



Meeting Auckland's Growth Challenge: The Innovation City

Discussion Document

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Executive Summary

Auckland is confronted with a three-sided growth challenge. There are not enough homes, there is growing traffic congestion and solving either problem is becoming increasingly unaffordable.

Rapid population growth is exacerbating pressures, but it is not the root cause of Auckland's growth challenge.

The allocations of housing and employment growth in the Unitary Plan are misaligned with Auckland's infrastructure services. The Independent Panel on the Unitary Plan assumed infrastructure could be provided to meet growth. Transport modelling shows that it cannot. Growth is everywhere and nowhere and lumpy infrastructure investment cannot keep up.

This discussion document proposes a different approach.

The Approach

We test the costs and feasibility of delivering an additional 30,000 homes and jobs, over and above current plans, built around rapid transit on undeveloped land. Homes closer to jobs will reduce regional travel. Transit oriented development will facilitate access to high capacity services. Raw land provides the opportunity to capture value to fund public infrastructure and build quickly.

We examine five locations around Auckland with sufficient land to support a city of 100,000 residents. We compare the costs of servicing these areas with infrastructure and examine whether housing can be delivered affordably.

We find Dairy Flat-Silverdale to be the most expensive location to grow. High land costs, water challenges and the prospect of extremely expensive transport upgrades suggest this area is not capable of accommodating planned growth, let alone an additional city. Growth and investment in the north should be deprioritised.

Kumeu south is more suitable. Recent motorway investments can support more growth, but public transport is inadequate. The new busway will be under immense pressure by the 2040s. A rail upgrade is expensive and will not provide sufficient speed and convenience. High and rising land prices reduce the capacity for value capture.

In unzoned Clevedon, land is cheap, but the area is off the infrastructure radar. High and uncertain transport costs and stormwater and flooding susceptibility discount the Clevedon valley.

Growth Should be Targeted in the South

The south represents Auckland's opportunity to grow the city affordably and efficiently.

Land around the rail line through Paerata is the most cost-effective location to add 30,000 homes. Karaka is competitive at higher levels. Paerata is up to \$150 million cheaper to service with water, fibre and energy infrastructure than other greenfield locations. On a per dwelling basis, this cost is relatively minor (around \$22,000), but at the regional level has a major impact on infrastructure providers.

Paerata's proximity to rail and SH1 lowers the substantial risks and uncertainties around future transport needs. We estimate regional road and water investment as low as \$700 million could be sufficient to add 30,000 dwellings to current Paerata plans. This is less than the estimated \$1 billion of development contributions the city would generate. All other locations we examine would likely cost more to service than the Auckland Council would receive in funding. Growth can pay for itself, if it is well planned.

The cost of local infrastructure and development for the satellite is greater. Almost \$3 billion would be required to cover fees and to service Paerata city with local roads, parks and water services. This is twice the estimated cost of all regional infrastructure and adds \$77,000 on average to every dwelling.

When development contributions are added to a conventional development today, the cost of servicing raw land rises above \$100,000 per dwelling. This is not only high and likely impacting housing supply, it does not reflect the large variations in the cost of servicing different greenfield locations.

Paerata's land is still cheap, but rising quickly. If bought at today's prices, an average section of raw land would cost \$17,000. Three years ago, it cost \$10,000. Land in Dairy Flat is over twice the price, rising faster and sections are smaller so land aggregation more difficult. If authorities can move before the market in Paerata, land value can be captured and used to offset infrastructure costs.

If authorities pursue a conventional approach, unserviced sections valued at less than \$20,000 today could be expected to rise to over \$360,000 post-development. Property owners would have to invest \$100,000 in residential development to realise this gain, leaving an almost \$250,000 difference between the total cost of development and the resale value of a section. Over a development of 30,000 homes, it translates to \$7 billion of increased value.

Part of this figure represents the cost of risk and reflects successful urban development. Part of it reflects public activities across zoning and infrastructure which are undervalued by a flawed approach to growth management.

Land can be accessed at its raw value and used to deliver affordable growth for homeowners and infrastructure providers. Integrated urban development at scale combined with emerging legislation will enable an Urban Development Agency to buy land, collaborate with land owners and realise land value.

Building at scale will facilitate a much-needed shift to prefabricated housing. Prefab is faster and cheaper than conventional building and requires less skilled labour. Procuring housing in large tranches will give the supply industry the confidence to invest in factory production of housing.

Assuming a shift to prefab and access to raw land, the average cost to deliver a completed home in the satellite, including land, development, infrastructure and dwelling construction would be \$450,000 (including a 15 per cent allowance for GST). This is the risk free cost of delivering a home in Paerata city.

Median home prices in Auckland today are \$825,000. After providing a margin for risk, the wide apparent difference between the cost of delivering a home in Paerata and current prices suggests integrated urban development at scale is cost effective.

A New Approach to Growth in Auckland

In addition to enabling land value to be captured, development in Paerata offers a number of strategic advantages. It is close to industrial land at Drury and proximate to key employment centres at Manukau and Auckland airport, as well as the productive Waikato and Bay of Plenty growth regions. Water, power and aggregate supplies come from the south and, most importantly, Paerata is located on the railway line. Scale development in this location provides a unique opportunity to leverage the capacity of rail as the alternative transport mode for Auckland.

Paerata's strategic location and Auckland's urgent need for affordable housing close to employment indicates there is an opportunity to go further.

The southern rail line between Pukekohe and the Auckland CBD needs investment. Strategic prioritisation of Paerata as a growth city would generate sufficient land value uplift to fund a \$2 billion duplication of the North Island Main Trunk Line.

Four rail lines between Papakura and Westfield, including grade separation from general traffic, would allow non-stop services from Paerata to the CBD. Rail freight services could be separated from commuter services, removing constraints on KiwiRail activities. Traffic congestion and risk taking at level crossings would reduce. Tens of thousands of homes would be within 30 minutes of central Auckland.

Growth could be extended north into Karaka to combine with a strategic link across the Pahurehure inlet. The new corridor would duplicate SH1 and provide direct access to SH20, the airport and Manukau. Light rail from the airport could connect with rail at Paerata, providing competitive rapid transit options to major employment centres at the airport, Manukau, Mt Wellington, Penrose, Newmarket and the city.

Integrated development could accommodate a new city to the south of not just one hundred thousand residents but four or five hundred thousand residents.

Wholesale changes to the Unitary Plan are not required. The Rural Urban Boundary has provision for local expansion to make way for growth. Coordinated public investment aligned with planning processes and combined with affordable housing can shape urban form, without dictating it.

Auckland must start using growth to catalyse the investments the city wants, not letting growth determine the investments it has to make.

Central government must play its part. Disproportionately high risk in relation to reward sits with the Auckland Council and developers, while too little remains with central government and the original land owners. A satellite city at Paerata will return \$3-4 billion in GST alone, but less than \$100 million in rates.

Planning for growth at scale around rapid transit allows more efficient use of land and is cheaper than retrofitting established urban areas. It will deliver benefits in the form of more affordable housing for the people who live in Paerata and in the form of lower congestion and infrastructure charges for wider residents.

But it is the ability to identify and isolate land at its raw price which provides the greatest opportunity. Auckland's existing growth paradigm transfers the value of public investment to land values without a concomitant requirement to deliver housing at pace. More infrastructure investment is required to deliver fewer houses and weak supply reinforces high prices.

The integrated planning and infrastructure approach of the satellite model enables infrastructure providers to share the benefit they create. Investment can be funded and affordable homes can be delivered.

The Time is Now

There is no time to waste. Auckland has 40,000 households living with family, in garages and on the street. The number is growing by 20 a day.

Property investors know the system is not working. They know the city will grow and they know there is money to be made betting on future zoning. Speculation is driving up the cost of land every week and reducing the ability to leverage land values to deliver affordable housing.

Investing in the Future

Planning for growth and masterplanning for quality opens the door for even bigger possibilities.

Technology is changing every aspect of cities. Connected networks, the internet of things and automation are the infrastructure of tomorrow. Incremental development does not support the trends and opportunities we know are coming to urban environments.

A brand new satellite city can be digitally enabled from the roads on the ground to the tallest buildings. People can communicate with vehicles, vehicles with networks, networks with operators and operators with people.

Incorporating new opportunities in design, engineering and sustainability, a new city can be made more efficient and more resilient. Streets can be configured to support autonomous vehicles. Low impact design can maximise existing land and water features to reduce impacts on the environment. Enhanced corridors and planned provision for services can protect Auckland's essential services.

The Innovation City

Leveraging public investments in research, education and health in a digitally enabled city will drive investment in high-skilled, high-income employment. Paerata can become the centre of a new southern city of 500,000 or more with technology, innovation and prosperity at its heart.

The Innovation City will deliver better jobs, better networks, stronger communities and desirable urban living.

Auckland's Growth Challenge

Auckland has a three-dimensional growth problem:

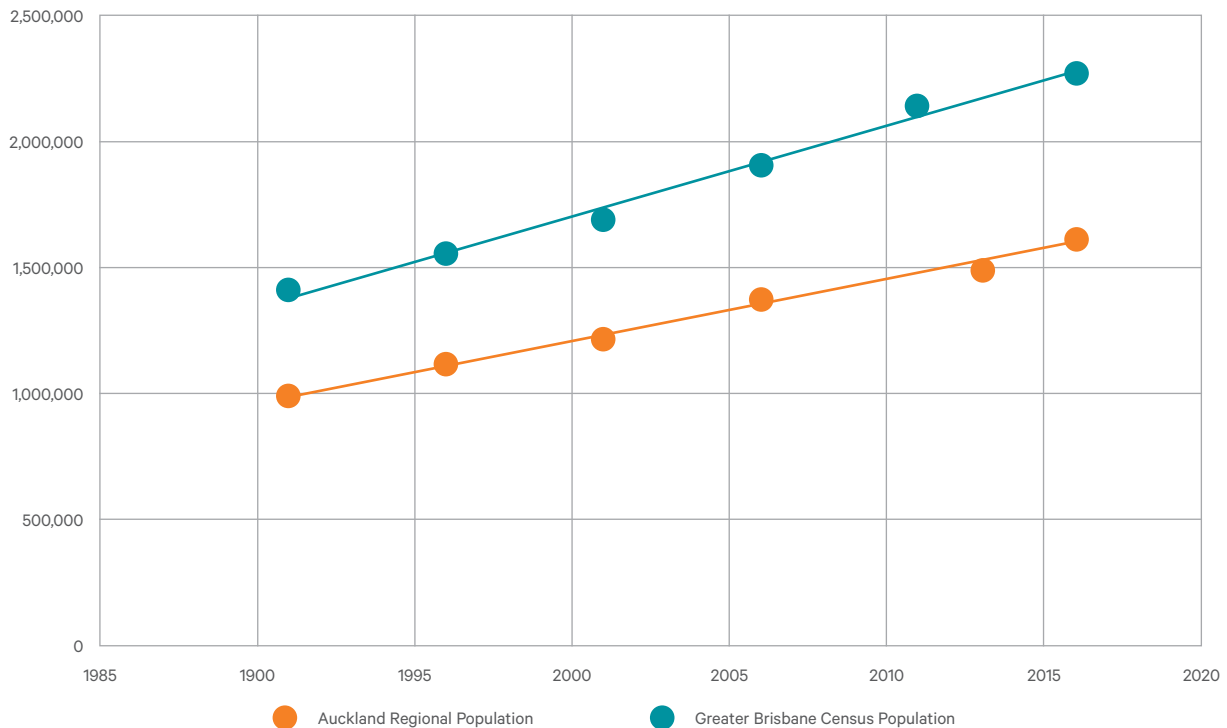
- 1 Not enough homes are being built;
- 2 Serious congestion is getting worse;
- 3 Funding growth is increasingly difficult.

In 2016, Infrastructure New Zealand (then the New Zealand Council for Infrastructure Development) investigated the second of the three big challenges. The report *Transport Solutions for a Growing City* found that how the region was responding to growth was more significant than the scale of growth in relation to network performance.

Auckland's population growth rate has been high in recent times, but has remained constant overall since the early 1990s (Figure 1). These levels are not out of step with faster growing cities globally, many of whom demonstrate lesser transport deterioration.¹

¹ The Auckland region's growth rate of 1.9 per cent per annum since 1996 is well below South East Queensland's 2.4 per cent average growth between 2003 and 2013, for example, and Brisbane performs much more strongly in terms of congestion, see <http://www.qgso.qld.gov.au/products/reports/pop-growth-highlights-trends-reg-qld/pop-growth-highlights-trends-reg-qld-2015.pdf> and Austroads, Congestion and Reliability Review, December 2016.

Figure 1: Auckland regional population vs Greater Brisbane²



Transport Solutions found that the allocations of growth assumed through the Unitary Plan are misaligned with transport infrastructure. It is this misalignment which is exacerbating transport pressures and increasing the need for additional investment. Specifically:

- Densification is permitted in a number of areas with poor transport connectivity, increasing demand for private vehicle trips and fuelling congestion.
- Redevelopment is impeded in a number of areas receiving large rapid transit investment, making public transport less attractive as an alternative.
- Greenfield housing growth is spread across the region but employment is concentrated in the centre and south, necessitating long journeys on constrained corridors.

Comprehensive analysis by the collective of New Zealand's leading transport bodies, via the Auckland Transport Alignment Project (ATAP), has shown that no investment programme can meet the growth allocations broadly set out in the Unitary Plan. Only by suppressing demand can congestion can be improved, but even this requires some \$6 billion of urgent investment beyond what is currently funded.

The Independent Hearings Panel on The Auckland Unitary Plan assumed infrastructure could be delivered to areas it identified for growth. Transport modelling has since shown this assumption to be misplaced. Government assistance to Watercare through the Housing Infrastructure Fund and Crown Infrastructure Partners indicates the problem is not limited to transport.

A new approach to growth is required which delivers more homes:

1. Rapidly,
2. Affordably, and
3. In a way which does not exacerbate transport pressures.

² Statistics New Zealand, Australian Bureau of Statistics.

A New Approach: Integrated Urban Development at Scale

The Housing Challenge is Large, Not Insurmountable

Auckland can deliver the homes and infrastructure it needs. Population growth is currently at record levels, but should not be expected to remain this high. Figure 1 displays a much more consistent growth profile over the long term than has been evident in the last decade. If Auckland continues along this long term growth trajectory, rather than the extreme levels seen recently, which is more likely, the regional population will be approximately 2.3 million in 2040.

A 2040 population of 2.3 million is 700,000 residents greater than today's population – an average growth rate of 30,000 people per annum over the next 23 years. At existing levels of around 3 persons per dwelling, Auckland under this scenario requires 10,000 new homes each year.

In addition, Auckland must deliver a further 40,000 new homes to address the backlog identified by both the Auckland Council and the Auckland Independent Hearings Panel on the Unitary Plan. Clearing this backlog within a decade will require 4,000 additional homes per annum over that period.

Delivering 14,000 homes per annum over the next decade will be challenging, but not impossible. With a population of under 1 million the Texas city of Austin issued almost 12,000 building permits in 2013.³ Brisbane and Perth, with populations 30-40 per cent greater than Auckland, both consistently issued around 20,000 residential building permits per annum over the early 21st century.⁴ Each city has managed to keep housing significantly more affordable than Auckland.

³ <http://www.cividdashboards.com/city/austin-tx-16000US4805000/#>
⁴ <http://blog.corelogic.com.au/2014/09/july-2014-building-approvals-data/>

Congestion Can be Reduced

Auckland's population of around 1.6 million is not large by global standards. Comparative congestion metrics suggest that the city's travel time delay is consistent with much larger cities, including Manchester, New York and Melbourne.⁵ It is significantly worse than higher performing cities, even those facing rapid growth.

Auckland's own congestion monitoring shows that performance can be improved. Between 2006 and 2013, travel time delay and variability on Auckland's strategic network improved. Lower population and economic growth through the Global Financial Crisis was one contributor, but so was effective investment. The combination of both, specifically, supportive land use change (in this case via slower housing and employment growth) and measured policy delivered benefits. Aligning new housing and employment activity with a fit-for-purpose investment programme will reduce pressure on transport networks.

Growth Can be Affordable

Integrating growth with infrastructure so that new homes and jobs arise where services have capacity will reduce costs. The major opportunity to grow affordably, however, is by channelling land value improvement from zoning and services to infrastructure funding.

Land outside a zoned and infrastructure enabled location has been shown to be around one-tenth that which is development ready.⁶ Conventional planning and development approaches do not tie value improvement from zoning or infrastructure to the provision of these services. Nor does service provision require development on any fixed timeframe. This disaggregated approach to planning, infrastructure and development has seen Auckland land values rise from around 40 per cent of the value of a home to over 60 per cent at the same time as property values have doubled.⁷

Capturing land value is not easy under existing practice, but emerging Urban Development Agency legislation does provide an avenue. Establishment of a public body with some combination of land acquisition, planning, rating and infrastructure authority would make value capture much more viable.

Integrated Development at Scale

Infrastructure New Zealand wanted to investigate a short and medium term response to Auckland's urgent housing, transport and affordability challenges. Specifically, we wanted to test a scenario which:

1. Delivered a large number of homes rapidly, and
2. Delivered them in a way and location which supported regional connectivity, and
3. Delivered them affordably for both infrastructure providers and new home owners.

