Future Development Strategy

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Growth scenarios evidence report

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Contents

Executive summary

The National Policy Statement for Urban Development requires the consideration of the advantages and disadvantages of different spatial scenarios when developing the Future Development Strategy. Four growth scenarios were developed, representing different spatial options for land use and accommodating a consistent quantum of Auckland's growth and change in dwellings and jobs over the next 30 years.

The growth scenarios reviewed the long-term approach to growth and development in Auckland, using updated information and responding to new policy directives, including an environmental and climate change lens. This work formed an important part of the evidential base for and underpins the spatial component of the Future Development Strategy review.

Scenario development and testing highlight the challenges of balancing greater flexibility to meet growth demands with greater certainty of how growth will occur. Differences in the levels of intensification and greenfield growth were investigated, along with variations in growth locations and the transport network. Figure 1 below provides a summary of the growth scenario development process.

Each scenario was evaluated through a multi-criteria analysis relying on modelling outputs as well as quantitative and qualitative information. The evaluation process enabled testing alternative growth scenarios and identifying key growth principles to inform decision-making on the spatial form for the Future Development Strategy land base.

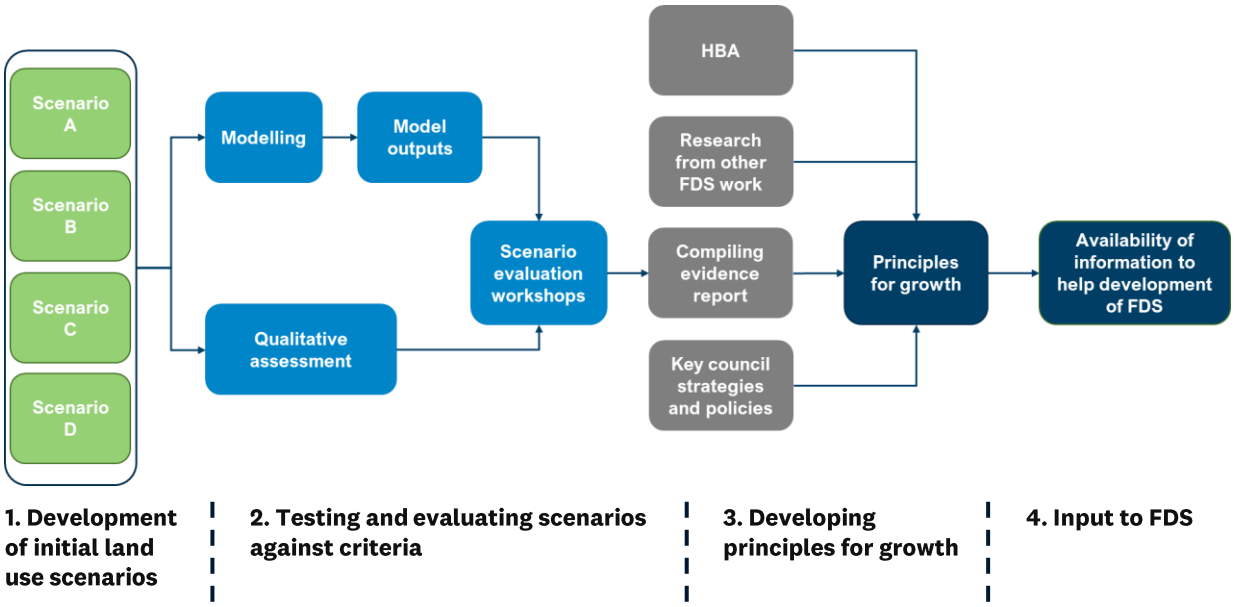


Figure 1 – Growth scenarios development process

Growth scenarios

Four alternative growth scenarios were developed, each representing a different urban form. Differences in the levels of intensification and greenfield growth were investigated, together with variations in the location and timing of growth within greenfield and brownfield areas. Box 1 (below) provides a high-level summary of the scenarios.

Box 1 – Scenario summaries

Scenario A

- more responsive to climate change
- intensive growth focused in key centres and around the RTN
- no suburban infill and reduced reliance on future urban areas

Scenario B

- more intensive focused approach
- all growth within existing urban area in centres and around the RTN and FTN
- limited suburban infill

Scenario C

- an update of the current quality compact strategy
- significant growth within currently planned urban area in centres and around the RTN
- planned future urban area and satellite centre growth

Scenario D

- more expansive approach
- growth in areas with development pressure
- less residential and employment growth in centres
- extensive suburban infill and additional future urban areas

Evaluation results

The evaluation process involved a multi-criteria analysis to provide a score for each scenario illustrating the extent to which each criterion was achieved on the scale of +3 (positive) and -3 (negative), with neutral being 0.

Table 1 (below) sets out how the scenarios scored against the criteria.

Table 1 – Evaluation scores

Criteria	Scenario A	Scenario B	Scenario C	Scenario D
The extent of new urban development areas in 100-year floodplains and areas prone to coastal inundation and coastal erosion (Greenfields)	-1	-1	-2	-3
The extent of urban development areas in 100-year floodplains and areas prone to coastal inundation and coastal erosion (Brownfields)	-1	-3	-2	-2
The extent to which scenarios impact carbon emissions.	-1	-2	-2	-3
The extent to which development provides opportunities to improve the health of natural wetlands, lakes, rivers (including their riparian margins), and coastal /marine environments. (GF)	+1	+1	+2	+2
The extent to which development provides opportunities to improve the health of natural wetlands, lakes, rivers (including their riparian margins), and coastal /marine environments. (BF)	-1	-1	-2	-2
The extent to which options reduce the ability to swim safely at in saltwater and freshwater, and to collect shellfish due to beach closure from water pollution.	-1	-1	-2	-3
The extent to which development promotes the restoration of, and connectivity between, existing and potential habitats / areas of indigenous biodiversity.	-1	-1	-1	-2
The degree to which urban development consumes highly productive soils.	-1	-1	-2	-3
Extent to which scenarios retain qualities of historic heritage places and values, e.g.: historic places, viewshafts, volcanic landscapes	-2	-1	-1	0
Extent to which scenarios are likely to result in improved levels of access to quality open space	+2	+1	+1	-1
Extent to which population is exposed to harmful air emissions from transport.	+3	+2	+1	+1
Extent to which growth creates greater housing choice to meet projected demand	+1	+1	+1	0
Extent to which scenarios promote mixed-use communities to reduce travelling distances and the safety risks people incur when they travel to access services, facilities, and social networks.	+2	+1	+1	-1

Criteria	Scenario A	Scenario B	Scenario C	Scenario D
Extent to which scenarios provide improved, inclusive, and equitable access to social infrastructure and public spaces: community facilities, ecological areas, open space (including quality green space), education (critical), health (critical), places of cultural significance. Degree to which essential social infrastructure is accessible by walking and cycling.	+1	+1	-1	-2
Degree to which essential social infrastructure and employment is accessible by multiple modes in areas of high deprivation	-2	-3	-3	-3
Extent of Māori land within growth areas.	+1	+1	+1	+2
Extent to which scenarios impact on Māori cultural landscapes (wahi tapu, sites and places of significance to mana whenua)	-2	-1	-1	-3
Extent to which key areas of economic activity are accessible by different modes - PT, active (cycling, walking)	+3	+3	+2	+1
Extent to which education is accessible by different modes - PT, active (cycling, walking)	+3	+2	+1	+2
Extent to which employment opportunities are aligned with areas of population growth	+3	+2	+2	+1
Extent to which household living costs can be reduced by increased proximity to employment opportunities	+3	+2	+1	+1
Extent to which rural production areas are accessible	-1	-2	-2	-2
Extent to which travel times are reliable	-1	-2	-2	-2
Extent to which opportunities for the agglomeration of similar/dependent industries are provided	+3	+1	+1	-1
Extent to which suitable land is available for Group 1 (land extensive) business	-2	-3	-2	-2
Extent to which scenarios support current committed infrastructure	+1	+2	+3	-2
The extent to which scenario results in measurable public monetary costs or losses over time	+2	+1	-1	-3
Extent to which physical constraints increase the cost of development	-1	-2	-2	-3
Extent to which the market is likely to respond to the proposed land use pattern.	+1	+1	-1	-2

The scores provide a comparison to differentiate between the scenarios, ranking them in terms of performance against the criteria. Where little difference could be identified, they were ranked equal.

Where a scenario scored highest, this does not necessarily demonstrate the scenario resulted in a positive response overall (it is a comparison between scenarios and sometimes a scenario was the “least bad”, though not necessarily net positive overall) and instead shows that further options or additional work would be needed to achieve the desired criteria outcome under any land use more fully.

Growth and development will cause some impacts on some measures, even with best practices. In most cases, a negative score indicates the need for a specific policy intervention in addition to, or even instead of, land use or transport interventions alone.

Overall, Scenario A performed best across most criteria. Scenario A was explicitly developed with significant shifts in land use planning and transport assumptions (as articulated by TERP[1]) to test whether modelled travel behaviour, mode share and especially emissions would change compared with other scenarios. As such, the fact that Scenario A performed well provides some important lessons but does not necessarily provide the solution for spatial planning. Scenario B also performed well and was highest across almost half of the criteria, although generally first equal with Scenario A. These scenarios, being the most intensive, typically performed the best against most criteria but not all.

Scenario C performed the best regarding its alignment to committed infrastructure because it most closely reflects the current growth scenario and, therefore, the current infrastructure planning and funding, which has been developed over several years to integrate with this pattern of growth. Generally, where Scenario C performed the best, it was scored equally with the more intensive scenarios.

Scenario D performed the worst overall, only resulting in the highest score on four criteria. The two criteria where Scenario D performed best overall related to the extent of Māori land within growth areas, whereby treaty settlement land in rural areas may be more likely to be urbanised[2], and retention of historic heritage because less growth would be located in the isthmus, reducing potential impacts on the concentration of heritage listings located there, as well as volcanic viewshafts and special character areas[3].

While the scores provide a useful indicator of the relativities between the scenarios, there was a strong inter-relationship between the scenarios and the criteria they are measured against. Therefore, the findings drawn from the results of the evaluation are thematic.

Key findings

Several key findings are identified. They are not isolated factors but are integrated elements that are needed to deliver a quality compact urban form and well-functioning urban environment.

Most of Auckland's future spatial form already exists and growth has limited influence

Over the last 180 years, Auckland has grown to a city of over 1.65 million people within a relatively established built form. The existing development patterns, the landscape and infrastructure have locked in options and precluded others. The resulting spatial layout will be added to rather than fundamentally altered by growth. This means that additional growth in the short to medium term is small relative to existing well-established patterns and often has little observable influence (at a macro scale) over and above the larger weight of current travel patterns and behaviour. However, over the longer term, even small changes in direction can be compounding.

The evaluation found little differentiation between the scenarios in terms of model outputs (acknowledging modelling limitations) relating to travel behaviour, except for Scenario A which is the most intensive and deliberately made significant shifts in land use patterns and transport assumptions. Key destinations for household trips, such as employment areas and education facilities, are well

[1] Auckland Council, Transport Emissions Reduction Pathway (2022).

[2] Assuming that this outcome reflects the aspirations of the relevant iwi.

[3] Also noting that no scenario exceeds existing plan imposed viewshaft limited capacity inputs, or requires development within special character areas, and all scenarios are assumed to avoid 'no-go' areas and significant values like heritage listings – this differential reflects the greater pressure, and potential for unintended impact rather than direct or assumed impact.

established, so changing the location of future dwellings (e.g. adding more origins) does not materially affect existing travel patterns other than reinforcing them by adding more trips.

Determining the location of land uses will only take us so far

The evaluation process suggests that while appropriately considering land use and avoiding no-go areas is important; many environmental impacts can be appropriately managed by good or best practices supported by a strong policy framework. However, it is important to note that none are currently in place and this will not be the case for all environmental impacts (i.e. carbon emissions).

Urban development is a significant contributor to environmental outcomes, but with strong policy and implementation frameworks, it can also provide opportunities to resolve issues (such as equity and climate mitigation and resilience) and enable positive outcomes.

Land use and infrastructure integration, particularly transport, is fundamental to spatial planning

Scenarios that focused on growth within the existing urban area and specifically within the walkable catchments of the rapid and frequent transit networks performed better against transport criteria specifically but also environmental, social, economic and cultural criteria.

More intensive compact urban forms perform better in terms of the least monetary cost of infrastructure over time, as they result in more efficient use of existing services and new infrastructure. More expansive urban forms require the greatest amount of new infrastructure with the highest costs.

The importance of locating homes and jobs in close proximity

Generally, the more intensive scenarios, with mixed-use communities around transport nodes, performed better concerning reducing the need to travel (to employment, education, community services and facilities) and reducing carbon emissions.

Improved access, particularly through public transport and safe, active transport modes, across the region also supports those areas currently experiencing social deprivation. It facilitates better access to a broader range of jobs and education (amenities less likely to move and difficult to create retrospectively).

Providing business land opportunities in future urban areas provides opportunities to balance employment and housing, in conjunction with greater mixed use and intensifying business areas in brownfields.

Principles for growth

The findings of the evaluation process provided for the identification of several principals for growth that will inform the spatial land use pattern of the Future Development Strategy (Box 2).

Box 2 – Key principles for the future growth pattern

Residential development capacity

- Housing types and location choices will be provided through a combination of intensification within walking distance from centres and rapid/frequent transit networks (six storeys plus) and committed future urban areas (live zoned), plus medium density across the urban environment.
- Natural and built heritage protection (including some special character areas) can be achieved while providing for substantial intensification within the central isthmus.
- Rely on additional future urban areas only where required to meet demand for housing (and contributing to other outcomes sought).
- Avoid future urban areas that are subject to significant hazards (i.e. Takaanini, Ōpaheke).
- Enable some growth within market attractive areas in proximity to the city centre and high amenity areas such as the eastern beaches.

Employment development capacity

- Focus growth within existing urban areas along rapid and frequent transit networks, centres, and future urban areas where required to meet demand for employment.
- Identify sufficient greenfield business land (at least 1,000 ha) to meet demand for Group 1 land extensive industrial activities.
- Provide for new centre / metropolitan centre zones within future urban areas.
- Increase jobs in sub-regions (nodes) and future urban areas, as well as local employment areas to locate jobs near housing to reduce vehicle kilometres travelled and increase active mode share.
- Rely on higher proportion of redevelopment (especially mixed use) in older/central business areas, and vacant/vacant potential in newer business areas that have been recently developed.

Rural

- Avoid all highly productive land outside identified future urban areas but also identify opportunities to slow or avoid growth within these areas (i.e. Pukekohe).
- Limit growth in rural settlements while also providing for growth including jobs for social and economic wellbeing through intensification in first instance.
- Limit residential growth across rural zoned land.

Other principles

- Avoid natural hazard areas including flooding and coastal inundation.
- Consider mitigation and adaptation opportunities within existing areas to better accommodate existing communities rather than accommodating more growth.
- Align growth to committed infrastructure (funded in 2021 Long Term Plan) and minimise the expansion of existing infrastructure networks as much as practicable to reduce costs of new infrastructure.
- Support mixed-use communities to provide most of what people need within 15-20 mins walking, cycling or public transport distance.
- Improve equity of access and enable a greater distribution of jobs.
- Increase public transport capacity and frequency and improve travel reliability to make public transport a viable mode alternative.

Introduction

This report sets out the process of developing and evaluating alternative scenarios to inform the Future Development Strategy in accordance with the requirements of the National Policy Statement for Urban Development (NPS-UD).

Four growth scenarios were developed, representing different spatial options for land use, accommodating a consistent quantum of Auckland's projected growth and change in dwellings and jobs over the next 30 years.

The scenarios have then been evaluated against a range of criteria to understand the advantages and disadvantages and forms an important part of the evidential base for and underpins the spatial component of the Future Development Strategy review.

The objective of the growth scenarios project was to test alternative scenarios through modelling and evaluation to understand how different land use patterns and transport networks would perform, and the relative costs and benefits, and potential supporting policy levels needed, at both regional and more local levels. Therefore, rather than determining that one scenario was preferred above the other, the process identified lessons to inform the refined spatial component of the Future Development Strategy.

Scenarios

Growth scenarios provide a view of how, when and where residential and employment growth will be distributed across the region across a 30-year period.

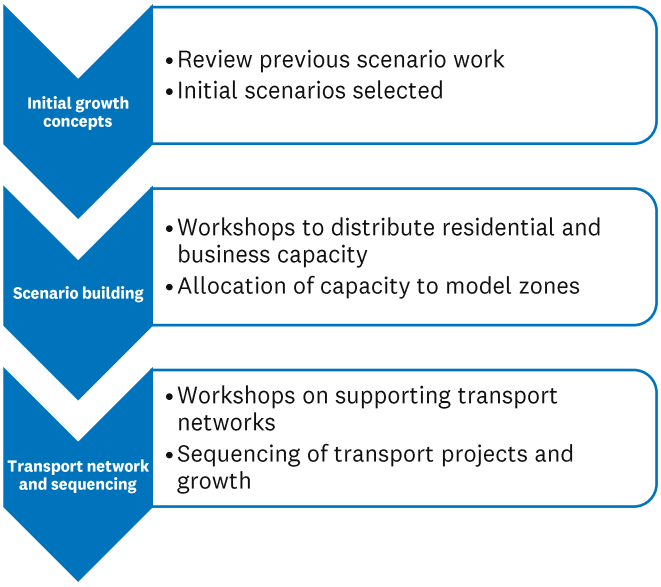


Figure 2 – Scenario development methodology

Figure 2 illustrates the three stages of the scenario development process, first developing initial growth concepts to inform scenario building for modelling.

The council has long used scenario development and testing to help inform the agreed long-term approach to growth for Auckland. A quality compact approach to growth was adopted by the council in the Auckland Plan 2012. This approach was tested and refined in 2016 and confirmed through the revised Auckland Plan 2050 Development Strategy. A full review to test the validity of the quality compact approach has been carried out to inform the Future Development Strategy.

Four scenarios were developed, each representing a different urban form. Differences in the levels of intensification within the existing urban area and greenfield growth within future urban areas were investigated, together with variations in the location and timing of growth. Scenario narratives are provided in Appendix A.

The four scenarios were developed to test how business and residential growth distribution and timing may occur in Auckland. These scenarios have been modelled using combined Land Use and Transport

Interaction (LUTI) modelling and evaluated to test what influence growth timing and distribution would have on household and business locations, and how travel demands and use of the various transport networks interact, and the other non-modelling criteria. Modelling is at a macro level focussed on the longer term and broader scale. As changes in policy, behaviour and technology are constantly occurring, it is impossible for any land use scenario to map out precisely what Auckland will look like in the future.

Initial growth concepts

A review of previous scenarios and evaluation undertaken for the Auckland Plan 2012 and Auckland Plan 2050, along with current council strategies, including Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan and the Transport Emissions Reduction Pathway (TERP), helped inform the development of the scenarios.

Each scenario has the same scale of overall growth and the same time period of the 30-years as required for the Future Development Strategy. All development in all scenarios is assumed to be well designed, have sufficient infrastructure, and utilise best practice.

Four scenarios were identified for development and testing:

- Scenario A - growth takes a climate change mitigation and adaptation approach first with increased levels of intensification within centres, nodes and along current and future rapid transit networks.
- Scenario B - growth reinforces the current development pattern with higher levels of intensification in nodes, centres, and along the rapid transit network.
- Scenario C - growth is largely aligned with the Auckland Plan 2050 Development Strategy, consolidating urban growth, and managing expansion into future urban areas.
- Scenario D - growth is more expansive, with a higher proportion of growth occurring in high amenity areas including existing and new future urban areas.

A high-level description of each scenario was drafted to guide participants of the scenario building workshops.

Scenario building

A series of workshops were held with subject matter experts from various teams across the council, council-controlled organisations (CCOs), Auckland Forecasting Centre[4] and Waka Kotahi.

Subject matter experts were divided into three groups at each scenario building workshop and required to allocate a minimum of 313,000 dwellings and 263,000 jobs to a map of the region. These figures reflected the anticipated residential and employment demand figures from the Auckland Plan 2050. Feedback was sought from experts on overarching principles for growth, additions to the scenario narratives, and commentary on the reasons behind the scenarios developed. Figure 3 (over the) page illustrates the outcomes of the workshop for Scenario C.

Post workshops, the growth expectations for each scenario were compiled to inform a narrative for each scenario to describe the growth approach and illustrate the key differentiating features. Following a further review of growth demand figures, the overall demand figures for each scenario were increased to a minimum of 408,000 dwellings (Development Strategy, 2018) and 380,000 jobs (Housing and Business Assessment, 2017).

[4] The Auckland Forecasting Centre is a team embedded in Auckland Transport operated as a partnership between the council, Auckland Transport and Waka Kotahi to operate and maintain the LUTI models.

To prepare the scenarios for modelling, the location and timing of dwellings (number of households) and employment (number of jobs) growth for each scenario were allocated across the 594 MSM zones contained in the transport model – the Auckland Macro-Strategic Model (MSM).

Adjustments to development capacity were required across the initial three scenarios to enable the model to run smoothly and deliver outputs consistent with the inputs and supporting transport networks. Sufficient development capacity needs to be available for the model to consider accessibility and attractiveness changes resulting from the supporting transport network. A balance between ensuring too much or too little capacity was provided was required. The models functions and processes do not exactly replicate the use of terms as they are used in the planning system. If development capacity is too restricted, then the model does not converge and crashes or breaks. Too much development capacity provided can affect the models development decisions where the local market is 'flooded' collapsing land prices and resulting in supply responses that exceeds any reasonably likely outcome given the locations accessibility (from the transport network) or attractiveness (as a function of previous demand and proximity to other development), or can conversely limit development feasibility by collapsing rents so that there is no uptake despite high attractiveness and accessibility.

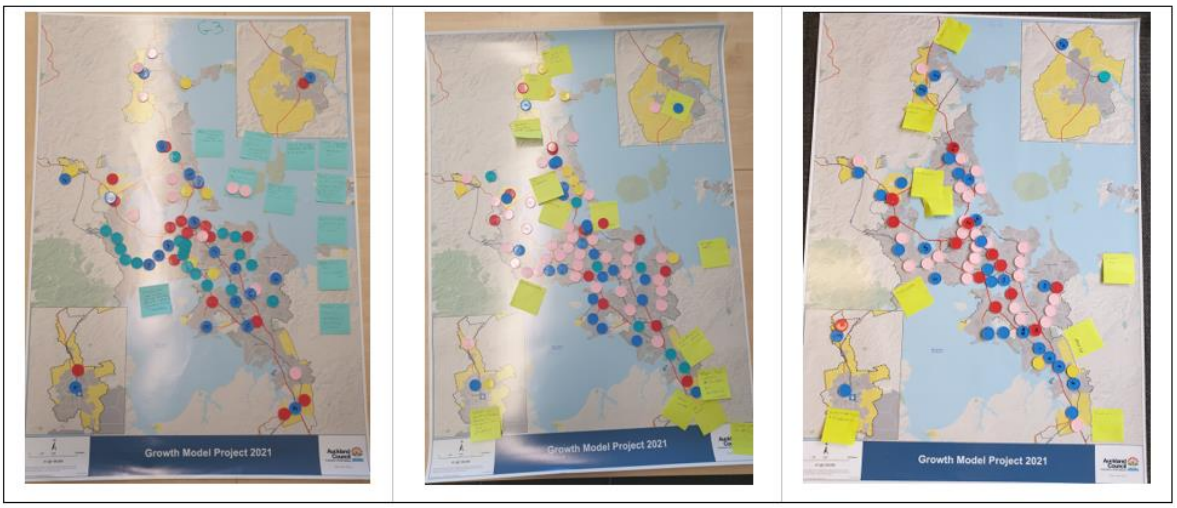


Figure 3 – Scenario C Workshop Scenarios

Developing the model inputs to ensure development capacity was at least 30% more than the scenario narrative inputs was found to provide a good balance between enabling the model to choose the most efficient location(s) for development and respond to accessibility and attractiveness functions, while also ensuring the models outputs still resembled the input spatial form narrative.

