



Making sense of the numbers

Review of growth model assumptions

Auckland Council

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Executive Summary

Business and Economic Research Limited (BERL) reviewed Auckland Council's developer contributions policy to ensure that it is well supported by a logical and consistent approach to the application of population and economic development forecasting to the growth forecasts required to calculate development contributions (DCs).

As a result of our review, BERL has identified three key recommendations to enable Auckland Council to improve the robustness and defensibility of its developer contributions calculations and charges.

- The first recommendation is that Auckland Council apply consistent inflation numbers in each Infrastructure Group's cost forecasts.
- The second recommendation is that the Infrastructure Groups should all use common development phasing and population growth assumptions within their base growth models. In practice this would see all three Groups use a consistent base growth model, which would include the same population growth for an area over the 30 year timeframe, as well as spatial phasing of the growth.
- The third recommendation is that all three Infrastructure Groups should use a consistent final growth model, where assumptions made by any of the three Infrastructure Groups, on growth within an area, are aligned across the three groups. The aim of this recommendation is to ensure that all three Infrastructure Groups are using the same final growth plan when calculating their infrastructure costs forecasts, for developer contributions.

In an extension to the work, BERL also reviewed a memorandum from the Council's Chief Economist's Unit, proposing a new approach to improving development contribution forecasts. The findings of the review are also presented in this report.

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1 Introduction

Auckland Council has commissioned Business and Economic Research Limited (BERL) to undertake a review of the Council's Development Contributions policy. The review aims to ensure a logical and consistent approach is taken to the application of population and economic development forecasting to the growth forecasts required to calculate development contributions (DCs).

DCs are calculated using the following formula:

$$\frac{\text{Numerator}}{\text{Denominator}} = \text{Output}$$

where the:

- Numerator is the capital expenditure required to provide the Community, Parks and Transport infrastructure to support growth. The capital expenditure is calculated using the growth assumptions forecast for the total growth expected in an area, and the time when it will occur. These growth forecasts allow each Infrastructure Group to assess the capital expenditure needed, and the optimum time to provide it
- Denominator is the population growth forecast for the total number of Household Unit Equivalents (HUEs) for an area, calculated from the DC model
- Output is the resultant DC price per HUE.

For the review, we have examined, for each type of infrastructure, the following:

- The base growth model used
- The additional modifications made to the growth model outputs
- All assumptions the different Infrastructure Groups made in modifying the base growth model outputs
- The reasoning behind the assumption modifications
- How each Infrastructure Group used the outputs from the base growth model in its infrastructure or capital expenditure forecasts
- The assumptions and reasoning upon which the Infrastructure Groups used the base growth model outputs to calculate their infrastructure or capital expenditure forecasts.

A summary of our review, and our understanding of these aspects, is captured in sections two, three, four and five of this report. In addition, the recommendations resulting from our review are presented in section six of this report.

Finally, BERL was also asked to review the methodology used by the Chief Economist's Unit's model, which looks to improve how the HUEs are calculated. The HUEs calculated for an area form the denominator of the developer contributions calculations. The findings of our review are covered in Appendix B of this report

2 Community Infrastructure Group

In this section, we summarise the following:

- The documents we reviewed that directly contribute to the Infrastructure Group's contributions policy
- The base growth model used by the Community Infrastructure Group
- The assumptions used by the Community Infrastructure Group in the calculation of their developer contributions (DCs) inputs
- The other data sources we identified, where these are used to modify the base growth model
- The process used by the Community Infrastructure Group to forecast its DC inputs
- Our initial analysis and observations on all of these topics.

Overall, the Community Infrastructure Group is responsible for planning infrastructure expenditure on new community facilities (libraries, swimming pools, leisure centres, and community spaces) across Auckland. These community facilities provide community services to the people of Auckland, in both existing communities and in new greenfield developments.

2.1 Documents reviewed

For the Community Infrastructure Group, we reviewed the following documents provided by Auckland Council:

- Development Contribution Policy Growth Assumptions (March 2022)
- Determining years 11 to 30+ greenfield provision requirements – Community Services and Facilities Guidance Note (March 2022).

2.2 Base growth model outputs used for population numbers

As of April 2022, the Community Infrastructure Group used the I11v6 base growth model for its population growth numbers, including both annual and total growth in population across each area of Auckland.

2.3 Other data sources

As of April 2022, the Community Infrastructure Group did not use other data sources to make any additional modifications to the population growth data from the base growth model. This makes this Group the only one of the three that does not modify the phasing of population growth outputted from the base growth model used.

2.4 Summary of process to generate DC inputs

Based on the documents reviewed, this section summarises our understanding of the DC calculation process used by the Community Infrastructure Group. This process is used to go from the base growth model outputs (population by annual growth and total growth out to 2048), through to determining the infrastructure expenditure required for each area of Auckland to provide the

necessary community facilities. This process also determines the share of infrastructure expenditure that should be funded by, or charged to, developers through the DCs.

For new community service provision, the following process is used to firstly assess and then, if a need is recognised, to build new community facilities. The same process is used when assessing if new community facilities are required for brownfields developments:

- Stage 1 – Initiation (determination of whether to progress the request for facilities)
- Stage 2 – Needs assessment
- Stage 3 – Feasibility
- Stage 4 – Business case
- Stage 5 – Project planning
- Stage 6 – Delivery
- Stage 7 – Evaluation.

However, for a new community facility in a greenfield development, needs can be modelled based on expected population growth in an area, rather than following the seven stage process. To model the community facility needs for a greenfield development, the annual population growth is merged into 10 year increments, with a 30 year planning horizon. The 10 year population growth increments are used because the timeframe for delivery of a community facility is around seven years.

Once a service provision gap is identified, based on the 10 year population growth increments, the gross floor size is calculated using the Community Infrastructure's guidelines, as well as information from any relevant recent projects. The costs of the building are then estimated using March 2022 building rates, which include the cost of the building, carparks, landscaping/playgrounds, fit-out, design development, and project contingency.