The combination of these factors led us to the concept of integrated development at scale. Scale is required because a large volume of housing is required and because larger building contracts can support innovation, standardisation and prefabrication. These factors are needed to increase productivity and deliver homes in a tight labour market at an affordable price.⁸

Integrating transport with development is necessary to optimise transport assets and limit regional travel demand. Timing and sequencing transport investment with development reduces the lag between infrastructure delivery and capacity utilisation. Masterplanning employment, housing and transport reduces pressure on regional movements. Collocating growth with rapid transit (transit oriented design) makes public transport more competitive for regional movements which must occur.

Integrated development is also needed to solve the affordability challenge. Zoning, infrastructure and services unlock land value. Tying zoning to service provision so that land value increases are allocated to infrastructure providers is necessary to fund growth infrastructure.

⁵ TomTom
⁶ Productivity Commission, Housing Affordability Inquiry: Final report, 2012.
⁷ Productivity Commission, Using Land for Housing, September 2016.
⁸ Productivity Commission, Housing Affordability Inquiry: Final report, 2012; Productivity Partnership, Construction Productivity in Canterbury, <http://www.mbie.govt.nz/publications-research/research/construction-sector-productivity/canterbury-rebuild-construction-productivity-in-canterbury.pdf>

Brown or Greenfields?

An early question confronting us was whether integrated transport and development at scale should be tested in a brown or greenfields environment. We opted for greenfields for three reasons. First, it is difficult outside of the advanced Tamaki project to find land holdings of a size which can support scale redevelopment in Auckland.

Second, brownfields redevelopment is more politically and technologically challenging. Addressing local concerns and operating within an established urban environment is complex and meeting expectations is likely to slow housing development and increase complexity.

Third, the higher cost of land in brownfield environments reduces the ability to leverage land value to fund transport and deliver more affordable housing.

The Option Tested: a Satellite City for 100,000

Following our evaluation, we concluded that testing a single major urban development in a greenfield location would best satisfy the need for more homes, quickly, affordably and consistently with transport services.

By focusing growth in a single, albeit large, undeveloped site, Auckland could sequence, target and align development and infrastructure. Raw land values could most easily be leveraged to align infrastructure costs with benefits and enable housing to be delivered at uninflated costs. The absence of major established communities would facilitate rapid delivery of both infrastructure and development and would be most feasible from a political and social perspective.

We decided we would investigate a development of roughly 100,000 residents. This is approximate to the 40,000 homes that Auckland needs to house its population. We opted for a slightly lower figure of 30,000 homes, to more neatly fit a third share each of high, medium and low density housing. To facilitate shorter journeys and lessen the impact of commuting, we decided we would also seek an outcome with one job per household – 30,000 jobs. We use the terms “city of 100,000” and “city of 30,000 homes and 30,000 jobs” interchangeably, noting a slightly larger number of homes would likely be required to house 100,000 residents.

For a development of this size, we concluded we would require a greenfield site of at least 2000 hectares. A city of 100,000 inside 2000ha would be comparably dense by Australasian standards (approximately two times more persons per hectare than metropolitan Auckland today and twice as dense as existing growth plans for Dairy Flat-Silverdale), but would support existing council policy to limit urban expansion.

The first phase of our study involved the identification of developable land around Auckland capable of accommodating a city of this size.

Identifying Innovation City Locations

The first step in planning integrated development at scale was to identify an appropriate location. Our objective was to narrow feasible locations down to a small number of priority sites which we could then investigate and compare. We followed a two-step process which, first, pinpointed all those areas with physical capacity for a new city and, second, narrowed options to those locations with the best transport potential.

We performed a desktop survey of all locations within 50km of the Auckland CBD with at least 2000ha of flat or rolling agricultural land. We excluded environmentally sensitive areas, elite soils and land which is undulating and therefore more expensive to develop. We did not take into consideration ownership, infrastructure feasibility or market attractiveness through this phase.

This process highlighted 14 separate locations around the region, including five in the north, two in the west, two in the east and five in the south.⁹ Two of the southern locations were situated outside the Auckland region. We also included in our analysis land around Wellsford which, at 65 km, is located beyond our 50km limit, but is also an existing Auckland centre and therefore of potential interest.

The 14 locations are identified below. Orange circles denote locations we discarded. Blue denotes areas we took forward for further investigation.

⁹ We chose to divide the southern area between Pukekohe and urban Auckland up into three distinct locations (Clarks Beach, Karaka and Paerata). We decided to exclude the area east of Drury which, although large enough, is already being readied for development and is so close to the urban area as to make independent development difficult. It should be noted that, unlike other parts of Auckland, there are limited geographical features separating the entire area north of Waiuku-Pukekohe-Bombay.

Map 1 and 2: Large developable land holdings in Auckland: North and West



Map 3: Large developable land holdings in Auckland: South and East



Phase 1 suggested there was much more developable land around Auckland capable of accommodating major growth than we had initially expected. It was evident, furthermore, that land sufficient to accommodate a major new city existed in each of the north, south, east and west of the region. This raised the possibility of a sample study in each “corner” of Auckland, enabling a potentially valuable comparison of different infrastructure and development challenges by sub-region. Our initial preference to sample between one and three priority locations was expanded to include one site north, south, east and west of the Auckland urban area.

Phase 2 involved a high level assessment of the comparative feasibility of providing transport services to the 14 locations identified in Phase 1.

North

Analysis of the north quickly indicated that more distant locations around Wellsford, Matakana, Warkworth and Waitoki presented no clear advantages to a development at Dairy Flat-Silverdale, which was closer to the Auckland CBD and to transport infrastructure. We did note, however, that lower land values in these areas could potentially offset higher investment needs. We decided to investigate Wellsford, Matakana, Warkworth and Waitoki only if Dairy Flat emerged as the preferred location in Phase 3.

West

Fewer options were present in the west, with only an area along the rail line south of Kumeu and land around Helensville large enough to accommodate a city of the study's size. The proximity of the area around Taupaki to the city and rail made it a clear priority.

East

Like the west, the east contained relatively few development options, with both identified sites part of the larger Clevedon valley. Although there is likely some amenity value gained if development is focused around the Clevedon coast, we did not consider this benefit to outweigh the added cost of providing transport and other services some 5-10km further from the Auckland metropolitan area.

South

Auckland's south provides the greatest availability of land. Virtually the entire area north of (and excluding) Pukekohe's elite soils is developable – some 20,000 hectares. In addition, there are other significant land holdings in the deeper south. Located further from central Auckland and less accessible, Clarks Beach, Aka Aka and Pokeno were rejected in favour of options closer to the CBD.

The obvious locations to locate a satellite city in the south are Paerata and Karaka. Paerata is located close to rail and motorway infrastructure and is already planned for growth (some is already under development). However, with a connection across the narrow Pahurehure inlet, Karaka would become significantly closer to Auckland. Karaka also possesses the benefit of not being zoned for future growth and therefore should be lower cost.

Including both Paerata and Karaka in the study provided the opportunity to investigate land values across zoned and unzoned land. Lower cost land increases the potential to capture land value for investment in infrastructure. We elected to take forward both Karaka and Paerata.

Map 4: Preferred sites for investigation and Unitary Plan zonings: Dairy Flat-Silverdale and South Kumeu



Map 5: Preferred sites for investigation and Unitary Plan zonings: Clevedon, Karaka and Paerata



Costing a Satellite: Infrastructure

To find out which part of Auckland provides the most cost-effective location for a major new development, we wanted to understand the relative costs of growth in each area.

We contacted key infrastructure providers and asked them to estimate the capital cost on their service of an additional 100,000 residents in each of the five locations. We asked providers to assume that the Unitary Plan provisions remain otherwise unchanged and that growth was additional to existing plans.

The numbers in this section should not be interpreted as being the total cost of providing for 100,000 people, but of 100,000 more over and above existing plans. All information in this section is indicative and reflective of average past experience, rather than the specific requirements of projects themselves. Risks regarding consenting, funding and sequencing have not been part of the assessment.

Water, Energy and Telecommunications Requirements

We approached key utility providers and asked them to provide a high level estimate of what assets and investment would be required to service a city comprising 30,000 homes and 30,000 jobs in each of the five locations. The total costs are set out in Table 1.

Table 1: Infrastructure costs in different parts of Auckland¹⁰

Agency	Service	Dairy Flat-Silverdale	Kumeu south	Clevedon	Paerata	Karaka
Watercare	Wastewater	\$185m	\$160m	\$230m	\$170m	\$150m
	Water supply	\$115m	\$65m	\$1m	\$0	\$75m
Transpower	Electricity transmission	\$46m	\$51m	\$30m	\$18m	\$25m
Vector Counties Power	Electricity distribution	\$210m	\$242m	\$237m	\$225m*	\$225m*
Vector	Gas	\$61m	\$61m	\$61m	\$61m	\$61m
Chorus	Fibre	\$185m	\$185m	\$185m	\$185m	\$185m
Total		\$802m	\$764m	\$744m	\$659m	\$721m

Several key findings are evident in the information provided. Firstly, there is a significant cost difference from development in different parts of Auckland. Up to \$150 million can be saved across water and energy services simply by growing closer to where existing and planned assets are located.

Secondly, infrastructure providers are not all affected by growth decisions equally. Chorus is not as exposed to capacity constraints (at least at the scale tested) as other providers. Impacts on Watercare, Vector and Transpower can be significant. For Watercare in particular, growth decisions can result in the deferral or bringing forward of investment decisions in the hundreds of millions of dollars. In light of Watercare's ownership by the Auckland Council and consequent debt limitations, the location of growth is of critical importance.

Each of these providers is regulated and none has a mechanism to allocate additional costs to the development. Increased costs are spread over all customers. For Vector, a partially privatised entity, higher costs are absorbed by shareholders. For Transpower, a national provider, higher costs are spread across all of New Zealand. Increased costs are only converted into higher charges with the approval of the regulator. Less profit or deferred investment elsewhere are the result.

Third, while the impact on infrastructure providers can be significant, these costs appear relatively insignificant in proportion to home prices. Spreading the total costs in each area across 30,000 households results in a maximum spend of \$27,000 per dwelling in Dairy Flat-Silverdale and a minimum of \$22,000 in Paerata.

Finally, the combination of the above three findings reveals a potential conflict. The large cost carried by an individual infrastructure company from a strategic growth decision is not shared by a home owner or developer. It may thus be in the infrastructure provider's interest to resist, defer or deprioritise spending on a development, when the cost difference to a developer is very minor. Any mechanism which allows and encourages the developer to meet these higher costs could have a major impact on an infrastructure provider's ability to meet demand and a developer's access to critical services.

The Paerata area was found to be the most cost effective location from a water, energy and telecommunications delivery perspective. The second cheapest location is Karaka, followed by Clevedon, indicating that new growth in the south is generally more cost effective than in other locations, before transport costs are considered.

¹⁰ Information provided by relevant providers, except where indicated by *. Counties Power have not investigated additional growth scenarios but expects costs to be equivalent to Vector. Vector mid-range estimates used. Mobile services not included. Provision is fully private and costs vary according to brown or greenfield, but not location.

Transport

The engagement of Auckland Transport and New Zealand Transport Agency officials in ongoing future growth area work restricted our ability to use the same approach for transport as with other network services. Infrastructure New Zealand developed transport networks for the purposes of comparison in each of the five locations. Networks are based wherever possible on those developed through the *Supporting Growth* initiative – Auckland’s future urban area transport planning process – and have evolved in discussions with participants in growth processes.

The clear limitations of this approach mean that there is significant uncertainty around transport costs. Consequently, we include in this section a risk assessment by location. Our priority was to ensure networks were broadly comparable.

In the Dairy Flat-Silverdale and Paerata locations, Supporting Growth networks have largely determined the shape and form of our comparative networks. In both locations, our major assumption is that the city could co-locate with and beside existing planned development. We assume road corridors remain the same, but increase their capacity.

In currently unplanned locations (principally Kumeu South, Clevedon and Karaka), we had to develop new network plans. We then tested these assumptions with transport planning experts to refine them and ensure they were broadly comparable with the professionally developed networks.

Our starting assumption was that each location must be served with rapid transit, an expressway linked to the strategic road network and be serviced by regional arterials (situated approximately 2km apart). Existing road corridors were used where possible (though in practice this may not always be desirable) and local roads were not included in this phase. The assumptions we used to develop networks in each of the locations are included in Appendix 1 at the end of this document.

Transport assessment of each location includes a direct, location specific transport cost and a wider regional risk assessment. This is to recognise that growth of 100,000 people in any location will carry significant regional travel implications and these have the potential to be very costly. We highlight the risk of these costs and provide indicative costs for improvements. All estimates are informed by ATAP modelling 2016 and assume Supporting Growth package delivery.¹¹

We identified the following networks and costs in each of the five locations:

Dairy Flat-Silverdale

The Auckland Independent Hearings Panel on the Unitary Plan identified approximately 4000ha of future urban area land in Silverdale and Dairy Flat. This land is earmarked for just under 30,000 homes so is comparable from a residential perspective to our satellite proposal, but across twice the land area. Our assumption for a satellite in the north is that an additional 100,000 residents can be accommodated broadly within the already planned growth area.

The presence of rapid transit, a motorway and extensive arterial network met the key requirements of our transport assumptions. We decided as a starting point to transfer across the exact Silverdale-Dairy Flat network from the *Supporting Future Growth* study, with one modification. We assumed regional arterial network demand would be doubled, increasing the average cost from \$20 million per km to \$35m per km. The Supporting Growth network and high level costs are included below.¹²

There are approximately 55km of arterials planned for the northern growth area. Using the mid-range estimate from Table 2, arterials are anticipated to cost \$1128 million. The cost of adding a lane to these roads is, using the assumptions set out in Appendix 1, \$15 million additional per km, or \$800 million in total.

- **Our baseline transport cost of an additional 30,000 homes and jobs in the north is \$800 million.**

¹¹ ATAP, Evaluation report, 2016.

Regional transport feasibility of Dairy Flat-Silverdale

We assess the overall risk that the above transport plan for a Silverdale-Dairy Flat satellite will require substantial additional regional investment as *high*.

A complicating factor for transport assumptions to, from and through the Silverdale-Dairy Flat growth area is that ATAP analysis clearly shows growth in the north is difficult to service. Under all ATAP scenarios modelled in 2016, except the indicative package, demand for travel to and from the north was severely constrained. Only with the application of pricing combined with an additional harbour crossing, improved mass transit and motorway widening was access to the north adequately supported.

These additions, however, are not included in the Supporting Growth programme. In total they add some \$10 billion to the cost of major transport infrastructure in the north and represent almost one-third of all Auckland's transport capital investment assumed by ATAP.¹³ It is true that these services will serve residents in the existing metropolitan area and further north, but the addition of the 30,000 dwellings in the Supporting Growth programme appears to trigger the need for exponentially higher transport expenditure. It must be assumed that the addition of another 30,000 homes assumed through this study would make this investment unavoidable (and in fact bring it forward).

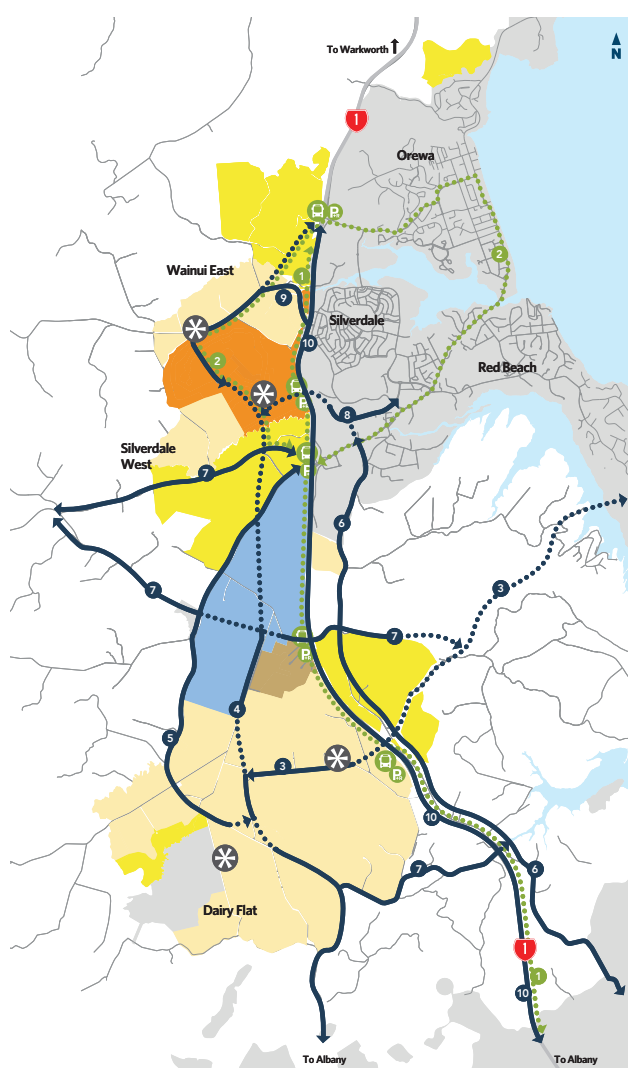
- **We consider in our regional risk appraisal a \$10 billion additional investment programme to service a satellite in the north.**

The operation of the SH1 corridor as a wider infrastructure corridor potentially carries costs for other assets. All rail options in a 2016 Aurecon study¹⁴ of mass transit options assumed trains use the busway alignment for at least a part of the journey. This may create an issue for any services running under the busway, most notably a high voltage transmission cable carrying electricity to the north. Accessing the cable will be more difficult if rail replaces the busway as rail services cannot be rerouted. Removal, re consenting and reconstruction of the cable is expensive, likely costing in the hundreds of millions of dollars.

