# RESPONSE TO COMMERCE COMMISSION REQUEST FOR INFORMATION '*CHORUS FLOOR SPACE MODEL ASSURANCE*' DATED 29 April 2022

**03 JUNE 2022**

## Contents

# Introduction

This document provides the information the Commission sought in its 29 April 2022 'Chorus floor space model assurance' request for information. The information corresponds to *Property footprint allocation (17012022).xlsx* (**Property Model**).

We demonstrate that Chorus applied our full internal certification process to the Property Model, describe the modelling of Chorus' property cost allocations and include explanations of the underlying assumptions used in the associated property model and the risk and limitations considered in relation to the model.

We will provide two pieces of the requested information separately:

- Assurance of the updated model that replaces all forecasts for the financial loss period with actuals for the final central office space allocator values (the initial RAB 'true-up' information which is the subject of the Commission's current section 221 notice). Our certification process for this update is still underway. We will provide assurance of this process to the Commission alongside our response to the section 221 notice on 3 June 2021.

- Confirmation that Deloitte has completed its independent model validation test procedures on the calculations in the Property Model and consistency with the model documentation will be provided in early June.

## Certification and assurance of the Property Model

Chorus' Board and Executive team take compliance and assurance very seriously. We dedicate significant resource to our certification process; it is comprehensive and reflects our understanding of best practice in this area. As the Commission is aware, Chorus has applied this process since demerger. It is the backbone of our regulatory compliance framework and is the same process we have used across all our disclosures since 2012, including Chorus' Open Access Deeds of Undertaking, annual Directors' certificates, certification of previous annual information disclosures and assurance over the IAV and MAR models the Commission has already decided upon.

Ahead of the Part 6 price-quality and information disclosure regime taking effect, we reviewed our certification process, including seeking external advice, to ensure it remained fit-for-purpose. We are satisfied it continues to be a robust process that is best practice and appropriately supports consideration of both compliance with requirements and accuracy of information. The key stages in our process are as outlined in appendix B11 to our 26 March 2021 section 221 notice response and as described further below.

## Application to the Commission's decision on our Property Model

As the Commission must reach evidence-based decisions, it is appropriate, having received this further information and assurance that our Property Model is based on our best-practice certification process, that the Commission removes the 50% multiplier on floor space allocated to FFLAS. We do not consider there to be any evidence about our network that would support the continued application of a discount factor, and the application of a discount factor does not best meet the purpose of Part 6.

The **attached** expert economist report by Incenta concludes there is no rationale for applying a discount factor to the allocation of exchange space that results from our allocation model. Specifically, applying such a discount:

- is not justified from a consideration of the requirements in the Input Methodologies with respect to asset allocators;
- would not flow from an application of the "shared cost cap". Testing against this cap requires extensive analysis at the level of individual assets, and a consideration of information beyond that contained in Chorus's allocation model, and
- would not promote real financial capital maintenance, and therefore not be consistent with the Part 6 purpose statement.

Incenta also concludes:

- The asset allocator we apply to exchange space meets the requirements of the Input Methodologies in both pre- and post-implementation periods;
- The desktop nature of our calculation is a practical necessity and has other strengths;
- The existence of vacant space in exchanges should not affect the quantum of the asset allocator;
- Vacant space should be included in the total space allocated;
- The property model does not include the information required to assess the shared cost cap. Applying the shared cost cap would require modelling the costs associated with repurposing assets and these costs are not included in the property model.

## Structure of our response

The remainder of this document is laid out as follows:

- Section 2 – Certification and assurance
- Section 3 – Overview of the Property Model
- Section 4 – Calculations
- Section 5 – Walk-through Individual Worksheets
- Section 6 – Replacing Forecasts with Actuals
- Section 7 – Glossary

# Certification and assurance

## Content of our internal certificates

The form of certificates for each process is bespoke to the information being prepared and reflects the specific information requirements, such as Input Methodologies (**IMs**) that must be applied and any applicable statutory notice requirements. However, the following key assurances are common across certificates (including those relating to the Property Model):

- whether all applicable IMs have been complied with (noting the point below that this assurance is sought in every certification process from people with requisite understanding of the IMs. This will not necessarily be the same person as prepared the information);
- a statement as to the accuracy of the information; and
- an assurance that the information materially reflects the operations of Chorus.

