
Otaihanga	$-	$3,654	$3,458	$3,296	$3,164	$3,049	$2,902	$2,808	$2,673	$2,576	$2,541	$2,485	$2,425	$2,404	$2,352
Otaki	$-	$3,769	$3,566	$3,399	$3,263	$3,144	$2,993	$2,896	$2,757	$2,657	$2,621	$2,563	$2,501	$2,479	$2,426
Otaki Forks	$-	$4,236	$4,008	$3,820	$3,668	$3,534	$3,364	$3,255	$3,099	$2,986	$2,946	$2,881	$2,811	$2,786	$2,727
Paekakariki	$-	$4,004	$3,788	$3,611	$3,466	$3,340	$3,179	$3,076	$2,929	$2,823	$2,784	$2,723	$2,657	$2,633	$2,577
Paraparaumu Beach North	$-	$3,593	$3,400	$3,241	$3,111	$2,998	$2,853	$2,761	$2,629	$2,533	$2,499	$2,444	$2,384	$2,363	$2,313
Paraparaumu Beach South	$-	$3,490	$3,302	$3,147	$3,021	$2,911	$2,771	$2,681	$2,553	$2,460	$2,427	$2,373	$2,316	$2,295	$2,246
Paraparaumu Central	$-	$3,779	$3,576	$3,408	$3,272	$3,153	$3,001	$2,904	$2,764	$2,664	$2,628	$2,570	$2,508	$2,486	$2,432
Peka Peka	$-	$3,936	$3,724	$3,549	$3,407	$3,283	$3,125	$3,024	$2,879	$2,775	$2,737	$2,677	$2,611	$2,589	$2,533
Raumati Beach	$-	$3,883	$3,674	$3,502	$3,362	$3,239	$3,083	$2,984	$2,840	$2,737	$2,700	$2,641	$2,576	$2,554	$2,499
Raumati South	$-	$4,326	$4,093	$3,901	$3,745	$3,609	$3,435	$3,324	$3,164	$3,050	$3,008	$2,942	$2,870	$2,845	$2,784
Te Horo	$-	$3,884	$3,675	$3,502	$3,362	$3,240	$3,084	$2,984	$2,841	$2,738	$2,701	$2,641	$2,577	$2,554	$2,500
Waikanae Beach	$-	$3,886	$3,677	$3,504	$3,364	$3,242	$3,086	$2,986	$2,842	$2,739	$2,702	$2,643	$2,578	$2,556	$2,501
Waikanae East	$-	$3,661	$3,464	$3,301	$3,169	$3,054	$2,907	$2,813	$2,678	$2,581	$2,546	$2,490	$2,429	$2,408	$2,356
Waikanae Park	$-	$3,563	$3,371	$3,213	$3,085	$2,972	$2,829	$2,738	$2,606	$2,512	$2,478	$2,423	$2,364	$2,343	$2,293
Waikanae West	$-	$3,328	$3,149	$3,001	$2,881	$2,776	$2,643	$2,557	$2,434	$2,346	$2,314	$2,263	$2,208	$2,189	$2,142

Source: Property Economics, WCC, KCDC

Due to limited availability of ratings data for apartment typologies, nominal values were used for a range of apartment sizes, with capital value determined by interpolating between these points, and scaling based on the average rating data across a suburb.

TABLE 4 – KAPITI COAST NOMINAL APARTMENT VALUES

APARTMENT	25	50	75	100	125	150
Average	$ 260,649	$ 321,729	$ 407,015	$ 530,160	$ 627,888	$ 718,774

APARTMENT	175	200	225	250	275	300
Average	$ 803,299	$ 881,907	$ 955,012	$ 1,023,000	$ 1,086,228	$ 1,145,031

Source: Property Economics, WCC, KCDC

The land value per sqm utilised in the commercially feasible capacity modelling for varying land sizes. This was utilised for both standalone and terraced typologies, however as described above apartments were modelled using nominal capital values.

A limitation identified during the modelling process was that by applying a percentage increase on the site-specific land value through the process of subdivision, meant that sites with a proportionally high underlying land value resulted in an impractical subdivided land value on a per sqm basis. This was identified as a specific problem for sites with underlying commercial land values.

As a solution, the maximum residentially zoned land value per sqm identified within the ratings database was used as a maximum limit for the land value per sqm after subdivision. This removed the impact of sites with underlying commercial land values resulting in impractically high profitability, and thus feasible yield.

Specific to Kapiti Coast was also the presence of significantly large sites around the fringes of urban residential areas. As such, this was skewing the land value per sqm and was not appropriately representing the per sqm land value of a residential site. As a solution a minimum land value per sqm was imposed based on the minimum residential land value per sqm (for a given site size) on a suburb level. This minimum, like the maximum applied above, was taken from the ratings database.

Average Suburb Age

Using the same ratings database, the average age of dwellings is determined for each suburb. This is undertaken in order to adjust the building value for each suburb based on values of houses from each decade. The data shows that there is a relationship between the age of a building and its per sqm improvement value. Therefore, finding the average age and distribution (of the built product) in a suburb allows the building values outlined above in Tables 2 and 3 to be appropriately adjusted. Note, this adjustment was performed in 'bands', with decades updated accordingly, rather than applying an average across the suburb. This step is important due to the fact that the a[application of sales data is based on a significant proportion of older stock and does not, therefore, appropriately value new builds.

Sales vs Capital Value (CV)

A statistically significant sample dataset of recent sales in Kapiti Coast was used to find the difference between the average sales price and the most recent valuation. This is to ensure the capacity modelling utilises the most up to date values data critical to the determination of current day feasible capacity.

Given the nominal level of sales over this period of time in Kapiti Coast, it was deemed appropriate to supplement this dataset with site-specific updated valuation samples for each suburb. Based on a representative sample from each suburb in Kapiti Coast, the average increase of sales price over the recent valuation is then determined. There exists a relationship between the suburb and this average increase, and thus the percentage increase is expressed per suburb. This average increase of sales over CV is then applied in the model to update the valuations (Tables 2 and 3) to reflect current market value.

Table 6 below shows the average Sales / CV percentage utilised in the model.

TABLE 5 – KAPITI COAST AVERAGE SALES / CV BY SUBURB

Suburb	Sales / CV
Kaitawa	109%
Kapiti Island	108%
Maungakotukutuku	104%
Otaihanga	104%
Otaki	110%
Otaki Forks	106%
Paekakariki	106%
Paraparaumu Beach North	107%
Paraparaumu Beach South	107%
Paraparaumu Central	109%
Peka Peka	105%
Raumati Beach	114%
Raumati South	108%
Te Horo	105%
Waikanae Beach	110%
Waikanae East	110%
Waikanae Park	108%
Waikanae West	108%

Source: Property Economics, WCC, KCDC

Construction Costs

Suburb based differentials between constructions costs for new dwellings were found by analysing the value of recent building consents granted within Kapiti. The historical building consent data shows that the average value of building consents varies across suburb within Kapiti, indicating the variety of product quality that is built.

Because of this, a table of average building consent per sqm by suburb was extracted from the building consent data in order to represent the average construction costs in a suburb. This is then used in the model as the construction costs of building a new dwelling. Note, this is only used for standalone and terraced dwellings, as apartments have been modelled using nominal capital values. Due to data restrictions some suburbs were grouped by quality for this purpose. This, once again, neutralises suburb-based sales data where these average sales are based on higher quality (and therefore more expensive) builds.

Tables 7, 8 and 9 below show the average build cost by suburb for standalone, terraced and apartment typology types.

TABLE 6 – KAPITI COAST STANDALONE BUILD COST BY SUBURB

STANDALONE	50	75	100	125	150	175	200	225	250	275	280
Kaitawa	$3,109	$2,509	$2,182	$1,971	$1,823	$1,794	$1,697	$1,618	$1,553	$1,499	$1,489
Kapiti Island	$2,386	$1,926	$1,675	$1,513	$1,400	$1,377	$1,302	$1,242	$1,192	$1,151	$1,143
Maungakotukutuku	$3,665	$2,958	$2,572	$2,324	$2,149	$2,115	$2,000	$1,908	$1,831	$1,767	$1,755
Otaihanga	$3,380	$2,728	$2,372	$2,143	$1,982	$1,951	$1,844	$1,759	$1,688	$1,630	$1,619
Otaki	$3,134	$2,529	$2,199	$1,987	$1,838	$1,809	$1,710	$1,631	$1,565	$1,511	$1,501
Otaki Forks	$3,797	$3,064	$2,665	$2,408	$2,227	$2,191	$2,072	$1,976	$1,897	$1,831	$1,818
Paekakariki	$3,667	$2,959	$2,573	$2,325	$2,150	$2,116	$2,001	$1,909	$1,832	$1,768	$1,756
Paraparaumu Beach Nor	$3,221	$2,599	$2,260	$2,042	$1,889	$1,859	$1,757	$1,676	$1,609	$1,553	$1,542
Paraparaumu Beach Sou	$3,128	$2,524	$2,195	$1,983	$1,834	$1,805	$1,707	$1,628	$1,562	$1,508	$1,498
Paraparaumu Central	$3,495	$2,821	$2,453	$2,216	$2,050	$2,017	$1,907	$1,819	$1,746	$1,685	$1,674
Peka Peka	$3,798	$3,065	$2,665	$2,408	$2,227	$2,192	$2,072	$1,977	$1,897	$1,831	$1,819
Raumati Beach	$3,480	$2,808	$2,442	$2,207	$2,041	$2,009	$1,899	$1,811	$1,738	$1,678	$1,667
Raumati South	$3,597	$2,903	$2,525	$2,281	$2,110	$2,076	$1,963	$1,872	$1,797	$1,734	$1,723
Te Horo	$3,481	$2,809	$2,443	$2,207	$2,041	$2,009	$1,899	$1,812	$1,739	$1,678	$1,667
Waikanae Beach	$3,483	$2,811	$2,444	$2,208	$2,042	$2,010	$1,900	$1,813	$1,740	$1,679	$1,668
Waikanae East	$3,281	$2,648	$2,303	$2,080	$1,924	$1,894	$1,790	$1,708	$1,639	$1,582	$1,571
Waikanae Park	$3,193	$2,577	$2,241	$2,025	$1,873	$1,843	$1,743	$1,662	$1,595	$1,540	$1,529
Waikanae West	$2,983	$2,407	$2,093	$1,891	$1,749	$1,722	$1,628	$1,553	$1,490	$1,438	$1,428

Source: Property Economics

TABLE 7 – KAPITI COAST TERRACED BUILD COST BY SUBURB

TERRACED	50	75	100	125	150	175	200	225	250	275	280
Kaitawa	$3,273	$2,641	$2,297	$2,075	$1,919	$1,889	$1,786	$1,703	$1,635	$1,578	$1,567
Kapiti Island	$2,512	$2,027	$1,763	$1,593	$1,473	$1,450	$1,371	$1,308	$1,255	$1,211	$1,203
Maungakotukutuku	$3,858	$3,114	$2,708	$2,446	$2,263	$2,227	$2,105	$2,008	$1,927	$1,860	$1,848
Otaihanga	$3,558	$2,871	$2,497	$2,256	$2,087	$2,053	$1,942	$1,852	$1,777	$1,715	$1,704
Otaki	$3,299	$2,662	$2,315	$2,092	$1,934	$1,904	$1,800	$1,717	$1,648	$1,590	$1,580
Otaki Forks	$3,997	$3,225	$2,805	$2,534	$2,344	$2,307	$2,181	$2,080	$1,996	$1,927	$1,914
Paekakariki	$3,860	$3,115	$2,709	$2,447	$2,263	$2,228	$2,106	$2,009	$1,928	$1,861	$1,848
Paraparaumu Beach Nor	$3,390	$2,736	$2,379	$2,150	$1,988	$1,957	$1,850	$1,765	$1,694	$1,635	$1,623
Paraparaumu Beach Sou	$3,292	$2,657	$2,311	$2,088	$1,931	$1,900	$1,797	$1,714	$1,645	$1,587	$1,577
Paraparaumu Central	$3,679	$2,969	$2,582	$2,333	$2,158	$2,124	$2,008	$1,915	$1,838	$1,774	$1,762
Peka Peka	$3,998	$3,226	$2,806	$2,535	$2,344	$2,307	$2,181	$2,081	$1,997	$1,927	$1,914
Raumati Beach	$3,663	$2,956	$2,571	$2,323	$2,148	$2,114	$1,999	$1,907	$1,830	$1,766	$1,754
Raumati South	$3,786	$3,056	$2,657	$2,401	$2,221	$2,185	$2,066	$1,971	$1,892	$1,826	$1,813
Te Horo	$3,664	$2,957	$2,571	$2,323	$2,149	$2,115	$1,999	$1,907	$1,830	$1,767	$1,755
Waikanae Beach	$3,666	$2,958	$2,573	$2,325	$2,150	$2,116	$2,001	$1,908	$1,831	$1,768	$1,756
Waikanae East	$3,454	$2,787	$2,424	$2,190	$2,025	$1,993	$1,885	$1,798	$1,725	$1,665	$1,654
Waikanae Park	$3,361	$2,713	$2,359	$2,131	$1,971	$1,940	$1,834	$1,750	$1,679	$1,621	$1,610
Waikanae West	$3,140	$2,534	$2,204	$1,991	$1,841	$1,812	$1,713	$1,634	$1,568	$1,514	$1,504

Source: Property Economics

TABLE 8 – KAPITI COAST APARTMENT BUILD COST BY SUBURB

APARTMENT	50	75	100	125	150	175	200	225	250	275	280
Kaitawa	$3,746	$3,169	$2,866	$2,664	$2,540	$2,516	$2,543	$2,463	$2,201	$2,070	$2,044
Kapiti Island	$2,875	$2,432	$2,200	$2,045	$1,950	$1,932	$1,952	$1,891	$1,689	$1,589	$1,569
Maungakotukutuku	$4,416	$3,736	$3,379	$3,140	$2,994	$2,967	$2,998	$2,904	$2,595	$2,441	$2,410
Otaihanga	$4,072	$3,445	$3,116	$2,896	$2,761	$2,736	$2,765	$2,678	$2,393	$2,251	$2,223
Otaki	$3,776	$3,194	$2,889	$2,685	$2,560	$2,536	$2,563	$2,483	$2,218	$2,087	$2,061
Otaki Forks	$4,575	$3,870	$3,500	$3,253	$3,102	$3,073	$3,105	$3,008	$2,688	$2,529	$2,497
Paekakariki	$4,418	$3,737	$3,380	$3,142	$2,996	$2,968	$2,999	$2,905	$2,596	$2,442	$2,411
Paraparaumu Beach North	$3,880	$3,282	$2,969	$2,759	$2,631	$2,607	$2,634	$2,551	$2,280	$2,145	$2,118
Paraparaumu Beach South	$3,768	$3,188	$2,883	$2,680	$2,555	$2,532	$2,558	$2,478	$2,214	$2,083	$2,057
Paraparaumu Central	$4,211	$3,563	$3,222	$2,995	$2,856	$2,829	$2,859	$2,769	$2,475	$2,328	$2,299
Peka Peka	$4,576	$3,871	$3,501	$3,254	$3,103	$3,074	$3,106	$3,009	$2,688	$2,529	$2,497
Raumati Beach	$4,193	$3,547	$3,208	$2,982	$2,843	$2,817	$2,846	$2,757	$2,464	$2,318	$2,289
Raumati South	$4,334	$3,666	$3,316	$3,082	$2,939	$2,912	$2,942	$2,850	$2,547	$2,396	$2,365
Te Horo	$4,194	$3,548	$3,209	$2,982	$2,844	$2,817	$2,847	$2,758	$2,464	$2,318	$2,289
Waikanae Beach	$4,196	$3,550	$3,210	$2,984	$2,845	$2,819	$2,849	$2,759	$2,465	$2,319	$2,290
Waikanae East	$3,953	$3,344	$3,024	$2,811	$2,681	$2,656	$2,684	$2,599	$2,323	$2,185	$2,158
Waikanae Park	$3,847	$3,255	$2,944	$2,736	$2,609	$2,585	$2,612	$2,530	$2,261	$2,127	$2,100
Waikanae West	$3,594	$3,040	$2,750	$2,556	$2,437	$2,414	$2,440	$2,363	$2,112	$1,986	$1,961

Source: Property Economics

Other Development Costs

As well as construction costs, a number of other costs have been incorporated in to the feasibility model on a per dwelling basis. Some of the key costs are outlined below in Table 10. Other costs are identified in Figure 1 but also include commercial interest at 8% p.a. and a 10% contingency on total costs (risk).

TABLE 9 – KAPITI COAST PER DWELLING DEVELOPMENT COSTS

COMPREHENSIVE COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ 100	$ 100	$ 100
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

INFILL COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ -	$ -	$ -
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

Source: Property Economics, WCC

4. FEASIBILITY MODELLING OUTPUTS

4.1. FEASIBLE CAPACITY OUTPUTS

Property Economics has assessed the variables outlined above in the Kapiti Coast market and run feasible capacity models across the range of locations, land values, improvement values, and land value changes. A key component of the market's willingness to develop infill is the relationship between a site's land value, fixed subdivision costs and the identifiable 'uptake' in value (sqm) through subdivision.

Tables 10 and 11 below outline a summary for the urban and rural areas of the number of potential sections on sites where the ratios meet a profit level suitable to meet market expectations (20% for the purpose of this analysis).

Tables 10 and 11 represents the subdivision undertaken by either an owner occupier or a developer, with the capacity representing the most profitable. This is an important difference as motivations and capital outlay are often different. These figures have removed all 'double ups' i.e. where multiple instances were tested on a specific site and represent the most profitable scenario for that site.

TABLE 10 – KAPITI COAST FEASIBLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB – OWNER AND DEVELOPER (URBAN)

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Maungakotukutuku	463	-	-	-	-	0%
Otaihanga	474	-	-	-	-	0%
Otaki	4214	-	209	1,120	1,329	32%
Paekakariki	284	-	22	3	25	9%
Paraparaumu Beach North	853	-	53	16	69	8%
Paraparaumu Beach South	1168	-	128	30	158	14%
Paraparaumu Central	4110	-	12	55	67	2%
Peka Peka	165	-	1	-	1	1%
Raumati Beach	1656	-	171	192	363	22%
Raumati South	1193	-	161	267	428	36%
Te Horo	49	-	-	1	1	2%
Waikanae Beach	1475	-	185	119	304	21%
Waikanae East	1027	-	13	48	61	6%
Waikanae Park	893	-	2	6	8	1%
Waikanae West	1483	-	87	131	218	15%
Grand Total	19,507	-	1,044	1,988	3,032	16%

Source: Property Economics, WCC, KCDC

If developments were to be undertaken by either a developer or owner occupier, there is then potential for 3,030 additional units (rounded) within the Kapiti Coast urban market. As all development options have been considered in Table 10, this represents the total feasible capacity in the urban market. This level of feasible capacity represents a 16% feasibility rate on the theoretical capacity.

TABLE 11 – KAPITI COAST FEASIBLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB – OWNER AND DEVELOPER (RURAL)

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Kaitawa	194	-	163	-	163	84%
Maungakotukutuku	372	-	253	-	253	68%
Otaihanga	202	-	145	-	145	72%
Otaki	34	-	22	-	22	65%
Otaki Forks	580	-	530	-	530	91%
Paraparaumu Central	130	-	40	-	40	31%
Peka Peka	232	-	229	-	229	99%
Te Horo	81	-	80	-	80	99%
Waikanae East	204	-	176	-	176	86%
Waikanae Park	2122	-	-	-	-	0%
Grand Total	4,151	-	1,638	-	1,638	39%

Source: Property Economics, WCC, KCDC

There is potential for 1,640 additional units (rounded) within the Kapiti Coast rural market. As all development options have been considered in Table 10, this represents the total feasible capacity in the rural market. This level of feasible capacity represents a 39% feasibility rate on the theoretical capacity.

4.2. SENSITIVITY ANALYSIS

As an extension to the feasibility modelling outlined above, scenarios testing the sensitivity of the feasibility model have also been undertaken. This has been done to test the robustness of the model, and see the practical implications due to small changes in the input variables.

The following scenarios have been tested in this sensitivity analysis:

- **Increasing the build value across all typologies by 15%.** This in essence represents a greater per sqm profit margin on any new built product. Tables 3 and 4 above show the build value per sqm utilised in the feasibility model for standalone and terraced developments. Under this sensitivity, the build values in this table were increased by 15%. Since nominal apartment values were used in the analysis, the average split between land value and improvement value was found on a suburb by suburb basis, with the 15% increase applied based on this proportional split i.e. applying only to build value. Within the model the relative difference between the build value of a development and the build cost is an important driver of profitability, and as such this sensitivity was run to investigate the impact on overall feasibility when this difference is greater.

- **Increasing the savings incurred due to Economies of Scale (EoS).** In the normal model, the maximum savings that could occur due to larger scale developments was savings of around 15% on relevant costs. This has been scaled to a maximum of around 50%, with the savings increased as the scale of the development increases. For example, a subdivision of one standalone dwelling will incur the same costs and thus profit level as the normal model, however an comprehensive apartment development of 50 units will incur significantly less costs than under the normal model. This sensitivity was included to investigate the effect of higher profitability drivers for large developments only.

- **Increasing the maximum attainable land value in the model by 10%**. This represents the possibility of the highest per sqm land value increasing by 10% in the future. Outlined in the process above, a maximum land value per sqm was applied on a suburb by suburb basis to remove the impact of scaling commercially valued land to inappropriately high per sqm land values. Increasing this maximum by 10% is expected to increase the feasibility of several sites as the profit made on the subdivision of the land would increase. This maximum was found by identifying the current highest residential land value per sqm within the suburb. The 10% increase as a sensitivity simply tests to see the relative impact of changing this imposed maximum.

- **Decreasing the maximum attainable land value in the model by 10%.** This represents the possibility of the highest per sqm land value increasing by 10% in the future. Similar to the sensitivity above, this represents a change in the imposed maximum land value achievable through subdivision, however, decreases this value by 10% rather than increasing. Again, this is to test the relative impact of changing this imposed maximum.

Each scenario has been tested independently of the other in order to isolate the sensitivity of the model to this specific scenario.

A summary of the feasible capacity under each of the four scenarios, compared against the original feasible capacity is given below in Tables 12 and 13 (urban and rural). A full breakdown of feasible capacity under each sensitivity scenario is given in Appendix 1.

TABLE 12 – FEASIBLE CAPACITY SENSITIVITY ANALYSIS (URBAN)

Scenario	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Normal Model	19,507	-	1,044	1,988	3,032	16%
Increased Economies of Scale	19,507	-	1,050	2,898	3,948	20%
Increased Build Value	19,507	-	2,035	4,572	6,607	34%
Increased Land Value (10%)	19,507	2	1,422	2,507	3,931	20%
Decreased Land Value (10%)	19,507	-	749	1,592	2,341	12%

Source: Property Economics, WCC, KCDC

TABLE 13 – FEASIBLE CAPACITY SENSITIVITY ANALYSIS (RURAL)

Scenario	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Normal Model	4,151	-	1,638	-	1,638	39%
Increased Economies of Scale	4,151	-	1,734	-	1,734	42%
Increased Build Value	4,151	-	2,125	-	2,125	51%
Increased Land Value (10%)	4,151	-	1,759	-	1,759	42%
Decreased Land Value (10%)	4,151	-	1,367	-	1,367	33%

Source: Property Economics, WCC, KCDC

The series of sensitivities show that the modelling process is most sensitive to the increased build value, increasing feasible urban capacity to over 6,600, a feasibility rate of 34%, and feasible rural capacity to almost 2,130, a feasibility rate of 51%.

4.3. REALISABLE CAPACITY OUTPUTS

On top of the feasible capacity modelling, practical considerations must be taken into account as to what is likely to be developed in the real world. While this section is separated from the sensitivities above the realisation rates essentially provide for 'development chance' given the propensity for development variances.

These considerations are based on:

- Dwelling typology
- Development option
- Greenfield competition

The identification of these variables not only provides for sensitivities but also addresses the relativity between typologies. While all three typologies may be feasible the development model identifies the site scenario with the highest profit margin. However, practically while the model assesses the standard 20% profit margin, there is greater risk in some typologies. The assessment below endeavours to consider these risks, and motivation, differentials.

The capacity for greenfield development within Kapiti Coast has been provided to Property Economics, and this has been cross referenced against future residential demand to give an indication of the proportion of demand that can be satisfied by greenfield development. Forecast demand for residential product has been based on Statistics NZ medium population and household projections.

Table 14 outlines greenfield capacity and future residential demand:

TABLE 14 – KAPITI COAST GREENFIELD DEVELOPMENT CAPACITY

	Greenfield Capacity	30-Year Demand	Greenfield % of Demand	Required Brownfield
Kapiti Coast District	2,106	5,300	40%	3,194

Source: Property Economics, WCC, KCDC, SNZ

Over the 30-year forecast period from 2018-2048, Kapiti Coast is forecast to require an additional 5,300 dwellings. Greenfield modelling provided by WCC has indicated that the District has capacity for 2,106 greenfield dwellings, making up 40% of 30-year demand. This level is considered a relatively high proportion of 30-year demand that is able to be satisfied by greenfield capacity. This, compared with the level of feasible development in rural areas outlined in the feasibility modelling process above, indicates a relatively high level of risk in urban development, due to the competition incurred by high levels of greenfield potential.

On top of greenfield consideration, the relative risk of each development type must be considered in quantifying what will practically be developed by the market. The risk is not homogenous across typology or development type, and thus a matrix of 'risk factors' have been applied across each combination of typology and development type.

Risk has been accounted for developments undertaking by developers by increasing the required profit level for a development to be classified as 'realisable', on top of being feasible. Table 15 below shows the profit levels required for each combination of typology and development option to be considered realisable by the model.

TABLE 15 – DEVELOPER REALISABLE PROFIT RATES

	Comprehensive Developer	Infill Developer	Infill Owner
Standalone	**20%**	**17%**	**25%**
Terraced	**23%**	**20%**	**28%**
Apartment	**32%**	**28%**	**39%**

Source: Property Economics, WCC, KCDC, SNZ

This reflects the market practicality that developments taken on by a developer have relatively lower risk if they are an infill development, rather than a comprehensive development. It also shows the increasing risk of development as the typology increases in scale from standalone dwellings, through to terraced product, and finally apartments.

For an owner occupier the model considers the profit level of the development relative to the capital value of the existing dwelling(s). This is because motivations for an owner to subdivide their property are inherently linked with the relative profit they can achieve against the value of their own home e.g. a $100,000 profit on a $1,000,000 site will be less likely to be developed by the owner, compared to a $100,000 profit on a $500,000 site, assuming similar fixed costs. Therefore, as a methodology for this, the model considers that the lowest quartile of feasible infill developments in terms of the relative profit / CV ratio will not be realised by the market.

Taking these market practicalities into consideration, Tables 16 and 17 represents the realisable capacity within Kapiti Coast for urban and rural areas.

TABLE 16 – KAPITI COAST REALISABLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB (URBAN)

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisability Rate
Maungakotukutuku	463	-	-	-	-	0%
Otaihanga	474	-	-	-	-	0%
Otaki	4214	-	1,001	-	1,001	24%
Paekakariki	284	-	19	-	19	7%
Paraparaumu Beach North	853	-	41	-	41	5%
Paraparaumu Beach South	1168	-	115	-	115	10%
Paraparaumu Central	4110	-	45	-	45	1%
Peka Peka	165	-	-	-	-	0%
Raumati Beach	1656	-	218	-	218	13%
Raumati South	1193	-	245	-	245	21%
Te Horo	49	-	-	-	-	0%
Waikanae Beach	1475	-	142	-	142	10%
Waikanae East	1027	-	3	-	3	0%
Waikanae Park	893	-	-	-	-	0%
Waikanae West	1483	-	125	-	125	8%
Grand Total	19,507	-	1,954	-	1,954	10%

Source: Property Economics, WCC, KCDC

TABLE 17 – KAPITI COAST REALISABLE RESIDENTIAL DEVELOPMENT CAPACITY BY SUBURB (RURAL)

Suburbs	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisability Rate
Kaitawa	194	-	158	-	158	81%
Maungakotukutuku	372	-	222	-	222	60%
Otaihanga	202	-	104	-	104	51%
Otaki	34	-	22	-	22	65%
Otaki Forks	580	-	489	-	489	84%
Paraparaumu Central	130	-	22	-	22	17%
Peka Peka	232	-	207	-	207	89%
Te Horo	81	-	80	-	80	99%
Waikanae East	204	-	153	-	153	75%
Waikanae Park	2122	-	-	-	-	0%
Grand Total	4,151	-	1,457	-	1,457	35%

Source: Property Economics, WCC, KCDC

Table 16 shows that the realisable capacity across the urban market in Kapiti Coast is just over 1,950 new dwellings, representing a 10% realisation rate across the Districts urban areas. In essence, this represents a 64% realisation rate of the already calculated urban feasible capacity outlined in Table 10 above. As expected, the realisation on standalone developments is higher than terraced, with all feasible terraced developments being 'trumped' in realisation by standalone dwellings. Thus, 100% of realisable capacity is standalone.

Table 17 shows that the realisable capacity in the rural market is just over 1,450 new dwellings, representing a 35% realisation rate across the District. This represents a 89% realisation rate of the already calculated rural feasible capacity outlined in Table 11.

APPENDIX 1 – SENSITIVITY ANALYSIS TABLES

EOS Scale (50%) - Urban Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Maungakotukutuku	463	-	-	-	-	0%
Otaihanga	474	-	-	36	36	8%
Otaki	4214	-	212	1,399	1,611	38%
Paekakariki	284	-	22	3	25	9%
Paraparaumu Beach No	853	-	53	25	78	9%
Paraparaumu Beach So	1168	-	128	59	187	16%
Paraparaumu Central	4110	-	12	76	88	2%
Peka Peka	165	-	1	-	1	1%
Raumati Beach	1656	-	171	380	551	33%
Raumati South	1193	-	161	321	482	40%
Te Horo	49	-	-	1	1	2%
Waikanae Beach	1475	-	185	156	341	23%
Waikanae East	1027	-	13	147	160	16%
Waikanae Park	893	-	2	73	75	8%
Waikanae West	1483	-	90	222	312	21%
Grand Total	19,507	-	1,050	2,898	3,948	20%

Build Value Increase (15%) - Urban Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Maungakotukutuku	463	-	-	-	-	0%
Otaihanga	474	-	19	165	184	39%
Otaki	4214	-	336	1,446	1,782	42%
Paekakariki	284	-	35	43	78	27%
Paraparaumu Beach No	853	-	126	33	159	19%
Paraparaumu Beach So	1168	-	200	108	308	26%
Paraparaumu Central	4110	-	136	605	741	18%
Peka Peka	165	-	1	24	25	15%
Raumati Beach	1656	-	279	472	751	45%
Raumati South	1193	-	285	365	650	54%
Te Horo	49	-	9	15	24	49%
Waikanae Beach	1475	-	316	204	520	35%
Waikanae East	1027	-	99	383	482	47%
Waikanae Park	893	-	56	368	424	47%
Waikanae West	1483	-	138	341	479	32%
Grand Total	19,507	-	2,035	4,572	6,607	34%

Land Value Increase (10%) - Urban Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Maungakotukutuku	463	-	-	-	-	0%
Otaihanga	474	-	3	2	5	1%
Otaki	4214	2	280	1,273	1,555	37%
Paekakariki	284	-	23	5	28	10%
Paraparaumu Beach No	853	-	108	23	131	15%
Paraparaumu Beach So	1168	-	143	67	210	18%
Paraparaumu Central	4110	-	66	33	99	2%
Peka Peka	165	-	1	-	1	1%
Raumati Beach	1656	-	183	317	500	30%
Raumati South	1193	-	185	316	501	42%
Te Horo	49	-	1	2	3	6%
Waikanae Beach	1475	-	257	139	396	27%
Waikanae East	1027	-	30	111	141	14%
Waikanae Park	893	-	9	31	40	4%
Waikanae West	1483	-	133	188	321	22%
Grand Total	19,507	2	1,422	2,507	3,931	20%

Land Value Decrease (10%) - Urban Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Maungakotukutuku	463	-	-	-	-	0%
Otaihanga	474	-	-	-	-	0%
Otaki	4214	-	117	987	1,104	26%
Paekakariki	284	-	21	4	25	9%
Paraparaumu Beach No	853	-	35	10	45	5%
Paraparaumu Beach So	1168	-	115	23	138	12%
Paraparaumu Central	4110	-	9	41	50	1%
Peka Peka	165	-	-	-	-	0%
Raumati Beach	1656	-	146	166	312	19%
Raumati South	1193	-	132	162	294	25%
Te Horo	49	-	-	-	-	0%
Waikanae Beach	1475	-	124	104	228	15%
Waikanae East	1027	-	1	10	11	1%
Waikanae Park	893	-	-	-	-	0%
Waikanae West	1483	-	49	85	134	9%
Grand Total	19,507	-	749	1,592	2,341	12%

EOS Scale (50%) - Rural Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Kaitawa	194	-	163	-	163	84%
Maungakotukutuku	372	-	261	-	261	70%
Otaihanga	202	-	145	-	145	72%
Otaki	34	-	22	-	22	65%
Otaki Forks	580	-	530	-	530	91%
Paraparaumu Central	130	-	43	-	43	33%
Peka Peka	232	-	229	-	229	99%
Te Horo	81	-	80	-	80	99%
Waikanae East	204	-	176	-	176	86%
Waikanae Park	2122	-	85	-	85	4%
Grand Total	4,151	-	1,734	-	1,734	42%

Build Value Increase (15%) - Rural Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Kaitawa	194	-	177	-	177	91%
Maungakotukutuku	372	-	313	-	313	84%
Otaihanga	202	-	196	-	196	97%
Otaki	34	-	22	-	22	65%
Otaki Forks	580	-	563	-	563	97%
Paraparaumu Central	130	-	107	-	107	82%
Peka Peka	232	-	231	-	231	100%
Te Horo	81	-	80	-	80	99%
Waikanae East	204	-	200	-	200	98%
Waikanae Park	2122	-	236	-	236	11%
Grand Total	4,151	-	2,125	-	2,125	51%

Land Value Increase (10%) - Rural Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Kaitawa	194	-	168	-	168	87%
Maungakotukutuku	372	-	273	-	273	73%
Otaihanga	202	-	182	-	182	90%
Otaki	34	-	22	-	22	65%
Otaki Forks	580	-	549	-	549	95%
Paraparaumu Central	130	-	54	-	54	42%
Peka Peka	232	-	231	-	231	100%
Te Horo	81	-	80	-	80	99%
Waikanae East	204	-	200	-	200	98%
Waikanae Park	2122	-	-	-	-	0%
Grand Total	4,151	-	1,759	-	1,759	42%

Land Value Decrease (10%) - Rural Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Kaitawa	194	-	146	-	146	75%
Maungakotukutuku	372	-	216	-	216	58%
Otaihanga	202	-	82	-	82	41%
Otaki	34	-	22	-	22	65%
Otaki Forks	580	-	452	-	452	78%
Paraparaumu Central	130	-	22	-	22	17%
Peka Peka	232	-	197	-	197	85%
Te Horo	81	-	80	-	80	99%
Waikanae East	204	-	150	-	150	74%
Waikanae Park	2122	-	-	-	-	0%
Grand Total	4,151	-	1,367	-	1,367	33%

Appendix 5.2

Appendix 5.2: Multi Criteria Analysis: Assessment of the feasibility of Kāpiti Business Areas

Details of the approach used to assess the feasibility of business areas across the Kāpiti Coast District is covered in section 4.5.1 of Chapter 5 of this report. Further detail on the use of the Multi Criteria Analysis methodology can also be found in Appendix 1.6.

The table below shows the scoring from the assessment of business areas. Scoring ranges from 0 (low score) to 5 (high score) and was applied to 14 criteria.

	1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact	TOTAL
Ōtaki	3	0	3	2	3	5	3	3	1	3	3	2	4	4	39
Waikanae	3	0	3	2	5	3	4	4	5	5	5	1	2	2	44
Paraparaumu Centre	5	0	4	3	5	2	4	4	1	4	4	1	4	4	45
Te Roto Drive / Kapiti Landing	5	0	5	3	4	5	4	4	4	4	4	3	3	3	51
Paraparaumu Beach	4	0	4	3	4	2	4	4	3	5	4	1	5	5	48
Raumati	3	0	3	3	3	2	4	4	3	5	5	1	5	5	46
Paekākāriki	4	0	3	3	4	3	3	4	2	4	2	1	3	3	39

Appendix 5.3

Appendix 5.3

Kāpiti Coast District Council:

NPS-UDC assessment of infrastructure availability to support future growth

Contents

Executive summary

The Kāpiti Coast District is set to grow by more than 13,000 people by 2047. The availability and cost of infrastructure to service new development is a significant factor affecting how and where growth and development takes place.

This report provides an assessment of Kāpiti District's key infrastructure networks for water supply, wastewater, stormwater, open space, and local transport, and their ability to meet future growth forecast for the District, while continuing to also meet the needs of existing residents.

Over the last few years, Council has been in the process of reviewing its District Plan and infrastructure management as part of the 30-Year Infrastructure Strategy. This process has helped Council to better identify and align infrastructure investment required to support the on-going operation and expansion of network infrastructure. This includes accounting for the future needs of growth.

Overall, Kāpiti is well placed to meet future needs across its range of local infrastructure. This includes the ability for most networks to meet anticipated growth beyond the next 10 years and, in the majority of cases, to 30 years. However, this requires significant on-going investment and is not without its challenges; with a number of planned investments providing critical points to meeting needs of new growth, such as new water mains to service Greenfield growth in Waikanae.

However, undertaking this NPS-UDC assessment has also helped identify areas for improvement. This includes the need to prioritise the update of modelling for Ōtaki wastewater and water supplies. The previous modelling data for Ōtaki used information that saw growth in Ōtaki declining in a few years' time, whereas the most recent Forecast ID shows moderate growth in the Ōtaki area that is in part a response to the construction of the expressway. The impact of this additional growth occurring is that available capacity could be taken up sooner than anticipated. Council is currently updating modelling to ensure relevant investments are identified and accounted for in future planning and ensure sufficient infrastructure is in place to meet longer-term growth in the area.

While the majority of network constraints are identified and planned to be mitigated, the assessment has identified capacity constraints for Kapiti's stormwater network. This is largely a result of early pipe networks being put in place according to what was required at the time, without foreseeing long term changes to Kāpiti's growth and climate. Council has committed to a $250m programme of works to increase capacity of the network; with future risks of flooding continuing to be controlled through planning restrictions on developing land susceptible to flooding. This includes requirements for new development to be hydraulically neutral whereby new development needs to offset/design stormwater impacts into new development. This assessment does not identify existing constraints as being a constraint on future development.

This report provides the first assessment under the NPS-UDC. It has already identified a number of learnings. Council intends to build on this first assessment, to further link, and align monitoring and modelling of growth to support on-going decisions on infrastructure investment.

Introduction

The NPS-UDC requires high and medium growth councils to assess whether there is sufficient development capacity to meet future residential and business demand across the short, medium, and long-term (3, 10, and 30 year periods).

A prerequisite for assessing sufficient development capacity is that land is serviced or planned to be serviced by Council infrastructure[1]. Drinking water, wastewater, stormwater (three waters), and roading infrastructure are all critical to servicing urban development. Parks and open space also form an important part of supporting green infrastructure, providing amenity and recreational services to current and future development. The need and availability (or planned provision) of these services is a key factor influencing the sequence, scale, location, cost, and overall feasibility of development.

There are also practical constraints on providing infrastructure. The ability to service and expand infrastructure networks, both with regards to physical capacity, topography, and efficient network operation, are all factors that can influence the cost, provision, and sequencing of infrastructure to service future growth and development.

This report provides an assessment of the capacity of Kāpiti's three waters, roading and open space networks to meet forecast urban growth across Kāpiti. Better understanding the nature and demands around future growth alongside infrastructure capacity and provision will help inform councils planning and investment decisions.

Approach to assessing infrastructure capacity

Assessing the availability or ability for infrastructure to support future development needs requires comparing forecast numbers and locations of future growth against currently known and available capacity across Council's key infrastructure.

The following report provides a description of each of the three waters, roading, and open space networks and assesses their ability to accommodate anticipated growth to 2047.

The assessment identifies key performance measures to help identify and test whether capacity and the required levels of service can be met alongside future anticipated development. The assessment also identifies any known and planned works that will help networks meet their future capacity and service levels.

To complete an assessment across infrastructure networks is complex and requires a number of assumptions to be made to enable modelling of current and future conditions. Some assumptions are addressed within the report itself, with more general assumptions made across modelling outlined at the end of the report.

[1] Provision of other non-Council infrastructure is also being assessed separately by responsible bodies – and will also be included in the housing and business assessment of development capacity.

Forecast population and dwelling growth for Kāpiti

The Kāpiti Coast population and household forecasts were last updated in 2017[2]. The ID Forecast shows anticipated changes in population and the type and location of households across the District from 2013 to 2043[3]. Over this period, Kāpiti's population is expected to increase by 12,985 with an additional 5,484 dwellings required.

The long term assessment of the NPS-UDC requires covering growth out across a 30-year period. To provide a consistent assessment period, figures from the ID Forecast have been extrapolated from 2043 to 2047 to enable the assessment to cover the period 2017 - 2047. Over this period, the Kāpiti Coast population is expected to increase by 13,441 and dwellings by 5,658.

The table below summarises the forecast population growth across the Kāpiti Coast from 2017 – 2047, across 3, 10, and 30 year periods. The population forecast is also used to forecast dwellings across the District. This takes into account factors influencing household formation including changes to the size and type of households from changing population demographics and the likely form of residential development that might occur in each location. This also takes into account factors for housing including development of new greenfield sites, subdivision, and infill within existing residential area, rezoned land for residential development, and densification of housing development.