- **We highlight the potential impact on other services from changes to the busway, but do not include them in our estimates.**

Table 2: Supporting Growth high and low estimates for greenfield growth in Dairy Flat-Silverdale.¹²

North	\$2,743	\$3,535
Improvements to SH1	\$345	\$457
Alternative Strategic Links	\$220	\$299
Rapid Transit & Public Transport Improvement	\$1,167	\$1,535
Arterial Roads North	\$263	\$339
Arterial Roads South	\$749	\$905

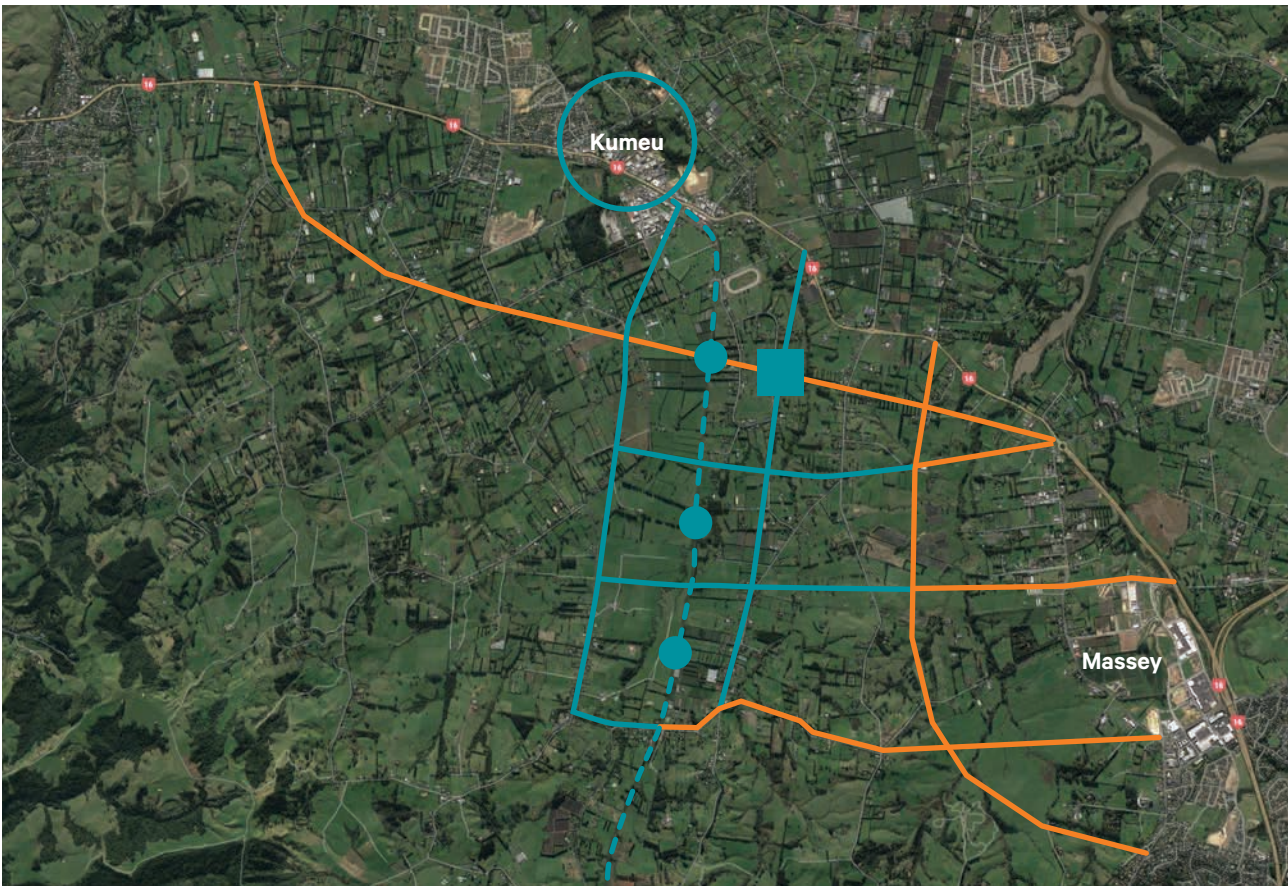


¹² Transport estimates are based on a number of general assumptions. No geotechnical assessment, surveys or full engineering assessment was undertaken for this stage of the Business Case.

¹³ ATAP, Evaluation report.

¹⁴ Aurecon, Rapid Transit Study: Summary, July 2016.

Map 6: Infrastructure NZ indicative transport plan for South Kumeu



Kumeu South

The area along the rail line south of Kumeu has not been identified as an area for future growth in the Unitary Plan. Supporting Growth network improvements have been identified for adjacent growth areas around Whenuapai, Red Hills and Kumeu. We developed a hypothetical transport network for Kumeu South building off these planned improvements and using the assumptions laid out in Appendix 1.

Orange lines illustrate the existing intention of authorities to support growth in Westgate, Kumeu and Huapai. Blue lines represent Infrastructure NZ hypothetical transport infrastructure necessary to support an additional city of 100,000 people, located broadly along the rail line. Blue solid lines represent arterial roads and the dotted line an upgraded western rail line. The blue square represents an interchange and the blue dots rail stations.

In total, around 15km of regional arterials and an interchange with the new motorway are assumed. Arterials are more tightly located under this option than in other areas, but the area serviced slightly smaller. We retain the same estimates as that used in Supporting Growth of around \$20 million per km. An interchange is costed at \$20 million.

- **Using the price assumptions set out in Appendix 1, road infrastructure in Kumeu South is estimated to cost \$320 million.**

A new busway to the north west is planned to run to the north of the hypothetical Kumeu South city. One option could be that the busway heads south to provide the rapid transit solution to the area, but we have assumed growth at this scale will necessitate extension of electrified rail from Swanson. KiwiRail estimates the cost of double-tracking, electrification and tunnel (or diversionary) works between Swanson and Kumeu at around \$200 million. Rail stations through this study are assumed to cost \$30 million and a slightly higher figure of \$50 million is assumed for the transport hub.

- **Including enabling works, two new rail stations, an integrated busway-rail hub, we estimate the cost of rapid transit for Kumeu South at \$340 million.**

Regional transport feasibility of Kumeu South

We assess the overall risk that the above transport plan for a Kumeu South satellite will require substantial additional regional investment as *high*.

Total transport network spending to service a city in the north west is comparatively low. This is due to the large amount of infrastructure either present or planned. An additional strength of Kumeu, and the wider north west, is that future modelling by ATAP indicates SH16 does have broadly sufficient capacity to 2046 if road pricing is introduced.

The weakness of the Kumeu South option is uncertainty around public transport. The ability to integrate rail with a busway at the junction of a realigned SH 16 adds resilience and flexibility, but it is not clear whether the busway will have capacity. ATAP modelling, under all scenarios including the indicative package, highlighted severe public transport capacity constraints by 2046 between the north west and CBD. Significant investment appears necessary to support existing, let alone additional, growth in the north-west.

Expansion of rail may assist with capacity constraints, but it is still not clear how viable rail is as a solution. Rail services from Swanson to the CBD currently take 55 minutes. Rail from South Kumeu would take approximately 70 minutes. Triple tracking the western line, which would not be sufficient to provide non-stop services to central Auckland, is estimated at around \$2-3 billion.¹⁵ Providing a fourth track to enable non-stop services and to radically cut commuting time will cost materially more.

A major further uncertainty concerns level crossings. There are 17 road crossings between Swanson and the CBD and a further eight (six of which are private) between Swanson and Kumeu. With increased train frequencies following the opening of the City Rail Link (CRL), these crossing will have a growing impact on traffic congestion. Worsening congestion will incentivise risk taking at level crossings, leading to safety issues. Grade separating road and rail carries a large cost and is disruptive.

- **We consider a cost of \$3 billion to four-track rail to a Kumeu South satellite.**

¹⁵ <http://www.stuff.co.nz/auckland/local-news/northland/78592378/kiwirail-delivers-a-reality-check-at-grow-northland-rail-meeting-in-whangarei>

Map 7: Infrastructure NZ indicative transport plan for Clevedon



Clevedon

Clevedon is not identified for future growth and has no motorway nor rapid transit access. The lack of existing corridors requires greater assumptions about the location and form of trunk infrastructure. Infrastructure New Zealand has provided an indicative outline of one potential network using the requirements for strategic road and rapid transit connectivity outlined in Appendix 1.

The orange lines indicate planned investments expected to support growth in the south-east. The Infrastructure New Zealand indicative network to support a city of 100,000 is illustrated in blue. The three blue dots represent busway stations and the blue square an interchange.

An expressway connecting the planned upgrade of Mill Rd to Clevedon is 10km in length and provides two lanes in each direction. It includes an interchange at Mill Rd. A further 23km of regional arterials are included. Using the estimates in Appendix 1, we cost the expressway at \$50 million per km, arterials at \$20 million per km and an interchange at \$20 million.

- **Our estimate for the Clevedon satellite road network is \$1 billion.**

Rapid transit is assumed to be provided via a busway along the expressway. The option costed runs from the current Clevedon village to Mill Rd and includes a busway along the new Mill Rd corridor to central Manukau. In total it is approximately 18km in length and costed at \$50 million per km.

- **Assuming an 18 km grade separated busway service with three stations, public transport to the area would cost \$960 million.**

Regional transport feasibility of Clevedon

We assess the overall risk that the above transport plan for a Clevedon satellite will require substantial additional regional investment as *high*.

Clevedon is a large land area generally unimpeded by existing activities. There are multiple options for transport within the area, including strategic links to the north and south. However, the connection of those links to the wider transport network is highly uncertain.

It is unlikely that the Mill Rd upgrade as presently envisaged would be capable of supporting travel demand to and from the satellite. The conversion of Mill Rd to a full motorway interchanging around Manukau may be required. As well as being expensive, such a project would be difficult to consent and a number of homes would be affected.

A more substantive risk with Clevedon is that it may trigger the need for major road investment. The satellite would be heavily dependent upon SH1, which is under extreme pressure by the 2040s under all modelled scenarios. Travel demand pressure would increase into and through Flat Bush and the eastern suburbs. An eastern motorway linking the CBD, Pakuranga and Clevedon may be required for a Clevedon satellite to proceed. This solution was costed at around \$10 billion by ATAP.

- **We note the risk that Clevedon development creates a need for a major motorway solution, but do not include it in our analysis.**

For the purposes of comparison, we assume an additional lane in each direction is provided along the Mill Rd-Redoubt Rd corridor between Popes Rd and Manukau. This much capacity intersecting at the junction of SH1 and SH20 suggests a full motorway and interchange would be required. Including the costs of consenting and property purchase, this solution would be costly.

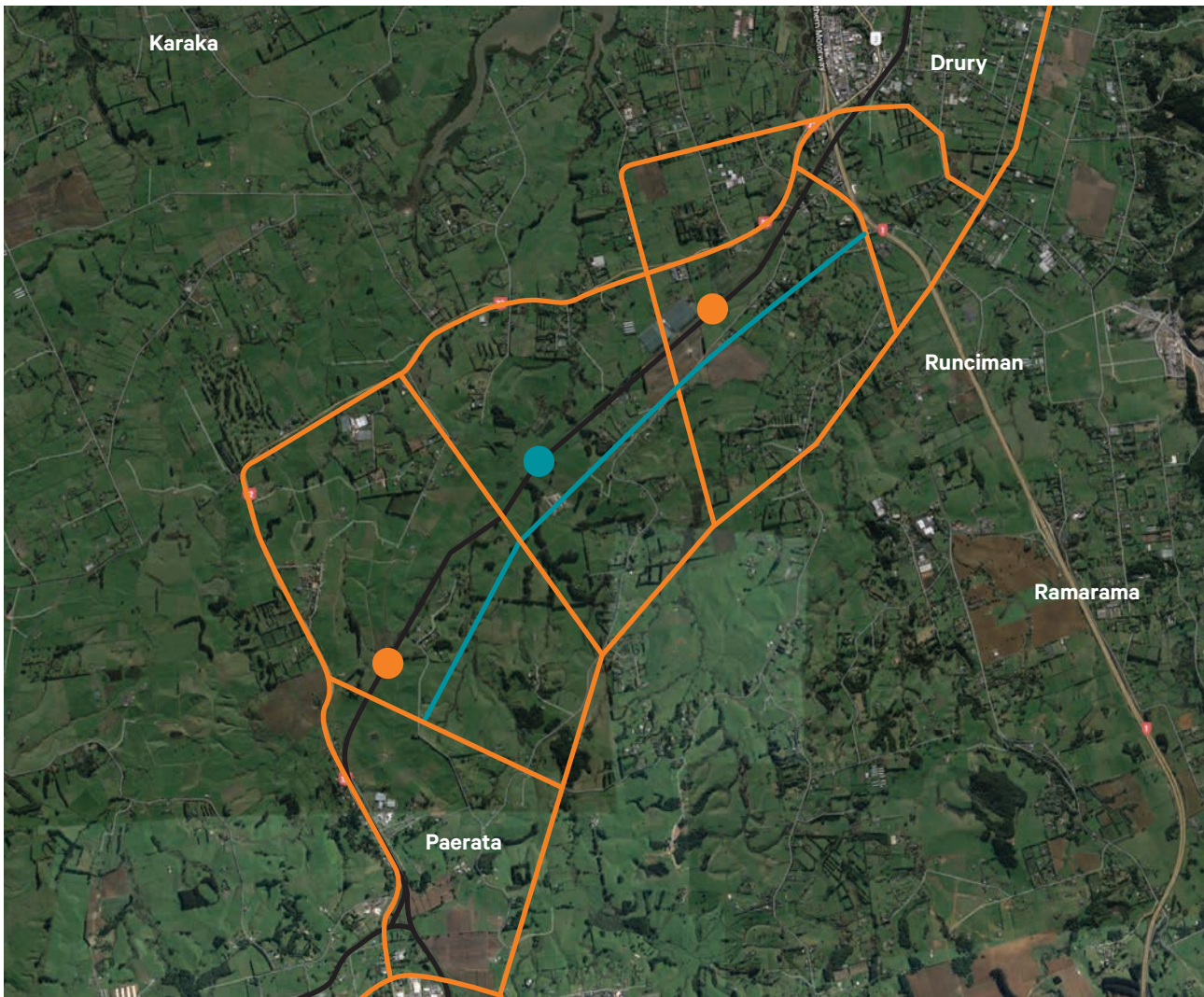
- **We consider a \$1 billion motorway upgrade linking the SH1 and SH20 interchange with Clevedon.**

Rapid transit services are equally uncertain. We have assumed a busway connecting to Manukau, but it is likely that more would be required. A rail trip from Manukau to the CBD takes 38 minutes today and passes through the eastern line, missing key employment nodes in Penrose and Newmarket. Journey times from a Clevedon satellite to the central city, including transfers would exceed 1 hour, potentially by a significant margin.

One advantage of introducing dynamic road pricing is that, if motorway speeds can be guaranteed, busway lanes would become unnecessary. Clevedon could potentially link directly to the CBD via bus.

- **We note that public transport options to Clevedon may be inadequate, but we do not estimate the costs of additions.**

Map 8: Infrastructure NZ indicative transport plan for Paerata



Paerata

The land to Auckland's south contains a very large amount of raw developable land. Infrastructure New Zealand identified land closest to rail south-west of Drury for the hypothetical city. This area includes a mix of live-zoned, future urban and land which is not zoned for development under the Unitary Plan. A comprehensive transport plan has been developed through the Supporting Growth programme.

We adopted a similar approach to a hypothetical Paerata city transport network as with Dairy Flat-Silverdale. We assumed existing planned corridors would proceed, but that densities would increase. Higher densities increase total demand, so we assume arterials in the Paerata area would include an additional lane in each direction. The planned investments and potential additions are outlined in Map 8.

Orange lines and dots indicate investments which are planned to support expected growth between Paerata and Drury. The blue line and dot indicate Infrastructure NZ additions to support an additional 100,000 residents.

There are approximately 13km of regional arterials servicing Paerata in the Supporting Growth network. This excludes the strategic Mill Rd to Pukekohe corridor and SH22 between Drury and Paerata. The cost of adding a lane to this network is \$200 million.

SH22 is earmarked for safety improvements which include some four-laning of the predominantly two-lane corridor. We assume that half of the 12km corridor will be converted to four lanes under existing plans and that a Paerata satellite will necessitate four-laning of the remaining 6km. The cost of this work is \$90 million.

The only new road corridor we identify runs adjacent to the rail line. We include this because the Paerata road network is less dense than in other planned areas in the north and north-west. This road is 6km long and, assuming two lanes in each direction, would cost around \$200 million.

- **Total road upgrades assumed for Paerata cost \$500 million.**

The Supporting Growth programme provides for major public transport improvements between Papakura and Pukekohe. Rail electrification and three more stations (two of which are located in the Paerata area and the third at Drury) are planned. The only entirely new public transport addition we include to support growth of Paerata city is a rail station on currently unzoned land.

- **The cost of public transport improvements for a Paerata satellite is \$30 million.**

Regional transport feasibility of Paerata

We assess the overall risk that the above transport plan for a Paerata satellite will require substantial additional regional investment as *medium*.

