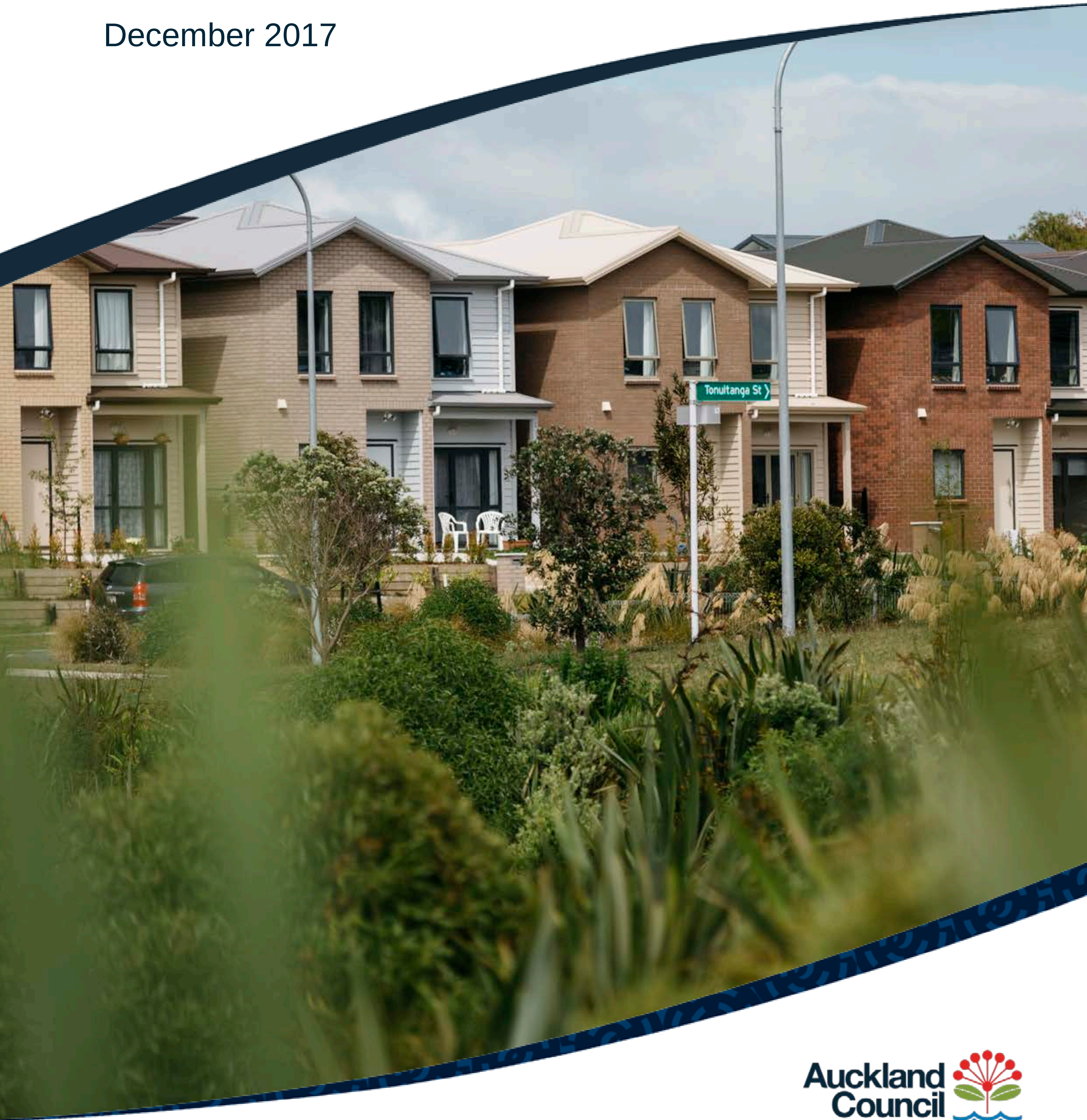
National Policy Statement on Urban Development Capacity 2016: Housing and business development capacity assessment for Auckland

December 2017



Auckland Council
Te Kaunihera o Tāmaki Makaurau

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Executive Summary

The National Policy Statement on Urban Development Capacity 2016 requires the completion of a housing and business development capacity assessment. The first of these is due by 31st December 2017. This report contains the methods and results of the assessment. The key conclusions of the assessment are specified below.

Housing assessment

Overall forecast population growth and demographic change related housing demand is assessed to be between 239,000 (low) and 397,000 (high) over the period 2016 to 2046. Under a medium growth scenario, additional demand is projected to be 319,000 dwellings. In addition to population driven demand a shortfall of 35,000 dwellings has been added.

Plan-enabled capacity in residential zones in the urban area ranges between 120,000 (infill – where no existing structure is removed) and 1.07 million (redevelopment, where sites are cleared and redeveloped to the maximum).

Plan enabled potential for dwellings in centres and mixed-use business areas is at least as much as the residential zone redevelopment figure, depending on the split of enabled floor space between business activities and assumed apartment size.

Estimated feasible dwelling development capacity in the urban areas (business and residential zones) is 140,000 residential dwellings.

Additional feasible capacity of 15,000 dwellings in the rural areas is assumed. This number will be revised pending the completion of Rural Subdivision appeals on the Auckland Unitary Plan.

Feasible capacity for 25,000 dwellings from Housing New Zealand has been assumed.

Feasible dwelling development capacity in the future urban areas is 146,000 residential dwellings, assuming a Mixed Housing Suburban zoning on all non-business areas.

Overall, currently feasible supply is expected to be sufficient to meet forecast demand for the short and medium terms. Longer term currently feasible supply is less than demand.

Given the changes in feasibility identified in the last 12 months due to factors other than ‘planning regulations’, the significant amount of plan enabled capacity that exists, significant alternation to planning policy and strategy to address this is not recommended.

Business assessment

The plan enabled business space capacity ranges from approximately 4,500 hectares (business land capacity) to over 30,000 hectares (floor space capacity).

There is no shortfall of feasible business land/ space in the short or medium term. However, there is a shortfall in some locations in the long term.

Business land or floor space that is feasible for residential development in mixed use zones is not included in the final feasibility assessment.

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1.0 Introduction

Auckland is New Zealand's largest city. Its population is estimated to be 1,657,200[1]. The land area of the Auckland region is 489,363 hectares, with the core urbanised area of the city covering just over 50,550 hectares. As well as being large, Auckland is also growing; in the last 10 years the region's population grew by 16 per cent or 223,900 people[2]. The city's population is projected to continue growing with an anticipated increase of 833,000 people between 2013 and 2043 – this increase accounts for more than half of New Zealand's population growth over this time (Statistics New Zealand, 2017). As well as an increase in population, the core urbanised area of the city is expected to increase in size also; the extent of the 'urban' and 'future urban' type zones the Auckland Unitary Plan (operative in part, November 2016) cover 59,453ha, potentially increasing the city's main urban area by 18 per cent.

Growth pressures and the changing nature of New Zealand's urban areas have led to the creation of National Policy Statement on Urban Development Capacity (NPS-UDC). The NPS-UDC is designed to provide direction to local councils to help them make informed decisions about planning in urban environments, ensuring that they "enable urban environments to grow and change in response to the changing needs of the communities, and future generations; and provide enough space for their populations to happily live and work. This can be both through allowing development to go "up" by intensifying existing urban areas, and "out" by releasing land in greenfield areas" (Ministry for the Environment & Ministry of Business Innovation and Employment, 2016). The NPS-UDC covers both housing and business, and seeks to make sure that planning decisions occur with evidence and understanding of land and development markets, and that planning enables enough supply of housing and business space to meet current and future demand.

The NPS-UDC requires Auckland Council to produce a housing and business development capacity assessment every three years. The first assessment is due by the 31st of December 2017. This report details the methods and results of our housing and business development capacity assessment.

The housing assessment section of this report includes assessments of:

- The demand for housing,
- The capacity for additional dwellings enabled through the Auckland Unitary Plan, Operative in Part (AUPOIP),
- Plan enabled capacity that is commercially feasible,

[1] Statistics New Zealand subnational population estimate, as at 30 June 2017 (final)

[2] Based on Statistics New Zealand population estimates, between 30 June 2007 to and 30 June 2016

- Take up of capacity, and
- The sufficiency of housing capacity to meet demand.

The business assessment section contains assessments of:

- Capacity for business space under the AUPOIP.

The remainder of the business analysis is contained in the business assessment produced by Market Economics.

Reconciliation between the housing and business assessments is also made, including analysis of their spatial interaction.

Under the NPS-UDC Auckland Council is required to produce a housing and business development assessment (HBA) at least every three years; the next version of this assessment is due to be completed in 2020, however due to the recent release of region wide valuations data and clarification of some details from the property industry regarding costs in the feasibility model, this component will be rerun early in the 2018.

In addition to this assessment Auckland Council has produced reports to monitor a range of indicators relating to housing, residential land, and business land. The first public edition of this three-monthly report series was published in late 2017 and is covered further in Section 2.0 below.

2.0 Quarterly monitoring reports

Under the NPS-UDC Auckland Council is required to monitor a range of indicators and report them on a quarterly basis. The first quarterly report was published in November 2017, and covers a wide range of indicators including:

- Residential land supply (number of new residential parcels created)
- Residential dwelling supply, measured through building consents
- Code Compliance Certificates issued
- Residential sales prices
- Buyer classification, types of buyers purchasing residential property
- Residential affordability, as measured by a serviceability affordability model
- State of the rental market, by looking at data provided by Tenancy Services
- Business floor space, measured through building consents
- Business sites created

A copy of the report can be found on Auckland Council's Knowledge Auckland website, www.knowledgeauckland.govt.nz.

MBIE have also produced many housing related indicators for Auckland and other high and medium growth territorial authorities, to supplement data analysed by local councils. The 'Urban Development Capacity Dashboard, provides a number of housing related metrics and can be found here: https://mbienz.shinyapps.io/urban-development-capacity/

Policy PB2 of the NPS-UDC states that information collected for the quarterly monitoring reports should be used to inform the housing and business development capacity assessments. Due to Auckland's first quarterly report being developed at the same time as this assessment was undertaken, the information within it has only been used in a limited way, but it is expected to be used more in the next and following assessments.

Part one:
Housing demand and development capacity

3.0 Assessment of demand for housing

3.1.1 Overview

Understanding demand is a key component of the NPS-UDC. The NPS-UDC defines demand requires Council's to use Statistics New Zealand population projections as a starting point (PB2). MBIE's guidance on evident and monitoring suggests Councils should understand aggregate demand, the composition of demand (by type, location and price point). A description of the methods and data used to project demand is also encouraged. This section of the report provides a summary and overview of the methods used to determine Auckland's short, medium and long-term housing demand.

3.2 Assessment of overall housing demand

This section briefly summarises the housing demand forecasts that were completed by Market Economics using their Auckland Housing Model. The full report is attached Appendix A. Market Economics' report provides a good overview of dwelling and household types as well as dwelling types by household income. This is important context for understanding the complexity of Auckland housing markets.

The demand forecast is based on Statistics New Zealand (SNZ) population projections (released February 2017), population estimates during the period 2013 to 2017 and references Statistics New Zealand household projections (released December 2017). Auckland's aggregate demand is below (Table 1); this shows the numbers from a 2017 "actual" base, with the SNZ projections for the 2017 to 2046 period added to that new base. The projected growth in households from 2016 to 2046 is projected to be between 397,000 (high) and 239,000 (medium). The medium growth scenario of 319,000 households is used as the base figure for this assessment.

Table 1: Projected housing demand 2013 - 2046

Year	Scenario		
	High	**Medium**	**Low**
2013	498,000	498,000	498,000
2016	544,000	544,000	544,000
2023	653,000	642,000	630,000
2026	692,000	673,000	654,000
2033	783,000	745,000	707,000
2038	844,000	791,000	738,000
2043	904,000	836,000	766,000
2046	941,000	863,000	783,000
Growth 2016 to 2046	**397,000**	**319,000**	**239,000**

Source: Market Economics

While the projected increase is an indicator of housing demand required to serve the future Auckland population it may not account for the existing housing shortfall. The shortfall is often calculated using a combination of population growth, household sizes and building consent data. MBIE estimate Auckland's housing shortfall to be approximately 45,000 dwellings (Ministry of Business Innovation and Employment, 2017a), Treasury suggest it is between 30,000 to 35,000 (to June 2016) (Cooke, 2017) while Auckland Council's Chief Economist argues it is at least 43,000 dwellings (Auckland Council Chief Economist Unit, 2017). Market Economics have included an estimate of the shortfall in the demand assessment of 35,000. This is the figure used as part of this assessment. Including the shortfall to the population based demand increases total demand in the Auckland region to 432,000 (high), 354,000 (medium) and 274,000 (low).

The table below summarises the potential demand future for *urban* Auckland, for the medium and high projections. It differentiates the shares of demand growth which are expected to be catered for by HNZC (social housing) and potentially catered for through KiwiBuild. However, demand expected to be met through retirement dwellings is not differentiated.

Table 2: Market demand 2016 to 2046 for urban Auckland

	Market element	2016	2016 (%)	2026	2026 (%)	2046	2046 (%)	2016-26	2016-46	2016-46 (%)
Medium	Private sector owned	308	59	387	60	512	62	79	204	67
	Private sector rental	180	35	173	27	200	24	-7	20	7
	Total Private Sector	**488**	**94**	**560**	**87**	**712**	**87**	**72**	**224**	**74**
	Public sector rental	30	6	42	7	60	7	12	30	10
	KiwiBuild/Other	0	0	39	6	50	6	39	50	16
	Total Other	**30**	**6**	**81**	**13**	**110**	**13**	**51**	**80**	**26**
	Total	**518**	**100**	**641**	**100**	**822**	**100**	**123**	**304**	**100**
High	Private sector owned	308	59	405	60	568	62	97	260	66
	Private sector rental	180	35	185	28	234	26	5	54	14
	Total Private Sector	**488**	**94**	**590**	**88**	**802**	**88**	**102**	**314**	**80**
	Public sector rental	30	6	42	6	60	7	12	30	8
	KiwiBuild/Other	0	0	39	**6**	50	**5**	39	50	13
	Total Other	**30**	**6**	**81**	**12**	**110**	**12**	**51**	**80**	**20**
	Total	**518**	**100**	**671**	**100**	**912**	**100**	**153**	**394**	**100**

Source: Market Economics

3.3 Assessment of patterns of demand

3.3.1 Overview

This section evaluates the composition of housing demand by price, location and dwelling type, using sales information. Its starts by reporting the estimation results of a hedonic price model which identifies the drivers of prices. Then market segments are constructed based on the clustering analysis of prices predicted by the hedonic model. Finally, a characterisation of the profiles of market segments is provided.

3.3.2 Method

The hedonic pricing model (HPM) estimates demand by breaking down the housing price into its constituent characteristics, and obtaining estimates of the contributory value of each characteristic. These characteristics correspond to internal features of a dwelling (e.g. number of bedrooms), structural characteristics (e.g. roof or walls conditions), external neighbourhood features (e.g. number of parks or green areas), typology (e.g. unit or standalone house), location and other amenities (proximity to coastal areas or forests) (Goodman 1978). Other variables of interest can be incorporated into the analysis to control for heterogeneity and unobserved behaviour.

The HPM uses a large data set of about 217,000 sale transactions between 2006 and 2016. To estimate the effects of the characteristics on prices, the form of the hedonic-pricing model is as follows:

$$\log Price = \beta_0 + \beta_1(Housing\ Internal\ features) + \beta_2(Neighbourhood\ features) + \beta_3(Typology) + \beta_4(Environmental\ Amenities) + \gamma(Other\ Covariates) + \epsilon \qquad (1)$$

where the variables are described as follows:

- $\log Price$ is the natural log of the sale price of a house. A sample of about 220,000 housing transactions over 2006 to 2016, with information on location by residence level is used. The sales price data is from the Auckland Council's District Valuation Role (DVR).
- $Housing\ Internal\ features$ includes the following:
    - Construction materials of roof (iron, aluminium, brick, cornet or fibrous cement, tiles, mixture materials or other),
    - Construction materials of walls (brick, concrete, fibrous cement, rough cast, wood, mixture materials or other),
    - Construction condition of walls and roof (poor, fair, average, good, mixed),
    - Building floor area,
    - Number of car spots for garage under main roof or free standing, and
    - Whether the dwelling has a deck (LINZ 2010).
- $Neighbourhood\ features$ includes the following
    - Dummy variables for aggregated area units to proxy for labour markets,
    - Distances to primary roads, the centre of the AU, the CBD, historical heritage sites, schools and Mana Whenua sites.
    - AU variables such as land area (in km^2), population density, average income, house ownership rate, ethnicity (European, Māori, pacific, Asian and others).
- $Typology$ includes the following
    - A categorical variable that takes the value of 0 if the dwelling is a single unit (standalone), 1 if multi use or multi-unit, or 2 for others (communal, public, or special accommodation),
    - Slope angle and orientation, which is categorised into North (>315° or ≤45°), East (>45° & ≤135°), South (>135° & ≤225°) and West (>225° & ≤315°), (North being the baseline).
- $Environmental\ Amenities$ includes the following

Based on the LUCAS New Zealand Land Use Map we construct six variables describing the proportional share by AU allocated to settlements, forests (natural and planted), grassland (low and high producing, and with woody biomass), wetlands (open water and vegetated non forest), cropland (annual and perennial), and other uses (sand dunes and beaches for the case of Auckland). Wetlands and other uses are aggregated into a single class , which is omitted from the regressions so that coefficients are interpreted as the effect on prices as the share in a given land cover is increased, while decreasing the share of other uses (Gibbons, Mourato, and Resende 2014).

- The share of AU land on green areas (urban parks, regional reserves and other green areas administered either by the Auckland Council or the Department of Conservation)
- Distances to distance to coastal areas, rivers, green areas, wetlands, and volcanoes. Distance is measured in a straight line to the nearest of these features.

    - A dummy variable that equals 1 if the dwelling is located in a volcanic view shafts, and 0 otherwise.
- $Other\ Covariates$ includes the following:
    - Time dummies for the year of sale,
    - Age of house and number of times it has been sold.
    - A categorical variable that takes the value 0 if there is no view, 1 if there is a water view, and 2 for other views (city, suburb or landscape views).
    - A categorical variable for the scope of view that takes the value of 0 if there is none, 1 if slight (close up peep view of up to 45^{o} or moderately wide view with little depth), 2 if moderate (close up view of up to 145^{o} or wide view with little depth), or 3 if wide (close up view of over 145^{o}) (LINZ 2010)
    - A dummy area if the house is located in a blanket height area

3.3.3 Results

3.3.3.1 Prices

The HPM model is estimated by Ordinary Least Squares (OLS). The results are summarized in Appendix B; other relevant effects are presented in Figure 1 and Figure 2.

The results shows a negative effect of green areas on price, for an additional unit point of green areas near a house, there is a 10.4 per cent decrease on prices. This result prevails on other specifications and robustness checks and is in agreement with Allpress, Balderston, and Nunns (2016). Compared to other cities, Auckland may have few places that are not close to parks, which raises the possibility of an oversupply of green areas relative to other needs of infrastructure in the city. This interpretation also applies to the insignificant effect detected for houses being near a green space area. Likewise, increases on any type of land use, in detriment of coastal areas and wetlands imply negative effects on prices. In increasing order of impacts, a unit increase on settlements brings about a price decrease of 22% while for the same increase on cropland there is a price decrease of 42 per cent.

Other significant effects identified correspond to houses located in a volcanic view shaft there is a premium of 1.1 per cent relative to the rest of houses. Likewise, houses located in blanket heights (i.e., in the proximity of a volcano) the sales price is on average 6.1 per cent higher than the rest of houses. Also, topography variables show significant effects on prices, an additional degree on slope implies a price reduction of 0.2 per cent, and houses with a north or west slope orientation have a price that is 0.6 per cent and 0.9 per cent higher that houses with eastern orientation. Thus, orientation toward day sunlight and sunset has economic value relative to orientation to sunrise.

In terms of housing features, there is a significant relationship between the age of the house when sold and the price, though the squared effect is weak. Also, the prices of multiuse/multiunit and other type of dwellings are 6.6 per cent and 7.1 per cent respectively lower than single units. Regarding construction materials, houses where roof is constructed with aluminium, brick, concrete or fibrous cement, and tiles have a price that is 9.1 per cent and 2 per cent higher than those constructed with iron. In the case of walls, only those constructed with wood show a price that is 3.6 per cent than walls constructed with brick. For the rest of materials, house price is between 1.3 per cent and 8 per cent lower than constructed with brick. Houses where roof condition is good, the price is 3.4 per cent higher than average condition. No other significant effects are found. In turn, for houses where walls condition is good, the price is 4.8 per cent higher than houses with walls in average conditions. For houses with fair and poor conditions, price is 2.7 per cent and 14.9 per cent lower respectively.

Furthermore, for every square meter of site area, price increases in 0.14 per cent, for living flor area, an additional square metre implies a price increase of 0.23 per cent. For an additional sport on an under-roof garage or freestanding garage implies a price increase of 2.3 per cent and 4 per cent. There is a significant effect from having a deck which implies a price increase of 6.2 per cent relative to houses without a deck.

Distances to environmental amenities show a heterogeneous pattern (Panel A of Figure 1). There is a nonlinear relationship between the distance to the nearest river and dwelling prices. But the non-significance of the linear term implies that for dwellings very proximate to rivers the impact of prices is weak. In turn, for every kilometre farther away from a coastal area, sales price decreases by 3 per cent without incorporating the quadratic effect which is also significant. For every kilometre away from a wetland, price increases by 2.2 per cent. There is a weaker effect on the distance to heritage sites, which is decreasing up to 1.8 km and then becomes positive. Distance to Mana Whenua sites have a weak impact on prices. More importantly, there is a clear effect that greater distance to coastal areas decreases sale prices.

Panel b of Figure 1 shows the effects from other distance variables. The price of a dwelling that is farther away from the AU centre increases by one per cent for every kilometre. In turn, there is a (weak) nonlinear relation with respect to the distance from the CBD, where the effect is important for dwellings located far from the city. For example, for an increase of 10 Km, price would decrease by 0.2 per cent. An inverted-U shape relationship occurs for the distance to the nearest main road, in this case proximity to roads is not a positive amenity to prices but beyond 2.8 kilometres there is a relative isolation that rather implies a prince penalty. Finally, there are positive impacts on prices for greater distances with respect to SHAs, schools and the AU centre; there is a weak impact on the distance to SPAs. There is a monotonic negative impact with the greatest distance to the CBD. Additional location variables indicate that greater distance to schools also show a positive and non-linear effect on prices. Also, those dwellings located in the Auckland Grammar and Auckland Girl's Grammar school zones have prices that are, respectively, 2.2 per cent and eight per cent higher than the rest of houses. However, the interaction term shows that those houses located in both school zones have a price that is 8.2 per cent lower than the rest of houses.

Year effects (relative to 2006) are displayed in Panel a of Figure 2, there are persistent price increases in Auckland despite the Global Financial Crisis (GFC), which may have also implied in turn significant negative effects on the prices of houses that were being sold numerous times between 2009 and 2012 (Panel b). Panel (c) shows that houses located in the denominated special priority areas show, for 2015 and 2016, an average price that is 8 per cent lower to comparable dwellings in the rest of the city. In turn, Panel (d) shows that for houses located in special housing areas, prices are on average five per cent higher than comparable houses in the rest of the city. These results do not evaluate the effectiveness of establishing the SPA and SHA areas, but appear to capture an "announcement" effect of their establishment.

Figure 1: Impact of distance from city and environmental amenities on prices

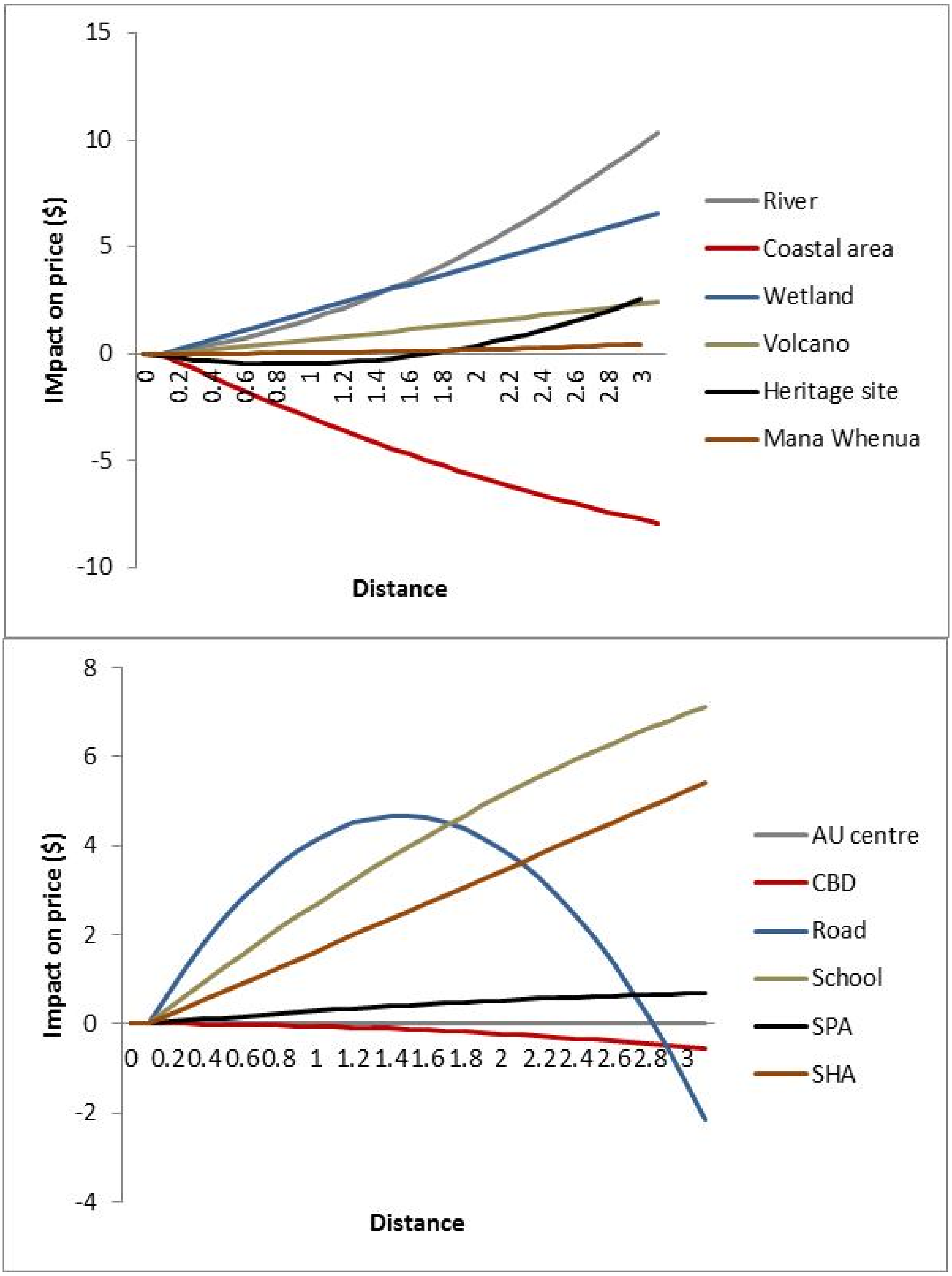
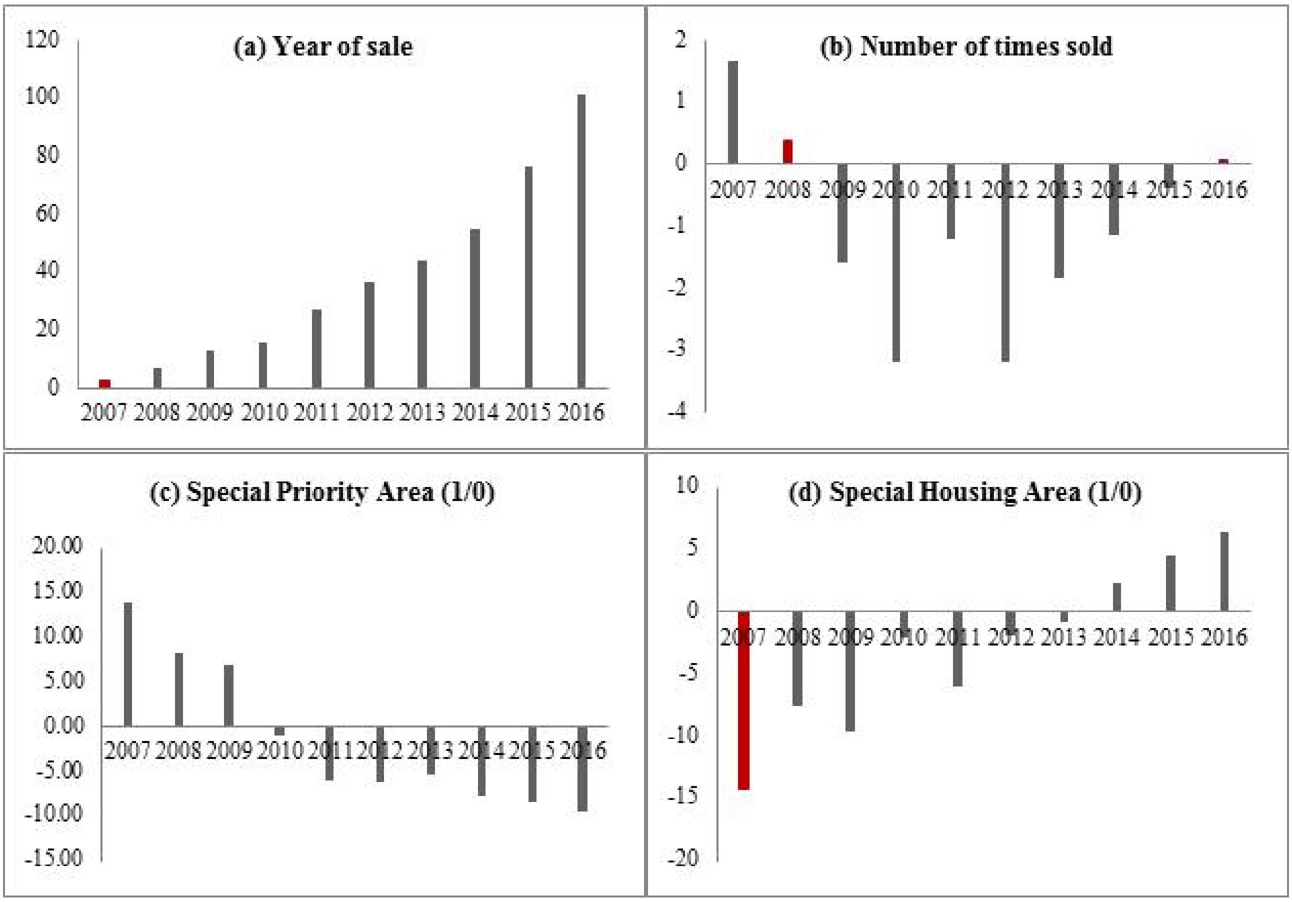


Figure 2: Year Effects of Selected Variables



Note: bars in red represent effects not significant at 95 per cent level.

3.3.3.2 Market Segments

This section presents the segmentation of the housing market in Auckland. Housing is a heterogeneous good, characterised by a diverse set of attributes and segmented and structured by complex spatial patterns, where different social groups (with specific tastes, preferences and endowments) tend to be organised into distinct territorial clusters (Galster 2001; Bhattacharjee et al. 2016). Market segments are usually defined as geographic areas where the price per unit of housing quantity is constant and individual housing characteristics are available for purchase (Goodman and Thibodeau 2007). Other criteria for submarket definition are the similarity in house attributes, similarity in hedonic prices and substitutability of houses (Bhattacharjee et al. 2016). Previous analysis on Auckland suggests that housing segments defined as small contiguous geographic areas result in better predictions than submarkets defined using statistical techniques that disregard spatial contiguity (Bourassa, Hoesli, and Peng 2003).

For the purpose of this assessment, the construction of market segments involves using clustering techniques on the prediction of sale prices from the hedonic regression in Section 3.1. In principle, the prediction of prices consists on the linear combination of all covariates, which have a reasonable degree of accuracy on explaining the prices (R-squared=0.69). The predicted prices then incorporate the effects of AU, which then captures spatial contiguity and the effects of unobservables. K-medians clustering is used, which calculates the median for each cluster to determine its centroid. The advantage of this technique, over k-means clustering, is its robustness to outliers or extreme values. We set at 40 the number of clusters.

The cluster analysis reveals those houses that on average have similar characteristics with statistical significant differences to those in other clusters. However, similarity does not imply that perfect substitutions should exist between houses within the same cluster.

Figures 3 to 7 map the spatial distribution of the segments for Auckland and other sections of the city. The first noticeable result is the concentration of high-price clusters along the coastal areas in the north shore, eastern bays, and north-eastern and central sections of the isthmus (Figure 3). Similar and smaller clusters locate in other smaller pockets in south and north Auckland. Low-price clusters in turn tend to concentrate in south-west and north areas of the city, as well as other smaller pockets in the south-west and the north. Intermediate-price clusters are scattered across the city.

In the Auckland isthmus (Figure 4), high-price clusters locate in most of the north and central areas (e.g., Freeman's Bay and the eastern bays) where prices are highly determined by the proximity to coastal areas. Clusters with relatively lower prices appear in the eastern and south eastern areas (e.g. Mount Wellington and Tamaki). It is evident that the number of residential transactions in Auckland CBD where low-price clusters are dominant. In turn, for South East Auckland (Figure 5), there is a clear distinction between high-price clusters (e.g. the Half-Moon bay area, Ormiston, Donegal Park and Maraetai) and low-price clusters that dominate the southernmost areas of the city (e.g. Manukau, Otahuhu). Small pockets of high-price clusters locate in Hingaia and Bombay, whereas most of Pukekohe and Waiuku are dominated by low and intermediate-price clusters. On the contrary, Auckland North Shore shows a pattern of high-price clusters located in the coastal areas and the vicinities.

Other clusters in the central and southern areas are dominated by intermediate-price clusters (e.g. Kaipatiki, Glenfield and Beachhaven), and low-price clusters are almost non-existent. In the west and north-west sections of the city (Figure 7), all areas are dominated by intermediate and low-price clusters, though some high-price clusters occur in areas of Titirangi and Green Bay. In the north-west several clusters are scattered where no dominant effect can be assessed.

Figure 3: Housing Market Segments - Auckland

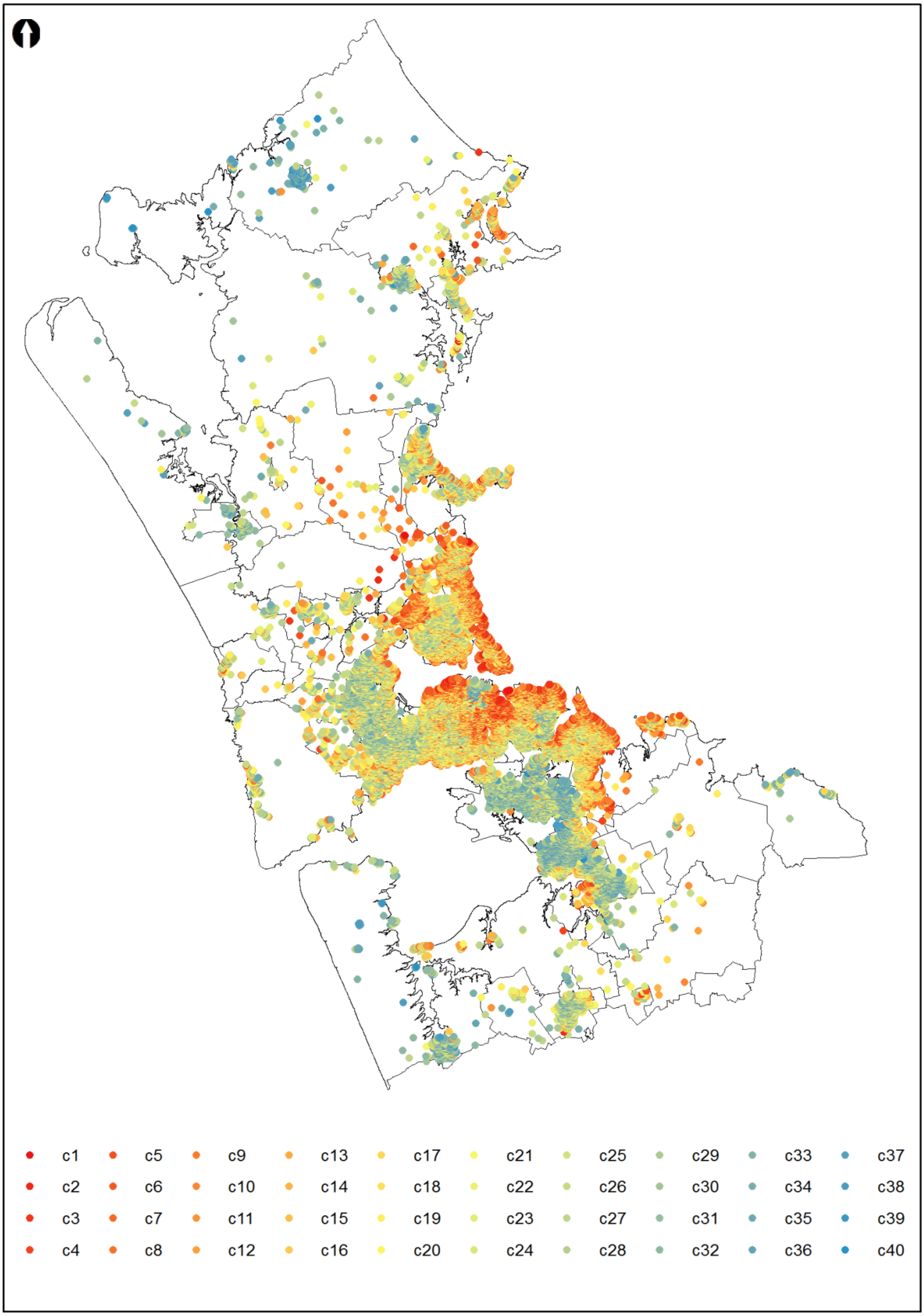


Figure 4: Housing Market Segments – Isthmus

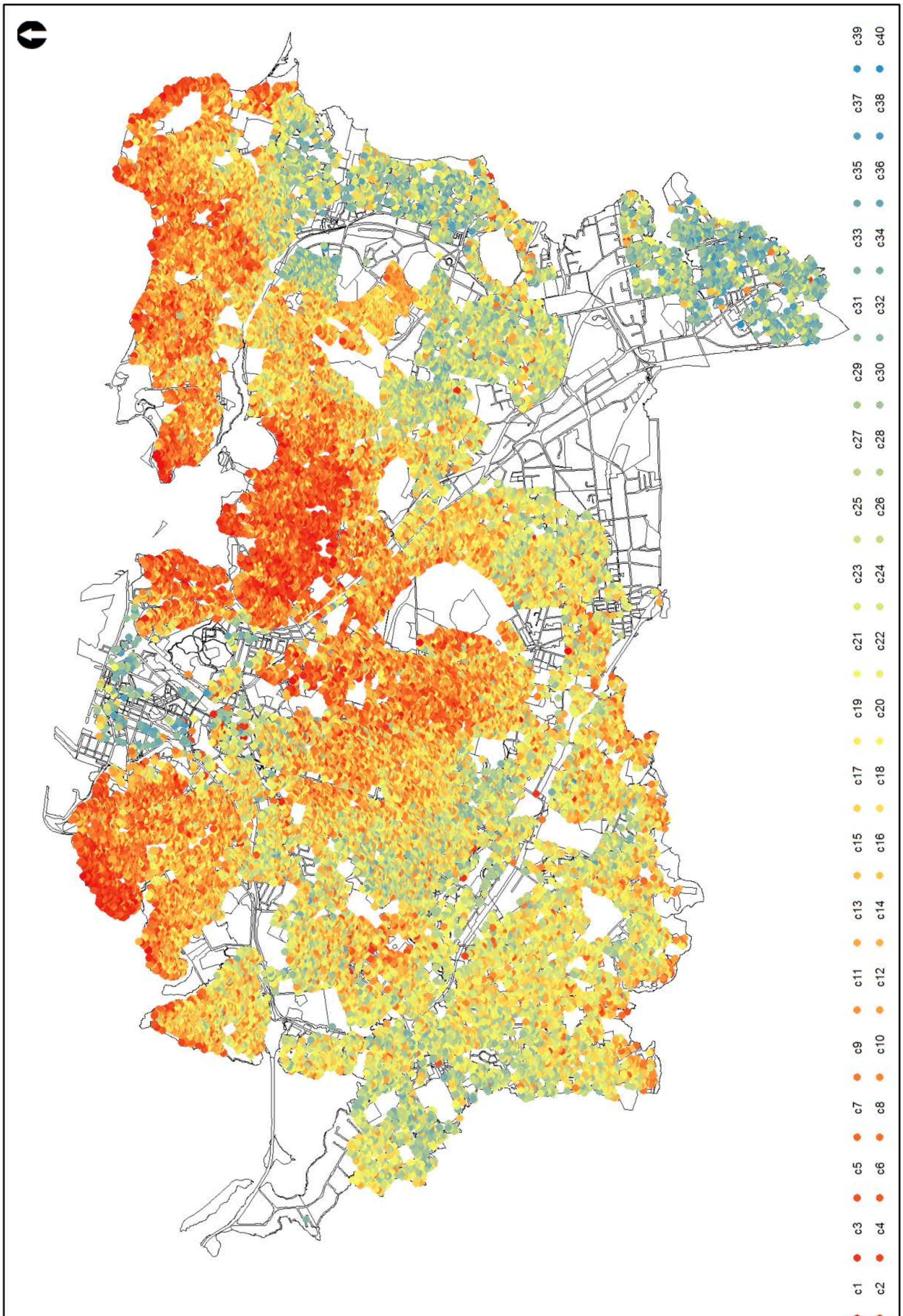


Figure 5: South East

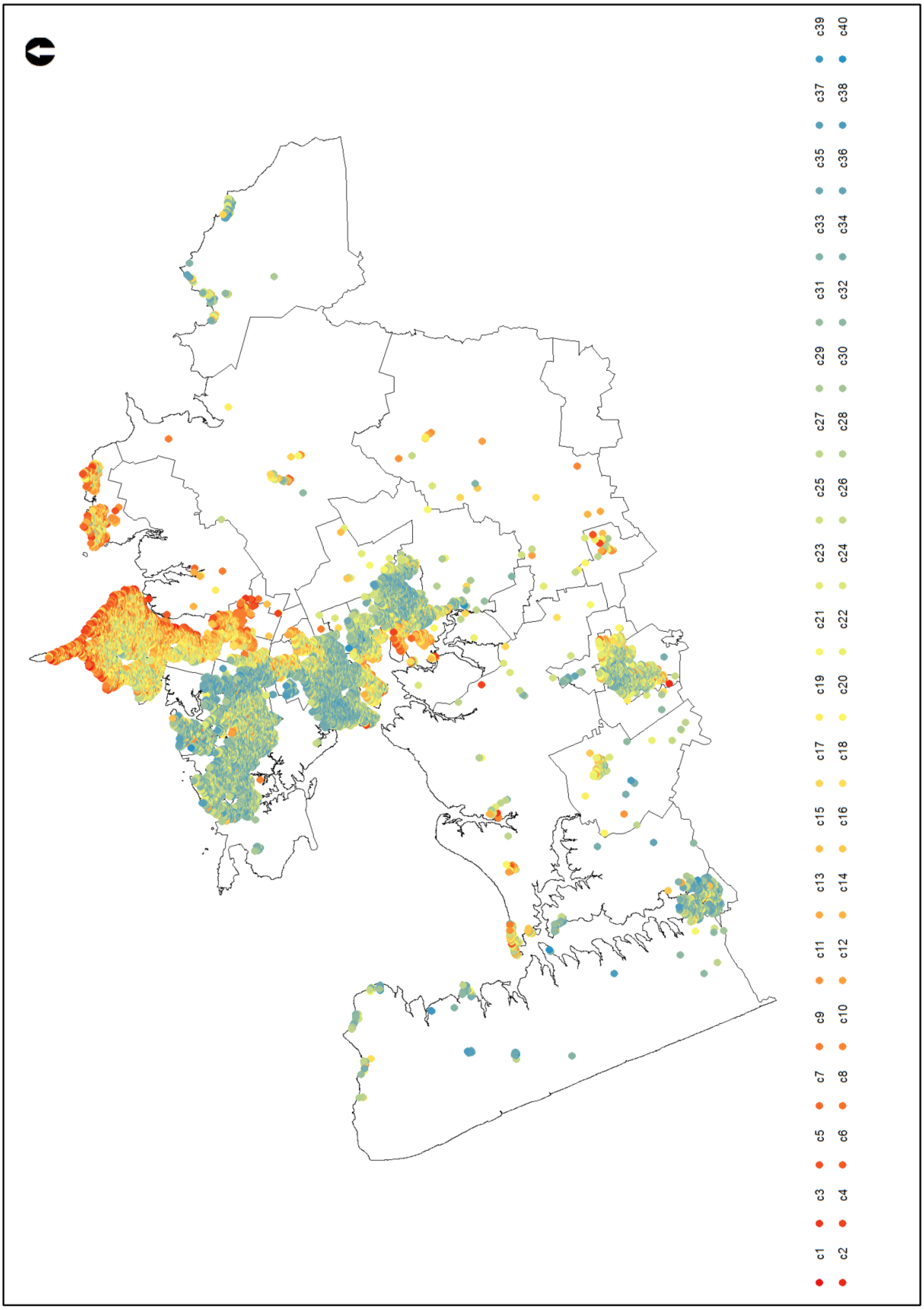


Figure 6: Housing Market Segments – North Shore

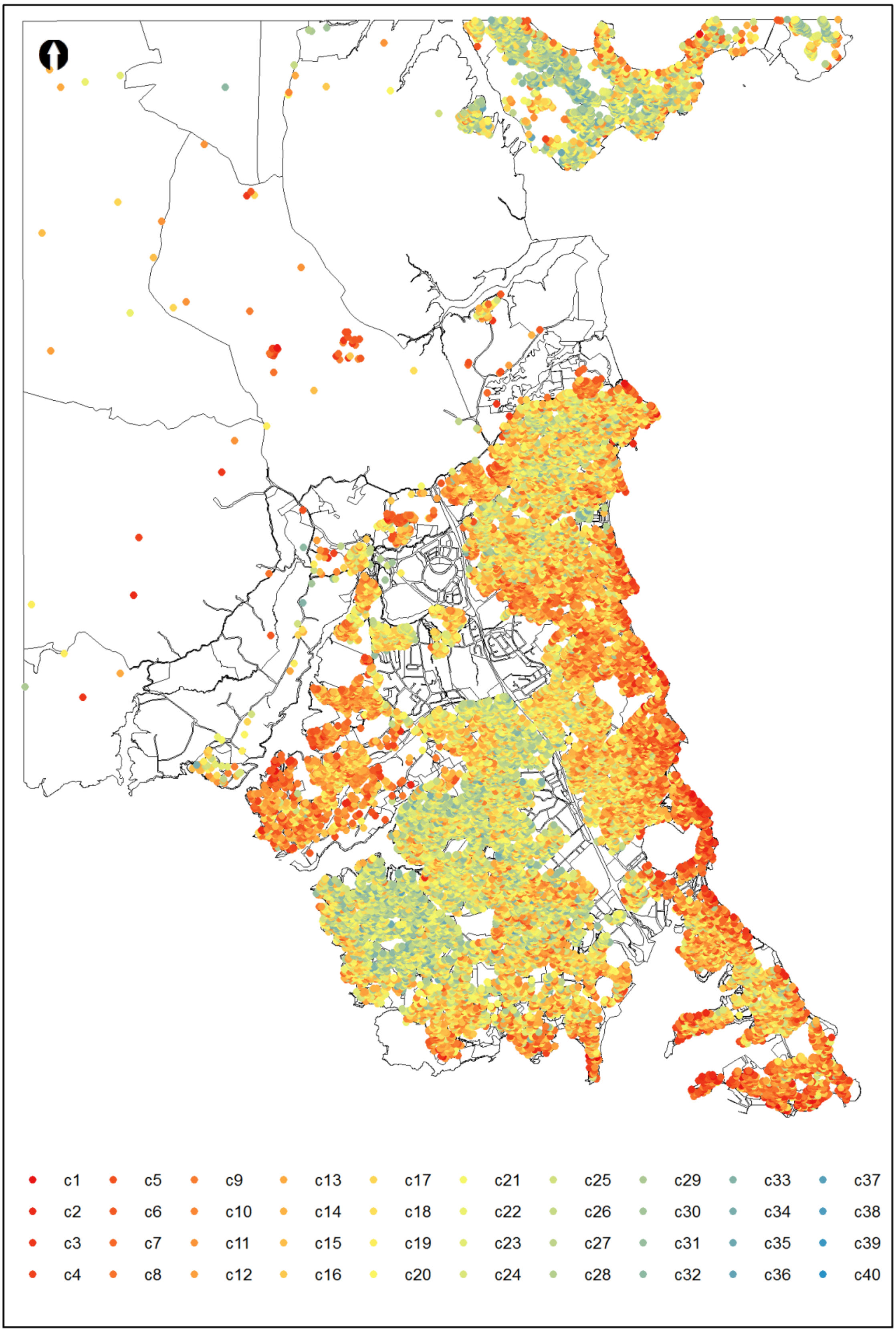
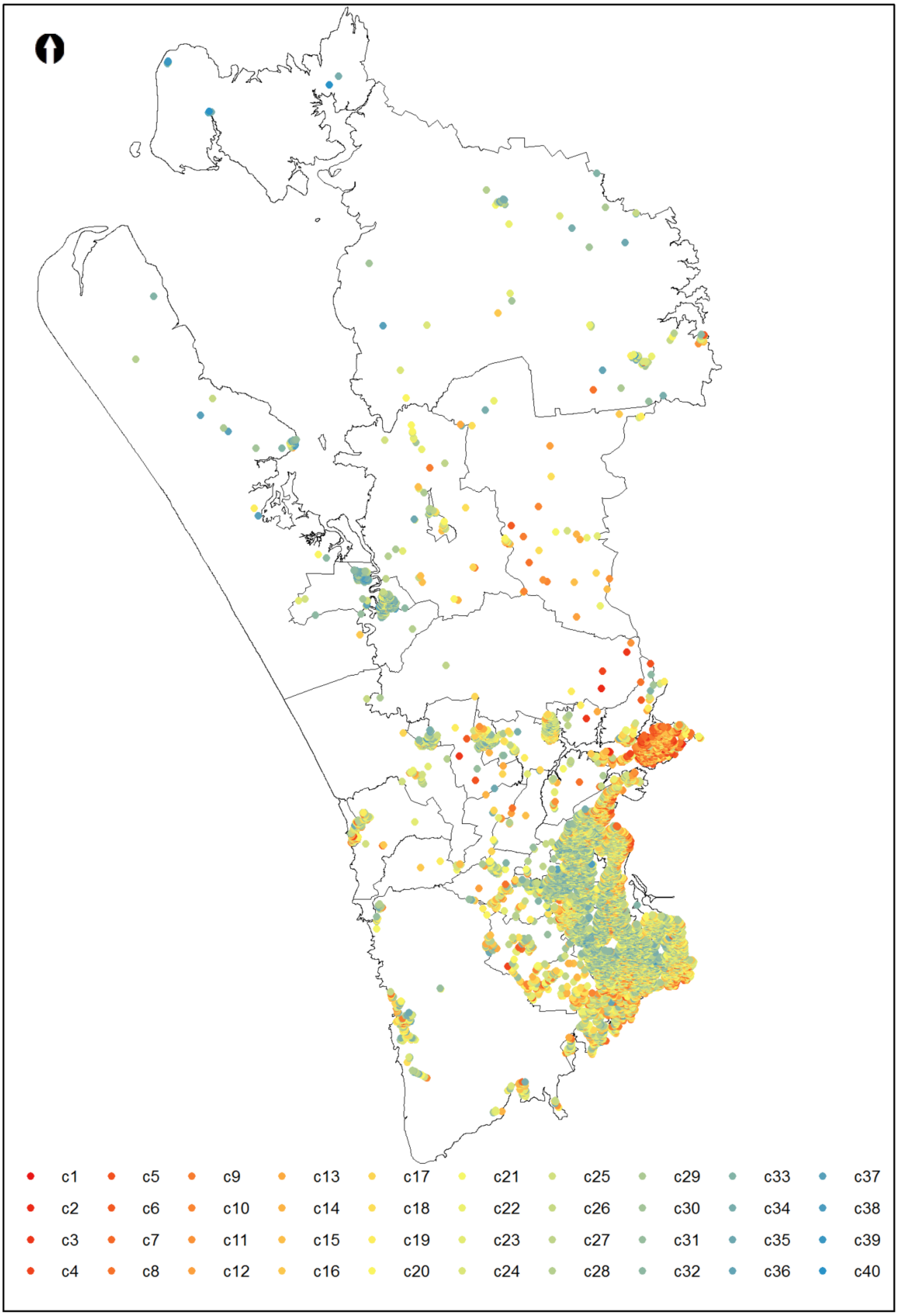


Figure 7: Housing Market Segments – North and West



3.3.3.3 Characterisation of Market Segments

To identify profiles in the market segments, the clusters are sorted starting on the highest price, and the resultant ordering is applied for a number of variables of interest (Figure 8). This approach reveals patterns on the behaviour of the variables across the clusters.

The c_1 cluster has the highest price where the average is \$4.03 million and c_{40} the lowest at \$195,000. Total floor area also shows a decreasing pattern with respect to price, on c_1 houses have on average 520 square meters of floor area whereas on c_{40} the average dwelling has 39.3 square meters. Likewise, the age of the house at the moment of sale is on average 56.7 years on clusters $c_1$to c_6, and then there is a decreasing pattern with respect to price, on c_{39} and c_{40}, dwellings are on average 10 years old.

There is no clear pattern regarding the number of times a house has been sold, all have been sold at least once, though there is no statistical differences across all clusters, dwellings on clusters c_{36} to c_{40} have been sold at least twice. Regarding slope, houses in clusters c_{40} to c_{35} are on land with average slope of 6.5 degrees. Slope slowly decreases up to c_{36} and then increases to an average of 9.7 degrees in c_{40}.

In terms of internal features of houses, those on clusters $c_1$to c_{16} have garage space under main roof for at least one car, but then average space decreases relative to the price and on clusters c_{39} and c_{40} garage under main roof is almost non-existent. In turn, for garage free standing, there is an increasing behaviour up to c_{30} but then the pattern reverts where average space on clusters c_{39} and c_{40} is almost non-existent. Roof condition oscillates between fair and good across all clusters, where roof material consists mainly of concrete, fabric, bitumen and butyl rubber, and cement, but for low-price clusters roof construction material switches mainly to iron. Walls condition also oscillates between good and fair across all clusters, where construction material for clusters c_1 to c_{12} consists mainly of wood, roughcast and other materials different to brick, concrete or cement. For the rest of clusters, material consists mainly of brick, concrete and fibrous cement.

It is widely acknowledged that neighbourhood variables and environmental amenities also influence housing prices. Thus, 40 per cent of houses in c_1 are in a volcanic view shaft, there is then a U-shaped behaviour where for clusters c_{20} to c_{32} the share of houses in a view shaft is around 12 per cent, and then for c_{40} the share is 42 per cent. However, for c_1 to c_7 , there is a range between 2.35 per cent to 3.8 per cent of houses located in blanket height areas, for c_{25} to c_{39} that share is less than 1 per cent and no house in c_{40} is in those areas.

Regarding land use, in agreement with results in, the share of the AU on green areas does not show significant heterogeneity across clusters, and ranges between 10 per cent and 12 per cent of the AU. In turn, the share on settlements is around 90 per cent for c_1 to c_7, this share decreases and remains stable around 74 per cent for c_{22} to c_{32}, after which the share increases up to 90 per cent for c_{39} and c_{40}. Land allocation to cropland is less than 1 per cent across all clusters but there is an inverted U-shaped pattern that shows that share for $c_1$to c_4 is less than 0.1 per cent, whereas for c_{18} to c_{34} the share is at least 0.6 per cent, and for c_{39} and c_{40} the share is also less than 0.1 per cent. Similar patterns arise for the shares on forest and grassland, where shares between high-price and low-price clusters are not statistically different. Share on coastal areas show instead a different pattern, where for high-priced clusters the share is around 1per cent and around 3.5 per cent for low-price clusters. Finally, share on wetlands is decreasing with respect to the price, where high-price clusters ($c_1$to c_{13}) show allocation of at least 0.6 per cent, whereas wetlands are almost non-existent in low-price clusters.

AU-level variables are also displayed in Figure 8. High-price clusters $c_1$to $c_4$correspond to areas where population density is less than 3000 people per square kilometre, whereas on clusters c_{38} to c_{40} density is above 3500. Clusters c_1 to c_{18} correspond to those with high average income, at least $80,000 per year; whereas for c_{38} to c_{40}, income is on average $57,500 per year. House ownership rates also represents economic endowments and it is at least 60 per cent for clusters $c_1$to c_{28}, then the rate is decreasing where for clusters c_{39} and c_{40} it is on average 22 per cent. Regarding ethnicity, on clusters $c_1$to c_{15} there is at least 70 per cent of population who identify as European. This share is decreasing with respect to the price, for c_{35} to c_{40} the concentration of Europeans is less than 50 per cent. In turn, concentration of Maori on c_1 to c_5 is less than 5 per cent, the share increases up to 14 per cent in c_{34} and then decreases to 5% on c_{40}.

Environmental and cultural amenities influence housing prices in Auckland. Clusters $c_1$to c_8 are on average less than 1.5 Km from a coastal area, and the distance is increasing with respect to the price. That is, the most expensive houses tend to locate in coastal areas or their vicinity. However, there is no significant effect when it comes to the distance to green areas, in agreement with results.

Distance to AU centre is increasing up to c_{32} after which it decreases. Cluster c_{40} is 0.59 km from the AU centre. Regarding distances to a volcanic feature, a historic heritage site or a Mana Whenua site, they all show U-shaped forms. That is, high and low-price clusters are not dissimilar in terms of proximity to any of those amenities, however drivers at the ends of the price distribution mainly consist on income and economic endowments.

Distances to roads is decreasing, clusters c_1 to c_3 are on average 1 km from a road, then the distance is decreasing relative to clusters where c_{40} is 417 meters to a road. Distance to the nearest school is stable around 600 meters across clusters. Average distance to CBD is increasing, c_1 to c_5 are less than 6.8 Km away from the CBD. Distance peaks at 15.5 km for c_{30} and then decreases to 3.3 km for c_{39} and c_{40}.

Figure 8

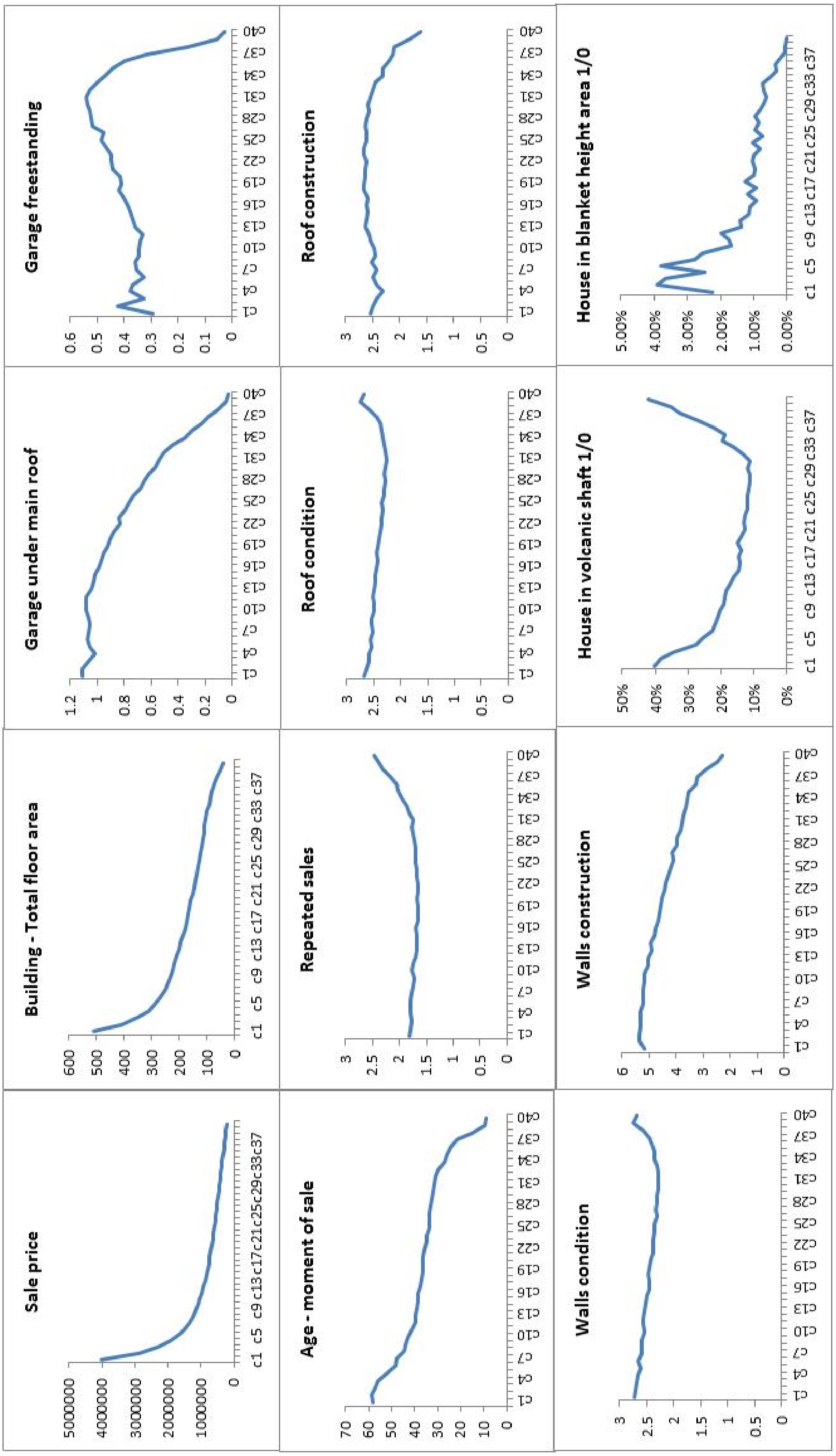

Sale price
Building - Total floor area
Garage under main roof
Garage freestanding
Age - moment of sale
Repeated sales
Roof condition
Roof construction
Walls condition
Walls construction
House in volcanic shaft 1/0
House in blanket height area 1/0

Figure 8 continued

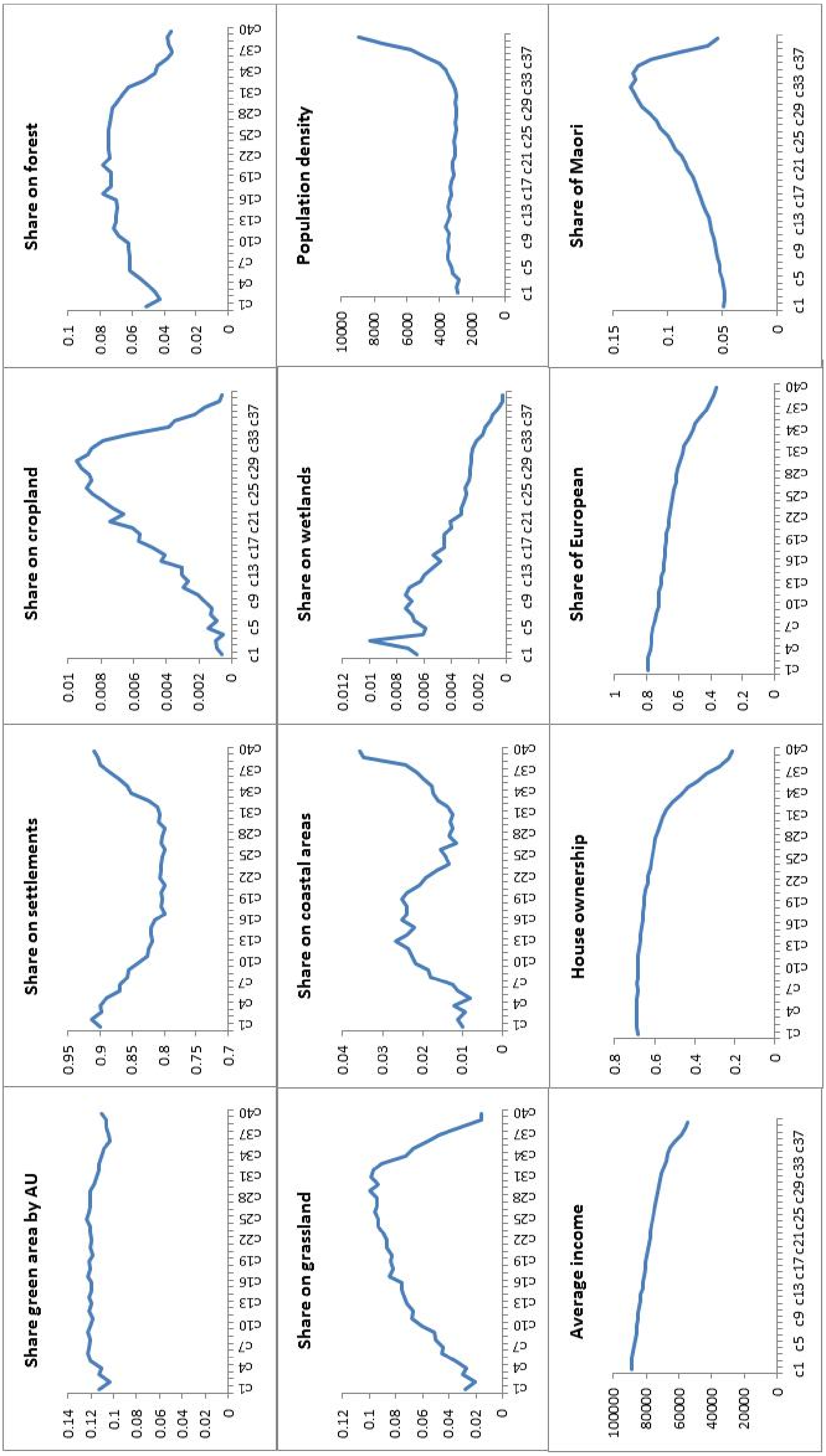
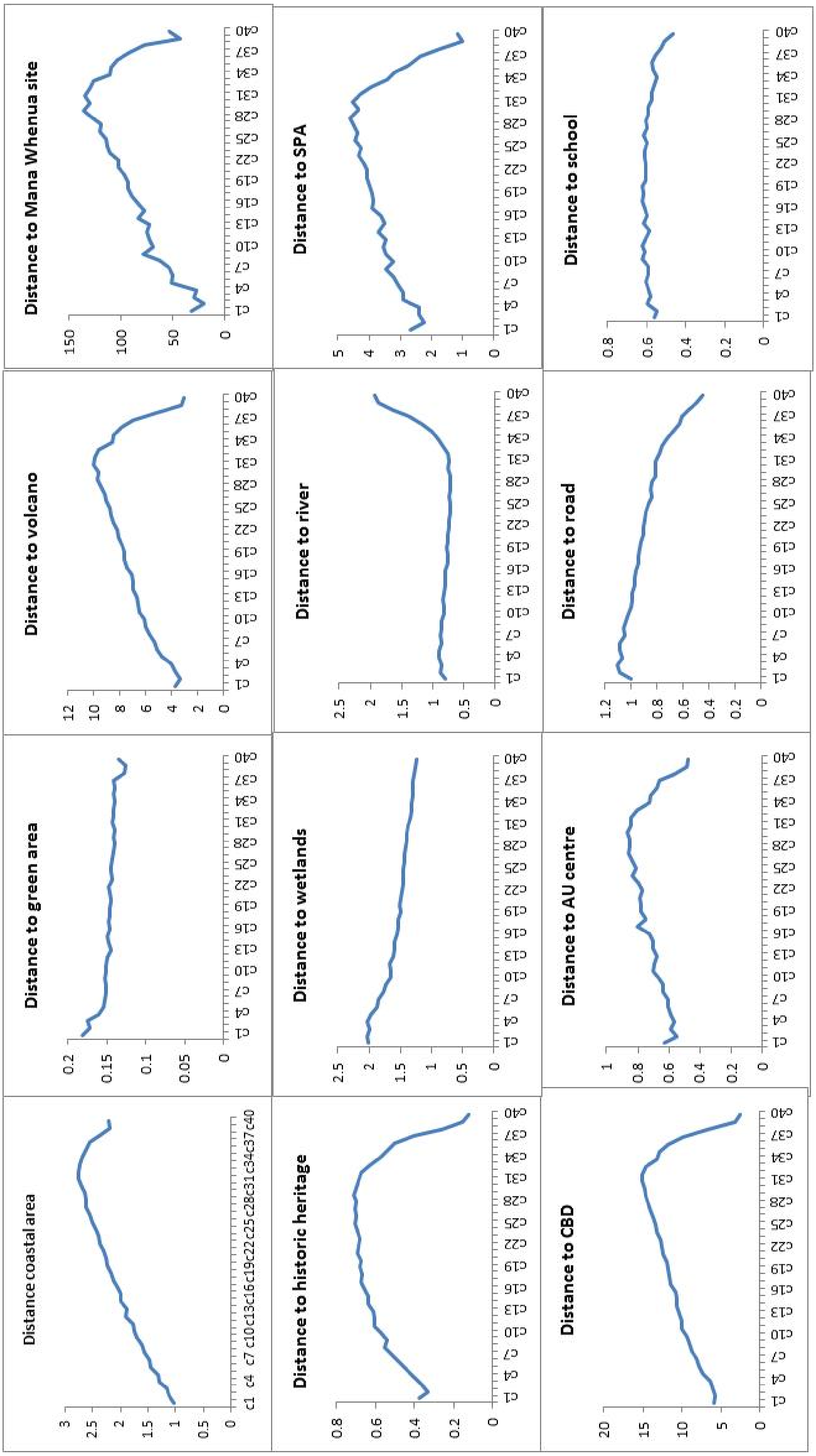


Figure 8 continued



Summary: Assessment of overall housing demand

- Underlying aggregate demand for housing under the medium scenario is assumed to be 354,000 for the next 30 years.
- The aggregate demand has two components – population growth of 319,000 units and the shortfall of 35,000 units.
- The outlook for Auckland population and households is for incremental change, even with substantial growth expected into the long term.
- The demand outlook is for relatively stable, incremental change, driven by household growth (primarily) and limited demographic change (notably gradual ageing).
- These factors mean that the main influences for changes in housing demand will be economic conditions (which are characteristically cyclical) and changes in the statutory planning environment, which are considerable under the new Auckland Unitary Plan.
- There are spatial variations in demand as evident in hedonic price modelling.

4.0 Assessment of plan enabled capacity for housing

4.1.1 Overview

The NPS-UDC specifies the requirements for conducting the residential and business capacity assessments. Policy PB3 requires that the assessment must include an analysis of the cumulative effect of all zoning, objective rules and overlays and designation. This section of the assessment provides a summary and overview of the methods used to determine Auckland's plan enabled capacity.

4.1.2 Method

The methodology for calculating urban plan enabled capacity is based on that detailed in the Capacity for Growth Study 2013 (CfGS) Methodology and Assumptions Report (Balderston & Fredrickson, 2014), using the provisions Auckland Unitary Plan – Operative in Part (AUPOIP). It is strongly advised that readers familiarise themselves with the method used for the 2013 study.

To calculate the enabled capacity, the AUPOIP provisions are utilised and translated into a variety of key parameters, contained in 'lookup' tables (Appendix B) and numeric constants (Appendix E). These parameters and constants are then mathematically and spatially tested and analysed across all residential and some business and mixed use zoned parcels to generate the plan enabled capacity for residential dwellings.

Plan enabled capacity is a measurement of the number of additional dwelling units that are 'allowed' to be built under the current planning provisions (simplified to those that are deemed to impact on capacity).

The following table describes the housing capacity types assessed when determining plan enable capacity.

Table 3: Housing capacity types assessed

Capacity Type	Definition of capacity type
Residential vacant	Capacity for dwelling units on residential zoned parcels that are currently wholly vacant (no dwellings or buildings), either via further subdivision or construction of a dwelling as of right.
Residential infill	Net capacity for additional dwelling units on residential zoned parcels that are partially vacant and have subdivision potential (based on the modelled consent category from AUPOIP rules) and are less than 2000 square metres.
Residential vacant potential	Net capacity for additional dwelling units on residential zoned parcels that are partially vacant and have subdivision potential (based on the modelled consent category from AUPOIP rules) and are equal to or greater than 2000 square metres.

Capacity Type	Definition of capacity type
Residential redevelopment	Net capacity for additional dwellings on residential zoned parcels presuming that all dwellings/structures are removed, and the sites are redeveloped to yield the maximum number of dwellings permitted (based on the modelled consent category from AUPOIP zone rules), less the existing number of dwellings, providing a net yield.
Residential rollover	This category of capacity relates to capacity sourced from non-modelled outputs. Structure plan areas relate to locations where modelling is unnecessary, inappropriate or impossible, and data has been sourced from elsewhere, usually the published structure planning information.

Housing development capacity in business zones (such as town centre, neighbourhood centres, city centres, etc.) is calculated as a part of the business floor space capacity component (Section 7.0).

The following subsections give an overview of the methods used to calculate each capacity category.

4.1.2.1 Residential vacant capacity

Residential vacant capacity refers to the number of dwelling units that can be built on residential zoned parcels that are currently vacant. Dwelling counts extracted from Council's rating information and building footprints from Council's spatial database are used to identify vacant parcels. Hence, a parcel must pass the following test:

$$Zone\ type = Residential\ AND\ dwelling\ count = 0\ AND\ count\ of\ building\ footprint = 0$$

Vacant parcels are then tested against relevant zoning and subdivision rules to generate the maximum number of plan enabled dwelling units. Capacity is calculated through two methods based on the size of the candidate parcel. These are:

a) For vacant parcels that are less than 2000m^2, where minimum lot size rules are applied to calculate dwelling yield:

$$Residential\ vacant\ yield = ROUNDDOWN\ \left(\frac{parcel\ area}{minimum\ lot\ size}\right)$$

Where the zone is more 'design based', a proxy for the minimum achievable density that will comply with the design standards (from worked examples) is utilised:

b) For vacant parcels that are equal to, or are larger than 2000m^2, 25 per cent of the parcel area is removed to allow for reserve contribution, access lots/vested roads, etc., then minimum lot size rules/maximum density proxies are applied to calculate dwelling yield on the remaining area:

$$Residential\ vacant\ yield = ROUNDDOWN\ \left(\frac{parcel\ area\ \times 75\%}{minimum\ lot\ size}\right)$$

Rateable units derivation to dwellings is imputed and may be subject to error where the current land use is not residential. Council's current building footprint database is an update using 2020 aerials to the 2006/2008 footprints layer, and is therefore a source of potential error. This is presently being updated using 2013 LiDAR and is expected to be completed in early 2018. Data from the current LiDAR aerial photography programme are expected to be processed for derivatives (including building footprints) starting from 2019 using a refined methodology currently being trialled on the 2013 data.

4.1.2.2 Residential infill and vacant potential

Residential infill and vacant potential capacity calculates the number of additional dwelling units that can be yielded from residential zoned parcels which are partially vacant and have subdivision potential. To differentiate infill and vacant potential parcels, a threshold of 2000 square metres is introduced. Parcels that are less than the threshold are tested through the infill capacity assessment. Parcels equal to or are greater than 2000 square metres are tested through vacant potential assessment.

While both infill and vacant potential assessments are like the vacant capacity assessment approach described earlier, extra procedures are introduced to determine whether additional dwelling units can be accommodated by considering a range of spatial factors. First, residential zoned parcels are tested against relevant zone rules to determine whether they are large enough to accommodate additional dwelling units. To achieve this, a residential zoned parcel must be at least twice the size of the minimum lot size as determined by its underlying zone rules, as both the existing and new site must comply with all relevant rules. Secondly, qualified candidate parcels are spatially tested by incorporating existing building footprints. Based on the building footprint data, the model can separate areas that are occupied by existing building structures and candidate infill areas. This is followed by another area calculation filter, which ensures that both areas are no less than the minimum lot requirements. Lastly, each infill candidate (area less than 2000 square metres) is spatially assessed to confirm that there is sufficient space from the road to the infill candidate area for vehicle access, and the space is not obstructed by the existing building structure.

Like the vacant capacity calculation, infill yield is calculated by

$$Residential\ infill\ yield = ROUNDDOWN\left(\frac{infill\ candidate\ area}{minimum\ lot\ size}\right)$$

The vehicle access test is not performed on vacant potential candidates (area ≥ 2000m^2), because 25 per cent of the area is reserved for reserve contribution, vehicle access/vested roads, etc. As a result, vacant potential capacity is calculated by

$$Residential\ vacant\ potential\ yield = ROUNDDOWN\left(\frac{candidate\ area\ \times 75\%}{minimum\ lot\ size}\right)$$

4.1.2.3 Residential redevelopment capacity

Residential redevelopment capacity is the number of additional dwelling units which can be built on residential zoned parcels, presuming that all buildings and structures are removed, and such parcels are redeveloped to yield the maximum dwelling number enabled by planning provisions. Because the Plan does not impose dwelling density controls as a specific rule in Mixed Housing Urban (MHU), and Terrace Housing and Apartment Buildings (THAB) zones and, an intensified capacity assessment approach is applied in these zones. All remaining residential zoned parcels are calculated through the standard redevelopment assessment.

4.1.2.3.1 **Intensified redevelopment assessment**

The AUPOIP does not impose maximum density requirements in the MHU, or THAB zones. This has enabled parcels located within these zones to achieve intensification through building more attached dwellings instead of standalone houses on smaller lots.

Development /design criteria rather than density rules are used to control development capacity on parcels within the MHU and THAB zones. These have been simplified to the following parameters:

a) **Effective maximum height:** determined by either zone height or height variation control derived from precinct and/or overlay rules (e.g. volcanic viewshafts and height variation control overlays)
b) **Yards:** ground level setbacks from parcel boundary(s)
c) **Building coverage:** the maximum amount of buildable area within a parcel to ensure sufficient onsite open space is available
d) **Height in relation to boundary (HIRB) factor:** upper level building setbacks that regulate overall shape of the building.

To generate the intensified redevelopment capacity, a simplified version of the calculation process is shown as follows:

a) Calculate net developable area

$$net\ developable\ area = parcel\ area - yard\ setback\ area$$

b) Calculate maximum building footprint

$$maximum\ building\ footprint = net\ developable\ area\ \times maximum\ building\ coverage\ percentage$$

c) Calculate maximum gross floor area

$$\begin{aligned} &maximum\ gross\ floor\ area \\ &= maximum\ building\ footprint \times \left(\frac{effective\ maximum\ height}{residential\ storey\ height}\right) \\ &\times height\ in\ relation\ to\ boundary\ factor \end{aligned}$$

d) Calculate maximum dwelling yield

$$\begin{aligned} &maximum\ dwelling\ yied \\ &= ROUNDDOWN\left(\frac{maximum\ gross\ floor\ area}{gross\ dwelling\ footprint}\right) - existing\ dwelling\ count \end{aligned}$$

4.1.2.3.2 **Standard redevelopment assessment**

Once the intensified redevelopment capacity is carried out for the MHU and THAB zoned parcels, all remaining residential parcels are fed through the standard redevelopment assessment model. Unlike the infill assessment, the model calculates capacity through a mathematical process which allows more flexibility and presumes physical restrictions such as vehicle access space and existing building location are overcome by demolishing the existing buildings and structures.

For parcels that are less than 2000 square metres, residential redevelopment capacity is calculated by utilising minimum lot size rules:

$$Residential\ redevelopment\ yield = \left(\frac{parcel\ area}{minimum\ lot\ size}\right) - existing\ dwelling\ count$$

For parcels that are equal to, or larger than 2000 square metres, 25 per cent of the parcel area is removed for reserve contribution, access lots, or vested roads, etc, then minimum lot size rules are applied to calculate redevelopment capacity:

$$Residential\ redevelopment\ yield = \left(\frac{parcel\ area \times 75\%}{minimum\ lot\ size}\right) - existing\ dwelling\ count$$

4.1.2.4 Residential rollover

Under the AUPOIP provisions, many special areas, mainly described in the precinct section, are given the maximum numbers of dwelling units and/or maximum amount of floor space depending on the statements in the relevant precinct or overlay, supplemented with discussions with the appropriate planners. In some cases, the precincts enable a high degree of flexibility and discussions are not advanced to clarify outcomes and remain ‘TBD’. The ‘numbers’ that are derived are deemed to be the enabled capacity and are carried over. They have not been assessed by the capacity model.

4.1.3 Assumptions/ limitations

Assumptions and limitations of the assessment methodology include:

- The AUPOIP provisions adopted for this assessment are based on the version as at 1 July 2017. Plan changes/variations or results of appeal settlements after this date have not been considered.
- Capacity is calculated under a subset of the AUPOIP provisions. These have been agreed with Auckland Council’s planners. The capacity assessments utilised the highest activity threshold in cases where the plan provides clear parameters for modelling. For most bulk and location parameters this is the Permitted Activity standard, however, subdivision and building development per se is rarely permitted, and requires resources consent of some sort. No Prohibited or Non-Complying Activity parameters have been used.
- Global assumptions are inherited from the CfGS with minor changes to reflect the AUPOIP provisions (Appendix B).
- The capacity results are a measure of plan enabled capacity, or ‘what does the current planning system allow’. Whether this capacity will be realised (or not) has not been a

consideration, nor is it implied that because the plan enables a certain kind of development that it will necessarily occur, or because a development has not been identified that it will not.

- Each AUPOIP zone is classified as either being residential, business, rural, special or other. This classification is an objective assessment based on the modelling approaches used and does not infer any classification for land use planning purposes, though for the most part these categories are interchangeable (special areas can be residential, business, rural or other for example).
- The capacity model has been adjusted and amended to incorporate additional precinct rules. However, some precincts have been modelled using their underlying zoning rules due to ambiguous precinct rules. These rules cannot be converted into standard parameters and/or constants to be consumed by the capacity model.
- Parcels or titles identified as having a designation on them that would severely restrict or prevent development of the parcel or title have been excluded from assessment for potential capacity.
- Parcel and title information (the base 'site' used for urban and rural capacity assessments respectively) was obtained from Land Information New Zealand's Data Service as at 1 July 2017.
- Property rating information is sourced from Auckland Council as at 1 July 2017. Although the latest property valuation has been completed at the starting time of the modelling work, the valuation output has not been made available for public use. Hence, rating data (including dwelling count and other rates sourced attributes) is based on the 2014 valuations except where a rates assessment has been updated by sale, change of use or further development.
- Building footprint information is extracted from Council's spatial database. The footprint data is mainly based on the 2010 aerial imagery with some additional ad hoc footprints amendments. Updates to this information (initially to 2013) are expected in 2018. 2017/18 LiDAR will be used to extract footprints following this.
- Capacity for minor dwellings, conversion of a dwelling into two, internal subdivisions, and parcels/titles amalgamations are not assessed.
- Land areas owned by public entities such as council owned reserves are not been considered as potential areas for residential and business developments.
- All reported residential capacity is rounded down to the nearest whole integer, for example if capacity for a parcel or title is calculated at 1.01 or 1.99 dwellings, then both would be reported as a potential yield of one (1).

4.1.4 Results

This section presents the results of the residential zones plan enabled dwelling capacity assessment. The capacity results are presented in two main categories, 1) capacity with infill, and 2) capacity with redevelopment. These capacities are calculated through different assessment methods, and have different constituents that makes up each of their totals (Table 4).

Table 4: Constituents of capacity totals

Capacity constituent	Total 'capacity with infill'	Total 'capacity with redevelopment capacity
Residential vacant	✓	✓
Residential infill	✓	×
Residential vacant potential	✓	✓
Residential redevelopment	×	✓
Residential rollover	✓	✓

4.1.4.1 Auckland region

Under the AUPOIP provisions, approximately 38,600 hectares (Table 5) of land is zoned for residential purpose, which consists of 8 per cent of the total regional land area (489,400 hectares in total) in Auckland. Almost 40 per cent of the residential zones are for Mixed Housing Suburban (15,119 hectares), followed by 22 per cent of Single House zone (8607 hectares), and 20 per cent of Mixed Housing Urban (7590 hectares).

The AUPOIP is complex. Its policies, objectives, rules, and other provisions such as overlays and precincts rules, are intertwined. In the CfGS setup process, the rules that are applied to a parcel is a function of its 'zoning'. The spatial relationship between zones, precincts and overlays, is overlapping and a parcel or title can be assessed under one set of rules only (to avoid double counting) even where they are 'multi zone', so a prioritisation is required. All precincts are considered zones (precincts > zones) and some overlays (special and historic character overlays in particular) act as zones (selected overlays > precincts or zones). Most overlays act as modifiers on some aspect of the base zone rules, but only a few are actively modelled where they are considered to materially affect 'capacity'. However, the AUP is not always consistent in these matters and some provisions triumph over others which may generate different results compared to their modelled outcomes.

As a result only 77 per cent (29,865 hectares) of the residential zoned areas are assessed under their underlying zoning rules (Table 5). A further 14 per cent (5,416 hectares) of the residential areas are modelled using a combination of zone rules and other provisions. The remaining residential areas are excluded from modelling, because of the overriding provisions such as designations, region wide overlays, precinct rules, or a lack of match with the many other internal and third-party data sources that are drawn on to provide the model with what it needs to accurately calculate capacity.

Table 5: Total residential zoned area vs total residential land modelled

AUPOIP base Zone	Total area (ha)	Proportion of total zoning	Residential zoned parcels modelled using base zone rules	Proportion of base zone modelled	Residential zoned parcels modelled by all AUPOIP provisions	Proportion of all modelled
Large Lot	2,912.15	8%	1,758.84	6%	2,652.64	8%
Mixed Housing Suburban	15,119.30	39%	13,259.88	44%	13,918.06	39%
Mixed Housing Urban	7,590.02	20%	6,534.16	22%	6,962.23	20%
Rural and Coastal Settlement	1,853.11	5%	864.22	3%	1,248.48	4%
Single House	8,607.50	22%	5,304.25	18%	8,206.58	23%
Terrace Housing and Apartment Buildings	2,507.61	6%	2,144.59	7%	2,294.00	7%
Total	**38,589.69**		**29,865.94**		**35,281.99**	
Proportion of total residential zoned area (ha)		**77.39%**		**91.43%**		

Across Auckland, housing development capacity under the AUPOIP residential provisions is between 119,306 additional dwellings (capacity with infill) and 1,076,267 additional dwellings (capacity with redevelopment) (Table 6). The modelling shows:

- 1,733 vacant residential parcels across the region that have a potential capacity for 16,554 dwellings
- 85,747 additional dwellings could be accommodated through infill development on 26,828 residential parcels
- If all residential parcels were redeveloped, a total of 1,076,276 dwellings can be added to the existing housing stock, and
- Through precinct and structure plans, a total of 17,005 dwelling units have been enabled.

The location of parcels that have been identified as having capacity, either with infill or redevelopment, can be seen in Figure 9 and Figure 10.

Figure 9: Residential parcels with infill capacity in Auckland's urban areas

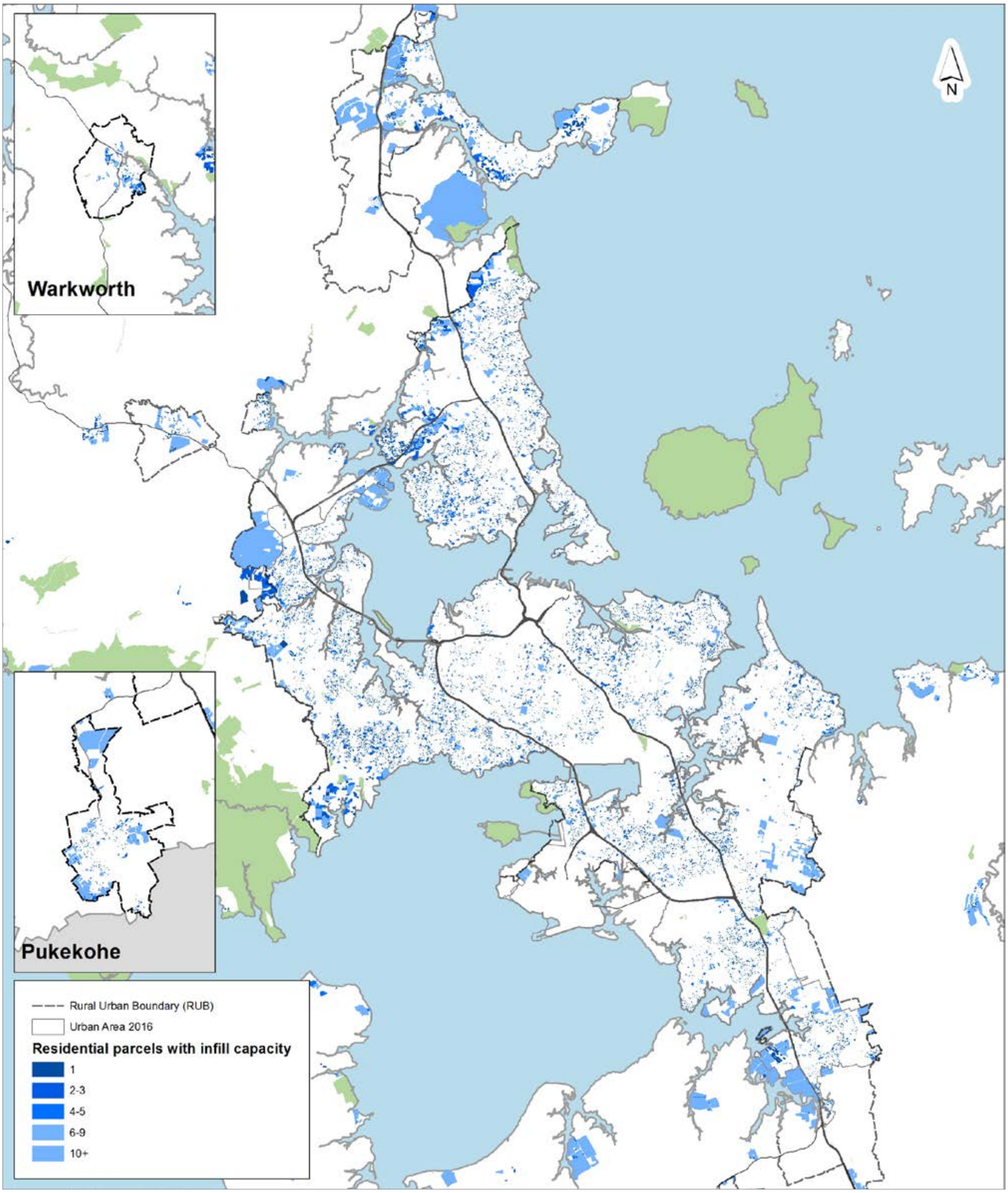
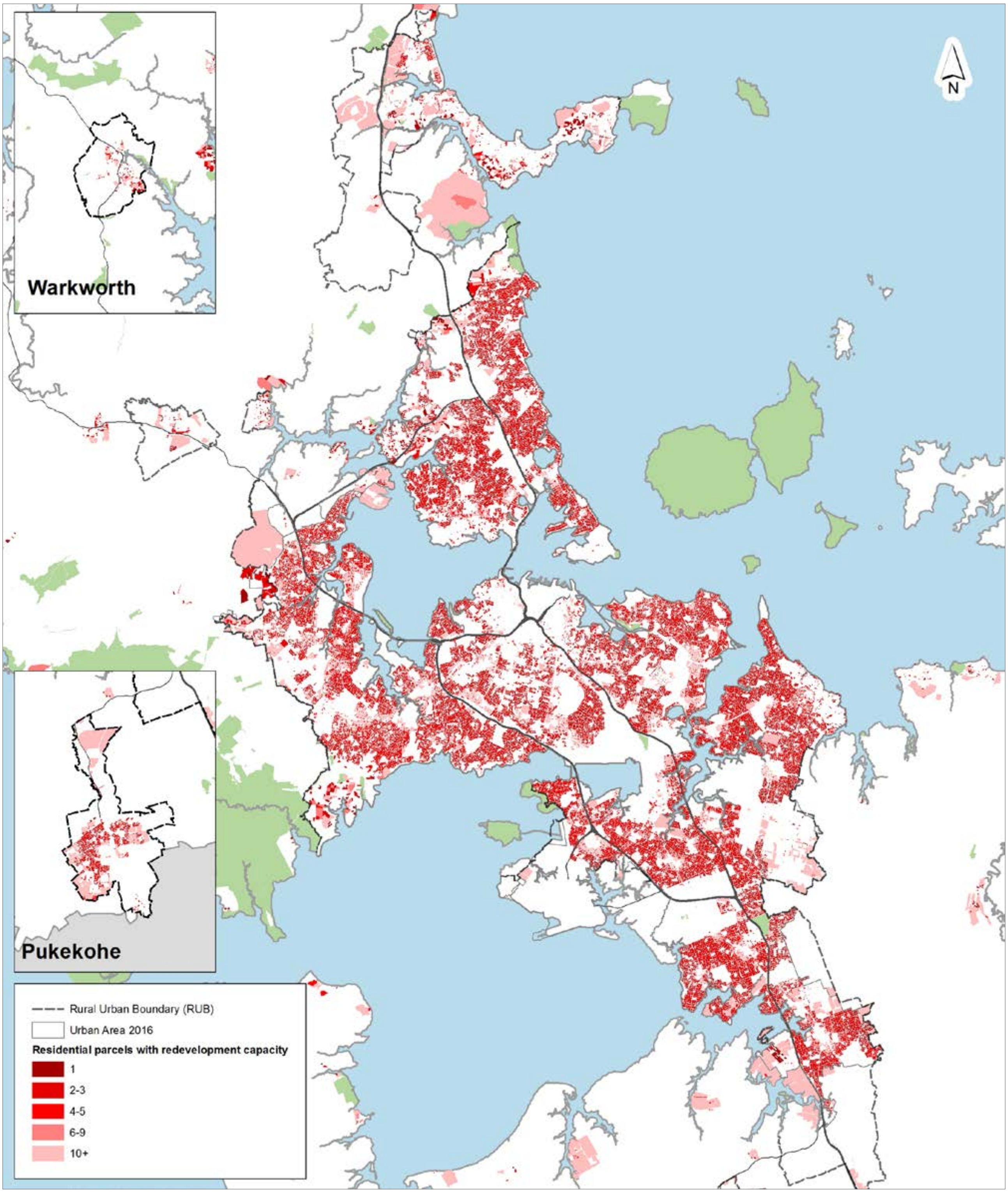


Figure 10: Residential parcels with redevelopment capacity in Auckland's urban areas



When looking at the results by AUPOIP base zones (Table 7), the MHS and MHU zones were identified with the largest amounts of residential development capacities. Combined the MHS and MHU zones have capacity for between 81,801 (capacity with infill) and 719,236 (capacity with redevelopment) additions dwellings. The THAB zone has the potential to deliver up to 310,634 addition dwellings (capacity with redevelopment).

Table 6: Auckland residential capacity summary by capacity type (in dwellings)[3]

Capacity type	Additional dwellings	Number of parcels
Residential vacant	16,554	1,733
Residential infill	22,952	20,384
Residential vacant potential	62,795	6,444
Residential redevelopment	979,913	204,264
Residential rollover	17,005	1,390
Total residential capacity with infill	**119,306**	
Total residential capacity with redevelopment	**1,076,267**	

Table 7: Residential capacity by AUPOIP base zones

Capacity type	Total infill capacity (dwellings)	Total redevelopment capacity (dwellings)
Large Lot	3,091	6,384
Mixed Housing Suburban	41,604	405,459
Mixed Housing Urban	40,197	313,777
Rural and Coastal Settlement	1,602	2,276
Single House	26,043	37,737
Terrace Housing and Apartment Buildings	6,769	310,634
Total	**119,306**	**1,076,267**

4.1.4.2 Urban areas and rural towns

Residential capacity identified in this report is a function of the AUPOIP zones, which not only calculates capacity in the existing urban areas, but also assesses capacity for residential zones in many rural towns. The capacity results are aggregated by urban areas, rural town centres and at each local board to better describe the enabled housing capacity (Table 8).

[3] Residential capacity on rural land is not included in this study. Residential capacity in business zones is included in the business floor space calculation.

The potential capacity for additional dwellings within urban areas ranges from 75,652 (capacity with infill) to 921,142 (capacity with redevelopment) (Table 8). The capacity for additional dwellings within rural towns ranges from 43,653 (capacity with infill) to 155,125 (capacity with redevelopment).

Table 8: Auckland residential capacity summarised by general location (in dwellings)

Location	Number of additional dwellings
Urban area capacity	75,652 to 921,142
Rural towns capacity	43,653 to 155,125
Total residential capacity	**119,306 to 1,076,267**

Potential residential capacities vary across local boards (Figure 11). Almost 70 per cent of the potential infill opportunities within the urban area are in Henderson-Massey, Hibiscus and Bays, Papakura and Upper Harbour local boards. Franklin rural towns have more than twice the amount of residential infill opportunities of the rural towns in Rodney (Figure 12).

The residential redevelopment assessment reveals the Henderson Massey Local Board has the most capacity opportunities (Figure 13). This is followed by Howick and Maungakiekie-Tamaki. Rodney and Waitematā are identified with two lowest residential zone redevelopment capacities.