For planning purposes, the current areas per facility used for calculating provision gaps, once population thresholds are met, are as follows:

- Community space – 600 square metres
- Leisure space – 2,700 square metres
- Pool/Aquatic – 3,500 square metres
- Library – 41 square metres per 1,000 of local catchment population.

Next, the land cost of the service provision is estimated, based on gross floor size of the building being between 40 and 60 percent of the required land size. Land costs are determined using the open space acquisition cost model (operated by the Parks Infrastructure Group). For example, if a new community space, which has a building space (gross floor size) of 600 square metres, is needed, the land size required will be between 1,000 and 1,500 square metres.

Finally, the building and land costs are allocated. When the Community Infrastructure Group allocates costs due to growth in a specific area, the calculation is based on the growth component within the facility catchment, divided by the overall total beneficiaries of the catchment. For example, if a new leisure space is required for population growth of 20,000 people within the catchment area and the existing population is 5,000 people, then 80 percent (20,000/25,000) of the costs would be allocated to be funded via DCs.

2.5 Assumptions

The following is a summary list of the assumptions used by the Community Infrastructure Group throughout the process of calculating its infrastructure expenditure by year for an area. These assumptions are used by the Group as part of its inputs into the DC model:¹

- Population and household growth over time is based on I11v6 projections
- Provision of services is based on 10 year population growth increments
- Pools and leisure centres target a catchment range of between 35,000 to 50,000 people, and 18,000 to 40,000 people, respectively, within prescribed catchment areas ranging from five to ten kilometres
- Community and library facilities have a catchment range of five kilometres
- All of the population that falls within the catchment area are beneficiaries/users of the facilities
- The gross floor size will be between 40 and 60 percent of the land required
- The share of the costs attributed to the additional population of an area is based on the additional population's share of the new population. For example, if a new greenfield is expected to have a growth of 30,000 people, and a new facility has an overall catchment of 40,000 people, then 75 percent of the cost (30,000 divided by 40,000) of the new service provision (land and building costs) would need to be allocated to the DCs.

2.6 BERL's analysis and observations

The following is a summary of BERL's initial analysis and observations on:

- The base growth model used by the Community Infrastructure Group
- The assumptions used by the Group in the calculation of its DCs inputs
- Identifying other data sources where these are used to modify the base growth model
- The process used by the Group to forecast its DCs inputs.

Overall:

- The processes used by the Group to go from the base growth model population projections to ultimately allocating costs to developer contributions are clear, logical and reasonable
- The assumptions used by the Group in its processes are also all logical and reasonable
- One cause for concern is that the Group uses a different base growth model to the other Infrastructure Groups, which may affect phasing of population growth in an area
- A second cause of concern is that the Group effectively uses a different population forecast to the other Infrastructure Groups. This is because the Community Infrastructure Group does not review or modify the timing of the population growth forecasts, as the other Infrastructure Groups do. As a result of this, it is likely, in our view, that the infrastructure planning by the Community Infrastructure Group could be incompatible with that of the Parks and Transport Infrastructure Groups. This could lead the Community Infrastructure Group to act, or plan to act, either too early or too late, compared to the other groups, when purchasing land and constructing facilities in greenfield developments.

¹ This is not a definitive list of all assumptions but rather a summary list to showcase the types of assumptions used in the infrastructure expenditure calculations.

3 Parks Infrastructure Group

In this section, we summarise the following:

- The documents we have reviewed that directly contribute to the Parks Infrastructure Group's contributions policy
- The base growth model used by the Group
- The assumptions used by the Group in the calculation of its development contributions (DCs) inputs
- The other data sources we identified, where these are used to modify the base growth model
- The process used by the Group to forecast its DC inputs
- Our initial analysis and observations on all of these topics.

Overall, the Parks Infrastructure Group is responsible for planning infrastructure expenditure on new parks (suburb, neighbourhood, organised sport, and civic parks) across Auckland. These parks provide green spaces for the people of Auckland, in both existing communities, and in new greenfield developments.

3.1 Documents reviewed

For this Group, BERL reviewed the following documents provided by Auckland Council:

- Development Contribution Policy Growth Assumptions (March 2022)
- Open Space Acquisition Cost Modelling Method (April 2022).

3.2 Base growth model outputs used for population numbers

As of April 2022, the Group used the following base growth model for its population growth numbers, both annual and total across each area of Auckland:

- The Future Urban Land Supply Strategy 2017 (FULSS). It should be noted that the FULSS is a key input component of the i11 base growth model used by the other two Infrastructure Groups.

3.3 Other data sources

As of April 2022, the Group used the following data sources to review, and potentially modify, the base population growth phasing in an area:

- Developer intentions
- Development structure plans.

3.4 Summary of the process to generate DC inputs

Based on a review of the documents we reviewed, the following is a summary of our understanding of the DC calculation process used by the Group. This process is used to go from the base growth model outputs (population by annual growth and total growth out to 2048, and beyond), through to determining, for each area of Auckland, the infrastructure expenditure required to provide the

necessary parks. The process determines the share of infrastructure expenditure that should be funded by, or charged to, developers through the DCs.

The Group uses a model called the Open Space Acquisition Cost Model to determine when parks will be needed in an area, and the annual costs of buying land for the four types of parks required in a greenfield development. The model uses three main variable inputs: the number of parks needed within specified areas, by type of park, based on the FULSS model; inflation forecasts; and recent property valuation reports on the cost of land by area within Auckland (the property valuations data is periodically updated when modelling updates are undertaken).