Forecast population growth and net change from 2017-2047

	Population forecasts 2017 - 2047				Net population change 2017 - 2047		
Unit area	**2017**	**2020**	**2027**	**2047**	**3 year**	**10 year**	**30 year**
Central Paraparaumu	2,824	2904	3106	3589	80	282	**765**
Ōtaki	3,451	3530	3664	4020	79	213	**569**
Ōtaki beach and surroundings	2,774	2880	3194	3529	106	420	**755**
Ōtaki Forks-Kaitawa-Te Horo	3,842	3916	4031	4445	74	189	**603**
Paekākāriki	1,645	1585	1489	1510	-60	-156	**-135**
Paraparaumu Beach, North Otaihanga, Kāpiti Island	5,109	5210	5443	5972	101	334	**863**
Paraparaumu Beach South	5,129	5134	5147	5153	5	18	**24**
Paraparaumu East	2,283	2318	2453	2936	35	170	**653**
Paraparaumu north	4,127	4450	4798	5351	323	671	**1,224**
Raumati Beach	5,178	5238	5257	5794	60	79	**616**
Raumati South	3,636	3620	3622	4459	-16	-14	**823**
Waikanae Beach – Peka Peka	3,642	3719	3921	4653	77	279	**1,011**
Waikanae Park	1,913	2004	2461	5076	91	548	**3,163**
Waikanae-Reikorangi	6,792	7006	7588	9299	214	796	**2,507**
Kāpiti Coast totals	**52,345**	**53,515**	**56,175**	**65,786**	**1,170**	**3,830**	**13,441**

[2] by .id, the population experts, on behalf of Kāpiti Coast

[3] Please note that population numbers in forecast.id for the 2013 base year are derived from estimated resident population from Statistics New Zealand. These differ from (and are usually higher than) Census counts as they factor in population missed by the Census and population overseas on Census night. They are generally considered a more accurate measure of population size than Census counts.

Forecast dwelling growth and net change from 2017-2047

	Dwelling forecasts 2017 - 2047				Net dwellings change 2017 - 2047		
Unit area	**2017**	**2020**	**2027**	**2047**	**3 year**	**10 year**	**30 year**
Central Paraparaumu	1,325	1351	1409	1578	26	84	**253**
Ōtaki	1,581	1614	1669	1799	33	88	**218**
Ōtaki beach and surroundings	1,542	1580	1680	1798	38	138	**256**
Ōtaki Forks-Kaitawa-Te Horo	1,779	1821	1911	2097	42	132	**318**
Paekākāriki	809	814	828	872	5	19	**63**
Paraparaumu Beach, North Otaihanga, Kāpiti Island	2,072	2120	2197	2401	48	125	**329**
Paraparaumu Beach South	2,387	2390	2422	2477	3	35	**90**
Paraparaumu East	877	890	920	1100	13	43	**223**
Paraparaumu north	1,780	1898	1984	2211	118	204	**431**
Raumati Beach	2,296	2322	2371	2616	26	75	**320**
Raumati South	1,561	1568	1610	1951	7	49	**390**
Waikanae Beach – Peka Peka	2,253	2307	2403	2687	54	150	**434**
Waikanae Park	969	1016	1238	2272	47	269	**1,303**
Waikanae-Reikorangi	3,168	3245	3496	4198	77	328	**1,030**
Kāpiti Coast totals	**24,399**	**24,936**	**26,138**	**30,057**	**537**	**1,739**	**5,658**

Percentage change in population and dwelling from the 2017 baseline

Area unit	**% change in population**	**% change in dwellings**
Central Paraparaumu	27	19
Ōtaki	16	14
Ōtaki beach and surroundings	27	17
Ōtaki Forks-Kaitawa-Te Horo	16	18
Paekākāriki	-8	8
Paraparaumu Beach, North Otaihanga, Kāpiti Island	17	16
Paraparaumu Beach South	0	4
Paraparaumu East	29	25
Paraparaumu North	30	24
Raumati Beach	12	14
Raumati South	23	25
Waikanae Beach – Peka Peka	28	19
Waikanae Park	165	134
Waikanae-Reikorangi	37	33
Totals	26	23

The greatest amount of forecast growth is expected to occur in the Waikanae area, with Paraparaumu and Raumati areas also expecting strong growth. Ōtaki is also expecting modest growth, while Paekākāriki is expecting a slight decline in population, but an increase in housing. This is due to changes in household compositions across the area. Further details on changes to residential and business demand are available in the assessment of demand report.

To understand and assess infrastructure capacity, the above levels of forecast growth are compared against recent modelling and assessments of infrastructure capacity. This helps us better understand current capacity, constraints and mitigating factors determining whether infrastructure servicing is available to meet on-going and additional needs from growth.

Capacity of Kāpiti Coast's water supply

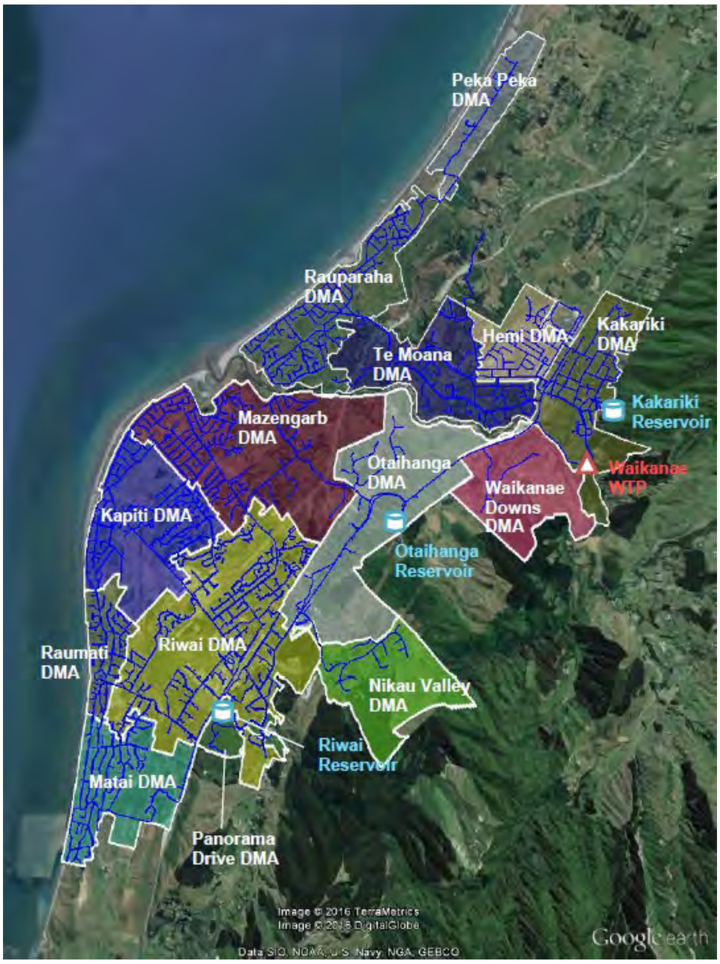
Description of schemes

The Council is responsible for the provision and management of four water supply schemes at Waikanae/Paraparaumu/Raumati, Ōtaki, Te Horo/Hautere, and Paekākāriki. The four schemes service approximately 22,000 properties and 47,000 people (93% of the District population), with the remaining relying on private tank water and bores.

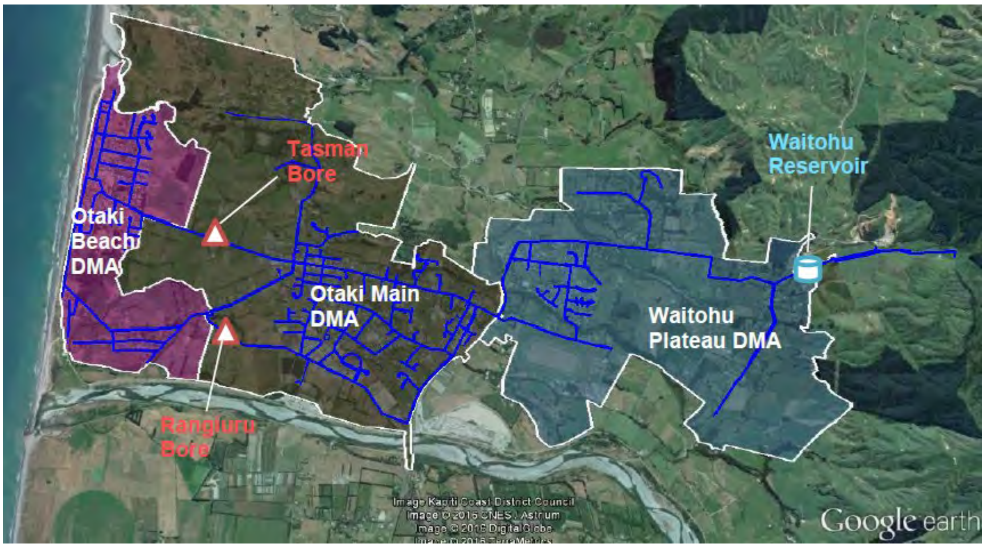
The overall water supply network for the District consists of 571km of water pipes, five water treatment plants, seven pump stations, and 15 groundwater bores. Based on the Council's most recent assessments, 72% of its water supply pipes are in moderate to very good condition. This assessment is based on industry expected base life knowledge, results of pipe sampling and risk profiling.

Works have been planned to maintain and improve the supply of drinking water to meet Kāpiti's future needs. This includes works to increase capacity for the both the supply and treatment of water. An example is work planned on the largest Waikanae/Paraparaumu/Raumati scheme to undertake groundwater recharge and enable long term supply to service a 30,700m3 per day peak demand for a population of 52,000 expected in 2060 during a once in fifty year drought. Other measures include purchasing land for a future dam to further future-proof the water supply for Kāpiti and provide security of supply for the next 100 years.

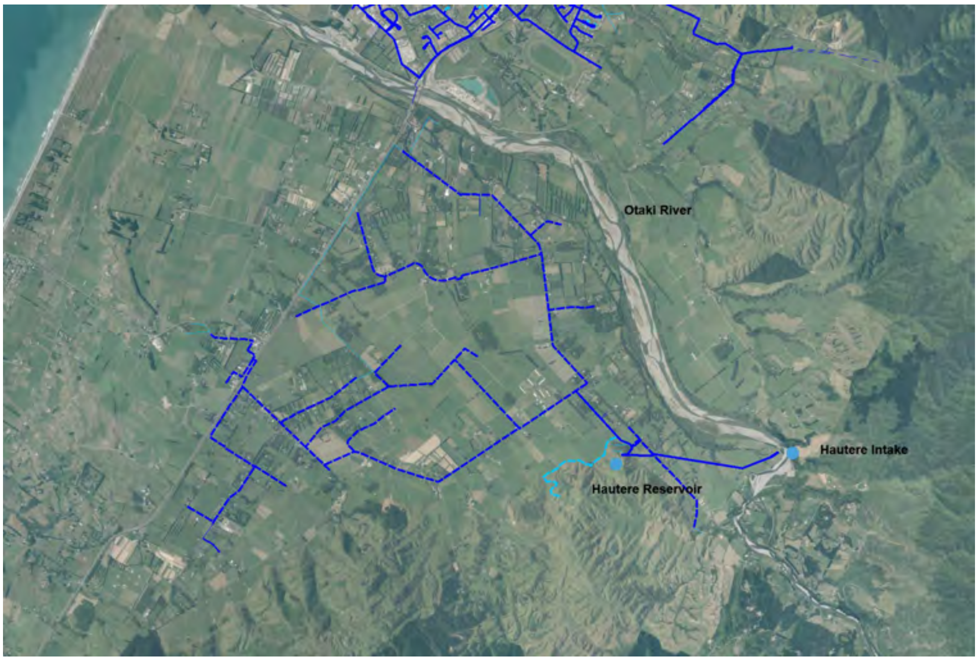
Picture 1: Waikanae/Paraparaumu/Raumati water supply scheme



Picture 2: Ōtaki water supply scheme



Picture 3: Te Horo/Hautere water supply scheme



Picture 4: Paekakariki water supply scheme

Measuring network performance

Modelling of the water supply network uses three sets of performance criteria for storage, minimum and maximum pressures, and fire flows. These three sets of criteria provide a baseline level of service across the four schemes.

Storage – that reservoirs have sufficient storage for 24 hours of average demand in the area they service, plus storage sufficient for fire fighting according to the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice SNZ:PAS 4509:2008 (known as the Fire Code).

Pressures – that pressures at the point of supply of properties connected to the Kāpiti Coast District Council water network should be above 25m or 10m during firefighting events.

Fire code – That fire code requirements will be met and that specified fire flows should be available at 2/3 of peak demand (peak demand is at 8pm for the Kāpiti network).

Summary of Assessment

Waikanae/Paraparaumu/Raumati and Ōtaki

Kāpiti's two largest water schemes were last modelled in 2017[4]. Population projections were used along with a target peak demand of 490 l/person/day to calculate the design demand for the total system. This includes a total of demand for residential demand, commercial/industrial demand, and water loss.

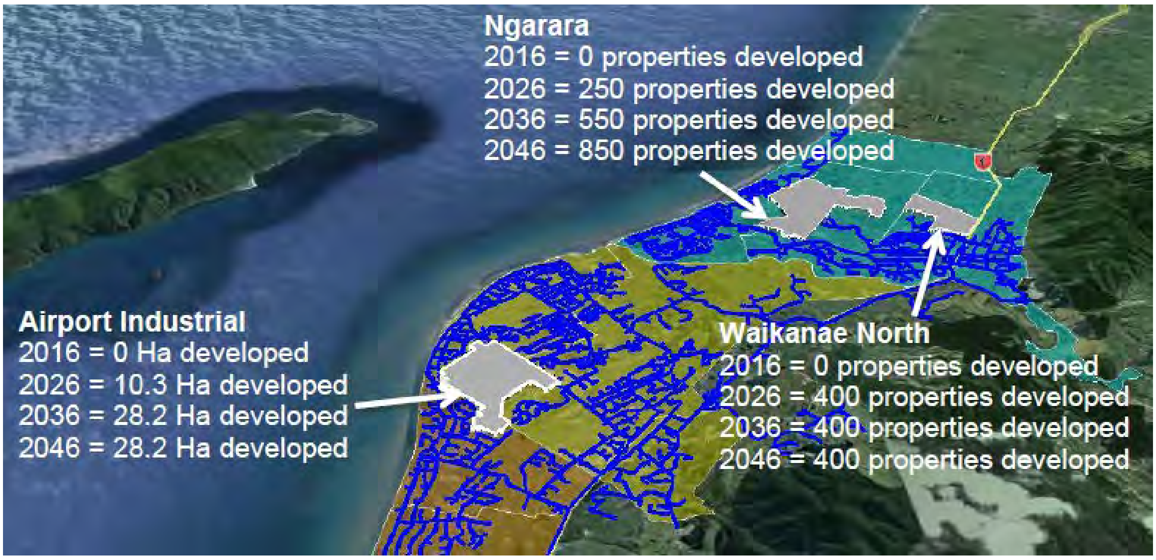
The modelling was based on projected population growth from 2016 to 2046, as shown in the table below.

Population projections 2016 - 2046

Water supply zone	**2016**	**2026**	**2036**	**2046**
Waikanae	11,426	13,056	14,669	16,207
Paraparaumu/Raumati	27,249	28,636	29,458	29,954
Ōtaki	5,883	5,912	5,771	5,547
Total	**44,558**	**47,603**	**49,898**	**51,708**

The population figures were then combined with factors including household size and usage to project future demand across each of the supply zones. Modelling also took into account the quantum and timing of key areas of anticipated greenfield development around Ngarara, Waikanae North, and around the airport in Paraparaumu to help also identify and phase additional likely demand created from these areas. It also factored in potential upgrading of water supply to Peka Peka from the current restricted system to on-demand supply, which would increase maximum peak demand.

[4] Kāpiti Coast water modelling phases 4+5 - Water Network Development Plan, Stantec, 2017



Summary of demand

Supply Zone / Category	2016 (m3/day)	2026 (m3/day)	2036 (m3/day)	2046 (m3/day)
Waikanae	**5,698**	**6,708**	**7,499**	**8,253**
Existing commercial	599	599	599	599
Existing leakage	1,877	1,877	1,877	1,877
Existing residential + infill	3,123	3,125	3,548	3,935
Greenfields	99	1,107	1,475	1,842
Paraparaumu/Raumati	**13,352**	**14,031**	**14,434**	**14,677**
Existing commercial	1,277	1,277	1,277	1,277
Existing leakage	1,672	1,672	1,672	1,672
Existing residential + infill	10,403	10,637	10,267	10,510
Greenfields	0	445	1,218	1,218
Ōtaki	**2,883**	**2,897**	**2,897**	**2,897**
Existing commercial	395	395	395	395
Existing leakage	732	732	732	732
Existing residential + infill	1,756	1,770	1,770	1,770
Greenfields	0	0	0	0
Total	**21,933**	**23,636**	**24,830**	**25,827**

Modelling for peak future flows out to 2046 identified a number of upgrades to address deficiencies. A summary is provided below, but the full assessment is available in the Water 2017 Network Development Plan.

- Pressure deficiencies – five areas affected: four moderate, one severe
- Fire flow deficiencies – 12 areas affected: five severe, four moderate, and three minor
- Storage deficiencies – Ōtaki lacking 2500m3

These deficiencies have been used to identify and prioritise a programme of work to mitigate and manage impacts on the networks ongoing delivery, while not affecting the ability to service growth expected in key locations (inline with projections). The work programme also identifies a number of strategic projects, which have been programmed to provide services and necessary capacity to key greenfield areas as development occurs over the next 30 years and beyond.

One of the most notable points identified from the assessment is the difference between the growth projections used for modelling in Ōtaki compared to the latest levels of growth anticipated. The projections used in the 2017 modelling anticipated a decrease in population; whereas, the more recent ID forecast shows an increase in growth across the wider Ōtaki area (including Ōtaki Beach). However, when modelled in 2017, an assumption was made that future demand in Ōtaki would remain constant after its peak of growth that was anticipated for 2023 (rather than modelling a decline).

This difference in anticipated growth also has a bearing on the storage deficiencies identified for Ōtaki reservoir storage was identified as lacking by some 2500m3. This increases further to 5,100m^3 when compared to the higher levels of growth anticipatred from the latest ID forecasts. Despite the specific existing storage deficiency, our current calculations of capacity and expected levels and location of growth identify sufficent capacity in the existing system to deliver water to meet the growth in Ōtaki for the next 10 years (see further discussion on network effciencies achieved through water metering under network improvements).

However, servicing growth beyond this level/period is expected to require key infrastructure upgrades. We are currently undertaking updating modelling of the growth and demand in Ōtaki. This updated modelling will update assumptions around growth in the area and help inform the nature and scale of investment required to enable the network to service future needs. This includes the provision of an additional reservoir.

Hautere Rural water supply scheme

The Hautere scheme services part of the Te Horo and Hautere plains area. The scheme currently has 803 water units allocated, with each water unit equating to 1 m^3/day (+/- 15%). Consented allocation is a maximum of 1,382.4m3/day with the difference allowing the scheme to have operational flexibility. The scheme is now closed which means that no new allocation is allowed from the scheme, but existing allocations can be divided across additional development to support the addition of new development within the cap.

Operational flexibility, especially for small public water schemes such as Hautere, is needed to account for such things as:

- Managing leakage control activities: for example, should two sizable (180-200 m^3/day) leaks progressively develop concurrently such as with tapping bands or lateral failures, it may take time to locate them for repair; and
- Maintenance activities: for example, refilling reservoirs following inspections or operational shut downs will draw additional short term flows.

While a small amount of uptake of existing allocation might be able to be accommodated within the existing capacity and servicing of the scheme (cap), new development in the area is otherwise required to be self-servicing, with onsite options for water supply (e.g. rainwater).

Paekākāriki water supply scheme
The Paekākāriki drinking water supply is a small urban supply providing water to a population of approximately 1,665 people in the town of Paekākāriki.

Filters were recently renewed alongside works preparing for construction of Transmission Gully. The scheme abstracts water from two bores before it undergoes treatment at the Paekākāriki water treatment plant. A third water source is available from Wainui Stream as an emergency backup.

Water from the treatment plant is then pumped from the treatment plant to a storage reservoir and gravity fed to the towns' reticulation.

The recently reviewed Paekākāriki Drinking Water Supply Water Safety Plan identified the average daily volume of water supplied by the scheme was 643 m^3/day with a peak daily volume at 850 m^3/day. The maximum consented take for the scheme is 2,160 m3/day, more than double the current maximum usage. The Paekākāriki area is currently forecast to decrease in population by 135 people by 2047, but dwellings are expected to increase by 63. Based on this limited forecast for growth, there is enough capacity within the water supply scheme to cater for need to 2047 and beyond.

Network improvements
A key consideration in determining available capacity is that many of the usage figures used in modelling were based on levels of water usage prior to the introduction of water metering. We have undertaken subsequent analysis that shows water metering has produced a 26% saving from previous peak day usesage since its introduction. This efficiency saving effectively extends the existing networks capacity to ensure we have at least 10 years of additional servicing avaliable across the systems, without the need for significant upgrades in that timeframe. However, there are a number of key network works required to provide capacity beyond that period in the Waikanae and Ōtaki areas.

Planned key infrastructure investments to support increasing capacity needs across the next 30 years include:

- Waikanae treatment plan stage 2 (2019)
- Waikanae treatment plan stage 3 (2024)
- River recharge stage 2 (2033)
- Ōtaki and Hautere water safety upgrades (2020)
- Ōtaki Reservoir upgrade (2025)
- Districtwide network upgrades (2026)
- Other measures includes the purchase of land for a future dam to further future-proof the water supply for Kāpiti and provide security of supply for the next 100 years.

Summary of capacity of water schemes to meet forecast growth levels
While there are some areas of current deficiency within and across Kāpiti's water supply schemes, discussion with the Infrastructure Services team and analysis of recent modelling

identifies that Kāpiti's water supply schemes have sufficient capacity available, or planned to be available, to support forecast development needs to 2047.

	3 years	10 Years	30 years	Comments
Waikanae/Paraparaumu /Raumati	Yes	Yes	Yes	Upgrades are planned in years 2026 to the Waikanae Trunk and Peka Peka Main in 2031 to provide additional capacity in key growth areas.
Ōtaki	Yes+	Yes*+	Yes**	*Capacity in the delivery network is available on the basis of effciencies from water metering and smaller upgrades ** The system faces constraints to meet levels of growth much beyond the current projections to 2047. + There are existing storage deficiences that are proposed to be addressed around 2024/25 to meet the future growth in the community.
Te Horo/Hautere	Yes	Yes	Yes	The Te Horo/Hautere Scheme is in a rural area and is a closed scheme, with limited capacity for new connections. New development will provide its own water supply.
Paekākāriki	Yes	Yes	Yes	Capacity from the scheme is sufficient to meet the current and future population forecast for the village.

Capacity of Kāpiti Coasts wastewater systems

Description of systems

Council has two wastewater treatment systems, one in Ōtaki and one in Paraparaumu serving Waikanae, Paraparaumu, and Raumati. These collectively serve approximately 21,000 properties and 42,000 people (83% of the Districts population).

Kāpiti Coasts wastewater network has more than 360km of wastewater pipes and 147 wastewater pumping stations. Many of the wastewater pipes were installed in the 1970s and 80s, with several now reaching middle age because the pumping stations are of varying ages and condition.

Areas not serviced by the two wastewater schemes have on-site treatment (septic tanks). Paekākāriki, Peka Peka, and Te Horo Beach are all urban residential areas that do not have reticulated wastewater systems.

Picture 5: Ōtaki wastewater scheme

Picture 6: Waikanae/Paraparaumu/Raumati wastewater scheme

Measuring network performance

Wastewater modelling has been undertaken to assess network performance during 1, 2, 5, and 10-year average recurrence interval (ARI) storms. A contributing measure to this is levels of inflow and infiltration (I/I) of stormwater into the wastewater system. This is important as I/I reduces available capacity of pipes and contributes to potential system overflows.

Summary of Assessment

Wastewater models were updated for Paraparaumu/Raumati and Waikanae schemes in 2017 and 2015 respectively[5], and an assessment of capacity in the Ōtaki wastewater treatment plant was undertaken in 2015, as part of the review of its wastewater consent. This information provides an indication of the current and future capacity across some of the wastewater assets to meet the anticipated growth, using a number of assumptions for demand.

The condition and capacity of the Paraparaumu wastewater treatment plant was assessed in 2016. From this study a programme of treatment plant process renewals and upgrades was developed to meet the future growth in the Waikanae and Paraparaunu/Raumati communites. These upgrades include hydraulic capacity of the inlet works and reconfiguration of the process units to accommodate the additional population expected.

Paraparaumu/Raumati

Modelling for the Paraparaumu/Raumati part of the wastewater network used a 2013 and 2046 population projection as its basis and then used a number of assumptions, including household formations, to distribute growth across vacant properties and large lots to come up with a modelled population connected to the network out to 2046.

Modelled population growth to 2046

Area unit	2013 modelled population connected	2046 modelled Population Connected
Otaihanga	1,116	1,302
Paraparaumu Beach North	3,348	3,348
Paraparaumu Beach South	4,956	4,956
Paraparaumu Central	8,562	10,553
Raumati Beach	4,738	4,738
Raumati South	3,609	6,153
Total	**26,329**	**31,051**

This growth scenario was then modelled against a 1, 2, 5, and 10-year average recurrence interval (ARI) storms. For the 2013 scenario, one manhole (located just upstream of the Hinemoa pump station) was predicted to overflow in a one year ARI design storm and above, and another manhole (also located just upstream of the Hinemoa pump station) was predicted to overflow in a five-year ARI design storm.

Overall, the modelled capacity of 31,051 for the Paraparaumu/Raumati network equates to 17 years of capacity when compared against the current ID forecasts for population growth across the same area. The results of modelling identified two locations of small manhole overflows. In

[5] Paraparaumu wastewater model update stage 2: Recalibration & system performance, Watershed, 2017; Waikanae Wastewater Modelling Ngarara Development Impact Assessment, Watershed, 2015

addition, work to address I/I impacts in the area impacting stormwater spikes is a priority under the current programme of work.

Work has been planned to refresh the wastewater strategy fo the Kāpiti wastewater networks. This work will consider their perfromance versus costs and benefits of interventions to achieve various systems containment standards and levels of service.

Waikanae

Modelling of the Waikanae wastewater system was updated in 2015 looking specifically at available network capacity and potential impacts from growth expected to service the Ngarara and Waikanae North developments, in addition to general infill across the wider area. Population projections were used to provide the basis of population increases across Waikane and the two large developments (anticipating 1880 and 800 lots respectively) rather than the actual staging plans for the developments. Future development scenarios included 10% infill through the existing Waikanae catchment, with the remainig 90% as greenfield development. Two periods were used for scenario testing of growth, 2018 and 2061. The Table below shows the figures used for the modelled furure growth.

Modelled future growth projections for Waikane (2015)

Area unit	**2013**	**2018**	**2061**
Waikanae Beach	3049	3049	3555
Waikanae Park	1937	1968	2508
Waikanae West*	1507	1562	2196
Waikanae East*	2830	2830	3297
Ngarara	0	498	4700
Waikanae North	0	288	800
Total	**9323**	**10194**	**18256**

*Future population excludes Ngarara and Waikanae North developments

Results for both a two and 10-year ARI were tested. Modelling showed that while existing piped conveyance capacity was exceeded for storm events modelled, this was able to be contained within allocated network storage facilities. Modelling identified an increased use of the ponds wastewater pump station storage with the addition growth anticipated out to 2061. The upgrades to the Waikanae terminal pump station and associated completion of the rising main in 2020-21 will reduce the need to use the storage to the same levels/extent, reducing the risk of discharge to the environment.

Latest ID forecast population projections indicate population growth across the whole of Waikanae area[6] of 12,726 by 2020, 13,970 by 2027, and 19,028 by 2047. While the latest projections for 2047 are higher than those used as part of the 2061 scenarios test, modelling indicates that there is sufficient capacity, with just short of 30 years capacity (until at least 2044) when compared to the latest ID forecast projections.

Ōtaki

Wastewater flows to the Ōtaki wastewater plant were assessed in 2015 as part of the resource consent renewal process. The consent assessment expected the population for Ōtaki to increase

[6] This also includes an element of population growth in the Peka Peka and Reikorangi areas that fall outside of the reticulated network.

from 5,960 over the 2005-2015 period, up to a total of 6,520 by 2035. This level of growth was used as the basis to calculate future wastewater flows to the Ōtaki wastewater treatment plan including dry and wet weather flows.

ID forecast of population for the Ōtaki and surrounding area shows a population of 7,159 at 2035; 639 more than the forecast used in the reconsenting work. The equivalent population level of 6,520 is expected to be reached by 2022 under the latest ID forecast.

The maximum effluent discharge volume is limited to 2820m3/day under the existing consent condition. There is sufficient storage within the secondary lagoons and the storm buffer ponds to store excess flow, as well as rainfall on the secondary lagoons during extended periods of wet weather (e.g. a typical wet month). No increase in this limit was requested for the consent at the time, as forecast population growth was relatively minor and any increase in dry weather flow due to population growth over the proposed consent period could be accommodated within the current system.

The growth projected will require review of the Ōtaki wastewater treatment plant process capacity and that of the associated discharge consent. The review will identify the required upgrades and any environmental impacts that need to be addressed to meet the growth.

Growth will continue to reduce available network capacity and exacerbate any potential wet weather overflows from the network. This will slowly reduce the containment levels that are being achieved by the wastewater network in Ōtaki and likely require upgrades in the future. Modelling is currently underway to identify the exact locations and extent of any overflows from the network with the projected growth.

<u>Network improvements</u>
Similar to water supply, the introduction of water metering has also contributed to improved capacity of the two wastewater treatment schemes. The reduction in the overall amount of water being used has resulted in reductions in the average and peak flows of wastewater. While not to the same extent as reductions in water supply, a reduced throughput on the piped system and treatment system has extended the capacity available within the system.

There are also a range of works underway to improve the performance and capacity of the wastewater network. There is a Districtwide programme of work to understand and address inflow and infiltration impacts. Paraparaumu treatment plan is also due for additional upgrades in 2024 along with the renewal of the aeration system in 2021 that will both support and expand the ongoing capacity of the main wastewater system in the District.

Key infrastructure investments to support increasing capacity needs across the next 30 years includes:

- 30-year asset renewal programme (2018 – 48)
- Paraparaumu wastewater treatment plant inlet works (2020 - 21)
- Paraparaumu wastewater treatment plant upgrade (2023 - 25)
- Aeration system renewal (2021 and 2039)

Summary of capcity of wastewater systems to meet forecast growth levels
Discussion with the Infrastructure Services team and analysis of the recent modelling identifies that Kāpiti's wastewater schemes have sufficient capacity available, or planned to be available, to support forecast development needs out to 2047.

Ōtaki's wastewater system, however, has known restrictions to growth that are currently being modelled to develop upgrades to service future growth. Continued growth in the long term without upgrades is likely to cause overflows and increase their magnitude.

	3 years	10 Years	30 years	Comments
Waikanae/Paraparaumu/Raumati	Yes	Yes*	Yes*	*Key renewals and upgrades are planned to the Paraparaumu wastewater treatment plant and networks in 2024 and 2021/39 that will ensure and expand its ongoing capacity.
Ōtaki	Yes	No*	No**	*Known capacity constraints exist in the current network that will likely restrict medium term growth. The exact nature and extent of these restrictions is being investigated to develop upgrades required to service the projected growth

Capacity of Kāpiti Coasts stormwater network

Description of network

The Council provides stormwater services in the urban areas of the District (Ōtaki, Waikanae, Paraparaumu/Raumati and Paekākāriki) to protect property from flooding and improve the quality of waterways . Most of the urban areas in the district receive stormwater protection through a variety of means including reticulated system (pipes), kerb discharge, a system of soak pits, retention ponds, and overland flow paths. Overall 21,901 properties are serviced by public stormwater systems.

The main characteristics of the urban systems are:

- coastal areas where stormwater is generally discharged to the sea;
- southern peat and dune areas that do not drain to any water course and are served by pump stations;
- Paraparaumu and Waikanae open water courses with smaller branches that are piped and/or open;
- varying design levels across the District depending on when the stormwater infrastructure was installed;
- significant barriers to east/west flow;
- vulnerability to key climate change factors (for example, sea level rise and storm surges, increasing rainfall and storm events);
- Nearly 50% of the piped reticulation system is exceeded in a one in 10-year event;

- 110km of open waterways forming part of the drainage network;
- Nearly 250 ponds form part of, or discharge into, the stormwater network.

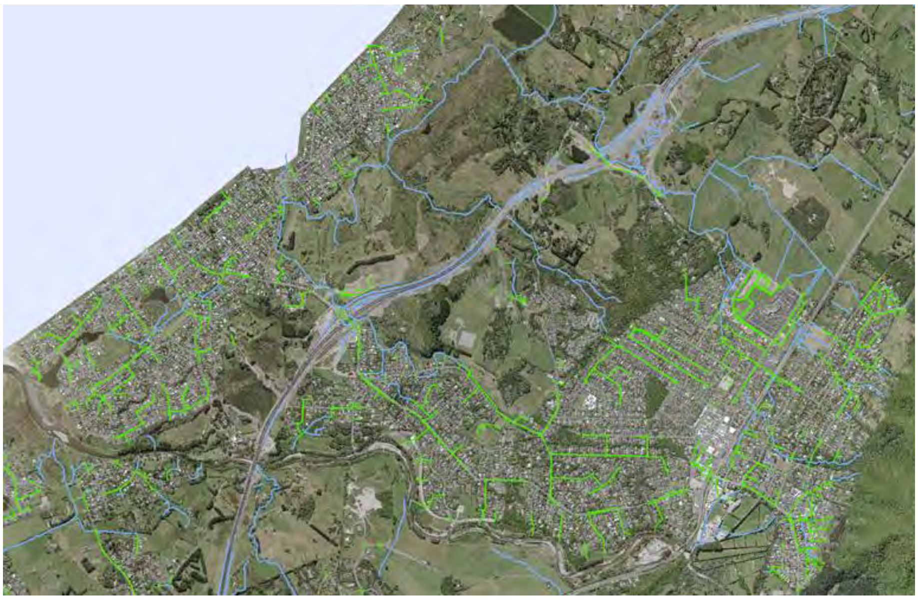
In the past, assessments of stormwater asset condition and capacity were typically undertaken on an ad hoc basis following a flooding event. This limited the Council's understanding of the condition of assets across the network.

Subsequent to the May 2015 flood event, Council has undertaken more comprehensive condition and capacity assessments across the network. These assessments are staged over several years.

Area	Length of piped network	Length of open waterways maintained by Council	Number of stormwater pump stations
Paraparaumu	130km	31km	6
Waikanae	48km	8km	3
Ōtaki	28km	0.9km	3
Paekākāriki	5.4km	0.65km	0
Te Horo	0.18km (sump leads only)	0km	0

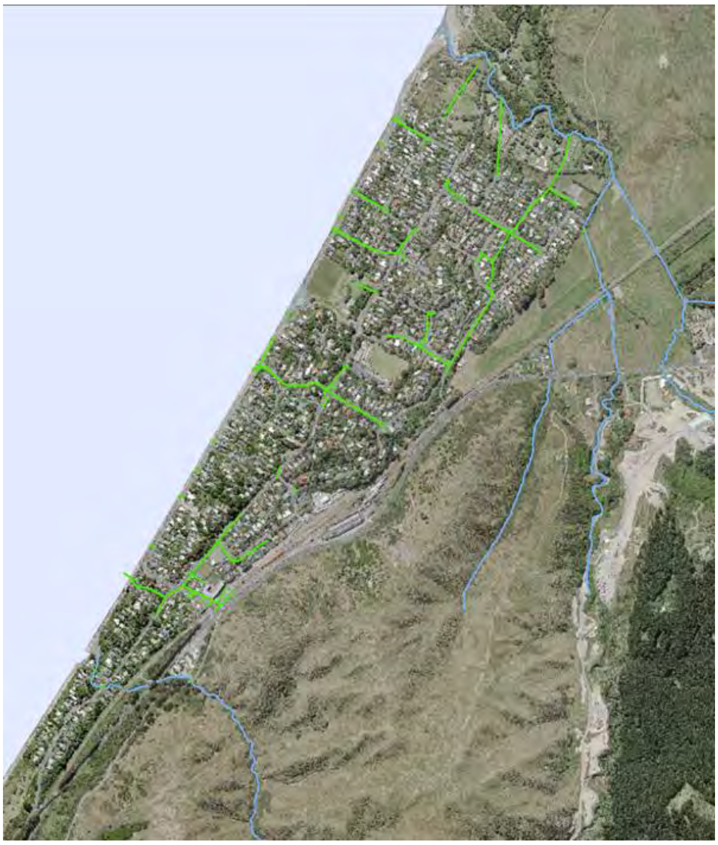
Picture X: Ōtaki stormwater system

Picture X: Waikanae stormwater system



Picture X: Paraparaumu/Raumati stormwater system

Picture X: Paekākāriki stormwater system



Measuring network performance

For existing dwellings, the main performance measure used for measuring provision and capacity for stormwater is the prevention of flooding of habitable floor space up to a one in 50 year event. All new developments are required to prevent flooding of habitable floor space up to a one in 100 year event, which includes the predicted impacts of climate change.

For this assessment, the water quality effects from stormwater are not considered in the level of service. However, the management of stormwater to achieve improved water quality will be needed to meet the new requirements in the Proposed Natural Resource Management Plan for the Wellington Region.

Summary of Assessment

Out of the 21,901 urban properties contributing stormwater rates, nearly 6,500 have a flood designation identified on the property in the District Plan's flood hazard maps for a one in 100 year rain event. Nearly 50% of the current infrastructure exceeds capacity in events smaller than a one in 10 year event.

Council has committed $250M to a programme of stormwater works [240 projects over 45 years], including upgrades to the stormwater network to a level that reduces dwelling inundation in events up to the one in 50 year event. The initial focus is on properties that are susceptible to habitable floor flooding.

To ensure future flooding issues are not exacerbated, all new development within the District is required to mimic its predevelopment flow regime in the range of design storm events, from one in two-year event, up to the one in 100 year event. This involves using a range of measures to ensure new development remains hydraulically neutral; including, but not limited to: detention or disposal areas, tanks, and limits to if or how areas susceptible to flooding and overland flows are developed (including earthworks).

New development is also required to ensure any loss of flood storage is mitigated on the subject site and that such loss does not adversely impact another property.

These requirements are key determinants of where and how land is appropriately developed, and as they vary by location can often only be considered on a site-by-site basis. Where a site is large enough it may be easy to accommodate stormwater requirements onsite. Smaller sites, including infill sites, may have more limited options. The feasibility of some sites to be developed are, therefore, influenced by site-specific considerations such as location, size, and the viability of the options available.

<u>Network improvements</u>

To address capacity and condition issues Council has formulated a work programme with 240 physical works projects; prioritised on the severity of flooding impact and implementation aspects (such as budget, downstream constraints, consenting requirements), which include:

- Habitable floor flooding 2018–48
- Addressing downstream constraints 2018–48
- Commercial property flooding 2018–40
- Garage flooding 2032–48
- 30-year asset renewal programme 2018-48.

In addition to the work programme for capital works, Council is undertaking a range of supporting tasks. These include:

- Replacement of pipes creating I/I issues and asset maintenance
- Open drain/stream maintenance
- Stormwater management strategy and bylaw
- Rebuild Council’s flood hazard models to reflect recent development which has occurred within the District and taking the opportunity to improve models through access to updated software and information
- Community education on maintaining private stormwater assets.

The Council’s hazard maps combine the model results from both Greater Wellington Regional Council and Kāpiti Coast District Council. Greater Wellington Regional Council is responsible for the modelling and maintenance associated with several of the major river systems in the District (principally the Waikanae and Ōtaki Rivers).

Summary of stormwater network capcity to meet forecast growth levels
Analysis and modelling from the Council's Stormwater team has indicated that areas of existing development are currently affected by flooding as a consequence of the current capacity of infrastructure being exceeded. Council has committed budget to undertake works to redress this issue. This work will not eliminate flooding in the one in 100-year event. It is considered that there is sufficient capacity available to meet forecast growth as the planning process requires all new development to meet and or mitigate stormwater requirements as part requirements for hydraulic neutrality, this includes improving the quality of waterways and providing compensatory storage for any displaced flood water. This report does not model the overall feasibility or impact of this requirement on development.

Planned upgrades and renewals are planned to support forecast development within the existing District Plan requirements for all new development.

	3 years	10 years	30 years	45 years	Comments
Paekākāriki	Yes	Yes	Yes	yes	Key renewals and upgrades are planned including town centre pipe upgrades (2030-2034), asset upgrades (2030-2034), Tilley Road upgrade and enhancement of Wainui Stream (2040-45)
Paraparaumu and Raumati	Yes	Yes	Yes	Yes	Key renewals and upgrades are planned including Kena Kena catchment upgrade and pumpstation (2018-2026), several bridge upgrades on Wharemauku and Mazengarb Stream (2018-2030), and Amohia upgrade (2018-2048), undercapacity network upgrades (2018-2028)
Waikanae	Yes	Yes	Yes	yes	Key renewals and upgrades are planned including Charmwood pumpstation and Richmond Avenue upgrade (2027-2030), Karariki Stream network upgrade (2018-2028), Waikanae lagoon and undercapacity network upgrades (2022-2030)
Ōtaki	Yes	Yes	Yes	yes	Key renewals and upgrades including Mangapouri culvert upgrade (joint project with GWRC 2040-2048), undercapacity network upgrades (2031-2036)

Assessing capacity of Kāpiti Coast's transport network

Description of network

Transport plays a key role in connecting communities, businesses, and markets. It is important that land transport enables housing and economic development within the District and that efficient links between production and communities are strengthened.

The wider transport network for Kāpiti is defined by a number of key elements. This includes

- State Highway 1, which runs through the middle of the District joining key settlements to one another, but also to Wellington to the south and Levin to the north. The new expressway improves connectivity within communities. While the Old State Highway 1

provided transport linkages within and outside Kāpiti it bi-sected our town centres, the Expressway now provides opportunities to improve connectivity at these locations;
- The completion of the Transmission Gully and the Peka Peka to Ōtaki Expressway projects are expected to further increase accessibility across the District;
- Commuter rail, which supports connectivity across Waikanae, Paraparaumu, and Paekākāriki, south to Wellington and the Capital Connect service from Levin, through Ōtaki to Wellington;
- Bus services connecting communities and to the railway stations, primarily in Paraparaumu and Waikanae which supports mode shift and can reduce pressure on commuter parking;
- Park and Ride at the railway stations;
- The Stride and Ride initiative has made it easier to walk and cycle around the District using the cycle, walkways, and bridleway network. These include shared path improvements between Paekākāriki and Waikanae, enhanced connections to and from our town centres and the Mackays to Peka Peka shared pathway, and links along the Peka Peka to Ōtaki Expressway.