Situating a city between Paerata and Drury would likely require comparatively little investment not already featured in official plans. The location is close to SH1 and a new strategic connection linking to Mill Rd. Papakura is 51 minutes from Britomart, meaning rail services in the area will provide direct services to the CBD in around 1 hour. Full end-to-end travel by rail from the area to the CBD will be competitive with private vehicles at busy times, assuming stops at all stations.

Growth at Paerata would add to pressures which are already significant along SH1. However, the new strategic connection to Mill Rd, the ability to access SH20 and the weighting of employment south of Penrose mitigate the significance of this impact.

In comparison to the increased demand placed on the western line by Kumeu South, the southern rail line is more readily upgradable. There are only four road crossings between Papakura and the CBD. In addition, there are well-developed plans to triple-track sections of the line.

We asked KiwiRail whether triple-tracking could enable non-stop rail services between a hypothetical Paerata city and the CBD. KiwiRail advised the four-tracking would be required. This would come with the added benefit of separating rail freight and commuter services. KiwiRail estimates the cost of four-tracking between Papakura and Westfield at around \$1.5 billion (including work like a third trunk line Westfield to Wiri which may proceed sooner). Four lanes exist north of Westfield, though along separate lines. Non-stop services would need to integrate with normal services beyond Westfield.

- **Including grade separation between Pukekohe and the CBD, we sensitivity test an additional \$2 billion rail cost from development at Paerata.**

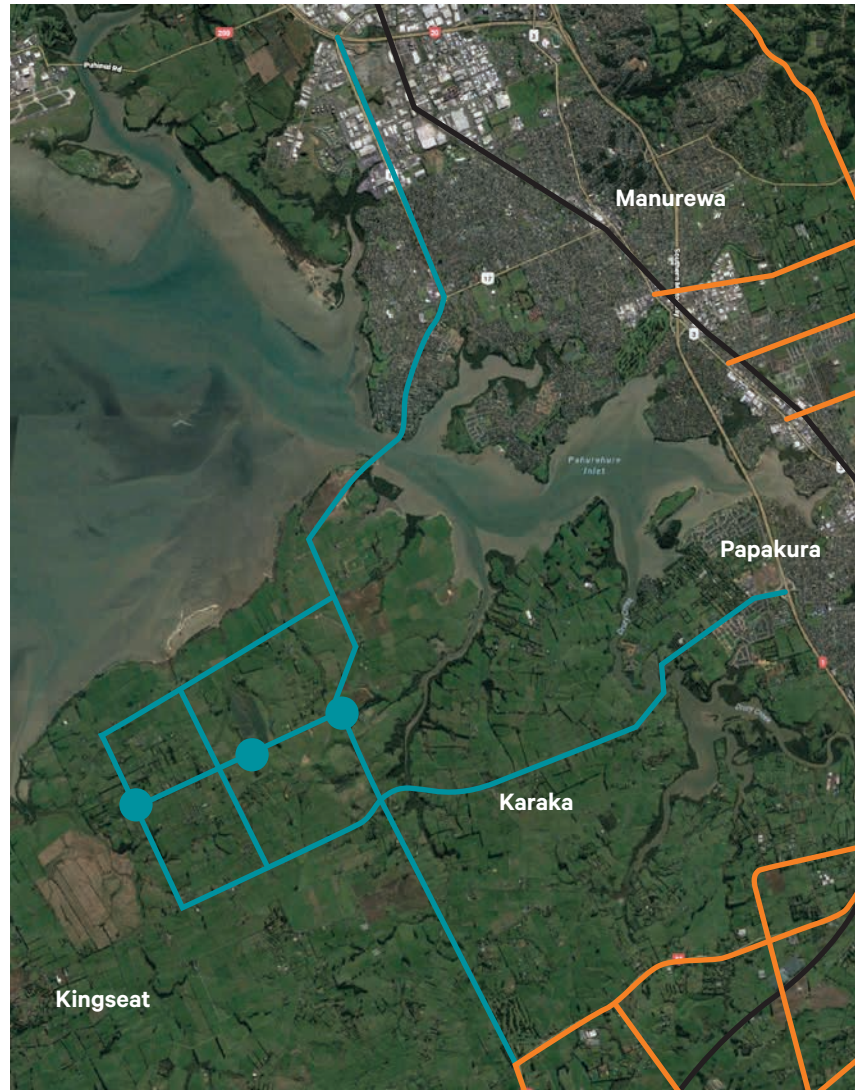
Karaka

The Independent Hearings Panel on the Unitary Plan considered at length rezoning land west of Hingaia. Land around Karaka was determined to be the most feasible unplanned location for development, but the Panel highlighted infrastructural challenges in electing not to shift the rural urban boundary.¹⁶ The network proposed below has been developed to overcome constraints identified by the Panel.

Orange lines indicate roads identified in future growth plans. Blue lines denote new roads and blue dots busway stations linked to the north.

The absence of existing plans in the area presents a wide range of options for planning transport. We have opted for a network premised on development broadly along the coast for market attractiveness reasons. Other options include development in a more north-south orientation, or shifted further east or west.

The proposed network addresses both leading transport concerns of the Unitary Plan hearings panel. Specifically, connectivity is provided across the Pahurehure inlet and Linwood Rd is upgraded to four-lanes. The Linwood Rd upgrade is 7.5km in length and, using the assumptions set out in Appendix 1, costed at \$260 million. The new corridor linking Weymouth to and through Karaka Rd has been costed by Auckland Transport at approximately \$1 billion.¹⁷ It is a four lane expressway and includes appropriate intersections and/or interchanges.



- Including regional arterials of 17km, the estimated total cost of road upgrades to support a Karaka satellite is \$1.6 billion.

The Pahurehure link does not include rapid transit. We assumed a busway linking the new city to the airport and Manukau centre, noting that under a dynamic road pricing scenario where travel speeds are guaranteed, bus lanes may not be required. An alternative could see light rail delivered. The requirement for a complex structure (across the Pahurehure inlet) makes estimating the cost of a busway difficult. The length of a busway from Manukau through the proposed Karaka satellite is 17km and from the airport 20km.

- Including three stations, we estimate the cost of a busway at \$1060 million, and total rapid transit costs of \$1200 million, making some additional provision for crossing the inlet.

¹⁶ Auckland Unitary Plan Independent Hearings Panel, Annexure 6 Changes to Rural Urban Boundary and Rezoning, July 2016, pp. 2-13.

¹⁷ Auckland Unitary Plan Independent Hearings Panel, Annexure 6 Changes to Rural Urban Boundary and Rezoning, 339667 July 2016, pp. 2-13.

Regional transport feasibility of Karaka

We assess the overall risk that the above transport plan for a Karaka satellite will require substantial additional regional investment as *low*.

A city at Karaka linked across the Pahurehure inlet opens up access to both SH1 and SH20. This offers the most flexibility and resilience of any satellite location with respect to road access. Consenting the crossing of the Pahurehure inlet is the greatest risk. A number of homes will be impacted, potentially requiring a tunnel. A tunnel option would cost significantly more.

- **We sensitivity test a 3km tunnel across the Pahurehure inlet between Karaka and Roscommon Rd costing an additional \$500 million.**

Public transport options are broad, though less clear. Bus services interchanging with rail at Manukau would provide CBD access in around an hour. The proposed extension of light rail from the CBD to the airport opens the possibility of an extension to Karaka as an alternative. Travel times from Karaka to the CBD would likely exceed an hour. Under a scenario with non-stop rail services between Paerata and the CBD, a busway to the south of the satellite may be viable.

- **We note the potential for light rail to Karaka and the opportunity for access to the CBD with four-tracking rail services, but do not include these in our cost comparison.**

Table 3: Cost comparison for transport services to satellite locations

Investment in addition to planned (Supporting Growth)	Silverdale Dairy Flat	Kumeu South	Clevedon	Paerata	Karaka
Road arterials	\$800m	\$320m	\$460m	\$500m	\$600m
Expressways			\$500m		\$1,000m
Rapid transit		\$340m	\$960m	\$30m	\$1200m
Total city investment	\$800m	\$660m	\$1,920m	\$530m	\$2,800m
Direct transport cost per dwelling	\$27,000	\$22,000	\$64,000	\$18,000	\$73,000
Risk of regional capacity constraints	High	High	High	Medium	Low
Regional road additions	\$5,000m	none	\$1,000m	none	\$500m
Regional rapid transit additions	\$5,000m	\$3,000m	none	\$2,000m	none
Total transport	\$10,800m	\$3660m	\$2920m	\$2530m	\$3300m
Total city and regional impact per dwelling	\$360,000	\$122,000	\$97,000	\$84,000	\$110,000

Key Transport Findings

Of the direct networks (i.e. assumed improvements needed within the satellite location) we tested to service an additional 30,000 homes and 30,000 jobs in the five locations, Paerata performed the best in terms of cost. Kumeu South and Dairy Flat-Silverdale were similar, given the high level nature of the exercise, but the ability to leverage existing commitments to electrify and enhance rail to Pukekohe gives Paerata an advantage over other locations.

Additionally, regional strategic risks are less evident in Paerata (and Karaka) than elsewhere. Rail performed well through ATAP modelling to 2046. Busways in the north and north-west did not. It is likely that an additional 100,000 residents in and around Paerata could be supported with only a comparatively small investment in new stations.

If growth did necessitate an upgrade of the rail line to the CBD, particularly for safety reasons, Paerata still performed well in comparison to other locations. The estimate of \$2 billion to four-track rail to Westfield is at the higher end. The \$3 billion estimate to four-track the western line is at the more conservative end. An upgrade of the southern line would, moreover, allow the separation of freight and commuter services, greater assisting KiwiRail activities between Auckland, Hamilton and Tauranga.

If port operations in Auckland were shifted to Whangarei and an upgrade of rail to Northport was effected, four-tracking the western line may be required with or without a Kumeu satellite. In this case, South Kumeu would become feasible.

In the north, assumptions are heavily impacted by the trigger points for converting the busway to rail (or delivering rail in addition to the busway) and constructing a new harbour crossing. If these very large investments are inevitable with or without additional growth in Dairy Flat-Silverdale, then the north may be feasible. If concentrating investment to accelerate growth in these locations creates the need for these investments, the north is unviable.

Clevedon and Karaka had the highest direct transport costs. Karaka's trigger points for large additional strategic investment appear less of a concern. Clevedon trigger points are very uncertain and potentially very high. Our \$1 billion estimate is conservative and assumes a comparatively small link between Mill Rd and the SH1/SH16 intersection. Further additions expanding the motorway into Clevedon or, more likely, north to employment centres around East Tamaki are a discernible risk.

In our assessment Karaka carried the lowest likelihood of major investment beyond that identified as necessary, but had the highest basic requirements. This dynamic suggests that growth of the magnitude considered (30,000 homes and jobs) is better placed elsewhere in the region, but that growth of much higher scales could be feasible in the area.

Local Infrastructure and Land Development

Local infrastructure includes the local roads, footpaths, parks and water, wastewater and stormwater assets needed for growth. Typically, these costs are picked up by the developer and are included in the price of a new home.

We asked leading engineering and design consultancy Harrison Grierson to provide some typical costings on local infrastructure costs for a city of 30,000 homes and 30,000 jobs. We were interested in the scale of these costs, whether there were differences around the region and what difference scale made. Harrison Grierson did not identify intrinsic cost differences around the region. The data set out in Table 4 is indicative of development costs for hypothetically identical pieces of land in each of the five locations.

Table 4: Local infrastructure costs for developing a city of 100,000



SATELLITE CITY PROJECT
SUMMARY OF INDICITIVE
CIVIL CONSTRUCTION COSTS

No of dwellings
10,000
10,000
10,000
30,000

Reference Number:		10/04/2017	
Date:		100,000	% of land area
Population		667 ha	34.7%
Residential (10,000 dwellings; Low density 15/ha - Average 450m ²)		400 ha	20.8%
Residential (10,000 dwellings; 25/ha - Med density ave 325m ²)		250 ha	13.0%
Residential (10,000 dwellings; 40/ha - High density ave 175m ²)		1,317 ha	68.6%
Total Residential including; lots, local roads and pocket parks A		225 ha	11.7%
Commercial/Retail (ASSUME AVERAGE 75x30=2,500m ² LOTS)		154 ha	8.0%
Stormwater and recreation reserves		104 ha	5.4%
Collector Roads (25m wide 42km long)		60 ha	3.1%
Primary Schools (allow 3ha each @ 1/5,000 population)		60 ha	3.1%
Primary Schools (allow 9ha each @ 1/15,000 population)		603 ha	
TOTAL B		1,919 ha	100.0%
TOTAL			

Civil Construction Costs	Typical Rates 2017/ha	Typical Rates 2017/lot	Civil Costs
RESIDENTIAL LOT DEVELOPMENT (LOTS, LOCAL ROADS, POCKET PARKS)			
100 PRELIMINARY AND GENERAL (5%)	65,124	2,754	82,627,083
200 DAYWORKS (5% of Item 300)	6,500	285	375,616
300 CLEARING, EROSION & SEDIMENT CONTROL & EARTHWORKS	130,000	5,706	171,166,667
400 LOCAL ROAD AND ACCESSWAY CONSTRUCTION	375,949	16,500	495,000,000
SIGNALIZED INTERSECTIONS	22,785	1,000	30,000,000
500 STREET AND ACCESSWAY LANDSCAPING	36,456	1,600	48,000,000
POCKET PARK PLANTING	20,000	878	26,333,333
600 STORMWATER	159,494	7,000	210,000,000
STORMWATER TREATMENT (ROAD RAINGARDENS)	54,684	2,400	72,000,000
STORMWATER TREATMENT (WETLANDS OR PONDS) 1 per 20Ha @ \$800K EACH	87,389	1,756	52,666,667
700 SANITARY SEWERS	82,025	3,600	108,000,000
Pump stations 1 per 20ha @ \$750,000	37,500	1,646	49,375,000
800 WATER RETICULATION	37,595	1,650	49,500,000
900 UTILITY SERVICES - ROAD DUCTING & STREETLIGHTS	121,899	5,350	160,500,000
Power, Gas and Comms connection charges	136,709	6,000	180,000,000
SUB TOTAL SECTION A	1,374,109	58,124	1,735,544,366
PLUS CONTINGENCY SUM @ 15%	206,116	8,719	260,331,655
Total Sum A	\$1,580,225	\$66,843	\$1,995,876,021
Other Costs			
Professional Design Fees (Planning, engineering and survey)	170,886	7,500	225,000,000
Concept/Masterplan design	28,986	100	3,000,000
Other professional services (geotech, traffic, ecological)	91,304	315	9,450,000
Council processing fees and charges	6,200	272	8,163,333
Council Development contributions	729,114	32,000	960,000,000
LINZ fees, as builds + LT Fees	35,316	1,550	46,500,000
Total Sum B	\$1,061,806	\$41,737	\$1,252,113,333
Total A + B	\$2,642,031	\$108,580	\$3,247,989,354
COMMERCIAL/RETAIL/SCHOOLS (LOTS, COLLECTOR ROADS, STORMWATER & RECREATION RESERVES)			
100 PRELIMINARY AND GENERAL (5%)	16,800		10,124,800
200 DAYWORKS (5% of Item 300)	5,250		3,164,000
300 CLEARING, EROSION & SEDIMENT CONTROL & EARTHWORKS	105,000		63,280,000
400 COLLECTOR ROADS	155,000		93,413,333
SIGNALIZED INTERSECTIONS	66,667		15,000,000
500 STREET LANDSCAPING	35,000		12,075,000
RECREATION RESERVES	12,000		7,232,000
600 STORMWATER	135,000		81,267,089
STORMWATER TREATMENT (WETLANDS OR PONDS) 1 per 20Ha @ \$800K EACH	59,602		35,920,000
700 SANITARY SEWER	65,000		22,425,000
Pump stations 1 per 20ha @ \$750,000	14,000		8,437,500
800 WATER RETICULATION	19,500		11,752,000
UTILITY SERVICES - INCLUDING STREETLIGHTS	75,000		33,637,500
Power, Gas and Comms connections	8,960	6,000	5,400,000
SUB TOTAL SECTION C	772,779		403,128,222
PLUS CONTINGENCY SUM @ 15%	115,917		60,469,233
Total Sum C	\$888,696		\$463,597,456
Other Costs			
Professional Design Fees (Planning, engineering and survey) (8% of item C)	71,096		37,087,796
Concept/Masterplan design	25,000		15,066,667
Other professional services (geotech, traffic, ecological) (2% of item C)	17,774		9,271,949
Council processing fees and charges	6,200		3,736,533
Council Development contributions	37,334	25,000	22,500,000
LINZ fees, as builds + LT Fees	2,987	2,000	1,800,000
Total Sum D	\$160,390		\$89,462,946
Total C + D	\$1,049,086		\$553,060,401
TOTAL DEVELOPMENT CIVIL COSTS A + B + C + D	\$1,980,401		\$3,801,049,755

Table 4 indicates that the total cost of local services for the city is around \$4 billion. The average cost per dwelling is almost \$110,000. Local infrastructure makes up around 60 per cent of the cost. The remaining 40 per cent is comprised of planning, design and council charges, the majority of which are development contributions (i.e. charges for regional infrastructure). To deliver a city of 100,000, almost \$1 billion of development contributions (including Watercare's growth charges) would be required from residential developers before houses could be sold and the costs recuperated.