All technical certifiers are also required to list any material risks, limitations and assumptions associated with the information they have prepared or are reviewing and to identify any confidential information.

In some cases, there are multiple certificates at each 'tier' of our internal process – for example, for the same information set, there may be a technical lead certificate relating to the accuracy of the information and a separate technical lead certificate relating to compliance with the IMs. This is to recognise people's areas of expertise and speciality and ensure the integrity of our process. For example, our SMEs who are expert in our business systems might take advice on how to prepare information in an IMs-compliant way but are not the appropriate people to provide assurance that the IMs have in fact been complied with. Instead, certification as to compliance with IMs is sought from a separate person or people with requisite understanding of the IMs.

## General structure of our internal certification process

### *Technical leads*

Given the volume of information we provide to the Commission and its very detailed and technical nature, it makes sense for our internal assurance process to begin from the insights and assurances from the SMEs who prepare/compile the information. These people are known as 'technical leads' in our internal certification process and provide the base information from which other checks and reviews are undertaken.

However, subsequent reviews and checks of the information are not simply a 'rubber stamping' exercise. Every certifier in a certification process is told what is expected of them ahead of certifying, including that they must turn their own mind to the statements in their certificate, review the information they are certifying and any underlying certificates (for technical reviewers and above), seek any further information and ask all questions they need in order to satisfy themselves as to the statements in their certificate. Any non-compliance or disagreement with the statements is to be noted.

### *Technical review*

Each piece of information is reviewed by a 'technical reviewer', which is a person who has sufficient subject matter expertise to perform a substantive and educated review of the information and the statements in the technical lead's certificate.

Technical reviewers are instructed to apply their own mind to the statements in their certificate, to request any further information and ask all questions they need to in order to be satisfied that, based on their reasonable enquiry, the information complies with the requirements and accurately reflects, in all material respects, the operations of Chorus. This includes the opportunity to discuss the information with the technical leads who prepared it in order to challenge or follow up any areas of concern.

### *Quality assurance*

Quality assurance is typically undertaken by a senior ('tier three') person with sufficient understanding of the subject matter and systems involved in the preparation of information to provide an arm's length review. Like the technical review, a quality assurer is required to turn their own mind to the statements in their certificate and, after reviewing the information and underlying certificates, certify to a 'reasonable enquiry' standard that the information complies with the requirements and/or is derived from and accurately represents in all material respects the operations of Chorus.

QA reviewers are also asked to record any risks, limitations and assumptions which, like those recorded by technical leads and technical reviewers, are compiled for overall consideration by the business owner. As with technical reviewers, QA reviewers also have the opportunity to discuss the information with technical leads and anyone else who has personal knowledge of its preparation, or the systems involved in order to challenge or follow up on any areas of concern.

### *Further certificates*

Certification by managers, business owners, Executives and Directors flow from the three-tier certification process as required by internal processes or regulatory requirements.

Our certification process is designed to, and does, identify gaps or errors in information. One of our example certificates (**Appendix B**), relating to the electricity and power allocation update in our current RAB true-up assurance process, shows the identification of an incorrect file being provided to Analysys Mason, which resulted in the correct file being sent in replacement.

## Evidence that Chorus' internal certification process was applied to the Property Model

The three-tier certification process described to the Commission in Appendix B11 of our 26 March 2021 IAV response was applied carefully and in full to the Property Model (and all other inputs to the IAV model). Our practice is to issue certificates at the final stages of information preparation or review, to make sure the information is in final form before it is certified (changes to the information require re-certification, which is necessary but cumbersome) and make the issuing, receiving and saving of certificates as efficient as possible. As explained above, all certifiers are told ahead of their review what aspects their certificate will address, so they can conduct their review in light of those requirements.