Figure 11: Residential capacity in urban area (capacity with infill) by local board

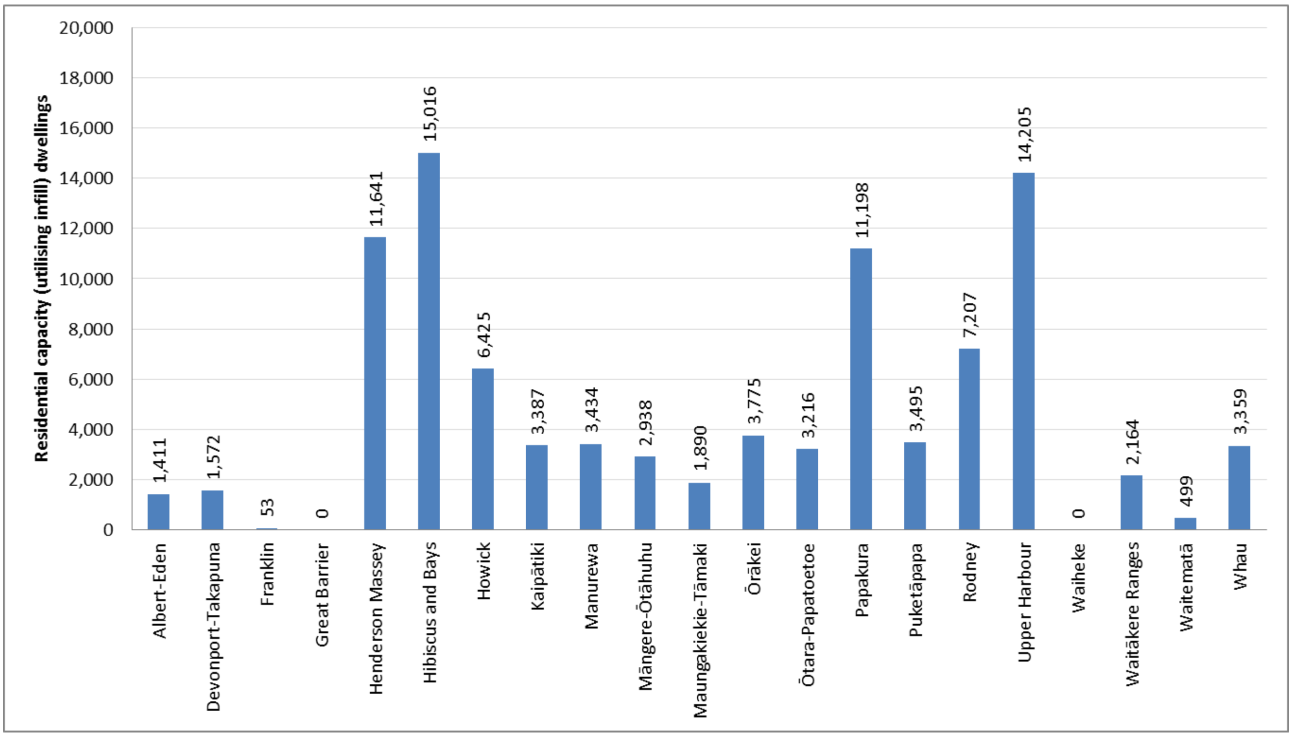


Figure 12: Residential capacity in rural towns (capacity with infill) by local board

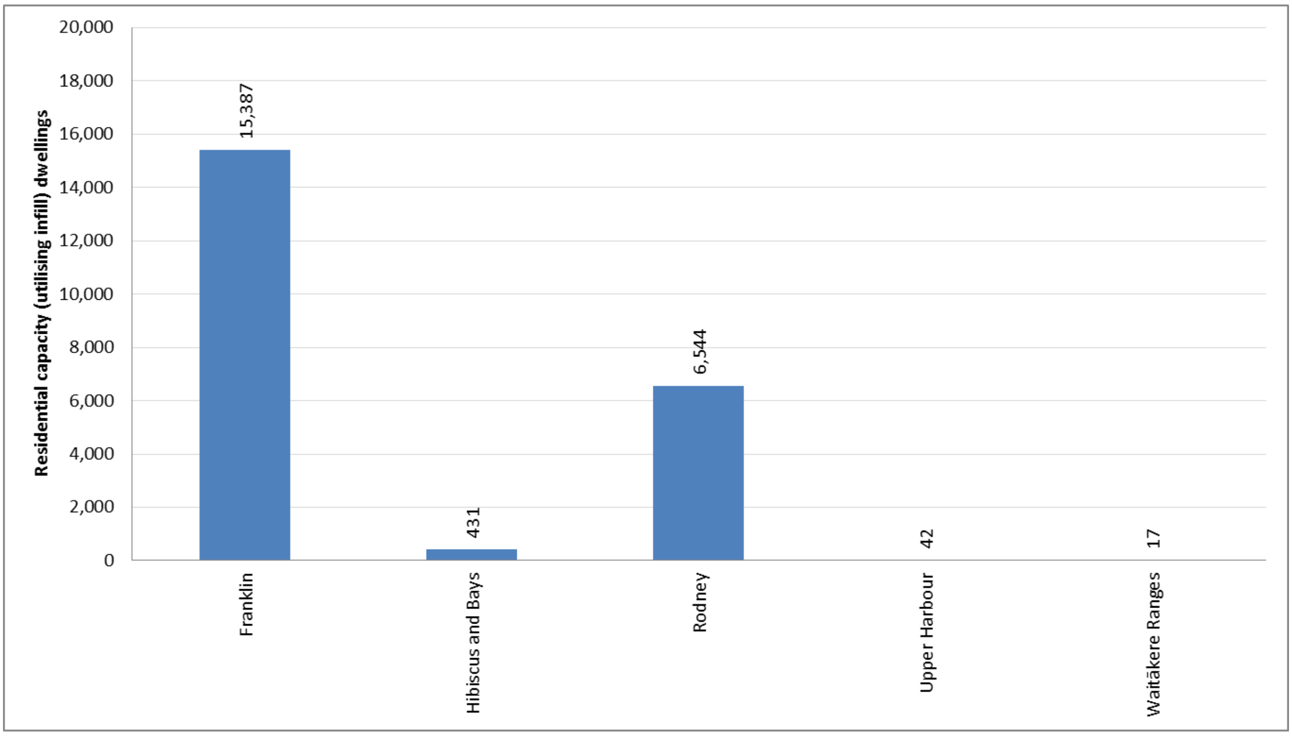


Figure 13: Residential capacity in urban area (capacity with redevelopment) by local board

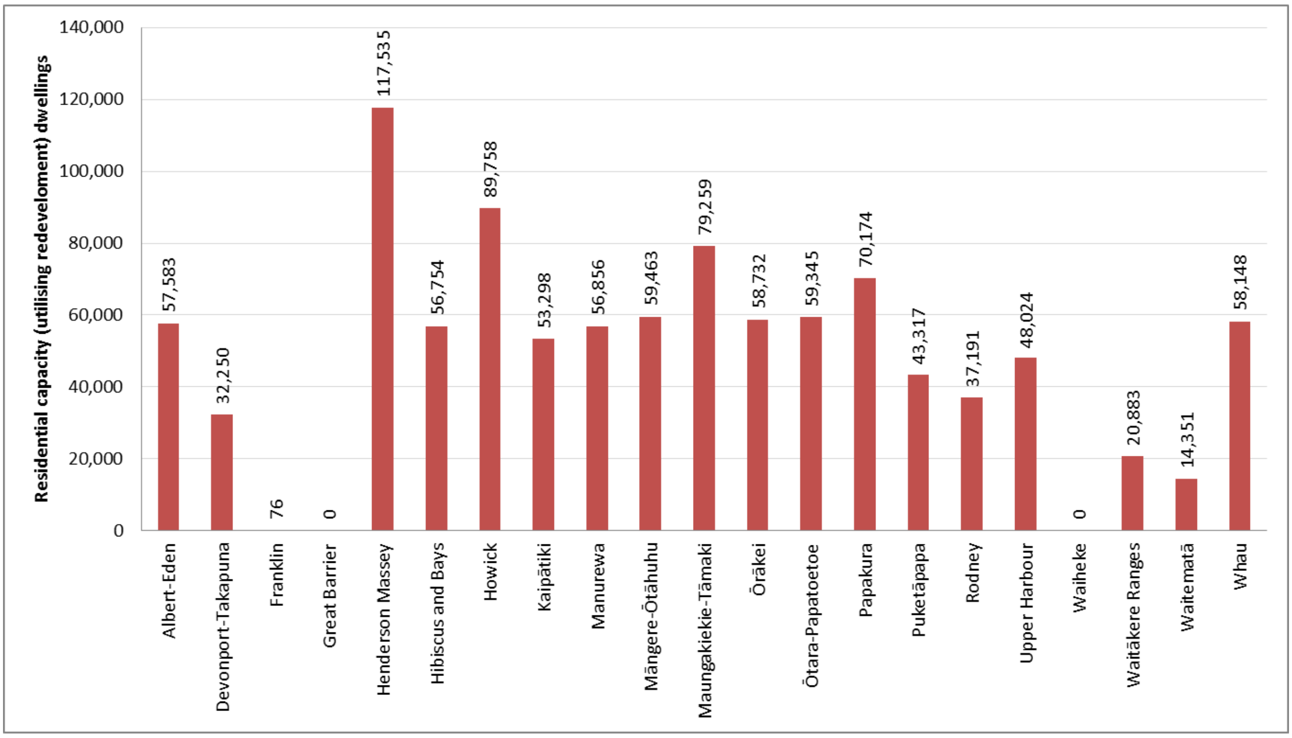
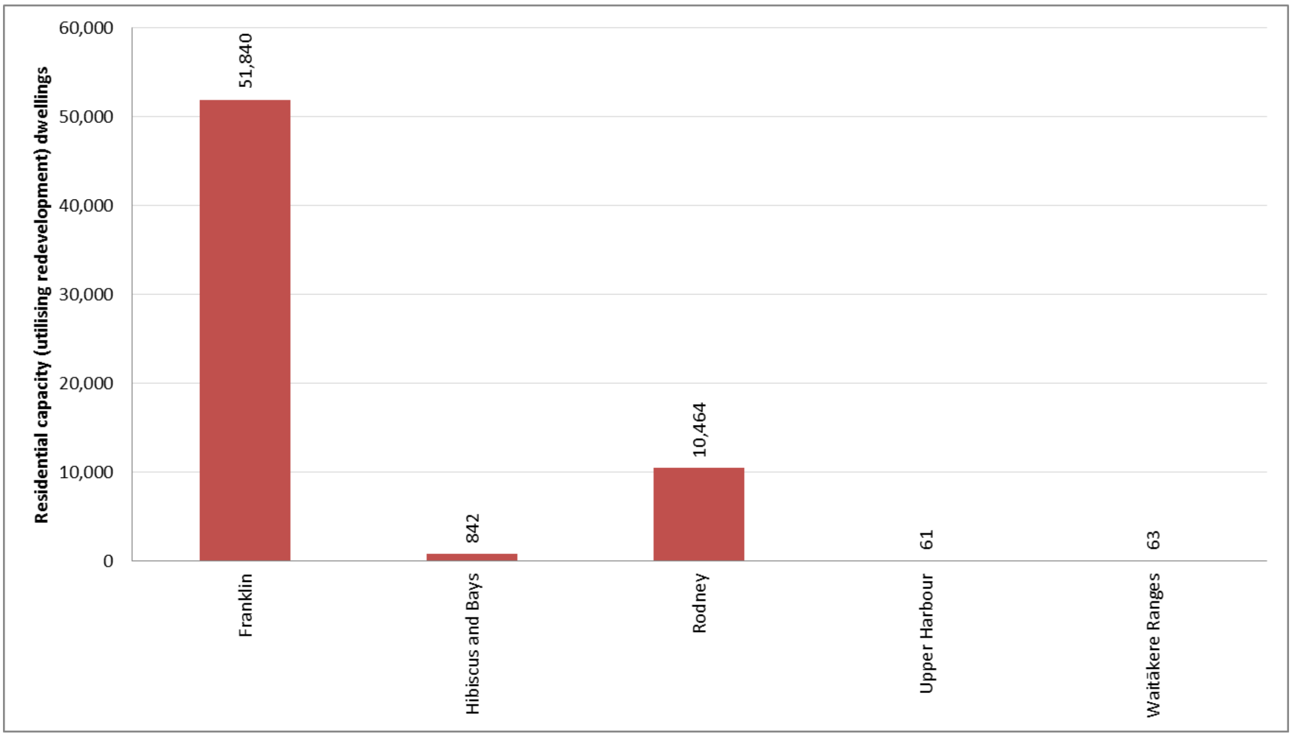


Figure 14: Residential capacity in rural towns (capacity with redevelopment) by local board



4.1.4.3 'Greenfields' plan enabled capacity

The AUPOIP does not enable residential or business development in the Future Urban Zone (FUZ). The 'plan enabled capacity' in these areas is zero, nor are these areas serviced for urban development. However, they are intended, at some point in in the future to be urban. These areas are known as 'greenfields' as they are usually green fields or farmland that is converted to an urban environment through the development process.

The FUZ is effectively a holding zone with rules that are intended to preclude subdivision and developments that will foreclose or make more difficult the eventual urbanisation of these areas, after they have been 'structure planned' to identify the eventual zoning patterns and areas of protection or enhancement and other facilities and services. This also informs the planning and construction of the appropriate bulk infrastructure required as a prerequisite for urban development.

The recently updated Future Urban Land Supply Strategy (FULSS) (Auckland Council, 2017) provides the agreed sequencing and indicative high level assumptions based on 'strategic frameworks', which are a high level principles based assessment. The report notes that "[t]he analysis done for this strategy is of sufficient scale and specificity to broadly determine bulk infrastructure requirements." (Auckland Council, 2017, p. 8).

The FULSS suggests, based on this high level strategic assessment that the areas it covers could deliver around 137,000 dwellings once built. This is the best estimate of what the future plan enabled capacity may be at this stage.

Only after a comprehensive structure planning process will a plan change to the Auckland Unitary Plan be undertaken to change from FUZ to whatever zoning pattern has been determined via the structure plan. For most of the FUZ this has not occurred, or is in the early stages of contextual assessment or preliminary consultation. The FULSS notes that the Unitary Plan requires a structure plan to identify, investigate and address the following matters[4] (taken from Auckland Council (2017, p. 9):

- **Urban growth** (e.g. future supply and projected demand for residential and business land, phases and timing for the staged release of land in coordination with infrastructure, the location, type and form of the urban edge, linkages and integration with existing urban-zoned and/or rural-zoned land adjoining the structure plan area and, opportunities to improve access to landlocked parcels, including Māori land)
- **Natural Resources** (e.g. the protection, maintenance and enhancement of natural resources, integration of green networks with open space and pedestrian and cycle networks, measure to manage natural hazards and contamination and the location of mineral resources)
- **Natural and built heritage** (the existence of natural and physical resources that have been scheduled in the Unitary Plan in relation to natural heritage, Mana Whenua, natural resources, coastal environment, historic heritage and special character)
- **Use and activity** (e.g. contribution to a compact urban form and the efficient use of land)
- U**rban development** (e.g. a desirable urban form at the neighbourhood scale)
- **Transport networks** (e.g. integration of land use and development with the local and strategic transport network)
- **Infrastructure** (e.g. location and protection of existing and planned infrastructure)
- **Feedback from stakeholders**.

No model can pre-empt or supersede the outcomes of these highly detailed and context specific processes, which by their very nature and purpose will be responsive the conditions that exist at the time of their undertaking, rather than now. For these reasons a simplified modelling approach to estimate potential future capacity and its feasibility of in the FUZ has been undertaken (see section 5.2.4).

[4] Refer to Appendix 1 of the Auckland Unitary Plan (Structure Plan Guidelines) for a complete list of matters to be identified, investigated and addressed in a structure plan. The matters included here provide an indication only and are not intended to be a full and complete list (Auckland Council, 2017).

Summary: Plan enabled residential capacity

- The plan enabled capacity analysis used the methods employed by the CfGS updated to include the precincts, zones and overlays included in the AUPOIP.
- The modelling is underpinned by a series of assumptions which have associated limitations.
- Some possible forms of development e.g. minor units, dwelling conversions, internal subdivisions, etc. have not been modelled.
- The modelled plan enabled capacity in the residential zones ranges from approximately 120,000 dwellings (utilising infill) to over 1 million dwellings (utilising redevelopment).
- The plan enabled capacity is a key input into the feasibility analysis.

4.2 Assessment of commercially feasible development capacity

4.2.1 Overview

This section describes process of calculating commercial feasibility for the urban and future urban areas. The NPS-UDC defines feasibility. It must consider the current likely costs, revenue and yield of undertaking residential development.

Commercially feasible development capacity is an assessment of the ability of an 'average developer' acting within normal commercial parameters to deliver developments within two current (but for the purposes of the assessment, immutable) constraints. These are the planning system (i.e. planning regulations sets the 'upper limit' to what can be considered for development) and the dwelling market (developers are 'price takers' for both retail prices of new dwellings, and for all of the costs they face in seeking to produce new dwellings).

The approach is an attempt to replicate the process a developer takes to determining what to develop on a site within the constraints of the current planning system, and current market for dwellings (and the various components required to make them).

The approach is a variation on the 'residual value' method, which is a widely used standard commercial methodology to determine the maximum price a developer should pay for a potential development site (the 'residual') given expected development costs, sale prices and minimum return requirements. The feasibility assessment replicates this process for all sites with capacity for a range of developments, acting essentially as an omnipotent developer where all sites are for sale and the price of dwellings and their input costs is unaffected by supply of or demand for those goods and services.

For this process, the basic equation is rearranged so that the result or unknown variable is the return on costs, given all other values. This is because the cost of a development site is assumed to be its market price (via an adjusted capital valuation), building and development costs are 'fixed' by the various lookup tables for each typology by location, and sales prices are similarly pre-determined.

A range of potential developments, all equal to or less than the upper limit set by the regulations (being the parameters set by the CfGS model), are tested given these parameters. Those that provide more than the minimum required return (set by consensus at 20% gross (pre-tax) over total costs), if any, are then assumed to be 'feasible developments' that the average developer may deliver.

Multiple feasible options are possible on some sites. When this occurs a further filtering process is required to generate 'scenarios' from these feasible options. The 'baseline' is the scenario where the developed greater than 20 per cent return are ranked by percentage return. This has been used as the reported baseline because it is assumed to be the commercially oriented developers' (who is acting on behalf of 'capital') first choice project[5].

The commercial feasibility assessment uses two separate but conceptually similar approaches. One for the existing urban zones, and the other for areas identified in the Future Urban Land Supply Strategy. This reflects the slightly different costs structures and nature of development required to 'redevelop' existing serviced and mostly developed smaller parcels in the existing zoned area (plan enabled capacity is greater than or equal to feasibility) and convert large un-serviced titles in the FUZ first to serviced sections and then build dwellings on them (FULSS ≥ land development ≥ feasibility) respectively.

Rural dwelling feasibility is not modelled in this assessment. Plan enabled capacity for new vacant site rural development is relatively low (between 10,000 and 20,000 depending on how it is measured[6]) and from a strategic perspective effectively allows only for minimal change to maintain rural character and productive potential. For this reason, it is considered reasonable to assume that a significant proportion of what is enabled will eventually (in the next 30 years) be taken up, and much as the approach taken by the IHP, an assumption that approximately 15,000 (the midpoint of the 10,000 to 20,000 new vacant site estimate) is a reasonable assumption to make.

Either way, the rural area deliberately and specifically provides little in the way of 'enabled growth', (10,000 to 20,000 of 400,000 is 2.5 to 5 per cent and well within the margin of error of the urban and Greenfield's assessments) and this overall treatment in a general sense is assumed to continue, as the policy justification for this approach (as outlined in the Auckland Plan and AUPOIP, and more or less consistently followed in Auckland for the last 20 years) is likely to become stronger with greater population growth and urbanisation rather than less.

The conceptual approach to the two approaches, highlighting the key differences is outlined below (Table 9).

[5] This is a valid assumption from the suppliers' perspective; however the supply/demand interactions suggest that only a few suppliers will be able to provide the highest return option before demand for the type of product in that scenario is satiated. The nth developer will then need to choose an alternate option to be able to sell.

[6] The rural subdivision rules enable a potentially complex mix of vegetation incentive based subdivisions, in-situ and transferrable rural subdivision site development options, in addition to significant potential for minor units, workers accommodation and additional dwellings on larger rural sites (without subdivision).

Table 9: Conceptual difference between existing and future urban area capacity and feasibility modelling.

Location	Existing Site	Servicing	Feasible Section Development	Feasible Dwelling Development
Existing urban area	Parcels with AUP Zoning and **CfGS plan enabled capacity**	Assumed Serviced/serviceable. All bulk infrastructure will be in place and payments towards upgrade costs (if any) are as per current DC policy.	N/A. Existing cadastre assumed to be base site for modelling. Some provision for reduced gross site area for access and etc. but not roads parks etc.	**ACDC Model** (re)develops sites with plan enabled capacity filters out a range of existing uses and designated sites, HNZ and outputs **feasible plan enabled dwellings**
Future urban area	Titles that are live zoned or FUZ[7], in **FULSS strategic frameworks** that are indicative residential[8].	Assume no existing services. New roads, reserves etc. are netted from sites. Assume all bulk infrastructure will be in place and payments to wards costs are as per current development contribution policy.	**GF-Land Development Model** removes non-developable areas, required roads, services, land for wholesale (parks, schools, hospitals etc.), and develops remaining net area for sections into serviced sections. Output is **feasible sections**	**GF-ACDC Model[9]** develops GF-LDM Feasible Sections using assumed blanket zoning[10] and filters out a range of existing uses and designated sites, HNZ and Outputs **feasible dwellings**

[7] Future Urban Zone does not permit intensive residential development; rather it is a 'holding zone' for future structure plans that will determine zoning and plan changes to enable development. Therefore, modelled development in FUZ is not strictly 'plan enabled'.

[8] Strategic frameworks have been developed to provide indicative high-level indications for bulk infrastructure planning, consultations and modelling purposes, as summarised in the latest FULSS. Indicative business, reserves and other activities are excluded from residential development. Various non-developable exclusion areas (various hazards and environmental features) are netted off remaining residential titles.

[9] This model is functionally the same as the ACDC model and uses the same lookup tables, but is optimised for the consumption of GF-LDM outputs rather than CfGS model outputs.

[10] As areas tested are predominantly FUZ, and one of the purposes of the modelling is to indicate market preferences, blanket zoning assumptions are applied to test outcomes. As the structure planning process advances, adjustments can be made to reflect decisions already made, or where appropriate feed new zoned and serviced sections into the ACDC model directly.

4.2.2 Urban zones ('brownfield') methodology

The approach used to assess feasible plan enabled capacity is a simple comparison between all the costs of undertaking a plan enabled development, and the expected sale price of that development. Where the relative difference (gross return on total site costs from total site dwelling sales) is sufficient to meet or exceed a reasonable return (set at 20 per cent, representing the accepted minimum required to obtain mainstream development finance in a 'normal' market), the tested development is considered 'feasible'.

The steps taken are:

1. Identify sites with plan enabled opportunities *(from CfGS)*
2. Combine with other data about site developments (*from lookup tables and site data*)
   - *Where **c** is total development costs (e.g. site costs, development contributions; construction; financing, demolition, build costs, landscaping, infrastructure)*
   - *Where **r** is minimum required per cent gross return on development costs*
   - *Where **p** is expected sale prices of that dwelling in that location*
3. Calculate Feasibility of tested development options*:*

- *IF **p ≥ c+r**, THEN development is feasible*

4. Filter plan enabled and feasible sites based on various criteria *(existing land uses, designations, Housing New Zealand owned etc.),* and rank remaining feasible options (if any) on each site using chosen criteria *(maximum percentage return, cheapest dwellings, etc.)*

While conceptually simple, the details of undertaking the approach to automatically respond to zoning constraints and other spatial variations to ensure the nine tested developments are within highly variable planning regulations over 10 different sales locations for is complex. It requires the development of cost and price assumptions for at least 90 developments to test over more than 300,000 individual parcels.

The 9 different development options tested on each site with capacity for development are small, medium and large sized; house, terrace and apartment typologies, that must be within the relevant parameters of the zone in which the site is located. In zones where 'low density' rules apply (e.g. one dwelling per 600 square metres of land area) this means the tested developments are functionally equivalent, but in zones where higher densities are enabled, a wider range of built forms, densities, prices and costs are tested.

The region is broken into 10 different sales location categories (arranged by 2013 census area units) for the purposes of applying different sales prices and build cost components as appropriate.

An update to the Auckland Council Development Capacity Model (ACDC) as used in the capacity calculation completed for the Auckland Unitary Plan Independent Hearings Panel report (Auckland Unitary Plan Independent Hearings Panel, 2016). The MBIE Microsoft Excel based NPS-UDC Dwelling Development Model is essentially a simplification of the ACDC approach and works for a single site (Ministry of Business Innovation and Employment, 2017b). The ACDC model applies the feasibility calculation nine ways, automatically responding to zone changes, over every single site with capacity.

The model was developed at request of the IHP by an expert group of witnesses including but not limited to Auckland Council, involved in the Urban Growth Topic to filter or analyse the plan enabled capacity (from the CfGS) to show which of the enabled opportunities were most likely to be realised, and evolved significantly though the process to its final iteration v3.8, as used in the reporting.

The model has been further refined and the version used in this assessment is v3.9.4. Changes to the model architecture (3.8 to 3.9) are limited to alterations to the Development Contributions costs module that now reflects Council's 2016/17 Development Contributions Policy (DC). Watercare Services Ltd (WSL) Integrated Growth Charges (IGCs) are also included. The net impact of the DC/IGC cost modelling and policy changes has been in general to increase the costs of this component to developers relative to the previous run.

Adjustments have also been made to the lookup tables (LUTs) that drive the costs inputs to the model. The changes made have been developed in conjunction with members of the Property Council and include per square metre build costs from Ryder Level Bucknell, an international quantity surveying firm. The LUTs used for this modelling can be found in Appendix G.

The key changes from the assumptions used in mid-2016 for the IHP modelling are:

- Build costs per square metre have increased, particularly for higher density developments and higher end locations. This cost centre includes materials and labour. The increase reflects construction sector constraints,
- Professional fees e.g. design and project management, have increased for higher densities/ larger projects,
- Funding costs generally have increased, both interest rates payable and the contingencies required (increasing overall costs and the interest payable) particularly for larger and more complex projects,
- The 2016/17 Development Contributions Policy and Watercare's Infrastructure Growth Charges are now included,
- Electrical and telecommunications per unit connections and site costs have increased. No gas connections are assumed,
- Site civil works costs (all physical works not included in build costs or demolition fees, which have not increased) such as earthworks, have increased by 10 per cent,
- The cost of a development site (applied as a relativity to the 06/2014 valuation data) has increased significantly for developable THAB and Mixed Use zoned sites in higher value areas, reflecting their scarcity, and

- The AUPOIP rules and zonings (including precincts and overlays) on a 2017 cadastral base is used for the input capacity.

The net effect of these changes is input cost increases combined with flat sales prices. This has an impact of project feasibility as the gap between costs and prices has narrowed especially for larger, more complex developments in higher value areas, which in an urban area are generally apartments.

4.2.2.1 Assumptions and limitations

This section outlines the key assumptions and limitations of the feasibility modelling. These assumptions apply to the greenfield areas also unless otherwise stated. Greenfield specific assumptions are stated in Section 4.1.4.3.

- The specific model assumption e.g. sales prices, land development costs are contained in lookup tables (Appendix G).
- The feasibility modelling is not a forecast or projection of development. It is a commercial filter on present plan enabled opportunities, providing a 'snapshot in time' of the sites that would be most appealing to an 'average' percentage return[11] motivated developer that wanted to commence a project today, also assuming that the tested sites are for sale and available for development; and that price and costs are unaffected by the actions of other potential suppliers (i.e. the assessment is a test of commercial potential replicating a single developer considering all possible sites in one instant, not a dynamic economic model or a forecast).
- Nine different typologies are tested that comply with simplified density, bulk and location rules. The typologies are small, medium and large, houses, terraces and apartments.
- The infrastructure costs use the 2016/17 development contributions policy and Watercare Infrastructure Growth Charge are included as a cost input.
- The 'actor' is a developer purchasing the land, building and then selling the development within 18 months, returning a minimum of 20 per cent gross (pre-tax) return on costs is assumed. The 20 per cent threshold is consistent with industry requirements when demonstrating pre-start feasibility to prospective financiers.

[11] Other scenarios are also produced after a minimum percentage return filter is applied (so they are still 'feasible', just not necessarily returning the greatest percentage yield on costs), including cheapest dwellings, most dwellings, lowest project cost and largest dwellings scenarios. By default, the maximum return scenario is reported as the yield motivated developers first choice of project. Should this demand be fully satiated, the potential for the nth developer to choose an alternate development is a good indicator of the potential for choice and efficiency in the market.

- Sales prices are set by sales location, floor area and typology, reflecting relativities to a 'standard' dwelling sale price. Generally, apartments and terraces will sell at a dollar per square metre ($\$/m^2$) of floor area discount to a house.
- The developer actor is assumed to be bound by regulation (i.e. cannot construct developments that are beyond the limits of the planning system tested). The planning system (i.e. planning regulations sets the 'upper limit' to what can result.
- The developer actor is a price taker (i.e. assumed prices and costs are not influenced by the developers' actions) – for example if a cost input increases, the developer cannot pass this on to the purchaser though a higher price, rather this easts into the return.
- The model is not dynamic – i.e. sales prices of dwellings, development sites or build costs are not affected by the calculated feasible supply[12].

4.2.3 Results

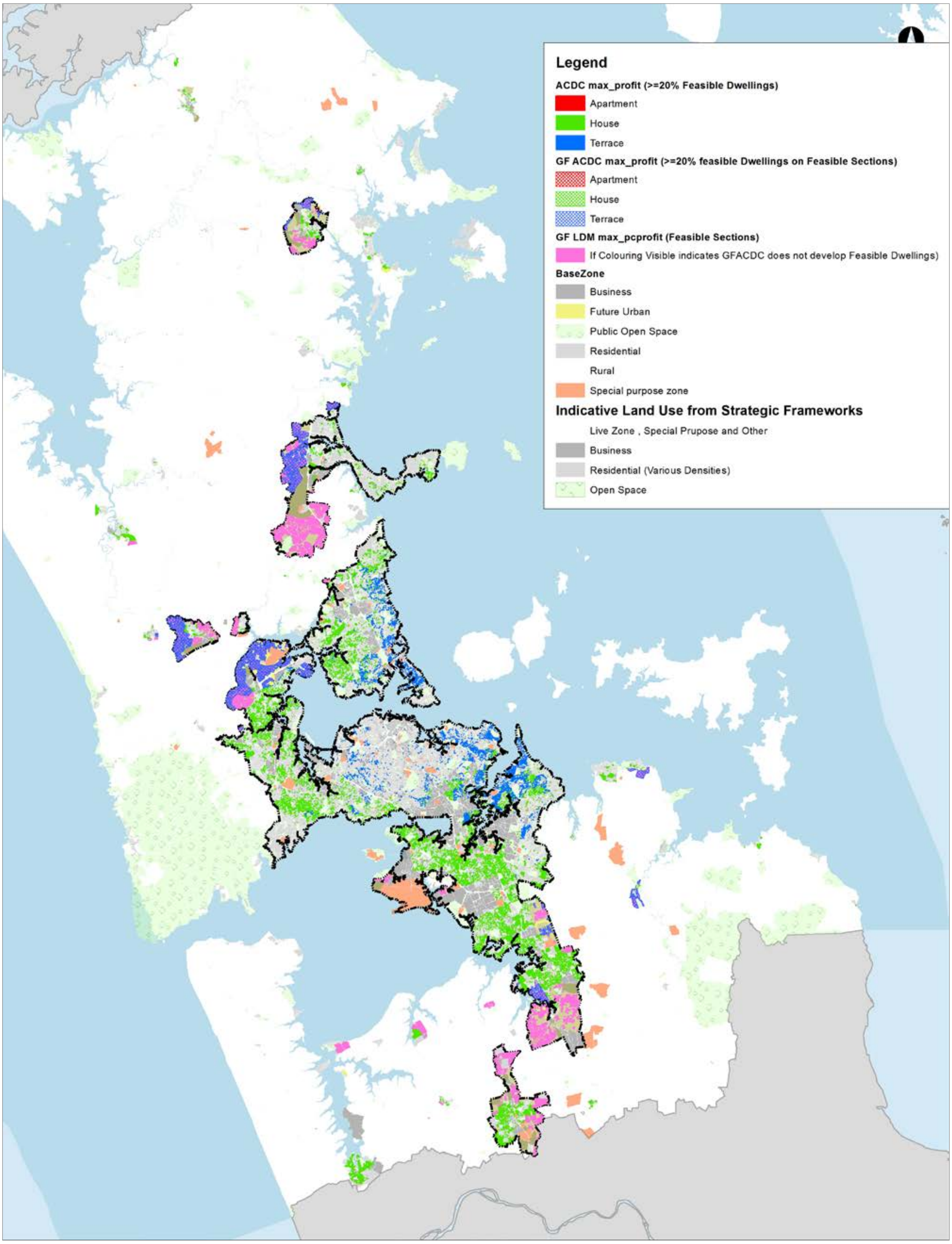
Approximately 140,000 residential dwellings are commercially feasible on residential and business zones in the urban area. The average sale price is $1.22 million. The two additional scenarios represent changes in input costs and profitability to illustrate the impact of the amount of feasibility and price (Table 10). The spatial distribution of parcels with feasible capacity under the baseline scenario in Auckland is illustrated in Figure 15.

Table 10: Commercially feasible development capacity modelling results

Scenario	Feasibility threshold	Feasible dwellings (000s)	Proportion of dwellings that are detached
Baseline urban area	≥20%	140	69.9%
Baseline with reduced profit threshold	≥15%	209	59.3%
Baseline with reduced profit threshold	>10%	291	50.8%

[12] Even if it were possible for the feasible supply to be delivered overnight, if it did occur it is unlikely that the nth developer would be able to achieve the assumed sale prices, purchase the site or obtain labour, specialist inputs and materials for the assumed values (because of the additional supply, in theory lowering prices (more supply), and increasing costs (increasing demand) all else being equal.

Figure 15: Feasibility results for baseline scenario for urban and greenfield areas by typology

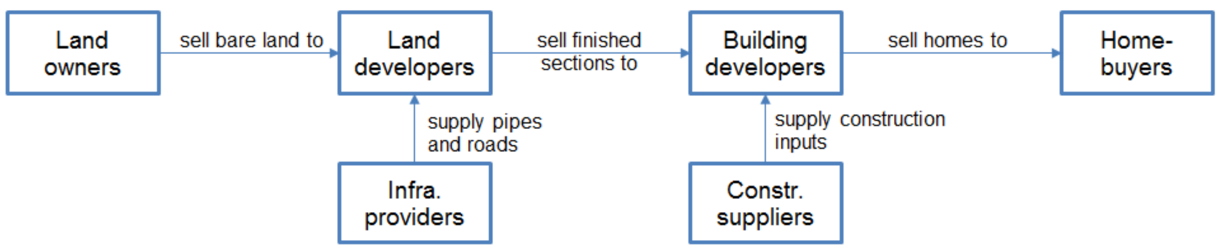


4.2.4 Future Urban Zones ('greenfields') Residential method

Due to the lack of 'plan enabled capacity' in the Future Urban Zones, a means of determining what might be possible at the site scale (under various potential future zonings that may be applied under future structure planning processes[13]) and what then might be feasible (under those assumed zonings and given present market conditions) has been created, utilising the Feasibility Tool provided by MBIE. MBIE outlined the development process (Figure 16), and note:

> Land development and building development are usually, although not always, undertaken by separate companies. Hence it is necessary to consider these as separate stages in the development process.
>
> This [Development Feasibility Tool] tool therefore includes two modules:
>
> (1) A land development feasibility model that analyses the commercial feasibility of developing new residential sections from previously undeveloped or vacated land, which could be either in a greenfield area or a major brownfield redevelopment area.
>
> (2) A building development feasibility model that analyses the commercial feasibility of developing distinct types of buildings on an existing residential section. This model could be applied to either a vacant section or a section with existing buildings or other constraints.
>
> While these two models are not integrated, they could be combined to model the feasibility of an integrated development undertaken by a single company. This could be done by using the outputs from the land development model (i.e. section costs) as inputs to the building development model, taking care to avoid double-counting costs for development and infrastructure contributions. (Ministry of Business Innovation and Employment, 2017b)

Figure 16: Diagram of modelling process



Source: MBIE

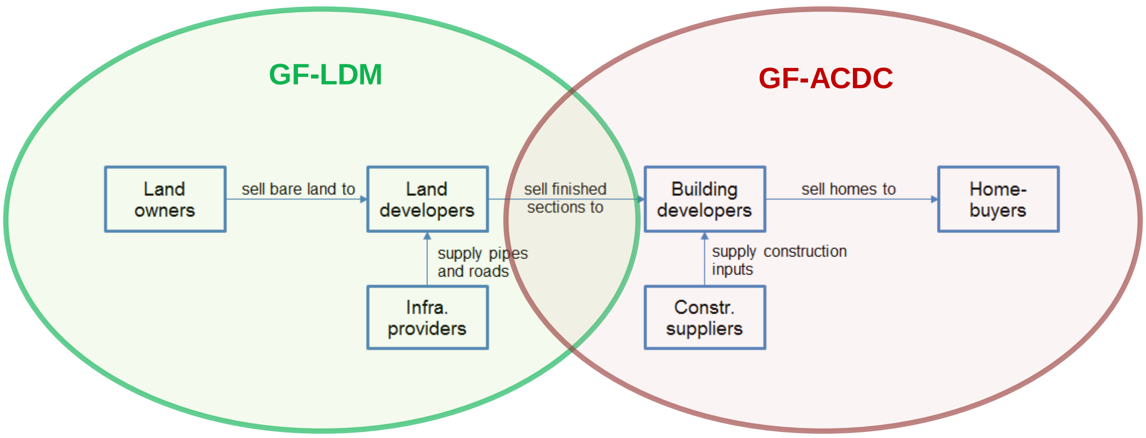
[13] Because of the 'one zone' approach taken to modelling in the various FULSS Locations the results of the modelling process are not useful as an indication or guide or target for detailed structure planning. The modelling approach can however be informed by preliminary more detailed zoning layouts and rerun to illustrate the impacts of these refined zoning decisions relative to feasibility, as only one of the several criteria that must be considered.

Modelling ‘potential capacity’ and ‘feasibility’ in the future urban areas, in accordance with the above diagram occurs through a two-step process covering the two halves of the diagram above. The first step is the Land Development Model which creates, from the existing rural titles (which are purchased using an adjusted 2014 CV from the current land owner by a land developer), capacity for serviced sections, under a range of sizes (which may be read as potential zonings), and select those that are feasible, on which subsequent dwelling development can occur that are sold to a dwelling developer. The second step involves the Dwelling Development Model that determines what dwellings are feasible (if any) on those feasible serviced sections, within a range of development parameters set by the ACDC settings that reflect the residential zonings in the AUPOIP.

Each of the stages is assumed to be undertaken by a separate actor[14], who must each gain a suitable return on their investment. The actors includes land developers who buys rural titles, installs roads and local infrastructure, sells land for reserves, schools or other wholesale purposes and sets aside some for protection, and then sells serviced sections, if they are feasible. The dwelling developer who purchases a newly created vacant serviced section at the retail price, and develops dwelling(s) on them, if that is feasible.

The modified diagram (Figure 13) illustrates how the two modelling stages relate to the processes described above.

Figure 17: Development process and relationship to models



[14] This approach would not correctly replicate more vertically integrated developers who undertake both stages, of land development and dwelling construction. The modelling approach could be modified to represent this by (for example) feeding non-feasible sections (e.g. no profit on the section is required but no loss is accepted) to the GF-ACDC Model.

Stage One, is modelled by the Greenfields Land Development Model (GF-LDM) is an additional step to the approach taken in the Urban Area, where the ‘development sites’ are already existing and serviced. The GF-LDM tests the feasibility of converting raw future urban land into serviced sections for retail sale[15].

Serviced sections from the GF-LDM are then input in to a slightly modified ACDC Model (GF-ACDC) that has been optimised to accept the input of ‘vacant serviced sections’ from the GF-LDM rather than plan enabled capacity from the CfGS. Other than the modifications required to deal with the different data input (including a single household unit equivalent, also known as a HUE, Development Contribution credit paid by the section developer, and a significant simplification as all inputs are vacant sites), all other aspects of the GF-ACDC Model are as per the ‘brownfields’ ACDC, including all of the Lookup Tables.

4.2.5 Greenfields Land Development Model (GF-LDM): Method

The Greenfields Land Development Model is essentially a copy of the Land Development Model component of the Microsoft Excel ‘Development Feasibility Tool’ which is explained as a “spreadsheet model can help councils determine how much development capacity, enabled in their plans and taking costs and revenues into account, would be feasible for a developer to develop. The model can be used on a standalone basis to understand the development feasibility of representative sites in specific greenfield or brownfield areas” (Ministry of Business Innovation and Employment, 2017b).

MBIE’s model is suitable for a single or representative site only. Given the diversity of locations within the FULSS, an FME based replica of the LDM[16] has been constructed that uses lookup tables to drive many of the key development cost assumptions (Appendix G), Council’s Strategic Frameworks to identify land indicatively set aside for business purposes, special activities (e.g. schools and major parks), and exclusion and protection areas (flooding and other hazards, environmental features, etc.), and CfGS based data that includes FUZ zoned title level information including zoning, site area, valuations and other data to model these areas.

The model then runs the titles input (identified by FULSS areas) though a process that tests a range (five, automatically generated between the input minimum and maximum density) scenarios:

[15] The conversion of ‘raw land’ to developable serviceable sections is also a highly contentious area of the planning system and is not well understood, other than by the developers who undertake it. Creation of a means to approximate this process, with a focus on the costs faced and impacts on returns will assist council and others to better appreciate the barriers and incentives to this key component of Auckland’s future growth.

[16] Interested readers will be able to closely replicate or review a particular rural titles modelled outcome by inputting the appropriate values (from the Appendix F lookup tables) or inputting their own values in the MBIE spreadsheet LDM, with the exception of the calculated wholesale and constraint areas, which are largely based on AUPOIP spatial data and the FULSS Strategic Frameworks.

- Calculates the 'net developable area' by removing
    - Non-developable land (exclusion and protection areas (flooding and other hazards, environmental features, etc.)
    - Assumed percentage for roads
    - Assumed percentage for stormwater/wastewater and landscaping reserves
- Calculates the 'net developable area for sections' by removing
    - Wholesale land' that is sold at cost after removal of the above but prior to application of DCs – this includes identified parks, storm water reserves and schools and hospitals and the like. (Presently this wholesale area is limited to specific identified areas in the Strategic Frameworks, but is included in anticipation of greater clarity as Structure planning progresses)
- Net developable area for sections is divided into a range of section sizes (set by LUTs), noting that the proportions of roads and reserves is relative to an assumed baseline density (higher densities assume lower net area available for section, as more is required for roads and reserves). The setting of the density range does require some consideration of the likely zoning framework, and for the purposes of this modelling has be tested in the 300 to 800 square metre range.[17]
- Costs of land clearance and earthworks are set using information gleaned from technical investigations for FULSS (e.g. geotechnical reports) and desktop analysis of vegetation, junk and buildings applied for each area/location;
- Development Contributions, WSL IGCs (applied as a HUE equivalent to each new site) telecoms and electrical connections, road and footpath construction, landscaping and etc. are costed on a per m2 of each basis;
- The sections are sold using the logarithmic size to price relationship between two sample sizes and prices (adjustable in the LUTs);
- Costs of each scenario are compared with the revenue from each scenario, and those that are feasible, (return greater than 20 per cent on costs before tax) if any, are then ranked by rural title based on percentage return (maximum profit being the default), sale price (cheapest sections) size (smallest and largest sections), etc.

[17] A possible area of improvement would be to apply a 'U' shaped curve (rather than the present natural log best fit) to very small sections where improved outcomes and consistency with real world outcomes suggest that below around 300 square metres typologies are likely to be attached suggesting a section size 'flip' to larger (1000 square metres) sections to enable better outcomes, better meet actual demand and potentially facilitate higher profits or lower costs.

The filtered feasible scenarios (by convention the default 'result' is the maximum return scenario) are then made available to the dwelling developer whose behaviour is modelled via the GF-ACDC Model[18], discussed in the next section.

4.2.6 Greenfields Residential Feasibility Model (GF-ACDC): Methodology

Viable section scenarios from the GF-LDM are then chosen and input into the GF-ACDC to test the feasibility of dwelling development on these new sections.

The GF-ACDC is a revised ACDC model optimised for the consumption of the GF-LDM data. The GF-ACDC Model utilises the same assumptions (as contained in the LUTs) as a the ACDC Model but does differ from the ACDC model in some key ways:

- All of the input development sites, being 'sections' from the GF-LDM are vacant, enabling simplification of many model components (no demolition costs, no infill or redevelopment processes)
- The 'sections' are a-spatial, other than being attributes associated with the parent title geometry, including the feasible size, price and total number of sections, DCs already paid and so on[19]
- For the purposes of modelling dwelling feasibility, one section is modelled, and the parent titles results are multiplied by the number of 'new lots' as every section is assumed to be substitutable within the parent lot (given they are exactly the same)
- DCs are calculated on the basis of the modelled typology, as per the ACDC model, and a credit for the HUE equivalent paid on the section is applied (negatives are reset to zero additional payment required rather than refunded as per the policy)
- IGCs, Electrical and Telecoms charges are treated in a similar way, again no refunds assumed
- As the parent titles and new lots are 'unzoned' (other than being in the FUZ), the GF-ACDC model requires a single AUP residential zone to be specified, which determines the built form parameters for dwelling feasibility modelling.

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[18] The MBIE/MfE spreadsheet based Building Development Model is essentially a simplified version of the existing ACDC model.

[19] The GF-LDC, GF-ACDC and ACDC model do not create 2D or 3D shapes of any of the tested developments, they are mathematical constructions. The models are essentially large calculators, not planners, designers, surveyors or architects.

4.2.6.1 Assumptions and limitations

This section contains the specific assumptions and limitations for the greenfield modelling. It should be read in conjunction with section 4.2.2.1 and the Lookup Tables.

- The locations in the adopted Future Urban Land Supply Strategy are the modelled areas, including now live zoned areas[20].
- GF-ACDC Sales Locations have been created from sales audit files and advertorial for new dwellings in new subdivisions (house and land packages) classified against the Reference Sales Price Ceilings, meaning the Sales Location Categories are often higher than the ACDC Model, which reflects the reference price of an average dwelling that includes a majority of second hand dwellings in built up areas[21].
- The greenfields feasibility approach assumes that existing land is bought, sections are created by ‘land developers’ and then sold for a profit at retail prices, to ‘dwelling developers’ who build and subsequently sell to residents/investors. Both steps include a minimum required gross profit of 20 per cent for each ‘developer’. Other approaches may be possible e.g. a spec builder purchasing $10 million worth of sections at commercial rates de-risking developments, or vertically integrated house and land package firms. These approaches can be modelled in a technical sense, but other than noting the potential for this to occur (improving feasibility as percentage profit is only required at the penultimate stage, on the total costs) it will be difficult to definitively determine where and when these situations may arise.
- The modelling utilises the current 2016/2017 Development Contributions Policy that does not presently include the currently estimated council infrastructure costs of approximately 10 to 15 billion needed to service these modelled areas[22].
- The Land Development Model due to the shape of the price/size best fir curve tends to develop lots into very small sections – perhaps too small given the typologies that would be reasonably expected especially on sub 400 square metre sections. Beyond a certain size, a ‘flip’ back to larger ‘super lots’ is potentially more likely.

[20] The ACDC Model has also modelled any ‘live zoned’ areas in the FULSS if they were zoned as at July 2017, strike date but as it is not optimised for large greenfields site development (which these areas are, other than the zoning). For reporting, the GF-ACDC Model results are used in preference.

[21] The ‘cooling market’ Scenario is run using the ACDC sales location categories illustrating the effect of this assumption on dwelling feasibility.

[22] The model can be used to test the relative impacts on feasibility of different approaches to cost recovery approaches, including significant decreases in ratepayer subsidy. Exact figures are expected to be included in the 2018 infrastructure strategy.

- Modelled sales price of sections or dwellings are based on present sales, which for some areas do not account for the value of future amenity which will have impacts on section price and size relationships and therefore feasible capacity[23].

4.2.7 Results

Approximately 146,000 residential dwellings are deemed commercially feasible. These dwellings have an average sale of $1.5 million (Table 11). Several scenarios have been included to illustrate how potential changes in input costs and profitability, zoning and the housing market might affect feasibility. As the table illustrates, there is significant variation in the results as these key variables change.

Table 11: Greenfields ACDC modelling results

Scenario	Sections model scenario	Dwellings model scenario			
		Feasibility threshold	Zoning	Feasible dwellings (000s)	Average sale price ($ million)
Baseline FULSS	Max % profit	≥20%	MHS	146	1.50
Baseline with reduced profit threshold	Max % profit	≥15%	MHS	192	1.40
Baseline with reduced profit threshold	Max % profit	>10%	MHS	288	1.21
'Restricted zoning'	Largest feasible sections	≥20%	Single House	73	1.83
'Enabling zoning'	Max % profit	≥20%	MHU	375	1.15
'Cooling market' (sales locations as per urban ACDC model)	Max % profit	≥20%	MHS	14	1.12

[23] This issue will also apply in existing urban areas that may experience significant changes in the provision of amenities or how they are valued over time as a result of infrastructure and transport changes, and intervening (re)development in and around these areas. For greenfields the issue is potentially exacerbated as present sales are of sites 'in the middle of nowhere' but in the future these locations will be in the heart of all new suburbs and town centres with much changes infrastructure base.

4.2.8 Housing New Zealand and KiwiBuild

Housing New Zealand (HNZ) is a major stakeholder in Auckland's housing market. Their intentions are to increase the number of units within Auckland, through the redevelopment of existing land and stock. Their development model is significantly different compared to the developer being modelled via feasibility testing in the urban and greenfield locations discussed above. Given Housing New Zealand's social mandate and their development intentions, their feasible capacity is not included in the results above. Rather it is assumed that they will develop in accordance with their publicly stated plans. At the current time it is assumed that HNZ will deliver 25,000 additional units over the 30 years period based on their Auckland Housing Programme (Harrowell, 2017) . This is made up of approximately 17,000 over the period 2016 – 2026 and another 8,000 through to 2046. Note these figures currently exclude development intentions within the Tamaki regeneration initiative.

In addition to the Housing New Zealand's plan, the new government's housing policy is to construct 100,000 high quality affordable homes in the next 10 years (2018 – 2028) of which 50 per cent are to be in Auckland. The policy is for standalone houses in Auckland to cost between $500,000 to $600,000, and apartments and townhouses under $500,000. It is unclear at this stage as to how this policy overlaps with HNZ KiwiBuild scheme. Accordingly, 25,000 additional units is probably a conservative estimate of future supply from central government.

Summary: Assessing commercial feasibility

- 140,000 dwellings are commercially feasible to construct in the urban area
- 146,000 dwellings are commercially feasible to construct in greenfield locations
- Feasibility of an additional 15,000 dwellings in the rural area is assumed as is 25,000 dwellings to be built on Housing New Zealand land.
- The feasibility analysis is a supplier's perspective uninfluenced by demand or actions of other suppliers.
- The scenarios are a sensitivity test, illustrating how changes in key modelling parameters impact on feasibility.

4.3 Assessment of the take-up of development capacity

4.3.1 Overview

Measuring the uptake of plan enabled and feasible capacity helps us understand what has happened on the ground compared to what has been modelled. It allows us to identify whether new built dwellings occurred within the bounds of the plan and whether capacity calculations align with actual development. The analysis can determine areas where development has either exceeded or been lower than what was planned or feasible.

This information can be used to calibrate further versions of the residential capacity assessment modelling, and provide insights into the way certain capacity types of capacity, in certain locations is consumed.

Auckland has undertaken several capacity assessments over the last two decades. To indicate how we might measure capacity uptake in the future, and what it might indicate, for this assessment, an analysis of capacity identified in the 2006 Capacity for Growth Study has occurred. The method used to undertake this analysis and the results are detailed below.

4.3.2 Method

Two datasets were used to measure the uptake of residential capacity identified in the 2006 Capacity for Growth Study (Table 12).

Table 12: List of data, descriptions and sources used to analyse the uptake of identified 2006 residential capacity

Data	Description	Organisation; source
Capacity for Growth Study 2006 results	Polygons (shapes) of all parcels in Auckland, annotated with data collected through analysis, including zoning, size, number of existing dwellings, valuation data, and capacity for additional dwellings including the type of capacity Capacity was calculated at March 2006. Full information on the method used to calculate capacity and the results of the study can be found in the Auckland Regional Council technical reports titled *Capacity for Growth Study 2006: Methodology and Assumptions (TR 2010/015*) and *Capacity for Growth Study 2006: Results (TR 2010/014).*	Auckland Council; Auckland Regional Council archives
Building consents	Points indicating the approximate location of building consents issued. Information associated with building consents include the month of issue, address, building type, floor area consented, value of building works, and number of dwellings or structures. Consents issued between April 2006 and August 2017 were used in this analysis.	Auckland Council & Statistics New Zealand; data collated by Auckland Council's Research and Evaluation Unit

Two approaches to assessing capacity update are employed. The first takes the 2006 capacity data and tags those parcels that have had any sort of building consent issued on them. This analysis is used to calculate the amount of capacity that has been taken up through development. The second, overlays building consent data with the 2006 capacity data and tags each building consent point with the capacity information of the parcel it intersects. This analysis allows us to calculate the amount and type of development that has occurred, and its location.

Limitations and assumptions of this analysis include:

- The building consent data supplied to Auckland Council by Statistics New Zealand is converted from a text file (address data) to a spatial file (point) using and the geocoding tool in ArcGIS. Part of this process is automated but some manual matching to address is required. Accuracy of the matching process is high, but older data may have matched some consent information to the wrong location, such as a similar address elsewhere in the region.
- The use of building consent information cannot be used to determine the net change in the number of dwellings on a parcel, or in any geographic area. Owners or developers of properties with existing dwellings on are not required to inform council of their intention to remove or demolish residential dwellings that are less than three storeys tall through the building consent process, under the Buildings Act 2010. As such we are unable to determine whether consents for dwellings issued on parcels with infill capacity are for infill development or the redevelopment of part or the entire site.
- This analysis only approximates the uptake of capacity measured at the time of the Capacity for Growth Study 2006, and does not consider changes in capacity that have taken place through plan changes that have occurred since the study.
- The method, limitations and the results of the Capacity for Growth Study 2006 can be found in *Capacity for Growth Study 2006: Results* (Gamble, 2010a) and *Capacity for Growth Study 2006: Methodology and Assumptions* (Gamble, 2010b).
- It should be noted that most of the analysis assesses the ability of parcels that are zoned for residential use in 2006. Residential zones exist both within the city's main urban areas (inside the Metropolitan Urban Limits that were in place at the time), as well as in residential zones in rural towns and settlements.
- The Capacity for Growth Study 2006 did not assess residential areas that were developed from 1990 to 2006 for additional capacity.
- Parcels can have both infill and redevelopment capacity. This means that parcels can have two capacity figures calculated for it. To prevent double counting, for the purposes of this analysis, parcels that have both infill and redevelopment capacity have been included in the infill category, while those parcels that have only redevelopment capacity have been included in the redevelopment category.

4.3.3 Results

4.3.3.1 Uptake of residential dwelling capacity on residential parcels

The Capacity for Growth Study 2006 assessed that there was capacity for an additional 95,446 dwellings on 66,115 parcels in the Metropolitan Urban Area and within rural towns. Analysis showed that 9,453 of those parcels had had a building consent issued on them between April 2006 and August 2017 (Figure 18).

Figure 18: Number of parcels with residential capacity identified in the Capacity for Growth Study 2006 that have or have not had development (building consent issued)

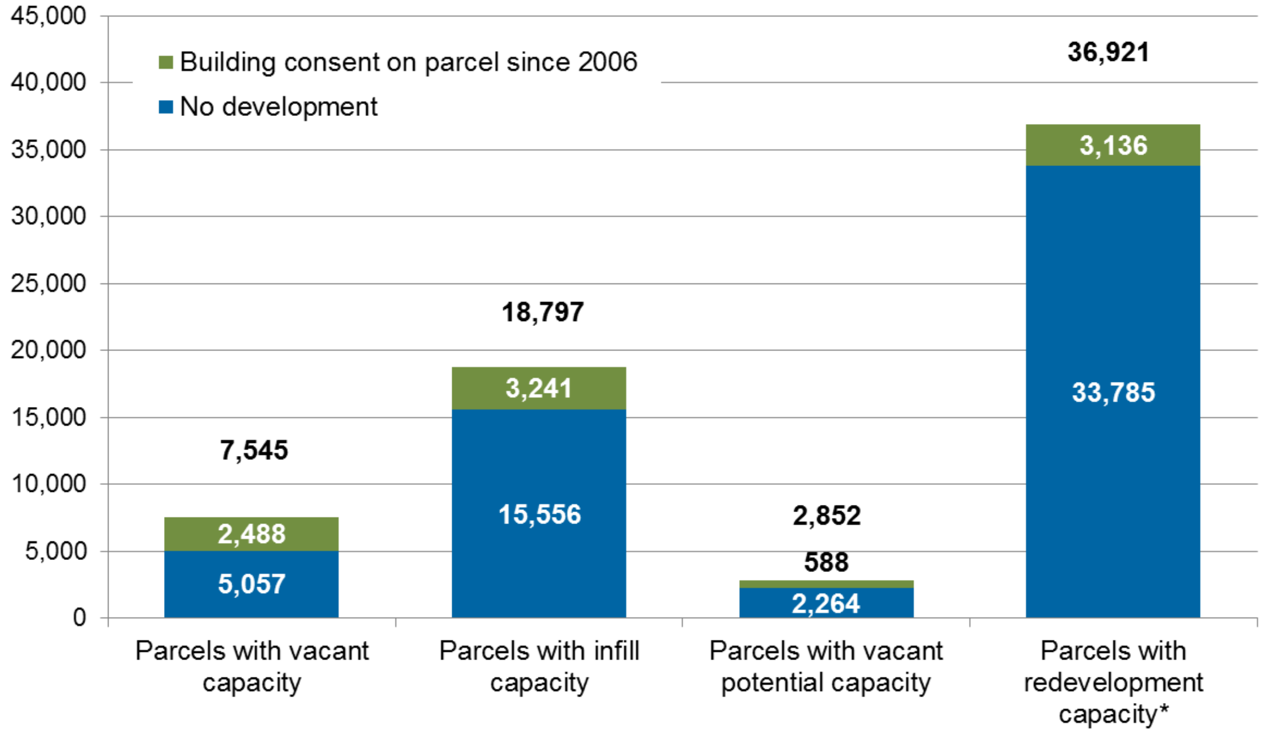


Figure 19 shows the amount of capacity for additional dwellings that were measured in the 2006 study, by capacity type – the figure contrasts this with the number of residential dwellings consented on those parcels. This comparison can be used as an indicator as to how much of the capacity measured in 2006 as been taken up, but as we are unable to determine where existing dwellings have been demolished or removed it does not indicate net change.

Figure 19: Capacity for additional dwellings identified in the Capacity for Growth Study 2006 and the count of dwellings that have been consented (April 2006 to August 2017) on sites with capacity, by capacity type

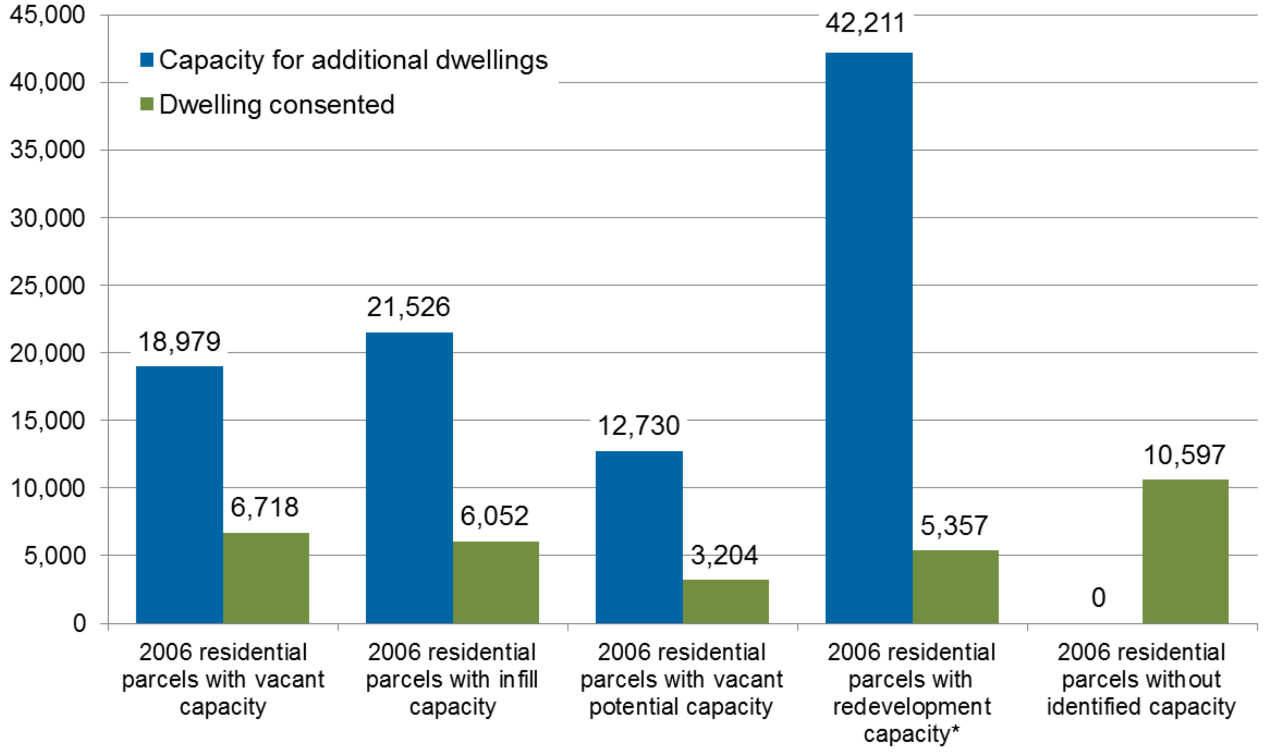
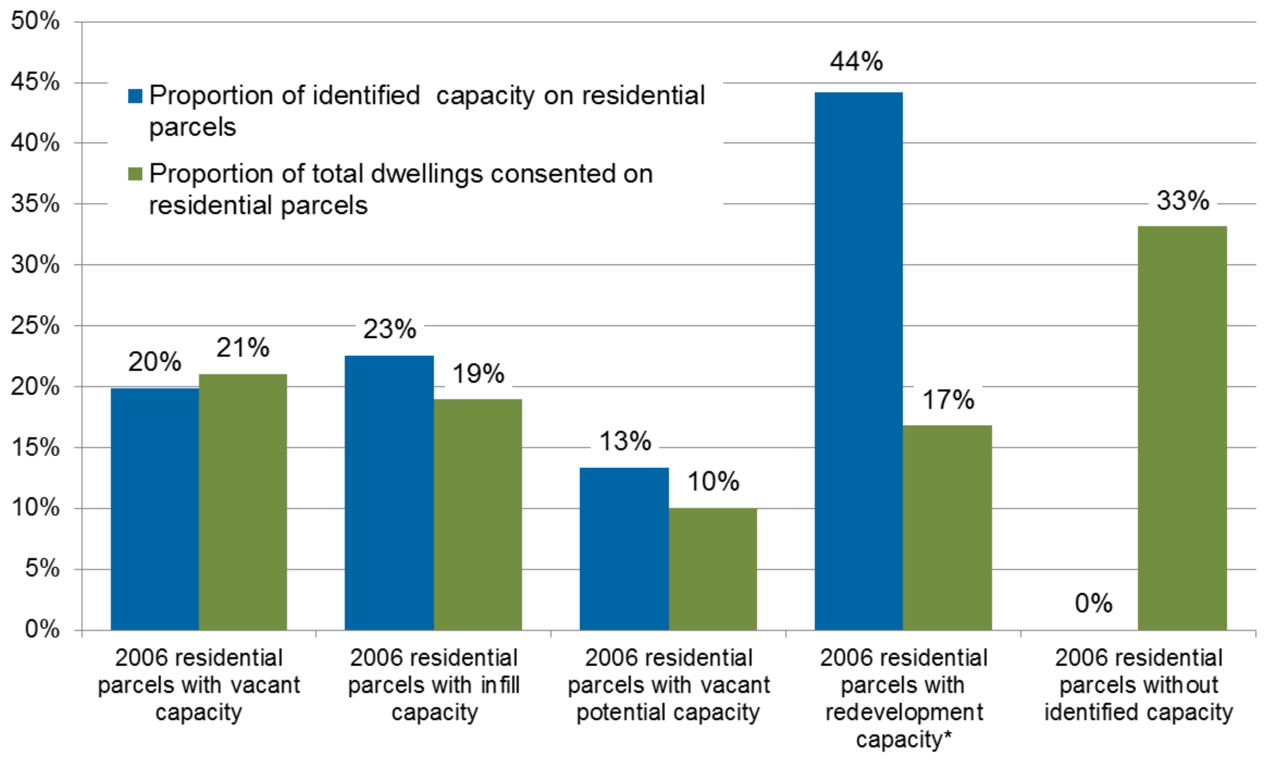


Figure 15 suggests a weak relationship between the parcels with capacity identified, versus the amount of take-up as measured by buildings consented. When comparing the proportions of parcels with capacity by type, and the buildings consented, there is a much stronger correlation (Figure 20), especially between development and parcels that had vacant, infill, and vacant potential capacity identified.

Figure 20: Proportions of capacity for additional dwellings by capacity type compared to proportion of number of dwellings consented (April 2006 to August 2017) by capacity type

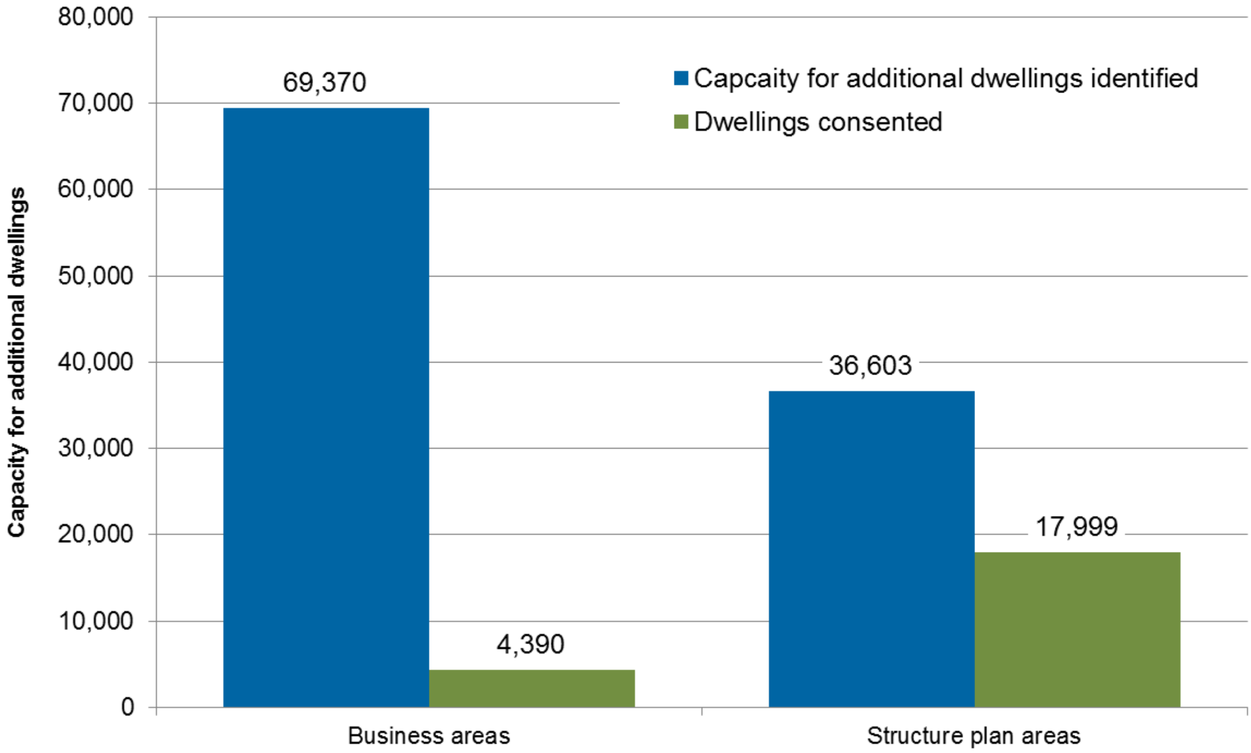


4.3.3.2 Business areas and structure plan areas.

Residential development can occur in non-residential zones. The Capacity for Growth Study 2006 measured the capacity for residential dwellings in business areas, such as the city centre along with metropolitan and town centres, where dwellings were permitted under the planning rules. Structure plan areas in the 2006 study included areas that were likely to be residential or business in the near future, but were currently zoned for another use, were going through a plan change process to change the zoning, or had recently completed the plan change process.

The 2006 study found that business areas had capacity for an additional 69,370 dwellings, and structure plan areas had capacity for an additional 36,603 areas (Figure 21). Analysis shows that in business areas, consents for 4,390 dwellings have been issued, comprising 1491 stand-alone dwellings and 2889 apartments, terraced houses, and flats. In structure plan areas 17,999 dwellings have been consented, comprising 15,375 stand-alone dwellings and 2624 apartments, terraced houses, and flats.

Figure 21: Capacity for additional dwellings (2006) in business areas and structure plan areas, and the number of dwellings consented between April 2006 and August 2017



4.3.3.3 What do these results show?

This analysis shows that capacity for additional dwellings identified in the Capacity for Growth Study 2006 has been taken up in many locations, especially on parcels that were identified as vacant or having infill capacity. One third (33 per cent) of parcels that were vacant in 2006 have had development on them, with lower take up on parcels that had been identified as having vacant potential and infill capacity (21 per cent and 17 per cent respectively). Parcels with redevelopment capacity that had no infill capacity had the lowest level of take up, with just eight per cent of parcels identified having development occur on them.

This analysis also shows that a large number of dwellings were consented on parcels on which no capacity was identified in 2006 – just over 10,000 dwellings or one third (33 per cent) of the total dwellings consented.

Take-up has also been strong in structure plan areas, with close to 50 per cent of capacity for additional dwellings now used.

4.3.4 Monitoring capacity uptake in the future

The datasets created as part of the capacity modelling undertaken for this assessment are different to the 2006 data analysed above. In three years' time Auckland Council will need to report on how both plan enabled and economically feasible residential capacity identified in this report has been taken up. While the method is yet to be finalised, a number of datasets that may be useful to undertake this calculation have been identified. These are:

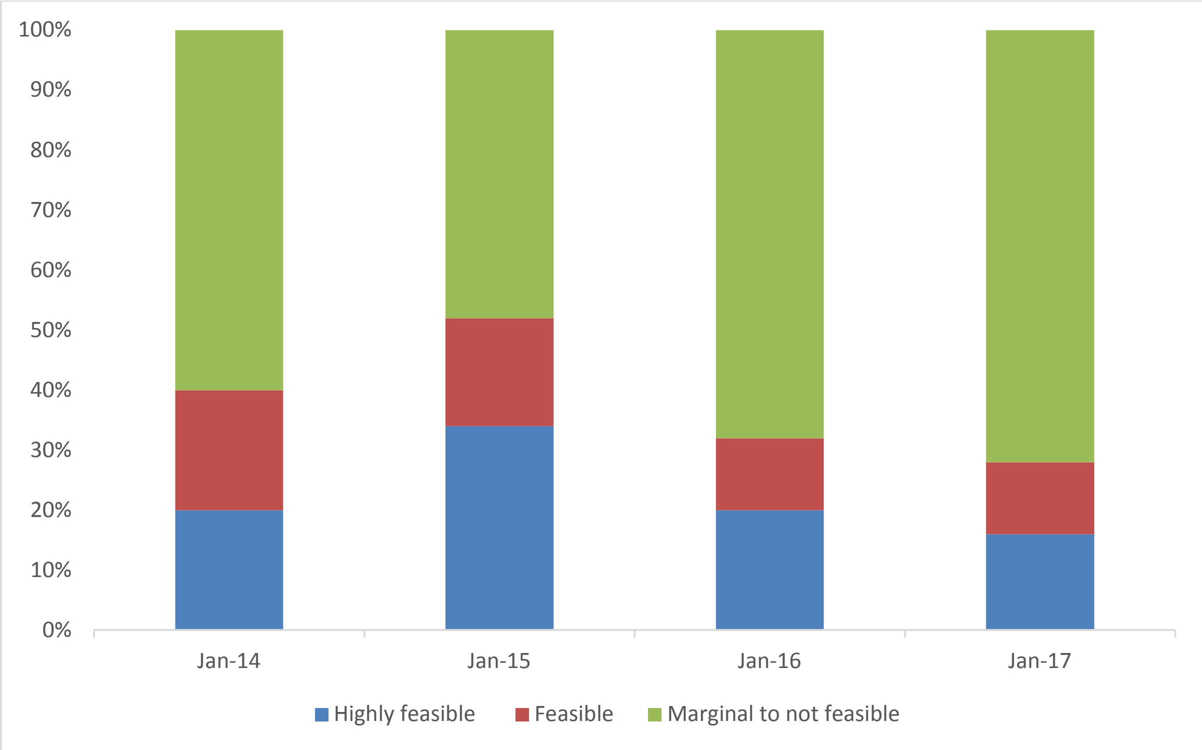
- Building consent data from Statistics New Zealand and Auckland Council. This is the same data used in the analysis above.
- Code Compliance Certificate (CCC) data that can be matched to spatial data that allows mapping and spatial analysis. Reliable data has been back-cast to October 2013, and is now updated monthly.
- District Valuation Roll (DVR) data for rates assessment areas. This data includes information such value of rates assessment areas and includes other details such as the number of rateable units (which for residential areas is often the equivalent of a dwelling). Monthly snapshots of this data are now being collected (from August 2017) to allow monitoring and analysis over time.
- Property boundary data, including parcels and titles. Auckland Council started collecting annual snapshots of spatial property datasets in July 2013 for monitoring purposes. In October 2013 the collection of monthly snapshots to be used for monitoring of the Auckland Housing Accord commenced.

4.3.5 Assessment of proposed apartment project abandonments

Examining the outcomes of individual projects is another means to understanding uptake. CBRE undertakes analysis of Auckland's apartment market. The supply of apartments peaked between 2003 and 2006, falling away significantly after the global financial crisis. Many apartments were sold to investors and most developments were in Auckland's city centre and fringe areas. Since 2015 the market has diversified; apartments are increasingly sold to owner occupiers, they are spread throughout the region and a broader range of sizes are being constructed.

While demand for apartments is strong, this form of development contains risk. CBRE's analysis of abandonments shows this. Since January 2014 some 29 apartment projects, totalling just over 2100 units, have been abandoned. Some of the abandoned projects had a large proportion of presold units. More recent analysis shows a decline in the proportion of suburban apartment projects since June 2015 (Figure 22). While project abandonments are part of the development landscape, CBRE's analysis shows the importance of balancing location, typology and price while still allowing for development profit is key for feasibility.

Figure 22: Apartment development feasibility of individual suburbs in Auckland



Source: CBRE, 2017

Summary: Assessing uptake

- Capacity for Growth Study results and location information on building consents issued can be used to assess where capacity for residential dwellings has been taken up
- Between April 2006 and August 2017, 9,453 of parcels had had a building consent issued on them that also had capacity identified on them in the 2006 study.
- When comparing the proportions of parcels with capacity by type, and the buildings consented, there is a strong relationship.
- Using consent and development information can be used to refine the plan enabled and feasibility models.

5.0 Sufficiency of housing capacity to meet demand

5.1 Aggregate demand and supply matching

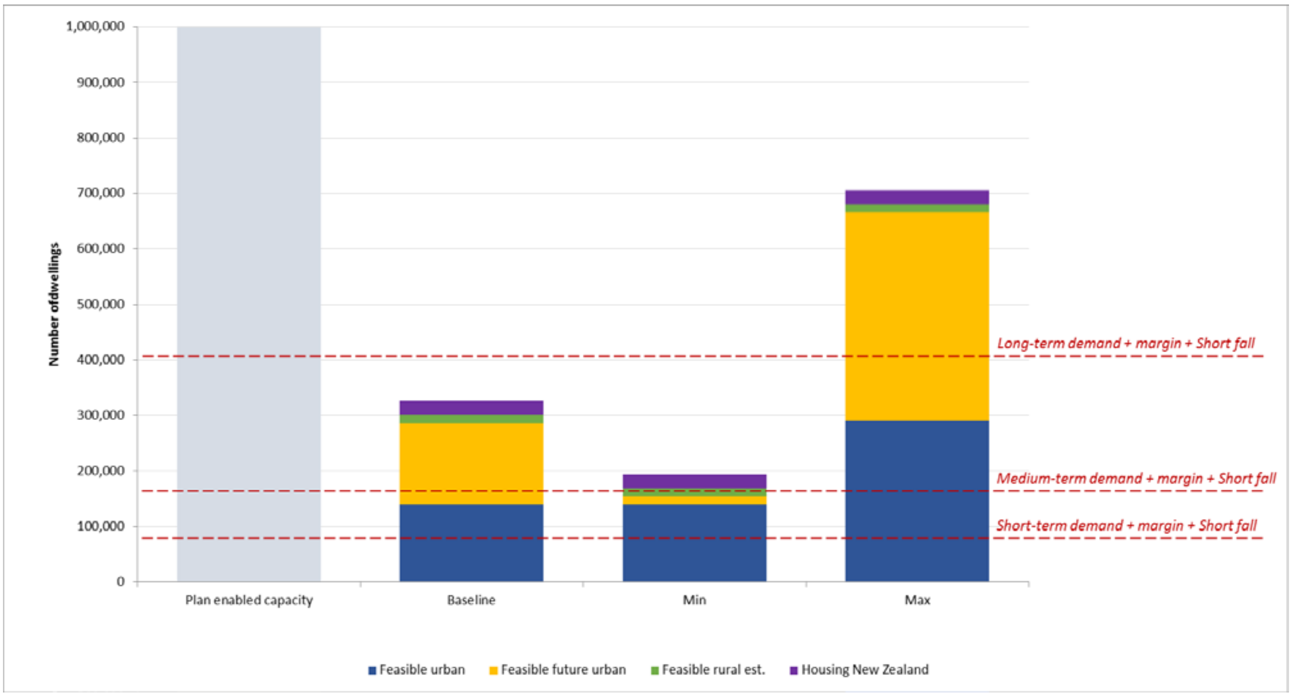
The primary objective of the housing demand and supply analysis is to test the sufficiency of the supply of feasible development capacity. The NPS-UDC evidence and monitoring guidance illustrates how sufficiency should be analysed. The approach is replicated below.

The expected level of residential demand over the next 30 years is 319,000 dwellings because of population growth plus an additional 35,000 dwellings because of the supply not keeping pace with underlying demand (the 'shortfall'). A 20 per cent margin is placed on demand on the short and medium terms and a 15 per cent margin on the long term.

Feasible capacity (baseline) is estimated to be 331,000 residential dwelling units of which 140,000 are in the urban area, 146,000 are in the future urban area, and 15,000 are rural, while Housing New Zealand contributes 25,000 dwellings.

As shown in Figure 23, baseline demand exceeds feasible supply in the long-term but not in the short or medium term.

Figure 23: Comparison of short, medium and long-term demand with alternative feasibility scenarios



A minimum and a maximum scenario are included for comparative purposes. In the minimum scenario, the lowest feasible capacity modelled for the urban and future urban areas is included and the opposite in the maximum scenario. The scenarios are included to recognise that the feasibility modelling shows a range of feasible options exist for developers.

For the purposes of this analysis the long term demand was calculated for a 30 year period from 2017, whereas the NPS-UDC defines long term demand as being that between 10 and 30 years (the 20 year period from 2027). Calculating the sufficiency of demand for housing using the period defined by the NPS-UDC shows that there is no shortfall of supply in this period.

5.2 Detailed demand and supply matching

This section summarises the insights developed in Section 4.1 regarding dwelling prices formation and identification of market segments, to match potential buyers to the additional dwelling capacity developed in Section 5. The approach helps address several aspects of the NPS-UDC. These include: what characterises the households that buy a dwelling? Is the rate of housing take-up high enough to guarantee commercial viability? Are the price distribution set by developers and income distribution of households compatible with housing affordability? Does the profile of the additional capacity across scenarios make a difference on the rate of take-up?

5.2.1 Method

We rely on a mathematical programming model to construct a housing allocation problem (HAP). The HAP represents a number of households who own the same number of houses, and each household has preferences over her and other houses. Preferences are configured as an ordinal ranking of houses that each household would be willing to buy. Each household pays the corresponding price to the initial owner and a house is allocated to the household with the strongest preference (i.e., the highest valuation). The analysis examines the extent to which the feasible capacity is commercially viable under reasonable assumptions behind the behaviour of the potential demand. The theoretical basis of the model and other procedures involved are discussed in the appendix.

5.2.2 Demand

The method to create the demand side is summarised as follows:

1. The 40 market segments identified in Section 3.3. It is assumed that a household may relocate only within a segment of distance, e.g., a household residing in segment 30 can only relocate to segments 29 or 31. Segments are then aggregated into 13 sections, and thus a household may relocate only within each section. Though this section aggregation may appear constrained, the market segments introduce flexibility on household mobility across the city rather than assuming that only geographic contiguity determines the possibility of dwellings substitution.
2. Several representative agents are created that mimic the potential demand of the additional houses. Three variables, namely: household income, weekly rent and the share of household type (single person, couple without children, couple with children, single-parent household) are used to mimic demand. Using census area unit (CAU) from the 2013 census data, average values of income and rent are created; it is assumed that CAU figures can be downscaled to meshblocks. Predictions from a regression analysis between rent and income and household type serve to impute consistent income and rent levels. It is assumed that 9,000 households are first-home buyers and will participate in the matching

mechanism. It should be noted that these households will only buy the new houses corresponding to the additional capacity induced by the NPS-UDC or a changing housing environment.

3. Meshblocks and market segments are combined to create a distribution by household type from which the 10 with the highest income are extracted. Thus, a spatial match between market segments and meshblocks to represent the relocation potential across Auckland is created. In case there is more than one segment in a meshblock, the lowest one is taken.

The number of representative households and average income by household type and section appear in Table 13 and Table 14, respectively. Dispersion of income is high within meshblocks and across sections, which explains the impossibility to define a decreasing pattern from sections 1 to 13. For the demand assessment we assume no income, demographic or economic shocks alter household formation and composition. The sample amounts to 9,017 households, where more than 90 per cent concentrates between sections 9 and 13, that is, market segments where dwelling prices are relatively low compared to other wealthier areas of Auckland. Household composition is 27 per cent and 28 per cent for couples and couples with children, and 22 per cent for single-parent and single-person households. Table 15 compares households in the entire Auckland region and the sample of representative agents. Average income and weekly rent are not dissimilar; the shares of household types differ because we take the 10 highest incomes by household type and meshblock. Because of census data limitations on wealth and assets, our approach explores take-up as a function mainly of income and not on equity. Nonetheless, annualised deposits (prior dwelling purchases) are modelled in the objective function.

Table 13: Number of households by type

Section	Couple (no children)	Couple with children	Single parent	Single person	Total
1	1	2	3	2	8
2	1	1	3	1	5
3	2	3	2	5	12
4	9	13	6	6	34
5	9	8	10	6	33
6	17	11	8	14	50
7	41	50	29	37	157
8	56	59	52	52	219
9	143	160	103	104	510
10	267	301	219	226	1013
11	563	584	449	458	2054
12	940	943	730	777	3390
13	404	408	355	365	1532
Total	2453	2543	1969	2053	9017

Table 14: Average income by household type and section

Section	Couple (no children)	Couple with children	Single parent	Single person
1	179,612	242,361	140,310	60,467
2	228,613	205,796	123,043	89,100
3	224,570	169,231	143,397	148,309
4	230,620	203,844	125,881	82,561
5	239,423	218,844	152,934	92,498
6	214,786	210,062	136,937	69,882
7	220,557	200,217	137,356	78,480
8	223,036	194,262	142,524	77,979
9	212,812	198,364	135,182	76,950
10	206,541	192,941	128,653	69,595
11	203,338	184,095	127,994	74,907
12	196,470	175,930	122,132	67,996
13	165,520	144,099	113,455	83,332

Table 15: Descriptive Statistics for Auckland and the Sample of Representative Households

		Annual income[1]		Weekly rent[1]	
	Share (%)	Mean	SD	Mean	SD
Auckland: 392,052 households					
Couple with children	36.6	176,080	121,770	588	120
Couple	25.9	195,603	116,649	549	121
Single person	23.1	64,335	71,910	449	316
Single parent (with children)	14.4	120,208	96,840	588	120
Sample: 9,017 households					
Couple with children	28.2	177,496	42,016	603	58
Couple	27.2	196,446	37,183	558	52
Single person	22.8	73,661	39,314	427	53
Single parent (with children)	21.8	134,354	34,350	593	48

Notes: [1]Values updated to 2017. From Census data we take rent by number of bedrooms and assume that one-bedroom houses are bought or rented by single-person households; two-bedroom houses by couples with or without children and single-parent households; houses with three or more bedrooms by couples with children or single-parent with children

5.2.3 Supply

Supply consists of the additional dwelling capacity induced by the NPS-UDC or changes in the housing environment. That is, the approach investigates the take-up of new dwellings and not on resale of currently existing dwellings.

The urban feasibility model tests nine developments per site, thus a selection process is required to determine which of the nine options is selected. A minimum feasibility criteria is the initial filter, so that only developments returning 20 per cent (the default) are passed forward for further filtering, which may result in a site having either no feasible development options, one or more. From the options, the output scenarios reflect the criteria used for a developer to select any of them, namely:

- The maximum-return or profit-descending (PD) scenario represents profit-maximiser developers, for example, if there are two possible feasible developments, returning 25 per cent and 22 per cent gross return on costs input, the developer will choose the 25 per cent return option. This may be considered the ‘yield seeking capital preferred’ option. This scenario consists mainly of large and relatively more expensive dwellings relative to the other scenarios.

- The minimum-price or price-ascending (PA) scenario represents a developer selecting the feasible development option whose dwelling retail price is the lowest. This would be the option that shows the lowest possible dwelling price that a profit motivated development community can deliver, and would be the “affordable housing advocates option”. For example, if two feasible development options are available where dwelling prices are $800,000 and $900,000, the developer will choose the lowest price. This scenario consists of relatively smaller dwellings as the feasibility model assumes floor space and price are strongly linked.
- The minimum project cost scenario chooses the feasible development option whose aggregate input cost is the lowest in dollar terms. This option is developed as the maximum return scenario may require both significant capital inputs and are typically more complex projects, and may be beyond the reach of the ‘average developer’, particularly where the developers own dwelling is used as collateral. This would be the option of lowest input costs that a profit motivated development community can deliver, and would be the ‘small developers’ option – e.g. two feasible development options one that generates higher percentage profits but requires $10 million to generate, versus another option that requires only $1 million of inputs even if it’s at a lower percentage return will be chosen. This option tends to provide a mix of dwelling sizes and prices somewhere between the other two ‘extremes’.

For the purposes of generating inputs to the demand model, which currently has a maximum supply input limit of 6000 dwellings, the most profitable, cheapest or lowest input cost developments are chosen from combined outputs of both the Urban and Greenfields feasibility models. A restricted set of dwelling criteria are carried forwards including a stratified dwelling retail price (modelled dwelling price plus a random number between zero and one), typology (house terrace, apartment) some locational information and the number of bedrooms.

The feasibility scenarios represent the potential spatial and price distribution of housing in Auckland. This analysis at unit-level allows a one-to-one matching between housing supply and household demand, conditional to the mobility determined by the market segments. The scenarios seek to represent the spatial variability of feasibility dwellings conditional to prices and other features inherent to the feasibility model. Thus, the distribution of dwellings by scenarios and sections (Table 16) shows that for the PD scenario, no dwellings are deemed profitable by developers in Section 13, i.e., relatively poorer areas; whereas the PA and CD scenarios, no dwellings are feasible to develop in Sections 1 and 2, i.e., relatively wealthier areas.

For the PD scenario, a bulk of dwellings (67 per cent) is developed in intermediate-price sections 6 to 10. Terraces only account for 4.5 per cent of the feasible dwellings which are in sections 2 to 9. On the contrary, for the PA and CD scenarios, 83 per cent and 88 per cent of the feasible dwellings (houses and terraces), respectively are concentrated in sections 10 to 13. It should be noted that terraces become feasible for the PA and CD scenarios and account for 20 per cent and 28 per cent of all feasible dwellings.

Accordingly, for the PD scenario, average dwelling prices tend to be higher in sections 1 to 6, compared to the rest of the sections (Table 17). The PA scenario does not show a clear decreasing pattern on prices which is explained by the high variability of prices even in neighbouring locations. Overall, average prices of houses in the PD scenario are 29 per cent and 25 per cent higher than for the PA and CD. Likewise, prices of terraces in the PD are 64 per cent and 36 per cent higher than for the PA and CD.

Table 16: Number of Dwellings by Scenarios and Sections

	Scenarios								
	Profit Descending			Price Ascending			Project Cost Descending		
Section	Houses	Terraces	Total	Houses	Terraces	Total	Houses	Terraces	Total
1	133		133						
2	254	6	260						
3	386	11	397	2	2	4	1		1
4	23	39	62	30	1	31	1		1
5	505	18	523	3	1	4	1	1	2
6	604	61	665	76	2	78	1	10	11
7	682	12	694	21	10	31	27	43	70
8	593	114	707	285	29	314	80	31	111
9	951	11	962	491	91	582	415	94	509
10	988		988	591	102	693	624	162	786
11	234		234	583	438	1021	640	494	1134
12	375		375	1428	515	1943	1560	819	2379
13				1275	24	1299	972	24	996
Total	5728	272	6000	4785	1215	6000	4322	1678	6000

Table 17: Average Sale Price by Dwelling Type and Section

	Scenarios					
	Profit Descending		Price Ascending		Project Cost Descending	
Section	Houses	Terraces	Houses	Terraces	Houses	Terraces
1	1,669,500					
2	1,170,001	1,809,601				
3	1,160,355	1,776,568	1,144,500	973,081	1,296,001	
4	1,294,310	2,373,120	766,174	1,259,281	1,296,001	
5	1,472,834	1,735,068	1,444,500	1,259,281	1,296,001	1,501,500
6	1,490,412	1,675,154	970,251	973,081	1,296,001	1,331,454
7	1,036,534	1,742,645	1,052,343	973,081	962,791	1,238,061
8	1,122,494	1,754,979	821,414	1,150,722	684,006	1,357,973
9	1,023,713	1,809,601	702,964	1,152,349	651,148	1,295,844
10	1,079,232		722,885	1,166,687	796,143	1,358,177
11	985,513		1,027,565	1,110,953	857,929	1,302,041
12	1,093,753		1,000,521	1,080,020	841,857	1,292,093
13			721,663	1,187,731	721,159	1,501,500

5.2.4 Simulation Results

The purpose of the matching simulation is to identify the type of households that may buy a particular dwelling, conditional on income and price distributions. The scenarios configured for the simulation represent the future outcomes of three potential supply settings. Households know in advance the location and prices of the additional housing capacity and their mobility is determined by the market segments. Thus, we assess whether the additional capacity is consistent with the purchase capabilities of the demand. The consistency between demand and supply could be measured through the rate of take-up.

Table 18 shows that for the PD scenario 2046 dwellings are sold and 3954 (65.9 per cent) remain unsold. Thus, developers may anticipate that a large share of the additional capacity will remain idle, so that they decrease supply to remain commercially viable and match the low rate of take-up.

As in Table 17, dwelling prices across all sections are comparatively lower for the PA and CD scenarios relative to the PD. Consequently, 5276 dwellings are sold and 724 (12.1 per cent) remain unsold for the PA; and, 5443 dwellings are sold and 557 (9.3 per cent) remain unsold for the CD. That is, under the PA and CD scenarios, the rate of take-up more than doubles the PD.

Regarding household types, as we assume that one household buys one dwelling only, for the PD scenario, 4532 households (50.3 per cent of the sample) cannot afford a dwelling; whereas for the PA and CD scenarios the figure decreases to 3741 (41.4 per cent) and 3574 (39.6 per cent), respectively. Across the scenarios, couples with or without children buy at least 80 per cent of houses, but under the PD scenario only three terraces are sold, whereas under the PA and CD scenarios couples buy 945 and 1102, respectively. Though single-parent households buy less than half of dwellings than couples, it should be noted that the number of dwellings bought under the PA and CD scenarios is at least 2.5 times higher than under the PD. It is worth mentioning that the output of feasibility model, used to mimic the supply side of the housing market, did not find it feasible to develop apartments or one-bedroom dwellings, which implies that no single-person household is buying any dwelling across the scenarios.

The output of the matching simulation in Table 18 serves to predict residential-selection patterns in Auckland. The main implication is that the greater rate of take-up under the PA and CD scenarios show that purchases are determined by the dwellings prices distribution rather than the stringency of the modelling assumptions, i.e., household mobility within each section. That is, the rate of take-up is low because households cannot afford paying a mortgage close to 50 per cent of income, in addition to not having enough wealth to pay the deposit.

Table 18: Number of houses sold

	Scenarios								
	Profit Descending			Price Ascending			Project Cost Descending		
Household type	Houses	Terraces	Total	Houses	Terraces	Total	Houses	Terraces	Total
Couple (no children)	926	2	928	1831	481	2312	1757	578	2335
Couple with children	800	1	801	1698	464	2162	1707	524	2231
Single parent	317		317	676	126	802	727	150	877
Total	2043	3	2046	4205	1071	5276	4191	1252	5443

Along with prices, the spatial distribution of the additional capacity also sets the conditions for demand response.

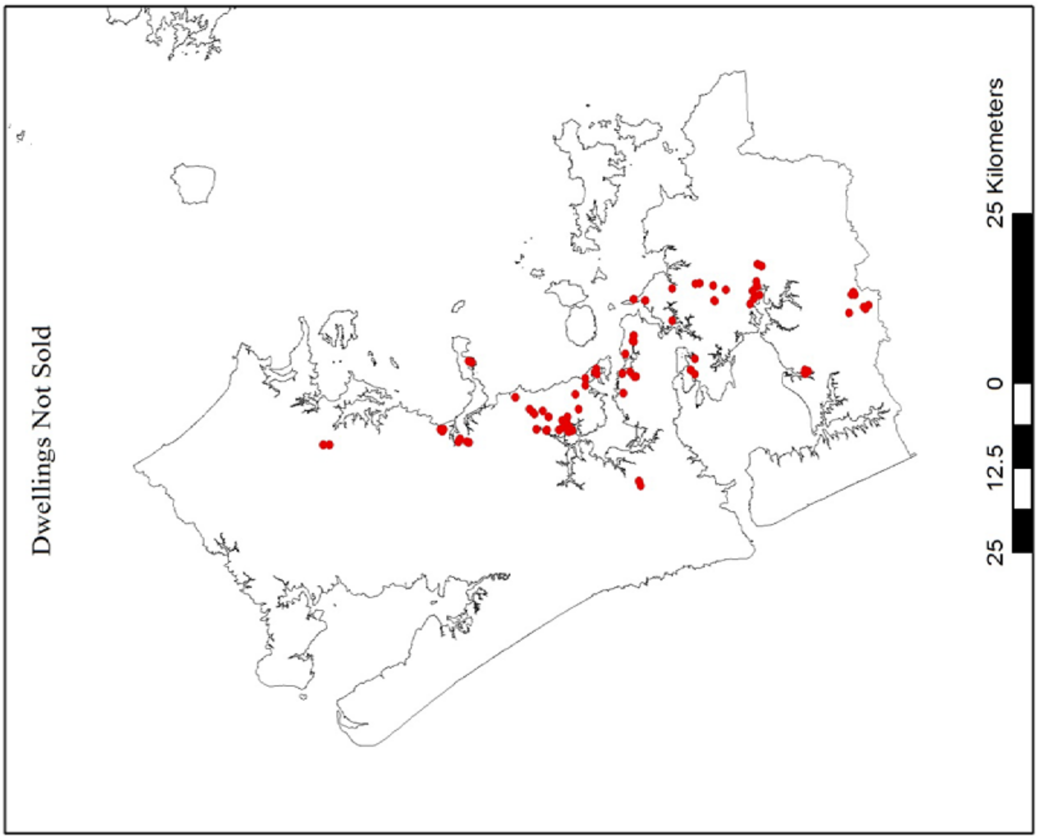
Figure 24, Figure 25, and Figure 26 show clear spatial variations in the matching solutions across scenarios. Expensive houses supplied under the PD scenario, that remain unsold, concentrate on wealthy coastal areas, e.g., Eastern Bays, North Shore. Dwelling supply is almost non-existent in other higher-density areas such as the isthmus and South and West Auckland. The PA and CD scenarios, in turn, are characterised by dwellings developed in relatively more affordable areas in West and South Auckland, as well as the North Shore and the Isthmus. The rate of take-up is higher than in the PD scenario, where those dwellings that would remain unsold are scattered across the city with no particular concentration.

Hence, it is evident that additional capacity where prices are high and where dwellings are located in wealthy areas of Auckland are not entirely compatible with the simulated demand in this study. It is still likely that the unsold houses are actually bought by high-income households not incorporated in the simulations, but we argue that number may not be high enough to close the idle capacity of the PD scenario.

By comparing the Eastern Bays areas in Figures 1 to 3, dwellings that remain unsold in the PD scenario are located roughly in the same areas as the houses actually sold under the PA and CD scenarios. This result indicates the following:

(i) The presence of several market segments in small geographic areas which justifies using the hedonic prices setting described in section 4.1; and,
(ii) The driving effect of the prices distribution to motivate demand response.

Figure 24: Spatial Distribution of House Trading - Profit Descending Scenario



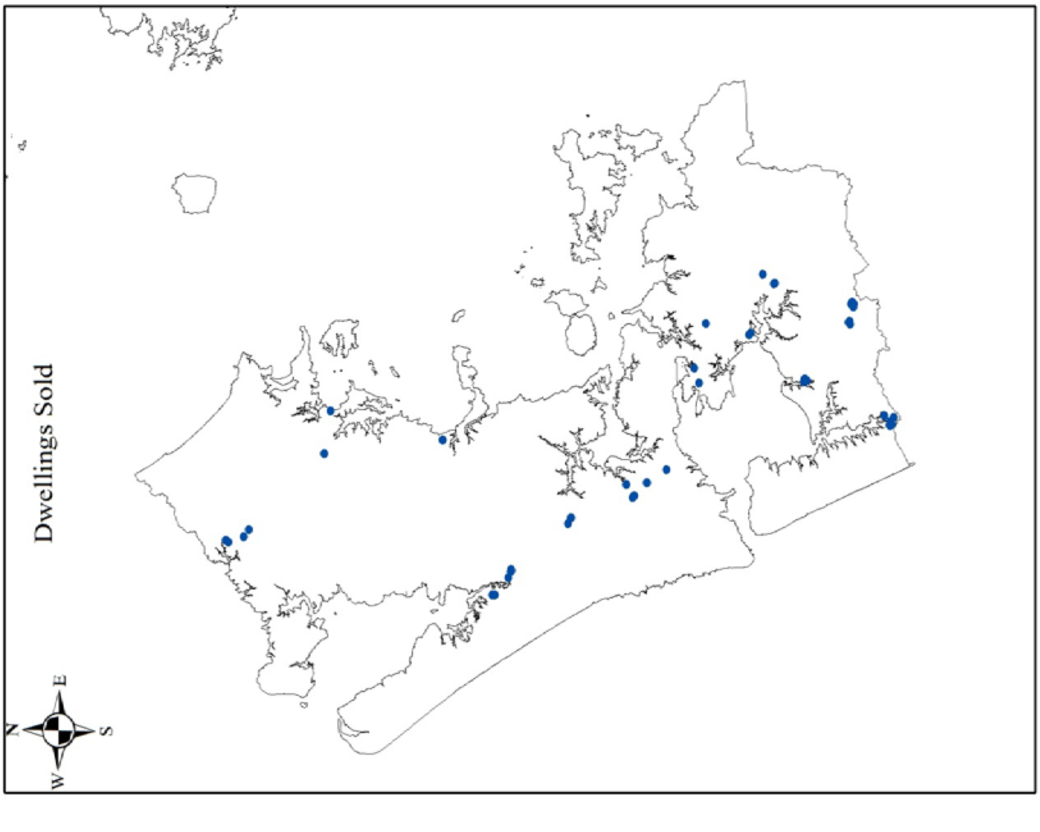


Figure 25: Spatial Distribution of House Trading – Price Ascending Scenario

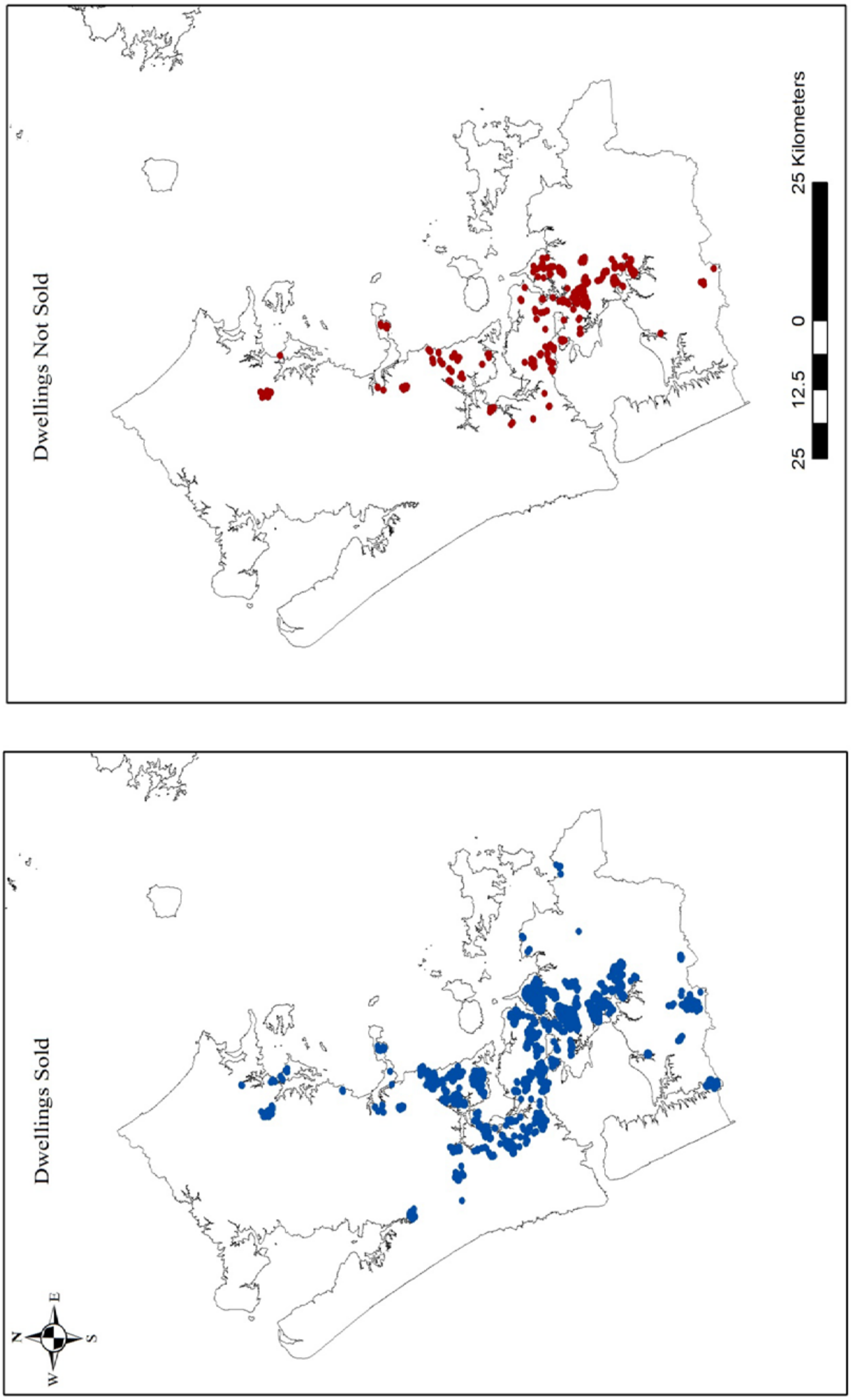
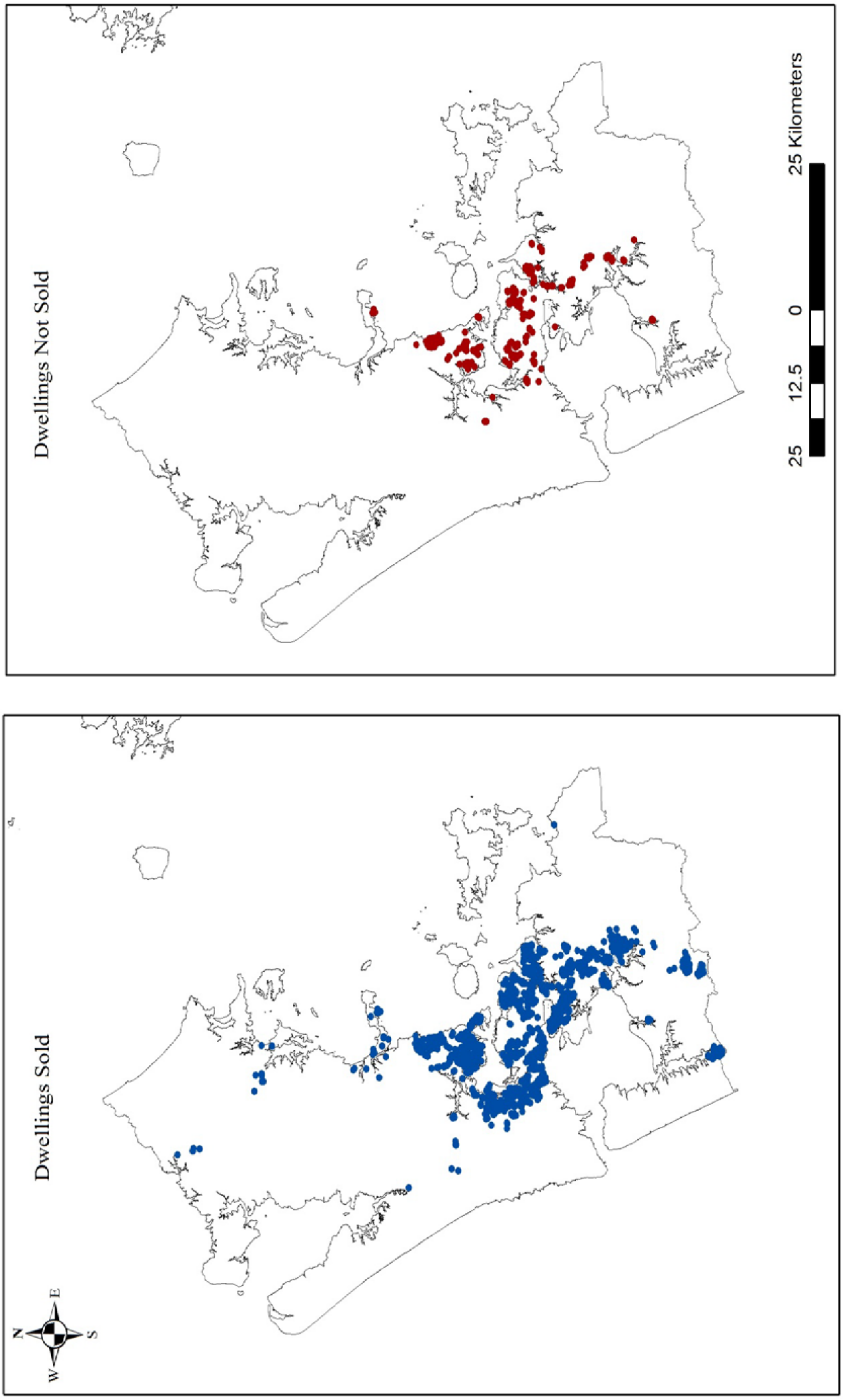


Figure 26: Spatial Distribution of House Trading - Cost Descending



Housing affordability is tied to the price distribution relevant in the market, households' disposable income and mortgage conditions.

Table 19 shows that for the PD scenario, the price paid for a dwelling is at least 20 per cent higher relative to the PA and CD scenarios, which explains the different rates of take-up. Prices paid by couples with and without children are not very dissimilar, but for the PD scenario average couples pay at least 9 per cent more than single-parent households, for the PA and CD they pay 12 per cent and 4 per cent more, respectively. Regarding terraces this difference is less than three per cent.