The scale of development contributions is imposing, but also unreflective of the actual costs of regional infrastructure. Development contribution charges do not differ by location.¹⁸ Infrastructure costs do. In a location like Paerata, development contributions are likely to be too high, while in a location like Clevedon they are likely to be too low.

¹⁸ They do differentiate between brownfield and greenfield, but not the location of greenfield.

Total Infrastructure Costs by Satellite Location

The sum of regional infrastructure data, including direct transport costs, and development information provided by Harrison Grierson is included in Table 5 below. To avoid double-counting, development costs have been revised to remove regional infrastructure costs included in our wider assessment.

Table 5: Total infrastructure costs by satellite location

	Silverdale Dairy Flat	Kumeu South	Clevedon	Paerata	Karaka
Water, telco, energy	\$802m	\$764m	\$744m	\$659m	\$721m
Transport - direct	\$800m	\$700m	\$1500m	\$500m	\$2800m
Development (excl. DCs)¹⁹	\$2800m	\$2800m	\$2800m	\$2800m	\$2800m
Total: satellite	\$4400m	\$4300m	\$5000m	\$4000m	\$6300m
Total per dwelling²⁰	\$130,000	\$125,000	\$150,000	\$115,000	\$210,000
Transport risk assessment	High	High	High	Medium	Low
Transport risk assessment	\$10,000m	\$3000m	\$1000m	\$2000m	\$500m

Table 5 shows that Paerata performs the best in terms of overall servicing cost, at the scales tested. Around \$115,000 is required to develop and service a home in a hypothetical Paerata satellite. Karaka and, to a lesser extent, Clevedon demonstrated direct costs materially higher than other locations.

Paerata carries the additional advantage that the risk of transport investment substantially greater than that assumed in our study is comparatively low. Only Karaka was considered to have a lower risk that development in the location would trigger much higher transport investment needs.

If growth in the north creates a need for \$10 billion of investment in rail and a new harbour crossing, the per dwelling cost to service a satellite rises from \$130,000 to over \$400,000. If \$3 billion of rail improvements are needed to service Kumeu South, per dwelling infrastructure costs rise from \$125,000 to \$225,000. Clevedon costs including a comparatively modest \$1 billion motorway upgrade rise from \$150,000 to \$185,000 and up to \$500,000 per dwelling with a new motorway corridor.

Paerata, by comparison, would only see per dwelling service costs rise from \$115,000 to \$185,000 with a major rail upgrade. Parts of this upgrade have, furthermore, wide political support to proceed regardless of the location of future growth.

Taking into consideration potential regional strategic transport impacts, only Karaka is competitive with Paerata. Karaka's lower risk reflects the need to deliver new strategic links as part of its basic package. These add significant cost in the first instance, but, once delivered, may defer the need for high future investment, even with growth significantly beyond 100,000 residents.

¹⁹ Development contributions cover the cost of council water and transport infrastructure, as well as several other council activities, including reserves. We have removed development contributions as an item, noting that in practice some additional charges would be required to cover other council activities.

²⁰ The sum of infrastructure, including transport, and a \$2.3 billion development cost (\$3.8 billion minus commercial development costs of \$550 million and residential development levies of \$960 million), divided by 30,000 homes. Numbers rounded to nearest \$5000.

Land Values

Paerata was found to be the cheapest location to situate a satellite city.

We wanted to understand how significantly land prices varied across potential satellite city locations. If land is sufficiently more affordable in another location, it may be more cost effective to target scale development there, in spite of higher servicing costs.

In this section we examine land costs in the five areas. We analyse data to understand where in Auckland is most likely to result in affordable housing close to transport.

Land Cost

Using Core Logic's land information directory, we collated approximately 2000 hectares of property in each of the five potential locations. We looked at the size of land holding as well as the cost of property in each zone. The properties included in this phase of the analysis are set out in Map 10, 11, 12, 13 & 14.

Limitations on Core Logic data retrieval mean a maximum of 400 properties can be analysed at one time. The small size of property holdings in Dairy Flat (and to a lesser extent South Kumeu) restricted analysis of all properties in satellite zones. To obtain data for at least 2000ha of land around Dairy Flat, two blocks of land were collated and analysed. Summary property data is set out in Table 6.

²¹ All data sourced from Core Logic.

Map 10, 11, 12, 13 & 14: Land information in the five satellite locations²¹

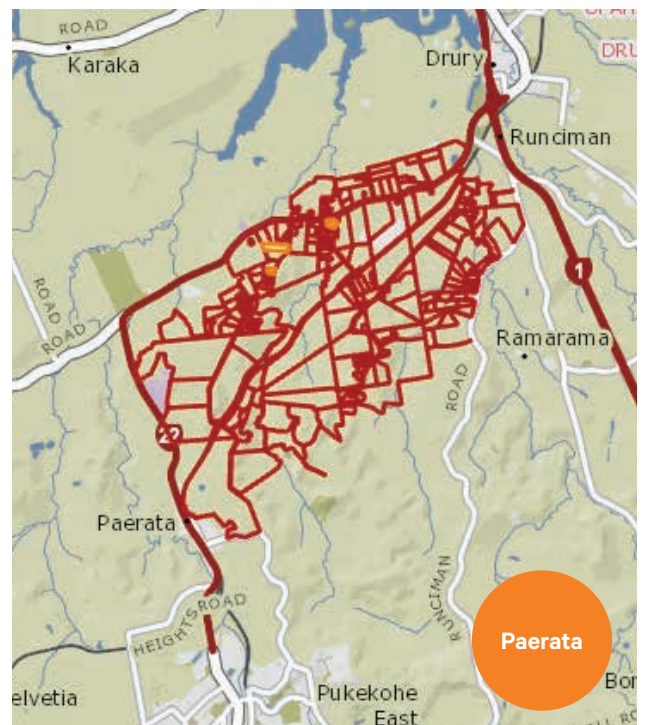
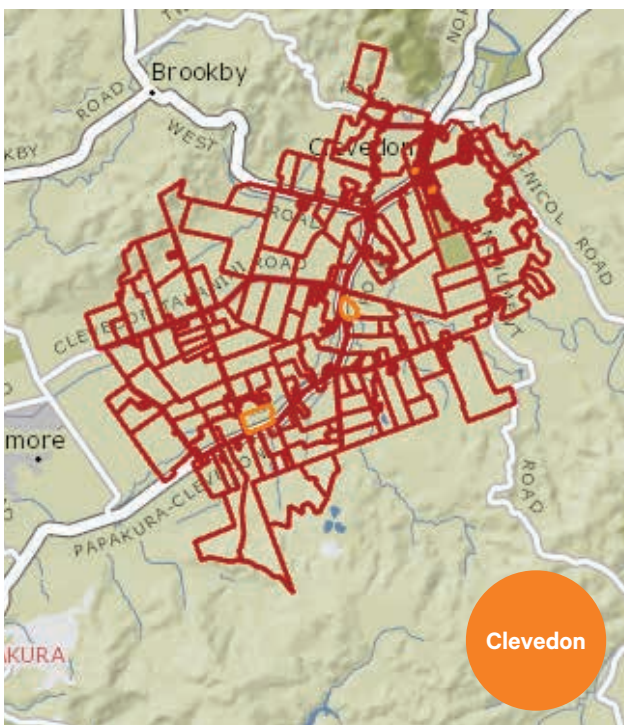
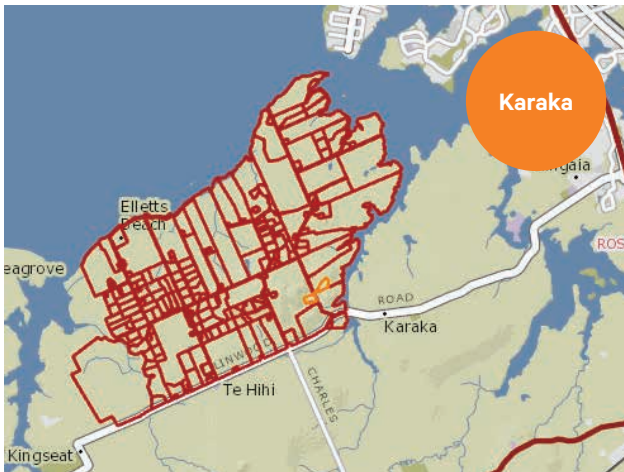
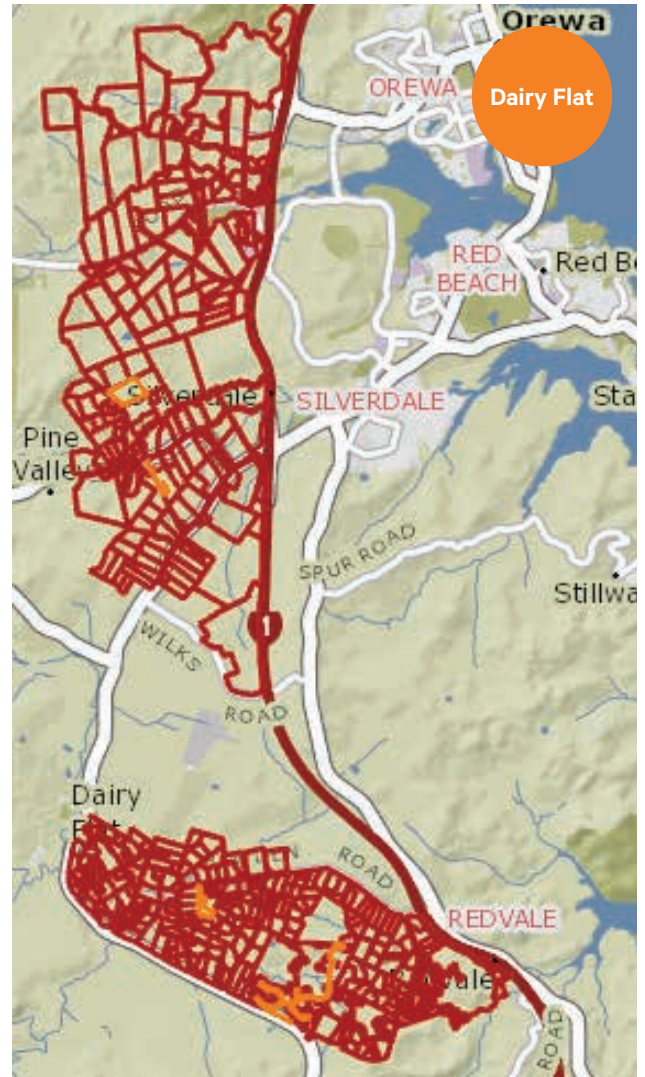
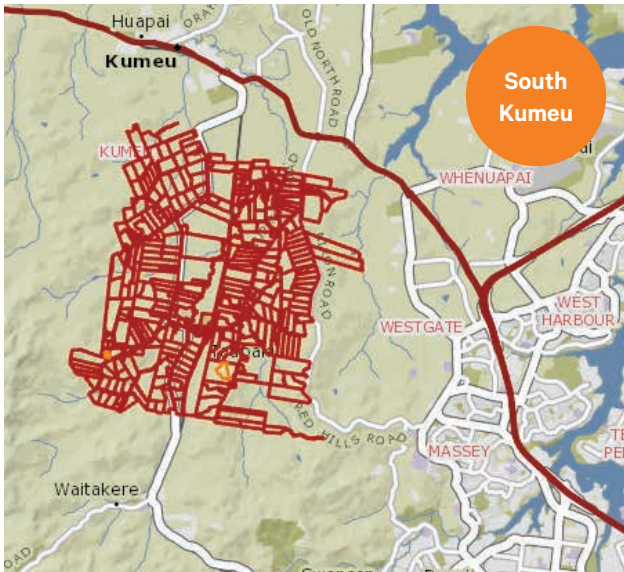


Table 6: Properties and total value in each location

	Dairy Flat	South Kumeu	Clevedon	Paerata	Karaka
Total area analysed	2289ha	1934ha	2209ha	2348ha	2503ha
Total number of properties	590	387	278	318	214
Average land holding	3.9ha	5.0ha	7.9ha	7.4ha	11.7ha
Total capital value 2014	\$997m	\$470m	\$397m	\$465m	\$414m
Total land value 2014	\$672m	\$293m	\$292m	\$286m	\$298m
Average capital cost/ha 2014	\$435,000	\$243,000	\$179,000	\$198,000	\$166,000
Average land cost/ha 2014	\$293,000	\$151,000	\$132,000	\$122,000	\$119,000
Property value inflation est. 2014-2017	+69%	+78%	+36%	+61%	+42%

Table 6 shows that land holdings are on average largest in Karaka, by some margin. Land holdings in Dairy Flat-Silverdale are the smallest, though larger holdings are present in the north of the area.

Smaller land holdings are correlated with higher property prices. This is because each section tends to have a home and the value of homes is factored into the overall property value. Dairy Flat-Silverdale is the most expensive place to redevelop. Capital and land values are around double other areas in the study, based on 2014 Auckland Council estimates (the most recent). Karaka has the lowest capital and land costs, closely followed by Paerata and Clevedon.

The age of property value information poses a problem. In light of rapid recent property value increases, price data is now out of date. It should be expected that Unitary Plan decisions, in particular, have and are having a significant impact on property prices, particularly in Paerata and Dairy Flat-Silverdale.

To understand the scale of this impact, we identified properties which have been sold in the past year and compared their sale price to the official capital value. The number of properties sold since June 1, 2016 ranged from 11 in Paerata to 30 in Dairy Flat-Silverdale. We removed the highest and lowest selling property in proportion to 2014 capital value to remove outliers that may distort raw price information. The average increase in property (i.e. capital) value is recorded in the final row.

Sale price information suggests the greatest price inflation since 2014 has been in Kumeu South, followed by Dairy Flat-Silverdale and Paerata. A property sold in Kumeu South in the last year sold, on average, at 78 per cent above the 2014 capital value. Inflation has been lowest in Clevedon, followed by Karaka. It is not clear why Kumeu South's price rise has been so rapid, given the lack of any upzoning through the Unitary Plan. It may reflect improved transport connectivity, proximity to a new town centre or be distorted by a comparatively small sample size (15 properties comprise the sales data set).

Analysing property information from the five satellite locations suggests land in Dairy-Flat Silverdale is now very expensive. A developer looking to convert property into new dwellings would expect to pay around \$735,000 per hectare or three times more than for land in Karaka and Clevedon. Prices are, furthermore, increasing faster (Table 6).

Table 7: Land and infrastructure costs in the five satellite locations

	Dairy Flat-Silverdale	Kumeu South	Clevedon	Paerata	Karaka
Infrastructure costs²²	\$1600m	\$1500m	\$2200m	\$1200m	\$2900m
Infrastructure cost per/ha	\$800,000	\$750,000	\$1,100,000	\$600,000	\$1,450,000
Property value/ha 2014	\$435,000	\$243,000	\$179,000	\$198,000	\$166,000
Property value/ha est. 2017	\$735,000	\$433,000	\$243,000	\$319,000	\$236,000
Total infrastructure and property cost 2017/ha	\$1,535,000	\$1,183,000	\$1,343,000	\$919,000	\$1,686,000

A further finding from Table 7 is that land is cheaper in Karaka and Clevedon, but the saving on land value is small in relation to additional infrastructure costs. Approaching \$100,000 can be removed from a hectare of development in Clevedon or Karaka due to lower property values. Increased infrastructure costs of between \$500,000 and \$800,000 are much more significant. Only in Dairy Flat-Silverdale are property prices becoming so high as to be comparative with average direct infrastructure costs.

²² Comprising regional transport, water, energy and telecommunications, excludes development costs.

The Preferred Location for a Satellite City: Paerata

Aggregating the total costs of developing land, including trunk and local infrastructure and land costs, we found that Paerata was the cheapest location to add 100,000 people. This is largely a result of low water supply costs, due to Paerata's situation along the Waikato pipeline, and the ability to leverage planned transport investments. The location of the rail line and the potential to expand the rail corridor at a comparatively low price to provide non-stop services to the CBD is a significant advantage for Paerata.

Paerata also benefits from competitively priced land and large lots. While prices are rising rapidly, available data suggests they are still significantly cheaper than Dairy Flat and Kumeu South. The lower price to acquire or redevelop land makes it easier to develop affordable housing and/or use land value appreciation to subsidise infrastructure costs. Larger lots make land aggregation and stakeholder engagement easier.

Cheaper Karaka land is insufficient to offset infrastructure costs - at assumed growth levels

From a land cost perspective, Karaka was the cheapest, but the higher price of developing up to 2000 hectares there does not outweigh the additional costs of infrastructure, at the scale tested. Applying the observed inflation estimate of 61 per cent to property values in Paerata takes the average per hectare cost of buying land to \$319,000 per hectare and \$640 million over a 2000 hectare development. This compares to under \$240,000 per hectare and \$480 million in Karaka, assuming inflation of 42 per cent since 2014.

Across a 2000ha development, acquiring or otherwise repurposing land for development would carry an additional \$160 million cost in Paerata over and above Karaka. This is a significant figure, but is not sufficient to offset the additional infrastructure costs of adding 100,000 people to Karaka (of around \$800-900 million in direct infrastructure costs).

Karaka's vast area in combination with cheap land and lower regional infrastructure trigger points mean that under a different test scenario it could become a priority growth area, in spite of high infrastructure costs. If higher growth levels are assumed (for example, 60,000 homes over 4000 hectares), better utilisation of Karaka strategic infrastructure and lower land costs would make it a more feasible growth location than Dairy Flat-Silverdale, Kumeu South or Clevedon.