The local roading network provides an important layer to the District's transport network, providing access and connecting locations in and across the District. Kāpiti Coast's local roading network is made up of 403.7 kilometres of sealed roads. 247.1 kilometres of this is in urban areas and 156.0 kilometres is in rural areas. As well as roads, Kāpiti has a wide array of supporting roading infrastructure, including footpaths, shared paths, kerb and channel, bridges, and streetlights. The table below provides an overview of current roading assets.

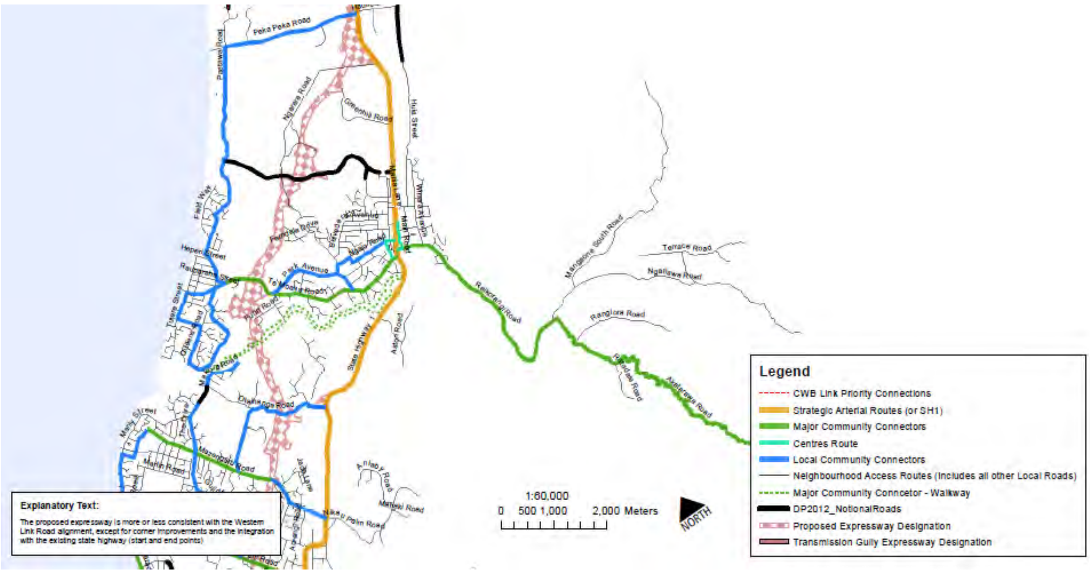
Summary of Kāpiti Coast's local roading assets

Asset	Asset component
Pedestrian network	427.08 kilometres of footpaths
	379.26 kilometres of berms
	17 pedestrian islands
	11 raised pedestrian crossings
Safety	190 railings equating to 8,080 metres (including guard rails, hand rails, and sight rails)
	22 speed humps
Water management	954 culverts equating to 14814.5 metres
	8,438 drainage elements (including manholes, soakpits, sumps, etc).
	Surface water channels (including kerb and channel, dish channel, and mountable kerb)
	5,347 sump leads equal to 46,237 metres
Vehicle network	13.3 kilometres of unsealed roads (all rural)
	403.7 kilometres sealed roads (247.7.1 kilometres urban and 156.0 kilometres rural)
	278 retaining walls equating to 7.14 kilometres
	55 bridges and bridge culverts
Traffic service	five sets of traffic signals (owned by Kāpiti Coast District Council)
	4,025 line/sign markings equating to 482.4 kilometres
	312 traffic islands (including kerb extension, median, raised platform, splitter, and other)
	35 traffic islands (rotary)
	5,825 signs

	5,382 street lights
Parking	54,038 square metres of formed car parks
Street furniture	154 benches

While the One Road Network Classification (ONRC) identifies a hierarchy of roads based on national standards, the appeals version of the Proposed District Plan also contains a hierarchy for planning purposes. This hierarchy can be seen in the map below and includes strategic arterial routes (such as State Highway 1), major community connectors (such as Te Moana Road and Kāpiti Road), and local community connectors such as Otaihanga Road and local roads. The hierarchy is described in the Sustainable Transport Strategy, but has been developed based on function and the level of traffic using these routes. All these roads serve to help support the movement and connectivity of people and goods.

Map of Kapiti Coast's central existing network hierarchy and notional roads



This report provides an assessment of the local transport network and its ability to support forecast growth. The map above, while identifying the existing network hierarchy, also shows notional roads that are identified in the Proposed District Plan as being necessary to support growth. While aspects and connectivity to the State Highway and Public Transport Networks are mentioned where relevant, they are assessed separately as part of regional assessments undertaken by New Zealand Transport Authority and Greater Wellington Regional Council.

Measuring network performance

The Kāpiti Coast District Council uses a range of indicators to monitor the performance of the roading network. This includes indicators on access and transport activity required under the Local Government Act 2002 and those customer levels of service that form part of the One Road Classification Network (ONRC). As the reporting evidence base grows, the ONRC and its performance measures will enable New Zealand Transport Agency and each Council to benchmark the performance of our network and inform our investment decisions.

Level of service measures focus on the following key areas:

- Mobility (travel time and reliability) - throughput at indicator sites.

- Resilience (network access and availability) - the number of journeys impacted by unplanned events.
- Accessibility (land access and road network connectivity) - proportion of network not available to Class 1 heavy vehicles and 50MAX vehicles.
- Amenity (travel quality and aesthetics) – aesthetic faults and roughness of road
- Safety – e.g. measured using number of deaths and serious injuries and the communities at risk register.

Looking at each of these performance measures in turn:

- Throughput is an issue on some of our local road network such as on our major community connectors form an important part of our network in moving people and goods. Our performance measures have identified that in Quarter 2 of 2018/19 73% of our residents considered that the existing transport system allows easy movement around the District, which dropped from 78% in 2017/18. We know that congestion is a problem in areas such as Kāpiti Road, which experiences traffic levels in excess of 24,000 vehicles per day, and at Elizabeth Street/Old State Highway 1 in Waikanae. More detail on how we intend to address this is identified in the Paraparaumu and Waikanae sections below.

- More frequent and severe weather events are damaging local road infrastructure and our coastal roads are vulnerable to sea level rise. In setting our funding priorities, we need to ensure that we plan for a more resilient network that prevents damage and can adapt to the effects of these events.

- With regards to accessibility, some of our network is not available for 50MAX vehicles and our ageing population can find that travel choices are more limited. Problems can include access to public transport services, pedestrian and cycle connectivity, parking, the ability for our network to accommodate mobility scooters, and road safety.

- Parking has been, and will continue to be, an issue particular to our major urban areas of Paraparaumu and Waikanae, and is as a result of land use (including out of centre developments with associated parking facilities), mode choice, accessibility, and commuter parking. These problems, particularly around the town centres and railway stations, include insufficient capacity to serve business and commuting needs, spill-over parking into residential areas, and providing the right balance of long term parking (e.g.: to serve commuting needs) and short term parking (to enable turnover of spaces for local businesses). These issues could become increasingly worse as a result of increased development across the District without a management strategy.

- Amenity is where we need to increase our focus. The performance measures shown in the table below identify that we have not met our resurfacing targets. Additionally, since 2017/18 residents consider that there has been a reduction in level of service in a number of areas relating to the objective of our network being affordable and reliable, and users can easily get around the district by their preferred means".

Level of Service: Performance Measures

Measure	Target	Result
Percentage of the sealed local road network that is	5% (expressed as kilometres)	A number of roads with the higher cost asphalt surfacing were resurfaced, rather than the lower

resurfaced		cost chip seal roads, so 5% was not achieved in 2017/18. This year result will be reported at the end of year but we are currently on track.
Residents (%) who are satisfied with the condition of roads	70%	Quarter 2 2018/19 68% - dropped from 2017/18 (which was 80%)
Roads that meet smooth roads standards	Overall smooth travel exposure is above 85%	NZTA's ONRC database shows a total smooth travel exposure of 90% for 2017/18
Residents (%) who are satisfied with the condition of footpaths	65%	64% Quarter 2 2018/19 – dropped from 69% in 2017/18
Percentage of footpaths that fall within the service standard for the condition of footpaths as set out in the activity management plan	2018/19 – 40% 2019/20 – 50% 2020/21 – 60%	A refined measure has been established using road asset maintenance management data for the 2018/19 year. Proposed is 'the % of footpaths that fall within the service standard for footpaths set out in the Activity Management Plan Year 1: 40%, Year 2: 50% and Year 3:60%'.

- Turning to safety, from the latest crash data published by NZTA it appears that that over the last 10 years, the serious injury and fatal crash numbers have been trending downwards until 2015, and from there show an upward trend both on the State Highway and on Council's local roads. Compared to our Council peer group, Kāpiti has higher personal risk on secondary roads and the second highest risk for arterial roads. Our accident statistics show that three serious injury crashes have been recorded for the first two quarters of this year on our roads compared to a total of 15 for the whole of 2017/18. Performance measures have also shown that 82% of residents in Quarter 2 2018/19 are satisfied with street lighting, which dropped from the 2016/17 result of 86%.

While these are measures of existing performance, there is also a need to ensure that they are not exacerbated by growth.

Summary of Assessment

Council aims to enhance community connectedness through the creation of a well-planned physical transport system that allows for the reliable, efficient, and safe movement of people and goods.

As can be seen from the above performance measures, there are some areas where we continue to need to prioritise our infrastructure spending and ensure that new developments contribute towards solutions rather than add to existing pressures.

Our improvement projects are based on the priorities established in our 30-year programme and Kāpiti Coast District Council has developed a response to our challenges based on a number of key elements:

- Providing additional capacity;
- Encouraging mode shift;
- Maintaining and making the best use of our existing network; and
- Managing the safety of our roads.

The most significant level of infrastructure provision in the Kāpiti District is the Roads of National Significance (RONS) projects being led by the NZTA. As well as increasing capacity within and across our District, the Expressway also provides Council with the opportunity to improve the current road network including the soon-to-be revoked State Highway 1. Additionally, Council has also identified investment in new roading infrastructure and the details of this are identified in the sections relating specific locations below.

However, balancing the ability for Council to maintain the current roading network and fund renewals, while meeting future growth needs, is an ongoing challenge, given the size and scale of the assets and limited funding sources, and increasing capacity is not sustainable in the long-term. Neither does it wholly address other key areas of performance such as resilience, amenity, accessibility and safety.

Opportunities for modal shift are also required as part of network improvements and individual developments. This includes the use and linkages of cycleways, walkways, and opportunities to connect to public transport. This is particularly important when considering 36.3% of our working population commutes outside of the District and there is a high reliance on private cars. It creates the need for good access and connectivity to the State Highway and public transport network and we will continue to work with our partners to monitor demand, seek improvements to public transport, and make the most of opportunities where they arise, such as improvements relating to the revocation of State Highway 1 and train station access. Both capacity improvements and opportunities to encourage mode shift will help support a resilient transport network as well as improve safety and accessibility.

To address issues relating to amenity our renewal and upgrades programme, that is co-funded by the NZTA, will continue to be a spending priority and we will gradually increase the footpath budget to improve on current levels of service measured by resident satisfaction.

With regards to safety, Council is currently undertaking a number of initiatives to support safety for all road users, give effect to the Government Policy Statement, and address communities identified at risk. This includes Districtwide speed limit review and safety interventions on roads that NZTA have identified as being the top 10% of roads that require improvement to address high risks to road users. These are undertaken in accordance with NZTA's requirements. We have a programme of localised road safety schemes such as new roundabouts on major community connectors and pedestrian crossings. In addition, revocation of State Highway 1 provides us with the opportunity to implement schemes that will improve high risk junctions and connectivity, accessibility, and safety within our town centres for all road users.

We work closely with the community through education to reduce the number of road accidents in the region and reduce the social cost of damage to people, vehicles, and property. We run a number of road safety projects and activities involving primary and secondary schools and a range of community groups. The LED lighting conversion will also address safety and performance measures relating to residents' satisfaction of lighting, as well as lead to significant energy cost savings and decrease carbon emissions from this source by more than half.

Future Development

Whilst our Long Term Plan identifies Council spending, local transport infrastructure to support new development is also provided by each new development on an 'as needed' basis through master planning, resource consent, and development contribution processes.

Funds from rates, development contributions, and NZTA subsidies are used to help address network maintenance and renewals such as safety of roads and structures, but two issues relate more specifically to new developments' impact on the network. This includes congestion, which is a problem impacting Paraparaumu and Waikanae, and parking; particularly around our town centres and transport hubs, which requires ongoing management. While congestion will be addressed through increased capacity, development led schemes, and projects to encourage mode shift, Council has also developed parking management strategies for Paraparaumu and Waikanae. Some of the parking issues in Waikanae are as a result of limited public transport services in the Ōtaki area, and we continue to perform an advocacy role, and work with our partners to seek improved public transport services.

Looking at our network in more detail, assessment of the local roading network and pressures across the key urban areas of Paraparaumu, Waikanae, Ōtaki, and Paekākāriki is outlined below. The revocation process to vest current State Highway 1 in Council has enabled Council to think more innovatively about how our town centres should look, feel, and operate in the future, supporting future growth.

The Council will continue to work with Greater Wellington Regional Council and New Zealand Transport Agency to ensure that schemes of significance are identified and funding secured in the Regional Land Transport Plan and National Land Transport Programme. We note that the Greater Wellington Regional Council have also identified the role of public transport in responding to growth and we will work with them to ensure the needs of Kāpiti are met. We are generally supportive of the approach to public transport provision and have been seeking bus and rail improvements in our District, particularly in Otāki. We note the layered hierarchy of services as being core routes, local routes, and targeted services and want to ensure that improvements to core routes are not at the expense of local routes. In addition, in planning new developments we will take account of the public transport planning and the needs of public transport through appropriate design.

<u>Paraparaumu</u>

While the completion of the McKay's to Peka Peka Expressway has improved capacity and helped reduce traffic levels across the wider network, it has not reduced congestion on Kāpiti Road, with inter-peak periods not varying significantly to the morning and afternoon peak. Poor east-west connections within Paraparaumu town centre and adjacent areas are a key contributor to congestion. Based on current conditions, future plans for anticipated growth and intensification around the Paraparaumu District Centre, along with future business development around Te Roto Drive and the Kāpiti Airport, would see congestion along Kāpiti Road and Rimu Road worsen.

The East West Connectors project has been identified as a significant project in both the Kāpiti Coast District Council Long Term Plan and the Regional Land Transport Plan. The project includes a number of proposals including providing a connection between Ihakara Street and Arawhata Road, linking Ihakara Street to the north-west, and improving access to town centre development. This will help address current issues such as congestion on Kāpiti Road and support economic and residential growth in the town centre and airport areas.

In combination with parking restrictions (such as time restrictions) to manage demand and enforcement, the number of existing car parking spaces available have gone some way to enable shopping, worker, and commuter parking to park safely in the Paraparaumu central business area. However, there are parking pressures from worker and commuter parking spilling into residential areas and creating problems around the railway station. We are developing

Phase 3 of a parking strategy, considering proposals and recommended actions from Phases 1 and 2, as well as working with our partners to look at options to address these issues in the future.

In addition, the proximity for intensification of residential development to the town centre and railway station is expected to support plans for modal shift. Plans are currently being developed for improved access to the railway station in Paraparaumu for public transport, pedestrians, and cyclists, and this includes an at-grade crossing, amenity improvements, and integrating bus and train services. Other schemes include:

- improved connections for Coastlands and the civic precinct;
- upgrade of Kāpiti Lights (completed)
- assessment of junctions along Kāpiti Road and possible improvements;
- improvements to Iver Trask Place (completed) to improve pedestrian activity and amenity;
- Rimu Road streetscaping to improve the pedestrian environment and amenity; and
- the Paraparaumu town centre link road.

<u>Waikanae</u>

Waikanae is expecting the largest amount of growth across the District, largely associated with the Ngarara and Waikanae North developments, but also as development occurs along Waikanae East (along the bottom of the Hemi Matanga Range) and in rural Reikorangi, linked to the back of Waikanae via the Akatarawa Road.

Growth and accessibility across the Ngarara and Waikanae North developments are supported by a proposed road in the Proposed District Plan. The proposed road will be developed and vested as development progresses and provide a second link between Waikanae Beach, new areas for development, the Waikanae town centre, and Old State Highway 1.

Waikanae currently experiences congestion where Elizabeth Street crosses the Old State Highway junction, which experiences congestion with traffic giving way at lights and a train crossing. A notional link road between Hadfield Road and Huia Street has been identified in the Proposed District Plan and is being investigated as an alternative route to relieve pressure on the Elizabeth Street junction.

Waikanae town centre has also been experiencing parking pressures, particularly with demand from train commuters. The Greater Wellington Regional Council has constructed a large new commuter car park in Waikanae town centre to add to the Park and Ride provision along the Kāpiti Line. This has helped relieve the parking pressures around the Waikanae train station, but has not completely resolved parking issues in the area. As a result, we are implementing the parking strategy, taking on board proposals and recommended actions from Phases 1 and 2, as well as working with our partners to look at options to address these issues in the future.

In Waikanae, the Council has a number of schemes planned or underway to deliver a viable and attractive roading and access system that can accommodate the impact of projected passenger transport and growth, vehicle, pedestrian and cycle movements and enhances the Waikanae town centre. This includes:

- improved connections to the railway crossing (such as a new pedestrian crossing);
- upgrades to Mahara Place, upgrades to car parking;
- improved links between the Whakarongotai Marae and the town centre;
- upgrade of the Te Moana intersection and connection to Waikanae River;
- improvements to the Ngaio Road streetscape;

- Minor road realignments;
- Revocation of State Highway 1; and
- Te Moana Road improvements.

Ōtaki

While Ōtaki is set to receive less growth than other centres, it is growing. The Peka Peka to Ōtaki expressway is currently in construction and expected to be completed in 2021. The new expressway will provide further challenges and opportunities to Ōtaki. While Ōtaki currently has limited rail services, the expressway will provide better access in and around the State Highway network. Roading link to support growth in Ōtaki North are currently being explored along with an assessment of the impact on the railway precinct and the town centre of the Peka Peka to Ōtaki Project. We continue to work with local interest groups to look at schemes that may be implemented in the future.

Paekākāriki

Paekākāriki local roading network has ongoing safety considerations where it adjoins the state highway network. The upcoming completion of Transmission Gully is expected to result in a significant reduction in the amount of traffic passing through the interchange. This, along with the revocation of State Highway 1, provides the opportunity for these safety issues to be addressed. The impacts of future development would need to be considered in the context of current pressures, such as safety and issues, relating to the railway line.

Network improvements

As discussed above a number of specific transport projects that are planned that will enable future development capacity. These will be considered further within the context of infrastructure to support growth within an infrastructure delivery strategy but include:

- Transmission Gully (government-led);
- Peka Peka to Ōtaki Expressway (government-led) and upgrade the connection at Te Horo from the Peka Peka Expressway to Ōtaki Forks (removes severance from Ōtaki township);
- Proposed Ihakara Street to Arawhata Road relief road (potentially 2022 subject to Provincial Growth Fund application);
- Ihakara and airport connector road (2035);
- Construct a roundabout at the Mazengarb Road/Ratanui Road intersection to improve the current level of service of this intersection and improve safety;
- Annual (low cost, low risk) minor safety enhancement programme;
- Notional roads identified in the Proposed District Plan such as Ōtaki North and Hadfield Road;
- Waikanae emergency rail access;
- Conversion of the District's streetlights to improve amenity and safety;
- Revocation Town Centre Projects – to improve accessibility, connectivity, and safety;
- Deliver the annual general maintenance and renewals programme for the roading network – including maintenance and renewals of footpaths;
- Road safety education programme including school travel planning;
- Road network planning as part of Council's regulatory planning processes;
- Kapiti Road signalisation optimisation to improve flows; and
- Continued work with partners to look at ways of improving access to and use of public transport services.

Summary of local roading network capcity to meet forecast growth levels
Discussion and analysis from the Council's Transport team has identified that Kāpiti Coast's local roading network has sufficient capacity to support its future forecast growth. This is largely based on the ability for the planning process to mitigate future issues from development on a case-by-case basis through the planning process. However, the realisation of capacity in key growth locations of Paraparaumu and Waikanae is reliant on resolving current constraints around congestion, through the realisation of key roading projects and encouraging mode shift through better infrastructure and seeking upgraded service provision.

	3 years	10 years	30 years	Comments
Paekākāriki	Yes	Yes	Yes	Improvements to the junction with Beach Road with Old State Highway 1 need to be explored further.
Raumati/Paraparaumu	Yes	Yes*	Yes	*The RONS projects and east-west connectors will play a large part in alleviating current congestion and supporting new growth.
Waikanae	Yes	Yes	Yes	RONS projects, new development, and notional roads in the Proposed District Plan will provide opportunities to support growth.
Ōtaki	Yes	Yes	Yes	RONS projects, new development and notional roads in the Proposed District Plan will provide opportunities to support growth.

Assessing capacity of Kāpiti Coast's open space network

Description of network
The Council manages an assortment of open spaces. These range from formal parks and gardens to sports grounds and natural areas, covering a total of 721.6 hectares. Open spaces provide recreational, social, and cultural opportunities for all people within the District as well as supporting biodiversity and ecological function. Likewise, in some areas, open spaces offer disaster relief, while also providing a capacity to manage stormwater runoff and overflow.

Open space category	Asset type	Area owned or managed
Total open space	Open space	721.65 hectares 536 land parcels
Parks	Sport & recreation Neighbourhood Public gardens Civic space	207.13 hectares
Sports grounds	Sports grounds	94 hectares
Playgrounds	Playgrounds	45 playgrounds

		4 skate parks
Reserves and monitored ecological sites[7]	Natural Recreation & ecological linkages	410.3 hectares
Cemeteries	Cemeteries	11.66 hectares 4 operating 1 closed
Built assets (pavilions, toilets, furniture, etc.)	Built assets	7,676 individual assets at minimum

Diagram: Map of Kāpiti Coast District public open space (2012)

Measuring network performance

A key level of service for open space is that residents in urban areas live reasonably close to a recreation facility (including other publicly owned space) and a range of active recreation facilities is available throughout the District. Specific measures of this include:

- Residential dwellings in urban areas are within 400 metres of a publicly owned open space
- Sports grounds are open (scheduled hours and weather dependent)
- Residents are satisfied with availability of facilities
- Residents are satisfied with the quality and range of recreation and sporting facilities in the District

[7] Monitored ecological sites may be Council owned or privately owned. Council assists with grants and advice for the privately owned sites.

- Residents are satisfied with council playgrounds

Summary of assessments

The Council's last assessment of open space was conducted as part of the development of the Open Space Strategy in 2012. The assessment identified that despite a period of significant population growth over the previous 20 years, the District remained abundant with open spaces. River corridors, coastal/beach reserves, and local parks all provided residents with a plethora of opportunities to use and enjoy open space. The Open Space Strategy 2012 is currently under review.

The assessment used a strategic comparison against a national standard of 4 hectares/1000 residents as a measure of provision. At that time, Kāpiti had an open space area of 445 hectares and a ratio of 9.32. If we used the same area and compared it the population forecast at that time for 2031 (58,284) the ratio would be 7.6. While this does not account for any additional reserves land acquired by council over the future period, it is still well above four. Comparing the current amount of open space of 721.6 hectares with the ID forecast for population of 65,786 by 2047, would provide a ratio of 10.96. Again, while this does not account for potential future reserve additions, it indicates that the open space ratio has continued to be well above the national standard and provide plenty of capacity to accommodate future development.

The difference between the 445 hectare figure in the 2012 Strategy and the latest 721.6 hectare figure includes the acquisitions of a number of significant reserves including Otaraua Park and as part of the Waikanae North Development, and better information on the range of council owned/managed reserve spaces, including those supporting water supply and ex-local road reserve purposes.

Kāpiti Coast District Council population figures from the Open Space Strategy 2012

Area	2010	2031	Projected % increase
Ōtaki	5,470	6,311	15.37
Rural North	2,741	2,607	-4.8
Waikanae	10,625	15,594	46%
Paraparaumu/Otaihanga	18,211	21,532	18.24
Raumati	8,264	10,061	21.74
Paekākāriki	1,559	1,284	-17.64
Rural South	872	896	2.75
Total	**47,742**	**58,284**	**22.08**

The assessment of current public open space provision was undertaken at two scales: at a community or ward scale to assess community needs, and at a Districtwide scale to assess broader landscape, ecological, and community needs.

However, while the ratio indicates a healthy provision of open space, Council goals with regard to containment of the urban area raises gaps within the distribution of open spaces, with unevenness between the different wards. Much of this issue can be explained by the large influence of regional parks that are located within some wards. However, because of the large distribution of open space in the District, many communities are not within the reasonable walking distance parameters addressed within the Open Space Strategy 2012.

The 2012 analysis identified some initial gaps with regards to community's access to Council open spaces, but these were mitigated by access to alternative open spaces i.e. schools, beaches, or Department of Conservation land. The strategy recognised that with growing demands in the District there may be a need for more proactive management and provision of open spaces.

Total open space provision from the Open Space Strategy 2012

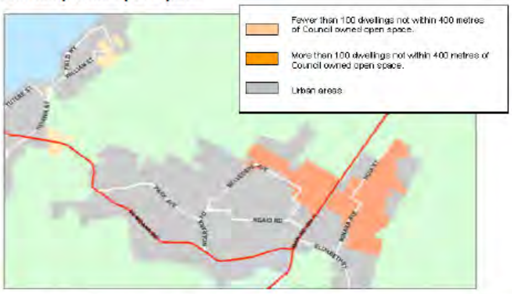
Ward	Kāpiti Coast District Council owned public land (hectare)	Total public open Space (hectare)
Ōtaki	61	33,142
Waikanae	97	415
Paraparaumu	78	853
Paekākāriki/Raumati	88	3235
Total	**324**[8]	**37,645 hectares**

Map 4: Paekākāriki residential areas with inadequate access to Council public open space

[8] This figure does not include reserve areas that are not owned by the Council but are actively managed by the Council on behalf of the owner (and example includes Crown-owned coastal reserve areas above mean spring tide).

Map 5: Paraparaumu/Raumati residential areas with inadequate access to Council public open space

Map 6: Waikanae residential areas with inadequate access to Council public open space



Map 7: Ōtaki residential areas with inadequate access to Council public open space

The location, type, and extent of new public open space is to a degree dictated by the location and extent of new private development. Council can identify areas of expansion, but the specifics are often not at a level applicable for development until a much later stage. Developments are also subject to economic forces and other factors which create uncertainty.

Currently, the primary locations of greenfield development which may lead to new parks and open space development are in the Ngarara zone, on the urban fringe of Waikanae North and some limited space in Ōtaki. It is also recognised that infill housing and intensification increases the use of existing assets, requiring additional investment in order to maintain levels of service in line with growth and community expectation.

The assessment of reserves is required as part of the process of assessing new development. This includes contributions to the Council towards the acquisition, protection and enhancement of areas of cultural, ecological, or amenity value. This is to address additional demand caused by development. The reserve contribution can either be paid to improve existing facilities, or land developers can set aside a piece of land for open space use, or a mix of both.

The prevailing trend in open space demand is the need to balance increased growth with the provision of quality open space experiences. The community has a desire for a quality natural environment and managing this expectation in relation to future growth will be one of the primary challenges for the open space network in the medium term. This will involve both reinvestment in existing open spaces as well as the acquisition of new open spaces.

The future demands on Council's open space network are currently being reassessed as part of a review of the Open Spaces Strategy, which guides the future development of the network. This strategy will be reviewed in consultation with the community in 2019/2020 to ensure it is in keeping with current needs. The review of the Open Spaces strategy will inform a review of the Development Contributions policy as part of the next Long Term Plan.

Network improvements

Our programme of key network improvements includes:

- Reviewing our Open Spaces Strategy to ensure we are up to date with issues relating to network development and management for the next Long Term Plan.
- A project to prepare and review Reserve Management Plans for all reserves in the District beginning in 2019.
- The development of Otaraua Park as a Districtwide sports and recreation facility.
- Rolling programme of asset renewals for the District's playgrounds.
- Drainage upgrades to major sports fields and the establishment of new artificial surfaces in 2021 and 2031.
- Minor upgrades to Maclean Park in 2018/19 and 2020/21 with new destination facilities in 2031.
- Continuation of new asset development to maintain burial capacity in our cemeteries.
- Rolling programme of environmental restoration and biodiversity improvements across the District.

Summary of openspace network capcity to meet forecast growth levels

Discussion and analysis with the Council's Parks and Open Spaces team identifies that, overall, the District has sufficient open space infrastructure available or planned to meet the needs of forecast growth. The ability to consider new development on a case-by-case basis at both the local and District scale provides a key mechanism to address any current gaps and future needs and demands. While there are some gaps in services to current developments, this does not constrain new greenfield development, but does present opportunities around infill to fill these gaps.

The current review of the Open Space Strategy will enable future needs, demand, and proprieties to be identified and applied through the development process as well as informing Council's wider reserve management and acquisition functions.

	3 years	10 years	30 years	Comments
Paekākāriki	Yes	Yes	Yes	The current review of the Open Space Strategy will refresh Council's strategic priorities for managing the Kapiti Coast's openspace reserves, including how, where, and how contributions from new development will support the ongoing development of the Kāpiti Coast' openspace network.
Raumati	Yes	Yes	Yes	
Paraparaumu	Yes	Yes	Yes	
Waikanae	Yes	Yes	Yes	
Ōtaki	Yes	Yes	Yes	

Assumptions made in assessments

In order to assess the capacity of infrastructure against future population growth, it has been necessary to make a number of assumptions and simplifications. A number of these are covered in the report itself, but a number are also identified below to serve as a caveats to the overall findings of this report.

Extrapolating future growth

ID forecast population projections cover a 30-year period from 2013 to 2043. The NPS-UDC requires 30 years' coverage from 2017 to 2047. To achieve this, it was necessary to extrapolate ID forecast figures out a further four years. This was undertaken by taking the growth rates for the last remaining years of the model and applying them out across the four-year period.

Differences between boundaries

There are a small number of differences between statistical areas and boundaries used for modelling against the boundaries or areas covered by network infrastructure. An example of this includes future population growth for parts of Peka Peka and Reikorangi which were included in the assessment against reticulated water and wastewater capacity, despite neither being connected to the reticulated network.

There are only a small number of examples where this is the case, with each only holding a small percentage of the overall population. Including these areas effectively increases the amount of people that need servicing, in effect creating further headroom in capacity calculations.

Future processes will look at opportunities to further improve capture and alignment of data across different boundaries.

Water and wastewater

A number of assumptions have been made consistently across the water and wastewater modelling. This includes an allocation of 10% to infill of current sites; that future need does not account for any new significant wet industries; and that inflow and infiltration does not get worse (e.g. new pipes should be water tight).

Stormwater

Current modelling of network capacity constraints and proposed District Plan planning restrictions take into account early projections for future predicted rainfall and sea level rise. Further modelling work is planned to update this information for the District in line with the latest central government guidance.

Appendix 6.1

Wellington Water

NPS-UDC Three Waters Infrastructure Enabled Development Capacity

Upper Hutt City Council

Our water, our future.

Version	Date	Author	Amendment Summary
0.9	21 December 2018	Emily Greenberg Nadia Nitsche	
1.0	23 January 2019	Emily Greenberg Nadia Nitsche	Revised water supply maps, detail on Silverstream storage tank outfalls, executive summary
2.0	4 February 2019	Emily Greenberg Nadia Nitsche	Minor edits
3.0	22 March 2019	Emily Greenberg	Clarification on model assumptions and limitations, status of Plan Change 42
4.0	29 April 2019	Emily Greenberg	Revised Table 1

Contents

Executive Summary

The purpose of this report is to meet the National Policy Statement on Urban Development Capacity requirements in terms of reporting on the infrastructure enabled capacity to support predicted urban growth in the short-term (next three years), medium-term (next three to ten years) and long-term (next ten to 30 years).

This report assesses where projected areas for urban growth in Upper Hutt City Council are supported with existing or planned water supply, wastewater systems and protection from stormwater flooding. We refer to these services as the three waters.

Council will combine the results in this report with an assessment of how much development capacity is enabled through zoning provisions in the District Plan.

The results of hydraulic modelling for water supply has identified shortfalls in the available and planned reservoir storage volumes to support predicted growth in the short, medium and long-term in several catchments. However, for site-specific growth the assessment would need to consider options such as expanding or reducing the area supplied by a specific reservoir. Nonetheless, significant upgrades would be needed to support the anticipated population growth.

There are also capacity shortfalls in the ability of the wastewater network to support short-term growth as well as medium and long-term growth predictions. These shortfalls are expressed as areas where overflows of untreated sewage from sewer manholes are predicted to increase during wet weather events.

Stormwater can limit growth by creating a flooding risk to life and property. There is currently little information on stormwater constraints to growth in Upper Hutt other than the results of flood hazard modelling for the Pinehaven Stream catchment. These results were incorporated into Plan Change 42 along with provisions to protect future growth from flood risks, although this plan change is currently under appeal.

Where available, hydraulic models were used in this report to identify where the water supply, wastewater and stormwater protection systems would not provide an adequate level of service for an increasing population. The results are presented by catchment as either, yes the catchment is enabled for water supply, wastewater or stormwater protection, or no the catchment is not enabled. The definition of enabled is limited to the existing or planned services and does not consider common site-specific mitigations for developments, such as the construction of a new reservoir or local detention for wastewater.

The next step is to finalise the models that need to be developed or calibrated and then to use the models to evaluate the various options for improving the systems to accommodate predicted population growth. The best options can then be considered for inclusion in the Long Term Plan and Infrastructure Strategy to enable anticipated urban development.

1. Purpose

This report assesses where projected areas for urban growth in Upper Hutt City Council (UHCC) can be serviced with existing or planned water supply, wastewater systems and protection from stormwater flooding. We refer to these services as the three waters.

This assessment is provided to UHCC as evidence to support their evidence and monitoring requirements under the National Policy Statement for Urban Development Capacity (NPS-UDC) 2016.

The flowchart below (Figure 1) is from the NPS-UDC *Guide on Evidence and Monitoring* (2017) that indicates how the evidence on infrastructure is used to assess feasible development capacity.

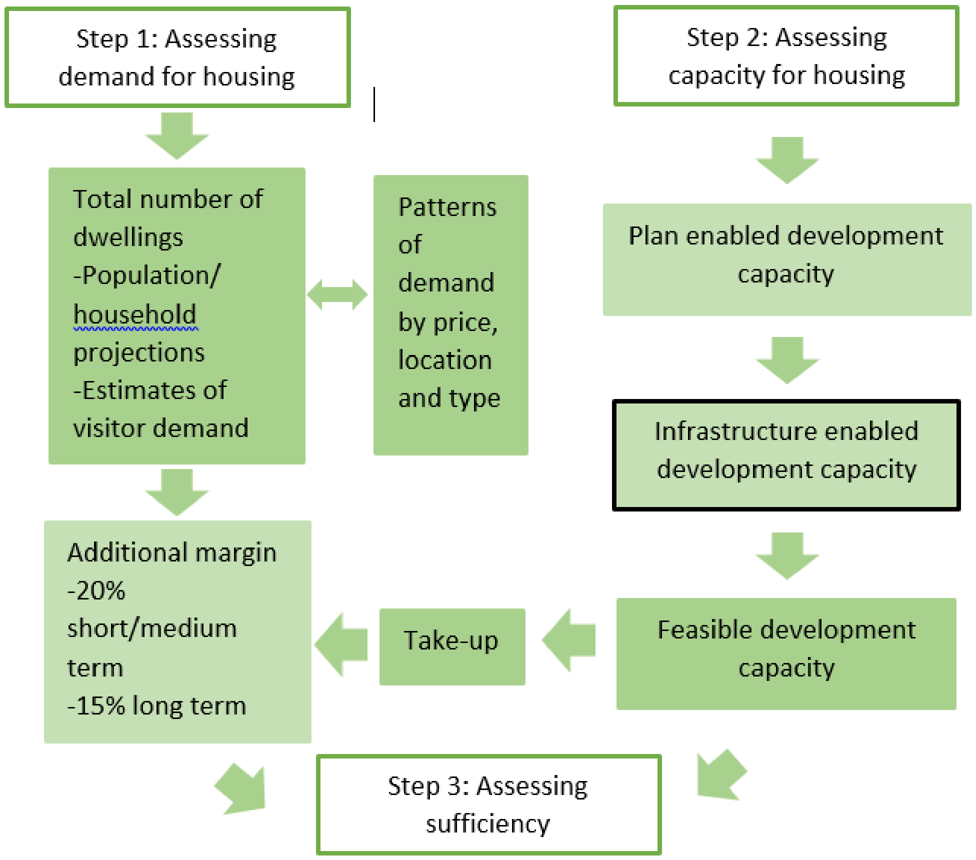


Figure 1: Housing Assessment Methodology overview Flow Chart. WWL's role is shown under Step 2, Infrastructure enabled development capacity.

2. Assessing Infrastructure Enabled Development Capacity

The NPS-UDC guidance document on evidence and monitoring acknowledges that it does not provide a method for assessing the amount of development capacity enabled by infrastructure (page 36 of the guidance document). However, the definition of development capacity in the NPS-UDC includes "the provision of adequate development infrastructure to support the development of the land".

The NPS-UDC defines "feasible" as "development that is commercially viable, taking into account the current likely costs, revenue and yield of developing". In addition, the guidance is clear that the term "feasible" does not include the cost to the local authority of providing infrastructure.

Therefore, for this report infrastructure enabled development capacity is assessed as areas that are adequately serviced by existing three waters infrastructure or areas that will be serviced by infrastructure identified in the LTP or Infrastructure Strategy.

The NPS-UDC also requires the local authority's to identify the cost of providing infrastructure to support growth beyond the next three years (for the medium- and long-term). The identification of this needed infrastructure and the associated costs will be provided in a separate report to support the next Long Term Plan and Infrastructure Strategy.

Areas that are currently zoned for residential or business development but which are not serviced are therefore not identified as infrastructure enabled for this report.

Similarly, areas that are currently zoned for development but where additional development cannot be guaranteed an adequate level of service are therefore also not infrastructure enabled. The adequate level of service for stormwater includes the protection from flooding through the use of land use restrictions as well as pipes and drains. The adequate level of service for wastewater includes that additional connections do not create or contribute to surcharges of untreated overflows; and for water supply the adequate level of service is based on minimum water pressure and storage volumes.

The levels of service are defined in Section 4.1, Level of Service.

For the three waters, infrastructure enabled development capacity is assessed

a) in the **short-term** as areas that are serviced by existing infrastructure (either existing or planned in the LTP to be in place within the next three years) with adequate capacity;

b) in the **medium-term** as areas that are serviced (either existing or planned in the LTP to be in place within the next ten years) with adequate infrastructure; and

c) in the **long-term** as areas that are serviced (either existing or identified in the Infrastructure Strategy to be in place within the next 30 years) with adequate infrastructure.

Adequate is based on levels of service defined for hydraulic modelling.

Where water supply or wastewater service is not adequate to support a proposed development, it is common for the developer to install mitigations, such as a new reservoir or a larger wastewater pipe. Depending on a number of factors, the need for mitigation can make or break the commercially viable (or feasibility) of a proposed development.

For the purposes of this report, the results of the assessment of infrastructure enabled development capacity are provided in mapped and tabular format (Section 5, Results). If the three waters infrastructure is adequate to support predicted development, it is identified as a "Yes". If the existing or planned infrastructure is inadequate, or mitigation is required, capacity for development is identified as a "No".

2.1 Where mitigation can enable

We acknowledge that mitigation for stormwater, water supply or wastewater could alternatively be assessed as a cost within the equation that determines "feasibility", or profitability. As this cost would vary by location and size of the required mitigation, the determination of mitigation cost is out of scope for the level of evidence provided in this report (see Section 4.6, Mitigation Options).

3. Upper Hutt City Model Availability for Three Waters

The catchments that are modelled for water supply and wastewater are defined by the operation of their separate infrastructure networks. Therefore the catchment boundaries for water supply and wastewater are different from each other. The stormwater catchments are defined by topography and are thus also different from the catchments used for the water supply and wastewater hydraulic models.

3.1 Water supply

A safe and reliable water supply is essential to public health and the social and economic development of a city. The water that is delivered to UHCC is sourced from the headwaters of the Te Awa Kairangi/Hutt River, the Wainuiomata and Orongorongo catchments and the Waiwhetu aquifer. It is treated and delivered via a bulk water system that supplies water regionally to Wellington, Hutt, Upper Hutt and Porirua cities.

The bulk water is delivered to local reservoirs that are positioned at elevations that can provide adequate water pressure for an uninterrupted reticulated supply for drinking water, fire-fighting, domestic and commercial use and also provide emergency storage.

The capacity of the water supply to accommodate future growth was assessed based on storage availability and network capacity as described for the level of service outlined in Section 4.1.1.

For this assessment for the NPS-UDC, Upper Hutt was defined by 10 Water Storage Areas (WSA). WSAs are defined as a water supply network comprising of at least one reservoir, which can be expected to operate independently if the supply is interrupted.

The WSA can contain one or several District Metered Areas (DMA) – which is a section of water supply network bounded by flow meters or closed valves. The water storage areas modelled for this report are shown in Figure 2 below. The methods and results for this water supply assessment are documented in two reports (Stantec 2018a and 2018b).

The network capacity for the UHCC water supply network was assessed using the calibrated model developed in 2015. If critical areas exist under current peak demand with a pressure below 27m, the WSA was considered to have reached its network capacity and any additional growth would worsen an already non-conforming situation. If there are no critical areas, the model was rerun with future demand at the catchment-scale.