During the development of the TERP, a further scenario was developed (Scenario A) with a smaller subject matter expert group to reflect a spatial distribution where climate mitigation and adaptation interventions and land use planning were prioritised over other goals and objectives for the region. A higher number of dwellings and jobs was allocated across this scenario (500,000 dwellings and 500,000 jobs) to enable the model to make more decisions on uptake of development capacity including providing a significantly more mixed-use environment to support more disbursed employment locations. In contrast, no growth was allocated across hazard-prone areas (i.e. erosion, slope instability, coastal inundation, and flood prone areas) in MSM zones, but existing dwellings and jobs were not removed. Outside focus areas for intensification the development capacity was reduced across the region (e.g. in greenfield areas as per TERP and outside walkable catchments) as a way to influence the model to respond according with the scenario narrative.

The underlaying development capacity within the land use model or Auckland Spatial Planning Model reflects the Operative Auckland Unitary Plan (AUP). For the initial three scenarios, a check occurred to ensure that sufficient enabled development capacity was available to reflect the growth allocated by each scenario. Where there was already enough development capacity available, no change was made to the underlying development capacity. That is, all scenarios are enabled by the operative zoning, the scenarios reflect different levels of take-up of those enabled opportunities, which in turn reflect responses to the transport opportunities made available by transport investments to reinforce or support the take-up, consistent with the scenario narrative.

The anticipated number of dwellings and jobs for each MSM zone was then converted into total floor space to enable each scenario to be run through the land use model.

Transport networks

Supporting transport networks for each scenario were developed in collaboration with and feedback from council staff, Auckland Transport, Waka Kotahi, Te Tupu Ngātahi / Supporting Growth Alliance, Auckland Forecasting Centre and KiwiRail. These networks were tailored to support the land use in each scenario and were informed by the Auckland Transport Alignment Project (ATAP) and planning for the Auckland Rapid Transit Plan.

The base transport network of the transport model reflects ATAP 2019. The list of transport projects considered for each scenario is included in Appendix B. Table 2 below illustrates the timing of key public transport projects by scenario to align with the allocated growth.

Table 2 – Timing of key public transport projects by scenario

Public Transport	Scenario A	Scenario B	Scenario C	Scenario D
Light Rail to the N/W				
- Pt Chev	2031	2036	2036	2036
- Westgate	2036	2041	2046	2041
- Kumeu	2041	-	2051	2046
Light Rail to North				
- Wynyard	2031	2031	2031	2031
- Smales	2036	2041	2041	2041
- Glenfield	2041	2046	2046	2046
- Albany	2041	-	2046	2046
- Millbrook	2046	-	-	2051
- Silverdale	2046	-	-	-
Airport to Botany Rapid Transit	2036	2036	2041	2046
Cross isthmus RTN (New Lynn-Penrose)	2041	2051	2051	-
Ellerslie to Panmure Eastern Busway Extn	2041	-	2051	2051
SH18 Westgate to Albany Rapid Transit	2046	2046	2046	2046
City Centre to Mangere Light Rail - partially tunnelled / surface	2031	2031	2031	2031
Additional Harbour Crossing	2051 (PT only)	-	-	2051

Sequencing

The sequencing of growth across the 30-year timeframe was achieved by determining what proportion of growth would occur within each spatial area (Urban, Future Urban, and Rural) for each decade. The Auckland Plan 2050 assigns proportions of 70:24:6 across the three spatial areas and these ratios were adjusted to best reflect the scenario narrative and ensure differentiation between the scenarios.

Table 3 and 4 (over the page) illustrate the total proportion of residential and employment growth across the urban, future urban and rural areas along with how this is split across each decade.

Table 3 – Residential urban, future urban and rural splits

Area	Decade 1	Decade 2	Decade 3	Total
Scenario A				
Urban	92%	92%	92%	92%
Future Urban Area	7%	7%	7%	7%
Rural	1%	1%	1%	1%
Scenario B				
Urban	85%	83%	80%	83%
Future Urban Area	12%	16%	19%	15%
Rural	2%	1%	1%	2%
Scenario C				
Urban	80%	75%	67%	74%
Future Urban Area	15%	21%	30%	22%
Rural	5%	4%	3%	4%
Scenario D				
Urban	70%	48%	37%	52%
Future Urban Area	21%	42%	49%	37%
Rural	9%	9%	14%	11%

Table 4 – Employment urban, future urban, and rural splits

Area	Decade 1	Decade 2	Decade 3	Total
Scenario A				
Urban	91%	90%	88%	90%
Future Urban Area	8%	9%	11%	9%
Rural	1%	1%	1%	1%
Scenario B				
Urban	92%	90%	88%	90%
Future Urban Area	6%	8%	11%	8%
Rural	2%	2%	1%	2%
Scenario C				
Urban	90%	86%	81%	86%
Future Urban Area	8%	12%	16%	12%
Rural	2%	2%	2%	2%
Scenario D				
Urban	83%	76%	67%	76%
Future Urban Area	15%	21%	29%	21%
Rural	2%	3%	4%	3%

Live zoned areas or areas identified in the 2017 Future Urban Land Supply Strategy (FULSS) as being development ready in 2018-2022 and 2023-2027 have been calculated by giving an overall proportion of expected future urban growth for that decade. For example, 40 per cent of overall growth is expected to be in Decade 1. In Scenario C, 17 per cent of Decade 1 growth is expected to be in future urban area. This calculation was done first.

Following this, figures for specific areas have been reallocated based on their sequencing in the FULSS. The FULSS sequencing assumptions are the same across all scenarios and it is the scale of growth allocated to each area that affects how much growth will occur in the 30-year period.

For areas released 2028-2032, growth has been split across Decades 1, 2 and 3:

- 25 per cent Decade 1, 25 per cent Decade 2, 50 per cent Decade three.

For areas released 2033-2037, growth has been split across Decades 2 and 3:

- 50 per cent Decade 2, 50 per cent Decade 3

For areas released 2043-2047 (i.e. Takaanini):

- 100 per cent of growth in Decade 3

For the remaining areas growth has been split based on the proportion of growth in the MSM zone relative to the overall growth allocated to future urban MSM zones for that decade.

$$\frac{\textit{MSM zone}}{\textit{Total growth for Future Urban in Decade}} \quad X \quad \textit{Total growth for Urban + Future Urban + Rural for decade}$$

For Scenario A future urban areas follow the overall split of 40 per cent, 30 per cent, 30 per cent. Following this, the following areas were sequenced according to the expected release of land as outlined in the FULSS.

Warkworth South, Whenuapai Stage 2, Red Hills North, Kumeu Huapai Riverhead, Puhinui (remainder), Opaheke Drury, Drury West Stage 2, Hatfields Beach		
Decade 1	*Decade 2*	*Decade 3*
25%	25%	50%
Rationale: FULSS first half Decade 2 runs 2028-2032. Some overlap with beginning of Decade 1. Not all growth is delivered within the decade the land is released. Growth ramps up over time.		
Warkworth North East, Wainui East (remainder), Upper Orewa, Silverdale Dairy Flat (remainder)		
Decade 1	*Decade 2*	*Decade 3*
0%	50%	50%
Rationale: Second half Decade 2 runs 2033 to 2037. Starts two years into growth scenario Decade 2. Land in Decade 1 areas are starting to be exhausted so development activity occurs slightly faster in Decade 2 than for Decade 1 areas.		
Takaanini		
Decade 1	*Decade 2*	*Decade 3*
0%	0%	100%
No growth occurs prior to Decade 3 due to infrastructure constraints.		

For employment, the splits are similar but adjusted based on the release of business land outlined in the FULSS.

Assumptions

There are several layers of assumptions within the growth scenarios themselves as well as the land use and transport models. Table 5 sets out key assumptions for the scenarios and whether remain constant or vary by scenario.

Table 5 – Scenario assumptions

Scenario elements	Variable	Explanation
Timeframe	No	All scenarios use a fixed 30-year timeframe
Land use model		
Quantum of growth	No	Household, population and employment growth are the same for each scenario over the 30-year period, informed by the Stats NZ medium growth projection for Auckland region (2018-base). The potential demand for housing and business development capacity has been informed by the 2017 Housing and Business Assessment and Auckland Plan 2050 Development Strategy. The base demand is 408,000 dwellings and 380,000 jobs.

Scenario elements	Variable	Explanation
Housing and business capacity	Yes	Scenario B, C, and D use the enabled development capacity within the AUP as a base. Additional capacity is added to this base where required to account for expected growth (in effect, up-zoning only). The Scenario A adjusts the AUP base to only allow for growth within walkable catchments of centres and the current and future rapid transit network, some frequent transit network stations, and identified future urban areas and rural centres (in effect, up-zoning and down-zoning).
Location and timing of growth	Yes	Each scenario represents different distributions and timing of residential and employment growth in existing urban, future urban and rural areas.
Development form	No	Where growth occurs, it takes a compact urban form, with more intensive growth in centres and around rapid and frequent transit networks.
Density and residential dwelling typologies	Yes	Each scenario has differing densities of residential and employment growth corresponding with the uptake of growth and available land within each MSM zone.
Growth within natural hazard, protected and no-go areas	No	Where growth has been identified in MSM zones that include protected (or no-go) areas, it is assumed growth can be accommodated outside of these areas, including: • Areas of coastal inundation and erosion • Significant Natural Areas • Wetlands and streams • Floodplains • Historic Heritage
Erosion and sediment control, water sensitive urban design	No	It is assumed development accords with best practice land use development including erosion and sediment control, and urban design to develop with nature and enhance the environment as part of urbanisation.
Transport model		
Transport networks	Yes	Each scenario has a transport network which has been built to support the pattern of residential and employment growth. Common elements include: - Transport projects in ATAP - each scenario includes the first 10 years as at 2019 - Potential future rapid transit station locations Variables include: - The timing and location of projects which occur within the 30-year period (including whether it occurs at all) - The type of public transport provided and the frequency of transport (rapid, frequent) Bus lanes provision and intersection upgrades
Active modes	No	It is assumed development takes a best practice approach in high intensity areas, supporting a higher uptake of action modes (walking and cycling).
Ability to service with infrastructure, including transport, social and waters	No	All scenarios assumed that providing required infrastructure services is technically feasible. The cost and efficiency of infrastructure provision is an evaluation criterion.
Port location	No	All scenarios assumed the Port of Auckland remains in the city centre on the Waitemata Harbour

Transport model assumptions

The transport model includes a comprehensive set of base input assumptions that influence the behaviour of travel between the MSM zones for a range of purposes. The potential limitations of current models to model behaviour change are acknowledged.

Transport model assumptions are based on ATAP3 and include GDP, value of time, private vehicle operating costs/km, public transport fares, parking costs, toll and road pricing, travel demand management assumptions for behaviour change, crash rates, and fuel use.

The following are key transport model input assumptions common across all scenarios:

- Road pricing as per the Congestion Question which identifies a city centre cordon to be in place by 2031, and from 2041 full road pricing.
- Active modes are counted as a proportion of public transport trips and change by distance, starting with active modes at 100 per cent for distances less than 1km, transitioning to 100 per cent public transport at distances of 3km and above (i.e. At 2km it is a 50/50 split of active mode and public transport).
- Work from home base assumption of 7 per cent (2018 Census) of commuting trips to work plus 5 per cent growth per annum increase over the 30-year period.
- Take up of electric vehicles is assumed to be 12.4 per cent of Vehicle Kilometres Travelled in 2031 and 71 per cent in 2048.
- Public transport fares increase by 0.45 per cent per annum from 2016 of $2.50.
- Parking costs increase from 2016 base using GDP per capita growth of 1.19 per cent and elasticity 1.2 for commuting and 1 for non-commuting.

Transport model assumptions were reviewed in collaboration with subject matter experts from the council, Waka Kotahi and Auckland Transport in discussions with the Auckland Forecasting Centre.

Overall, it was determined to retain the base transport assumptions for all scenarios apart from the following changes that were applied to Scenario A reflecting a stronger emphasis on climate mitigation and resilience considerations:

- Working from home – 1 day per week for industries that can work from home (i.e. 20 per cent of commuter trips for office-based employment).
- Public transport fares – flat rate of $2 per trip.
- Active modes growth of an additional 1 per cent per annum from the base forecast.

Land use model assumptions

The land use model includes various land use assumptions (i.e. floorspace by AUP zone within each MSM zone, average dwelling areas, industry splits, rural/urban zone classifications, vacant land) sourced from the input land use potential or ‘development capacity’ scenarios. Running the development capacity presented by each scenario through the land use model, which considers overall demand, attractiveness and changes in accessibility (supplied from the transport model), delivers the outputs which relate to land uses at MSM zone scale.

A high-level description is provided of the key land use model assumptions and the inputs developed for the scenarios.

Residential typologies

Two residential typologies, attached and detached, are identified in the land use model. The proportion of attached and detached dwellings changes across development areas depending on the scenario. The split determines the urban form outcomes anticipated within each scenario across each MSM zone and key development areas.

Each of the MSM zones was classified to reflect different residential typologies consistent with the Development Strategy 2018. The following classifications were used:

- City and city fringe
- Urban nodes (i.e. Albany and Manukau)
- Development areas (i.e. Takapuna and Avondale)
- Metropolitan and Town Centres
- Remaining urban (all other urban MSM zones not already classified)
- Future urban areas
- Rural nodes (i.e. Warkworth and Pukekohe)
- Remaining rural (all other rural MSM zones not already classified).

For Scenario C, the proportion of attached and detached dwellings was determined based on the current building consent monitoring trends for the relevant MSM zones. These proportions were then adjusted to reflect the overall growth approach for each scenario, with more intensive scenarios having a greater proportion of attached dwellings (requiring less land per dwelling and less expansion and a denser city) and more expansive scenarios having more detached dwellings (requiring more land per dwelling and therefore more greenfield take-up and an overall less dense city).

Table 6 illustrates how the scenarios were developed in terms of residential typology splits.

Table 6 – Residential typology splits by scenario and MSM classification

Areas	Scenario A		Scenario B		Scenario C		Scenario D	
	Attached	Detached	Attached	Detached	Attached	Detached	Attached	Detached
City and city fringe	100%	0%	100%	0%	100%	0%	90%	10%
Urban nodes	90%	10%	90%	10%	80%	20%	70%	30%
Development areas (urban)	90%	10%	80%	20%	80%	20%	70%	30%
Metro and town centres	100%	0%	100%	0%	90%	10%	80%	20%
Remaining urban	80%	20%	70%	30%	60%	40%	60%	40%
Future urban	80%	20%	60%	40%	50%	50%	40%	60%
Rural nodes	80%	20%	50%	50%	30%	70%	20%	80%
Remaining rural	50%	50%	20%	80%	20%	80%	10%	90%

Employment typologies

The land use model includes four employment typologies and different splits apply depending on the AUP business zone.[5] The four employment typologies are Office, Industry, Warehousing, and Retail. The proportion of employee growth (jobs) is allocated across the urban business areas, future urban business areas, and the urban centres.

The employment splits were not changed across the scenarios and rely on the underlying assumptions within the land use model. The following tables illustrate the key assumptions for each business zone, Table 7 by business zone and employment typology, and Table 8 by business zone across the three primary spatial areas.

Table 7 – Employment splits by employment typology

Auckland Unitary Plan Zone	Land Use Model Space Category			
	Retail	Office	Industry	Warehouse
Light Industry		21%	27%	52%
Local Centre	37%	47%	16%	
Business Park		100%		
Metropolitan Centre	23%	77%		
Mixed Use	42%	37%	21%	
Town Centre	33%	67%		
Heavy Industry		16%	53%	31%
City Centre	10%	90%		
General Business	65%	22%	13%	
Neighbourhood Centre	65%	20%	15%	

Table 8 – Employment splits by spatial area

Auckland Unitary Plan Zone	Proportions for splitting employment scenario input		
	Urban Business	Future Urban	Urban Centre
Light Industry	25%	25%	
Local Centre			16.7%
Business Park	25%	25%	
Metropolitan Centre			16.7%
Mixed Use			16.7%
Town Centre			16.7%
Heavy Industry	25%	25%	
City Centre			16.7%
General Business	25%	25%	
Neighbourhood Centre			16.7%

[5] More than four floorspace types are modelled, including two residential and a number of other floorspace types including education medical and government. These latter floorspace types are handled internally to the land use model more or less in line with demographic change and do not require modelling by the Business or Residential Land Development Module.

The land use model converts the existing business floorspace into land use space available for redevelopment which the model then 'takes-up' in accordance with its internal process, considering overall demand, and more local factors such as the cost of development, estimated rents, and accessibility. This process is described in more detail in the modelling section below.

Evaluation process

The evaluation process considers the four scenarios against criteria developed to address economic, environmental, social and cultural wellbeing and also align with the Auckland Plan 2050 outcomes to reflect long-term objectives for Auckland's future.

The council last undertook growth scenario evaluation in 2011. The current iteration builds on the previous approach by updating the criteria to reflect up-to-date policy directions. Rather than identify criteria under a specific wellbeing, the 2021 approach reflects that some criteria are relevant to multiple wellbeings and the Auckland Plan 2050 outcomes.

An evaluation team of subject matter experts was established in 2021 to assist in developing the criteria, including identifying measures and updated data sources for evaluation. The previous criteria were updated through a series of workshops to identify current goals and outcomes for evaluating the scenarios. It was agreed to use a 7-point scoring system (+3 to -3, and neutral as) and not apply any weighting of criteria. However, where there is uncertainty about the information available for evaluation some weighting could be applied to the scoring within a criterion.

An evaluation template was prepared for each subject matter expert to complete, including confirming the data sources used for the evaluation. The subject matter expert assessed the scenarios, applying a score for each scenario using the 7-point scoring system, including a description and reasons for scoring.

The evaluation process relied on modelling outputs and quantitative and qualitative information enabling a comprehensive assessment of the relative merits of each scenario against the criteria. The evaluation process is shown in Figure 4.

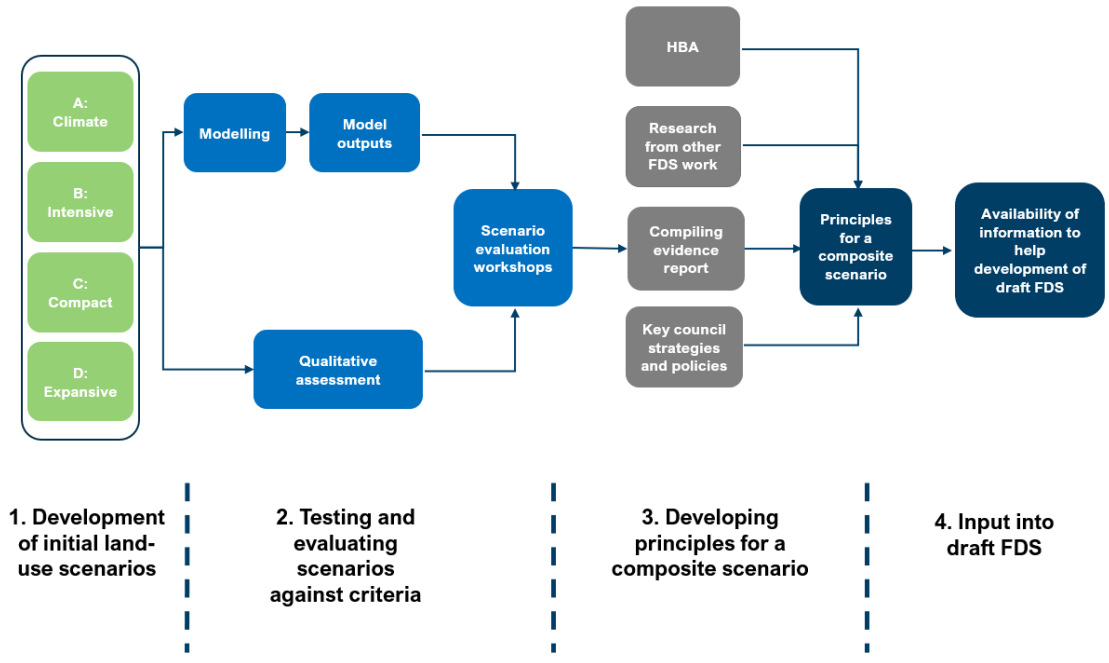


Figure 4 – Growth scenarios evaluation process

Evaluation criteria

A draft set of criteria were workshopped with the evaluation team of subject matter experts to identify appropriate measures and data sources. The objectives for criteria included that they were outcome focused, spatial, clear and able to be measured consistently.

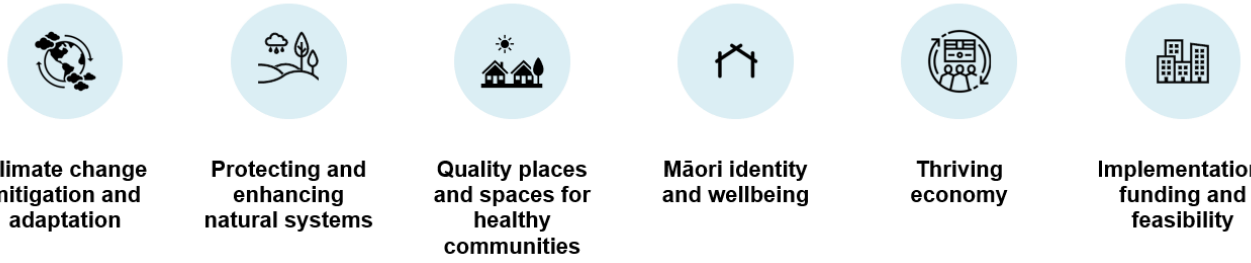
Box 3 below identifies the themes identified through the evaluation criteria workshops.

Box 3 Evaluation themes	
Resilience	Safety
Mitigation and adaptation	Access to education
Reducing emissions	Māori development
Water as taonga – recognising intrinsic values	Remote working
Elite and prime soils	Infrastructure funding and viability
Avoid making things worse and improve	Development feasibility
Protecting, enhancing and connecting	Ensuring there is enough land for business
Relationships between housing and places – social infrastructure, open space, ecological areas	Housing affordability
	Relationship between housing and employment
Choices – travel, housing	Quality social infrastructure
	Gentrification and displacement

Having considered the range of criteria identified, it was then determined that only criteria that would differentiate the scenarios should be taken through into the evaluation process. This recognised that some outcomes were expected to be achieved by all scenarios, e.g. compact urban form.

Information was collated from the following data sources to support the development of appropriate criteria:

- Waka Kotahi - Benefits Framework
- Te Tāruke-ā-Tāwhiri Climate Action Plan – priorities and action areas
- Auckland Plan 2050 – strategic directions, focus areas, and measures
- Feedback from Natural Environment Strategy on environmental criteria
- Communities of most need
- Māori Plan
- Supporting Growth Multi Criteria Analysis
- Report from MHUD – Measuring the wider costs and benefits of urban growth.