Conclusion

Development in Dairy Flat-Silverdale is very expensive

High land and infrastructure costs and low trigger points for major additional investment suggest that new growth should not be encouraged in the north. Both public transport and motorway modelling indicates that significant investment above and beyond what is currently committed through the Supporting Growth programme is needed just to meet expected demand. The addition of 100,000 residents would require rail and motorway investments which make growth in the north very expensive.

Evidence suggests not only that the north cannot accommodate 100,000 additional residents, but that current growth expectations should be dialled back. Slower growth may avoid the need for multi-billion dollar investment in a new rail corridor and state highway capacity. Land costs of between two and three times other peripheral locations in Auckland indicate land acquirement will add \$400 million to \$800 million to the underlying cost of a 2000ha development.

Kumeu south land is uncompetitive

Infrastructure costs to develop a city of 100,000 in Kumeu south are mid-range. However, very high apparent property price inflation in recent years suggests it may be difficult to develop affordably. Updating property costs by applying a price inflator of 78 per cent, indicates land per hectare in the area is now around \$430,000. This is over \$100,000 per hectare more than Paerata, with the added complication that land holdings are smaller, making land aggregation and redevelopment more difficult.

Clevedon transport solutions are expensive and uncertain

Lower property inflation in recent years makes Clevedon more attractive for development, but this benefit is insufficient to offset high transport costs. Clevedon's location away from established infrastructure and uncertainties about how strategic transport services link to regional networks are major issues. In light of flooding risk, Clevedon has to demonstrate major land cost or infrastructure efficiencies to justify development prioritisation, which it does not.

We determined that Paerata best suited the aims of the study to investigate an integrated development, aligned with transport and leveraging land value. We progressed Paerata to the next stage to investigate more detailed city information.

Paerata City: Employment and Construction

The final stage of costing up a mock satellite city was to understand construction. This process included understanding employment needs in Paerata, including potential public investments which could catalyse employment growth, and estimating the cost of housing.

Employment

From the outset, a baseline assumption for the satellite city project was that at least as many jobs would be provided for as homes. This is a critical component of the transport strategy, which is to limit as far as possible trips to and from the CBD through Auckland's capacity-constrained core.

Existing growth plans for Auckland's south assume 42,000 homes and 19,000 jobs.²³ We wanted to identify at least 11,000 more jobs which could be added if the city was integrated and delivered as a single development.

We analysed a range of public investment opportunities which are or would likely become necessary if a city developed around Paerata. The following activities and theme around science, health and education emerged.

²³ Supporting Growth.

1. Paerata Hospital

The health agency responsible for the wider south Auckland area is Counties-Manukau DHB. Its major facility is located at Middlemore in Mangere east, some 20km north of Paerata. The facility's location was determined in the 1940s with some structures on the site dating from this era. The site is proximate to rail but not the strategic road network, which is critical to emergency services.

Manukau DHB does not have plans for a replacement of the Middlemore site, but does own a significant amount of land in Manukau, some 15km north of Paerata. Further development of the superclinic site is possible and is expected, but would further consolidate medical facilities in the DHB to the very northern portion of the serviced area.

A new major medical facility for Counties-Manukau DHB is therefore viable under a Paerata city growth scenario. In terms of employment, Middlemore directly employs 4100 staff (full time equivalents). Available studies of the economic impact of hospitals suggest direct hospital employment is only around 55 per cent of all employment generated by hospitals. Indirect employment accounts for the remaining 45 per cent.²⁴ Around 7500 jobs are likely created by Middlemore, the great majority of which would move to Paerata under this scenario.

An alternative is that Middlemore remains the DHB's principal medical facility, but a new facility is opened in Paerata. Counties Manukau DHB would sell its surplus land (or a UDA redevelop it) in Manukau and focus new investment on the new Paerata hospital. A smaller facility, equivalent to the 400-bed Dunedin hospital would employ approximately 3000 staff. Including indirect employment, this option would create around 5500 new jobs.

2. Paerata University

Auckland tertiary education facilities are predominantly provided in and around the Auckland CBD. The concentration of students and staff at the University of Auckland and AUT CBD sites is a major generator of transport demand and congestion. Establishment of a major new university in Paerata would significantly reduce pressures on Auckland's transport network.

There has not been an entirely new university established in New Zealand since the University of Waikato in 1964. More recent additions to university status have either been off-shoots of existing universities (Lincoln University separated from the University of Canterbury in 1990) or expansions of existing facilities (AIT became AUT in 2000).

Universities New Zealand identifies a ratio of one university to 500,000 population as in line with international norms.²⁵ This is consistent with where New Zealand is at currently, but not where New Zealand or Auckland will be in a decade. A new university should be expected somewhere in New Zealand within the next two decades and Auckland's primary growth location is the most feasible location for this facility.

Auckland University is New Zealand's largest university and is not likely to be replicated outside of Auckland's CBD. AUT provides a wider range of educational options than the University of Auckland and actively targets students from southern Auckland.²⁶ AUT currently employs around 2500 staff and has an enrolment of nearly 30,000.

Research by BERL suggests that AUT also provides a much wider employment impact than direct numbers show. A total economy-wide impact of 4300 jobs (FTEs) is created via the operation of AUT.²⁷ Not all these jobs would be created in and around Paerata with the presence of a Paerata University, but the initiative would generate significant employment.

²⁴ See, for example, IBRC, *Economic Impact of the New Reid Hospital*, February 2006; and Hospital Council of Northern and Central California, *Economic and Health Impact of Hospitals*, 2016.

²⁵ <http://www.universitiesnz.ac.nz/about-university-sector/key-facts>

²⁶ AUT, Annual report, 2015.

²⁷ AUT, Annual report, 2015.

Residential Construction

3. Te Papa North

Discussions about a new Te Papa museum exhibition and storage facility in Manukau have accelerated in recent years.²⁸ With an annual operating spending of \$3 million per annum, a facility of this scale will not significantly lift employment if located in Paerata. However, it could sit at the heart of a wider science, cultural and educational strategy for the city.

In combination, the hospital, university and museum would set Paerata up as a new hub for learning and innovation in Auckland's south. The objective would be to catalyse additional private sector investment in services linked to the three main public investments. For example, at Barangaroo in Sydney, the developer has successfully targeted financial services with larger floor plates consistent with the model deployed in Canary Wharf, London. Masterplanning for Paerata would specifically cater for wider industry capable of leveraging off the three key public investments.

Total employment added

Including a major hospital, university and museum in Paerata city could be expected to add between 9000 and 12,000 jobs in Auckland's south. This estimate includes supporting activities, but does not include private employment catalysed by the presence of a science, health and innovation hub.

The largest individual cost of a development is the construction of homes. New Zealand's home construction market is dominated by small, independent contractors specialising in bespoke homes. A major advantage of the integrated urban development at scale model is the potential to support greater use of modern home construction techniques. Housing procured in sufficiently large blocks will provide the opportunity to move to prefabricated construction.

Prefabrication

Prefabrication, or prefab, refers to the off-site manufacture and assembly of building components. It is a wide term incorporating the manufacture of discrete parts of a structure, such as panels, right through to the near complete assembly of a home in a factory.

Prefabrication

Prefab is critical for two reasons. Firstly, home construction costs are comparably high in New Zealand and prefab represents a major opportunity to bring these costs down. In 2012, the Productivity Commission estimated that New Zealand new home build costs were 15-25 per cent higher than in Australia.²⁹ This estimate was based on a detached home build of \$1650 per m2, which is very low by today's standard. Construction costs for a "typical" 160-180m2 standalone dwelling in Auckland are now around \$2000m2.³⁰

Research by Massey University has shown that prefab can significantly reduce construction costs. In a 2015 case study of Auckland construction projects, researchers identified a 20 per cent cost saving on housing initiatives using prefab.³¹ Not all studies have shown equivalent cost savings, but some related work on commercial property found a strong link between the amount of prefab used and a project's cost performance. Specifically, the higher proportion of prefab, the greater the savings.³²

Secondly, prefab is required to resource the number of homes which need to be built. It is doubtful that Auckland can build a city using conventional construction approaches. Labour is currently stretched building just 7000 homes a year, well short of the 14,000 required. Upward pressure on wages created by construction of Paerata city will undermine affordability without major productivity improvements.

²⁸ <http://www.stuff.co.nz/dominion-post/news/72833407/te-papas-planned-auckland-offshoot-is-put-on-ice>

²⁹ Productivity Commission, *Housing Affordability Report*, March 2012, pg. 179.

³⁰ Rawlinsons.

³¹ Shahzad, W.M, Mbachu, J. and Domingo, N., *Marginal Productivity Gained Through Prefabrication: Case Studies of Building Projects in Auckland*, 2015.

³² Shahzad, W.M, Mbachu, J. and Domingo, N., *Prefab content versus cost and time savings in construction projects: A regression analysis*, 2014.

The 2016 Massey study showed that prefab was able to halve the time needed to deliver housing initiatives. The assembly of homes off site is not only advantageous in terms of time and productivity, it is less dependent upon high demand skills. Panels and other housing components manufactured off site do not require skilled labour and faster assembly on site reduces the time commitments of builders, plumbers, electricians and other skilled labour.

In addition, there is evidence to show that prefabricated homes tend to be higher quality. Greater energy efficiency, higher sustainability ratings and less wastage are typical benefits. Savings on procurement can also be expected where prefab leads to wider sourcing of materials and products.³³

Estimating housing costs

A major driver for development at scale is to enable and support a shift to prefabrication. Small housing developments do not provide the certainty needed to invest in more productive processes. Procuring housing in large tranches will give the market greater confidence to invest in plant and machinery needed for offsite manufacturing.

Using representative per metre costs for building at high, medium and low density in Auckland today, Table 8 provides a guide to the overall value proposition of prefab at scale.

Table 8: Indicative savings from procuring housing at scale with prefab

	Low	Medium	High	Total Satellite City
Sample description	160-180m2 detached	120-140m2 duplex	60-70m2 apartment	
Indicative build cost 2017	\$2000m2	\$2500m2	\$4000m2	
Cost to build one unit	\$340,000	\$325,000	\$260,000	
Cost to build 10,000 units	\$3.4 billion	\$3.25 billion	\$2.6 billion	\$9.25 billion
Prefab saving 10%	\$3.06 billion	\$2.925 billion	\$2.34 billion	\$8.325 billion
Prefab saving 20%	\$2.7 billion	\$2.6 billion	\$2.08 billion	\$7.4 billion

Table 8 indicates that to construct a typical low density home in Auckland today costs around \$340,000, excluding development costs, land and fees. Scaling that build up to 10,000 units as per the assumption of the satellite city, the total cost of constructing low density housing using conventional building practices is likely to cost around \$3.4 billion. Including the \$3.25 billion to construct medium density and \$2.6 billion to construct high density, the total cost to build homes in Paerata city using conventional practices is around \$9.25 billion.

Constructing the same low density home using prefab is likely to cost \$270,000, assuming a 20 per cent saving. A 20 per cent saving on medium density is consistent with observations,³⁴ and would remove around \$65,000 from the cost of a duplex. A 20 per cent saving on high density housing would reduce the cost of a 65m2 apartment by around \$50,000, though evidence suggests a 10 per cent saving may be more realistic.³⁵

We include in our overall cost of Paerata city, residential construction of \$7640 million. It assumes a 20 per cent cost saving is made on low and medium density dwellings and a 10 per cent saving on high density.

³³ Buckett, NR., Building Better – Advanced Residential Construction Techniques for New Zealand, BRANZ, 2013.

³⁴ Shahzad, W.M, Mbach, J. and Domingo, N., Marginal Productivity Gained Through Prefabrication: Case Studies of Building Projects in Auckland, 2015.

³⁵ See, for example, <http://www.prefabnz.com/Downloads/Assets/3841/1/>

Total Construction Costs for Paerata City

In this section we combine the total costs of developing and construction Paerata city (including commercial property development, but excluding commercial property construction). Only capital costs are included.

Paerata hospital

Using Dunedin's new hospital as a guide, a new major hospital facility serving up to 200,000 residents can be expected to cost approximately \$1.2-\$1.4 billion. We use \$1.3 billion as a mid-range estimate.

Paerata University

Costing construction of a new university is particularly difficult give the length of time since New Zealand last build a major tertiary education facility. AUT's 2016 annual report records \$809 million of plant, equipment and property. We have used an estimate of \$1 billion for a new university.

Te Papa North

Te Papa North has an estimated capital cost of \$40 million.

Wider Education Infrastructure

Like hospitals, schools are funded out of central government taxes. We do not include the cost of critical school infrastructure in our final cost estimate, but given the scale of investment it is important to include schools in the overall assessment.

Primary school aged children typically comprise 9 per cent of a local population and secondary aged children 7 per cent. Across a city of 100,000, we therefore assume 9000 primary students and 7000 secondary.

Assuming a standard primary school roll of 700 students, Paerata city would require 13 primary schools. A typical primary school cost is approximately \$15 million, resulting in a total cost of around \$200 million.

Assuming a standard secondary school roll of 1000 students (noting Auckland secondary schools are in practice likely to be larger), Paerata city would require seven secondary schools. A typical secondary school cost is around \$30 million, resulting in a total cost of around \$200 million.

School infrastructure for a city of 100,000 is therefore likely to cost the Government approximately \$400 million.

Infrastructure and Development

Drawing on the information above, we estimate the cost of delivering infrastructure to Paerata city at \$1.2 billion. Land development is a further \$4 billion.

Housing

Assuming 20 per cent cost savings on low and medium density home construction and a 10 per cent saving on high density, the total indicative cost of prefab housing across the satellite is \$7.64 billion. This is a saving of around \$1.6 billion from a conventional approach.

Conclusion

Aggregated information on the cost of delivering Paerata city is included in Table 9 below.

Table 9: Total capital costs of delivering Paerata City

	Total	Average cost per dwelling (excl. GST)	Per dwelling assumptions and notes
Water, telco, energy	\$660m	\$22,000	
Transport	\$500m	\$17,000	Direct costs only
Land development (excl. DCs)	\$2800m	\$77,000	Excludes commercial development costs
Land 2017 (cost to buy 2000ha today)	\$640m	\$21,000	Includes commercial land and schools
Residential construction	\$7640m	\$255,000	Average across all housing. Assumes cost saving via shift to prefab housing
Total development	\$12,240m	\$392,000	
Residential development excl. telco, energy		\$375,000	Assumes regional fibre, electricity and gas network costs covered by provider and commercial development self funded
Schools	\$400m		
University	\$1000m		
Hospital	\$1300m		
Museum	\$40m		
Total additional	\$2740m		
Total city	\$14,980m		

The total cost of all development in a city of 30,000 homes and 30,000 jobs is estimated to be \$15 billion. This includes the largest public investments, but excludes smaller items which collectively will add significant cost, such as justice, emergency services and community facilities. It also excludes some fully private activities, most notably mobile services. Operating costs are also excluded.

Fifteen per cent of costs we examine are attributed to public sector seed investments to catalyse employment and wider growth in the area. Around half of all costs are driven by residential construction and 30 per cent by infrastructure and development.

Table 9 reveals that regional infrastructure is a comparatively small component of an overall house price (\$39,000 or less than 10 per cent). At its raw cost before zoning and infrastructure, land is also a small overall proportion (5 per cent). Much more significant are local infrastructure and land development costs, at around 20 per cent of the total. If rail improvements were triggered by a Paerata city and attributed exclusively to the development, transport costs would rise from \$17,000 to \$83,000 per dwelling.

Construction of the home itself is clearly the most expensive component, at 65 per cent of the total. Without the assumed efficiency saving from shifting to prefab, the average home construction price in our example would rise around \$50,000 to just over \$300,000.

Adding the complete costs of development, we estimate that the average cost to deliver a home in Paerata city would be \$392,000. This assumes that development profit and land value increases are not captured by those parties. This is equivalent to the risk-free cost if the Government owned the land and developed the property itself. Including a GST charge on the final product, the cost of a dwelling rises to \$450,000.

Infrastructure charges include telecommunications and energy costs of \$500 million across the development. Normally these are absorbed by the provider and repaid via monthly account charges. Removing this item reduces an average dwelling cost by \$17,000 and takes the average total cost to \$375,000 (\$430,000 including GST).

Case study comparison: A conventional approach in Dairy Flat-Silverdale

We estimate the cost of delivering an integrated city development in Paerata at \$392,000 (excluding GST). Using data from the Dairy Flat-Silverdale location, this cost increases by around \$80,000. This is an increase of around 20 per cent.

Most of this cost (\$55,000) is driven by assumptions around a standard build vs prefab. Excluding residential housing construction, Dairy Flat-Silverdale delivers an average home at \$27,000 above Paerata costs.

Table 10: Development costs in Dairy Flat-Silverdale.

Dairy Flat-Silverdale comparator	All	Average cost per dwelling
Water, telco, energy	\$800m	\$27,000
Transport	\$800m	\$27,000
Land development (excl. DCs)	\$2800m	\$77,000
Land 2017	\$1000m	\$33,000
Residential construction	\$9250m	\$310,000
Total cost	\$14,150m	\$474,000
Total including GST	\$16,270m	\$545,000



Funding Tools

The \$375,000 cost to deliver a home in a hypothetical Paerata city includes no provision for profit. The next phase of the project was to understand the value created by the city. We look at both the direct tax revenue captured by central government, property tax revenue collected by local government and the potential value uplift generated when a complete dwelling is sold on the open market. We do not examine commercial property potential.