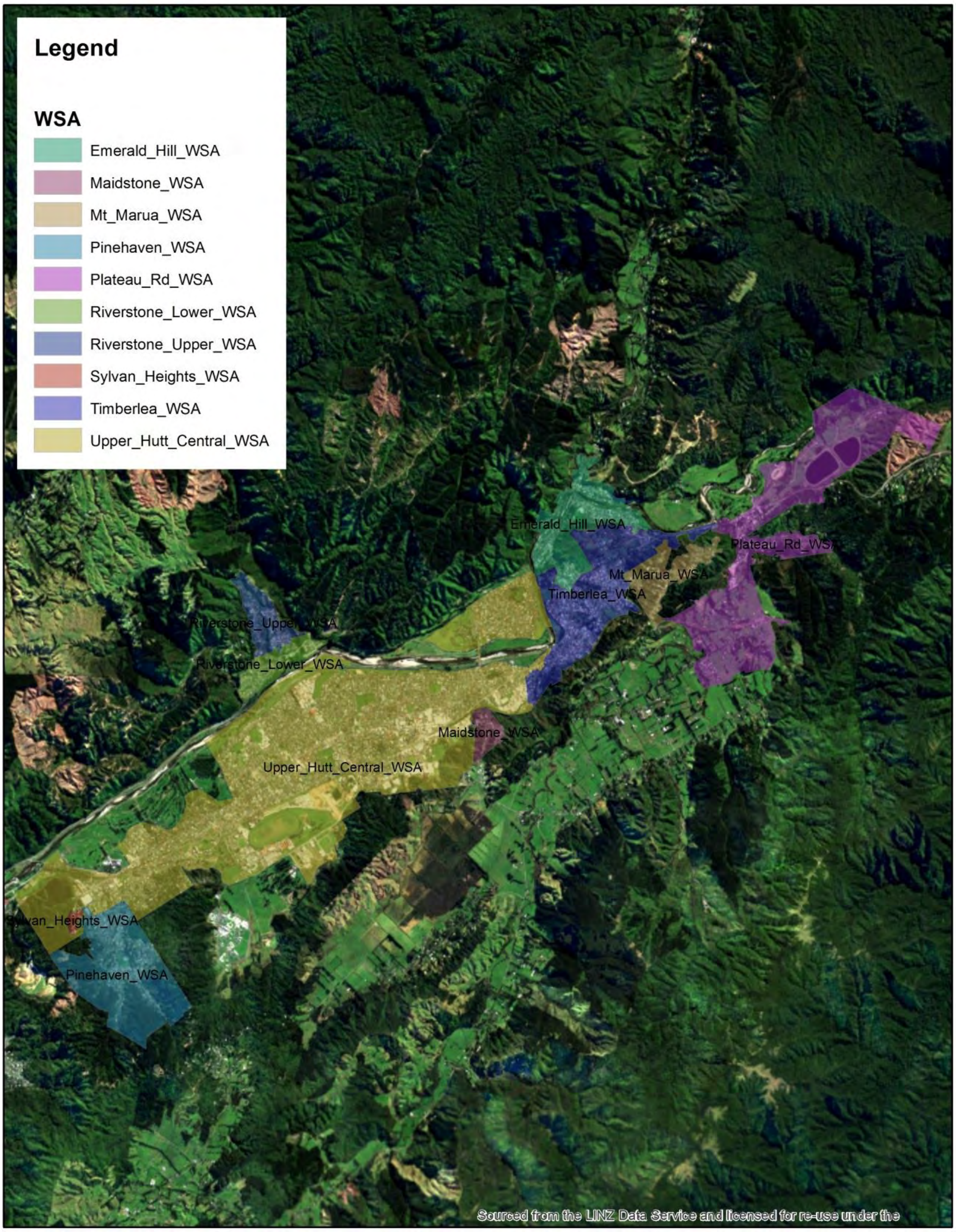


Figure 2: Locations of the 10 Water Storage Areas in Upper Hutt

3.2 Wastewater

After the water delivered to houses and businesses has been used, it becomes wastewater. This wastewater needs to be safely conveyed through reticulated networks to the wastewater treatment plant where it is treated and disposed in an appropriate way to minimise risks to human and environmental health.

During heavy rain events, stormwater and groundwater can enter the wastewater network resulting in overloading the capacity of the wastewater networks. When this happens, untreated wastewater can overflow to the environment through surcharging manholes or constructed overflow structures or to private property via gully traps. These overflows are exacerbated by cross connections where stormwater downpipes are incorrectly connected into the wastewater system.

The pipes that make up the UHCC wastewater network are aging and prone to leaking and overflowing. Network capacity constraints and declining condition, coupled with increased rainfall and rising water tables may result in increased overflows and potential risks to public health and contamination of receiving waters. The level of service for the wastewater network, which is based on managing overflows during rain events rather than preventing leaks during dry weather, may not be sufficient for achieving the desired water quality for the region's streams and rivers.

Wastewater from UHCC is treated at the Seaview Wastewater Treatment Plant in Hutt City.

Note: The Silverstream storage tank is used to control the flow from the UHCC catchment before it enters the Hutt City wastewater network on its way to the Seaview Wastewater Treatment Plant The operation of the Silverstream storage facility, including wet weather overflows of partially treated wastewater to the Te Awa Kairangi/Hutt River is not included in the UHCC model. This outlet will be included when the Hutt City wastewater model is completed and both models are combined by the end of 2019.

For UHCC, the wastewater network is modelled as one catchment, as shown in Figure 3 below.

The hydraulic model was developed and calibrated in 2017. A full update to the existing wastewater model for the UHCC catchment was required to improve the understanding of the network performance. A consultant was engaged to complete the model conversion of the existing 2009 UHCC Mike Urban wastewater model to Infoworks ICM. This conversion included updating the model with several network upgrades that were not reflected in the original model.

More recently Beca was appointed to undertake preliminary system performance assessments and at that time the model was assessed with the future residential development growth areas identified by Forecast.id (see subsection 4.2).

At the time the hydraulic modelling work was undertaken, information for the following network changes was not available: Gibbons Street upgrade; non-residential growth in the brewery quarter; and planned increases at Rimutaka Prison.

The level of service for the wastewater system to accommodate future growth was assessed based on the hydraulic capacity of the sewer mains during a 1-year rainfall event, as discussed in Section 4.1.2.

Additional information on the limitations and assumptions for the hydraulic modelling for wastewater is provided section 4 below.

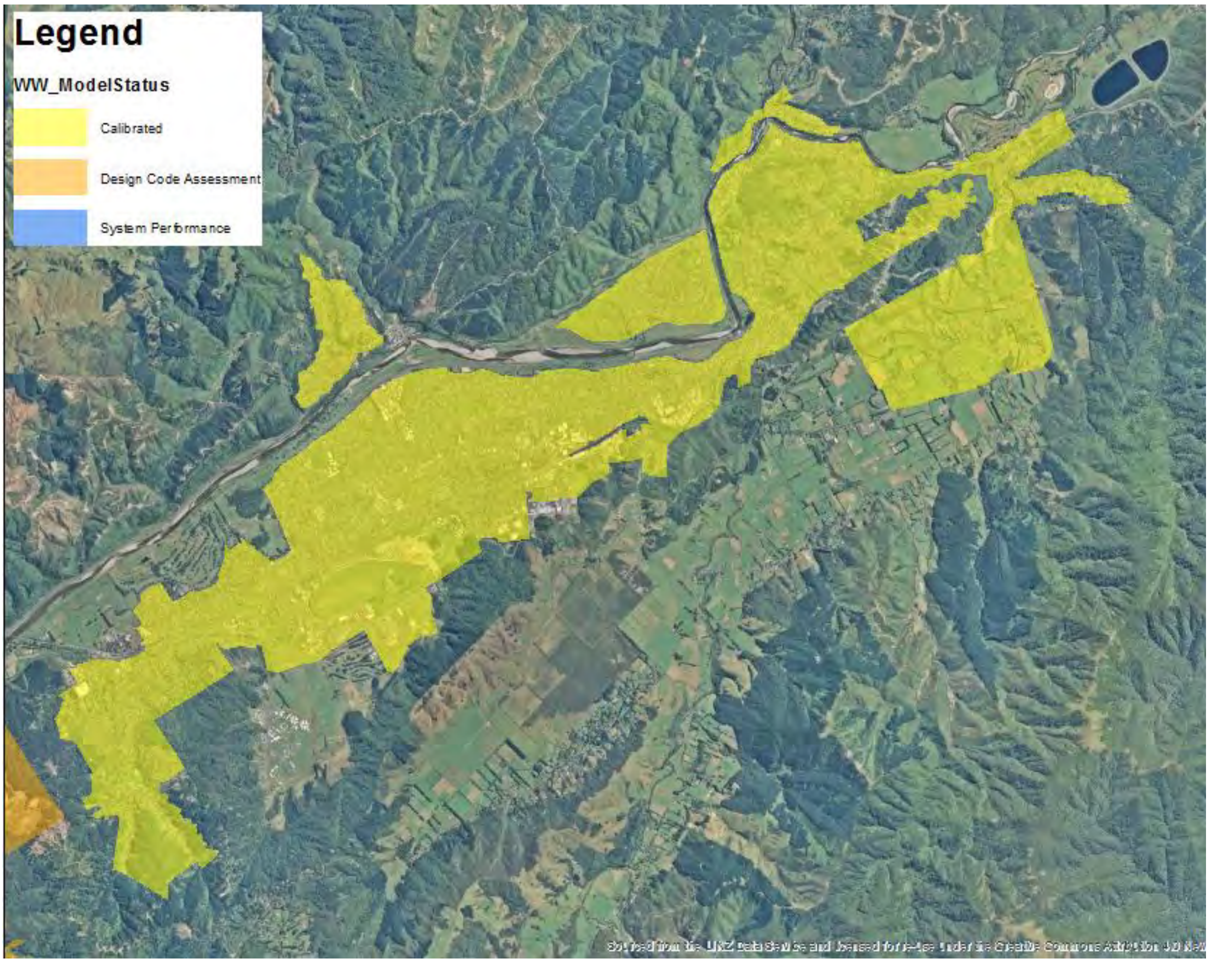


Figure 3: The modelled wastewater catchment for Upper Hutt City

3.3 Stormwater

Stormwater services are essential to the protection of public health and property. Rainfall needs to be drained away to prevent damp ground and the various illness that can affect people and property.

Stormwater pipe networks historically were designed to carry away only the low to medium intensity rainfall events. When the storm intensity exceeds the capacity of this pipe design, water flows overland and residences and businesses can be at risk of flooding.

The region's stormwater networks, including UHCC, comprise both built assets such as pipes and intakes, as well as natural assets, such as overland flow paths and watercourses. These networks discharge stormwater into streams, the harbour and the ocean at many locations across the region. Land use and building restrictions that protect overland flow paths from being built over or blocked are also important for protecting people and property.

As stormwater picks up sediment, contaminants, petrochemicals and heavy metals such as zinc, copper and lead, it can result in harmful water quality where it discharges to streams or coastal waters. Stormwater from greenfield development in particular, can result in excessive discharges of sediment.

Pinehaven Stream has a history of flooding and the flood hazards were modelled and mapped by Greater Wellington Regional Council in 2015. The recently adopted Plan Change 42 to the UHCC

District Plan incorporates these new flood hazard maps. The GWRC mapped results are not included in this report, as all of Plan Change 42, including these maps, are under appeal.

Wellington Water is reviewing the need to model the UHCC urban areas in order to assess the stormwater flood hazard during a 1 in 100 year event plus climate change.

The catchment boundaries for the stormwater modelling are shown in Figure 4 below.

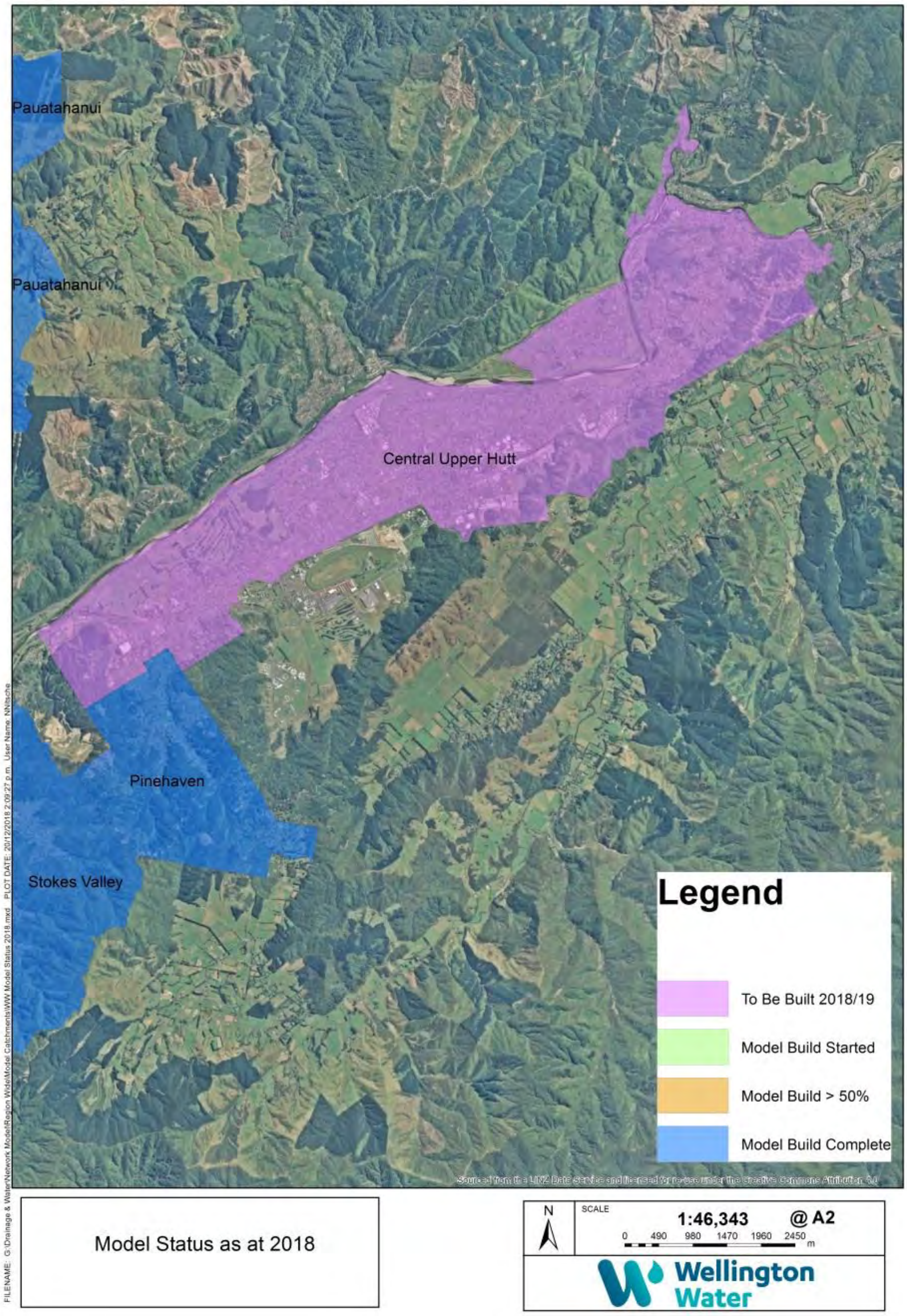


Figure 4: Stormwater catchments in Upper Hutt.

4. Criteria and Assumptions

The main criteria and assumptions that were used in the assessment of infrastructure enabled development capacity are described in this section.

4.1 Level of service

As noted in Section 2 above, the assessment of infrastructure enabled development capacity relies on the ability to identify infrastructure that provides an adequate level of service (LOS) to new development. In particular, the LOS needs to be adequate for the assessment of feasible development capacity over the short-term (the next three years) and meaningful for the identification of funding for development infrastructure required to service capacity in the medium- and long-term.

The LOS and associated criteria in the Regional Standard for Water Services (RSWS) are target LOS for new assets and are therefore not a useful or consistent framework for assessing existing infrastructure's suitability for enabling development capacity as required under the NPS-UDC. Although some criteria in the RSWS are relevant to this assessment, the design codes in the RSWS are not specific to identifying capacity constraints in the primary systems for new developments (brownfield or greenfield) or specific to identifying upgrades and extensions needed to service projected growth in the medium- and long-term.

Therefore to fulfil the evidence needs under the NPS-UDC, the LOS and associated criteria for water supply, wastewater and stormwater capacity have been consulted on with our Client Councils and are defined in the following subsections.

4.1.1 Water supply level of service

Wellington Water has defined the LOS for water supply for the assessment of infrastructure enabled development capacity as:

The provision of safe and healthy water based on:

a. Minimum pressure of 25m at the point of supply

b. Reservoir Storage requirements at the maximum of either:

1. 700 L/person storage requirements where existing demand are unknown (e.g., new development area)

   2 x Average Day Demand (ADD*) plus firefighting storage requirements when existing demand is available

   OR

2. Peak day demand (PDD*) plus 20% for operational storage plus firefighting storage requirements as outlined in SNZ PAS 4509 "Code of practice for firefighting water supplies"

   OR

3. Storage for seismic resilience – required storage to provide minimum levels of service after a significant earthquake based on:

Days 1 to 7 – Emergency State - People and businesses will be self-sufficient, relying on their own stored water supplies, their communities, and Civil Defence centres.

Days 8 to 30 – Survival & Stability - Residents collect up to 20 litres per person per day from Distribution Points while Critical Customers begin to receive water to their boundary.

From Day 30 – Restoration & Recovery - The region moves toward restoration of normal service through provision of reliable reticulated supplies.

This LOS is referred to as Network LOS based on water pressure or a Storage LOS based on either Operational storage LOS or the Seismic LOS.

A key component of constraints in the water supply network is the storage capacity of the reservoirs that supply each zone. The criteria for reservoir storage to achieve the level of service for water supply is based on a combination of firefighting storage requirements as well as population. Therefore there is a direct correlation between reservoir storage and population.

Reconfiguring the water supply network, such as expanding or reducing the area supplied by a specific reservoir, is a common method used to service site-specific growth. Nonetheless, Wellington Water's assessment of infrastructure enabled development capacity does not consider this option for the evidence provided for the NPS-UDC, as this method is only relevant to proposals for site-specific developments.

In addition, the assessment assumes that there are no changes to the bulk water supply network. If needed, further detailed studies could be considered on the flow capacity of the bulk water distribution system to supply projected peak day demand. It is of value to note that this level of service is also dependent on the volume of water used (demand). Currently there are relatively few restrictions on the volume of water used (demand management). As noted in subsection 4.4, Consenting Requirements, further restrictions on the ability to take additional volumes of water from our rivers and aquifers are likely in the near future.

4.1.2 Wastewater level of service

Wellington Water defined the LOS for the wastewater network for the assessment of infrastructure enabled development capacity as:

> Peak wet weather flow capacity and overflows at the 1-year Average Recurrence Interval (ARI) shall not be made worse (volume or frequency).

It is important to note that the LOS above is different than the LOS used in the Interim Guideline for New Wastewater Connections, which considers overflows only at unconstructed overflows (such as manholes and gully traps). This is because the LOS for new wastewater connections is project specific, whereas the LOS for the assessments under the NPS-UDC needs to consider the capacity of the entire network to support growth over the medium- and long-term.

Where capacity is limited, the LOS for the NPS-UDC needs to help identify infrastructure needs for funding in a LTP or Infrastructure Strategy.

4.1.3 Stormwater level of service

The capacity for new development with an adequate level of stormwater protection is a combination of built assets such as pipes and natural assets such as overland flow paths. The level of service for stormwater protection is determined based on risk, and the impacts of the development on stormwater risk are influenced by site-specific considerations and how the development is undertaken.

Wellington Water defined the LOS for stormwater capacity and constraints for the assessment of infrastructure enabled development as:

1. Safe access to and protection from flooding of habitable floors in the 100 year flood event that includes the predicted impacts of climate change.
2. Safe access to and protection of flooding for Commercial/Business in the 10 year flood event

This LOS can be achieved using the following criteria in new developments:

a. Development in a ponding area is only allowed if there is safe access at time of flooding and no loss of storage. Ponding[1] of 300mm or greater is considered to preclude safe access.
b. New developments do not impede flood flows in open channel – in the absence of detailed assessment of appropriate setbacks, as a minimum all new buildings are constructed at least 5m horizontal from the top of bank of any stream or drain. [2]
c. New habitable floor levels are set at or above the level of the flood hazard expected in a 100 year rainfall event that includes the predicted impacts of climate change (20%[3] increase in rainfall intensities and 1m of sea level rise).
d. The provision of drainage to protect commercial/business floor levels in a 10 year flood event.
e. Overland flow paths remain unimpeded.
f. New development is hydraulically neutral and does not increase flooding risk in the catchment. In practice we measure this in a 10 year rainfall event and a 100 year rainfall event[4].

This LOS for stormwater protection does not assume that these standards are in place in the RSWS or the relevant district plan. Nonetheless to achieve this LOS defined to assess capacity, Wellington Water strongly recommends that Councils implement planning controls for overflow paths,

---

[1] Ponding for an assessment of access does not include freeboard.

[2] The minimum setback of 5m allows a corridor for the conveyance of flood flows, the erosion of the stream banks and maintenance access to the watercourse.

[3] 20% is consistent with the Regional Asset Management Plan investment performance measure and is proposed to be incorporated in to the revised RSWS.

[4] An assessment at both events is needed to assess hydraulic neutrality along the range of events. Depending on topography and design of mitigation structures, an assessment of only a 100-year event does not necessarily assess neutrality at a lesser event.

hydraulic neutrality and protection of streams. Without these controls the risk of flooding will limit growth and also exacerbate flooding risks elsewhere in the catchments.

Where councils incorporate into their district plans rules to manage flood hazards then new developments typically can avoid flood hazards and downstream impacts through elevated floor levels, protection of watercourses and overland flow paths and hydraulic neutrality. If these controls are embedded in district plans the stormwater network is not considered to be a restriction on development enabled capacity for this report.

We point out that for this report on infrastructure enabled development capacity only criteria a) and b) contain absolute constraints to development – development is not enabled in locations where there is no safe access during flooding and development is not enabled within 5m to a stream or drain.

In other areas, development could occur if the development is designed to meet the criteria (e.g., floors built above the flood hazard, designs that do not impede overland flow paths and development which is hydraulically neutral). We acknowledge, however, that in some locations the costs of these design solutions could be high and therefore development would be economically unfeasible due to flood risks. These assumptions are reiterated in Section 4.6, Mitigation Options.

4.2 Population and dwelling growth estimates

The predicted population growth and where this growth is anticipated to occur are important inputs for the water supply and wastewater hydraulic models.

For the water supply models, projected increases in dwellings over the short-term, medium-term and long-term scenarios were based on growth and location data from Forecast.id (forecast.idnz.co.nz). The totals within each Forecast.id area were adjusted as needed to reflect the catchment boundaries specific to the water supply areas used in the hydraulic models.

UHCC also adopts the Wellington UDC Residential Demand Model, which uses both Forecast ID and StatsNZ forecasts as inputs to produce a 'Baseline' and 'High Growth' scenario, respectively.

For the wastewater models, projected population growth over the short-term, medium-term and long-term scenarios were based on the 'High Growth' scenario in the Wellington UDC Residential Demand Model, which were then distributed equally between the growth areas from Forecast.id. Therefore UHCC's UDC model input of the predicted population distribution for the Forecast.id areas are slightly different than the population distribution used in the wastewater hydraulic model, although the total populations are similar.

As such, the modelled water supply results reflect the infrastructure capacity for a slightly lower predicted growth than UHCC's Residential Demand Model results.

The modelled wastewater results reflect a similar population size to UHCC's Residential Demand Model, but the specific locations within the network that are under capacity (experience wastewater overflows) may be unreliable. This is examined in more detail in Section 5 below.

Table 1: Projected growth in population and dwellings for Upper Hutt City Council used in the hydraulic models.

Catchment	Short Term (2017 – 2020) Pop'n/Dwelling	Medium Term (2020 – 2027) Pop'n/Dwelling	Long Term (2027 – 2047) Pop'n/Dwelling
Akatarawa-Rimutaka-Kaitoke-Mangaroa-Moonshine Valley	3,144/1,128	3,225/1,209	5,120/1,880
Clouston Park - Kingsley Heights - Maidstone	3,015/1,182	3,177/1,271	3,567/1,445
Elderslea	3,508/1,350	3,658/1,432	3,915/1,589
Emerald Hill - Birchville	2,984/1,144	3,019/1,238	3,312/1,396
Maoribank	3,414/1,299	3,601/1,426	3,801/1,600
Pinehaven - Blue Mountains	3,044/1,128	3,171/1,197	3,891/1,495
Riverstone Terraces	1,824/632	1,856/659	1,815/708
Silverstream - Heretaunga	5,463/2,080	5,814/2,243	6,770/2,651
Te Marua	1,239/453	1,332/497	2,396/887
Totara Park	3,113/1,137	3,060[5]/1,197	3,224/1,303
Trentham	5,126/1,897	6,682/2,517	7,360/2,903
Trentham - Brentwood	4,749/1,803	4,976/1,957	5,402/2,179
Upper Hutt Central - Ebdentown	2,780/1,193	2,991/1,282	3,389/1,482
Wallaceville	2,317/1,010	2,416/1,070	2,672/1,201
TOTAL	45,400/17,437	48,820/19,196	56,640/22,727

4.3 Modelling assumptions and limitations

The assumptions and limitations of the modelling needs to be considered when interpreting and using the results. The key assumptions and limitations are shown in the table below:

[5] Decreased population reflects predicted decrease in the size of households.

Table 2: Modelling assumptions and limitations

Model	Assumption/Limitation
Water supply	Reconfiguring the water supply network, such as expanding or reducing the area supplied by a specific reservoir, is a common method used to service site-specific growth. This assessment of infrastructure enabled development capacity for the NPS-UDC does not consider this option. The bulk water supply system has not been analysed in the capacity assessment. The modelling does not consider future efficiency of the network (leak prevention) and customer use (demand management). The same existing commercial water consumption is assumed for commercial users in future horizons. There are often multiple solutions possible to meet the fire-fighting requirements and therefore this criteria is not used for the purpose of identifying infrastructure enabled development capacity. Site-specific development within a larger water supply zone are not assessed as site-specific developments require a more detailed assessment. This is because the LOS for minimum pressure is dependent on the infrastructure required to service the new development. The model results for the network capacity were inconclusive for three WSAs - Plateau Road, Riverstone Upper and Riverstone Lower. This suggests that further assessments are needed to accurately model these DMAs
Wastewater	Some results on wet weather overflows can be due to errors in the asset data or model confidence (if located far from the calibration point). A 1-year design rainfall event with a 2-hour duration (Cardno 2018) was used to assess pipe capacity and wet weather overflows. The increased rainfall intensity predicated to occur from climate change was used in the modelling scenarios. There are very few registered constructed overflows in the UHCC catchment. However there is an outfall structure downstream of the Silverstream storage tank. The storage tank and outfall at this location controls the wastewater flow from the UHCC network to the Hutt Valley Trunk Wastewater network. This overflow outlet is not included in the UHCC model, but will be in the future once the Hutt City wastewater model is completed by the end of 2019 and both models are combined. Additional monitoring is required to confirm in the field the location of manholes that the model indicates are overflowing at the 1-year ARI. The model does not consider future reduction of overflows at manholes from renewals and upgrades that reduce inflow and infiltration.

	The model assumes a 25% increase in inflow and infiltration per 50 years as a result of increased deterioration in condition (WWL 2017). Dry weather performance, such as leaks that can affect freshwater quality outcomes and areas of blockage from maintenance related issues such as fats or tree roots, is not included in the level of service for the hydraulic modelling.
Stormwater	Wellington Water does not have any stormwater models for Upper Hutt. New development is assumed to achieve hydraulic neutrality in all flood events up to and including the 1 in 100-year event. This means that new development would be designed so flooding is not increased. For this assessment, the water quality effects from stormwater are not considered in the level of service. However, the management of stormwater to achieve improved water quality will be needed to meet the new requirements in the Proposed Natural Resource Management Plan for the Wellington Region, the future recommendations from the Te Whanganui-a-Tara Whaitua Committee and the aspirations of the wider community.

4.4 Consenting requirements

The operation of our infrastructure networks need to respond to consenting requirements, which in some cases may constrain our ability to provide the adequate level of services.

Water supply – Upper Hutt, along with Wellington, Hutt and Porirua city councils, purchase their water in bulk from Greater Wellington Regional Council. This water is delivered to the community via a network of reservoirs, pump stations and water mains. With the current level of regional demand, a new water supply source will be required in approximately 2040. However, provisions in the Proposed Natural Resource Management Plan restrict the ability to take additional volumes of water from our rivers and aquifers.

Wastewater – The wastewater network requires resource consent for its discharges of treated wastewater from the treatment plant to the marine environment.

In the UHCC catchment there is one constructed overflow of untreated wastewater to freshwater associated with the Silverstream storage facility. The Silverstream storage facility is used to relieve pressure on the downstream Hutt City network and is designed to limit sewer flows to the Hutt Valley Western Trunk Sewer. The operation of this overflow will be included in the Hutt City model and then combined with the UHCC hydraulic model.

The location and monitoring of all overflows is a new programme that has resulted, in part, from our better understanding of the performance of the wastewater network as we complete our hydraulic models. Many of these locations overflow into the stormwater network before discharging to fresh water. Unconstructed overflows are manholes that surcharge due to excessive flows that exceed the hydraulic capacity of the pipes or, in some cases, operational issues such as partial blockages from gravel, tree roots or fat.

Overflow locations are obvious risks to human health and safety and are the focus of renewal and upgrades. Wellington Water now has a short-term resource consent (WGN180027 expires 30

November 2023) for the majority of the constructed overflows that go to the stormwater network, which includes the overflow from the Totara Park pump station plus four others. This consent requires monitoring and reporting, the management of acute effects on human health, and the development of a stormwater management strategy to guide a longer-term consent. There is a separate consent for the discharge of overflow events from the Silverstream storage facility. This consent is in the process of being renewed. The management strategy for all discharges will likely include the need for progressive reduction or elimination of overflow discharges during most rainfall events.

The costs to Council for the required renewal and upgrades for elimination of unconstructed overflows and progressive reduction or elimination of constructed overflows may be significant.

Stormwater – The new Wellington regional plan (Proposed Natural Resource Management Plan) has introduced new and more stringent provisions for the protection of water quality, including the requirement to have a consent for stormwater discharges, including discharges of stormwater contaminated with wastewater.

Water sensitive urban design and planning and designing for stormwater runoff and its discharge to fresh and coastal water are relatively new disciplines in the Wellington Region and regulatory tools requiring their use for land use and subdivision are still in progress. Achieving these new objectives will require significant investment. While the water quality limits have yet to be set it is anticipated that new development will be required to meet increasingly higher levels of water quality outcomes.

It is strongly recommended that Councils implement planning controls for overflow paths, hydraulic neutrality and protection of streams as well as water quality outcomes. Without the controls stormwater will limit growth and also increase the risk of flooding elsewhere in the catchments.

4.5 Greenfield development

For this report infrastructure enabled development capacity is assessed only in areas that are currently serviced by infrastructure and areas where future infrastructure is funded in the LTP or identified in the Infrastructure Strategy. This includes greenfield areas that are enabled by District Plan zoning provisions and where development in the area could connect to and be serviced by the existing sewer system and water supply.

Where infrastructure upgrades are funded in the LTP or identified in the Infrastructure Strategy, the indicated timing of the upgrade determines if the new infrastructure for greenfield development is considered for short, medium or long-term development capacity.

4.6 Mitigation options

As noted in Section 2.1, if development were to require mitigation to overcome a constraint in the existing infrastructure, we have assessed that area/development as not having infrastructure enabled development capacity.

An alternative assessment could include providing a cost for mitigation that could be included in the assessment of feasibility.

4.7 Resilience

The need for resilience of the network to a major earthquake are not factored into the LOS, other than storage requirements for water supply.

5. Results

This section provides a series of maps and tables to describe where infrastructure enabled development capacity exists and where it does not exist based on the results of hydraulic modelling.

5.1 Mapped Results

Maps are provided for the model results for water supply and wastewater.

5.1.1 Water supply mapped results

The Upper Hutt water supply network was mapped as 10 discrete WSAs and each comprises at least one reservoir. The reservoirs are refilled from the Greater Wellington bulk supply network, which is in turn fed from a number of sources in the Hutt Valley and Wainuiomata. As noted in Section 4.3, the model results do not take into account the ability to reconfigure the water supply network, such as expanding or reducing the area supplied by a specific reservoir, to enable site-specific growth.

The modelling results in Figure 5 to Figure 7 indicate the water supply capacity that exists currently (2017) and what is projected in the short-term (2020), medium-term (2027) and long-term (2047) for the network, storage and overall assessment.

The results show WSA catchments that have no constraints (green), constraints from under capacity in the LOS for either network or storage (orange) or whether the constraints are due to under capacity in the LOS for both network and storage (red). Catchments with inconclusive results are shown as green with hash lines.

On a catchment scale, the ability of the water supply network to support projected population growth in the short-, medium- and long-terms and meet the defined LOS is best described in Table 3 in subsection 5.2.1.

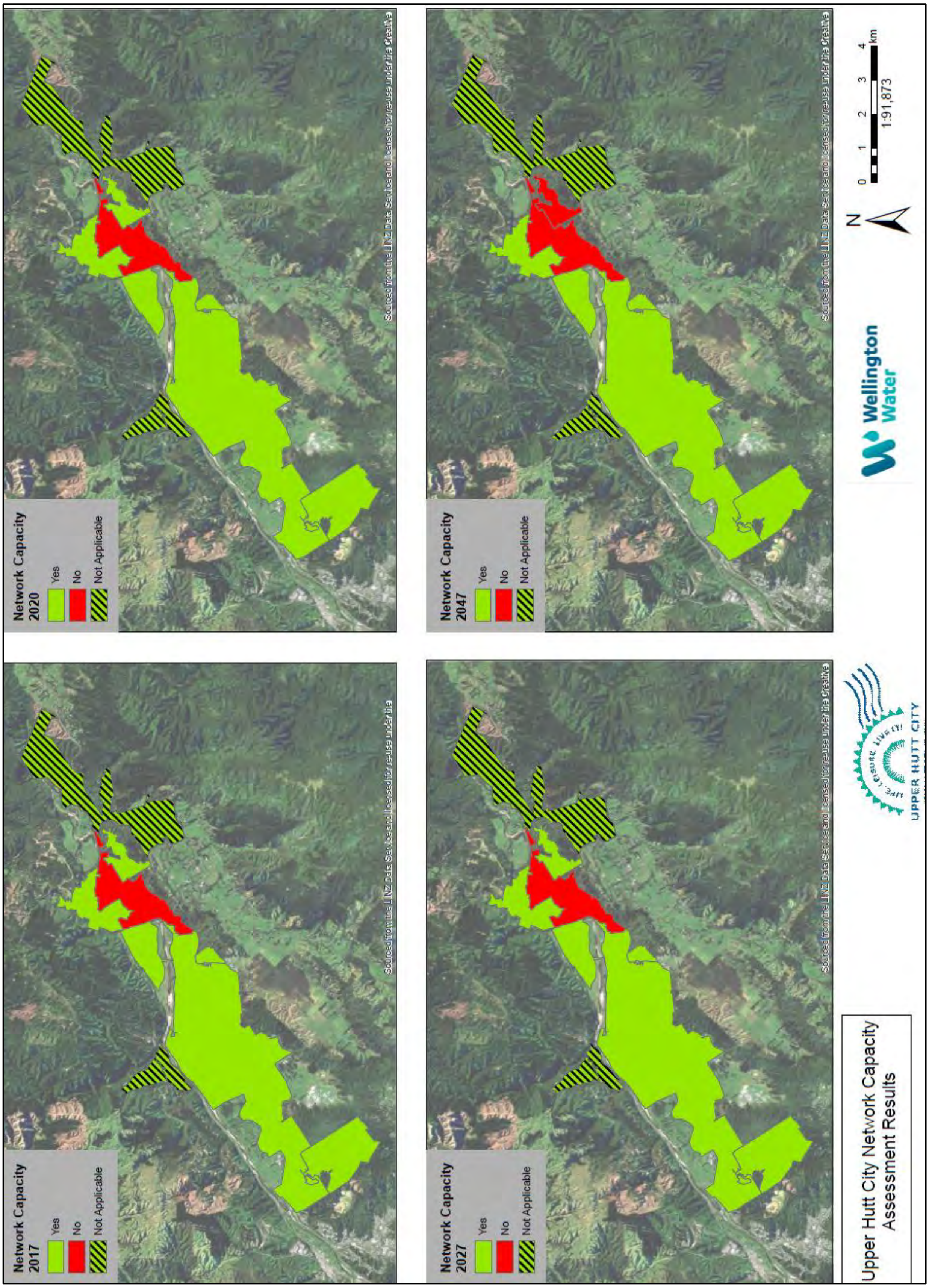


Figure 5: Water supply assessment of the network capacity for Upper Hutt at 2017, 2020, 2027 and 2047.

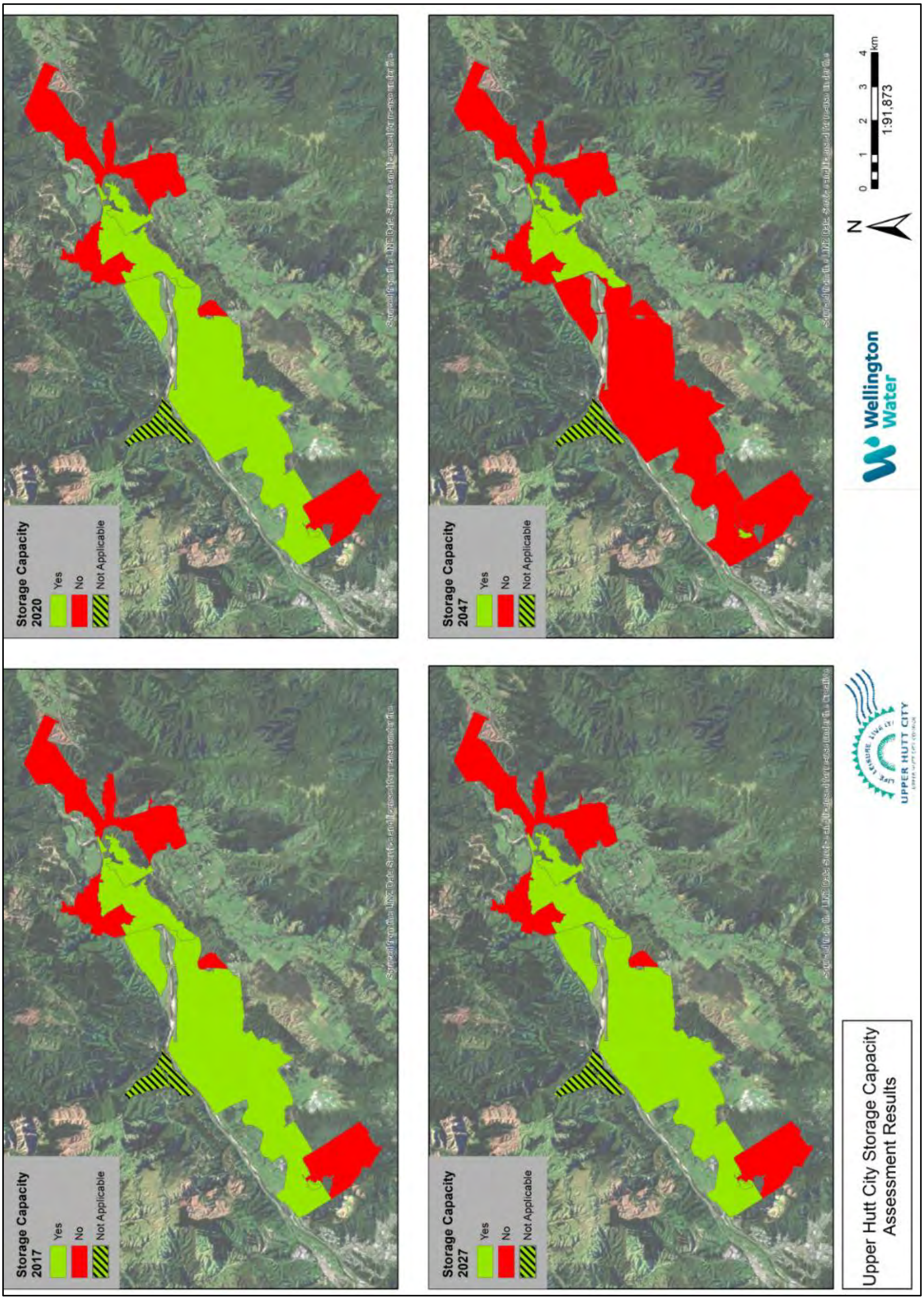


Figure 6: Water supply assessment of the storage capacity for Upper Hutt at 2017, 2020, 2027 and 2047.