The final list of evaluation criteria is provided in Appendix C illustrating how each criterion responds to the Auckland Plan outcomes.

Modelling

Modelling the scenarios was undertaken utilising the LUTI model, which consists of a land use model or Auckland Spatial Planning Model, and a transport model or Macro-Simulation Model (MSM) in recognition of its purpose as a high level strategic (i.e. Macro) model. These two models working together, informing each other, are a 'LUTI' model – the land use and transport models are integrated, reflecting the reality that land use affects transport, as much as transport decisions impact land use.

The region is divided into MSM zones within which growth (households and jobs) potential is allocated as plan-enabled capacity that is available to be 'taken up' by the land use model. Plan-enabled capacity in the land use model in most cases[6] reflects the AUP operative zones and the draft Plan Change 78 – Intensification (PC78)[7]. Within the land use model if the existing plan-enabled capacity is breached by a scenario, then adjustments are made to increase available development capacity to enable the model to take-up additional growth, if that growth is scenario consistent. This process bypasses potential planning constraints reflecting the ability to change the plan-enabled capacity through future plan changes. There is significant plan-enabled capacity within the AUP which forms the baseline capacity of the land use model and provides more than enough capacity to meet expected long-term demand for residential growth. Therefore, to direct 'take-up' to specific locations sometimes required the plan-enabled capacity to be reduced (or capped) to limit take up and force the model to develop in accordance with the scenario narrative.

The attractiveness of a zone is determined through the land use model based on various aspects. Firstly, it looks at the permissible development (capacity together with the projected household and employment growth) to determine how much additional development is required to accommodate growth. It then looks at the "rent values" in each to determine which zones are profitable to develop (from developer's point of view higher rent means more profit). Baseline rent values are from the council's rating database. Once the development is done it then locates people and jobs taking into account rent values (more floorspace development means lower rent from household and employers point of view) and changes in accessibility coming from the transport model. Base development cost is estimated from Rawlinson's Handbook.

Then the transport model is run to test the land use pattern against the evolved transport network with outputs for travel behaviour or trips between dwellings and jobs or education or specified places, which in turn affect accessibility between locations. This information is fed back to the land use model for another iteration. This process of land use => transport => land use 'pass the parcel' continues until the scenario time horizon is reached.

The outputs from these LUTI model runs help to differentiate the pinch points of transport bottlenecks and plan-enabled capacity limits. Where there are nonsensical outputs, additional analyses can be undertaken to isolate the causes individually, and the inputs amended in either model as appropriate for additional LUTI runs. For example, a greenfield area is 'released' in the land use model in 2025 but doesn't show development occurring until 2035, which is when a key transport network improvement occurs – adjustments could be made to delay land release till 2035 or bring forward the network improvement to 2025 or a mix of both.

[6] The exception being Future Urban Zones which have no plan enabled capacity, or greenfield areas that are larger/new/different than indicated in FULSS. In both of these cases bespoke assumptions are used, consistent with FULSS or more recent plan change data where relevant, or otherwise created as needed.

[7] Plan-enabled capacity from PC78 utilises the draft plan provisions provided by Council's Plans and Places department as of June 2022.

Model outputs from the combined LUTI modelling provided much of the quantitative data used to evaluate the scenarios against the evaluation criteria.

Evaluation of the following matters was focused on LUTI model outputs:

- Housing choice
- Mixed use communities
- Greenhouse gas emissions from transport
- Air quality
- Reliability of travel times
- Agglomeration
- Availability of industrial land
- Opportunities for agglomeration
- Accessibility by multiple modes
- Alignment of employment and population growth
- Household living costs
- Access to:
  - Quality open space
  - Social infrastructure
  - Employment
  - Rural production areas
  - Education
  - Key economic activity

Subject matter expert evaluation

Analysis of the scenarios by subject matter experts is an important part of the evaluation process because model outputs alone do not provide all the information required to evaluate the scenarios fully. The more specific outputs of the model are accompanied by broader feedback from subject matter experts to identify potential implications of growth patterns, timings or integration issues.

The LUTI model is not able to respond to all the criteria, especially in relation to environmental, social, and cultural criteria. Where outputs from the LUTI model required further interpretation or were not available to evaluate criteria, an assessment was undertaken by a subject matter expert.

Subject matter experts were asked to undertake an evaluation based on available data sources including quantitative GIS analysis, other models, and information sources to provide qualitative analysis.

Evaluation of the following matters was primarily undertaken by subject matter experts:

- Natural Hazards
- Carbon emissions
- Housing choice
- Biodiversity
- Health of water bodies
- Water quality
- Highly productive soils
- Natural and built heritage

- Access to social infrastructure
- Air quality
- Māori land and cultural landscapes
- Costs of development
- Infrastructure
- Market feasibility

Evaluation group

The evaluation group included members of the project team and subject matter experts from council departments and CCOs to ensure consistency with council policies and guide the process. The purpose of evaluation group was to ensure the guide the evaluation process to ensure it was robust and considered an appropriate range of evidence to inform decisions on the spatial form for the Future Development Strategy.

The evaluation group had two key roles in the process:

1. Technical Reports to support evaluation: producing a report describing assessment of how each scenario performs against relevant criteria with draft scoring.
2. Evaluation Group: attending three evaluation workshops to challenge evaluation and draft scores to agree on final scores for each criterion.

Evaluation results

The evaluation process involved a multi-criteria analysis to provide a score for each scenario illustrating the extent to which each criterion was achieved on the scale of between +3 (positive) and -3 (negative), and neutral being 0. Initial scores prepared by the project team and subject matter experts were challenged through an evaluation workshop and where appropriate revised.

Table 9 identifies the final scores for each scenario against the criteria as a result of the evaluation process.

Table 9 – Evaluation scores

Criteria	Scenario A	Scenario B	Scenario C	Scenario D
The extent of new urban development areas in 100-year floodplains and areas prone to coastal inundation and coastal erosion (Greenfields)	-3	-1	-2	-1
The extent of urban development areas in 100-year floodplains and areas prone to coastal inundation and coastal erosion (Brownfields)	-1	-3	-1	-2
The extent to which scenarios impact carbon emissions.	-1	-2	-2	-3
The extent to which development provides opportunities to improve the health of natural wetlands, lakes, rivers (including their riparian margins), and coastal /marine environments. (GF)	+1	+1	+2	+2
The extent to which development provides opportunities to improve the health of natural wetlands, lakes, rivers (including their riparian margins), and coastal /marine environments. (BF)	-1	-1	-2	-2
The extent to which options reduce the ability to swim safely at in saltwater and freshwater, and to collect shellfish due to beach closure from water pollution.	-1	-1	-2	-3

Criteria	Scenario A	Scenario B	Scenario C	Scenario D
The extent to which development promotes the restoration of, and connectivity between, existing and potential habitats / areas of indigenous biodiversity.	-1	-1	-1	-2
The degree to which urban development consumes highly productive soils.	-1	-1	-2	-3
Extent to which scenarios retain qualities of historic heritage places and values, e.g.: historic places, viewshafts, volcanic landscapes	-2	-1	-1	0
Extent to which scenarios are likely to result in improved levels of access to quality open space	+2	+1	+1	-1
Extent to which population is exposed to harmful air emissions from transport.	+3	+2	+1	+1
Extent to which growth creates greater housing choice to meet projected demand	+1	+1	+1	0
Extent to which scenarios promote mixed-use communities to reduce travelling distances and the safety risks people incur when they travel to access services, facilities, and social networks.	+2	+1	+1	-1
Extent to which scenarios provide improved, inclusive, and equitable access to social infrastructure including community facilities, health (critical). Degree to which essential social infrastructure is accessible by walking and cycling.	+1	+1	-1	-2
Degree to which essential social infrastructure and employment is accessible by multiple modes in areas of high deprivation	-2	-3	-3	-3
Extent of Māori land within growth areas.	+1	+1	+1	+2
Extent to which scenarios impact on Māori cultural landscapes (wahi tapu, sites and places of significance to mana whenua)	-2	-1	-1	-3
Extent to which key areas of economic activity are accessible by different modes - PT, active (cycling, walking)	+3	+3	+2	+1
Extent to which education is accessible by different modes - PT, active (cycling, walking)	+3	+2	+1	+2
Extent to which employment opportunities are aligned with areas of population growth	+3	+2	+2	+1
Extent to which household living costs can be reduced by increased proximity to employment opportunities	+3	+2	+1	+1
Extent to which rural production areas are accessible	-1	-2	-2	-2
Extent to which travel times are reliable	-1	-2	-2	-2
Extent to which opportunities for the agglomeration of similar/dependent industries are provided	+3	+1	+1	-1
Extent to which suitable land is available for Group 1 (land extensive) business	-2	-3	-2	-2
Extent to which scenarios support current committed infrastructure	+1	+2	+3	-2
The extent to which scenario results in measurable public monetary costs or losses over time	+2	+1	-1	-3
Extent to which physical constraints increase the cost of development	-1	-2	-2	-3
Extent to which the market is likely to respond to the proposed land use pattern.	+1	+1	-1	-2

Overall performance of scenarios

The scores provided a comparison to differentiate between the scenarios, ranking them in terms of performance against the criteria. Where little difference could be identified, they were ranked equal. Therefore, often there were only three scores and rarely was a scenario ranked 4th. Figure 5 illustrates how the scenarios performed against each other regarding individual criteria ranking, where a scenario ranked the highest/first (so rank of 1) or lowest/worst (so rank of 3 or 4).

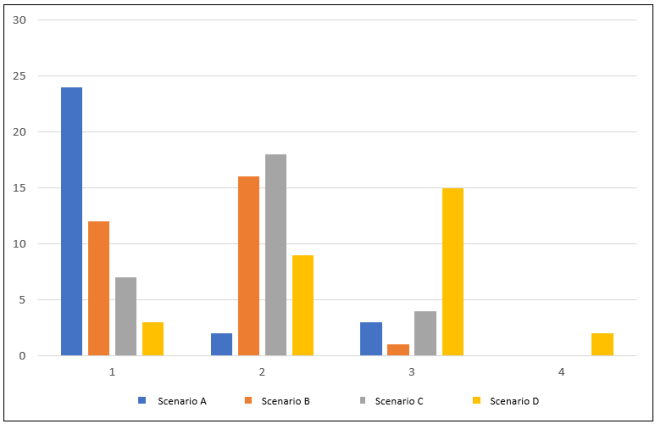


Figure 5 – Overall scenario ranking

Where a scenario scored highest this does not necessarily demonstrate the scenario resulted in a positive response (sometimes it was the 'least bad') and instead demonstrated further work would be needed to achieve the desired criteria outcome more fully.

Growth and development will cause some impacts on some measures even with best practice. In most cases, a negative score indicates the need for a specific policy intervention to avoid, reduce or mitigate the adverse effect in addition to, or even instead of land use or transport alone.

Overall, Scenario A performed the best across most criteria. Scenario A was specifically developed with significant shifts in land use planning and transport assumptions to better reflect the expectations of the TERP[8], to test whether modelled travel behaviour, mode share and especially transport greenhouse gas emissions would change compared with other scenarios. As such, the fact that Scenario A performed better provides some important lessons but does not necessarily provide the solution for spatial planning. However, these differences also make it challenging to compare outputs on a like-for-like basis with the other scenarios, particularly when trying to identify the land use, transport, model input or other reason for these differences. The findings from the evaluation of Scenario A and the other three scenarios inform the spatial component of the Future Development Strategy.

Scenario B also performed well and was the highest for half of the criteria, although generally equal with Scenario A. These scenarios, being the most intensive scenarios, typically performed the best against the most criteria but not all.

Scenario C performed the best in relation to its alignment to committed infrastructure because it most closely reflects the current growth scenario, and therefore the current infrastructure planning and funding developed over several years to integrate with this pattern. Generally, where Scenario C performed the best, this was scored equally with the more intensive scenarios.

Scenario D performed the worst overall, only resulting in the highest score for four criteria, two of which were also equally scored with other scenarios. The two criteria where the Scenario D performed best overall related to the extent of Māori land within growth areas, whereby treaty settlement land in rural areas may be more likely to be urbanised[9], and retention of historic heritage because less growth would

[8] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/Pages/transport-emissions-reduction-pathway.aspx

[9] Assuming that this outcome reflects the aspirations of the relevant iwi.

be located in the isthmus, reducing potential impacts on the concentration of heritage listings located there, as well as volcanic viewshafts and special character areas[10].

Natural hazards

Two criteria consider natural hazards to differentiate between brownfield and greenfield development. These criteria were assessed by subject matter experts and relied on the GIS analysis of natural hazard constraints.

At the evaluation workshop, it was noted that all scenarios are assumed to avoid development within floodplains and coastal inundation areas. Therefore no scenarios should be identified to have growth within these areas. However, the greater the extent of growth in an MSM zone that is constrained the greater the potential impacts of development encroaching on natural hazard areas.

The extent of new urban development areas in 100-year floodplains and areas prone to coastal inundation and coastal erosion (Greenfields)

In summary, the evaluation identified the following key differentiating factors for natural hazards in greenfields:

- Scenario D directs the most residential (c. 159,000 homes) and employment growth (c. 92,000 jobs) to greenfield locations within the future urban areas and/or certain rural settlements, some of which contain a large proportion of 1 per cent AEP floodplain (e.g. Drury, Takaanini, Upper Orewa), as well as coastal erosion and/or inundation zones (e.g. Hatfields Beach, Clarks Beach, Helensville).
- Scenario C directs the next highest amount of residential (c. 102,000 homes) and employment growth (c. 59,000 jobs) to greenfield locations within the same future urban areas and rural settlements as Scenario D, but with higher housing at Pukekohe.
- Scenario A and B both allow for much less housing and employment growth in the future urban areas and rural settlements affected by natural hazards. Exceptions are Hibiscus Coast and Drury West, which include areas of 1 per cent AEP floodplain; and Whenuapai, which includes areas susceptible to both coastal inundation and erosion.

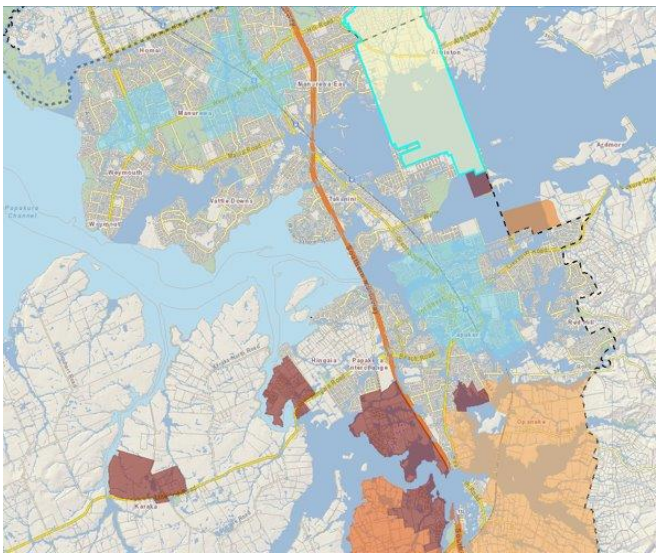


Figure 6 – GeoMaps showing 1% AEP floodplain across Takaanini and Drury future urban areas

[10] Also noting that no scenario exceeds existing plan imposed viewshaft limited capacity inputs, or requires development within special character areas, and all scenarios are assumed to avoid no-go areas and significant values like heritage listings – this differential reflects the greater pressure, and potential for unintended impact rather than direct or assumed impact.

Through the evaluation workshop there was general agreement with the draft scoring and an expectation that development does not occur in floodplains or coastal inundation areas. Within greenfield areas there is greater opportunity to infiltrate and store water and therefore limit the impact and extent of floods or natural hazards. However, there is currently no mechanism or policy to ensure that areas at risk of natural hazards are avoided. Therefore areas with significant natural hazards should not be developed.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-1	-2	-3

The extent of urban development areas in 100-year floodplains and areas prone to coastal inundation and coastal erosion (Brownfields)

In summary, the evaluation identified the following key differentiating factors for natural hazards in brownfields:

- The Scenario A and B both allow for more housing and employment intensification in the existing urban area (80 and 90 per cent respectively) than the other scenarios, which include many coastal areas susceptible to inundation and/or erosion, as well as areas that contain large amounts of 1 per cent AEP floodplain (i.e. Development areas and nodes on the isthmus, as well as at Manukau, Henderson and the North Shore).
- Scenario C directs the next highest amount of intensification (75 per cent) to the existing urban area.
- Scenario D directs the lowest proportion of residential and employment growth to existing urban areas (50 per cent). However, it would increase impervious surfaces and exposure of new developments to flooding, coastal erosion and/or inundation in the existing urban area, as most of the brownfield growth would be delivered as lower density infill housing across the urban area, rather than in concentrated locations.

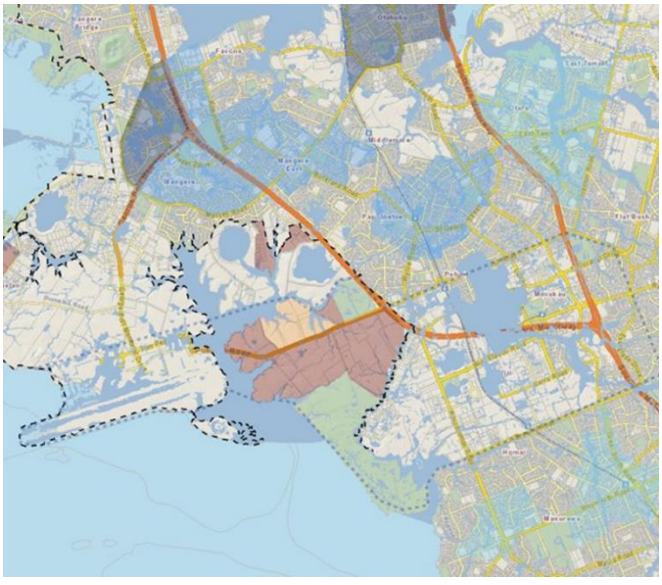


Figure 7 – GeoMaps 1% AEP floodplain across Manukau node and Development areas at Māngere, Papatoetoe, Otara and Otahuhu

Scenario A is the only scenario that totally avoids coastal inundation areas by removing all growth. Where growth is identified in MSM zones with flooding constraints the evaluation considered whether growth could develop. Therefore, Scenario A is likely to have the least effect (small negative) on natural hazards.

Scenarios C and D have more infill development including in coastal areas. Therefore, these scenarios are considered to perform the worst. However, due to the assumption that hazard areas are avoided this is only a moderate negative.

Scenario B has the most growth in areas that are affected by flooding such as Māngere and Manukau and as such scored a strong negative (Figure 7).

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-3	-2	-2

Carbon emissions

The following criterion was evaluated by subject matter expert and included assessment based on model outputs on transport carbon emissions and household numbers.

The extent to which scenarios impact carbon emissions.

Three aspects of carbon emissions were evaluated including, transport operational emissions, residential embodied and operational emissions, and infrastructure embodied emissions.

A key assumption for assessing residential emissions is that different growth scenarios result in additional residential buildings, which will result in additional carbon emissions (embodied and operational emissions), and attached buildings have lower carbon emissions due to more efficient heating and lower floor space.

In summary, the evaluation identified the following key differentiating factors between the scenarios for carbon emissions:

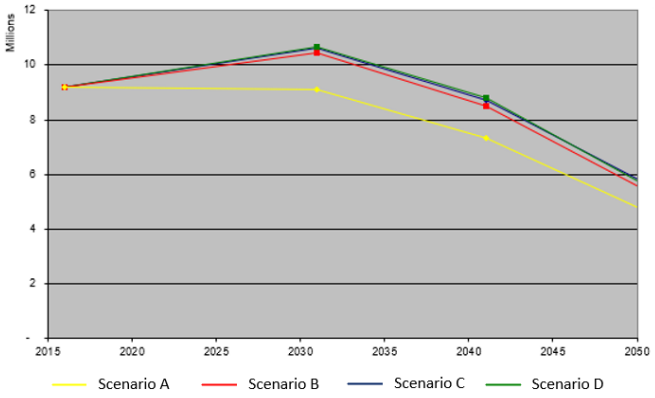


Figure 8 – Modelled total transport related GHG emissions (CO2e) – kg/24hr

Transport operational emissions:

- For transport carbon emissions (Figure 8), the model suggests that the differences are marginal Scenarios B - D. Only Scenario A differs appreciably from the other scenarios.
- The model results suggest that all scenarios are expected to result in a significant decrease in transport carbon emissions (c. 40 – 50 per cent) and there is not a major difference between them so they constitute a strong positive score.
- No scenario achieved the scale of reduction required by Te Tāruke-ā-Tāwhiri or the TERP.

Residential embodied and operational emissions:

- The model suggests the Scenarios A-C will result in similar amounts of additional floor space (in the order of 47M sqm), while Scenario D is expected to result in significantly more floor space (c. 59M sqm). Assuming the buildings were of the same design and constructed the same way, the greater the floor space the greater the embodied carbon emissions.
- On average detached buildings lose more heat more quickly than attached buildings due to the greater external surface area (per unit of floor space), and as such require more heating which results in greater operational carbon emissions. Scenario D has the greatest proportion of detached dwellings and therefore has greater operational carbon emissions.
- Combining the impact of expected floor space and housing typology for the assessment of the four scenarios, Scenario D can be expected to result in the greatest amount of carbon emissions from residential housing construction and operation (building use), while the other three scenarios are likely to result in broadly similar amounts of carbon emissions.

Infrastructure embodied and operational emissions:

- Scenarios A - C which are understood to result in less development of additional or new infrastructure, are expected to result in fewer infrastructure-related emissions than Scenario D.

Scenario A was by far the best-performing scenario on carbon emissions, but the quantitative model outputs did not reach desired targets. Additional work would be necessary to further explore how TERP outcomes can best be delivered, including under more 'likely to be realised' spatial scenarios.

At the evaluation workshop, there was general agreement on the relativity between the scenarios. All scenarios are scored in the negative because there are still carbon emissions in excess compared to the reduction targets. Further work is required through the Future Development Strategy to understand the impacts of land use on carbon emissions particularly to achieve the 2030 targets.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-2	-2	-3

Health of water bodies

The following criterion for the health of water bodies was evaluated by subject matter experts by considering the potential impacts of each scenario on permanent, intermittent, and ephemeral watercourses and the ecosystem current extent.

The extent to which development provides opportunities to improve the health of natural wetlands, lakes, rivers (including their riparian margins), and coastal /marine environments.

An assumption of all scenarios is that growth can be accommodated outside of wetlands and streams and will not contribute to the reclamation of these features in accordance with the national policy framework. However, there will still be risks to the extent and values of natural wetlands and rivers/streams from development under the current policy framework.

The scenarios all have both potentially positive and negative effects, depending on the scale, typology and location of growth and the potential for improvements to degraded watercourses and natural wetlands. On balance, across both brownfield and greenfield environments, all scenarios are likely to have a slight net positive effect, given the current degraded baseline state of most watercourses and natural wetlands in both urban and rural areas.

Scenario D results in the largest benefits in greenfield and rural areas due to the opportunities for enhancement and reduction in sediment runoff but a slight negative in brownfield areas. Whereas Scenarios A and B are more likely to result in net positive brownfield outcomes but have a relatively minimal impact on greenfield areas. While Scenario C sits in the middle of these outcomes. Therefore the draft scoring resulted in similar minor positive scoring across all four scenarios.