GST Generated by Paerata City

Assuming all elements of the Paerata city concept were delivered at cost, totalling \$15 billion, the Government would receive \$2.25 billion in GST. If residential property was sold on the open market and the value of the development increased by just around \$10 billion, in line with Karaka Lakes and Pokeno, the Government would receive a further \$1.5 billion in GST.

A GST take of between \$3 and \$4 billion is equivalent to all land and development costs across the full 2000 hectare development. If GST was tied to development, central government could, conceptually, fund all infrastructure and development itself, allowing homes to be sold at their average construction build cost of \$255,000 (plus GST).

In practice, GST is a general tax used to fund, among other things, schools, which are included in the overall development costs but not attributed to total home costs. Allocating GST to the activity which generates it would be a major shift with wider ramifications, not only for other housing developments by other Government responsibilities. Nevertheless, the exercise shows that growth is strongly net positive from a central government revenue perspective and that taxes generated from housing are affecting affordability.

Rates

The Auckland Council levies rates on property in Auckland. Currently, rates sit at around \$3000 per annum for an average residential property. An average rate of \$3000 would levy \$90 million per annum. Factoring in rates the council already obtains from the area and the desirability of targeting the more affordable end of the residential market, a net rates increase of \$60 million may be expected.

A revenue stream of \$60 million is sufficient to repay a debt of over \$1 billion over 30 years, assuming an interest rate of 4 per cent. The cost of Paerata city's roads and water infrastructure above and beyond that already in planning documents was estimated at around \$700 million. The council provides other services, for example parks and community facilities, but these are unlikely to exceed the servicing capacity of a \$60 million rates increase. Furthermore, half of road investment can be expected to be funded through the National Land Transport Fund and water services are ultimately self-funding.

This suggests that well-planned growth does not deliver a net cost to the Auckland Council before operating and maintenance costs are considered. Estimating whole of life costs is outside the scope of this study, but in a location like Paerata it is likely that the council's whole of life obligations can be met. In a location like Dairy Flat-Silverdale, it is likely that the council would receive less in rates than it would cost to service new growth in the area over the long term.

As previously noted, the council's principal challenge is financing investment without exceeding debt ratios highlighted by ratings agencies. If Auckland Council infrastructure responsibilities were undertaken by the development, for example, if land value improvement was used to raise debt and repay network or "trunk" service investment on behalf of the council, Paerata land owners would require a rates rebate. This would ensure that Paerata residents were not subsidising other developments across Auckland which did receive council funding.

Estimating the appropriate rebate to a fully funded development is difficult. The Auckland Council provides a wide range of services which are not easily disaggregated into growth and non-growth investments by location. The overall impact would, however, be minor in relation to wider taxation.

Value Capture

The increase in land value from zoning, infrastructure and successful development typically provides the margin of profit to a developer or land owner. Under existing practice, public authorities do not specifically target this margin, but in some cases it can provide a significant capital windfall to property owners. This section looks at what scale of value uplift might be reasonably expected in a Paerata city.

There are no perfect comparators to understand the future potential value of residential development. To provide insight we have therefore used two different, but broadly comparable initiatives currently underway near Paerata. The first is Karaka Lakes, 5km north of Paerata. It is closer to Auckland and is a higher end development. It is used as the upper benchmark for what properties delivered in Paerata could be sold for on the open market.

The second location is Pokeno, 12km south of Paerata. It is in the Waikato region, so falls under a different planning and governance jurisdiction, but is a housing satellite for Auckland workers. It generally provides a more affordable housing option and is used as the lower benchmark for potential housing value in Paerata.

We analyse developed land across the two comparators, separating their land and capital values. We then apply an average land value increase to account for higher density development enabled in Paerata by colocation with rapid transit and employment.

Map 15 & 16: The Karaka Lakes development



Karaka Lakes

The closest major urban development to Paerata currently underway is in the Hingaia area, 5km to the north. It is also located adjacent to SH1, but has no proximate rail access. We used Core Logic to source data on housing underway and recently sold. The properties used in our analysis and its location in relation to Paerata are shown in Map 15 & 16.

We analysed the property information of 364 properties covering 18.5 hectares of a 30 hectare site. The development includes a mix of medium and low density housing and is less dense than what has been assumed across a full Paerata satellite city. The average lot size is around 520m².

The total 2014 capital value of the 364 properties analysed is \$272 million, or \$740,000 per property. Homes are larger than those considered in the Paerata concept, averaging around 200m². Land value across the properties analysed was \$123 million, equating to \$6 million per hectare. Land across Karaka Lakes comprises 45 per cent of all value and improvements 55 per cent.

There have been 62 property sales in 2017 and the average sale price has been 40 per cent above capital value. Adding this improvement across the development increases the total value of property to \$380 million and the average property value to \$1,050,000.

If capital value improvement consistent with 2017 sales is attributed entirely to land value (i.e. that no alterations have been made to existing homes), the value of land across the 18.5 hectares of housing is now \$227 million, or \$12.5 million per hectare. The average property value is now 60 per cent land and 40 per cent improvements.

Map 17 & 18: The Pokeno development



Pokeno

The second location we tested against was Pokeno. It is around 12km south of Paerata and has similar access to SH1. There is a proximate rail line, but no rail commuter services. We used Core Logic to source data on housing underway and recently sold. The properties used in our analysis and its location in relation to Paerata are shown in Map 17 & 18.

We analysed 308 residential properties, 27 of which had no dwelling. Residential land comprised 21 hectares of the 35 hectare site examined. There is no medium or high density housing on the development. The average site is around 670m².

The total 2014 capital value of the development is \$162 million, comprised of \$60 million of land and \$103 million of improvements. Excluding vacant sites, the average home size is around 200m² with an average capital value of \$530,000. On a per hectare basis, property in Pokeno has a capital value of \$7.9 million and a land value of \$2.9 million. Land comprises 37 per cent of all value in Pokeno and improvements 63 per cent.

There have been 15 home sales in 2017. The average sale price has been 34 per cent above capital value. Adding this value across the development increases the total capital value to \$220 million and the average home value to \$700,000.

Allocating the value of observed capital value improvement to land value across the 21 hectares of residential property results in a current land value estimate of \$5.6 million per hectare.

Karaka Lakes, Pokeno and Paerata today compared

Table 11 presents property information for Karaka Lakes, Pokeno and Paerata. Using existing 2014 estimates of land value, it shows that a completed hectare of residential land in Karaka Lakes (\$6 million) is valued at 49 times that of the same amount of land in Paerata. In Pokeno (\$2.9 million) the equivalent figure is 24 times higher. Analysis of 2017 data suggests similar ratios of 46 times Karaka Lakes land value and 23 times Pokeno.

Table 11: Properties and total value in each location

	Karaka Lakes		Pokeno		Paerata	
	2014	2017	2014	2017	2014	2017
Housing area investigated (ha)	30		35		2348	
Residential property (ha)	18.5		21		n/a	
Number of residential properties	364		308		318	
Housing typology	Low/Medium		Low		Rural/lifestyle	
Average lot size (m2)	520		670		7400	
Total capital value (\$m)	\$270	\$375	\$160	\$220	\$465	\$750
Total land value (\$m)	\$120	\$225	\$60	\$115	\$286	\$570
Capital value per property (\$000)	\$740	\$1035	\$530	\$700	\$1460	\$2356
Land value per property (\$000)	\$330	\$625	\$190	\$370	\$901	\$1794
Capital value per hectare (\$m)	\$14.5	\$20.5	\$7.9	\$10.5	\$0.198	\$0.319
Land value per hectare (\$m)	\$6.5	\$12.5	\$2.9	\$5.6	\$0.122	\$0.243

Although developed land may be up to 50 times higher than in an undeveloped area like Paerata, the focus on residential property in Karaka Lakes and Pokeno distorts the comparison. Not all of Paerata could ever be completely converted to housing lots. A significant amount of additional land is needed to support dwellings. This not only includes the roads and pocket parks, but schools and other facilities. (However, for a property owner whose land is fully on land rezoned for housing, the potential is for land value increases in the vicinity of 50 times original value.)

The Paerata Land Value Opportunity

Table 11 shows that the value of land used for housing in Karaka Lakes is approximately \$12.5 million today and in Pokeno \$5.6 million. The mid-point estimate for Paerata residential land is therefore \$9 million per hectare. We use this as our average estimate for post-development low density housing in Paerata city. In practice, the smaller sections assumed in Paerata would increase land value, but we also anticipate targeting a more affordable market.

Higher density development increases the underlying value of land. In Karaka Lakes, land value per hectare of the 37 sections under 300m² reveals a per hectare land value in 2014 of \$11.3 million. This is almost double the \$6 million average value of land across the whole area examined.

In Hobsonville, a more advanced development again and featuring high, medium and low density, land value differences are less pronounced. Existing 2014 land value per hectare for high density property is \$21 million. It is \$12.5 million for medium density and \$10 million per hectare for low density.

There is no high density development in the developments we examined at Karaka Lakes and Pokeno, and only a small portion of medium density. We decided to use the identified land value ratios in Hobsonville as a guide to estimating the value of medium and high density residential land in Paerata. We applied a factor of 1.25 to estimate medium density land value and a factor of 2 to estimate high density. The findings are set out in Table 12 below.

Table 12: Estimating residential property uplift potential for Paerata city

	Paerata residential land value			
	Low	Medium (low x 1.25)	High (low x 2)	Total
Land value per hectare	\$9m	\$11.25m	\$18m	
Average lot size	450m ²	325m ²	175m ²	
Average land value per lot	\$400,000	\$365,000	\$315,000	
Total land consumed	450ha	325ha	175ha	1000ha
Total value land	\$4050m	\$3656m	\$3150m	\$10,890m

Ten thousand low density units averaging 450m² would consume 450 hectares but require in total 667 hectares, including roads, parks and other supporting services (Harrison Grierson). Its total value would be \$4.05 billion and section values would be \$400,000.

Allocating an average of 325m² per lot for medium density housing would consume a total of 325 hectares, or 400 including supporting local services. Assuming a land value factor of 1.25 above low density value, this land would be worth \$3.656 billion.

An average 175m² per high density dwelling would consume 175 hectares in Paerata, or 250 hectares including local services. Using a multiple of two times low density value, this land once developed would be worth \$3.15 billion, using 2017 estimates.

Altogether, we estimate that developing existing Paerata land into 10,000 each of high, medium and low density dwellings would result in a total residential land value in today's prices of \$10.9 billion. This is over \$10 billion higher than the \$640 million estimate of 2000 hectares of property today, but would only cover 1317 hectares, including roads, parks and other services needed to support housing.

Including schools, collector roads and stormwater land identified by Harrison Grierson, the total land consumed would be 1574 hectares. To buy 1574 hectares in Paerata today would cost approximately \$500 million. The post development land value of \$10.9 billion is \$10.4 billion and almost 22 times greater.

To realise this uplift, infrastructure and development costs of \$3.5 billion (excluding commercial development costs) would be required, resulting in a net uplift of approximately \$6.9 billion. This is the value created above and beyond costs from infrastructure, zoning and successful development.

Paerata house prices

By combining projected land value with development costs it is possible to estimate the retail price of housing in Paerata, assuming market rates. A post development land value of \$10.9 billion would see average land value per property rise from \$21,000 (\$17,000 across just the 1574 hectares of housing-related land) to \$360,000. It would cost \$117,000 to achieve this value (or \$99,000 excluding energy and telecommunications). The net value improvement of land after zoning, infrastructure and development would on this basis average \$246,000 per property.

Land values at this level infer that an average home in Paerata would sell for \$615,000 (excluding GST), comprised of land worth \$360,000 and improvements of \$255,000. This is closer to the price of housing in Pokeno than in Karaka, which reflects smaller average dwellings (given assumptions around high and medium density).

Table 13: Estimated home values in Paerata city 2017 prices

Density	Land	Home	Total
Low	\$400,000	\$272,000	\$672,000
Medium	\$365,000	\$260,000	\$625,000
High	\$315,000	\$234,000	\$549,000
Average	\$360,000	\$255,000	\$615,000

Conclusion

The principal beneficiaries of development are central government and property owners. Local government, home owners and developers who are not land owners benefit to a lesser degree. Indeed, once risk and other factors are included they may in fact be disincentivised from participating in development-related activities (including buying a home).

GST related to development of 30,000 homes would be significant, but “capturing” it for development would be a major shift. It would not, furthermore, necessarily lead to more homes or more affordable housing. What GST does do is provide an incentive and return on investment for the Government to facilitate development. The Government can, and arguably has an interest in, assuming development risk on the basis that it will benefit from tax revenue. This would allow housing to be delivered close to cost.

However, unless land can be accessed at its pre-development value and the subsequent uplift tied to the activities which enable it, there is little chance housing can be provided at price points which are affordable on Auckland incomes. The difference in price between the average cost to deliver a completed home (\$375,000) and what an average completed home would sell for on the assumptions above is almost \$250,000.

Delivering Paerata City

A net land value improvement from development of around \$250,000 per dwelling and \$7 billion over a 30,000 home city is significant. A portion reflects the fair risk associated with residential development and the success of the schemes examined. The remainder is value resulting from public activities, principally zoning and infrastructure, in a context of housing undersupply.

This chapter looks at the models which could be employed to capture and leverage this value to support more housing, faster and in a way which lessens pressure on infrastructure services.

It is beyond the scope of this study to consider what proportion of land value improvement is the result of public and which is the result of private (i.e. developer) activities. What can be said is that if public authorities were to take on a greater role in urban development, such as proposed through new UDA legislation, up to \$250,000 per property could be realised in value uplift. This is after infrastructure has been paid for and assumes land at its raw value can be accessed.

Funding and Delivery Models for Paerata City

The options for delivering a new city for 100,000 residents in Paerata can be reduced down to several basic alternatives. City development must be led by either central government, local government or the property owners in the affected area (including a party acting on their behalf). Funding can be sourced from taxes or user charges, included either in the capital cost of a new home or in rates over the longer term.

The main conceptual options are outlined below, noting that in practice hybrids of each of the options would be likely:

1. Central Government “Hard” UDA Model

Under this model, central government would take the lead in delivering the Paerata satellite. Emerging legislation suggests that it would be represented by an urban development agency (UDA).

The UDA would acquire land for the city in order to capture value uplift (differentiating this model from the “soft UDA” position where land remains with existing owners). The UDA would work with the Auckland Council to arrange zoning, approvals and infrastructure. It could manage the entire development process through to home sale itself. Alternatively, the UDA could sell rezoned, infrastructure-enabled land at its improved value to developers, moderating the price depending on public objectives.

Funding and financing

The UDA would finance all related infrastructure and development using the Crown's balance sheet, removing the responsibility from the Auckland Council and property owners.

Central government has a wide range of funding options. Most obviously, it can fund new development out of the consolidated account or through Crown debt. Crown revenue can be expected to increase as homes and jobs are delivered, so there is a link between the funder and the beneficiary of this approach. However, the Government has resisted reassuming this responsibility, having delegated it principally to local authorities. Funding via this route would carry significant implications for existing developments across the country.

Alternatively, the Government could finance development using its balance sheet, but require repayment. The UDA would have two options under this approach. It could repay the Crown as and when properties are developed and sold. Or, assuming legislative change or collaboration with the Auckland Council, it could apply some form of property tax to the area which would be repaid by property owners over the long term. Both options would ultimately shift the cost of development onto homeowners.

Although payment would sit with homeowners, risk would be retained by the Crown. Higher home fees and taxes which disincentivised property purchase would carry costs in the form of underutilised assets and lower residential and commercial property prices. Likewise, a very successful development could either materialise as lower property prices and faster home construction, or higher prices for the Crown.

2. Paerata Local Authority Model

Risk allocation

The Crown would assume overall risk relating to development of the city and uptake of housing. Construction risk would sit with individual contractors to the Crown. This is the most risky option for the Crown of the models examined.

Feasibility assessment

A hard UDA approach is the simplest and, potentially, fastest means to deliver integrated development at scale. Funding and financing arrangements would be streamlined and the Crown would automatically capture all land value uplift. There would be no issues with land banking or price gouging and efficiencies could be recycled into more affordable housing.

However, project management and demand risks would be accepted by a new Crown organisation without necessarily the skills, experience or decision making frameworks to execute. New Zealand taxpayers would be liable for project issues.

Key to the success of this model is purchasing land at its raw cost. To prevent existing land owners from leveraging their position to drive property values higher or slowing overall development, the Government would need to possess and to exercise compulsory acquisition. Assuming these powers are applicable, such a response is likely to result in significant opposition across an area as large as 2000ha.

The Auckland Council's debt limitations prevent the easy application of a UDA option without balance sheet assistance from the Crown. These limitations also make a public-private partnership (PPP) between the Auckland Council and a private partner very unlikely. Thus, the only identified local-led development option is for a local entity with rating powers and balance sheet independence from the Auckland Council.

There are two options possible under existing law. A district council or a unitary authority could be established for Paerata and charged with leading the development. With comparatively minor changes to existing law, a strengthened local board with rating powers may also be an option, if debt can be removed from council accounts. Other options, principally those where rating powers are transferred to independent parties working in collaboration with the council are considered under the "soft" UDA model below.