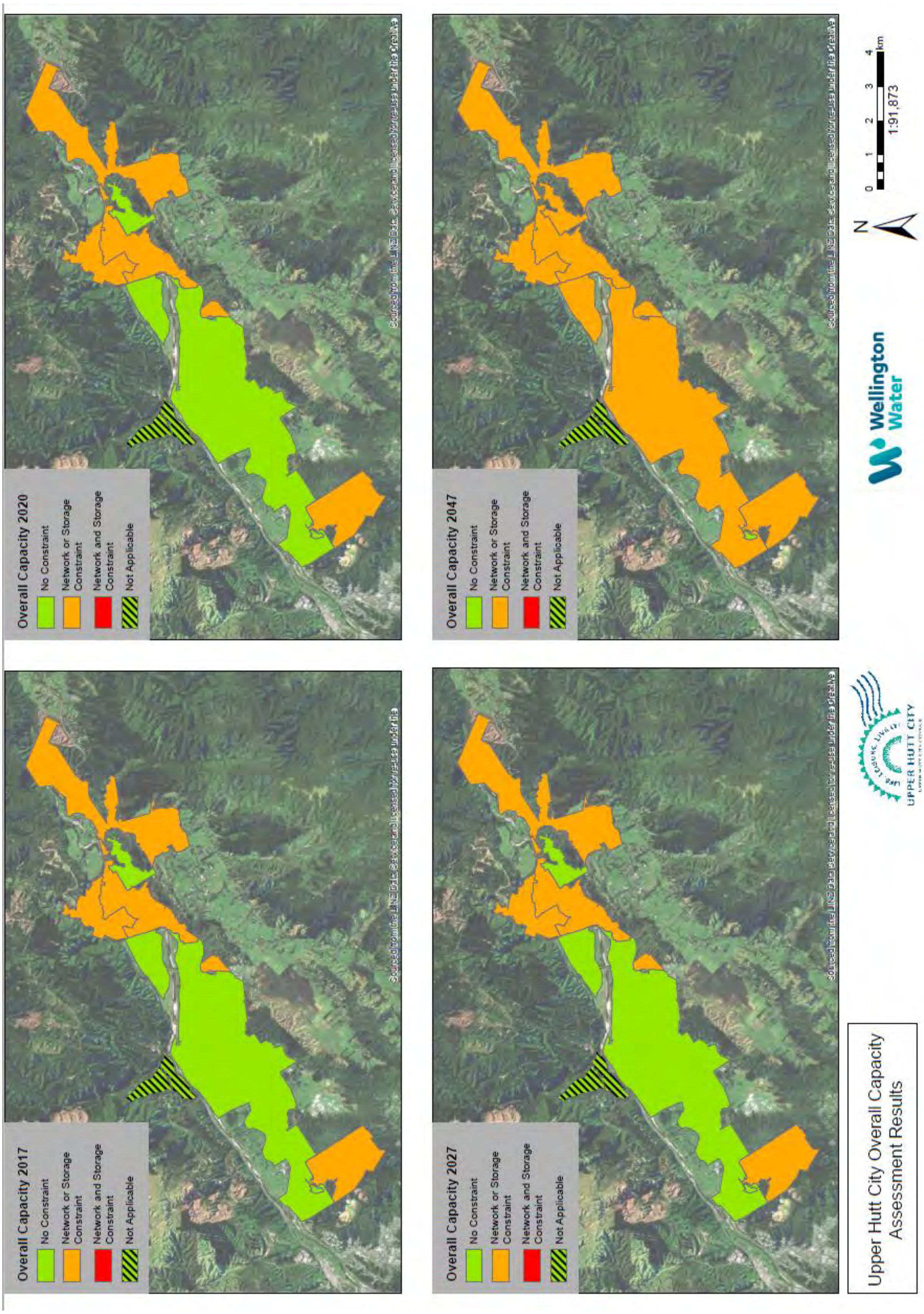


Figure 7: Water supply assessment of the overall capacity for Upper Hutt at 2017, 2020, 2027 and 2047.

5.1.2 Wastewater mapped results

The wastewater modelling was based on one catchment.

The results in Figure 8 shows the capacity assessment for the long-term projected population at year 2047. Sewer pipes that are under capacity are shown in red and locations of untreated wastewater overflows are indicated with coloured circles, with red circles indicating overflow locations with the largest volume. Note that this excludes overflows from the Silverstream storage facility.

On a catchment scale, the ability of the wastewater network to accommodate additional flows from projected population growth in the short-, medium- and long-terms and to meet the defined LOS is best described in Table 4 in subsection 5.2.2.

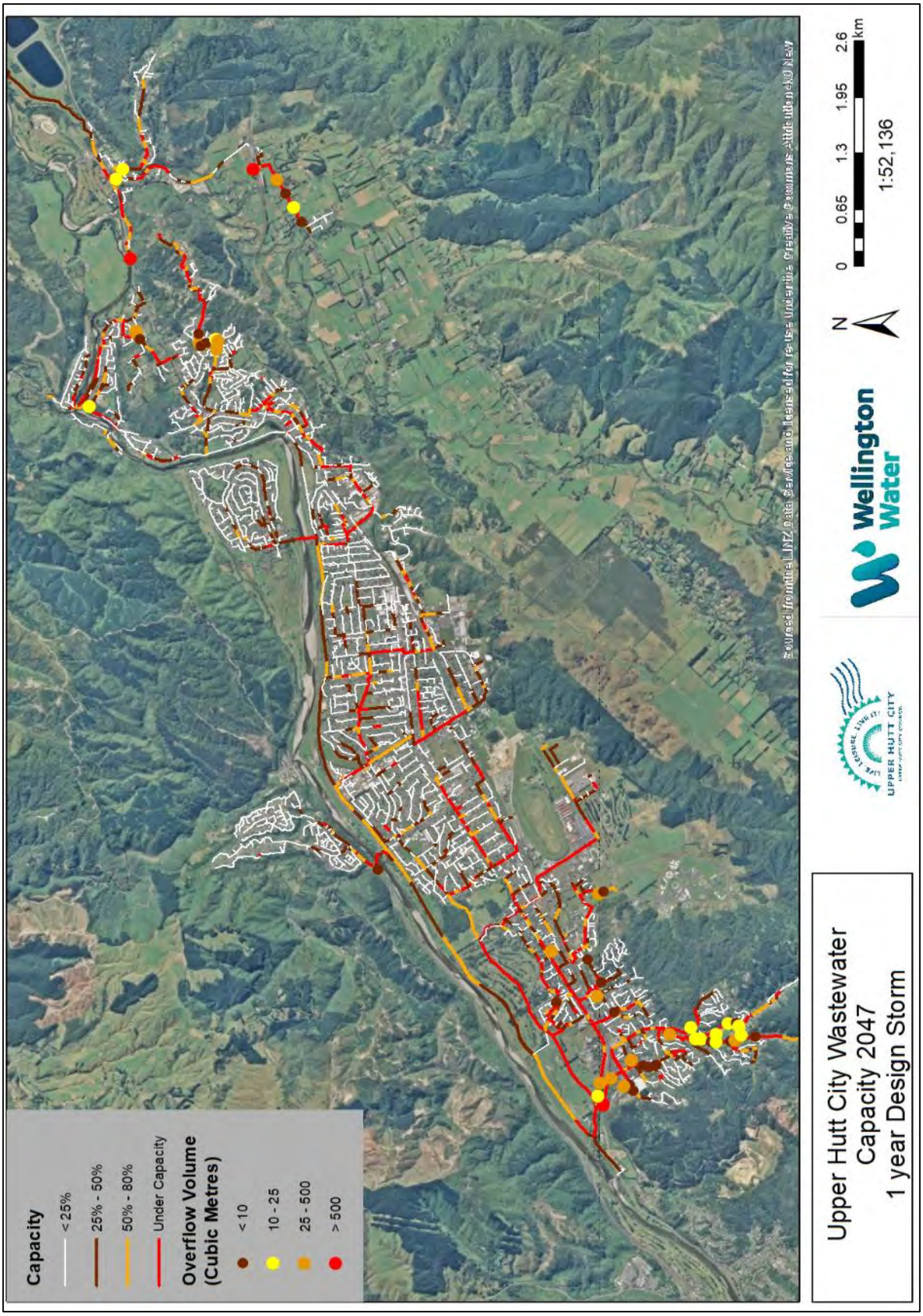


Figure 8: Future Population (2047) – Upper Hutt wastewater capacity assessment

5.1.3 Stormwater mapped results

As discussed above in subsection 3.3, the mapped stormwater results are not included in this report. Results are only provided in tables and text in subsection 5.2.3.

5.2 Tabled results

Tables of the model results are provided for water supply, wastewater and stormwater.

5.2.1 Water supply tabled results

Table 3 below indicates the constraints in infrastructure enabled capacity for each of the modelled WSAs in the short-term, medium-term and long term. Similar to the maps, the results for each WSA indicate the capacity in the water supply using the LOS based on network pressure (N), storage volumes (S) and both network and storage (O for Overall).

Where appropriate, the table provides additional information on whether the results for the storage LOS are relevant to the LOS of for operational storage or seismic resilience.

Where pressure in the network is modelled to be lower than the level of service, small network modifications or upgrades would eliminate these deficiencies in most cases, enabling urban growth from a network capacity point of view. Alternatively, it is possible that in some locations, localised substandard pressure could be acceptable.

It is unknown how the model results would differ if the more up-to-date UHCC population predictions were used. It can be assumed, however, that if increased predicted populations were located within WSAs with modelled storage constraints that these extent of these constraints would also be increased.

Table 3: Water supply enabled development capacity in Upper Hutt by Water Storage Area (N: network LOS, S: storage LOS, O: Overall LOS)

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Emerald Hill	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that the network can accommodate forecasted growth. Storage: The existing shortfall is mostly related to the seismic storage level of service.
Maidstone	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that the network can accommodate forecasted growth. This is typical of a small water supply zone where the pipework has been sized to

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
				cater for firefighting rather than head losses occurring from customer demand. Storage: There are existing shortfalls for both the operational and seismic storage level of service.
Mount Marua	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: No S: Yes O: Yes	Network: The model indicates that the network can accommodate forecasted growth through medium-term growth. Storage: The calculated storage shortfall is well within the margin of error of this assessment.
Pinehaven	N: Yes S: No O: No	N: Yes S: No O: No	N: Yes S: No O: No	Network: The model indicates that the network can accommodate forecasted growth. Storage: There is an existing shortfall for the seismic storage level of service.
Plateau Road	N: NA S: No O: No	N: NA S: No O: No	N: NA S: No O: No	Network: The assessment is inconclusive. Additional information is needed on the Maymorn DMA demand and the Pump Station. Storage: There are existing shortfalls for both the operational and seismic storage level of service.
Riverstone Lower	N: NA S: NA O: NA	N: NA S: NA O: NA	N: NA S: NA O: NA	Network: The assessment is inconclusive. Additional information is needed on the network configuration and calculated demand. Storage: There appears to be existing shortfalls for both the operational and seismic storage level of service. However, the demand is not well understood and needs to be resolved.
	N: NA	N: NA	N: NA	

Water Storage Area	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Riverstone Upper	S: NA O: NA	S: NA O: NA	S: NA O: NA	Network: The assessment is inconclusive. Additional information is needed on the network configuration and calculated demand. Storage: There appears to be adequate storage. However, the demand is not well understood and needs to be resolved.
Kingsley Heights (Sylvan Heights WSA)	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	Network: The model indicates that the network can accommodate forecasted growth. This is typical of a small water supply zone where the pipework has been sized to cater for firefighting rather than head losses occurring from customer demand. Storage: The calculated shortfall in operational capacity is well within the margin of error of this assessment.
Timberlea	N: No S: Yes O: No	N: No S: Yes O: No	N: No S: Yes O: No	Network: There is no spare capacity in the network. It may be possible to rezone the low-pressure properties onto the adjacent higher-HGL Emerald Hill DMA network. Storage: There is sufficient storage to supply projected growth.
Upper Hutt Central	N: Yes S: Yes O: Yes	N: Yes S: Yes O: Yes	N: No S: Yes O: No	Network: There is spare capacity in the network to support the projected medium-term population growth. Storage: Available storage is acceptable until 2027. Calculated storage shortfall in the long term will be covered by the planned Cruickshank reservoir funded in the LTP for 2028.

5.2.2 Wastewater

The hydraulic wastewater model for Upper Hutt shows an increased frequency and/or volume of untreated wastewater surcharging from up to 33 manholes during a 1-year ARI with the projected long-term population at year 2047 (see Table 4 below).

These results indicate that the existing and planned wastewater network would not support the predicted population growth and that there is significant inflow of rainwater and infiltration of groundwater (I&I) in some local areas. This could be due to the age of the pipes, high groundwater levels or stormwater pipes that are connected to the wastewater network.

The population distribution used in the hydraulic model does not reflect the most up-to-date predictions from UHCC on where urban growth is most likely to occur. If the more up-to-date predictions from UHCC were used, it is likely that the overflow frequencies and volumes at some of the more upstream locations may be lessened. However, most of the modelled overflows are located at the downstream end of the network and as the total predication populations are similar for both scenarios it is unlikely that the results in these locations would be significantly different.

Although the model does not include the outfall downstream of the Silverstream storage facility, this outfall will be included in the combined Upper Hutt/Hutt model, once the Hutt model is completed. The storage facility is used to control of the flow of wastewater into the downstream system and is operated to throttle the flows flowing downstream into the Hutt City catchments. In 2016/17 there were 10 events which discharged a total of 243,480 m^3 to the Te Awa Kairangi/Hutt River. In 2017/18 there were 8 events which spilled 214,927 m^3. This location is the largest regional overflow of wastewater. There is an opportunity to reduce the frequency and volume of these overflows through advanced control to optimise the capacity of the main trunk sewer.

Table 4: Wastewater enabled development capacity in Upper Hutt.

Wastewater	Infrastructure Enabled Development Capacity			
	Short Term (2017 – 2020)	Medium Term (2020 – 2027)	Long Term (2027 – 2047)	Comments
Upper Hutt	No	No	No	Short-term: increased overflows at 20 manholes. Medium term: increased overflows at 21 manholes. Long-term: increased overflows at 33 manholes.

5.2.3 Stormwater

Upper Hutt City is situated on the banks of the Te Awa Kairangi/Hutt River and the surrounding hill slopes. In most places the city is separated from the river by stopbanks and Greater Wellington Regional Council flood modelling indicates the areas that flood in a 0.23% AEP. Reserve land along the city side of the stopbanks fill during heavy rainfall, and these floodplains drain to the south along the stopbank and eventually into the Te Awa Kairangi/Hutt River.

Pinehaven Stream has a history of flooding, especially in the lower reaches where the capacity of the stream channel is restricted. These flood hazards were modelled and mapped by Greater Wellington Regional Council. The recently adopted (and under appeal) Plan Change 42 to the Upper Hutt District

Plan incorporates these new flood hazard maps. The provisions seek to avoid development in the high hazard area and mitigate the risk of flooding on development in the lower hazard areas. A range of structural and non-structural measures would be put in place to reduce flood risk to the community. Plan Change 42 also includes provisions for achieving hydraulic neutrality.

At the top of the catchments, there generally is less risk of surface ponding where the terrain is steeper. However, in steeper areas overland flow paths can be a threat to life due to the high velocities. It is therefore critical that overland flow paths remain unobscured to reduce the flood risk to people and property. In addition, deep ponding in some locations can preclude safe access.

It is also important to maintain the capacity of the waterways not just during low flow but also when they are in flood.

One of the assumptions for the analysis for the NPS-UDC is that planning and building restrictions will require new development to achieve hydraulic neutrality in all rainfall events up to and including the 1 in 100-year rainfall event including the predicted impacts of climate change (refer to subsection 4.1.2 Level of Service, Table 2 in subsection 4.3 Modelling Assumptions and Limitations and Table 5 below). With this assumption the stormwater modelling results are relevant for today's population level as well as for the anticipated population in 2047.

A requirement for hydraulic neutrality is the policy in the (currently under appeal) District Plan Change 42 for the Pinehaven stormwater catchment. If this policy were included in the District Plan for all of Upper Hutt and implemented for new developments, stormwater risks would not be increased as a result of increased population and its associated development.

There are many methods available to achieve hydraulic neutrality and the provisions in Plan Change 42 and the assumptions in this report do not specify which methods should be used.

Table 5: Stormwater protection enabled development capacity in Upper Hutt.

<table>
<tr><th rowspan="2">Stormwater</th><th colspan="3">Infrastructure Enabled Development Capacity</th><th></th></tr>
<tr><th>Short Term (2017 – 2020)</th><th>Medium Term (2020 – 2027)</th><th>Long Term (2027 – 2047)</th><th>Comments</th></tr>
<tr><td>Pinehaven</td><td>Yes</td><td>Yes</td><td>Yes</td><td rowspan="2">Development can occur in combination with adequate planning provisions.

For example, development must be hydraulically neutral so that flooding isn't increased, and development should be restricted in areas at risk of flooding.</td></tr>
<tr><td>Central Upper Hutt</td><td colspan="3">Not modelled</td></tr>
</table>

6. Conclusion

The results of hydraulic modelling for water supply and wastewater have identified significant limitations to the infrastructure enabled development capacity for Upper Hutt.

The hydraulic modelling for water supply shows shortfalls in the available and planned reservoir storage volumes to support predicted growth in the short, medium and long-term in several catchments. However, for site-specific growth the assessment would need to consider options such as reconfiguring the network by expanding or reducing the area supplied by a specific reservoir. Nonetheless, significant upgrades would be needed to support the anticipated population growth.

There are also capacity shortfalls in the ability of the wastewater network to support short-term growth as well as medium and long-term growth predictions. These shortfalls are expressed as areas where overflows of untreated sewage from sewer manholes are predicted to increase during wet weather events. These overflows are modelled to result from population growth that exacerbates wastewater flows without planned upgrades to the network to increase capacity or to reduce inflow and infiltration.

Stormwater can limit growth by creating a flooding risk to life and property. There is currently little information on stormwater constraints to growth in UHCC other than the results of flood hazard modelling for the Pinehaven Stream catchment. These results were incorporated into Plan Change 42 to the District Plan, which is currently under appeal, and the plan change includes provisions to protect and mitigate future growth from flood risks.

As stormwater pipes are designed to safely carry away only nuisance flooding from low to medium intensity rain events, most stormwater protection must result from planning restrictions on where and how development occurs. For example, this report assume that all new development is managed so that flooding is not increased up to and including the 1 in 100-year rainfall event and that buildings would not impede overland flow paths or areas of ponding.

The results provided in this report reflect defined levels of service and identified limitations and assumptions. As such this is considered to be a high-level assessment which does not consider potential site-specific mitigations.

The next steps are to assess the possible options to rectify these constraints and then include the best options in the next UHCC LTP and Infrastructure Strategy.

7. References

Cardno. 2018. Rainfall input files for wastewater modelling. Prepared for Wellington Water Ltd October 2018.

Stantec. 2018a. NPSUDC – Regional water supply capacity assessment: Methodology and summary. Prepared for Wellington Water Ltd. October 2018. 58 pages

Stantec. 2018b. NPSUDC – Regional water supply capacity assessment: Detailed assessments – Upper Hutt. Prepared for Wellington Water Ltd. October 2018.

Wellington Water Limited (WWL). 2017. Regional wastewater model specification: Modelling specifications. 18 September 2017.

Appendix 6.2

NPS-UDC Infrastructure assessment

Roading

Purpose

This assessment of the Upper Hutt City Council (Council) road network has been prepared to meet the requirements of the National Policy Statement on Urban Development Capacity 2016 (NPS-UDC). The NPS-UDC requires an assessment of the sufficiency of development capacity, and in doing so:

- whether development capacity is serviced with infrastructure; and
- whether development infrastructure required to service development is identified in the Council's Long Term Plan[1], or Infrastructure Strategy[2].

The assessment is not contingent on the location of development capacity, but assesses the infrastructure as it currently stands, and its potential to enable further growth over the next 30 years.

For the purpose of this report the scope of the road network includes facilities for walking, cycling, public transport and motorised traffic.

Overview of the local road network

SUMMARY OF ASSETS

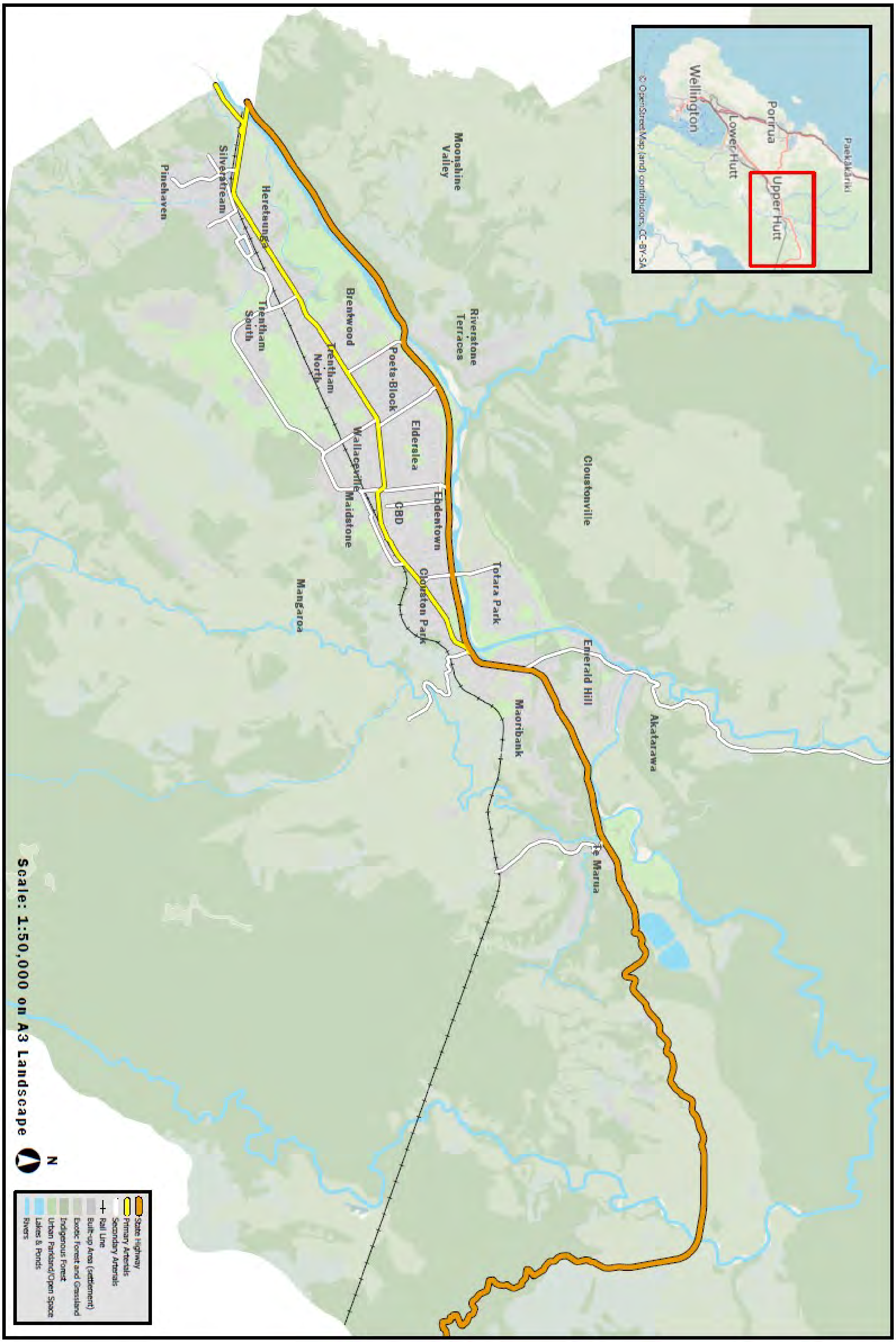
Upper Hutt's land transport network includes:

- 247km of roads (82 km rural and 165 km urban),
- 4.7km of cycleways
- 323km of kerbs and channels,
- 245km of footpath
- 3890 street lights
- 53 bridges (including 7 pedestrian foot bridges),
- three sets of traffic signals
- numerous sumps and street signs.

Note the quantity of assets vested in Council is increasing to match growth driven development and these reported numbers will increase overtime.

[1] UHCC Long Term Plan 2018 - 2028
[2] UHCC Infrastructure Strategy 2018 – 2043

Network map


Upper Hutt City Roading Infrastructure for NPS-UDC
Paekākāriki
Porirua
Wellington
Lower Hutt
Upper Hutt
© OpenStreetMap (and) contributors, CC-BY-SA
Pinehaven
Silverstream
Heretaunga
Moonshine Valley
Brentwood
Trentham South
Trentham North
Riverstone Terraces
Poets Block
Elderslea
Wallaceville
Maidstone
CBD
Ebdentown
Clouston Park
Totara Park
Cloustonville
Mangaroa
Emerald Hill
Maoribank
Akatarawa
Te Marua
Scale: 1:50,000 on A3 Landscape
N
State Highway
Primary Arterials
Secondary Arterials
Rail Line
Built-up Area (settlement)
Exotic Forest and Grassland
Indigenous Forest
Urban Parkland/Open Space
Lakes & Ponds
Rivers

How performance is monitored

The levels of service agreed with the community are set out in Council's Long Term Plan (LTP).

Council monitors the performance of the network in many ways, including:

- conducting regular condition assessments of assets
- monitoring of road safety outcomes
- surveying residents' opinions annually
- reporting on financial performance to quarterly and annual reports; and
- reporting on a number of non-financial key performance indicators.

PHYSICAL CONDITION

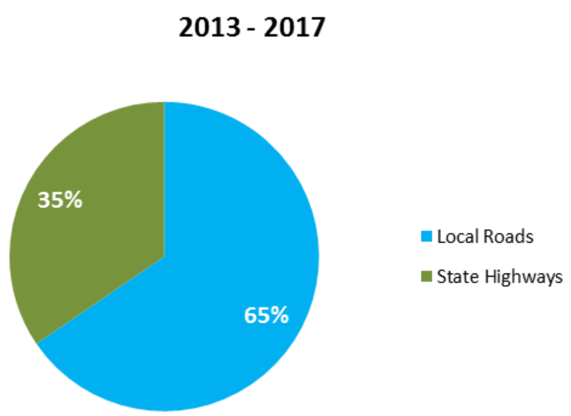
Council's transport assets are regularly inspected and condition is recorded in various management systems, primarily through the Road Asset Maintenance Management system (RAMM).

The majority of Council's transport network assets are in good condition with maintenance and renewal programmes being adequately funded through the LTP. Maintenance and renewal programmes are undertaken to ensure assets provide an acceptable level of service throughout their service lives.

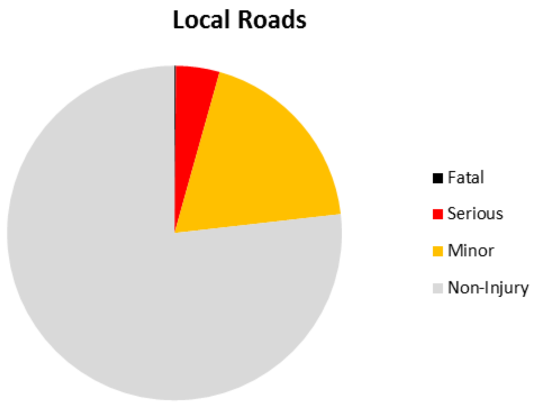
ROAD SAFETY OUTCOMES

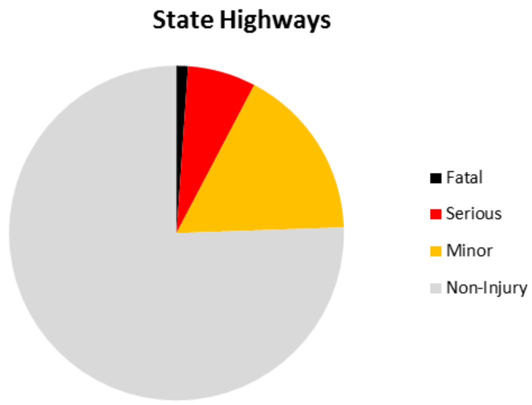
Council monitors a range of road safety outcomes as part of reporting requirements by New Zealand Transport Agency (NZTA) and in accordance with the Government's *Safer Journeys 2020*[3] initiatives. Council's annual road safety action plan identifies areas of concern and provides a basis for initiatives in partnerships with NZTA, the New Zealand Police and the Accident Compensation Corporation (ACC).

The following key indicators summarise the NZTA Crash Analysis System[4] (CAS) database, as at January 2019. This demonstrates where traffic incidence occurred and their severity. Crash data for recent years show no discernible pattern that can be linked to specific parts or attributes of the local roading network, i.e none occurred at the same location, and there was no common factor involved.



[3] Safer Journeys 2020
[4] NZTA Crash Analysis System





2013-2017		Local Roads			State Highways			All Upper Hutt		
5 year period		TOTAL	AVG.	%	TOTAL	AVG.	%	TOTAL	AVG.	%
Crashes Involving Vulnerable Road Users	Pedestrians	31	6.2	4%	5	1.0	1%	36	7.2	3%
	Cyclists	28	5.6	4%	2	0.4	1%	30	6.0	3%
	Motorcyclists	33	6.6	5%	25	5.0	7%	58	11.6	6%
	Young Road Users	64	12.8	9%	36	7.2	10%	100	20.0	9%
	Drivers 60+	48	9.6	7%	28	5.6	8%	76	15.2	7%
	Total	204	40.8		96	19.2		300	60.0	
Crashes Involving Vulnerable Road Users	Fatal	1	0.2	1%	3	0.6	4%	4	0.8	2%
	Serious	29	5.8	19%	19	3.8	24%	48	9.6	21%
	Minor	100	20.0	65%	47	9.4	59%	147	29.4	63%
	Non-Injury	24	4.8	16%	10	2.0	13%	34	6.8	15%
	Total	154	30.8		79	15.8		233	46.6	

FINANCIAL PERFORMANCE

Financial results are published in Council's annual reports[5]. Results for the Land Transport activity for 2017/18 were as follows:

- Actual total operating cost was $10.412 million, compared to the budgeted $9.656 million (the majority of this additional spending was funded by external sources, in particular due to the completion of the LED streetlight upgrade ahead of schedule).
- Actual capital expenditure (renewals and developments) was $8.385 million, compared to the budgeted $8.385 million, with the underspend being due to project timing issues and funding changes.

NON-FINANCIAL PERFORMANCE

Council reviewed its performance measures in the Long Term Plan 2018 - 2028 and the framework was aligned with its strategic priority areas. This clearly identifies linkages between what we do and why we do it, with the ultimate goal of working towards community outcomes.

Targets are set so that Council can measure and continually improve services provided to the community. Performance is reported on in our Annual Reports and where appropriate, based on data availability, some measures will be reported on more frequently (quarterly or half-yearly).

Council is also required to report on some mandatory measures for aspects of land transport activities.

[5] UHCC Annual Report 2017 - 2018

The Land Transport performance indicators measured are (seven in total):

- Community satisfaction with the street lighting throughout the city.
- Community satisfaction with the cleanliness of the city's streets.
- Road safety: The change from the previous financial year in the number of fatalities and serious injury crashes on the local road network, expressed as a number.
- Road conditions: The average quality of ride on a sealed local road network, measured by †smooth travel exposure.
- Road maintenance: The area of the sealed local road network that is resurfaced
- Footpaths: The percentage of footpaths within Upper Hutt that fall within the level of service or service standard for the condition of footpaths that is set out in the Council's relevant document (such as its Annual Plan, Long Term Plan, activity management plan, asset management plan or annual works programme).
- Response to service requests: The percentage of customer service requests relating to roads and footpaths to which Council responds within the timeframe specified in the Long Term Plan

The following is a summary of non-financial performance results against the agreed measures for the Land Transport activity for 2017 – 2018 (the most recent complete data available).

- Achieved: 4 (Road safety, Road conditions, Footpaths, Response to service requests)
- Not achieved: 3 (Street lighting, Street cleanliness, Road maintenance)

Responses to constraints and/or issues

GROWTH AND DEMAND STRATEGIC RESPONSES: LAND USE STRATEGY 2016 – 2043

Council's Land Use Strategy 2016 – 2043[6] (LUS) identifies key areas for growth in Upper Hutt to meet the needs of a changing population and to encourage and support future growth and development. Any future growth areas are well signalled in the Land Use Strategy and Council plans to carry out modelling of its networks as the implementation of the growth areas proceed.

The LUS included the following desired movement and infrastructure outcomes relating to roading for the period to 2043.

Infrastructure outcomes

- Networks and infrastructure that have been identified, assessed and planned to accommodate future growth
- Infrastructure requirements for new development that have been efficiently integrated with existing development

[6] UHCC Land Use Strategy 2016 - 2043

- Adoption of new and emerging infrastructure technology that improves both cost and environmental outcomes, wherever possible
- Adoption of best practice in network and infrastructure design and construction, to ensure that the development of infrastructure is compatible with both natural values and new development
- Collaborative working with other infrastructure providers, where this is practicable, to deliver outcomes that are efficient and effective
- Infrastructure that is resilient to the effects of climate change and natural hazards, and is able to operate quickly and safely if emergency events occur

Movement outcomes

- Safe and attractive connections and linkages between residential, business, community and recreation areas within the city
- Improved, safe and efficient connectivity to the wider region
- Efficient and affordable public transport options and further development of sustainable transport infrastructure
- Development that is carefully located to avoid any adverse effects of movement network operation.

INFRASTRUCTURE STRATEGY

Council prepared its latest 30-year Infrastructure Strategy as part of the Long Term Plan 2018 – 2028 (LTP), in accordance with the Local Government Act 2002[7]. The purpose of the Strategy is to identify significant infrastructure challenges and opportunities for Upper Hutt over the next 30 years. Decisions made in regard to the most likely option for responding to these issues are reflected in budgets incorporated into the LTP.

Council has assessed the likely impact of any future development as a result of Council's Land Use Strategy 2016 – 2043 on the roading network through modelling. The LTP includes potential projects to ensure that adequate capacity is provided for the expected traffic volumes from future development.

Key drivers and trends

Council anticipates the following key drivers and trends will influence the growth or decline in demand for roading infrastructure services in Upper Hutt over the next 30 years:

- Changes in demographics
- Planning for growth: Implementation of the Land Use Strategy (additional infill and greenfields development)
- Community desire for improved walking and cycling facilities; and
- Greater community awareness of the need to have resilient service networks.

These factors influence the demand for Council's services delivered by its infrastructure assets and consequently the programme of works reflected in the LTP. The challenge is to time any CAPEX projects (new or upgrades to existing assets) in order to provide the agreed level of service.

---

[7] Local Government Act 2002, Section 101B

Recent housing and residential growth has begun to increase pressure on key assets. Some of these growth-related needs have been reflected in projects brought forward in the LTP.

Similarly Council has partially-reinstated its Development Contributions Policy, applying only to the rural areas, with the intention to expand this across the whole of the city in the near future.

Focus areas

The focus areas identified in the Infrastructure Strategy for Land Transport for 2018 – 2048 are:

- Ensuring the road network is resilient, efficient, effective, and safe and assists in the delivery of councils strategic goals.
- Assessing and mitigating the vulnerability of the rural roading network to natural hazard events (see Resilience below).
- Addressing substandard rural carriageway widths, which impact on safety of motorists, cyclists and pedestrians on rural roads.
- Delivering agreed levels of service as the city enters a period of growth.
- Providing cycling and walking facilities that meets the agreed levels of service for all ages.
- Continuing advocacy work with Greater Wellington Regional Council (GWRC) and NZTA for capacity and safety upgrades of State Highway 2 and State Highway 58.

Demand management

Council has also invested in a number of opportunities to assist in demand management. These include:

- The construction of cycle ways including the provision of cycle safety infrastructure such as markings at intersections. This work being co-funded through the Urban Cycle Fund (UCF) and the New Zealand Transport Agency (NZTA). Although notionally concluding in July 2018, there are indications that this national programme will be ongoing.
- The investment in improvements to railway stations and their environs recognising that transport hubs can become medium density development opportunities. An example of this has been the shared development by GWRC and Council of the Upper Hutt Railway station, commuter parking and Princess Street upgrade.
- The ongoing monitoring and review of parking in the city centre to ensure the balance between demand and turnover is maintained. This requires identification an assessment of council owned off-street parking and how it is managed to be made.
- As the population ages and as medium density housing becomes more common, the demand on footpaths and maintaining footpath condition continues to grow.

OTHER ISSUES

Resilience

Upper Hutt lies within a floodplain with much of the city exposed to flood risk. Climate change is likely to exacerbate this risk through increased frequency and intensity of flooding events. It is uncertain whether the effects of climate change will be seen during the lifetime of this Strategy; however there is the potential to see increasing rainfall variability.

Both the Fergusson Drive transport corridor (which include the Silverstream Bridge) and State Highway 2 have known vulnerabilities which reduce their resilience to natural hazards.

The alternative routes involve the use of local roads and studies continue as to what can be done at a local level to bolster resilience on these routes.

The resilience of the roading network has been recently reviewed with the major concerns being the number of hilly rural roads that could be affected by major slips and some important access roads that could be affected by fallen overhead cables after a severe event whether it is seismic or weather related. A plan has been prepared to assist in the recovery of these roads to a condition that would permit access for emergency services and access to essential services such as water reservoirs and pump stations as quickly as possible.

There are also a number of bridges that require upgrading to varying degrees to increase their ability to cope with a large seismic event. Some of these structures have been upgraded and others are programmed for upgrading. The upgrading would be to at least a state where there was a good chance that they could be quickly opened again to emergency services.

Although resilience is an important issue it is a conscious decision that, where possible, resilience will be addressed concurrently within the renewals programme. Evidence would suggest that an often marginal change in cost to a renewals programme can bring about significant resilience benefits. Therefore although significant resilience costs and programmes may not be specifically identified resilience benefits will nevertheless be delivered as part of the renewals programme. It is considered best practice to not to just replace “like with like” but to replace to present day standards—this includes incorporating our current knowledge of resilience and hazard mitigation.

In other words, resilience in incorporated in all that is done. Networks are renewed with more resilient materials. Renewals are prioritised with resilience being one of the key drivers alongside condition.

Rural roads

The quality and safety of rural roads is an issue for the rural community. Rural roads are used by different users for different purposes and at times these uses can potentially conflict, resulting in safety concerns. The issue tends not just to be the amount of traffic on rural roads, but the speed of some drivers and potential conflicts between horse riders, pedestrians, cyclists, stock and motorised vehicles, including rural vehicles such as tractors. Many residents feel there is a need to separate these users from one another and upgrade the quality of the roading network.

Challenges are also emerging in rural communities due to subdivision and use demands. Roads which were generally narrow were fine for low traffic volumes but as development has occurred new residents are expecting a higher level of service as well as contributing to traffic growth.

At the same time many of these rural roads are popular with multiple users including cyclists, walkers and horse riders. The mixed use combined with increasing traffic volumes is a growing and ongoing problem. Using Development Contributions funding has a role to play in how these issues will be resolved.

Rural roads are also particularly vulnerable to land movement and the frequency/severity of these events is increasing. This is due to the increased frequency of high intensity localised rainfall events.

The ability for Council to recover costs of maintenance and upgrade of roads is limited by the LGA and RMA. The maintenance cost varies according to vehicle volumes, design standards and the level of service provided.

With more development likely to occur in the rural area over the next 30 years, Council will need to re-examine the design, capacity and function of specific rural roads to ensure that safety and efficiency are addressed, and that road maintenance and upgrades remain in step with the pace of anticipated development.

Other forms of movement and transport

Upper Hutt's flat topography is ideal for encouraging non-motorised transport such as cycling and walking, and particularly for young people, riding things like scooters and skateboards. Human-powered transport has the advantages of being cheap, emission-free and providing long-term health benefits.

Creating and maintaining a good quality network of safe paths for non-motorised transport (and permitted motorised vehicles such as mobility scooters) needs to be a high priority for Upper Hutt. Since 2016, $1.5 million has been allocated to Upper Hutt from the national Urban Cycleways Fund to construct new cycleways in the city.

As well as providing for non-vehicle movement between specific destinations, there is also a need to provide a safe and well-maintained network of recreational paths and links around the city. Recreational cycling, walking and (in the rural areas) horse riding need to be accommodated. Some of these paths can be shared, but user safety needs to be a top priority.

Improving the physical connectedness of the city

Council will continue to encourage improvements to the city's movement network, and improved connectivity to the regional transport networks.

With a high proportion (over 50%) of workers commuting to jobs outside the city, Council needs to continue to ensure ease of access to the strategic roading and rail networks, advocate for public transport improvements and upgrades to existing network connections, and encourage development that makes efficient use of existing networks.

Council will continue to work with external and government agencies to direct development of, and provide upgrades to, transport network infrastructure.

Council will continue to ensure that there are good linkages and connections between the city and local centres, areas of work, residential areas, community focal points and open spaces, for all types of transportation. There is also a need to ensure that recreational paths and linkages are enhanced, particularly for walking, cycling and in the rural areas, horse riding. Council will continue to work with the community to identify and improve these connections.

Council will also identify areas, such as shopping streets or local centres where improvements to public space, roading or pedestrian areas will enhance the quality of the environment and improve the economic vitality, vibrancy and use of the area.

Providing access to the network and local services will include monitoring and review of demand for parking to ensure that parking is adequately provided for across the city.

Network constraints

TRACKS MODELLING RESULTS

In early 2019, Council completed updated modelling to identify and measure transport network deficiencies out to 2028. The future years (in 5-year increments) have been developed from the recently completed base 2013 Upper Hutt Transportation Model and future Urban Development Capacity (UDC) land use and population data, provided as part of overall Housing and Business Capacity Assessment reporting inputs.

At present, traffic flow on the local road network is generally quite stable in both the morning and evening peak periods. However, volumes on State Highway 2 are resulting in significant restrictions to drivers along the single lane section between the Fergusson Drive (south at Silverstream) and Whakatiki Street intersections.

Along State Highway 2, intersections with Fergusson Drive (south at Silverstream), Moonshine Hill Road, Whakatiki Street and Akatarawa Road all show degraded intersection levels of service during peak periods, ranging from forced flow to nearing unstable flow.

The section of Fergusson Drive (also State Highway 2) south of Akatawara Road to Maoribank intersection is operating at unstable flows in both peak periods. Similarly in the south of the city Fergusson Drive between Field Street and Barton Avenue is also starting to show impacts of increased traffic flow.

Based on the 2028 modelling, locations of network deficiencies are largely unchanged compared to 2018, however the severity of the deficiencies is predicted to increase. Intersection and link deficiencies generally increase over time with more locations experiencing the lowest level of service of forced flow conditions by 2028, meaning traffic volumes are exceeding the network capacity at these points.

SUMMARY

As at early 2019, the land transport network is currently able to meet agreed levels of service. Generally traffic can move around the city with relative ease, with some areas of congestion developing during both peak flows. However, continued growth and future land development will increase congestion and degraded levels of service on some parts of the network.

In order to address some key capacity constraints along the Fergusson Drive transport corridor, several major projects (notably the Silverstream Bridge replacement and two significant roundabout upgrades) have been brought forward in the Long Term Plan 2018 – 2028 works programme.

Modelling also shows that the level of service provided by State Highway 2 through Upper Hutt is less than acceptable, and is a key constraint on the levels of service of the local network connecting to this route. Advocacy to seek improvement on this route will continue with the New Zealand Transport Agency. The beneficial impacts from further planned improvements to the local network linking to this route are contingent upon its level of service being improved.

Planned and/or budgeted improvements

This section outlines planned and/or budgeted improvements to the roading network, by way of summaries for major projects, extracted from the Long Term Plan works programme for 2018 – 2028.

MAJOR PROJECTS

Rural roads high-priority safety projects (2018 – 2028)

With the increased usage of our rural roads by multiple users including residents, cyclists, walkers, and horse riders safety is becoming a concern. 'Hot spots' have been identified and work is already in progress to improve safety and lessen the risk of serious crashes.