Once a certificate is received, it is sent to the next certifier 'up the chain', together with that person's own certificate template (i.e. a technical review is sent the technical lead's

certificate as well as their certificate template for completion). This does not mean that person's review of the information begins at that point. As the record of meetings on the Property Model below shows, there has often been many discussions during the development of information, well ahead of the certification process.

As such, the date on certificates simply reflects the date *of* certification, marking the end of that person's preparation or review of information. The date is not demonstrative of the length of the process to prepare or review information. Our practice of waiting for the completion of an underlying certificate before sending it to the next certifier is designed to ensure every certifier carefully considers the statements and observations made in underlying certificates and has the chance to ask any questions of that underlying certifier or seek further information (as our process requires).

### *Certifiers of the Property Model*

The Property Model was certified by the following personnel:

- Technical lead (substantive information) – Asset & Investment Manager on 23 November 2020 (who developed the desktop modelling exercise, using the methodology developed with a number of internal SMEs, and endorsed by senior management). This certificate is attached as one of our three sample certificates at **Appendix C**;
- Technical review - Head of Network Technology on 24 November 2020 (reviewed the data supplied by the technical lead and considered the accuracy of the data and the suitability of the inputs, including that it was consistent with the operations of Chorus);
- Quality assurance - Head of Technology Strategy & Architecture on 30 November 2020 (considering whether the appropriate people have been involved in the preparation of information, the right systems have been used and whether the headline numbers look to be reasonable);
- Technical lead (IMs compliance) – Regulatory and Costing Analyst on 24 March 2021;
- Head of Economics and Modelling on 25 March 2021, which served, amongst other purposes, as technical review of IMs compliance; and
- Business Owner certificate of 25 March 2021[1], which served, amongst other purposes, as quality assurance on IMs compliance.

These certificates all included statements that the information was derived from and represented, in all material respects, the operations of Chorus.

In addition, the data inputs to the model were also subject to our internal certification process and the Property Model was the subject of a number of other reviews, including by an external modelling consultant (mechanics of the model) and a senior finance manager (who ensured the methodology had been applied as agreed).

### *Risks, limitations and assumptions*

[1] As explained above, these are the dates on which certificates were signed, and does not reflect all preceding review and compliance discussions.

We provided the recorded risks, limitations and assumptions from the Property Model (substantive information) certificates to the Commission in our response to its June 2021 s221 notice and have discussed these with the Commission. We are aware Commission staff view these documented risks, limitations and assumptions as brief and high-level.

As we have discussed with the Commission, the statements recorded in the certificates were meaningful to an internal audience given the number of preceding meetings on the approach to and preparation of the Property Model. The table below records these meetings, dating back to 2018, which included the technical lead and technical reviewer for the substance aspects of the model.

These meetings provide further context to our certificates and demonstrate that the Commission should not read the brief statements in the model certificates as giving cause for scepticism about the robustness of the Property Model itself. Our certification process is designed specifically to support internal assurance and compliance processes. As such, it is not realistic to expect the certificates (which date back to 2020 when the information was prepared) to contain detailed explanations of issues that were fully discussed in meetings, nor to be fit for later consideration by an external audience.

The RFI states "Commission staff expect that documentary evidence will include … any certificates, reports or other relevant documents produced at the end of each stage of assurance". We agreed with **CCI[ ]** on 21 April 2021 to provide three example certificates and understood this would meet Commission staff's expectation in relation to provision of certificates.[2] We trust the detailed information we now supply on the limitations to the Property Model, in response to the Commission's specific questions, provides the insights the Commission is seeking. We are happy to discuss any outstanding concerns with the Commission.

In addition to the record of certificates provided above and record of meetings below, **Appendix A** to this response lists the staff who internally certified the information provided to the Commission on 26 March 2021 (our IAV model submission) and the relevant requirements in the Input Methodologies. These certificates were at a level above individual input models (such as the Property Model) but demonstrates the level of transparency and detail provided to senior certifiers through our internal process.