At the evaluation workshop, it was agreed that the original criterion should be split to assess greenfield and brownfield separately because when considering both together they cancel each other out and therefore the scenarios cannot be differentiated.

<u>Greenfield</u>

In greenfield areas urban development is likely to result in a net positive improvement to watercourse value and extent (not including water quality), due to the existing degraded baseline state coupled with fewer physical restrictions (such as historic subdivision patterns) and a more stringent planning framework. Therefore, all scenarios are scored positivity.

Significant growth in greenfield areas is likely to result in restoration, such as bank stabilisation, riparian planting, fish passage improvements etc. Because of this, Scenarios C and D perform the best and are scored moderately positive, with Scenarios A and B only having a slight positive due to the lower proportion of growth in greenfield areas.

No scenarios achieve a strong positive score as risks to watercourse extent/values always exist and some loss may be experienced in certain instances.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+1	+1	+2	+2

Brownfield

In brownfield areas, net positive outcomes are less likely due to a more permissive planning framework and a higher proportion of constrained sites (i.e. small single-lot developments). Therefore all scenarios are scored negatively.

As previously outlined, Scenarios A and B present the lowest risks, as intensive development is more likely to require a stormwater management plan and enable targeted intervention of public resources. Scenarios C and D present a greater risk, due to the dispersed infill nature of growth.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-1	-2	-2

Water quality

The following criterion for water quality was evaluated by subject matter experts by qualitative assessment.

The extent to which options reduce coastal and freshwater quality including the ability to swim safely and to collect shellfish due to beach closure from water pollution

Coastal and freshwater quality is affected by different types and sources of pollutants:

- sedimentation from stream bank erosion or land disturbance during construction;
- heavy metals from building materials and road traffic mobilised through stormwater run-off;
- E. coli and nutrients from rural land use or due to combined sewer overflows or in rural areas serviced by on-site wastewater systems.

In summary, the evaluation identified the following key differentiating factors for water quality:

- Greenfield growth and rural expansion would increase net imperviousness (stream bank erosion), sedimentation and heavy metal hence Scenario D would have a strong negative effect, with Scenario C, then Scenarios A and B having moderate and small negative effects respectively.
- While greenfield growth is better for E. Coli and nutrient pollution due to land use change from rural production to urban reducing sources of those contaminants, Scenario D is still considered to have strong negative effects overall.

At the evaluation workshop, there was general agreement on the draft scores. Key feedback was that all scenarios will need to improve the shading of streams to mitigate temperature increases as a result of climate change as a policy intervention.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-1	-2	-3

Biodiversity

The following criterion was evaluated by subject matter experts by considering the proportion of MSM zones comprising natural resource constraints such as significant ecological areas (refer to Figure 9 below).

The extent to which development promotes the restoration of, and connectivity between, existing and potential habitats/areas of indigenous biodiversity

It was assumed that none of the scenarios would result in development directly within significant ecological areas due to current policy safeguards in the AUP and the upcoming National Policy Statement for Indigenous Biodiversity. Therefore, a strong negative impact on habitats and species was considered unlikely within those areas, which would not be lost or damaged directly by development.

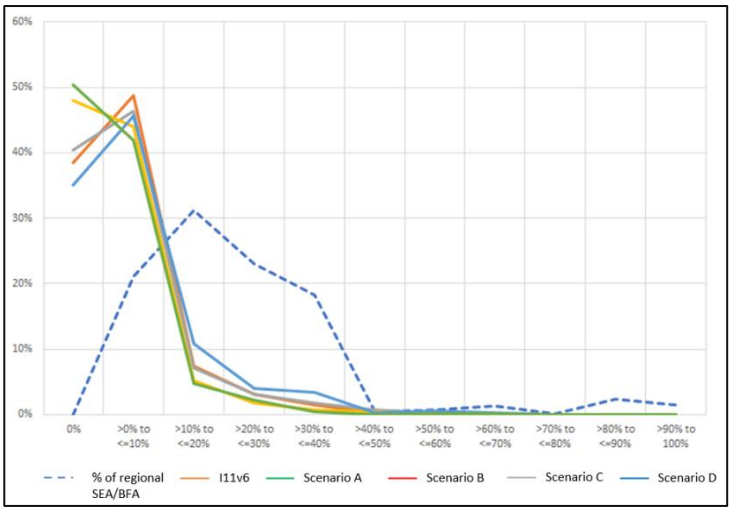


Figure 9 – Location of housing growth relative to: BFA & SEA (Grouped by % of MSM covered)

All scenarios were considered likely to have at least a small negative effect on indigenous biodiversity as they all allow for future development in locations that are within MSM zones with between 10 per cent and 45 per cent coverage by significant ecological areas and/or biodiversity focus areas. In addition, they all allow for infill housing and varying degrees of intensification within the existing urban area, which could result in the loss of existing trees and vegetation, reducing urban ngāhere and impacts on significant ecological areas within the urban area, such as in Northcote, Albany and Te Atatū Peninsula.

Scenario D would see slightly more development (approx. 1-4 per cent) occurring within MSM zones with between 10 per cent and 45 per cent coverage by significant ecological areas and/or biodiversity focus areas than the other scenarios and therefore is considered likely to have a moderate negative effect on areas of indigenous biodiversity.

Scenario D directs more growth into new future urban areas compared to the other scenarios that contain or adjoin significant ecological areas, biodiversity focus areas, and some unprotected indigenous biodiversity areas (i.e. around Warkworth, Pukekohe, Huapai/Kumeu, Dairy Flat, Wainui East and smaller rural settlements such as Algies Bay, Hatfields Beach, Clevedon, Kingseat and Maraetai). Development in these greenfield locations is likely to have a greater effect on indigenous biodiversity if not designed and constructed in a sensitive way to avoid loss, damage, and disturbance and/or maintain and enhance linkages between fragmented areas.

At the evaluation workshop, there was general agreement with scores and agreement with focusing on risk to score all scenarios negatively.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-1	-1	-2

Highly productive soils

The following criterion was evaluated by subject matter expert based on GIS analysis of highly productive soils (FARMLUC 1 – 3) within MSM zones as illustrated in Figure 10. Where the proportion of highly productive soils exceeds 60 per cent coverage it was deemed more difficult to avoid loss from development.

The degree to which urban development consumes highly productive soils

In summary, the evaluation identified the following key differentiating factors considering highly productive soils:

- Scenario D has the most growth across highly productive soils in both existing future urban areas and additional future urban areas, including around rural settlements, particularly in the south and northwest. Therefore, this scenario has the greatest impact.
- Scenario A and B have the least impact, with limited use of future urban areas. Some growth in future urban areas occurs primarily within live-zoned areas (i.e. Paerata and Redhills) with less growth in other parts of the future urban areas enabling greater avoidance of highly productive soils.
- Scenario C has slightly greater impacts in future urban areas compared to Scenarios A and B because it utilises more future urban land and has higher levels of growth in these areas.

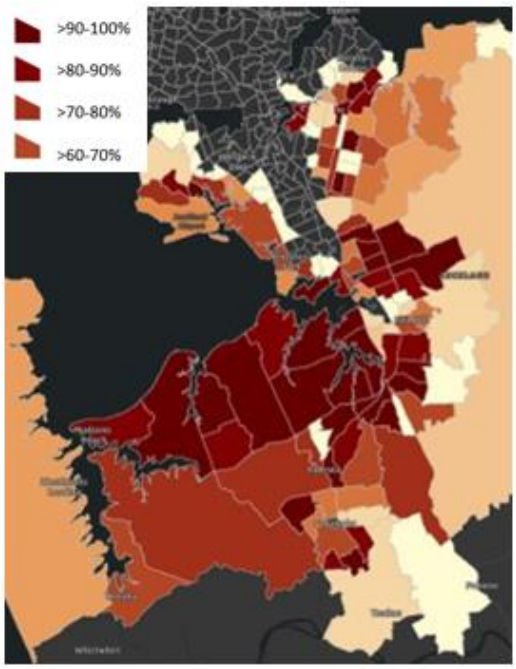


Figure 10 – GeoMaps proportion of FARMLUC 1 - 3 soils by MSM zone (south)

At the evaluation workshop, the evaluation group agreed with the draft scores. Since the evaluation workshop, the National Policy Statement for Highly Productive Land has come into force, which requires the protection of highly productive soils establishing a stronger policy framework. However, an exception is included for land zoned for future urban development.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-1	-2	-3

Natural and built heritage

The following criterion was evaluated by subject matter expert based on the proportion of growth and number of dwellings in areas with scheduled natural and built character or affected by built and natural heritage controls (i.e. volcanic viewshafts).

Extent to which scenarios retain qualities of historic heritage places and values, e.g. historic places, viewshafts, volcanic landscapes

Natural and built heritage is generally protected by overlays in the AUP, as such the assumption is that growth can be accommodated outside these areas. Therefore, the scenarios are neutral for most heritage overlays.

In summary, the evaluation identified the following key differentiating factors considering natural and build heritage:

- Scenarios that increase intensification around the City Centre and Auckland Isthmus have the biggest impact on volcanic viewshafts, height sensitive areas, and special character areas because this is where these values are concentrated.
- Scenario D will have the least impact on these values because less growth is focused in the isthmus.

At the evaluation workshop, draft scores were moderated in response to feedback that significantly more capacity is enabled through PC78 than provided for in the scenarios within the isthmus while maintaining heritage values.

PC78 enables capacity of over 18M sqm of residential floorspace in the Waitematā Local Board area excluding the qualifying matters and overlays (i.e. volcanic viewshafts). In contrast, Scenario A only provides approx. 3.8M sqm, Scenario B approx. 2.7M sqm, Scenario C approx. 2.1M sqm, and Scenario D approx. 1.1M sqm. Therefore, all scenarios are considered able to maintain the special character areas and overlay constraints.

Scenario D would have the least growth in affected areas and can be considered neutral. Scenarios B and C would have a potential minor impact, and Scenario A would have moderate negative impact.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-2	-1	-1	0

Access to open space

The following criterion was evaluated by subject matter expert considering the number of households and people within a walkable catchment of open space greater than 3,000 sqm (Figure 11).

Extent to which scenarios are likely to result in improved levels of access to quality open space

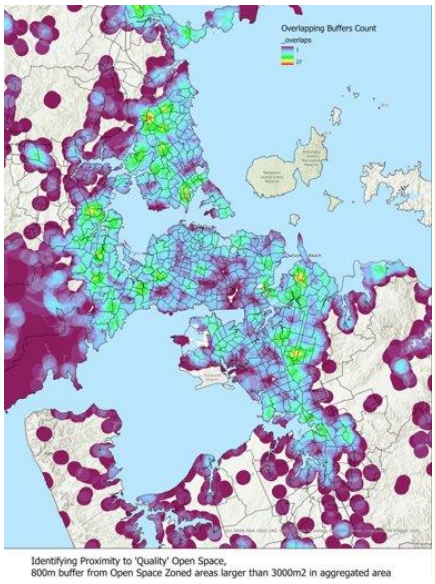


Figure 11 – Accessibility (within 800m) to open space 3,000 sqm or greater

Improved levels of access to quality open space assume more people can walk or cycle to access it. It is accepted that open space is broader than public open space and includes a variety of types. However, it is difficult to measure this with the information available and therefore open space of 3,000 sqm is used as a proxy indicator of quality.

Most areas have good access to quality open space, although some areas have less access. Therefore all scenarios have good access within the existing urban area.

More intensive scenarios place more people within walking and cycling distance of existing open spaces. It is reasonable to assume that with a higher population, there would be more investment in these existing spaces and therefore quality would be improved. More expansive scenarios have less intensification around these existing open spaces but still have access.

It was assumed that additional open space will be provided for within Scenario D through structure planning. However, this will likely come at the expense of providing new or upgrading existing open space within the

existing footprint which would naturally have a larger catchment due to a higher density of development.

In summary, the evaluation identified the following key differentiating factors considering access to open space:

- Scenario A is assumed to have a higher investment in walking and cycling infrastructure due to higher intensification levels and correspondingly the most improved access to open space.
- Scenario B and C are likely to be similar but with different extents of intensification and less investment in walking and cycling compared to the Scenario A so identified as minor positive.
- Scenario D is identified as a minor negative because although there will be opportunities to access open space, they will be less than other scenarios.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+2	+1	+1	-1

Air quality

The following criterion was evaluated by subject matter experts based on model outputs on air emissions from transport.

Extent to which population is exposed to harmful air emissions from transport

Despite Tāmaki Makaurau/Auckland's growing urban population, the long-term trends have seen improvements in air quality thanks to cleaner fuels, improved vehicle technology and declining use of solid fuels (coal and wood) for home heating. However, as population increases, more people will be exposed to air pollution and reducing the associated health burden is challenging.

Key pollution sources are transport throughout the year and home heating in winter. The main air pollutants in Auckland are nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$ (particulate matter with diameters less than 10 and 2.5 microns). NO_2 is primarily associated with traffic (vehicle emissions) while PM_{10} and $PM_{2.5}$ have several sources such as traffic, road dust, sea salt and smoke from home heating fires during winter.

While the model estimates transport emissions, used as a proxy for air pollutants, the population exposure has not been evaluated. People near congested roads and vulnerable population (e.g. children and asthmatics) could be exposed to air pollution in every scenario although the extent of exposure varies from one scenario to another.

In summary, the evaluation identified the following key differentiating factors considering exposure to air emissions from transport:

- Scenario A generates the lowest regional emissions for every decade across the 30-year timeframe, accounting for 80 – 87 per cent of Scenario C for four indicators (NO_x, NO_2, PM_{10} and $PM_{2.5}$) and is therefore scored most positively.
- Scenario B is the next lowest regional emissions, accounting for 95 – 98% of Scenario C for four indicators. This could be attributable to the fact that growth is focused within the existing urban area, urban nodes and centres.
- Scenario D produces about the same amount of emissions (98 – 101 per cent) as Scenario C and as such there is no differentiation between them and both scenarios are evaluated as having a small positive impact.

At the evaluation workshop, it was agreed that all scenarios should be scored positively because the model results indicate hazardous emissions reductions of more than 50 per cent for all scenarios by

2050. The population will benefit from improvements in air quality because of large reductions in vehicle emissions of Nitrogen oxides, NO_2, PM_{10}, and $PM_{2.5}$. All scenarios see improvements because there is increased take-up of electric vehicles and improvements in access to public transport.

The evaluation found that more intensive landform integrated with public transport achieves better outcomes for air quality with a significant reduction in transport emissions. However, it is noted that Scenario A includes several transport assumptions that the other scenarios did not, and further sensitivity testing is required to determine what can appropriately be taken forward into a preferred scenario.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+3	+2	+1	+1

Housing choice

The following criterion was evaluated by subject matter experts based on model outputs on the uptake of different housing typologies (attached and detached) across different locations (e.g. centres, nodes, development areas, future urban areas).

Extent to which growth creates greater housing choice to meet projected demand

Council's growth model (i11v6) identifies growth of approximately 291,000 households over the next 30 years. This is higher than Statistic NZ's medium household growth projection of 253,000 (pro-rated to 2051 based on the average growth rate provided by Statistics NZ), but lower than its high growth projection – 356,000. The slightly higher projected growth creates buffering room for future adjustment if the rate of growth is faster/slower than envisaged.

In summary, the evaluation identified the following key differentiating factors considering housing choice:

- Scenario A delivers a highly compressed urban form which improves accessibility to many existing and future services but results in the most limited locational choice out of the four scenarios. Modelled dwelling supply sees 77 per cent of the new housing stock in medium- and high-density dwelling units which are spread across the existing urban area within proximity to the region's largest existing and planned employment areas which are well-serviced by existing and planned services.
- Scenario B locates future housing supply along rapid transport corridors, and near urban centres, development nodes and priority housing development areas providing for good utilisation of existing and planned services. Housing choice within the urban area under this scenario is limited to predominately (over 70 per cent of the total new housing stock) medium- and high-density attached terraces, townhouses, and apartments.
- Scenario C provides an overall balanced housing growth distribution and predominately aligns with the existing Development Strategy and is therefore served by existing and planned services. A large portion of the future household growth is expected at the urban fringe and future urban areas increasing location choices.
- Scenario D relies more on the future urban areas and rural settlements which are currently either poorly serviced or not currently planned to be serviced at all, and likely to be expensive to do so. Housing choice provides a much higher number and a greater proportion of low-density detached housing options. Medium- and high-density housing choices along rapid transport corridors, centres and nodes are reduced relative to other scenarios. The locational choice is the highest of the scenarios, but typological choices are much more limited in those locations. Under this scenario,

development conditions at greenfield locations are highly favourable which see a total of 68 per cent of the future household growth occurring in Franklin and Rodney.

A key issue identified with Scenario A is the lack of developable land and development incentives/commitment from landowners to convert existing or create capacity for high-density residential use. Without additional policy intervention, the anticipated growth form is considered extremely difficult to achieve and would be the least feasible relative to today's incentives and preferences.

Overall, it was agreed through the evaluation workshop that maximising housing choice includes both intensifying and expanding to meet demand. The preferred spatial pattern needs to respond to the updated Housing and Business Assessment to identify any gaps that need to be filled.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+1	+1	+1	0

Mixed use communities

The following criterion was evaluated by subject matter expert based on model outputs including safety, congestion, and distance travelled by mode.

Extent to which scenarios promote mixed-use communities to reduce travelling distances and the safety risks people incur when they travel to access services, facilities, and social networks

A key assumption of the evaluation is that a more intensive scenario provides greater access through public transport and active modes.

In summary, the evaluation identified the following key differentiating factors considering mixed-use communities:

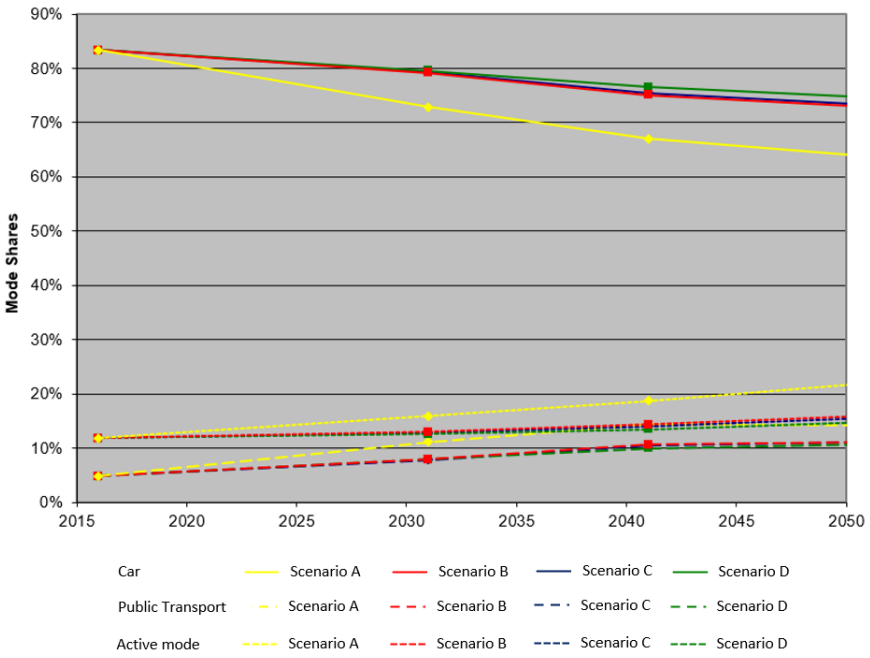


Figure 12 – Daily Mode Share (%) - model results

- Scenario D has a minor negative impact with the highest VKT travelled overall and lowest public transport and active mode share (combined) and highest car mode share of the scenarios. Crashes based on VKT are the highest under the Scenario D.
- Scenarios B and C are considered to sit between Scenario A and Scenario D.
- Scenario A has a moderate positive impact with the lowest VKT and highest public transport and active mode share (combined) out of all the scenarios. The percentage of congestion under Scenario A is generally much less than the other scenarios on local, arterial and motorways all times of day. The number of serious crashes based on VKT travelled is also the lowest under the Scenario A.

At the evaluation workshop, while the relativity of draft scores was agreed the scores were adjusted to reflect that Scenario C should not be considered neutral.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+2	+1	+1	-1

Access to social infrastructure

The following criterion was evaluated by subject matter experts based on model outputs and consideration of the proportion of households and people living within a walkable catchment of essential social infrastructure, and the rapid and frequent transit network (Figure 13).

Extent to which scenarios provide improved, inclusive, and equitable access to social infrastructure including community facilities, health (critical). Degree to which essential social infrastructure is accessible by walking and cycling

Within the existing urban area, there is a range of existing community facilities including recreation centres, youth facilities, and libraries. Libraries, for example, are focused in centres and there is generally good coverage although not all are within walking distance, they can generally be accessed by public transport. More Scenario Bs that focus on centres will therefore have a greater population in proximity to libraries. Regional facilities are by definition less dispersed therefore few are within walking distance with a strong focus in the City Centre as well as provision at larger centres such as Albany, Takapuna, Manukau.

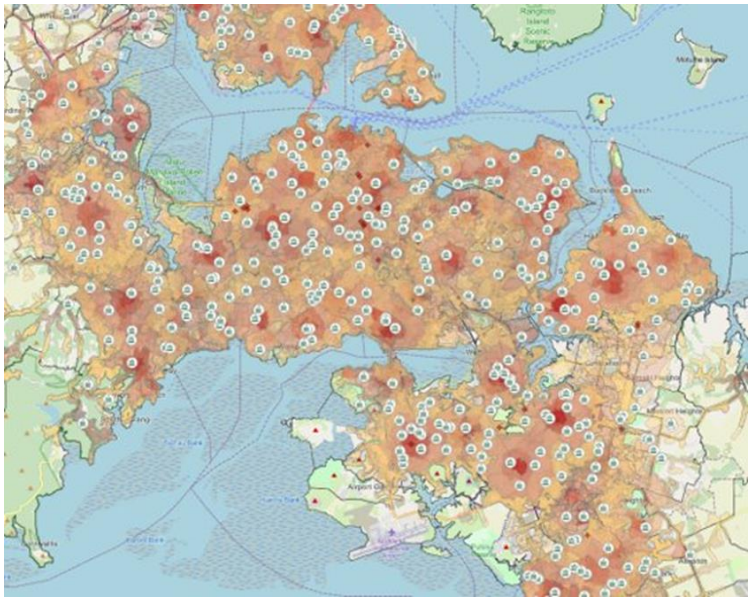


Figure 13 – GeoMaps analysis of access to community facilities

There are limited hospitals, and these are regionally based and therefore rarely within walking distance. However, there is public transport access. There are currently no plans to provide new hospitals within greenfield areas, therefore expansive scenarios place population further away from these services (including rural settlements).

It was agreed at the evaluation workshop to refine the original criterion to focus on social infrastructure (including social services) to include hospitals and community facilities.

Overall, the scoring reflects that the more intensive scenarios provide better access to existing facilities including hospitals and community facilities and the more expansive the scenario is the greater impact on accessibility to community facilities.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+1	+1	-1	-2

Access to social infrastructure and employment in areas of high deprivation

The following criterion was evaluated by subject matter experts considering model outputs on travel time and the current deprivation index (Figure 14).

Degree to which essential social infrastructure and employment is accessible by multiple modes in areas of high deprivation

Essential social infrastructure in the context of this criterion was determined to be tertiary education for the purpose of measuring accessibility.