Fergusson/Ward/Whakatiki intersection upgrade (2019 – 2020)

Over the next few years significant development is planned to take place on Alexander Road and the previously owned AgResearch site on Ward Street. This will result in a substantial increase in traffic using the Fergusson/Ward/Whakatiki intersection. To mitigate traffic congestion due to increased demand this intersection will be redesigned and upgraded.

Fergusson/Main/Gibbons intersection upgrade (2020 – 2021)

Increased growth in and around Upper Hutt is putting a strain on the Fergusson/Main/Gibbons intersection causing congestion. The intersection will be redesigned and upgraded to cater for larger traffic volumes.

Totara Park Bridge widening (2020 – 2021)

Widening this bridge will improve levels of service for this intersection, as well as local resilience.

Silverstream Bridge replacement (2021 – 2025)

This bridge is a key gateway to the city from the south and is due for replacement; this has been brought forward to increase the capacity of the bridge with double lanes, to accommodate congestion resulting from growth. The bridge provides a critical access point to the city in the event of State Highway 2 being compromised, boosting the city's resilience.

Eastern Hutt/Fergusson Drive intersection and access to county lane (2023 – 2024)

This section of Eastern Hutt Road/Fergusson Drive will be remodeled and upgraded to improve peak congestion and provide safer access to County Lane as part of the Silverstream Bridge replacement.

Linkages to State Highway developments/improvements

State Highway 2 runs the length of the city and is a critical link for both Upper Hutt and the wider region. Its capacity is also the single biggest deficiency in the Upper Hutt network. It was recommended that State Highway 2 be four-laned between Gibbons Street and Western Hutt Road (Silverstream intersection) after the last urban growth traffic study was conducted in 2009 and this is consistent with the level of service modelling results Council has just completed in 2019.

The beneficial impacts from further planned improvements to the local network linking to this route are contingent upon its level of service being improved. The main improvement currently planned by NZTA within the city limits is to upgrade the Silverstream intersection (timing unconfirmed).

A full regional assessment of the State Highway network has been provided by NZTA as part of the Housing and Business Assessment.

Summary statement

Term	Statement
Short term 0 – 3 years: Assessment of whether development capacity is serviced with transport infrastructure	Business-as-usual land transport programmes, including some capital projects, are provided for in Council's Long Term Plan and Infrastructure Strategy for this period, including: • Rural roads high-priority safety projects (2018 – 2028 • Fergusson/Ward/Whakatiki intersection upgrade (2019 – 2020) • Fergusson/Main/Gibbons intersection upgrade (2020 – 2021) • Totara Park Bridge widening (2020 – 2021)
Medium term 3 – 10 years: Assessment of whether development infrastructure required to service development is identified in the Council's Long Term Plan, or Infrastructure Strategy.	Business-as-usual land transport programmes, including some capital projects, are provided for in Council's Long Term Plan and Infrastructure Strategy for this period, including: • Silverstream Bridge replacement (2021 – 2025) • Eastern Hutt/Fergusson Drive intersection and access to county lane (2023 – 2024)
Long Term 10 – 30 years: Development capacity must be feasible, identified in relevant plans and strategies, and the development infrastructure required to service it must be identified in the relevant Infrastructure Strategy required under the Local Government Act 2002.	Council's Infrastructure Strategy and Land Use Strategy cover this period, providing the basis for Council's high level planning of infrastructure provision to service development capacity. The Infrastructure Strategy is reviewed every three years in line with the Long Term Plan to adjust Council's work programmes and funding requirements accordingly in response to a range of factors, including growth.

Appendix 6.3

Open space

Introduction

This assessment of the Upper Hutt City Council (Council) open space network aims to meet the requirements of the National Policy Statement on Urban Development Capacity 2016 (NPS-UDC).

Overview of the open space network

DESCRIPTION

Upper Hutt has a large open space network with a variety of spaces for the many recreation activities enjoyed by our community. Parks and open spaces provide opportunities for a wide range of users to be active, socialise and relax. The diverse character of these spaces contributes to what makes the city unique and distinctive.

The city is located within the upper reaches of the Hutt River/Te Awa Kairangi, surrounded by Whakatikei, Akatarawa, Tararua and Rimutaka Ranges, and the Southern Hills. This landscape provides a strong natural setting for the city. The linear character of the natural landscape and the movement and infrastructure networks play a significant role in the accessibility and connectivity of public open space across the city.

SUMMARY OF ASSETS

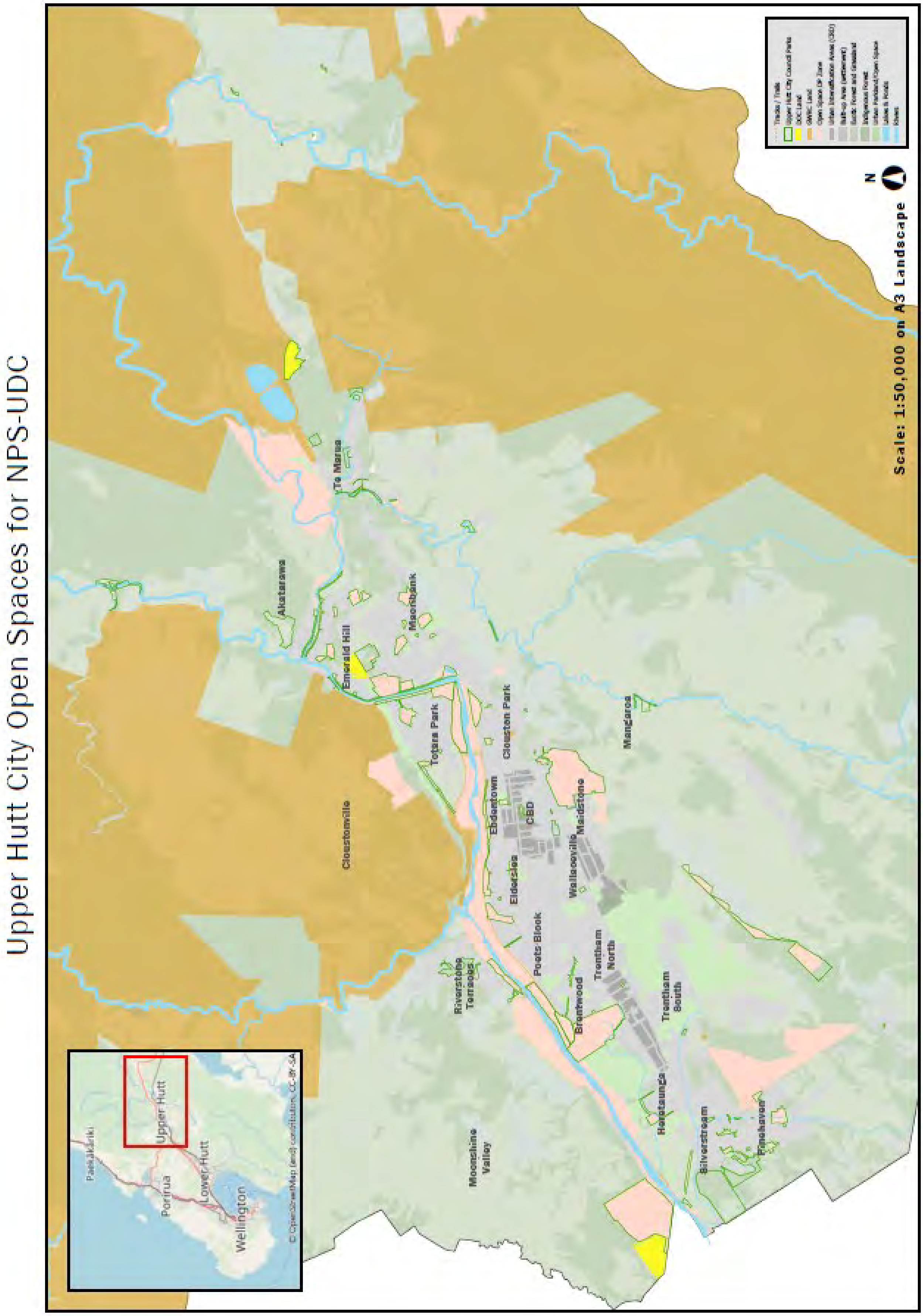
Council manages and maintains 421 hectares of reserve land including 54 individual parks and reserves with 67 sports fields, 36 playgrounds, 11 hectares of public gardens and 37 kilometres of walking and cycling tracks.

OTHER OPEN SPACES IN UPPER HUTT

The city has a further 34,600 hectares of open space that is owned or managed by the Department of Conservation, Greater Wellington Regional Council and the Queen Elizabeth II Trust, or are privately owned. Most of these lands are on the periphery of the city, except for the regional council land along the Hutt River/Te Awa Kairangi.

As a result the majority of Upper Hutt's natural resources that form part of the wider open space network are not managed by Council. They include landscapes and features like the hills that surround the city, our regional parks, and the Hutt River /Te Awa Kairangi and its tributaries. Some areas of open space are held primarily for other management purposes, and secondarily for recreation. For example the Hutt River corridor and water collection areas managed by the regional council have primary purposes for flood management and water collection.

Network map



Upper Hutt City Open Spaces for NPS-UDC
Te Marua
Akatarawa
Maoribank
Emerald Hill
Totara Park
Clouston Park
Cloustonville
Mangaroa
Ebdentown
CBD
Maidstone
Elderslea
Wallaceville
Poets Block
Trentham North
Riverstone Terraces
Brentwood
Trentham South
Heretaunga
Silverstream
Pinehaven
Moonshine Valley
N
Scale: 1:50,000 on A3 Landscape
Paekākāriki
Upper Hutt
Porirua
Lower Hutt
Wellington

Responses to constraints and/or issues

OPEN SPACE STRATEGY

Council's Open Space Strategy[1] (adopted in 2018) was developed as an outcome from several prior long term plans as well as an action from the Land Use Strategy[2] (LUS). The purpose of the Strategy is to provide an overarching framework and strategic direction for public parks and open space for the next 10 years. It is the principle, long-term planning document that will help Council manage, plan, develop and maintain our parks, reserves and open spaces in a collaborative, sustainable manner to meet the current and future recreational needs of the community.

The Strategy recognises the value of open space to our community, visitors and workers and the contribution open space makes towards the quality of life in Upper Hutt. The city is located close to these open spaces—local parks, the rivers, reserves, and walking and cycling trails. The relatively easy access we have to these parks and open spaces forms part of the city's identity and the lifestyle it offers. These are important features that attract people to Upper Hutt.

Upper Hutt is growing and changing which presents opportunities and challenges. We are experiencing increased demand for housing and business space, and need to ensure that the values of open space are retained as our city evolves. The Strategy considers both quality and quantity to enable the continued provision of open space that meets the recreational needs of current and future generations.

As well as meeting the recreation needs (both passive and active) of the community, there are opportunities to link to the regional open space network and draw visitors to our city through events and tourism.

The Strategy sets the following strategic direction: "Upper Hutt has an open space network of great spaces and places that are valued for their role in contributing to the health and wellbeing of the people and the environment of our city. "

Scope

For the purpose of the Strategy, 'open space' is land that is, or should be, set aside for public recreation, that the community has a relatively free right of access to.

The Strategy will guide the use, management, and development of open spaces with a framework for decision making on future projects and work to improve our open space network. It includes:

- Goals and objectives for Upper Hutt's open spaces.
- Guidelines for optimising open spaces, purchasing new open spaces and disposing of land that offers limited open space opportunities for the community.
- An analysis of existing open spaces to identify some of the opportunities for future improvements and development to achieve the goals of the strategy.
- A high level action plan to help implement the Strategy.

[1] UHCC Open Space Strategy 2018 - 2028
[2] UHCC Land Use Strategy 2016 - 2043

The Strategy does not contain specific projects or actions relating to maintenance or operations for specific parks or open spaces—this work will follow through Council's Long Term Plan[3] (LTP) and ongoing operations and asset management.

INFRASTRUCTURE STRATEGY

Leveraging off the Open Space Strategy, significant investment is proposed in refreshing facilities such as Maidstone Max to take into account both the age of facility and the changing demand of users. Similarly there will be significant investment in cycleways and ancillary infrastructure particularly where these routes add to or enhance the connection of regional and national cycleways. Levels of service will be consistent with the Strategy taking into account affordability. Nevertheless it is expected that there will be demand for increases in levels of service for walking and cycling.

Focus areas

The focus areas identified in the Infrastructure Strategy for Parks and Reserves for 2018 – 2048 are:

- Catering for anticipated future growth in burial requirements.
- Providing and extending of cycling and walking facilities.
- Disposing of surplus land holdings.
- Upgrading Maidstone Max and the development of a Maidstone Sports Hub including turfs and shared sports facilities.
- Aligning work programmes and levels of service with the Open Space Strategy.

Assessment of the overall sufficiency of the network

GENERAL

Each open space has its own identity within the open space network depending on its location, configuration and function. As part of developing the Open Space Strategy the character of each open space was assessed and the distribution mapped. This has provided an understanding of what open space exists, what the distribution is and the experiences provided for within each open space.

PHYSICAL CONDITION

Open space assets are managed in accordance with Council's asset management plan, which provides for lifecycle management and condition assessments. Annual condition inspections are undertaken on assets to ensure they are still in good working order and that current maintenance contracts managed by Parks and Reserves officers are fulfilled at a satisfactory level, to prolong asset lives for the benefit of the public.

Assets are maintained at a physical condition grading of one (being excellent) to three (being average). Average physical condition is an acceptable minimum asset condition, at which point Council would either renew, maintain or replace the asset. Any assets that have a condition grade of four (being poor) or five (being very poor) would need to be renewed, refurbished or replaced immediately as they are no longer serving their purpose or fulfilling levels of service.

[3] UHCC Long Term Plan 2018 - 2028

The Open Space Strategy action plan includes plans for ongoing condition audits using the guidelines for ideal open space to review each open space, taking account of the needs of present and future users.

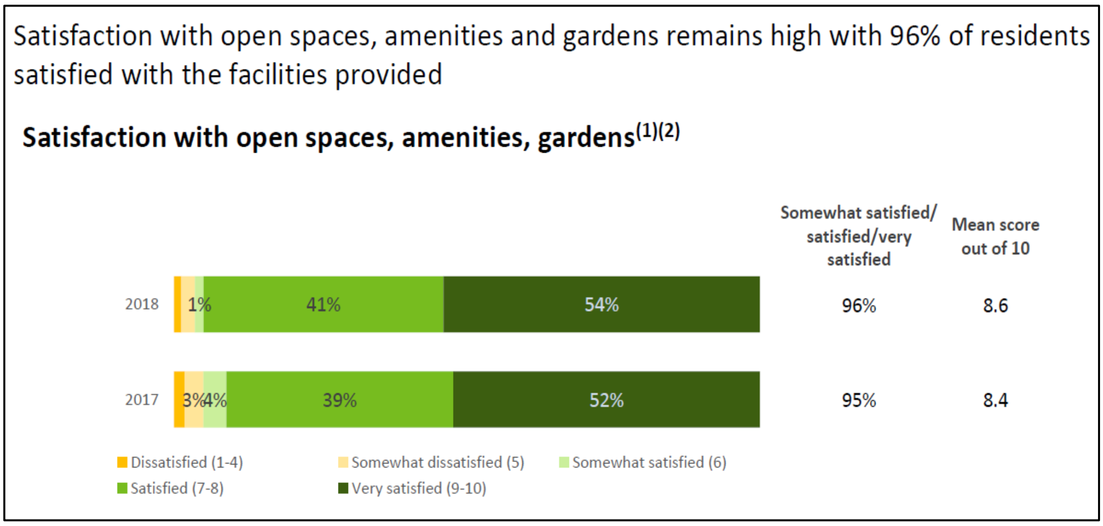
FINANCIAL PERFORMANCE AND NON-FINANCIAL PERFORMANCE

Financial results are published in Council's annual reports[4]. Results for the Parks and Reserves activity for 2017/18 were as follows:

- Actual total operating cost was $3,957,979, compared to the budgeted $3,576,850, with the overspend due to some increased project costs, unbudgeted loss on disposal of fixed assets and a significant overspend on deprecation.
- Actual capital expenditure (renewals and developments) was $323,763, compared to the budgeted $2,526,725, with the underspend being due to project timing issues and project delays.

The following is a summary of performance against the agreed measures for the Parks and Reserves activity for 2017/18.

Annual community survey results 2017 – 2018



GUIDELINES FOR FUTURE OPEN SPACE

The Open Space Strategy guidelines are designed to guide Council with the continued protection, development or optimisation of open space to make Upper Hutt a liveable city and deliver great value for money to the community. The guidelines will assist in the practical realisation of the goals and objectives within the Strategy using best practice for open space.

It provides a consistent and balanced framework for decision-making regarding the open space network to ensure its continued contribution to the health and wellbeing of our community and the environment.

Over the next 10 years, these guidelines will assist Council to effectively manage, protect and ensure values are maintained across the open space network through:

- Maintaining and enhancing the existing open spaces before acquiring more.

[4] UHCC Annual Report 2017 - 2018

- Ensuring assets are fit-for-purpose for their defined activity and intended user group.
- Disposing of underperforming assets that won't meet present or future community needs.
- Realising opportunities for flexible and multi-purpose spaces where possible and desirable.
- Where possible, acquiring open space in areas of walkable gaps, intensification or greenfield development to provide for a range of recreation opportunities.

Not all open spaces will address all of the factors included in the guidelines as it will depend on the function, type and nature of the open space. Consideration of these factors will assist in evaluating the strengths and weaknesses and potential of an existing or proposed open space when making decisions.

Network gaps and pressures

The Open Space Strategy included an analysis undertaken on a neighbourhood basis to allow more detailed assessment of the existing situation and forecast future change. These are based on 22 Census Area Units (CAUs) which together comprise the Upper Hutt urban area (also used for other Council planning purposes).

ANALYSIS OF ANTICIPATED GROWTH AREAS

The table below shows an extract from the Open Space Strategy, summarising the neighbourhoods identified for future intensification as per the LUS.

Neighbourhood	***Analysis summary***
Akatarawa	*Future growth in the way of urban expansion is forecast for this area (see the Land Use Strategy for details). As part of the new urban form access and connectivity of open spaces should be considered to enhance the network and make it easy for the community to connect with each other and nature.*
Ebdentown	*Ebdentown is an urban area proposed for intensification in the Land Use Strategy, this could provide opportunities to address accessibility to the Oxford Park open space.An opportunity exists within the open space at Riverbank Park to enhance the arrival and connectivity to the Upper Hutt city centre. This could be complemented by improved access to the Hutt River.Further development of the safe cycle route within the neighbourhood linking spaces is another opportunity.*
Elderslea	*With future intensification proposed (see the Land Use Strategy for details) an opportunity exists to investigate the accessibility, visibility and open space gaps within the neighbourhood. Poets Park is part of the open space network along the Hutt River Trail and provides great opportunities to enhance biodiversity as well as access for recreational purposes.*
Heretaunga – Silverstream	*With a future urban intensification zone in this area (see the Land Use Strategy), there is an opportunity to investigate and address open space gaps in this neighbourhood. Another opportunity is to improve walking and cycling access to the Hutt River Trail. Additional entry points into Witako Scenic Reserve from adjacent areas would make it more accessible for a greater part of the neighbourhood.*

Neighbourhood	***Analysis summary***
Trentham North	*Tawai Park is a neighbourhood park located along Tawai Street supplying the southern part of Trentham North with an open space. With a future urban intensification zone in this area (see the Land Use Strategy for details), an opportunity presents to further investigate and address the gaps in this neighbourhood and improve the open space provision.*
Trentham South	*Future growth in the way of urban expansion is forecast for this area (see the Land Use Strategy for details). As part of the new urban form open spaces should be considered to enhance the corridor network and address gaps. There is great potential to create shared pathways and ecological corridors, linking Witako and Maidstone reserves.*
Pinehaven	*With a future urban intensification zone in this area (see the Land Use Strategy for details), an opportunity presents to further investigate and address open space gaps in this neighbourhood.*
Upper Hutt Central	*The whole neighbourhood area is designated for urban intensification (see the Land Use Strategy for details). Retaining, improving and acquiring accessible open spaces in this area will be crucial to create an attractive, liveable neighbourhood.*
Wallaceville	*The neighbourhood is subject for urban intensification (see the Land Use Strategy for details) which will provide a great opportunity to investigate where additional open spaces can be located. However, access is an issue now without the future development and increased numbers. This neighbourhood would benefit from further analysis of open space acquisition in the near future.*

Commentary on sufficiency based on use

Upper Hutt is well-served with an abundance of open space, containing a significant portion of the Wellington region's regional park area, while making up only 8.4% of the region's population. The open space network is currently meeting agreed levels of service and is providing a variety of grounds for a diversity of activities, sports and other recreational uses.

Upper Hutt has both a growing and aging population. Household sizes are likely to be smaller and the LUS has identified the need for more infill housing and a more diverse range of housing. An increase in housing density may put pressure on our open spaces, so it will be important to maintain and enhance the spaces we have to ensure they serve the populations they will provide for in the future.

The Open Space Strategy is the guiding framework for Council to respond and manage the open space network to continue to meet the needs of the community.

PROVISION OF SPORTS FIELDS

Council was involved in a regional survey project in 2013, the Wellington Region Sports Field Strategy (prepared for: Wellington Region Territorial Authorities in September 2013).

The summary assessment from this survey for Upper Hutt, for winter sports codes only, stated:

> "With the Maidstone Park artificial turf field added to the network further investment in capacity increase projects is unlikely to be needed for the foreseeable future. A re-balancing of competition and training supply will meet the current and projected training shortfall. If council wishes there is also potential to retire some under-performing fields."

At the time of writing in 2013, the report stated that there was a surplus of 71 hours FFE (Full-size Field Equivalent) usage and with the new Maidstone artificial turfs (45 FFE) this would increase to a surplus of 116 FFE hours.

With Maidstone Park being utilised fully since 2013, there has been a significant reduction in natural grass usage. Football and rugby have both reconfigured their respective competitions, resulting in less grounds being required, i.e Awakairangi Park had 10 football fields which are now no longer use for seasonal sport.

There is currently no additional sports field developments planned in Upper Hutt. General maintenance and refurbishments, such as converting the current soil rugby fields to sand-based fields at Maidstone Park will also increase the number of playable hours.

Planned improvements to 2028

This section outlines planned and/or budgeted improvements to the open space network, by way of summaries for major projects, extracted from the LTP works programme for 2018 – 2028.

MAJOR PROJECTS

Maidstone Sports Hub (Stage 1 2018 – 2019, Stage 2 2022 – 2023)

Council will complete the development of the sports fields and buildings at Maidstone Park by upgrading the playing fields (stage 1) and redeveloping the clubrooms (stage 2) into a new combined facility, for which Council will seek one third external funding.

Trentham Memorial Park upgrade (2018 – 2019)

The upgrades at Trentham Memorial Park will include: improving existing tracks and drainage; replacing the playground bark with matting to improve accessibility for users with disabilities; and construction of a new interactive water-play feature.

Walking and cycling network (2018 – 2028)

Council plans to continue developing our walking and cycling network. This would improve the liveability of our city and provide easy, safe access to our highly valued open space network. It supports the strong recreational focus of our city vision and is aligned to the goals and objectives of the Open Space Strategy.

Regional cycle trails (2018 – 2028)

Council will participate in the regional cycle trails framework and contribute to the part-funding of a resource to provide a coordinated approach to the development and promotion of cycleways, including enabling greater access to government and other funding sources. One of the proposed signature trails in the regional framework is the Remutaka Cycle Trail. This regionally funded initiative will enable further track development, building of infrastructure (toilets/shelters), and the development and implementation of a consistent high-quality experience for users of regional cycleways including the Remutaka Cycle Trail.

Maidstone Max upgrade (2019 – 2020)

Council will carry out a complete redevelopment of the entire play area including the skate park following consultation with the public. Options may include; replacing the play equipment with modern, interactive equipment to suit all ages and abilities, a new skate park, lighting to allow for night-time use and to add points of interest, and a cluster of youth-specific play spaces.

City centre open space (2021 – 2024)

Investigations will be carried out to determine an appropriate location and design for a new open space in the Upper Hutt city centre.

Maidstone Park artificial turf renewals (2023 – 2024 and 2035 – 2036)

The two existing artificial turfs have a lifespan of 12 years and renewals are scheduled accordingly. These turfs have very high utilisation and extend the opportunity for recreational activity through greater consistency of playing surface

Summary statement

Term	Statement
Short term 0 – 3 years: Assessment of whether development capacity is serviced with open space infrastructure	Business-as-usual work programmes, including some capital projects, are provided for in Council's Long Term Plan and Infrastructure Strategy for this period, including: • Maidstone Sports Hub Stage 1 (2018 – 2019) • Trentham Memorial Park upgrade (2018 – 2019) • Maidstone Max upgrade (2019 – 2020) • Walking and cycling network project (2018 – 2028) • Regional cycle trails (2018 – 2028)
Medium term 3 – 10 years: Assessment of whether development infrastructure required to service development is identified in the Council's Long Term Plan, or Infrastructure Strategy.	Business-as-usual work programmes, including some capital projects, are provided for in Council's Long Term Plan and Infrastructure Strategy for this period, inlcuding: • City Centre open space (2021 – 2024) • Maidstone Sports Hub Stage 2 (2022 – 2023) • Maidstone Park artificial turf renewals (2023 – 2024) • Walking and cycling network project (2018 – 2028) • Regional cycle trails (2018 – 2028)
Long Term 10 – 30 years: Development capacity must be feasible, identified in relevant plans and strategies, and the development infrastructure required to service it must be identified in the relevant Infrastructure Strategy required under the Local Government Act 2002.	Council's Infrastructure Strategy and Land Use Strategy cover this period, providing the basis for Council's high level planning of infrastructure provision to service development capacity. In addition, Council's Open Space Strategy has specifically analysed network gaps and deficiencies to enable the continued management and development of the open space network to meet current and future community needs. The Infrastructure Strategy is reviewed every three years in line with the Long Term Plan to adjust Council's work programmes and funding requirements accordingly in response to a range of factors, including growth. The Open Space Strategy has a ten-year planning horizon and will be reviewed on this basis (around 2028).

Appendix 6.4

NPS: URBAN DEVELOPMENT CAPACITY

Q4 2017 reporting – Upper Hutt City Council

Upper Hutt is located within the Greater Wellington region, inland from Lower Hutt, and has a population of over 42,000 people. The district covers some 43,400 hectares, with the urban population only covering approximately 8% of this area, while the remainder of the district is rurally zoned.

The National Policy Statement on Urban Development Capacity (NPS-UDC) requires the Council to monitor various market and consenting parameters to evaluate both the feasibility and affordability of development within the district.

Policy PB6 of the NPS-UDC specifically states that the quarterly assessment must assess:

> a) *Prices and rents for housing, residential land and business land by location and type; and changes in these prices and rents over time*
>
> b) *The number of resource consents and building consents granted for urban development relative to the growth in population*
>
> c) *Indicators of housing affordability*

The following provides an assessment of these three parts using the information available at the time of writing. It is expected that the level of detail in reporting will increase as additional data sources become available.

The assessment provides analysis of Q4 2017 (fourth quarter of 2017, being October to December) and offers a comparative assessment against both Q4 2016, and the previous quarter of 2017, Q3. Additionally, this report acts as an opportunity to provide an assessment against annual indices and to provide a comparative analysis of 2017 against 2016.

PART A: Changes to Dwelling Sales and Rents

The Ministry of Business, Innovation and Employment (MBIE) and the Ministry for the Environment (MfE) have jointly published data from CoreLogic on dwelling sales and rents across New Zealand. This data is available through the Urban Development Capacity Dashboard[1], and was made available to the Upper Hutt City Council on 1 June 2017.

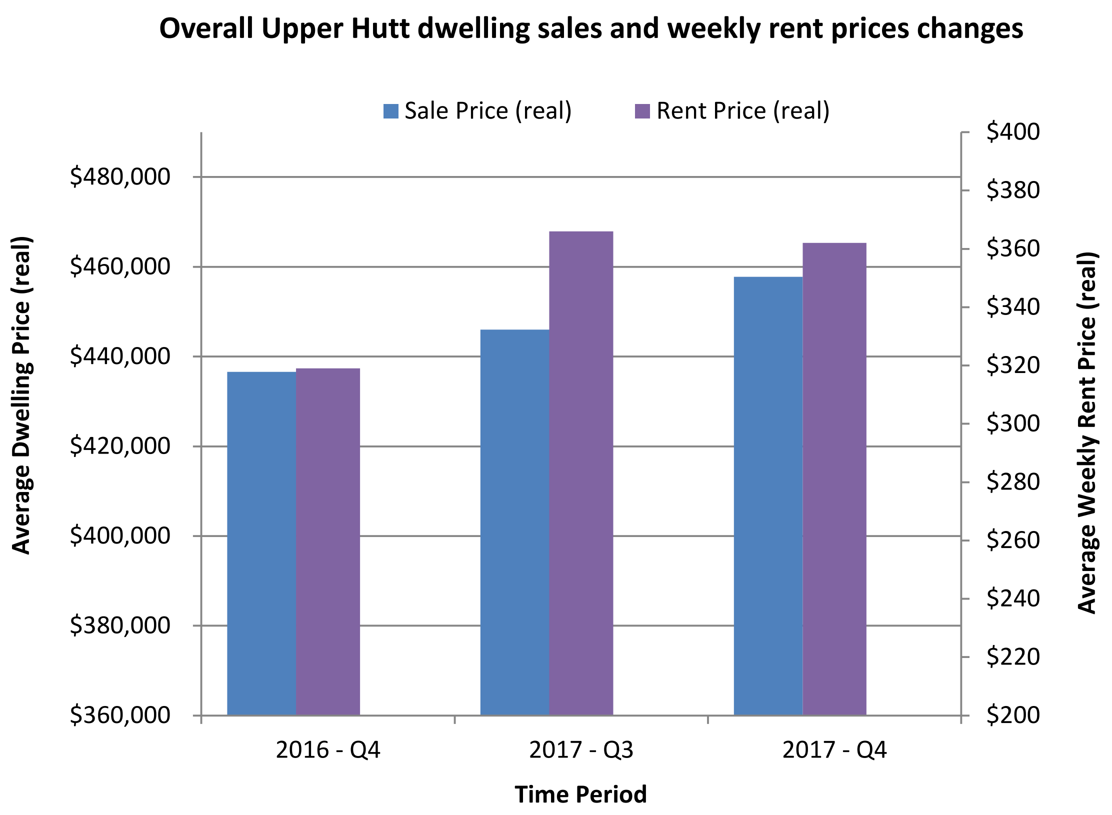
The following tables and graph provides a comparative analysis of information available through the MBIE/MfE Dashboard to inform analysis of Part A requirements.

Table 1 - Change in Dwelling Sale Prices:

	Sale Price (real)	% Change (cf Q4 2017)
2017 - Q4	$436,602	
2017 - Q3	$446,000	2.63%
2016 - Q4	$457,750	4.84%

Table 2 - Change in Dwelling Rental Prices:

	Rental Price (real)	% Change (cf Q4 2017)
2017 - Q4	$362	
2017 - Q3	$366	-1.09%
2016 - Q4	$319	13.48%



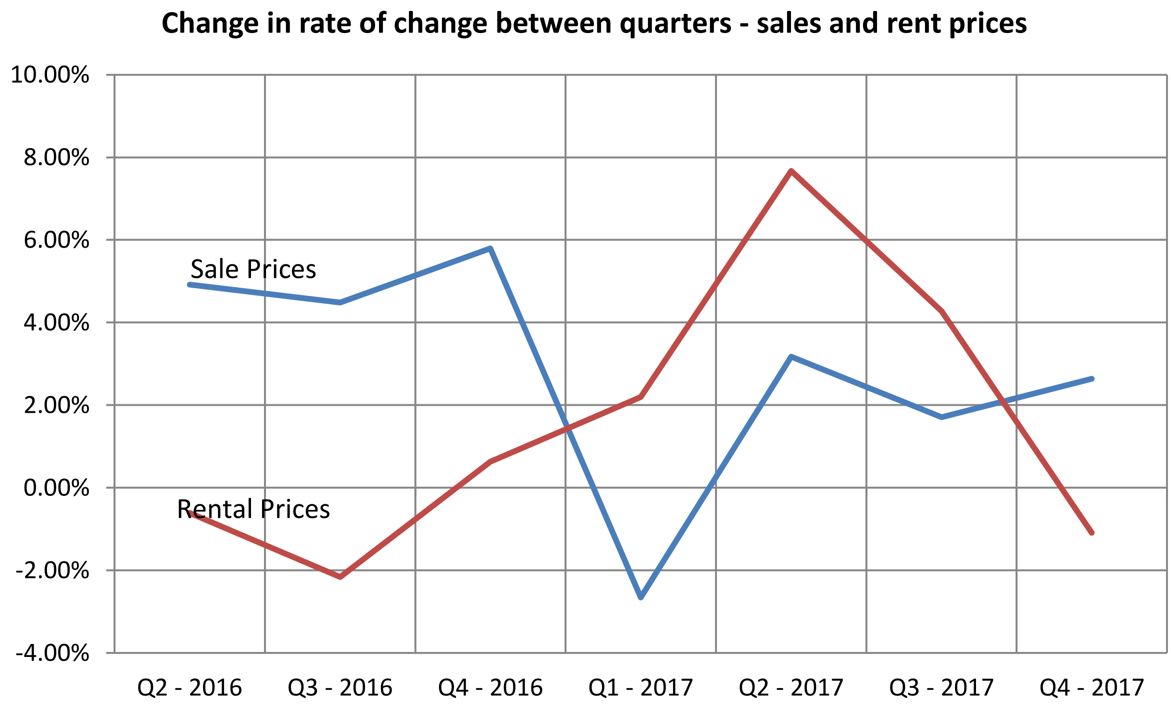
[1] MBIE and MfE Urban Development Capacity Dashboard: https://mbienz.shinyapps.io/urban-development-capacity/

While the average dwelling sales prices annually continues to increase, data also demonstrates that the rate of increase is moderately steady across 2017, with a median quarterly sales price increase of 2.17%, compared to a 2016 median quarterly sales increase of 4.92%. This is illustrated further below.

In monetary terms, sales prices across the Upper Hutt District have increased $21,148 since the beginning of 2017 (4.84%), while since Q1 2016, average sale prices have increased $81,266 (21.59%). This shows that while prices in 2017 continued to rise, the rate of the rise is slowing, comparatively, and stabilising overall.

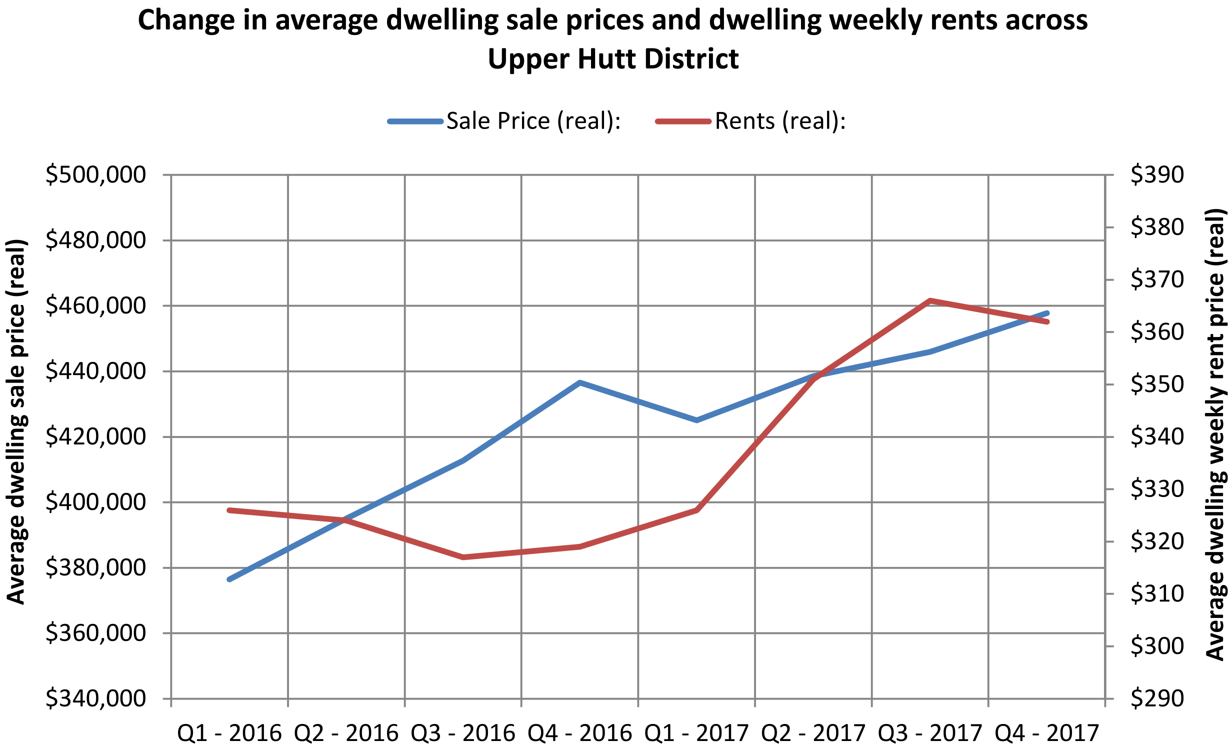
Rental prices however show a slightly different trend, with the annual rental price increasing by 13.48% in 2017, compared to an overall increase in rental prices since Q1 2016 of 11.04%.

The contrast between sale and rental prices may indicate that property owners are choosing to rent dwellings, or is reflective of a greater scarcity in the Upper Hutt rental market, overall. It is anticipated that further analysis of dwelling types, as well as land prices, will be included in future monitoring reports as additional information becomes available. The changes in the rate of sales and rental price changes between quarters is demonstrated below, with blue denoting sale prices and red denoting rental prices.



This shows how changes in both indices can be different overall, with a potential lag effect on rental prices of about three quarters. This will need to be further evaluated throughout 2018 to demonstrate is this effect remains constant.

Overall, the above does demonstrate that both sale price and rental price increases are declining. While the above is encouraging, prices overall remain high. The overall actual price increases are shown below and demonstrate a continuing trajectory of increasing prices across Upper Hutt.



The above shows real prices only, which means they have been adjusted for inflation to retain comparability across time periods.

PART B: Urban Building and Resource Consents Relative to Population Growth

The Upper Hutt City Council (UHCC) is part of the .id Community suite of population statics[2], which leverages on the latest Statistics New Zealand data. The organisation also works closely with the Council to consider local conditions which may alter population statistics, like significant development works, to provide a greater level of detail than sometimes available through Statistics New Zealand. It is for this reason that the .id Community profile information was chosen.

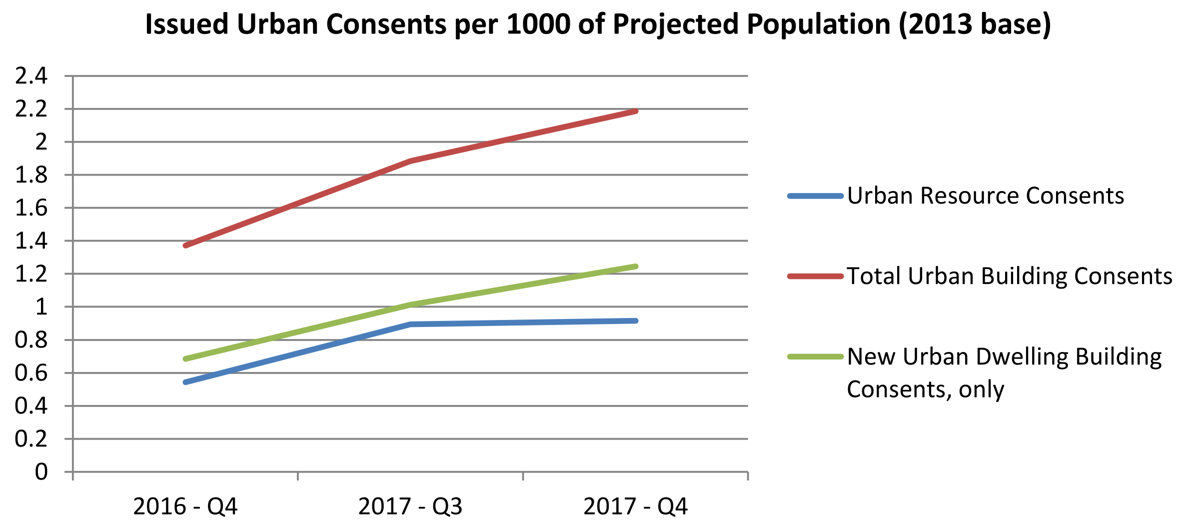
Population projection information is calculated in five-year intervals, from a 2013 base. Projected population growth will therefore remain constant for every quarter until 2018. The .id Community information forecasts annual population growth of 266[3] from 2013 to 2018. Divided into quarterly segments, the Upper Hutt population is projected to grow by 66.5 people per quarter. This figure was used to calculate the number of urban building and resource consents granted relative to population growth.