The model also assumes standard conditions for mortgage payments, that is, a time horizon of 30 years and a 6 per cent interest rate. Mortgage payments between couples with and without children are not dissimilar for the PD scenario. Interestingly, mortgage payments are not very dissimilar between couples and single-parent households for terraces for the PA and CD scenarios. To further identify the economic profile of buyers, for the PD scenario, average annual income of couples is roughly 12 per cent higher than the PA and CD scenarios. For couples that buy terraces, this difference increases to 22 per cent. Likewise, terraces prices are higher than houses across scenarios, consequently households that can afford them have incomes higher than those than afford a house. Also, annual incomes of couples is at least 30 per cent higher than single-parent households across the scenarios.

Jointly, these results show that the lower prices under the PA and CD scenarios allow for a greater number of relatively low-income households to enter the market and buy a dwelling.

Table 19: Average Price and Mortgage Payments of Dwellings Sold, and Annual Income by Household Type

	Scenarios					
	Profit Descending		Price Ascending		Project Cost Descending	
	Houses	Terraces	Houses	Terraces	Houses	Terraces
Sale Prices						
Couple (no children)	1,008,828	1,735,067	841,016	1,100,091	787,173	1,262,580
Couple with children	999,764	1,735,067	822,473	1,103,831	784,468	1,251,021
Single parent	919,748		744,501	1,084,364	752,133	1,214,679
Annual mortgage payments						
Couple (no children)	58,065	99,865	48,406	63,318	45,307	72,670
Couple with children	57,543	99,865	47,339	63,533	45,152	72,005
Single parent	52,938		42,851	62,413	43,290	69,913
Annual Income						
Couple (no children)	222,902	246,474	199,277	203,326	198,993	201,845
Couple with children	207,662	232,233	184,069	191,480	183,270	191,304
Single parent	146,162		144,893	165,172	147,050	162,601

Figure 27 shows the sale prices of dwellings. For the PD scenario, the median price is the highest compared to the other two scenarios, but there is also relatively less dispersion. That is, contrary to the PA and CD scenarios, the price distribution of the PD concentrates on high prices. Thus, in agreement with results in Table 18, the greater dispersion in the PA and CD scenarios signal the inclusion of lower-income households in the pool of buyers.

Figure 23 shows annual household income of buyers for all scenarios. Median income for the whole sample is 152,000 which is lower with respect to the three scenarios. Median income for buyers in the PD scenario is the highest, which indicates that only relatively wealthy households can afford buying a dwelling under the high prices in this scenario. Note than in none of the three scenarios the income distribution includes the lower-end observations present in the income distribution of the whole sample. Thus, we cannot argue that the PA and CD scenarios are addressing housing affordability under the current configuration of the model.

Figure 27: Sale prices of dwellings sold

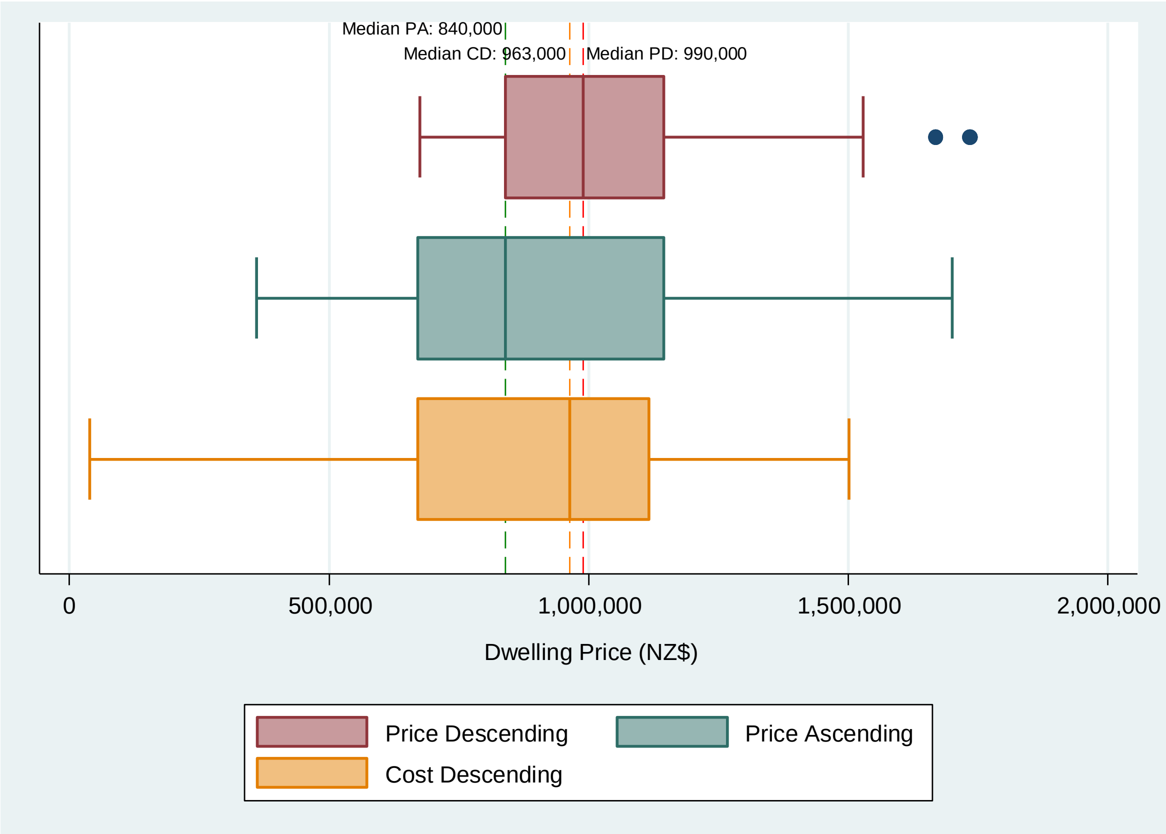
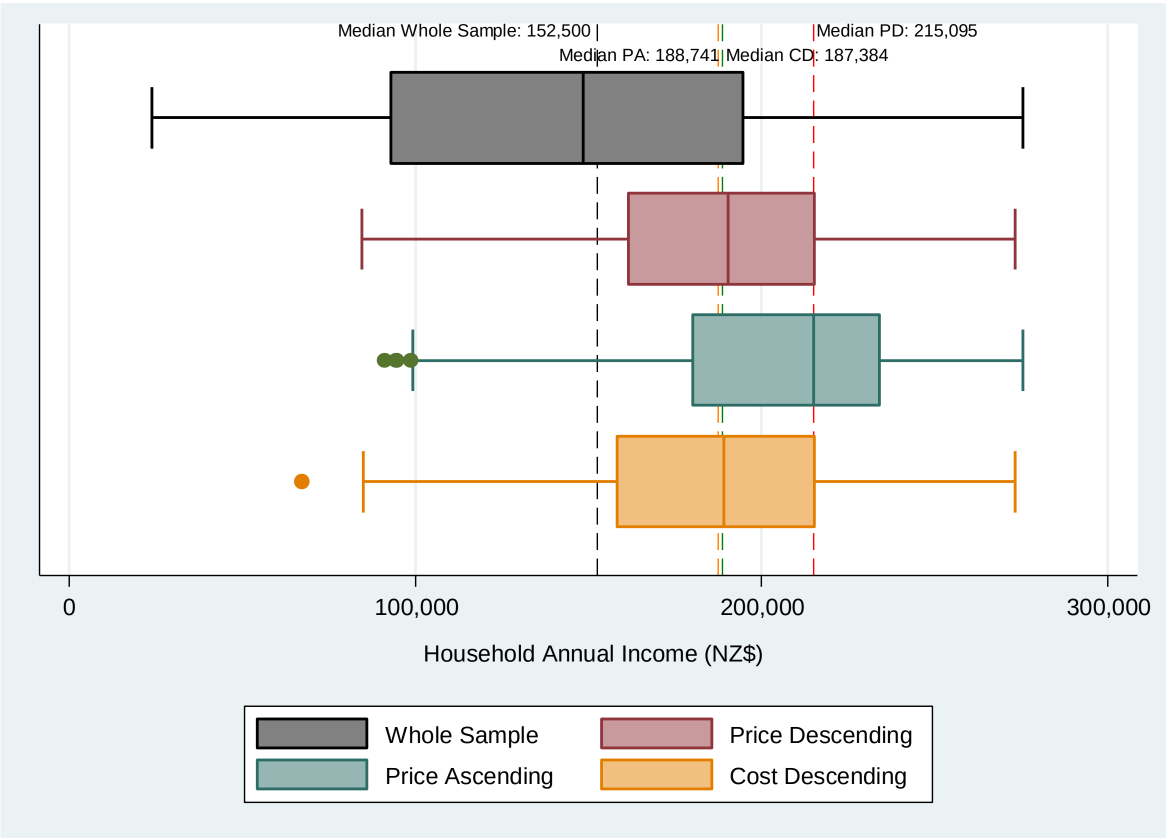


Figure 28: Annual household income of buyers



Another measure of the economic value of the additional housing capacity is the share of household income allocated to mortgage payments, which is referred to as income stress (Table 20). The model allows for households to allocate up to 50 per cent of income toward mortgage payments. Baseline stress is calculated with respect to the buyers only, not with respect to the entire sample. Table 20 shows that stress almost doubles for couples across the scenarios, whereas single-parent households' stress increases most under the PD scenario, 62 per cent, but 39 per cent and 46 per cent under the PA and CD, respectively. Stress rates are not that dissimilar between the scenarios, but it is worth mentioning that only in a few cases, stress reaches the 50 per cent upper bound.

Table 20: Average Stress of Buyers (per cent of mortgage payments relative to household income)

	Scenarios					
	Profit Descending		Price Ascending		Project Cost Descending	
	Baseline	Scenario	Baseline	Scenario	Baseline	Scenario
Couple (no children)	14.0	26.5	14.9	26.3	14.9	26.7
Couple with children	16.4	28.4	17.7	28.2	17.6	28.6
Single parent	22.8	37.0	22.7	31.6	22.3	32.5

5.2.5 Assumptions and Limitations

Some assumptions and limitations should be mentioned:

- The approach assumes that households are fully informed of the benefits they may accrue from each house available. Households face a fixed number of housing types, and have no power to modify prices, i.e., they are price takers. Market distortions such as externalities and public goods may shape market behaviour, but the configuration of the market segments by means of hedonic pricing allows incorporation of those issues. Hence, we are confident that our approach is reliable on assessing the extent to which feasible development, reported by the feasibility model, translates into commercial feasibility (measured by the rate of take-up).
- The model relies on Census databases available online. All statistical measures are calculated with respect to grouped data, which may underestimate the weight of observations in the tails. Nonetheless, grouped data helps with controlling outliers and extreme values.
- Census data omits observations in many instances for privacy purposes. To mitigate further distortions on the calculations, we used only valid and stated household data, which amounts to 392,052 households (Table 15).
- Sensitivity analysis should be undertaken to explore the implications of allowing households greater relocation flexibility or to introduce more realistic issues in the modelling approach, e.g., a household residing in Section 1 but buying a dwelling in Section 13 for renting purposes. Though our aggregation of market segments may appear arbitrary or excessively constrained, it introduces flexibility on household mobility across the city rather than assuming that only geographic contiguity determines the possibility of dwellings substitution.
- Household sample size may be contested as insufficient to represent first-home buyers. However, any changes in the household distribution should occur across all sections, e.g., including wealthy and poorer households in the simulation. We argue that qualitative results and the rate of take-up should be similar to those found in this report. Finally, the sample sizes for demand (9017) and supply (6000) were fixed at those sizes after preliminary simulation exercises demonstrated that the model became intractable and no simulation solution could be found for larger samples.
- The model focuses on first-home buyers and new dwellings induced by the NPS-UDC or changes in the housing environment, where we also assume a single trading period. We are certain that this comparative-static setting suffices for the purposes of a housing demand assessment prescribed by the NPS-UDC. Future research will explore the timing of purchases and the environment of decision-making.
- The feasibility model does not report that apartments or dwellings with less than two bedrooms are feasible to develop (baseline results). This implies no single-person

household can afford buying a dwelling. Likewise, further scenarios should be explored to incorporate as well the lower end of the income distribution.

5.2.6 Discussion and Policy Implications

Physical location of dwellings and prices distribution are keys to determine the market outcome and the rate of take-up. This is a high-level assessment on the compatibility of additional capacity with the socioeconomic profile of demand. Though statistical tools may provide the likelihood of a household to buy a dwelling, they are not suitable to calculate the rate of take-up and other measures that mathematical programming does. Planners and policy makers may benefit of replicating this strategy as it is possible to get a deeper understanding of the physical, economic and social attributes of housing. Some policy implications are discussed as follows:

- The model focuses on first-home buyers who are currently renting and need to accumulate wealth to pay for the deposit. Households compete for dwellings and, conditional to the predominant prices distribution, dwellings may remain unsold. As these are houses not currently built, developers may anticipate and adjust supply downwards, and likely worsening the housing shortage. Alternatively, on an ex-post basis, dwellings may still be built but remain unsold, and then retained and be available for the next trading period (i.e. the following year as the model is parameterised on annualised terms). Under the same circumstances, supply may also be adjusted downwards in the following year. The bottom line is that developers anticipate this excess supply and delay land release or dwellings construction.
- Dwelling supply depicted by the three scenarios do not correspond to any type of affordable or subsidised housing. They describe the potential configuration of supply in accordance with market behaviour in Auckland, so that the demand model describes household behaviour in selecting whether to buy a dwelling or not. The PD scenario corresponds to the most profitable projects for the developers, whereas the PA and CD may not be necessarily considered affordable per se as take-up occurs for households with annual average incomes that are still higher than Auckland’s median.
- As the ACDC provides data that correspond to profitability given market behaviour, further analysis is necessary for the case of dwellings that are developed under different types of subsidisation (e.g. via deposit or mortgage assistance) and low-income households. In the model market behaviour is represented by the purchasing power of households, on which they compete for the additional dwellings. Thus, the matching simulation does not represent a central planner’s intervention by directly allocating a share of dwellings to a particular population group. Hence, the model describes the insights of the results of the realisation of any of the scenarios, and it does not prescribe any policy path in particular.
- Likewise, even though the same buyers of the PD scenario appear in the other two, it does not preclude that prices distributions in the PA and CD allow lower-income households to enter the market. The model assumes the outcome is stable as no further incentives exist for a household to relocate once a dwelling is bought.

Summary: Assessing sufficiency

- In the short and medium term there is sufficient feasible capacity to meet demand throughout the region but not in the long term.
- Physical location of dwellings and prices distribution are keys to determine the market outcome and the rate of take-up.
- Rate of take-up is highly dependent on the prices distribution of new dwellings. Rate might be as 2.5 times higher if developers supply dwellings at lower than market prices
- Dwelling supply depicted by the three scenarios do not correspond to any type of affordable or subsidised housing. Affordability per se would require further analysis where government role is significant.
- Housing affordability is tied to the price distribution prevalent in the market, households' disposable income and mortgage conditions.
- Only relatively wealthy households can afford buying a dwelling under the high prices in the PD scenario. in none of the three scenarios the income distribution includes the lower-end observations present in the income distribution of the whole sample. Thus, we cannot argue that the PA and CD scenarios are addressing housing affordability under the current configuration of the model

6.0 Areas for possible future work

Many areas of possible future work have been identified emerged in completing this initial assessment. Auckland Council may incorporate these into future work as resources and demands allow.

Future areas of work include:

- Remodelling plan enabled, and feasible capacity using the 2017 District Valuation Role and associated cadastral pattern.
- Explore options to model other forms of plan enabled capacity such as minor household units.
- Work with property experts to further analyse apartment feasibility.
- Review the location and typology framework within the feasibility model.
- Review the capacity and feasibility models in response to building consent and completion information.
- Incorporating central governments KiwiBuild strategy (details of which are yet to be confirmed), and other government policy into the assessment (where appropriate).
- Modelling the effects of subsidies or mortgage schemes on housing decision-making.
- Further develop the demand and supply matching model, incorporating the detailed demand produced by Market Economics.
- Complete research project on commercial building conversions.
- Consider how future feasibility might be understood and modelled.

Part two:
Business demand and development capacity

7.0 Business land supply and demand

For this assessment, business land supply and demand has been assessed in a separate report (Appendix C).

This report presents an overview of the process followed to estimate the business land capacity in Auckland in the context of the expected demand, for the short term (3 years), medium term (10 years) and long term (30 years). The findings are presented in a set of summary tables along with a high-level discussion of the outcomes.

The key findings of this report are:

- The current situation indicates that intensity of business activity has changed marginally since the 2015 study – however in most zones intensity has increased. This result was expected, as it is common outcome for high growth cities, general in Auckland the demand for land for a given amount of business activity has decreased relative to the previous study (i.e. productivity has increased).
- The economic projections and resulting demand for land is higher than was estimated in the 2015 study. Recently economic growth in Auckland has exceeded all expectations. The medium demand projections from the 2017 model are generally higher than the previous medium projection, but lower than the high projections. The sectoral structure of future growth is broadly similar to the 2015 study, with half of the growth focussed in a few sectors (health, professional services, retail and education). However, employment in construction and wholesale sectors is also expected to grow strongly.
- The supply patterns assessment shows that the adopted AUP has enabled significantly more supply than the proposed AUP. This additional supply combined with the Contemporary Development Scenarios development density, results in a significant increase in supply compared to the 2015 study.
- The Machine Learning Model combined with the NPS-UDC sufficiency test indicates that there may be some areas in the long run that may not meet the requirements of the NPS-UDC.

8.0 Assessment of capacity for business space

8.1 Assessment of plan enabled development capacity

8.1.1 Overview

This section of the report addresses the potential urban development capacity within Auckland's business zoned land. The business development capacity is assessed in three ways. First, the assessment identifies the amount of additional capacity in business land areas that are either currently vacant or contain a significant portion of land. Secondly the maximum amount of floor space that is enabled if each individual business zoned parcel is redeveloped under the AUPOIP provisions is modelled. Thirdly, business zoned areas that fall within special precincts and are given a specific amount of floor space, which is carried over and deemed to be their maximum development potential.

8.1.2 Method

The following sections provide an overview of the methods used to calculate business development capacity, and to explain necessary changes made to the assessment methods to closely reflect the AUPOIP provisions. The detailed procedures and processes are explained in the *Capacity for Growth Study 2013: Methodology and Assumptions* (Balderston and Frederickson, 2013).

8.1.2.1 Business vacant capacity

Business vacant capacity measures the potential development opportunities on business zoned parcels that are wholly vacant. Ideally, vacant land refers to an area that is not being used for any purpose. In addition to this approach to determine vacant land, business land parcels that are occupied for temporary uses and/ or without permanent/ significant building structures located on them, are also considered vacant. These two approaches are then grouped by their underlying zones to generate the vacant business land results.

8.1.2.2 Business vacant potential capacity

Business vacant potential capacity measures the potential of future development on business zoned parcels, which have a building or permanent structure located on them. Like the residential vacant potential assessment, the model is designed to analyse existing building footprints, dwelling counts and building counts to identify candidate parcels with further development opportunities. A candidate parcel ranking procedure is adopted from the CfGS to identify parcels with significant development potential areas. The results are then sorted according to their underlying zoning groups to produce the vacant potential output.

8.1.2.3 Business redevelopment capacity

Business redevelopment capacity calculates the maximum building floor space of Auckland's business zones under the AUPOIP provisions. The latest assessment builds on the three dimensional (3D) method developed in the CfGS and applies it across all business zoned parcels. This includes the city centre. In the 3D modelling environment, though the parcel area defines the maximum amount of coverage a building can have. Height limitations are the primary driver which determines the maximum floor space capacity.

While most of the 3D assessment procedures remain the same as before, a number of extra steps are introduced to incorporate additional height control rules. The combination of these height controls determines the effective height limit for individual business zoned parcels. This section of the report summarises the additional processes for the redevelopment capacity calculation.

Conversion of precinct rules

The AUPOIP has over 150 precincts and more than 400 sub-precincts. Of these precincts and sub-precincts, 89 are associated with business zones[24].

The latest assessment has adopted some, but not all, of the precincts rules and converted them into a range of modelling parameters (Appendix D). The most critical rules have been included, which set the ceiling heights of the maximum enabled development capacity. For example, city centre precincts' floor to area ratio, height limits and storey limits are all standardised and combined to establish the ceiling height limits across these precincts. These parameters are then incorporated by the assessment model and are used to calculate the maximum floor space at the parcel level.

Sunlight admission controls

While the Unitary Plan promotes high density urban development, it also recognises the importance to protect existing public open spaces. Section H8.6.3 of the AUPOIP introduces sunlight admission controls to ensure that many identified public open spaces receive adequate amount of sunlight during the day and throughout the year. This means places that are further from these open spaces have a greater potential for taller buildings than the ones that are closer to them. As a result, shadowing effects must be considered when calculating maximum building heights for the surrounding parcels.

Building shadow length is a function of building height, solar azimuth angle and solar zenith angle, as well as the seasonal sun path. The solar azimuth angle determines the direction of the sun and the solar zenith angle defines the elevation of the sun. The seasonal sun path determines the

[24] One of the reasons that the city centre excluded from previous capacity studies and some were modelled through their underlying zone rules, was due to extra tiers of complexity and ambiguity these precincts and sub-precinct rules introduced.

length of daylight hours and the maximum range of solar zenith angles. Figure 29 illustrates how a building's shadows vary during summer and winter. The summer midday shadow is significantly smaller than its winter counterpart due to the position of the summer sun being much higher than its winter position.

Figure 29: Seasonal building shadow variations

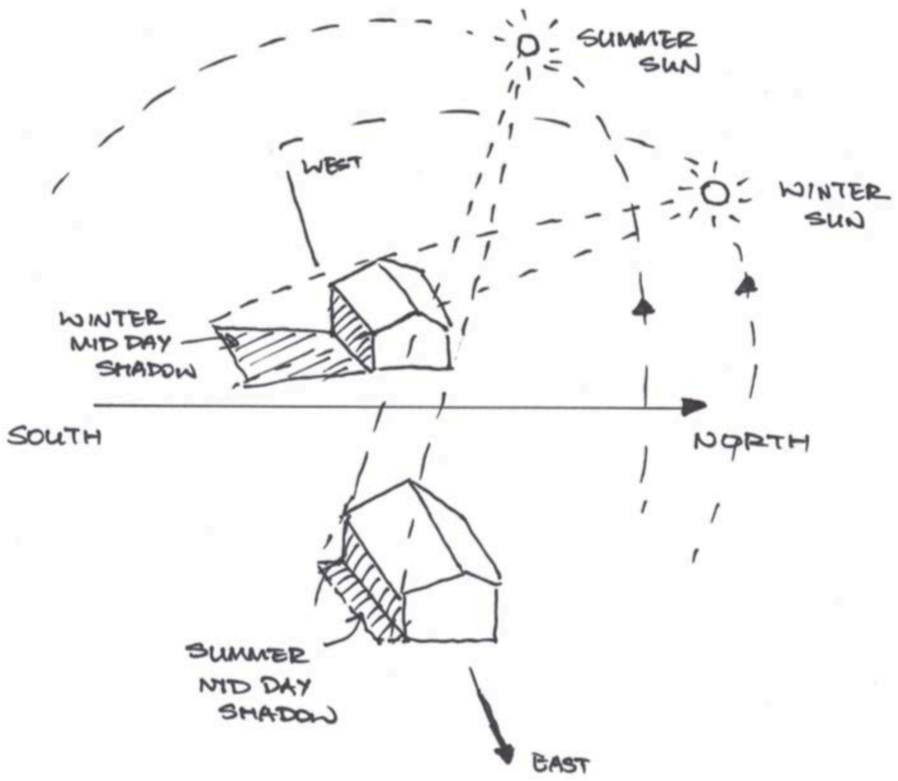
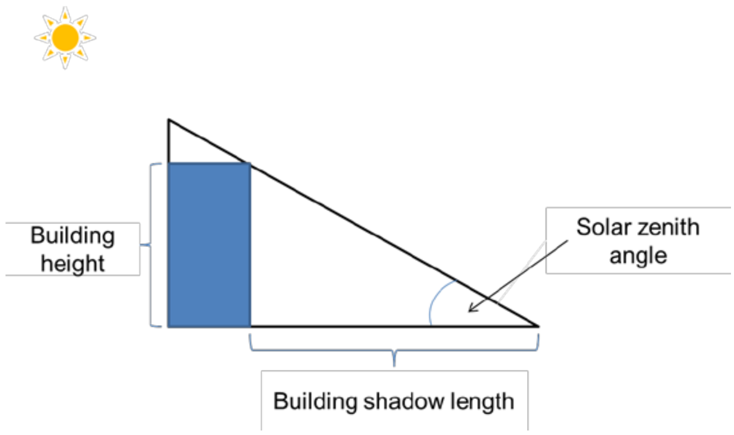


Figure 30: Solar zenith angle and building height



As mentioned above, building shadow length is a function of building height and solar angles (Figure 30). The relationship of these factors can be explained by a basic trigonometry formula, where

$$building\ shadow\ length = \frac{building\ height}{\tan(solar\ zenith\ angle)}$$

For example, if a standard one-storey building height is 3.6m, and the solar zenith angle is at 45 degrees, the shadow length of this one storey building is calculated by $hadow\ length = \frac{3.6m}{\tan(45°)}$. It is because $\tan(45°)$ equals to 1, therefore, the shadow length is 3.6m. Vice versa, to avoid a site from being over shadowed by this one-storey building, the building must be located at least 3.6 meters away from the site boundary in the same direction of the 45-degree sunlight is coming from. Therefore, the maximum building height is determined by the solar zenith angle and, the distance between the open space site and the building site, which is

$$building\ height = \ distance\ between\ sites\ \times \tan(solar\ zenith\ angle)$$

Appendix 11 of the AUPOIP outlines the sunlight admission requirements of the identified public open spaces, these rules as utilised in this assessment are summarised as,

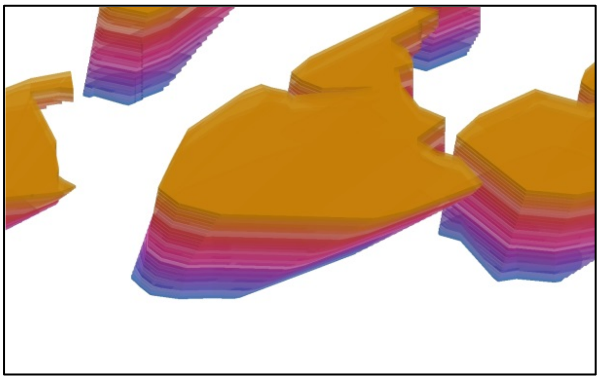
- Summer daylight hour requirements;
- Winter daylight hour requirements; and/or
- All year daylight hour requirements.

To translate these requirements into sets of parameters so that they can be analysed spatially and mathematically, NIWA's sunlight hour dataset has been adopted. A copy of Auckland's annual sunlight hours and sun angles is extracted from the NIWA SolarView database and can be found in Appendix F. The solar azimuth angles and solar zenith angles are calculated according to the daylight hour requirements at equinoxes, summer solstice and winter solstice for each public open space (Appendix F). These calculations are then used to set the highest and lowest limits of solar angles, and the range of sunlight directions.

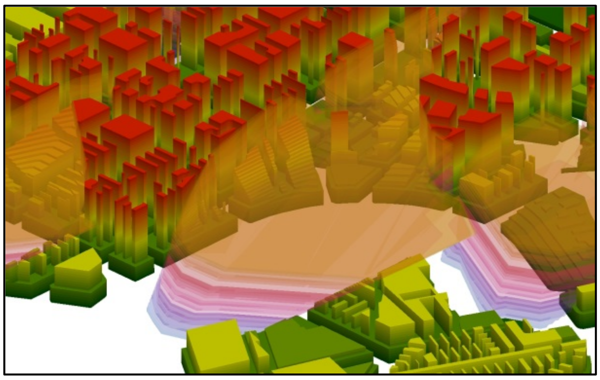
Once the solar angle and direction attributes are generated, the HIRB 'inverted ziggurats' method (Balderston and Frederickson, 2013) is adopted to construct the sunlight admission control planes. Instead of using a standardised angle to calculate recession planes, it is replaced by the solar zenith angle to calculate each recession plane at a specific time of the day (e.g. at the beginning of sunlight admission hour, at midday, and at the end of sunlight admission hour). Each of these recession planes is then projected and offset by its corresponding solar azimuth angle to determine the maximum allowable building height where the recession plane protrudes. For example, the 'inverted ziggurats' of Albert Park's sunlight admission control planes are illustrated in Figure 31. Panel one of illustrates the total volume of the sunlight admission controls by stacking all recession planes together. Panel two shows where the sunlight admission controls intersect with maximum building envelopes that are adjacent to Albert Park. The terraced-shaped building envelopes in panel three outline the outcome after applying the sunlight admission control over building sites that surround Albert Park.

Figure 31: Albert Park sunlight admission control

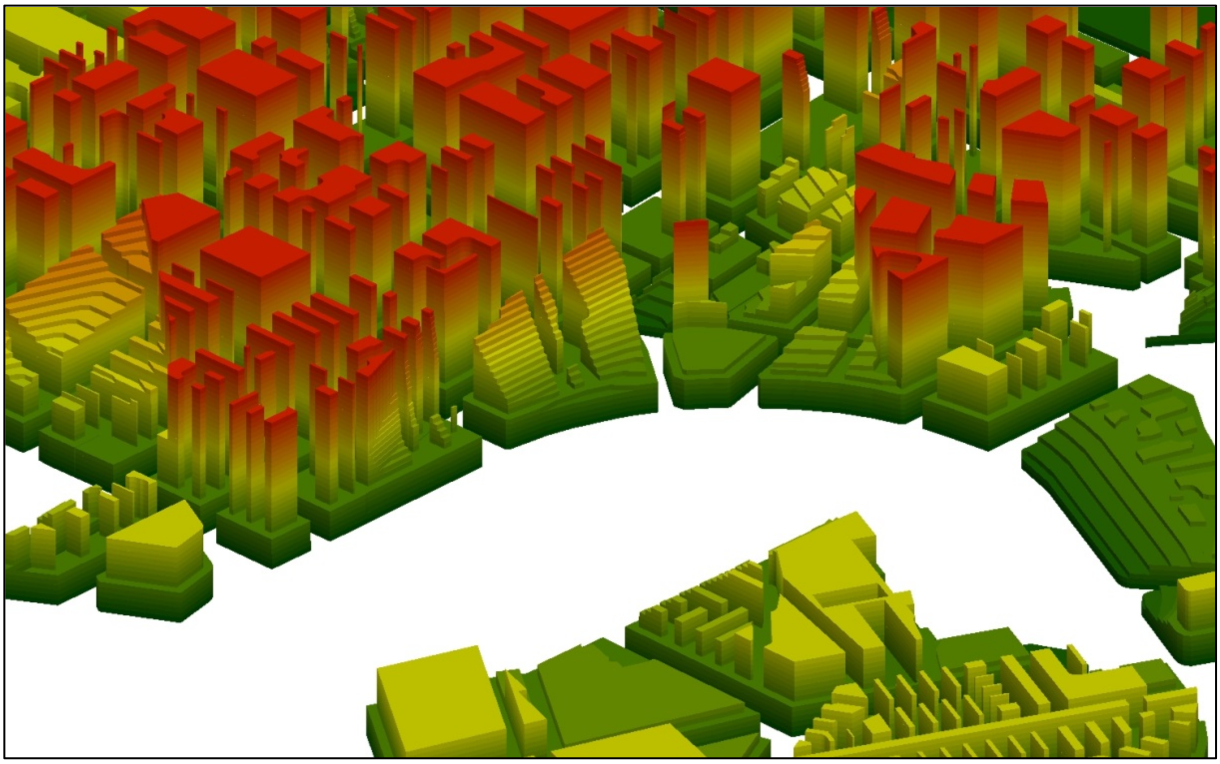
1) Sunlight admission control



2) Applying sunlight admission control



3) Maximum building envelope after applying sunlight admission control



Other changes applied

In addition to precinct rules and sunlight admission controls, further modifications and adjustments to the redevelopment capacity assessment model. These include:

- Site coverage assessments have been removed except in Business Park Zones to reflect changes made to the AUPOIP provisions.
- Two additional height control planes, namely Aotea Square height control plane and Harbour edge height control planes are incorporated into the maximum building height assessment. The HIRB method is adjusted to calculate the maximum heights of the adjacent parcels.

- Business redevelopment scenario and floor space conversions to dwellings and employees are not carried out in this assessment. All potential floor spaces are being fed through the feasibility assessment, which is explained and discussed in the [insert section number] of this report.

8.1.2.4 Rollover floor spaces

Under the AUPOIP provisions, several special areas, mainly described in the precinct section, are given with the maximum amount of floor spaces. These floor spaces are deemed to be the enabled capacity and are carried over; hence, they have not been assessed by any of the capacity assessment.

8.1.3 Assumptions and limitations

- The AUPOIP provisions adopted for this assessment are based on the version as at 1 July 2017. Plan changes as a result of appeal settlements after this date have not been taken into account.
- Each AUPOIP zone has been classified as either being residential, business, rural, special or other. This classification is an objective assessment based on the modelling approaches used and does not infer any classification for land use planning purposes, though for the most part these categories are interchangeable (special areas can be residential, business, rural or other for example).
- Capacity is calculated under a subset of the AUPOIP provisions. These have been discussed, agreed upon and approved by the Auckland Council's Planning teams. The capacity assessments utilised the highest activity threshold in cases where the plan provides clear parameters for modelling. For most bulk and location parameters this is the Permitted Activity standard, however subdivision and building development per se is rarely permitted, and requires resources consent of some sort. No Prohibited or Non-Complying Activity parameters have been used.
- Global assumptions are inherited from the CfGS with minor changes to reflect the AUPOIP provisions (Appendix E).
- The capacity model is adjusted and amended to incorporate additional precinct rules. However, some precincts were modelled using underlying zoning rules due to ambiguous precinct rules. These rules could not be converted into standard parameters and/or constants to be consumed by the assessment model.
- Parcels or titles identified as having a designation on them that would severely restrict or prevent development of the parcel or title have been excluded from assessment for potential capacity.
- Parcel and title information is obtained from Land Information New Zealand's Data Service as at 1 July 2017.

- Building footprint information is extracted from council's spatial database. The footprint data is mainly based on the 2010 aerial imagery with additional ad hoc footprints amendments.
- Sunlight admission assessment does not account for existing buildings and their shadowing effects, and assumes the surface to be flat across the entire region. Future studies should explore how the option of including the existing topology and existing building heights could affect the sunlight control assessment.
- Residential floor space in business zones have not been separated from the overall floor space calculation. The modelling team is not in the position to introduce any arbitrary assumptions to determine the amount of floor space to be used for any specific purpose.

8.1.4 Results

This section of the report summarises the results of the business development capacity assessment. The results are presented in two ways, the overall regional overview, and by urban areas and rural towns.

8.1.4.1 Auckland region

In total, the AUPOIP has 9,210 hectares of land zoned for business and mixed-use purposes across Auckland (Table 21). Of the total business zoned land, 86 per cent (7,894 hectares) of the land areas have been modelled for business development capacity assessment. Within which, more than 50 per cent (2034 hectares) of the modelled land areas are zoned for light industry. This is followed by 16 per cent (1,268 hectares) of heavy industry zones and 11 per cent (900 hectares) of mixed use zones.

Table 21: Total business zoned land vs total business zone land modelled

Capacity Type	Total base zone Area (ha) - spatial data form GIS	Total Area of modelled parcels by base zone provisions	Total Area modelled parcels by all provisions
Business Park	60.65	16.95	32.43
City Centre	258.10	63.99	221.01
General Business	353.95	258.09	334.96
Heavy Industry	1869.51	1259.54	1267.86
Light Industry	4481.45	3295.82	4034.45
Local Centre	245.50	172.05	237.29
Metropolitan Centre	381.67	206.33	353.21
Mixed Use	977.44	786.18	900.26
Neighbourhood Centre	135.35	108.29	126.35

Capacity Type	Total base zone Area (ha) - spatial data form GIS	Total Area of modelled parcels by base zone provisions	Total Area modelled parcels by all provisions
Town Centre	446.82	344.31	386.99
Total	**9210.45**	**6511.54**	**7894.82**

Across Auckland (Table 22), a total of 1,035 hectares of business land has been identified as vacant, which is approximately 11 per cent of the total business zoned land. There is a further 3502 hectares of business zoned land that has been identified as vacant potential, which consists of 38 per cent of the total business land.

Table 22: Business development capacity by AUPOIP base zones

Capacity Type	Vacant land (ha)	Vacant potential land (ha)	Total capacity (ha)
Business Park	13.91	8.60	22.51
City Centre	35.28	133.72	169.00
General Business	63.23	148.97	212.21
Heavy Industry	109.46	603.83	713.29
Light Industry	574.07	1,705.85	2,279.92
Local Centre	29.75	90.95	120.70
Metropolitan Centre	63.40	146.09	209.49
Mixed Use	95.89	446.12	542.01
Neighbourhood Centre	6.16	55.63	61.80
Town Centre	43.96	162.79	206.74
Total	**1,035.12**	**3,502.56**	**4,537.67**

Table 23 lists that the maximum amount of floor space enabled by the AUPOIP provisions is approximately 331 million square metres across the region. Of which, only nine per cent (28 million square metres) of the maximum floor space has been consumed by the existing built environment. Therefore, the floor space capacity for growth is enormous. For example, the capacity assessment has identified the city centre as being the most densely developed area in Auckland. Having said that, there is a remaining 8.8 million square metres of floor space enabled to accommodate future growth in the city centre.

Table 23: Floor space capacity by AUPOIP base zones

Capacity Type	Maximum capacity (m^2)	Existing floor space (m^2)	Capacity for growth (m^2)
Business Park	1,608,976.89	221,389.00	1,387,587.89
City Centre	12,672,982.88	3,851,539.00	8,821,443.88
General Business	11,420,863.97	1,033,736.00	10,387,127.97
Heavy Industry	57,868,500.99	3,960,786.00	53,907,714.99
Light Industry	155,654,835.50	10,436,404.00	145,218,431.50
Local Centre	6,316,993.48	596,432.00	5,720,561.48
Metropolitan Centre	33,523,947.05	2,227,078.00	31,296,869.05
Mixed Use	30,679,315.45	4,080,729.00	26,598,586.45
Neighbourhood Centre	2,601,865.36	368,262.00	2,233,603.36
Town Centre	18,673,420.31	1,922,791.00	16,750,629.31
Total	331,021,701.88	28,699,146.00	302,322,555.88

Maps illustrating the distribution of capacity of business land (Figure 32) and business floor space (Figure 33) are below.

Figure 32: Business parcels identified as having infill capacity in Auckland's urban area

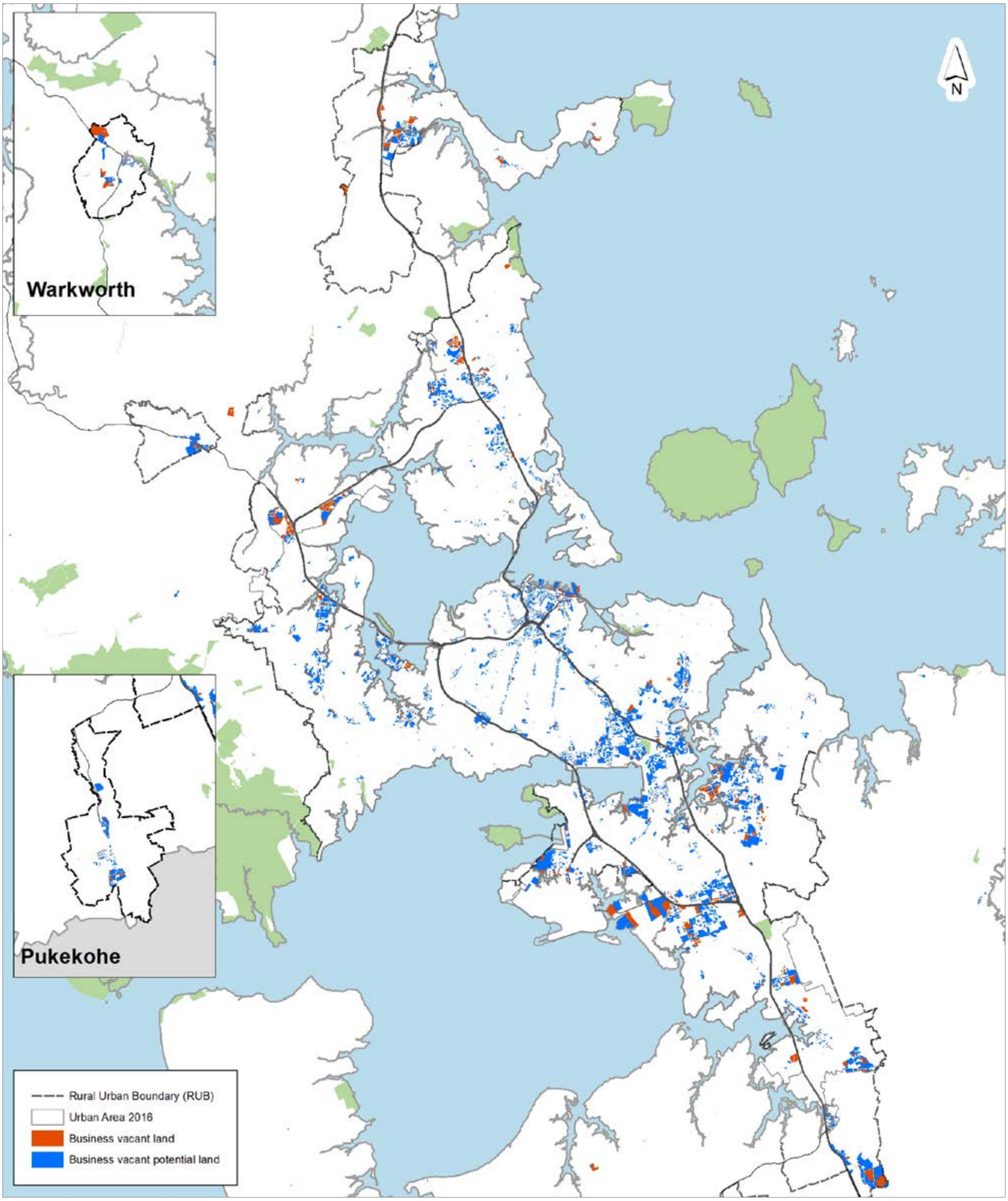
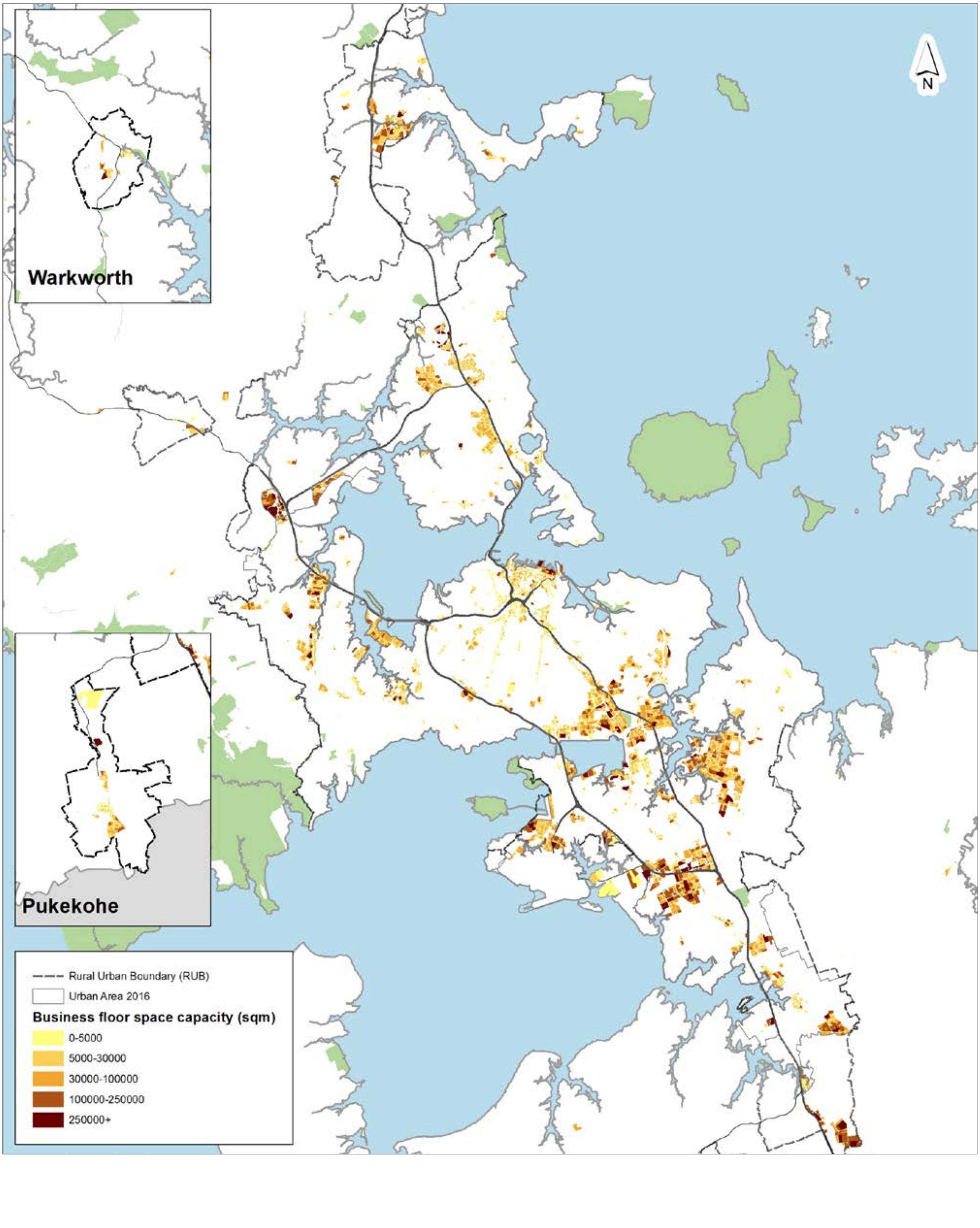


Figure 33: Business parcels identified as having floor space capacity in Auckland's urban area



8.1.4.2 Urban areas and rural towns

The majority of the business zoned land is located within Auckland's urban areas and a small portion lies among Auckland's rural towns. In the urban areas, 884 hectares (Table 24) of business zoned land is considered vacant. Figure 34 shows that Ōtara-Papatoetoe Local Board and Upper

Harbour Local Board combined have the largest proportion of vacant business land, which consists of 22 per cent of the regional total (201 hectares). Waitakere Ranges Local Board has the least amount of vacant business land available (4.77 hectares) to accommodate future business activities. In rural towns, Rodney Local Board has triple the amount of vacant business land (113 hectares) available than Franklin Local Board (37 hectares).

Table 24: Business development capacity by general location (hectares)

Capacity Type	Vacant land (ha)	Vacant potential land (ha)	Total capacity (ha)
Urban areas	884.25	3,160.85	4,045.10
Rural towns	150.86	341.71	492.57
General Business	1,035.12	3,502.56	4,537.67

Figure 34: **Distribution of vacant business land in Auckland's urban area, by local boards**

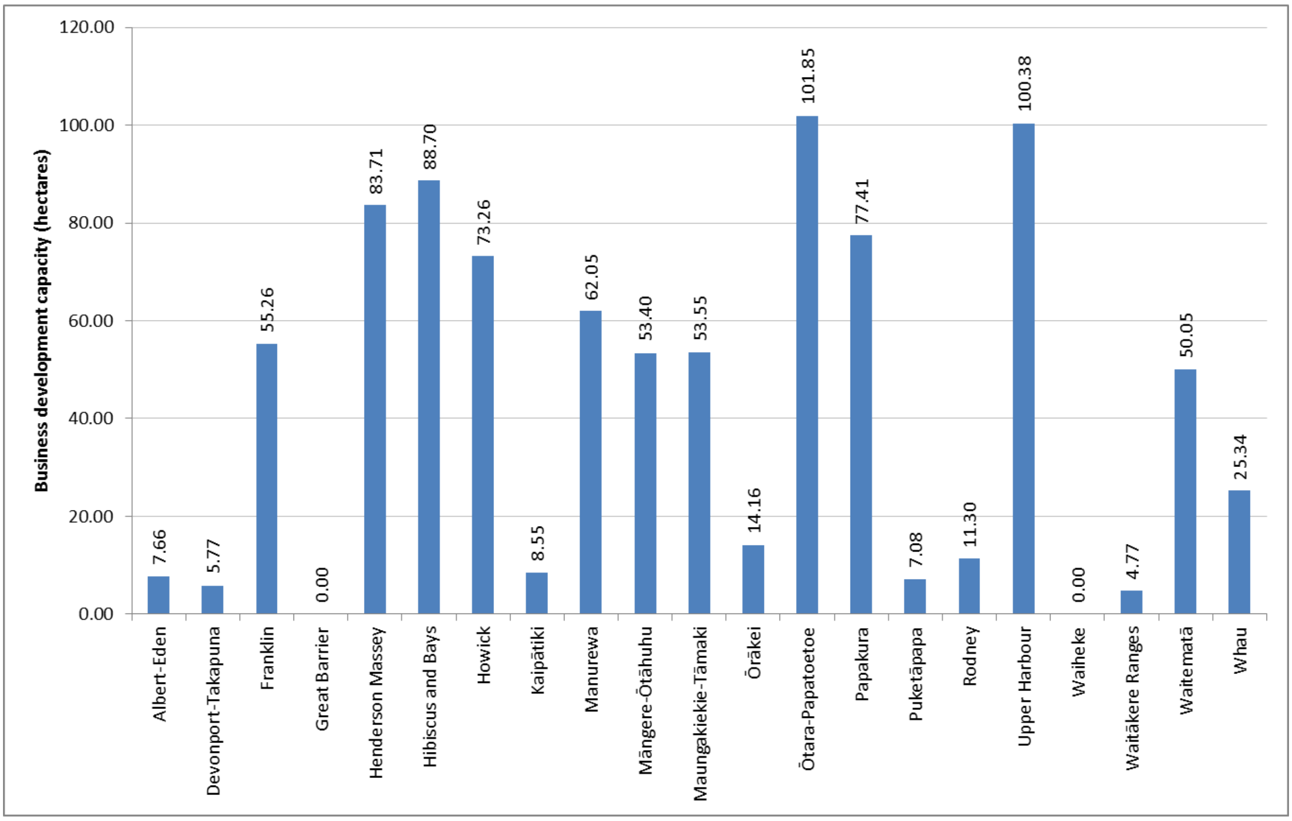
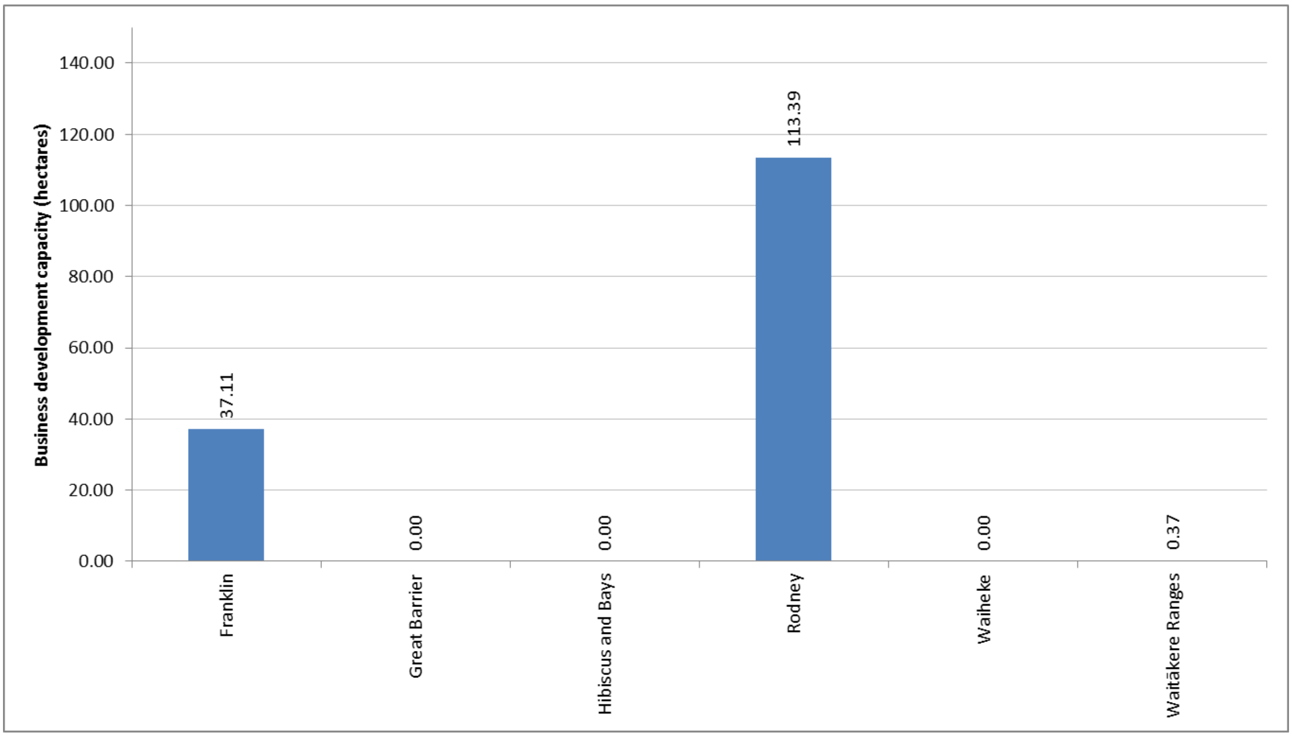


Figure 35: Distribution of vacant business land in Auckland's rural towns, by local boards



Of all business zoned vacant potential land, 91 per cent (3160 hectares) is located within Auckland's urban areas. Maungakiekie-Tāmaki Local Board has been identified with the largest amount of business vacant potential land (519 hectares), which is approximately 16 per cent of the total vacant potential land (Figure 36). In rural towns there are 188 hectares of business vacant potential land located within the Franklin Local Board area and 147 hectares within the Rodney Local Board area Figure 37.

Figure 36: Distribution of business vacant potential land in Auckland's urban area by local boards

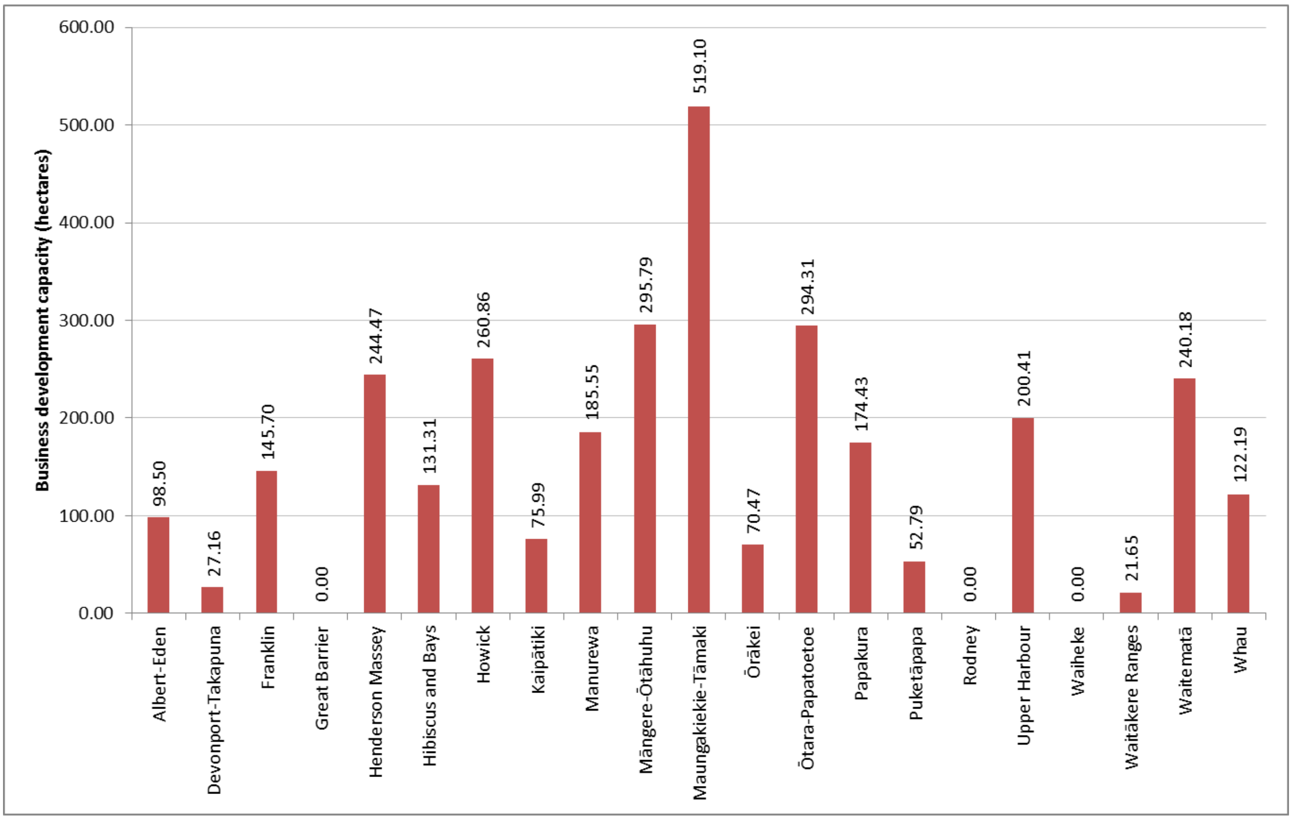
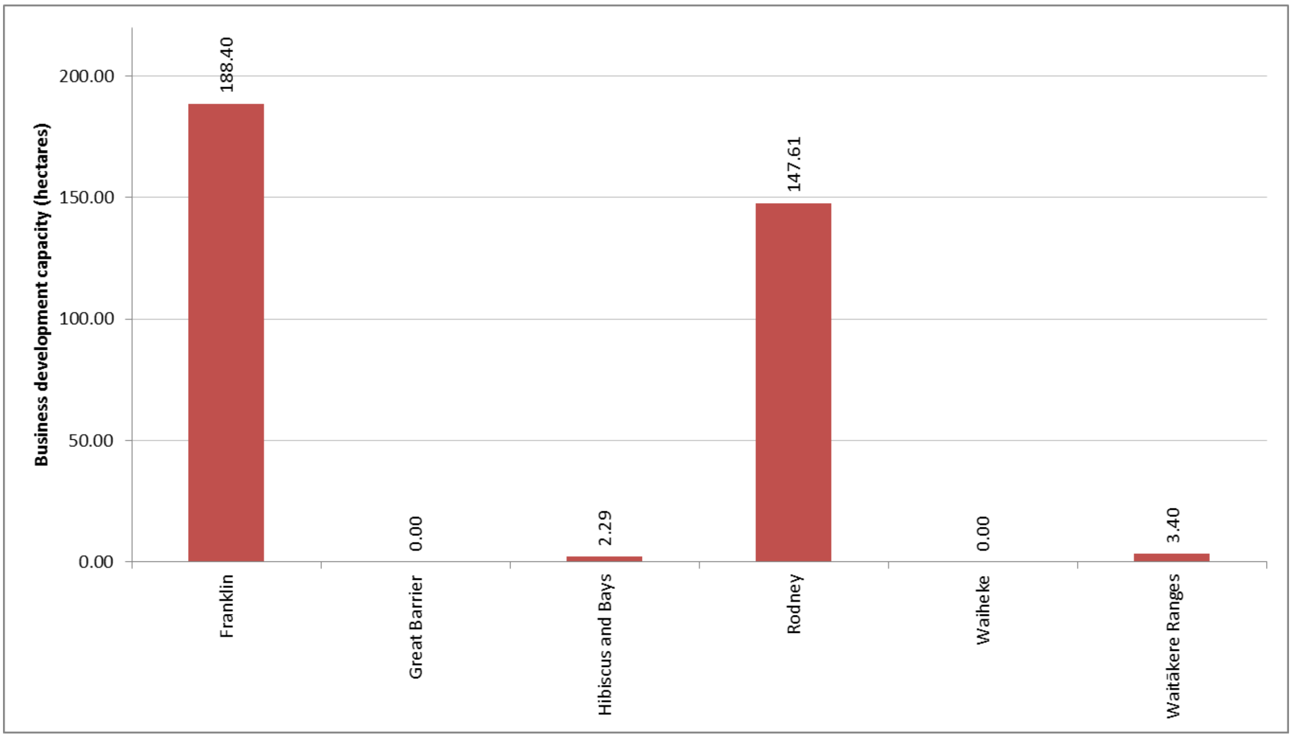


Figure 37: Distribution of business vacant potential land in Auckland's rural towns by local boards



Correlating with the AUPOIP base zone distribution, over 90 per cent (282 million square metres) of the floor space capacity (Table 25) has been identified within Auckland's urban areas. As shown in Figure 38, six local boards combined have over 60 per cent of the region's floor space capacity; Henderson Massey with nine per cent (25 million square metres), Howick with 10 per cent (30 million square metres), Mangere-Otahuhu with nine per cent (26 million square meters), Maungakiekie-Tamaki with 14 per cent (40 million square metres), Otara-Papatoetoe with nine per cent (26 million square metres), and Upper Harbour with eight per cent (23 million square metres). The remaining 10 per cent of floor space capacity for growth is scattered across rural towns in the Franklin and Rodney Local Boards (Figure 39).

Table 25: Floor space capacity by general location

Capacity Type	Maximum capacity (m^2)	Existing floor space (m^2)	Capacity for growth (m^2)
Urban areas	310,444,836.76	27,818,165.00	282,626,671.76
Rural towns	20,576,865.11	880,981.00	19,695,884.11
Total floor space	331,021,701.88	28,699,146.00	302,322,555.88

Figure 38: Distribution of floor space capacity for growth in Auckland's urban area by local boards

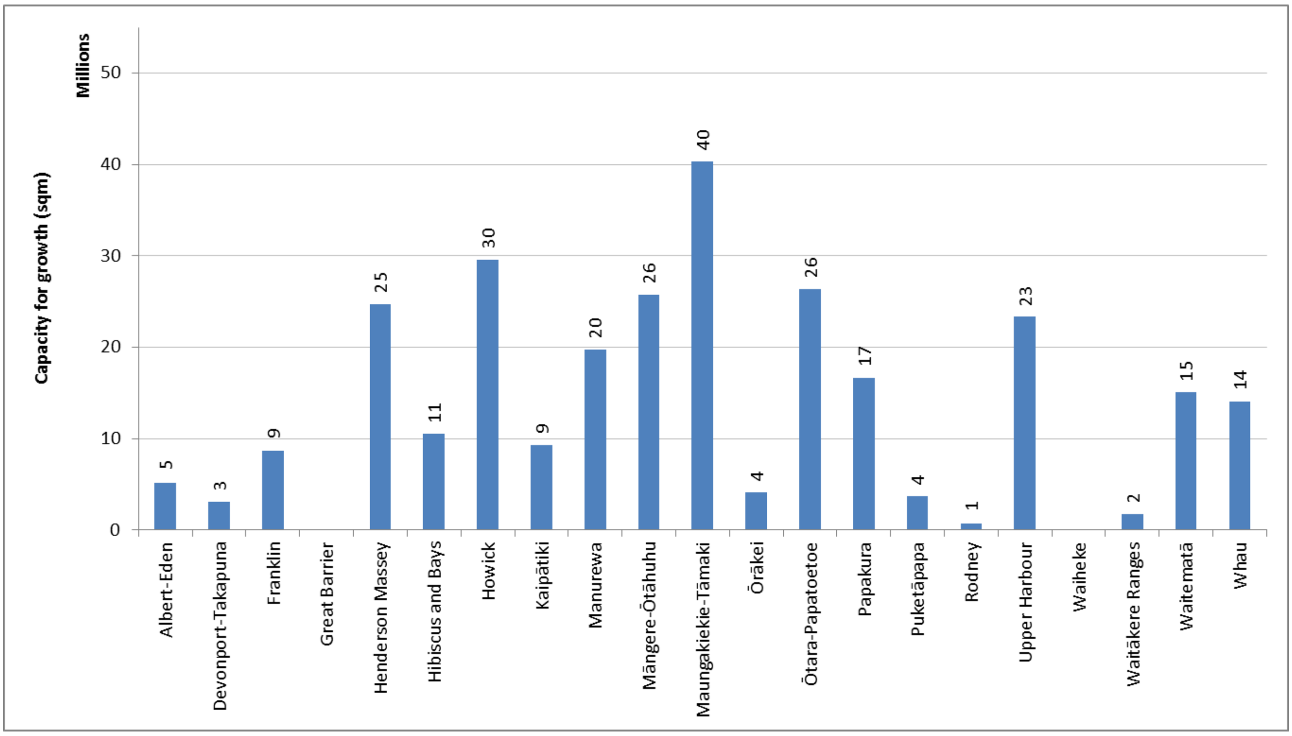
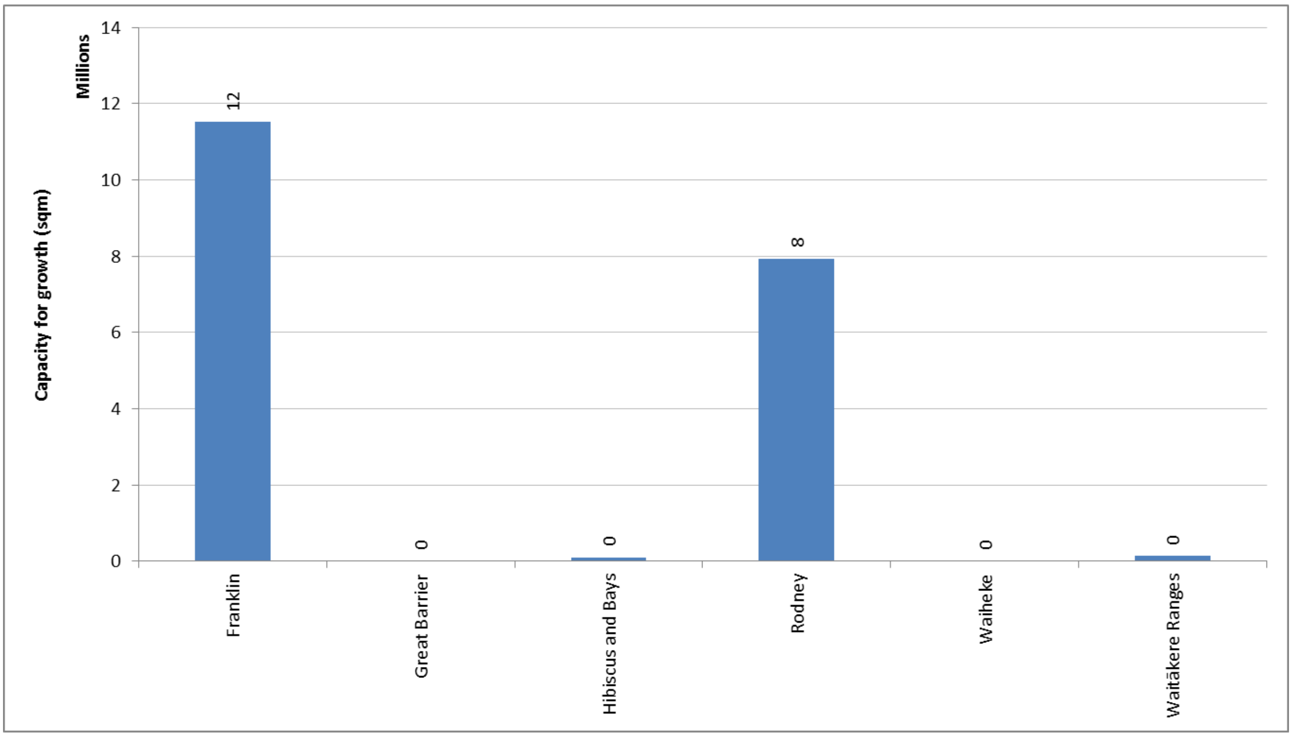


Figure 39: Distribution of floor space capacity for growth in Auckland's rural towns by local boards



Summary: Business land plan enabled capacity

- The plan enabled capacity for business space assessment adopts the methods used by the CfGS with updated AUPOIP provisions.
- The enabled floor space capacity is calculated via a three-dimensional assessment method which allows the assessment model to include additional building height control mechanisms such as sunlight admissions and special height control planes.
- The modelled plan enabled capacity reflects the maximum allowable buildable floor spaces across all business zoned land.
- The plan enabled business space capacity ranges from approximately 4,500 hectares (business land capacity) to over 30,000 hectares (floor space capacity).
- The majority of the enabled business capacity lies within the light industrial zone

Part three:
Housing and business interactions

9.0 Spatial interactions between housing and business capacity

9.1.1 Overview

The interactions between housing and business activities, and their impacts on one another need to be assessed as part of the NPS-UDC. This section outlines some of the ways this has been undertaken as part of the assessment.

9.1.2 Results

9.1.2.1 Capacity calculations

Feasible business capacity was modelled using all of the plan enabled capacity. In some locations, such as town centres, the potential floor space could be fully used for a single use e.g. a commercial building or for multiple uses e.g. retail on the ground floor with residential above it. To ensure floor space was not double counted, all floor space that was feasible for residential development in business areas has been assumed to be taken for residential uses.

9.1.2.2 Building conversions

The conversion of lower grade commercial floor space to residential uses has been a key process in the growth of Auckland's apartment market. The conversion of commercial space to residential can be cheaper compared to undertaking a new development from scratch. Commercial building conversions are a small part of Auckland's housing market, but it may have an impact on localised commercial markets as floor space that was used for business is removed and replaced with dwellings.

9.1.2.3 Airbnb

The growth of Airbnb in Auckland is another example of interaction between housing and business floor space. There are more 7,700 Airbnb listings in Auckland which cover individual rooms in current dwellings through to whole dwellings.

It is estimated that that Airbnb has removed as many as 1236 units of housing from the rental market in Auckland. This represents less than one per cent of the total rental stock in Auckland which suggests that any impact on rental supply is small, and limited to a handful of neighbourhoods where such services are most popular as the figure below indicates (Osborne and Tuatagaloa, forthcoming).

Figure 40: Distribution of recently active Airbnb listings by broad Auckland area in the 12-month period, September 2016 to August 2017

Area	Entire home or apartment	Private room	Shared room	Total	Per cent of Auckland's estimated population 2017	Per cent of Auckland's private occupied dwellings, 2013 Census
Central	52%	49%	57%	51%	27%	28%
North	26%	25%	12%	25%	24%	25%
Waiheke and Great Barrier	9%	2%	0%	6%	1%	1%
West	6%	10%	12%	8%	16%	16%
South	4%	8%	7%	6%	24%	21%
East	3%	6%	12%	4%	9%	9%

Source: Osborne and Tuatagaloa (forthcoming).

Part five:
Conclusion and references

10.0 Conclusion

Auckland's housing market is characterised by significant complexity. It contains a plethora of stakeholders and is influenced by a range of local, national and global processes that operate at various scales and timeframes. The housing market is diverse, and it is changing; median sales prices have increased considerably since 2013 but they also vary considerably depending on location and typology; standalone residential typologies have traditionally dominated the construction sector and existing stock, but attached forms of development are increasingly prevalent. Dwellings are no longer just for shelter, but are financial commodities, and are increasingly purchased by investors. Increased competition and changed supply, finance and regulatory settings are fundamentally affecting home ownership rates for new market entrants, particularly when compared to the immediate post-war period when extraordinarily[25] high home ownership rates were encouraged by state supplied dwellings, finance and low international investment.

In addition to these examples it is possible to add affordability, homelessness, the social housing sector and a plethora of other topics or issues (to what?). It is more accurate to talk of Auckland's multiple housing markets which can on partially be grasped with medians and means.

The plan enabled capacity analysis shows significant opportunities for additional residential development in Auckland. This is due to AUPIOP and the enabling zoning framework it contains. A significant amount of development meets the commercial feasibility tests as set down in the NPS-UDC. In the short and medium term, feasible supply is above demand (including the margins and the estimated dwelling shortfall). This is not the case however in the long term. However, this feasibility analysis is based on ***current*** costs and prices, in accordance with the NPS-UDC, for the purposes of identifying potential actions needed to improve current feasibility to above demand for the long term, as a proxy for sufficiency.

Auckland Council has now run two feasibility analysis in a relatively short timeframe. The common aspect to both model runs has been the planning system; the urban planning system is largely identical between the IHP modelling and that used for this housing and business assessment. However changes to various cost components of the feasibility models have had a significant impact on resulting feasibility and in particular on the feasibility of apartment typologies in the urban area, reducing the feasible dwelling supply by around 50 per cent. This suggests that the consequential responses, based on the assessment, probably need to focus on development input costs over a range of scales and timeframes, and not necessarily on the planning system per se.

These cost increases are, at least in part, due to increased demand for development sites, builders, specialist consultants, equipment and materials, largely induced because of the planning system becoming more enabling, reflecting constraints in the building industries capacity to deliver

[25] Both historically in New Zealand, and internationally, arguably declining home ownership rates in New Zealand reflect a reversion to the long run mean. Given the long absence of state intervention, the only surprise is how long it has taken.

the increased potential. This has impacted on the larger, more complex projects (i.e. multi-storey apartment developments) where the need for specialist skills and experience is greatest and the supply is tightest.

Compounding this is an increase in finance costs driven by two related factors. Increase in risk adversity by the Reserve Bank of NZ (its Loan to Value Ratio test and other financial system tools are primarily driven at financial prudential stability, not housing affordability per se) and by lenders, particularly the Australian owned banks who are factoring in potential housing oversupply in the larger Australian cities who have experienced an apartment boom in recent years. Again these factors appear to most impact on larger more complex developments generally, and apartment developments in particular.

In effect this assessment, being a snapshot at mid-2017 has captured a dynamic market where sales prices are flat (to falling) but costs have risen, relative to the IHP assessment of mid-2016.

Achieving an overall goal of lower dwelling prices, while at the same time delivering more dwellings, will be difficult as these two aims are, partially conflicting. Achieving this dual aim will require serious attention to all the cost components of dwelling development, including those beyond focussing on land use regulations alone. This will become even more difficult as an overdue focus on economic efficiency in cost recovery from public funding is also likely to play out that will impact on the amount of subsidisation and therefore feasibility of some locations.

The modelling also indicates that on average, land costs are a relatively small proportion of the average new feasible build, with the costs per square metre making up the greatest proportion of costs, improving productivity here is potentially the area where the largest gains can be made

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12.0 Appendices

Appendix A Auckland Housing Demand Assessment

Auckland Housing Demand Assessment 2017

19 December 2017 – Final

m.e consulting

Auckland Housing Demand Assessment 2017

Prepared for

Auckland Council

Document reference: Auckland Housing Demand Assessment Dec 2017 Final.docs

Date of this version: December 2017

Report author(s): Douglas Fairgray

Director approval: Greg Akehurst

www.me.co.nz

Contents

1 Introduction

1.1 Objective

This Report is the Auckland Housing Demand Assessment for Auckland Council ("**AC**") which is required under the National Policy Statement on Urban Development Capacity ("**NPS-UDC**" or "**the NPS**").

1.2 NPS-UDC

The NPS-UDC came into effect in December 2016 and sets out specific requirements which AC as a council in a high growth urban areas must comply with by December 2017. Other requirements have to be met by December 2018.

The core elements of the NPS focus on comprehensive assessments of Auckland's capability to provide for future growth. The NPS specifies three new reporting requirements, as substantial technical outputs through which councils will need to document their compliance. These are:

1. A **Housing Development Capacity Assessment** ("**HDCA"**) by 31 December 2017
2. A **Business Development Capacity Assessment** ("**BDCA"**) by 31 December 2017
3. A **Future Development Strategy** ("**FDS"**) by 31 December 2018.

The reporting required by December 2017 is to examine how well existing Auckland Unitary Plan ("**AUP**") provisions may conform to the intent of the NPS, and what new provisions (and information, analysis and reporting) may be required to ensure compliance with all of the December 2017 requirements.

This Report is an important part of the HDCA, though it does not provide a complete HDCA. It examines the demand for housing in Auckland, based on projected population and household numbers.

The NPS-UDC is based on a suite of four Objectives, for which compliance by all councils is identified as being required from the start, "*immediate and ongoing*[1]". These Objectives have sets of related Policies, some of which require immediate and ongoing compliance, while others have to comply by December 2017. Those Policies requiring immediate and ongoing compliance are:

1. PA1: Sufficient development capacity in the short, medium and long term
2. PA2: Other infrastructure required to support urban development
3. PA3: Provide choice; promote efficient use of land and infrastructure; limit adverse effects on competition

[1] Ministry for the Environment and Ministry of Business, Innovation and Employment. 2016. *Introductory Guide to the National Policy Statement on Urban Development Capacity 2016*. Wellington: Ministry for the Environment and Ministry of Business, Innovation and Employment; Table 1, p9.

4. PA4: Take into account the benefits and costs of urban development at a national, interregional, regional, district and local scale
5. PC1–2: Provide an additional margin of feasible development capacity
6. PC3: Respond when development capacity is insufficient
7. PC4: Use all practicable options to provide development capacity
8. PD1–2: Work with other local authorities and infrastructure providers on housing and business assessment and to agree development capacity
9. PD3–4: Work with neighbouring local authorities and infrastructure providers to agree minimum targets and future development strategy

The policy on monitoring market indicators is required by 1 June 2017:

10. PB6: Monitor market indicators

Key requirements by 31 December 2017 are:

11. PB7: Apply price efficiency indicators
12. PB1–5: Produce the housing and business development capacity assessments

Key requirements to be achieved by 31 December 2018 are:

13. PC5–11: Set minimum targets in plans
14. PC12 – PC14: Future development strategy

The NPS requirements are extensive and quite comprehensive. Although councils have long had responsibilities to provide for growth, but a number of key aspects are new responsibilities, particularly in relation to underlying economics, and the efficiency of property markets. The information and resources needed to meet the December timetable are extensive.

1.2.1 HDCA and BDCA

The HDCA (and the BDCA) are at the core of the NPS, and these need to draw from many other requirements which are set out in the Policies.

The Objective and Policy suites of the NPS contain a number of inter-linkages, and compliance with some Policies depends on information and analysis which results from compliance with other Policies.

For the HDCA, most of the information and outputs from Policies from PA1-4, PB1-7, and PC1-4 are required. Those outputs are required to directly support / feed into the HDCA and the BDCA.

2 Methodology

This Section details the methodology for the Housing Demand Assessment. It covers the requirements which are set out in the NPS, and details the approach and information to meet those requirements. The methodology and the Report structure are based on the NPS requirements.

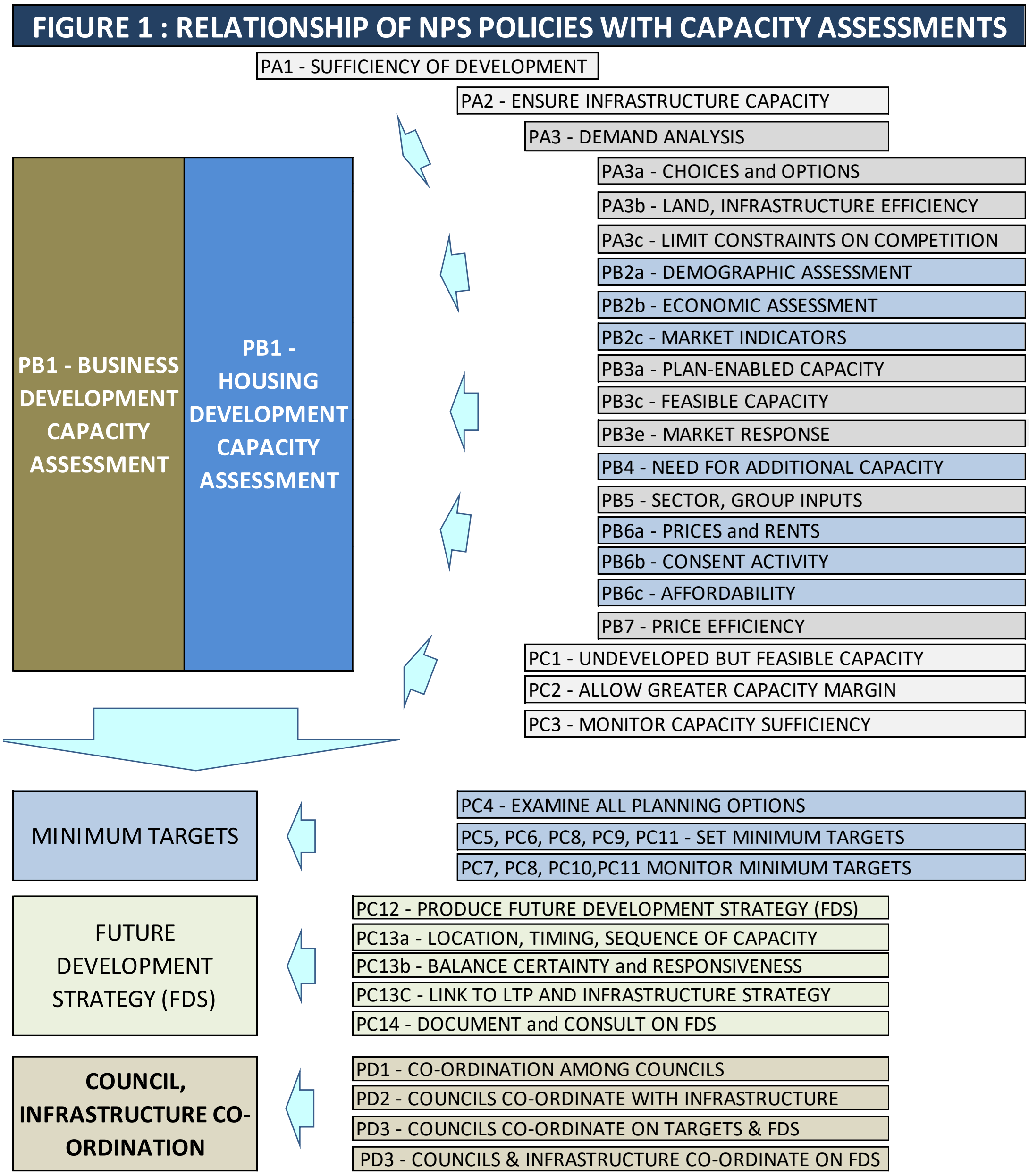
2.1 Overview

The NPS-UDC specifies the overall requirement for the HDCA, together with a range of requirements in the Policies. Each Policy assessment needs a sound analytical / technical base and good supporting information, and most need quantification to demonstrate compliance. There are many inter-linkages and inter-dependencies among the policies, which make it important to understand the NPS both holistically, and as to the specific requirements for each Policy. The individual policies cannot be satisfied if treated in isolation.

Figure 2.1 sets out the overall policy structure of the NPC-UDS, and shows the relationship of each policy to the overall requirement to produce Housing (and Business) Development Capacity Assessments (PB1). A key feature of the flow chart is that while there are significant cross-flows between Policies (these are not shown in the figure to maintain some clarity), the main focus of all Policies from PA1 to PC3 is on the capacity assessments.

Subsequent to the completion of the HDCA and BDCA, Policies PC4 to PC11 are oriented to setting and achieving Minimum Targets for growth and capacity. Policies PC12, PC13a-c, and PC14 are geared toward the third of the major reporting documents, the FDS. The remaining policies PD1 through PD4 are to ensure co-ordination among councils and between councils and infrastructure providers.

Within this wide suite of policies, the major part of the technical analysis and monitoring is set out in policies PA1 through PC3, which contribute most directly to the Housing and Business Development Capacity Assessments. These are considered in more detail below. For clarity, the required research is described in terms of tasks relating to each Policy. These have been initially defined by M.E as modules of work, as part of our core research into the NPS and its implications for councils.



2.2 ME Auckland Housing Model 2017

The methodology described in the following sections has been incorporated into the ME Auckland Housing Model 2017.xlxs, an Excel-based capability which draws together the core information, and enables testing of various combinations of future projections and allowances for varying mixes of outcomes.

The Model outputs provide the tables and graphs in this Report. We note that a wide range of combinations is able to be examined, although the focus in this Report is the basic outcomes.

The Model combines information on the demand side, in terms of current (2016) and future numbers of households of each type over the period to 2046, and on the dwelling supply side. The supply side analysis focuses on dwelling types and dwelling values, in order to understand the relationships between household types and the type and value of dwellings which they occupy.

The estimates of future demand for dwellings are based primarily on the projected increases in household numbers over the planning period. However, the future supply side outcome will depend on a range of matters, including the plan enabled capacity, dwelling affordability, and shifts in the revealed preferences for dwellings. Any shifts in preferences will be affected by, and affect, the supply of dwellings of each type, and the value of those dwellings.

The Model addresses these matters through a scenario approach, which takes into account:

a. The projected demand from households of each type;

b. The base case or current demand by household type, to identify a simple pro rata future where dwelling demand is driven simply by the change in the number of households in each segment of the community;

c. Progressive shifts in the supply of new dwellings, which are generally manifest as a trend away from detached dwellings, and toward attached dwellings, such that the balance shifts over time;

d. Associated with the trend toward attached dwellings is allowance for the proportion of multi-level attached dwellings to increase, reflecting the trend toward apartments and terrace housing;

e. The change in dwelling preferences implies some change in the value range of the housing estate, given that attached dwellings are generally lower value than detached dwellings (especially because of the larger land area, dwelling size and value associated with detached dwellings). However, that relationship does not necessarily follow, given the generally higher construction costs per sqm for apartments (especially those requiring lift access), and the expected preference for larger attached dwellings by households opting to re-locate from detached dwellings (including those in the baby boom generation in their later life-stages).

These matters are taken into account in the core outputs of the Auckland Housing Model, to provide an overview of future demand for housing by household type, and the associated demand for owned and rental dwellings, by indicative value band.

f. However, to provide a more nuanced assessment, allowance also needs for housing demand which arises from specific segments of the population, including social housing (served primarily by Housing New Zealand Corporation (HNZC), and retirement villages. In addition, the coalition Government's KiwiBuild initiative is expected to deliver up to 50,000 affordable dwellings into the Auckland market in the medium-long term. Both the HNZC and KiwiBuild initiative focus on the lower income segments, and renters rather than owners. Retirement village demand is obviously oriented toward the older age groups.

Each aspect of housing needs, aimed at satisfying the requirements of the NPS-UDC is set out in the following sections, including reference to specific NPS policies.

2.3 Assessing Housing Demand (PA3a, PB2)

Housing demand is defined here in terms of the housing requirements of the resident population and visitor populations of Auckland (or any city, district or region).

The main dimensions of housing demand are the occupancy (owned or rented) of dwellings by households of each type, the numbers of dwellings required currently and at each point in time into the future, and the nature of those dwelling requirements in terms of dwelling type and dwelling value (taking into account the nature of households which require those dwellings).

Dwelling demand in turn directly affects demand for residential land, just as residential land supply and planning provisions in combination affect development capacity. The adequacy or sufficiency of dwelling capacity can be broadly defined at the highest level in terms of the numbers of dwellings able to be supplied, but also in terms of their type, value and location.

The requirement to consider housing demand in some detail is set out clearly in NPS Policies, most notably:

> *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;*
>
> *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…*
>
> *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;*

The demand side assessment needs to consider housing requirements of the (current and projected) resident population, and the visitor population, and the consequent numbers of households of each type. These matters affect the numbers of dwellings required, the dwelling typology, and dwelling price points.

The assessment includes both resident population and visitor population including owners of "holiday" dwellings, and takes into account options and choices that will meet the needs of people and communities and future generations for a range of dwelling types and locations (PA3a). These matters are in the context of providing for the social, economic, cultural and environmental wellbeing of people and communities and future generations (PA3).

2.3.1 Household Types

The NPS requires assessment of housing demand by different types of household within a community, including demographics (household structure, size and age) which are important drivers of housing needs, and household incomes, which are an important driver of ability to pay. Dwelling affordability is a key matter in the NPS (PB 6c).

Households may be defined on a number of dimensions, and the more standard ones are household type (such as single persons, couples or 2-parent families), household size or the number of members, the age of the householders, and their income level. These dimensions directly influence housing preferences and affordability.

A standard household typology used by M.E has been applied, based on Census information. The typology broadly conforms with SNZ household types, although it offers more detail on matters directly relevant to housing affordability[2]. The segmentation used here is based first on household type:

a. Single person
b. Couple
c. 2-parent family with 1-2 children
d. 2-parent family with 3+ children
e. 1-parent family
f. Multi-family
g. Non-family.

Households are further differentiated by household age. This is the age of the "reference person" (as identified for Census purposes), and is a strong indicator of a household's stage in the life-cycle. It is important because housing needs and future expectations vary during the life-cycle. For this analysis, six age bands are used – from young adults of 15-29 years, 30-39 years, 40-49 years, 50-64 years, 65-74 years, through to older households in the 75 years and over age band.

The third key point of differentiation is household income level. This is based 2013 Census bands which broadly correspond with household income quintiles, though do not correspond exactly. The five bands used in the 2013 Census are less than $30,000 per year (pre-tax); $30,000 to 50,000; $50,000 to 70,000; $70,000 to 100,000; and more than $100,000.

These combinations provide the option to define up to 210 household groups – 7 types x 6 age bands x 5 income bands – although this level of disaggregation is typically applied only at national level, or for large

[2] This typology has been applied over many years to effectively differentiate household needs – both for dwellings and a range of consumer goods and services – according to both requirements and ability to pay (driven by income levels).

regional or TLA populations. For most analysis, detail by household type and income, or by household type and age, is easily sufficient to identify the most important patterns of demand.

The mix of household types varies by location. For this HDCA analysis, a dataset from 2013 Census has been applied, which counts the numbers of households of each type x age x income category. This is available at the census unit (CAU) level[3].

2.3.2 Urban and Rural Demand

The focus of the NPS-UDC is on urban development capacity. A significant number of Auckland households reside in rural locations, predominantly on rural lifestyle blocks, and on farms and other properties associated with rural activities. Currently, there are approximately 20,000 rural lifestyle properties, around 82% of these have one or more established dwellings on the property. In addition, there are approximately 4,200 farms or other rural properties with dwellings, again with the great majority of these dwellings usually occupied by resident farmers or workers, or other tenants.

In addition, Auckland region has many towns and villages including rural coastal settlements, which lie outside the main Auckland urban area, but which offer urban albeit small town living. A number of these towns and settlements offer capacity for housing, with Warkworth and Pukekohe both identified as substantial satellite towns, and a number of the coastal and rural villages expecting population and household growth.

While it is reasonably straightforward to separate out the lifestyle and farm holdings within the dwelling estate, it is somewhat more difficult to accurately differentiate the households associated with these properties. It is important to do this, because the mean value of lifestyle blocks in particular is considerably higher than the value of urban residential properties. If lifestyle block residents are included in the analysis of household types and residential property values, then the risk is that because they are generally higher income and net worth households, there may be some distortions in the assessment of the relationships between household types and dwelling values.

Accordingly, the base household count for each census unit has been examined to identify the estimated households on lifestyle properties, and farms and rural properties. This estimation does not apply a *pro rata* adjustment to the household types identified from the 2013 Census, but makes allowance has been made for lifestyle and farm households to be relatively more concentrated in the higher household income bands, and less evident in the lower income bands.

Acknowledging that these various options are able to taken into account, the base case for this assessment covers the main urban area and the towns and villages across the region, but excludes lifestyle blocks and farms since they are not part of the current urban capacity. As a consequence, the base case household count is 517,000 resident “urban” households (95.1% of the 2016 total), with the balance of 27,000

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[3] In an economy as large as Auckland’s it is useful to examine the different geographic areas, and the Model is intended to also allow examination of the North (former Rodney and North shore), West (Waitakere), Central (former Auckland city), South (Manukau, Papakura and Franklin), as well as Auckland Urban and Auckland Rural.

households being those residing on rural lifestyle blocks (approximately 20,000 households) and other rural properties including farms (7,000 households).

2.3.3 Visitor Population and Non-Resident Owners

It is necessary to examine the incidence of usually unoccupied dwellings which are part of the total dwelling estate. Unoccupied dwellings are commonly associated with holiday dwellings, and/or absentee owners who leave dwellings unoccupied rather than rent them out.

Analysis of usual vacancy levels in the Auckland housing estate was undertaken by Market Economics for Auckland Council in 2014, drawing from customised data from StatisticsNZ. While the Census night vacancy rates are often cited, that figure substantially overstates the real level of vacancy, because part or all of many households are absent on Census night. The real level of dwelling vacancy in Auckland was estimated at 0.9% for 2013. This is very close to the 2006-2011 vacancy rate estimated by StatisticsNZ for greater Christchurch, for studies relating to the earthquake recovery.

Applying the same level (0.9%) to the estimated total 518,000 occupied dwellings suggests there are around 4,700 dwellings which are usually vacant.

That is generally consistent with Auckland's tourism role. Auckland is a major visitor destination, for both tourists and business travellers, though the incidence of holiday dwellings is limited[4], and is concentrated geographically into coastal areas and settlements, rather than the main urban area. Moreover, the high demand for housing in Auckland suggests that many such holiday or other dwellings owned by absentee owners are likely to be occupied for rental purposes, particularly in the main urban area.

For this assessment, a constant 0.9% share of dwellings is assumed to be usually vacant.

2.4 Future Housing Demand

For the assessment, housing demand is assumed to be driven primarily by the numbers of usually resident households, based on the StatisticsNZ population and household projections.

StatisticsNZ released in February 2017 an updated population projection series for Auckland region and unitary area. That replaced the earlier (2015) series, and allowed for considerably higher population growth than previously.

StatisticsNZ released in 2016 a household projection series which corresponded with the 2015 population series, and very recently the corresponding updated household projections have been released.

[4] Analysis of the northern North Island holiday dwelling estate was undertaken by Market Economics in 2014. This covered coastal towns and settlements as well as urban centres, and took into account the numbers of unoccupied dwellings as at Census night, adjusted for the average level of vacancy across all urban areas, to indicate the likely incidence of holiday dwellings. That showed holiday dwellings are (unsurprisingly) heavily concentrated in coastal and other holiday destinations, and indicated there are around 4 such dwellings (in those destinations) per 100 resident households across the whole northern North Island. It also showed low incidence in the main urban areas themselves including Auckland.

For this assessment, total housing demand is based on the StatisticsNZ household projections, on the basis of one dwelling per household. The net increase in dwelling demand is therefore based on the net increase in household numbers, from the 2016 base.

This is set out in Section 4. We note that the growth outlook for the 2017 StatisticsNZ population series made allowance for very high ongoing in-migration gains, both nationally and for Auckland in particular. The new Government has signalled changes to in-migration levels, which may impact on total population and housing growth for Auckland, especially in the shorter term to 2023. This is examined in the Appendix.

2.5 Housing Supply 2016

The HDCA also requires assessment of how demand for housing is currently being met by the Auckland dwelling estate. The analysis reported on here is based on the situation as at the 2013 Census, and estimated for 2016, and covers the number of dwellings by type and value.

2.5.1 Dwelling Types

There is a substantial amount of information available from 2013 Census to identify dwelling types. A customised dataset has been used which identifies dwelling numbers by type and location within Auckland, to show dwellings as being a separate house or one of 2 or more dwellings in a building. Dwelling type categories are:

a. Separate house (77.0% nationally);
b. (one of) 2 or more dwellings in a 1-storey building (9.6%)
c. 2 or more dwellings in a 2- to 3-storey building (5.8%)
d. 2 or more dwellings in a 4 or more storey dwelling (1.4%)
e. 2 or more dwellings not further defined (0.03%)
f. Other private dwellings (0.4%)
g. Private dwellings not further defined (5.8%)

Simple cross-tabulation of household types with these dwelling types for each city or district council offers a base analysis of the relationship of households and dwellings.

However, for the NPS a more detailed assessment is necessary, especially to understand how the household-type to dwelling-type relationships vary according to household age and income.

2.5.2 Dwelling Tenure

It is also important to understand the importance of dwelling tenure, within those patterns of dwelling occupancy. This analysis is also based on the customised Census dataset from SNZ. The basic Census output is detail of owned dwellings and rented dwellings, each identified by dwelling type, and the distribution of households (by type) across this dwelling estate.

2.5.3 Dwelling Occupancy

Dwelling occupancy is used here as a key indicator of demand. This is because the Census describes the households which occupy a dwelling, and their tenure as owners or renters, but it does not identify the owners of dwellings which are occupied by renters[5].

Accordingly, the household which occupied a dwelling as at Census 2013 is taken here as the best indicator of that household's demand for that dwelling. This is on the basis that the Census 2013 snapshot is a sound indicator of the dwellings sought by those owner occupiers, and the type of dwelling sought by those renting a dwelling.

2.5.4 Dwelling Value

A core aspect of the NPS Policy PB1a is to identify *"demand for dwellings, including the demand for different types of dwellings, locations and price points."* This adds a further dimension to the analysis. The 2013 Census does not capture any information about property values.

For this assessment, a detailed analysis of the Auckland Council rating database was undertaken. This dataset provides detail on each rating assessment, and identifies improvements including the number of dwellings of each type, and the assessment's land, improvement and capital values, as at June 2014.

A considerable number of the rating assessments show the presence of more than one dwelling. This required examination to identify the number and type of dwellings, in order to show the numbers of detached and attached dwellings, and their mean value.

This process identified some 392,350 detached dwellings in Auckland, and 140,200 attached dwellings, or 532,500 in total.

The dwelling value data was then further disaggregated to identify the estimated value range for detached and attached dwellings at the census unit level, to be applied to the dwelling data available from the Census.

2.5.5 Households, Dwellings and Values

There is no data available to directly link household types to dwelling values. Understanding this relationship is a key requirement for the NPS-UDC.

Nevertheless, these inter-relationships have been estimated for Auckland, by making use of the spatial data at census unit (CAU) level, for households and dwelling types on one hand, and dwelling types and dwelling values, on the other.

[5] Including those who may not being paying rent, as family members or others.

The approach is to use the Census data on households and dwelling types occupied at CAU level, and apply the dwelling types to dwelling value relationships at CAU level. The relationships between household types, dwelling types, and dwelling values may be reasonably approximated by pro rating dwelling values across household types.

Thus, if 50 single-person households occupy a separate house in a CAU, then the value pattern for separate houses in that CAU is assumed to apply to those households *pro rata*. If 20% of all separate houses in that CAU are in the $300,000 to $400,000 value band, then it is assumed *a priori* that 20% of all single person households occupying separate houses in that CAU will occupy a house in that value band.

In most instances at the CAU level, the number of dwellings does not concord exactly with the number of usually resident households. This is because some dwellings counted at Census time may be unoccupied, or be occupied by visitors. For that reason, the analysis of the relationship between household types, dwelling types and dwelling values is based on the number of usually resident households. The dwelling type and dwelling value information is in effect distributed across those resident households, at the CAU level. This is the appropriate base point, because the analysis is focused on household types, and the dwellings which they occupy as owners or tenants. The practical outcome is that at the CAU level it avoids the need to account for unoccupied dwellings, and bases the demand on resident households – that is, for the given number of households of each type, the demand is estimated for *x* separate dwellings and *y* attached dwellings, and further disaggregated into value bands.

This approach does not achieve a direct matching of households to dwelling values, and it is necessarily an approximation. However, there are some 405 CAUs in Auckland for which household, dwelling and dwelling value data is available. Moreover, there are substantial differences among CAUs in the mix of household types and income bands. This substantial variation suggests it provides a suitable basis for understanding how each type of household (including their income levels and age) is related to the dwelling estate.

2.6 Demand by Household Type, Dwelling Type, and Dwelling Value

The purpose of the analysis and reconciliation described above is to understand and where possible quantify the patterns of dwelling ownership and occupancy by each household type (including the household type to dwelling type relationships), and the relationships between household types and dwelling values. This reconciliation has not been undertaken before, primarily because of the lack of information on the value of dwellings which can be linked to Census detail on households and incomes.

Understanding this relationship is a core requirement of the NPS, with current patterns of demand being the base indicator of future demands – by dwelling type and value band – from the future population.

A major output from the analysis described above is estimates of how households of each type including income band, and age group, occupy dwellings of each type and value band. The estimates for Auckland provide the overall view of the relationships between resident household types and dwelling types and values, at a level which is appropriate for the NPS requirements.

The relationships for 2013 and estimated for 2016 are captured in the Auckland Housing Model 2017

2.7 Projected Demand for Housing

The Model then estimates future demand for housing in Auckland by dwelling type and value band, based on the projected numbers of households of each type. A major output is estimated dwelling numbers by type (detached and attached) in each value band.

Overall demand for housing is further disaggregated by dwelling tenure, based on current shares of owned and rented dwellings). This pattern is shown by each household type, in order to better understand the nature of future demand.

2.7.1 Base Case

The Base Case output applies the medium and high growth projections, and allows for the current dwelling mix and dwelling value distribution for each household type to persist into the future. In effect, this *pro rates* forward the existing demand levels. It factors demand (dwelling numbers) up (or down) according to the net change in household numbers.

2.7.2 Variations

However, the *Auckland Housing Model* also provides a number of capabilities to test possible future outcomes. In particular, there is scope to vary the future mix of dwellings, as between detached dwellings and attached dwellings. A key aspect is the ability to reduce the share of dwellings which are detached, and increase the share of attached dwellings. This is not done *pro rata*, however, because part of an expected change in dwelling typology will be a reduction in the importance of one-level attached dwellings – the units and town houses commonly built in the 1970s and 1980s – and a corresponding increase in the importance of 2 and 3 level dwellings (terrace houses) and developments of 4 or more levels (mainly apartments).

The structure of the Model means that any shift in the structure of housing supply over time will flow on as changes in the mix of detached and attached dwellings which are occupied by households of each type. This is an approximation, based on the current (2016) mix of attached and detached dwellings.

2.7.3 Dwellings by Value

Any change in the mix of dwellings can be expected to have some effect on the numbers of dwellings in each value band. across each value band. The base case assumption is that the future mix of detached dwellings and attached dwellings will each have a distribution of values which is very close to that observed in 2016. The future distribution of dwelling values will change, but this is simply the result of a *pro rata* estimate which reflects only the greater proportion of attached dwellings and the lower proportion of detached dwellings.

The Auckland Housing Model does not have capability to estimate the values of new dwellings which would be added to the existing building estate through a development process (in the same way, for example, as the Council's ACDC Model).

3 Auckland Housing Demand 2016

3.1 Scope

This section details the estimated housing demand and supply side situation as at June YE 2016. This is for the estimated 544,000 resident households estimated for Auckland, from the resident population of 1,614,300[6]

Initially it provides some key information from the 2013 Census for the regional population as a whole, then it focuses on the 2016 estimated situation urban population and households, so it covers the estimated 518,000 households in the main urban area and towns and villages, and excludes the 21,000 households on rural lifestyle blocks, and 5,000 on farms and rural holdings.

3.2 Household Type and Dwelling Type

The first key indicator is the pattern of housing demand in terms of dwellings occupied by each household type, as at Census 2013. Table 3.1 and Figure 3.1 show the overall pattern for Auckland at that time, for urban and rural households. This is not differentiated by dwelling value.

The 2013 Census data provides detail for 462,090 households out of 468,000 identified on Census night in Auckland. The analysis achieves good coverage of households as at Census night (98.8%), and still quite strong coverage (92.8%) of the estimated 498,000 resident private households as at June 2013. The post-Census enumeration process does not estimate the dwellings which were occupied by households absent on Census night.

Nevertheless, the available data does provide a very solid base for estimating the household type to dwelling type and dwelling value patterns for Auckland, and is the most comprehensive available.