While the number of projected parks used in the Open Space Acquisition Cost Model are from the FULSS, the phasing of parks can be adjusted based on developer intentions. For example, in the Drury West Step 2, developers have indicated that housing development (a stage four activity) could begin in 2025, while the FULSS projections indicate that stage four should begin in 2028. Based on this, the phasing could be brought forward for this area. However, it is a subjective decision by the Group whether or not to adjust the phasing of parks in an area based on developer intentions, or to stay with the forecast park projections. For the example above, the Group decided to stick with the phasing from the FULSS model.

Once the number of parks for each area is adjusted, or left unchanged, the costs per stage for each park type are calculated. The overall number of parks, and type of park, is specified in the development structure plans. In the absence of plans, a similar previous development is used by the Group to determine the number of parks required.

Land costs per square metre by stage of development, and type of park, are then applied to the square metres required for each portion of the park, although this is adjusted for any parks that have been acquired, or whose acquisition is in progress, as the real cost can be substituted in the model for the estimated cost. Land prices (land costs per square metre) are reviewed annually for each area within Auckland by a contracted valuer, who provides the Parks Infrastructure Group with a range of per square metre costs by development stage, based on recent sales of land.

Land costs, per square metre, by type of park and stage of development, are calculated as in the following illustrative example:

- Two suburb parks (30,000 square metres) are required for Drury
- In stage one, 15 percent of the total costs are spread over three years (five percent per year). The per square metre cost for land for that stage is \$175. Five percent multiplied by \$175 multiplied by 60,000 equals \$525,000 for each of the three years
- In stage two, 50 percent of the total costs are spread over four years (12.5 percent per year). The per square metre cost for land for that stage is \$250. So, 12.5 percent multiplied by \$250 multiplied by 60,000 equals \$1,875,000 for each of the four years
- In stage three, 25 percent of the total costs are spread over five years (five percent per year). The per square metre cost for land for that stage is \$375. Five percent multiplied by \$375 multiplied by 60,000 equals \$1,125,000 for each of the five years
- In stage four, 10 percent of the total costs are spread over three years (3.3 percent per year). The per square metre cost for land for that stage is \$1,450. So, 3.3 percent multiplied by \$1,450 multiplied by 60,000 equals \$2,900,000 for each of the three years
- Therefore, if the Drury area was expected to be development-ready in 2028, then stage one would need to begin in 2025 and proceed until 2039

- Overall, the total cost of the two parks would be \$23.4 million, spread over 15 years.

These overall land costs are weighted, to determine the amount that can be on charged to developers via DCs. While these beneficiary weightings generally start at the same weighting point, area analysis and peer review can alter the weightings for an area. This means that overall, the weightings are not uniform for all areas across the Auckland Region. An example of the beneficiary factors and their weightings, are illustrated as follows:

- Cause of growth (100 percent new residents for both greenfields and brownfields)
- Beneficiaries (95 percent new residents for greenfield and 70 percent new residents for brownfield)
- Intergenerational equity (proportion of new residents in the next 10 years and proportion of new residents over the following 20 years).

The last part of the process is to submit the weighted annual costs as inputs into the DC model.

3.5 Assumptions

The following is a summary list of the assumptions used by the Group throughout the process of calculating its infrastructure expenditure by year for an area. These assumptions are used by the Parks Infrastructure Group as part of their inputs into the DC model:²

- The open space model assumes that there are four stages of development, which are:
 - Stage one – Future Urban Zone (land is rezoned to an ‘intermediary’ zone to indicate its potential for future development)
 - Stage two – Urban Zoned (land is rezoned to some form of Urban Zone)
 - Stage three – Infrastructure installed (Infrastructure including utilities and roading is constructed to allow for development)
 - Stage four – Completed subdivision to urban lots (land is developed and subdivided into urban lots ready for sale to builders, and titles are issued for each lot)
- The open space model assumes a standard lifecycle for park acquisitions of three years in stage one, four years in stage two, five years in stage three, and three years in stage four
- The open space model assumes the following phased acquisition by park type:
 - Suburb parks (30,000 square metres each): 15 percent of cost in stage one, 50 percent in stage two, 25 percent in stage three, and 10 percent in stage four
 - Neighbourhood parks (4,000 square metres each): 20 percent in stage two, 30 percent in stage three, and 50 percent in stage four
 - Organised sport (100,000 square meters each): 40 percent in stage one, 40 percent in stage two, and 20 percent in stage three
- Civic parks (2,000 square meters for local centre, and 4,000 square meters for town centre): 50 percent in stage three, and 50 percent in stage four
- For greenfield developments, it is assumed that 100 percent of the cost of acquisition is due to growth, unless there are specific non-growth factors

² This is not a definitive list of all assumptions but rather a summary list to showcase the types of assumptions used in the infrastructure expenditure calculations

- For brownfield developments, it is assumed that any new acquisitions are due to growth. However, already acquired parks will usually be updated, rather than new parks acquired
- For greenfield development, it is assumed that 95 percent of beneficiaries are new, while for brownfields it is assumed that 70 percent of beneficiaries are new
- The open space model assumes that, if land is not acquired in the usual phase, the acquisitions are pushed to later years. For example, if land for a neighbourhood park (which should have had 20 percent purchased in stage two) cannot be purchased until stage three and four, then the model will effectively pro-rata the 20 percent across the next two stages. Stage three will go from 30 percent to 37.5 percent and stage four will go from 50 percent to 62.5 percent.

3.6 BERL's analysis and observations

The following is a summary of our analysis and observations on:

- The base growth model used by the Parks Infrastructure Group
- The assumptions used by the Group in the calculation of its developer contributions (DCs) inputs
- Identifying any other data sources that are used to modify the base growth model
- The process used by the Group to forecast its DCs inputs.