Table 3 - Change in Urban Resource Consents Granted

	Number of Resource Consents Granted	*% change (cf Q4 2017)*
Q4 2017	39	
Q3 2017	38	2.63%
Q4 2016	23	69.57%

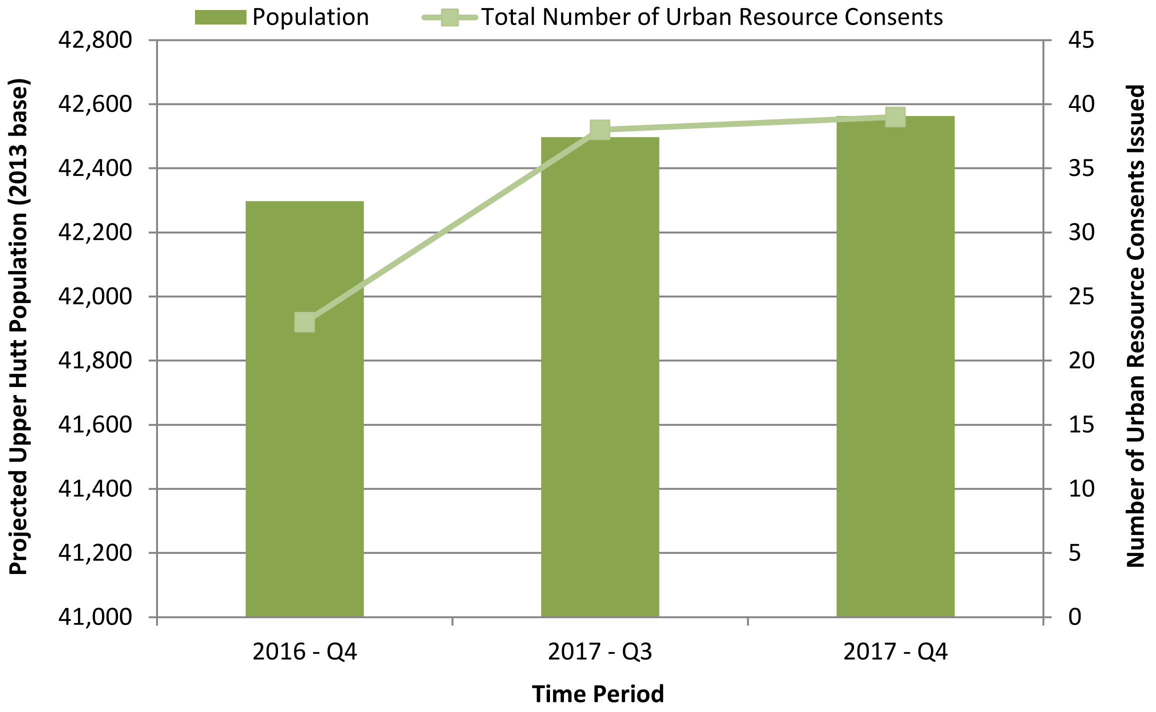
Table 4 - Change in Urban Building Consents Granted

	Number of Urban Building Consents Granted	*% change (cf Q4 2017)*	*Number of Urban New Dwellings Consented*	*% change (cf Q4 2017)*
Q4 2017	93		53	
Q3 2017	80	16.25%	43	23.26%
Q4 2016	58	60.34%	29	82.76%



[2] Upper Hutt Community Profile (http://profile.idnz.co.nz/upper-hutt), .id community, .id Consulting Pty Ltd.
[3] Last updated November 2016.

Number of urban resource consents granted relative to projected population growth: Q3 2016, Q2 & Q3 2017

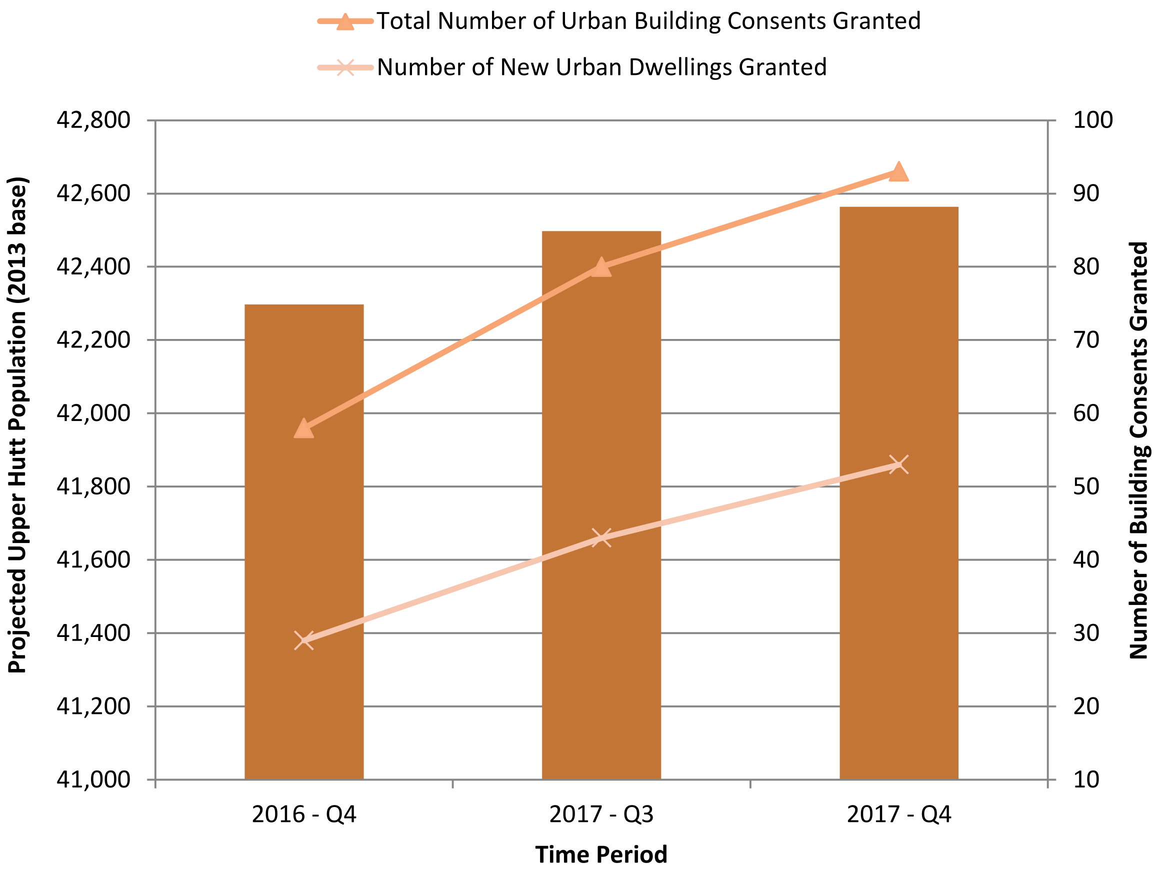


Resource consenting over the 2017 period has been relatively steady, and has not dramatically changed from the number of consents issued from 2016. The predominant changes, as detailed above, are between comparative Q4 periods, with a 69.6% increase, from 23 to 39 consents being issued. Overall, there was a 22.8% increase in resource consents issued between 2016 to 2017, or an increase of 28 consents issued. Further detail on this is provided below.

Urban building consent figures remain comparatively high when compared to resource consent figures. These saw an increase of almost 31.2% from 2016 to 2017, with almost an extra 70 urban building consents being issued. Once again, between the Q4 2016 and Q4 2017 figures, this increase was most prominent, with a 60.3% increase in building consents, and an 82.8% increase in new urban dwelling consents, specifically. This may be due to the number of new vacant allotments which have been created, which is detailed further below.

The 'urban building consents' definition incorporates all building works for new residential and business construction, including accessory buildings. This also included the substantial renovations (where occupation capacity is increased, new rooms added, or large internal alterations), and included building reconstructions and relocations. Building consents for the likes of services (i.e. three waters), internal fit-outs, minor alterations and construction, structural alterations and fireplaces were not included.

Number of urban building consents granted relative to projected population gowth: Q4 2016, Q3 & Q4 2017

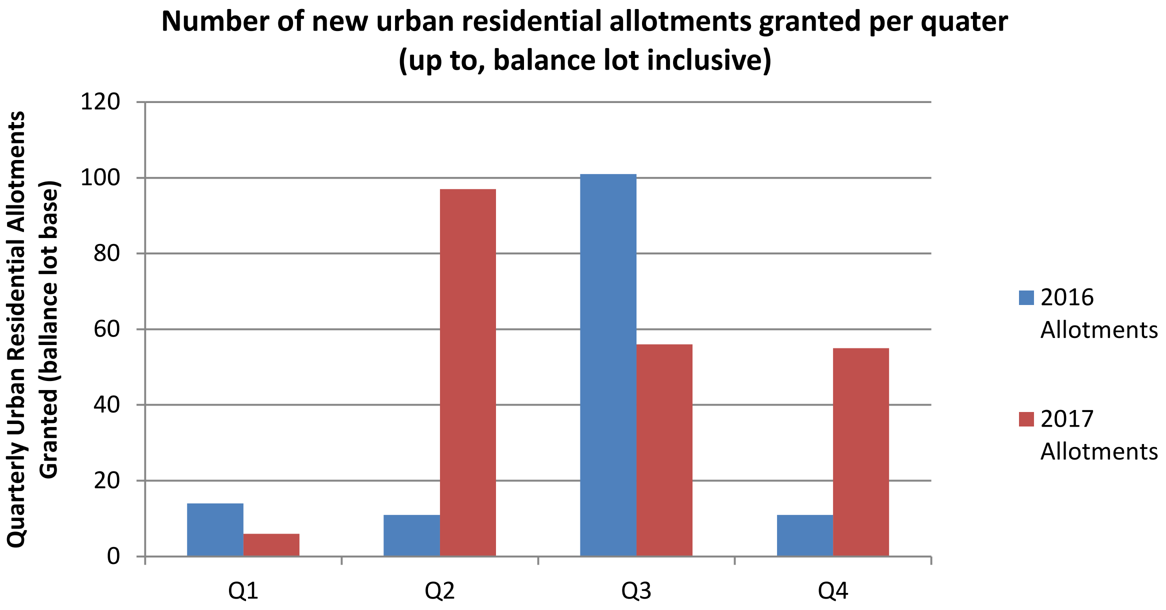


The stability of resource consent figures is in strong contrast to the growth in granted building consents, and may therefore mean that the average allotments per resource consent was higher, or conversely, there was a large number of 223/224 certificates[4] released. It should be remembered that these certificates are not assessed in resource consenting statistics, and that the 'urban' resource consents granted captures all consents granted for a land use or subdivision consent. This excludes any rurally zoned land or section 127 variations[5] to previously granted consents. The definition does also not take into account the number of lots created or the number of legal sites the consent covered.

Resource consent data was derived from the UHCC Director of Planning and Regulatory Services Policy Committee Reports[6], with the building consents data provided directly from the UHCC Building Control Team.

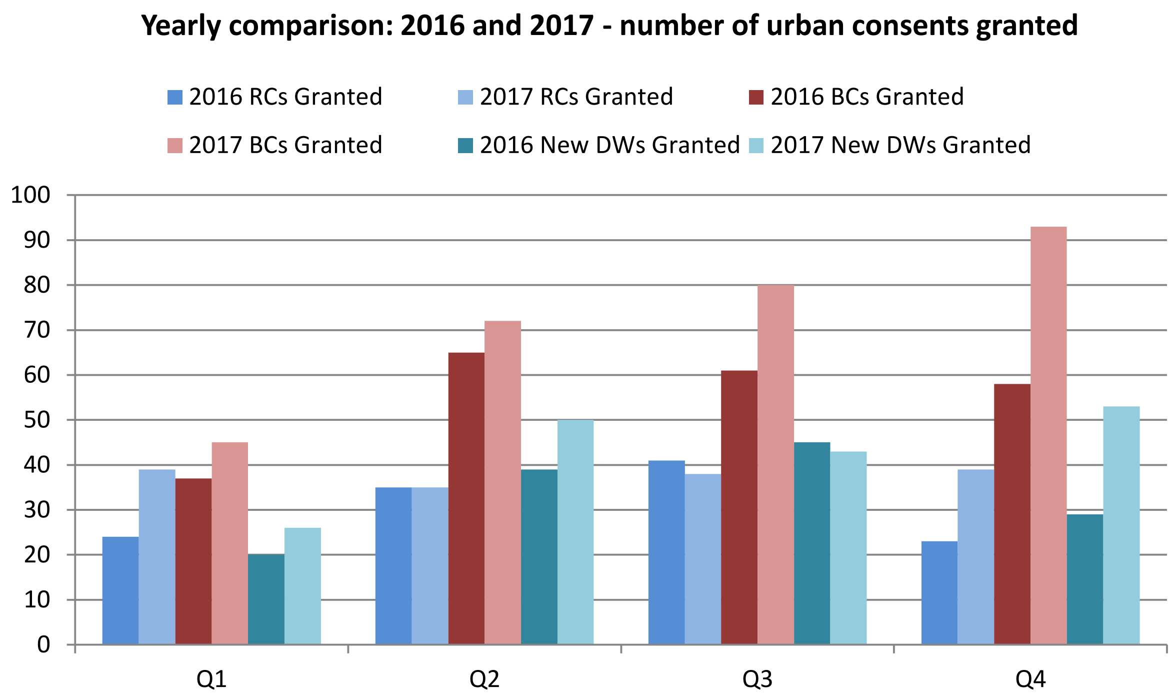
As discussed above, a reason for the increase in the number of building consents in the final quarter of 2017 may be due to the number of new allotments which have been created through subdivision resource consent over 2017. The below shows the number of new urban residential allotments created over the 2016 and 2017 periods.

[4] Subdivision certification process to release new land titles.
[5] Application to change or cancel conditions of consent by consent holder.
[6] Policy Committee Minutes available at: http://upperhuttcity.com/your-council/agendas-and-minutes/policy-committee/



In total, there were 137 urban residential allotments consented in 2016, compared to 214 in 2017 – a 56% increase. Of note is the amount median allotments granted per month, comparatively. This shows that in 2016 the median allotments consented was 13 per quarter, while in 2017 this was 56 – a 344% increase. Much of this is due to the large greenfield development taking place in Upper Hutt, known as the Wallaceville Estate. This is supported by anecdotal information from the resource consents planning team.

Overall consenting is provided below:



PART C: Indicators of Housing Affordability

Upper Hutt has a relatively small population comparative to its administrative boundaries, and is projected to maintain a steady growth of 0.06% on an annual basis. The following demonstrates the overall percentage changes between previous quarters to the parameters discussed in the preceding sections of this report as a means for comparison.

Table 6 - Overall quarterly comparative changes

Change from previous quarter	***UH Average Sale Price***	***UH Average Weekly Rent Price***	***Urban Building Consents***	***Urban Resource Consents***
2017 Q1	**-2.4%**	**11.0%**	**-11.8%**	**69.6%**
2017 Q2	**3.2%**	**-0.3%**	**57.8%**	**-10.3%**
2017 Q3	**1.7%**	**4.3%**	**11.1%**	**8.6%**
2017 Q4	**2.6%**	**-1.1%**	**16.3%**	**2.6%**

Is urban development meeting projected population demands?

The trend data to date suggests that current levels of urban development are meeting projected population growth in Upper Hutt. For example, the projected quarterly population growth is estimated at approximately 67 people, compared to a total of 132 urban building and resource consents granted in Q4 2017 – 53 of these representing building consents for new urban dwellings. The average household size in Upper Hutt is 2.59 people per household[7]. This indicates that the 53 granted urban building consents for new dwellings can accommodate 137 people – exceeding the projected population growth for the fourth quarter of 2017. The validity of this population projection figure will of course be tested upon the completion of the 2018 census.

Annually, this positive outlook is seen throughout both 2016 and 2017. The table below shows the estimated capacity consented for over both years, using the projected population growth of 266 people per year in the Upper Hutt District.

Table 7 – Overall capacity calculations

	Dwelling Consents Granted	*Average Household Occupation*	*Theoretical Capacity*	*Capacity after projected population growth*
2016	133	2.59	344.47	+78.47
2017	172	2.59	445.47	+179.48

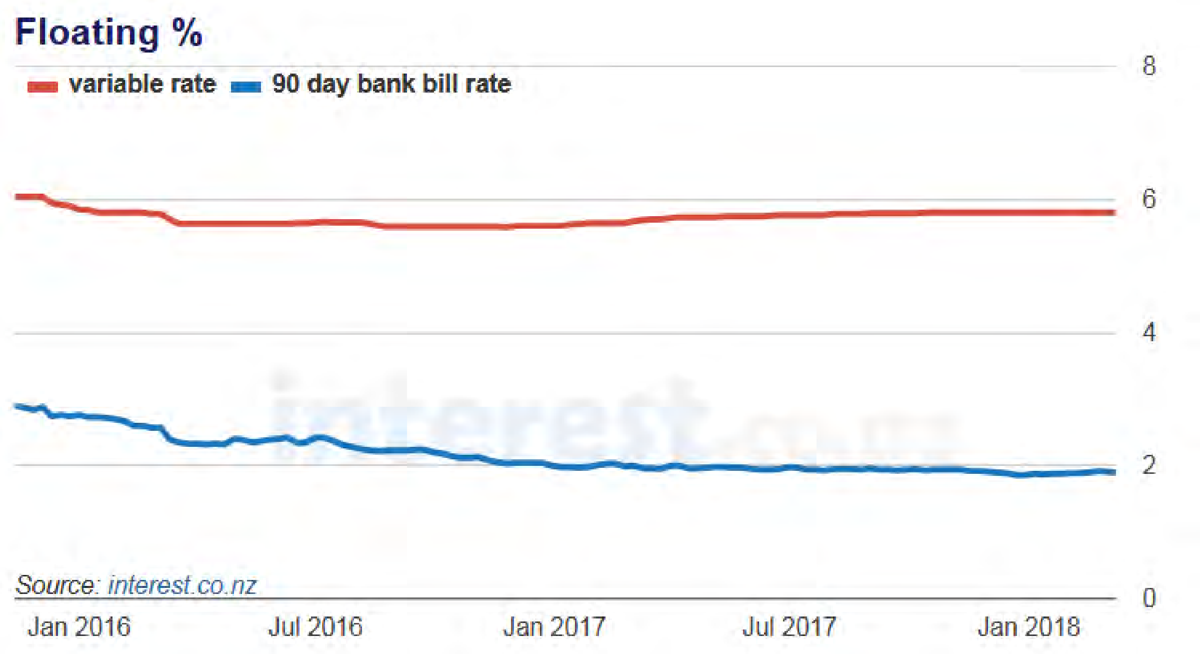
As can be seen, while the number of newly consented dwellings is exceeding projected population growth in both 2016 and 2017, this has been vastly accelerated in 2017 – increasing 128.7%. The current estimated theoretical capacity is 67.5% higher than the capacity required of 266, based on projected population growth. Anecdotal information from the Building Department suggests that much of this is located within the Wallaceville Estate development. It should be remembered that this capacity is theoretical, and may be less due to market factors and the uptake of new developments in Upper Hutt, such as the Wallaceville Development.

[7] Average household size in overall profile: http://profile.idnz.co.nz/upper-hutt/highlights

Additional indicators of wider housing affordability in Upper Hutt

In simple terms, housing affordability can be seen as a function of mortgage rates, immigration, population demographics, income, and building supply. While the growth in residential building supply currently exceeds the projected population growth of Upper Hutt, this is only one factor which contributes to housing affordability. Therefore it remains important to consider this development in the context of other affordability indicators.

One of these factors is the ability for consumers to obtain a mortgage at a fair price. In assessing this, floating and fixed mortgage rates have remained steady since January 2017, at about 5.8% for floating, and only increasing about 0.3% to 5.73% for a fixed rate[8] (average floating variable rate and 5 year fixed rate).



As demonstrated above, this is a continuing trend throughout the last 2 years (mainly for the floating rate), and is a positive sign for those seeking to obtain and pay for a mortgage.

The building supply is influenced by the number of people seeking housing. Net migration however continues to be an issue across New Zealand. Statistics New Zealand figures show that in the year to December 2017, national migration is slightly up from the previous quarter to 131,500 people, however produced a slight reduction in net migration to 70,000 people. This break-down is provided below.

A continuing increase in net migration will continue to reduce the likelihood of attaining affordable housing.

[8] Mortgage rates are bank averages from interest.co.nz, retrieved 9/03/17: http://www.interest.co.nz/charts/interest-rates/mortgage-rates

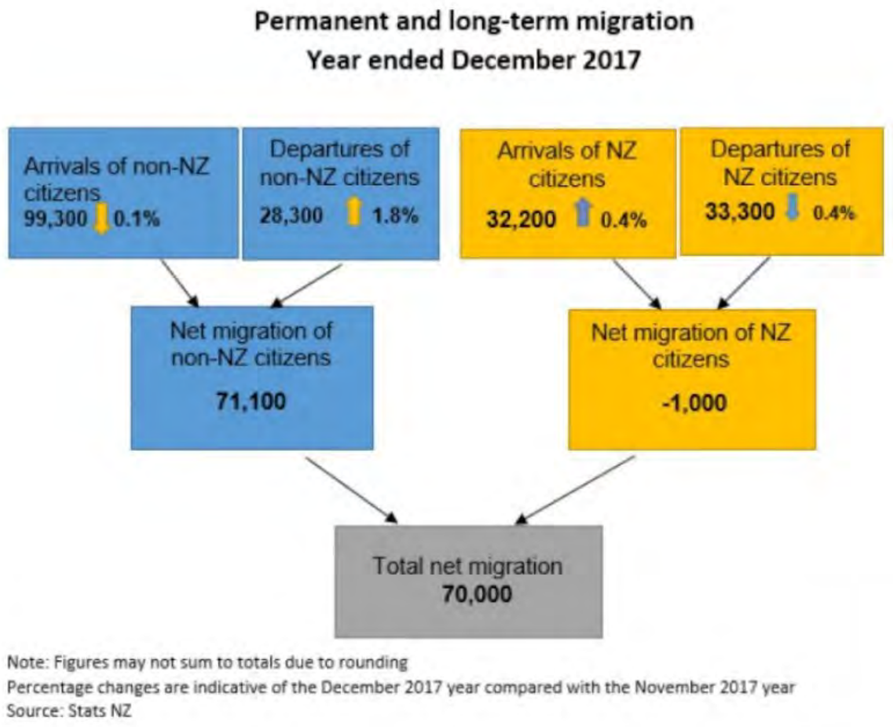


Figure 1: Statistics New Zealand Graphic on New Zealand Migration[9]

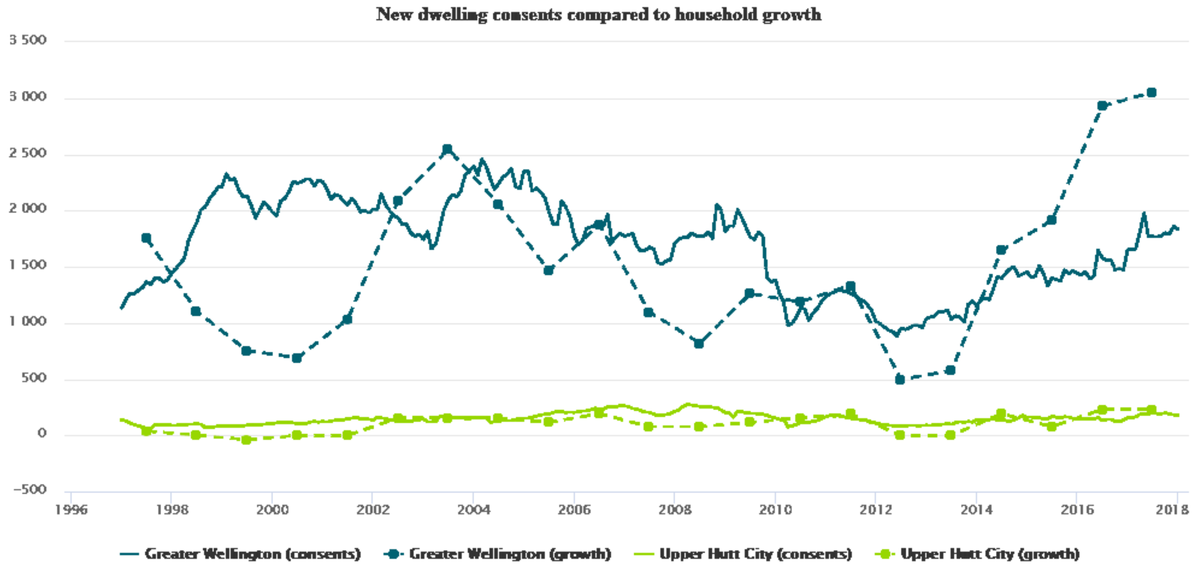
Recent data from MBIE shows that the average household income in the Upper Hutt District is $103,300 for 2017[10], increasing from the 2013 Census results which showed that household income is higher in Upper Hutt than the New Zealand average, with 42.7% of households earning an income of $70,000 or more[11]. This is a positive sign for Upper Hutt residence looking at purchasing a home.

MBIE data also shows that another positive is the reducing unemployment rate over the 2016-2017 period, which fell 0.8% for the Wellington region. This is another positive sign when comparing the trends from 2006 to 2013, which showed that 402 people became unemployed, an increase of 1.8[12].

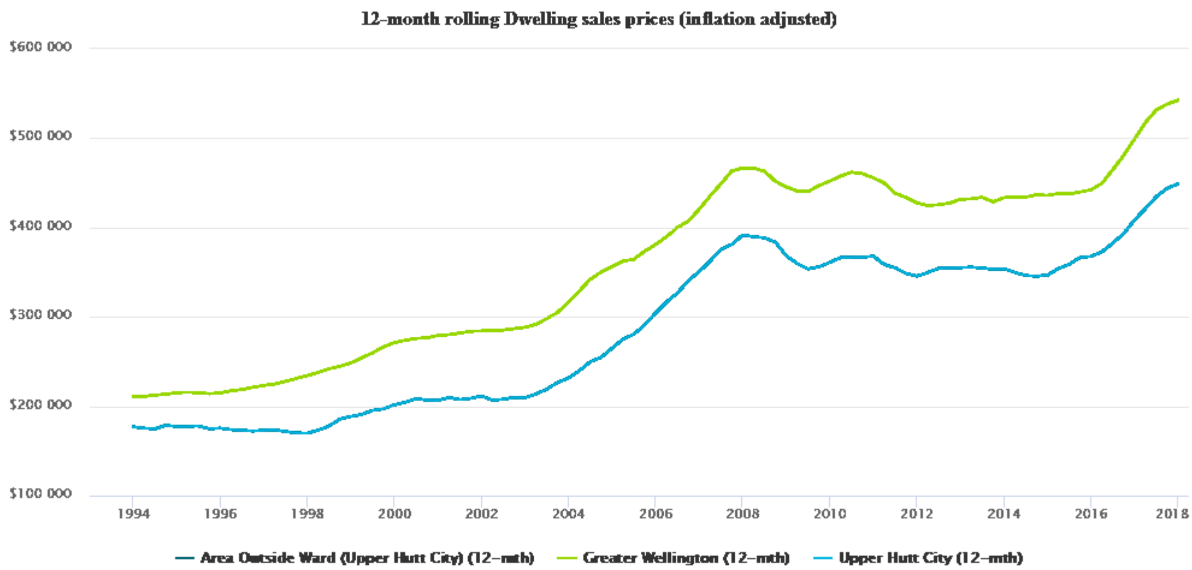
[9] Migration figures from Statistics New Zealand media release, retrieved 9/03/18: http://www.scoop.co.nz/stories/PO1802/S00023/net-migration-of-70000-in-december-2017-year.htm
[10] MBIE income data, retrieved 9/03/18 at http://webrear.mbie.govt.nz/summary/upper-hutt?accessedvia=wellington&mapzoom=1
[11] Household incomes: http://profile.idnz.co.nz/upper-hutt/household-income?BMID=30
[12] Employment statistics: http://profile.idnz.co.nz/greater-wellington/employment-status?WebID=160

Overall Conclusions

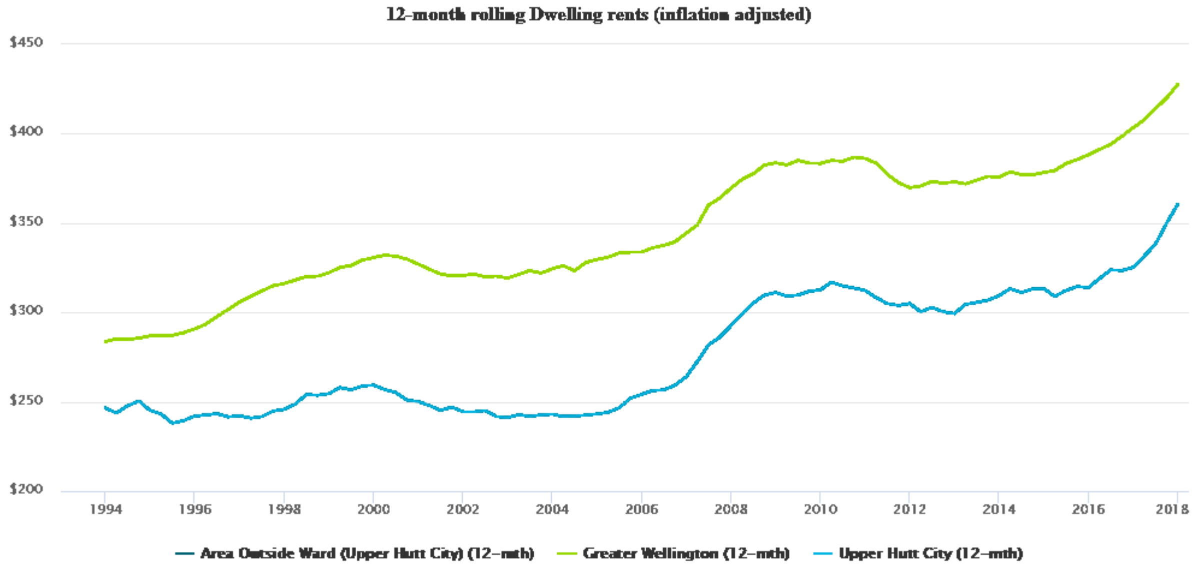
It is important to evaluate how Upper Hutt growth is seen in the context of the Greater Wellington region. The below shows the MBIE estimates[13] of growth versus consenting for the Upper Hutt District compared to the region as a whole. This illustrates that while UHCC consenting makes up a small proportion of consents across the region, the rate of consenting largely meets or exceeds demand. This is supported in the consenting evaluation undertaken in this report.



However, while rate of consenting in Upper Hutt is positive, the district very much is responsive to the Greater Wellington housing market – as demonstrated below.



[13] Retrieved 9/03/18 from: https://mbienz.shinyapps.io/urban-development-capacity/



As can be seen above, both average dwelling sales and weekly rents in Upper Hutt are closely tied to the region overall. This demonstrates the fluidity of the market across district boundaries, as well as the impacts of the market on the Upper Hutt District.

The table below ranks the overall indicators of housing affordability (1 = low favourability, 5 = high favourability) by how favourable they are to creating affordability in the housing market.

Table 8 – Overall housing affordability indicators

Indicator	*Favourability*
Mortgage Rates	4
Net Migration	1
Population Demographics	4
Household Income	4

This demonstrates that the key threat to affordability overall is net migration, with local population demographics also a slight concern, due to localised unemployment. This will need to be re-evaluated following the completion of the 2018 census.

Appendix 6.5

PROPERTY ECONOMICS

UPPER HUTT COMMERCIALLY FEASIBLE RESIDENTIAL CAPACITY ASSESSMENT

Client: Upper Hutt City Council

Project No: 51743

Date: May 2019

SCHEDULE

Code	Date	Information / Comments	Project Leader
51743.4	May 2019	Report	Tim Heath / Phil Osborne

DISCLAIMER

This document has been completed, and services rendered at the request of, and for the purposes of Upper Hutt Council only.

Property Economics has taken every care to ensure the correctness and reliability of all the information, forecasts and opinions contained in this report. All data utilised in this report has been obtained by what Property Economics consider to be credible sources, and Property Economics has no reason to doubt its accuracy. Property Economics shall not be liable for any adverse consequences of the client's decisions made in reliance of any report by Property Economics. It is the responsibility of all parties acting on information contained in this report to make their own enquiries to verify correctness.

1. INTRODUCTION

Property Economics has been engaged by Wellington City Council, on behalf of Upper Hutt City Council (**UHCC**) as part of a wider region residential capacity project team, to undertake an assessment of the commercially feasible residential capacity (supply) of the Upper Hutt City District within the context of Council's obligations under the National Policy Statement on Urban Development Capacity (**NPS UDC**).

The purpose of this report is to provide UHCC with robust market intelligence to assist in making more informed and economically justified decisions in regard to the design and implementation of a residential policy framework for the District Plan and other long-term planning documents.

This report discusses the work undertaken by both Property Economics and Wellington City Council in analysing the existing theoretical residential capacity of Upper Hutt City and developing a capacity model for calculating the level of feasible development within the District. This will inform policy makers on the feasible level of housing supply, and which areas are able to accommodate future residential development based on current zonings, policy settings and market parameters.

2. THEORETICAL CAPACITY

Property Economics have been provided with GIS layers containing the sites within Upper Hutt that provided for infill, or comprehensive redevelopment. Theoretical residential capacity was calculated by WCC utilising current theoretical District Plan policy settings and algorithmic, GIS and 3D modelling. The information contained several different scenarios, based on housing typology and quantum, that were identified as theoretically viable to develop.

Table 1 below outlines the theoretical capacity output by the model provided to Property Economics by WCC by Census Area Unit (**CAU**).

TABLE 1 – UPPER HUTT THEORETICAL RESIDENTIAL DEVELOPMENT CAPACITY BY CAU

CAU	Theoretical Capacity
Akatarawa	169
Brentwood	351
Clouston Park	679
Ebdentown	841
Elderslea	1284
Emerald Hill	786
Heretaunga-Silverstream	1880
Maidstone	25
Maoribank	900
Pinehaven	2057
Poets Block	681
Riverstone Terraces	784
Te Marua	638
Totara Park	621
Trentham North	1017
Trentham South	882
Upper Hutt Central	828
Wallaceville	1065
Grand Total	15,488

Source: Property Economics, WCC, UHCC

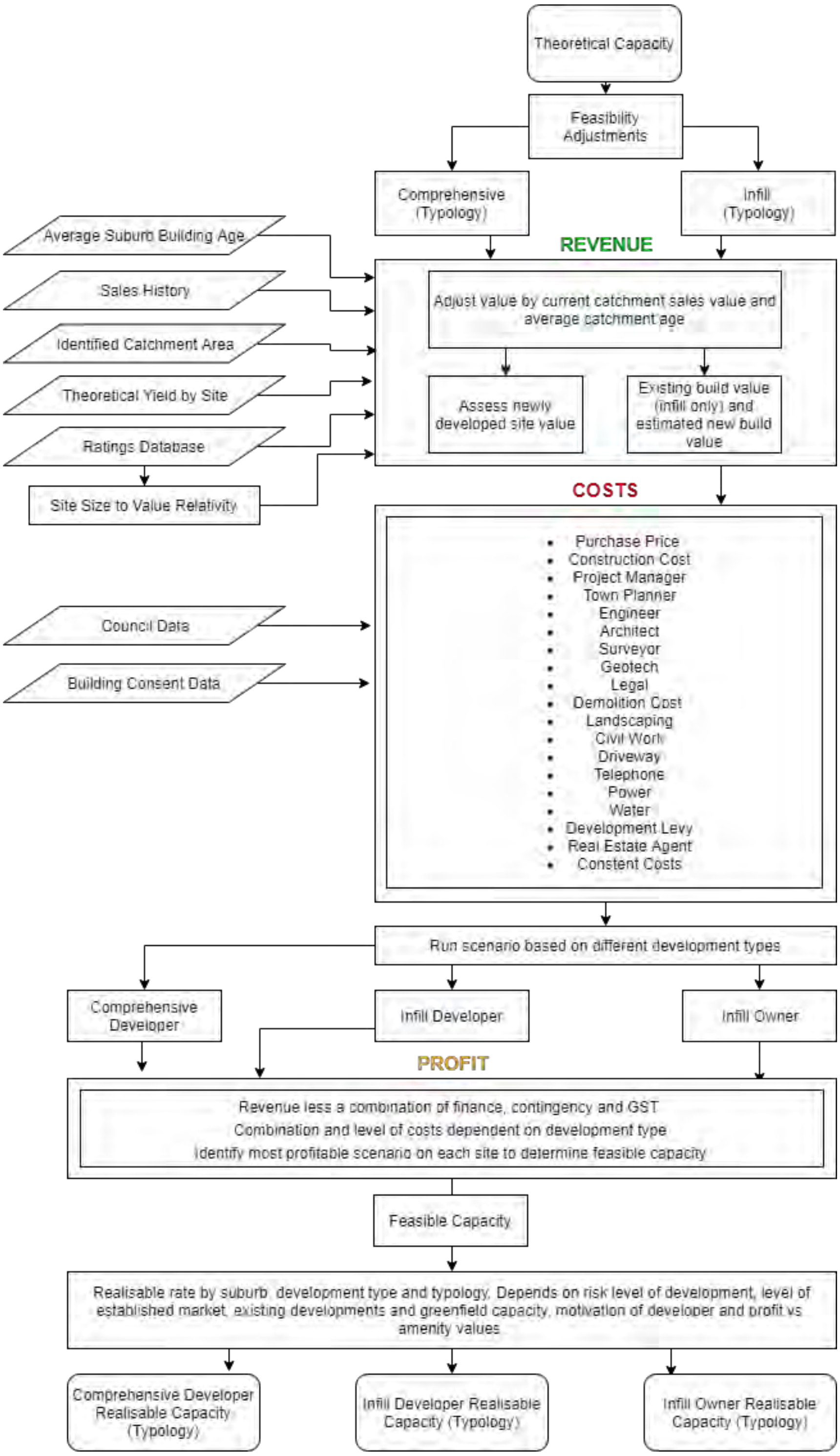
Table 1 shows there is theoretical capacity within Upper Hutt for around 15,488 new dwellings (rounded). The CAU of Pinehaven has the highest level of theoretical capacity at 2,057, while the CAU of Maidstone has the lowest level of theoretical capacity at only an estimated 25 dwellings.

It is important to note that Table 1 represents the sum of the maximum attainable yield attainable yield of any typology on an individual site basis. The theoretical model outputs passed to Property Economics by WCC contained several different development scenarios on each site, therefore the theoretical yield represents the scenarios on each site where the development potential is the highest.

3. FEASIBLE CAPACITY MODELLING

A high-level overview of the model utilised by Property Economics in determining the feasible residential capacity for Upper Hutt is outlined in the flow chart in Figure 1 below, with detailed descriptions of each stage of the process given following.

FIGURE 1: PROPERTY ECONOMICS RESIDENTIAL FEASIBILITY MODEL OVERVIEW



Source: Property Economics

Land and Improvement Value per SQM

Using the ratings database provided by Upper Hutt City Council, the land value per sqm and improvement value per sqm is calculated. This is then summarised by suburb, size and typology to give the average per sqm value for various types of dwellings.

By splitting the valuation into land and improvement value, it accounts for variations of both sizes e.g. a large dwelling on a small piece of land compared to the same size dwelling on a larger piece of land.

Values are not the same across each suburb (due to differing structures and quality), and thus it is required to give the per sqm value for each suburb individually. Also, the per sqm rate for land and improvement value are shown not to be consistent across all sizes. For example, a larger dwelling has on average a lower per sqm improvement value than a smaller one. This inverse relationship between size and per sqm value is the same for both land value per sqm and building value per sqm.

Tables 2-3 below show the build value per sqm utilised in the commercially feasible capacity modelling for varying building sizes for standalone and terraced typologies.