The key parameters of current (2013) housing demand are:

a. Separate houses (detached) are the dominant dwelling type (327,060 dwellings or 70.8%);
b. Attached dwellings (town houses, terrace houses and apartments) account for 106,100 dwellings or 22.9% of the total estate;
c. Nearly 6.3% of all private dwellings (28,890) were identified as dwellings at the Census, but were not further defined as being detached or attached. This means that the share of dwellings which are detached or standalone may be as high as 77.1% (if all the “nfd” dwellings were detached, or the attached share may be as high as 29.2% (if all “nfd” dwellings were attached). The likely situation was between the two extremes, with detached dwellings accounting for 70.8% to 75%, and attached dwellings between 22.9% and 25% ;

[6] StatisticsNZ, 2017.

d. Of the attached dwellings, nearly half (48,630, 10.5% of the total) are single level, typically town house and home unit typology;

e. Some 41,790 attached dwellings are in buildings of 2 or 3 levels (9.0%), with a further 14,200 (3.1%) in buildings of 4 levels or more (predominantly apartments). In total, there are 55,990 dwellings in structures which are built "upwards" to 2 levels or higher. Generally higher intensity development, including up to 4 or 5 levels in some residential zones, is a key aspect of the Auckland Unitary Plan.

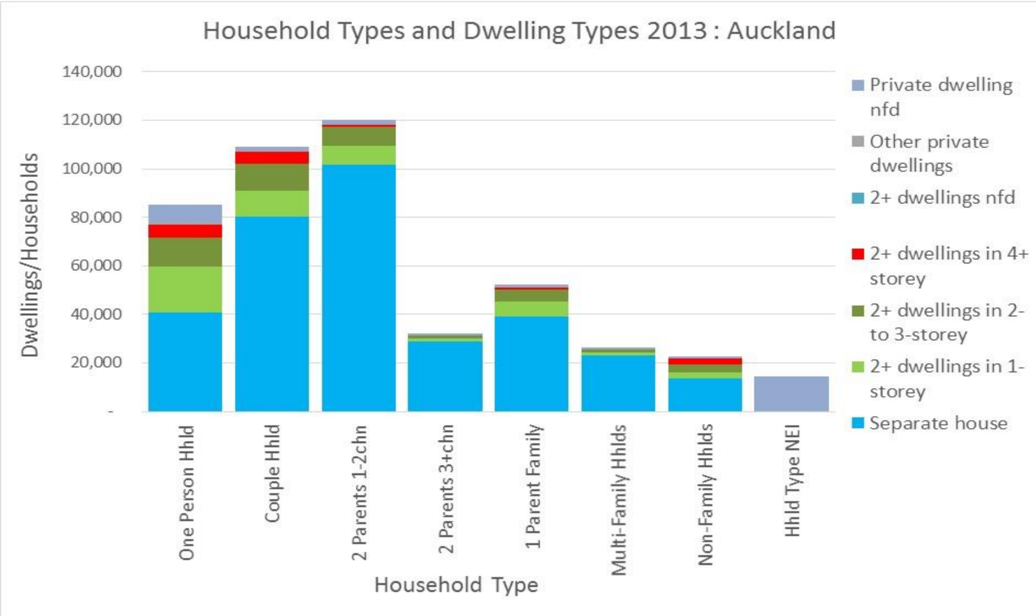
Table 3.1 – Auckland Dwelling Occupancy by Household Type 2013

Dwelling Type	One Person Hhld	Couple Hhld	2 Parents 1-2chn	2 Parents 3+chn	1 Parent Family	Multi-Family Hhlds	Non-Family Hhlds	Hhld Type NEI	Total Hhlds
Separate house	40,620	80,110	101,670	28,820	39,180	23,060	13,500	100	327,060
2+ dwellings in 1-storey	19,020	10,680	7,850	1,210	5,960	1,150	2,760	-	48,630
2+ dwellings in 2- to 3-storey	11,950	11,280	7,620	1,400	5,050	1,260	3,230	-	41,790
2+ dwellings in 4+ storey	5,300	4,880	1,010	20	680	30	2,270	10	14,200
2+ dwellings nfd	220	30	50	10	80	-	10	-	400
Other private dwellings	710	250	80	-	60	10	10	-	1,120
Private dwelling nfd	7,520	1,690	1,700	710	1,350	710	860	14,350	28,890
Total Private Dwellings	85,340	108,920	119,980	32,170	52,360	26,220	22,640	14,460	462,090
Structure % by Household type									
Separate house	47.6%	73.5%	84.7%	89.6%	74.8%	87.9%	59.6%	0.7%	70.8%
2+ dwellings in 1-storey	22.3%	9.8%	6.5%	3.8%	11.4%	4.4%	12.2%	0.0%	10.5%
2+ dwellings in 2- to 3-storey	14.0%	10.4%	6.4%	4.4%	9.6%	4.8%	14.3%	0.0%	9.0%
2+ dwellings in 4+ storey	6.2%	4.5%	0.8%	0.1%	1.3%	0.1%	10.0%	0.1%	3.1%
2+ dwellings nfd	0.3%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.1%
Other private dwellings	0.8%	0.2%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.2%
Private dwelling nfd	8.8%	1.6%	1.4%	2.2%	2.6%	2.7%	3.8%	99.2%	6.3%
Total Private Dwellings	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Overall Structure									
Separate house	8.8%	17.3%	22.0%	6.2%	8.5%	5.0%	2.9%	0.0%	70.8%
2+ dwellings in 1-storey	4.1%	2.3%	1.7%	0.3%	1.3%	0.2%	0.6%	0.0%	10.5%
2+ dwellings in 2- to 3-storey	2.6%	2.4%	1.6%	0.3%	1.1%	0.3%	0.7%	0.0%	9.0%
2+ dwellings in 4+ storey	1.1%	1.1%	0.2%	0.0%	0.1%	0.0%	0.5%	0.0%	3.1%
2+ dwellings nfd	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Other private dwellings	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Private dwelling nfd	1.6%	0.4%	0.4%	0.2%	0.3%	0.2%	0.2%	3.1%	6.3%
Total Private Dwellings	**18.5%**	**23.6%**	**26.0%**	**7.0%**	**11.3%**	**5.7%**	**4.9%**	**3.1%**	**100%**

Source: Census 2013

Unsurprisingly, there are clear differences among household types in the dwellings occupied as at 2013. Single person households show a much higher propensity than average (42.8%) to occupy attached dwellings, especially single level dwellings. Nearly as many single person households are in attached dwellings as are in detached (47.8%).

Figure 3.1: Auckland Dwelling Occupancy by Household Type 2013.



Couple households also show greater propensity to live in attached dwellings, although three out of four couples still live in detached dwellings. Two-parent family and multi-family households show high propensity (85%+) to live in detached dwellings, one-parent families also show high propensity (three of every four) to live in detached dwellings, and less than one quarter in attached dwellings. Non-family households (usually flatting structures) also show relatively high occupation of attached dwellings, though three in five are still in detached dwellings.

3.3 Dwelling Type and Household Income

Broad patterns are also evident in dwelling occupancy among household income groups. These are shown in Table 3.2. The key features are:

a. Lower income households show general greater propensity than average to reside in attached dwellings, while higher income households show much higher than average propensity to reside in detached dwellings;

b. To a considerable degree, these patterns reflect the household types, especially with older single and couple households on low to low-medium incomes showing some preference for attached dwellings. This "preference" may be based on choice of dwelling style, or affordability.

Table 3.2: Auckland Dwelling Occupancy by Household Income 2013

Household Income ($000) / Dwelling Type	Income < $30K	Income $30-50K	Income $50-70K	Income $70-100K	Income $100K +	Income Not Stated	Total
Separate house	40,220	37,790	35,430	51,820	119,780	42,020	327,060
2+ dwellings in 1-storey	15,370	8,390	6,700	6,640	5,560	5,970	48,630
2+ dwellings in 2- to 3-storey	8,120	6,230	5,570	6,750	10,510	4,610	41,790
2+ dwellings in 4+ storey	3,540	2,020	1,800	2,100	3,360	1,370	14,190
2+ dwellings nfd	190	30	10	10	10	160	410
Other private dwellings	520	250	90	100	80	80	1,120
Private dwelling nfd	3,190	1,450	930	900	1,420	20,990	28,880
Total private dwellings	71,150	56,160	50,530	68,320	140,720	75,200	462,080
Structure by Income Band							
Separate house	56.5%	67.3%	70.1%	75.8%	85.1%	55.9%	70.8%
2+ dwellings in 1-storey	21.6%	14.9%	13.3%	9.7%	4.0%	7.9%	10.5%
2+ dwellings in 2- to 3-storey	11.4%	11.1%	11.0%	9.9%	7.5%	6.1%	9.0%
2+ dwellings in 4+ storey	5.0%	3.6%	3.6%	3.1%	2.4%	1.8%	3.1%
2+ dwellings nfd	0.3%	0.1%	0.0%	0.0%	0.0%	0.2%	0.1%
Other private dwellings	0.7%	0.4%	0.2%	0.1%	0.1%	0.1%	0.2%
Private dwelling nfd	4.5%	2.6%	1.8%	1.3%	1.0%	27.9%	6.3%
Total private dwellings	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Overall Demand Structure							
Separate house	8.7%	8.2%	7.7%	11.2%	25.9%	9.1%	70.8%
2+ dwellings in 1-storey	3.3%	1.8%	1.4%	1.4%	1.2%	1.3%	10.5%
2+ dwellings in 2- to 3-storey	1.8%	1.3%	1.2%	1.5%	2.3%	1.0%	9.0%
2+ dwellings in 4+ storey	0.8%	0.4%	0.4%	0.5%	0.7%	0.3%	3.1%
2+ dwellings nfd	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Other private dwellings	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.2%
Private dwelling nfd	0.7%	0.3%	0.2%	0.2%	0.3%	4.5%	6.3%
Total private dwellings	**15.4%**	**12.2%**	**10.9%**	**14.8%**	**30.5%**	**16.3%**	**100%**

Source: Census 2013

While the above results are unsurprising, it is nevertheless important to demonstrate clearly how demand for housing varies within the community, and to show how the characteristics of households influence their demand for dwellings (as indicated by occupancy).

The figures show how demand for housing is influenced strongly by household type and age – affecting household size and organization, stage in the life cycle and also indicating stage in dwelling ownership sequence – as well as by income – affecting ability to pay. These drivers of demand influence dwelling type needed, and able to be afforded, and dwelling tenure.

If clear demand patterns may be demonstrated for 2013, then these same drivers may be used to assess likely future demand. Auckland will have a considerably larger community in the future. The changes in the structure of that demand – household type and age, and income – will underpin the demand for housing. In parallel, there will also be changes in dwelling tenure – including possible increase in ownership rates among existing households – and in the demand for different types of dwellings, particularly because much of Auckland's capacity for growth is based on attached dwellings including apartments.

3.4 Current Demand Assessment

The following sections set out the estimated demand pattern for 2016, taking into account the patterns observed in 2013, and with allowance for the growth in household numbers and dwellings in the period to 2016.

Existing dwelling occupancy and ownership patterns are important, and the revealed preferences can be seen as a strong indicator of the dwelling and ownership arrangements which households currently prefer. This is because Auckland is a large and mature market, and the ownership and occupancy patterns evident in 2013 are the aggregate outcome from many hundreds of thousands of household choices.

This is not to imply that all households are able to choose the dwelling type, location and tenure which best meets their needs and preferences. Rather, it shows the patterns of occupancy which reflect the preferences and abilities – especially ability to pay – of households of each type. As such, the current patterns are a very important indicator of likely future patterns of demand, if other factors are held constant.

3.4.1 Household Type and Dwelling Tenure 2016

Table 3.3 sets out the tenure patterns by broad dwelling type (detached and attached) for households of each type and income band. An important feature is the higher incidence of dwelling ownership for households in the higher income bands. This is evident for all household types.

Overall, the estimates show 60% of households live in owned dwellings, with the other 40% in rented or other dwellings not owned by them. However, the ownership rate is substantially higher than average for the top income band (75% compared with 60% overall), and substantially lower for households in the lowest income category (41%). Ownership also varies among household types. Two parent families with 1-2 children (70%) and couple households (68%) have relatively higher levels – reflecting in part their higher than average income levels, and the longer time in the property market for mature and older couples - while lower among single person households (54%), one parent families (42%) and non-family households (33%).

The table also shows the higher incidence of detached dwellings (74%) compared with attached. The focus on detached dwellings is also evident for two parent families with children (86%), and multi-family households (90%), though with lower incidence for single person households (51%), and non-family households (60%).

Table 3.3: Auckland Household Tenure by Type and Income : 2016.

		Owned Dwellings		Not-Owned Dwellings			Owned Dwellings		Not-Owned Dwellings		
Household Type	Income	Detached	Attached	Detached	Attached	Total	Detached	Attached	Detached	Attached	Total
One Person Hhld	Up to $30,000	15,490	9,380	8,880	17,710	51,460	30%	18%	17%	34%	100%
	$30,001 - $50,000	7,210	3,840	3,400	6,030	20,480	35%	19%	17%	29%	100%
	$50,001 - $70,000	5,860	3,010	2,090	4,180	15,140	39%	20%	14%	28%	100%
	$70,001 - $100,000	4,260	2,200	1,130	2,540	10,130	42%	22%	11%	25%	100%
	$100,001 and over	3,550	1,610	760	1,700	7,620	47%	21%	10%	22%	100%
	Total	36,370	20,040	16,260	32,160	104,830	35%	19%	16%	31%	100%
Couple Hhld	Up to $30,000	5,870	1,210	2,850	3,620	13,550	43%	9%	21%	27%	100%
	$30,001 - $50,000	12,390	2,570	3,390	3,580	21,930	56%	12%	15%	16%	100%
	$50,001 - $70,000	9,290	1,650	2,950	3,350	17,240	54%	10%	17%	19%	100%
	$70,001 - $100,000	15,050	2,430	4,760	5,140	27,380	55%	9%	17%	19%	100%
	$100,001 and over	34,250	5,210	7,820	6,270	53,550	64%	10%	15%	12%	100%
	Total	76,850	13,070	21,770	21,960	133,650	58%	10%	16%	16%	100%
2 Parents 1-2chn	Up to $30,000	2,970	440	2,810	2,070	8,290	36%	5%	34%	25%	100%
	$30,001 - $50,000	4,880	610	3,950	2,580	12,020	41%	5%	33%	21%	100%
	$50,001 - $70,000	7,990	920	5,000	2,760	16,670	48%	6%	30%	17%	100%
	$70,001 - $100,000	17,430	1,780	7,100	3,350	29,660	59%	6%	24%	11%	100%
	$100,001 and over	59,180	3,720	10,480	3,060	76,440	77%	5%	14%	4%	100%
	Total	92,450	7,470	29,340	13,820	143,080	65%	5%	21%	10%	100%
2 Parents 3+chn	Up to $30,000	720	-	1,860	630	3,210	22%	0%	58%	20%	100%
	$30,001 - $50,000	1,140	60	2,230	620	4,050	28%	1%	55%	15%	100%
	$50,001 - $70,000	1,940	100	2,470	560	5,070	38%	2%	49%	11%	100%
	$70,001 - $100,000	4,230	170	2,890	530	7,820	54%	2%	37%	7%	100%
	$100,001 and over	13,920	490	3,440	480	18,330	76%	3%	19%	3%	100%
	Total	21,950	820	12,890	2,820	38,480	57%	2%	33%	7%	100%
1 Parent Family	Up to $30,000	3,980	720	9,710	5,340	19,750	20%	4%	49%	27%	100%
	$30,001 - $50,000	4,510	790	6,770	3,160	15,230	30%	5%	44%	21%	100%
	$50,001 - $70,000	4,200	780	3,640	1,620	10,240	41%	8%	36%	16%	100%
	$70,001 - $100,000	4,910	830	2,940	1,220	9,900	50%	8%	30%	12%	100%
	$100,001 and over	5,040	650	1,880	720	8,290	61%	8%	23%	9%	100%
	Total	22,640	3,770	24,940	12,060	63,410	36%	6%	39%	19%	100%
Multi-Family Hhlds	Up to $30,000	550	30	840	200	1,620	34%	2%	52%	12%	100%
	$30,001 - $50,000	910	10	1,070	270	2,260	40%	0%	47%	12%	100%
	$50,001 - $70,000	1,450	100	1,340	390	3,280	44%	3%	41%	12%	100%
	$70,001 - $100,000	2,990	180	2,100	410	5,680	53%	3%	37%	7%	100%
	$100,001 and over	13,000	900	4,990	900	19,790	66%	5%	25%	5%	100%
	Total	18,900	1,220	10,340	2,170	32,630	58%	4%	32%	7%	100%
Non-Family Hhlds	Up to $30,000	600	240	1,420	2,430	4,690	13%	5%	30%	52%	100%
	$30,001 - $50,000	1,280	260	1,430	1,470	4,440	29%	6%	32%	33%	100%
	$50,001 - $70,000	1,220	260	1,380	1,440	4,300	28%	6%	32%	33%	100%
	$70,001 - $100,000	1,670	340	1,690	1,720	5,420	31%	6%	31%	32%	100%
	$100,001 and over	2,780	680	3,380	2,260	9,100	31%	7%	37%	25%	100%
	Total	7,550	1,780	9,300	9,320	27,950	27%	6%	33%	33%	100%
Total Households	Up to $30,000	30,170	12,020	28,370	32,000	102,560	29%	12%	28%	31%	100%
	$30,001 - $50,000	32,310	8,150	22,230	17,710	80,400	40%	10%	28%	22%	100%
	$50,001 - $70,000	31,950	6,810	18,860	14,300	71,920	44%	9%	26%	20%	100%
	$70,001 - $100,000	50,540	7,930	22,610	14,900	95,980	53%	8%	24%	16%	100%
	$100,001 and over	131,710	13,250	32,740	15,390	193,090	68%	7%	17%	8%	100%
	Total	276,680	48,160	124,810	94,300	543,950	51%	9%	23%	17%	100%

Source: ME Auckland Housing Model 2017

Table 3.4 sets out the tenure patterns by broad dwelling type (detached and attached) for households of each type and age group. An important feature is the higher incidence of dwelling ownership for households in the over 40s age bands, but the lower rates of ownership in the older age bands (75+ years).

This to a considerable degree reflects the common move in later life stages to attached dwellings, and retirement village accommodation, especially among single person households. Among other household types, the levels of ownership are generally high through the later life stages.

Table 3.4: Auckland Households' Tenure by Type and Age: 2016.

		Owned Dwellings		Not-Owned Dwellings			Owned Dwellings		Not-Owned Dwellings		
Household Type	Age	Detached	Attached	Detached	Attached	Total	Detached	Attached	Detached	Attached	Total
One Person Hhld	15-29	630	500	1,040	4,070	6,250	10%	8%	17%	65%	100%
	30-39	2,060	1,420	1,750	5,080	10,310	20%	14%	17%	49%	100%
	40-49	4,090	2,100	2,600	4,930	13,720	30%	15%	19%	36%	100%
	50-64	11,650	5,080	4,600	7,760	29,090	40%	17%	16%	27%	100%
	65-74	9,000	4,520	2,850	4,830	21,200	42%	21%	13%	23%	100%
	75+	8,930	6,420	3,420	5,490	24,270	37%	26%	14%	23%	100%
	Total	36,360	20,040	16,260	32,160	104,840	35%	19%	16%	31%	100%
Couple Hhld	15-29	4,260	1,090	5,140	8,230	18,720	23%	6%	27%	44%	100%
	30-39	7,740	1,470	3,940	5,700	18,840	41%	8%	21%	30%	100%
	40-49	6,780	1,070	2,240	1,700	11,780	58%	9%	19%	14%	100%
	50-64	28,920	3,720	5,100	2,680	40,420	72%	9%	13%	7%	100%
	65-74	20,480	3,190	3,210	1,980	28,860	71%	11%	11%	7%	100%
	75+	8,660	2,520	2,140	1,670	14,990	58%	17%	14%	11%	100%
	Total	76,840	13,060	21,770	21,960	133,610	58%	10%	16%	16%	100%
2 Parents 1-2chn	15-29	5,690	590	4,780	2,750	13,820	41%	4%	35%	20%	100%
	30-39	22,350	2,300	9,410	5,630	39,680	56%	6%	24%	14%	100%
	40-49	31,340	2,410	8,420	3,490	45,650	69%	5%	18%	8%	100%
	50-64	28,250	1,930	5,520	1,780	37,480	75%	5%	15%	5%	100%
	65-74	3,730	200	890	140	4,960	75%	4%	18%	3%	100%
	75+	1,090	30	310	20	1,450	75%	2%	21%	1%	100%
	Total	92,450	7,460	29,330	13,810	143,040	65%	5%	21%	10%	100%
2 Parents 3+chn	15-29	1,080	10	1,610	390	3,090	35%	0%	52%	13%	100%
	30-39	5,550	270	4,650	1,090	11,550	48%	2%	40%	9%	100%
	40-49	10,600	390	4,750	980	16,720	63%	2%	28%	6%	100%
	50-64	4,450	150	1,740	360	6,700	66%	2%	26%	5%	100%
	65-74	220	-	160	-	380	58%	0%	42%	0%	100%
	75+	40	-	-	-	40	100%	0%	0%	0%	100%
	Total	21,940	820	12,910	2,820	38,480	57%	2%	34%	7%	100%
1 Parent Family	15-29	1,670	220	4,640	2,720	9,240	18%	2%	50%	29%	100%
	30-39	2,510	410	6,620	3,010	12,540	20%	3%	53%	24%	100%
	40-49	6,800	1,210	7,280	3,520	18,810	36%	6%	39%	19%	100%
	50-64	8,270	1,450	5,020	2,350	17,080	48%	8%	29%	14%	100%
	65-74	1,900	290	830	340	3,370	56%	9%	25%	10%	100%
	75+	1,480	210	550	130	2,360	63%	9%	23%	6%	100%
	Total	22,630	3,790	24,940	12,070	63,400	36%	6%	39%	19%	100%
Multi-Family Hhlds	15-29	2,270	140	2,440	650	5,490	41%	3%	44%	12%	100%
	30-39	4,110	330	2,220	510	7,170	57%	5%	31%	7%	100%
	40-49	3,800	240	2,420	440	6,910	55%	3%	35%	6%	100%
	50-64	6,550	400	2,540	510	10,000	66%	4%	25%	5%	100%
	65-74	1,740	110	590	60	2,510	69%	4%	24%	2%	100%
	75+	430	-	120	-	550	78%	0%	22%	0%	100%
	Total	18,900	1,220	10,330	2,170	32,630	58%	4%	32%	7%	100%
Non-Family Hhlds	15-29	930	400	3,970	5,390	10,690	9%	4%	37%	50%	100%
	30-39	1,230	290	1,780	1,890	5,180	24%	6%	34%	36%	100%
	40-49	1,140	240	1,160	760	3,300	35%	7%	35%	23%	100%
	50-64	2,470	510	1,560	990	5,530	45%	9%	28%	18%	100%
	65-74	1,170	220	540	240	2,180	54%	10%	25%	11%	100%
	75+	610	110	290	60	1,060	58%	10%	27%	6%	100%
	Total	7,550	1,770	9,300	9,330	27,940	27%	6%	33%	33%	100%
Total Households	15-29	16,540	2,950	23,610	24,190	67,290	25%	4%	35%	36%	100%
	30-39	45,550	6,490	30,360	22,890	105,290	43%	6%	29%	22%	100%
	40-49	64,550	7,660	28,870	15,820	116,890	55%	7%	25%	14%	100%
	50-64	90,560	13,240	26,070	16,420	146,290	62%	9%	18%	11%	100%
	65-74	38,240	8,530	9,080	7,600	63,460	60%	13%	14%	12%	100%
	75+	21,240	9,290	6,820	7,370	44,710	48%	21%	15%	16%	100%
	TOTAL	276,680	48,160	124,810	94,290	543,930	51%	9%	23%	17%	100%

Source: ME Auckland Housing Model 2017

3.4.2 Owner-Occupier Market Structure

Table 3.5 sets out the structure of the Auckland market for dwelling ownership, estimated for 2016, by household income group. Key features include:

a. The clear positive relationship between dwelling ownership and income, with higher income households showing higher ownership rates across all household types;

Table 3.5: Auckland Owner-Occupier Households Income and Dwelling Type : 2016.

		Dwelling Type			Dwelling Type %			Ownership Incidence			
Household Type	Income	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Rented%
One Person Hhld	Up to $30,000	14,870	9,030	23,900	4.8%	2.9%	7.8%	30%	18%	48%	52%
	$30,001 - $50,000	6,850	3,660	10,510	2.2%	1.2%	3.4%	35%	19%	54%	46%
	$50,001 - $70,000	5,610	2,890	8,500	1.8%	0.9%	2.8%	39%	20%	58%	42%
	$70,001 - $100,000	4,090	2,110	6,200	1.3%	0.7%	2.0%	42%	22%	64%	36%
	$100,001 and over	3,410	1,550	4,960	1.1%	0.5%	1.6%	46%	21%	68%	32%
	Total	34,830	19,240	54,070	11.3%	6.3%	17.6%	35%	19%	54%	46%
Couple Hhld	Up to $30,000	5,510	1,130	6,640	1.8%	0.4%	2.2%	43%	9%	52%	48%
	$30,001 - $50,000	11,510	2,420	13,930	3.7%	0.8%	4.5%	56%	12%	68%	32%
	$50,001 - $70,000	8,560	1,530	10,090	2.8%	0.5%	3.3%	53%	10%	63%	37%
	$70,001 - $100,000	13,880	2,260	16,140	4.5%	0.7%	5.2%	54%	9%	63%	37%
	$100,001 and over	31,870	4,850	36,720	10.4%	1.6%	11.9%	64%	10%	73%	27%
	Total	71,330	12,190	83,520	23.2%	4.0%	27.2%	57%	10%	67%	33%
2 Parents 1-2chn	Up to $30,000	2,860	430	3,290	0.9%	0.1%	1.1%	36%	5%	41%	59%
	$30,001 - $50,000	4,680	590	5,270	1.5%	0.2%	1.7%	40%	5%	46%	54%
	$50,001 - $70,000	7,590	870	8,460	2.5%	0.3%	2.8%	48%	5%	53%	47%
	$70,001 - $100,000	16,550	1,690	18,240	5.4%	0.5%	5.9%	59%	6%	65%	35%
	$100,001 and over	55,830	3,510	59,340	18.1%	1.1%	19.3%	77%	5%	82%	18%
	Total	87,510	7,090	94,600	28.4%	2.3%	30.8%	64%	5%	70%	30%
2 Parents 3+chn	Up to $30,000	700	-	700	0.2%	0.0%	0.2%	22%	0%	22%	78%
	$30,001 - $50,000	1,100	60	1,160	0.4%	0.0%	0.4%	28%	2%	30%	70%
	$50,001 - $70,000	1,850	90	1,940	0.6%	0.0%	0.6%	38%	2%	40%	60%
	$70,001 - $100,000	4,030	160	4,190	1.3%	0.1%	1.4%	54%	2%	56%	44%
	$100,001 and over	13,000	460	13,460	4.2%	0.1%	4.4%	76%	3%	79%	21%
	Total	20,680	770	21,450	6.7%	0.3%	7.0%	57%	2%	59%	41%
1 Parent Family	Up to $30,000	3,840	700	4,540	1.2%	0.2%	1.5%	20%	4%	24%	76%
	$30,001 - $50,000	4,370	770	5,140	1.4%	0.3%	1.7%	30%	5%	35%	65%
	$50,001 - $70,000	4,080	750	4,830	1.3%	0.2%	1.6%	41%	8%	49%	51%
	$70,001 - $100,000	4,750	800	5,550	1.5%	0.3%	1.8%	50%	8%	58%	42%
	$100,001 and over	4,850	630	5,480	1.6%	0.2%	1.8%	61%	8%	69%	31%
	Total	21,890	3,650	25,540	7.1%	1.2%	8.3%	36%	6%	42%	58%
Multi-Family Hhlds	Up to $30,000	540	30	570	0.2%	0.0%	0.2%	34%	2%	36%	64%
	$30,001 - $50,000	900	10	910	0.3%	0.0%	0.3%	40%	0%	41%	59%
	$50,001 - $70,000	1,420	100	1,520	0.5%	0.0%	0.5%	44%	3%	47%	53%
	$70,001 - $100,000	2,940	180	3,120	1.0%	0.1%	1.0%	53%	3%	56%	44%
	$100,001 and over	12,460	870	13,330	4.1%	0.3%	4.3%	66%	5%	70%	30%
	Total	18,260	1,190	19,450	5.9%	0.4%	6.3%	58%	4%	61%	39%
Non-Family Hhlds	Up to $30,000	580	240	820	0.2%	0.1%	0.3%	13%	5%	18%	82%
	$30,001 - $50,000	1,230	250	1,480	0.4%	0.1%	0.5%	29%	6%	34%	66%
	$50,001 - $70,000	1,190	250	1,440	0.4%	0.1%	0.5%	28%	6%	34%	66%
	$70,001 - $100,000	1,620	330	1,950	0.5%	0.1%	0.6%	31%	6%	37%	63%
	$100,001 and over	2,710	660	3,370	0.9%	0.2%	1.1%	30%	7%	38%	62%
	Total	7,330	1,730	9,060	2.4%	0.6%	2.9%	27%	6%	33%	67%
Total Households	Up to $30,000	28,890	11,550	40,440	9.4%	3.8%	13.1%	29%	12%	41%	59%
	$30,001 - $50,000	30,630	7,750	38,380	10.0%	2.5%	12.5%	40%	10%	50%	50%
	$50,001 - $70,000	30,290	6,480	36,770	9.8%	2.1%	12.0%	44%	9%	54%	46%
	$70,001 - $100,000	47,850	7,530	55,380	15.6%	2.4%	18.0%	52%	8%	61%	39%
	$100,001 and over	124,130	12,520	136,650	40.4%	4.1%	44.4%	68%	7%	75%	25%
	Total	**261,790**	**45,830**	**307,620**	**85.1%**	**14.9%**	**100.0%**	**51%**	**9%**	**59%**	**41%**

Source: ME Auckland Housing Model 2017

b. The low preferences for ownership of attached dwellings by all family household types (including multi-family) across all income bands. The low shares of attached owned dwellings is evident for 2-parent and 1-parent households in all income bands, even though the overall ownership levels increase significantly as income increases. This su8ggests that for family households 9ie with children) there is low preference for purchase of attached dwellings, even if they may be less costly than detached dwellings. This is likely to be influenced by the generally greater space requirements for family households;

c. The pattern for single person and couple households is different, with the split between detached and attached dwellings fairly consistent across all income bands. Single person households show by far the highest propensity of all types to own attached dwellings, whether in lower or higher income bands;

d. Single person households (17%) and couple households (27%) account for just under half of total dwelling ownership. Two-parent families account for 38%, and s1-parent families a further 8%;

e. High income and high-medium income households account for some 62.4% of total dwelling ownership, while representing some 53% of all households. In contrast, low and low-medium income households account for 25.6% of all dwelling ownership, while representing 34% of all households.

These patterns are consistent with those evident in Table 3.6, which shows the structure of dwelling ownership by type and age of household.

The preferences for detached dwellings by family households are evident across all age groups, although both single person and couple households show increasing propensity with age to own attached dwellings. This is generally consistent with a shift in later life, especially retirement years, into smaller dwellings, often in more central locations.

An important feature of the dwelling ownership market is that there are no stand-out surprises in the owner patterns. The effects of both income on ownership, and age on dwelling type, are both consistent with a wide range of market assessments and commentary.

Table 3.6: Auckland Owner-Occupier Households Age and Dwelling Type : 2016.

		Dwelling Type			Dwelling Type %			Ownership Incidence			
Household Type	Age	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Rented%
One Person Hhld	15-29	610	480	1,090	0.2%	0.2%	0.4%	10%	8%	18%	82%
	30-39	2,010	1,390	3,400	0.7%	0.5%	1.1%	20%	14%	34%	66%
	40-49	3,940	2,020	5,960	1.3%	0.7%	1.9%	30%	15%	45%	55%
	50-64	11,060	4,830	15,890	3.6%	1.6%	5.2%	40%	17%	58%	42%
	65-74	8,570	4,300	12,870	2.8%	1.4%	4.2%	42%	21%	64%	36%
	75+	8,640	6,210	14,850	2.8%	2.0%	4.8%	37%	26%	63%	37%
	Total	34,830	19,230	54,060	11.3%	6.3%	17.6%	35%	19%	54%	46%
Couple Hhld	15-29	4,140	1,060	5,200	1.3%	0.3%	1.7%	23%	6%	29%	71%
	30-39	7,530	1,430	8,960	2.4%	0.5%	2.9%	41%	8%	49%	51%
	40-49	6,280	990	7,270	2.0%	0.3%	2.4%	57%	9%	67%	33%
	50-64	26,310	3,390	29,700	8.6%	1.1%	9.7%	72%	9%	81%	19%
	65-74	18,830	2,930	21,760	6.1%	1.0%	7.1%	71%	11%	82%	18%
	75+	8,220	2,390	10,610	2.7%	0.8%	3.4%	58%	17%	75%	25%
	Total	71,310	12,190	83,500	23.2%	4.0%	27.1%	57%	10%	67%	33%
2 Parents 1-2chn	15-29	5,500	570	6,070	1.8%	0.2%	2.0%	41%	4%	45%	55%
	30-39	21,520	2,220	23,740	7.0%	0.7%	7.7%	56%	6%	62%	38%
	40-49	29,510	2,270	31,780	9.6%	0.7%	10.3%	69%	5%	74%	26%
	50-64	26,450	1,810	28,260	8.6%	0.6%	9.2%	75%	5%	80%	20%
	65-74	3,500	190	3,690	1.1%	0.1%	1.2%	75%	4%	79%	21%
	75+	1,040	30	1,070	0.3%	0.0%	0.3%	75%	2%	78%	22%
	Total	87,520	7,090	94,610	28.4%	2.3%	30.8%	64%	5%	70%	30%
2 Parents 3+chn	15-29	1,040	10	1,050	0.3%	0.0%	0.3%	35%	0%	35%	65%
	30-39	5,260	250	5,510	1.7%	0.1%	1.8%	48%	2%	50%	50%
	40-49	9,900	360	10,260	3.2%	0.1%	3.3%	63%	2%	65%	35%
	50-64	4,230	140	4,370	1.4%	0.0%	1.4%	66%	2%	69%	31%
	65-74	210	-	210	0.1%	0.0%	0.1%	58%	0%	58%	42%
	75+	40	-	40	0.0%	0.0%	0.0%	100%	0%	100%	0%
	Total	20,680	760	21,440	6.7%	0.2%	7.0%	57%	2%	59%	41%
1 Parent Family	15-29	1,630	210	1,840	0.5%	0.1%	0.6%	18%	2%	20%	80%
	30-39	2,440	400	2,840	0.8%	0.1%	0.9%	20%	3%	23%	77%
	40-49	6,580	1,170	7,750	2.1%	0.4%	2.5%	36%	6%	43%	57%
	50-64	7,970	1,400	9,370	2.6%	0.5%	3.0%	48%	9%	57%	43%
	65-74	1,840	280	2,120	0.6%	0.1%	0.7%	56%	9%	65%	35%
	75+	1,440	200	1,640	0.5%	0.1%	0.5%	63%	9%	72%	28%
	Total	21,900	3,660	25,560	7.1%	1.2%	8.3%	36%	6%	42%	58%
Multi-Family Hhlds	15-29	2,230	140	2,370	0.7%	0.0%	0.8%	41%	3%	44%	56%
	30-39	4,030	330	4,360	1.3%	0.1%	1.4%	57%	5%	62%	38%
	40-49	3,680	240	3,920	1.2%	0.1%	1.3%	55%	4%	59%	41%
	50-64	6,230	370	6,600	2.0%	0.1%	2.1%	65%	4%	69%	31%
	65-74	1,670	110	1,780	0.5%	0.0%	0.6%	69%	5%	74%	26%
	75+	410	-	410	0.1%	0.0%	0.1%	77%	0%	77%	23%
	Total	18,250	1,190	19,440	5.9%	0.4%	6.3%	58%	4%	61%	39%
Non-Family Hhlds	15-29	910	400	1,310	0.3%	0.1%	0.4%	9%	4%	12%	88%
	30-39	1,210	280	1,490	0.4%	0.1%	0.5%	24%	5%	29%	71%
	40-49	1,100	240	1,340	0.4%	0.1%	0.4%	34%	8%	42%	58%
	50-64	2,390	490	2,880	0.8%	0.2%	0.9%	45%	9%	54%	46%
	65-74	1,130	220	1,350	0.4%	0.1%	0.4%	54%	10%	64%	36%
	75+	580	110	690	0.2%	0.0%	0.2%	56%	11%	67%	33%
	Total	7,320	1,740	9,060	2.4%	0.6%	2.9%	27%	6%	33%	67%
Total Households	15-29	16,060	2,870	18,930	5.2%	0.9%	6.2%	25%	4%	29%	71%
	30-39	44,000	6,300	50,300	14.3%	2.0%	16.3%	43%	6%	49%	51%
	40-49	60,990	7,290	68,280	19.8%	2.4%	22.2%	55%	7%	62%	38%
	50-64	84,640	12,430	97,070	27.5%	4.0%	31.6%	62%	9%	71%	29%
	65-74	35,750	8,030	43,780	11.6%	2.6%	14.2%	60%	13%	74%	26%
	75+	20,370	8,940	29,310	6.6%	2.9%	9.5%	47%	21%	68%	32%
	Total	**261,810**	**45,860**	**307,670**	**85.1%**	**14.9%**	**100.0%**	**51%**	**9%**	**59%**	**41%**

Source: ME Auckland Housing Model 2017

3.4.1 Renter Market Structure

Table 3.7 sets out the structure of the Auckland market for rented dwellings, estimated for 2016, by household income group. Key features include:

a. The relatively high incidence of attached dwellings in the rental property estate. Overall, attached dwellings make up around one quarter of the total dwelling estate, but account for some 43% of the total rental dwelling estate;

Table 3.7: Auckland Renter Households Income and Dwelling Type : 2016.

		Dwelling Type			Dwelling Type %			Rental Incidence			
Household Type	Income	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Owned%
One Person Hhld	Up to $30,000	8,520	16,990	25,510	4.1%	8.1%	12.1%	17%	34%	52%	48%
	$30,001 - $50,000	3,240	5,750	8,990	1.5%	2.7%	4.3%	17%	29%	46%	54%
	$50,001 - $70,000	2,010	4,020	6,030	1.0%	1.9%	2.9%	14%	28%	42%	58%
	$70,001 - $100,000	1,090	2,460	3,550	0.5%	1.2%	1.7%	11%	25%	36%	64%
	$100,001 and over	740	1,640	2,380	0.4%	0.8%	1.1%	10%	22%	32%	68%
	Total	15,600	30,860	46,460	7.4%	14.7%	22.1%	16%	31%	46%	54%
Couple Hhld	Up to $30,000	2,680	3,430	6,110	1.3%	1.6%	2.9%	21%	27%	48%	52%
	$30,001 - $50,000	3,170	3,390	6,560	1.5%	1.6%	3.1%	15%	17%	32%	68%
	$50,001 - $70,000	2,760	3,190	5,950	1.3%	1.5%	2.8%	17%	20%	37%	63%
	$70,001 - $100,000	4,490	4,920	9,410	2.1%	2.3%	4.5%	18%	19%	37%	63%
	$100,001 and over	7,420	6,010	13,430	3.5%	2.9%	6.4%	15%	12%	27%	73%
	Total	20,520	20,940	41,460	9.8%	10.0%	19.7%	16%	17%	33%	67%
2 Parents 1-2chn	Up to $30,000	2,720	2,000	4,720	1.3%	1.0%	2.2%	34%	25%	59%	41%
	$30,001 - $50,000	3,800	2,490	6,290	1.8%	1.2%	3.0%	33%	22%	54%	46%
	$50,001 - $70,000	4,770	2,640	7,410	2.3%	1.3%	3.5%	30%	17%	47%	53%
	$70,001 - $100,000	6,770	3,200	9,970	3.2%	1.5%	4.7%	24%	11%	35%	65%
	$100,001 and over	9,930	2,910	12,840	4.7%	1.4%	6.1%	14%	4%	18%	82%
	Total	27,990	13,240	41,230	13.3%	6.3%	19.6%	21%	10%	30%	70%
2 Parents 3+chn	Up to $30,000	1,820	610	2,430	0.9%	0.3%	1.2%	58%	19%	78%	22%
	$30,001 - $50,000	2,150	600	2,750	1.0%	0.3%	1.3%	55%	15%	70%	30%
	$50,001 - $70,000	2,360	540	2,900	1.1%	0.3%	1.4%	49%	11%	60%	40%
	$70,001 - $100,000	2,760	500	3,260	1.3%	0.2%	1.5%	37%	7%	44%	56%
	$100,001 and over	3,210	450	3,660	1.5%	0.2%	1.7%	19%	3%	21%	79%
	Total	12,300	2,700	15,000	5.8%	1.3%	7.1%	34%	7%	41%	59%
1 Parent Family	Up to $30,000	9,430	5,190	14,620	4.5%	2.5%	6.9%	49%	27%	76%	24%
	$30,001 - $50,000	6,560	3,060	9,620	3.1%	1.5%	4.6%	44%	21%	65%	35%
	$50,001 - $70,000	3,530	1,570	5,100	1.7%	0.7%	2.4%	36%	16%	51%	49%
	$70,001 - $100,000	2,850	1,180	4,030	1.4%	0.6%	1.9%	30%	12%	42%	58%
	$100,001 and over	1,810	700	2,510	0.9%	0.3%	1.2%	23%	9%	31%	69%
	Total	24,180	11,700	35,880	11.5%	5.6%	17.1%	39%	19%	58%	42%
Multi-Family Hhlds	Up to $30,000	830	200	1,030	0.4%	0.1%	0.5%	52%	13%	64%	36%
	$30,001 - $50,000	1,050	270	1,320	0.5%	0.1%	0.6%	47%	12%	59%	41%
	$50,001 - $70,000	1,310	390	1,700	0.6%	0.2%	0.8%	41%	12%	53%	47%
	$70,001 - $100,000	2,060	410	2,470	1.0%	0.2%	1.2%	37%	7%	44%	56%
	$100,001 and over	4,800	870	5,670	2.3%	0.4%	2.7%	25%	5%	30%	70%
	Total	10,050	2,140	12,190	4.8%	1.0%	5.8%	32%	7%	39%	61%
Non-Family Hhlds	Up to $30,000	1,380	2,390	3,770	0.7%	1.1%	1.8%	30%	52%	82%	18%
	$30,001 - $50,000	1,390	1,430	2,820	0.7%	0.7%	1.3%	32%	33%	66%	34%
	$50,001 - $70,000	1,340	1,410	2,750	0.6%	0.7%	1.3%	32%	34%	66%	34%
	$70,001 - $100,000	1,650	1,680	3,330	0.8%	0.8%	1.6%	31%	32%	63%	37%
	$100,001 and over	3,320	2,220	5,540	1.6%	1.1%	2.6%	37%	25%	62%	38%
	Total	9,080	9,130	18,210	4.3%	4.3%	8.7%	33%	33%	67%	33%
Total Households	Up to $30,000	27,370	30,820	58,190	13.0%	14.7%	27.7%	28%	31%	59%	41%
	$30,001 - $50,000	21,360	16,980	38,340	10.2%	8.1%	18.2%	28%	22%	50%	50%
	$50,001 - $70,000	18,080	13,750	31,830	8.6%	6.5%	15.1%	26%	20%	46%	54%
	$70,001 - $100,000	21,660	14,330	35,990	10.3%	6.8%	17.1%	24%	16%	39%	61%
	$100,001 and over	31,230	14,790	46,020	14.8%	7.0%	21.9%	17%	8%	25%	75%
	Total	**119,700**	**90,670**	**210,370**	**56.9%**	**43.1%**	**100.0%**	**23%**	**18%**	**41%**	**59%**

Source: ME Auckland Housing Model 2017

b. For both single person and couple households which are renting, attached dwellings account for more than half of the total dwellings;

c. In similar vein, for family households which are renting, attached dwellings account for one third of their total accommodation, compared with less than one-tenth of dwellings for owner occupiers;

d. For non-family renting households, attached dwellings account for half of their total accommodation.

Similar patterns are evident when the renter market is examined on the basis of household age (Table 3.8). while the share of households which are renters rather than owner-occupiers does decrease with age, overall some 32% of households in the 75 years and over category are renters, and 26% in the 65-74 age bands.

Table 3.8: Auckland Renter Households Age and Dwelling Type : 2016.

		Dwelling Type			Dwelling Type %			Rental Incidence			
Household Type	Age	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Owned%
One Person Hhld	15-29	1,000	3,920	4,920	0.5%	1.9%	2.3%	17%	65%	82%	18%
	30-39	1,700	4,940	6,640	0.8%	2.3%	3.2%	17%	49%	66%	34%
	40-49	2,490	4,710	7,200	1.2%	2.2%	3.4%	19%	36%	55%	45%
	50-64	4,370	7,360	11,730	2.1%	3.5%	5.6%	16%	27%	42%	58%
	65-74	2,720	4,600	7,320	1.3%	2.2%	3.5%	13%	23%	36%	64%
	75+	3,310	5,320	8,630	1.6%	2.5%	4.1%	14%	23%	37%	63%
	Total	15,590	30,850	46,440	7.4%	14.7%	22.1%	16%	31%	46%	54%
Couple Hhld	15-29	4,990	7,980	12,970	2.4%	3.8%	6.2%	27%	44%	71%	29%
	30-39	3,830	5,530	9,360	1.8%	2.6%	4.4%	21%	30%	51%	49%
	40-49	2,080	1,580	3,660	1.0%	0.8%	1.7%	19%	14%	33%	67%
	50-64	4,630	2,430	7,060	2.2%	1.2%	3.4%	13%	7%	19%	81%
	65-74	2,960	1,830	4,790	1.4%	0.9%	2.3%	11%	7%	18%	82%
	75+	2,040	1,590	3,630	1.0%	0.8%	1.7%	14%	11%	25%	75%
	Total	20,530	20,940	41,470	9.8%	10.0%	19.7%	16%	17%	33%	67%
2 Parents 1-2chn	15-29	4,630	2,660	7,290	2.2%	1.3%	3.5%	35%	20%	55%	45%
	30-39	9,080	5,440	14,520	4.3%	2.6%	6.9%	24%	14%	38%	62%
	40-49	7,950	3,310	11,260	3.8%	1.6%	5.4%	18%	8%	26%	74%
	50-64	5,190	1,670	6,860	2.5%	0.8%	3.3%	15%	5%	20%	80%
	65-74	840	130	970	0.4%	0.1%	0.5%	18%	3%	21%	79%
	75+	290	20	310	0.1%	0.0%	0.1%	21%	1%	22%	77%
	Total	27,980	13,230	41,210	13.3%	6.3%	19.6%	21%	10%	30%	70%
2 Parents 3+chn	15-29	1,560	370	1,930	0.7%	0.2%	0.9%	52%	12%	65%	35%
	30-39	4,450	1,050	5,500	2.1%	0.5%	2.6%	40%	10%	50%	50%
	40-49	4,490	930	5,420	2.1%	0.4%	2.6%	29%	6%	35%	65%
	50-64	1,660	340	2,000	0.8%	0.2%	1.0%	26%	5%	31%	69%
	65-74	150	-	150	0.1%	0.0%	0.1%	42%	0%	42%	58%
	75+	-	-	-	0.0%	0.0%	0.0%	0%	0%	0%	100%
	Total	12,310	2,690	15,000	5.9%	1.3%	7.1%	34%	7%	41%	59%
1 Parent Family	15-29	4,520	2,650	7,170	2.1%	1.3%	3.4%	50%	29%	80%	20%
	30-39	6,440	2,930	9,370	3.1%	1.4%	4.5%	53%	24%	77%	23%
	40-49	7,040	3,400	10,440	3.3%	1.6%	5.0%	39%	19%	57%	43%
	50-64	4,830	2,260	7,090	2.3%	1.1%	3.4%	29%	14%	43%	57%
	65-74	800	330	1,130	0.4%	0.2%	0.5%	25%	10%	35%	65%
	75+	530	130	660	0.3%	0.1%	0.3%	23%	6%	29%	71%
	Total	24,160	11,700	35,860	11.5%	5.6%	17.0%	39%	19%	58%	42%
Multi-Family Hhlds	15-29	2,390	640	3,030	1.1%	0.3%	1.4%	44%	12%	56%	44%
	30-39	2,180	500	2,680	1.0%	0.2%	1.3%	31%	7%	38%	62%
	40-49	2,360	430	2,790	1.1%	0.2%	1.3%	35%	6%	42%	58%
	50-64	2,440	490	2,930	1.2%	0.2%	1.4%	26%	5%	31%	69%
	65-74	570	60	630	0.3%	0.0%	0.3%	24%	2%	26%	74%
	75+	120	-	120	0.1%	0.0%	0.1%	23%	0%	23%	77%
	Total	10,060	2,120	12,180	4.8%	1.0%	5.8%	32%	7%	39%	61%
Non-Family Hhlds	15-29	3,900	5,310	9,210	1.9%	2.5%	4.4%	37%	51%	88%	12%
	30-39	1,750	1,850	3,600	0.8%	0.9%	1.7%	34%	36%	71%	29%
	40-49	1,120	740	1,860	0.5%	0.4%	0.9%	35%	23%	58%	42%
	50-64	1,510	950	2,460	0.7%	0.5%	1.2%	28%	18%	46%	54%
	65-74	520	230	750	0.2%	0.1%	0.4%	25%	11%	36%	64%
	75+	280	60	340	0.1%	0.0%	0.2%	27%	6%	33%	67%
	Total	9,080	9,140	18,220	4.3%	4.3%	8.7%	33%	34%	67%	33%
Total Households	15-29	22,990	23,530	46,520	10.9%	11.2%	22.1%	35%	36%	71%	29%
	30-39	29,430	22,240	51,670	14.0%	10.6%	24.6%	29%	22%	51%	49%
	40-49	27,530	15,100	42,630	13.1%	7.2%	20.3%	25%	14%	38%	62%
	50-64	24,630	15,500	40,130	11.7%	7.4%	19.1%	18%	11%	29%	71%
	65-74	8,560	7,180	15,740	4.1%	3.4%	7.5%	14%	12%	26%	74%
	75+	6,570	7,120	13,690	3.1%	3.4%	6.5%	15%	17%	32%	68%
	Total	**119,710**	**90,670**	**210,380**	**56.9%**	**43.1%**	**100.0%**	**23%**	**18%**	**41%**	**59%**

Source: ME Auckland Housing Model 2017

On the basis that dwelling ownership rates are unlikely to increase markedly for households in the 65 years and over age brackets, given their life-stage and the reduction in income for many entering the retirement years, there is still a very substantial rental market for households in the older age groups, in the order of some 29,000 households currently, of whom over four-fifths are single person or couple households.

Dwelling ownership rates do improve markedly through the life-stages – from a low of 29% for households in the under 30 age band, to 49% for those in the 30-39 band, 62% for those in the 40-49 band, reaching 71% for those in the 50-64 band, and the high of 74% for those in the 65-74 band. However, it is important to not assume that the future population will automatically achieve those relatively high levels of dwelling ownership in the future, because the effects of high dwelling prices have already flowed through to ownership rates for those in the 30-39 age bands which are substantially lower than was the case for earlier generations.

For example, if Auckland households in 2013 had achieved the same levels of dwelling ownership as they had in 2001 (taking into account age, income and ethnicity) then there would have been some 16,800 more households (5.6%) owning dwellings in 2013 than the Census figures actually showed. The difference was clearly evident among the low and low-medium income households, and most pronounced for those in the 25-39 age bands, which covers the years in which households' moves into dwelling ownership are most marked.

3.5 Household Type and Dwelling Value Band 2016

The second major focus of this assessment is the relationship between households and the values of the dwellings which they occupy. A key output from the Auckland Housing Model is the estimates of the dwellings by value which are occupied by households of each type. Although the mean and median dwelling values do have some relevance, the core matter for the market as a whole is the distribution of dwelling values, for households of each type in total, and also for households which own or rent their dwellings.

Note that the tables in the section below are based on the $2014 dwelling values[7], which have been broadly updated to 2017 values based on the Auckland-wide average increase recorded between 2014 and 2016. The estimates are based on the 2013 dwelling occupancy patterns by household type at CAU level, factored up for estimated household numbers as at June 2016. This assumes the relationships between household type and dwelling type observed in 2013 have persisted to 2016.

Ideally, once the detailed 2017 revaluation data is available, that can be applied to the 2016 household estimates to indicate $2016 values. The 2017 data showed an average value increase in the order of 45% for Auckland dwellings as a whole, though this varied within the urban area, and on average there was nil net increase in values between June 2016 and June 2017.

[7] The 2017 valuation statistics indicate an average increase of some 45% for Auckland residential properties over the 2014-2017 period.

Within that proviso that the value ranges are indicative, the following tables and figures show important patterns of dwelling occupancy by the Auckland community.

3.5.1 Dwelling Values by All Households

Table 3.9 shows the estimated distribution of dwelling values for all household types and each main household type as at June 2016. The Auckland-wide pattern shows that each household type occupies a substantial number of dwellings in every value band. There is limited difference among the main household types in terms of their mean dwelling value, and in the distribution of dwellings by value;

Table 3.9: Households by Type and Dwelling Value Band 2016

Dwelling Value ($000)	One Person	Couple	2 Parents 1-2 Chn	2 Parents 3+ Chn	1 Parent Family	Multi-Family Hhlds	Non-Family Hhlds	Total Households
$0-300	2,790	1,870	1,450	360	1,130	320	700	8,610
$300-440	9,640	7,260	5,780	1,680	4,670	1,540	2,480	33,040
$440-580	16,190	14,590	14,550	5,470	10,810	5,570	4,250	71,440
$580-730	16,680	18,060	18,790	6,250	11,280	6,060	4,480	81,610
$730-880	14,910	18,650	20,020	5,470	9,560	4,910	3,940	77,450
$880-1020	11,370	16,710	19,110	4,690	7,470	4,160	3,170	66,680
$1020-1170	8,130	13,140	15,540	3,560	5,130	2,990	2,240	50,740
$1170-1310	5,600	9,670	11,690	2,550	3,430	2,110	1,570	36,610
$1310-1450	3,750	6,520	7,880	1,730	2,220	1,330	1,080	24,520
$1450-1750	4,340	7,170	8,460	1,850	2,330	1,210	1,300	26,670
$1750-2050	2,500	4,040	4,570	1,020	1,250	570	780	14,710
$2050-2350	1,420	2,260	2,520	570	670	290	430	8,160
$2350-2650	940	1,470	1,630	370	430	180	280	5,300
$2650-2950	610	960	1,030	230	280	100	170	3,390
$2950-3300	510	760	810	190	220	80	130	2,690
$3300-3650	350	560	580	130	150	50	80	1,910
$3650+	740	1,300	1,340	310	350	130	180	4,360
TOTAL	**100,470**	**124,990**	**135,750**	**36,430**	**61,380**	**31,600**	**27,260**	**517,890**
$0-300	2.8%	1.5%	1.1%	1.0%	1.8%	1.0%	2.6%	1.7%
$300-440	9.6%	5.8%	4.3%	4.6%	7.6%	4.9%	9.1%	6.4%
$440-580	16.1%	11.7%	10.7%	15.0%	17.6%	17.6%	15.6%	13.8%
$580-730	16.6%	14.4%	13.8%	17.2%	18.4%	19.2%	16.4%	15.8%
$730-880	14.8%	14.9%	14.7%	15.0%	15.6%	15.5%	14.5%	15.0%
$880-1020	11.3%	13.4%	14.1%	12.9%	12.2%	13.2%	11.6%	12.9%
$1020-1170	8.1%	10.5%	11.4%	9.8%	8.4%	9.5%	8.2%	9.8%
$1170-1310	5.6%	7.7%	8.6%	7.0%	5.6%	6.7%	5.8%	7.1%
$1310-1450	3.7%	5.2%	5.8%	4.7%	3.6%	4.2%	4.0%	4.7%
$1450-1750	4.3%	5.7%	6.2%	5.1%	3.8%	3.8%	4.8%	5.1%
$1750-2050	2.5%	3.2%	3.4%	2.8%	2.0%	1.8%	2.9%	2.8%
$2050-2350	1.4%	1.8%	1.9%	1.6%	1.1%	0.9%	1.6%	1.6%
$2350-2650	0.9%	1.2%	1.2%	1.0%	0.7%	0.6%	1.0%	1.0%
$2650-2950	0.6%	0.8%	0.8%	0.6%	0.5%	0.3%	0.6%	0.7%
$2950-3300	0.5%	0.6%	0.6%	0.5%	0.4%	0.3%	0.5%	0.5%
$3300-3650	0.3%	0.4%	0.4%	0.4%	0.2%	0.2%	0.3%	0.4%
$3650+	0.7%	1.0%	1.0%	0.9%	0.6%	0.4%	0.7%	0.8%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

This is clear in Figure 3.1, which shows a peak for every household type occurring in the $440,000 to $880,000 value bands, except for couples and two-parent family households which peak in the $730,000 to $1,020,000 value bands. The distribution is consistent with the Corelogic figures showing median dwelling values in the $840,000 to $860,000 band, and mean values of just over $1,000,000.

Figure 3.1: Auckland Dwelling Value Distribution by Household Type, 2016.

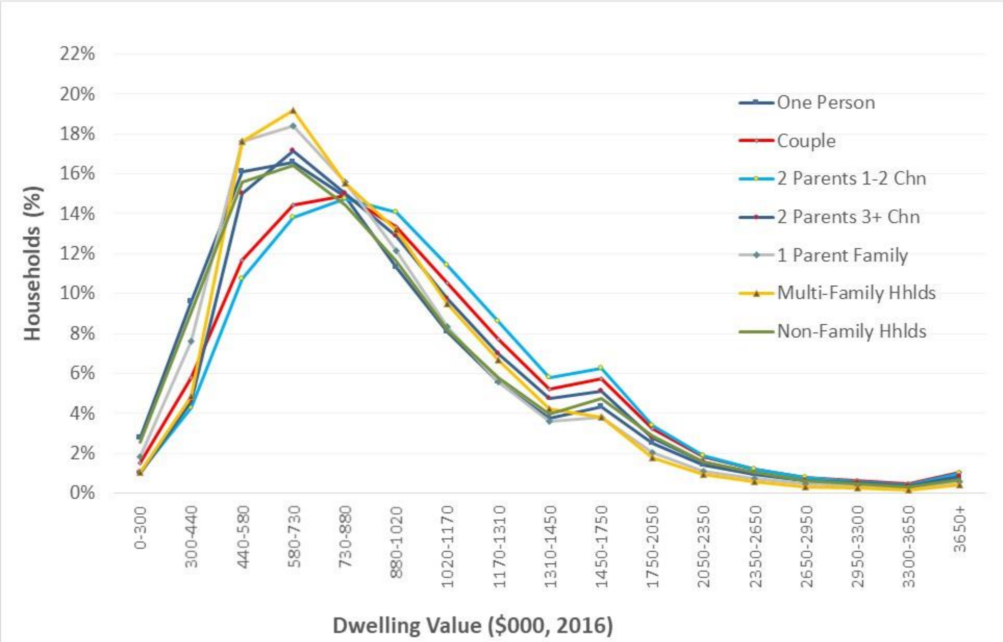
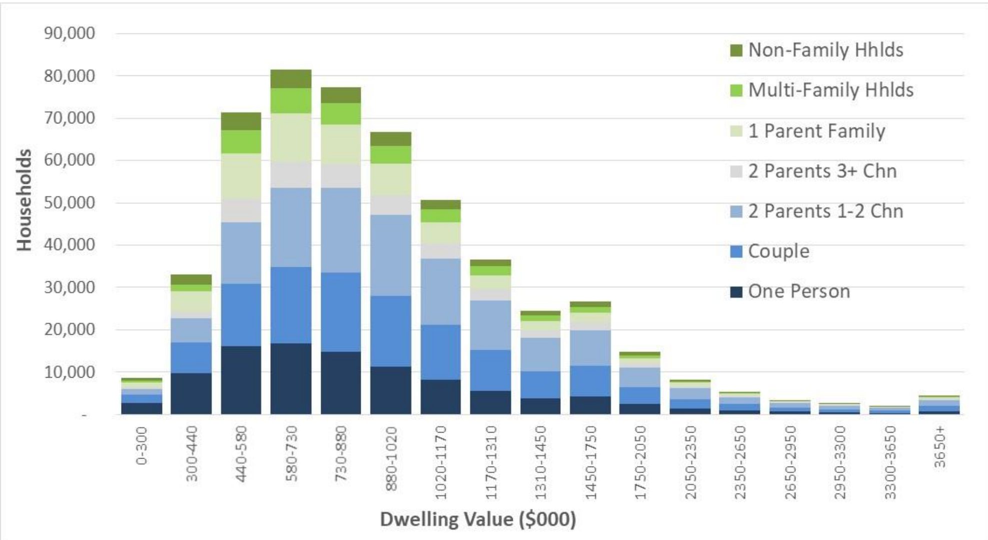


Figure 3.2 shows the distribution of households in total across the value bands, and the incidence of each household type within each value band.

Figure 3.2: Auckland Households' Dwelling Occupancy by Value 2016.



3.5.2 Tenure and Dwelling Values

Table 3.10 summarises the structure of the housing market in terms of tenure and main dwelling type for 2016. The most important segments of the total market are highlighted.

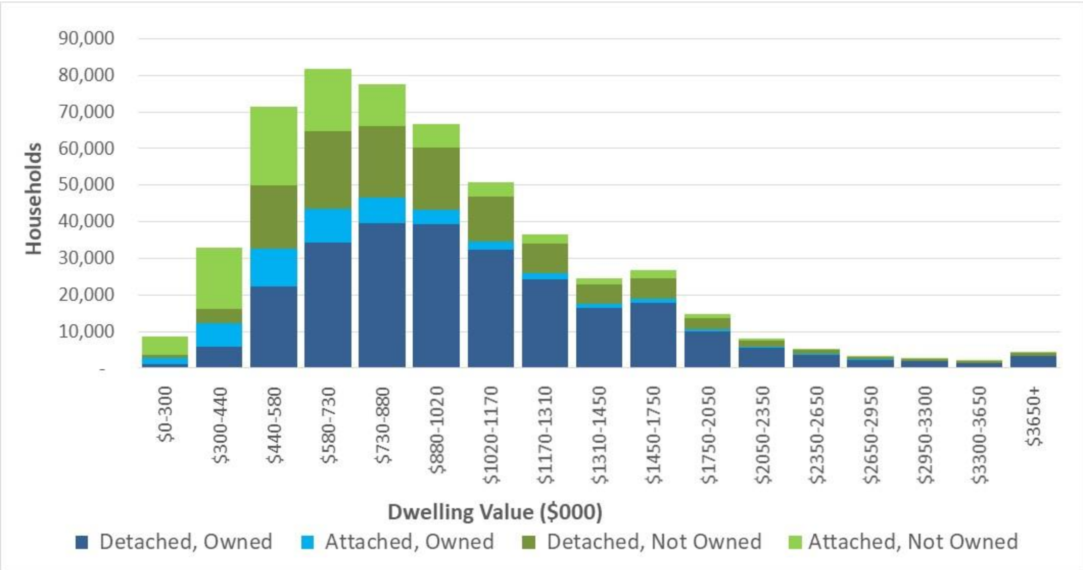
Table 3.10: Auckland Total Households: Dwellings by Value and Tenure 2016.

Dwelling Value ($000)	Detached, Owned	Attached, Owned	Detached, Not Owned	Attached, Not Owned	TOTAL	Detached, Owned	Attached, Owned	Detached, Not Owned	Attached, Not Owned	TOTAL
$0-300	1,150	1,680	850	4,930	8,610	0.2%	0.3%	0.2%	1.0%	1.7%
$300-440	5,830	6,540	3,810	16,870	33,050	1.1%	1.3%	0.7%	3.3%	6.4%
$440-580	22,300	10,290	17,480	21,380	71,450	4.3%	2.0%	3.4%	4.1%	13.8%
$580-730	34,340	9,110	21,290	16,870	81,610	6.6%	1.8%	4.1%	3.3%	15.8%
$730-880	39,650	6,830	19,750	11,210	77,440	7.7%	1.3%	3.8%	2.2%	15.0%
$880-1020	39,340	3,980	16,960	6,400	66,680	7.6%	0.8%	3.3%	1.2%	12.9%
$1020-1170	32,270	2,410	12,130	3,940	50,750	6.2%	0.5%	2.3%	0.8%	9.8%
$1170-1310	24,360	1,460	8,290	2,500	36,610	4.7%	0.3%	1.6%	0.5%	7.1%
$1310-1450	16,480	950	5,420	1,670	24,520	3.2%	0.2%	1.0%	0.3%	4.7%
$1450-1750	17,940	1,080	5,630	2,020	26,670	3.5%	0.2%	1.1%	0.4%	5.1%
$1750-2050	10,010	580	3,060	1,070	14,720	1.9%	0.1%	0.6%	0.2%	2.8%
$2050-2350	5,590	320	1,640	610	8,160	1.1%	0.1%	0.3%	0.1%	1.6%
$2350-2650	3,620	210	1,040	430	5,300	0.7%	0.0%	0.2%	0.1%	1.0%
$2650-2950	2,320	140	660	280	3,400	0.4%	0.0%	0.1%	0.1%	0.7%
$2950-3300	1,820	120	510	250	2,700	0.4%	0.0%	0.1%	0.0%	0.5%
$3300-3650	1,370	60	380	110	1,920	0.3%	0.0%	0.1%	0.0%	0.4%
$3650+	3,310	60	880	110	4,360	0.6%	0.0%	0.2%	0.0%	0.8%
TOTAL	261,700	45,820	119,780	90,650	517,950	50.5%	8.8%	23.1%	17.5%	100%

Source: ME Auckland Housing Model 2017

Figure 3.3 shows the distribution of dwelling main type and tenure across the value bands. Attached and rented dwellings are strongly focused toward the lower end of the value range, while detached rented dwellings are relatively concentrated into the lower and middle value ranges. Detached and owned dwellings become increasingly dominant for dwellings valued at $1,100,000 and over.

Figure 3.3: Auckland Households' Dwelling Tenure and Value 2016.



3.5.3 Owned Dwellings by Value Band

Table 3.11 and Figure 3.4 show the structure of the dwelling owner market by value of dwelling. An obvious feature is the general similarity of the dwelling value distribution for all household types, with limited variations in value between household types.

Table 3.11: Owning Households by Type and Dwelling Value Band 2016

Dwelling Value ($000)	One Person	Couple	2 Parents 1-2 Chn	2 Parents 3+ Chn	1 Parent Family	Multi-Family Hhlds	Non-Family Hhlds	Total Households
$0-300	960	690	590	100	240	130	120	2,830
$300-440	3,690	3,130	2,670	570	1,160	670	490	12,380
$440-580	7,290	7,700	7,960	2,330	3,350	2,840	1,110	32,580
$580-730	8,470	11,020	11,720	3,190	4,210	3,460	1,380	43,450
$730-880	8,380	12,540	13,730	3,210	4,150	3,080	1,390	46,480
$880-1020	6,840	11,980	13,950	2,990	3,560	2,780	1,230	43,330
$1020-1170	5,070	9,800	11,810	2,410	2,610	2,080	900	34,680
$1170-1310	3,560	7,370	9,110	1,810	1,820	1,510	650	25,830
$1310-1450	2,400	4,990	6,190	1,250	1,200	950	440	17,420
$1450-1750	2,770	5,480	6,710	1,370	1,290	880	520	19,020
$1750-2050	1,610	3,090	3,670	770	700	420	310	10,570
$2050-2350	930	1,740	2,040	440	380	220	170	5,920
$2350-2650	610	1,130	1,320	280	250	130	110	3,830
$2650-2950	400	740	840	180	160	80	60	2,460
$2950-3300	330	580	660	140	120	60	50	1,940
$3300-3650	240	450	480	100	90	40	30	1,430
$3650+	540	1,060	1,120	250	220	100	80	3,370
TOTAL	**54,090**	**83,490**	**94,570**	**21,390**	**25,510**	**19,430**	**9,040**	**307,520**
$0-300	1.8%	0.8%	0.6%	0.5%	0.9%	0.7%	1.3%	0.9%
$300-440	6.8%	3.7%	2.8%	2.7%	4.5%	3.4%	5.4%	4.0%
$440-580	13.5%	9.2%	8.4%	10.9%	13.1%	14.6%	12.3%	10.6%
$580-730	15.7%	13.2%	12.4%	14.9%	16.5%	17.8%	15.3%	14.1%
$730-880	15.5%	15.0%	14.5%	15.0%	16.3%	15.9%	15.4%	15.1%
$880-1020	12.6%	14.3%	14.8%	14.0%	14.0%	14.3%	13.6%	14.1%
$1020-1170	9.4%	11.7%	12.5%	11.3%	10.2%	10.7%	10.0%	11.3%
$1170-1310	6.6%	8.8%	9.6%	8.5%	7.1%	7.8%	7.2%	8.4%
$1310-1450	4.4%	6.0%	6.5%	5.8%	4.7%	4.9%	4.9%	5.7%
$1450-1750	5.1%	6.6%	7.1%	6.4%	5.1%	4.5%	5.8%	6.2%
$1750-2050	3.0%	3.7%	3.9%	3.6%	2.7%	2.2%	3.4%	3.4%
$2050-2350	1.7%	2.1%	2.2%	2.1%	1.5%	1.1%	1.9%	1.9%
$2350-2650	1.1%	1.4%	1.4%	1.3%	1.0%	0.7%	1.2%	1.2%
$2650-2950	0.7%	0.9%	0.9%	0.8%	0.6%	0.4%	0.7%	0.8%
$2950-3300	0.6%	0.7%	0.7%	0.7%	0.5%	0.3%	0.6%	0.6%
$3300-3650	0.4%	0.5%	0.5%	0.5%	0.4%	0.2%	0.3%	0.5%
$3650+	1.0%	1.3%	1.2%	1.2%	0.9%	0.5%	0.9%	1.1%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

Table 3.12 and Figure 3.5 show the structure of the dwelling rental market, again by value of dwelling. As is the case for owned dwellings, the obvious feature is the similarity of the dwelling value distribution for all household types. The table again shows limited variations in value between household types.

Table 3.12: Renting Households by Type and Dwelling Value Band 2016

Dwelling Value ($000)	One Person	Couple	2 Parents 1-2 Chn	2 Parents 3+ Chn	1 Parent Family	Multi-Family Hhlds	Non-Family Hhlds	Total Households
$0-300	1,840	1,180	860	250	880	200	580	5,790
$300-440	5,950	4,130	3,110	1,110	3,510	870	1,990	20,670
$440-580	8,910	6,890	6,590	3,140	7,460	2,730	3,150	38,870
$580-730	8,210	7,040	7,070	3,060	7,070	2,600	3,100	38,150
$730-880	6,530	6,110	6,290	2,250	5,420	1,830	2,550	30,980
$880-1020	4,540	4,730	5,170	1,690	3,910	1,380	1,950	23,370
$1020-1170	3,070	3,350	3,730	1,140	2,530	910	1,340	16,070
$1170-1310	2,040	2,290	2,590	750	1,600	600	930	10,800
$1310-1450	1,350	1,530	1,690	480	1,020	370	640	7,080
$1450-1750	1,570	1,690	1,750	480	1,050	330	780	7,650
$1750-2050	890	940	900	240	540	150	470	4,130
$2050-2350	500	520	480	130	290	80	260	2,260
$2350-2650	330	340	310	80	190	50	170	1,470
$2650-2950	210	220	200	50	120	30	110	940
$2950-3300	180	180	150	40	100	20	90	760
$3300-3650	110	110	110	30	60	10	50	480
$3650+	200	230	230	60	140	40	100	1,000
TOTAL	**46,430**	**41,480**	**41,230**	**14,980**	**35,890**	**12,200**	**18,260**	**210,470**
$0-300	4.0%	2.8%	2.1%	1.7%	2.5%	1.6%	3.2%	2.8%
$300-440	12.8%	10.0%	7.5%	7.4%	9.8%	7.1%	10.9%	9.8%
$440-580	19.2%	16.6%	16.0%	21.0%	20.8%	22.4%	17.3%	18.5%
$580-730	17.7%	17.0%	17.1%	20.4%	19.7%	21.3%	17.0%	18.1%
$730-880	14.1%	14.7%	15.3%	15.0%	15.1%	15.0%	14.0%	14.7%
$880-1020	9.8%	11.4%	12.5%	11.3%	10.9%	11.3%	10.7%	11.1%
$1020-1170	6.6%	8.1%	9.0%	7.6%	7.0%	7.5%	7.3%	7.6%
$1170-1310	4.4%	5.5%	6.3%	5.0%	4.5%	4.9%	5.1%	5.1%
$1310-1450	2.9%	3.7%	4.1%	3.2%	2.8%	3.0%	3.5%	3.4%
$1450-1750	3.4%	4.1%	4.2%	3.2%	2.9%	2.7%	4.3%	3.6%
$1750-2050	1.9%	2.3%	2.2%	1.6%	1.5%	1.2%	2.6%	2.0%
$2050-2350	1.1%	1.3%	1.2%	0.9%	0.8%	0.7%	1.4%	1.1%
$2350-2650	0.7%	0.8%	0.8%	0.5%	0.5%	0.4%	0.9%	0.7%
$2650-2950	0.5%	0.5%	0.5%	0.3%	0.3%	0.2%	0.6%	0.4%
$2950-3300	0.4%	0.4%	0.4%	0.3%	0.3%	0.2%	0.5%	0.4%
$3300-3650	0.2%	0.3%	0.3%	0.2%	0.2%	0.1%	0.3%	0.2%
$3650+	0.4%	0.6%	0.6%	0.4%	0.4%	0.3%	0.5%	0.5%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

The similarity between household types in both cases raises the question of the accuracy of the method used to estimate the incidence of households, which relies on the geographical variations in household incidence between census units to distinguish the differences in dwelling values.

However, the difference in values between owned and rented dwellings becomes quite clear when Figure 3.4 and Figure 3.5 are compared. The value range for owned dwellings has generally similar shape to that for rented dwellings, but the values for owned dwellings are considerably higher than those for rented dwellings. Simply, the peak in Figure 3.4 is well to the right (higher value range) than the peak for Figure 3.5.

In any case, the Census data shows limited differences between household types in their dwelling occupancy between household types for every type of h

Figure 3.4: Auckland Owned Dwelling Value Distribution by Household Type, 2016.

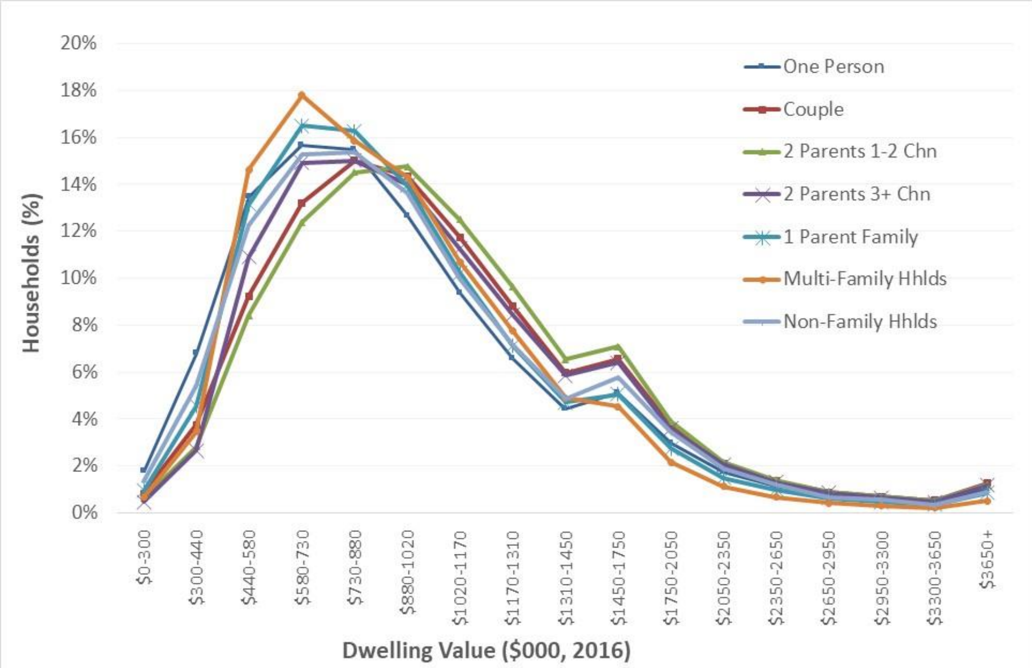
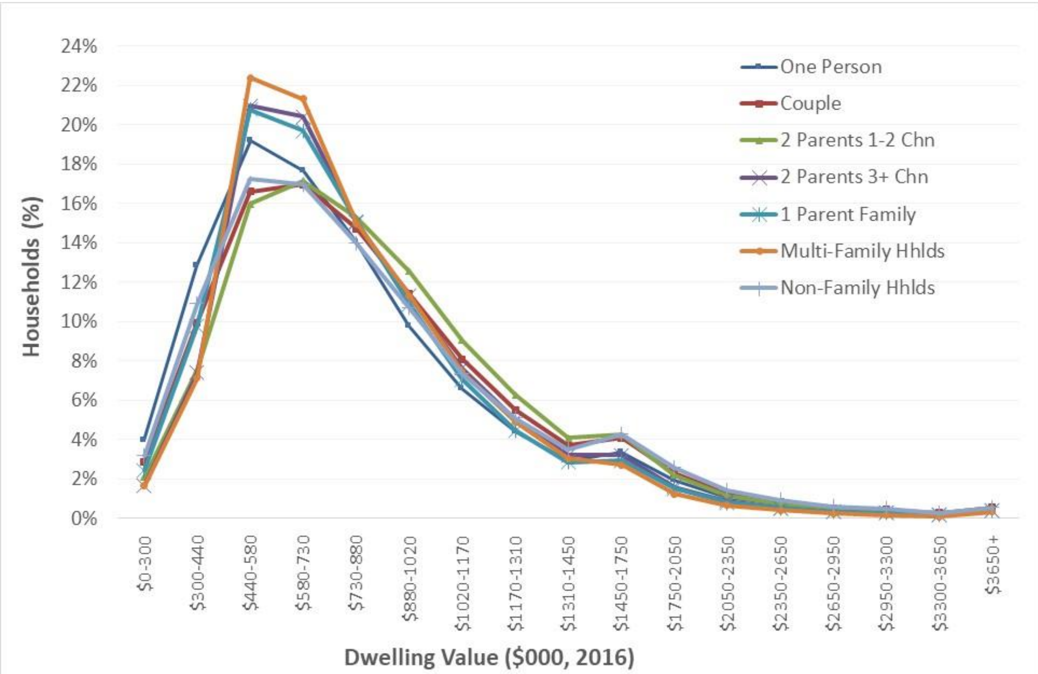
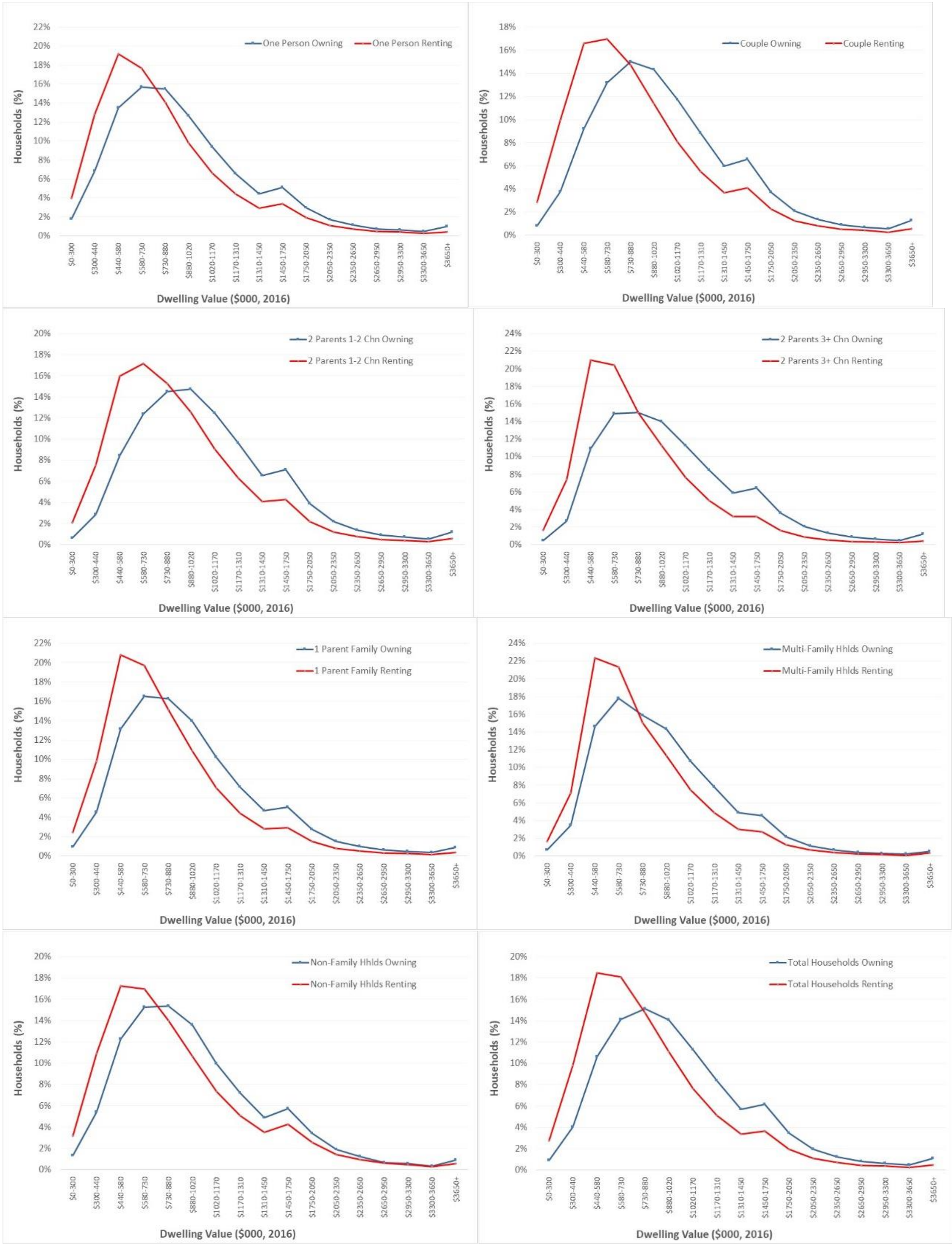


Figure 3.5: Auckland Rented Dwelling Value Distribution by Household Type, 2016.



This is further illustrated in Figure 3.6, which compares the distribution across value bands of owned dwellings and rented dwellings, for each main household type.

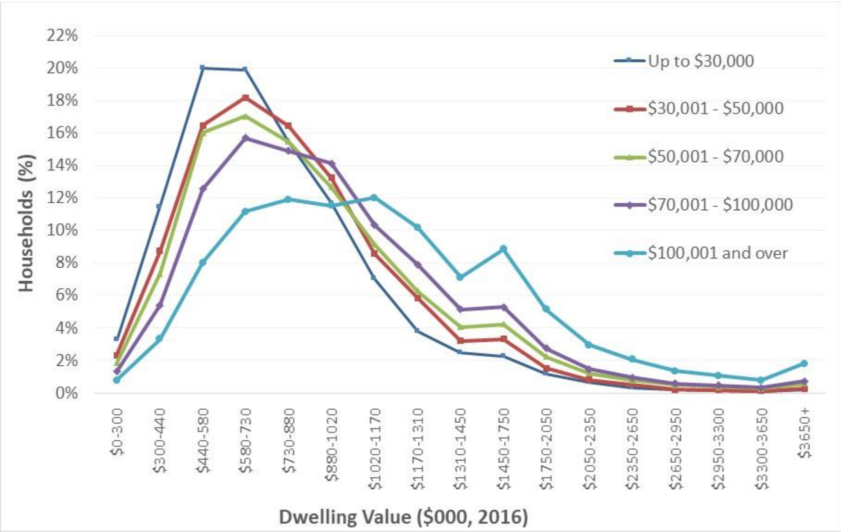
Figure 3.6: Distribution of Dwelling Values : Owned v Rented, 2016.



3.6 Dwelling Values and Household Income

Figures 3.7 to 3.9 show the overall relationship between household income, and the value of dwellings occupied. The clear pattern is for lower income households to occupy dwellings toward the lower end of the value range, and for medium and higher income households to occupy progressively higher value dwellings. This is evident for total households (Figure 3.7), as well as households owning their dwellings (Figure 3.8) and renting or otherwise not owning (Figure 3.9).

Figure 3.7: Dwellings Occupied by Value by Household Income: 2016.



Also clear is the overall difference in value range between owning and renting households, with rented dwellings relatively concentrated toward the middle and lower ends of the value range.

Among owners, there is clear differentiation between households on low, medium and higher income levels. However, this difference is not as apparent with renting households, apart from those in the highest income band (Figure 3.9).

The patterns are generally as expected, given the known influence of household income on ability to pay and housing affordability.

Nevertheless, the capability to extend the understanding available from Census data – which establishes the links between household income and tenure, and type of dwelling occupied – to now incorporate dwelling values is important for the NPS-UDC requirements. The clarity of the differences evident from the analysis is a good indicator of the strength of the underlying relationship across Auckland.

Figure 3.8: Owned Dwellings Occupied by Value by Household Income: 2016.

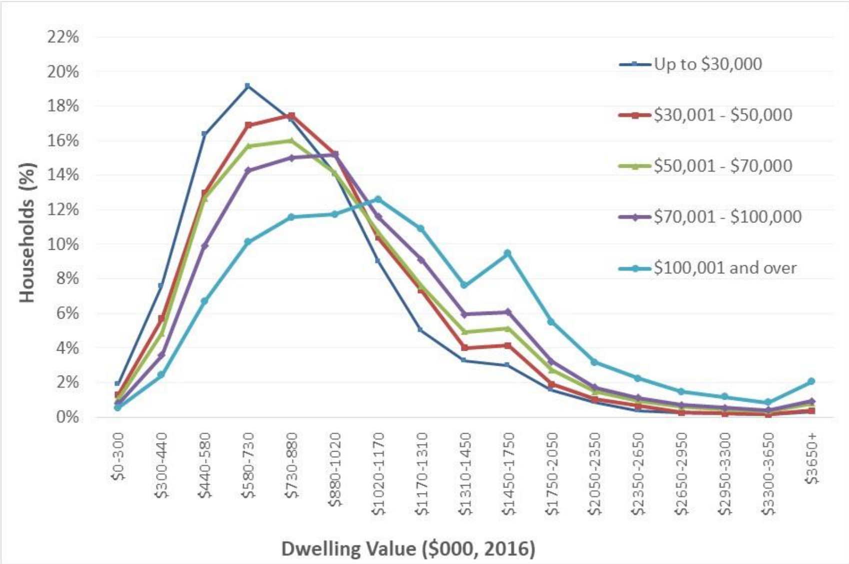
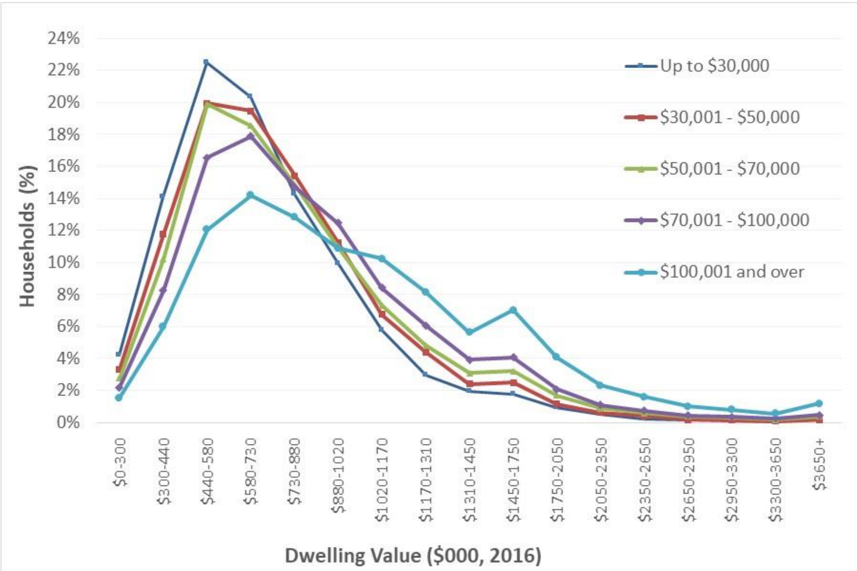


Figure 3.9: Rented/Not Owned Dwellings Occupied by Value by Household Income: 2016.



3.7 Auckland Housing Model 2017

The information presented above covers several key parameters of Auckland housing market as at 2016. The reporting here is at a quite aggregated level, to identify the most important, big picture features of Auckland housing demand and supply.

However, as well as the top-line results, the *Auckland Housing Model* does have capability for more refined analysis of the current (2016) situation, as and when required to examine specific aspects of the Auckland housing market. The Model includes an extensive dataset of customised 2013 Census outputs, including geographic (census unit) detail, together with data on dwelling types and values.

These datasets allow detailed analysis of specific segments of the market, to show current dwelling occupancy (type and value range) by household type and income and age. The Model therefore offers considerable capability to investigate the dwelling ownership and occupancy patterns of key segments of the housing market, and to show the estimated link with dwellings according to type and value band. This gives the option to produce considerable detail on segments of interest if required. This detail has not been produced for this Report.

As such, the Model can function as a tool to fine-tune assessment of the current and future housing markets. This is aimed especially at the requirements of the NPS-UDC, and the need to understand specific segments of the housing market, particularly in regard to housing affordability (which impacts differently on each segment of the market) and market efficiency.

4 Future Housing Demand

4.1 Scope

The assessment in Section 3 provides a sound base for examining the future prospects for Auckland's housing needs.

This section examines future household growth in Auckland, as the core driver of future housing needs. This is based on Auckland's population outlook, which examines growth from both natural increase and net migration gains or losses. It is based on the SNZ (February 2017) population projection series. SNZ have very recently (8 December 2017) produced updated household projections based on that population series, and this Report is able to draw on those projections to 2038. For the balance of the period to 2046, household numbers have been estimated from the population projections, together with mean household size extrapolated to 2046 from the SNZ 2013-2038 trends.

4.2 Household Projections

The focus is on projected household numbers for the period 2016 to 2046, which provides the 30 year long-term horizon of the NPS-UDC. These are shown in Table 4.1. Currently, Auckland's population growth is tracking close to the Medium growth projection, according to the SNZ population estimates for June 2017.

These projections are based on the SNZ population projections from the 2013 to 2043, and the SNZ estimates of population growth during the 2013-2017 period. The projections on the left side of the table show the base SNZ figures, and do not adjust for the estimated growth which occurred during the 2013-2017 period. The projections on the right side of the table show the numbers from a 2017 "actual" base, with the SNZ projections for the 2017-2046 period added to that new base.

The population projections unadjusted for the 2013-2017 period, in combination with projected mean household size, indicate growth for Auckland of between 230,000 households (Low) and 406,000 households (High) between 2016 and 2046. The Medium growth projection is for an increase of 319,000 households. For the 10 year medium term period 2016 to 2026, the indicated growth is between 104,000 households (Low) and 155,000 households (High), with the Medium projection at 129,000 households.

The projections adjusted for the estimated increase during the 2013-2017 period, indicate growth for Auckland of between 239,000 households (Low) and 397,000 households (High) between 2016 and 2046. The Medium growth projection is for an increase of 319,000 households, reflecting the quite close match between the medium projection and the 2017 estimated population. For the medium term period to 2026, the indicated growth is between 110,000 households (Low) and 148,000 households (High), with the Medium projection at 129,000 households.

Table 4.1: Auckland Household Projections 2013-2046

Year	SNZ Projections (2013-2043 Series)			SNZ 2017-2043 on 2017 Actual		
	SNZ High	SNZ Medium	SNZ Low	SNZ High	SNZ Medium	SNZ Low
2013	498,000	498,000	498,000	498,000	498,000	498,000
2016	551,000	544,000	537,000	544,000	544,000	544,000
2023	667,000	642,000	617,000	653,000	642,000	630,000
2026	706,000	673,000	641,000	692,000	673,000	654,000
2033	797,000	745,000	693,000	783,000	745,000	707,000
2038	859,000	791,000	723,000	844,000	791,000	738,000
2043	920,000	836,000	750,000	904,000	836,000	766,000
2046	957,000	863,000	767,000	941,000	863,000	783,000
2016-26	155,000	129,000	104,000	148,000	129,000	110,000
2026-38	153,000	118,000	82,000	152,000	118,000	84,000
2038-46	98,000	72,000	44,000	97,000	72,000	45,000
2016-46	406,000	319,000	230,000	397,000	319,000	239,000

Source: ME Auckland Housing Model 2017

4.3 Previous Projections

The new projections are intended to replace the household projection series applied in the AUP hearings, which were based on the SNZ 2015 population and household projection series, summarised in Table 4.2.

Table 4.2: Previously used Auckland Household Projections (000) 2013-2046

Year	SNZ Projections (2013-2043 Series)			SNZ 2017-2043 on 2017 Actual			SNZ Projections 2015 Series (IHP)		
	SNZ High	SNZ Medium	SNZ Low	SNZ High	SNZ Medium	SNZ Low	SNZ High	SNZ Medium	SNZ Low
2013	498	498	498	498	498	498	498	498	498
2016	551	544	537	544	544	544	542	534	525
2023	667	642	617	653	642	630	639	609	578
2026	706	673	641	692	673	654	680	639	598
2033	797	745	693	783	745	707	772	705	638
2038	859	791	723	844	791	738	837	750	663
2043	920	836	750	904	836	766	901	794	688
2046	957	863	767	941	863	783	937	819	703
2016-26	155	129	104	148	129	110	138	106	73
2026-38	153	118	82	152	118	84	157	111	65
2038-46	98	72	44	97	72	45	100	69	40
2016-46	406	319	230	397	319	239	395	285	178

Source: ME Auckland Housing Model 2017

The main differences from the projections used for the IHP hearings and the decisions version of the Auckland Unitary Plan are as follows:

4.3.1 Medium Term (2016-2026)

a. The **high projection** growth is 155,000 households (15,500 pa), or 17,000 more than the previous projections;
b. However, based on the actual growth recorded to 2017, plus future growth during 2017-2026 as per the latest series high projection, the growth would be 148,000 households (14,800 pa), which is around 10,000 more than the growth assumed for the AUP decisions;

c. The **medium projection** growth is 132,000 households (13,200 pa), or 26,000 more than the previous projections;
d. Based on the actual growth recorded to 2017, plus future growth 2017-2026 as per the latest SNZ medium projection, the growth would also be 129,000 households (12,900 pa). This is about 25% more than the growth assumed for the AUP decisions over that period;
e. The **low projection** growth is 104,000 households (10,400 pa), or 31,000 more than the previous projections;
f. Based on the actual growth recorded to 2017, plus future growth 2017-2028 as per the latest SNZ low projection, the growth would be 110,000 households (11,000 pa). This is about 50% more than the low growth assumed for the AUP decisions over that period, although the IHP based their recommendations on the high and medium projections only.

An important feature of the SNZ 2017 projection series is that it allows for considerably faster growth in the period until about 2028, and thereafter less growth than was previously projected in the post-2028 period.

4.3.2 Long Term (2016-2046)

a. The **high projection** growth is for 406,000 additional households (13,500 pa), or 11,000 more than the previous long term (30 year) projections;
b. Based on the actual growth recorded to 2017, plus future growth 2017-2046 as projected, the growth would be 397,000 households (13,200 pa), which is marginally above (+0.5%) the growth assumed for the AUP decisions (395,000);
c. The **medium projection** growth is for 319,000 additional households (10,600 pa), or 34,000 more than the previous long term (30 year) medium projections. This concords well with the actual growth recorded to 2017, and allowing for future growth 2017-2046 as per the latest SNZ medium projection, is about 12% more than the medium growth assumed for the AUP decisions over that period;
d. The **low projection** growth is 230,000 households (7,700 pa), or 52,000 more (29%) than the previous projections. Based on the actual growth recorded to 2017, plus future growth 2017-2046 as per the latest SNZ low projection, the growth would be 239,000 households (8,000 pa). This is about 29% more than the low growth assumed for the AUP decisions over that period;

4.4 Housing Supply Shortfall

A priori, the projected increase in household numbers is taken as the indicator of additional dwellings required to serve the future Auckland population.

However, the supply side has lagged behind demand in Auckland, especially since 2012, and there is general acceptance that Auckland has a dwelling shortfall. This was estimated at around 14,000 dwellings in 2013, and it is expected to have increased since then, as the number of additional dwellings has lagged behind the number of additional households (according to the population estimates). Total household numbers have increased by some 46,000, while the number of dwelling units consented was 24,850 for the three years to June 2016.

While estimation of the dwelling shortfall is more complex than this, a simple comparison of household growth with dwelling growth indicates the shortfall grew by in the order of 21,000 dwellings to June 2016. Combined with the estimated 14,000 as at June 2013, the total shortfall would be in the order of 35,000 dwellings by June 2016.

This suggests that in order to accommodate both household growth, and the estimated supply shortfall, that the dwelling requirement is between 265,000 (Low), 354,000 (Medium) and 441,000 (High).

We note that the MBIE Briefing to the Incoming Minister shows an estimated shortfall of 45,000 dwellings for Auckland[8].

4.5 Medium Growth Households by Type

Table 4.3 shows the Medium growth projection to 2048, for each household type. The focus is on the 30-year period from 2016 to 2046.

A key feature of the growth is the increase in single person households, and couple households, which between them account for over 60% of the net change in household numbers. The rate of increase in larger households (2-parent families and multi-family households) is more modest, though still substantial. Over the period to 2026, the outlook is for an additional 131,000 households, of which 54% would be singles and couples, and some 37% would be families with children. In the later part of the period (2026 to 2046), the shift in demographic structure is more marked, with single and couple households accounting for some 70% of the change, and family households around 24%.

Table 4.3: Auckland Household Medium Growth Projection 2016-2046

Household Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
One-Person Household	104,800	112,600	129,400	138,500	160,700	176,600	213,700	225,400	33,700	75,200	108,900
Couple Only	133,600	142,700	160,900	169,200	189,300	202,700	227,900	235,200	35,600	58,700	94,300
2 Parents with 1 to 2 Chn	143,100	150,600	164,400	170,500	183,600	190,700	193,000	191,800	27,400	22,500	49,900
2 Parents with 3+ Chn	38,500	40,300	43,900	45,800	49,800	52,000	53,500	53,500	7,300	7,700	15,000
One Parent Families	63,400	66,800	73,300	76,500	83,500	87,600	91,900	92,500	13,100	15,400	28,500
Multi-Family Households	32,700	34,500	38,000	39,400	42,600	44,400	45,600	45,600	6,700	6,200	12,900
Non-Family Households	27,900	29,400	31,900	32,900	35,400	36,800	37,700	37,600	5,000	4,800	9,800
I Total Households	**544,000**	**577,000**	**642,000**	**673,000**	**745,000**	**791,000**	**863,000**	**882,000**	**129,000**	**191,000**	**319,000**
One-Person Household	19.3%	19.5%	20.2%	20.6%	21.6%	22.3%	24.8%	25.6%	26.1%	39.4%	34.1%
Couple Only	24.6%	24.7%	25.1%	25.1%	25.4%	25.6%	26.4%	26.7%	27.6%	30.7%	29.6%
2 Parents with 1 to 2 Chn	26.3%	26.1%	25.6%	25.3%	24.6%	24.1%	22.4%	21.7%	21.2%	11.8%	15.6%
2 Parents with 3+ Chn	7.1%	7.0%	6.8%	6.8%	6.7%	6.6%	6.2%	6.1%	5.7%	4.0%	4.7%
One Parent Families	11.7%	11.6%	11.4%	11.4%	11.2%	11.1%	10.6%	10.5%	10.2%	8.1%	8.9%
Multi-Family Households	6.0%	6.0%	5.9%	5.9%	5.7%	5.6%	5.3%	5.2%	5.2%	3.2%	4.0%
Non-Family Households	5.1%	5.1%	5.0%	4.9%	4.8%	4.7%	4.4%	4.3%	3.9%	2.5%	3.1%
I Total Households	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

[8] http://www.mbie.govt.nz/about/who-we-are/our-publications/briefings-to-incoming-ministers/2017-bims/housing-urban-development.pdf

4.6 High Growth Households by Type

Table 4.4 shows the High growth projection to 2048, for each household type. As with the Medium projection, the focus is on the 30 year period 2016-2046. Again a key feature is the increase in single person households, and couple households, which between them account for 60% of the net change in household numbers. However, in the High future the rate of increase in larger households (2-parent families and multi-family households) is considerably higher than in the Medium outlook, even though both projections assume high levels of in-migration.

Table 4.4: Auckland Household High Growth Projection 2016-2048

Household Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
One-Person Household	106,200	115,100	134,800	145,600	172,600	192,400	238,700	253,400	39,400	93,100	132,500
Couple Only	135,300	145,600	167,100	177,400	202,500	219,900	252,500	261,800	42,100	75,100	117,200
2 Parents with 1 to 2 Chn	144,900	153,600	170,700	178,500	196,000	206,400	212,300	211,800	33,600	33,800	67,400
2 Parents with 3+ Chn	39,000	41,200	45,600	47,900	53,200	56,500	59,200	59,300	8,900	11,300	20,200
One Parent Families	64,200	68,200	76,200	80,100	89,300	95,400	102,200	103,400	15,900	22,100	38,000
Multi-Family Households	33,100	35,200	39,400	41,300	45,500	48,200	50,600	50,900	8,200	9,300	17,500
Non-Family Households	28,300	30,000	33,100	34,400	37,800	40,000	41,800	42,000	6,100	7,400	13,500
Total Households	**551,000**	**589,000**	**667,000**	**705,000**	**797,000**	**859,000**	**957,000**	**983,000**	**154,000**	**252,000**	**406,000**
One-Person Household	19.3%	19.5%	20.2%	20.7%	21.7%	22.4%	24.9%	25.8%	25.6%	36.9%	32.6%
Couple Only	24.6%	24.7%	25.1%	25.2%	25.4%	25.6%	26.4%	26.6%	27.3%	29.8%	28.9%
2 Parents with 1 to 2 Chn	26.3%	26.1%	25.6%	25.3%	24.6%	24.0%	22.2%	21.5%	21.8%	13.4%	16.6%
2 Parents with 3+ Chn	7.1%	7.0%	6.8%	6.8%	6.7%	6.6%	6.2%	6.0%	5.8%	4.5%	5.0%
One Parent Families	11.7%	11.6%	11.4%	11.4%	11.2%	11.1%	10.7%	10.5%	10.3%	8.8%	9.4%
Multi-Family Households	6.0%	6.0%	5.9%	5.9%	5.7%	5.6%	5.3%	5.2%	5.3%	3.7%	4.3%
Non-Family Households	5.1%	5.1%	5.0%	4.9%	4.7%	4.7%	4.4%	4.3%	4.0%	2.9%	3.3%
Total Households	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

Over the period to 2026, the outlook is for an additional 154,000 households, of which 53% would be singles and couples, and some 38% would be families with children. In the later part of the period (2026 to 2046), the change is again more marked, with single and couple households accounting for 67% of the change. Nonetheless, in this future family households account for nearly 27% of the net growth. Over the period to 2046, the increase in family households (excluding multi-family households) is some 58,000 to 2026, and 126,000 by 2046, which represents a substantial increase overall.