Overall:

- The Group's base growth quantum and phasing is based on the FULSS rather than i11v6; and, while the i11 model is based on the FULSS timings and anticipated growth, the i11 model does include other inputs, including transport into its model and outputs. This means that the i11 model and FULSS could have different growth phasing for different areas
- The phasing of staging for park acquisition can be adjusted based on discussions the group has with larger developers. However, this adjustment is subjective, which means the phasing may, or may not, be adjusted, based on how the Group decides to act
- After the phasing of population growth is settled within the model, then the remainder of the process used by the Group, and the assumptions made, are both logical and reasonable to create the inputs into the DC model
- Also, if phasing (for example development starts years) are altered for an area, based on developer intentions, then any changes need to be applied to other Infrastructure Groups to ensure all infrastructure spending plans are based on the same timing and growth information. While these changes may not change the spending plans of the other Groups, based on how they calculate their spending and costs, it does show a lack of consistency within the Groups that input cost data into the DC model.

4 Transport Infrastructure Group

In this section, we summarise the following:

- The documents we have reviewed that directly contribute to the Transport Infrastructure Group's contributions policy
- The base growth model used by the Group
- The assumptions used by the Group in the calculation of its developer contributions (DCs) inputs
- The identification of other data sources, where these are used by the Group to modify the base growth model
- The process used by the Group to forecast its DCs inputs
- Our initial analysis and observations on all of these topics.

Overall, the Group is responsible for planning infrastructure expenditure on new roading, and transport projects (roundabouts, two lane roads, four lane roads, bridges, and interchanges) across Auckland. This infrastructure provides transport routes for the people of Auckland, in both existing communities, and in new greenfield developments.

4.1 Documents reviewed

For this Group, we reviewed the following documents provided by Auckland Council:

- Development Contribution Policy Growth Assumptions (March 2022)
- Drury Developer Contributions Policy – Transport Assessment (February 2022)
- Drury Infrastructure Funding and Financing (DIFF) – Cost Allowances (April 2022).

4.2 Base growth model outputs used for population numbers

As of April 2022, the Group used the following base growth model for its population growth numbers, both annual and total, across each area of Auckland:

- The i11v5 growth model. This is the fifth version of the i11 model. The main difference between the newer i11v6 (sixth version of the i11 model) and the older i11v5 used by the Community Infrastructure Group, is that the newer model has a different timing of growth, compared to the older version. However, both versions of the i11 model have the same total population growth in any area out to 2048.

4.3 Other data sources

As of April 2022, the Group used the following data sources to review, and potentially modify, the base population growth phasing in an area:

- All private plan changes by developers, which are assumed to supersede i11 or FULSS projections, and to occur immediately
- Financing funding availability, with projects only able to proceed once funding is available
- Transport assessment undertaken by the Te Tupu Ngātahi Supporting Growth Alliance (SGA).

4.4 Summary of process to generate DC inputs

From the documents we reviewed, the following is a summary of our understanding of the DC calculation process used by the Group. This process is used to go from the base growth model outputs (population by annual growth and total growth out to 2048), through to determining for each area of Auckland the expenditure required to provide the necessary transport infrastructure. Lastly this process determines the share of infrastructure expenditure that should be funded or charged to developers through the DCs.

For this review, we were provided with two reports on the Drury area that describe the process that the Group uses to calculate the DCs for such an area. The first of these reports was the Drury Infrastructure Funding and Financing (DIFF) – Cost Allowances (April 2022). This report was compiled to inform the funding and financing options for the transport infrastructure needed to support the plan changes in Drury. The report encompassed approximately 70 projects and their descriptions, along with the likely range of cost for each project.

The SGA, who developed the DIFF report, determined the overall proposed scope of each of the transport projects for Drury. Because in many cases the final design solution of each transport project is not yet known, the cost allowances developed in the report were based on a number of assumptions and cost elements.

The cost elements of the cost allowances include:

- Property costs
- Project development phase
- Pre-Implementation phase
- Implementation phase
- Construction Management and Supervision (MSQA)
- Environment Compliance
- Traffic Management and Temporary Works
- Preliminary and General (P&G).

Overall within the DIFF report, each of the project scopes is noted, including assumptions for any project not already scoped, and the elemental cost items for that project. For example, alternative project 38a N-S Ōpāheke arterial from development to Ponga Rd, is a new two lane urban road with active modes on both sides. The following has therefore been assumed:

- It will be a new greenfield road
- It includes a long bridge over the flood plain
- It includes a simple roundabout at the Ponga Rd intersection
- SGA estimates will be used, with 85 percent of costs used for initial work
- Costs are 85 percent of SGA cost estimates, the cost of one simple roundabout, and that all property is acquired as per SGA costs.

The document details that the sequencing assessment within the report did not consider funding methods, or constraints, in delivering the infrastructure, and was undertaken prior to specific staging provisions being confirmed for each plan change. The key purpose of the assessment was to inform Council's consideration of options to fund and finance the required infrastructure for Drury.

The second part of this process is the Drury Developer Contributions Policy – Transport Assessment document. This document notes the following:

- DIFF costs information
- That as noted earlier in section 4.3, the Transport Infrastructure Group treated seven plan changes for Drury at face value, and assumed all could proceed immediately, regardless of the FULSS projections
- That the growth assumptions in the wider area remain generally aligned with FULSS.

The Drury Developer Contributions Policy – Transport Assessment document also sources scheduling information from other reports, including the DIFF staging plan, the SGA Indicative Business Case (IBC), and the SGA transport assessment.

Following the DIFF study, the document notes that Auckland Council advised that it wished to explore the Drury DC policy as a key method to fund the required transport networks. It also submitted to the hearings on the private plan changes, indicating its opposition to the acceleration of urban development, due to the lack of infrastructure funding to support such development. In addition, in mid-2021, Auckland Council advised that, apart from any projects with committed funding, the delivery of transport projects should be delayed until post decade one. This means that projects identified in DIFF as being desirable for immediate (unconstrained) growth development would be deferred until decade two (i.e. out past 2032).

This revised timing was applied, with the largest deferral on the earliest projects until after decade one, but with no change in the timing of the longer-term projects. This required a sliding scale of adjustment as detailed in the table below. It should be noted that the timing for each project presented in DIFF was intended to be indicative, rather than being specific to any year. This revised project timing was retained for most projects in this update, unless specifically amended, due to new information being available.