Some certificates in relation to other aspects of the IAV and MAR models contain more detailed descriptions, such as the certificate relating to quality assurance of corporate costs (**Appendix D**).

### *Compliance with the IMs*

Many hours were spent in workshops to ensure every clause in the relevant IMs had been complied with in the preparation of the input models and the IAV models themselves. These workshops involved at least one lawyer, regulatory personnel, members of our Economics and Modelling team and various SMEs. In addition to informing legal sign-off, a key output of these workshops was a comprehensive 'compliance roadmap'. A version of this roadmap was provided to the Commission as part of our 26 March 2021 section 221 response.

[2] Our 27 April 2021 email to CCI[ ] outlined what we agreed with the Commission (in our 21 April meeting) to provide. Commission staff in that meeting asked to see three sample certificates from across our certification processes to understand what information our certificates typically contain.

Compliance with the Cost Allocation IM was discussed at workshops on 21 January, 10 February and 2 March 2021. An example of these checks relating specifically to the Property Model can be found in line 71 of the compliance roadmap, which refers to ratios of estimated exchange space, in relation to clause 3.2.1(5)(a) of the Cost Allocation IM.

The 18-page, 24 March 2021 technical lead certificate by one of our Regulatory and Costing Analysts specifically provided assurance that all applicable IMs had been complied with. This fed into further consideration of IMs compliance by Chorus' Economics and Modelling Manager, Business Owner and our legal team.

### *Development of the Property Model*

The following record of meetings held about the preparation and review of the Property Model shows the level of consideration given to the model and the approach Chorus took to it. These sessions included robust challenge as to confidence in the data, whether cost allocation approaches had been correctly applied and whether the right data sources were being used. They also resulted in there being a very in-depth understanding of the Property Model, including by those involved in the certification of it. This record is not necessarily exhaustive but captures the key meetings.

| Date | Meeting Purpose | Attendees |
|---|---|---|
| 15/10/2018 | Initial meeting to explore possible allocation options for property and the supporting infrastructure | **Internal Experts**<br>Asset & Investment Manager (**Note:** technical lead for the Property Model preparation)<br>Senior Finance Manager, Customer and Network Operations (**CNO**)<br><br>**Regulatory**<br>Regulatory & Costing Analyst |
| 15/11/2018 | BBM cost allocation workshop for property space, discussing possible modelling options:<br>- Connections<br>- Estimation of the fibre footprint<br><br>Optimally we would have used network records to compile the information and mark-off what is actually used. As we have explained, our network records are limited and in some respects not wholly accurate, which required a pragmatic alternative approach. | **Internal Experts**<br>Asset & Investment Manager<br>Head of Network Technology (**Note**: technical reviewer of the Property Model)<br>Portfolio Architect (Network. & Assurance)<br>Senior Finance Manager CNO<br><br>**Regulatory**<br>Asset Management Lead<br>Regulatory Accountant<br>Regulatory & Costing Analyst<br>Regulatory Economist<br>Regulatory Programme Manager<br>Principal Economist |
| 27/02/2020 | Property/network maintenance – capex – | **Internal Experts**<br>Asset & Investment Manager |