5 Auckland Housing Demand 2016-2046

5.1 Scope

A priori, the projected increase in household numbers is taken as the indicator of additional dwellings required to serve the future Auckland population. However, for assessment of urban growth capacity, it is important to differentiate the urban population and households from the rural component. The following assessment of Auckland's housing demand excludes the estimated rural population.

Further, as noted there is considerable scope for Auckland's future population and household outcomes to vary, and affect the consequent demand for urban growth capacity. Accordingly, a conservative approach has been applied here, to consider "likely" base case futures – medium and high growth – and to examine the implications of plausible changes in housing demand, particularly in relation to changes in future supply patterns which may arise from the new planning environment enabled under the Auckland Unitary Plan (Operative in Part).

5.1.1 Medium and High Futures

The base analysis presented here considers:

a. A medium growth future which corresponds with the SNZ 2017 medium population projection series; and
b. A high growth future which corresponds with the SNZ 2017 high population projection series.

5.1.2 Dwelling Preferences and Values

For the assessment of housing demand, the focus is on two of the core matters within the NPS:

a. Dwelling demand by dwelling type, particularly the split between detached dwellings which account for about 70% of supply currently, and attached dwellings which will account for an increasing share of the dwelling estate going forward, as the AUP provides for considerable intensification of residential areas; and
b. the dwelling demand by value band, which covers both volume of demand, and indicates housing affordability.

A directly related issue is the demand arising from different types of household, since the gradual ageing of the population is expected to see some general shift toward attached dwellings in the future. However, we note that the analysis of dwelling occupancy by different types of household indicates that household income is the main differentiator of occupancy, rather than household age.

This means that the shift toward a more intensive urban environment for Auckland is likely to require a substantial change in dwelling preferences.

The Model has been applied to examine outcomes, and identify likely patterns in terms of demand by household types, across dwelling types and across dwelling value bands, over time:

a. the medium term future for the period 2016 to 2026, which corresponds with the NPS medium term of 10 years plus a margin, and
b. the long term for the period 2016 to 2046, which the 30 years required by the NPS.

The analysis focuses on the urban population, and excludes households in rural areas (lifestyle blocks and rural holdings.

5.1.3 2016 Base

The SNZ projections are based on the 2013 situation, as per Census 2013. However, the three years of population growth to 2016 are close to the SNZ revised (2017) medium growth projection, and indicate a total household count of 544,000 for Auckland. This is in line with the Medium projection, but considerably lower than the High growth projection for 2016, of 551,000 households. For clarity, the 544,000 figure for 2016 is used for all tables, including those relating to the High growth projection. This makes comparison of Medium and High growth futures more straightforward. Moreover, the High growth outcome may still arise if growth in the future continues at a faster rate than the Medium projection.

Once adjusted to exclude the rural population, the base household count for 2016 in most tables is 518,000.

5.1.4 Scenarios

To understand the implications of such change, a scenario approach has been applied, where the Model allows for progressive shifts in the mix of dwellings, with steady reductions in the share of detached dwellings and corresponding increases in the share of attached dwellings. The scenarios applied are:

a. ***Base Case*** demand, where there are no significant shifts in dwelling preferences for each household type. This scenario would see future demand increase pro rata with the existing dwelling preference shown by each household type. Shifts in the total demand pattern would arise only from the changes in the demography of the population, notably the expected increase in single person and couple households, who show some greater propensity to occupy attached dwellings. There would be limited change from the base situation, in which detached dwellings account for some 75% of specified demand (excluding dwellings not defined), single storey attached dwellings a further 11%, attached dwellings in 2-3 storey buildings 10%, and those in 4 or more levels just 3.4%;
b. ***Moderate Shift*** in dwelling preference. This scenario would see the detached dwelling share decrease slowly, from 75% in 2016 to 68% by 2046, with attached single storey dwellings reducing also to 8%, attached 2-3 storey dwellings up to 14% and attached dwellings in 4 or more storeys to 10%;
c. ***High Shift*** in dwelling preference. This scenario would see the detached share decrease more quickly, to 64% by 2046, with attached single storey dwellings reducing to 9%, attached 2-3 storey dwellings up to 16% and attached dwellings in 4 or more storeys to 12%;

d. ***Very High Shift*** in dwelling preference. This scenario would see the detached share decrease to 58% by 2046, with attached single storey dwellings also lower at 10%, attached 2-3 storey dwellings up to 19% and attached dwellings in 4 or more storeys to 14%.

Note that the scenarios depict the total dwelling estate, including existing dwellings, and those outcomes imply more substantial changes in the mix of new dwellings develop0ed over the period.

5.2 Demand by Dwelling Types – Medium Growth

One core output from the scenarios is projections of numbers of dwellings by type. These projections take into account the current observed preferences by household type, and the scenario preferences.

5.2.1 Nil Preference Shift

Table 5.1 shows the projected dwelling demand under a Nil Preference Change scenario – that is, where the current (2013) patterns of dwelling occupancy persist, and the increase in dwelling numbers of each type is more or less *pro rata* from the current situation. With the rural households excluded, the projected growth in demand is in the order of 123,000 households by 2026, and 304,000 in total to 2046.

This future would see detached dwellings continue to account for the major share of dwelling growth - around 73% to 2028, and 70% thereafter.

Table 5.1: Auckland Dwelling Medium Growth Projection 2016-2046 – Nil Preference Shift

Dwelling Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
Detached House	381,500	404,500	449,500	470,800	519,900	551,000	597,600	608,900	89,300	126,800	216,100
2+ Dwgs : 1 level	57,400	61,200	69,000	72,900	82,400	88,900	101,800	105,600	15,500	28,900	44,400
2+ Dwgs : 2-3 levels	49,700	52,700	58,600	61,500	68,000	72,100	78,800	80,500	11,800	17,300	29,100
2+ Dwgs : 4+ levels	17,100	18,000	19,800	20,600	22,400	23,600	25,000	25,300	3,500	4,400	7,900
2+ Dwgs : undef	300	300	400	400	500	600	700	800	100	300	400
Other Private	1,300	1,400	1,600	1,600	1,800	1,900	2,000	2,100	300	400	700
Private Not Defined	10,600	11,200	12,300	12,900	14,200	14,900	16,000	16,300	2,300	3,100	5,400
TOTAL	**518,000**	**549,000**	**611,000**	**641,000**	**709,000**	**753,000**	**822,000**	**840,000**	**123,000**	**181,000**	**304,000**
Detached House	73.6%	73.7%	73.6%	73.4%	73.3%	73.2%	72.7%	72.5%	72.6%	70.1%	71.1%
2+ Dwgs : 1 level	11.1%	11.1%	11.3%	11.4%	11.6%	11.8%	12.4%	12.6%	12.6%	16.0%	14.6%
2+ Dwgs : 2-3 levels	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%
2+ Dwgs : 4+ levels	3.3%	3.3%	3.2%	3.2%	3.2%	3.1%	3.0%	3.0%	2.8%	2.4%	2.6%
2+ Dwgs : undef	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%
Other Private	0.3%	0.3%	0.3%	0.2%	0.3%	0.3%	0.2%	0.3%	0.2%	0.2%	0.2%
Private Not Defined	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	1.9%	1.9%	1.9%	1.7%	1.8%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

One important implication of such an outlook is that this is likely to be associated with greenfield development rather than urban intensification, which would be more aligned with an increase in attached dwellings. In particular, the implied growth in detached dwellings would take up a substantial share of the greenfield capacity in Auckland's Future Urban zone (FUZ) in the medium term, with the FUZ having estimated capacity for up to 145,000 dwellings.

Longer term, if detached dwellings continued to dominate the market and the construction sector response, then the greenfield capacity is likely to be largely taken up by the mid-2030s.

However, we note that this outcome would run counter to both the demographic shift in Auckland's population and the strong growth among older and smaller households - including their propensity to seek central rather than peripheral locations – and the substantial increase in feasible redevelopment capacity provided for in the AUP(OiP). Accordingly, it is included primarily as a comparator.

5.2.2 Moderate Preference Shift

Table 5.2 shows the projected dwelling demand under a *Moderate Preference shift* scenario – that is, where the current (2013) patterns of dwelling occupancy gradually but progressively change, and there is a shift away from detached dwellings toward attached dwellings including terrace houses and apartments.

This future would see detached dwellings continue to account for the major share of dwelling growth, but that share would drop from the current 73% to 67% of the increase by 2026, and less than 46% by 2046. The change reflects the existing dominance of detached dwellings, and even where less than half of the net increase in the future were in detached dwellings, the total estate by 2046 would still reflect much of the current housing stock.

Table 5.2: Auckland Dwelling Medium Growth Projection 2016-2046 – Moderate Preference Shift

Dwelling Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
Detached House	381,500	403,000	444,700	463,600	502,700	524,200	546,600	552,200	82,100	83,000	165,100
2+ Dwgs : 1 level	57,400	46,700	53,900	57,700	65,900	72,900	88,500	93,100	300	30,800	31,100
2+ Dwgs : 2-3 levels	49,700	50,900	58,200	62,000	74,200	83,300	102,000	106,600	12,300	40,000	52,300
2+ Dwgs : 4+ levels	17,100	37,400	42,100	44,400	51,800	57,100	67,500	69,900	27,300	23,100	50,400
2+ Dwgs : undef	300	300	400	400	500	500	700	700	100	300	400
Other Private	1,300	1,200	1,400	1,400	1,600	1,700	1,900	1,900	100	500	600
Private Not Defined	10,600	9,600	10,600	11,100	12,500	13,200	14,800	15,000	500	3,700	4,200
TOTAL	**518,000**	**549,000**	**611,000**	**641,000**	**709,000**	**753,000**	**822,000**	**839,000**	**123,000**	**181,000**	**304,000**
Detached House	73.6%	73.4%	72.8%	72.3%	70.9%	69.6%	66.5%	65.8%	66.7%	45.9%	54.3%
2+ Dwgs : 1 level	11.1%	8.5%	8.8%	9.0%	9.3%	9.7%	10.8%	11.1%	0.2%	17.0%	10.2%
2+ Dwgs : 2-3 levels	9.6%	9.3%	9.5%	9.7%	10.5%	11.1%	12.4%	12.7%	10.0%	22.1%	17.2%
2+ Dwgs : 4+ levels	3.3%	6.8%	6.9%	6.9%	7.3%	7.6%	8.2%	8.3%	22.2%	12.8%	16.6%
2+ Dwgs : undef	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%
Other Private	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%	0.3%	0.2%
Private Not Defined	2.0%	1.7%	1.7%	1.7%	1.8%	1.8%	1.8%	1.8%	0.4%	2.0%	1.4%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

5.2.3 High Preference Shift

Table 5.3 shows the projected dwelling demand under a *High Preference shift* scenario. This would reflect an outcome where just less than half (47%) of the new dwelling stock added during the period were detached dwellings, and some 53% was in terrace housing and apartments.

We note that such change is quite possible under the more liberal planning provisions of the AUP(OiP), while the continued pressure to produce affordable dwellings may also see greater focus on attached dwellings. This future would see detached dwellings' share of the total estate decrease to just over 68% by 2026, and decrease further to under 63% by 2046.

Table 5.3: Auckland Dwelling Growth Projection 2016-2046 – High Preference Shift

Dwelling Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
Detached House	381,500	391,300	424,800	438,700	473,000	493,700	521,000	526,900	57,200	82,300	139,500
2+ Dwgs : 1 level	57,400	50,500	60,300	66,000	72,300	79,300	93,300	97,500	8,600	27,300	35,900
2+ Dwgs : 2-3 levels	49,700	55,400	66,200	72,200	88,800	98,500	115,600	120,300	22,500	43,400	65,900
2+ Dwgs : 4+ levels	17,100	40,200	46,700	50,200	59,900	65,500	74,700	77,200	33,100	24,500	57,600
2+ Dwgs : undef	300	300	400	400	500	500	700	700	100	300	400
Other Private	1,300	1,300	1,500	1,500	1,700	1,700	1,900	1,900	200	400	600
Private Not Defined	10,600	10,300	11,300	11,700	13,000	13,700	14,700	14,900	1,100	3,000	4,100
TOTAL	**518,000**	**549,000**	**611,000**	**641,000**	**709,000**	**753,000**	**822,000**	**839,000**	**123,000**	**181,000**	**304,000**
Detached House	73.6%	71.3%	69.5%	68.4%	66.7%	65.6%	63.4%	62.8%	46.5%	45.5%	45.9%
2+ Dwgs : 1 level	11.1%	9.2%	9.9%	10.3%	10.2%	10.5%	11.4%	11.6%	7.0%	15.1%	11.8%
2+ Dwgs : 2-3 levels	9.6%	10.1%	10.8%	11.3%	12.5%	13.1%	14.1%	14.3%	18.3%	24.0%	21.7%
2+ Dwgs : 4+ levels	3.3%	7.3%	7.6%	7.8%	8.4%	8.7%	9.1%	9.2%	26.9%	13.5%	18.9%
2+ Dwgs : undef	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%
Other Private	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Private Not Defined	2.0%	1.9%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	0.9%	1.7%	1.3%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

The notable shift would be in the role of attached housing, with another 66,000 terrace house or similar dwellings (2-3 levels) and some 57,000 apartments (dwellings in 4 or more levels). There would be substantial growth also in single storey attached dwellings.

5.2.4 Very High Preference Shift

Table 5.4 shows the projected dwelling demand under a *Very High Preference shift* scenario. This future would reflect an outcome where just 35% of the new dwelling stock added during the period to 2046 were detached dwellings, and some 65% was in terrace housing and apartments.

The notable shift again would be in the role of attached housing, with another 84,000 terrace house or similar dwellings (2-3 levels) and some 67,000 apartments (dwellings in 4 or more levels). There would be significant growth also in single storey attached dwellings. This intensification would be consistent with the AUP, and possible in terms of plan-enabled capacity.

Table 5.4: Auckland Dwelling Medium Growth Projection 2016-2046 – Very High Preference Shift

Dwelling Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
Detached House	381,500	391,300	421,500	433,100	462,800	475,500	487,900	489,500	51,600	54,800	106,400
2+ Dwgs : 1 level	57,400	50,500	61,400	67,800	74,000	82,300	98,700	103,600	10,400	30,900	41,300
2+ Dwgs : 2-3 levels	49,700	55,400	67,700	74,700	94,400	108,500	133,900	141,000	25,000	59,200	84,200
2+ Dwgs : 4+ levels	17,100	40,200	47,500	51,500	62,900	70,700	84,200	87,900	34,400	32,700	67,100
2+ Dwgs : undef	300	300	400	400	500	500	700	700	100	300	400
Other Private	1,300	1,300	1,400	1,500	1,700	1,700	1,800	1,900	200	300	500
Private Not Defined	10,600	10,300	11,200	11,700	12,900	13,600	14,600	14,800	1,100	2,900	4,000
TOTAL	**518,000**	**549,000**	**611,000**	**641,000**	**709,000**	**753,000**	**822,000**	**839,000**	**123,000**	**181,000**	**304,000**
Detached House	73.6%	71.3%	69.0%	67.6%	65.3%	63.1%	59.4%	58.3%	42.0%	30.3%	35.0%
2+ Dwgs : 1 level	11.1%	9.2%	10.0%	10.6%	10.4%	10.9%	12.0%	12.3%	8.5%	17.1%	13.6%
2+ Dwgs : 2-3 levels	9.6%	10.1%	11.1%	11.7%	13.3%	14.4%	16.3%	16.8%	20.3%	32.7%	27.7%
2+ Dwgs : 4+ levels	3.3%	7.3%	7.8%	8.0%	8.9%	9.4%	10.2%	10.5%	28.0%	18.1%	22.1%
2+ Dwgs : undef	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%
Other Private	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Private Not Defined	2.0%	1.9%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	0.9%	1.6%	1.3%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

5.3 Demand by Dwelling Types – High Growth

5.3.1 Nil Preference Shift

Table 5.5 shows the projected dwelling demand under a Nil Preference Change scenario, where the current (2013) patterns of dwelling occupancy persist, and the increase is more or less *pro rata* from the current situation. With the rural households excluded, the projected growth in demand is in the order of 154,000 households by 2026, and 394,000 in total to 2046.

This future would see detached dwellings continue to account for the major share of dwelling growth - around 73% to 2026, and 71% thereafter.

Table 5.5: Auckland Dwelling High Growth Projection 2016-2046 – Nil Preference Shift

Dwelling Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
Detached House	381,500	412,800	466,900	493,400	556,100	598,200	662,000	677,700	111,900	168,600	280,500
2+ Dwgs : 1 level	57,400	62,500	71,700	76,500	88,300	96,700	113,500	118,500	19,100	37,000	56,100
2+ Dwgs : 2-3 levels	49,700	53,800	60,900	64,400	72,700	78,300	87,500	89,900	14,700	23,100	37,800
2+ Dwgs : 4+ levels	17,100	18,400	20,600	21,600	24,000	25,600	27,900	28,300	4,500	6,300	10,800
2+ Dwgs : undef	300	400	400	500	600	600	800	900	200	300	500
Other Private	1,300	1,400	1,600	1,700	1,900	2,100	2,200	2,300	400	500	900
Private Not Defined	10,600	11,400	12,800	13,500	15,100	16,200	17,800	18,200	2,900	4,300	7,200
TOTAL	**518,000**	**561,000**	**635,000**	**672,000**	**759,000**	**818,000**	**912,000**	**936,000**	**154,000**	**240,000**	**394,000**
Detached House	73.6%	73.6%	73.5%	73.4%	73.3%	73.1%	72.6%	72.4%	72.7%	70.3%	71.2%
2+ Dwgs : 1 level	11.1%	11.1%	11.3%	11.4%	11.6%	11.8%	12.4%	12.7%	12.4%	15.4%	14.2%
2+ Dwgs : 2-3 levels	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.5%	9.6%	9.6%
2+ Dwgs : 4+ levels	3.3%	3.3%	3.2%	3.2%	3.2%	3.1%	3.1%	3.0%	2.9%	2.6%	2.7%
2+ Dwgs : undef	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Other Private	0.3%	0.2%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%	0.3%	0.2%	0.2%
Private Not Defined	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	1.9%	1.9%	1.8%	1.8%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

As with the medium growth future, this outlook is likely to be associated with greenfield growth rather than urban intensification, which would be more aligned with an increase in attached dwellings. The implied growth in detached dwellings would take up a large share of the greenfield capacity in Auckland's Future Urban zone (FUZ) in the medium term. The projected increase of some 116,500 detached dwellings would take up a substantial share of the FUZ, with its estimated capacity for up to 145,000 dwellings.

Longer term, if detached dwellings continued to dominate the market and the construction sector response, then the greenfield capacity is likely to be largely taken up by the late-2020s.

As with the medium projection, this outcome would run counter to both the demographic shift in Auckland's population and the strong growth among older and smaller households - including their propensity to seek central rather than peripheral locations – and the substantial increase in feasible redevelopment capacity provided for in the AUP(OiP). Accordingly, it is included primarily as a comparator, to illustrate the nil-change outcome.

5.3.2 Moderate Preference Shift

Table 5.6 shows the projected dwelling demand under a *Moderate Preference shift* scenario, where the shift towards attached dwellings is clear but not dramatic.

This future would see detached dwellings continue to account for the major share of dwelling growth, but there would be a clear shift from the current 73% to 68% by 2026, and to 58% by 2046. The future reflects the existing dominance of detached dwellings, and even where less than half of the net increase were in detached dwellings, the total estate by 2046 would still reflect much of the current housing stock.

Table 5.6: Auckland Dwelling High Growth Projection 2016-2046 – Moderate Preference Shift

Dwelling Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
Detached House	381,500	411,400	461,900	485,900	537,700	569,100	605,300	614,200	104,400	119,400	223,800
2+ Dwgs : 1 level	57,400	47,700	56,000	60,600	70,600	79,300	98,600	104,400	3,200	38,000	41,200
2+ Dwgs : 2-3 levels	49,700	52,000	60,500	65,000	79,400	90,400	113,300	119,000	15,300	48,300	63,600
2+ Dwgs : 4+ levels	17,100	38,200	43,700	46,500	55,400	62,100	75,200	78,300	29,400	28,700	58,100
2+ Dwgs : undef	300	300	400	400	500	600	800	800	100	400	500
Other Private	1,300	1,300	1,400	1,500	1,700	1,900	2,100	2,100	200	600	800
Private Not Defined	10,600	9,800	11,100	11,700	13,300	14,400	16,400	16,800	1,100	4,700	5,800
TOTAL	**518,000**	**561,000**	**635,000**	**672,000**	**759,000**	**818,000**	**912,000**	**936,000**	**154,000**	**240,000**	**394,000**
Detached House	73.6%	73.3%	72.7%	72.3%	70.8%	69.6%	66.4%	65.6%	67.8%	49.8%	56.8%
2+ Dwgs : 1 level	11.1%	8.5%	8.8%	9.0%	9.3%	9.7%	10.8%	11.2%	2.1%	15.8%	10.5%
2+ Dwgs : 2-3 levels	9.6%	9.3%	9.5%	9.7%	10.5%	11.1%	12.4%	12.7%	9.9%	20.1%	16.1%
2+ Dwgs : 4+ levels	3.3%	6.8%	6.9%	6.9%	7.3%	7.6%	8.2%	8.4%	19.1%	12.0%	14.7%
2+ Dwgs : undef	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%
Other Private	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%	0.3%	0.2%
Private Not Defined	2.0%	1.7%	1.7%	1.7%	1.8%	1.8%	1.8%	1.8%	0.7%	2.0%	1.5%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

5.3.3 High Preference Shift

Table 5.7 shows the projected dwelling demand under a *High Preference shift* scenario. This would reflect an outcome where half the new dwelling stock added during the period were detached dwellings, and half in terrace housing, units and apartments.

Table 5.7: Auckland Dwelling High Growth Projection 2016-2046 – High Preference Shift

Dwelling Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
Detached House	381,500	399,400	441,300	459,700	505,900	536,000	576,900	586,100	78,200	117,200	195,400
2+ Dwgs : 1 level	57,400	51,500	62,700	69,300	77,500	86,300	104,000	109,300	11,900	34,700	46,600
2+ Dwgs : 2-3 levels	49,700	56,600	68,800	75,700	95,000	107,000	128,400	134,300	26,000	52,700	78,700
2+ Dwgs : 4+ levels	17,100	41,100	48,500	52,600	64,100	71,200	83,300	86,500	35,500	30,700	66,200
2+ Dwgs : undef	300	300	400	400	500	600	800	800	100	400	500
Other Private	1,300	1,400	1,500	1,600	1,800	1,900	2,100	2,100	300	500	800
Private Not Defined	10,600	10,500	11,700	12,300	13,900	14,800	16,300	16,700	1,700	4,000	5,700
TOTAL	**518,000**	**561,000**	**635,000**	**672,000**	**759,000**	**818,000**	**912,000**	**936,000**	**154,000**	**240,000**	**394,000**
Detached House	73.6%	71.2%	69.5%	68.4%	66.7%	65.5%	63.3%	62.6%	50.8%	48.8%	49.6%
2+ Dwgs : 1 level	11.1%	9.2%	9.9%	10.3%	10.2%	10.6%	11.4%	11.7%	7.7%	14.5%	11.8%
2+ Dwgs : 2-3 levels	9.6%	10.1%	10.8%	11.3%	12.5%	13.1%	14.1%	14.3%	16.9%	22.0%	20.0%
2+ Dwgs : 4+ levels	3.3%	7.3%	7.6%	7.8%	8.4%	8.7%	9.1%	9.2%	23.1%	12.8%	16.8%
2+ Dwgs : undef	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%
Other Private	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Private Not Defined	2.0%	1.9%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.1%	1.7%	1.4%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

The notable shift would be in the role of attached housing, with another 78,700 terrace house or similar dwellings (2-3 levels) and some 66,200 apartments (dwellings in 4 or more levels). There would be substantial growth (46,600) in single storey attached dwellings.

Nevertheless, a major component of the increase in the dwelling estate would be detached dwellings.

5.3.4 Very High Preference Shift

Table 5.8 shows the projected dwelling demand under a *Very High Preference shift* scenario. This future would reflect an outcome where just 40% of the new dwelling stock added during the period to 2046 were detached dwellings, and some 60% was in terrace housing, units and apartments.

The notable shift again would be in the role of attached housing, with another 99,000 terrace house or similar dwellings (2-3 levels) and some 76,700 apartments (dwellings in 4 or more levels). There would be substantial growth (52,700 dwellings) in single storey attached dwellings. This intensification would be consistent with the AUP, and possible in terms of plan-enabled capacity.

Table 5.8: Auckland Dwelling High Growth Projection 2016-2046 – High Preference Shift

Dwelling Type	2016	2018	2023	2026	2033	2038	2046	2048	2016-26	2026-46	2016-46
Detached House	381,500	399,400	437,800	454,000	495,000	516,200	540,200	544,300	72,500	86,200	158,700
2+ Dwgs : 1 level	57,400	51,500	63,900	71,200	79,300	89,500	110,100	116,100	13,800	38,900	52,700
2+ Dwgs : 2-3 levels	49,700	56,600	70,300	78,300	101,000	117,900	148,700	157,400	28,600	70,400	99,000
2+ Dwgs : 4+ levels	17,100	41,100	49,300	54,000	67,300	76,900	93,800	98,500	36,900	39,800	76,700
2+ Dwgs : undef	300	300	400	400	500	600	700	800	100	300	400
Other Private	1,300	1,400	1,500	1,600	1,800	1,900	2,000	2,100	300	400	700
Private Not Defined	10,600	10,500	11,700	12,200	13,800	14,800	16,200	16,500	1,600	4,000	5,600
TOTAL	**518,000**	**561,000**	**635,000**	**672,000**	**759,000**	**818,000**	**912,000**	**936,000**	**154,000**	**240,000**	**394,000**
Detached House	73.6%	71.2%	68.9%	67.6%	65.2%	63.1%	59.2%	58.2%	47.1%	35.9%	40.3%
2+ Dwgs : 1 level	11.1%	9.2%	10.1%	10.6%	10.4%	10.9%	12.1%	12.4%	9.0%	16.2%	13.4%
2+ Dwgs : 2-3 levels	9.6%	10.1%	11.1%	11.7%	13.3%	14.4%	16.3%	16.8%	18.6%	29.3%	25.1%
2+ Dwgs : 4+ levels	3.3%	7.3%	7.8%	8.0%	8.9%	9.4%	10.3%	10.5%	24.0%	16.6%	19.5%
2+ Dwgs : undef	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Other Private	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Private Not Defined	2.0%	1.9%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.0%	1.7%	1.4%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: ME Auckland Housing Model 2017

5.4 Dwelling Values – Future Growth in the Auckland Dwelling Estate

The second core output from the scenarios is projections of numbers of dwellings in each value band, based on estimated demand for dwellings from each type of household.

5.4.1 Scope

The starting point is that the current situation (2016) reflects existing demand for dwellings (owned and rented) by households of each type. Further, that the value profile for existing dwellings broadly reflects expressed demand (dwelling type and value) from Auckland households. On this basis, the household projections have been used to estimate future demand for housing – owned and rented, by dwelling type – in each value band.

Projected future demand is based in the first instance on existing demand patterns, projected forward *pro rata* with the growth in each segment of the market (household type).

We note that there has been considerable and on-going assessment of issues in the Auckland housing market, especially the effects of high dwelling prices on housing affordability, and household numbers. Three main effects relevant to this assessment are:

a. The potential for the current base year patterns to reflect a situation where dwelling ownership levels are artificially low, because dwelling prices are high relative to household incomes. Pro rating forward the base year pattern may understate likely ownership levels (numbers of owned dwellings), and overstate likely rental levels (numbers of rented dwellings);
b. Second, the current high price levels may overstate the price levels in a future situation where changes in market conditions would see a reduction in prices relative to household incomes, with consequent positive effects on affordability;
c. The potential for household numbers to have been lower than the "normal" for the population, because formation of new households has been suppressed or deferred by lack of dwelling supply and poor housing affordability.

These are matters which need to be taken into account in any consideration or evaluation of the demand assessment presented here.

However, in developing the demand outlook there has been no attempt to make adjustments for any of these matters. That is because dwelling ownership rates may increase or decrease in the future or remain unchanged, and while higher levels of ownership are generally seen as a positive for individuals and the community, there is no optimal level of ownership; while the medium term outlook is for slow or slower growth in housing prices, there is no certainty that affordability will improve in the medium term, and there is no ideal or optimum number of households for a given population size.

For those reasons, the assessment used here is the simple *pro rating* forward of the current demand pattern, though taking into account future changes in the demography of the Auckland population, and consequent shifts in the mix of households of each type.

Having stated that, the projection scenarios do allow for changes in the mix of dwellings for Auckland, most notably a decrease in the share of detached dwellings in the Auckland housing estate, and an increase in attached dwellings. This will have some impact on the projected value distribution of dwellings, because the value of attached dwellings is generally lower than the value of detached dwellings. Accordingly, a change in the dwelling mix can be expected to have some flow-on effect for the distribution of dwelling values for the market in total, and segments within the market.

Hence, the distribution of dwelling values has been estimated first by allowing for change in the dwelling mix as between detached and attached dwellings for each household type, then by applying the current value distribution by dwelling type to the future projected numbers. The core output is estimated demand for dwellings by type and value band, and the indicated change in demand.

As noted, there is no econometric component to this Model, to consider such matters as potential change in dwelling ownership levels if housing prices increase or decrease, or calculation of the price bands of future dwelling supply (in a manner similar to the ACDC Model's costing of feasible new development, for example).

5.5 Medium Growth

The projection results are set out in Tables 5.9 to 5.12 (Medium growth) and 5.13 to 5.16 (High growth). Each table shows the distribution of dwellings by value for 2016 for owned and rented/not owned dwellings, and the future outcome for the projected year. It also shows the net increase in demand for dwellings in each value band over the period. 2026 and 2046.

The tables also show the implied ownership and rental balance in the future. The indicated changes toward a higher share of owned dwellings reflect the demographic shift, and the current mix of owned and rented dwellings for each segment. Note that this is a *pro rata* shift from the current situation, and assumes that the current ownership levels for each segment will apply to the same market segments as at 2046.

However, this indicator needs to be treated with caution, because the relatively high ownership levels recorded for middle and older age groups as at 2013 may not accurately represent the ownership levels in those cohorts in 30 years' time. The ownership levels as at 2013 in the younger age cohorts were lower than recorded for those same cohorts at earlier Census points, and if those lower levels persist through the life stages, then the dwelling ownership levels as at 2046 would be lower than those indicated in the tables. With that caveat, the ownership indicator is nevertheless included to indicate how future patterns may pan out.

5.5.1 Nil Preference Change

Table 5.9 shows the projected dwelling numbers for 2046 in a medium growth future, with nil preference change across segments of the market. The distribution shows low shares of dwellings in the lower value bands, with demand centred on the mid-range values – reflecting the current dwelling mix and value patterns.

The total increase in demand of some 304,000 dwellings represents substantial growth in demand. However, the similarity in the distribution of values with the current pattern also reflects stability in the structure of demand.

The point of note is that the household projections show incremental change from the current base, and do not indicate substantial shifts in the underlying pattern of housing demand. It follows that the projected demand reflects quite strongly this incremental shift, where the main change is the number of dwellings, rather than the mix of dwellings and values.

This relative stability in the population structure means there is also relative stability in the future structure of housing demand. This applies to all of the scenarios, which means that the key differences arise from changes in household preferences rather than shifts in household numbers.

Table 5.9: Dwelling Demand by Tenure and Value 2016-46 – Medium Growth and Nil Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Owned	Not Owned	Total	Owned	Not Owned	Total	Owned	Not Owned	Total	Total %
$0-300	2,800	5,800	8,600	5,100	9,100	14,200	2,200	3,300	5,500	1.8%
$300-440	12,400	20,700	33,100	22,000	32,100	54,100	9,700	11,400	21,100	6.9%
$440-580	32,600	38,900	71,500	53,500	57,400	110,900	20,900	18,500	39,400	13.0%
$580-730	43,500	38,200	81,700	71,100	57,100	128,200	27,700	18,900	46,600	15.3%
$730-880	46,500	31,000	77,500	74,300	45,500	119,800	27,800	14,600	42,400	13.9%
$880-1020	43,300	23,400	66,700	69,000	34,800	103,800	25,600	11,400	37,000	12.2%
$1020-1170	34,700	16,100	50,800	57,100	23,800	80,900	22,400	7,800	30,200	9.9%
$1170-1310	25,800	10,800	36,600	43,700	15,900	59,600	17,900	5,200	23,100	7.6%
$1310-1450	17,400	7,100	24,500	28,900	10,200	39,100	11,500	3,100	14,600	4.8%
$1450-1750	19,000	7,700	26,700	32,900	11,100	44,000	13,900	3,500	17,400	5.7%
$1750-2050	10,600	4,100	14,700	18,200	5,900	24,100	7,600	1,800	9,400	3.1%
$2050-2350	5,900	2,300	8,200	10,200	3,300	13,500	4,300	1,000	5,300	1.7%
$2350-2650	3,800	1,500	5,300	6,900	2,100	9,000	3,000	600	3,600	1.2%
$2650-2950	2,500	900	3,400	4,300	1,300	5,600	1,900	300	2,200	0.7%
$2950-3300	1,900	800	2,700	3,400	1,000	4,400	1,500	300	1,800	0.6%
$3300-3650	1,400	500	1,900	2,600	700	3,300	1,100	200	1,300	0.4%
$3650+	3,400	1,000	4,400	6,100	1,400	7,500	2,700	500	3,200	1.1%
Total	**308,000**	**211,000**	**518,000**	**509,000**	**313,000**	**822,000**	**202,000**	**102,000**	**304,000**	**100.0%**
Share %	*59%*	*41%*	*100%*	*62%*	*38%*	*100%*	*66%*	*34%*	*100%*	

Source: ME Auckland Housing Model 2017

Table 5.10: Dwelling Demand by Type and Value 2016-46 – Medium Growth and Nil Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Total %
$0-300	2,000	6,600	8,600	3,000	11,200	14,200	1,000	4,600	5,600	1.8%
$300-440	9,600	23,400	33,000	15,100	39,000	54,100	5,400	15,600	21,000	6.9%
$440-580	39,800	31,700	71,500	59,000	51,800	110,800	19,200	20,200	39,400	13.0%
$580-730	55,600	26,000	81,600	84,700	43,500	128,200	29,100	17,500	46,600	15.3%
$730-880	59,400	18,000	77,400	89,800	30,000	119,800	30,400	12,000	42,400	13.9%
$880-1020	56,300	10,400	66,700	86,400	17,300	103,700	30,100	7,000	37,100	12.2%
$1020-1170	44,400	6,400	50,800	70,600	10,400	81,000	26,200	4,000	30,200	9.9%
$1170-1310	32,700	4,000	36,700	53,400	6,300	59,700	20,700	2,300	23,000	7.6%
$1310-1450	21,900	2,600	24,500	35,200	4,000	39,200	13,300	1,400	14,700	4.8%
$1450-1750	23,600	3,100	26,700	39,300	4,700	44,000	15,800	1,600	17,400	5.7%
$1750-2050	13,100	1,700	14,800	21,700	2,400	24,100	8,600	800	9,400	3.1%
$2050-2350	7,200	900	8,100	12,100	1,400	13,500	4,900	500	5,400	1.8%
$2350-2650	4,700	600	5,300	8,100	900	9,000	3,400	200	3,600	1.2%
$2650-2950	3,000	400	3,400	5,000	600	5,600	2,100	100	2,200	0.7%
$2950-3300	2,300	400	2,700	4,000	500	4,500	1,700	100	1,800	0.6%
$3300-3650	1,800	200	2,000	3,000	200	3,200	1,300	100	1,400	0.5%
$3650+	4,200	200	4,400	7,300	200	7,500	3,100	100	3,200	1.1%
Total	**382,000**	**137,000**	**518,000**	**598,000**	**224,000**	**822,000**	**216,000**	**88,000**	**304,000**	**100.0%**
Share %	*74%*	*26%*	*100%*	*73%*	*27%*	*100%*	*71%*	*29%*	*100%*	

Source: ME Auckland Housing Model 2017

5.5.2 Moderate Preference Change

Table 5.11 shows the projected dwelling numbers for 2046 in a medium growth future, with moderate preference shift. The distribution again reflects continuation of the overall pattern, but with some general transfer toward lower value dwellings (reflecting the shift toward attached dwellings), but with demand centred on the mid-range values. Table 5.12 shows the equivalent outcome by dwelling type.

Table 5.11: Dwelling Demand by Tenure and Value 2016-46 – Medium Growth and Moderate Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Owned	Not Owned	Total	Owned	Not Owned	Total	Owned	Not Owned	Total	Total %
$0-300	2,800	5,800	8,600	6,300	9,600	15,900	3,400	3,800	7,200	2.4%
$300-440	12,400	20,700	33,100	26,400	33,900	60,300	14,000	13,300	27,300	9.0%
$440-580	32,600	38,900	71,500	58,800	58,400	117,200	26,200	19,500	45,700	15.0%
$580-730	43,500	38,200	81,700	74,100	56,900	131,000	30,700	18,700	49,400	16.3%
$730-880	46,500	31,000	77,500	74,700	44,600	119,300	28,200	13,600	41,800	13.8%
$880-1020	43,300	23,400	66,700	67,200	33,400	100,600	23,900	10,100	34,000	11.2%
$1020-1170	34,700	16,100	50,800	55,000	22,800	77,800	20,300	6,700	27,000	8.9%
$1170-1310	25,800	10,800	36,600	41,800	15,200	57,000	16,000	4,400	20,400	6.7%
$1310-1450	17,400	7,100	24,500	27,600	9,800	37,400	10,200	2,700	12,900	4.2%
$1450-1750	19,000	7,700	26,700	31,300	10,700	42,000	12,300	3,000	15,300	5.0%
$1750-2050	10,600	4,100	14,700	17,300	5,700	23,000	6,700	1,500	8,200	2.7%
$2050-2350	5,900	2,300	8,200	9,700	3,100	12,800	3,800	900	4,700	1.5%
$2350-2650	3,800	1,500	5,300	6,500	2,000	8,500	2,600	600	3,200	1.1%
$2650-2950	2,500	900	3,400	4,100	1,200	5,300	1,600	300	1,900	0.6%
$2950-3300	1,900	800	2,700	3,300	1,000	4,300	1,300	200	1,500	0.5%
$3300-3650	1,400	500	1,900	2,400	600	3,000	1,000	100	1,100	0.4%
$3650+	3,400	1,000	4,400	5,600	1,300	6,900	2,200	300	2,500	0.8%
Total	**308,000**	**211,000**	**518,000**	**512,000**	**310,000**	**822,000**	**204,000**	**100,000**	**304,000**	**100.0%**
Share %	*59%*	*41%*	*100%*	*62%*	*38%*	*100%*	*67%*	*33%*	*100%*	

Source: ME Auckland Housing Model 2017

Table 5.12: Dwelling Demand by Type and Value 2016-46 – Medium Growth and Moderate Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Total %
$0-300	2,000	6,600	8,600	2,700	13,200	15,900	700	6,600	7,300	2.4%
$300-440	9,600	23,400	33,000	13,700	46,700	60,400	4,000	23,300	27,300	9.0%
$440-580	39,800	31,700	71,500	54,300	62,900	117,200	14,500	31,200	45,700	15.0%
$580-730	55,600	26,000	81,600	77,600	53,300	130,900	22,000	27,400	49,400	16.3%
$730-880	59,400	18,000	77,400	82,100	37,200	119,300	22,700	19,200	41,900	13.8%
$880-1020	56,300	10,400	66,700	79,000	21,700	100,700	22,700	11,300	34,000	11.2%
$1020-1170	44,400	6,400	50,800	64,600	13,200	77,800	20,200	6,800	27,000	8.9%
$1170-1310	32,700	4,000	36,700	49,000	8,100	57,100	16,300	4,100	20,400	6.7%
$1310-1450	21,900	2,600	24,500	32,200	5,200	37,400	10,300	2,500	12,800	4.2%
$1450-1750	23,600	3,100	26,700	36,000	6,000	42,000	12,400	2,900	15,300	5.0%
$1750-2050	13,100	1,700	14,800	19,800	3,200	23,000	6,700	1,500	8,200	2.7%
$2050-2350	7,200	900	8,100	11,000	1,800	12,800	3,800	800	4,600	1.5%
$2350-2650	4,700	600	5,300	7,400	1,100	8,500	2,700	500	3,200	1.1%
$2650-2950	3,000	400	3,400	4,600	700	5,300	1,600	300	1,900	0.6%
$2950-3300	2,300	400	2,700	3,600	600	4,200	1,300	300	1,600	0.5%
$3300-3650	1,800	200	2,000	2,700	300	3,000	1,000	100	1,100	0.4%
$3650+	4,200	200	4,400	6,600	300	6,900	2,400	100	2,500	0.8%
Total	**382,000**	**137,000**	**518,000**	**547,000**	**276,000**	**822,000**	**165,000**	**139,000**	**304,000**	**100.0%**
Share %	*74%*	*26%*	*100%*	*67%*	*34%*	*100%*	*54%*	*46%*	*100%*	

Source: ME Auckland Housing Model 2017

5.5.3 High Preference Change

Table 5.13 shows the projected dwelling numbers for 2046 in a medium growth future, with high preference shift. The distribution still reflects continuation of the overall pattern, but the transfer toward dwellings in the lower value range is more marked. Table 5.14 shows the outcome by dwelling type.

Table 5.13: Dwelling Demand by Tenure and Value 2016-46 – Medium Growth and High Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Owned	Not Owned	Total	Owned	Not Owned	Total	Owned	Not Owned	Total	Total %
$0-300	2,800	5,800	8,600	6,900	9,900	16,800	4,000	4,100	8,100	2.7%
$300-440	12,400	20,700	33,100	28,800	34,900	63,700	16,400	14,200	30,600	10.1%
$440-580	32,600	38,900	71,500	61,500	58,800	120,300	28,900	19,900	48,800	16.1%
$580-730	43,500	38,200	81,700	75,600	56,700	132,300	32,100	18,500	50,600	16.6%
$730-880	46,500	31,000	77,500	74,800	44,100	118,900	28,400	13,100	41,500	13.7%
$880-1020	43,300	23,400	66,700	66,100	32,800	98,900	22,800	9,400	32,200	10.6%
$1020-1170	34,700	16,100	50,800	53,800	22,300	76,100	19,100	6,200	25,300	8.3%
$1170-1310	25,800	10,800	36,600	40,800	14,900	55,700	15,000	4,100	19,100	6.3%
$1310-1450	17,400	7,100	24,500	26,900	9,600	36,500	9,500	2,500	12,000	3.9%
$1450-1750	19,000	7,700	26,700	30,600	10,400	41,000	11,500	2,800	14,300	4.7%
$1750-2050	10,600	4,100	14,700	16,800	5,500	22,300	6,200	1,400	7,600	2.5%
$2050-2350	5,900	2,300	8,200	9,400	3,000	12,400	3,500	800	4,300	1.4%
$2350-2650	3,800	1,500	5,300	6,300	2,000	8,300	2,500	500	3,000	1.0%
$2650-2950	2,500	900	3,400	4,000	1,200	5,200	1,500	300	1,800	0.6%
$2950-3300	1,900	800	2,700	3,200	1,000	4,200	1,200	200	1,400	0.5%
$3300-3650	1,400	500	1,900	2,300	600	2,900	900	100	1,000	0.3%
$3650+	3,400	1,000	4,400	5,400	1,300	6,700	2,000	300	2,300	0.8%
Total	**308,000**	**211,000**	**518,000**	**513,000**	**309,000**	**822,000**	**206,000**	**98,000**	**304,000**	**100.0%**
Share %	*59%*	*41%*	*100%*	*62%*	*38%*	*100%*	*68%*	*32%*	*100%*	

Source: ME Auckland Housing Model 2017

Table 5.14: Dwelling Demand by Type and Value 2016-46 – Medium Growth and High Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Total %
$0-300	2,000	6,600	8,600	2,500	14,200	16,700	500	7,600	8,100	2.7%
$300-440	9,600	23,400	33,000	13,000	50,700	63,700	3,300	27,300	30,600	10.1%
$440-580	39,800	31,700	71,500	51,800	68,500	120,300	12,000	36,900	48,900	16.1%
$580-730	55,600	26,000	81,600	73,900	58,400	132,300	18,300	32,400	50,700	16.7%
$730-880	59,400	18,000	77,400	78,000	40,900	118,900	18,600	22,800	41,400	13.6%
$880-1020	56,300	10,400	66,700	75,100	23,800	98,900	18,800	13,400	32,200	10.6%
$1020-1170	44,400	6,400	50,800	61,600	14,500	76,100	17,200	8,100	25,300	8.3%
$1170-1310	32,700	4,000	36,700	46,800	8,900	55,700	14,100	4,900	19,000	6.3%
$1310-1450	21,900	2,600	24,500	30,800	5,700	36,500	8,900	3,100	12,000	3.9%
$1450-1750	23,600	3,100	26,700	34,400	6,600	41,000	10,800	3,500	14,300	4.7%
$1750-2050	13,100	1,700	14,800	18,900	3,500	22,400	5,800	1,800	7,600	2.5%
$2050-2350	7,200	900	8,100	10,500	2,000	12,500	3,300	1,000	4,300	1.4%
$2350-2650	4,700	600	5,300	7,000	1,300	8,300	2,400	600	3,000	1.0%
$2650-2950	3,000	400	3,400	4,400	800	5,200	1,400	400	1,800	0.6%
$2950-3300	2,300	400	2,700	3,400	700	4,100	1,100	300	1,400	0.5%
$3300-3650	1,800	200	2,000	2,600	300	2,900	800	200	1,000	0.3%
$3650+	4,200	200	4,400	6,300	400	6,700	2,100	200	2,300	0.8%
Total	**382,000**	**137,000**	**518,000**	**521,000**	**301,000**	**822,000**	**139,000**	**165,000**	**304,000**	**100.0%**
Share %	*74%*	*26%*	*100%*	*63%*	*37%*	*100%*	*46%*	*54%*	*100%*	

Source: ME Auckland Housing Model 2017

5.5.4 Very High Preference Change

Table 5.15 shows the projected dwelling numbers for 2046 in a medium growth future, with very high preference shift. The distribution still reflects continuation of the overall pattern, but the transfer toward dwellings in the lower value range is much more apparent. Table 5.14 shows the outcome by dwelling type.

Table 5.15: Dwelling Demand by Tenure and Value 2016-46 – Medium Growth, Very High Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Owned	Not Owned	Total	Owned	Not Owned	Total	Owned	Not Owned	Total	Total %
$0-300	2,800	5,800	8,600	7,700	10,200	17,900	4,900	4,500	9,400	3.1%
$300-440	12,400	20,700	33,100	31,800	36,100	67,900	19,400	15,400	34,800	11.4%
$440-580	32,600	38,900	71,500	65,100	59,300	124,400	32,500	20,400	52,900	17.4%
$580-730	43,500	38,200	81,700	77,600	56,400	134,000	34,100	18,300	52,400	17.2%
$730-880	46,500	31,000	77,500	75,100	43,300	118,400	28,600	12,400	41,000	13.5%
$880-1020	43,300	23,400	66,700	64,900	31,900	96,800	21,600	8,500	30,100	9.9%
$1020-1170	34,700	16,100	50,800	52,400	21,600	74,000	17,700	5,500	23,200	7.6%
$1170-1310	25,800	10,800	36,600	39,500	14,400	53,900	13,700	3,600	17,300	5.7%
$1310-1450	17,400	7,100	24,500	26,100	9,300	35,400	8,600	2,200	10,800	3.6%
$1450-1750	19,000	7,700	26,700	29,600	10,100	39,700	10,600	2,500	13,100	4.3%
$1750-2050	10,600	4,100	14,700	16,300	5,300	21,600	5,700	1,200	6,900	2.3%
$2050-2350	5,900	2,300	8,200	9,100	3,000	12,100	3,200	700	3,900	1.3%
$2350-2650	3,800	1,500	5,300	6,100	1,900	8,000	2,300	500	2,800	0.9%
$2650-2950	2,500	900	3,400	3,900	1,200	5,100	1,400	200	1,600	0.5%
$2950-3300	1,900	800	2,700	3,100	900	4,000	1,100	200	1,300	0.4%
$3300-3650	1,400	500	1,900	2,200	600	2,800	800	100	900	0.3%
$3650+	3,400	1,000	4,400	5,100	1,200	6,300	1,700	200	1,900	0.6%
Total	**308,000**	**211,000**	**518,000**	**516,000**	**307,000**	**822,000**	**208,000**	**96,000**	**304,000**	**100.0%**
Share %	*59%*	*41%*	*100%*	*63%*	*37%*	*100%*	*68%*	*32%*	*100%*	

Source: ME Auckland Housing Model 2017

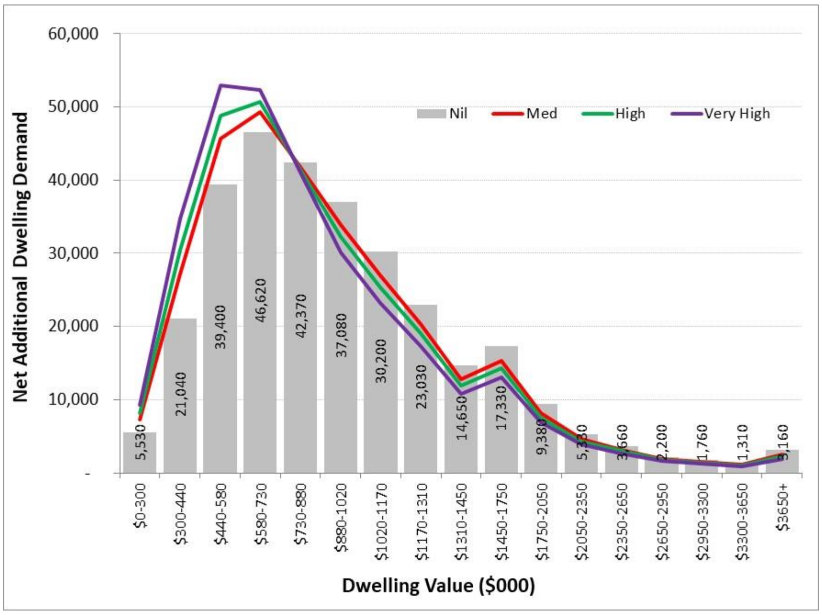
Table 5.16: Dwelling Demand by Type and Value 2016-46 – Medium Growth and High Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Total %
$0-300	2,000	6,600	8,600	2,300	15,600	17,900	300	9,000	9,300	3.1%
$300-440	9,600	23,400	33,000	12,000	55,800	67,800	2,400	32,400	34,800	11.4%
$440-580	39,800	31,700	71,500	48,500	75,900	124,400	8,700	44,200	52,900	17.4%
$580-730	55,600	26,000	81,600	69,200	64,800	134,000	13,500	38,900	52,400	17.2%
$730-880	59,400	18,000	77,400	72,900	45,600	118,500	13,500	27,500	41,000	13.5%
$880-1020	56,300	10,400	66,700	70,200	26,600	96,800	13,900	16,200	30,100	9.9%
$1020-1170	44,400	6,400	50,800	57,800	16,200	74,000	13,400	9,900	23,300	7.7%
$1170-1310	32,700	4,000	36,700	44,000	9,900	53,900	11,300	6,000	17,300	5.7%
$1310-1450	21,900	2,600	24,500	29,000	6,300	35,300	7,100	3,700	10,800	3.6%
$1450-1750	23,600	3,100	26,700	32,300	7,400	39,700	8,800	4,300	13,100	4.3%
$1750-2050	13,100	1,700	14,800	17,700	3,900	21,600	4,700	2,200	6,900	2.3%
$2050-2350	7,200	900	8,100	9,900	2,200	12,100	2,700	1,200	3,900	1.3%
$2350-2650	4,700	600	5,300	6,600	1,400	8,000	1,900	800	2,700	0.9%
$2650-2950	3,000	400	3,400	4,100	900	5,000	1,100	500	1,600	0.5%
$2950-3300	2,300	400	2,700	3,200	800	4,000	900	400	1,300	0.4%
$3300-3650	1,800	200	2,000	2,400	400	2,800	700	200	900	0.3%
$3650+	4,200	200	4,400	5,900	400	6,300	1,700	200	1,900	0.6%
Total	**382,000**	**137,000**	**518,000**	**488,000**	**334,000**	**822,000**	**107,000**	**198,000**	**304,000**	**100.0%**
Share %	*74%*	*26%*	*100%*	*59%*	*41%*	*100%*	*35%*	*65%*	*100%*	

Source: ME Auckland Housing Model 2017

Figure 5.1 compares the net additional dwelling demand for the four scenarios. The value distribution of the net increase is similar for all scenarios, and very close to the current Auckland structure. However, it is clear that the increase in attached dwellings in each of the scenarios is associated with higher shares of dwellings in the lower and middle value bands, and smaller shares in the higher value bands. This shift reflects the current value distributions for detached and attached dwellings, and does not reflect any modelling of future supply.

Figure 5.1: Auckland Dwelling Demand by Value 2016-46 – Medium Growth



5.6 High Growth

5.6.1 Nil Preference Change

The high growth future reflects similar changes, albeit affecting a larger volume of growth in dwelling demand.

Table 5.17 shows the projected dwelling numbers for 2046 in the high growth future, with nil preference change across segments of the market. The distribution reflects the current pattern, with relatively few dwellings in the lower value bands, and demand centred on the mid-range values.

The total increase in demand of 447,000 dwellings is very substantial growth, the pro rata projection indicating growth shared relatively evenly across all value bands.

Table 5.17: Dwelling Demand by Tenure and Value 2016-46 – High Growth and Nil Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Owned	Not Owned	Total	Owned	Not Owned	Total	Owned	Not Owned	Total	Total %
$0-300	2,800	5,800	8,600	5,700	10,100	15,800	2,800	4,300	7,100	1.8%
$300-440	12,400	20,700	33,100	24,500	35,600	60,100	12,100	15,000	27,100	6.9%
$440-580	32,600	38,900	71,500	59,400	63,800	123,200	26,800	24,900	51,700	13.1%
$580-730	43,500	38,200	81,700	79,000	63,400	142,400	35,600	25,200	60,800	15.4%
$730-880	46,500	31,000	77,500	82,500	50,600	133,100	36,000	19,600	55,600	14.1%
$880-1020	43,300	23,400	66,700	76,500	38,600	115,100	33,200	15,300	48,500	12.3%
$1020-1170	34,700	16,100	50,800	63,300	26,500	89,800	28,600	10,400	39,000	9.9%
$1170-1310	25,800	10,800	36,600	48,400	17,700	66,100	22,600	6,900	29,500	7.5%
$1310-1450	17,400	7,100	24,500	32,000	11,300	43,300	14,600	4,300	18,900	4.8%
$1450-1750	19,000	7,700	26,700	36,400	12,400	48,800	17,300	4,700	22,000	5.6%
$1750-2050	10,600	4,100	14,700	20,100	6,600	26,700	9,500	2,400	11,900	3.0%
$2050-2350	5,900	2,300	8,200	11,300	3,600	14,900	5,400	1,400	6,800	1.7%
$2350-2650	3,800	1,500	5,300	7,600	2,300	9,900	3,700	900	4,600	1.2%
$2650-2950	2,500	900	3,400	4,800	1,400	6,200	2,300	500	2,800	0.7%
$2950-3300	1,900	800	2,700	3,800	1,100	4,900	1,800	400	2,200	0.6%
$3300-3650	1,400	500	1,900	2,800	800	3,600	1,400	300	1,700	0.4%
$3650+	3,400	1,000	4,400	6,700	1,600	8,300	3,400	600	4,000	1.0%
Total	**308,000**	**211,000**	**518,000**	**565,000**	**347,000**	**912,000**	**257,000**	**137,000**	**394,000**	**100.0%**
Share %	*59%*	*41%*	*100%*	*62%*	*38%*	*100%*	*65%*	*35%*	*100%*	

Source: ME Auckland Housing Model 2017

Table 5.18: Dwelling Demand by Type and Value 2016-46 – High Growth and Nil Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Total %
$0-300	2,000	6,600	8,600	3,300	12,400	15,700	1,300	5,800	7,100	1.8%
$300-440	9,600	23,400	33,000	16,700	43,400	60,100	7,100	20,000	27,100	6.9%
$440-580	39,800	31,700	71,500	65,500	57,700	123,200	25,700	26,000	51,700	13.1%
$580-730	55,600	26,000	81,600	93,900	48,500	142,400	38,300	22,500	60,800	15.4%
$730-880	59,400	18,000	77,400	99,600	33,500	133,100	40,200	15,400	55,600	14.1%
$880-1020	56,300	10,400	66,700	95,800	19,300	115,100	39,500	8,900	48,400	12.3%
$1020-1170	44,400	6,400	50,800	78,200	11,600	89,800	33,800	5,200	39,000	9.9%
$1170-1310	32,700	4,000	36,700	59,100	7,000	66,100	26,400	3,000	29,400	7.5%
$1310-1450	21,900	2,600	24,500	38,900	4,500	43,400	17,000	1,800	18,800	4.8%
$1450-1750	23,600	3,100	26,700	43,500	5,200	48,700	19,900	2,100	22,000	5.6%
$1750-2050	13,100	1,700	14,800	24,000	2,700	26,700	10,900	1,000	11,900	3.0%
$2050-2350	7,200	900	8,100	13,400	1,500	14,900	6,200	600	6,800	1.7%
$2350-2650	4,700	600	5,300	8,900	1,000	9,900	4,300	300	4,600	1.2%
$2650-2950	3,000	400	3,400	5,600	600	6,200	2,600	200	2,800	0.7%
$2950-3300	2,300	400	2,700	4,400	500	4,900	2,100	200	2,300	0.6%
$3300-3650	1,800	200	2,000	3,300	300	3,600	1,600	100	1,700	0.4%
$3650+	4,200	200	4,400	8,100	300	8,400	3,900	100	4,000	1.0%
Total	**382,000**	**137,000**	**518,000**	**662,000**	**250,000**	**912,000**	**281,000**	**113,000**	**394,000**	**100.0%**
Share %	*74%*	*26%*	*100%*	*73%*	*27%*	*100%*	*71%*	*29%*	*100%*	

Source: ME Auckland Housing Model 2017

5.6.2 Moderate Preference Change

Table 5.19 shows the projected dwelling numbers for 2046 in a high growth future, with moderate preference shift. The distribution again reflects continuation of the overall pattern, but with some general transfer toward lower value dwellings (reflecting the shift toward attached dwellings), but with demand centred on the mid-range values. Table 5.20 shows the equivalent outcome by dwelling type.

Table 5.19: Dwelling Demand by Tenure and Value 2016-46 – High Growth and Moderate Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Owned	Not Owned	Total	Owned	Not Owned	Total	Owned	Not Owned	Total	Total %
$0-300	2,800	5,800	8,600	7,000	10,700	17,700	4,100	4,900	9,000	2.3%
$300-440	12,400	20,700	33,100	29,400	37,700	67,100	17,000	17,000	34,000	8.6%
$440-580	32,600	38,900	71,500	65,300	64,800	130,100	32,700	26,000	58,700	14.9%
$580-730	43,500	38,200	81,700	82,300	63,100	145,400	38,900	25,000	63,900	16.2%
$730-880	46,500	31,000	77,500	83,000	49,500	132,500	36,500	18,500	55,000	14.0%
$880-1020	43,300	23,400	66,700	74,500	37,100	111,600	31,200	13,700	44,900	11.4%
$1020-1170	34,700	16,100	50,800	60,900	25,300	86,200	26,200	9,200	35,400	9.0%
$1170-1310	25,800	10,800	36,600	46,200	16,900	63,100	20,400	6,100	26,500	6.7%
$1310-1450	17,400	7,100	24,500	30,500	10,800	41,300	13,100	3,700	16,800	4.3%
$1450-1750	19,000	7,700	26,700	34,600	11,800	46,400	15,600	4,200	19,800	5.0%
$1750-2050	10,600	4,100	14,700	19,100	6,300	25,400	8,500	2,100	10,600	2.7%
$2050-2350	5,900	2,300	8,200	10,700	3,400	14,100	4,800	1,200	6,000	1.5%
$2350-2650	3,800	1,500	5,300	7,200	2,200	9,400	3,300	800	4,100	1.0%
$2650-2950	2,500	900	3,400	4,500	1,400	5,900	2,100	400	2,500	0.6%
$2950-3300	1,900	800	2,700	3,600	1,100	4,700	1,700	300	2,000	0.5%
$3300-3650	1,400	500	1,900	2,600	700	3,300	1,200	200	1,400	0.4%
$3650+	3,400	1,000	4,400	6,200	1,500	7,700	2,800	500	3,300	0.8%
Total	**308,000**	**211,000**	**518,000**	**568,000**	**344,000**	**912,000**	**260,000**	**134,000**	**394,000**	**100.0%**
Share %	*59%*	*41%*	*100%*	*62%*	*38%*	*100%*	*66%*	*34%*	*100%*	

Source: ME Auckland Housing Model 2017

Table 5.20: Dwelling Demand by Type and Value 2016-46 – High Growth and Moderate Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Total %
$0-300	2,000	6,600	8,600	2,900	14,700	17,600	900	8,100	9,000	2.3%
$300-440	9,600	23,400	33,000	15,200	51,900	67,100	5,500	28,500	34,000	8.6%
$440-580	39,800	31,700	71,500	60,200	70,000	130,200	20,400	38,300	58,700	14.9%
$580-730	55,600	26,000	81,600	86,100	59,400	145,500	30,400	33,400	63,800	16.2%
$730-880	59,400	18,000	77,400	91,000	41,500	132,500	31,600	23,400	55,000	14.0%
$880-1020	56,300	10,400	66,700	87,500	24,100	111,600	31,200	13,700	44,900	11.4%
$1020-1170	44,400	6,400	50,800	71,600	14,600	86,200	27,200	8,300	35,500	9.0%
$1170-1310	32,700	4,000	36,700	54,200	8,900	63,100	21,500	5,000	26,500	6.7%
$1310-1450	21,900	2,600	24,500	35,600	5,700	41,300	13,700	3,100	16,800	4.3%
$1450-1750	23,600	3,100	26,700	39,800	6,700	46,500	16,200	3,600	19,800	5.0%
$1750-2050	13,100	1,700	14,800	21,800	3,500	25,300	8,800	1,800	10,600	2.7%
$2050-2350	7,200	900	8,100	12,200	2,000	14,200	5,000	1,000	6,000	1.5%
$2350-2650	4,700	600	5,300	8,100	1,300	9,400	3,500	600	4,100	1.0%
$2650-2950	3,000	400	3,400	5,100	800	5,900	2,100	400	2,500	0.6%
$2950-3300	2,300	400	2,700	4,000	700	4,700	1,700	300	2,000	0.5%
$3300-3650	1,800	200	2,000	3,000	300	3,300	1,300	200	1,500	0.4%
$3650+	4,200	200	4,400	7,300	300	7,600	3,100	200	3,300	0.8%
Total	**382,000**	**137,000**	**518,000**	**606,000**	**306,000**	**912,000**	**224,000**	**170,000**	**394,000**	**100.0%**
Share %	*74%*	*26%*	*100%*	*66%*	*34%*	*100%*	*57%*	*43%*	*100%*	

Source: ME Auckland Housing Model 2017

5.6.3 High Preference Change

Table 5.21 shows the projected dwelling numbers for 2046 in a high growth future, with high preference shift. The distribution still shows continuation of the existing pattern, but the greater volume of growth means the transition toward the lower value ranges is somewhat more marked. Table 5.22 shows the outcome by dwelling type.

Table 5.21: Dwelling Demand by Tenure and Value 2016-46 – High Growth and High Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Owned	Not Owned	Total	Owned	Not Owned	Total	Owned	Not Owned	Total	Total %
$0-300	2,800	5,800	8,600	7,700	11,000	18,700	4,800	5,200	10,000	2.5%
$300-440	12,400	20,700	33,100	32,000	38,700	70,700	19,600	18,000	37,600	9.5%
$440-580	32,600	38,900	71,500	68,400	65,300	133,700	35,800	26,400	62,200	15.8%
$580-730	43,500	38,200	81,700	84,000	63,000	147,000	40,500	24,800	65,300	16.6%
$730-880	46,500	31,000	77,500	83,100	48,900	132,000	36,600	17,900	54,500	13.8%
$880-1020	43,300	23,400	66,700	73,400	36,400	109,800	30,000	13,000	43,000	10.9%
$1020-1170	34,700	16,100	50,800	59,600	24,700	84,300	24,900	8,700	33,600	8.5%
$1170-1310	25,800	10,800	36,600	45,100	16,500	61,600	19,300	5,700	25,000	6.3%
$1310-1450	17,400	7,100	24,500	29,800	10,600	40,400	12,300	3,500	15,800	4.0%
$1450-1750	19,000	7,700	26,700	33,800	11,600	45,400	14,800	3,900	18,700	4.7%
$1750-2050	10,600	4,100	14,700	18,600	6,100	24,700	8,000	2,000	10,000	2.5%
$2050-2350	5,900	2,300	8,200	10,400	3,400	13,800	4,500	1,100	5,600	1.4%
$2350-2650	3,800	1,500	5,300	7,000	2,200	9,200	3,200	700	3,900	1.0%
$2650-2950	2,500	900	3,400	4,400	1,300	5,700	1,900	400	2,300	0.6%
$2950-3300	1,900	800	2,700	3,500	1,100	4,600	1,600	300	1,900	0.5%
$3300-3650	1,400	500	1,900	2,600	700	3,300	1,100	200	1,300	0.3%
$3650+	3,400	1,000	4,400	5,900	1,400	7,300	2,600	400	3,000	0.8%
Total	**308,000**	**211,000**	**518,000**	**569,000**	**343,000**	**912,000**	**262,000**	**132,000**	**394,000**	**100.0%**
Share %	*59%*	*41%*	*100%*	*62%*	*38%*	*100%*	*66%*	*34%*	*100%*	

Source: ME Auckland Housing Model 2017

Table 5.22: Dwelling Demand by Type and Value 2016-46 – High Growth and High Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Total %
$0-300	2,000	6,600	8,600	2,800	15,800	18,600	800	9,200	10,000	2.5%
$300-440	9,600	23,400	33,000	14,400	56,300	70,700	4,700	32,900	37,600	9.5%
$440-580	39,800	31,700	71,500	57,400	76,300	133,700	17,600	44,600	62,200	15.8%
$580-730	55,600	26,000	81,600	82,000	65,000	147,000	26,300	39,000	65,300	16.6%
$730-880	59,400	18,000	77,400	86,500	45,500	132,000	27,100	27,500	54,600	13.9%
$880-1020	56,300	10,400	66,700	83,200	26,500	109,700	26,900	16,100	43,000	10.9%
$1020-1170	44,400	6,400	50,800	68,200	16,100	84,300	23,800	9,800	33,600	8.5%
$1170-1310	32,700	4,000	36,700	51,800	9,800	61,600	19,100	5,900	25,000	6.3%
$1310-1450	21,900	2,600	24,500	34,100	6,300	40,400	12,200	3,700	15,900	4.0%
$1450-1750	23,600	3,100	26,700	38,000	7,400	45,400	14,400	4,300	18,700	4.7%
$1750-2050	13,100	1,700	14,800	20,900	3,800	24,700	7,800	2,200	10,000	2.5%
$2050-2350	7,200	900	8,100	11,600	2,200	13,800	4,400	1,200	5,600	1.4%
$2350-2650	4,700	600	5,300	7,800	1,400	9,200	3,100	800	3,900	1.0%
$2650-2950	3,000	400	3,400	4,800	900	5,700	1,900	500	2,400	0.6%
$2950-3300	2,300	400	2,700	3,800	800	4,600	1,500	400	1,900	0.5%
$3300-3650	1,800	200	2,000	2,900	400	3,300	1,100	200	1,300	0.3%
$3650+	4,200	200	4,400	7,000	400	7,400	2,800	200	3,000	0.8%
Total	**382,000**	**137,000**	**518,000**	**577,000**	**335,000**	**912,000**	**196,000**	**199,000**	**394,000**	**100.0%**
Share %	*74%*	*26%*	*100%*	*63%*	*37%*	*100%*	*50%*	*51%*	*100%*	

Source: ME Auckland Housing Model 2017

5.6.4 Very High Preference Change

Table 5.23 shows the projected dwelling numbers for 2046 in a medium growth future, with very high preference shift. The distribution still reflects continuation of the overall pattern, but the transfer toward dwellings in the lower value range is much more apparent. Table 5.24 shows the outcome by dwelling type.

Table 5.23: Dwelling Demand by Tenure and Value 2016-46 – High Growth, Very High Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Owned	Not Owned	Total	Owned	Not Owned	Total	Owned	Not Owned	Total	Total %
$0-300	2,800	5,800	8,600	8,600	11,400	20,000	5,700	5,600	11,300	2.9%
$300-440	12,400	20,700	33,100	35,400	40,000	75,400	23,000	19,400	42,400	10.8%
$440-580	32,600	38,900	71,500	72,400	65,800	138,200	39,800	26,900	66,700	16.9%
$580-730	43,500	38,200	81,700	86,100	62,600	148,700	42,700	24,500	67,200	17.1%
$730-880	46,500	31,000	77,500	83,400	48,100	131,500	36,900	17,100	54,000	13.7%
$880-1020	43,300	23,400	66,700	72,000	35,300	107,300	28,700	12,000	40,700	10.3%
$1020-1170	34,700	16,100	50,800	58,000	24,000	82,000	23,300	7,900	31,200	7.9%
$1170-1310	25,800	10,800	36,600	43,700	16,000	59,700	17,900	5,200	23,100	5.9%
$1310-1450	17,400	7,100	24,500	28,800	10,200	39,000	11,400	3,200	14,600	3.7%
$1450-1750	19,000	7,700	26,700	32,700	11,200	43,900	13,700	3,600	17,300	4.4%
$1750-2050	10,600	4,100	14,700	18,000	5,900	23,900	7,400	1,800	9,200	2.3%
$2050-2350	5,900	2,300	8,200	10,100	3,300	13,400	4,200	1,000	5,200	1.3%
$2350-2650	3,800	1,500	5,300	6,700	2,100	8,800	2,900	700	3,600	0.9%
$2650-2950	2,500	900	3,400	4,300	1,300	5,600	1,800	400	2,200	0.6%
$2950-3300	1,900	800	2,700	3,400	1,000	4,400	1,500	300	1,800	0.5%
$3300-3650	1,400	500	1,900	2,500	700	3,200	1,000	200	1,200	0.3%
$3650+	3,400	1,000	4,400	5,600	1,300	6,900	2,200	400	2,600	0.7%
Total	**308,000**	**211,000**	**518,000**	**572,000**	**340,000**	**912,000**	**264,000**	**130,000**	**394,000**	**100.0%**
Share %	*59%*	*41%*	*100%*	*63%*	*37%*	*100%*	*67%*	*33%*	*100%*	

Source: ME Auckland Housing Model 2017

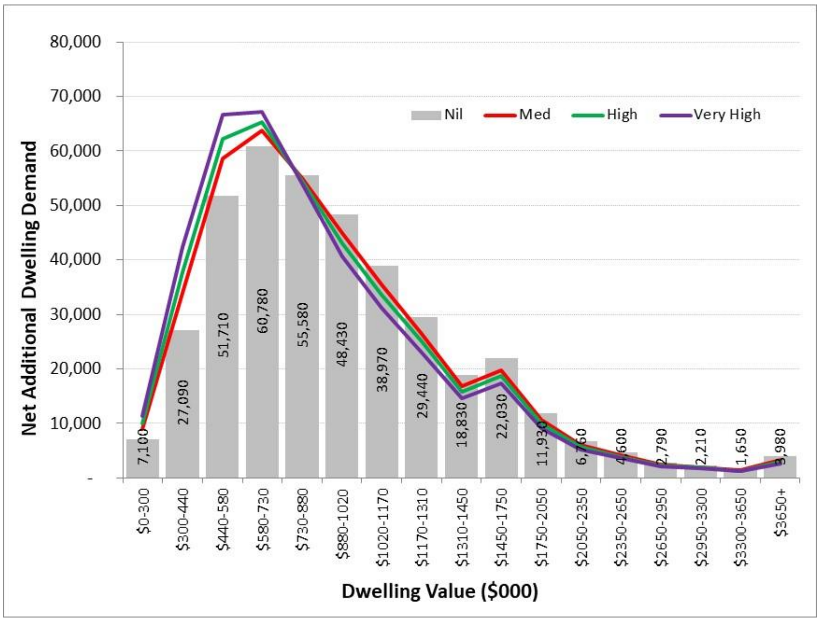
Table 5.24: Dwelling Demand by Type and Value 2016-46 – High Growth and High Preference Shift

Value Band (000)	2016			2046			Net Change 2016-46			
	Detached	Attached	Total	Detached	Attached	Total	Detached	Attached	Total	Total %
$0-300	2,000	6,600	8,600	2,600	17,400	20,000	600	10,800	11,400	2.9%
$300-440	9,600	23,400	33,000	13,400	62,100	75,500	3,700	38,700	42,400	10.8%
$440-580	39,800	31,700	71,500	53,700	84,500	138,200	13,900	52,800	66,700	16.9%
$580-730	55,600	26,000	81,600	76,600	72,200	148,800	21,000	46,200	67,200	17.1%
$730-880	59,400	18,000	77,400	80,700	50,700	131,400	21,300	32,700	54,000	13.7%
$880-1020	56,300	10,400	66,700	77,800	29,600	107,400	21,500	19,200	40,700	10.3%
$1020-1170	44,400	6,400	50,800	64,000	18,000	82,000	19,600	11,700	31,300	7.9%
$1170-1310	32,700	4,000	36,700	48,600	11,000	59,600	16,000	7,100	23,100	5.9%
$1310-1450	21,900	2,600	24,500	32,000	7,000	39,000	10,100	4,400	14,500	3.7%
$1450-1750	23,600	3,100	26,700	35,700	8,200	43,900	12,200	5,100	17,300	4.4%
$1750-2050	13,100	1,700	14,800	19,600	4,300	23,900	6,500	2,600	9,100	2.3%
$2050-2350	7,200	900	8,100	10,900	2,400	13,300	3,700	1,500	5,200	1.3%
$2350-2650	4,700	600	5,300	7,300	1,600	8,900	2,600	900	3,500	0.9%
$2650-2950	3,000	400	3,400	4,500	1,000	5,500	1,600	600	2,200	0.6%
$2950-3300	2,300	400	2,700	3,600	900	4,500	1,200	500	1,700	0.4%
$3300-3650	1,800	200	2,000	2,700	400	3,100	900	300	1,200	0.3%
$3650+	4,200	200	4,400	6,500	400	6,900	2,300	300	2,600	0.7%
Total	**382,000**	**137,000**	**518,000**	**540,000**	**372,000**	**912,000**	**159,000**	**235,000**	**394,000**	**100.0%**
Share %	*74%*	*26%*	*100%*	*59%*	*41%*	*100%*	*40%*	*60%*	*100%*	

Source: ME Auckland Housing Model 2017

Figure 5.2 compares the net additional dwelling demand for the four scenarios. The value distribution of the net increase is again similar for all scenarios, and close to the current Auckland structure.

Figure 5.2: Auckland Dwelling Demand by Value 2016-46 – High Growth



5.7 Summary

The results above provide base projections of housing demand in urban Auckland into the medium and long terms, consistent with the requirements of the NPS-UDC.

The key outputs from the analysis are projected dwelling demand by main dwelling type, and dwelling value band.

The analysis of the current 2016 housing demand situation detailed the main patterns of housing demand. The consistency of these patterns with both the research and conceptual bases in housing demand indicates:

a. The Auckland housing market is large, diverse, and mature. While the recent issues around supply and affordability have seen changes to the historical patterns, those changes are at the margin rather than fundamental shifts. This means that the existing structure reflects a relatively stable situation, meeting (more or less) the housing requirements of a large and relatively stable resident population. This means that the parameters of the current Auckland housing market situation offer a robust foundation for projecting future outcomes;
b. The future outlook for Auckland population and households is for incremental change, even with substantial growth expected into the long term;
c. Accordingly, the demand outlook is for relatively stable, incremental change, driven by household growth (primarily) and limited demographic change (notably gradual ageing).

d. These factors mean that the main influences for changes in housing demand will be economic conditions (which are characteristically cyclical) and changes in the statutory planning environment, which are considerable under the new Auckland Unitary Plan.

Accordingly, the combination of an incremental demand projection - based on demographic shift and established patterns of dwelling tenure and occupancy of different dwelling value bands – and scenarios which reflect the most likely drivers of change provides a suitable basis for the assessment to meet NPS-UDC requirements.

The variations in demand numbers which are driven by the scenarios provide a sufficiently diverse range of outcomes for initial assessment.

Having stated that, it is also important to consider key sub-sectors of the Auckland housing market. While the market situation is dominated by privately owned owner-occupier and rental dwellings, three important sub-sectors require further consideration. These are the Housing New Zealand Corporation's social housing portfolio, the Government's intended KiwiBuild strategy to deliver affordable dwellings to the market, and the role of retirement housing which is expected to provide an increasing share of future capacity. These are considered in the following section.

6 Housing Market Sub-sectors

6.1 Scope

This section examines the roles in Auckland's future housing market and dwelling supply of key sub-sectors, retirement housing, Housing New Zealand Corporation (HNZC) as the primary supplier of social housing in Auckland, and the proposed KiwiBuild initiative by the new Government to deliver 50,000 affordable dwellings to the Auckland market over the next decade.

All three represent substantial shares of Auckland's housing supply. The retirement sector is expected to provide up to 27,000 dwellings, while HNZC currently provides an estimated 30,000 dwellings (5.5% of the regional total) predominantly as rental accommodation to lower income households. The corporation has estimated that a further 30,000 dwellings will be developed in the medium term, taking the total HNZC estate to 60,000 dwellings. The KiwiBuild initiative to develop a total of 50,000 affordable dwellings in Auckland is expected to have significant impact on dwelling ownership levels.

In combination, these sub-sectors may provide up to 100,000 dwellings in Auckland, in a period when total demand growth is in the order of 304,000 to 394,000 dwellings – in round terms, 300,000 to 400,000 over the three decades to 2046. Together, they may potentially provide between 25% (High growth future, with 100,000 out of 400,000 dwellings) and 33% (Medium growth future, with 100,000 out of 300,000 dwellings).

6.2 Retirement Dwellings

There is substantial demand for retirement dwellings, particularly with an ageing population. The economics and space requirements of the sector differ significantly from most private sector housing, which means retirement villages do not conform especially well to dwelling feasibility assessment based on standard commercial development and sale or development for rental model. Further, the density of retirement villages (dwellings per hectare) is typically considerably higher than for private dwellings, so that land requirement for this sub-sector cannot be directly equated with that for standard private dwellings. That said, retirement villages compete for land with private dwellings, and a substantial share of future capacity is expected to be provided for through retirement apartments, for which the economics of development may not differ markedly from other apartment projects.

Retirement housing is included in both demand and supply statistics. SNZ has confirmed that it identifies retirement village residents in care as non-private households, but otherwise identifies individual dwellings in retirement villages (commonly standalone or attached villas or units) as separate dwellings. This is consistent with their treatment in the dwelling consent statistics. Residents of retirement villages are identified as individual households, predominantly one-person or couples, and are not included as part of a non-private household or residential arrangement.

Projected demand for retirement dwellings is in the range of 21,000 (Low) to 27,000 (High) over the period to 2046. Demand is predominantly one-person households (about 87% of units), and couples (the other 13% of units), and is almost entirely in the older age groups.

While it is a distinct sub-sector, retirement demand is not further differentiated for this assessment, and is included in the private sector owned component of the market.

6.3 Housing New Zealand Corporation

HNZC's current capacity is 30,000 dwellings in Auckland. The additional 30,000 dwellings are assumed to be developed with about 25 years (around 2041), and are assumed to be provided as rental accommodation to low income households. Accordingly, for modelling purposes they are assumed to cover a share of :

a. Low income households (up to $30,000 in Census 2013 terms (approximately $36,000 in 2016 terms) for single persons, couples and non-family households;
b. Low and low-medium income households (up to $30,000, and $30-50,000 in 2013 terms (approximately $36-60,000 in 2016 terms)[9] for 2-parent and 1-parent families with children, and multi-family households.

Because of the targeted nature of the HNZC involvement in the market, this would apply to households in these income bands and seeking housing in the lower value end of the market, corresponding with dwellings below the 40th percentile by value (up to approximately $730,000, though with a small number in the next highest band). While most households in the HNZC portfolio would be seeking dwellings in lower value bands, a significant component of the HNZC customer base is larger family households, who require medium-size dwellings at least.

The indicative components of housing demand which would be catered for by the HNZC portfolio is shown in Table 6.1 (medium growth). This segmentation is part of total housing demand, but is used here to indicate the HNZC client base, which is identified separately from the open market demand for rental accommodation.

We note that this is indicative, as we do not have access to information on the demography of the HNZC client base. Nevertheless, it is important to identify this demand and distinguish it from the demand which Council needs to provide for in the AUP.

[9] http://nzdotstat.stats.govt.nz/wbos/Index.aspx#

Table 6.1: Indicative Segments of Housing Demand Catered by HNZC (2046)

Household Type	Income Band	$0-300,000	$300-440,000	$440-580,000	$580-730,000	$730-880,000	TOTAL	Share %
One Person Hhld	Up to $30,000	1,400	4,260	6,010	4,290	780	16,700	28%
Couple Hhld	Up to $30,000	360	1,200	1,710	1,240	220	4,700	8%
2 Parents 1-2chn	Up to $30,000	240	830	1,410	1,030	180	3,700	6%
	$30,001 - $50,000	290	980	1,700	1,330	270	4,600	8%
2 Parents 3+chn	Up to $30,000	100	460	980	630	90	2,300	4%
	$30,001 - $50,000	110	440	940	690	110	2,300	4%
1 Parent Family	Up to $30,000	810	3,170	5,080	3,440	550	13,100	22%
	$30,001 - $50,000	440	1,680	2,910	2,230	430	7,700	13%
Multi-Family Hhlds	Up to $30,000	30	160	400	270	40	900	2%
	$30,001 - $50,000	50	220	470	330	60	1,100	2%
Non-Family Hhlds	Up to $30,000	240	820	1,040	750	130	3,000	5%
TOTAL		**4,100**	**14,200**	**22,700**	**16,200**	**2,900**	**60,000**	100%
Share %		*7%*	*24%*	*38%*	*27%*	*5%*	*100%*	

Source: ME Auckland Housing Model 2017

6.4 KiwiBuild

The KiwiBuild intended capacity is 50,000 dwellings in Auckland. For this assessment, they are assumed to be built over the next decade, by about 2026.

While details of the scheme are not yet available, it is expected that KiwiBuild will seek to deliver affordable dwellings (generally priced at less than $650,000) to the market, oriented toward lower income households which have been most affected by the high housing prices, and unable to transition to housing ownership. These dwellings are assumed to be owned by low, low-medium and medium income households, who would otherwise be renting their accommodation. For modelling purposes they are assumed to include some low income households (up to $30,000), low medium ($30-50,000) and some medium income households, across all household types except non-family households.

These household types are also assumed to be seeking rental accommodation in the lower dwelling value bands. The targeted nature of HNZC activity places it in the lowest income bands, whereas KiwiBuild will be targeted at those who are able to service debt, which suggest the second and third income quintiles for the most part. This would apply to households in these income bands seeking dwellings in the lower value end of the market, predominantly up to the 30th percentile or 40th percentile by value (up to approximately $730,000).

The indicative components of housing demand which would be catered for by the KiwiBuild initiative are shown in Table 6.2 (medium growth). As with the HNZC estimate, this is part of total housing demand. The table is indicative, but is important to show this segment of the market within the total market assessment.

It is used here to indicate the extent of potential change (negative) in the numbers of renting households (all KiwiBuild households are assumed to be otherwise renting) and the corresponding increase in the numbers of owned dwellings.

Table 6.2: Indicative Segments of Housing Demand Catered by KiwiBuild (2046)

Household Type	Income Band	$0-300,000	$300-440,000	$440-580,000	$580-730,000	$730-880,000	Total	Share %
One Person Hhld	Up to $30,000	240	720	1,050	970	610	3,590	7%
	$30,001 - $50,000	650	2,180	2,980	2,640	1,140	9,590	19%
	$50,001 - $70,000	160	610	910	750	310	2,740	5%
Couple Hhld	Up to $30,000	90	290	430	400	230	1,440	3%
	$30,001 - $50,000	450	1,560	2,490	2,470	1,150	8,120	16%
	$50,001 - $70,000	210	770	1,280	1,130	510	3,900	8%
2 Parents 1-2chn	Up to $30,000	10	40	70	80	90	290	1%
	$30,001 - $50,000	50	150	280	330	420	1,230	2%
	$50,001 - $70,000	270	970	2,050	1,920	850	6,060	12%
2 Parents 3+chn	Up to $30,000	10	20	50	50	40	170	0%
	$30,001 - $50,000	20	70	160	170	180	600	1%
	$50,001 - $70,000	80	360	1,050	920	340	2,750	6%
1 Parent Family	Up to $30,000	40	140	250	260	270	960	2%
	$30,001 - $50,000	60	250	470	570	690	2,040	4%
	$50,001 - $70,000	180	730	1,560	1,420	610	4,500	9%
Multi-Family Hhlds	Up to $30,000	-	10	10	10	10	40	0%
	$30,001 - $50,000	10	30	80	80	90	290	1%
	$50,001 - $70,000	70	240	680	550	200	1,740	3%
TOTAL		**2,600**	**9,100**	**15,900**	**14,700**	**7,700**	**50,000**	**100%**
Share %		*5%*	*18%*	*32%*	*29%*	*15%*	*100%*	

Source: ME Auckland Housing Model 2017

6.5 Combined effects

The combined effects of HNZC and KiwiBuild are summarised in Table 6.3 (Medium growth) and 6.4 (High Growth). The retirement sub-sector is included in the private sector owned dwellings, and is not differentiated here.

The left side of the each table shows the overall urban (non-rural) demand for housing, by value band and disaggregated between rental and owned dwellings.

The right side of the tables show the effect of KiwiBuild on dwelling ownership, by estimated value band, allowing for KiwiBuild dwellings to be predominantly in the $440,000 to $730,000 value band (9th to 39th percentile). The main effects of the KiwiBuild initiative would be to generate higher ownership levels (from 62% to 68%), and therefore correspondingly reduce demand for rental dwellings.

The combined effects of HNZC and KiwiBuild will be to reduce the demand for private rental dwellings. Note that the total HNZC effect is not a reduction *per se*, given that HNZC is a long established component of the housing market, and the net additional effect will be 30,000 rather than the full 60,000 estate. The HNZC column represents an estimate of the scale of Government sector social housing for 2046.

Nevertheless, it is important to understand the overall structure of the future housing market with both HNZC and KiwiBuild as part of the mix – particularly in regard to the NPS requirements to understand the sufficiency of supply.

Table 6.3: Dwelling Demand 2046 Medium Growth – Adjusted for HNZC and KiwiBuild

		Base Case 2046			Base Case 2046 : Adjusted for HNZC and KiwiBuild						
Value Band (000)	Value Percentile	Owned	Not Owned	Total	Private Sector Owned	KiwiBuild	Total Owned	Private Sector Rental	HNZC	Total Not Owned	Total
0-300	0%-2%	6,250	9,590	15,840	6,250	2,580	8,830	3,500	3,520	7,020	15,850
300-440	2%-9%	26,420	33,940	60,360	26,420	9,140	35,560	12,680	12,120	24,800	60,360
440-580	9%-24%	58,750	58,370	117,120	58,750	15,830	74,580	22,390	20,150	42,540	117,120
580-730	24%-39%	74,110	56,860	130,970	74,110	14,730	88,840	24,570	17,560	42,130	130,970
730-880	39%-54%	74,720	44,550	119,270	74,720	7,720	82,440	30,180	6,660	36,840	119,280
880-1020	54%-66%	67,190	33,430	100,620	67,190	-	67,190	33,430	-	33,430	100,620
1020-1170	66%-76%	54,990	22,800	77,790	54,990	-	54,990	22,800	-	22,800	77,790
1170-1310	76%-83%	41,780	15,230	57,010	41,780	-	41,780	15,230	-	15,230	57,010
1310-1450	83%-87%	27,590	9,770	37,360	27,590	-	27,590	9,770	-	9,770	37,360
1450-1750	87%-92%	31,310	10,670	41,980	31,310	-	31,310	10,670	-	10,670	41,980
1750-2050	92%-95%	17,240	5,650	22,890	17,240	-	17,240	5,650	-	5,650	22,890
2050-2350	95%-97%	9,690	3,110	12,800	9,690	-	9,690	3,110	-	3,110	12,800
2350-2650	97%-98%	6,480	2,020	8,500	6,480	-	6,480	2,020	-	2,020	8,500
2650-2950	98%-98%	4,090	1,220	5,310	4,090	-	4,090	1,220	-	1,220	5,310
2950-3300	98%-99%	3,250	980	4,230	3,250	-	3,250	980	-	980	4,230
3300-3650	99%-99%	2,380	630	3,010	2,380	-	2,380	630	-	630	3,010
3650+	99%-100%	5,580	1,320	6,900	5,580	-	5,580	1,320	-	1,320	6,900
Total		**512,000**	**310,000**	**822,000**	**512,000**	**50,000**	**562,000**	**200,000**	**60,000**	**260,000**	**822,000**
		62%	38%	100%	62%	6%	68%	24%	7%	32%	100%

Source: ME Auckland Housing Model 2017

Figure 6.1 illustrates the projected demand structure for 2046 (medium growth).

Figure 6.1: Projected Demand Structure including HNZC and KiwiBuild : Medium Growth 2046

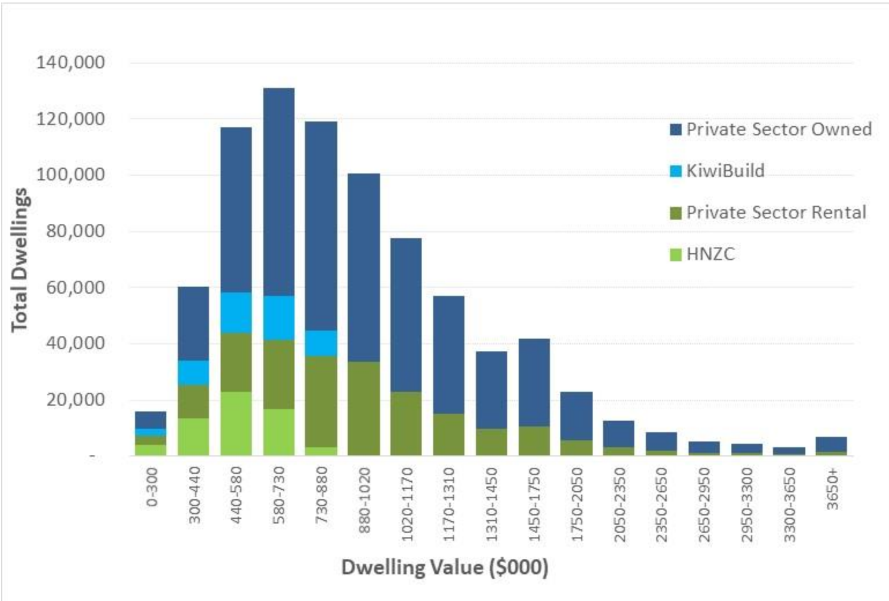


Table 6.4 shows the future demand structure in a high growth future by 2046. The obvious difference is the larger size of the private ownership and private rental sectors in this High growth future, with HNZC capacity and KiwiBuild assumed to be relatively fixed in scale.

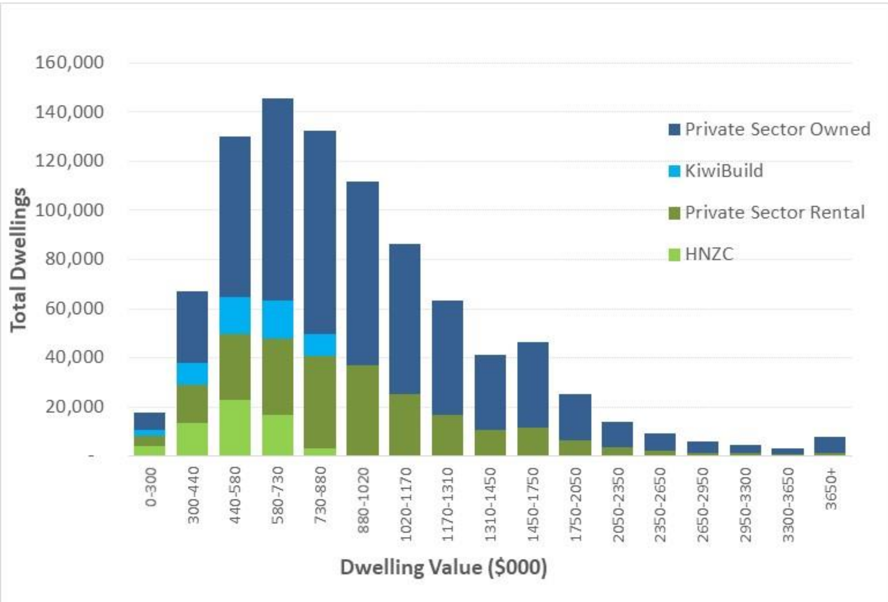
Table 6.4: Dwelling Demand 2046 High Growth – Adjusted for HNZC and KiwiBuild

Value Band (000)	Value Percentile	Base Case 2046			Base Case 2046 : Adjusted for HNZC and KiwiBuild						
		Owned	Not Owned	Total	Private Sector Owned	KiwiBuild	Total Owned	Private Sector Rental	HNZC	Total Not Owned	Total
0-300	0%-2%	6,950	10,650	17,600	6,950	2,600	9,550	4,580	3,470	8,050	17,600
300-440	2%-9%	29,380	37,700	67,080	29,380	9,190	38,570	16,440	12,060	28,500	67,070
440-580	9%-24%	65,290	64,810	130,100	65,290	15,910	81,200	28,690	20,210	48,900	130,100
580-730	24%-40%	82,300	63,150	145,450	82,300	14,760	97,060	30,790	17,600	48,390	145,450
730-880	40%-54%	82,950	49,450	132,400	82,950	7,540	90,490	35,250	6,660	41,910	132,400
880-1020	54%-66%	74,510	37,090	111,600	74,510	-	74,510	37,090	-	37,090	111,600
1020-1170	66%-76%	60,900	25,280	86,180	60,900	-	60,900	25,280	-	25,280	86,180
1170-1310	76%-83%	46,230	16,860	63,090	46,230	-	46,230	16,860	-	16,860	63,090
1310-1450	83%-87%	30,510	10,830	41,340	30,510	-	30,510	10,830	-	10,830	41,340
1450-1750	87%-92%	34,640	11,810	46,450	34,640	-	34,640	11,810	-	11,810	46,450
1750-2050	92%-95%	19,070	6,250	25,320	19,070	-	19,070	6,250	-	6,250	25,320
2050-2350	95%-97%	10,700	3,440	14,140	10,700	-	10,700	3,440	-	3,440	14,140
2350-2650	97%-98%	7,160	2,230	9,390	7,160	-	7,160	2,230	-	2,230	9,390
2650-2950	98%-98%	4,520	1,360	5,880	4,520	-	4,520	1,360	-	1,360	5,880
2950-3300	98%-99%	3,600	1,100	4,700	3,600	-	3,600	1,100	-	1,100	4,700
3300-3650	99%-99%	2,640	700	3,340	2,640	-	2,640	700	-	700	3,340
3650+	99%-100%	6,160	1,470	7,630	6,160	-	6,160	1,470	-	1,470	7,630
Total		**568,000**	**344,000**	**912,000**	**568,000**	**50,000**	**618,000**	**234,000**	**60,000**	**294,000**	**912,000**
		62%	38%	100%	62%	5%	68%	26%	7%	32%	100%

Source: ME Auckland Housing Model 2017

Figure 6.2 illustrates the projected demand structure for 2046 (high growth).

Figure 6.2: Projected Demand Structure including HNZC and KiwiBuild : High Growth 2046



7 Implications for Auckland Housing

7.1 Scope

This section draws together the analysis of housing demand and dwelling supply implications, the key roles of sub-sectors of the market, and the importance of migration in Auckland's population outlook.

7.2 Migration and Population Growth

The importance of in-migration in Auckland's population and household growth, and the potential for lower or later population outcomes, are examined in the Appendix (Section 8).

Migration accounts for between 42% (Medium growth) and 46% (High growth) of Auckland's total population gain, and higher shares in the short term.

The base case household projections show increases in household numbers – and implied dwelling demand - of 304,000 (Medium growth) to 394,000 (High growth by 2046). Scenarios of lower levels of migration gain indicate lesser household growth:

a. A limited migration slowdown would see between -13,000 (Medium) and -25,000 (High) fewer households by 2046;
b. a moderate migration slowdown would see between -26,000 (Medium) and -55,000 (High) fewer households by 2046;
c. Limited migration slowdown would see between -36,000 (Medium) and -71,000 (High) fewer households by 2046;

These are scenarios, and are not forecasts. Nevertheless, they highlight the potential variability in Auckland's growth outlook, particularly given the potential for migration patterns to be heavily influenced by economic cycles, and to encompass negative (net outflow) changes in the future.

7.3 Implications for Housing Demand

The demand assessment, and the migration analysis, indicate the range of potential outcomes for Auckland, and the uncertainty of outcomes within the long term growth trend.

These have direct implications for the NPS-UDC assessment, because different outcomes will directly affect the assessment of the sufficiency of Auckland's capacity for housing.

The possible range of outcomes needs to take into account that:

a. total demand for housing is a function of projected growth in household numbers over the planning period, together with any indicated shortfall in dwelling supply;
b. the major share of dwelling capacity needs to be evaluated on the basis of its feasibility in a standard commercial development mode

c. however, key components of housing demand will be met through other supply mechanisms, notably social housing (HNZC), KiwiBuild, and a share of retirement dwellings, all of which are subject to different delivery models, and to different underlying economics of development;

d. on this basis, the housing capacity which needs to be met through the standard commercial development model is broadly total housing demand, less social housing, less KiwiBuild, less retirement housing;

e. the total household growth future is also subject to the effects of migration policy into the medium term, or longer;

Any forward looking assessment is subject to uncertainty, and a scenario approach is commonly useful for examining the implications of different drivers individually and in combination, without venturing toward a "likely" future outcome.

7.4 Summary

Table 7.1 summarises the potential demand futures for urban Auckland, for Medium and High futures. It differentiates the shares of demand growth which are expected to be catered for by HNZC (social housing) and potentially catered for through KiwiBuild. However, demand expected to be met through retirement dwellings is not differentiated.

Table 7.1: Auckland Dwelling Demand Growth by Sector 2016-2046

Market Element	2016	2016 %	2026	2026 %	2046	2046 %	2016-26	2016-46	2016-46 %
Medium Growth									
Private Sector Owned	308	59%	387	60%	512	62%	79	204	67%
Private Sector Rental	180	35%	173	27%	200	24%	-7	20	7%
Private Sector Total	488	94%	560	87%	712	87%	72	224	74%
Public Sector Rental	30	6%	42	7%	60	7%	12	30	10%
KiwiBuild/Other	0	0%	39	6%	50	6%	39	50	16%
Total Other	30	6%	81	13%	110	13%	51	80	26%
Total	**518**	**100%**	**641**	**100%**	**822**	**100%**	**123**	**304**	**100%**
Total Owned	308	59%	426	66%	562	68%	118	254	
High Growth									
Private Sector Owned	308	59%	405	60%	568	62%	97	260	66%
Private Sector Rental	180	35%	185	28%	234	26%	5	54	14%
Private Sector Total	488	94%	590	88%	802	88%	102	314	80%
Public Sector Rental	30	6%	42	6%	60	7%	12	30	8%
KiwiBuild/Other	0	0%	39	6%	50	5%	39	50	13%
Total Other	30	6%	81	12%	110	12%	51	80	20%
Total	**518**	**100%**	**671**	**100%**	**912**	**100%**	**153**	**394**	**100%**
Total Owned	308	59%	444	66%	618	68%	136	310	

Source: ME Auckland Housing Model 2017

The key elements of future housing demand are as follows:

Medium Growth

a. In the Medium growth future, total housing demand growth is around 123,000 dwellings by 2026. Of this, an estimated 12,000 (10%) would be catered for by HNZC, and up to 39,000 (32% gross) through KiwiBuild;
b. This would leave a net 72,000 dwellings to be provided through the private sector, predominantly as dwellings for owner-occupiers (since KiwiBuild would reduce demand for rental accommodation). However, if the KiwiBuild contribution is less than anticipated, then the private sector requirement could be up to 111,000 dwellings;
c. In the long term to 2046, total housing demand growth is around 304,000 dwellings. Of this, an estimated 30,000 (10%) would be catered for by HNZC, and up to 50,000 (16%) through KiwiBuild;
d. This would leave a net 224,000 dwellings to be provided through the private sector, for both owners and renters. The KiwiBuild initiative would limit demand growth for rental accommodation into the long term. If the KiwiBuild contribution is less than anticipated, then the private sector requirement could be up to 274,000 dwellings;

High Growth

a. In the High growth future, total housing demand growth is around 153,000 dwellings by 2026. Of this, an estimated 12,000 (8%) would be catered for by HNZC, and up to 39,000 (25% gross) through KiwiBuild;
b. This would leave a net 102,000 dwellings to be provided through the private sector, again predominantly as dwellings for owner-occupiers because of the KiwiBuild effect on rental demand. If the KiwiBuild contribution is less than anticipated, then the private sector requirement could be up to 141,000 dwellings;
c. In the long term to 2046, total housing demand growth is around 394,000 dwellings. Of this, an estimated 30,000 (10%) would be catered for by HNZC, and up to 50,000 (16%) through KiwiBuild;
d. This would leave a net 314,000 dwellings to be provided through the private sector, for both owners and renters. The KiwiBuild initiative would still limit demand growth for rental accommodation into the long term. If the KiwiBuild contribution is less than anticipated, then the private sector requirement could be up to 364,000 dwellings;

These estimates are based on the SNZ household growth projections, and do not make any allowance for changes in migration levels, and consequent effects on housing demand.

8 Appendix: Key Influences on Housing Demand Futures

8.1 Scope

As noted, the above assessment of future resident housing demand is based on the SNZ population projection series. However, a range of influences on housing demand (and supply) in Auckland may generate different outcomes. The potential effect of the KiwiBuild initiative, and the expected growth in the role of HNZC, have been considered above.

This Appendix focuses on the Government's stated intentions around migration policy, and examines the implications of lower levels of migrant numbers for Auckland's future population and household growth in the short, medium and long term.

8.2 Migration Futures

There is uncertainty relating to Auckland's population and household growth in the medium term and potentially longer term.

This arises because the most recent SNZ population projections allow for large volumes of in-migration. The 2017 high projection allows for a net 502,000 persons over the period 2016-2046, or a 46% share of total population growth (Table 8.1). The SNZ Medium projection allows for a net 322,000 persons, or a 42% share of total growth. The Low projection is more conservative, allowing for a net gain of 142,000 persons, or 31% of total growth.

The high growth projection at 16,730 per annum is around double the historical gain (7,600 per annum) recorded for the 1996-2013 period, while the medium projection at 10,700 per annum is also substantially above the historical rate. Moreover, much of the migration gain is expected in the medium term (2016-2031), with the high growth at 19,000 per annum and the medium at 13,000 per annum.