Access to tertiary education

Looking at accessibility to tertiary education compared to current areas of deprivation, many of these areas are significantly less accessible than other areas that are not deprived. While the Glen Innes, Māngere-Otahuhu and Otara areas generally have good accessibility in 2051 within 60 mins by public transport, in Scenario A this reduces significantly within 45 mins.

Importantly the areas further south of Otara do not have good accessibility across any scenario and therefore all scenarios are scored negatively. All scenarios perform poorly in relation to accessibility within 30 mins with most areas being further away from tertiary institutions.

Key differentiating factors considering access to tertiary education are identified as follows:

- Scenario D performs similarly to Scenario A because they have a similar public transport network.
- Scenario B and C also perform similarly but with additional small gaps in the west, east and south within 60 mins that will impact areas of deprivation. This gets significantly worse within 45 mins.

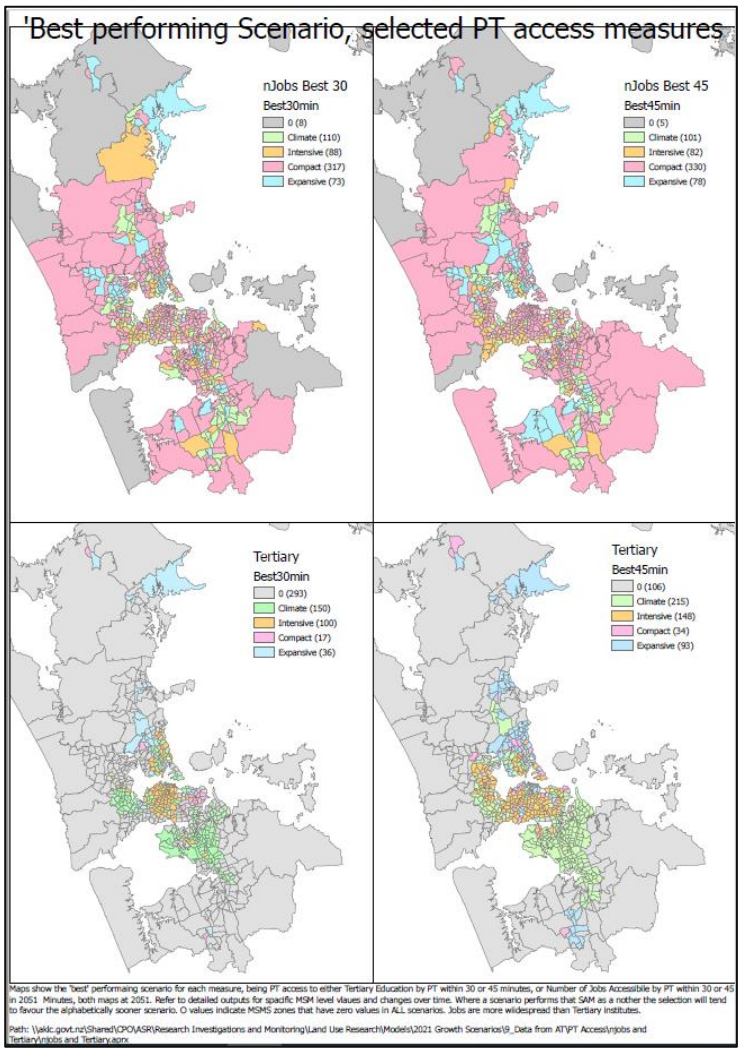


Figure 14 – GeoMaps analysis of best scenario by MSM zone - access to tertiary education and jobs (within 30 or 45 mins by public transport

Access to jobs:

Key employment areas do not differ significantly across the scenarios and there is very limited access to jobs within 30 mins of public transport. Therefore, evaluation focuses on jobs within 45 mins.

Across all scenarios there is stronger access to jobs along rapid transit routes by 2051 in relation to areas of deprivation with much-improved accessibility to the West and some improved accessibility to the East.

Key differentiating factors considering access to jobs are identified as follows:

- Scenario A has a more even spread of jobs compared to other scenarios.
- Scenarios B and C have a slightly better concentration of improved accessibility in areas of deprivation including Mt Roskill and Māngere.
- Scenario D has the lowest accessibility in those areas of deprivation compared to all other scenarios and therefore performs the worst.

All scenarios are scored negatively because the southern areas that are currently highly deprived will continue to have poor access to both jobs and tertiary education across the scenarios. Overall, Scenarios A - C are similar and Scenario D is slightly worse.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-2	-3	-3	-3

Māori land

The following criterion was evaluated by subject matter expert based on information within the councils GIS database in relation to the location of marae, Māori land, and Treaty Settlement land.

Only Mana Whenua can determine what impact the scenarios would have on Māori land and what types of Māori land are of greatest priority. This assessment relies on available information to try and differentiate between the scenarios to understand potential impacts. It does not represent the views of Mana Whenua.

Extent of Māori land within growth areas

Scoring of scenarios was based of perceived opportunities for the development of Māori land including commercial redress. A lot of Māori land is covered by the Māori Purpose Zone enabling development and therefore the ability to develop would not necessarily be impacted by growth. The greatest opportunity is therefore considered to be for commercial redress land.

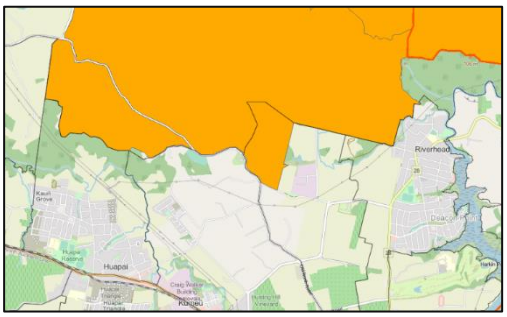


Figure 15 Riverhead Forest Commercial Redress land (GeoMaps)

Commercial redress land is identified at Papakura centre, Bayswater, Vauxhall, Paremoremo, Riverhead Forest, and Woodhill Forest. Additional land within the existing urban area will be available as Right of First Refusal that is not mapped. Commercial redress land within the existing urban area provides the greatest development opportunities. Therefore, more intensive scenarios would more greatly benefit these sites.

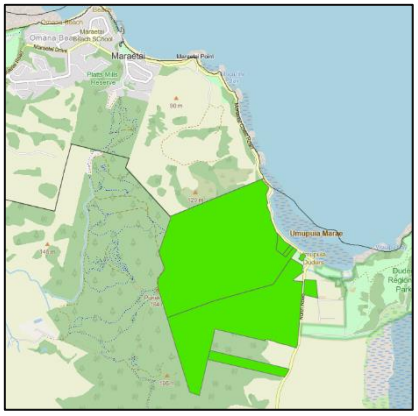


Figure 16 Umupuia Māori Land Block (GeoMaps)

Māori land blocks are identified at Karaka (opposite Weymouth, Whatapaka Marae), Pukekohe north, West of Waiuku (Tahuna/Reretewhioi Marae), Umupuia, Orakei, west of Parakai, west of Waimauku, Woodhill, and Māngere. Where urban growth expands beyond the current future urban area this is likely to increase opportunities for development of Māori land blocks within rural areas. For example, at Maraetai growth could potentially extend towards and include Umupuia.

In summary, the evaluation identified the following key differentiating factors considering Māori land:

- Scenario D is less likely to foreclose on development opportunities within the existing urban area and would also increase potential opportunities for Māori land in rural areas such as Riverhead and Umupuia.
- The other scenarios provide some opportunities within different locations within the existing urban areas but cannot be differentiated.

At the evaluation workshop, there was general agreement with the draft scoring although noting that a more nuanced approach would come through engagement with Mana Whenua. Opportunities for Māori land could include a range of activities, for example solar farms. Mana Whenua engagement on the Future Development Strategy will identify iwi and hapū aspirations that will feed into the draft spatial form.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+1	+1	+1	+2

Māori cultural landscapes

The following criterion was evaluated by subject matter expert based on the scale of growth in areas within or adjacent to identified Māori cultural landscapes including, Sites and Places of Significance to Mana Whenua, Statutory Acknowledgement Areas and recorded archaeological sites of Māori origin.

Only Mana Whenua can determine what impact the scenarios would have on Māori cultural landscapes. This assessment relies on available information to try and differentiate between the scenarios to understand potential impacts. It does not represent the views of Mana Whenua.

Extent to which scenarios impact on Māori cultural landscapes (wahi tapu, sites and places of significance to mana whenua)

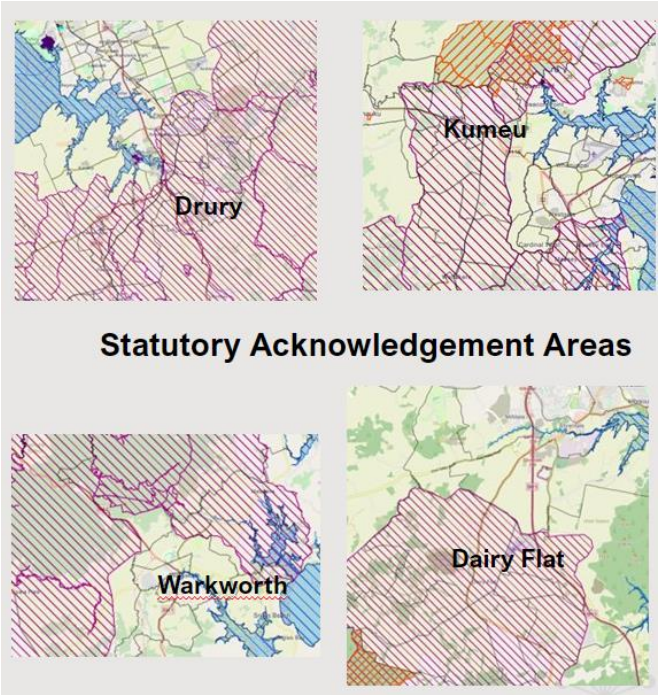


Figure 17 – Statutory Acknowledgement Areas in proximity to future urban areas

Scenarios that expand urban development into new rural areas will impact Statutory Acknowledgement Areas (Drury, Warkworth, Kumeū and Dairy Flat as illustrated in Figure 17). While recognising that within the new rural areas development could potentially avoid, remedy and mitigate adverse effects.

Concentrations of archaeological sites of Māori origin signal the historical occupation of an area and associated values and indicate a likelihood of discovering further archaeology that could be impacted by development. In addition to physical damage, development can impact intangible cultural values associated with cultural landscapes. Many areas have not been fully investigated, and a lack of recorded archaeological sites does not indicate there are no cultural landscape values.

Scheduled Sites of Significance to Mana Whenua are protected under the AUP and all scenarios maintain this protection. Therefore any impacts are not related to the sites themselves but the edge effects, including maunga viewshafts, encroachment, also the fact that scheduled sites do not necessarily correspond to the full extent of the values of a site.

However, scheduled sites only represent a small proportion of the sites of significance to iwi and hapū. Much of the Māori cultural landscapes are not currently protected and are vulnerable to the effects of intensive development. As such, all scenarios are scored negatively.

In summary, the evaluation identified the following key differentiating factors for Māori cultural landscapes:

- Scenario D has less infill and intensive development in existing urban areas and is therefore likely to have less impact on cultural landscape values. However, because Scenario D extends into new rural areas there is a higher risk of encroaching on undeveloped areas and therefore it is scored significant negative.
- Scenario A has the greatest potential impact within existing urban areas because it places the most significant growth within the inner isthmus potentially impacting unscheduled sites and maunga viewshafts. However, growth is limited within future urban areas reducing impacts to a moderate negative impact.
- Scenario B may be more impactful than the Scenario C as a result in higher levels of intensification but Scenario C has more dispersed infill across the isthmus. Scenario B and C sit in between the other two scenarios and are not sufficiently different to distinguish between them.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-2	-1	-1	-3

Accessibility to key economic activity

The following criterion was evaluated based on model outputs on accessibility to key areas of economic activity (i.e. centres) and employment. Key economic destinations identified in the model include the City Centre, Airport, and Metropolitan Centres.

Extent to which key areas of economic activity are accessible by different modes - PT, active (cycling, walking)

Shorter public transport trips of less than 10km (AM peak) indicate greater accessibility at a regional level enabling more people to access their needs within closer proximity. The more intensive the scenario the more trips by public transport occur for shorter distances, where Scenario A has the highest number of short-distance public transport trips in both 2031 and 2041, followed by Scenario B. While Scenario A continues to maintain a high number of short-distance trips by public transport an increasing number of these trips will be by active modes over time. Therefore, in 2051 Scenario B has the highest number of short-distance public transport trips.

Looking at longer trips by public transport, Scenario A has more trips than Scenario D for those trips over 36km and including 60km. This is likely to be partly due to the underlying transport network, where Scenario A doesn’t have the additional roads but does have the best public transport network. Scenarios B and C are similar and both less than Scenario D.

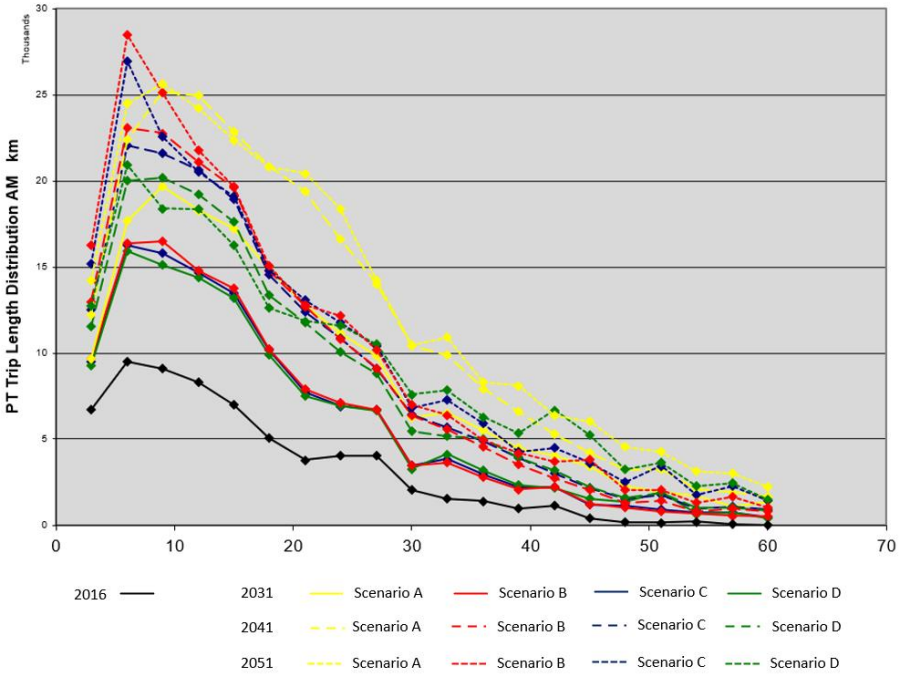


Figure 18– PT Trip Length Distribution in km (AM)

Looking at car trips less than 10km (AM peak), there are significantly more of these in number because these would generally be quicker trips. The pattern is slightly different, with Scenario A considerably lower than the other three scenarios which are all similar. But a lower number of car trips could be showing that accessibility is by other means including public transport and active modes so doesn't illustrate reduced accessibility.

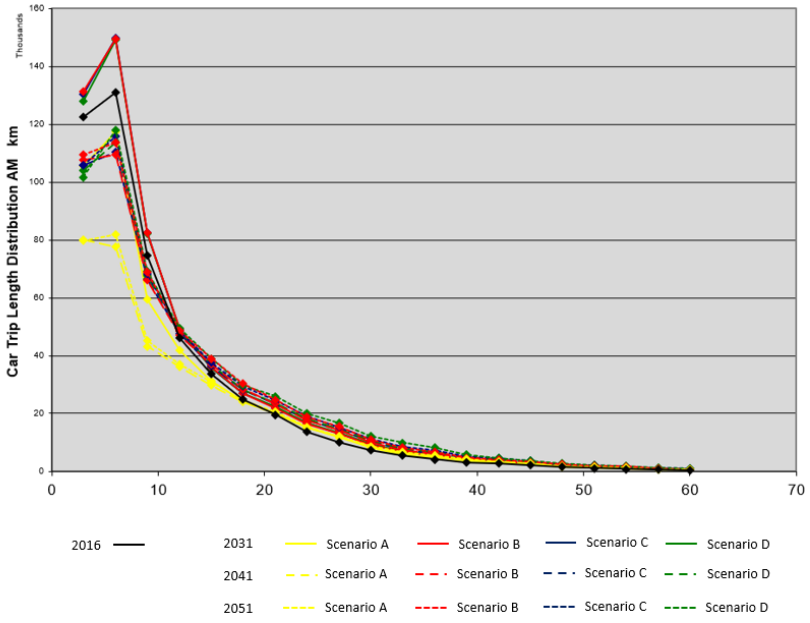


Figure 19 - Car Trip Length Distribution in km (AM)

Scenario B has the most people in proximity to the City Centre (22 per cent), followed by Scenario A (20.5 per cent). Scenario C is slightly less (19 per cent), and Scenario D significantly less again (15.9 per cent) reducing from 2041. A similar pattern is evident for the City Fringe. For Metropolitan Centres, Scenario A has the greatest proportion (58 per cent) of the population within 30 mins, with little

difference between Scenario B (51.7 per cent) and Scenario C (49 per cent), and slightly less again for Scenario D (42 per cent). A similar pattern occurs for town centres, but the difference increases between Scenario A (62 per cent) and Scenario D (47 per cent) as you would expect given the land use approach taken for each scenario.

In summary, the evaluation identified the following key differentiating factors for accessibility to key economic activity:

- Scenario A has significantly more households in proximity to key destinations than Scenario D other than those areas on the periphery (i.e. Albany, Pukekohe and Papakura).
- Scenario D has a lower number of households with access to key destinations generally across the board because of the more spread-out nature of the urban form.
- Scenarios A and B are assumed to have a higher proportion of active modes within the walkable catchments of centres due to the scale of intensification focused in these areas. Therefore, accessibility by active modes is higher for these scenarios.
- Scenario C performs positively but less so than the more intensive scenarios and better than Scenario D.

All scenarios are assessed as positive at a regional level because public transport accessibility improves over time. Even Scenario D has improved access to key economic places such as Metropolitan Centres, including new centres such as Drury, and public transport services improve access to the City Centre and Airport. However, without the supporting public transport network accessibility for the Scenario D would reduce significantly.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+3	+3	+2	+1

Access to education

The following criterion was evaluated based on model outputs on access to tertiary education by number of modes available, reliability of mode, and travel time.

Extent to which education is accessible by different modes - PT, active (cycling, walking)

The Ministry of Education is required to provide adequate primary and secondary schools for the population, and it is assumed that this would be achieved for all scenarios. However, tertiary education is more centralized and therefore was the focus of the evaluation to differentiate scenarios.

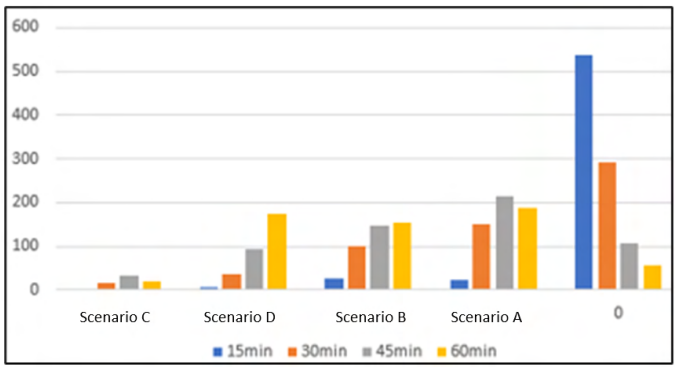


Figure 20 – Tertiary education accessible by PT, by travel time (2031, 3041, 2051)

While it is acknowledged that some areas may have poorer access, scoring is undertaken on a regional basis. Data on access to tertiary education by public transport enables consideration of which scenario has the most locations with the highest access. The graph (Figure 20) shows that accessibility changes over time, with significantly more locations with higher accessibility for Scenario A in the first decade but then evening out across the scenarios in the third decade. The '0' category reflects where there are all zeros for the particular MSM zones across the scenario.

Overall, looking across the three decades, Scenario C has the least locations with accessibility by public transport across all time periods compared to other scenarios. There is very limited accessibility within 15 mins of public transport, so this indicator was not considered further.

The evaluation focused on the third decade to determine the overall performance of scenarios identifying the following key differentiating factors:

- Scenario A performs best looking across most time periods 30/45/60 mins therefore significant positive.
- Scenarios B and D are scored as moderate positive because on the whole accessibility is similar, although Scenario B is significantly better than Scenario D within 30 mins and better for the other time periods.
- Scenario C performs similarly to Scenario B within 45 mins and 60 mins but worse for 30 mins and is therefore less positive.

All scenarios have significant gaps in the south reflecting the lack of tertiary institutions in the south. To better achieve accessibility to education will require additional tertiary institutions, particularly in the south. However, a complete public transport network that enables cross town connections will support improved accessibility to tertiary education.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+3	+2	+1	+2

Alignment of employment and population growth

The following criterion was evaluated based on model outputs looking at the location of job growth, as well as the mix of jobs available.

Extent to which employment opportunities are aligned with areas of population growth

Model outputs include industry floorspace by local board area providing a comparison of the types of jobs including healthcare, education, retail, office, industrial, and warehousing.

Healthcare jobs generally align with population growth. Where little population growth occurs the healthcare jobs are lower. The highest concentrations remain within the same local board areas across all scenarios, being Devonport-Takapuna and Otara-Papatoetoe. These areas include the North Shore Hospital and Middlemore Hospital. Scenario A has the greatest number of jobs in both local board areas and generally aligns with population growth.

Industrial and warehouse jobs are primarily focused in Māngere-Otahuhu, which includes the Airport, but all scenarios also have a significant increase in Rodney. Scenario A has the greatest increase in both areas, followed by Scenario B, then Scenario D and lastly Scenario C. A key issue for industry and warehouse jobs is the availability of vacant land and therefore it is not surprising that industry and warehouse jobs focus in areas with more land.

Primary and Secondary education jobs are evenly spread across the scenarios and local board areas and generally align with population growth. For example, the biggest variance between scenarios is in Rodney where Scenario D has the greatest growth, consistent with the population growth.

Retail and office jobs show similar growth trends across the scenarios with the most significant growth occurring in Māngere-Otahuhu, Rodney, and Franklin across all scenarios. Scenario D sees the greatest growth in retail jobs in Rodney but in Franklin it is Scenario A with the greatest growth in jobs, likely to reflect the focused development of the new Drury Metropolitan Centre. For office jobs, Scenario A has

the greatest growth in Rodney. In Māngere-Otahuhu Scenario A also has the greatest growth in retail and office jobs, followed by Scenario C for retail and Scenario B for office.

In Waitematā, which includes the City Centre, the greatest growth in retail is in Scenario B, then Scenario D and Scenario C. Scenario A has the lowest growth in retail jobs and almost no growth in office jobs reflecting the emphasis on dispersing jobs with population growth.

Across all scenarios the model favours greenfield areas with the most job growth in Rodney and then Franklin. Therefore, Scenario D has a slightly higher number of overall jobs.