Table 1 Revision to (Unconstrained) DIFF Project Timing

DIFF Indicative Delivery Period	Definition	Adopted Date for DC Assessment
2022	refers to being needed at the outset of Plan Change development	2032
2026	refers to within the first 5 years of development	2034
2031	refers to within the first 10 years of development	2037
2041	refers to within the first 15 years of development	2040
2036	refers to within the first 20 years of development	2043
2046	refers to within the first 25 years of development	2046

The Drury Developer Contributions Policy – Transport Assessment document takes the project costs and scheduling to calculate the DC model inputs. The document shows, for each project, how renewal costs, service level increases, and beneficiaries, are calculated. The methodology adopted is illustrated by the following hypothetical example:

1. Project X involves an upgrade of a 2 kilometre (km) existing rural road to an urban arterial corridor suitable for urban development. Its role is to support adjacent urban development, and

provide improved multi-modal connections between the two adjacent growth areas (sub-areas A and B)

2. From the SGA route protection work, the indicative CAPEX to fully redevelop the corridor into the proposed new form is \$50 million(\$m)
3. The works would remove the need for an expected renewal of the existing rural road (assuming no urban development). This renewal cost is estimated at \$2m based on the average rate of \$1m/km. This \$2m renewal cost is removed from the \$50m CAPEX estimate to give \$48m of upgrade costs
4. The local community currently comprises 500 existing households and 100 jobs (giving an estimated HUE of 550), which is expected to grow to 5,000 households and 3,000 jobs (with an estimated HUE of 6,500). This means that the existing community comprises 8.5 percent of the future development, which is assumed to gain an increased level of service through the works. This means that the 91.5 percent is considered the growth component
5. Applying the 91.5 percent growth proportion to the \$48m CAPEX gives \$44m of growth-related CAPEX to be allocated
6. The causation assessment indicates that the need for the project is caused equally between sub-area A and B (i.e. 50 percent allocated to each of sub-areas A and B)
7. The beneficiary assessment indicated that, while both sub-areas A and B would gain similar benefits from improved accessibility and mode choice, there would also be some benefits to the wider network through increased resilience and mode share (i.e. the project would increase network resilience and remove travel on the wider network). This wider-network benefit was estimated at 20 percent, with 40 percent to each of sub-areas A and B
8. The average of the causation and beneficiary assessments gives 45 percent of each to areas A and B and 10 percent for the wider area.

4.5 Assumptions

The following is a summary of the assumptions used by the Group during the process of calculating its infrastructure expenditure, by year, for an area. These assumptions are used by the Transport Infrastructure Group as part of their inputs into the DC model:³

- An additional time horizon is added to enable the full buildout of any Future Urban Zone (FUZ) areas to be scheduled
- Within the DIFF report, where there is an 'Interim' cost, the 'Ultimate' cost allowance has been developed on the basis that the interim option had already been constructed. Where there is no 'Interim' option, the 'Ultimate' cost allowance is based on the current environment as being the base situation
- The DIFF report's estimated costs include a 30 percent contingency, and a funding risk contingency of 25 percent
- In the Drury Developer Contributions Policy report, all non-committed transport projects have moved out beyond 2032, due to funding constraints. Based on these constraints on transport projects, it is possible that growth in the Drury development area will not occur until after 2032, when the deferred projects can be funded.

³ This is not a definitive list of all assumptions but rather a summary list to showcase the types of assumptions used in the infrastructure expenditure calculations

4.6 BERL's analysis and observations

The following is a summary of our analysis and observations on:

- The base growth model used by the Transport Infrastructure Group
- The assumptions used by the Group in the calculation of its developer contributions (DCs) inputs
- Identifying the other data sources used to modify the base growth model
- The process used by the Group to forecast its DCs inputs.

Overall:

- Due to funding availability, the Transport Infrastructure Group wants to push transport projects out past 2032. However, this does mean that, potentially, population growth will be pushed back to after 2032, because developers will probably be reluctant to build if key transport infrastructure is not in place
- As noted in the Drury Developer Contributions Policy – Transport Assessment document, the Group has treated the seven plan changes at face value, assuming all changes could proceed immediately, which would imply that development would occur earlier than forecast under any of the base growth models. But, due to its overriding funding restrictions, the Group is, in effect, potentially changing the pace of growth to match the availability of funding, rather than changing, as the Parks Infrastructure Group did, when things are funded based on changes to development plans
- If the Group's funding does push out past 2032, this could have implications for the Parks and Community Infrastructure Groups' plans. According to the Development Contribution Policy Growth Assumptions (March 2022) document, the Transport Infrastructure Group has further growth in Drury starting after 2032, while both Parks and Community are expecting further growth in Drury to start in 2027 (five years earlier)
- How the Transport Infrastructure Group calculates the costs estimates for each project, and how the DC contributions for each project are calculated, are reasonable and logical
- Overall, the Group's funding restrictions push it significantly out of alignment, compared with when the other two Infrastructure Groups (Parks and Community) are expecting their infrastructure investments to take place for Drury. Ideally, all three Infrastructure Groups should have the same growth expectations going forward. In theory all three Infrastructure Groups are expecting the same overall growth to occur in an area by the end of the population growth forecasts in 2048, but the timing or phasing is different.

5 Recommendations and conclusions

In this section, we present our recommendations to Auckland Council from our review. Our review covered:

- How each of the three Infrastructure Groups use base growth models
- How modifications are made to population projections
- How the Groups use the population forecasts in their developer contributions (DC) calculations
- What other data is used by each Group in their DC calculations
- What assumptions are made by each Group in this process
- The consistency of approach across each group
- The logic and reasoning underpinning each Group's assumptions and approaches.