Table 8.1: Auckland Migration Projections 2016-2046

	1996-2013	2016-31			2016-46		
	Historical	High	Medium	Low	High	Medium	Low
Total Increase	129,200	284,500	194,500	104,500	502,000	322,000	142,000
Annual Increase	7,600	19,000	13,000	7,000	16,700	10,700	4,700
As % Historical		250%	171%	92%	220%	141%	62%
Share of Growth		47%	43%	35%	46%	42%	31%

Source: StatisticsNZ 2017

The high volumes of migration increase in combination with the on-going constraints on house building capacity have acted to exacerbate the housing supply shortfall and the associated rapid growth in dwelling prices during the 2012-2017 period.

The Government has signalled its intention to substantially reduce the volume of in-migration. If such policy comes into place, it is likely to have a direct impact on the rate of population and household growth in Auckland.

Recently, a number of economic commentators and banks have suggested that the migration boom is subsiding, and that migration growth may be considerably less than projected, into the medium term.

The obvious difficulty for the NPS assessment is that the sufficiency of housing capacity needs to be measured against the projected demand growth in the short, medium and long terms. Simply, if population growth is less than projected, then the number of household will be directly affected, as will the total increase in demand for housing.

However, the degree to which in-migration may be reduced or may change at all, and the longevity of such limits, remains unknown. The implications of lesser migration growth may only be indicated.

8.2.1 Scenario Approach

An exploratory scenario approach is useful for examining potential outcomes under different migration futures. Three scenarios have been developed to indicate potential changes in the volume of migration gain for Auckland, and to illustrate the implications first for population growth, and then for household growth and implied demand for housing. The method is straightforward:

1. Draw from the SNZ population projections for high, medium and low futures, as released in February 2017. Those projections identify both the natural increase in population (births less deaths) and the net migration gain in each inter-Censal period;
2. Apply reductions to the projected migration gain in each period, and recalculate the total resident population at the end of each period;
3. Recalculate the natural increase in the following inter-Censal period, applying the same rates as used by SNZ, to the recalculated resident population;
4. Calculate the projected household numbers at the end of each period (2023, 2028, 2033, 2038, 2043 and 2046) based on the re-estimated population, and the SNZ projected mean household size figures.

The findings are shown in Tables 8.2 to 8.4 below.

8.2.2 Limited Reduction in Migration

In the first scenario "Limited Reduction" the net migration gain is factored down by -2% for the period ending June 2018 (since there is only a short time remaining, and it will take some time for any policy shifts to take effect), and the reductions are otherwise:

a. -11% reduction in the high growth projection, reducing the net migration gain by -57,000 persons, from 502,000 to 445,000;
b. -9% reduction in the medium growth projection, reducing the net migration gain by -30,000 persons, from 322,000 to 292,000;

c. -1% reduction in the low growth projection, from 142,000 to 140,000.

The effect is summarised in Table 8.2. Projected Auckland household numbers would be lower by -25,000 over the thirty year 2016 to 2046 period in the high scenario (-8%), and by -13,000 households in the medium projection (-5%), with a small -1,000 change in the low growth projection.

In this future, the projected increase in household numbers 2016 to 2046 would be 383,000 (high), 306,000 (medium) and 229,000 (low).

Table 8.2: Auckland Household Growth 2016-46 : Limited Migration Reduction

	SNZ High	SNZ Medium	SNZ Low
Base Case			
2016-26	155,000	129,000	104,000
2026-36	128,000	99,000	69,000
2036-46	123,000	91,000	57,000
2016-46	**406,000**	**319,000**	**230,000**
Limited Reduction			
2016-26	143,000	123,000	103,000
2026-36	121,000	95,000	69,000
2036-46	119,000	88,000	57,000
2016-46	**383,000**	**306,000**	**229,000**
Difference			
2016-26	- 12,000	- 6,000	- 1,000
2026-36	- 7,000	- 4,000	-
2036-46	- 4,000	- 3,000	-
2016-46	**- 23,000**	**- 13,000**	**- 1,000**
Difference %	**-6%**	**-4%**	**-0.4%**
Change in Migration %	***-11%***	***-9%***	***-1%***
Difference (pa)	***- 1,900***	***- 1,000***	***- 100***

Source: ME Auckland Housing Model 2017

8.2.3 Moderate Reduction in Migration

In the second scenario "Moderate Reduction" the net migration gain is factored down by -2% for the period ending June 2018, and the reductions are otherwise:

a. -25% reduction in the high growth projection, reducing the net migration gain by -126,000 persons, from 502,000 to 376,000;
b. -19% reduction in the medium growth projection, reducing the net migration gain by -81,700 persons, from 322,000 to 262,000;
c. -6% reduction in the low growth projection, reducing the net migration gain by -9,000 persons, from 142,000 to 133,000

The effect is summarised in Table 8.3. Projected Auckland household numbers would be lower by -55,000 over the thirty year 2016 to 2046 period in the high scenario (a -16% reduction), and by -26,000 households in the medium projection (a -10% reduction). The change in the low growth projection is -5,000 households or -2%.

Table 8.3: Auckland Household Growth 2016-46 : Moderate Migration Reduction

	SNZ High	SNZ Medium	SNZ Low
Base Case			
2016-26	155,000	129,000	104,000
2026-36	128,000	99,000	69,000
2036-46	123,000	91,000	57,000
2016-46	**406,000**	**319,000**	**230,000**
Moderate Reduction			
2016-26	132,000	118,000	101,000
2026-36	111,000	91,000	69,000
2036-46	112,000	85,000	56,000
2016-46	**355,000**	**294,000**	**226,000**
Difference			
2016-26	- 23,000	- 11,000	- 3,000
2026-36	- 17,000	- 8,000	-
2036-46	- 11,000	- 6,000	- 1,000
2016-46	**- 51,000**	**- 25,000**	**- 4,000**
Difference %	**-13%**	**-8%**	**-1.7%**
Change in Migration %	***-25%***	***-19%***	***-6%***
Difference (pa)	***- 4,200***	***- 2,000***	***- 300***

Source: ME Auckland Housing Model 2017

In this future, the projected increase in household numbers 2016 to 2046 would be 355,000 (high), 294,000 (medium) and 226,000 (low).

8.2.4 Major Reduction in Migration

In the third scenario "Major Reduction" the net migration gain is factored down by -2% for the period ending June 2018, and the reductions are otherwise:

a. -35% reduction in the high growth projection, reducing the net migration gain by -176,000 persons, from 502,000 to 326,000;
b. -27% reduction in the medium growth projection, reducing the net migration gain by -87,000 persons, from 322,000 to 235,000;
c. -13% reduction in the low growth projection, reducing the net migration gain by -20,000 persons, from 142,000 to 122,000

The effect is summarised in Table 8.4. Projected Auckland household numbers would be lower by -71,000 over the thirty year period 2016 to 2046 period in the high scenario (a -16% reduction), and by -36,000 households in the medium projection (a -11% reduction). The change in the low growth projection is -8,000 households or -4%.

In this future, the projected increase in household numbers 2016 to 2046 would be 335,000 (high), 283,000 (medium) and 230,000 (low).

Table 8.4: Auckland Household Growth 2016-46: Major Migration Reduction

	SNZ High	SNZ Medium	SNZ Low
Base Case			
2016-26	155,000	129,000	104,000
2026-36	128,000	99,000	69,000
2036-46	123,000	91,000	57,000
2016-46	**406,000**	**319,000**	**230,000**
Major Reduction			
2016-26	127,000	114,000	99,000
2026-36	104,000	88,000	68,000
2036-46	104,000	81,000	55,000
2016-46	**335,000**	**283,000**	**222,000**
Difference			
2016-26	- 28,000	- 15,000	- 5,000
2026-36	- 24,000	- 11,000	- 1,000
2036-46	- 19,000	- 10,000	- 2,000
2016-46	**- 71,000**	**- 36,000**	**- 8,000**
Difference %	**-17%**	**-11%**	**-3.5%**
Change in Migration %	***-35%***	***-27%***	***-13%***
Difference (pa)	***- 5,900***	***- 2,900***	***- 600***

Source: ME Auckland Housing Model 2017

The scenarios are indicative, but they highlight two key matters:

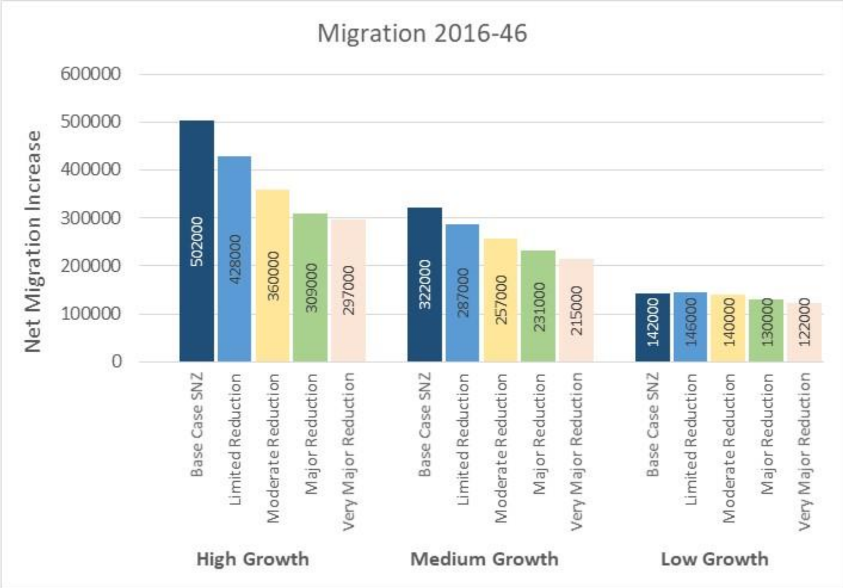
a. Auckland's household projections, and associated dwelling demand estimates, are sensitive to the assumptions / projections of the region's migration gains, and therefore to national policies on migration; and
b. Migration is a very important component of Auckland's projected growth, especially in the high projection, but also in the medium projection, and especially in the medium term.

To place these projections in context:

a. the projected migration in the high future is slightly above the total (2013) population of Wellington region;
b. the projected migration in the medium future is more than the total (2013) populations of Otago region and Southland region combined.

The migration scenarios are summarised in Figure 8.1.

Figure 8.1: Auckland Migration Scenarios 2016-2046



Appendix B Selected OLS estimates of the hedonics model

Selected OLS estimates of the Hedonics Model

		Coefficient	Standard error	P value
Share of AU on green areas		-0.110	0.016	0.000
Share of AU on:	Cropland	-0.539	0.059	0.000
	Forest	-0.368	0.031	0.000
	Grassland	-0.289	0.027	0.000
	Settlements	-0.246	0.024	0.000
Distance to green area		-0.019	0.010	0.052
Distance to green area - squared		-0.002	0.008	0.818
Distance to river		0.011	0.005	0.034
Distance to river - squared		0.008	0.002	0.001
Distance to coastal area		-0.037	0.002	0.000
Distance to coastal area - squared		0.003	0.000	0.000
Distance to wetland		0.022	0.004	0.000
Distance to wetland - squared		0.001	0.001	0.220
Distance to volcano		0.007	0.002	0.004
Distance to volcano - squared		0.000	0.000	0.001
Distance to AU centre		0.004	0.003	0.145
Distance to AU centre - squared		0.000	0.000	0.521
Distance to CBD		0.000	0.003	0.988
Distance to CBD - squared		-0.001	0.000	0.000
Distance to main road		0.067	0.004	0.000
Distance to main road - squared		-0.026	0.002	0.000
Distance to historic heritage site		-0.011	0.004	0.002
Distance to historic heritage site - squared		0.007	0.001	0.000
Distance to Mana Whenua site		-0.001	0.002	0.523
Distance to Mana Whenua site - squared		0.000	0.000	0.000
Volcanic viewshaft - No:0		0.011	0.003	0.001
Dwelling in blanket height - No:0		0.060	0.009	0.000
Slope (degrees)		-0.002	0.000	0.000
Slope orientation - East:0	North	0.006	0.002	0.002
	South	0.000	0.002	0.854
	West	0.008	0.002	0.000
Age at moment of sale		-0.003	0.000	0.000
Age at moment of sale - squared		0.000	0.000	0.000
Dwelling type: Single unit:0	Multi use/Multi unit	-0.068	0.002	0.000
	Other	-0.074	0.012	0.000
Times sold		0.005	0.004	0.148
Distance to school		0.032	0.003	0.000
Distance to school - squared		-0.003	0.000	0.000

Whether dwelling in Auckland Grammar school zone - No:0		0.022	0.010	0.030
Whether dwelling in Auckland Girl's Grammar school zone - No:0		0.074	0.011	0.000
Interaction effect Auckland Grammar and Girls Grammar school zones		-0.086	0.013	0.000
Roof construction - Iron:0	Other materials	-0.004	0.005	0.407
	Aluminium, brick, concrete or fibrous cement	0.072	0.006	0.000
	Tiles	0.017	0.002	0.000
	Mixture without a predominant material	0.005	0.008	0.526
Walls construction - Brick:0	Concrete	-0.088	0.004	0.000
	Fibrous cement	0.000	0.003	0.870
	Other materials	-0.048	0.006	0.000
	Roughcast	-0.072	0.003	0.000
	Wood	0.045	0.003	0.000
	Mixture without a predominant material	-0.020	0.003	0.000
Walls condition - Average:0	Fair	-0.018	0.007	0.012
	Good	0.041	0.003	0.000
	Poor	-0.090	0.015	0.000
	Mixed	0.025	0.016	0.114
Roof condition - Average:0	Fair	-0.008	0.007	0.279
	Good	0.027	0.003	0.000
	Poor	-0.079	0.017	0.000
	Mixed	0.057	0.017	0.001
Floor area		0.001	0.000	0.021
Garage spots under main roof		0.041	0.008	0.000
Garage sports freestanding		0.044	0.002	0.000
Mass view - None:0	Water	0.053	0.155	0.733
	Other (city, suburb or landscape views)	0.127	0.155	0.412
Scope of view - None:0	Slight	-0.021	0.155	0.891
	Moderate	-0.019	0.155	0.904
	Wide	0.098	0.155	0.527
Floor area (m2)		0.003	0.000	0.000
Dwelling has a deck - No:0		0.045	0.002	0.000
Area of AU		0.000	0.000	0.358
Joint coefficients = 0, p value			0.000	
AU dummies jointly = 0, p value			0.000	
Year dummies jointly = 0, p value			0.000	
R-squared			0.69	

Appendix C Business land demand and supply

Auckland Business Land Demand and Supply NPS-UDC

Methodology and Key Findings

19/12/2017

m.e consulting

Prepared for

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Contents

Figures

1 Introduction

The National Policy Statement on Urban Development Capacity (NPS-UDC or the NPS) came into effect in December 2016. The NPS sets out specific requirements which councils in high growth urban areas (including Auckland) must comply with by December 2017 and December 2018.

The NPS-UDC is based on a suite of four Objectives, for which compliance is required from the start (i.e. "*immediate and ongoing*[1]"). These Objectives have sets of related Policies, some of which require immediate and ongoing compliance, while others must be in place by December 2017 and December 2018. While most high growth councils, including the Auckland Council (AC), have long had responsibilities to provide for growth, the NPS has imposed new reporting requirements, particularly in relation to underlying economics, and the efficiency of real estate markets.

Two of the core elements of the NPS focus on two development capacity assessments, residential and business land, which are required by December 2017. Market Economics Ltd (M.E) has been commissioned by the AC to assist it with the analysis associated with the business land component.

Importantly for this study and AC, the NPS guidelines on business land capacity assessment were defined based on previous work conducted by Market Economics for Auckland Council for the Auckland Unitary Plan hearings.[2] Specifically, the study 'PAUP Business Land – Land Demand by Activity and PAUP Supply' was conducted by Market Economics in 2015 to provide evidence on the scale of demand for land as compared to the supply of land in the business zones in the Proposed Auckland Unitary Plan.[3] The method applied in the 2015 study formed the basis of the guidance note on the NPS guidelines. As a result, this study is mostly an update of the previous study.

1.1 Purpose

The purpose of this report is to present an overview of the process followed to estimate the business land capacity in Auckland in the context of the expected demand, for the short term (3 years), medium term (10 years) and long term (30 years). The findings are presented in a set of summary tables along with a high-level discussion of the outcomes. It is not the intention to discuss or analyse the findings *per se*. Several assumptions were made throughout the process and these have different implications for the assessment. Where necessary, we comment on these implications.

As mentioned in the introduction, most of the work in this study is to update the previous study, as such we do not repeat the details of the method applied. The following key inputs have been updated using the most recently available data,

- **Employment:** Modified Employment Count (MEC) from Market Economics (2016),
- **Floorspace:** rates database from Auckland Council (2017),
- **Land**: parcel database from Auckland Council (2017),
- **Building Consents:** consent database from Auckland Council (2017),

[1] Ministry for the Environment and Ministry of Business, Innovation and Employment. 2016. *Introductory Guide to the National Policy Statement on Urban Development Capacity 2016*. Wellington: Ministry for the Environment and Ministry of Business, Innovation and Employment; Table 1, p9.

[2] Ministry for the Environment and Ministry of Business, Innovation and Employment. 2017. National Policy Statement on Urban Development Capacity: Guide on Evidence and Monitoring.

[3] Yeoman *et al*. (2016) PAUP Business Land – Land Demand by Activity and PAUP Supply.

- **Zones**: the adopted Auckland Unitary Plan (AUP) from Auckland Council (2017),
- **Enabled Capacity**: from the Capacity for Growth Study (CfGS) from Auckland Council (2017), and
- **Economic Forecasts:** current Auckland Economic Futures Model (AEFM) from Market Economics (2017).

The key difference between the 2015 study and this study is that Market Economics have now conducted two assessments of the CfGS enabled capacity, and improved the modelling of the interaction between the demand and supply. These differences will be discussed in more detail below.

1.2 Process

In summary, the business land demand and supply assessment was undertaken using the following approach:

- **Part 1: Demand outlook**: Part 1 required estimating demand for business land in the future. This was done by assessing the existing revealed patterns of demand for business land in the economy. The revealed patterns were established by assessing current employment, floorspace and land by zone and location in the region. The analysis considered the spatial distribution of employees, relative to floorspace and land area (as recorded in the datasets). Like the 2015 study, output from this assessment was a set of density ratios - Floor Area Ratio (FAR) and Workspace Ratio (WSR). Next, employment densities were combined with employment projections to identify potential demand for floorspace and land, by location, into the future. The model translates future growth/change from the latest AEFM (2017) medium scenario employment projection[4], to establish future demand for business land. This first part of the modelling delivered an outlook for land and floorspace demand by zone for the Auckland region.
- **Part 2**: **Supply patterns:** Part 2 required estimating the supply of floorspace and business zoned land area across the sub-region. As in the 2015 study, this study draws from the CfGS (now updated to 2017) which provides an estimate of the maximum theoretical capacity by parcel and zone.[5] In summary, the CfGS estimates the potential 3-dimensional floorspace that can be developed in each parcel according to bulk and location rules in the AUP (theoretical maximum). Broadly, the AUP enables a vast amount of floorspace relative to current levels of development and/or future demand. It is unlikely that this level of supply will be fully utilised in the foreseeable future. Again, we applied the same approach as the 2015 study to estimate a 'Contemporary Development Scenario' which reflects a realistically achievable level of development. In both studies this assessment was based on an analysis of recent developments (building consents) to identify the patterns and relationships in how the market has delivered floorspace – especially with respect to the land area consumed. Development intensity in the different locations was assessed to identify revealed patterns of how the market utilised development sites – this offered an indication of the development potential in the current market. The second part of modelling delivered an outlook of business land and floorspace supply by zone for the region.
- **Part 3: Reconcile demand and supply:** Part 3 of the assessment compares demand and supply estimates and spatially allocates the supply constrained demand using a Machine Learning model (MLM). This model is an improvement on the previous study which assumed that growth would locate according to existing revealed distribution. In summary, the MLM uses detailed data for each

[4] Market Economics (2017) Auckland Economic Futures Model 2017.

[5] Auckland Council (2017) Capacity for Growth Study 2017.

parcel to establish which parcels are likely to be preferred for future development.[6] Also it is important to note that the NPS requires councils to provide evidence that there is sufficient 'financially feasible capacity' in the short, medium and long term. In this study, financial feasibility of business land capacity was not **directly** modelled or assessed. However, the reconciliation adopted the Contemporary Development Scenario capacity as representing financially feasible capacity, or supply. This is in effect an **indirect** test of feasibility. The Contemporary Development Scenario capacity represents a level of development intensity that has been delivered by the market and therefore must have been financially feasible. By applying the Contemporary Development Scenario, to other vacant sites the modelling is restricted to a supply level that has been observed to be feasible in the past. This restriction on supply represents a conservative position, and in some instances, it will be feasible for a developer to build to the maximum Plan Enabled capacity. The final result of this Part is a set of tables that show whether there is sufficient business land capacity to meet future demands by zone and locations across the region.

- Part 4: Reporting: The reporting is at an aggregate capacity level (land area, and potential floorspace) for the main business types (sectors), by broad spatial areas (geographical areas) for each sub-regional urban area. We provide comment on the surplus/deficit of land area and floor area over the short, medium and long term.

1.3 Limitations

The following issues are important limitations or caveats of this study,

- The NPS-UDC requires councils to have sufficient land to meet demand for the short term (3 years), medium term (10 years) and long term (30 years). This study has presented results for all three periods; however, it is important to understand that it is inherently difficult to forecast demand over the long term.[7] There are only two long term forecast models which are maintained in New Zealand, Treasury Long Term Fiscal Model and Market Economics EFM.[8] Given the uncertainty around the technological changes that could occur in the future, it is difficult to predict demand for land and as such the long-term results presented in this study should only be viewed as indicative.
- The NPS-UDC defines capacity that can be included in the assessment of business land as being land which is 'zoned'[9] or 'identified'[10]. This tight definition excludes land that is potentially or likely to be developed over the course of the medium and long term. For example, in Auckland, the Future Urban Zone land is expected to be made available for development over the next three decades and could enable development of 1,400 hectares of new business zoned land.[11] Much of the business

[6] Note: the NPS-UDC guidelines released by MBIE in 2017 recommends that multi-criteria analysis could be used to which sites are most likely to be candidates to meet demand. We have chosen to use MLM (a more complex method) for assessing the most likely candidates.

[7] D Foy, D Hunter, C Taylor, K Bligh, T Erasmus, D Fairgray. (2017) "The future of employment and economic activity and its transport and land use implications" pending NZTA Research Report.

[8] The majority of economic forecasts produced in New Zealand only extend to the short term (Commercial Banks) or medium term (RBNZ, Treasury budget forecasts, and other consultancies).

[9] Short and medium term.

[10] Long term.

[11] Auckland Council (2017) Auckland Future Urban Land Supply Strategy (refresh).

land within these zones has no active zoning and only indicated in the strategies (i.e. not yet spatially identified). Also, the Auckland Unitary Plan is likely to be updated several times over the coming 30 years (next AUP update in approx. 2026). These new plans are likely to include rule and zone changes that will enable other supply. It is important for the reader to understand that the NPS-UDC does not allow the councils to include this new capacity, either in the medium or long term.

- The NPS-UDC defines feasibility as "current likely", which excludes any development that could become feasible in the future. Broadly, as an economy grows or changes, historic uses of land will become less viable and old buildings become can become redundant. In a high growth area, we would expect to observe changes in the feasibility from the "current likely" – especially in the medium and long term. Therefore, the NPS-UDC definition of feasibility is likely to result in an underestimation of the level of capacity that is in fact feasible in the future.
- The NPS-UDC Guidelines suggest that modelling could be developed "*via a process of engagement with industry stakeholders and any large commercial and industrial operators, to gain an understanding of the nature of the local area*". There was no engagement process undertaken for this study.
- There is a wide range of types of economic activity in most economies. This range and diversity means translates into very different land and floorspace requirements, including lot size, and land slope amongst others. We note that the modelling undertaken does not attempt to identify whether there is sufficient land of different lot sizes to meet this range of requirements, rather it focused on scale overall and location. In some instances, the modelling in this report could suggest sufficient land is available, however the peculiarity of a particular economic activity may mean that there is no land suitable. Therefore, we consider that further detailed assessments of specific economic activity and locations will be valuable and can be conducted as required in the future.

1.4 Structure

In terms of the structure, the report's sections cover the following areas:

- Section 2 sets out the methods, assumptions, and limitations.
- Section 3 presents the results tables and the main findings. An Excel spreadsheet with the different data tables accompany the report.
- Section 4 concludes the report and in this section, we offer high-level comments about the findings.

2 Methodology

This section discusses the methodology applied to develop outputs that allow Council to meet the requirements of the NPS-UDC in 2017. The modelling has three key steps,

1) **Business Land Demand:** an assessment of the current intensity of use in the business zones, and potential future economic growth translated into floorspace and land demand.
2) **Business Land Supply:** an assessment of the AUP zones to understand maximum development potential and the level of development that has been delivered by the market.
3) **Reconcile Demand and Supply:** an assessment of the nature of the development potential in each zone as compared to expected demand, to establish potential locations for development in the future.

The output of these three assessments is a set of results which establishes the locations where there may be shortfalls in supply in short, medium and long term - assuming NPS-UDC restrictions of no new land being zoned and/or “current likely” feasibility definition. The results provide guidance as to the level of sufficiency within the region – in short this report provides an insight to where more detailed studies may be warranted.

2.1 Business Land Demand

The assessment of business land demand in this study is an update of the 2015 Business Land study. In summary, we have collected the latest data on employment, floorspace, land area, zones and economic projections and updated the projections. These data sets have been used to establish current and future demand for both business floorspace and land, between 2016 and 2048. This period matches the requirements of the NPS-UDC, short term (3 years), medium term (10 years) and long term (30 years).

2.1.1 Current Demand

First, current demand and intensity of use across all business zones in Auckland, were assessed. Land is used more intensively in some locations than others due to factors such as land value, access to regional infrastructure, population demand, accessibility, etc. This affects the rate at which employment in each business sector may translate into land or floorspace requirements in each location. In addition, the characteristics of the business sector itself, have a strong influence on the volume of land area required to cater for growth.

Empirical data on current land uses can be triangulated to establish the intensity of land use by location (and differentials between locations) across Auckland. In this study we have replicated the assessment carried out in the 2015 study. In summary, we have assessed land use intensity using two metrics,

1. Floor Area Ratio (**FAR**). This is a measure of the degree of intensity to which land is utilised (described below). Specifically, it is the amount of built floorspace divided by land area for each parcel and,

2. Workspace ratio (**WSR**). This is a measure of the amount of built floorspace per employee. It is a measure of the level of intensity of floorspace usage by industry.[12]

[12] Note: in the 2015 study the employment metric used for the modelling was Employment Count (EC). The EC only records employees that are paid a wage or salary. The EC does not capture Working Proprietors, which can be important in some sectors

These metrics are commonly used in urban economics to understand the utilisation of land in terms of building (built form) and the density of activity within buildings. The methods used to establish the FAR and WSR are not repeated in this report, the reader can refer to the technical report from 2015.

2.1.2 Future Demand

Second, potential future demand for business land, driven by growth in the economy, was assessed. Projections of future demand were developed using the Auckland Economic Futures Model (AEFM), the AUP Activity Tables and Current Demand (discussed above). Key output was demand for floorspace and business zoned land by zone between 2016 and 2048. Again, the methods used in this assessment are explained at length in the 2015 technical report and are not repeated in this report.

The AEFM is an economic model of the Auckland Economy that provides projections of employment, GDP and other key metrics across 48 industries.[13] The same AEFM was used in the previous two studies of business land demand, however this study utilises the latest version developed in late 2017.

Briefly, the AEFM projections include differing growth rates for each industry, based on observed and expected relationships for each industry. For example, this model captures structural changes such as a shift toward a greater proportion of activity within tertiary sectors and healthcare (as the population ages). Broadly, in the Auckland Region the higher growth industries are expected to be driven by population growth, such as services, and professional based industries such as finance. The lower growth industries are expected to be export driven industries, such as manufacturing. In this study, the Medium growth future scenarios were used to illustrate the potential demand in the future. The Medium projection represents the mid-point projection of potential future employment outcomes.

The study of demand for floorspace and land in an urban economy commonly focusses on the relationship between workers and their space requirement. Specifically, the employment metric is important from the planning perspective, because growth in employment in an urban economy commonly manifests as demand for floorspace and/or land.

Second, the relationship between employment from the AEFM and zones was modelled, using the same concordance used in the 2015 study. In summary, a concordance was developed using the AUP rules which define the types of activities that are allowed in each zone. The result of this assessment is a projection of the employment by zone between 2016 and 2048.

Finally, employment by zone projections are converted into floorspace and land area using the profile of current demand (see 2.1.1). There are two key assumptions in the analysis, namely that land and floorspace intensity (utilisation) remains **constant** over the forecast period and that **all** future growth in employment generates need for new floorspace (and land).

By and large the land and floorspace utilisation rates are generally not fixed in high growth economies. Broadly, in a growing city like Auckland, rates of utilisation tend to increase over time as the city intensifies.

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such as retail, construction and professional services. The 2017 study has used Modified Employment Count (MEC), which includes Working Proprietors.

[13] It segments the Auckland economy into 48 sectors based on ANZSIC coding and projects growth in each sector. The sum of the sectors is the total economic group anticipated for Auckland Region.

These changes in intensity can be driven by either increasing the scale of built form on business land and/or more efficient use of the existing floorspace within those buildings.

These assumptions have two important consequences;

1. Future growth in employment could require less land than is currently observed in Auckland. In other words, land could be used more efficiently in the future. This means that the amount of land required/demanded could be less than estimated in this study.

2. Existing land (and floorspace) could accommodate more employment and economic activity than is currently observed. The amount of economic activity within **existing** buildings and land could increase in the future. This means that some of the growth in employment may be accommodated in existing areas. This means that some of the employment growth may not manifest as demand for vacant land (or floorspace).

These aspects are important and the processes are real, however this study has not modelled the potential implications of possible changes in land and floorspace utilisation. It is considered that changes in utilisation rates may result in less demand for land (and floorspace) and that the estimates in this study should be viewed as conservative, as they are likely to overestimate the need for new zoned land.

Notwithstanding the consequences, it is prudent for the Council to zone more land than is needed (in absolute terms) to ensure that the economy is not unnecessarily constrained by land shortages, or price rises as land becomes more scarce overtime.

2.2 Business Land Supply

As in the 2015 study, most of the analysis of development capacity or supply of business zoned land in the AUP zones was assessed by Auckland Council. Auckland Council's Capacity for Growth Study (CfGS) model estimates the capacity within each AUP zone across Auckland.[14] The model identifies existing vacant sites and sites where building coverage is unusually low (vacant potential), then establishes an estimate of capacity.

In summary the CfGS, estimates Plan Enabled capacity using the 'Maximum Theoretical' scenario - a measure of the potential development that is *theoretically* possible. That is the building envelop according to zone rules is developed fully (maximum height etc.).

In the previous CfGS there was a capacity measure termed the 'Contemporary' scenario. The Contemporary Development Scenario estimated the capacity that could occur if sites were developed to the same level as the market had already delivered in similar and proximate zones/locations. Due to time constraints it was not possible for Auckland Council to reproduce this scenario in the 2017 CfGS. In this study we have developed a 'Contemporary Development Scenario' using recent building consents.

Finally, we note that in the future there is likely to be new land zoned for business activity which according to the definitions in the NPS-UDC cannot be included in this assessment. For example, Future Urban Zone land in Auckland is expected to be made available for development over the next 30 years and could enable 1,400 hectares of new land.[15] Also the Auckland Unitary Plan is likely to be updated several times over the coming 30 years (next AUP approx. 2026). These new plans are likely to include rule and zone changes that will enable other supply. For this reason, there is likely to be new capacity enabled during the medium and long term – which cannot be assessed in this study.

In the following subsections we provide summary discussion for the, Plan Enabled Development Capacity and Contemporary Development Capacity.

2.2.1 Plan Enable Development Capacity

The CfGS includes a module that estimates the overall availability capacity on business zoned parcels, both commercial and industrial land. The CfGS applies a spatial model that applies bulk and location rules to estimate the total maximum theoretical floorspace that could be developed on each parcel. Details of the CfGS can be found in the Auckland Council Technical report.[16]

In this study we present summary results from the CfGS for two types of developable business land, 'Vacant' and 'Vacant Potential'. The following definitions are provided in the CfGS model technical report,

- Vacant Land: *"land that is on parcels that are wholly vacant (i.e. there are no buildings located on the parcel)……There are two distinct types of vacant business parcels, the first being a business*

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[14] Auckland Council (2017) Auckland Unitary Plan Adopted Zones.

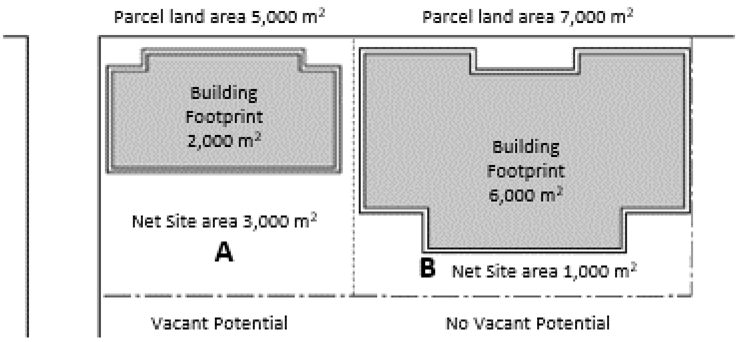
[15] Auckland Council (2017) Auckland Future Urban Land Supply Strategy (refresh).

[16] Balderston et al. (2014). Capacity for growth study 2013 (Proposed Auckland Unitary Plan): methodology and assumptions. Auckland Council technical report, TR2014/009

zoned parcel that is an empty lot and the second being a business parcel that while it has no buildings located on it is currently used for other purposes".[17]

- Vacant Potential Land: "*is land that has an unusually large 'vacant area' or 'percent vacant area', when compared to other parcels of similar generalised zoning within a similar location.*"[18] The vacant potential land (on these parcels) is equal to a proportion of the parcel that does not have an existing structure, i.e. excludes land in the parcel that has an existing building. Figure 2-1 illustrates the Vacant Potential in the CfGS with the area being shown by 'A', i.e. the parcel land area less the existing building footprint. However the parcel must also have an unusually large vacant area, the area 'B' in the diagram depicts an area that is not considered to be Vacant Potential. Vacant potential was established using a statistical method[19], which was tested for the industrial zones using a 'ground truth' exercise.[20]

Figure 2-1: Illustration of Vacant Potential in CfGS



We note that neither of these measures includes potential redevelopment of properties that are fully covered[21] with existing buildings. The AUP rules enable greater intensity of use, e.g. an increased height envelope or coverage. The enabled increase in intensity may encourage redevelopment of properties that have existing buildings that cover a majority[22] of the site.

This type of (re)development can be illustrated by the following hypothetical example. A property which has a building that covers almost the entire land area, i.e. building footprint of almost 100% but may not have the maximum number of storeys or be at the height limit has some potential for expansion. This type of development has been excluded as it i.e. neither Vacant or has Vacant Potential (no vacant land potentially useable for additional business activity). However, the new AUP zone rules could allow the owner of this property to build additional levels. In some cases, given an increase in enabled development potential the market may choose to demolish the existing building to allow development upwards.

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[17] Balderston et al. (2014). pg. 81.

[18] pg. 86, Balderston, K. et al. (2014).

[19] Balderston et al. (2014). Capacity for growth study 2013 (Proposed Auckland Unitary Plan): methodology and assumptions. Auckland Council technical report, TR2014/009.

[20] Studio D4 (2014) Auckland Industrial Land Fine Grained Analysis.

[21] i.e. neither vacant or vacant potential land.

[22] Specifically more than the current average area.

Finally, building footprints used in the CfGS were developed from 2010 aerial photos. This means that new buildings after 2010 have not been accounted for in the CfGS. In this study Building Consents between 2010 and 2017 have been used to filter out (remove) recent developments from the CfGS model. Specifically, it is assumed that parcels that have an associated building consent between 2010 and 2017 are not available for future development. This assumption is likely to filter out too much supply, as in some instances development may be still under construction or being undertaken in stages. The end result is a conservative estimate of available developable capacity.

2.2.2 Contemporary Development Capacity

In the 2015 study Auckland Council CfGS included a 'Contemporary' scenario which modelled the development potential based on recent development activity.

In summary the 'Contemporary' scenario was *ex post* scenario, which implicitly assumes AUP urban form rules will have no effect on market outcomes (i.e. intensity of development remains unchanged, as if the AUP did not exist). Due to time constraints it was not possible for this scenario to be reproduced in the 2017 CfGS.

In this study a new 'Contemporary Development Scenario' was developed using building consents from the last decade (2007-2016). The assessment of building consent data shows the intensity of land use in each zone, i.e. floorspace developed relative to the land consumed. This highlights the level of development that has been achieved by the market which can be thought of as 'currently feasible'. The Contemporary Development Scenario applies an average intensity of development observed in the building consents over the last decade.

As noted in the NPS-UDC guidelines, direct estimation of 'feasible' capacity for commercial and industrial land is complex and problematic. This is because there are numerous diverse development options and/or uses that could occur on any given piece of business land. These numerous development options and final uses can have very different development costs and rents (returns) that result in vast numbers of potential outcomes, each of which would need to be tested. We consider that while modelling feasibility of business land development may be theoretically possible, in practice the application of such a model to all properties in Auckland would be an intractable (impossible) problem.[23]

In addition, the rate at which the measures of feasibility change over time is impossible to predict with any certainty, as feasibility relates to underlying economic conditions. This means that feasibility in the medium term or long term has the potential to be very different to today. Projecting feasibility with any certainty over 10 or 30 years is also impossible.

We consider that development level in the Contemporary Development Scenario represents an average development that was **feasible** under recent past market conditions (supply and demand). This scenario is an *ex post* projection, i.e. how much development would the market choose in the future if past market conditions (supply and demand) continue into the future?

While we can be confident that the Contemporary Development Scenario is overly conservative and unlikely to eventuate, it still provides a relevant base line for understanding the least amount of potential development that could be feasible in Auckland.

[23] Given the large number of alternative development options available and the large number of properties in the commercial and industrial zones this modelling would take a substantial amount of time and effort to solve and add little in terms of understanding.

2.3 Reconcile Demand and Supply

In the 2105 study reconciliation of demand and supply to location was estimated using a simple allocation method based on revealed preferences as observed in the existing structure of the economy – i.e. a projection of the existing state. This projection model assumed that growth is distributed *pro rata* across Auckland according to the existing structure of employment. The method was noted in the previous study as "a simple estimation method for understanding the distribution of growth". While there are alternative methods for forecasting the geographic spread of demand growth, known methods require substantial amounts of time, which meant they could not be utilised in the 2015 study. Although the projection method was selected as the core analytical framework for the 2015 study, it was recognized at that time that alternative methodologies do existed.

For the purposes of this study, it was decided that the previous simple model would be updated with a more robust method. Therefore, the reconciliation of demand and supply is modelled using a Machine Learning Model (MLM). This method is described below.

2.3.1 Machine Learning Model (MLM)

The MLM applies an approach that determines which parcels of land are most suitable for development based on existing characteristics of development. When firms and developers make decisions regarding location and development, they will try to find the most suitable land available. Notwithstanding that there will be a range of developers that have different preferences for land, there are general characteristics of land which makes one parcel more attractive than others. These characteristics, while not explicitly stated by developers, or directly collected in any dataset, can be deduced by the behaviour of many developers over time.

Using data on the characteristics of land parcels and the surrounding areas in which they are located, a predictive model can be created. This predictive model 'learns' patterns in the data which indicate if a parcel is suitable for development (or not). The model can apply what it has learnt about the nature of developed parcels to provide a development suitability measure for other vacant and vacant potential parcels. The predictive model used in this study is constructed using a "Random Forest" (RF) algorithm implemented in the statistical software package 'R'.

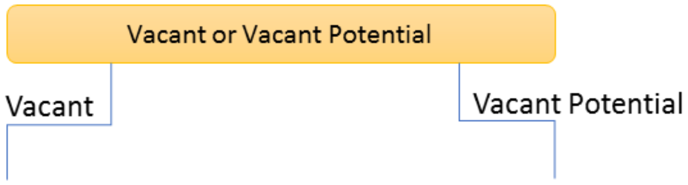
Formally, Random Forests are an ensemble machine learning method that can be used for classification. Random Forests were first proposed by Leo Breiman and are constructed using a given number of decision trees, the model predicts classifications by each tree 'voting' on the outcome variable, with the most popular vote 'winning'. Trees are created by creating decision splits which can be applied to the data. The beginning of the tree is called the root node, and the end points are known as terminal nodes. In addition to these nodes there are nodes at each split in the tree. For each split, the algorithm looks at a subset of observations and a subset of predictor variables, and creates a split in the data based on a single variable which creates the most 'pure' split[24]. In this context the purer a split is, the better the split discriminated

[24] Purity measures how well the categories are separated at each node. A perfectly pure node would have all 0's (non-developed parcels) or all 1's (developed parcels). Having 50% 0 and 50% 1 is an impure, meaning that this node doesn't help with classification. The model seeks to have the purest nodes it can create through different decision splits.

developed parcels from non-developed parcels. This is then repeated until there are no longer any 'good' splits which increase purity[25].

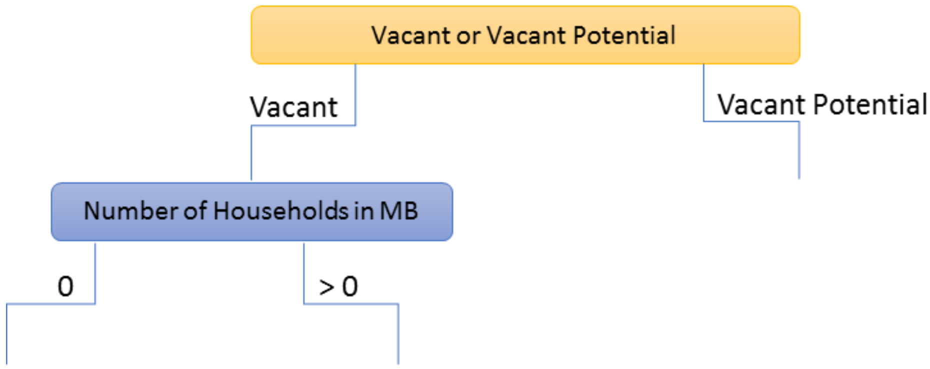
A decision tree is created decision by decision, top down (from root node through to terminal nodes). An example of decision tree is shown below.

Figure 2-2: Decision Tree Step 1 - Root node



In this simplistic example, the model has assessed a sample of all variables included within the model, and has determined that the best split for trying to predict whether a parcel will be developed is to first understand whether it is a vacant parcel, or a vacant potential parcel. In predicting the suitability of a given parcel, this is the first condition tested (in this example).

Figure 2-3: Decision Tree Step 2 - Nodes



Next the model tests only the vacant parcels, and looks for the best split. In this case the best split is the number of households in the surrounding meshblock, with the value of the split being 0. All parcels with 0 households in their containing meshblock will keep going down the nodes on the left, and parcels with greater than 0 households in the surrounding meshblock will go down the right-hand nodes. This means that the decision at each node is created using data that fit the above criteria (so each side of tree will be different). For instance, when the model created the number of Households in MB split, it only looked at vacant parcels to decide this. This allows the model to better understand the patterns in the data and in particular, combinations of variables.

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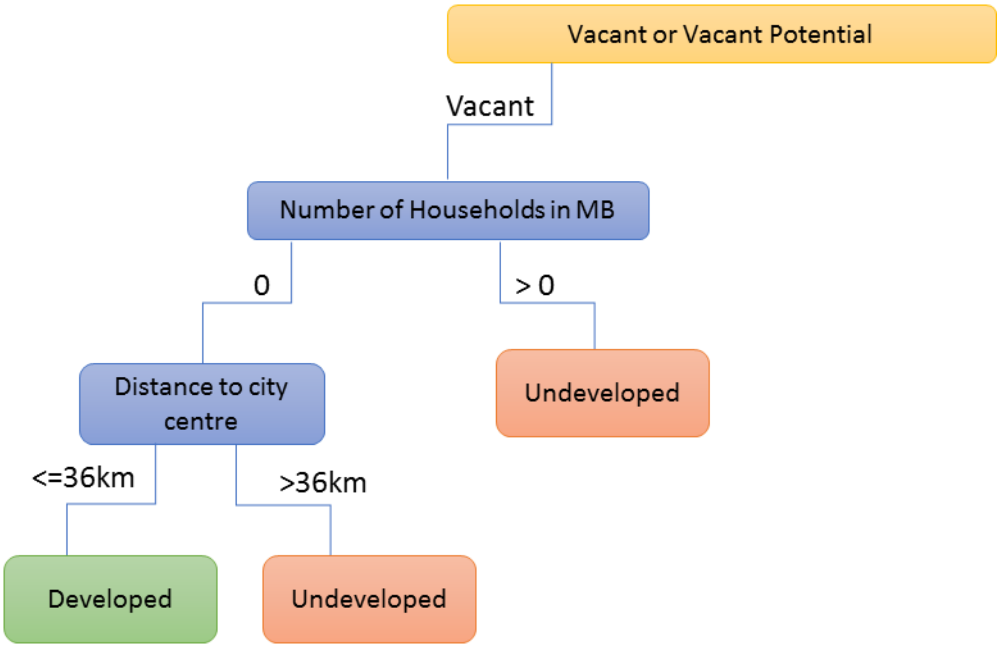
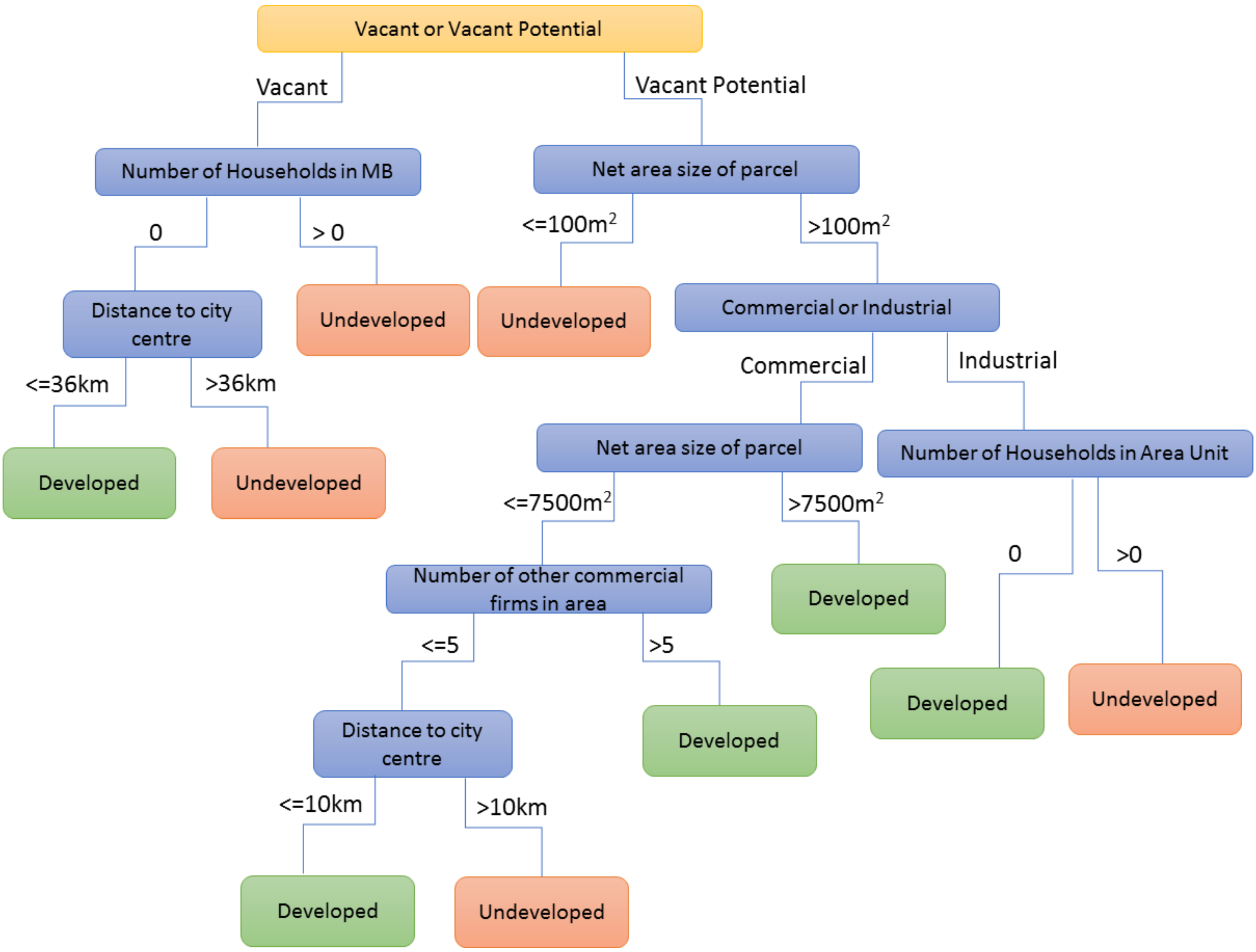
[25] Other stopping rules include: The minimum number of observations in the node is reached, the minimum number of observations in the potential nodes are reached, the maximum tree depth (sequential splits) is reached, or all samples for a given node belong to the same class.

Figure 2-4: Decision Tree Step 3 - Terminal Nodes



As you can see in the diagram above, there is now terminal nodes in the tree. These occur when no further 'good' splits can be created, or when data has run out. In this case Vacant parcels with 0 households in the surrounding meshblock and that are within 36km of the city centre are likely developed, whereas being further than 36km from the city centre or having more than households in the surrounding meshblock mean that the parcels are likely undeveloped.

Figure 2-5: Decision Tree Step 4: Full Tree (simplistic example only)



The full decision tree can be applied to every observation in the dataset, or future observation (provided all data is available).

Using the above tree, the model can predict whether a parcel is suitable for development or not. However, from a single tree, the prediction can be heavily biased. Combining the predictive power of 500 or 1000 trees greatly reduces single tree bias. The reason for this, is that at each node, a random sample of all observations and a random sample of all variables are used to define splits. This means that a single variable cannot dominate every single node which allows the model to generalise a lot better. Additionally random forest models tend to not overfit the model, as not every observation is used at every node. Due to the sampling with replacement method of random forests, each tree will be different. The suitability measure of parcels is derived by taking the percentage of votes (votes are the results of each tree) that predicted that the parcel is developed. If the model predicts a parcel is developed, it shows that it shares many characteristics with already developed parcels and therefore is likely suitable for development.

The features of Random forest algorithms are:

- Can be run efficiently with large data sets both in terms of variables and observations
- Importance of variables can be estimated (so that the key drivers of predictors can be understood).
- Individual trees are easily interpretable, when compared with other 'black box' forms of machine learning such as neural networks.
- No need to transform any variables, RF algorithms can handle numeric, binary and categorical data types.
- There is no need to select the best variables, or eliminate variables which are not significant (such as in multiple regression), as the tree method only uses those that create the best splits.
- They are robust to data errors – individual errors in the data often have little effect on the tree.
- It has an effective method for estimating missing data and maintains accuracy when a large proportion of the data are missing.
- Once the forest has been created, it can be saved and applied to new data.

3 Key findings

This section presents the key findings in terms of the business land demand, supply and the relationship between supply and demand (i.e. the available capacity). The results are presented to match the NPS-UDC time horizons for the short term (3 years), medium term (10 years) and long term (30 years). The results include the NPS-UDC sufficiency margins of 20% buffer for the short term and medium term and the 15% in the long term.

The following key findings are presented,

- a high-level summary of the current economic activity and the growth outlook is presented. This outlook draws on the employment project work.
- the supply patterns present capacity assessment using two metrics – plan enabled capacity and a contemporary development capacity.
- the assessment of sufficiency of capacity (including buffers) to meet the requirements of the NPS-UDC.

3.1 Current Demand

The land use patterns within the Auckland local board areas were analysed to provide an understanding of the differences in land use intensity across Auckland spatially. We have presented the results from this assessment using the same groups (Local Board Group) as used in the 2015 study (see Appendix A for the spatial definition).

As would be expected the FAR is largest for the more central (older) areas. The Urban Central area has an average FAR of 0.68 in the commercial zones and 0.41 in the industrial zones. The observed higher utilisation in Urban Central area is likely to be driven by the higher land values (and rents) which mean that businesses must utilise land more intensively in this area.

The Urban North, Urban South and Urban West have similar FAR for both commercial (ranging from 0.4 to 0.45) and industrial (ranging from 0.28 to 0.36) zones. The Rural North and Rural South also have similar FAR for both commercial (0.25) and industrial (0.11 and 0.07) zones.

Figure 3-1: Average FAR by AUP Activity Table and Local Board Group

Local Board Group	Activity Table 1 Commercial	Activity Table 2 Industrial	City Centre
Urban Central	0.68	0.41	2.04
Urban North	0.40	0.30	-
Urban South	0.40	0.28	-
Urban West	0.45	0.36	-
Rural North	0.25	0.11	-
Rural South*	0.25	0.07	-

** excludes Glenbrook Steel Mill from Heavy Industry*

The FAR reported in the two studies are not directly comparable because there was a reasonable amount of zone change between the Proposed AUP (2015 study) and the final Adopted AUP (this study).[26] However, in summary land use intensity (FAR) observed in the commercial and City Centre zones is marginally higher in this study. While the industrial land use intensity may have dropped in some locations (driven by up zoning of some of the more intensely utilised industrial land).

Floorspace utilisation patterns within the Auckland local board areas were analysed to provide an understanding of the difference in intensity of land use across Auckland. Seen in Figure 3-2, generally the WSR were lowest for urban Local Board Groups and highest in AUP Activity Table 2. The rural Local Board Groups had an average WSR of around 70m^2 per employee for commercial zones and 100m^2 per employee for industrial zones. These areas, located on the edge of the region are away from the central city and northern areas and as such have the spatial capacity to cater to lower density activities.

In contrast, the Urban Central and Urban North areas had a much lower average WSR in both commercial zones (Activity table 1) and industrial zones (Activity table 2). The average WSR for Urban Central and North were around 40m^2 per employee for commercial zones and 80m^2 per employee for industrial zones. These results show that floorspace in these areas is used more intensively than in the other Local Board areas. This is likely to be related to the higher land rents and prices in these Local Board Groups, making activities which require greater floorplans more expensive to operate.

The commercial zones (Activity table 1) in the Urban West and Urban South areas had a similar average WSR to the rural areas (around 60-70m^2 per employee), whereas the average WSR of the industrial zones (Activity table 2) in these areas was around 90m^2 per employee.

Figure 3-2: Average WSR (m^2 per employee) by AUP Activity Table and Local Board Group

Local Board Group*	Activity Table 1 Commercial	Activity Table 2 Industrial	City Centre
Urban Central	39	78	39
Urban North	41	70	-
Urban South	56	93	-
Urban West	68	93	-
Rural North	66	99	-
Rural South	68	96	-

** WSR uses MEC. So the results in this table are not directly comparable to the 2015 study which used EC*

The WSR reported in the two studies are not directly comparable because there was a change in the employment metric used, 2015 study used Employment Count (EC) and this study uses Modified Employment Count (MEC).[27] However we have undertaken a brief review of some of the data and the WSR productivity seems to have increased (i.e. less floorspace per employee) since the previous study.

[26] Some industrial zoned land was up zoned to mixed use zone. This up zoning will have reduced the average land use intensity.

[27] In the 2015 study the employment metric used for the for modelling was Employment Count (EC). The EC only records employees that are paid a wage or salary. The EC does not capture Working Proprietors, which can be important in some sectors such as retail,

3.2 Future Demand

The future demand results discussed in this section covers the summary sector level employment projections from the AEFM, the economic sector to activity concordance results and the final demand results for the NPS-UDC time periods.

At a summary level the AEFM medium scenario employment projection for the years 2028 (short/medium term) and 2048 (long term) show the following demand profiles,

- Employment in Auckland is expected to grow by 192,000 (over the NPS-UDC short/medium term) which is equivalent to growth of 23% compared to 2016 or annual growth rate of 1.8%.
- Employment in Auckland is expected to grow by 380,000 (over the NPS-UDC long term), which is equivalent to growth of 46% compared to 2016 or annual growth rate of 1.2%.

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construction and professional services. The 2017 study has used Modified Employment Count (MEC), which includes Working Proprietors.

Figure 3-3: Future Demand AEFM Employment Projections Medium Scenario 2028 and 2048

Employment: ECs Projections [MECs]		Medium			Medium (growth)		
Industry	2016	2018	2028	2048	2016 - 2018	2016 - 2028	2016 - 2048
Horticulture & fruit growing	4,151	4,333	5,084	6,198	181	932	2,047
Sheep, beef cattle & grain farming	1,533	1,559	1,658	1,798	25	124	265
Dairy cattle farming	723	767	965	1,274	44	243	552
Poultry, deer & other livestock farming	828	859	988	1,178	31	160	350
Forestry & logging	234	253	311	414	19	76	180
Fishing & aquaculture	203	223	314	479	20	111	276
Agri, forestry & fishing support svcs	900	966	1,251	1,790	66	351	890
Mining, quarrying, exploration & support svcs	320	368	499	760	49	180	440
Oil & gas extraction	9	9	9	9	- 0	- 0	- 1
Meat & meat product manuf	2,979	2,994	3,042	3,059	15	64	80
Dairy product manuf	1,944	2,073	2,662	3,572	130	718	1,629
Other food manuf	11,992	12,454	14,213	16,587	462	2,221	4,595
Beverage & tobacco product manuf	2,986	3,175	3,966	5,133	189	980	2,147
Textile & apparel manuf	4,488	4,505	4,399	4,292	17	- 89	- 196
Wood product manuf	3,205	3,470	3,709	4,024	265	504	819
Pulp, paper product manuf	1,696	1,744	1,895	2,107	48	199	411
Printing	4,462	4,693	5,396	6,322	231	934	1,860
Petroleum & coal product manuf	195	210	243	285	15	48	90
Chem, polymer & rubber product manuf	9,662	10,198	11,864	14,282	536	2,201	4,620
Non-metallic mineral product manuf	3,467	4,007	4,653	5,545	540	1,187	2,079
Primary metal & metal product manuf	1,874	1,990	2,276	2,630	116	402	756
Fabricated metal product manuf	9,234	10,216	11,510	13,257	982	2,275	4,023
Transport equipment manuf	4,629	4,809	5,385	6,148	180	756	1,519
Machinery & equipment manuf	12,259	13,039	15,947	20,365	780	3,688	8,106
Furniture & other manuf	4,394	4,551	5,066	5,680	157	672	1,286
Electricity generation & supply	1,463	1,571	1,965	2,686	108	502	1,223
Gas supply	122	130	162	221	9	41	99
Water, sewerage, drainage & waste svcs	2,932	3,176	3,984	5,455	245	1,052	2,524
Construction	63,536	77,163	88,364	106,181	13,627	24,828	42,645
Wholesale trade	59,572	62,712	71,783	84,044	3,139	12,211	24,472
Retail Trade	75,753	80,689	99,696	130,245	4,936	23,943	54,492
Accommodation & food svcs	55,338	57,443	64,442	70,889	2,105	9,105	15,551
Road transport	14,508	15,267	17,532	20,614	759	3,025	6,106
Other trans & support, postal & storage svcs	19,348	20,139	22,504	25,539	791	3,156	6,191
Air & space transport	5,889	6,021	6,445	6,793	132	556	904
Info media & telecommunications	21,507	22,268	24,401	25,851	762	2,894	4,344
Finance	15,103	15,923	18,837	23,144	819	3,733	8,041
Insurance & superannuation funds	7,015	7,416	8,845	10,940	401	1,830	3,925
Auxiliary finance & insurance svcs	7,786	8,216	9,731	11,959	430	1,944	4,173
Rental, hiring & real estate svcs	20,083	21,319	25,893	33,455	1,236	5,811	13,373
Ownership of owner-occupied dwellings	0	0	0	0	-	-	-
Prof, scientific, technical, admin & support svcs	151,858	159,105	179,025	196,499	7,247	27,166	44,641
Central govt admin, defence & public safety	25,420	26,927	32,348	40,200	1,507	6,928	14,781
Local govt admin	7,861	8,328	10,024	12,502	467	2,163	4,641
Education & training	61,806	64,630	74,734	87,043	2,824	12,928	25,237
Health care & social assistance	76,287	80,450	97,135	126,884	4,164	20,848	50,597
Arts & recreation svcs	15,277	16,067	18,697	20,952	790	3,420	5,675
Personal & other svcs	23,170	24,342	27,737	30,620	1,172	4,567	7,449
Industry Total	819,999	872,764	1,011,587	1,199,905	52,766	191,589	379,907

- Much of the growth in employment is expected in industries that generally prefer to locate in commercial zones or non-business zones. The projections indicate that almost half of employment growth is expected in four industries, health, professional services, retail and education.

- However, employment in construction and the wholesale sectors is also expected to grow strongly and these industries tend to locate in industrial or non-centre zones.

The results from the concordance of economic sector to planning activity type shows that much of the growth in employment is expected to be in the following types,

- **Non-Business Zones:** as with all urban economies there is a large proportion of economic activity in non-business zones. This includes home based, special purpose zones (airports/hospitals/ports etc.) and rural zones. In the model approximately 30% of future employment growth is expected to locate in non-business zones.

- **CBD Zone:** is expected to attract 13% of employment in the Auckland Region.

- **Office Activity**: In total, the office relationships assigned 25% of employment in the Auckland Region.

- **Retail Activity**: In total, the retail relationships assigned 10% of employment in the Auckland Region.
- **Food and Beverage Activity**: In total, the food and beverage relationships assigned 2% of employment in the Auckland Region.
- **Industrial Activities:** In total the industrial activity relationships allocated 13% of employment in the Auckland Region.
- **Facilities Activities and Other Activities:** In total, the facilities activity relationships allocated 8% of employment in the Auckland Region.

As with the 2015 study, the new model shows that much of the growth in employment is expected in sectors of the economy that are generally 'more' enabled within commercial zones rather than industrial zones. This indicates that most of the growth in employment is expected to locate within the commercial zones and the CBD zone.

Finally, the future demand results suggest that around half of future demand will be in commercial zones and two fifths in industrial zones. The largest demand for floorspace is expected in the Mixed Use zone (103,000m^2 per annum in the Short/Medium Term) and the Light Industrial zones (152,000m^2 per annum in the Short/Medium Term). The City Centre Zone is the third largest, with demand for 73,000m^2 per annum (to 2028), dropping to 47,000m^2 per annum over the long term (to 2048).

Figure 3-4: Future Demand NPS-UDC Short/Medium Term (2016-28) and Long Term (2016-48)

Future Demand by Zone floorspace m2 (000)	Short/Medium Term 2016 - 2028		Long Term 2016 - 2048	
	Quant	p.a.	Quant	p.a.
City Centre Zone	871	73	1,504	47
Metropolitan Centre Zone	698	58	1,259	39
Town Centre Zone	659	55	1,189	37
Local Centre Zone	204	17	368	12
Neighbourhood Centre Zone	120	10	217	7
Mixed Use Zone	1,233	103	2,223	69
General Business Zone	381	32	687	21
Business Park Zone	86	7	155	5
Heavy Industry Zone	710	59	1,397	44
Light Industry Zone	1,830	152	3,600	112

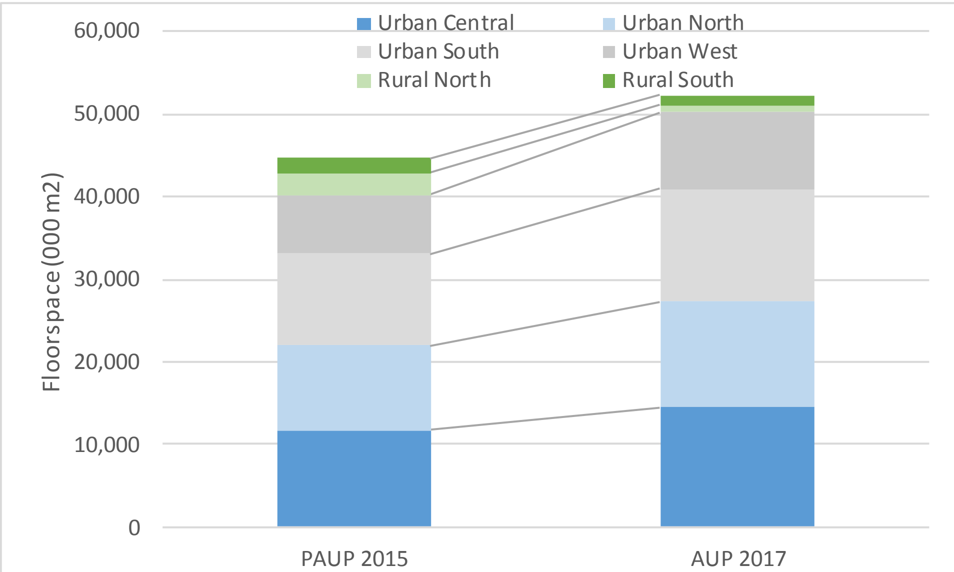
3.3 Supply Patterns

The AUP zoning rules enable a large amount of floorspace to be developed in the business zoned areas. However, given demand and supply constraints it is very unlikely that all Plan Enabled capacity will be developed in the time span of the NPS-UDC (even long term of 30years).

The extent of zones has changed since the previous CfGS was used in the 2015 study. We have not attempted to classify or understand all the nuances of changes in rules and zone geographies between the PAUP in 2015 and the current adopted AUP in 2017. However, in summary changes between 2015 and 2017 have significantly increased Maximum Theoretical development beyond the level presented in the 2015 study.

Under the adopted AUP zoning provisions, there is an increase from 44.7 million m^2 (2015) to 52.2 million m^2 commercial floorspace capacity – a 17% increase. Most of the increase is located in the Urban areas (Central, North, South and West) where there was substantial up zoning to Mixed Use in the adopted AUP.

Figure 3-5: Maximum Theoretical Floorspace - Business Zones 2017



The maximum theoretical floorspace that is enabled by the adopted AUP in the City Centre zone and the Industrial zones is so vast compared to demand in the long run and/or the existing supply that it is not meaningful to discuss them in this study. Similarly, to the previous study the maximum theoretical floorspace from the CfGS is not presented for these zones.

The analysis in this study does not rely upon the Plan Enabled capacity in the assessment of the sufficiency of the business zones to meet the demands of the economy. The key results from the supply patterns is the Contemporary Development Scenario, which models current likely development potential based on historic building consents – i.e. the level of feasible development that the market has delivered in the past.

While we can be confident that the Contemporary Development Scenario is unlikely to eventuate, it still provides a relevant base line for understanding the least amount of potential development that could occur in Auckland.

The results of the Contemporary Development Scenario show that potential floorspace by Local Board Group by AUP was generally higher than the 2015 scenario for most zones and Local Broad Groups. This increase is driven by application of the average FAR from the updated building consents assessment (described above).

- In total the commercial zones could accommodate a significant supply of floorspace. The Contemporary Development Scenario suggests that there is potential for large volumes of floorspace in the Metropolitan, Town Centre, Mixed Use zones and General Business zones. The other commercial zones are relatively small.

- The industrial zones have an overall potential industrial floorspace of 7.9 million m^2 Auckland wide. Additional large areas of industrial zoned floorspace are identified as being potentially available in the Urban South (2.7 million m^2) and Rural South (1.4 million m^2) areas. The Urban West also has more than a million square metres of floorspace capacity in the industrial zones.

Figure 3-6: Contemporary Development Scenario Floorspace - Business Zones 2017

Local Board Group	City Centre	Metropolitan centre	Town centre	Local centre	Neighbourhod centre	Mixed Use	General Business	Business Park	Heavy Industry	Light Industry
Contemporary Scenario Potential Floorspace (000)										
Urban Central	5,919	158	1,527	64	26	3,401	7	4	649	287
Urban North	-	142	38	35	41	85	1,069	39	39	607
Urban South	-	336	349	65	28	314	112	-	524	2,713
Urban West	-	1,745	92	49	10	484	102	-	84	1,289
Rural North	-	-	57	18	4	121	6	-	-	145
Rural South	-	-	19	20	16	130	39	-	208	1,364
Total	5,919	2,381	2,082	251	124	4,535	1,335	44	1,505	6,404

3.4 Future Sufficiency

The results from the MLM are displayed along with the NPS-UDC buffer test for the Short-Medium term (2028) and the Long term (2048). There is no need to present short term and medium term results separately because the test for the short term will be passed as long as the medium term is also passed. The following tables show,

- demand by zone type (City Centre, Metropolitan Centre, Other Centre[28], Mixed Use, Commercial[29] and Industrial[30]) in terms of floorspace m^2,
- the Contemporary Development Scenario supply by Local Board Group area and zone type in terms of floorspace m^2,
- Machine Learning model consumption results by Local Board Group area and zone type in terms of floorspace m^2, and
- NPS-UDC Buffer which shows a binary code by Local Board Group area and zone type, where 1 means that machine learning consumption is lower than capacity by at least 20% (short-medium) or 15% (long term). The cases where the binary code is equal to 0 are the location/zone areas where the supply does not exceed the demand plus the NPS-UDC buffer.

In summary, the results indicate that there may be some zones within the Local Board Groups where the NPS-UDC buffer test is not passed – i.e. 0 in the NPS-UDC binary code. This issue is most apparent in the long term for the Other Centre zones (Town, Local and Neighbourhood centre zones) and the Rural North Industrial zones.

However, it is important to reiterate the limitation of the NPS-UDC with respect to the exclusion of the Future Urban Zone and other future plans. It is very likely that there will be future changes to the AUP zones which will add significant capacity in the medium term and long term. An example of this is the Rural North, where the current strategy suggests that there could be large volumes of supply zoned in the FUZ for industrial uses in the medium term.

[28] Town Centre, Local Centre and Neighbourhood Centre.

[29] Business Park and General Business.

[30] Light Industrial and Heavy Industrial.

In the short-medium term there is only one location (Urban North) where the MLM consumption results are close to the level of capacity in the Contemporary Development Scenario. Given the level of supply in the other zones in Urban North and the ability of the market to build above the Contemporary Development Scenario capacity this issue is unlikely to be binding.

Figure 3-7: Future Sufficiency Short-Medium Term - Business Zones 2017

Local Board Group	City Centre Zone	Metropolitan Centre Zone	Other Centre Zones	Mixed Use Zone	Commercial Zones	Industrial Zones
Demand - EFM Medium Scenario and Activity Model						
2028 - Short/Medium Term	870,947	698,005	983,689	1,232,617	467,017	2,539,842
Supply - Contemporary Scenario Floorspace Capacity AUP 2017						
Urban Central	5,919,109	157,837	1,616,928	3,400,599	11,683	936,398
Urban North	-	141,924	113,512	85,357	1,108,980	645,930
Urban South	-	336,305	441,526	314,436	111,507	3,237,391
Urban West	-	1,744,997	151,096	483,885	101,784	1,372,962
Rural North	-	-	78,947	120,611	6,030	144,748
Rural South	-	-	55,206	130,071	39,166	1,572,049
Total	5,919,109	2,381,063	2,457,214	4,534,960	1,379,149	7,909,477
Consumption Results - Machine learning						
2028						
Urban Central	872,337	49,455	418,713	824,298	4,699	295,378
Urban North	-	93,635	101,144	21,166	378,396	256,779
Urban South	-	204,333	270,348	130,467	7,472	1,096,517
Urban West	-	356,298	95,612	186,430	26,258	342,665
Rural North	-	-	58,558	30,191	-	98,971
Rural South	-	-	40,689	41,171	22,890	469,427
Total	872,337	703,722	985,063	1,233,723	439,716	2,559,736
NPS-UDC - Buffer						
2028						
Urban Central	1.00	1.00	1.00	1.00	1.00	1.00
Urban North		1.00	-	1.00	1.00	1.00
Urban South		1.00	1.00	1.00	1.00	1.00
Urban West		1.00	1.00	1.00	1.00	1.00
Rural North			1.00	1.00		1.00
Rural South			1.00	1.00	1.00	1.00
Total	1.00	1.00	1.00	1.00	1.00	1.00

In the long term there may be more locations where the MLM consumption results are close to the level of capacity under the Contemporary Development Scenario. This indicates that in the long run the AUP zones may not be sufficient to meet the demands of the economy. However, we consider that as the FUZ planning moves forward that this issue may be resolved. There is likely to be four or five more capacity assessments for the NPS-UDC before capacity constraints become binding.

Figure 3-8: Future Sufficiency Long Term - Business Zones 2017

Local Board Group	City Centre Zone	Metropolitan Centre Zone	Other Centre Zones	Mixed Use Zone	Commercial Zones	Industrial Zones
Demand - EFM Medium Scenario and Activity Model						
2048 - Long Term	1,503,724	1,259,011	1,774,306	2,223,305	842,371	4,996,415
Supply - Contemporary Scenario Floorspace Capacity AUP 2017						
Urban Central	5,919,109	157,837	1,616,928	3,400,599	11,683	936,398
Urban North	-	141,924	113,512	85,357	1,108,980	645,930
Urban South	-	336,305	441,526	314,436	111,507	3,237,391
Urban West	-	1,744,997	151,096	483,885	101,784	1,372,962
Rural North	-	-	78,947	120,611	6,030	144,748
Rural South	-	-	55,206	130,071	39,166	1,572,049
Total	5,919,109	2,381,063	2,457,214	4,534,960	1,379,149	7,909,477
Consumption Results - Machine learning						
2048						
Urban Central	1,507,008	56,580	843,847	1,613,247	6,536	675,267
Urban North	-	124,282	110,010	33,689	667,066	493,904
Urban South	-	250,533	368,937	201,870	9,728	2,186,242
Urban West	-	885,657	122,434	267,016	26,258	775,736
Rural North	-	-	70,052	47,607	-	120,678
Rural South	-	-	49,889	65,328	27,631	790,738
Total	1,507,008	1,317,052	1,565,169	2,228,758	737,220	5,042,564
Demand vs Supply (no Buffer)						
NPS-UDC - Buffer						
2048						
Urban Central	1.00	1.00	1.00	1.00	1.00	1.00
Urban North		-	-	1.00	1.00	1.00
Urban South		1.00	-	1.00	1.00	1.00
Urban West		1.00	1.00	1.00	1.00	1.00
Rural North			-	1.00		-
Rural South			-	1.00	1.00	1.00
Total	1.00	1.00	1.00	1.00	1.00	1.00

4 Conclusion

This study has assessed the business land demand and supply in Auckland which included assessments of: the current situation, future demand, supply patterns enabled in the AUP and the potential interaction between supply and demand to understand whether there is sufficient supply (as defined in the NPS-UDC).

The key result of these assessments is that the adopted AUP has enabled sufficient capacity to meet most demands of the economy in the short term, medium term and long term. There are some instances where the NPS-UDC test of sufficiency is not met, however most of these instances occur in the long term.

The following key points can be drawn from this study,

- The current situation indicates that intensity of business activity has changed marginally since the 2015 study – however in most zones intensity has increased. This result was expected, as it is common outcome for high growth cities, general in Auckland the demand for land for a given amount of business activity has decreased relative to the previous study (i.e. productivity has increased).
- The economic projections and resulting demand for land is higher than was estimated in the 2015 study. Recently economic growth in Auckland has exceeded all expectations. The medium demand projections from the 2017 model are generally higher than the previous medium projection, but lower than the high projections. The sectoral structure of future growth is broadly similar to the 2015 study, with half of the growth focussed in a few sectors (health, professional services, retail and education). However, employment in construction and wholesale sectors is also expected to grow strongly.
- The supply patterns assessment shows that the adopted AUP has enabled significantly more supply than the proposed AUP. This additional supply combined with the Contemporary Development Scenarios development density, results in a significant increase in supply compared to the 2015 study.
- The Machine Learning Model combined with the NPS-UDC sufficiency test indicates that there may be some areas in the long run that may not meet the requirements of the NPS-UDC.

In conclusion, results of this study suggest that the Auckland Unitary Plan has provided sufficient zoned land for business purposes for the short and medium term. Some instances exist where the zoned land in the AUP may not be sufficient to meet demands of the economy or the NPS-UDC requirements in the long term.

This outcome is unsurprising given the timeframe that defines the long term assessment (three decades). Results from this study provide an early warning of potential issues, however it is unlikely that any long term shortage identified will ever eventuate.

It is important to understand that the NPS-UDC requires high growth councils to undertake an assessment of business land every three years and that the objectives of the NPS-UDC must be taken into account by decision makers when making planning decisions. Therefore, in the medium term there will be at least three more business land assessments for the NPS-UDC, much of the FUZ will be zoned for use, the AUP will be updated and there will be many other plan changes. As a result, it is unlikely that there will be no planning response before this long term issue of supply eventuates.

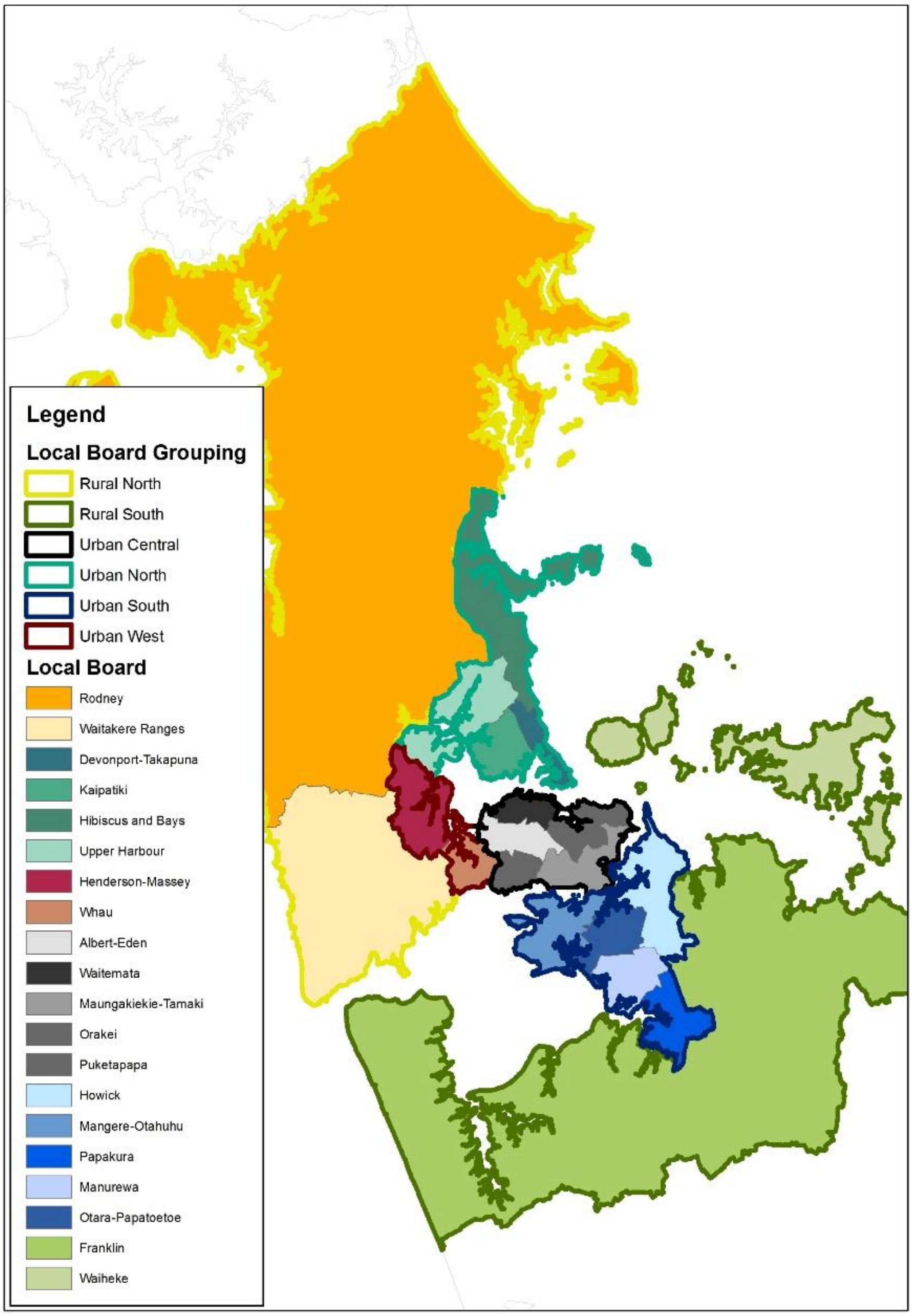
In addition, the wide range of uncertainty around the demand in the long run suggests that the results should be viewed with caution. There are a wide range of views about the influences of technology and disruptive business activity which may have significant impacts on demands for business land. There is likely to be substantial changes in the future in terms of economic activity and the demand for business land.[31]

Finally, the NPS-UDC restricts the capacity assessment to "currently likely" feasible. This does not allow for changes in feasibility that are commonly observed in high growth economies. Broadly, as an economy grows or changes, historic uses of land will become less viable and old buildings can become redundant. In a high growth area, we would expect to observe changes in the feasibility from the "current likely" – especially in the medium and long term. However, it is a difficult task to project future feasibility with any certainty over 10 or 30 years. This study adopted a scenario (Contemporary Development Scenario) that reflects observed developments as an approximation of "current likely" feasibility. While this scenario is a reasonable method for modelling the requirements of the NPS-UDC, it is overly conservative and unlikely to eventuate or reflect future feasibility patterns. This scenario does provide a relevant base line for understanding the least amount of potential development that could be feasible in Auckland in the medium and long term.

Notwithstanding the limitations stated above, it is considered that this report provides an 'early warning' of long term issue of supply, however there is little need to react immediately to the potential long term requirements of the NPS-UDC.

[31] D Foy, D Hunter, C Taylor, K Bligh, T Erasmus, D Fairgray. (2017) "The future of employment and economic activity and its transport and land use implications" pending NZTA Research Report.

Appendix 1: Local Board Grouping Map



Appendix D Plan enabled capacity calculation lookup tables

Plan enabled capacity calculation look up table – Residential

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	ZONE_HEIGHT	ZONE_STOREYS	PARCEL_AREA_MIN_QUALIFIER	PARCEL_AREA_MIN_INFILL	ACCESS_WIDTH_MIN	BLDG_SETBACK_MIN	SECOND_DWELLING	PSUEDOCODE	VAR_1	VAR_2	VAR_3	VAR_4	VAR_5	VAR_6
ZN_2_8	Residential - Terrace Housing and Apartment Building Zone	Residential	Frontage_Only		16	5	2400	1200	2.5	0	1				3	25	0.5	120
ZN_2_18	Residential - Mixed Housing Suburban Zone	Residential	Frontage		8	2	800	400	2.5	0	1					400	0.4	165
ZN_2_19	Residential - Single House Zone	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
ZN_2_20	Residential - Rural and Coastal Settlement Zone	Residential	Infill		8	2	5000	2500	2.5	1	1						0.2	
ZN_2_23	Residential - Large Lot Zone	Residential	Infill		8	2	8000	4000	2.5	6	0						0.2	
ZN_2_60	Residential - Mixed Housing Urban Zone	Residential	Frontage		11	3	600	300	2.5	0	1				2	18	0.45	155
PR_0_291_0	|Flat Bush sub-precinct A	Residential	Infill		9	3	650	325	2.5	0	1						0.4	
PR_0_292_0	|Flat Bush sub-precinct B	Residential	Infill		9	3	600	300	2.5	1.2	1						0.4	
PR_0_708_0	|Albany 9 sub-precinct C	Residential	Frontage		8	2	800	400	2.5	0	1						0.5	
PR_0_808_0	|Flat Bush sub-precinct C	Residential	Infill		10	3	800	400	2.5	1.2	1						0.5	
PR_0_810_0	|Huapai 2	Residential	Infill	Sub-precinct not specially modelled as input data does not differentiate sub precincts	8	2	600	300	2.5	1	1						0.5	
PR_0_811_0	|Hingaia 1 sub-precinct A	Residential	Frontage		8	2	600	300	2.5	0	1					1000	0.5	165
PR_0_812_0	|Hingaia 1 sub-precinct B	Residential	Frontage		8	2	600	300	2.5	0	1					1000	0.5	165
PR_0_813_0	|Hingaia 1 sub-precinct C	Residential	Frontage		8	2	600	300	2.5	0	1					1000	0.5	165
PR_0_833_0	|Flat Bush sub-precinct D	Residential	Infill		12	4	650	325	2.5	1.2	1						0.5	
PR_0_834_0	|Flat Bush sub-precinct E	Residential	Infill		16	5	650	325	2.5	1.2	1						0.5	
PR_0_835_0	|Flat Bush sub-precinct F	Residential	Infill		9	3	650	325	2.5	1.2	1						0.5	
PR_0_865_0	|Waiwera sub-precinct C	Residential	Frontage		10.5	3	800	400	2.5	0	1					1000	0.4	165
PR_0_903_0	|Clarks Beach	Residential	Frontage	Sub-precinct not specially modelled as input data does not differentiate subprecincts	10	2	800	400	2.5	0	1				2	18	0.45	155
PR_0_905_0	|Glenbrook 3 sub-precinct A	Residential	Infill		8	2	2400	1200	2.5	1	1						0.35	
PR_0_914_0	|Opaheke 1	Residential	Infill	Sub-precinct not specially modelled as input data does not differentiate subprecincts	8	2	640	320	2.5	1	1						0.6	
PR_5_761_0	Rural precinct|Puhinui sub-precinct G	Residential	Infill		10	2	8000	4000	2.5	1	1						0.2	
PR_9_21	Business precinct|Kumeu sub-precinct C	Residen	Frontage		8	2	600	300	2.5	0	1						0.5	

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5_0		tial																
PR_9_230_0	Business precinct|Ellerslie 1 sub-precinct A	Residential	Frontage_Only		26	8	2200	1100	2.5	0	1				4	25	0.55	120
PR_9_231_0	Business precinct|Ellerslie 1 sub-precinct B	Residential	Frontage_Only		20	6	2200	1100	2.5	0	1				4	25	0.35	120
PR_9_232_0	Business precinct|Ellerslie 1 sub-precinct C	Residential	Frontage_Only		14	4	2200	1100	2.5	0	1				3	25	0.55	120
PR_9_243_0	Business precinct|New Lynn sub-precinct A	Residential	Frontage_Only		41	13	2400	1200	2.5	0	1				5	25	0.6	120
PR_9_687_0	Business precinct|Big Bay sub-precinct A	Residential	Infill		8	2	5000	2500	2.5	1	1						0.2	
PR_9_804_0	Business precinct|Grafton sub-precinct B	Residential	Frontage_Only		18	6	2400	1200	2.5	0	1				4	25	0.6	120
PR_9_805_0	Business precinct|Grafton sub-precinct C	Residential	Frontage_Only		16	5	2400	1200	2.5	3	1				5	25	0.5	120
PR_10_158_0	Residential precinct|Mangere 2	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
PR_10_179_0	Residential precinct|Beachlands 1	Residential	Infill		8	2	1600	800	2.5	2.5	1						0.3	
PR_10_203_0	Residential precinct|Rosella Road	Residential	Infill		5.5	1	800	400	2.5	3	1						0.2	
PR_10_206_0	Residential precinct|Greenhithe sub-precinct A	Residential	Infill		8	2	40000	20000	2.5	1.2	1						0.2	
PR_10_341_0	Residential precinct|Rodney Landscape sub-precinct A	Residential	Infill		8	2	4000	2000	2.5	6	1						0.2	
PR_10_342_0	Residential precinct|Rodney Landscape sub-precinct B	Residential	Infill		8	2	16000	8000	2.5	1	1						0.2	
PR_10_343_0	Residential precinct|Rodney Landscape sub-precinct C	Residential	Infill		8	2	8000	4000	2.5	6	1						0.2	
PR_10_344_0	Residential precinct|Rodney Landscape sub-precinct D	Residential	Infill		8	2	8000	4000	2.5	6	1						0.2	
PR_10_345_0	Residential precinct|Rodney Landscape sub-precinct E	Residential	Infill		8	2	8000	4000	2.5	6	1						0.2	
PR_10_346_0	Residential precinct|Rodney Landscape sub-precinct F	Residential	Infill		8	2	8000	4000	2.5	6	1						0.2	
PR_10_347_0	Residential precinct|Rodney Landscape sub-precinct G	Residential	Infill		8	2	8000	4000	2.5	6	1						0.2	
PR_10_348_0	Residential precinct|Rodney Landscape sub-precinct H	Residential	Infill		8	2	8000	4000	2.5	1	1						0.2	
PR_10_349_0	Residential precinct|Rodney Landscape sub-precinct I	Residential	Infill		8	2	8000	4000	2.5	1	1						0.2	
PR_10_372_0	Residential precinct|Penihana North sub-precinct A	Residential	Infill		8	2	2400	1200	2.5	1	1						0.35	
PR_10_373_0	Residential precinct|Penihana North sub-precinct B	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
PR_10_374_0	Residential precinct|Penihana North sub-precinct C	Residential	Frontage		8	2	800	400	2.5	0	1					2000	0.4	165

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PR_10_377_0	Residential precinct|Orewa 1 sub-precinct A	Residential	Frontage		10	3	600	300	2.5	0	1					6	0.27	155
PR_10_378_0	Residential precinct|Orewa 1 sub-precinct B	Residential	Frontage		13.2	4	600	300	2.5	0	1					6	0.49	155
PR_10_379_0	Residential precinct|Orewa 1 sub-precinct C	Residential	Frontage	Averaged zone height	13.2	4	600	300	2.5	0	1					6	0.27	155
PR_10_473_0	Residential precinct|Babich sub-precinct A	Residential	Infill	Not including Large Lot Zone	8	2	900	450	2.5	1	1						0.35	
PR_10_474_0	Residential precinct|Babich sub-precinct B	Residential	Infill		8	2	80000	40000	2.5	6	0						0.2	
PR_10_475_0	Residential precinct|Babich sub-precinct C	Residential	Infill		8	2	900	450	2.5	1	1						0.35	
PR_10_477_0	Residential precinct|Devonport Peninsula sub-precinct A	Residential	Frontage	Averaged zone height	13	4	800	400	2.5	0	1				2	18	0.4	155
PR_10_478_0	Residential precinct|Devonport Peninsula sub-precinct B	Residential	Frontage	Averaged zone height	11	3	800	400	2.5	0	1				2	18	0.4	155
PR_10_479_0	Residential precinct|Devonport Peninsula sub-precinct C	Residential	Frontage	Averaged zone height	12	4	800	400	2.5	0	1				2	18	0.4	155
PR_10_480_0	Residential precinct|Devonport Peninsula sub-precinct D	Residential	Frontage	Averaged zone height	11	3	800	400	2.5	0	1				2	18	0.4	155
PR_10_481_0	Residential precinct|Devonport Peninsula sub-precinct E	Residential	Frontage	Averaged zone height	11	3	800	400	2.5	0	1				2	18	0.4	155
PR_10_483_0	Residential precinct|Greenhithe sub-precinct B	Residential	Infill		8	2	1000	500	2.5	1.2	1						0.35	
PR_10_540_0	Residential precinct|Albany 3 sub-precinct A	Residential	Infill		8	2	2000	1000	2.5	1	1						0.35	
PR_10_541_0	Residential precinct|Albany 3 sub-precinct B	Residential	Infill		8	2	1400	700	2.5	1	1						0.35	
PR_10_542_0	Residential precinct|Albany 3 sub-precinct C	Residential	Infill		8	2	1000	500	2.5	1	1						0.35	
PR_10_563_0	Residential precinct|Devonport Peninsula sub-precinct F	Residential	Frontage	Averaged zone height	11	3	800	400	2.5	0	1				2	18	0.4	155
PR_10_604_0	Residential precinct|Franklin 2 sub-precinct A	Residential	Infill		10	3	600	300	2.5	0	1						0.5	155
PR_10_605_0	Residential precinct|Franklin 2 sub-precinct B	Residential	Frontage		13.5	4	600	300	2.5	0	1						0.5	155
PR_10_791_0	Residential precinct|Beachlands 1 sub-precinct A	Residential	Infill		8	2	1600	800	2.5	1	1						0.3	
PR_10_792_0	Residential precinct|Beachlands 1 sub-precinct B	Residential	Infill		8	2	1600	800	2.5	1	1						0.3	
PR_10_793_0	Residential precinct|New Lynn sub-precinct D	Residential	Frontage_Only		41	13	2400	1200	2.5	0	1				5	25	0.6	120
PR_10_875_0	Residential precinct|Patumahoe	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
PR_10_876_0	Residential precinct|Patumahoe sub-precinct A	Residential	Infill		8	2	1600	800	2.5	1	1						0.35	
PR_10_8	Residential precinct|Drury South Residential sub-	Residen	Frontage	Max retail 2500m2	10	3	800	400	2.5	0	1				2	18	0.4	155

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99_0	precinct A	tial															5	
PR_10_901_0	Residential precinct|Drury South Residential sub-precinct C	Residential	Frontage	Max retail 2500m2	10	3	800	400	2.5	0	1				2	18	0.45	155
PR_11_266_0	Comprehensive precinct|Whitford Village sub-precinct B	Residential	Infill		8	2	1300	650	2.5	1	1						0.35	
PR_11_276_0	Comprehensive precinct|Westgate sub-precinct D	Residential	Frontage_Only		32.5	8	2400	1200	2.5	0	1				3	25	0.5	120
PR_11_506_0	Comprehensive precinct|Matakana 1 sub-precinct B	Residential	Infill		8	2	1600	800	2.5	1	1						0.35	
PR_11_552_0	Comprehensive precinct|Kingseat sub-precinct A	Residential	Frontage		12	4	800	400	2.5	0	0					1000	0.5	165
PR_11_553_0	Comprehensive precinct|Kingseat sub-precinct B	Residential	Infill		8	2	900	450	2.5	1	1						0.35	
PR_11_554_0	Comprehensive precinct|Kingseat sub-precinct C	Residential	Frontage		8	2	800	400	2.5	0	1					1000	0.4	165
PR_11_710_0	Comprehensive precinct|Clevedon sub-precinct A	Residential	Infill		8	2	1000	500	2.5	1	1						0.35	
PR_11_711_0	Comprehensive precinct|Clevedon sub-precinct B	Residential	Infill		8	2	2000	1000	2.5	1	1						0.35	
PR_11_773_0	Comprehensive precinct|Kingseat sub-precinct F	Residential	Infill		8	2	3000	1500	2.5	1	1						0.25	
PR_11_774_0	Comprehensive precinct|Kingseat sub-precinct G	Residential	Infill		8	2	5000	2500	2.5	1	1						0.2	
PR_11_775_0	Comprehensive precinct|Mangere Gateway sub-precinct E	Residential	Frontage		15	5	800	400	2.5	0	0					1000	0.4	165
PR_11_837_0	Comprehensive precinct|Flat Bush sub-precinct H	Residential	Infill		8	2	1040	520	2.5	1	1					1000	0.35	165
PR_11_840_0	Comprehensive precinct|Flat Bush sub-precinct K	Residential	Infill		8	2	2000	1000	2.5	1	1						0.3	
PR_14_820_0	Coastal precinct|Hobsonville Marina sub-precinct A	Residential	Frontage_Only		12	4	2400	1200	2.5	0	0				3	25	0.6	120
PR_14_821_0	Coastal precinct|Hobsonville Marina sub-precinct B	Residential	Frontage		8	2	800	400	2.5	0	1				2	18	0.6	155
PR_14_822_0	Coastal precinct|Hobsonville Marina sub-precinct C	Residential	Frontage_Only		15	5	2400	1200	2.5	0	1				3	25	0.6	120
OV_SPCH_4540	SpecialCharacterOverlay||Residential Helensville|1	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4541	SpecialCharacterOverlay||Residential Isthmus A|2	Residential	Infill		8	2	2000	1000	2.5	1	1						0.35	
OV_SPCH_4542	SpecialCharacterOverlay||Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4543	SpecialCharacterOverlay|Epsom / Greenlane|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4544	SpecialCharacterOverlay|Herne Bay|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4545	SpecialCharacterOverlay|Mission Bay|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	

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OV_SPCH_4546	SpecialCharacterOverlay|Mt Albert|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4547	SpecialCharacterOverlay|Mt Roskill|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4548	SpecialCharacterOverlay|Otahuhu|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4549	SpecialCharacterOverlay|Parnell|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4550	SpecialCharacterOverlay|Remuera|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4551	SpecialCharacterOverlay|Remuera / Meadowbank|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4552	SpecialCharacterOverlay|St Heliers|Residential Isthmus B|3	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4553	SpecialCharacterOverlay|Mt Albert|Residential Isthmus C|4	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4554	SpecialCharacterOverlay|Mt Eden|Residential Isthmus C|4	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4555	SpecialCharacterOverlay|Remuera / Epsom|Residential Isthmus C|4	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4556	SpecialCharacterOverlay|Three Kings|Residential Isthmus C|4	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4572	SpecialCharacterOverlay||Residential General|29	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4576	SpecialCharacterOverlay||General Hill Park|36	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4577	SpecialCharacterOverlay||General Balmoral tram Suburb East|37	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4578	SpecialCharacterOverlay||General Foch Avenue and Haig Avenue|38	Residential	Infill		8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4579	SpecialCharacterOverlay||General Puhoi|39	Residential	Infill	No min size control introduced, apply RaCSZ rules as default	8	2	5000	2500	2.5	1	1						0.2	
OV_SPCH_4580	SpecialCharacterOverlay||Residential Balmoral Tram Suburb West|40	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4581	SpecialCharacterOverlay||Residential Pukehana Avenue|41	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4582	SpecialCharacterOverlay||Residential Early Links Road|42	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4583	SpecialCharacterOverlay||Residential Station Road Papatoetoe|43	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4584	SpecialCharacterOverlay||Residential Kings Road and Princes Avenue|44	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4585	SpecialCharacterOverlay||Residential North Shore Northcote Point|45	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPCH_4586	SpecialCharacterOverlay||Residential North Shore Devonport and Stanley Point|46	Residential	Infill	No min size control introduced, apply SHZ rules as default	8	2	1200	600	2.5	1	1						0.35	
OV_SPC	SpecialCharacterOverlay||Residential North Shore	Residen	Infill	No min size control introduced, apply SHZ rules	8	2	1200	600	2.5	1	1						0.3	

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H_4587	Birkenhead Point|47	tial		as default													5	
OV_SUBV_4679	SubdivisionVariationControl|Urban|Beachlands 700m2|5	Residential	Infill		8	2	1400	700	2.5	0	0						0.35	
OV_SUBV_4680	SubdivisionVariationControl|Urban|Buckland 800m2|7	Residential	Infill		8	2	1600	800	2.5	1	0						0.35	
OV_SUBV_4681	SubdivisionVariationControl|Urban|Clarks Beach 800m2|8	Residential	Infill		8	2	1600	800	2.5	1	0						0.35	
OV_SUBV_4682	SubdivisionVariationControl|Urban|Glenbrook Beach 800m2|9	Residential	Infill		8	2	1600	800	2.5	1	0						0.35	
OV_SUBV_4683	SubdivisionVariationControl|Urban|Herald Island 800m2|10	Residential	Infill		8	2	1600	800	2.5	1	0						0.35	
OV_SUBV_4684	SubdivisionVariationControl|Urban|Maraetai and Omana Beach 700m2|12	Residential	Infill		8	2	1400	700	2.5	1	0						0.35	
OV_SUBV_4685	SubdivisionVariationControl|Urban|Waiau Beach 800m2|14	Residential	Infill		8	2	1600	800	2.5	1	0						0.35	
OV_SUBV_4686	SubdivisionVariationControl|Urban|Point Wells 1000m2|18	Residential	Infill		8	2	2000	1000	2.5	1	0						0.35	
OV_SUBV_4687	SubdivisionVariationControl|Urban|Patumahoe 800m2|19	Residential	Infill		8	2	1600	800	2.5	1	0						0.35	
OV_SUBV_4688	SubdivisionVariationControl|Urban|Eastern Whangaparaora Peninsula 700m2|47	Residential	Infill		8	2	1400	700	2.5	1	0						0.35	
OV_SUBV_4707	SubdivisionVariationControl|Urban|Parau 4000m2|77	Residential	Infill		8	2	8000	4000	2.5	1	0						0.2	
OV_SUBV_4708	SubdivisionVariationControl|Urban|Huia 4000m2|78	Residential	Infill		8	2	8000	4000	2.5	1	0						0.2	
OV_SUBV_4709	SubdivisionVariationControl|Urban|Little Huia 4000m2|79	Residential	Infill		8	2	8000	4000	2.5	1	0						0.2	
OV_SUBV_4710	SubdivisionVariationControl|Urban|Karekare 4000m2|80	Residential	Infill		8	2	8000	4000	2.5	1	0						0.2	
OV_SUBV_4711	SubdivisionVariationControl|Urban|Piha 4000m2|81	Residential	Infill		8	2	8000	4000	2.5	1	0						0.2	
OV_SUBV_4712	SubdivisionVariationControl|Urban|Bethells / Te Henga 4000m2|82	Residential	Infill		8	2	8000	4000	2.5	1	0						0.2	
OV_SUBV_4713	SubdivisionVariationControl|Urban|Cornwallis 4000m2|83	Residential	Infill		8	2	8000	4000	2.5	1	0						0.2	
OV_SUBV_4714	SubdivisionVariationControl|Urban|Waimauku 800m2 serviced / 2500m2 unserviced|84	Residential	Infill		8	2	1600	800	2.5	1	0						0.35	
OV_SUBV_4715	SubdivisionVariationControl|Urban|Bombay 800m2 serviced / 2500m2 unserviced|85	Residential	Infill		8	2	1600	800	2.5	1	0						0.3	

Plan enabled capacity calculation look up table – Business

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	ASSESSMENT_SUBTYPE	Notes	ZONE_HEIGHT	ZONE_STOREYS	PSUEDOCODE	VAR_1	VAR_2	VAR_3	VAR_4	VAR_5	VAR_6
ZN_3_1	Business - Business Park Zone	Business	Commercial	Business Park		20.5	5							
ZN_3_5	Business - Heavy Industry Zone	Business	Industrial	Heavy Industry		20	5							
ZN_3_7	Business - Local Centre Zone	Business	Commercial	Local Centre		16	4							
ZN_3_10	Business - Metropolitan Centre Zone	Business	Commercial	Metropolitan Centre		72.5	20							
ZN_3_12	Business - Mixed Use Zone	Business	Commercial	Mixed Use		16	4							
ZN_3_17	Business - Light Industry Zone	Business	Industrial	Light Industry		20	5							
ZN_3_22	Business - Town Centre Zone	Business	Commercial	Town Centre	Height from AHCO									
ZN_3_35	Business - City Centre Zone	Business	Commercial	City Centre	Height from AHCO									
ZN_3_44	Business - Neighbourhood Centre Zone	Business	Commercial	Neighbourhood Centre		11	3							
ZN_3_49	Business - General Business Zone	Business	Commercial	General Business		16.5	4							
PR_0_76_0	|Tamaki	Business	Commercial	Mixed Use		24	6							
PR_0_592_0	|Lincoln sub-precinct B	Business	Commercial	Mixed Use	Residential activity permitted	20	5							
PR_0_629_0	|Manukau 2	Business	Commercial	General Business		24	6							0.5
PR_0_758_0	|Puhinui sub-precinct D	Business	Industrial	Light Industry		10	2							
PR_0_760_0	|Puhinui sub-precinct F	Business	Industrial	Light Industry		10	2							
PR_0_807_0	|Bombay 1 sub-precinct B	Business	Commercial	Neighbourhood Centre		7.5	1				5			
PR_0_864_0	|Waiwera sub-precinct B	Business	Commercial	Mixed Use		16	4							0.5
PR_0_867_0	|Clevedon Waterways sub-precinct B	Business	Commercial	Neighbourhood Centre		10	2							
PR_5_746_0	Rural precinct|Puhinui sub-precinct A	Business	Industrial	Light Industry		10	2							
PR_5_756_0	Rural precinct|Puhinui sub-precinct B	Business	Industrial	Light Industry		10	2							
PR_5_759_0	Rural precinct|Puhinui sub-precinct E	Business	Industrial	Light Industry		10	2							
PR_8_38_0	City centre precinct|Wynyard [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_39_0	City centre precinct|Port [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_41_0	City centre precinct|Viaduct Harbour [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_42_0	City centre precinct|Karangahape Road	Business	Commercial	City Centre	Height from AHCO and precinct model									