TABLE 2 – UPPER HUTT STANDALONE BUILD VALUE / SQM BY SUBURB

STANDALONE	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350
AKATARAWA	$-	$4,455	$4,215	$4,017	$3,857	$3,717	$3,537	$3,423	$3,259	$3,140	$3,098	$3,030	$ 2,956	$ 2,930	$ 2,867
BIRCHVILLE	$-	$4,280	$4,050	$3,860	$3,706	$3,571	$3,399	$3,289	$3,131	$3,017	$2,977	$2,911	$ 2,840	$ 2,815	$ 2,755
BROWN OWL	$-	$3,379	$3,197	$3,047	$2,925	$2,819	$2,683	$2,596	$2,472	$2,382	$2,350	$2,298	$ 2,242	$ 2,222	$ 2,175
CENTRAL	$-	$2,711	$2,565	$2,445	$2,347	$2,262	$2,153	$2,083	$1,983	$1,911	$1,885	$1,844	$ 1,799	$ 1,783	$ 1,745
Ebdentown	$-	$2,771	$2,622	$2,499	$2,399	$2,312	$2,200	$2,129	$2,027	$1,954	$1,927	$1,885	$ 1,839	$ 1,823	$ 1,784
HERETAUNGA	$-	$3,045	$2,881	$2,746	$2,636	$2,540	$2,418	$2,339	$2,227	$2,146	$2,117	$2,071	$ 2,020	$ 2,003	$ 1,960
KAITOKE	$-	$5,369	$5,080	$4,842	$4,648	$4,479	$4,263	$4,125	$3,927	$3,785	$3,734	$3,652	$ 3,562	$ 3,531	$ 3,456
KINGSLEY HEIGHTS	$-	$3,165	$2,994	$2,854	$2,740	$2,640	$2,513	$2,432	$2,315	$2,231	$2,201	$2,152	$ 2,100	$ 2,081	$ 2,037
MANGAROA	$-	$4,271	$4,041	$3,851	$3,698	$3,563	$3,391	$3,282	$3,124	$3,011	$2,970	$2,905	$ 2,834	$ 2,809	$ 2,749
MAORIBANK	$-	$3,828	$3,622	$3,452	$3,314	$3,194	$3,040	$2,942	$2,800	$2,699	$2,662	$2,604	$ 2,540	$ 2,518	$ 2,464
MAYMORN	$-	$4,006	$3,790	$3,612	$3,468	$3,342	$3,181	$3,078	$2,930	$2,824	$2,786	$2,724	$ 2,658	$ 2,635	$ 2,578
PINEHAVEN	$-	$4,365	$4,130	$3,936	$3,779	$3,641	$3,466	$3,354	$3,193	$3,077	$3,035	$2,969	$ 2,896	$ 2,871	$ 2,809
Riverstone Terraces	$-	$3,556	$3,365	$3,207	$3,079	$2,967	$2,824	$2,732	$2,601	$2,507	$2,473	$2,419	$ 2,360	$ 2,339	$ 2,289
SILVERSTREAM	$-	$3,359	$3,178	$3,029	$2,908	$2,802	$2,667	$2,581	$2,457	$2,368	$2,336	$2,285	$ 2,229	$ 2,209	$ 2,162
TE MARUA	$-	$3,159	$2,989	$2,849	$2,735	$2,636	$2,509	$2,428	$2,311	$2,227	$2,197	$2,149	$ 2,096	$ 2,078	$ 2,033
THE PLATEAU	$-	$3,828	$3,622	$3,452	$3,314	$3,194	$3,040	$2,941	$2,800	$2,699	$2,662	$2,603	$ 2,540	$ 2,518	$ 2,464
TIMBERLEA	$-	$2,586	$2,447	$2,332	$2,239	$2,158	$2,054	$1,987	$1,892	$1,823	$1,799	$1,759	$ 1,716	$ 1,701	$ 1,665
TOTARA PARK	$-	$3,967	$3,754	$3,578	$3,435	$3,310	$3,150	$3,048	$2,902	$2,797	$2,759	$2,698	$ 2,632	$ 2,609	$ 2,553
TRENTHAM	$-	$3,078	$2,913	$2,776	$2,665	$2,568	$2,444	$2,365	$2,252	$2,170	$2,141	$2,094	$ 2,042	$ 2,025	$ 1,981
WALLACEVILLE	$-	$2,909	$2,753	$2,624	$2,519	$2,427	$2,310	$2,236	$2,128	$2,051	$2,023	$1,979	$ 1,930	$ 1,914	$ 1,873
WHITEMANS VALLEY	$-	$4,621	$4,372	$4,167	$4,001	$3,855	$3,669	$3,550	$3,380	$3,257	$3,213	$3,143	$ 3,066	$ 3,039	$ 2,974

Source: Property Economics, WCC, UHCC

TABLE 3 – UPPER HUTT TERRACED BUILD VALUE / SQM BY SUBURB

TERRACED	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350
AKATARAWA	$-	$4,790	$4,532	$4,320	$4,147	$3,996	$3,804	$3,681	$3,504	$3,377	$3,331	$3,258	$3,178	$3,151	$3,083
BIRCHVILLE	$-	$4,602	$4,355	$4,150	$3,985	$3,840	$3,655	$3,536	$3,367	$3,245	$3,201	$3,130	$3,054	$3,027	$2,962
BROWN OWL	$-	$3,633	$3,438	$3,277	$3,146	$3,031	$2,885	$2,792	$2,658	$2,561	$2,527	$2,471	$2,411	$2,390	$2,339
CENTRAL	$-	$2,915	$2,758	$2,629	$2,524	$2,432	$2,315	$2,240	$2,132	$2,055	$2,027	$1,983	$1,934	$1,917	$1,876
Ebdentown	$-	$2,980	$2,819	$2,687	$2,580	$2,486	$2,366	$2,290	$2,180	$2,101	$2,072	$2,027	$1,977	$1,960	$1,918
HERETAUNGA	$-	$3,274	$3,098	$2,952	$2,834	$2,731	$2,600	$2,516	$2,395	$2,308	$2,277	$2,227	$2,172	$2,153	$2,107
KAITOKE	$-	$5,773	$5,462	$5,206	$4,998	$4,816	$4,584	$4,436	$4,223	$4,070	$4,015	$3,926	$3,831	$3,797	$3,716
KINGSLEY HEIGHTS	$-	$3,403	$3,220	$3,069	$2,946	$2,839	$2,702	$2,615	$2,489	$2,399	$2,366	$2,314	$2,258	$2,238	$2,190
MANGAROA	$-	$4,592	$4,345	$4,141	$3,976	$3,831	$3,647	$3,529	$3,359	$3,237	$3,194	$3,123	$3,047	$3,020	$2,956
MAORIBANK	$-	$4,117	$3,895	$3,712	$3,564	$3,434	$3,269	$3,163	$3,011	$2,902	$2,863	$2,800	$2,731	$2,708	$2,650
MAYMORN	$-	$4,307	$4,075	$3,884	$3,729	$3,593	$3,420	$3,310	$3,151	$3,037	$2,995	$2,930	$2,858	$2,833	$2,772
PINEHAVEN	$-	$4,693	$4,441	$4,232	$4,063	$3,916	$3,727	$3,606	$3,433	$3,309	$3,264	$3,192	$3,114	$3,087	$3,021
Riverstone Terraces	$-	$3,824	$3,618	$3,448	$3,311	$3,190	$3,036	$2,938	$2,797	$2,696	$2,659	$2,601	$2,537	$2,515	$2,461
SILVERSTREAM	$-	$3,612	$3,417	$3,257	$3,127	$3,013	$2,868	$2,775	$2,642	$2,546	$2,512	$2,456	$2,397	$2,376	$2,325
TE MARUA	$-	$3,397	$3,214	$3,064	$2,941	$2,834	$2,698	$2,610	$2,485	$2,395	$2,362	$2,310	$2,254	$2,234	$2,186
THE PLATEAU	$-	$4,116	$3,895	$3,712	$3,564	$3,434	$3,268	$3,163	$3,011	$2,902	$2,862	$2,799	$2,731	$2,707	$2,649
TIMBERLEA	$-	$2,781	$2,631	$2,508	$2,408	$2,320	$2,208	$2,137	$2,034	$1,961	$1,934	$1,891	$1,845	$1,829	$1,790
TOTARA PARK	$-	$4,266	$4,036	$3,847	$3,693	$3,559	$3,387	$3,278	$3,120	$3,007	$2,967	$2,901	$2,831	$2,806	$2,746
TRENTHAM	$-	$3,310	$3,132	$2,985	$2,866	$2,761	$2,628	$2,543	$2,421	$2,333	$2,302	$2,251	$2,196	$2,177	$2,130
WALLACEVILLE	$-	$3,128	$2,960	$2,821	$2,709	$2,610	$2,484	$2,404	$2,288	$2,205	$2,176	$2,128	$2,076	$2,058	$2,014
WHITEMANS VALLEY	$-	$4,969	$4,701	$4,481	$4,302	$4,145	$3,945	$3,818	$3,634	$3,503	$3,455	$3,379	$3,297	$3,268	$3,198

Source: Property Economics, WCC, UHCC

Due to limited availability of ratings data for apartment typologies, nominal values were used for a range of apartment sizes, with capital value determined by interpolating between these points, and scaling based on the average rating data across a suburb.

TABLE 4 – UPPER HUTT NOMINAL APARTMENT VALUES

Apartment	25	50	75	100	125	150
Average	$ 260,201	$ 321,176	$ 406,315	$ 529,249	$ 626,808	$ 717,539

Apartment	175	200	225	250	275	300
Average	$ 801,918	$ 880,390	$ 953,370	$ 1,021,241	$ 1,084,361	$ 1,143,063

Source: Property Economics, WCC, UHCC

The land value per sqm utilised in the commercially feasible capacity modelling for varying land sizes. This was utilised for both standalone and terraced typologies, however as described above apartments were modelled using nominal capital values.

A limitation identified during the modelling process was that by applying a percentage increase on the site-specific land value through the process of subdivision, meant that sites with a proportionally high underlying land value resulted in an impractical subdivided land value on a per sqm basis. This was identified as a specific problem for sites with underlying commercial land values.

As a solution, the maximum residentially zoned land value per sqm identified within the ratings database was used as a maximum limit for the land value per sqm after subdivision. This removed the impact of sites with underlying commercial land values resulting in impractically high profitability, and thus feasible yield.

Average Suburb Age

Using the same ratings database, the average age of dwellings is determined for each suburb. This is undertaken in order to adjust the building value for each suburb based on values of houses from each decade. The data shows that there is a relationship between the age of a building and its per sqm improvement value. Therefore, finding the average age and distribution (of the built product) in a suburb allows the building values outlined above in Tables 2 and 3 to be appropriately adjusted. Note, this adjustment was performed in 'bands', with decades updated accordingly, rather than applying an average across the suburb. This step is important due to the fact that the a[application of sales data is based on a significant proportion of older stock and does not, therefore, appropriately value new builds.

Sales vs Capital Value (CV)

A statistically significant sample dataset of recent sales in Upper Hutt was used to find the difference between the average sales price and the most recent valuation. This is to ensure the capacity modelling utilises the most up to date values data critical to the determination of current day feasible capacity.

Given the nominal level of sales over this period of time in Upper Hutt, it was deemed appropriate to supplement this dataset with site-specific updated valuation samples for each suburb. Based on a representative sample from each suburb in Upper Hutt, the average increase of sales price over the recent valuation is then determined. There exists a relationship between the suburb and this average increase, and thus the percentage increase is expressed per suburb. This average increase of sales over CV is then applied in the model to update the valuations (Tables 2 and 3) to reflect current market value.

Table 5 below shows the average Sales / CV percentage utilised in the model.

TABLE 5 – UPPER HUTT AVERAGE SALES / CV BY SUBURB

Suburb	Sales / CV
AKATARAWA	107%
BIRCHVILLE	107%
BROWN OWL	107%
CENTRAL	111%
Ebdentown	111%
HERETAUNGA	110%
KAITOKE	107%
KINGSLEY HEIGHTS	107%
MANGAROA	107%
MAORIBANK	107%
MAYMORN	107%
PINEHAVEN	110%
Riverstone Terraces	110%
SILVERSTREAM	111%
TE MARUA	107%
THE PLATEAU	107%
TIMBERLEA	107%
TOTARA PARK	107%
TRENTHAM	111%
WALLACEVILLE	111%
WHITEMANS VALLEY	107%

Source: Property Economics, WCC, UHCC

Construction Costs

Suburb based differentials between constructions costs for new dwellings were found by analysing the value of recent building consents granted within Upper Hutt. The historical building consent data shows that the average value of building consents varies across suburb within Upper Hutt, indicating the variety of product quality that is built.

Because of this, a table of average building consent per sqm by suburb was extracted from the building consent data in order to represent the average construction costs in a suburb. This is then used in the model as the construction costs of building a new dwelling. Note, this is only used for standalone and terraced dwellings, as apartments have been modelled using nominal capital values. Due to data restrictions some suburbs were grouped by quality for this purpose. This, once again, neutralises suburb based sales data where these average sales are based on higher quality (and therefore more expensive) builds.

Tables 6, 7 and 8 below show the average build cost by suburb for standalone, terraced and apartment typology types.

TABLE 6 – UPPER HUTT STANDALONE BUILD COST BY SUBURB

STANDALONE	50	75	100	125	150	175	200	225	250	275	280
AKATARAWA	$3,973	$3,206	$2,788	$2,519	$2,330	$2,293	$2,168	$2,068	$1,985	$1,916	$1,903
BIRCHVILLE	$3,881	$3,132	$2,724	$2,461	$2,276	$2,240	$2,118	$2,020	$1,939	$1,871	$1,859
BROWN OWL	$3,520	$2,841	$2,471	$2,232	$2,065	$2,032	$1,921	$1,832	$1,759	$1,697	$1,686
CENTRAL	$2,418	$1,951	$1,697	$1,533	$1,418	$1,395	$1,319	$1,259	$1,208	$1,166	$1,158
Ebdentown	$2,472	$1,995	$1,735	$1,567	$1,449	$1,426	$1,349	$1,286	$1,235	$1,192	$1,184
HERETAUNGA	$2,715	$2,191	$1,906	$1,722	$1,593	$1,567	$1,482	$1,413	$1,357	$1,309	$1,300
KAITOKE	$4,240	$3,421	$2,976	$2,688	$2,486	$2,447	$2,314	$2,207	$2,118	$2,044	$2,030
KINGSLEY HEIGHTS	$3,240	$2,615	$2,274	$2,055	$1,900	$1,870	$1,768	$1,687	$1,619	$1,562	$1,552
MANGAROA	$3,809	$3,074	$2,673	$2,415	$2,234	$2,198	$2,079	$1,983	$1,903	$1,837	$1,824
MAORIBANK	$3,471	$2,801	$2,436	$2,201	$2,036	$2,004	$1,894	$1,807	$1,734	$1,674	$1,662
MAYMORN	$3,573	$2,883	$2,507	$2,265	$2,095	$2,062	$1,950	$1,860	$1,785	$1,723	$1,711
PINEHAVEN	$3,893	$3,142	$2,732	$2,469	$2,283	$2,247	$2,124	$2,026	$1,945	$1,877	$1,864
Riverstone Terraces	$3,647	$2,943	$2,559	$2,312	$2,139	$2,105	$1,990	$1,898	$1,822	$1,758	$1,746
SILVERSTREAM	$3,046	$2,458	$2,138	$1,931	$1,786	$1,758	$1,662	$1,585	$1,522	$1,469	$1,459
TE MARUA	$3,235	$2,610	$2,270	$2,051	$1,897	$1,867	$1,765	$1,684	$1,616	$1,560	$1,549
THE PLATEAU	$3,414	$2,755	$2,396	$2,165	$2,002	$1,970	$1,863	$1,777	$1,706	$1,646	$1,635
TIMBERLEA	$2,648	$2,137	$1,859	$1,679	$1,553	$1,528	$1,445	$1,378	$1,323	$1,277	$1,268
TOTARA PARK	$3,597	$2,903	$2,525	$2,281	$2,110	$2,076	$1,963	$1,873	$1,797	$1,735	$1,723
TRENTHAM	$2,745	$2,216	$1,927	$1,741	$1,610	$1,585	$1,498	$1,429	$1,371	$1,324	$1,315
WALLACEVILLE	$2,595	$2,094	$1,821	$1,645	$1,522	$1,498	$1,416	$1,351	$1,296	$1,251	$1,243
WHITEMANS VALLEY	$4,190	$3,381	$2,941	$2,657	$2,457	$2,418	$2,286	$2,181	$2,093	$2,020	$2,006

Source: Property Economics

TABLE 7 – UPPER HUTT TERRACED BUILD COST BY SUBURB

TERRACED	50	75	100	125	150	175	200	225	250	275	280
AKATARAWA	$4,192	$3,383	$2,942	$2,658	$2,458	$2,419	$2,287	$2,182	$2,094	$2,021	$2,007
BIRCHVILLE	$4,095	$3,304	$2,874	$2,596	$2,401	$2,363	$2,234	$2,131	$2,045	$1,974	$1,961
BROWN OWL	$3,714	$2,997	$2,607	$2,355	$2,178	$2,144	$2,027	$1,933	$1,855	$1,791	$1,779
CENTRAL	$2,551	$2,059	$1,790	$1,617	$1,496	$1,472	$1,392	$1,328	$1,274	$1,230	$1,222
Ebdentown	$2,607	$2,104	$1,830	$1,653	$1,529	$1,505	$1,423	$1,357	$1,303	$1,257	$1,249
HERETAUNGA	$2,865	$2,312	$2,011	$1,817	$1,680	$1,653	$1,563	$1,491	$1,431	$1,381	$1,372
KAITOKE	$4,473	$3,610	$3,139	$2,836	$2,623	$2,582	$2,441	$2,328	$2,234	$2,157	$2,142
KINGSLEY HEIGHTS	$3,418	$2,759	$2,399	$2,168	$2,005	$1,973	$1,865	$1,779	$1,708	$1,648	$1,637
MANGAROA	$4,019	$3,243	$2,820	$2,548	$2,357	$2,319	$2,193	$2,092	$2,008	$1,938	$1,924
MAORIBANK	$3,662	$2,956	$2,570	$2,322	$2,148	$2,114	$1,999	$1,906	$1,830	$1,766	$1,754
MAYMORN	$3,769	$3,042	$2,645	$2,390	$2,210	$2,175	$2,057	$1,962	$1,883	$1,817	$1,805
PINEHAVEN	$4,107	$3,314	$2,882	$2,604	$2,409	$2,370	$2,241	$2,138	$2,052	$1,980	$1,967
Riverstone Terraces	$3,847	$3,105	$2,700	$2,440	$2,256	$2,221	$2,099	$2,003	$1,922	$1,855	$1,842
SILVERSTREAM	$3,213	$2,593	$2,255	$2,038	$1,884	$1,855	$1,753	$1,673	$1,605	$1,549	$1,539
TE MARUA	$3,413	$2,754	$2,395	$2,164	$2,001	$1,970	$1,862	$1,776	$1,705	$1,645	$1,634
THE PLATEAU	$3,602	$2,907	$2,528	$2,284	$2,112	$2,079	$1,966	$1,875	$1,799	$1,737	$1,725
TIMBERLEA	$2,794	$2,255	$1,961	$1,772	$1,638	$1,612	$1,525	$1,454	$1,396	$1,347	$1,338
TOTARA PARK	$3,795	$3,063	$2,664	$2,407	$2,226	$2,190	$2,071	$1,976	$1,896	$1,830	$1,817
TRENTHAM	$2,896	$2,337	$2,033	$1,837	$1,699	$1,672	$1,581	$1,508	$1,447	$1,397	$1,387
WALLACEVILLE	$2,738	$2,209	$1,921	$1,736	$1,605	$1,580	$1,494	$1,425	$1,368	$1,320	$1,311
WHITEMANS VALLEY	$4,420	$3,567	$3,102	$2,803	$2,592	$2,551	$2,412	$2,301	$2,208	$2,131	$2,117

Source: Property Economics

TABLE 8 – UPPER HUTT APARTMENT BUILD COST BY SUBURB

STANDALONE	50	75	100	125	150	175	200	225	250	275	280
AKATARAWA	$4,787	$4,049	$3,663	$3,404	$3,246	$3,216	$3,250	$3,148	$2,813	$2,646	$2,613
BIRCHVILLE	$4,676	$3,956	$3,578	$3,325	$3,171	$3,141	$3,174	$3,075	$2,748	$2,585	$2,552
BROWN OWL	$4,241	$3,588	$3,245	$3,016	$2,876	$2,849	$2,879	$2,789	$2,492	$2,345	$2,315
CENTRAL	$2,913	$2,464	$2,229	$2,072	$1,975	$1,957	$1,978	$1,916	$1,712	$1,610	$1,590
Ebdentown	$2,978	$2,519	$2,278	$2,118	$2,019	$2,001	$2,022	$1,958	$1,750	$1,646	$1,625
HERETAUNGA	$3,272	$2,768	$2,503	$2,327	$2,219	$2,198	$2,221	$2,151	$1,922	$1,808	$1,786
KAITOKE	$5,108	$4,321	$3,908	$3,633	$3,464	$3,432	$3,468	$3,359	$3,001	$2,824	$2,788
KINGSLEY HEIGHTS	$3,904	$3,302	$2,987	$2,776	$2,647	$2,623	$2,650	$2,567	$2,294	$2,158	$2,131
MANGAROA	$4,589	$3,882	$3,511	$3,264	$3,112	$3,083	$3,116	$3,018	$2,697	$2,537	$2,505
MAORIBANK	$4,183	$3,538	$3,200	$2,974	$2,836	$2,810	$2,839	$2,750	$2,457	$2,312	$2,283
MAYMORN	$4,305	$3,641	$3,293	$3,061	$2,919	$2,892	$2,922	$2,831	$2,529	$2,379	$2,349
PINEHAVEN	$4,690	$3,968	$3,589	$3,336	$3,181	$3,151	$3,184	$3,084	$2,756	$2,593	$2,560
Riverstone Terraces	$4,394	$3,717	$3,362	$3,125	$2,979	$2,952	$2,983	$2,889	$2,582	$2,429	$2,398
SILVERSTREAM	$3,670	$3,104	$2,808	$2,610	$2,488	$2,465	$2,491	$2,413	$2,156	$2,028	$2,003
TE MARUA	$3,897	$3,297	$2,982	$2,772	$2,643	$2,618	$2,646	$2,563	$2,290	$2,154	$2,127
THE PLATEAU	$4,113	$3,480	$3,147	$2,925	$2,789	$2,763	$2,792	$2,705	$2,417	$2,274	$2,245
TIMBERLEA	$3,191	$2,699	$2,441	$2,269	$2,163	$2,143	$2,166	$2,098	$1,875	$1,764	$1,741
TOTARA PARK	$4,334	$3,666	$3,316	$3,082	$2,939	$2,912	$2,942	$2,850	$2,547	$2,396	$2,366
TRENTHAM	$3,308	$2,798	$2,531	$2,352	$2,243	$2,222	$2,246	$2,175	$1,944	$1,828	$1,805
WALLACEVILLE	$3,126	$2,645	$2,392	$2,223	$2,120	$2,100	$2,122	$2,056	$1,837	$1,728	$1,706
WHITEMANS VALLEY	$5,048	$4,270	$3,862	$3,590	$3,423	$3,391	$3,427	$3,319	$2,966	$2,790	$2,755

Source: Property Economics

Other Development Costs

As well as construction costs, a number of other costs have been incorporated in to the feasibility model on a per dwelling basis. Some of the key costs are outlined below in Table 9. Other costs are identified in Figure 1 but also include commercial interest at 8% p.a. and a 10% contingency on total costs (risk).

TABLE 9 – NEW PLYMOUTH PER DWELLING DEVELOPMENT COSTS

COMPREHENSIVE COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ 100	$ 100	$ 100
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

INFILL COSTS	Standalone	Terraced	Apartment
Demo Cost (per sqm)	$ -	$ -	$ -
Landscaping	$ 3,125	$ 3,750	$ 750
Civil Work	$ 20,000	$ 15,000	$ 5,000
Driveway	$ 20,000	$ 6,600	$ 3,300
Telephone	$ 4,500	$ 2,500	$ 2,000
Power	$ 6,000	$ 6,000	$ 2,250
Water and Wastewater	$ 16,500	$ 7,500	$ 7,500

Source: Property Economics, WCC

4. FEASIBILITY MODELLING OUTPUTS

4.1. FEASIBLE CAPACITY OUTPUTS

Property Economics has assessed the variables outlined above in the Upper Hutt market and run feasible capacity models across the range of locations, land values, improvement values, and land value changes. A key component of the market's willingness to develop infill is the relationship between a site's land value, fixed subdivision costs and the identifiable 'uptake' in value (sqm) through subdivision.

Table 10 below outlines a summary of the number of potential sections on sites where the ratios meet a profit level suitable to meet market expectations (20% for the purpose of this analysis).

Table 10 represents the subdivision undertaken by either an owner occupier or a developer, with the capacity representing the most profitable. This is an important difference as motivations and capital outlay are often different. These figures have removed all 'double ups' i.e. where multiple instances were tested on a specific site and represent the most profitable scenario for that site.

TABLE 10 – UPPER HUTT FEASIBLE RESIDENTIAL DEVELOPMENT CAPACITY BY CAU – OWNER AND DEVELOPER

CAU	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Akatarawa	169	-	-	-	-	0%
Brentwood	351	-	34	30	64	18%
Clouston Park	679	-	5	-	5	1%
Ebdentown	841	-	61	13	74	9%
Elderslea	1284	-	158	9	167	13%
Emerald Hill	786	-	-	-	-	0%
Heretaunga-Silverstream	1880	-	218	71	289	15%
Maidstone	25	-	3	1	4	16%
Maoribank	900	-	-	-	-	0%
Pinehaven	2057	-	8	7	15	1%
Poets Block	681	-	90	43	133	20%
Riverstone Terraces	784	-	-	-	-	0%
Te Marua	638	-	-	-	-	0%
Totara Park	621	-	-	-	-	0%
Trentham North	1017	-	43	11	54	5%
Trentham South	882	-	109	9	118	13%
Upper Hutt Central	828	9	-	4	13	2%
Wallaceville	1065	-	64	12	76	7%
Grand Total	15,488	9	793	210	1,012	7%

Source: Property Economics, WCC, UHCC

If developments were to be undertaken by either a developer or owner occupier, there is then potential for 1,012 additional units within the Upper Hutt market. As all development options have been considered in Table 10, this represents the total feasible capacity in the market. This level of feasible capacity represents an 7% feasibility rate on the theoretical capacity.

4.2. SENSITIVITY ANALYSIS

As an extension to the feasibility modelling outlined above, scenarios testing the sensitivity of the feasibility model have also been undertaken. This has been done to test the robustness of the model, and see the practical implications due to small changes in the input variables.

The following scenarios have been tested in this sensitivity analysis:

- **Increasing the build value across all typologies by 15%.** This in essence represents a greater per sqm profit margin on any new built product. Tables 3 and 4 above show the build value per sqm utilised in the feasibility model for standalone and terraced developments. Under this sensitivity, the build values in this table were increased by 15%. Since nominal apartment values were used in the analysis, the average split between land value and improvement value was found on a suburb by suburb basis, with the 15% increase applied based on this proportional split i.e. applying only to build value. Within the model the relative difference between the build value of a development and the build cost is an important driver of profitability, and as such this sensitivity was run to investigate the impact on overall feasibility when this difference is greater.
- **Increasing the savings incurred due to Economies of Scale (EoS).** In the normal model, the maximum savings that could occur due to larger scale developments was savings of around 15% on relevant costs. This has been scaled to a maximum of around 50%, with the savings increased as the scale of the development increases. For example, a subdivision of one standalone dwelling will incur the same costs and thus profit level as the normal model, however an comprehensive apartment development of 50 units will incur significantly less costs than under the normal model. This sensitivity was included to investigate the effect of higher profitability drivers for large developments only.
- **Increasing the maximum attainable land value in the model by 10%**. This represents the possibility of the highest per sqm land value increasing by 10% in the future. Outlined in the process above, a maximum land value per sqm was applied on a suburb by suburb basis to remove the impact of scaling commercially valued land to inappropriately high per sqm land values. Increasing this maximum by 10% is expected to increase the feasibility of several sites as the profit made on the subdivision of the land would increase. This maximum was found by identifying the current highest residential land value per sqm within the suburb. The 10% increase as a sensitivity simply tests to see the relative impact of changing this imposed maximum.
- **Decreasing the maximum attainable land value in the model by 10%.** This represents the possibility of the highest per sqm land value increasing by 10% in the future. Similar to the sensitivity above, this represents a change in the imposed maximum land value achievable through subdivision, however, decreases this value by 10% rather than increasing. Again, this is to test the relative impact of changing this imposed maximum.

Each scenario has been tested independently of the other in order to isolate the sensitivity of the model to this specific scenario.

A summary of the feasible capacity under each of the four scenarios, compared against the original feasible capacity is given below in Table 11. A full breakdown of feasible capacity under each sensitivity scenario is given in Appendix 1.

TABLE 11 – FEASIBLE CAPACITY SENSITIVITY ANALYSIS

Scenario	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Normal Model	15,488	9	793	210	1,012	7%
Increased Economies of Scale	15,488	13	1,108	294	1,414	9%
Increased Build Value	15,488	22	1,945	515	2,483	16%
Increased Land Value (10%)	15,488	11	955	253	1,218	8%
Decreased Land Value (10%)	15,488	8	733	194	936	6%

Source: Property Economics, WCC, UHCC

The series of sensitivities show that the modelling process is most sensitive to the increased build value, increasing feasible capacity to almost 2,500, a feasibility rate of 16%.

4.3. REALISABLE CAPACITY OUTPUTS

On top of the feasible capacity modelling, practical considerations must be taken into account as to what is likely to be developed in the real world. While this section is separated from the sensitivities above the realisation rates essentially provide for 'development chance' given the propensity for development variances.

These considerations are based on:

- Dwelling typology
- Development option
- Greenfield competition

The identification of these variables not only provides for sensitivities but also addresses the relativity between typologies. While all three typologies may be feasible the development model identifies the site scenario with the highest profit margin. However, practically while the model assesses the standard 20% profit margin, there is greater risk in some typologies. The assessment below endeavours to consider these risks, and motivation, differentials.

The capacity for greenfield development within Upper Hutt has been provided to PE, and this has been cross referenced against future residential demand to give an indication of the proportion of demand that can be satisfied by greenfield development. Forecast demand for residential product has been based on Statistics NZ medium population and household projections. Table 12 outlines greenfield capacity and future residential demand.

TABLE 12 – UPPER HUTT GREENFIELD DEVELOPMENT CAPACITY

	Greenfield Capacity	30-Year Demand	Greenfield % of Demand	Required Brownfield
Upper Hutt City	2,818	4,500	63%	1,682

Source: Property Economics, WCC, UHCC, SNZ

Over the 30-year forecast period from 2018-2048, Upper Hutt is forecast to require an additional 4,500 dwellings. Greenfield modelling provided by WCC has indicated that the District has capacity for 2,818 greenfield dwellings, making up 63% of 30-year demand. Compared to other TA's within the Wellington Region, this represents a comparatively high proportion of 30-year demand that can be satisfied by greenfield capacity. Therefore, this places higher risk on brownfield development due to the competition of low-risk and easily accessible greenfield options.

On top of greenfield consideration, the relative risk of each development type must be considered in quantifying what will practically be developed by the market. The risk is not homogenous across typology or development type, and thus a matrix of 'risk factors' have been applied across each combination of typology and development type.

Risk has been accounted for developments undertaking by developers by increasing the required profit level for a development to be classified as 'realisable', on top of being feasible. Table 13 below shows the profit levels required for each combination of typology and development option to be considered realisable by the model.

TABLE 13 – DEVELOPER REALISABLE PROFIT RATES

	Comprehensive Developer	Infill Developer	Infill Owner
Standalone	**20%**	**17%**	**25%**
Terraced	**23%**	**20%**	**28%**
Apartment	**32%**	**28%**	**39%**

Source: Property Economics, WCC, UHCC, SNZ

This reflects the market practicality that developments taken on by a developer have relatively lower risk if they are an infill development, rather than a comprehensive development. It also shows the increasing risk of development as the typology increases in scale from standalone dwellings, through to terraced product, and finally apartments.

For an owner occupier the model considers the profit level of the development relative to the capital value of the existing dwelling(s). This is because motivations for an owner to subdivide their property are inherently linked with the relative profit they can achieve against the value of their own home e.g. a $100,000 profit on a $1,000,000 site will be less likely to be developed by the owner, compared to a $100,000 profit on a $500,000 site, assuming similar fixed costs. Therefore, as a methodology for this, the model considers that the lowest quartile of feasible infill developments in terms of the relative profit / CV ratio will not be realised by the market.

Taking these market practicalities into consideration, Table 14 represents the realisable capacity within Upper Hutt:

TABLE 14 – UPPER HUTT REALISABLE RESIDENTIAL DEVELOPMENT CAPACITY BY CAU

CAU	Theoretical Capacity	Realisable Apartment	Realisable Standalone	Realisable Terraced	Total Realisable Capacity	Realisation Rate
Akatarawa	169	-	-	-	-	0%
Brentwood	351	-	24	-	24	7%
Clouston Park	679	-	1	-	1	0%
Ebdentown	841	-	57	-	57	7%
Elderslea	1284	-	145	-	145	11%
Emerald Hill	786	-	-	-	-	0%
Heretaunga-Silverstream	1880	-	196	10	206	11%
Maidstone	25	-	2	-	2	8%
Maoribank	900	-	-	-	-	0%
Pinehaven	2057	-	2	-	2	0%
Poets Block	681	-	75	-	75	11%
Riverstone Terraces	784	-	-	-	-	0%
Te Marua	638	-	-	-	-	0%
Totara Park	621	-	-	-	-	0%
Trentham North	1017	-	28	-	28	3%
Trentham South	882	-	97	-	97	11%
Upper Hutt Central	828	-	-	-	-	0%
Wallaceville	1065	-	54	-	54	5%
Grand Total	15,488	-	681	10	691	4%

Source: Property Economics, UHCC, WCC

Table 14 shows that the realisable capacity across Upper Hutt is around 690 new dwellings, representing a 4% realisation rate across the District. In essence, this represents a 68% realisation rate of the already calculated feasible capacity outlined in Table 10 above. As expected, the realisation on standalone developments is higher than terraced, with 86% of all feasible standalone developments being realised, compared to 5% for terraced.

APPENDIX 1 – SENSITIVITY ANALYSIS TABLES

EOS Scale (50%) - Feasible Capacity

CAU	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Akatarawa	169	-	-	-	-	0%
Brentwood	351	-	48	42	89	25%
Clouston Park	679	-	7	-	7	1%
Ebdentown	841	-	85	18	103	12%
Elderslea	1284	-	221	13	233	18%
Emerald Hill	786	-	-	-	-	0%
Heretaunga-Silverstrea	1880	-	305	99	404	21%
Maidstone	25	-	4	1	6	22%
Maoribank	900	-	-	-	-	0%
Pinehaven	2057	-	11	10	21	1%
Poets Block	681	-	126	60	186	27%
Riverstone Terraces	784	-	-	-	-	0%
Te Marua	638	-	-	-	-	0%
Totara Park	621	-	-	-	-	0%
Trentham North	1017	-	60	15	75	7%
Trentham South	882	-	152	13	165	19%
Upper Hutt Central	828	13	-	6	18	2%
Wallaceville	1065	-	89	17	106	10%
Grand Total	15,488	13	1,108	294	1,414	9%

Build Value Increase (15%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Akatarawa	169	-	-	-	-	0%
Brentwood	351	-	83	74	157	45%
Clouston Park	679	-	12	-	12	2%
Ebdentown	841	-	150	32	182	22%
Elderslea	1284	-	388	22	410	32%
Emerald Hill	786	-	-	-	-	0%
Heretaunga-Silverstrea	1880	-	535	174	709	38%
Maidstone	25	-	7	2	10	39%
Maoribank	900	-	-	-	-	0%
Pinehaven	2057	-	20	17	37	2%
Poets Block	681	-	221	105	326	48%
Riverstone Terraces	784	-	-	-	-	0%
Te Marua	638	-	-	-	-	0%
Totara Park	621	-	-	-	-	0%
Trentham North	1017	-	105	27	132	13%
Trentham South	882	-	267	22	289	33%
Upper Hutt Central	828	22	-	10	32	4%
Wallaceville	1065	-	157	29	186	18%
Grand Total	15,488	22	1,945	515	2,483	16%

Land Value Increase (10%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Akatarawa	169	-	-	-	-	0%
Brentwood	351	-	41	36	77	22%
Clouston Park	679	-	6	-	6	1%
Ebdentown	841	-	73	16	89	11%
Elderslea	1284	-	190	11	201	16%
Emerald Hill	786	-	-	-	-	0%
Heretaunga-Silverstrea	1880	-	262	85	348	19%
Maidstone	25	-	4	1	5	19%
Maoribank	900	-	-	-	-	0%
Pinehaven	2057	-	10	8	18	1%
Poets Block	681	-	108	52	160	24%
Riverstone Terraces	784	-	-	-	-	0%
Te Marua	638	-	-	-	-	0%
Totara Park	621	-	-	-	-	0%
Trentham North	1017	-	52	13	65	6%
Trentham South	882	-	131	11	142	16%
Upper Hutt Central	828	11	-	5	16	2%
Wallaceville	1065	-	77	14	91	9%
Grand Total	15,488	11	955	253	1,218	8%

Land Value Decrease (10%) - Feasible Capacity

Suburbs	Theoretical Capacity	Feasible Apartment	Feasible Standalone	Feasible Terraced	Total Feasible Capacity	Feasibility Rate
Akatarawa	169	-	-	-	-	0%
Brentwood	351	-	31	28	59	17%
Clouston Park	679	-	5	-	5	1%
Ebdentown	841	-	56	12	68	8%
Elderslea	1284	-	146	8	154	12%
Emerald Hill	786	-	-	-	-	0%
Heretaunga-Silverstrea	1880	-	202	66	267	14%
Maidstone	25	-	3	1	4	15%
Maoribank	900	-	-	-	-	0%
Pinehaven	2057	-	7	6	14	1%
Poets Block	681	-	83	40	123	18%
Riverstone Terraces	784	-	-	-	-	0%
Te Marua	638	-	-	-	-	0%
Totara Park	621	-	-	-	-	0%
Trentham North	1017	-	40	10	50	5%
Trentham South	882	-	101	8	109	12%
Upper Hutt Central	828	8	-	4	12	1%
Wallaceville	1065	-	59	11	70	7%
Grand Total	15,488	8	733	194	936	6%

Appendix 6.6

Appendix 6.7

Appendix 6.7

Upper Hutt Business Area MCA Assessment Sheets

Site:	1 - Maymorn Road				Business type(s):				Industrial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
4	**5**	**2**	**2**	**2**	**5**	**5**	**5**	**5**	**2**	**5**	**2**	**3**	**3**

Commentary:

- Northern proportion difficult to develop further because of clean fill use
- Southern proportion would be attractive due to lack of industrial land
- Travelling through the residential areas is unattractive for a lot of businesses
- Hazard constraints along the rear of the site are not an issue
- Good proximity to SH2

Maximum Possible total:	70
Total Score	50
Median Score	3.5
Score as percentage	71.4%

Site:	2 - Upper Fergusson				Business type(s):				Suburban Commercial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
5	**1**	**2**	**2**	**4**	**4**	**4**	**5**	**3**	**2**	**4**	**2**	**3**	**3**

Commentary:

- The layout of shops on Akatarawa Road needs to change to be more successful, perhaps changing zoning to allow for more mixed use would help
- The fuel station on Fergusson Drive is one of the busiest in the country. Developing the site next door could be an option (perhaps a motel), but currently very un-kept
- Commercial area near the tail end is unattractive and very prone to natural hazards

Maximum Possible total:	70
Total Score:	44
Median Score:	3
Score as percentage:	62.9%

Site:	3 - Montgomery Cres				Business type(s):				Industrial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
4	**2**	**2**	**2**	**4**	**5**	**5**	**4**	**5**	**4**	**4**	**2**	**4**	**4**

Commentary:

- Very good for established businesses due to good separation and a general acceptance of industrial activity
- From a development perspective, somewhat difficult as it is largely at capacity
- Good connection to SH2

Maximum Possible total:	70
Total Score:	51
Median Score:	4
Score as percentage:	72.9%

Site:	4 - Park St	Business type(s):	Industrial

1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
4	**5**	**2**	**2**	**4**	**5**	**5**	**4**	**5**	**4**	**4**	**3**	**4**	**4**

Commentary:

- Expectation for light industrial operations here, so attractive for businesses
- There are limited options for re-development, but a few are being considered

Maximum Possible total:	70
Total Score	55
Median Score	4
Score as percentage	78.6%

Site:	5 - CBD				Business type(s):				Commercial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
5	**5**	**2**	**2**	**5**	**3**	**5**	**5**	**5**	**5**	**4**	**3**	**5**	**5**

Commentary:

- Very well connected and businesses heading in the right direction
- Strong public transport links
- There are a number of issues which are affecting a diversity of development opportunities:
    - Lack of parking space, with little requirements to provide for parking.
    - Buildings which are on offer require an upfront investment to get them business-ready. This has flow-on effects in terms of the rent they need to charge to re-coop costs.
    - This is worsened by the fact that the majority of working residents leave Upper Hutt, meaning there is very little weekday activity. It therefore makes it challenging to justify higher rents to re-coop redevelopment costs.
    - There is seen to be a market for more apartment-style developments in the CBD but parking here is again an issue. The latter predominantly relates to redeveloping existing buildings into apartments, where providing parking at the ground level is challenging. Apartments need parking spaces to be feasible, but the District Plan is lacklustre on parking requirements in the CBD.

Maximum Possible total:	70
Total Score	59
Median Score	5
Score as percentage	84.3%

Site:	6 - Lane St				Business type(s):				Commercial-Industrial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
4	**3**	**2**	**2**	**5**	**3**	**5**	**4**	**5**	**3**	**2**	**5**	**5**	**5**

Commentary:

- More of an upmarket area, when compared to other industrial areas in Upper Hutt
- There is an issue with parking here due to the funeral home, which has large overspill
- Development opportunities are constrained by land ownership. The south-eastern proportion has vacant buildings and vacant allotments (fairly large), but owner is reluctant to sell

Maximum Possible total:	70
Total Score	53
Median Score	4
Score as percentage	75.7%

Site:	7 - Ward St	Business type(s):	Commercial

1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
5	**4**	**2**	**2**	**5**	**4**	**5**	**4**	**5**	**3**	**5**	**4**	**4**	**4**

Commentary:

- Attractive area for development with good connections to Fergusson Drive and SH2
- Shops on Miro Street are unattractive

Maximum Possible total:	70
Total Score	56
Median Score	4
Score as percentage	80.0%

Site:	8 - Whakatiki St				Business type(s):				Industrial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
4	**2**	**2**	**2**	**4**	**5**	**5**	**4**	**3**	**4**	**4**	**2**	**4**	**4**

Commentary:

- A favourable location for running industrial business
- From a development perspective, somewhat difficult as it is largely at capacity

Maximum Possible total:	70
Total Score	49
Median Score	4
Score as percentage	70.0%

Site:	9 - Lower Fergusson				Business type(s):				Suburban Commercial-Industrial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
5	**1**	**2**	**2**	**4**	**4**	**4**	**5**	**3**	**2**	**4**	**2**	**3**	**3**

Commentary:

- Similar is nature to Upper Fergusson

Maximum Possible total:	70
Total Score	44
Median Score	3
Score as percentage	62.9%

Site:	10 - Alexander Rd	Business type(s):	Industrial

1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
4	**3**	**2**	**2**	**2**	**5**	**5**	**5**	**5**	**4**	**4**	**5**	**5**	**5**

Commentary:

- Sites have been selling more lately, with prices doubled over 18 months
- The area is not attractive for heavy industry as vehicles need to travel through residential areas, and there is a convoluted route to SH2
- Overall, there needs to be more space for heavy industry in Upper Hutt

Maximum Possible total:	70
Total Score	56
Median Score	4.5
Score as percentage	80.0%

Site:	11 - Fergusson Dr, Silverstream	Business type(s):	Commercial

1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Seperation from more sensitive activities	14 - Community impact
5	**5**	**2**	**2**	**4**	**4**	**4**	**5**	**3**	**2**	**4**	**2**	**3**	**3**

Commentary:

- Similar in nature to the rest of Fergusson Drive
- More high profile businesses here have a clustering effect, but largely at capacity

Maximum Possible total:	70
Total Score	48
Median Score	3.5
Score as percentage	68.6%

Site:	12 - Silverstream				Business type(s):				Commercial-Industrial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Separation from more sensitive activities	14 - Community impact
5	**5**	**2**	**2**	**4**	**4**	**4**	**5**	**3**	**2**	**4**	**2**	**3**	**3**

Commentary:

- Good connection to local consumers and labour
- Is largely at development capacity, so options are limited, which is worsened by flood hazard potential

Maximum Possible total:	70
Total Score	48
Median Score	3.5
Score as percentage	68.6%

Site:	13 - Eastern Hutt Rd				Business type(s):				Industrial				
1 - Proximity to major roading corridors	2 - Access to rail routes	3 - Access to airport	4 - Access to seaport	5 - Public transport accessibility	6 - Parking availability & accessibility	7 - Access to required labour force	8 - Access to markets/consumers & reliance	9 - Resilience to hazards	10 - Supporting business/services in the area	11 - Land & property cost	12 - Developability/functionality	13 - Seperation from more sensitive activities	14 - Community impact
4	**2**	**2**	**2**	**1**	**5**	**5**	**4**	**3**	**3**	**4**	**4**	**5**	**5**

Commentary:

- Good for heavy industry as no neighbours to complain
- Poor rail connectivity, but close to SH2
- Increased cost of initial development due to flood hazards

Maximum Possible total:	70
Total Score	49
Median Score	4
Score as percentage	70.0%