As part of the presentation of our recommendations, we have included the reasoning behind each of them.

Outside of the population model, the approaches of each of the three Groups were logical and reasonable. This was evidenced, for example, by the Community Infrastructure Group using the Parks Infrastructure Group's open space model for land costs, so ensuring consistent land costs across both groups. In addition, all three Infrastructure Groups made use of experts to provide consistent, up to date cost data (building, land, and transport costs).

The one exception outside of the population model is the treatment of inflation across the three Groups. While the Parks Infrastructure Group open space model contained an inflation variable in its cost modelling, neither of the other two Groups explicitly mentioned inflation as being part of their cost calculation forecasts. Because of the impact inflation can have on cost estimates and forecasts across long time periods, such as those forecast by the three Infrastructure Groups, inflation is a variable that needs to be consistently applied across all cost variables and groups.

Recommendation one

BERL's first recommendation is that Auckland Council applies consistent inflation factors in each Infrastructure Group's cost forecasts. BERL has not included a recommendation on which price index, price index component, or combination of price indices should be used by each group, because, at the time of writing, the Council's Chief Economist's Unit was undertaking work to determine which price indices each group should use. BERL considers that the Chief Economist's Unit is well placed to provide the Infrastructure Groups with specific price indices that they can use to consistently apply inflation to their cost forecasts.

Inflation is a product of the relationship between demand and supply. If demand is higher for any products than the supply of those products, the price will rise until demand and supply are equal, and vice versa. Such price rises and falls are called inflation and deflation, respectively.

Population growth within an area, can be linked to inflation because, as the population of an area grows, so too does the economic growth of an area, along with its demand for goods and services. As already noted increased demand can cause inflation until either price rises reduce demand, or supply catches up to demand.

BERL's reasons behind this recommendation are as follows:

- Infrastructure costs will rise over time, and this needs to be explicitly part of the forecasts, otherwise future infrastructure costs may be underestimated
- If inappropriate inflation forecasts are used by each group, this will directly affect the final DC calculations.

At the time of writing, each of the three Infrastructure Groups uses a different base growth model, or a different version of the same model. The Community Infrastructure Group uses version 6 of i11, while the Transport Infrastructure Group uses version 5 of i11, and the Parks Infrastructure Group uses the Future Urban Land Supply Strategy 2017 (FULSS).

In addition, all three Infrastructure Groups use different approaches to modifying/updating the population forecasts, when new information becomes available. The Community Infrastructure Group currently does not adjust the population forecasts. By contrast, the Parks Infrastructure Group talks regularly to developers about their intentions and then, based on these discussions, subjectively decides if it should alter population growth phasing, or if it should continue using the FULSS. For its part, the Transport Infrastructure Group alters the population phasing in an area by, firstly, taking all plan changes at face value and, secondly, using availability of funding for the infrastructure. If no funding is available, the Group defers the expenditure on infrastructure needed to support growth and, therefore, alters the population phasing in the given area.

Overall, the use of developer intentions, new private plan changes, and availability of infrastructure funding, are reasonable inputs to use to alter the phasing of population growth in an area. These variables provide the Infrastructure Groups with a more accurate picture of when growth will occur, when compared to the base model growth outputs for a particular area.

Recommendation two

BERL's second recommendation is that all Infrastructure Groups should use common development phasing and population growth assumptions within their base growth models. In practice, this would see all three Groups use a consistent base growth model, which would include the same population growth for an area over the 30 year timeframe, as well as spatial phasing of the population growth.

BERL suggests Auckland Council should use the latest version of the i11 model for all three Infrastructure Groups, as long as spatial phasing is incorporated into this model. The i11 model uses the FULSS as part of its inputs and is updated annually, to ensure it is using the latest input information. Given the process each Infrastructure Group currently uses to calculate their DC inputs, it is effectively the phasing of population growth that is the most important aspect of the population forecasts to each Infrastructure Group.

BERL's reasons behind this recommendation are as follows:

- Using the same base population growth model would ensure more consistency between the three Infrastructure Groups. Using the same model means each Group, prior to modification, will be working off the same exact population forecasts, rather than ones that may be similar
- Using the same base population growth model would also increase the robustness and defensibility of the modelled outputs
- It seems unjustifiable for each Infrastructure Group to use a different model, when it is possible for each to use the same model. Currently, there appears to be no good reason why each Infrastructure Group uses a different model.

Recommendation three

BERL's third recommendation is that all three Infrastructure Groups should use a consistent final growth model, where assumptions made by any of the three Infrastructure Groups, on growth within an area, are aligned across the three groups. The aim of this recommendation is to ensure that all three Infrastructure Groups are using the same basis for calculating their infrastructure costs forecasts, in order to assess developer contributions. For example, currently for Drury, the Transport Infrastructure Group, due to a lack of funding, is pushing infrastructure spending, and therefore its growth forecasts, out past 2032. At the same time, the other two Infrastructure Groups (Parks and Community) both expect growth in population, requiring new infrastructure, to start occurring in 2027. This is five years earlier than the Transport Infrastructure Group are planning to put in the required transport infrastructure.

One option for Auckland Council is for the Parks and Community Infrastructure Groups to use the final transport growth model, after all adjustments have been made by the Transport Infrastructure Group. Any changes to the phasing of the population growth enacted by the Parks and Community Infrastructure Groups would need be communicated to the Transport Infrastructure Group, so that these could be incorporated into the final growth assumptions, prior to the final forecasts.