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	ASSESSMENT_SUB TYPE	Notes	ZONE_HEIGHT	ZONE_STOREYS	PSUEDOCODE	VAR_1	VAR_2	VAR_3	VAR_4	VAR_5	VAR_6
PR_8_43_0	City centre precinct|Queen Street Valley	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_45_0	City centre precinct|Cook Street Depot	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_46_0	City centre precinct|Victoria Park Market	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_47_0	City centre precinct|Quay Park	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_388_0	City centre precinct|Learning sub-precinct A	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_389_0	City centre precinct|Downtown West	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_394_0	City centre precinct|Viaduct Harbour sub-precinct A [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_395_0	City centre precinct|Viaduct Harbour sub-precinct B [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_396_0	City centre precinct|Wynyard sub-precinct A [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_397_0	City centre precinct|Wynyard sub-precinct B [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_398_0	City centre precinct|Wynyard sub-precinct C [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_399_0	City centre precinct|Wynyard sub-precinct D [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_400_0	City centre precinct|Wynyard sub-precinct E [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_401_0	City centre precinct|Wynyard sub-precinct F [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_402_0	City centre precinct|Wynyard sub-precinct G [rcp/dp]	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_414_0	City centre precinct|Quay Park sub-precinct A	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_587_0	City centre precinct|Britomart sub-precinct A	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_588_0	City centre precinct|Britomart sub-precinct B	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_845_0	City centre precinct|City Centre Residential	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_862_0	City centre precinct|Viaduct Harbour sub-precinct C	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_890_0	City centre precinct|Downtown West sub-precinct A	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_8_891_0	City centre precinct|Downtown West sub-precinct B	Business	Commercial	City Centre	Height from AHCO and precinct model									
PR_9_87_0	Business precinct|Albany Centre	Business	Commercial	Metropolitan Centre	No additional rules introduced by precinct plan for Albany Centre precinct, modelled as basezone	72.5	20							
PR_9_213_0	Business precinct|Kumeu sub-precinct A	Business	Commercial	Town Centre	Height from AHCO						3	2000		
PR_9_214_0	Business precinct|Kumeu sub-precinct B	Business	Commercial	Town Centre	Height from AHCO						1.2	2000		

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	ASSESSMENT_SUB TYPE	Notes	ZONE_HEIGHT	ZONE_STOREYS	PSUEDOCODE	VAR_1	VAR_2	VAR_3	VAR_4	VAR_5	VAR_6
PR_9_235_0	Business precinct|Hobsonville Corridor sub-precinct A	Business	Commercial	Mixed Use	No dwellings on ground floor	16	4							
PR_9_236_0	Business precinct|Hobsonville Corridor sub-precinct B	Business	Commercial	Local Centre		16	4							
PR_9_240_0	Business precinct|Albany Centre sub-precinct A	Business	Commercial	Metropolitan Centre		72.5	20				3			
PR_9_241_0	Business precinct|Albany Centre sub-precinct B	Business	Commercial	Metropolitan Centre		72.5	20							
PR_9_242_0	Business precinct|Albany Centre sub-precinct C	Business	Commercial	Metropolitan Centre		72.5	20				5			
PR_9_245_0	Business precinct|New Lynn sub-precinct C	Business	Commercial	Metropolitan Centre		72.5	20							
PR_9_357_0	Business precinct|Boat Building	Business	Industrial	Light Industry		9	2				5			0.2
PR_9_363_0	Business precinct|Takapuna 1 sub-precinct A	Business	Commercial	Metropolitan Centre		24.5	6							
PR_9_364_0	Business precinct|Takapuna 1 sub-precinct B	Business	Commercial	Metropolitan Centre		36.5	9							
PR_9_365_0	Business precinct|Takapuna 1 sub-precinct C	Business	Commercial	Metropolitan Centre	Height data added on Sep 27.2017	72.5	20						6:1	
PR_9_366_0	Business precinct|Takapuna 1 sub-precinct D	Business	Commercial	Metropolitan Centre		12.5	3							0.5
PR_9_386_0	Business precinct|Manukau	Business	Commercial	Metropolitan Centre	Sunlight admission applies, see model	72.5	20							
PR_9_447_0	Business precinct|Waiuku sub-precinct A	Business	Industrial	Light Industry		12	3					1000		
PR_9_448_0	Business precinct|Waiuku sub-precinct B	Business	Industrial	Light Industry		18	4							
PR_9_449_0	Business precinct|Waiuku sub-precinct C	Business	Industrial	Light Industry		9	2							
PR_9_500_0	Business precinct|Albany Centre sub-precinct D	Business	Commercial	Business Park	Setback from precinct lines	20.5	5							
PR_9_514_0	Business precinct|Silverdale 2	Business	Commercial	General Business		10	2				5	10000		
PR_9_535_0	Business precinct|Waiuku sub-precinct D	Business	Industrial	Light Industry		9	2							
PR_9_591_0	Business precinct|Lincoln sub-precinct A	Business	Industrial	Light Industry	Special height and height in relation to boundary not modelled	20	5							
PR_9_634_0	Business precinct|Lincoln sub-precinct C	Business	Commercial	Mixed Use	Special height and height in relation to boundary not modelled	16	4							
PR_9_670_0	Business precinct|Silverdale 3 sub-precinct A	Business	Commercial	General Business	Frontage control not modelled	16.5	4				4			
PR_9_745_0	Business precinct|Silverdale 3 sub-precinct C	Business	Commercial	General Business	Frontage control not modelled	16.5	4				4			
PR_9_751_0	Business precinct|Pukewairiki sub-precinct C	Business	Industrial	Light Industry		45	11							
PR_9_803_0	Business precinct|Grafton sub-precinct A	Business	Commercial	Mixed Use		30	7							
PR_9_863_0	Business precinct|Waiwera sub-precinct A	Business	Commercial	Mixed Use	Building exclusion area not included in master dataset, all area modelled	16	4							0.4

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	ASSESSMENT_SUBTYPE	Notes	ZONE_HEIGHT	ZONE_STOREYS	PSUEDOCODE	VAR_1	VAR_2	VAR_3	VAR_4	VAR_5	VAR_6
PR_9_889_0	Business precinct|Boat Building [rcp/dp]	Business	Industrial	Light Industry		9	2				5			0.2
PR_9_909_0	Business precinct|Highgate sub-precinct A	Business	Industrial	Light Industry		20	4				3			
PR_9_910_0	Business precinct|Highgate sub-precinct B	Business	Commercial	Neighbourhood Centre		11	3							
PR_9_911_0	Business precinct|Highgate sub-precinct C	Business	Commercial	Neighbourhood Centre		11	3							
PR_10_199_0	Residential precinct|Saint Heliers	Business	Commercial	Local Centre		12.5	3							
PR_10_606_0	Residential precinct|Franklin 2 sub-precinct Wesley	Business	Commercial	Local Centre		11	3							
PR_11_257_0	Comprehensive precinct|Mangere Gateway sub-precinct B	Business	Industrial	Light Industry		9	2					4000		
PR_11_258_0	Comprehensive precinct|Mangere Gateway sub-precinct C	Business	Industrial	Light Industry		9	2					2000		
PR_11_259_0	Comprehensive precinct|Mangere Gateway sub-precinct A	Business	Industrial	Light Industry		9	2					2000		
PR_11_265_0	Comprehensive precinct|Whitford Village sub-precinct A	Business	Commercial	Neighbourhood Centre		11	3							
PR_11_269_0	Comprehensive precinct|Takanini sub-precinct B	Business	Commercial	Local Centre		12	3							
PR_11_273_0	Comprehensive precinct|Westgate sub-precinct A	Business	Commercial	Metropolitan Centre		72.5	20							
PR_11_274_0	Comprehensive precinct|Westgate sub-precinct B	Business	Commercial	General Business		32.5	8							
PR_11_275_0	Comprehensive precinct|Westgate sub-precinct C	Business	Commercial	Mixed Use		32.5	8							
PR_11_277_0	Comprehensive precinct|Westgate sub-precinct E	Business	Commercial	Metropolitan Centre		72.5	20							
PR_11_507_0	Comprehensive precinct|Matakana 1 sub-precinct C	Business	Industrial	Light Industry		12	3							
PR_11_508_0	Comprehensive precinct|Matakana 1 sub-precinct D	Business	Commercial	Local Centre		12	3							
PR_11_555_0	Comprehensive precinct|Kingseat sub-precinct D	Business	Commercial	Local Centre		16	4							
PR_11_630_0	Comprehensive precinct|Westgate sub-precinct G	Business	Industrial	Light Industry		20	5							
PR_11_772_0	Comprehensive precinct|Kingseat sub-precinct E	Business	Industrial	Light Industry		20	5							
PR_11_787_0	Comprehensive precinct|Long Bay sub-precinct J	Business	Commercial	Local Centre		14	3				2			1
PR_11_788_0	Comprehensive precinct|Long Bay sub-precinct K	Business	Commercial	Local Centre		8	2							0.3
PR_11_806_0	Comprehensive precinct|Bombay 1 sub-precinct A	Business	Commercial	Neighbourhood Centre		7.5	1				5			

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	ASSESSMENT_SUB TYPE	Notes	ZONE_HEIGHT	ZONE_STOREYS	PSUEDOCODE	VAR_1	VAR_2	VAR_3	VAR_4	VAR_5	VAR_6
PR_14_857_0	Coastal precinct|Gabador Place [rcp\dp]	Business	Industrial	Light Industry		20	5							
OV_SPCH_4557	SpecialCharacterOverlay||Business Helensville|7	Business	Commercial	Town Centre		18	4		13	18				
OV_SPCH_4558	SpecialCharacterOverlay||Business Howick|9	Business	Commercial	Town Centre		9	2		9	13				
OV_SPCH_4559	SpecialCharacterOverlay||Business West Lynn|10	Business	Commercial	Local Centre		13	3							
OV_SPCH_4560	SpecialCharacterOverlay||Business Grey Lynn|11	Business	Commercial	Local Centre		13	3							
OV_SPCH_4561	SpecialCharacterOverlay||Business Upper Symonds Street|12	Business	Commercial	Town Centre		18	4		18	21				
OV_SPCH_4562	SpecialCharacterOverlay||Business Sandringham|13	Business	Commercial	Local Centre		13	3							
OV_SPCH_4563	SpecialCharacterOverlay||Business Balmoral|14	Business	Commercial	Local Centre		13	3							
OV_SPCH_4564	SpecialCharacterOverlay||Business Eden Valley|15	Business	Commercial	Local Centre		13	3							
OV_SPCH_4565	SpecialCharacterOverlay||Business Kingsland|16	Business	Commercial	Local Centre		13	3							
OV_SPCH_4566	SpecialCharacterOverlay||Business Onehunga|17	Business	Commercial	Town Centre		27	6							
OV_SPCH_4567	SpecialCharacterOverlay||Business Ponsonby|18	Business	Commercial	Town Centre		13	3							
OV_SPCH_4568	SpecialCharacterOverlay||Business Parnell|19	Business	Commercial	Town Centre		13	3							
OV_SPCH_4569	SpecialCharacterOverlay||Business Ellersllie|21	Business	Commercial	Town Centre		13	3							
OV_SPCH_4570	SpecialCharacterOverlay||Business Newmarket|25	Business	Commercial	Metropolitan Centre	Height from AHCO and precinct model									
OV_SPCH_4571	SpecialCharacterOverlay||Business Devonport|27	Business	Commercial	Town Centre		13	3		9	13				
OV_SPCH_4573	SpecialCharacterOverlay||Business Lower Hinemoa Street|33	Business	Commercial	Mixed Use		13	3							
OV_SPCH_4574	SpecialCharacterOverlay||Business Mt Eden Village|34	Business	Commercial	Mixed Use		13	3							
OV_SPCH_4575	SpecialCharacterOverlay||Business Otahuhu|35	Business	Commercial	Town Centre		13	3							

Plan enabled capacity calculation look up table – Special

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	SECOND_DWELLING	ZONE_HEIGHT	ZONE_STOREYS	DWG_MIN	DWG_MAX	FAR_MIN	FAR_MAX	GFA_MAX_M2	PSUEDOCODE	VAR_1	VAR_2	VAR_3
ZN_7_43	Hauraki Gulf Islands	Special	Rollover HGI		0											
ZN_8_4	Future Urban Zone	Special	Structural Plan		0											
PR_0_499_0	|Ardmore 2	Special	Structural Plan	Density control, I452.4.17	0	8	2		400							
PR_0_623_0	|Hillsborough	Special	Structural Plan	Building platform determined, I317.10.1	0											
PR_0_624_0	|Hillsborough sub-precinct A	Special	Structural Plan	Building platform determined, I317.10.1	0											
PR_0_625_0	|Hillsborough sub-precinct B	Special	Structural Plan	Building platform determined, I317.10.1	0											
PR_0_632_0	|Epsom	Special	Special Activity		0											
PR_0_638_0	|Akoranga 1	Special	Special Activity		0									18	30	
PR_0_672_0	|Red Beach	Special	Structural Plan	Maxiumum number of dwellings, I533.6.1	0	9	3		570							
PR_0_684_0	|Mount Wellington 5	Special	Special Activity		0	12	3									
PR_0_706_0	|Albany 9 sub-precinct A	Special	Special Activity		0	32.5	8									
PR_0_707_0	|Albany 9 sub-precinct B	Special	Special Activity		0	32.5	8									
PR_0_847_0	|Glenbrook Steel Mill	Special	Special Activity		0	20	5									
PR_0_848_0	|Okahu Bay [rcp]	Special	Special Activity		0											
PR_0_858_0	|Pinewoods	Special	Structural Plan	Maximum number of dwellings, I532.6.1	1	8	2		275							
PR_0_866_0	|Clevedon Waterways sub-precinct A	Special	Structural Plan	Maximum number of dwellings, I409.6.1	1	8	2		350							
PR_0_868_0	|Clevedon Waterways sub-precinct C	Special	Special Activity		0											
PR_0_869_0	|Clevedon Waterways sub-precinct D	Special	Special Activity	Table I409.4.4 Subdivision D/NC	0											
PR_0_880_0	|Hatfields	Special	Structural Plan	Maximum number and density of sites for dwellings, I511.6.2	0	8	2		58							
PR_0_881_0	|Kaipara Flats Airfield sub-precinct A	Special	Special Activity		0	15	3									
PR_0_882_0	|Kaipara Flats Airfield sub-precinct B	Special	Structural Plan	Maxiumum number of sites, I513.6.2.7	0	15	3		8							
PR_0_883_0	|Clevedon Waterways sub-precinct E	Special	Special Activity	.	0											
PR_0_887_0	|North Shore Airport	Special	Special Activity		0	15	3									

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	SECOND_DWELLING	ZONE_HEIGHT	ZONE_STOREYS	DWG_MIN	DWG_MAX	FAR_MIN	FAR_MAX	GFA_MAX_M2	PSUEDOCODE	VAR_1	VAR_2	VAR_3
PR_0_888_0	|St John's Theological College	Special	Special Activity		0									12	16	
PR_0_904_0	|Glenbrook 3	Special	Structural Plan	Density control, net area consists 60% of total area	1	8	2		823							
PR_3_12_0	Social Infrastructure precinct|Leigh Marine Laboratory	Special	Special Activity		0	10	2									
PR_4_20_0	Infrastructure precinct|HMNZ Dockyard	Special	Special Activity		0	12	3									
PR_4_211_0	Infrastructure precinct|Auckland Airport sub-precinct Core	Special	Special Activity	I402.6.12 height control	0											
PR_4_212_0	Infrastructure precinct|Auckland Airport sub-precinct Gateway	Special	Special Activity		0	20	5									
PR_4_295_0	Infrastructure precinct|Devonport Naval Base sub-precinct A	Special	Special Activity		0	9	2									
PR_4_296_0	Infrastructure precinct|Devonport Naval Base sub-precinct B	Special	Special Activity		0	12.5	3									
PR_4_870_0	Infrastructure precinct|Ardmore Airport sub-precinct Airport	Special	Special Activity		0	20	5					7500				
PR_4_871_0	Infrastructure precinct|Ardmore Airport sub-precinct Residential	Special	Special Activity		0	20	5									
PR_4_893_0	Infrastructure precinct|Auckland Airport sub-precinct Coastal [rcp]	Special	Special Activity		0	20	5									
PR_5_351_0	Rural precinct|Weiti sub-precinct A	Special	Structural Plan	Maximum number of dwellings, I 547.6.1	0	15	4		150							
PR_5_352_0	Rural precinct|Weiti sub-precinct B	Special	Structural Plan	Maximum number of dwellings, I 547.6.1	0	11	2		400							
PR_5_353_0	Rural precinct|Weiti sub-precinct C	Special	Special Activity		0	9	2									
PR_5_432_0	Rural precinct|Te Arai North	Special	Structural Plan	Maximum number fo dwellings and subdivisions, I541.6.1 and I541.6.2	0	8	2		43							
PR_5_433_0	Rural precinct|Te Arai South	Special	Structural Plan	Maximum number fo dwellings and subdivisions, I542.6.4 and I542.6.6	0	8	2		58							
PR_5_437_0	Rural precinct|Matakana 3	Special	Structural Plan	Building platform determined, H19.10.2 (2) other buildings - height of 15m	0	15	3									
PR_5_488_0	Rural precinct|Riverhead 3	Special	Structural Plan	H19.10.2 (1)	0	9	2		30							
PR_5_534_0	Rural precinct|Swanson North	Special	Structural Plan	Maximum number of sites, I611.11.1	0	9	2		24							
PR_5_537_0	Rural precinct|Kawau Island sub-precinct B	Special	Structural Plan	Modelling error, capacity calculation to be fixed in 2018	0	8	2		275							
PR_6_312_0	Maori purpose precinct|Orakei 2 sub-precinct A	Special	Special Activity		0											
PR_6_313_0	Maori purpose precinct|Orakei 2 sub-precinct B	Special	Special Activity		0											
PR_6_314_0	Maori purpose precinct|Orakei 2 sub-precinct C	Special	Special Activity		0											
PR_6_315_0	Maori purpose precinct|Orakei 2 sub-precinct D	Special	Special Activity		0											

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	SECOND_DWELLING	ZONE_HEIGHT	ZONE_STOREYS	DWG_MIN	DWG_MAX	FAR_MIN	FAR_MAX	GFA_MAX_M2	PSUEDOCODE	VAR_1	VAR_2	VAR_3
PR_6_316_0	Maori purpose precinct|Orakei 2 sub-precinct E	Special	Special Activity		0											
PR_6_317_0	Maori purpose precinct|Orakei 2 sub-precinct F	Special	Special Activity		0											
PR_8_48_0	City centre precinct|Learning	Special	Special Activity		0											
PR_8_49_0	City centre precinct|Arts, Civic and Entertainment	Special	Special Activity		0											
PR_8_390_0	City centre precinct|Central Wharves [rcp/dp]	Special	Special Activity		0											
PR_9_51_0	Business precinct|Karaka 1	Special	Special Activity		0	20	5									
PR_9_55_0	Business precinct|Saint Lukes	Special	Structural Plan	Site intensity, I330.6.1	0	20	5					92500				
PR_9_60_0	Business precinct|Smales 1	Special	Structural Plan	Maximum floor area, I538.6.1	0	20.5	5					162000				
PR_9_63_0	Business precinct|Central Park	Special	Structural Plan	I308.6.2.1 Height variations	0	20.5	5					114000				
PR_9_227_0	Business precinct|Chelsea sub-precinct A	Special	Special Activity		0											
PR_9_228_0	Business precinct|Chelsea sub-precinct B	Special	Special Activity		0											
PR_9_229_0	Business precinct|Chelsea sub-precinct C	Special	Special Activity		0											
PR_9_238_0	Business precinct|Smales 2 sub-precinct A	Special	Structural Plan	Maximum floor area, I539.6.1	0	15	3		68			45000				
PR_9_239_0	Business precinct|Smales 2 sub-precinct B	Special	Structural Plan	Maximum number of dwellings, I539.6.7	0				145							
PR_9_368_0	Business precinct|Ellerslie 2 sub-precinct A	Special	Structural Plan	Building platform determined	0	18	4					8952				
PR_9_369_0	Business precinct|Ellerslie 2 sub-precinct B	Special	Structural Plan	Building platform determined	0	25	6					13833				
PR_9_370_0	Business precinct|Ellerslie 2 sub-precinct C	Special	Special Activity		0											
PR_9_431_0	Business precinct|Wairaka	Special	Special Activity	I334.6.4 Height variations	0											
PR_9_458_0	Business precinct|Wairaka sub-precinct B	Special	Structural Plan	I334.6.4 Height variations	0	16	4					7500				
PR_9_489_0	Business precinct|Wairaka sub-precinct A	Special	Structural Plan	I334.6.4 Height variations	0	16	4					7500				
PR_9_579_0	Business precinct|Orakei Point sub-precinct A	Special	Structural Plan	I328.10.1 Height variations	0	16	4		700			10000				
PR_9_580_0	Business precinct|Orakei Point sub-precinct B	Special	Structural Plan	I328.10.1 Height variations	0	16	4					18000				
PR_9_581_0	Business precinct|Orakei Point sub-precinct C	Special	Structural Plan	I328.10.1 Height variations	0	16	4					9000				
PR_9_582_0	Business precinct|Orakei Point sub-precinct D	Special	Structural Plan	I328.10.1 Height variations	0	16	4					13000				

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	SECOND_DWELLING	ZONE_HEIGHT	ZONE_STOREYS	DWG_MIN	DWG_MAX	FAR_MIN	FAR_MAX	GFA_MAX_M2	PSUEDOCODE	VAR_1	VAR_2	VAR_3
PR_9_583_0	Business precinct|Orakei Point sub-precinct E	Special	Structural Plan	I328.10.1 Height variations	0	16	4					9000				
PR_9_584_0	Business precinct|Orakei Point sub-precinct F	Special	Structural Plan	I328.10.1 Height variations	0	16	4					15000				
PR_9_686_0	Business precinct|Three Kings	Special	Structural Plan	I333.10.2 Height variations	0	16	4		1500			2000				
PR_9_688_0	Business precinct|Big Bay sub-precinct B	Special	Structural Plan	Specific building area, I405.10.1	0	8	2		6							
PR_9_716_0	Business precinct|Sylvia Park sub-precinct A	Special	Structural Plan	Site intensity, I336.6.1	0	72.5	18					121390				
PR_9_717_0	Business precinct|Sylvia Park sub-precinct B	Special	Structural Plan	Site intensity, I336.6.1	0	50	12					83480				
PR_9_718_0	Business precinct|Sylvia Park sub-precinct C	Special	Structural Plan	Site intensity, I336.6.1	0	27	6					45130				
PR_9_768_0	Business precinct|Big Bay sub-precinct C	Special	Structural Plan	Specific building area, I405.10.1	0	8	2		5							
PR_9_853_0	Business precinct|Drury South Industrial sub-precinct D	Special	Special Activity		0											
PR_10_193_0	Residential precinct|Birdwood	Special	Structural Plan	Maximum number of subdivision, I602.10.1	0	8	2		110							
PR_10_195_0	Residential precinct|Mangere 1	Special	Special Activity		0	20	5									
PR_10_334_0	Residential precinct|Omaha South sub-precinct A	Special	Structural Plan	Total 600 dwellings, averaged between 5 sub-precincts	0	6	2		120							
PR_10_335_0	Residential precinct|Omaha South sub-precinct B	Special	Structural Plan	Total 600 dwellings, averaged between 5 sub-precincts	0	6	2		120							
PR_10_336_0	Residential precinct|Omaha South sub-precinct C	Special	Structural Plan	Total 600 dwellings, averaged between 5 sub-precincts	0	6	2		120							
PR_10_337_0	Residential precinct|Omaha South sub-precinct D	Special	Structural Plan	Total 600 dwellings, averaged between 5 sub-precincts	0	6	2		120							
PR_10_338_0	Residential precinct|Omaha South sub-precinct E	Special	Structural Plan	Total 600 dwellings, averaged between 5 sub-precincts	0	6	2		120							
PR_10_457_0	Residential precinct|Dairy Flat	Special	Structural Plan	Maximum number of subdivision, I506.10.1	1	8	2		77							
PR_10_538_0	Residential precinct|Mount Albert 2 sub-precinct A	Special	Structural Plan	Building platform determined	0	10	3									
PR_10_539_0	Residential precinct|Mount Albert 2 sub-precinct B	Special	Structural Plan	Building platform determined	0	10	3									
PR_10_659_0	Residential precinct|Huapai Triangle sub-precinct A	Special	Structural Plan	Huapai Triangle SHA rule, Table 2	0	10	3		452							
PR_10_660_0	Residential precinct|Huapai Triangle sub-precinct B	Special	Structural Plan	Huapai Triangle SHA rule, Table 2	0	10	3		185							
PR_10_661_0	Residential precinct|Huapai Triangle sub-precinct C	Special	Structural Plan	Huapai Triangle SHA rule, Table 2	0	10	3		152							
PR_10_662_0	Residential precinct|Huapai Triangle sub-precinct D	Special	Structural Plan	Huapai Triangle SHA rule, Table 2	0	10	3		171							
PR_10_663_0	Residential precinct|Huapai Triangle sub-precinct E	Special	Structural Plan	Huapai Triangle SHA rule, Table 2	0	10	3		116							

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	SECOND_DWELLING	ZONE_HEIGHT	ZONE_STOREYS	DWG_MIN	DWG_MAX	FAR_MIN	FAR_MAX	GFA_MAX_M2	PSUEDOCODE	VAR_1	VAR_2	VAR_3
PR_10_664_0	Residential precinct|Huapai Triangle sub-precinct F	Special	Structural Plan	Huapai Triangle SHA rule, Table 2	0	10	3		124							
PR_10_680_0	Residential precinct|Beachlands 2 sub-precinct A	Special	Special Activity	Specific development plan applies	0	RL47	2									
PR_10_681_0	Residential precinct|Beachlands 2 sub-precinct B	Special	Special Activity	Specific development plan applies	0	RL49.3	3									
PR_10_682_0	Residential precinct|Beachlands 2 sub-precinct C	Special	Special Activity	Specific development plan applies	0		3									
PR_10_693_0	Residential precinct|Matingarahi sub-precinct A	Special	Structural Plan	Maximum number of sites, I426.6.5	0	5	1		2							
PR_10_694_0	Residential precinct|Matingarahi sub-precinct B	Special	Structural Plan	Maximum number of sites, I426.6.5	0	5	1		18							
PR_10_695_0	Residential precinct|Matingarahi sub-precinct C	Special	Structural Plan	Maximum number of sites, I426.6.5	0	5	1		4							
PR_10_696_0	Residential precinct|Matingarahi sub-precinct D	Special	Structural Plan	Maximum number of sites, I426.6.5	0	5	1		1							
PR_10_697_0	Residential precinct|Matingarahi sub-precinct E	Special	Structural Plan	Maximum number of sites, I426.6.5	0	5	1		6							
PR_10_727_0	Residential precinct|Orewa 2 sub-precinct A	Special	Structural Plan	Density control, I530.6.1.1, 3500-5800 dwellings	0	8	2		725							
PR_10_728_0	Residential precinct|Orewa 2 sub-precinct B	Special	Structural Plan	Density control, I530.6.1.1, 3500-5800 dwellings	0	8	2		725							
PR_10_729_0	Residential precinct|Orewa 2 sub-precinct C	Special	Structural Plan	Density control, I530.6.1.1, 3500-5800 dwellings	0	8	2		725							
PR_10_730_0	Residential precinct|Orewa 2 sub-precinct D	Special	Structural Plan	Density control, I530.6.1.1, 3500-5800 dwellings	0	8	2		725							
PR_10_731_0	Residential precinct|Orewa 2 sub-precinct E	Special	Structural Plan	Density control, I530.6.1.1, 3500-5800 dwellings	0	8	2		725							
PR_10_732_0	Residential precinct|Orewa 2 sub-precinct F	Special	Structural Plan	Density control, I530.6.1.1, 3500-5800 dwellings	0	8	2		725							
PR_10_733_0	Residential precinct|Orewa 2 sub-precinct G	Special	Structural Plan	Density control, I530.6.1.1, 3500-5800 dwellings	0	8	2		725							
PR_10_734_0	Residential precinct|Orewa 2 sub-precinct H	Special	Structural Plan	Density control, I530.6.1.1, 3500-5800 dwellings	0	8	2		725							
PR_10_735_0	Residential precinct|Orewa 3 sub-precinct A	Special	Structural Plan	Maximum number of dwellings, I531.6.2	0	8	2		201							
PR_10_736_0	Residential precinct|Orewa 3 sub-precinct B	Special	Structural Plan	Maximum number of dwellings, I531.6.2	0	8	2		85							
PR_10_737_0	Residential precinct|Orewa 3 sub-precinct C	Special	Structural Plan	Maximum number of dwellings, I531.6.2	0	8	2		50							
PR_10_738_0	Residential precinct|Orewa 3 sub-precinct D	Special	Structural Plan	Maximum number of dwellings, I531.6.2	0	8	2		160							
PR_10_739_0	Residential precinct|Orewa 3 sub-precinct E	Special	Structural Plan	Maximum number of dwellings, I531.6.2	0	8	2		120							
PR_10_740_0	Residential precinct|Orewa 3 sub-precinct F	Special	Structural Plan	Maximum number of dwellings, I531.6.2	0	8	2		100							
PR_10_741_0	Residential precinct|Orewa 3 sub-precinct G	Special	Structural Plan	Maximum number of dwellings, I531.6.2	0	8	2		120							

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	SECOND_DWELLING	ZONE_HEIGHT	ZONE_STOREYS	DWG_MIN	DWG_MAX	FAR_MIN	FAR_MAX	GFA_MAX_M2	PSUEDOCODE	VAR_1	VAR_2	VAR_3
PR_10_743_0	Residential precinct|Martins Bay sub-precinct A	Special	Structural Plan	Density control, I520.6.1	0	8	2		58							
PR_10_744_0	Residential precinct|Martins Bay sub-precinct B	Special	Structural Plan	Density control, I520.6.1	0	8	2		6							
PR_10_769_0	Residential precinct|Waimana Point sub-precinct A	Special	Structural Plan	Rule I543.6.3	0	6	2		15							
PR_10_770_0	Residential precinct|Waimana Point sub-precinct B	Special	Structural Plan	Rule I543.6.3	0	6	2		16							
PR_10_771_0	Residential precinct|Waimana Point sub-precinct C	Special	Structural Plan	Rule I543.6.3	0	6	2		1							
PR_10_784_0	Residential precinct|Wattle Bay	Special	Structural Plan	Maximum number of sites, I440.6.2	0	8	2		12							
PR_10_796_0	Residential precinct|Red Beach sub-precinct A	Special	Structural Plan	Maximum number of dwellings, I533.6.1	0	5	1		150							
PR_10_797_0	Residential precinct|Red Beach sub-precinct B	Special	Structural Plan	Maximum number of dwellings, I533.6.1	0	5	1		210							
PR_10_798_0	Residential precinct|Red Beach sub-precinct C	Special	Structural Plan	Maximum number of dwellings, I533.6.1	0	5	1		210							
PR_10_801_0	Residential precinct|Whangaparaoa sub-precinct A	Special	Structural Plan	Max building coverage 11400, 2 storeys	0	10	3					22800				
PR_10_828_0	Residential precinct|Karaka North sub-precinct A	Special	Structural Plan	Maximum yield, I417.6.2	0	8	2		460							
PR_10_877_0	Residential precinct|Patumahoe sub-precinct B	Special	Structural Plan	Maximum number of dwellings, I430.6.8	0	8	2		24							
PR_10_878_0	Residential precinct|Patumahoe sub-precinct C	Special	Structural Plan	Maximum number of dwellings, I430.6.8	0	8	2		24							
PR_10_879_0	Residential precinct|Patumahoe sub-precinct D	Special	Structural Plan	Maximum number of dwellings, I430.6.8	0	8	2		25							
PR_10_908_0	Residential precinct|Millwater South	Special	Structural Plan	Density control, I550.6.1	0	9	3		663							
PR_11_267_0	Comprehensive precinct|Whitford Village sub-precinct C	Special	Structural Plan	Maximum density control, I442.6.2	1	8	2		105							
PR_11_287_0	Comprehensive precinct|Hobsonville Point sub-precinct A	Special	Structural Plan	Table I605.6.6.1.1 Height	0				274							
PR_11_288_0	Comprehensive precinct|Hobsonville Point sub-precinct B	Special	Structural Plan	Table I605.6.6.1.1 Height	0				120							
PR_11_289_0	Comprehensive precinct|Hobsonville Point sub-precinct C	Special	Structural Plan	Table I605.6.6.1.1 Height	0				1175							
PR_11_290_0	Comprehensive precinct|Hobsonville Point sub-precinct D	Special	Structural Plan	9.5 ha net area (approximately) 150/ha	0				1425							
PR_11_297_0	Comprehensive precinct|Alexandra Park	Special	Special Activity		0											
PR_11_415_0	Comprehensive precinct|Hobsonville Point sub-precinct E	Special	Structural Plan	21 ha net area (approximately) 150/ha	0	20.5	6		3150							
PR_11_450_0	Comprehensive precinct|Mangere Gateway sub-precinct D	Special	Special Activity	Future urban zone	0											
PR_11_558_0	Comprehensive precinct|Pine Harbour sub-precinct B	Special	Special Activity	Specific development plan applies	0		2									

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	SECOND_DWELLING	ZONE_HEIGHT	ZONE_STOREYS	DWG_MIN	DWG_MAX	FAR_MIN	FAR_MAX	GFA_MAX_M2	PSUEDOCODE	VAR_1	VAR_2	VAR_3
PR_11_559_0	Comprehensive precinct|Pine Harbour sub-precinct C	Special	Special Activity	Specific development plan applies	0		2									
PR_11_598_0	Comprehensive precinct|Bethells	Special	Structural Plan	Maximum number of dwellings, I601.6.4	0	8	2		10							
PR_11_612_0	Comprehensive precinct|Te Henga	Special	Structural Plan	Maximum number of subdivisions, I612.10.1	0	8	2		2							
PR_11_620_0	Comprehensive precinct|Wainamu	Special	Structural Plan	Maximum number of dwellings, I614.6.5	0	8	2		4							
PR_11_676_0	Comprehensive precinct|Pine Harbour sub-precinct D	Special	Special Activity	Specific development plan applies	0	12	4									
PR_11_677_0	Comprehensive precinct|Pine Harbour sub-precinct E	Special	Special Activity	Specific development plan applies	0	15	5									
PR_11_678_0	Comprehensive precinct|Pine Harbour sub-precinct F	Special	Special Activity	Specific development plan applies	0	9	3									
PR_11_679_0	Comprehensive precinct|Pine Harbour sub-precinct G	Special	Special Activity	Specific development plan applies	0	9	3									
PR_11_846_0	Comprehensive precinct|Hobsonville Point sub-precinct F	Special	Special Activity	Table I605.6.6.1.1 Height, I605.10.6	0											
PR_11_873_0	Comprehensive precinct|Oratia Village	Special	Structural Plan	Maximum floor area	0	8	2					1700				
PR_14_28_0	Coastal precinct|Mana Whenua Management [rcp]	Special	Special Activity		0											
PR_14_383_0	Coastal precinct|Rowing and Paddling [rcp]	Special	Special Activity		0											
PR_14_391_0	Coastal precinct|Waitemata Navigation Channel [rcp]	Special	Special Activity		0											
PR_14_444_0	Coastal precinct|Okahu Marine sub-precinct C [dp]	Special	Special Activity		0	9.5	2									
PR_14_463_0	Coastal precinct|Bayswater Marina sub-precinct A [rcp/dp]	Special	Special Activity		0	10	2									
PR_14_464_0	Coastal precinct|Bayswater Marina sub-precinct B [rcp/dp]	Special	Special Activity		0	12	3									
PR_14_465_0	Coastal precinct|Bayswater Marina sub-precinct C [rcp/dp]	Special	Special Activity		0	10	2									
PR_14_466_0	Coastal precinct|Bayswater Marina sub-precinct D [rcp/dp]	Special	Special Activity		0	10	2									
PR_14_467_0	Coastal precinct|Bayswater Marina sub-precinct E [rcp/dp]	Special	Special Activity		0	10	2									
PR_14_468_0	Coastal precinct|Bayswater Marina sub-precinct F [rcp/dp]	Special	Special Activity		0	10	2									
PR_14_576_0	Coastal precinct|Gulf Harbour Marina sub-precinct A [rcp]	Special	Special Activity		0	15	5									
PR_14_577_0	Coastal precinct|Gulf Harbour Marina sub-precinct B [rcp]	Special	Special Activity		0	12	4									
PR_14_715_0	Coastal precinct|Gulf Harbour Marina sub-precinct C [rcp]	Special	Special Activity		0	9	3									
PR_14_823_0	Coastal precinct|Hobsonville Marina sub-precinct D	Special	Special Activity	I604.6.1 Building height variations	0											

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	Notes	SECOND_DWELLING	ZONE_HEIGHT	ZONE_STOREYS	DWG_MIN	DWG_MAX	FAR_MIN	FAR_MAX	GFA_MAX_M2	PSUEDOCODE	VAR_1	VAR_2	VAR_3
PR_14_824_0	Coastal precinct|Hobsonville Marina sub-precinct E [rcp]	Special	Special Activity	I604.6.1 Building height variations	0											
PR_14_825_0	Coastal precinct|Hobsonville Marina sub-precinct F [rcp]	Special	Special Activity	I604.6.1 Building height variations	0											
PR_14_831_0	Coastal precinct|Okahu Marine sub-precinct A [rcp/dp]	Special	Special Activity		0	9.5	2									
PR_14_832_0	Coastal precinct|Okahu Marine sub-precinct B [rcp/dp]	Special	Structural Plan	Maximum floor space	0	9.5	2					8840	0	0	0	0
ZN_6_52	Special Purpose - Maori Purpose Zone	Special	Special Activity		0	10	2									
ZN_6_53	Special Purpose - Cemetery Zone	Special	Special Activity		0											
ZN_6_54	Special Purpose - Major Recreation Facility Zone	Special	Special Activity		0											
ZN_6_55	Special Purpose - Healthcare Facility and Hospital Zone	Special	Special Activity		0	35	9									
ZN_6_56	Special Purpose - Airports and Airfields Zone	Special	Special Activity		0											
ZN_6_63	Special Purpose - School Zone	Special	Special Activity		0	16	4									
ZN_6_64	Special Purpose - Tertiary Education Zone	Special	Special Activity		0	24	6									

Appendix E Plan enabled capacity calculation global assumption parameters

Global residential capacity calculation assumption

Assumption name	Assumption Value	Description	Components assumption used in
Minimum valid parcel size	100 m²	There are many small parcels across the region; these can include the likes of small parcels adjoining larger ones, vehicle access ways, pedestrian accesses etc. Such parcels are considered too small to realise any form of capacity as such parcels that are smaller than 100 m^2 were excluded from the modelling process. A further 'shape test' and some parcel attribute queries are also undertaken to remove access lots and the like with an area greater than the minimum valid parcel size.	All residential components
Infill and vacant potential demarcation threshold	2000 m²	A threshold of 2,000 m^2 was used as a demarcation point between infill and vacant potential. This allowed for the application of different densities on larger parcels. The 2000 m² demarcation threshold is consistent with previous studies.	Infill Vacant potential Redevelopment

Assumption name	Assumption Value	Description	Components assumption used in
Minimum building footprint area	50 m²	Buildings that are small, and therefore easily moved or removed should not be considered as a constraint to realising capacity; as such buildings that had a foot print that were smaller than 50 m^2 were excluded from the modelling process.	All residential components
Minimum dimension for a building/dwelling platform	11 m x 11 m (120 m²)	The plan specifies that each new vacant site be capable of containing a rectangle of eight metres by 15 metres (total of 120 m²). Note: Due to the practicality of geospatial modelling, we use a representation of a regular polygon (a square) of the same area (roughly 11 metres by 11 metres). This may result in some candidate areas with 'narrow' platforms failing to qualify that may otherwise pass a manual assessment, potentially balanced by 'squat' dwelling platforms that do pass that shouldn't have.	Infill
Parcel area minimum qualifier	Varies, refer LUT	Minimum size of the residential parcel to be assessed for infill type capacity. This is calculated as parcel area minimum plus the balance area minimum. However, under the PAUP this is always twice the minimum infill area, as both the infill candidate and the balance must meet the minimum parcel area requirements.	All residential components, but assumptions are zone specific. Refer LUT.

Assumption name	Assumption Value	Description	Components assumption used in
Parcel area minimum	Varies, refer LUT	Minimum size of the resultant residential parcel infill candidates	Infill, but assumptions are zone specific, Refer LUT
Parcel vehicle access width minimum	Varies, refer LUT, never less than minimum 2.5 m formed carriageway.	Minimum width between any existing building footprints (larger than the minimum building footprint area) and the parcel boundary, which would allow a vehicle to pass from the road to a non-frontage infill candidate.	Infill, but assumptions are zone specific, Refer LUT
Parcel building setback minimum	Refer LUT	Minimum (average) distance from any existing building footprint (larger than the minimum building footprint area) that infill development candidate areas can occur. This effectively operates as a yard from existing building footprints to ensure the new boundary is set back an appropriate distance (obviously impacting on the area that is available). Where no yards are required this can be set to zero. Where yards vary by boundary, an 'average' is created.	Infill, but assumptions are zone specific, Refer LUT.

Global business land capacity assumptions

Assumption name	Assumption Value	Description	Components where assumption used
Minimum valid parcel size	100 m^2	There are many small parcels across the region; these can include the likes of small parcels adjoining larger ones, vehicle access ways, pedestrian accesses etc. Such parcels are considered too small to realise any form of capacity as such parcels that are smaller than 100 m^2 were excluded from the modelling process. Note: Additional spatial testing for removing slivers is also undertaken.	Vacant land Vacant potential land
Minimum valid building footprint area	50 m^2	Buildings that are small, and therefore easily moved or removed should not be considered as a constraint to realising capacity; as such buildings that had a foot print that were smaller than 50 m^2 were excluded from the modelling process. Note: Where building footprints cross parcel boundaries, they are clipped to the underlying parcel - small portions of large buildings that lay across parcel boundaries may therefore be removed from assessment.	Vacant land Vacant potential land

Appendix F Solar view lookup table

Solar view look up table

Public space name	St Patrick's Square	Emily Place	Freyberg Place A	Freyberg Place B	Freyberg Place C	Aotea Square A	Aotea Square B	Albert Park A	Albert Park B	Albert Park C	Albert Park D	Myers Park A	Myers Park B	Old Government House	Queen Elizabeth Square	Aotea Square B Building Height Limited Cone
Sunlight requirement	All year Time between 12pm to 2pm	Seasonal Height Control	Height Control Cone	Seasonal Height Control	Seasonal Height Control	Seasonal Height Control	Seasonal and Height Control Cone	Seasonal Height Control	Seasonal Height Control	All year and seasonal height control	All year and seasonal height control	All year height control	All year height control	All year height control	Seasonal Height Control	Seasonal and Height Control Cone
Count_Times_to_Model	8	15	1	16	15	9	15	18	15	30	30	12	12	12	9	
All_Year_BuildingHeight_Cone_Plane			65	65												30
Time_Date_1	03-20-12:00	04-01-12:00	Baseline A	04-01-12:00	04-01-12:00	10-01-11:00	03-13-13:00	11-01-11:00	09-01-10:00	03-20-10:00	03-20-11:00	03-20-11:00	03-20-11:00	03-20-11:30	04-01-11:30	
Azimuth_1	359	358	297	358	358	18	335	21	36	44	24	24	24	13	29	360
Elevation_1	53	48	65	48	48	55	53	66	38	44	51	51	51	52	44	30
Time_Date_2	03-20-14:00	04-01-14:00		04-01-14:00	04-01-14:00	10-01-12:00	03-13-14:00	11-01-12:00	09-01-12:00	03-20-12:00	03-20-12:00	03-20-12:00	03-20-12:00	03-20-12:00	04-01-12:00	
Azimuth_2	316	318		318	318	351	314	344	357	359	359	359	359	359	358	
Elevation_2	44	39		39	39	56	46	67	45	53	53	53	53	53	48	
Time_Date_3	06-21-12:00	06-21-12:00		06-21-12:00	06-21-12:00	10-01-14:00	06-21-13:00	11-01-13:00	12-21-10:00	03-20-14:30	03-20-14:00	03-20-14:30	03-20-14:30	03-20-14:00	04-01-14:00	
Azimuth_3	358	358		358	358	308	343	314	67	308	316	308	308	316	318	
Elevation_3	30	30		30	30	43	28	60	63	39	44	39	39	44	39	
Time_Date_4	06-21-14:00	06-21-14:00		06-21-14:00	06-21-14:00	12-21-11:00	06-21-14:00	12-21-11:00	12-21-12:00	06-21-10:00	06-21-11:00	06-21-11:00	06-21-11:00	06-21-11:30	06-21-11:30	
Azimuth_4	328	328		328	328	41	328	41	349	28	14	14	14	8	8	
Elevation_4	23	23		23	23	73	23	73	76	24	28	28	28	29	29	
Time_Date_5	09-22-12:00	09-30-12:00		09-30-12:00	09-30-12:00	12-21-12:00	09-30-13:00	12-21-12:00	04-15-10:00	06-21-12:00	06-21-12:00	06-21-12:00	06-21-12:00	06-21-12:00	06-21-12:00	
Azimuth_5	353	352		352	352	349	327	349	35	358	358	358	358	358	358	
Elevation_5	52	55		55	55	76	51	76	37	30	30	30	30	30	30	
Time_Date_6	09-22-14:00	9-30-14:00		9-30-14:00	9-30-14:00	12-21-14:00	09-30-14:00	12-21-13:00	04-15-12:00	06-21-14:30	06-21-14:00	06-21-14:30	06-21-14:30	06-21-14:00	06-21-14:00	
Azimuth_6	312	309		309	309	286	309	307	357	322	328	322	322	328	328	
Elevation_6	41	43		43	43	59	43	70	43	19	23	19	19	23	23	

Public space name	St Patrick's Square	Emily Place	Freyberg Place A	Freyberg Place B	Freyberg Place C	Aotea Square A	Aotea Square B	Albert Park A	Albert Park B	Albert Park C	Albert Park D	Myers Park A	Myers Park B	Old Government House	Queen Elizabeth Square	Aotea Square B Building Height Limited Cone
Time_Date_7	12-21-12:00	10-01-11:00		10-01-11:00	10-01-11:00	03-31-11:00	10-01-11:00	01-31-11:00	10-01-09:00	09-22-10:00	09-22-11:00	09-22-11:00	09-22-11:00	09-22-11:30	09-22-11:30	
Azimuth_7	349	18		18	18	20	18	40	57	39	18	18	18	13	13	
Elevation_7	76	55		55	55	47	55	66	40	45	51	51	51	51.5	51.5	
Time_Date_8	12-21-14:00	10-01-12:00		10-01-12:00	10-01-12:00	03-31-12:00	10-01-12:00	01-31-12:00	10-01-12:00	09-22-12:00	09-22-12:00	09-22-12:00	09-22-12:00	09-22-12:00	09-30-12:00	
Azimuth_8	286	351		351	351	358	351	3	351	353	353	353	353	353	352	
Elevation_8	59	56		56	56	49	56	71	56	52	52	52	52	52	55	
Time_Date_9		10-01-14:00		10-01-13:00	10-01-13:00	03-31-14:00	10-01-14:00	01-31-13:00	10-01-14:00	09-22-14:30	09-22-14:00	09-22-14:30	09-22-14:30	09-22-14:00	9-30-14:00	
Azimuth_9		308		327	327	318	308	324	308	305	312	305	305	312	309	
Elevation_9		43		51	51	40	43	67	43	36	41	36	36	41	43	
Time_Date_10		12-21-11:00		12-21-11:00	12-21-11:00		12-21-11:00	10-01-11:00	12-21-09:00	12-21-10:00	12-21-11:00	12-21-11:00	12-21-11:00	12-21-11:30		
Azimuth_10		41		41	41		41	18	82	67	41	41	41	26		
Elevation_10		73		73	73		73	55	51	63	73	73	73	75		
Time_Date_11		12-21-12:00		12-21-12:00	12-21-12:00		12-21-12:00	10-01-12:00	12-21-12:00	12-21-12:00	12-21-12:00	12-21-12:00	12-21-12:00	12-21-12:00		
Azimuth_11		349		349	349		349	351	349	349	349	349	349	349		
Elevation_11		76		76	76		76	56	76	76	76	76	76	76		
Time_Date_12		12-21-14:00		12-21-13:00	12-21-13:00		12-21-14:00	10-01-12:30	12-21-14:00	12-21-14:30	12-21-14:00	12-21-14:30	12-21-14:30	12-21-14:00		
Azimuth_12		286		307	307		286	330	286	280	286	280	280	286		
Elevation_12		59		70	70		59	53	59	53	59	53	53	59		
Time_Date_13		03-31-11:00		03-31-11:00	03-31-11:00		03-12-11:00	12-21-11:00	03-15-09:00	08-01-9:30	08-15-10:00					
Azimuth_13		20		20	20		26	41	61	50	33					
Elevation_13		47		47	47		54	73	36	17	32					
Time_Date_14		03-31-12:00		03-31-12:00	03-31-12:00		03-12-12:00	12-21-12:00	03-15-12:00	08-01-12:00	08-15-12:00					
Azimuth_14		358		358	358		0	349	0	359	359					
Elevation_14		49		49	49		56	76	55	35	39					

Public space name	St Patrick's Square	Emily Place	Freyberg Place A	Freyberg Place B	Freyberg Place C	Aotea Square A	Aotea Square B	Albert Park A	Albert Park B	Albert Park C	Albert Park D	Myers Park A	Myers Park B	Old Government House	Queen Elizabeth Square	Aotea Square B Building Height Limited Cone
Time_Date_15		03-31-14:00		03-31-13:00	03-31-13:00		03-12-14:00	12-21-12:30	03-15-14:00	08-01-15:00	08-15-14:30					
Azimuth_15		318		336	336		314	328	314	314	317					
Elevation_15		40		46	46		47	73	46	20	27					
Time_Date_16				Baseline B				03-15-11:00		12-21-9:30	12-21-10:00					
Azimuth_16				191				25		86	67					
Elevation_16				65				53		46	63					
Time_Date_17								03-15-12:00		12-21-12:00	12-21-12:00					
Azimuth_17								0		349	349					
Elevation_17								55		76	76					
Time_Date_18								03-15-12:30		12-21-15:00	12-21-14:30					
Azimuth_18								348		274	280					
Elevation_18								54		47	53					
Time_Date_19										04-30-09:30	04-30-10:00					
Azimuth_19										51	31					
Elevation_19										21	32					
Time_Date_20										04-30-12:00	04-30-12:00					
Azimuth_20										356	356					
Elevation_20										38	38					
Time_Date_21										04-30-15:00	04-30-14:30					
Azimuth_21										310	316					
Elevation_21										21	25					
Time_Date_22										10-01-09:30	10-01-09:00					

Public space name	St Patrick's Square	Emily Place	Freyberg Place A	Freyberg Place B	Freyberg Place C	Aotea Square A	Aotea Square B	Albert Park A	Albert Park B	Albert Park C	Albert Park D	Myers Park A	Myers Park B	Old Government House	Queen Elizabeth Square	Aotea Square B Building Height Limited Cone
Azimuth_22										52	57					
Elevation_22										45	40					
Time_Date_23										10-01-12:00	10-01-12:00					
Azimuth_23										351	351					
Elevation_23										56	56					
Time_Date_24										10-01-16:00	10-01-15:00					
Azimuth_24										283	294					
Elevation_24										22	33					
Time_Date_25										12-21-09:30	12-21-09:00					
Azimuth_25										86	82					
Elevation_25										46	51					
Time_Date_26										12-21-12:00	12-21-12:00					
Azimuth_26										349	349					
Elevation_26										76	76					
Time_Date_27										12-21-16:00	12-21-15:00					
Azimuth_27										265	274					
Elevation_27										35	47					
Time_Date_28										03-15-09:30	03-15-09:00					
Azimuth_28										53	61					
Elevation_28										41	36					
Time_Date_29										03-15-12:00	03-15-12:00					
Azimuth_29										0	0					
Elevation_29										55	55					

Public space name	St Patrick's Square	Emily Place	Freyberg Place A	Freyberg Place B	Freyberg Place C	Aotea Square A	Aotea Square B	Albert Park A	Albert Park B	Albert Park C	Albert Park D	Myers Park A	Myers Park B	Old Government House	Queen Elizabeth Square	Aotea Square B Building Height Limited Cone
Time_Date_30										03-15-16:00	03-15-15:00					
Azimuth_30										287	299					
Elevation_30										25	36					

Appendix G ent capacity models lookup tables

Auckland Council (Feasible Residential) Development Capacity Models

Look Up Tables

As used in ACDC and GF-ACDC v3.9 (Feasibility) Models

(as used for inaugural National Policy Statement: Urban Development Capacity

Housing and Business Assessment, December 2017)

INTRODUCTION

The Auckland Council Development Capacity Model (**ACDC**) is an FME[26] based model that attempts to replicate a commercial developers site scale development feasibility process using information about urban zone plan enabled opportunities for residential development (capacity) as supplied to it by the Capacity for Growth Study (**CfGS**) Model.

This document outlines the detailed look up tables (**LUT**'s) utilised by the ACDC Model version 3.9 which are Excel tables that can be manually varied to test the effect of changes in typology, floorspace, costs and prices on the feasibility of input plan enabled capacity to be commercially realisable given the assumed market (including the price of completed dwellings and the costs of inputs required to create them including development sites, building materials and labour and council related costs and fees) .

Variations to zoning or capacity (including spatial application of the zoning) must however be first supplied to the CfGS Model to calculate and supply to the ACDC model the appropriate parcel level data.

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[26] Feature Manipulation Engine, an increasingly popular spatially enabled data transformation software package developed by Safe Software www.safe.com

SUMMARY OF MODEL

The model has been designed and used to test the potential implications for 'average' development commercial feasibility of variation in planning provisions from the perspective of an 'average' commercially oriented residential developer.

The model uses an approach which is largely 'typical behaviour based' and 'instantaneous' and produces a measurement (not a forecast!) of the potential for commercially feasible development in this instant by the developer 'actors, which the model attempts to simulate.

In effect the model assesses, if it is commercially viable to undertake a development in accordance with the rule parameters being tested given current prices and costs. This is not an indication of development definitely occurring either now, or soon, but rather a further filter on plan enabled capacity indicating a cascade of probability from highly possible to not very. Given a population of 'all sites', we assume that sites with plan enabled capacity have a higher probability of development than sites without plan enabled opportunities, and of those with plan enabled potential, where that potential is feasible are more likely to have that potential realised than those that do not. In other words the assessment is probabilistic, not deterministic.

The model instantaneously assess all available sites with capacity, against a variety of pre-calibrated development options and calculates the likely commercial return of those development son them at the same instant in time. Clearly not all of these developments will be built under these conditions even if it was physically possible to do so. The outputs therefore are not a 'growth forecast' but rather a more refined or filtered version of plan enabled capacity that is a measure of the opportunities for the development market to deliver under 'todays' conditions presuming also that the planning rules and zoning being tested also applied. Considerations of other instants and other actors might require different approaches, including the extension of the results into a forecast also requiring consideration of the potential effect on the n+1 th supplier given the nth suppled dwelling and subsequent demand interactions on prices and costs.

The **'actors'** whose decision making process the model attempts to replicate is an 'average developer' who builds and sells dwellings on the sites with dwelling capacity within the model in accordance with the parameters set by the LUTs around costs and prices – specific site conditions are accounted for by influencing the input capacity and development options, and also land values, site conditions, various costs to overcome constraints, and, expected sale prices.

The model is 'instantaneous' in two ways –

Firstly, the costs and prices are fixed by the LUT as at the time of LUT construction. For this assessment, Land, Improvement and overall development site costs are based on the June 2014 Valuations with sales locations based 'factoring' to inflate the land component from 2014 to mid-2017. Future runs will be updated with the June 2017 valuations, which will also be refined by the objections process at this time. Some adjustment for the number of owners representing a transaction cost of dealing with multiple owners and the potential for hold outs is also made, recognising that multiple owned properties are more difficult and costly to acquire.

Secondly, the expected costs and prices do not vary in response to ‘supply’ (being feasible developments produced from other sites within the model irrespective of if this is low or high) or ‘demand’ – which is entirely exogenous to the model – if the development option on the particular site in front of the models ‘average developer’ will return more than 20% on costs (or wherever the feasibility threshold happens to be set), then the site is reported as being commercially feasible by the model.

In this sense the model is very strongly a ‘commercial’ model – testing the relative attractiveness for development of sites tested against all the other sites that are tested – it is NOT an ‘economic’ model (which would account for all of the individual suppliers actions in consideration of both the actions of consumers AND other suppliers) , nor can the feasibility output be considered a ‘forecast’ – it is a measure of sites passing our thresholds given an instantaneous assessment – in reality developers will be cognisant of the demand and supply situations within which they operate and the costs, prices and market reponse rarely remains static particularly over 30 years.

The outputs of the model may be considered as an instantaneous supply curve – demand is considered only implicitly in the model by way of consideration of the expected sale price, or externally by comparing a quantum of demand (over some time period) against the instantaneous supply.

However the outputs of this ‘commercial’ modelling will provide for a much refined filtering of potential development outcomes than the CfGS provides (being the totality of the opportunities provided by regulation) and further more dynamic economic modelling and analysis that can account for these complex interactions, including over time can be undertaking using this information.

ACDC Model.

The model is developed and run in FME 2015 SP1 software. Input parcel capacity data is input as a filegeodatabase (a polygon geometry representing the shape of the parcel, and an attribute table associated with the details about the parcel) and filtered to different development building pathways depending on zoning, each parcel with capacity (infill or redevelopment) is then cloned, once for each of the typologies to be tested, and each clone is allocated a specific development option and its associated costs and prices to calculate feasibility. The individual parcel clones developments are then filtered for feasibility, those that are feasible (return greater than minimum threshold) are ranked according to the feasibility scenario, such as maximum percentage return or cheapest dwellings. On sites with a single feasible option that same development will occur in all scenarios, on those with multiple feasible developments will vary.

FME uses the 'Joiner' transformer to attach the appropriate value based on Typology and Sales Location Category from the relevant Lookup Table (LUT) to each parcel (or parcel clone) passing though the model. This report outlines the LUTs that are joined, and a brief description of their function.

The Model undertakes its operations in three key stages, each with its own workbench.

1. **Stage 1**: Feasibility Calculations (this calculates the feasibility of each of the 9 development typologies possible within the zone and practical limits of the parcel per infill or redevelopment opportunity identified by the CfGS)
2. **Stage 2**: Parcel Filtering (this step removes parcels for various non-zoning reasons such as HNZC ownership or existing uses)
3. **Stage 3**: Scenario Choosing (this step choses from the (upto) 18 development options per site, a single feasible development (or none if none are feasible) that best matches the Scenario. Maximum Return (highest gross profit) to the developer is used as the 'default' in most results reporting as this will generally reflect a developers first choice option, however the other scenarios provide an indication of the scope for the market to deliver alternate, still feasible development opportunities.

Figure 1 below illustrates the FME workbench for Stage 1, with numbers relating to each Joiner and LUT in the order in which they are tagged to each parcel.

The following sections of this memo contain the relevant Lookup Tables as they have been utilised in Version 3.8 of the model

Figure 1: ACDCv3.8 Model Workbench: Primary FDC Model with LUT joiner locations in workflow order of join

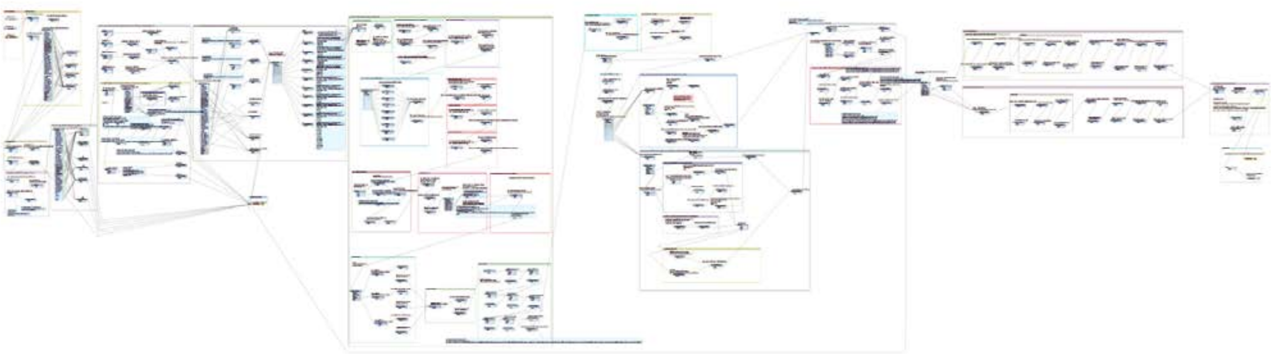


Table 1: LUT Joiners

Change from v3.7	Joiner Flow Order	Joiner ID	Group	LUT	Joined on Attribute	Establishes	Reason to Update?
	1	0	Sales (Location)	Sales_Location_Category_LUT.xlsx	CAU	Sales Location Category (SLC)	Changes to spatial distributions of dwelling prices
	2	12	Sales (Price)	Sales_PriceCeilings_LUT.xlsx	SLC (1-10)	Reference Price Ceiling for 'standard' dwelling in SLC	Changes to price distributions of dwelling sales
	3	13	Floorspace	Typology_Matrix_Code_LUT	Built Form ID (1-9)	Establish 9 Typologies (SML, HTA)	
	4	4	Floorspace	FloorspaceTypologyCode_LUT.xlsx	FDC_Floorspace_Typology_Initial (A1 - K15)	FDC_Floorspace_typology_Initial	Changes to rules
	5	18	Floorspace	FloorspaceTypologyCode_BuildCosts_LUT	FDC_Floorspace_Typology_Initial (A1 - K15)	FDC_Dwelling Typology Code (A-K), by 9 Locations	
	6	19, 8, 10, 20, 21, 22, 23, 24, 25	Floorspace	FloorspaceArea_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	Based on the Built Form ID, each dwelling form/parcel clone has a floorspace table	Changes to rules
NEW!	7	9	Floorspace	FloorspaceBuiltForm_Density_LUT	FDC_DwellingFloorspace_Typology_Code	Max Storeys, Building Coverage, Imperviousness and Density based on zoning and typoology	Changes to Rules
NEW!	8	28	Floorspace	FloorspaceBuiltForm_FAR_LUT	FDC_DwellingFloorspace_Typology_Code	Maximum practical/rule limited FAR	Changes to Rules
	9	27	Floorspace	FloorspaceBuiltForm_SLFactor_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	FDC_BuiltForm_Factor - Adjustment factor for XXX based on typology	
	10	2	Costs	Costs_ProfFees_LUT.xlsx	FDC_dwelling_typology_code	Per unit and site % fees	Changes to costs (time)
	11	3	Costs	Costs_Demolition_LUT.xlsx	FDC_dwelling_typology_code	Single Unit demo Cost and multiunit multiplier factors	Changes to costs (time)
MAJOR AMENDMENT	12	6	Costs	Costs_DCsandConnections_LUT.xlsx	FDC_BuiltForm (Apartment, House, Terrace)	DCs (HUE and SW/m2) and Phone and Power Connections	Changes to costs (time) or changes to DC Policy
	13	15, 16, 17	Costs	Costs_FSBuild_**<size>**_LUT.xlsx	FDC_Dwellignfloorspace_BuildCost_Typology_Code	One Table for each S, M, L based on location	Changes to costs (time)
	14	5	Costs	Costs_SiteCivil_LUT.xlsx	FDC_dwelling_typology_code	Site Civil Costs per site m2	Changes to costs (time)
	15	7	Costs	Costs_Constraints_LUT.xlsx	FDC_dwelling_typology_code	Site costs related to intersection with constraints	Changes to costs (time) and constraints
	16	14	Sales (Price)	Sales_PriceCeiling_Factor_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	Adjustment to standard dwelling ceiling based on typology	Changes to price distributions of dwelling sales
	17	11	Sales (Price)	Sales_PriceFS_LUT.xlsx	FDC_Dwelling_BuildCost_Typology_Code	Sale Price per m2 based on location and typology	Changes to price distributions dwelling sales
NEW!	18	26	Costs	Costs_SiteCV_Adjustment_LUT.xlsx	SLC (1-10)	Developable Site costs to model to account for difference between LCV and modelling date	Changes to costs (time), price and spatial distributions of dwelling sales

Table 2: LUT Details and relationships

Group	LUT	Joined on Attribute	ROWS by	COLUMNS by	Establishes
Sales (Location)	Sales_Location_Category_LUT.xlsx	CAU 2013	CAU 2013	Single SLC Value	Sales Location Category (SLC)
Sales (Price)	Sales_PriceCeilings_LUT.xlsx	SLC (1-10)	SLC	Sale Price Min & Max	Reference Price Ceiling for 'standard' dwelling in SLC
Floorspace	Typology_Matrix_Code_LUT	Built Form ID (1-9)	FDC_Built_Form_ID	Size, Type and NameType	Establish 9 Typologies (SML, HTA)
Floorspace	FloorspaceTypologyCode_LUT.xlsx	FDC_Floorspace_Typology_Initial (A1 - K15)	FDC_Floorspace_Typology_Initial	FDC_Built_Form_ID	FDC_Dwelling Typology Code (A-K), by 9 Locations AND FDC_Dwelling_Floorspace_Typology_Code (Ax-Kx)
Floorspace	FloorspaceTypologyCode_BuildCosts_LUT	FDC_Floorspace_Typology_Initial (A1 - K15)	FDC_Dwelling Typology Code	FDC_Built_Form_ID	FDC_Dwelling FloorspaceTypology Code (A-K), by 9 Locations
Floorspace	FloorspaceArea_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	FDC_DwellingFloorspace_Typology Code	**SLC, with a sheet for each FDC_Built_Form_ID**	Based on the Built Form ID, each dwelling form/parcel clone has a floorspace table
Floorspace	FloorspaceBuiltForm_Density_LUT	FDC_DwellingFloorspace_Typology_Code	FDC_DwellingFloorspace_Typology Code	FDC_Built_Form_ID	Max Storeys, Building Coverage, Imperviousness and Density based on zoning and typoology
Floorspace	FloorspaceBuiltForm_FAR_LUT	FDC_DwellingFloorspace_Typology_Code	FDC_DwellingFloorspace_Typology Code	FDC_Built_Form_ID	Maximum practical/rule limited FAR
Floorspace	FloorspaceBuiltForm_SLFactor_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	FDC_DwellingFloorspace_Typology Code	SLC	FDC_BuiltForm_Factor - Adjustment factor for XXX based on typology
Costs	Costs_ProfFees_LUT.xlsx	FDC_dwelling_typology_code	FDC_Dwelling Typology Code & SLC	Fee Category	Per unit and site % fees
Costs	Costs_Demolition_LUT.xlsx	FDC_dwelling_typology_code	FDC_Dwelling Typology Code	SLC	Single Unit demo Cost and multiunit multiplier factors
Costs	Costs_DCsandConnections_LUT.xlsx	FDC_BuiltForm (Apartment, House, Terrace)	FDC_Dwelling Typology Code (by Dwelling Type; House, Terrace Apartment)	Fee Category	DCs (HUE and SW/m2) and Phone and Power Connections
Costs	Costs_FSBuild_**<size>**_LUT.xlsx	FDC_Dwellignfloorspace_BuildCost_Typology_Code	FDC_Dwelling Typology Code (By Dwelling Size; Small, Medium, Large).	SLC	One Table for each S, M, L based on location
Costs	Costs_SiteCivil_LUT.xlsx	FDC_dwelling_typology_code	FDC_Dwelling Typology Code	SLC	Site Civil Costs per site m2
Costs	Costs_Constraints_LUT.xlsx	FDC_dwelling_typology_code	FDC_Dwelling Typology Code	Fee Category	Site costs related to intersection with constraints
Sales (Price)	Sales_PriceCeiling_Factor_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	FDC_DwellingFloorspace_Typology Code	FDC_Built_Form_ID	Adjustment to standard dwelling ceiling based on typology
Sales (Price)	Sales_PriceFS_LUT.xlsx	FDC_Dwelling_BuildCost_Typology_Code	FDC_DwellingFloorspace_Typology Code	SLC	Sale Price per m2 based on location and typology
Costs	Costs_SiteCV_Adjustment_LUT.xlsx	SLC (1-10)	CfGS_Dwelling Typology Code	SLC	Developable Site costs to model to account for difference between LCV and modelling date, set by current zoning (i.e. use CfGS Codes)

1 Sales_Location_Category_LUT.xlsx

This LUT is a list of all CAUs in Auckland Region tagged with a 'Sales Location Category' and a 'GF_Sales_Location_Category' from 1 to 10 inclusive.

This works in conjunction with the Sales_PriceCeiling_LUT in the next section.

The 'reference development' is a 'standard' house on a 600m2 section. Values are based on recent sales (past 2 years) of standalone dwellings, but manually adjusted for various known anomalies including lack of standalone dwelling sales (e.g. CBD) and inflated average prices due to greenfields developments (e.g. Flat Bush). A variation from v3.8 is the addition of a 'GF_Sales_Location_Category' which is used in the GF_ACDC Model for its modelling, which explicitly recognises this anomaly, and 'fixes it', but in the reverse, in that the inflated sales prices from new dwellings in Flat Bush is entirely appropriate basis to assess the price and therefore size, fit and finish of dwellings that are being constructed in the 'all new' greenfields areas as a separate 'market' to the average sale price of 'second hand dwellings' that new developments in existing built up areas in the same CAU are selling into. This partially reflect the nature of CAUs being based on the existing situation, rather than boundaries that may be useful for planning.

Sales Location Categories from v3.8 have been reused, reflecting the narrative that prices have risen since mid 2016 but fallen back to essentially the same point they were in the previous assessment.

A new Field, GF_Sales_Location_Categories are set using average sale prices of NEW dwellings from TradeMe, real estate sites , major developer websites and advertising, Sales Audit File (from Rates) and other information on current asking and sales prices, which are then classified against the Sales Locaiton Category Price Ceiling LUT min and max ranges. As a general rule, the GF Sales Location Category is higher than the 'other half' of the CAU, sometimes several steps higher. This may reflect a potentially over inflated greenfields market, or an under estimated adjoining urban area assumption. The GF vs existing SLC differential is most noticeable in outer edge and rural town peripheries. The GF Sales Location Categories are only used by the GF_ACDC Model but all CAUs have been classified.[27]

Sales Location Category 1 Locations are areas where the lowest average expected sales values in the region would be expected, Sales Location Category 10 locations are those where the highest sales values would be expected for an 'average' standalone dwelling.

The Central and East Coastal areas are typically higher value with prices decreasing by distance from these areas, largely reflecting the underlying land value per m2 patterns – these reflect where the market has determined that access to amenities is highest, and therefore dwellings tend to sell for more, all else being equal. The predominant amenities are generally accepted to be proximity to

[27] A GF_ACDC model run has been undertaking using the 'normal' SLC reported as the 'Falling Market' Scenario

the CBD and views of the Hauraki Gulf. Other more localised factors do also play a role in providing texture to the land value patterns, including school zoning (the Double Grammar Zone effect), localised views and access to smaller centres or transport.[28] These highly specific locational issues are somewhat smoothed (lost) by the CAU level price settings.

Pockets of low sale price areas within the urban areas are concentrated in South Auckland and to a lesser degree West Auckland, and some of the remoter areas.

A sample table (the actual table is over 500 rows) is shown in Table 3 below, and maps showing the Categorisation for both ACDC and GFACDC (highlighting the CAUs that apply) are shown in Figure 2 and 3 below.

Table 3 Extract from Sales Location Category LUT (EXAMPLE ONLY)

CAU_2013_name	Sales_Location_Category	GF_Sales_Location_Category
Wellsford	1	2
Leigh	4	4
Warkworth	3	4
Waimauku	4	6
Huapai	3	7
Riverhead Urban	3	7
Kumeu East	3	6
Kumeu West	3	8
Waipareira West	3	10
Waiwera	2	3
Hatfields Beach	4	8
Orewa	5	6
Silverdale Central	6	7
Red Beach West	4	5
Red Beach East	5	6
Manly	5	5

[28] For more on the potential factors driving variation in house prices due to amenities see also Nunns, Peter, Hitchins, Hadyn and Balderston, Kyle (2015). *The value of land, floorspace and amenities: a hedonic price analysis of property sales in Auckland 2011-2014*. Auckland Council technical report, TR2015/012 and Nunns, P., Allpress, J and Balderston, K (2016). *How do Aucklanders value their parks? A hedonic analysis of the impact of proximity to open space on residential property values*. Auckland Council technical report, TR2016/031.

CAU_2013_name	Sales_Location_Category	GF_Sales_Location_Category
Army Bay	4	5
Vipond	4	5
Stanmore Bay West	3	4
Stanmore Bay East	3	5
Wade Heads	4	4

Figure 2: Sales Location Category LUT – Regional Map

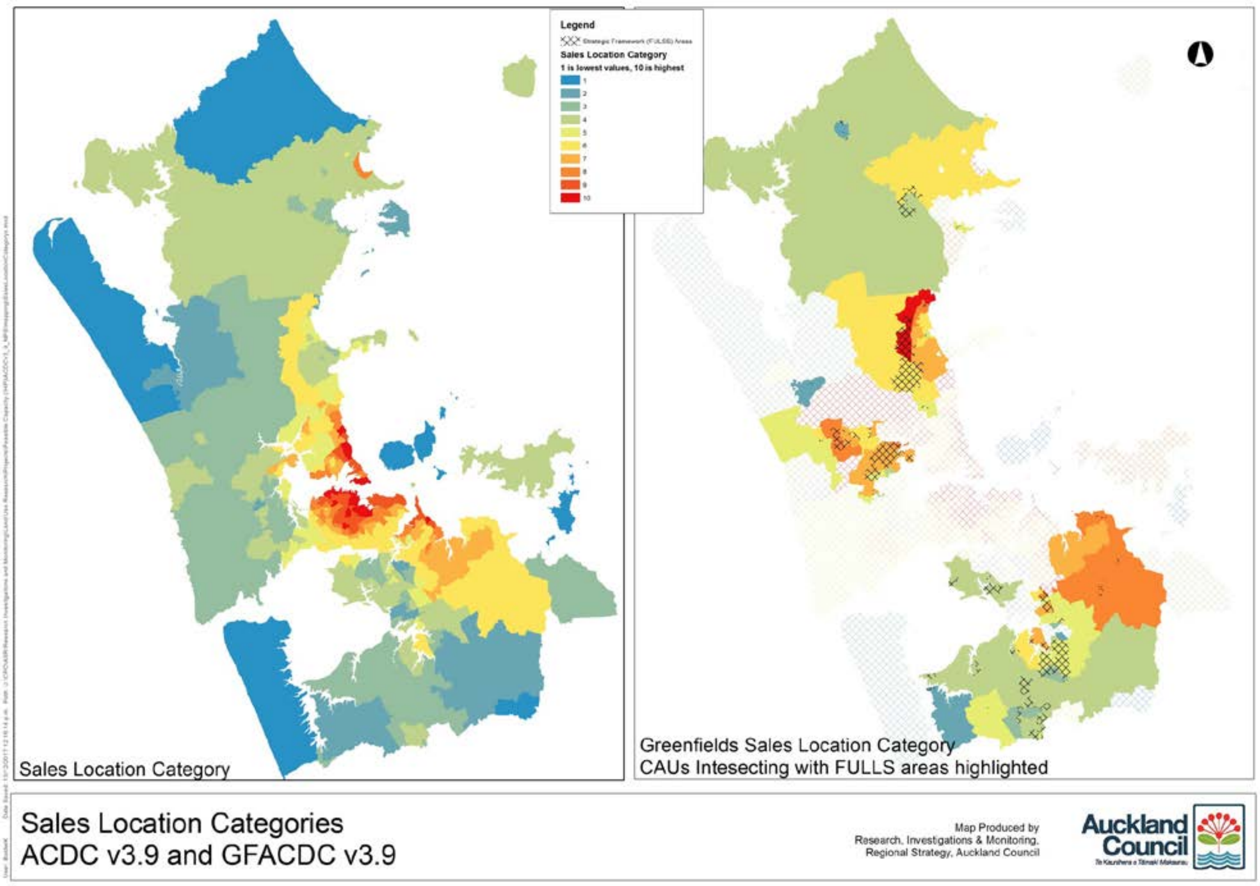
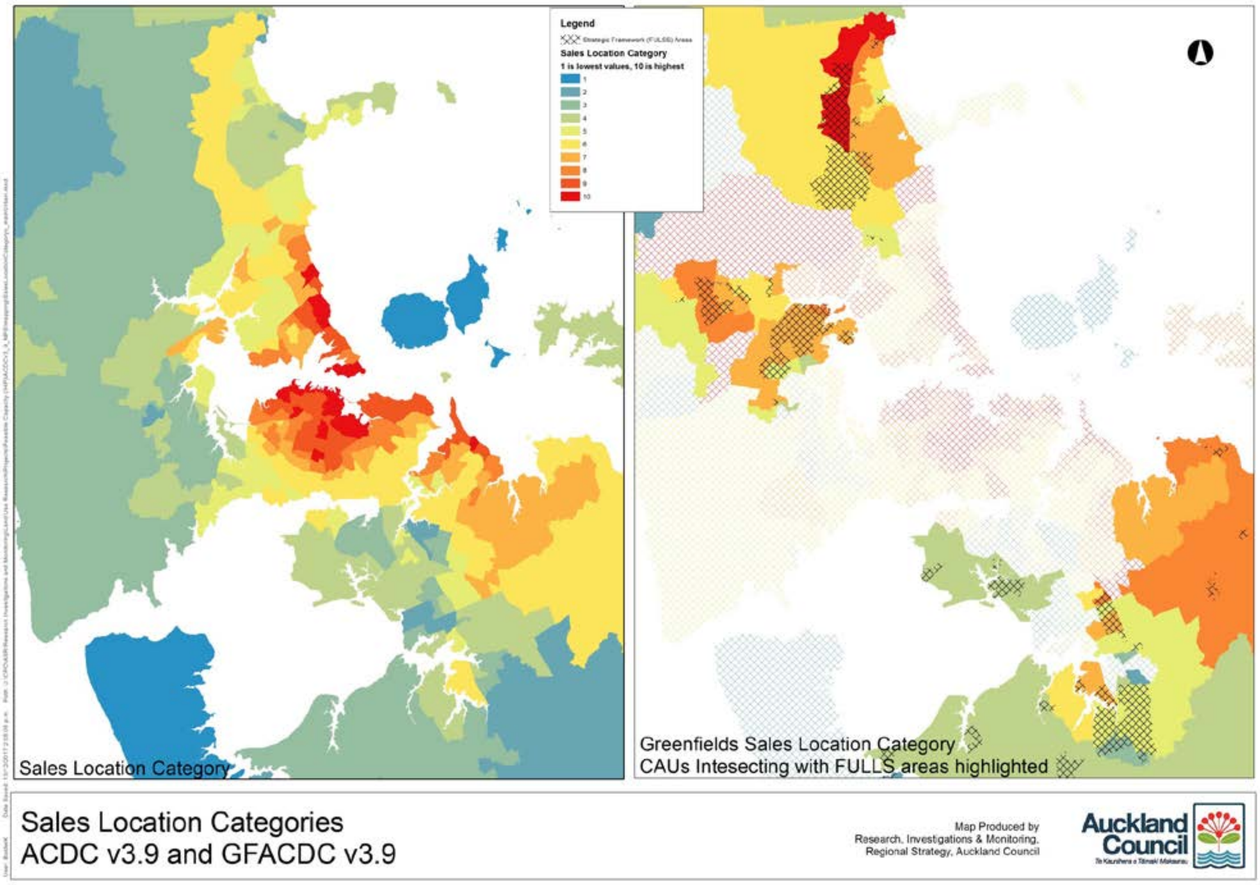


Figure 3: Sales Location Category – Main Urban Area map



2 Sales_PriceCeilings_LUT

This LUT exists to moderate the effect of the Floorspace_Area and Sales_FS_Price per m2 LUTs (*floorspace area x floorspace price = dwelling sale price*) constructing dwellings that are too far out of the price range (mainly above) for the sales location to support. However, ideally the Floorspace Area would be calibrated to ensure that when multiplied by the Sale Price per M2 value would not exceed the Price Ceiling.

The price ceiling is based on the reference sale price (based on an expected sale price for a 'standard' stand alone dwelling of average age and condition in that location – effectively a Medium House) used to classify the Sale Locations in the first place, (note the legend in the map on the preceding pages).

The Price ceiling is set for each Typology by a combination of the Reference Sale Price Max from the Sales_PriceCeilings_LUT below and the Price Ceiling Factor based on the form in the FloorspaceBuiltForm_LUT.

$$\textit{Typology Price Ceiling} = \textit{Reference Sale Price Max} \times \textit{Typology Price Ceiling Factor}$$

This is variable by typology due to the relationship between the cost of 'new' dwellings generally (which the model is building and selling) and all existing dwellings which include a proportion of second hand dwellings (which would sell at a discount to new product all else being equal), and the relativity between prices paid for various typologies and the reference dwelling (standalone) – a detached dwelling will typically sell at a premium to attached products, all else being equal.

Ideally, the combination of dwelling floor area and sale price per m2 will be reviewed and the floor area calibrated to the (typology factored) Sale price celling prior to running the model. Testing the feasibility of dwellings that are too expensive for the location is unnecessary, as while they may be 'feasible' it is likely because they are overpriced, and therefore would not sell.

Sales_Location_Category	Reference_Sale_Price_Min	Reference_Sale_Price_Max
1		450000
2	450000	560000
3	560000	670000
4	670000	780000
5	780000	890000
6	890000	1000000
7	1000000	1150000
8	1150000	1350000
9	1350000	1600000
10	1600000	

Note that location 10 has no upper limit on prices so a ceiling is not imposed (all commercially feasible developments are carried forward)

A calibration process was undertaken for v3.7 of the model (all resulting dwellings that exceeded the respective ceiling were reduced in size such that the sale price was <= factored ceiling), but this was not redone for v3.8.

Sales_Location_Category	Reference_Sale_Price_Min	Reference_Sale_Price_Max
1		400000
2	400000	500000
3	500000	600000
4	600000	700000
5	700000	800000
6	800000	900000
7	900000	1050000
8	1050000	1250000
9	1250000	1500000
10	1500000	

3 Typology_Matrix_Code_LUT.xlsx

This LUT sets up the relationship between the typologies and their names.

In order to test 9 different developments per capacity opportunity, each site is ‘cloned’ 9 times, the FDC_Built_Form_ID joins to the Clone iteration ID.

More or less development options are possible, but would require population of all of the other LUTs to match, and it is expected that the 9 developments below would cover most requirements[29].

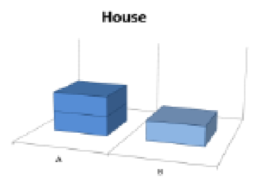
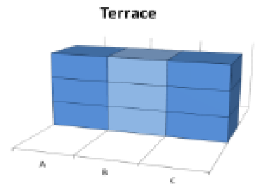
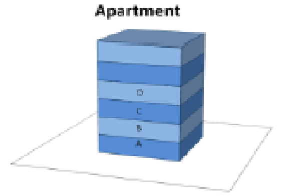
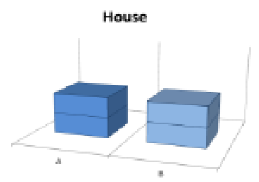
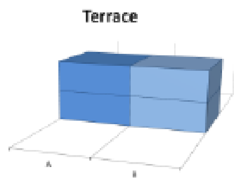
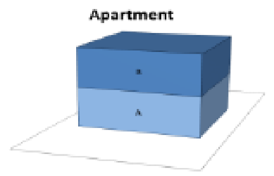
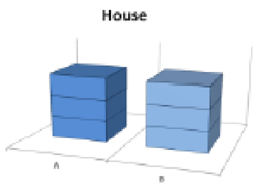
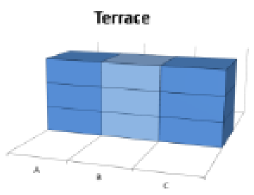
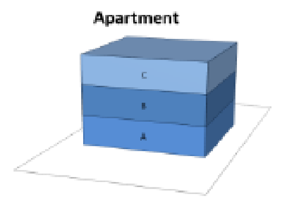
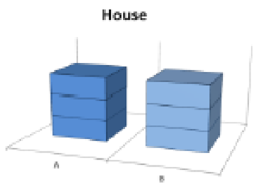
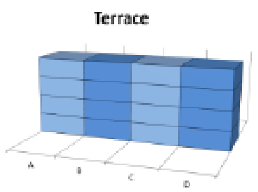
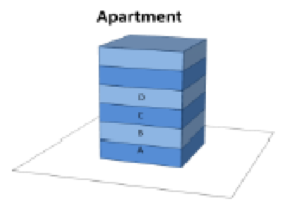
Table 4: Typology Matrix Code LUT

FDC_BuiltForm_ID	FDC_BuiltForm	FDC_BuiltForm_Size	FDC_BuiltForm_Name
1	Apartment	Small	Apartment Small
2	Terrace	Small	Terrace Small
3	House	Small	House Small
4	Apartment	Medium	Apartment Medium
5	Terrace	Medium	Terrace Medium
6	House	Medium	House Medium
7	Apartment	Large	Apartment Large
8	Terrace	Large	Terrace Large
9	House	Large	House Large

This approach was established in version 3 due to the thoughts of the E.G. that the single optimised development per site may not be well optimised, and that depending on various factors, the most intensive development per site will not always be feasible (e.g. terrace developments occur in apartment zones, etc.). In this application, more intensive forms are also tested on sites that in theory would not permit them, but Figure 4 below should provide some further reference points for why this may not necessarily be the case.

[29] A possible extension to this may be to include MHU development and/or second dwelling conversions, though a separate model specifically structured around the quite different cost and return structures of this form of development (MHUS and Second Dwelling Conversions are not separately saleable form the main dwelling) may actually be more appropriate for investigating these typologies.

Figure 4: Typology formats within different densities/zones

	House	Terrace	Apartment
Definition	**Stand alone - Not adjoining All dwellings have direct access to ground level outdoor space**	**Walls Shared/Adjoin All dwellings have direct access to ground level outdoor space**	**Ceiling/Floor/Walls Shared/Adjoin Not all dwellings have direct access to ground level outdoor space**
Typical or Common Example			
Development Examples	The tables below attempt to illustrate potential built form arrangements by typology within the 3 main groups of zonings on a nominal 1000m2 site, that potentially could comply with the relevant constraints. Depending on the typology and zone, compliance with the relevant rules or practical considerations will be the limiting factor for the total quantum of dwellings possible of each type. On smaller sites in the lower density residential zones actual differences between typologies are relatively nominal.		
2 Storey Max Residential Zones (Large Lot, Rural and Coastal Settlements, Single House			
Typology Notes	Much as per typical Example	Townhouses or units (Walls Adjoin)	Upstairs/Downstairs (Floor/Ceiling Adjoins)
Limiting Factor on Number of Dwellings per site	Rules (density)	Rules (density)	Rules (density)
2/3 Storey Terrace Zones (MHS, MHU)			
Typology Notes	Much as per typical Example	Much As per typical example	Upstairs/Downstairs (Floor/Ceiling Adjoins)
Limiting Factor on Number of Dwellings	Practicality/Rules	Rules (density, coverage, HIRB, building Seperation, Yards, Parking, Outlook/Privacy, Height)	Rules (density, coverage, HIRB, building Seperation, Yards, Parking, Outlook/Privacy, Height)
3 Storey + Apartment Zones (THAB, Mixed Use, Centres)			
Typology Notes	Much as per typical Example	Much As per typical example	Much As per typical example
Limiting Factor on Number of Dwellings	Practicality (Nature of Typology limits number of dwellings per site via min practical land area per 'house')	Practicality (nature of typology limites dwellings per site,via min practical land area per 'terrace'	Rules (Coverage, HIRB, building Seperation, Yards, Parking, Outlook/Privacy, Height)

4 FloorspaceTypologyCode_LUT.xlsx

This LUT is arguably no longer required, as the initial typology set by the model (based on zoning and capacity of the incoming development site) is maintained (all typology options are equal across typologies).

It was quicker to maintain this LUT in an amended form than amend the model to deal with its absence. The retention of the LUT also permits future models to have more complex (or simpler) arrangements with the floorspace typology options if required.

Table 5: Floorspace Typology Code LUT

FDC_Floorspace_Typology_Initial	1	2	3	4	5	6	7	8	9
Typology Name	Apartment Small	Terrace Small	House Small	Apartment Medium	Terrace Medium	House Medium	Apartment Large	Terrace Large	House Large
A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
B1	B1	B1	B1	B1	B1	B1	B1	B1	B1
C1	C1	C1	C1	C1	C1	C1	C1	C1	C1
F1	F1	F1	F1	F1	F1	F1	F1	F1	F1
F2	F2	F2	F2	F2	F2	F2	F2	F2	F2
F3	F3	F3	F3	F3	F3	F3	F3	F3	F3
G1	G1	G1	G1	G1	G1	G1	G1	G1	G1
G2	G2	G2	G2	G2	G2	G2	G2	G2	G2
G3	G3	G3	G3	G3	G3	G3	G3	G3	G3
K1	K1	K1	K1	K1	K1	K1	K1	K1	K1
K2	K2	K2	K2	K2	K2	K2	K2	K2	K2
K3	K3	K3	K3	K3	K3	K3	K3	K3	K3
K4	K4	K4	K4	K4	K4	K4	K4	K4	K4
K5	K5	K5	K5	K5	K5	K5	K5	K5	K5
K6	K6	K6	K6	K6	K6	K6	K6	K6	K6
K7	K7	K7	K7	K7	K7	K7	K7	K7	K7
K8	K8	K8	K8	K8	K8	K8	K8	K8	K8
K9	K9	K9	K9	K9	K9	K9	K9	K9	K9
K10	K10	K10	K10	K10	K10	K10	K10	K10	K10
K11	K11	K11	K11	K11	K11	K11	K11	K11	K11
K12	K12	K12	K12	K12	K12	K12	K12	K12	K12
K13	K13	K13	K13	K13	K13	K13	K13	K13	K13

FDC_Floorspace_Typology_Initial	1	2	3	4	5	6	7	8	9
Typology Name	Apartment Small	Terrace Small	House Small	Apartment Medium	Terrace Medium	House Medium	Apartment Large	Terrace Large	House Large
K14	K14	K14	K14	K14	K14	K14	K14	K14	K14
K15	K15	K15	K15	K15	K15	K15	K15	K15	K15

5 FloorspaceTypologyCode_BuildCosts_LUT

This table sets the details of the Floorspace typology building costs as set by the previous Floorspace Typology Code, which varies by Dwelling Typology Code (small Apartment though Large House).

E.g. on sites identified as an A1 Floorspace Typology Code option, a Small Apartment (Dwelling Typology 1) costs are drawn from Dwelling Typology Code I costs, but a small House is developed using A costs. These may vary by location depending on the values in the LUTs that reference this code and relate mainly to the density of the final product (which is a function of the rules – large houses in single House zone have A costs, B costs in the Mixed Housing Suburban and Urban Zones but C costs in more intensive zones)

(these Cost LUTS include Site Civil Costs, Constraints, Demolition Costs, and Professional fees)

Table 6: FloorspaceTypologyCode_BuildCosts_LUT

FDC_Dwelling_Typology_Code	1	2	3	4	5	6	7	8	9
Typology_Name	**Apartment Small**	**Terrace Small**	**House Small**	**Apartment Medium**	**Terrace Medium**	**House Medium**	**Apartment Large**	**Terrace Large**	**House Large**
A1	I	D	A	I	D	A	I	D	A
B1	I	D	B	I	D	B	I	D	B
C1	I	E	B	I	E	B	I	E	B
F1	I	F	C	I	F	C	I	F	C
F2	I	F	C	I	F	C	I	F	C
F3	I	F	C	I	F	C	I	F	C
G1	J	G	C	J	G	C	J	G	C
G2	J	G	C	J	G	C	J	G	C
G3	J	G	C	J	G	C	J	G	C
K1	K	H	C	K	H	C	K	H	C
K2	K	H	C	K	H	C	K	H	C
K3	K	H	C	K	H	C	K	H	C
K4	K	H	C	K	H	C	K	H	C
K5	K	H	C	K	H	C	K	H	C
K6	K	H	C	K	H	C	K	H	C
K7	K	H	C	K	H	C	K	H	C
K8	K	H	C	K	H	C	K	H	C
K9	K	H	C	K	H	C	K	H	C

FDC_Dwelling_Typology_Code	1	2	3	4	5	6	7	8	9
Typology_Name	Apartment Small	Terrace Small	House Small	Apartment Medium	Terrace Medium	House Medium	Apartment Large	Terrace Large	House Large
K10	K	H	C	K	H	C	K	H	C
K11	K	H	C	K	H	C	K	H	C
K12	K	H	C	K	H	C	K	H	C
K13	K	H	C	K	H	C	K	H	C
K14	K	H	C	K	H	C	K	H	C
K15	K	H	C	K	H	C	K	H	C

6 FloorspaceArea_LUT.xlsx

Based on the Typology Code set up previously, the expected floorspace area of the dwelling is set based on the dwellings location and typology. The LUT has been coloured to highlight the range of values.

Note that it is this set of inputs that are adjusted to calibrate the dwelling sale prices to the price ceilings (this is the reason for the sub m² values), on the basis that the per m2 build costs are relatively fixed and knowable[30], and the floor area of the building is both easily adjustable by the developer and has a direct influence on consumers purchase price behaviour.

Dwelling Floorspace Area values are joined on the Dwelling Floorspace Typology Code by Sales Location, with a sheet for each dwelling typology (small apartment (code 1) though large house (code 9).

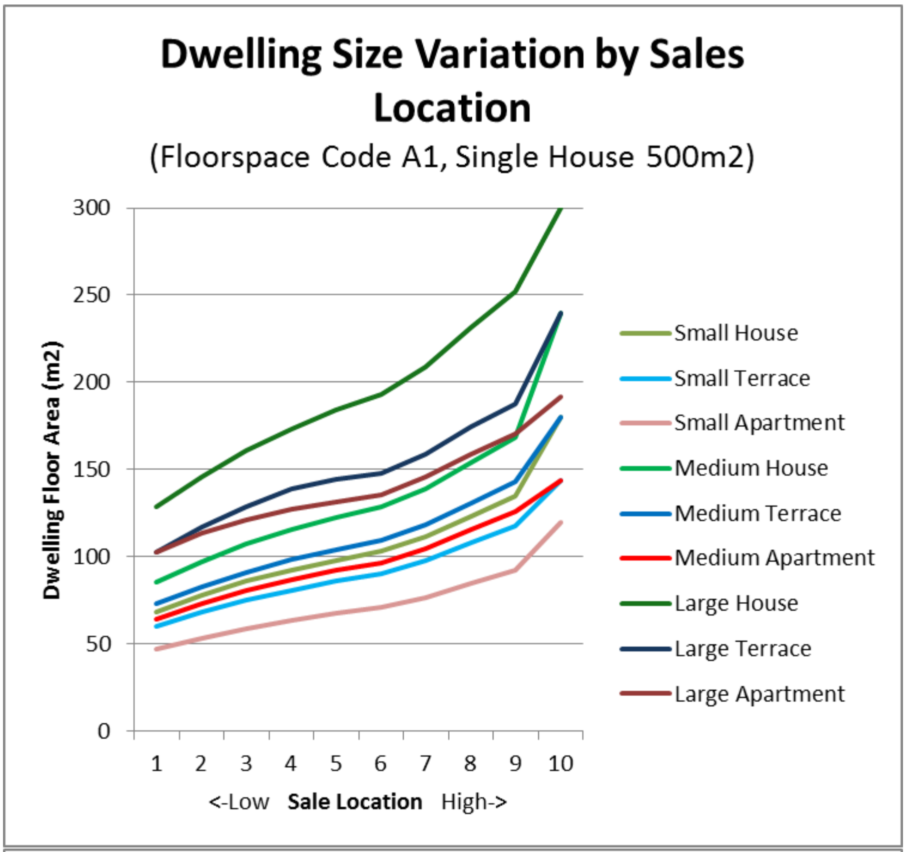
Figures below illustrate the variation between Typology (and Size) and Location using the top and bottom rows of the following tables (being A1: Single House on 500m2 and k15 Town Centre 30+ levels).

As an example, within a Sales Location 10 area, Large Houses could be between 300 and 200m2 depending on zone small apartments could be between 120 and 49m2 depending on zone. In Sales Location 1 areas the range of potential size options is much narrower reflecting the reduced flexibility possible within much lower budgets/price ceilings.

Ultimately the size and zone variations alone allow the testing of 10 Sales Locations x 9 Development Typologies x24 Floorspace Typology Codes = 2160 different dwelling possibilities across the urban zones of the region. While this may seem like many options it is a fraction of the permutations of consented construction and a very small fraction of all the permutations run that are not progressed by developers and owners.

Conversely, this level of diversity imposes a significant deadweight on checking, reviewing and updating the model and as can be seen in the tables many of the rows have minimal variation (e.g. all K types over 5 storeys have the same values).

[30] In this instance the calibration assumption assumes the relationship between build cost and size are directly linear, which is incorrectly, but probably appropriate for the (ideally) small adjustments that are made to the manually generated initial assumptions.