In summary, the evaluation identified the following key differentiating factors for alignment of employment and population growth:

- Scenario A sought to provide a greater balance of jobs with population growth and provides the greatest mix of jobs based on the assumption that mixed-use occurs in all intensification areas. The other scenarios have a similar land use pattern in terms of employment and therefore the mix of jobs does not vary much.
- Scenarios B and C show similar results with mismatches across some urban areas, relying heavily on the City Centre and Airport and not addressing the deficit of jobs at the periphery when compared to Scenario A.
- Scenario D is positive because it has a more even spread of jobs across the region including Silverdale West, Whenuapai, Drury, Warkworth and Pukekohe, as well as existing key employment areas of the City Centre and Airport. However, Scenario D also expands residential growth outwards and therefore increases the number of people travelling to across the region to other jobs.

It was agreed at the evaluation workshop that alignment of employment opportunities with population should be an assumption of all scenarios. Key places like the City Fringe, Airport, and East Tamaki will always be nearby for most jobs and draw labour from across the region. Providing business land opportunities in future urban areas provides opportunities to balance employment and housing.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+3	+2	+2	+1

Household living costs

The following criterion was evaluated based on model outputs on fuel consumption, public transport costs, vehicle kilometres travelled (VKT) and trip distance to work.

Extent to which household living costs can be reduced by increased proximity to employment opportunities

There is no exact measure for whether people drive or take public transport, so this is assumed from the distance travelled by mode and mode share. Public transport trips are assumed to be cheaper overall than the running costs of a vehicle. The costs of operating private vehicles form part of the transport model input assumptions and remain constant over the 30-year time period off-set in part by the significant increase in take up of electric vehicles.

The number of car trips over medium to longer distances are similar across Scenarios B – D, largely reflecting the similar distribution of employment growth.

In summary, the evaluation identified the following key differentiating factors for household living costs:

- Scenario A has the lowest VKT travelled and the highest proportion of public transport and active travel mode share (combined) out of all the scenarios. It shows a reduced number of car trips over a

short distance compared to the other scenarios as well as the highest number of jobs available within 15, 30, 45 and 60 mins from home by car and public transport.

- Although Scenarios B – D perform similarly in terms of VKT, Scenario B has the least VKT although the public transport network is not as extensive as Scenario D and as discussed under previous criteria it has accessibility more closely aligned with Scenario A.
- Scenarios C and D cannot be differentiated due to the similarity of model outputs and sit between Scenarios A and B.

The indicated number of reduced car trips over a shorter distance and the high number of public transport trips combined with the highest level of access to jobs by both car / public transport indicates that Scenario A may reduce household costs through reduced car trips over a shorter distance, a higher number of public transport trips and greater alignment of jobs and dwellings. The proportion of active mode travel is also assumed to be the highest under Scenario A reducing household costs.

At the evaluation workshop, the relativity between scenarios was agreed. The performance of Scenario A responds to a different set of transport assumptions compared to the other scenarios (i.e., working from home, best public transport network and lowest costs). Therefore, demonstrating the important role of policy interventions to support better transport outcomes.

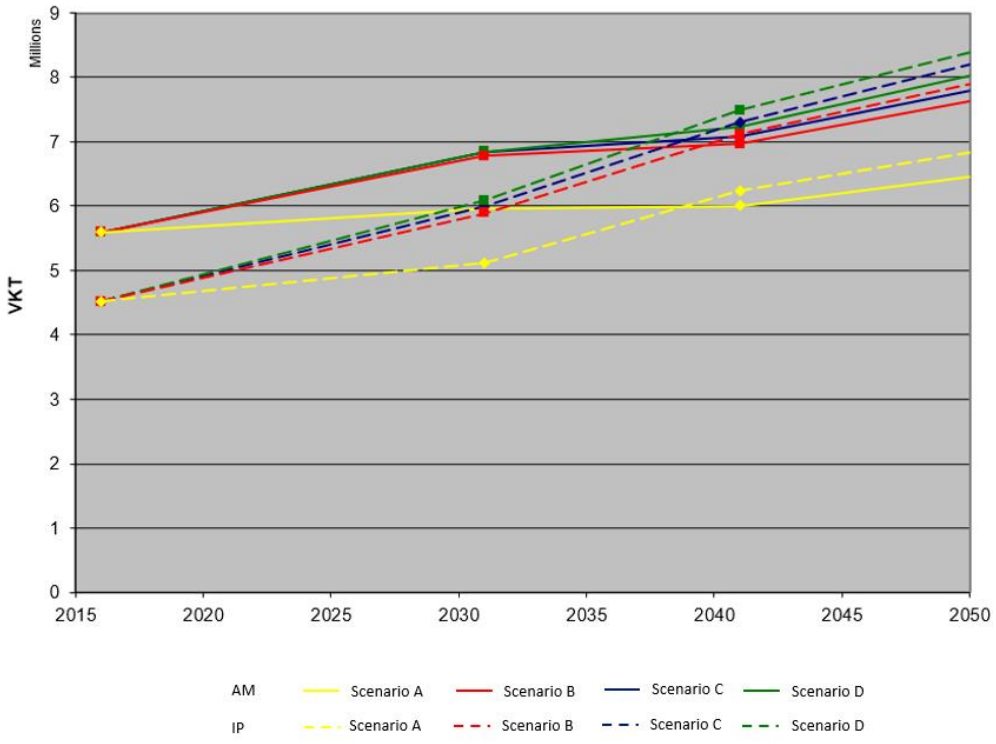


Figure 21 – Vehicle Kilometres travelled (AM and Interpeak)

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+3	+2	+1	+1

Accessibility of rural production areas

The following criterion was evaluated based on model outputs for congestion for heavy commercial vehicles (HCV) and key routes to the Port and Airport.

Extent to which rural production areas are accessible

Rural production is an important part of Auckland's economy. For the purposes of the assessment rural production areas are focused on productive land and not specifically highly productive soils. This recognises that other factors in addition to soils determine the productive capacity of land for primary production.[11] Therefore the focus of the evaluation is on access to rural production activity areas zoned Rural Production and Mixed Rural Production in the AUP.

In addition, to the areas with highly productive land parts of Rodney around Matakana and parts of Franklin such as Clevedon are highly productive for a range of primary products.

The proportion of HCV travel time spent in severe congestion (LOS E & F) AM and IP is considered most relevant and demonstrates that congestion increases across all scenarios to 2051 (Figure 22). Scenarios B – D increase from a 2016 base of 13.7 per cent to between 36.8 and 37.3 per cent in the interpeak period and as such the scenarios cannot be differentiated.

Scenario A performs significantly better than the other scenarios, particularly in the AM peak where congestion decreases slightly from 2016 levels. However, the scenario still increases in the interpeak period from a 2016 based of 13.7 per cent to 28 per cent which is less than the other scenarios.

While travel to access rural productive areas to move primary products does not necessarily need to travel at peak times there are times when this must occur in order to meet market requirements. Therefore, across all scenarios access is maintained to rural productive areas but accessibility worsens and so all are scored negatively.

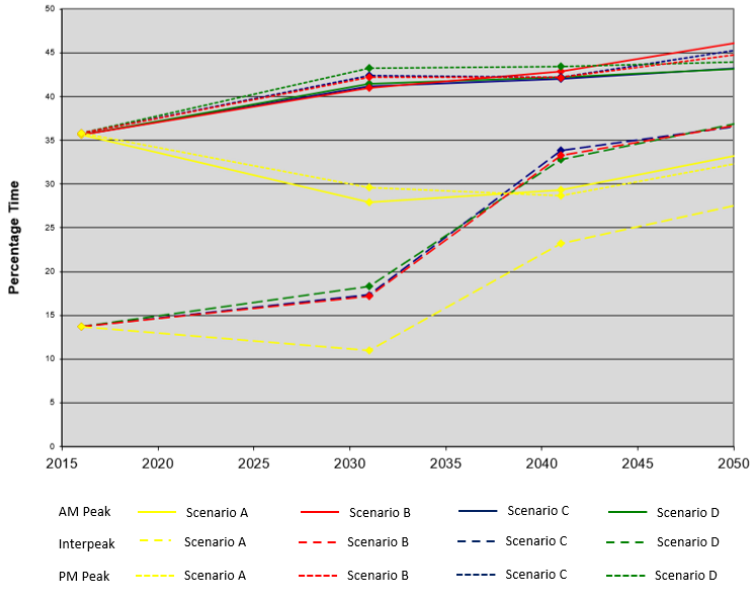


Figure 22 – Proportion of HCV travel time spent in congestion (LOS E and F)

[11] Valuing highly productive land: a discussion document on a proposed national policy statement for highly productive land.

At the evaluation workshop, it was acknowledged that there is a need to recognise the impact of encroaching urbanisation into rural areas affecting rural production when considering spatial form.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-2	-2	-2

Reliability of travel times

The following criterion was evaluated based on model outputs for levels of congestion.

Extent to which travel times are reliable

The issue of concern for reliable travel times relates to economic impacts and therefore the focus of the evaluation is congestion on the freight network, congestion by mode, and congestion on different road classifications.

In summary, the evaluation identified the following key differentiating factors for the reliability of travel times:

- Scenario A performs significantly better than the other scenarios across all the measures of congestion evaluated but still sees increased congestion and will therefore have negative impacts.
- Investment in roads and public transport in 2041 see some increased differentiation between the scenarios. Scenario D sees a reduced percentage of time by mode in severe congestion compared to Scenarios B and C (Figure 23). However, there is little differentiation overall between Scenarios B – D across the congestion measures with all worsening against 2016 levels, particularly in the interpeak periods.

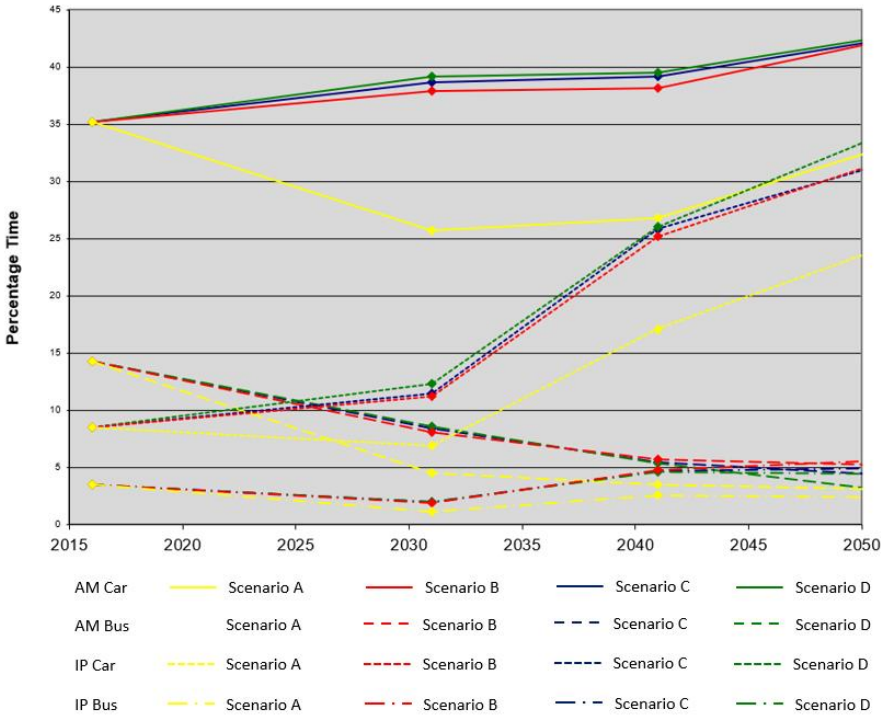


Figure 23 – Percentage of time by mode in severe congestion (LOS E and F)

At the evaluation workshop, issues discussed included the number of transfers and the capacity of the public transport affecting reliability for commuters. Where there are both congestion and capacity issues for public transport the problem will therefore be bigger.

The evaluation demonstrates that the reliability of travel is heavily influenced by investment in both roads and public transport, and less so by where additional growth is located.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-2	-2	-2

Opportunities for agglomeration

The following criterion was evaluated based on model outputs on the concentration of job types within the same location and assumes that the intensity of jobs reflects increased opportunities for agglomeration.

Extent to which opportunities for the agglomeration of similar/dependent industries are provided

Model outputs on the number of jobs by local board area show that all scenarios have much the same pattern, with jobs focused in Rodney, Franklin, Waitematā and Māngere-Otahuhu. Within these local board areas are the existing key employment areas of the City Centre and the Airport, as well as new greenfield employment areas.

A lower proportion of jobs in Waitematā (7 per cent) under Scenario A reflects the approach taken to disperse jobs. This has also resulted in the greatest proportion of jobs in Rodney and Franklin (62 per cent combined) compared to other scenarios. When you take out the outliers, jobs in Scenario A are fairly evenly spread out across the other local board areas but there isn't much left to distribute because the model prefers the key employment areas where agglomeration is already occurring.

Looking at the distribution of jobs, the key opportunities for agglomeration will continue to occur in and around the City Centre and Airport as well as new areas in Rodney and Franklin. It is likely that the model chooses job growth in Rodney and Franklin because of congestion charging and increased costs of travelling to the City Centre, therefore making the periphery more attractive.

In summary, the evaluation identified the following key differentiating factors for agglomeration opportunities:

- Scenario A provides the greatest intensification in centres and walkable catchments to rapid and frequent transit networks and therefore places skills closer to potential locations for agglomeration.
- Scenario D spreads things further out and therefore potentially reduces opportunities for agglomeration.
- Scenario B and C can be considered much the same in terms of opportunities for agglomeration and sit between Scenarios A and D.

At the evaluation workshop, it was identified that empirical research indicates that the most important thing for maximizing agglomeration effects is loosening of land use restrictions.[12] Scenario A achieves this best with an assumption that all intensification areas are mixed-use providing the greatest flexibility, rather than focusing on providing additional land. Therefore, Scenario A scored significant positive.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+3	+1	+1	-1

[12] Morretti and Hseih (2017).

Availability of Group 1 business land

The following criterion was evaluated based on model outputs on the amount of floorspace available for industrial and warehousing.

Extent to which suitable land is available for Group 1 (land extensive) business

The Auckland Plan 2012 identified the need for 1400ha greenfield land for business growth including 1,000ha for Group 1 business activities. All scenarios sought to provide additional greenfield land to accommodate Group 1 business land. However, none of the scenarios achieved the scale of Group 1 business land required to meet the anticipated demand and all were considerably below at less than 50 per cent):

- Scenario A = 449ha,
- Scenario B = 215ha.
- Scenario C = 412ha, and
- Scenario D = 414ha,

All scenarios are scored negatively because they do not meet the demand for Group 1 business land and there is little to differentiate between the scenarios other than the fact that Scenario B produced significantly less than the others.

None of the scenarios identified adequate capacity for jobs – particularly Group 1 in the greenfield areas and therefore the model was unable to allocate sufficient growth for Group 1 activities. The model appeared to focus growth within the existing urban area but with insufficient vacant land the demand could not be met by any of the scenarios. Additional greenfield land will need to be identified to provide sufficient land for Group 1 business activities.

The model allocated most industrial and warehousing floorspace in Māngere-Otahuhu across all scenarios, then Rodney and then Franklin. The model does not recognize the additional capacity that is provided for in the greenfield areas of Rodney and Franklin in any of the scenarios or it does not consider these areas to be attractive. Equally, additional land provided at Whenuapai in Upper Harbour was not taken up.

The land use model allocates a proportion of the employment capacity inputs across the four different industry types according to the assumptions of the model (discussed earlier). In future urban areas where the MSM zones are large and currently rural, the model does not necessarily respond according to the intention of the scenario. There are limitations to the value of using the model results to inform the Future Development Strategy, and a detailed analysis of Group 1 business land needs and the appropriate locations for growth is required such as that being undertaken through the Housing and Business Assessment.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-2	-3	-2	-2

Committed infrastructure

The following criterion was evaluated by subject matter expert.

Extent to which scenarios support current committed infrastructure

Committed infrastructure is those projects in the council's 10-year budget and beyond 10 years it is those projects identified in asset management plans. This assumes that none of the planned growth investments can be redirected.

In summary, the evaluation identified the following key differentiating factors for committed infrastructure:

- Scenario C performs the best because it most closely resembles the current growth scenario used and the current basis used to inform infrastructure investment planning. The Scenario C is also different to the status quo because it avoids some future urban areas reducing infrastructure costs making it a significant positive.
- Scenario A and B may require more upgrades in the existing urban area than currently planned for or may make existing investment more efficient. However, Scenario A is anticipated to be more divergent from committed plans compared to Scenario B and this differentiates them from one another.
- Scenario D performs the worst, not only is it the most divergent from our current approach but it would also have the greatest monetary cost for new infrastructure investments. It would require significantly altered budgets, beyond what the council and CCOs are able to afford with a consequential increase to operating budgets causing affordability challenges.

At the evaluation workshop, it was acknowledged that this criterion favours the status quo. It is important to understand the difference between the scenarios in relation to committed infrastructure to understand the implications of changing the approach to growth.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+1	+2	+3	-2

Infrastructure costs

The following criterion was evaluated by subject matter expert.

The extent to which scenario results in measurable public monetary costs or losses over time

Investment intention exists for all growth scenarios and not funding infrastructure is not an option. Therefore, scoring is relative to the return on investment from the available pool of money.

In summary, the evaluation identified the following key differentiating factors for infrastructure costs:

- Scenario A results in the most efficient use of infrastructure and the least monetary cost.
- Scenario B enables higher density and infill likely to generate less

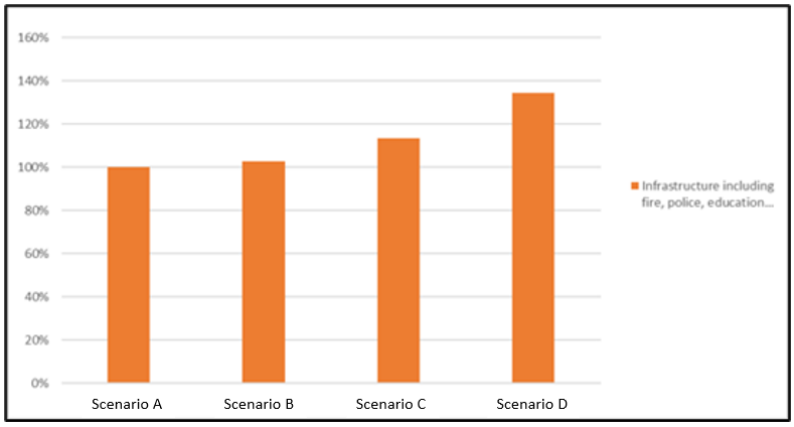


Figure 24 – Relative cost of infrastructure to service expected growth

traffic and shorter trips, with consequentially more cost-efficient operations and maintenance expenditure.

- Scenario C has good utilisation of existing infrastructure but still requires new infrastructure to support future urban areas and therefore has minor negative impacts.
- Scenario D requires the greatest amount of new infrastructure with the most significant costs (35 per cent higher than Scenario A) and least efficient use of infrastructure because of lower intensification in existing urban areas and expansion into additional future urban areas.

Efficiency is considered a core element of the scoring assumption. However, the differentiation between the scenarios is not significant. Scenario A utilizes existing infrastructure but there are upgrade costs to provide sufficient capacity although less extension is required.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+2	+1	-1	-3

Costs of development

The following criterion was evaluated by subject matter expert based on GIS analysis of land affected by physical constraints that make development more expensive. Physical constraints are identified through GeoMaps and include peat soils, unstable land, and steep slopes and GIS analysis identifies the proportion of each MSM zone are affected by physical constraints.

Extent to which physical constraints increase the cost of development

All scenarios are scored negatively because they all include some areas affected by physical constraints.

In summary, the evaluation identified the following key differentiating factors for costs of development:

- Scenario B performs well by avoiding or limiting growth in some areas but has relatively high growth in the City Centre waterfront and Māngere as well as Warkworth. Scenario C is more evenly spread and while limiting growth in some areas does not avoid any. Scenarios B and C are similarly affected by constrained areas, although in different places, and cannot be differentiated
- Scenario A performs only slightly better than Scenarios B and C because it avoids growth in Drury East, Takaanini, and Pukekohe and has limited growth in areas such as the City Centre waterfront, Maraetai and Pukekohe.
- Scenario D has the highest proportion of growth within constrained areas and therefore would be more costly to develop. Key areas of concern include Drury East, Takaanini, North Shore as illustrated by Figure 25.

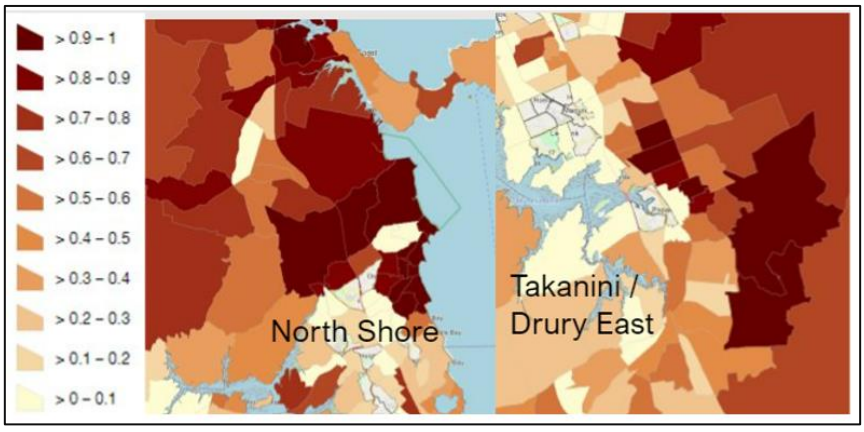


Figure 25 – Proportion of MSM zone affected by physical constraints

At the evaluation workshop, the relativity between the scenarios was agreed because Scenario D takes development into more marginal land. However, it was also acknowledged that within existing urban areas there may be additional development costs that are not addressed by the evaluation.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	-1	-2	-2	-3

Market feasibility

The following criterion was evaluated by subject matter expert considering how each scenario responded to market attractive areas, determined as those areas with high land values.

Extent to which the market is likely to respond to the proposed land use pattern

In summary, the evaluation identified the following key differentiating factors for market feasibility:

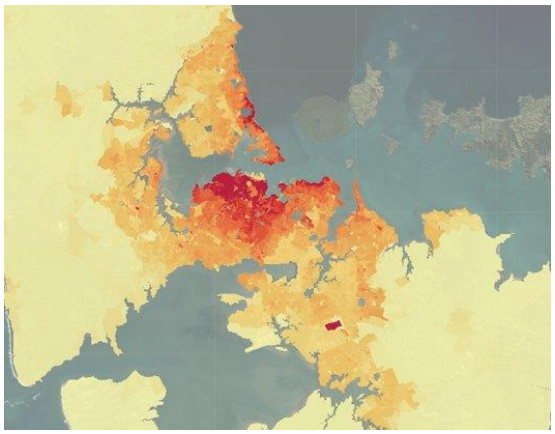


Figure 26 – Auckland Council rates revaluation data (2021)

- Scenario A is more weighted to central areas and rapid transit with more opportunities for residential growth to align with demand patterns compared to Scenario B, while also assuming supply constraints are removed. However, the more dispersed pattern of job growth is more than theory and evidence suggest is plausible reducing overall feasibility.
- Scenario B is more weighted to central areas with more growth enabled around rapid transit and near existing employment hubs. The impact on wellbeing is positive as more opportunities for residential growth align with demand patterns.
- Scenario C is consistent with recent trends in residential growth towards more central areas, including major employment areas. However, the supply constraints in central areas remain which maintain displacement to less attractive areas.
- Scenario D places more growth in peripheral areas where there is low demand and is unlikely to be market feasible. It implies that people are willing to live in lower-demand areas, further from the things they value. Outer areas where demand is lower will be in competition with higher-demand areas. The scenario undervalues the social costs of sprawl and implies inefficient infrastructure.