BERL's reasons behind this recommendation are as follows:

- The lack of consistency between the three Infrastructure Groups raises questions about the actual accuracy of the DC calculations, as each Infrastructure Group's DC inputs appear to be based on differing expectations of when population growth will occur in any given area
- The Transport Infrastructure Group's infrastructure expenditure makes the largest impact on the phasing of population growth within areas of Auckland. Accordingly, if it plans to defer infrastructure spending, then a significant proportion of population growth is also likely to be pushed back, acknowledging that some growth may still occur. On the other hand, if the Parks or the Community Infrastructure Groups were to defer their spending, it is unlikely that this would affect the timing of population growth in an area. This is because, while people can make do without parks and community facilities for a while, they generally cannot do without transport infrastructure to enable them to drive to and from their homes
- The Transport Infrastructure Group makes the most explicit use of additional information when modifying its population forecasts, compared to the other Infrastructure Groups. The Transport Infrastructure Group makes use of developer intentions through private plan changes, as well as factoring in funding restrictions. For example for Drury, the Transport Infrastructure Group has 2032 as the start of population growth, compared to 2027 for the other Groups
- Again, using the same final population phasing for the calculation of infrastructure costs would increase the robustness and defensibility of the modelled outputs
- Given the limited funding resources available to each of the three Infrastructure Groups, using the same final population growth data would ensure that each Infrastructure Group was able to make the most efficient use of their limited funds. This is because it should ensure that no Infrastructure Group was spending on infrastructure earlier than it needed to, so avoiding imposing opportunity costs on themselves through mismatched population growth forecasts.

Finally, it should be noted that our third recommendation is subject to the first two recommendations being taken up by Auckland Council.

Appendix A Reviewed documents

The documents reviewed in this report were:

- Development Contribution Policy Growth Assumptions (March 2022)
- Determining years 11 to 30+ greenfield provision requirements – community services and facilities guidance note (March 2022)
- Open Space Acquisition Cost Modelling Method (April 2022)
- Drury Developer Contributions Policy – Transport Assessment (February 2022)
- Drury Infrastructure Funding and Financing (DIFF) – Cost Allowances (April 2022)
- Chief Economist's Unit's memorandum on a Methodology for Improving Development Contribution Forecasts.

Appendix B Chief Economist's model method review

In this section, we present our review of the Chief Economist's Unit's memorandum on a Methodology for Improving Development Contribution Forecasts. It should be noted that the memorandum is dated 12 April 2021, and that some market and other conditions have changed since then. In what follows, we summarise the key points of the memorandum, with our comments shown in italics.

The starting point in the memorandum is that, contrary to the assumption underpinning the existing methodology, the number of annual households (from I11 population and household growth projections) will not equal the number of new dwellings added each year.

BERL's view is that this is entirely plausible, but, ideally, it would be good to demonstrate the difference between additional households and additional dwellings, using past data.

However, Statistics New Zealand data doesn't enable this, and we doubt whether the Council has the necessary data on household numbers.

The proposed revised methodology for forecasting the number of rateable units completed in the medium-term, uses data on consent applications, the average time lag between application and consent, and then the time lag between consent and completion. The logic here is that, given knowledge of the number of Resource Consent (RC) and Building Consent (BC) applications in each quarter, it will be possible to estimate the future number of completions (and Developer Contributions (DCs)) for each quarter.

The logic here is also plausible, but the question is whether the lags are stable over time, and we wonder if the data was examined to test whether this is the case. Ideally, it would have been. There is anecdotal evidence (e.g. Hutt City) that the lag between application and granting of consent is blowing out, partly or largely due to a large increase in the number of applications. We also wonder what the effect of materials shortages (e.g. GIB), and skills shortages, has been on the lag between consent and completion.

Based on this proposed approach, the memorandum's focus shifts to considering what will happen to the number of consent applications over the next few years. It is argued that it is already known what will happen to completions in the next 1-2 years, because consents have already been granted, so the question becomes: what will happen to completions and DCs beyond the medium-term, i.e. 2-4 years ahead?

The medium-term number is argued to be a function of three key influences: house prices, COVID-19 containment measures that impacted migration, and Unitary Plan changes. The memorandum assumes that:

- Buoyant house prices will support applications.

They have, but prices are now stabilising and are forecast to fall in the short-term

- Migration will surge once border controls are relaxed

The opposite has happened and the consensus appears to be that there will be significant negative migration, although this might not endure beyond the short-term

- Unitary Plan changes will affect the type and location of applications, towards multi-unit on brownfield sites

This appears to be happening.

The validity of these assumptions beyond the short-term could be debated, but we suggest it would have been good to test the effect of varying the assumptions, and the relative weights assigned to them.

The memorandum also mentions that a mid-point scenario for forecasting RC and BC applications from March 2021 onwards was developed, but it is not clear what alternative scenario(s) was(were) considered, based on different assumptions about the drivers and their respective weights. Ideally, it would be good to test the performance of the chosen scenario by examining how well it would have forecast past applications.

The memorandum then proposes a way, based on a set of sequenced steps, of converting from Rateable Unit (RU) completions to HUEs.

The process here looks logical and reasonable

The memorandum then notes a set of limitations of revised methodology, namely:

- There is scant data on demolitions to net-off the gross number of RU completions. Accordingly, the number was based on assumptions.

Again, in an ideal world, the effect of varying the assumptions would be demonstrated, although we suspect the precise assumption adopted would not have a dramatic impact on the net number of completions.

- The complexity within subdivision and multi-unit development is not separately modelled, although it may take longer to get consent, and may take longer to complete, than the average development. Limited data means that median approval times across all subdivision RC applications, and across all multiunit BC applications and builds, were applied.

This seems reasonable in the absence of the necessary data.

- Applications data is historically poorly recorded. As a result, the Council is still working through historical applications data to align them better with dwellings consented data. However, it means there is likely to be significant inaccuracy in historical applications data. Over time, as this data is corrected, the applications information will become more reliable.

Our questions here are: How significant have the changes to date been? And do the changes have a consistent pattern, in terms of the direction of corrections (i.e. upwards or downwards)?