Dwelling Size Variation by Sales Location
(Floorspace Code A1, Single House 500m2)
Dwelling Floor Area (m2)
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
<-Low Sale Location High->
Small House
Small Terrace
Small Apartment
Medium House
Medium Terrace
Medium Apartment
Large House
Large Terrace
Large Apartment

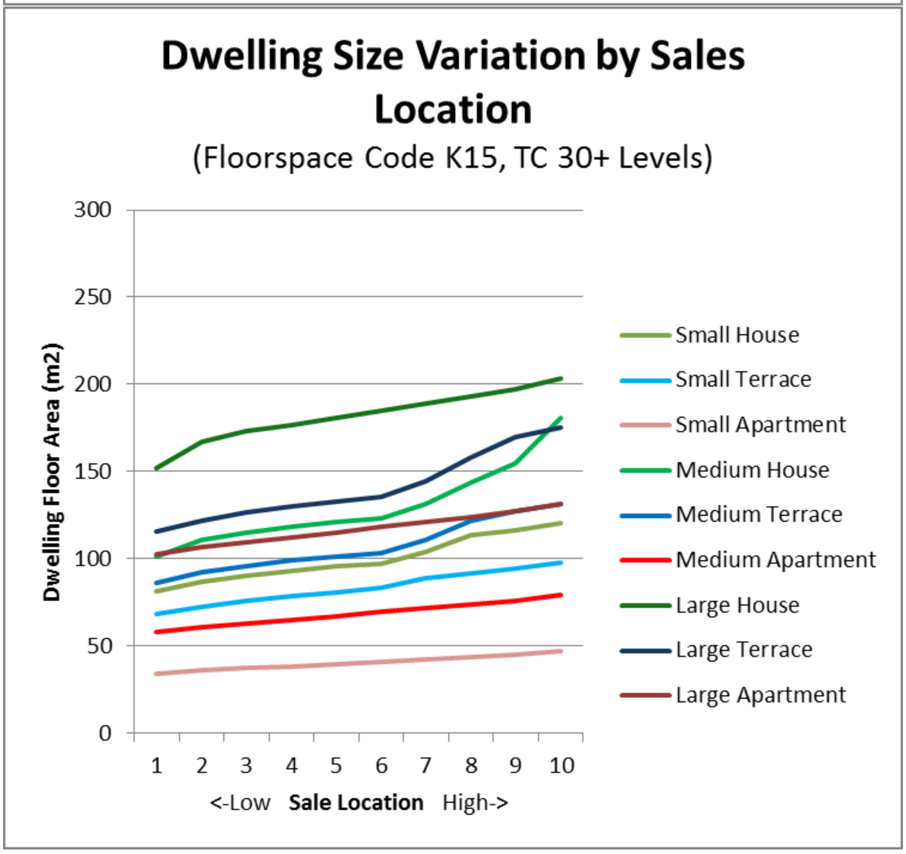

Dwelling Size Variation by Sales Location
(Floorspace Code K15, TC 30+ Levels)
Dwelling Floor Area (m2)
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
<-Low Sale Location High->
Small House
Small Terrace
Small Apartment
Medium House
Medium Terrace
Medium Apartment
Large House
Large Terrace
Large Apartment

Table 7: Floorspace Area LUT, Small Apartment

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	47.14	53.59	59.05	63.58	67.50	70.92	76.61	84.81	92.54	120.00
B1	MH Sub: 4	51.56	58.97	64.03	69.19	74.45	76.76	79.87	83.81	87.81	91.08
C1	MH Urb: 40	47.60	51.17	54.81	58.52	61.68	63.63	65.61	67.62	69.66	72.38
F1	THAB 3 Le	42.08	43.99	45.46	46.95	48.46	50.00	51.55	53.13	54.73	56.87
F2	THAB 4 Le	37.80	39.53	40.85	42.20	43.56	44.95	46.35	47.78	49.22	51.15
F3	THAB 5 Le	37.35	39.06	40.38	41.71	43.07	44.44	45.84	47.25	48.69	50.60
G1	MU 3 Leve	42.08	43.99	45.46	46.95	48.46	50.00	51.55	53.13	54.73	56.87
G2	MU 4 Leve	37.80	39.53	40.85	42.20	43.56	44.95	46.35	47.78	49.22	51.15
G3	MU 5 Leve	37.35	39.06	40.38	41.71	43.07	44.44	45.84	47.25	48.69	50.60
K1	TC 3 Level	38.25	39.99	41.33	42.68	44.06	45.45	46.87	48.30	49.76	51.70
K2	TC 4 Level	37.80	39.53	40.85	42.20	43.56	44.95	46.35	47.78	49.22	51.15
K3	TC 5 Level	37.35	39.06	40.38	41.71	43.07	44.44	45.84	47.25	48.69	50.60
K4	TC 6 Level	36.90	38.60	39.90	41.23	42.57	43.94	45.32	46.73	48.15	50.05
K5	TC 7 Level	36.68	38.36	39.66	40.98	42.32	43.68	45.06	46.46	47.88	49.78
K6	TC 8 Level	36.45	38.13	39.43	40.74	42.08	43.43	44.81	46.20	47.62	49.50
K7	TC 9 Level	36.23	37.90	39.19	40.50	41.83	43.18	44.55	45.94	47.35	49.23
K8	TC 10 Lev	36.00	37.67	38.95	40.26	41.58	42.93	44.29	45.68	47.08	48.95
K9	TC 11 Lev	35.78	37.43	38.71	40.01	41.33	42.67	44.03	45.41	46.81	48.68
K10	TC 12 Lev	35.55	37.20	38.48	39.77	41.09	42.42	43.78	45.15	46.55	48.40
K11	TC 13-15 L	35.33	36.97	38.24	39.53	40.84	42.17	43.52	44.89	46.28	48.13
K12	TC 16-18 L	35.10	36.74	38.00	39.29	40.59	41.92	43.26	44.63	46.01	47.85
K13	TC 18-25 L	34.88	36.50	37.76	39.04	40.34	41.66	43.00	44.36	45.74	47.58
K14	TC 25-30 L	34.65	36.27	37.53	38.80	40.10	41.41	42.75	44.10	45.48	47.30
K15	TC 30+ Le	34.43	36.04	37.29	38.56	39.85	41.16	42.49	43.84	45.21	47.03

Table 8: Floorspace Area LUT, Small Terrace

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	60.00	68.20	75.16	80.92	85.91	90.26	97.50	107.94	117.78	144.00
B1	MH Sub: 4	65.63	77.78	84.00	89.09	93.33	96.92	104.00	108.00	112.00	115.00
C1	MH Urb: 40	65.63	77.78	84.00	89.09	93.33	95.95	97.85	99.75	101.65	104.50
F1	THAB 3 Le	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
F2	THAB 4 Le	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
F3	THAB 5 Le	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
G1	MU 3 Leve	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
G2	MU 4 Leve	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
G3	MU 5 Leve	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
K1	TC 3 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K2	TC 4 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K3	TC 5 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K4	TC 6 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K5	TC 7 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K6	TC 8 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K7	TC 9 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K8	TC 10 Lev	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K9	TC 11 Lev	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K10	TC 12 Lev	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K11	TC 13-15 L	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K12	TC 16-18 L	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K13	TC 18-25 L	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K14	TC 25-30 L	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K15	TC 30+ Le	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01

Table 9: Floorspace Area LUT, Small House

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	68.57	77.95	85.90	92.49	98.18	103.16	111.43	123.36	134.61	180.00
B1	MH Sub: 4	75.00	88.89	96.00	101.82	106.67	110.77	120.00	129.60	134.40	138.00
C1	MH Urb: 40	75.00	88.89	96.00	101.82	106.67	110.77	120.00	126.00	128.40	132.00
F1	THAB 3 Le	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
F2	THAB 4 Le	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
F3	THAB 5 Le	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
G1	MU 3 Leve	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
G2	MU 4 Leve	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
G3	MU 5 Leve	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
K1	TC 3 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K2	TC 4 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K3	TC 5 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K4	TC 6 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K5	TC 7 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K6	TC 8 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K7	TC 9 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K8	TC 10 Leve	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K9	TC 11 Leve	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K10	TC 12 Leve	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K11	TC 13-15 L	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K12	TC 16-18 L	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K13	TC 18-25 L	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K14	TC 25-30 L	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K15	TC 30+ Le	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40

Table 10: Floorpsace_Area_LUT, Medium Apartment

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	64.29	73.08	80.53	86.71	92.04	96.71	104.47	115.65	126.20	144.00
B1	MH Sub: 4	70.31	81.00	87.00	93.00	99.00	101.00	104.00	108.00	112.00	115.00
C1	MH Urb: 40	70.31	83.33	90.00	95.00	99.00	101.00	103.00	105.00	107.00	110.00
F1	THAB 3 Le	72.90	76.17	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
F2	THAB 4 Le	68.09	71.15	73.48	75.85	78.26	80.70	83.17	85.68	88.22	91.63
F3	THAB 5 Le	63.36	66.22	68.40	70.62	72.86	75.14	77.46	79.80	82.18	85.36
G1	MU 3 Leve	72.90	76.17	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
G2	MU 4 Leve	68.09	71.15	73.48	75.85	78.26	80.70	83.17	85.68	88.22	91.63
G3	MU 5 Leve	63.36	66.22	68.40	70.62	72.86	75.14	77.46	79.80	82.18	85.36
K1	TC 3 Level	64.80	67.70	69.92	72.17	74.45	76.76	79.10	81.48	83.89	87.12
K2	TC 4 Level	64.08	66.96	69.16	71.39	73.66	75.95	78.28	80.64	83.03	86.24
K3	TC 5 Level	63.36	66.22	68.40	70.62	72.86	75.14	77.46	79.80	82.18	85.36
K4	TC 6 Level	62.64	65.47	67.64	69.84	72.07	74.34	76.63	78.96	81.32	84.48
K5	TC 7 Level	61.92	64.73	66.88	69.06	71.28	73.53	75.81	78.12	80.46	83.60
K6	TC 8 Level	61.56	64.36	66.50	68.68	70.88	73.12	75.40	77.70	80.04	83.16
K7	TC 9 Level	61.20	63.98	66.12	68.29	70.49	72.72	74.98	77.28	79.61	82.72
K8	TC 10 Leve	60.84	63.61	65.74	67.90	70.09	72.32	74.57	76.86	79.18	82.28
K9	TC 11 Leve	60.48	63.24	65.36	67.51	69.70	71.91	74.16	76.44	78.75	81.84
K10	TC 12 Leve	60.12	62.87	64.98	67.12	69.30	71.51	73.75	76.02	78.32	81.40
K11	TC 13-15 L	59.76	62.50	64.60	66.74	68.90	71.10	73.34	75.60	77.90	80.96
K12	TC 16-18 L	59.40	62.12	64.22	66.35	68.51	70.70	72.92	75.18	77.47	80.52
K13	TC 18-25 L	59.04	61.75	63.84	65.96	68.11	70.30	72.51	74.76	77.04	80.08
K14	TC 25-30 L	58.68	61.38	63.46	65.57	67.72	69.89	72.10	74.34	76.61	79.64
K15	TC 30+ Le	58.32	61.01	63.08	65.18	67.32	69.49	71.69	73.92	76.18	79.20

Table 11: Floorpsace_Area_LUT, Medium Terrace

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	72.86	82.82	91.27	98.27	104.32	109.61	118.40	131.07	143.02	180.00
B1	MH Sub: 4(	79.69	94.44	102.00	108.18	113.33	117.69	127.50	141.67	154.55	161.00
C1	MH Urb: 4(	79.69	94.44	102.00	108.18	113.33	117.69	127.50	136.50	139.10	143.00
F1	THAB 3 Le	88.54	96.64	102.00	106.33	109.93	113.01	121.48	129.28	132.41	136.81
F2	THAB 4 Le	88.54	96.64	102.00	106.33	109.93	113.01	121.13	124.11	127.12	131.34
F3	THAB 5 Le	88.54	96.64	102.00	106.33	109.93	113.01	121.13	124.11	127.12	131.34
G1	MU 3 Leve	88.54	96.64	102.00	106.33	109.93	113.01	121.48	129.28	132.41	136.81
G2	MU 4 Leve	88.54	96.64	102.00	106.33	109.93	113.01	121.13	124.11	127.12	131.34
G3	MU 5 Leve	88.54	96.64	102.00	106.33	109.93	113.01	121.13	124.11	127.12	131.34
K1	TC 3 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K2	TC 4 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K3	TC 5 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K4	TC 6 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K5	TC 7 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K6	TC 8 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K7	TC 9 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K8	TC 10 Lev	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K9	TC 11 Lev	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K10	TC 12 Lev	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K11	TC 13-15 L	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K12	TC 16-18 L	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K13	TC 18-25 L	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K14	TC 25-30 L	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K15	TC 30+ Le	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34

Table 12: Floorspace_area_LUT, Medium House

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	85.71	97.43	107.37	115.61	122.72	128.95	139.29	154.20	168.26	240.00
B1	MH Sub: 4(	93.75	111.11	120.00	127.27	133.33	138.46	150.00	166.67	181.82	207.00
C1	MH Urb: 4(	93.75	111.11	120.00	127.27	133.33	138.46	150.00	166.67	181.82	187.00
F1	THAB 3 Le	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	186.44
F2	THAB 4 Le	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	180.96
F3	THAB 5 Le	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	180.96
G1	MU 3 Leve	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	186.44
G2	MU 4 Leve	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	180.96
G3	MU 5 Leve	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	180.96
K1	TC 3 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K2	TC 4 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K3	TC 5 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K4	TC 6 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K5	TC 7 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K6	TC 8 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K7	TC 9 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K8	TC 10 Lev	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K9	TC 11 Lev	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K10	TC 12 Lev	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K11	TC 13-15 L	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K12	TC 16-18 L	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K13	TC 18-25 L	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K14	TC 25-30 L	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K15	TC 30+ Le	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96

Table 13: Floorspace_Area_LUT, Large Apartment

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	102.86	113.64	121.00	127.08	131.43	135.60	145.69	158.82	170.27	192.00
B1	MH Sub: 4(	100.00	111.11	120.00	127.27	133.33	138.46	145.60	151.20	156.80	161.00
C1	MH Urb: 40	100.00	110.50	117.00	123.50	128.70	131.30	133.90	136.50	139.10	143.00
F1	THAB 3 Le	105.56	113.69	118.56	121.69	124.84	128.02	131.22	134.45	137.71	142.29
F2	THAB 4 Le	105.56	113.69	118.56	121.69	124.84	128.02	131.22	134.45	137.71	142.29
F3	THAB 5 Le	105.56	111.02	114.00	117.01	120.04	123.09	126.18	129.28	132.41	136.81
G1	MU 3 Leve	105.56	113.69	118.56	121.69	124.84	128.02	131.22	134.45	137.71	142.29
G2	MU 4 Leve	105.56	113.69	118.56	121.69	124.84	128.02	131.22	134.45	137.71	142.29
G3	MU 5 Leve	105.56	111.02	114.00	117.01	120.04	123.09	126.18	129.28	132.41	136.81
K1	TC 3 Level	102.70	108.52	112.94	116.47	119.38	121.88	130.25	134.45	137.71	142.29
K2	TC 4 Level	102.70	108.52	112.94	116.47	119.38	121.88	130.25	134.45	137.71	142.29
K3	TC 5 Level	102.70	108.52	112.94	116.47	119.38	121.88	126.18	129.28	132.41	136.81
K4	TC 6 Level	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K5	TC 7 Level	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K6	TC 8 Level	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K7	TC 9 Level	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K8	TC 10 Leve	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K9	TC 11 Leve	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K10	TC 12 Leve	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K11	TC 13-15 L	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K12	TC 16-18 L	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K13	TC 18-25 L	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K14	TC 25-30 L	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K15	TC 30+ Le	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34

Table 14: Floorspace_Area_LUT, Large Terrace

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	102.86	116.92	128.85	138.73	144.57	147.84	158.81	174.71	187.30	240.00
B1	MH Sub: 4(	110.00	122.22	132.00	140.00	146.67	152.31	165.00	183.33	200.00	218.50
C1	MH Urb: 40	110.00	122.22	132.00	140.00	146.67	152.31	165.00	183.33	192.60	198.00
F1	THAB 3 Le	118.56	127.42	134.20	139.60	144.03	147.75	158.49	171.69	175.49	180.96
F2	THAB 4 Le	118.56	127.42	134.20	139.60	144.03	147.75	158.49	171.69	175.49	180.96
F3	THAB 5 Le	118.56	127.42	134.20	139.60	144.03	147.75	158.49	166.49	170.17	175.47
G1	MU 3 Leve	118.56	127.42	134.20	139.60	144.03	147.75	158.49	171.69	175.49	180.96
G2	MU 4 Leve	118.56	127.42	134.20	139.60	144.03	147.75	158.49	171.69	175.49	180.96
G3	MU 5 Leve	118.56	127.42	134.20	139.60	144.03	147.75	158.49	166.49	170.17	175.47
K1	TC 3 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	180.96
K2	TC 4 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	180.96
K3	TC 5 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K4	TC 6 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K5	TC 7 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K6	TC 8 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K7	TC 9 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K8	TC 10 Leve	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K9	TC 11 Leve	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K10	TC 12 Leve	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K11	TC 13-15 L	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K12	TC 16-18 L	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K13	TC 18-25 L	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K14	TC 25-30 L	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K15	TC 30+ Le	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47

Table 15: Floorspace_Area_LUT, Large House

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500m2	128.57	146.15	161.06	173.41	184.09	193.42	208.94	231.30	252.39	300.00
B1	MH Sub: 400m2	140.63	166.67	180.00	190.91	200.00	207.69	225.00	248.40	257.60	264.50
C1	MH Urb: 400m2	140.63	166.67	180.00	190.00	198.00	202.00	206.00	210.00	214.00	220.00
F1	THAB 3 Level T	156.25	173.52	177.61	181.72	185.84	189.98	194.13	198.30	202.49	208.58
F2	THAB 4 Level T	156.25	173.52	177.61	181.72	185.84	189.98	194.13	198.30	202.49	208.58
F3	THAB 5 Level T	156.25	168.95	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
G1	MU 3 Level Tce	156.25	173.52	177.61	181.72	185.84	189.98	194.13	198.30	202.49	208.58
G2	MU 4 Level Tce	156.25	173.52	177.61	181.72	185.84	189.98	194.13	198.30	202.49	208.58
G3	MU 5 Level Tce	156.25	168.95	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K1	TC 3 Level Apm	152.03	167.39	173.65	178.50	182.40	185.63	194.13	198.30	202.49	208.58
K2	TC 4 Level Apm	152.03	167.39	173.65	178.50	182.40	185.63	194.13	198.30	202.49	208.58
K3	TC 5 Level Apm	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K4	TC 6 Level Apm	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K5	TC 7 Level Apm	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K6	TC 8 Level Apm	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K7	TC 9 Level Apm	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K8	TC 10 Level Ap	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K9	TC 11 Level Ap	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K10	TC 12 Level Ap	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K11	TC 13-15 Level	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K12	TC 16-18 Level	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K13	TC 18-25 Lev A	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K14	TC 25-30 Lev A	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K15	TC 30+ Lev Apı	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09

7 FloorspaceBuiltForm_Density_LUT

This LUT provides a mix of practical and regulatory limits to the built form being tested, particularly a maximum storeys, coverage and density (land area per unit).

The limitations work in isolation and combination to ensure the particular typology being tested does not exceed either the regulatory limitation (e.g. 600m2 maximum density in A1 (Single House) for all typologies) or practical limitation (e.g. 120m2 maximum density for Medium Houses in Mixed Use and Centre Zones.

This is because while the mixed use and centre zones have no regulatory density limits, as a matter of practical reality, a ‘house’ (of around 180m2 floor area in this case) will need at least 200m2 of land. Compare this with 180m2 floor area terrace in the same zones which has a practical limit of 100m2 of land per unit.

Max Building Coverage is utilised in combination with the lowest of Maximum Effective Storeys (a value from the input data based on the combination of zone heights, bonus heights and volcanic viewshafts limits) to ensure the floorspace is also limited.

Max Impervious Coverage is used in the calculation of SW Development Contributions.

The model calculates the dwelling yield on the site using all of these approaches and will choose the minimum yielding result to carry forwards. House typologies (and all development in zones with density rules, namely the Single House Zone) are rounded down to the nearest integer, Terrace and Apartment developments are rounded to the nearest integer reflecting the greater flexibility inherent within more intensive forms.

Table 16: FloorspaceBuiltForm_Density_LUT

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	Max_Storeys	Max_Building_Coverage	Max_Impervious_Coverage	1	2	3	4	5	6	7	8	9
A1	Single Hs: 500m2+	2	0.35	0.60	600	600	600	600	**600**	**600**	600	600	600
B1	Mixed House Suburban	2	0.40	0.60	75	120	190	100	**135**	**210**	125	150	250
C1	Mixed House Urban	3	0.45	0.60	50	100	190	70	120	210	90	140	250
F1	THAB 3 Level	3	0.50	0.60	35	90	190	60	110	210	80	130	250
F2	THAB 4 Level	4	0.50	0.60	25	90	190	45	105	210	65	120	250
F3	THAB 5 Level	5	0.50	0.60	23	90	190	40	105	210	55	120	250
G1	Mixed Use 3 Level	3	1.00	1.00	22	80	180	38	105	200	52	130	240
G2	Mixed Use 4 Level	4	1.00	1.00	20	80	180	35	100	200	48	120	240
G3	Mixed Use 5 Level	5	1.00	1.00	17	80	180	30	100	200	40	120	240
K1	TC 3 Level	3	1.00	1.00	25	80	180	45	105	200	65	130	240
K2	TC 4 Level	4	1.00	1.00	22	80	180	38	100	200	52	120	240
K3	TC 5 Level	5	1.00	1.00	18	80	180	31	100	200	43	120	240
K4	TC 6 Level	6	1.00	1.00	15	80	180	25	100	200	37	120	240
K5	TC 7 Level	7	1.00	1.00	12	80	180	21	100	200	32	120	240
K6	TC 8 Level	8	1.00	1.00	10.5	80	180	18	100	200	28	120	240
K7	TC 9 Level	9	1.00	1.00	9.2	80	180	15.5	100	200	24	120	240
K8	TC 10 Level	10	1.00	1.00	8.0	80	180	13.5	100	200	20	120	240
K9	TC 11 Level	11	1.00	1.00	7.0	80	180	11.5	100	200	17.5	120	240
K10	TC 12 Level	12	1.00	1.00	6.0	80	180	10.0	100	200	15	120	240
K11	TC 13-15 Level	15	1.00	1.00	5.4	80	180	9.0	100	200	13.5	120	240
K12	TC 16-18 Level	18	1.00	1.00	4.8	80	180	8.0	100	200	12	120	240
K13	TC 18-25 Level	25	1.00	1.00	4.0	80	180	7.0	100	200	10.6	120	240
K14	TC 25-30 Level	30	1.00	1.00	3.5	80	180	6.0	100	200	9.2	120	240
K15	TC 30+ Level	99	1.00	1.00	3.0	80	180	5.0	100	200	8	120	240

8 FloorspaceBuiltForm_FAR_LUT

This LUT works in combination with the other FloorspaceBuiltForm LUTs but in this case imposing a another limitation on developable floorspace via FAR (Floor Area Ratio), based on *parcel area x FAR = max floorspace (FAR).*

Table 17: FloorspaceBuiltForm_FAR_LUT

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9
A1	Single Hs: 500m2+	0.45	0.5	0.5	**0.5**	**0.6**	**0.6**	0.6	0.7	0.7
B1	Mixed House Suburban	**0.7**	**0.7**	**0.65**	**0.75**	**0.75**	**0.7**	0.8	0.8	0.7
C1	Mixed House Urban	**1**	**0.9**	**0.75**	1.1	0.95	0.75	1.2	1	0.8
F1	THAB 3 Level	1.2	1	0.75	1.3	1.1	0.8	1.4	1.2	0.85
F2	THAB 4 Level	1.5	1.1	0.75	1.6	1.2	0.85	1.7	1.3	0.9
F3	THAB 5 Level	1.6	1.2	0.8	1.7	1.3	0.9	1.8	1.4	1
G1	Mixed Use 3 Level	2	1.1	0.7	2.1	1.2	0.8	2.2	1.3	0.9
G2	Mixed Use 4 Level	2.2	1.2	0.75	2.3	1.3	0.85	2.4	1.4	1
G3	Mixed Use 5 Level	2.5	1.25	0.8	2.6	1.35	0.9	2.7	1.45	1
K1	TC 3 Level	2.2	1.1	0.7	2.4	1.2	0.8	2.6	1.3	0.9
K2	TC 4 Level	2.4	1.2	0.75	2.8	1.3	0.85	3.2	1.4	1
K3	TC 5 Level	2.9	1.25	0.8	3.4	1.35	0.9	3.9	1.45	1
K4	TC 6 Level	3.5	1.3	0.85	4	1.4	0.95	4.5	1.5	1
K5	TC 7 Level	4	1.35	0.9	4.5	1.45	0.95	5	1.55	1
K6	TC 8 Level	4.5	1.35	0.9	5	1.45	0.95	5.5	1.55	1
K7	TC 9 Level	4.9	1.35	0.9	5.4	1.45	0.95	5.9	1.55	1
K8	TC 10 Level	5.3	1.35	0.9	5.8	1.45	0.95	6.3	1.55	1
K9	TC 11 Level	5.7	1.35	0.9	6.2	1.45	0.95	6.7	1.55	1
K10	TC 12 Level	6.1	1.35	0.9	6.6	1.45	0.95	7.1	1.55	1
K11	TC 13-15 Level	6.6	1.35	0.9	7.2	1.45	0.95	7.8	1.55	1
K12	TC 16-18 Level	7.3	1.35	0.9	8	1.45	0.95	8.7	1.55	1
K13	TC 18-25 Level	8.7	1.35	0.9	9.5	1.45	0.95	10.3	1.55	1
K14	TC 25-30 Level	10	1.35	0.9	11	1.45	0.95	12	1.55	1
K15	TC 30+ Level	11	1.35	0.9	12	1.45	0.95	13	1.55	1

Table 17 below shows the same information as in the table above, but converted to m2 of land required per m2 of floorspace. In the modelled example, at its maximum land use efficiency, 1m2 of 'House' floorspace requires 1m2 of land to be provided. The minimum cost of 1m² of House floorspace is therefore LV/m² + the m² cost of construction. More intensive typologies are able to reduce the end cost of floorspace by increasing the amount of floorspace per land area (or reducing the land area per floorspace), but this is offset by the higher cost of construction for more intensive forms, and the lower price per m2 purchasers are willing to pay per m2 (all else equal) for more intensive forms. The threshold points (the $LV/m² where house floorspace per m² are less efficient than terrace, and terrace are less efficient than apartments) will vary by location via the combination of LV, expected Sale Price, regulation and developer.

Table 18: FloorspaceBuiltForm_FAR_LUT inverted (1/x) to show m2 land area needed per m2 of floorspace by typology

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9
A1	Single Hs: 50	2.22	2.00	2.00	**2.00**	**1.67**	**1.67**	1.67	1.43	1.43
B1	Mixed House	**1.43**	**1.43**	**1.54**	**1.33**	**1.33**	**1.43**	1.25	1.25	1.43
C1	Mixed House	**1.00**	**1.11**	**1.33**	0.91	1.05	1.33	0.83	1.00	1.25
F1	THAB 3 Level	0.83	1.00	1.33	0.77	0.91	1.25	0.71	0.83	1.18
F2	THAB 4 Level	0.67	0.91	1.33	0.63	0.83	1.18	0.59	0.77	1.11
F3	THAB 5 Level	0.63	0.83	1.25	0.59	0.77	1.11	0.56	0.71	1.00
G1	Mixed Use 3	0.50	0.91	1.43	0.48	0.83	1.25	0.45	0.77	1.11
G2	Mixed Use 4	0.45	0.83	1.33	0.43	0.77	1.18	0.42	0.71	1.00
G3	Mixed Use 5	0.40	0.80	1.25	0.38	0.74	1.11	0.37	0.69	1.00
K1	TC 3 Level	0.45	0.91	1.43	0.42	0.83	1.25	0.38	0.77	1.11
K2	TC 4 Level	0.42	0.83	1.33	0.36	0.77	1.18	0.31	0.71	1.00
K3	TC 5 Level	0.34	0.80	1.25	0.29	0.74	1.11	0.26	0.69	1.00
K4	TC 6 Level	0.29	0.77	1.18	0.25	0.71	1.05	0.22	0.67	1.00
K5	TC 7 Level	0.25	0.74	1.11	0.22	0.69	1.05	0.20	0.65	1.00
K6	TC 8 Level	0.22	0.74	1.11	0.20	0.69	1.05	0.18	0.65	1.00
K7	TC 9 Level	0.20	0.74	1.11	0.19	0.69	1.05	0.17	0.65	1.00
K8	TC 10 Level	0.19	0.74	1.11	0.17	0.69	1.05	0.16	0.65	1.00
K9	TC 11 Level	0.18	0.74	1.11	0.16	0.69	1.05	0.15	0.65	1.00
K10	TC 12 Level	0.16	0.74	1.11	0.15	0.69	1.05	0.14	0.65	1.00
K11	TC 13-15 Lev	0.15	0.74	1.11	0.14	0.69	1.05	0.13	0.65	1.00
K12	TC 16-18 Lev	0.14	0.74	1.11	0.13	0.69	1.05	0.11	0.65	1.00
K13	TC 18-25 Lev	0.11	0.74	1.11	0.11	0.69	1.05	0.10	0.65	1.00
K14	TC 25-30 Lev	0.10	0.74	1.11	0.09	0.69	1.05	0.08	0.65	1.00
K15	TC 30+ Level	0.09	0.74	1.11	0.08	0.69	1.05	0.08	0.65	1.00

10 Costs_ProfFees_LUT.xlsx

This Table provides the basis for the majority of Professional Fees. These are generally higher where the project is more complex and/or the sales value is higher.

pcBuild_x values are applied as a percentage of the total construction costs. E.g. if Construction costs are $100, design fees are another (100*0.030) = $3

The values are increased for more complex building projects – e.g. the design fees on a TC Apartment (Typology K) are 12%, compared with 6% for a Single House in lower sales value areas (1-5) which would typically be spec built or a ‘catalogue’ house where the design costs can be spread across may similar products, to 8% for Single Houses in 6-10 Sales categories which would be expected to be (on average) slightly more bespoke and potentially architecturally designed.

pcSale_x values are applied as a percentage of the total expected sale price.

pcLCV_x values are applied as a percentage of the LCV as an annual payable amount (total rates bill), which must be prorated for the development period (id x1.5 for an 18 month build timeframe).

Change Narrative (vs v3.8):

BuildDesignFees: Increase in Consultant Rates for both higher and lower end developments

DevelopmentMgmt: Increase in both Consultant Rates and required Levels of Service for more complex developments

Contingency: Change in Contingency banks are requiring for projects on construction (at time of tender) and overall project contingency generally due to rising costs/falling prices

Funding Costs: Funding Costs (i.e. charged interest rates reflecting perceived risk) Increased for bigger projects, and normalised for smaller ones. Keep in mind that while an increase from 7% to 10% may appear to be ‘only’ a 3 percentage point change, but is actually a 43% increase in finance costs relative to v3.8.

Sale and Marketing: fees charged as percentage of Sale Pricing **incl** GST rather than excluding (effectively a 15% increase in this cost over v3.8)

Table 19: Costs_ProfFees_LUT

FDC_Dwelling_typology_Code	pcBuild_BuildDesignFees	pcBuild_Planner	pcLCV_Rates	pcBuild_LegalnSurvey	pcBuild_DevelopmentMgmt	pcBuild_Contingency	pcBuild_FundingCosts	pcSale_SalesnMktg
A_1_5	0.0600	0.0030	0.0034	0.0020	0.0100	0.0300	0.0400	0.0350
A_6_10	0.0600	0.0040	0.0034	0.0020	0.0150	0.0500	0.0400	0.0350
B	0.0600	0.0040	0.0034	0.0040	0.0120	0.0500	0.0400	0.0350
C	0.0600	0.0040	0.0034	0.0040	0.0130	0.0500	0.0400	0.0350
D	0.0800	0.0040	0.0034	0.0150	0.0150	0.0500	0.0400	0.0350
E	0.0800	0.0040	0.0034	0.0150	0.0250	0.0800	0.0500	0.0350
F	0.0800	0.0040	0.0034	0.0150	0.0250	0.0800	0.0500	0.0350
G	0.0800	0.0040	0.0034	0.0150	0.0250	0.0800	0.0500	0.0350
H	0.0800	0.0040	0.0034	0.0150	0.0250	0.0800	0.0500	0.0350
I	0.1200	0.0030	0.0034	0.0150	0.0300	0.1000	0.1000	0.0350
J	0.1200	0.0030	0.0034	0.0150	0.0300	0.1000	0.1000	0.0350
K	0.1200	0.0030	0.0034	0.0150	0.0300	0.1000	0.1000	0.0350

Table 20: Professional Fees Groupings

Fee Group	Professional Fees	Applied as a multiple of
pcBuild_	BuildDesign Planner LegalnSurvey DevelopmentManagement Contingency FundingCosts *(i.e. interest & fees etc)*	Sum of all other build costs (ex GST)
pcSale_	SalesnMarketing	Expected Sale price (**incl** GST)
Pc_LCV	Rates *(Payable over the development period)*	LCV, for each whole year of construction (note rates are based on valuation, irrespective of market movements since)

11 Costs_Demolition_LUT.xlsx

This table provides the basis for demolition costs based on the typology code and sales location.

The demolition costs looked up are applied as a demolition cost per unit on the site, factored via a log function.

Costs to demolish a low quality 1 or 2 storey standalone dwelling (Type A in Sales Location 1) with good access and boundary setbacks are much lower per unit than demolishing a high rise built to the boundaries in a high value town centre (Type K in Sales Location 10).

The Log function is applied to recognise the economies of scale of dealing with multiple units per site as follows:

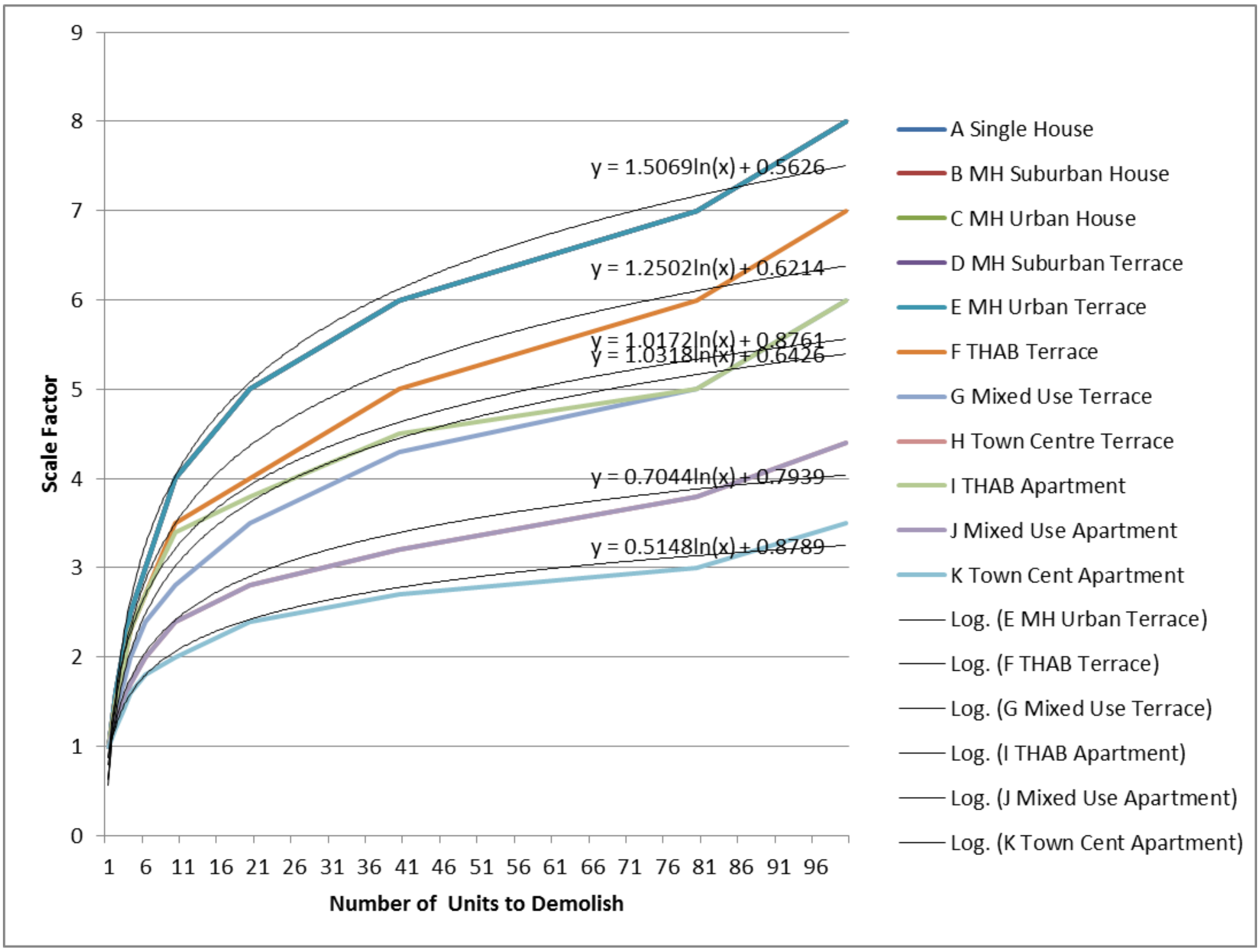
$$Site\ Demolition\ Costs\ Scale\ Factor = < ScaleFactor\_Logn > x\ \mathrm{Logn}(number\ of\ units\ to\ demolish) + < ScaleFactor\_plus >$$

$$Site\ Demolition\ Costs = Typology: Location\ Code\ Cost\ x\ Site\ Demolition\ Costs\ Scale\ Factor$$

Table 21: Costs_Demolition _LUT

FDC_Dwelling_Typology_Code	1	2	3	4	5	6	7	8	9	10	ScaleFactor_Logn_of_COUNT_RA	ScaleFactor_plus
A	16666.67	17708.33	18750.00	19791.67	20833.33	22916.67	25000.00	27083.33	29166.67	31250.00	1.5069	0.5926
B	16666.67	17708.33	18750.00	19791.67	20833.33	22916.67	25000.00	27083.33	29166.67	31250.00	1.5069	0.5926
C	16666.67	17708.33	18750.00	19791.67	20833.33	22916.67	25000.00	27083.33	29166.67	31250.00	1.5069	0.5926
D	16666.67	17708.33	18750.00	19791.67	20833.33	22916.67	25000.00	27083.33	29166.67	31250.00	1.5069	0.5926
E	16666.67	17708.33	18750.00	19791.67	20833.33	22916.67	25000.00	27083.33	29166.67	31250.00	1.5069	0.5926
F	16666.67	17708.33	18750.00	19791.67	20833.33	22916.67	25000.00	27083.33	29166.67	31250.00	1.2502	0.6214
G	33333.33	35416.67	37500.00	39583.33	41666.67	43750.00	45833.33	47916.67	50000.00	52083.33	1.0318	0.6426
H	54166.67	56250.00	58333.33	60416.67	62500.00	64583.33	66666.67	68750.00	70833.33	72916.67	0.7044	0.7939
I	33333.33	35416.67	37500.00	39583.33	41666.67	43750.00	45833.33	47916.67	50000.00	52083.33	1.0172	0.8761
J	54166.67	56250.00	58333.33	60416.67	62500.00	64583.33	66666.67	68750.00	70833.33	72916.67	0.7044	0.7939
K	62500.00	67708.33	72916.67	78125.00	83333.33	88541.67	93750.00	98958.33	104166.67	109375.00	0.5148	0.8789

Figure 5: Previous version of Costs_Demolition_LUT input calculations demonstrating economies of scale from multiple units.



12 Costs_DCsandConnections_LUT.xlsx

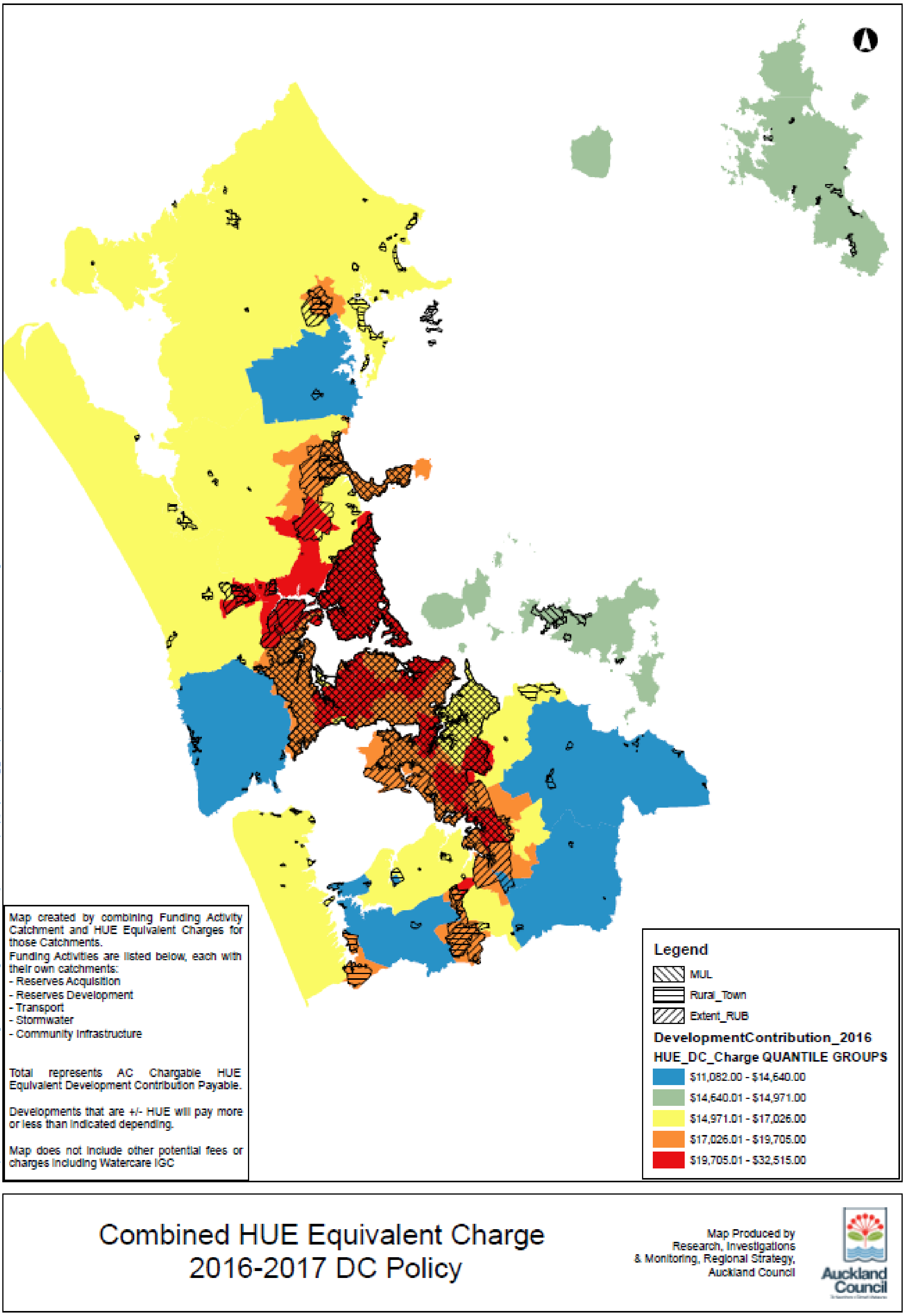
This table has been replaced by a more complex spatial and table based approach that more completely replicates the 2016/2017 Development Contributions Policy, WSL IGC Charges, Telecoms (Chorus) and Electrical (Vector) Connections Fees

This information is initialised via the parcel setup process to tag parcels with the 'activity catchment' that they fall within, covering Storm water, Transport, Reserves Development, Reserves Acquisitions and Community Facilities. Each development option is then individually calculated based on the typology and estimated additional impervious surface area to calculate the estimated Development Contribution for the site, in accordance with the relevant activity, which is then netted of any credits. (for e.g. a high rise apartment may pay a lesser charge for say transport than a standalone house, and these changes will vary by location)

Watercare IGC Changes, Electrical and Telecommunications connections fees are also calculated.

The map below indicates the spatial distribution of a Household Unit Equivalent (HUE) charge summed across all 5 Council Activities.

Figure 6: Combined HUE Equivalent DC Change



Watercare IGCs are charged for every dwelling (with a discount for sub 65m2 dwellings) in accordance with the published schedule (Table 22) , with the fee catchments relating to the final treatment plant. However spatial data that defines the catchments is not available (as this is often determined at the time of application) so Figure 7: Water IGC Catchments for ACDC Model Figure 7 below (has been developed for the ACDC and GFACDC models.

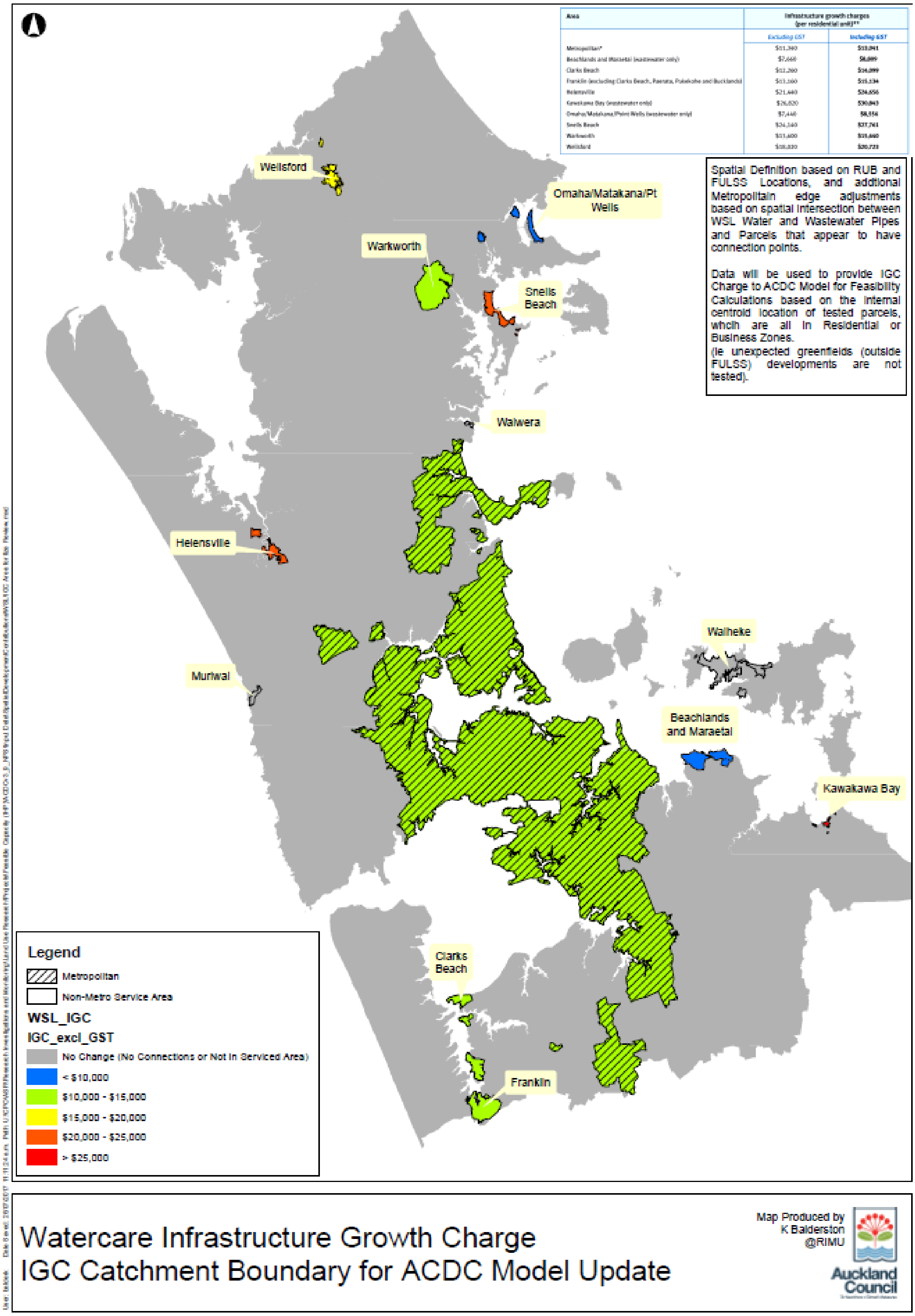
The Metropolitan Service Area covers the main urban area and the 'inner' main towns, some of the outer towns and villages have different charges, where they are serviced.

Water meters are charged on a per dwelling basis, and one inspection per 'site' is assumed

Table 22: WSL IGC Charges

Location_Name	Comments	IGC_excl_GST	Watermeter_Redev_excl_GST	Watermeter_Vacant_excl_GST	Inspections_Excl_GST
Metropolitan	covers customers supplied by Watercare's contiguous water supply system and/or serviced by any of Watercare's wastewater treatment plants at Mangere, Rosedale, Army Bay or Pukekohe. It includes the Hibiscus Coast, Kumeu, Huapai, Riverhead, Paerata, Pukekohe and Bucklands	11340	395	800	297.85
Beachlands and Maraetai		7660	395	800	297.85
Clarks Beach		12260	395	800	297.85
Franklin	Excluding Clarks Beach, Paerata, Pukekoke and Bucklands)	13160	395	800	297.85
Helensville		21440	395	800	297.85
Kawakawa Bay	Wastewater only	26820	395	800	297.85
Omaha/Matakana/Pt Wells	Wastewater only	7440	395	800	297.85
Snells Beach		24140	395	800	297.85
Warkworth		13600	395	800	297.85
Wellsford		18020	395	800	297.85
Muriwai	No Connections Avalaible	0	0	0	0
Waiheke	No Connections Avalaible	0	0	0	0
Waiwera	No Connections Avalaible	0	0	0	0
Outside Serviced Area	No Connections Avalaible	0	0	0	0

Figure 7: Water IGC Catchments for ACDC Model



Electrical Connection Fees are based on a review of the ‘Connections’ section of Vector.co.nz website and discussions with developers.

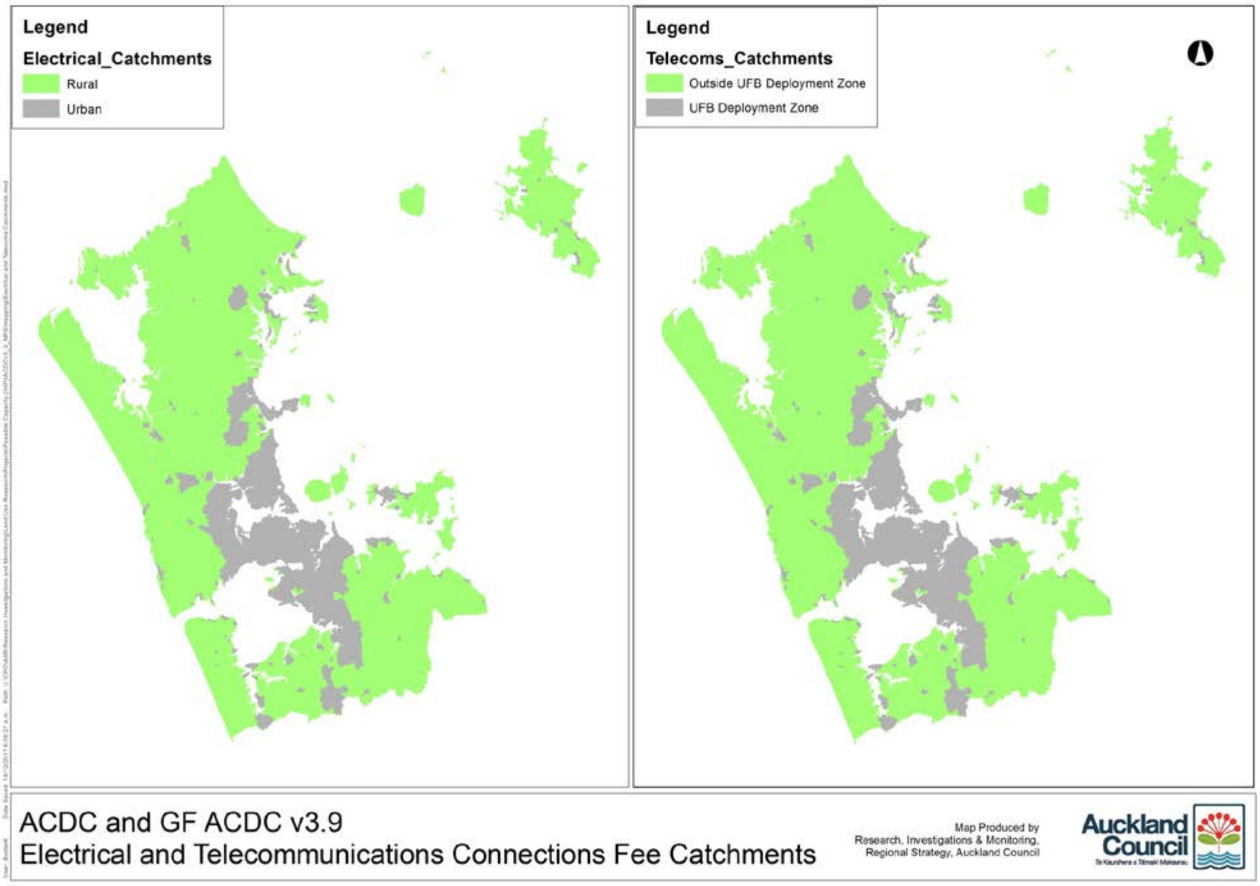
Fees vary based on the site being ‘rural’ or ‘urban’. For the purposed of this model all modelled developments are urban, (which is not defined on Vectors site), so Residential, Business and FUZ zones are assumed to be Urban, all else rural (see, and charged a single site fee and a per dwelling fee, depending on typology as outlined in Figure 8.

Vector is not the only wholesaler in the Region, and their site advised indicative costs only, but the general principles and costs identified are considered to be a reasonable basis for comparative modelling. Both the website and discussions with developers highlight that site context, development, and network conditions can influence costs considerably. The approach taken, while more complex than v3.8, is still relatively simplistic and could be further complicated if required and further information was available.

Table 23: Electrical Connections Fees

Electrical_Fee_Catchment	Single_SiteFee_exclGST	Single_UnitConnection_exclGST	MDU_SiteFee_exclGST	MDU_UnitConnection_exclGST
Urban	1500	500	1500	500
Rural	2000	500	2000	500

Figure 8: Electrical and Telecoms Connections Fee Catchments (based on AUPOIP Zoning)



Telecommunications Connections Charges are charged in a similar way to Electrical connections, with a single site fee and a per dwelling fee applied, that varies by typology and location. Table 24 below outlines these, which are based on discussions with developers and a review of Chorus.co.nz. Similar to Electrical Connections, site context, development particulars and network conditions may vary actual costs but for comparative modelling this simple approach is considered reasonable.

For example a four dwelling development that are of House typology would pay (1 site fee x$0) + (4 dwelling fee x $1200) = $4800 excl GST, but a 4 terrace development would pay (1 site fee x$1200) + (4 dwellings fee x $500) = $3200 excl GST

The present extent of the UFB Deployment area for the purposes of connections fees is unclear, but is assumed to eventually be rolled out in all Residential and Business Zones and Future Urban Areas as shown in in Figure 8. For the purposes of this modelling, there are therefore no modelled locations outside of the UFB Deployment Zone. This could be varied if required.

Table 24: Telecommunications Connections Charges

Telecoms_Fee_Catchment	Single_SiteFee_exclGST	Single_UnitConnection_exclGST	MDU_SiteFee_exclGST	MDU_UnitConnection_exclGST
UFB Deployment Zone	0	1200	1200	500
Outside UFB Deployment Zone	0	1600	0	1600

13 Costs_FSBuild_<size>_LUT.xlsx

These tables applies the ‘build’ cost applied as a $ value per m2 of floorspace of each dwelling.

Values are joined on the Dwelling_ BuildCost_Typology_Code and relevant Typology (Types 1, 4, and 7 get small, 2, 5, 8, get medium, 3, 6, 9 get large) and applied by Sales Location.

Note how the costs per m2 vary by costs location but also by typology, and there are small efficiency gains in moving from the small to the medium /large sizes. (smaller dwellings are slightly less efficient on a cost per m2 basis to construct). This is because the floor to wall/kitchen/bathroom ratio is more efficient in larger dwellings (i.e. a kitchen and bathroom cost about the same and are about the same area,in a 50m2 or 80 m2 apartment, but in the larger apartment the costs can be spread over 50% more floorspace and the walls needed take out less useable floorspace

The site development build cost is the *Floorspace of dwellings x the number of dwellings constructed* x *Costs_FS_build*

The cost generally increases as the sales location rises, reflecting materials, fit and finish, building layout (bathrooms per bedroom, stories, etc) and ‘architectural flair’. Costs also increase with ‘density’ due to increasing complexity and specialist skills and equipment and the requirement to pay for ancillary items that are not ‘in’ the floorspace being sold (like they are in the house) but still must be accounted for such as access ways, corridors, lifts and stairs, building systems services and structures and etc

Table 25: Costs_FSBuild_Small_LUT

FDC_Dwelling_BuildCost_Typology_Code	FDC_BuildCost_Typology_Name	1	2	3	4	5	6	7	8	9	10
A	House: Single	1,760	1,925	2,090	2,310	2,530	2,640	3,300	3,575	3,905	4,400
B	House: MHS, MHU	1,760	1,925	2,090	2,310	2,530	2,640	2,970	3,300	3,630	4,180
C	House: THAB,TC	1,760	1,925	2,090	2,310	2,530	2,640	2,970	3,300	3,630	4,180
D	Terrace: Single, MHS	2,915	2,970	3,025	3,080	3,135	3,190	3,355	3,520	3,685	4,015
E	Terrace: MHU	2,915	2,970	3,025	3,080	3,135	3,190	3,355	3,520	3,685	4,015
F	Terrace: THAB	2,860	2,915	2,970	3,025	3,080	3,135	3,300	3,465	3,630	3,960
G	Terrace: Mixed Use	2,915	2,970	3,025	3,080	3,190	3,300	3,465	3,630	3,795	4,070
H	Terrace: Town Centre	2,970	3,080	3,190	3,245	3,300	3,355	3,520	3,685	3,850	4,180
I	Apmt: Sing,MH,THAB	4,070	4,070	4,070	4,070	4,070	4,235	4,455	4,785	5,060	5,280
J	Apmt: Mixed Use	4,070	4,070	4,070	4,070	4,070	4,290	4,510	4,840	5,115	5,390
K	Apmt: Town Centre	4,180	4,180	4,180	4,180	4,180	4,400	4,620	4,950	5,225	5,500

Table 26: Costs_FSBuild_Medium_LUT

FDC_Dwelling_BuildCost_Typology_Code	FDC_BuildCost_Typology_Name	1	2	3	4	5	6	7	8	9	10
A	House: Single	1600	1750	1900	2100	2300	2400	3000	3250	3550	4000
B	House: MHS, MHU	1600	1750	1900	2100	2300	2400	2700	3000	3300	3800
C	House: THAB,TC	1600	1750	1900	2100	2300	2400	2700	3000	3300	3800
D	Terrace: Single, MHS	2650	2700	2750	2800	2850	2900	3050	3200	3350	3650
E	Terrace: MHU	2650	2700	2750	2800	2850	2900	3050	3200	3350	3650
F	Terrace: THAB	2600	2650	2700	2750	2800	2850	3000	3150	3300	3600
G	Terrace: Mixed Use	2650	2700	2750	2800	2900	3000	3150	3300	3450	3700
H	Terrace: Town Centre	2700	2800	2900	2950	3000	3050	3200	3350	3500	3800
I	Apmt: Sing,MH,THAB	3700	3700	3700	3700	3700	3850	4050	4350	4600	4800
J	Apmt: Mixed Use	3700	3700	3700	3700	3700	3900	4100	4400	4650	4900
K	Apmt: Town Centre	3800	3800	3800	3800	3800	4000	4200	4500	4750	5000

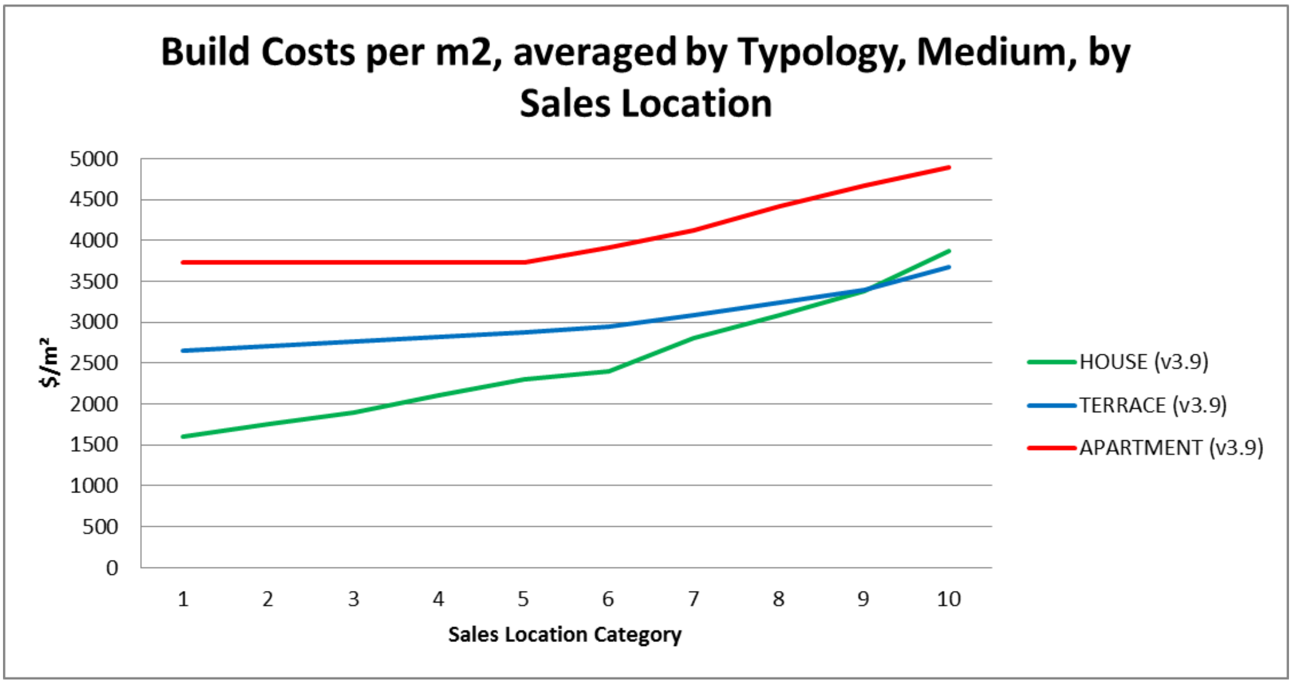
Table 27: Costs_FSBuild_Large_LUT

FDC_Dwelling_BuildCost_Typology_Code	FDC_BuildCost_Typology_Name	1	2	3	4	5	6	7	8	9	10
A	House: Single	1600	1750	1900	2100	2300	2400	3000	3250	3550	4000
B	House: MHS, MHU	1600	1750	1900	2100	2300	2400	2700	3000	3300	3800
C	House: THAB,TC	1600	1750	1900	2100	2300	2400	2700	3000	3300	3800
D	Terrace: Single, MHS	2650	2700	2750	2800	2850	2900	3050	3200	3350	3650
E	Terrace: MHU	2650	2700	2750	2800	2850	2900	3050	3200	3350	3650
F	Terrace: THAB	2600	2650	2700	2750	2800	2850	3000	3150	3300	3600
G	Terrace: Mixed Use	2650	2700	2750	2800	2900	3000	3150	3300	3450	3700
H	Terrace: Town Centre	2700	2800	2900	2950	3000	3050	3200	3350	3500	3800
I	Apmt: Sing,MH,THAB	3700	3700	3700	3700	3700	3850	4050	4350	4600	4800
J	Apmt: Mixed Use	3700	3700	3700	3700	3700	3900	4100	4400	4650	4900
K	Apmt: Town Centre	3800	3800	3800	3800	3800	4000	4200	4500	4750	5000

Interestingly build costs are generally lower for house dwellings in low value areas than for apartments, but as house build costs rise much faster than apartment costs though the sales areas, this is reversed in the higher end locations. This reflects that house standards in these high value areas are typically very high end construction commensurate with the underlying land values.

The graph below illustrates the relative values used in this version using the averaged by typology values from the medium table by Sales Location.

Table 28: Build costs per m2

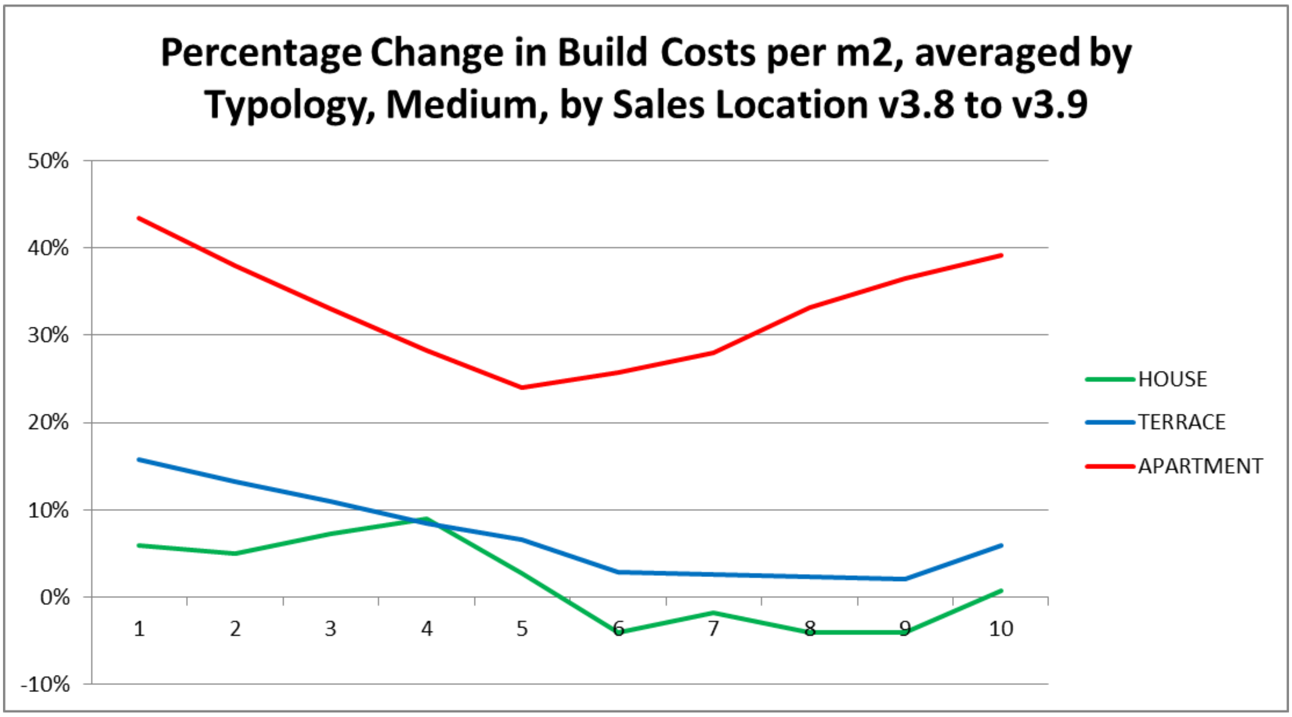


Change Narrative (vs v3.8):

Costs per m2 for smaller and more intensive units have increased significantly (25-45%) while costs for larger and lower density units have increased slightly (~10%) or in some cases reduced very slightly (-5%) .

The percentage change in $/m² build costs relative to v3.8 are shown below, which clearly indicate large increases in apartment costs in all locations in excess of 20%, and up to 45% in SLC 1. Terrace and House developments show more modest rises particularly at the lower end, and in the case of upper end houses, show minor reductions. This flows though in to output changes where apartments have fallen away considerably and are not necessarily being replaced by feasible terrace or house developments, and where they are, these typologies do not deliver the same quantum of dwellings.

Table 29: Percentage Change in build costs for 'Medium' group relative to v3.8



14 Costs_SiteCivil_LUT.xlsx

This table provides information on the site works, civil (installation of underground services and connections, etc.) and landscaping costs within the boundary of each property and are applied as a $ value per m2 of land area.

Site Total Civil Costs = parcel_area x Costs_SiteCIvil

Variation is provided between typologies (detached developments have lower landscape in a site/civil costs on a per m² basis) and sales location value (largely reflecting a greater emphasis on quality and quantity of landscaping including specialist designers and planting as sales values rise).

Table 30: Costs_SiteCivil_LUT

FDC_Typology_Code	FDC_Typology_Name	1	2	3	4	5	6	7	8	9	10
A	Single House	41.67	67.71	93.75	119.79	145.83	177.08	208.33	239.58	270.83	312.50
B	MH Suburban House	41.67	67.71	93.75	119.79	145.83	177.08	208.33	239.58	270.83	312.50
C	MH Urban House	33.33	54.17	75.00	95.83	116.67	141.67	166.67	191.67	216.67	250.00
D	MH Suburban Terrace	52.08	67.71	83.33	98.96	114.58	145.83	177.08	208.33	239.58	260.42
E	MH Urban Terrace	52.08	67.71	83.33	98.96	114.58	145.83	177.08	208.33	239.58	260.42
F	THAB Terrace	52.08	67.71	83.33	98.96	114.58	145.83	177.08	208.33	239.58	260.42
G	Mixed Use Terrace	52.08	67.71	83.33	98.96	114.58	145.83	177.08	208.33	239.58	260.42
H	Town Centre Terrace	52.08	67.71	83.33	98.96	114.58	145.83	177.08	208.33	239.58	260.42
I	THAB Apartment	52.08	67.71	83.33	98.96	114.58	145.83	177.08	208.33	239.58	260.42
J	Mixed Use Apartment	52.08	67.71	83.33	98.96	114.58	145.83	177.08	208.33	239.58	260.42
K	Town Cent Apartment	52.08	67.71	83.33	98.96	114.58	145.83	177.08	208.33	239.58	260.42

Change Narrative vs v3.8

Blanket increase of 10% over v3.8.

Potential Improvements:

Potential improvements could include a more specific method of determining civil connection costs, wastewater and stormwater in particular as this has been raised as a major source of time cost by developers anecdotally.

However the cost of these works is very development/design/site specific and time costs (dealing with network owners) may also relate to the (temporary) state of the respective networks at the time of connection.

An improved cost function could be developed based on the known network details from the GIS system such as:

- presence of reticulated network feature (non-presence implies greater cost)
- distance of nearest manhole from site (greater distance implies greater cost)
- diameter of reticulated network feature simplistically related to net increase (small diameter and large increase implies greater cost)

- condition of reticulated network feature (using material (e.g. implied cost would increase moving from PCV, concrete, asbestos cement, ceramic or unknown) or condition if known
- use of known capacity constraints (see Costs_Constraints_LUT.xlsx discussion below), but these issues
    - affect only the *n*th development, which is not knowable by the model who assesses all options instantaneously (does not 'forecast'), or
    - are generally temporary, (planned works will address in due course – may be a present cost, but may not exist at a future date of development), or
    - often relate to a level of service measure for a broad or downstream catchment (and may not physically affect the development site specifically), e.g. more connections may increase the possibility of wastewater overflows in storm events, more development in the upper catchment might increase downstream flooding (ideally these should be reflected in DC charges so double counting must be avoided).

15 Costs_Constraints_LUT.xlsx

This table provides information on the additional costs potentially imposed by various constraints.

The values are imposed as a single site cost value added to the site costs if the site *intersects* with the spatial feature representing the constraint.

These figures were initially developed by the 013EG for version 1 as a placeholder pending improved information. For v3.8 these initial values have simply been inflated by the general cost increases suggested by Mr Fontein for the other building related costs (4.17%).

The costs are considered to represent the cost of obtaining a specialist report relating to the constraint feature, and the cost of review of this report via the consent process. Costs of 'changing design' are not included as it is presumed the findings of the specialist report obtained by the developer has been used in the site layout and design process (i.e. the presence of these features is no surprise), and there is no loss of overall development potential[31] as a result (e.g. notable trees in the corner of the site are worked around by slightly more clustered development in the remainder).

Potential improvements could involve

- variable costs dependent on area of constraint, however, the cost of overcoming some constraints is not necessarily 'area of constraint' dependent
- variable costs dependent on number of constraints (e.g. a scale factor) however some constraints are not as costly to overcome as others (i.e. area != cost)
- consideration of other costs and constraints not listed (e.g. resource consent category?, infrastructure capacity constraints)
- consideration of applying 'negative costs' (i.e. benefits as a cost reduction) from positive aspects (e.g. reduced time cost from SHA processing, or known site specific amenities e.g. good views etc.)

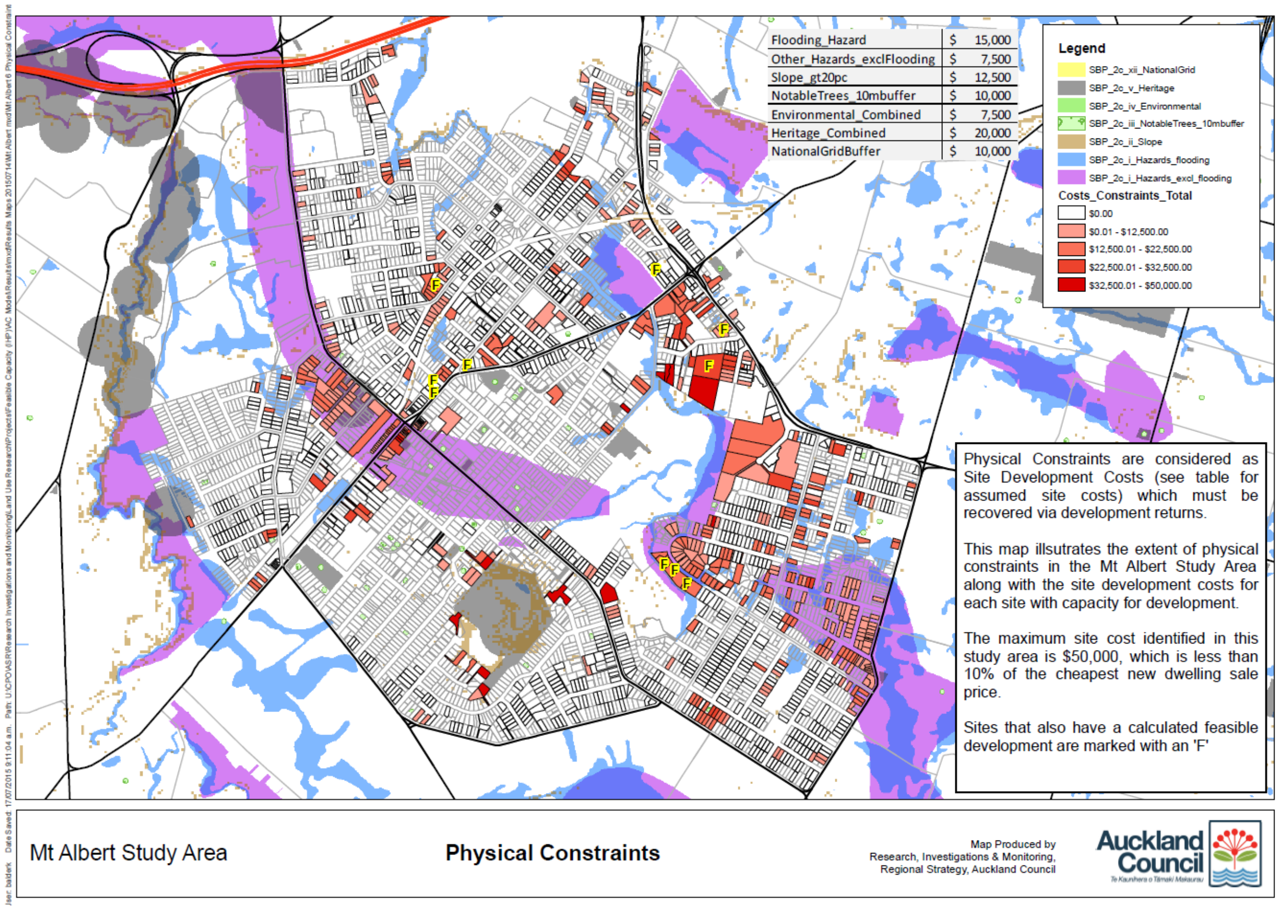
Table 31: Costs Constraints LUT

FDC_Typology_Cod	FDC_Typology_Name	Flooding_Hazard	Other_Hazards_exclFloo	Slope_gt20pc	NotableTrees_10mbuffer	Environmental_Combine	Heritage_Combined	NationalGridBuffer
A	House: Single	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
B	House: MHS, MHU	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
C	House: THAB,TC	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
D	Terrace: Single, MHS	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
E	Terrace: MHU	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
F	Terrace: THAB	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
G	Terrace: Mixed Use	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
H	Terrace: Town Centre	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
I	Apmt: Sing,MH,THAB	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
J	Apmt: Mixed Use	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
K	Apmt: Town Centre	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67

[31] This is also reflected in the way the costs are applied to the site as a whole – development options with more dwellings (higher density) can amortise any imposed site costs across more dwellings (noting that the profitability of more intensive developments is also generally tighter).

The Map in Figure 9 below illustrates how the constraint costs (as used in a previous version of the model) been applied in a sample area illustrating the wide spatial variability in the presence of constraints and combinations thereof:

Figure 9: Physical Constraints: Location and Costs Mapping



16 Sales_PriceCeiling_Factor_LUT.xlsx

This table works in conjunction with Sales_PriceCeilings_LUT (which sets the reference dwelling price) to establish the relative ceiling for each typology.

A Large House typology development on an A1 (Single House Zone) site is expected to sell for 1.5x the reference price ceiling (being closest to the Medium House typology), but a small Apartment has a ceiling of 0.75x of the reference price ceiling. Differentials on a K15 site (high rise town centre) would be 1.2x for a Large House and 0.55x for a Small Apartment.

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9
		Apartment Small	Terrace Small	House Small	Apartment Medium	Terrace Medium	House Medium	Apartment Large	Terrace Large	House Large
A1	Single Hs: 500m2+	0.75	0.85	0.9	0.85	0.9	1.2	1.2	**1.3**	**1.5**
B1	Mixed House Suburban	0.65	0.75	0.85	0.8	0.85	1.1	1.2	**1.2**	**1.4**
C1	Mixed House Urban	0.65	0.75	0.85	0.8	0.85	1.1	1.2	**1.2**	**1.4**
F1	THAB 3 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.3**
F2	THAB 4 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.3**
F3	THAB 5 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.3**
G1	Mixed Use 3 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
G2	Mixed Use 4 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
G3	Mixed Use 5 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K1	TC 3 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K2	TC 4 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K3	TC 5 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K4	TC 6 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K5	TC 7 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K6	TC 8 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K7	TC 9 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K8	TC 10 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K9	TC 11 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K10	TC 12 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K11	TC 13-15 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K12	TC 16-18 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K13	TC 18-25 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K14	TC 25-30 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**
K15	TC 30+ Level	0.55	0.7	0.8	0.75	0.85	1	1.1	**1.1**	**1.2**

17 Sales (Price) Sales_PriceFS_LUT.xlsx

This table supplies the estimated sales price of the constructed dwellings, on a $ per m2 basis, excluding GST.

This is calculated using the floorspace assumed from FloorspaceArea_LUT multiplied by the values in this table.

The values reflect the expected average sale price of the dwelling typology (per m2 of floorspace) in the sales location based on expert opinion.

This reflects the relative expected price of the single dwelling in that location – while the primary driver of the sale price is the area (in floorspace) of the dwelling, the typologies do have variable prices within the typologies reflecting some variation in the amount of land (e.g. while A1 and B1 typologies are the same (Houses) A1 dwellings will have a larger section than B1 Houses.

While existing evidence suggests floorspace is the largest factor explaining variability in sale prices potential improvement may be to take a $price = a + bx$ approach to explicitly price and sell the (quite variable) land associated with each dwelling.

Table 32: Sales Price FS LUT

FDC_Dwelling_BuildCost_Typology_Code	FDC_BuildCost_Typology_Name	1	2	3	4	5	6	7	8	9	10
A	House: Single	5250	5748	6240	6747	7252	7755	8256	8755	9509	10260
B	House: MHS, MHU	4800	5040	5500	5995	6480	6955	7420	7875	8580	9270
C	House: THAB,TC	4800	5040	5500	5995	6480	6955	7420	7875	8580	9270
D	Terrace: Single, MHS	4320	4704	5280	5886	6480	7062	7632	8190	9048	9888
E	Terrace: MHU	4320	4704	5280	5886	6480	7062	7632	8190	9048	9888
F	Terrace: THAB	4320	4704	5280	5886	6480	7062	7632	8190	9048	9888
G	Terrace: Mixed Use	4320	4704	5280	5886	6480	7062	7632	8190	9048	9888
H	Terrace: Town Centre	4320	4704	5280	5886	6480	7062	7632	8190	9048	9888
I	Apmt: Sing,MH,THAB	4440	4928	5610	6322	7020	7704	8374	9030	10036	11021
J	Apmt: Mixed Use	4440	4928	5610	6322	7020	7704	8374	9030	10036	11021
K	Apmt: Town Centre	4440	4928	5610	6322	7020	7704	8374	9030	10036	11021

The data in the LUT above is aggregated into groups based on the common sales values and graphed in Figure 10 and Figure 11 below.

Figure 10 shows that the Sale prices are within a relatively narrow band across the region, widening slightly towards the upper end of the value range, most obvious pattern is the 'flip' of the apartments from the bottom of the price band in the lower value areas to highest priced option in high value areas.

Figure 10: Sales Price Floorspace per m2 (aggregated)

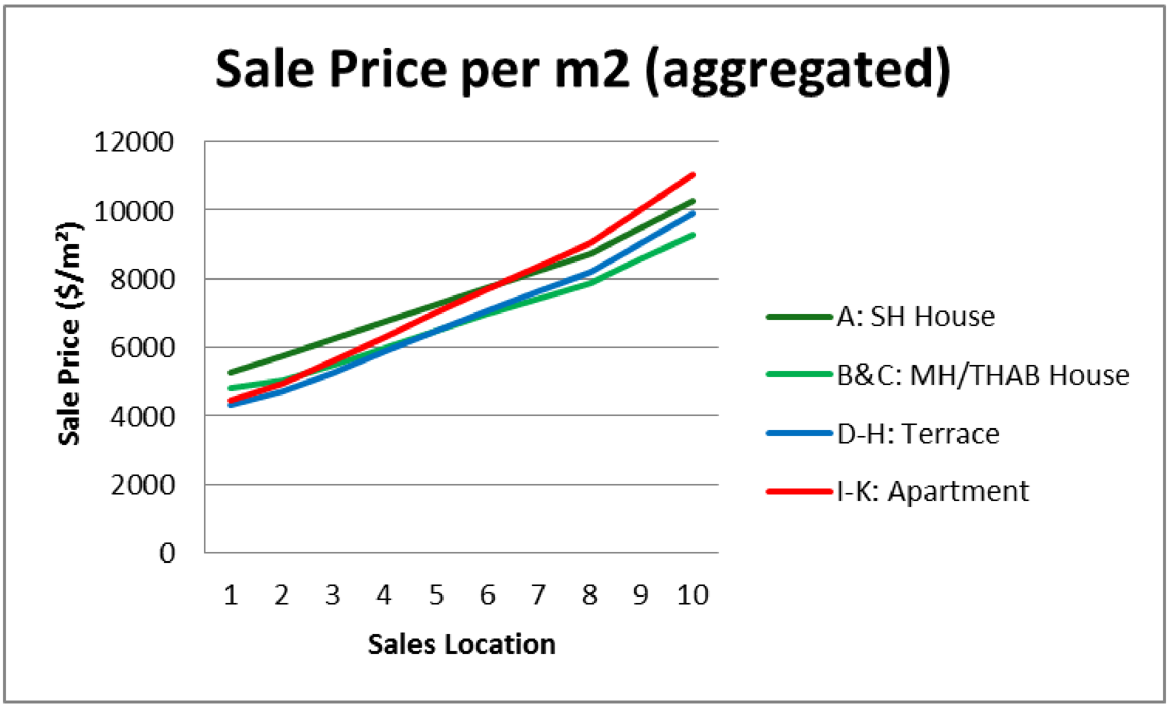
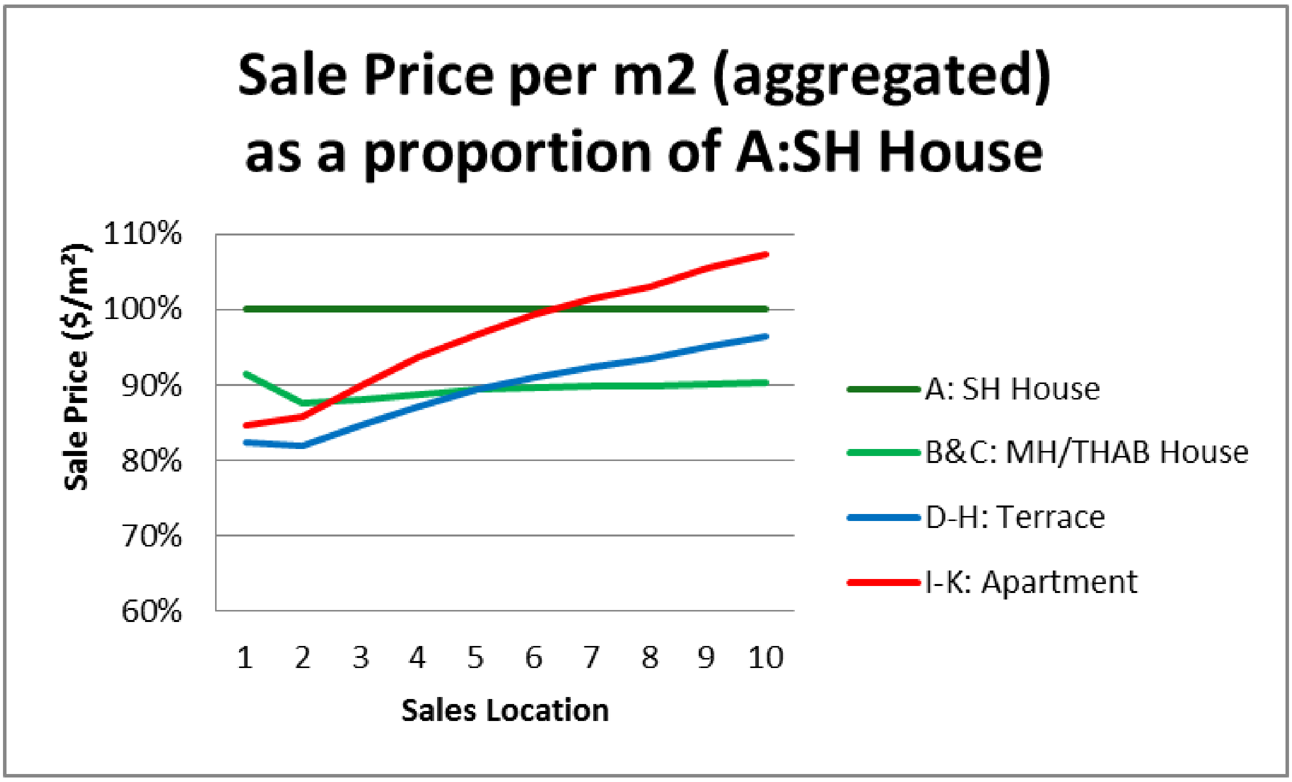


Figure 11 shows the same data but as a proportion of the A (Single House House) sale price per m2, which exaggerates these patterns. The two House typologies generally follow each other, the ~10% differential representing the 'discount' applied for the (upto 60%) smaller land area associated with denser houses in the non-Single House Zone (representing the difference in relative value placed on provision of land area vs floor area as a determinant of dwelling prices). Conversely the attached (Terrace and Apartment) typologies generally track together but widening as value increases.

Figure 11: Sales Price (Floorspace) aggregated, as a proportion of A: (Single House House)



18 Costs_SiteCV_Adjustment_LUT.xlsx

This Table imposes an inflation adjustment on the site purchase costs based on assumed differences in the LCV (based on June 2014 Auckland Council valuations) used as the regional base cost for every site in the region and the 'current market value' of developable sites by zone and sales location at the 'strike date' of this version of the model being Mid 2017.

The relative differences reflect the development communities' anecdotal experiences, and are explained as a function of the up zoning effect of the evolving AUP, and the passage of time since the 2014 Valuations. **NOTE: Runs in 2018 will incorporate June 2017 Valuations, which will have been be refined by objections process, at the time of use.**

Sites in the SHZ are inflated 10% on previous values (reflecting general house price inflation offset by some down zoning from legacy plans) compared with say Mixed Use zoning which has increase in value by upto 70% reflecting both the significant (and very flexible) up zoning most of these sites have experienced and the well located (relative to amenities) of a significant proportion of it.

Change Narrative:

Changes made to v3.8 assumptions are limited to Mixed Use and THAB zoned sites in location 7 up, reflecting the relative scarcity of developable sites with this zoning (high redevelopment potential) in these sales locations, compared with lower value areas. Mixed Housing Suburban and Urban Zoned sites are far more widespread and are therefore able to be purchased at general market rates.

Table 33: Costs_CV_Adjustment

CfGS_Dwelling_typol	Zone Group	1	2	3	4	5	6	7	8	9	10
A	Single House	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
B	MH Suburban	1.3	1.3	1.3	1.31	1.32	1.33	1.35	1.33	1.31	1.3
C	MH Urban	1.35	1.36	1.37	1.38	1.39	1.4	1.41	1.4	1.39	1.38
F	THAB	1.5	1.52	1.54	1.56	1.58	1.6	1.7	1.8	2	2
G	Mixed Use	1.6	1.62	1.64	1.66	1.68	1.7	1.7	1.8	2	2
K	Town Centre	1.4	1.42	1.44	1.46	1.48	1.5	1.5	1.48	1.46	1.44

Appendix H Auckland Council Planning Committee, 28 November 2017, agenda item 14: National Policy Statement on Urban Development Capacity initial assessment results

Auckland Council
Te Kaunihera o Tāmaki Makaurau

I hereby give notice that an ordinary meeting of the Planning Committee will be held on:

Date:	**Tuesday, 28 November 2017**
Time:	**9.30am**
Meeting Room:	**Reception Lounge**
Venue:	**Auckland Town Hall 301-305 Queen Street Auckland**

Planning Committee

OPEN ADDENDUM AGENDA

MEMBERSHIP

Chairperson	Cr Chris Darby	
Members	Cr Dr Cathy Casey	Cr Daniel Newman, JP
	Deputy Mayor Bill Cashmore	IMSB Member Liane Ngamane
	Cr Ross Clow	Cr Dick Quax
	Cr Fa'anana Efeso Collins	Cr Greg Sayers
	Cr Linda Cooper, JP	Cr Desley Simpson, JP
	Cr Alf Filipaina	Cr Sharon Stewart, QSM
	Cr Hon Christine Fletcher, QSO	Cr Sir John Walker, KNZM, CBE
	Mayor Hon Phil Goff, CNZM, JP	Cr Wayne Walker
	IMSB Member Hon Tau Henare	Cr John Watson
	Cr Richard Hills	
	Cr Penny Hulse	
	Cr Mike Lee	

(Quorum 11 members)

Kalinda Gopal
Senior Governance Advisor
24 November 2017

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National Policy Statement on Urban Development Capacity initial assessment results

File No.: CP2017/24289

Purpose

1. To receive the preliminary high-level results of the housing demand capacity assessment required under the National Policy Statement on Urban Development Capacity.

Executive summary

2. The National Policy Statement on Urban Development Capacity (NPS-UDC) became operative in 2016. The policy requires the council to undertake a housing and business development capacity assessment (the assessment) by 31 December 2017.
3. The assessment is a key part of council's evidence base. It informs the future development strategy and the feasibility targets which are to be included in the Unitary Plan. These requirements need to be completed by 31 December 2018.
4. Overall housing demand is assessed to be between 350,000 (Statistics NZ medium population forecast) and 410,000 (Statistics NZ high population forecast) households from 2016 to 2046:
    - Plan-enabled capacity in residential zones in the urban area ranges between 120,000 (infill) and 1.07 million (redevelopment).
    - Feasible development capacity in the urban areas is 140,000 residential dwellings
    - Feasible development capacity in the future urban areas is 146,000 residential dwellings
    - When including rural capacity of around 20,000 (not modelled) and redevelopment of Housing New Zealand land of around 30,000 (still being confirmed), total assumed feasible development capacity is around 336,000 throughout the region
5. The enabled feasible capacity for dwelling supply, as modelled for the 2016 draft Unitary Plan recommended by the Independent Hearings Panel, was for approximately 422,000 – being 270,000 (modelled) in brownfield existing urban areas and 130,000 (assumed feasible) in future urban areas, with the remainder being potential Housing NZ developments and future dwelling growth in rural-zoned areas. The new modelling shows, principally due to rising construction costs and flat to declining sales prices, that the brownfield enabled feasible capacity of 270,000 has since reduced to 140,000; and that the future urban feasible enabled capacity has changed slightly as it is now modelled, from 130,000 to 146,000 dwellings.
6. The Statistics New Zealand medium population forecast is being used for all council planning purposes. On that basis, the preliminary assessed demand is around 14,000 more than the feasible development capacity in 2046. Or demand is around 66,000 more in 2046 when the NPS-UDC's required 15 per cent long-term margin is added.
7. Further analysis is being undertaken which will be included in the final assessment report that will be put to government prior to Dec 31st this year, via the proposed delegated authority outlined in the recommendations.
8. The business development capacity assessment is being done externally and results are not yet finalised.
9. Note that the feasibility models will be refined and rerun in early 2018. This will form the basis of council's response required under the NPS-UDC.
10. This is a snapshot of development capacity at a moment in time and is the first assessment under the national policy statement. It is important not to assume trends or patterns based on one assessment alone.

Recommendation/s

That the Planning Committee:

a) receive the preliminary high-level findings of the housing development capacity assessment.

b) delegate responsibility for signing off the finalised housing and business development capacity assessment to the chair of the Planning Committee and Deputy Mayor, before 31 December 2017.

c) note that the feasibility models will be re-run in early 2018 to produce a final assessment which will form the basis of council's response required under the National Policy Statement on Urban Development Capacity.

Comments

11. National Policy Statements are a legislative tool in the Resource Management Act 1991. They are a means for central government to prescribe objectives and policies for matters of national significance which all local authorities must implement within their planning framework.

12. To qualify for national direction, a topic must involve one of the following:

    - significant national-level benefits, costs or values
    - significant benefits of having a consistent approach across the country
    - technical complexity that makes it more efficient and effective to address the issues at the national level.

13. The NPS-UDC came into effect in December 2016. Its purpose is to enable urban environments to grow and change in response to the changing needs of communities and to provide enough space for their populations to live and work.

14. The NPS-UDC has four objectives. These are:

    - outcomes from planning decisions
    - evidence and monitoring to support planning decisions
    - responsive planning and coordinated planning evidence
    - decision-making.

15. Each objective has an associated set of policies.

16. The evidence and monitoring objective requires a robustly developed, comprehensive and frequently updated evidence base to inform planning decisions. The evidence base has two components; the assessment, and the monitoring and reporting of indicators.

17. An assessment is required at least every three years. The first assessment requires completion by 31 December 2017. In relation to housing, the assessment must estimate 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.

18. The short, medium and long-terms are defined as 3, 10 and 30 years respectively. A margin is to be added to the feasible development capacity amount. This is in recognition that not all that is feasible is built (the margin is 20 per cent in the short and medium term and 15 per cent in the long term).

19. The assessment is to enable decision makers to make well-informed planning decisions.

20. However, doing the assessment and interpreting is a complex task that is still evolving, including the development of guidance from central government.

Requirements and responses

21. If the assessment indicates insufficient development capacity in the short, medium or long term, providing further development capacity and enabling development is required.

22. This could include reviewing the consenting process or initiating plan changes to increase feasible development capacity.

23. Minimum targets for feasible residential development capacity must be included in the regional policy statement section of council's Unitary Plan by 31 December 2018.

24. A future development strategy that uses the results of the assessment is required by 31 December 2018. Demand must be met with a minimum 15 per cent buffer. The strategy must therefore identify:

    - the broad location, timing and sequencing of future development capacity over the long term in future urban environments
    - intensification opportunities within existing urban environments.

25. The Auckland Plan is currently being refreshed. It incorporates a development strategy. This will be the council's future development strategy as required by the NPS-UDC.

Demand assessment

26. Statistics New Zealand's most recent population projections are the starting point for demand. Council must calculate future housing demand which includes:

    - the total number of dwellings required to meet projected household growth and projected visitor accommodation growth
    - demand for different types of dwellings
    - demand for different locations within the urban environment
    - demand for different price points.

Capacity assessment

Independent Hearings Panel modelling

27. Modelling undertaken for the Independent Hearings Panel (IHP) as part of the Unitary Plan hearings process concluded that the recommended Unitary Plan enabled approximately 1 million additional residential units, of which 422,000 were commercially feasible.

28. Urban locations were modelled using a feasibility model. The final IHP result also replaced feasible capacity from the feasibility model with Housing New Zealand's development objectives (~39,000 residential units).

29. For the IHP's purposes, greenfield and rural sites and Housing New Zealand land was assumed to be feasible but not modelled.

NPS-UDC modelling

30. Development capacity is the basis of supply. There are two aspects to this. The first is plan-enabled capacity which must include an analysis of:

    - the cumulative effect of all zoning, objectives, policies, rules and overlays and existing designations in plans
    - the actual and likely availability of development infrastructure and other infrastructure in the short, medium and long term.

31. The second aspect of supply is feasible development capacity. This involves analysing:

    - Plan-enabled supply to determine which developments are commercially viable considering current costs, revenues and yields
    - the rate of take up of development capacity, observed over the past 10 years and estimated for the future
    - the market's response to planning decisions.

32. Plan-enabled capacity has been calculated using council's Capacity for Growth Model.
33. Feasible capacity for existing urban areas has been calculated using the ACDC model. This model was developed as part of the Unitary Plan Hearings IHP process in collaboration with property and planning experts.
34. Feasible capacity for the Future Urban Land Supply Strategy (FULSS) areas was calculated in two stages:
    - stage one involved testing the commercial feasibility of creating sections in the FULSS
    - stage two involved testing the commercial feasibility of developing residential units on those sections.
35. Feasible capacity was calculated in two different sets of locations – urban residential zones (urban) and future urban zones (as per the FULSS).
36. In the urban area the ACDC model was used. This is largely the same model as developed at the request of and used for the IHP Feasibility Assessments by the Urban Growth Expert Group.
37. However, a number of assumptions have been updated to reflect current (as at 'mid' 2017) costs and prices from the 'mid' 2016 values used for the IHP.
38. The changes made have been developed in conjunction with members of the Property Council and include per m2 build costs from Ryder Level Bucknell. The key changes are:
    - build costs per m2 have increased, particularly for higher density developments and higher end locations. This cost-centre includes materials and labour. The increase reflects construction sector constraints
    - professional fees e.g. design and project management, have increased for higher densities / larger projects
    - funding costs have generally increased; both interest rates payable and the contingencies required (increasing overall costs and the interest payable) particularly for larger and more complex projects
    - the 2016/17 Development Contributions Policy and WaterCare's Infrastructure Growth Charges are now included. A universal growth charge was used in previous models.
    - electrical and telecommunications per unit connections and site costs have increased. No gas connections are assumed
    - site civil works costs (all physical works not included in build costs or demolition fees) such as earthworks, have increased by 10 per cent
    - the cost of a development site (applied as a relativity to the 06/2014 valuation data) has increased significantly for developable Terraced Housing and Apartment Buildings and Mixed Use zoned sites in higher value areas, reflecting their scarcity
    - the Operative in Part Auckland Unitary Plan rules and zonings (including precincts and overlays) on a 2017 cadastral base are used for the input capacity.
39. The net effect of these changes is input cost increases combined with flat sales prices. This has an impact on project feasibility.
40. The feasibility model is underpinned by a number of assumptions. The key assumptions are:
    - nine different typologies are tested that comply with simplified density, bulk and location rules
    - a developer purchasing the land, building and then selling the development within 18 months, returning a minimum of 20 per cent gross (pre-tax) return on costs is assumed. The 20 per cent threshold is consistent with industry requirements when demonstrating pre-start feasibility to prospective financiers
    - an 'average' developer and development is assumed. Developers can, and do, structure, development to account for different risks and opportunities. However, these options are not modelled

- sales prices are set by sales location, floor area and typology, reflecting relativities to a 'standard' dwelling sale price. As a general rule, apartments and terraces will sell at a $/m2 of floor area discount to a house
- land area is not explicitly considered but is implicit in the per m^2 of floorspace rates
- costs vary by a number of model variables - e.g. floor area, typology, civil works - to reflect the development process
- as a general rule, apartments are more expensive to build (on a per m^2 of floorspace) than terraces. Terraced are more expensive to build than houses.

41. The feasibility model is not a forecast or projection of development. It is a commercial filter on present plan-enabled opportunities, providing a 'snapshot in time' of the sites that would be most appealing to an 'average' percentage return[1] motivated developer that wanted to commence a project today. The model does however allow scenarios to be tested to understand what impacts policies might have on feasibility.

42. FULSS locations are the second area modelled, but this time using a two-step process.

43. Current Future Urban Zone titles (i.e. land holdings as they currently are) are first developed into sections for sale (step one). Sections that are commercially feasible are then assessed for dwelling feasibility (step two).

44. They key assumptions in the FULSS area feasibility model are:

    - FULSS-related infrastructure costs use the 2016/17 development contributions policy and WaterCare Infrastructure Growth Charge.
    - the feasibility model assumes that existing land is bought, sections are created by 'land developers' and then sold for a profit at retail prices, to 'dwelling developers' who build and subsequently sell to residents/investors. Both steps include a minimum required gross profit of 20 per cent for each developer.
    - 'Mixed Housing Suburban' is the assumed zoning framework for the baseline
    - costs such as earthworks, development contributions, and sales prices vary across FULSS areas to reflect localised constraints.

<u>Rural capacity and Housing New Zealand developments</u>

45. Rural capacity is complex (transfers and incentives) and is subject to appeal. It is not presently modelled for feasibility.

46. It is anticipated that an agreed approach will be developed as part of the Unitary Plan rural appeals process.

47. The assessment results (feasible development capacity) do not yet include Housing New Zealand developments. These will be included in the final assessment. The 2016 IHP modelling added 39,000 dwellings that were assumed to be feasible to the total.

[1] Other scenarios are also produced after a minimum percentage return filter is applied (so they are still 'feasible', just not necessarily returning the greatest percentage yield on costs), including cheapest dwellings, most dwellings, lowest project cost and largest dwellings scenarios. By default the maximum return scenario is reported as the yield motivated developers first choice of project. Should this demand be fully satiated, the potential for the nth developer to choose an alternate development is a good indicator of the potential for choice and efficiency in the market.

Capacity assessment results

48. Plan-enabled development capacity for all residential zones in the urban area are shown in the table below. The results exclude potential capacity in town centres and business areas and Housing New Zealand developments.

Plan enabled capacity type by zone	Vacant	Vacant potential	Infill	Redevelopment	Special	Total Infill	Total Redevelopment
Large Lot	107	2700	222	3515	62	3091	6384
Mixed Housing Suburban	5105	23927	10094	373949	2478	41604	405459
Mixed Housing Urban	5141	19581	10521	284101	4954	40197	313777
Rural and Coastal Settlement	85	950	0	674	567	1602	2276
Single House	2114	15129	2099	13793	6701	26043	37737
THAB	4002	508	16	303881	2243	6769	310634
Total	**16554**	**62795**	**22952**	**979913**	**17005**	**119306**	**1076267**

49. The dwelling feasibility results for the FULSS areas are shown in the table below.

50. The baseline result is consistent with the reporting of previous feasibility, representing the highest percentage return outcome for both the land developer and the house developer. The other scenarios are used to illustrate how changes to model variables affect feasible dwelling capacity and potential house prices.

Scenario	Sections Model scenario	Dwellings Model Scenario			
		Feasibility Threshold	Zoning	Feasible dwellings (000's)	Average Sale Price ($M)
Baseline FULSS	**Max % Profit**	**>=20%**	**MHS**	**146**	**1.50**
Baseline w/ Reduced profit threshold	Max % Profit	*>=15%*	MHS	192	1.40
Baseline w/ Reduced profit threshold	Max % Profit	*>10%*	MHS	288	1.21
'Restricted Zoning'	*Largest Feasible Sections*	>=20%	*Single House*	73	1.83
'Enabling Zoning'	Max % Profit	>=20%	*MHU*	375	1.15
'Cooling Market' *(Sales Locations as per Urban ACDC model)*	Max % Profit	>=20%	MHS	14	1.12

51. The feasibility results for the residential and business zones (urban area) are shown in the table below:

Scenario	Feasibility threshold	Feasible dwellings (000's)	Average Sale Price ($M)
Baseline urban area	**>=20%**	**140**	**1.22**
Baseline w/ Reduced profit threshold	*>=15%*	209	1.22
Baseline w/ Reduced profit threshold	*>10%*	291	1.21

In conclusion

52. The scenarios highlight the potential for development to proceed using a 'non-average' developer. They also highlight how sensitive the model outputs are to changes in assumptions. The scenarios serve as a reminder that feasibility is, primarily, not a function solely of the planning system.
53. The feasibility models only consider current prices and costs faced by a theoretical developer, testing the feasibility of providing plan-enabled developments on the sites tested into that market.
54. The models do not consider demand (other than implicitly in present prices) or the actions of other developers.
55. The consideration of demand will alter the outcomes from what is best for the developer (as shown) to the results of a balancing between what is demanded and what can be supplied that meets this demand.
56. That is, if dwelling prices are too high for households' ability to pay (or borrow), or the location or typology does not suit, then the mix of developments that will eventuate will vary. For example, it is unlikely that all 374,000 terrace houses and apartments that are feasible in the 'enabling zoning' scenario will be demanded, given the nature of many of the tested locations and the potential alternatives. Even if demand matched the results of the feasibility models, the prices and costs faced by developers over time will vary from the current situation.
57. Addressing the demand side requires further modelling, which is well advanced, but is pending the final feasibility assessment to be able to be completed.

Consideration

Local board views and implications

58. This is a modelling and data collection/analysis process which, in itself, has no impact on local boards or their communities. The plan-enabled and feasible capacity modelling results can be reported by local boards as can the demand and supply matching.

Māori impact statement

59. This is a modelling and data collection/analysis process which, in itself, has no impact on iwi or mana whenua.
60. Iwi-owned land was modelled through applicable planning provisions however, it is understood that iwi development intentions may be different from that modelled.
61. Confirmation of known iwi development intentions is currently being sought. The final assessment will replace council's analysis of land being developed by iwi authorities (including their commercial arms) where confirmed, and will become publicly available information as part of that assessment.

Implementation

62. Council will have to include the feasible residential development capacity targets in the Regional Policy Statement, based on the final assessment, by 31 December 2018.
63. Further work to finalise the housing development capacity assessment is required. It needs to:
    - review the results of the feasibility modelling, including agreeing finalised costs and price information
    - complete the demand and supply matching process against those results
    - incorporate consideration of supply and demand for business capacity, some of which will overlap with residential (mainly office demands in town centres of which there is significant capacity for both)
    - complete the final assessment.
64. The business development capacity assessment underway will be finalised and will be subject to recommendation b).
65. The feasibility models will be re-run in early 2018 to produce a final assessment. This will form the basis of council's response required under the NPS-UDC. However, these initial results suggest that sufficient feasible development capacity exists in the short and medium terms, but probably not in the long term.
66. The results of the preliminary assessment were used to inform the development strategy in the Auckland Plan. Changes may be made to the development strategy prior to its finalisation in June 2018.

Attachments

There are no attachments for this report.

Signatories

Author	Regan Solomon - Acting Manager, Research & Evaluation Unit
Authorisers	Jacques Victor - GM Auckland Plan Strategy and Research Jim Quinn - Chief of Strategy