The following key principles for market feasibility were identified through the evaluation:

- Land values are the primary indicator of demand for a location as they represent what buyers are willing to pay for the attributes of that location (illustrated in Figure 26).
- Preferences for location are driven by proximity to things of value. Proximity to jobs, transport and amenities, with convenience (travel time) and accessibility (mode options).
- Supply responds to demand – where developers are confident of sales, subject to opportunities being commercially feasible.
- Planning can enable or constrain supply.
- Infrastructure facilitates demand whether greenfield or brownfield.
- The extent of commitment to public transport investment will impact market feasibility.

	Scenario A	Scenario B	Scenario C	Scenario D
Evaluation scores	+1	+1	-1	-2

Approach for the Future Development Strategy review

The evaluation scores provide a useful indicator of the relativities between the scenarios. There was a strong inter-relationship between the scenarios and the criteria they are measured against. Therefore, the key findings drawn from the results of the evaluation are thematic and cover several criteria.

Key findings

When comparing the scenarios, Scenario A performs the best overall because of significant shifts in land use and transport assumptions. Therefore, demonstrating that significant shifts are needed if we want to achieve a step-change in behaviour.

The following themes reflect the key findings from the evaluation of the scenarios. They are not isolated factors but are integrated elements that are needed to deliver a quality compact urban form and well-functioning urban environment.

Most of Auckland's future spatial form already exists and growth has limited influence

Over the last 180 years Auckland has grown to a city of 1.65 million people, with an established built form. The scale and pattern of development that has occurred over time has responded to and modified geographical constraints and advantages, made decisions that have locked in options and precluded others, and invested in infrastructure, facilities and amenities that provide other opportunities. The built form we inherit includes the network of centres (large and small), employment areas, and the transport network. This means that additional growth in the short to medium term is small relative to existing well-established patterns and often has little observable influence (at a macro scale) over and above the larger weight of current travel patterns and behaviour. However, over the longer term, even small changes in direction can be compounding.

The evaluation found there was little differentiation between the scenarios in terms of model outputs relating to travel behaviour, except for Scenario A which is the most intensive. This is somewhat expected given that aside from the timing of some projects, the transport network and 'exogenous' assumptions in all the scenarios are largely the same (except Scenario A where urban form and transport assumptions are more aligned with the objectives and direction set in TERP).

The additional growth reflected by the 'take up' of capacity in the different scenarios has limited weight on current travel patterns and behaviour (acknowledging the potential shortcomings of modelling). Key destinations for household trips such as employment areas and education facilities are well established (and largely assumed to remain where they are) and so changing the location of future dwellings (e.g. adding more origins, more or less dispersed) alone does not materially affect existing travel patterns, other than reinforcing them by adding more trips.

Auckland's existing urban form compared with expected growth over this period illustrates that it will be hard for land use on its own to achieve transformational changes to urban form or the way that community's function over the next 10, 20 and 30 years.

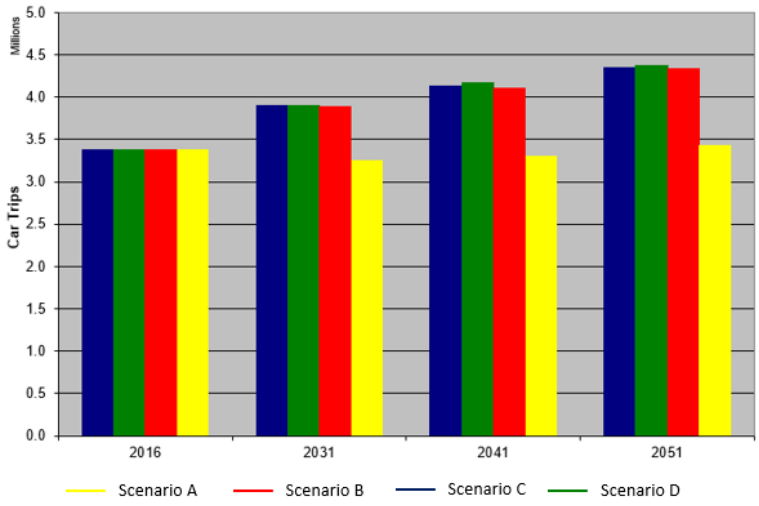


Figure 27 – Daily Car Trips

The evaluation found the greatest reduction in daily trips per capita occurred in response Scenario A which included alternative transport assumptions (i.e. more jobs associated with dwelling growth, working from home). While the transport network was the same across all scenarios for the first decade, a significant reduction in daily trips occurred within the first 10 years of Scenario A with little change after that. While congestion charges are also relevant, these were constant across all scenarios.

Determining the location of land uses will only take us so far

The evaluation process suggests that while appropriately considering land use and avoiding no-go areas is important, many environmental impacts can be appropriately managed by good or best practice supported by a strong policy framework. However, it is important to note that none are currently in place and this will not be the case for all environmental impacts (i.e. carbon emissions).

Urban development is a significant contributing factor to environmental outcomes. For example, the Freshwater Management Tool[13] demonstrates that the highest levels of sedimentation in Auckland's watercourses is from stream bank erosion from increased impervious surfaces in the catchments that increase runoff flows. Focusing growth within the existing urban footprint can reduce impacts on the environment from urbanisation of greenfields – effectively avoiding sedimentation in development catchments. However, overall evaluation against environmental criteria suggests that while more intensive urban forms reduce potential environmental impacts, it will be important to have a strong policy framework to implement best practice in order to avoid, remedy, or mitigate impacts of growth.

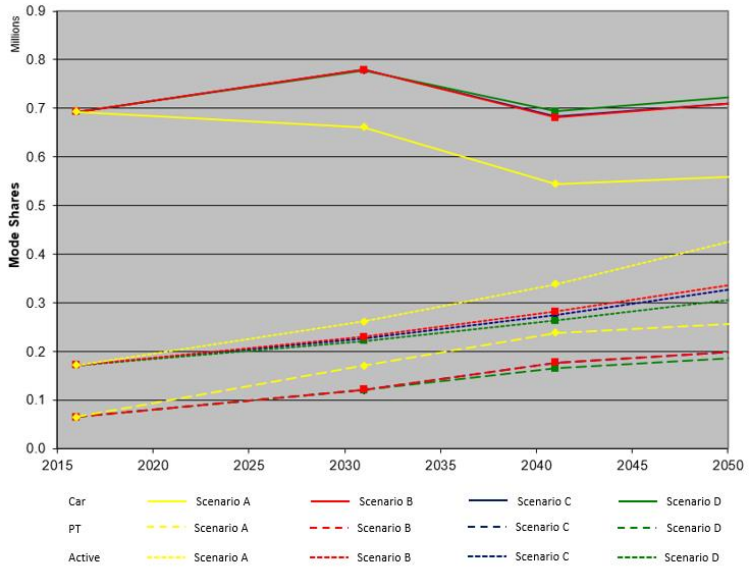


Figure 28 – Morning peak mode share (Car, PT, and active)

[13] See https://www.knowledgeauckland.org.nz/publications/freshwater-management-tool-report-1-baseline-data-inputs/ and https://www.knowledgeauckland.org.nz/publications/freshwater-management-tool-report-2-baseline-configuration-and-performance/

TERP[14] seeks radical shifts over the next 10 years to achieve the goals to reduce carbon emissions from transport to give effect to Te Tāruke a Tāwhiri: Auckland's Climate Plan. Scenario A attempted to develop a land use pattern aligned with the principles and direction of TERP, and to reduce vehicle kilometres travelled. While VKT for light vehicles decreased for Scenario A it was not significant, the land use pattern did support a higher level of mode shift from cars to public transport and active modes compared to other scenarios (Figure 28).

Achieving the outcomes sought by TERP will require ambitious policy support, in addition to land use decisions, to enable the shift to sustainable modes of transport (including public transport and electric vehicles) to happen faster. More intensive mixed land uses can help drive travel behaviour change, but only if safe, attractive and affordable alternatives are provided, and the mix of land uses provides for the majority of day-to-day needs. It is also important to note that even the 'best' location might not meet the needs of every member of every household in the immediate vicinity, and travel for work, recreation or specialist facilities will always need to occur and be provided for.

Generally, all scenarios had negative impacts because urban development will have some environmental impacts – future traffic is generally greater than present and, in all cases increases. More intensive scenarios and utilisation of the existing urban area were identified through the evaluation to provide opportunities for environmental enhancement and mitigation in brownfields and avoid potential new impacts in greenfield areas. However, structure planning in greenfield areas also provide opportunities to achieve positive environmental outcomes such as stream enhancement and restoration[15]. Regardless of the location of growth, achieving positive environmental outcomes requires a strong policy framework.

A key assumption of all scenarios was that development would not occur in areas affected natural hazards. However, only Scenario A explicitly accounted for this by not allocating any growth to MSM zones significantly affected by natural hazards. In other scenarios growth was allocated and it was assumed that development occurred outside natural hazards areas. The evaluation determined that locating growth within MSM zones that include areas subject to flooding, coastal erosion or coastal inundation will have a negative impact because risk is increased. How development occurs in or near areas at risk from natural hazards will need to be determined through policy decisions. Intensification, where development occurs outside of hazard prone areas can provide opportunities to reconfigure growth through redevelopment to avoid, remedy or mitigate the effects of natural hazards.

A strong policy framework includes not just the directive to avoid or manage effects, but policies and rules that are enforceable and require implementation. Ensuring good practice is practised so that policy outcomes are achieved remains the most significant challenge in all locations/scenarios.

Land use and infrastructure integration, particularly transport, is fundamental to spatial planning

Scenarios that focused growth within the existing urban area and specifically within the walkable catchments of the rapid and frequent transit networks performed better against the transport criteria specifically but also the environmental, social and cultural criteria.

Focusing growth within walkable catchments of centres and rapid/frequent transit supports higher levels of accessibility to a wider range of employment, education, health, open space, services and

[14] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/Pages/transport-emissions-reduction-pathway.aspx

[15] This protection and enhancement could also occur without immediately proximate urban development with the appropriate policy framework and may in fact be required to achieve NPSFM requirements.

amenities through both public transport and active modes. As illustrated above, Scenario A demonstrated that where growth of jobs and housing is more balanced and focused in more intensive and mixed-use centres the active mode share was higher.

While all scenarios had a well-connected public transport network to support growth, improvements are also required to the public transport network within existing areas. Scenario B demonstrated that where the public transport network was only aligned with growth and didn't address gaps in the public transport network (i.e. Kumeū/Huapai), the travel behaviour of existing areas reduced the overall performance of the scenario against transport criteria.

The evaluation determined that the more intensive the compact urban form the better it performs in terms of least monetary cost of infrastructure over time, as they result in more efficient utilisation of existing services and require less new infrastructure. More expansive urban forms require the greatest amount of new infrastructure with the most significant costs, which is also spread over fewer users.

In general, the capital and operational costs of infrastructure, for a given population and economy, increases as the urban area increases. This increase in area equates to longer, more dispersed, less efficient higher cost networks with fewer users (i.e. higher prices) per unit of infrastructure. Therefore, infrastructure costs are considered to be greater for more expansive and lower for the more intensive scenarios.

Not funding required infrastructure is not an option and as such the evaluation of scenarios focused on the return on investment from the available funds. The more intensive the scenario the higher the return on existing investment by more efficiently utilising existing and planned infrastructure. Costs associated with upgrades of existing infrastructure to provide sufficient capacity are offset by not needing to extend infrastructure into future urban areas. The evaluation of the costs of infrastructure confirmed that initial capital costs and operating costs of sprawling developments outweigh the costs associated with inner-city redevelopment. This was validated by actual known infrastructure costs which showed greenfield development locations such as Drury, Redhills, Whenuapai, Westgate have significantly greater costs when compared with brownfield development locations such as Tāmaki, Mt Roskill and Māngere.

The importance of locating homes and jobs in close proximity

A well-connected public transport network provides for multi-trips to cross the region and any successful scenario will need to integrate land use and transport. More intensive scenarios support the take-up of mixed-use communities reducing the need to travel by car for short trips to access services, facilities, and social networks. Improved access across the region also supports those areas currently experiencing social deprivation and facilitates better access to a wider range of jobs and education (amenities that are less likely to move and difficult to retrospectively create).

Locating more employment opportunities either near dwellings or accessible from a well-connected public transport network, along with supporting transport policies had the biggest impact on improving travel patterns and behaviour (reduced VKT, increased public transport mode share). Scenarios that relied on the current employment areas for jobs all performed similarly regardless of the location of dwellings, because travel was required to largely the same destinations for jobs and education, the only difference being how dispersed relative to these destinations growth was – for this reason Scenario D which put more people at a greater average distance from most things performed the worst.

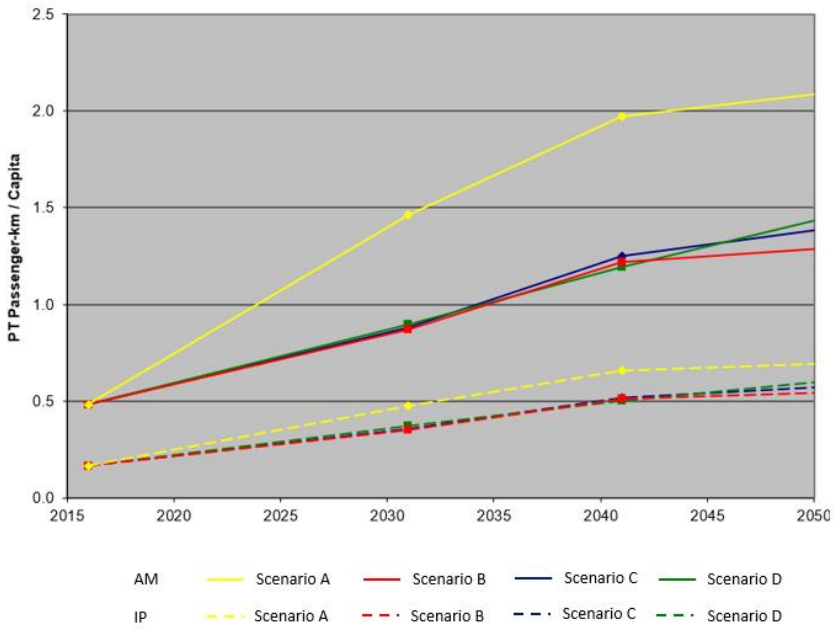


Figure 29 – Public Transport Passenger Km per Capita (AM an Interpeak)

Modelling demonstrated that where intensive scenarios were integrated with public transport there was an increased utilisation of public transport. Figure 29 illustrates that it is not enough to have an intensive urban form, but this must be integrated with public transport. Scenario A performs significantly better than other scenarios, including Scenario B on this measure, partially explained by variations in the exogenous modelling assumptions imposed in this particular scenario relative to the other three but also better balances employment opportunities with population growth.

Principles for growth

The findings of the evaluation process provided for the identification of several principals for growth that will inform the preferred spatial land use pattern to be included in the Future Development Strategy (Box 4).

Box 4 – Key principles for the future growth pattern

Residential development capacity

- Housing types and location choices will be provided through a combination of intensification within walking distance from centres and rapid/frequent transit networks (six storeys plus) and committed future urban areas (live zoned), plus medium density across the urban environment.
- Natural and built heritage protection (including some special character areas) can be achieved while providing for substantial intensification within the central isthmus.
- Rely on additional future urban areas only where required to meet demand for housing (and contributing to other outcomes sought).
- Avoid future urban areas that are subject to significant hazards (i.e. Takaanini, Ōpaheke).
- Enable some growth within market attractive areas in proximity to the city centre and high amenity areas such as the eastern beaches.

Employment development capacity

- Focus growth within existing urban areas along rapid and frequent transit networks, centres, and future urban areas where required to meet demand for employment.
- Identify sufficient greenfield business land (at least 1,000 ha) to meet demand for Group 1 land extensive industrial activities.
- Provide for new centre / metropolitan centre zones within future urban areas.
- Increase jobs in sub-regions (nodes) and future urban areas, as well as local employment areas to locate jobs near housing to reduce vehicle kilometres travelled and increase active mode share.
- Rely on higher proportion of redevelopment (especially mixed use) in older/central business areas, and vacant/vacant potential in newer business areas that have been recently developed.

Rural

- Avoid all highly productive land outside identified future urban areas but also identify opportunities to slow or avoid growth within these areas (i.e. Pukekohe).
- Limit growth in rural settlements while also providing for growth including jobs for social and economic wellbeing through intensification in first instance.
- Limit residential growth across rural zoned land.

Other principles

- Avoid natural hazard areas including flooding and coastal inundation.
- Consider mitigation and adaptation opportunities within existing areas to better accommodate existing communities rather than accommodating more growth.
- Align growth to committed infrastructure (funded in 2021 Long Term Plan) and minimise the expansion of existing infrastructure networks as much as practicable to reduce costs of new infrastructure.
- Support mixed-use communities to provide most of what people need within 15-20 mins walking, cycling or public transport distance.
- Improve equity of access and enable a greater distribution of jobs.
- Increase public transport capacity and frequency and improve travel reliability to make public transport a viable mode alternative.

Appendix A Growth scenario narratives

Scenario A

Narrative

The most intensive scenario provides growth that aims to both reduce overall greenhouse emissions and avoid locations increasingly impacted by climate change, such as low-lying coastal areas and floodplains.

This scenario allows for a growth option that focuses on public transport and walkable catchments within dense centres, nodes and corridors. Rural expansion is avoided and uptake of future urban areas is limited and pushed out to later decades. Employment is provided for close to homes and through a wider mix of uses. Elite and Prime soils are protected for food production and coastal and flood-prone areas are avoided.

Growth in Centres and Corridors - Growth is provided in the walkable catchments of centres, nodes and corridors located along the Future Transit Network. No suburban infill occurs outside the walkable catchments. Greater intensification around the isthmus as well sub-regional and metro centres (i.e. Albany, Westgate, Manukau, Papakura, Botany, and Henderson).

Future urban areas - Existing future urban areas will have extents reduced and timeframes pushed out by decades. No new future urban areas are identified. Drury is a focus for growth as are areas that provide for employment land. Infrastructure and flooding constrained areas will not be developed.

Rural growth - Growth in rural towns and villages will be limited to the existing urban extent. No new urban land will be provided. Rural urban boundaries will be established around settlements to constrain residential and employment growth.

Employment - Location of employment and residential areas are co-ordinated and balanced in close proximity. Any greenfield employment and growth on the urban periphery is to serve existing populations and balance deficiencies (e.g. Whenuapai). Higher proportion of those with jobs that are able to will working from home some of the time (i.e. 1 day per week).

Additional land for land extensive industries is provided in those future urban areas that are structure-panned to provide for this type of employment (e.g. Silverdale West).

Infrastructure - Public transport projects are bought forward and prioritised with associated increases in growth and to enhance underserviced areas. Growth around CRL, A2B and ALR stations. Focus on providing efficient walking and cycling networks to increase active mode share and improving frequency and capacity of ferries. Second harbour crossing provides for Public Transport only.

Climate Change – Some coastal areas in the existing urban area will be impacted by sea level rise and/or coastal inundation which makes these areas unsuitable for urban growth. Growth and development need to occur in a way that supports a reduction in transport emissions. Infrastructure in locations that are at risk from the impacts of climate change need to be protected or relocated.

Environment - Growth and development need to create opportunities to improve environmental outcomes. The existing state of the environment may mean that growth and development is not suitable in some locations. Future urban areas with floodplains are avoided while floodplains in existing urban areas are redeveloped (to allow for adaptation and mitigation). Productive soils are avoided. The scenario provides for enhanced environmental design and practices including water sensitive design, provision of open space and blue/green networks.

Scenario B

Narrative

An intensive scenario that concentrates growth within the existing urban area through the better alignment of walkable catchments, transport (primarily Rapid Transit Networks) and land use whilst considering the effects on the environment.

This scenario largely reinforces the current urban form but with higher levels of intensification. Future growth in the City Centre and City Centre Fringe is supported and enhanced, ensuring agglomeration benefits are likely to be achieved. Similar productivity gains are likely to occur in the nodes of Albany, Westgate and Manukau which will accommodate a significant proportion of Auckland's future residential and employment growth.

Growth in Centres and Corridors - The majority of growth will be provided for in the walkable catchments of centres and corridors that are serviced by the Rapid Transit Network. Some growth may also occur in centres and corridors that are well-serviced by the Frequent Transit Network. Focused growth in sub-regional centres (including Manukau, New Lynn, Newmarket and Botany) and additional intensification of inner suburbs of the Isthmus.

Future urban areas – Areas that are committed for growth (live zones) will continue to growth. However, growth will occur more slowly in future urban areas, beyond the 30-year timeframe of this scenario. No new future urban areas are provided for.

Rural growth - Growth in rural towns and villages will be limited to the existing urban extent. No new urban land will be provided. Provision of residential and employment growth in the general rural area will also be limited.

Employment - Office and retail employment growth in this scenario is primarily focused in centres, existing business areas, and in some of the structure-planned future urban areas. This approach reinforces past employment growth trends and supports agglomeration benefits of business growth the City Centre and nodes. Some focused growth on the urban periphery to balance existing deficiencies (e.g. Drury).

Existing employment land is protected including industrial areas such as Manukau, Wiri, the Airport Precinct, Lincoln Road, Henderson, Target Road and Wairau Park, Mt Wellington and Penrose, East Tamaki and Papakura. Additional land for land extensive industries is provided in those future urban areas that are structure-panned to provide for this type of employment, for example Takaanini, Whenuapai, Drury South, Silverdale North and Warkworth.

Infrastructure - In this scenario, recent and committed infrastructure investment must be respected and growth provided in locations of new planned infrastructure.

Climate Change - Infrastructure in locations that are at risk from the impacts of climate change need to be protected or relocated. Growth avoids areas constrained by natural hazards such as flooding, sea level rise and/or coastal inundation. Growth and development need to occur in a way that supports a reduction in transport emissions.

Environment - Growth and development need to create opportunities to improve environmental outcomes. The existing state of the environment may mean that growth and development is not suitable in some locations. Future Urban Areas with floodplains are avoided while floodplains in existing urban areas are redeveloped (to allow for mitigation). Productive soils are protected.

Scenario C

Narrative

A quality compact scenario that seeks to provide for dispersed urban growth across the existing urban footprint allowing for the benefits derived from combined land use and transport focused growth while minimising further effects on the environment through urban sprawl.

This scenario provides for growth widely distributed across the current urban form, with higher concentrations around centres and corridors but also allowing for suburban infill/redevelopment, growth in established rural centres and sequenced growth across future urban areas.

Growth in Centres and Corridors - Focused growth is provided for on those centres and corridors located on the Rapid Transit Networks and Frequent Transit Networks. Suburban housing and employment are provided for through infill and redevelopment. Warkworth and Pukekohe are important rural growth centres.

Future urban areas - Sequenced and managed growth provided for in future urban areas largely consistent with the Future Land Supply Strategy 2017. Future urban areas with major constraints such as flooding and infrastructure are not prioritised (e.g. Dairy Flat, Takaanini, Opaheke). Slower growth into the northwest future urban greenfield areas.