Any local authority permutation would represent a fundamental shift in local governance nationally. Significant questions surround the establishment of such an entity and what impact it would have on the Auckland Council. For simplicity, we assume for this model a Paerata city council with responsibility for city planning, trunk water and local road transport.

The potential advantage of this approach would be to generate competition in a growth location for residents. If an environment could be created where councils desired and competed for growth, then investment prioritisation would be influenced not only by demands from existing ratepayers, but also new residents. How councils balanced that demand would determine how attractive they were.

Funding and financing

Local authorities only have rates as a funding tool. The Paerata City Council model would thus entail the council raising debt against the rateable value of property in the area. Debt would be repaid by property owners. As and when property values increase in relation to rezoning and infrastructure provision, rates would also increase, providing the means to repay debt.

Risk allocation

Project management and demand risk would sit with the new entity and its "shareholders" - Paerata ratepayers. Neither central government nor Auckland Council would in general be liable.

Feasibility

This option is unlikely. Revising Auckland governance less than a decade after a major restructure would be problematic. Auckland Council unitary authority status would be compromised unless the new entity also became a unitary authority. Complexity would surround the allocation of responsibilities and funding for regional infrastructure.

3. Market-led “Soft” UDA Model

Much wider changes to statute and existing practice would be required to engender positive competition across local government. Further funding tools or reallocations of central government funding are needed to make growth attractive to councils. This discussion is much wider than the question of a satellite city in Auckland.

Auckland Council debt to revenue would increase if ratepayers joined the new local authority, unless debt was also transferred. This would transfer debt challenges over to the new council, rather than remove them. It is not clear whether a new council established to deliver the city could manage the scale of debt and risk. Conventional growth management is performed incrementally. Under this approach, a new council with limited residents would be required to deliver major infrastructure. Current structures are not well-suited to this approach.

A new council would be required to develop a series of statutory documents, including RMA plans, a Long Term Plan and others. It would also inherit other local authority responsibilities. Planning and engagement fatigue would likely slow delivery of the city. Recent analysis of the Waiheke and Rodney local governance restructure proposals indicated that rates would need to increase by around 40 per cent in order to re-establish district or unitary authorities.³⁶

The final party capable of leading development of a new city, and thereby accepting overall risk, is the collection of existing property owners in Paerata. The need for zoning, approvals and infrastructure collaboration would still require interface with public bodies. This approach assumes a UDA owned by central or local government, or both, would partner with property owners and deliver public functions.

There is no large scale public acquisition of land for redevelopment assumed under this approach. Responsibilities for infrastructure and development could be retained or shared across either the UDA or property owners. In return for prioritised zoning and approvals, land owners would be required to meet agreed targets, such as minimum housing targets or more affordable housing.

Funding and financing

With little public land acquisition, the value of zoning and other public activities will be incorporated into privately owned land. Public authorities will have three basic choices. First, they can accept “repayment” in the form of delivery targets. For example, instead of being repaid, they could require faster or more affordable housing.

Second, the UDA could require payment on point of sale, or by a fixed date. Development contributions would be cancelled and the actual costs of public infrastructure and other services would be factored into the sale price of homes and sections sold to a schedule. Public authorities would finance public investment and property owners would finance local development and construction. Homes not completed on time would still be liable for repayment of public services, incentivising delivery.

Third, assuming strengthened powers, the UDA could levy a long term targeted rate to repay its costs (and potentially some of those of the developers). The rate would be applied to land in proportion to its developable value and repayment would be the responsibility of those land owners. The much higher cost of holding land with zoning and services would incentivise the land owner to develop and on-sell property. This model may allow greater Auckland Council participation.

Risk allocation

Construction and delivery risks would be shared between the UDA and property owners. In theory, developed property demand risk would sit with property owners. In practice, the UDA may be required to share this risk.

Under an approach where property owners are contracted to deliver the city and repay the UDA for its services at point of resale, property owners take demand risk. The UDA would be contractually bound to deliver trunk services and approvals according to the agreed schedule. Property owners would be bound to develop land as and when those services become enabled. Property owners would sell developed property at market rates.

³⁶ Morrison Low, Auckland Reorganisation Process: Auckland Options Assessment, August 2017.

4. Urban Development PPP

If targeted rates, rather than contracted outputs, were applied, project risk allocation would be similar, but the UDA may give up some of its ability to prescribe development outputs. The UDA's focus would be on repayment for its activities rather than delivery of the city. Property owners could hold land as long as they were prepared to incur increasing targeted rates. Development and demand risk would remain with property owners.

Feasibility

This approach is closest to existing practice. Its principal point of difference is that, in return for priority public investment, the UDA would require property owners to carry significantly more risk than they do currently.

Its comparative advantage is the relatively small impact on property rights. The UDA would exercise tools other than land acquisition to ensure development in accordance with the timeframes and vision of the city.

Its principal weakness is that too much risk may be transferred and progress stalls. It is not clear that property owners in an area most suitable for Paerata City will be interested in development within the timeframes required. Reaching agreement across several hundred land owners could be slow; there is likely to be some disagreement over the appropriate spread of density and development typology across the area. In return for participating, property owners may require incentives which undermine affordability.

Some land owners in Paerata already possess land which is either live zoned or zoned future urban. The marginal benefit of receiving priority public investment or upzoning may be insufficient to induce them to take on the significant risk of developing land to an agreed schedule.

The final delivery model which could be used to deliver a city in Paerata is a public private partnership (PPP). The PPP approach would seek to allocate risk across the development to the party best able to manage that risk. From a risk allocation perspective it would sit between the hard and soft UDA approaches. An overriding objective of this approach would be to attract scale and expertise into the delivery of a successful city.

Under this model, the Crown (or a UDA majority owned by the Crown) would acquire land and open a tender for the right to co-plan, finance, develop, build, sell and lease property on that land. The winning consortium would establish a special purpose vehicle (SPV) to oversee the development in accordance with outcomes prescribed by the public partner.

The SPV would be comprised of development, construction, real estate and financial experts. Paerata property owners would have the choice of co-owning the SPV, their land representing equity investment. Other investment partners would be secured to enable the development to proceed. A main contractor and other partners would be appointed to develop land and deliver homes and infrastructure.

Central and local government would likely use a UDA or UDA-type model (for example, Crown Infrastructure Partners) to interface with the SPV. Depending on the allocation of risk, Auckland Council could play a larger role in this option than is possible under other options.

The broad objective of this approach would be to use land value uplift to fund the SPV's activities, which would include the majority of infrastructure and development costs. Carrying the bulk of risk pertaining to property resale, the SPV would lead masterplanning and development sequencing.

The public partner would take responsibility for non-commercial activities, including the processing of approvals and zoning, consistent with the masterplan. Basic outcomes, such as minimum thresholds for new home delivery and affordability, would be contracted by the public partner. There would also be the opportunity to expand these outcomes to include more aspirational targets, for example, a minimum number of local residents employed locally and maximum travel time delay at peak times.

Funding and financing

The SPV would arrange private financing for the development, including trunk infrastructure. Its repayment mechanism would be from the resale of attractive commercial and residential property. Development costs would be included in the sale of new homes and other property.

Depending on the arrangement, the Crown may include in the agreement bonus payments for achieving public objectives. There would be no property tax or development contributions above and beyond general Auckland Council rates.

Risk allocation

The SPV and public partner would agree risk allocation through the contract. Conceptually, risk would be assumed by the party best able to manage that risk. Thus, the public partner would accept the risk of acquiring land and providing the zoning and approvals for that land to be developed. It would interface with the wider public to generate support for the development.

Project construction and delivery risks would largely sit with the private partner. Demand risk may be shared, depending on the market's assessment of risk. Where a private partner is contracted to achieve either delivery targets or wider outcomes, payments from the public partner become more likely. Payment could be in the free provision of land. The private partner would have the ability to buy and sell land, though not acquire it.

Feasibility

The model would be unprecedented and executing it correctly would carry its own risk. It is unlikely that a single PPP would be viable for a development of the size assumed. Several PPPs, or a PPP as part of a UDA-guided development is more realistic.

It is not clear how existing property owners would react to the contracting of an independent private entity to oversee development. Forced acquisition of property for transfer to a private consortium could be politically challenging. Existing property owners are unlikely to be aware of the risks involved in a PPP, making their participation challenging.

The agreement between the public and private partners would be complex. The private partner would operate, at least for a fixed term, all infrastructure it financed and delivered. It would not necessarily deliver trunk infrastructure which could be accessed by other developments. Doing so would incur a charge, creating counter-incentives for good regional planning if the contract is weak.

The Right Model for the Job

In practice, hybrids and combinations of the above conceptual models would be needed to deliver a city for 100,000. The exact composition would depend on the outcomes and objectives set by public authorities and the expectations of existing property owners. Public authorities can deliver faster, more affordable housing but only if they are prepared to take on significant development risk. Risk can be lowered by transferring responsibilities to other parties, but the value upside and ability to control development will be reduced.

- **Faster, cheaper housing**

If lower cost housing and faster delivery are the priorities, a model more heavily weighted towards a hard UDA would be effective. If the Government (as the likely majority owner of a UDA) determined that its risk was compensated for via GST and other taxes and was otherwise not factored into home prices, a hard UDA option could deliver homes at an average cost of \$375,000.

Under this scenario, the Government could choose to sell homes at market rates of around \$635,000 (excluding GST). Increasing supply may reduce this price over the longer term, but the difference between current prices and cost would provide the Government with significant headroom.

Alternatively, the Government could deliver a portion of public or social housing in the city at below \$375,000 average price and recoup its costs on market sales. At \$635,000 per unit, the \$12.2 billion development cost of the city could be recouped with around 20,000 home sales. This would deliver 10,000 “free” homes for use as social or public housing.

A variation on this approach could see the UDA finance infrastructure and/or development. Homes would be sold for the cost of a house and land, or from \$276,000. A targeted rate on the development area would repay the debt. The model would assist first home buyers who did not have a large deposit. The public sector’s lower cost of borrowing may allow a marginally cheaper whole of life home cost, but administrative costs would likely make the difference nominal.

If the Government was unwilling to take on the significant risks of delivering a successful urban development, it could transfer these risks to experienced developers or land owners. Still owning the land, the UDA would sell development rights, raising or lowering the cost of land to ensure a steady flow of properties onto the market. The price of housing and the UDA’s return on investment would reflect market conditions.

Fully costed market homes under this model would be sold at between \$375,000 and \$635,000, average price per unit at current prices and excluding GST, depending on the state of the housing market.

- **Lower risk**

If speed of housing delivery was less important than keeping risks manageable, a UDA partnering with property owners would be attractive. By shifting development risk to land owners, the UDA and its public stakeholders would largely give up the value improvement potential, but cost recovery could be guaranteed. Taxes would be set at levels which funded public costs, homes would be sold at the pricing discretion of the land owner and developer. The speed of housing delivery would be influenced by market trends.

Replacing general development contributions with a targeted rate introduced at agreed points in time would change the risk exposure of land owners and developers. A targeted rate of \$110 per month per property would be required to repay transport and water network costs of \$700 million over 30 years. This assumes public sector borrowing rates of around 4 per cent (i.e. a UDA’s cost of borrowing).

A bond programme established to shift development debt off public sector balance sheets would demand a higher interest rate. At a 6 per cent interest rate, the rate would rise to \$140 per month, or around \$1700 per annum. This may not be sufficient to incentivise development at pace and could lead to land banking.

Homes under this model would be sold at market rates. It would not be economic for land owners to deliver average housing at less than \$350,000, assuming a targeted rate funds network infrastructure and risk is not valued.

Conclusion

- **Balancing risk with speed**

If the Government wanted development expertise, but also wanted to retain some value uplift, and placed a premium on rapid housing supply, it could contract expertise through a PPP. Outputs, including price and minimum delivery targets, would be specified in the contract.

The costs of establishing the PPP would be high, due to complex tendering and contract negotiation, but a midground could be reached balancing risks and outputs. A likely model would include market development with an agreed number of affordable homes.

Home prices would depend on the contract. To fund the private partner's activities, the minimum home price would need to exceed \$375,000, but conditions could be applied to the upper limit so that more or faster affordable housing was delivered.

Land value can be captured. By changing the model used to identify, plan, zone and invest in growth, public authorities can access land at its raw cost to deliver more infrastructure, more housing or more affordable housing. Raw value can be accessed either by acquiring land directly or by attaching the costs of public activities to zoning and approval processes in agreement with land owners.

However, the estimated value uplift of \$250,000 per dwelling is sufficiently large that more may be required. Auckland's housing deficit is 40,000 units. A Paerata satellite of 30,000 homes built at speed would improve access to housing, but not for everyone. Demand in excess of supply is likely to keep prices elevated. Average home prices are likely to be sold close to the \$615,000+GST price point, when there is headroom to deliver them for less, while still retaining a margin for development risk.

The Paerata city case study suggests urban development at scale is efficient, feasible and can meet growth needs effectively. The opportunity before Auckland is to expand the response to meet growth the city's growth needs.

The Innovation City

A new satellite city around Paerata makes sense. Targeting urban development at scale along the rail line is more economical than in other greenfield locations around Auckland. Infrastructure costs less and cheap developable land is still available.

Master-planning for density is more cost-effective than retrofitting developed areas and consumes less land than low density urban expansion. Development can proceed at pace. Communities can be planned around all travel modes.

The location of tens of thousands of new jobs and homes in Paerata will not only help to meet Auckland's large growth needs. It will deliver growth in a way which supports existing infrastructure services. Growth can be targeted around services with the capacity to accommodate more demand, taking pressure off other parts of the city.

But it is the ability to identify and isolate land at its raw price which provides the greatest opportunity. Auckland's existing growth paradigm transfers the value of public investment to land values without a concomitant requirement to deliver housing at pace. More infrastructure investment is required to deliver fewer houses and weak supply reinforces high prices.

The integrated planning and infrastructure approach of the satellite model enables infrastructure providers to share the benefit they create. Investment can be funded and affordable homes can be delivered.

The Time is Now

There is no time to waste. Auckland has 40,000 households living with family, in garages and on the street. The number is growing by 20 a day.

Property investors know the system is not working. They know the city will grow and they know there is money to be made betting on future zoning. Speculation is driving up the cost of land every week and reducing the ability to leverage land values to deliver affordable housing.

The benefit provided by the Waterview Connection will be lasting, but it cannot accommodate another half-million people across urban Auckland. Within a decade the city will be congested throughout the day. No transport package can meet the demands of the Unitary Plan. Growth must be moved to different locations across Auckland and supported with regional transport urgently.

The Opportunity is Much Greater

Analysis of Paerata land and infrastructure plans suggests that a satellite model can deliver homes and infrastructure at prices below market levels. The \$250,000 per dwelling difference between the costs of housing at scale and comparable real estate prices provides scope for more housing, faster and at no net cost to public providers.

Extending a Paerata satellite city into Karaka could provide for Auckland's growth needs to the end of the century. An area the size of the Auckland isthmus, sits just 7km south of the Auckland International Airport.

A connection across the Pahurehure inlet could be Auckland's next Harbour bridge. A combined light rail-motorway corridor linking the airport to Manukau, Karaka and Paerata could service Auckland's collective growth for decades. Non-stop rail to the CBD will put the entire area within one hour of Auckland's major employment centres.

Analysis showed that at 30,000 dwellings Karaka was uneconomic to grow, but there is room for 300,000 dwellings north of, and separate from, Pukekohe's elite soils. Integrated development at this scale can fund investment and enable housing a fraction of today's cost.

Investing in the Future

Planning for growth and master-planning for quality opens the door for even bigger possibilities.

Technology is changing every aspect of cities. Connected networks, the internet of things and automation are the infrastructure of tomorrow. Incremental development does not support the trends and opportunities we know are coming to urban environments.

A brand new satellite city can be digitally enabled from the roads on the ground to the tallest buildings. People can communicate with vehicles, vehicles with networks, networks with operators and operators with people.

Incorporating new opportunities in design, engineering and sustainability, a new city can be made more efficient and more resilient. Streets can be configured to support autonomous vehicles. Low impact design can maximise existing land and water features to reduce impacts on the environment. Enhanced corridors and planned provision for services can protect Auckland's essential services.

The Innovation City

Leveraging public investments in research, education and health in a digitally enabled city will drive investment in high-skilled, high-income employment. Paerata can become the centre of a new southern city of 500,000 or more with technology, innovation and prosperity at its heart.

The Innovation City will deliver better jobs, better networks, stronger communities and desirable urban living.

Appendix 1: Assumptions Used to Inform Transport Networks

The following assumptions were used to inform transport networks in the five satellite locations:

Location of services:

- Each satellite must be oriented around rapid transit connected to the CBD.
- Each satellite must be connected to an expressway or motorway linked to the regional motorway network
- Existing plans, corridors and networks are used wherever possible.
- Road networks will be set out in a grid, where possible, and arterials spaced approximately 2km apart.
- Rapid transit stations will be located approximately 2 km apart.

Cost estimate assumptions:

- Expressways (two lanes in each direction) = \$50m per km
- Greenfield interchanges = \$20m each
- Brownfield interchanges = \$50m each
- Standard road arterials (one lane in each direction) = \$20m per km
- Additional road arterial lane (in each direction) = \$15 m per km
- Four-lane arterials (two lanes in each direction) = \$35m per km
- Busways = \$50m per km
- Busway stations = \$20m each
- Rail stations = \$30m each
- Local road requirements and costs are included in the section covering land development.









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