- The total number of rateable units is historically poorly recorded. Although 70% of residential DCs are triggered by subdivision RCs rather than BCs, data from Financial Strategy suggests of late the figure is more a 50:50 split. This matters because while it is possible to forecast total new dwellings delivered to final inspection, or total new RUs generated by subdivision, these are not additive. The total number of new RUs added is less than the sum of new dwellings delivered and new subdivided properties because some of those dwellings will be delivered on subdivided properties.

The significance of this point is not fully understood. However, we note that the end of the memorandum indicates that the 50:50 split is the more accurate for the past 21 months. Because of this, an assessment should be made about what caused the shift and whether it is permanent.

- Conversion of parent properties into child properties. To estimate the number of net new RUs formed by subdivision, it is necessary to understand on average how many net new “child” properties are produced by a typical subdivision. A large share of subdivision RC applications do not clarify how many parent properties are being used to produce child properties.

The notion of parent and child properties is unfamiliar to us, so the significance of this point is not understood

- Matching approved subdivision RCs to 224C. Issuing of 224C is currently the trigger point for a subdivision to pay DCs, but the dataset that tracks the application to approval process is not directly linked to the dataset that tracks progress to 224C. This makes the process of determining how quickly an approved subdivision moves to 224C (completion) fraught, and all that is available is a basic estimate. This needs immediate improvement to improve the reliability of the DCs model.

This point is confusing. It was stated near the beginning the memorandum that the average lag between RC application and consent, and then consent to completion, is known.

Next, the memorandum states that the new model uses recent applications information, historical time lags, and known future events to forecast RUs for the next two to three years. Beyond that it adopts a longer-term average growth path.

Reversion to a longer-term growth path is standard in modelling, but, as argued previously, it is important to examine whether historical time lags are stable, and question whether specified future events are actually known.

The memorandum states that the approach raises important questions the model cannot answer including: Where will these dwellings go? What further infrastructure will be needed? How can we more accurately price the likely cost of infrastructure? Having established the extra infrastructure needed, how will it be funded?

These questions are important, and need to be addressed, but they are beyond the scope of the memorandum and, therefore, this review.

Leaving the questions aside, the memorandum goes on to present some initial forecast results. The results show more growth in the number of new dwellings than I11v6, the scenario currently being used by the Council. This scenario was a more pessimistic model run with regard to population growth in the short to medium-term than its predecessor, which in part explains the higher figures in the new model.

Conclusions

BERL's conclusion is that, overall, the broad approach described in the memorandum is reasonable, but it is obvious that any results from the model will be sensitive to the quality of the data upon which it relies, and on the modelling assumptions applied.

Concerning the data quality, it is reassuring to note that the Chief Economist's Unit was evidently aware of the data quality issues when the memorandum was drafted, and that steps were being taken within the Council to address the issues. Needless to say, if the work in this area is progressed, it will be important for the Unit to be alert to the possible emergence of further issues, so that they can be addressed.

One of the complications affecting this review is that it was reported to us that none of the staff who were involved in the work to develop the model are still with the Council. Consequently, we are unable to tell what, or how much, testing was done to ascertain how the model behaves.

Ideally, we would have expected the staff in the Unit to:

- Examine the stability of some of the statistical relationships in the model,
- Question the validity of the modelling assumptions and
- Test the sensitivity of the model outputs to varying the assumptions.

We were provided with a copy of the model as part of this review. It is possible, of course, that all these things were done during the process of developing the approach, but the memorandum does not indicate whether this was the case.

Lastly, it would have been useful to explore how well the model tracked the actual past numbers of RUs. This sort of tracking is widely used in economic modelling to help the assessment of a model's performance. How well a model tracks what actually happened in the past is also often a useful indicator of the value of the model, and whether work is needed to develop it further.

We were not able to examine how well the model tracks what actually happened in the past. However, we were provided with information that indicates the model developed by the Chief Economist's Unit produced projections of the number of HUEs in Financial Years 2021 and 2022 that were close to the estimated actual number. Furthermore, the margin of error in these projections was smaller than the margin of error from the existing DC growth modelling for the Financial Year 2021, as well as being significantly smaller than the margin of error from the DC modelling in earlier years.

It should be noted that the Chief Economist's Unit model should be seen as a complementary model to the existing DC growth model. The Chief Economist's Unit model is best used to assist in estimating the short-term number of HUEs and consequently likely development contribution revenue. This is because the Chief Economist's Unit model is focussed on the short- to medium term, where it informs estimates of development contribution revenues, and is driven by the number of consents. By contrast the overall DC growth model is focused on the long-term, where it informs estimates of expenditure for infrastructure that will need to be funded by development contributions. The DC growth model is driven by population estimates.

BERL would consider it appropriate for the Council to use both models. We recommend that the Chief Economist's Unit model should be used by Council to estimate the number of HUEs and, consequently, the likely development contribution revenues, to complement the DC growth model.

Our reasons for this recommendation are that:

- The logic underpinning the model is sound. It highlights that the number of dwellings developed will not necessarily equal the number of new households or growth in the population. The emphasis on using consents data as the basis of the dwellings forecasts is appropriate
- The model's focus on the drivers of development (i.e. house price, migration and the Unitary Plan) is also appropriate
- It is evident that deficiencies in the data used in the model have been identified

- It also appears that, albeit on the basis of just two years, the model performs better than the current model used by the Infrastructure Groups, in terms of goodness-of-fit with the estimated actual number of HUEs developed
- The apparently good performance of the model suggests that it might have been tested rigorously in the course of its development.

However, the recommendation above is subject to a further recommendation that there should be ongoing work to:

- Remedy or ameliorate, as far as possible, the data problems identified in the memorandum
- Assess the stability of the relationships in the model, especially the observed time lag between applying for and receiving a planning consent, and between receiving a consent and completing the building work
- Review the validity of the key assumptions in the model on a regular basis, especially the assumptions about what is likely to happen to house prices and migration
- Test the sensitivity of the model outputs to the assumptions and their respective weights
- Test the performance of the model in forecasting the estimated actual number of HUEs.