Rural growth - Growth in rural towns and villages is limited to the existing urban extent. No new urban land will be provided.

Employment - Office and retail employment growth is focused in centres, existing business areas, and in some of the structure-planned future urban areas. This approach reinforces past employment growth trends and supports agglomeration benefits of business growth in the City Centre and nodes.

Existing employment land is protected including industrial areas such as Manukau, Wiri, the Airport Precinct, Lincoln Road, Henderson, Target Road and Wairau Park, Mt Wellington and Penrose, East Tamaki and Papakura. Additional land for land extensive industries is provided in those future urban areas that are structure-panned to provide for this type of employment, for example Takaanini, Whenuapai, Drury South, Silverdale North and Warkworth.

Infrastructure - Sequenced growth around planned infrastructure including CRL, A2B and ALR stations.

Climate Change - Infrastructure in locations that are at risk from the impacts of climate change need to be protected or relocated. Growth avoids areas constrained by natural hazards such as flooding, sea level rise and/or coastal inundation. Growth and development need to occur in a way that supports a reduction in transport emissions.

Environment - Growth and development need to create opportunities to improve environmental outcomes. The existing state of the environment may mean that growth and development is not suitable in some locations. Future urban areas with floodplains are avoided while floodplains in existing urban areas are redeveloped (to allow for mitigation). Productive soils are protected.

Scenario D

Narrative

The expansive scenario provides for growth that reflects market pressure for growth beyond the existing urban area. Growth is still focused in centres, corridors and nodes serviced by Rapid Transit Networks but these are refined to those considered more market attractive.

This scenario places less emphasis on the city centre and city fringe and more emphasis on residential infill across both urban and rural areas. Expansion into rural areas will create the need for additional public transport facilities and trade-offs in areas with prime and elite soil classifications. Expansion will, however, not be at the cost of the environment, i.e. no-go areas will remain protected.

Growth in Centres and Corridors - Key nodes located along the Rapid Transit Network that market-attractive are identified for growth. Diminished emphasis on the City Centre and City Fringe for growth as well as along the Frequent Transit Network. Large amounts of infill within suburban and rural areas. Warkworth and Pukekohe are important rural growth centres.

Future urban areas - Future urban areas (existing and new) are key areas for growth, including new growth corridors between Westgate and Kumeu/Westgate as well as Drury West and Pukekohe. Areas of growth identified around new rail stations at Drury Central, Drury West and Paerata. Sequenced and managed growth provided for in future urban areas, and areas with major constraints such as flooding and infrastructure are not prioritised (e.g. Dairy Flat, Takaanini, Opaheke). Slower growth into the northwest future urban greenfield areas.

Rural growth - Rural areas considered market attractive are identified for growth through expansion and infill/redevelopment although there may be no public transport.

Employment - Office and retail employment growth is focused in centres, existing business areas, and in some of the structure-planned future urban areas. This approach reinforces past employment growth trends and supports agglomeration benefits of business growth in the City Centre and nodes.

Existing employment land is protected including industrial areas such as Manukau, Wiri, the Airport Precinct, Lincoln Road, Henderson, Target Road and Wairau Park, Mt Wellington and Penrose, East Tamaki and Papakura. Additional land for land extensive industries is provided in those future urban areas that are structure-panned to provide for this type of employment, for example Takaanini, Whenuapai, Drury South, Silverdale North and Warkworth.

Infrastructure - Scenario requires new infrastructure projects to support growth, however existing planned and committed infrastructure investment is still supported by growth where it aligns with market-attractive locations. Diminished allocation of growth around CRL, A2B and ALR.

Climate Change - Infrastructure in locations that are at risk from the impacts of climate change need to be protected or relocated. Growth avoids areas constrained by natural hazards such as flooding, sea level rise and/or coastal inundation. Growth and development need to occur in a way that supports a reduction in transport emissions.

Environment - Growth and development need to create opportunities to improve environmental outcomes. The existing state of the environment may mean that growth and development is not suitable in some locations. Urban growth will conflict with the protection of elite and prime soils and while protecting No-go areas will start to encroach on them. Future urban areas with floodplains are avoided while floodplains in existing urban areas are redeveloped (to allow for mitigation). Productive soils are protected.

Appendix B Transport projects

ATAP

ATAP Project No.	Project
1	Dome Valley Safety Improvements (Waka Kotahi)
2	Matakana Link Road (AT)
3	Safety Programme - Matakana Road (Melwood Drive to Green Road) (AT)
4	Rodney Targeted Rate - Warkworth Community Transport Hub (AT)
5	Puhoi-Warkworth (Waka Kotahi)
6	Safety Programme – Hibiscus Coast Highway (Hatfields Bridge to Waiwera Road) (AT)
7	Wainui Improvements (AT)
8	Penlink (Waka Kotahi / NZUP)
9	Glenvar Road / East Coast Road intersection and corridor improvements (AT)
10	Medallion Drive Link (AT)
11	Northern Corridor (includes busway extension) (Waka Kotahi)
12	Rosedale Road Corridor (AT)
13	Rosedale and Constellation Bus Stations (AT)
14	Northern Busway Enhancements (AT)
15	SH16 Brigham Creek-Waimauku (Waka Kotahi)
16	Huapai Improvements (AT)
17	SH18 Squadron Drive Interchange Upgrade (Waka Kotahi)
18	Greenfield transport infrastructure – Northwest (AT) and Northwest Growth Improvements (AT)
19	Northwest Interim Bus Improvements (AT/CRRF)
20	Lincoln Road Corridor Improvements (AT)
21	Te Whau Pathway (Auckland Council)
22	Public Transport Minor Capital Improvements - Neighbourhood Interchanges (AT)
23	Urban Cycleways Programme (AT)
24	Northern Pathway (Waka Kotahi/NZUP) (Westhaven to Akoranga)
25	Lake Road/Esmonde Road Improvements (AT)
26	Safety Programme - Devonport Town Centre (AT)
27	Matiatia Park and Ride (AT)
28	Glen Innes to Tamaki cycleway (AT/Waka Kotahi)
29	Connected Communities (AT)
30	Network Performance - Maioro Street Dynamic Bus Lane (AT)
31	Meadowbank Kohimarama Connectivity Project (AT)
32	Projects Supporting Auckland Housing Programme (Tamaki) (AT) and Tamaki Regeneration (AT)
33	Eastern Busway (AT)
34	Sylvia Park Bus Improvements (AT)
35	Network Performance - Mount Wellington Highway/SH1 Southbound Onramp (AT)
36	Projects Supporting Auckland Housing Programme (Roskill) (AT)
37	Old Mangere Bridge Pedestrian & Cycling Link (Waka Kotahi)
38	Mangere Cycleway (Airport Access) (AT)
39	Projects Supporting Auckland Housing Programme (Mangere) (AT)
40	Smales Allens Road Widening and Intersection Upgrade (AT)

ATAP Project No.	Project
41	Wiri to Quay Park (KiwiRail/NZUP)
42	Network Performance - East Tamaki Road/Ormiston Road/Preston Road (AT)
43	Airport to Botany Interim Bus Improvements (AT)
44	Ormiston Town Centre Link (AT)
45	SH20B Improvements (Waka Kotahi)
46	Mill Road Corridor (Waka Kotahi/NZUP) - Northern section and road improvements
47	Safety Programme - Manurewa (Coxhead Quadrant) (AT)
48	Safety Programme - Popes Porchester Intersection (AT)
49	Papakura Rail Station Park and Ride (AT)
50	State Highway 1 Papakura to Drury South (Waka Kotahi/NZUP)
51	Drury Stations (KiwiRail / NZUP)
52	Drury Local Road Improvements (AT)
53	Papakura to Pukekohe Electrification (KiwiRail/NZUP)
54	Network Performance - Pukekohe Dual Signals (Manukau / Massey / King / Stadium and East / Stadium) (AT)
55	Safety Programme – Waiuku Road corridor (Colombo Road to Domain Road) (AT)
56	Downtown Crossover Bus Facilities (AT)
57	Wynyard Quarter Integrated Road Programme (AT)
58	Safety Programme – Fanshawe Street (AT)
59	Safety Programme – Hobson Street / Nelson Street (AT)
60	Optimisation Programme - The Strand Special Vehicle Lane (Waka Kotahi)
61	Midtown Bus Improvements (AT)
62	Albert and Vincent Street Bus Priority Improvements (AT)
63	City Rail Link (CRLL) and CRL Road Side Projects (AT)
64	Safety Programme – Glenfield Road (AT)
65	Safety Programme – Onewa Road (AT)
66	Carrington Road Improvements (AT)
67	Safety Programme – Ash Street and Rata Street (AT)
68	Safety Programme – Mt Albert Road (AT)
69	Safety Programme – Atkinson Avenue (AT)
70	Safety Programme – Takanini School Road / Manuroa Road Intersection (AT)
71	Level Crossing Removal – Group 1 (AT)
72	Downtown Ferry Basin Redevelopment (AT)
73	Tamaki Drive / Ngapipi Road safety improvements (AT)
74	Wolverton Culverts (AT)
75	Scott Point Repayment (AT)
	Additional Future Projects
	Additional Waitemata Harbour Crossing
	City Centre to Mangere Light Rail - partially tunnelled / surface
	SH18 Hobsonville - local improvements
	Northwest Rapid Transit - to Pt Chev
	Northwest Rapid Transit – Pt Chevalier to Westgate
	North Shore Rapid Transit - Smales farm to City via Takapuna
	Airport to Botany

ATAP Project No.	Project
	Cross-isthmus rapid transit – New Lynn to Penrose and Onehunga
	Ellerslie to Panmure eastern busway extension
	North Shore Rapid Transit (Smales Farm to Albany)
	SH18 Upper harbour (Westgate to Albany) / Hobsonville rapid transit
	SH1 Warkworth to Wellsford
	Mill Road Corridor
	Northwest Rapid Transit extension to Kumeu
	North Shore Rapid Transit (Albany to Orewa)
	East West Link
	Pukekohe electrification, third main Westfield-Wiri and further new electric trains
	Fourth main rail line between Westfield and Wiri
	Third and fourth main rail between Wiri and Papakura
	Third main rail between Papakura and Pukekohe
	Enhanced walking and cycling, bus priority and network optimisation programmes
	Rail network upgrades to enable express and inter-city trains
	Upgrade to the State Highway 16 and State Highway 18 interchange
	Improved access to Port / Grafton Gully

Supporting Growth Projects

Warkworth

Project No.	Project
1	New medium quality bus interchange with park and ride (Project 4 – RLTP) Replaced by new Warkworth South Interchange
2	New high quality bus interchange at Warkworth South (with park and ride)
4	New arterial road – one lane in each direction
5	Western Link Road (including upgrade of Mansel Drive and Evelyn Street) - New arterial, one lane in each direction
6	Wider Western Link - New arterial road, one lane in each direction
7	Southern interchange and arterial connection, south facing ramps
9	Matakana Link Road – two lanes each direction
10	Ara Tūhono Puhoi to Warkworth New State Highway motorway – two lanes each direction (RLTP project 5)
11	Ara Tūhono Warkworth to Wellsford

North

Project Number	Project
1	North Shore Rapid Transit - Albany to Milldale Light rail from Milldale to the City with stations at: • Milldale, Silverdale, Wilks Road, Postman Road, Dairy Flat, Bawden Road, Park and Ride at Silverdale Wilks Road stations
2	Bus shoulder lanes from Albany to Silverdale (interim) (Motorway shoulder bus lanes from Oteha Valley Road to Silverdale SH1 interchanges)
3	High frequency bus route connecting Orewa and Silverdale with the Rapid Transit corridor
5	Additional managed motorway capacity between Albany and Silverdale - SH1 Northern Motorway widened to provide three lanes northbound between Oteha Valley Road and Redvale (Penlink) interchanges - Widening through Oteha Valley Road interchange to provide three lanes each direction - SH1 Northern Motorway widened to provide consistent three lanes between Silverdale and Oteha Valley Road interchanges – both directions
7	New connection between Milldale and Grand Drive
8	Upgrade Pine Valley Road, Wainui Road, Dairy Flat Highway and Bawden Road to urban standards including walking and cycling
10	New connection from Dairy Flat Highway to Penlink via Jackson Way
11	New connection between Bawden Road and SH1
12	New full interchange at Redvale (Penlink) (RLTP Project 8) - Interchange with south facing ramps - North facing ramps added to Redvale (Penlink) interchange
13	New SH1 crossing near Dairy Stream
14	New motorway interchange at Wilks Road
15	Upgrade East Coast Road from Silverdale to Redvale Interchange
16	Upgrade southern section of Dairy Flat Highway
18	Penlink (RLTP project 8)
19	New Argent Lane connection and Milldale to Highgate SH1 crossing (RLTP Project 7) - New arterial roads – one lane each direction (Milldale north-south arterial and Highgate SH1 crossing) - Milldale north-south arterial widened to two lanes each direction (Dairy Flat Highway to Highgate SH1 crossing)
	New north-south arterial 'Postman Road extension' from Dairy Flat Highway near Silverdale to Wilks Road – two lanes each direction
	Postman Road added as new arterial – two lanes each direction

North West

Project No.	Project
1	Rapid transit corridor extending to Kumeu-Huapai - Light Rail line extended westward. New stations at Matua Road, Huapai and Kumeu. - Park and ride at Matua Road station.
4	Alternative State Highway Corridor - New 'Kumeu Bypass' arterial – two lanes each direction

Project No.	Project
6	Upgrade Access and Station Road - Access Road widened to two lanes each direction
8	Upgrade Coatesville-Riverhead Highway between SH16 and Riverhead - Coatesville-Riverhead Highway widened to two lanes each direction
10	Upgrade and extension of Taupaki Road and Nixon Road - New arterial – one lane each direction
11	Upgrade Fred Taylor Drive and Don Buck Road to Red Hills Road - Fred Taylor Drive widened to two lanes each direction (from Dunlop Road to Don Buck Road) - Fred Taylor Drive and Don Buck Road (Brigham Creek Road to Redhills Road) widened to two lanes each direction
12	New east west connections from Nelson Road to Fred Taylor Drive - New arterials – one lane each direction (from project 13 to Fred Taylor Drive) - New arterial extended westward to Nixon Road – one lane each direction
13	New north south connection from the east-west connection (12) to Royal Road - New arterial – one lane each direction
14	Upgrade and extension of Spedding Road from Fred Taylor Drive to Hobsonville Road, including SH16 and SH18 crossings - New arterial – one lane each direction
15	Dunlop Road extension from Fred Taylor Drive to Maki Street - New arterial – one lane each direction
16	Upgrade Royal Road from Don Buck Road to SH16 - Royal Road widened to two lanes each direction
17	Upgrade and extension of Māmari Road from Northside Drive to Brigham Creek Road - New arterial – two lanes each direction
18	Upgrade Brigham Creek Road - Brigham Creek Road widened to two lanes each direction
19	Upgrade Trig Road from Brigham Creek Road to Hobsonville Road - Realign Trig Road (south of SH18) so joins Hobsonville Road at a new Hobsonville / Trig / Luckens intersection - Widen Trig Road to two lanes each direction (Brigham Creek Road to Northside Drive)
20	Upgrade Hobsonville Road and Fred Taylor Drive between SH18 and Don Buck Road - Widen Hobsonville Road to two lanes each direction
22	Direct State Highway connection between SH16-SH18, new shared paths and interchange upgrades - New motorway-to-motorway links: SH18 southbound to SH16 westbound, SH16 eastbound to SH18 northbound - New Northside Drive interchange with east facing ramps
23	Northside Drive East - New arterial – two lanes each direction
24	City Centre to Northwest Rapid Transit - Light Rail line from Brigham Creek Road to the City. LRT stations in the Supporting Growth Area are at Brigham Creek Road and Westgate/Northwest. Park and ride at Brigham Creek Road Station.
25	Upper Harbour Rapid Transit (Westgate to Hobsonville) - Small section of busway from Westgate/Northwest LRT station to a new Rawiri Busway Station - Busway extended eastward to SH18 Squadron Drive interchange. New Hobsonville Busway Station. Park and ride added to Rawiri Busway Station.

Project No.	Project
26	Safe Network Programme – SH16 Brigham Creek to Waimauku - SH16 widened to four lanes each direction (Brigham Creek Road to Taupaki roundabout)
	SH16 North-western Motorway widened to provide four lanes each direction between Westgate and Te Atatu interchange
	West facing ramps added to Sh18 Squadron Drive interchange

South

Project No.	Project
2	Closure of road level crossings to vehicles – Manuroa Road and Spartan Road
3	Grade separation of level crossings at Taka Street and Walters Road
4	New Drury Central Train Station (with park and ride)
5	New Drury West Train Station (with park and ride)
6	New Paerata Train Station (with park and ride)
7	New frequent / rapid bus service from Drury West to Airport via SH1 and Manukau City Centre. Includes new bus lanes and stations along route. - Minor enhancements to bus lanes along Great South Road (Papakura to Manukau) - over and above Connected Communities project delivered in 2028 - New bus lanes along Jesmond Road, Bremner Road, Great South Road (Drury to Papakura), project 13 new arterial, Hunua Road, Settlement Road, Marne Road, Clevedon Road and Broadway.
9	Mill Road Corridor – Including Connections (RLTP Project 46) - Redoubt Road widened to two lanes each direction (SH1 interchange to Murphys Road). - New Redoubt / Murphys Road intersection. Murphys Road widened to two lanes each direction. - New arterial from Mill / Walters / Cosgrove Road intersection to Dominion / Papakura-Clevedon Road intersection – one lane each direction - Drury South SH1 interchange connecting to Great South Road and Quarry Road - Widen existing roads and implement new arterials to deliver Mill Road Corridor - two lanes each direction from Redoubt Road to new Drury South SH1 interchange
10	Additional long-term upgrades to SH1 between Manukau and Takaanini - SH1 Southern Motorway widened to provide four lanes each direction between SH20 Manukau and Takanini interchanges
11	Upgrade Mahia Road and Popes Road (including a new grade separated rail and SH1 crossing) - Mahia and Roscommon Roads widened to two lanes each direction. - New grade separated arterial crossing of SH1 and rail line to connect Mahia and Rangi Roads (two lanes each direction). - Rangi Road, a small section of Takanini School Road and Popes Road widened to two lanes each direction.
12	Upgrade Opaheke Road and Ponga Road - Widen Ōpaheke Road to two lanes each direction. Ponga Road added as new arterial – two lanes each direction.
13	New arterial between Papakura industrial area to Waihoehoe Road – one lane each direction
14	Upgrade Jesmond Road, Bremner Road, and Waihoehoe Road

Project No.	Project
	- Recognise Bremner, Jesmond and Oira Roads as new / improved arterials – one lane each direction - Widen Waihoehoe Road to two lanes each direction (project 13 to Mill Road Corridor)
15	Upgrade Drury West Section of SH22 - Widen SH22 to two lanes each direction (Drury SH1 interchange to Oira Road) (included in list above)
16	Connections for SH22 to the Pukekohe Expressway
17	New Pukekohe Expressway connecting Pukekohe to SH1
18	Pukekohe Ring Road - Widen existing roads and implement new arterials to deliver ring road - two lanes each direction
19	Upgrade Mill Road between Harrisville Road intersection and the Bombay interchange - Widen Mill Road to two lanes each direction
21	Rail electrification – Papakura to Pukekohe - Electrification extended from Papakura to Pukekohe. Allows direct EMU services from Pukekohe to the City.
22	SH1 Papakura to Bombay Project - SH1 Southern Motorway widened to provide three lanes each direction between Papakura to Drury South interchanges - SH1 Southern Motorway widened to provide three lanes each direction between Drury South and Bombay interchanges

Appendix C Evaluation criteria against the Auckland Plan Outcomes

Evaluation Criteria	Belonging and participation	Māori identify and wellbeing	Homes and places	Transport and access	Environment and cultural heritage	Opportunity and prosperity
The extent of new urban development areas in 100-year floodplains and areas prone to coastal inundation and coastal erosion (Greenfields)	✔	✔	✔		✔	
The extent of urban development areas in 100-year floodplains and areas prone to coastal inundation and coastal erosion (Brownfields)	✔	✔	✔		✔	
The extent to which scenarios impact carbon emissions.	✔	✔	✔	✔	✔	✔
The extent to which development provides opportunities to improve the health of natural wetlands, lakes, rivers (including their riparian margins), and coastal /marine environments. (GF)		✔	✔		✔	
The extent to which development provides opportunities to improve the health of natural wetlands, lakes, rivers (including their riparian margins), and coastal /marine environments. (BF)		✔	✔		✔	
The extent to which options reduce the ability to swim safely at in saltwater and freshwater, and to collect shellfish due to beach closure from water pollution.	✔	✔			✔	
The extent to which development promotes the restoration of, and connectivity between, existing and potential habitats / areas of indigenous biodiversity.		✔	✔		✔	
The degree to which urban development consumes highly productive soils.		✔	✔		✔	✔
Extent to which scenarios retain qualities of historic heritage places and values, e.g.: historic places, viewshafts, volcanic landscapes	✔	✔	✔		✔	
Extent to which scenarios are likely to result in improved levels of access to quality open space	✔	✔	✔		✔	

Evaluation Criteria	Belonging and participation	Māori identify and wellbeing	Homes and places	Transport and access	Environment and cultural heritage	Opportunity and prosperity
Extent to which population is exposed to harmful air emissions from transport.	✔	✔	✔	✔	✔	
Extent to which growth creates greater housing choice to meet projected demand	✔	✔	✔	✔	✔	✔
Extent to which scenarios promote mixed-use communities to reduce travelling distances and the safety risks people incur when they travel to access services, facilities, and social networks.	✔	✔	✔	✔	✔	✔
Extent to which scenarios provide improved, inclusive, and equitable access to social infrastructure and public spaces: community facilities, ecological areas, open space (including quality green space), education (critical), health (critical), places of cultural significance. Degree to which essential social infrastructure is accessible by walking and cycling.	✔	✔	✔	✔	✔	✔
Degree to which essential social infrastructure and employment is accessible by multiple modes in areas of high deprivation	✔	✔		✔		✔
Extent of Māori land within growth areas.		✔	✔	✔	✔	✔
Extent to which scenarios impact on Māori cultural landscapes (wahi tapu, sites and places of significance to mana whenua)		✔	✔		✔	✔
Extent to which key areas of economic activity are accessible by different modes - PT, active (cycling, walking)	✔	✔	✔	✔	✔	✔
Extent to which education is accessible by different modes - PT, active (cycling, walking)	✔	✔	✔	✔	✔	✔
Extent to which employment opportunities are aligned with areas of population growth	✔	✔	✔	✔		✔
Extent to which household living costs can be reduced by increased proximity to employment opportunities	✔	✔	✔	✔		✔
Extent to which rural production areas are accessible			✔	✔	✔	✔
Extent to which travel times are reliable	✔		✔	✔		✔

Evaluation Criteria	Belonging and participation	Māori identify and wellbeing	Homes and places	Transport and access	Environment and cultural heritage	Opportunity and prosperity
Extent to which opportunities for the agglomeration of similar/dependent industries are provided						✔
Extent to which suitable land is available for Group 1 (land extensive) business						✔
Extent to which scenarios support current committed infrastructure	✔		✔		✔	
The extent to which scenario results in measurable public monetary costs or losses over time	✔		✔		✔	
Extent to which physical constraints increase the cost of development	✔		✔		✔	
Extent to which the market is likely to respond to the proposed land use pattern.			✔			✔

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