| | | |
|---|---|---|
| | workshop on the draft property model | Senior Finance Manager CNO<br><br>**Regulatory**<br>Expenditure Lead<br>Regulatory & Costing Analyst<br>Regulatory Economist<br>Regulatory & Policy Affairs Manager<br>Project Manager |
| 05/06/2020 | To discuss options discussed at property model workshops [not sure what this was or that it adds in value to include] | **Regulatory**<br>Head of Economics and Modelling<br>Head of Regulatory Policy & Affairs<br>Programme Manager<br>Project Manager |
| 10/08/2020 | Implications of the Commission Consultation's Papers – why property costs have a high allocation to copper, and how this may look as equipment is decommissioned | **Internal Experts**<br>Head of Network Technology<br>Head of Technology Strategy & Architecture (**Note**: quality assurer for the Property Model)<br>Senior Finance Manager CNO<br><br>**Regulatory**<br>Head of Economics and Modelling<br>Project Manager |
| 11/08/2020 | Principles and framework for thinking about cost allocation, engaging key internal experts across a number of specialties (including, but not limited to, Property) | **Internal Experts**<br>CTO Finance Managers<br>Head of Business Technology & Operations<br>Head of Finance Systems & Technology<br>Head of Network Technology<br>Head of Technology Strategy & Architecture<br>Senior Finance Manager CNO<br><br>**Regulatory**<br>Head of Economics and Modelling<br>Head of Regulatory & Policy Affairs<br>Project Manager<br>Regulatory & Costing Analyst<br><br>**External Expert**<br>Economist (Incenta)<br>Cost Modeller (Analysys Mason) |
| 20/08/2020 | External expert presenting economic principles for cost allocation, and applying the draft IM rules specifically to property space | **Internal Experts**<br>Head of Network Technology<br>Head of Technology Strategy & Architecture<br>Senior Finance Manager CNO<br><br>**Regulatory** |

| | | |
|---|---|---|
| | | Head of Economics and Modelling<br>Head of RESET<br>Regulatory Accountant<br>Regulatory & Costing Analyst<br>Regulatory Programme Manager<br><br>**External Expert**<br>Economist (Incenta) |
| 26/08/2020 | Internal experts to presenting back their final property modelling, testing methodology with external economist, ahead of presenting to the executive sponsor | **Internal Experts**<br>Asset & Investment Manager (TL)<br>Head of Network Technology (TR)<br>Head of Technology Strategy & Architecture (QA)<br>Senior Finance Manager CNO<br><br>**Regulatory**<br>Head of Economics and Modelling<br>Head of RESET<br>Regulatory Accountant<br>Regulatory & Costing Analyst<br>Regulatory Programme Manager<br><br>**External Expert**<br>Economist (Incenta) |

The gap between November 2018 and February 2020 can be explained based on Commission's key dates. For example:

- Initial modelling commenced ahead of the Commission's consultation on IMs, which started with the release of its first paper in November 2018.
- After the Commission's draft decision was released in November 2019 and submissions prepared, we re-engaged SMEs on cost allocation in February 2020.

Then in August 2020, we had our external advisers review our final approach.

# Overview of the Model

Chorus developed the Property Model to allocate the value of buildings between fibre fixed line access services (**FFLAS**) and non-FFLAS for the Initial Asset Valuation (**IAV**) Model. The outputs are also used in the opex model, as well as Chorus' RP1 expenditure proposal.

The model estimates, for each Exchange Service Area (**ESA**), the amount of floor space within exchange buildings that is utilised for FFLAS and non-FFLAS, then aggregates by Building Block Model (**BBM**) geography (Won/Lost/Non) for Chorus-owned sites and for Leased Spark sites.

The FFLAS area (**Fibre Floor Area**) and non-FFLAS (**Copper Floor Area**) for each ESA are estimated from the average floor area used by each major network asset that

supports the relevant service. The Property Model calculates floor space required for each major network component to either FFLAS or non-FFLAS by ESA, or in the case of Optical Fibre Distribution Frame (**OFDF**), apportions the area based on the use of individual fibres on each OFDF.

The Property Model takes into account the footprint required for each piece of equipment, or OFDF / Main Distribution Frame (**MDF**) areas, how much equipment can be installed in each footprint, as well as the amount of each type of equipment required at each site over time.

### Methodology

Due to the limitations with network records, internal subject matter experts (**SMEs**) workshopped approaches for an appropriate alternative approach to allocating building assets, identifying two options:

- Full audit of Chorus-owned ESAs, and timestamp the results for a static view; or
- Desktop modelling exercise, utilising network records.

Due to time and cost constraints, the full audit wasn't possible. In addition, while it could be replicated in future, it couldn't recreate historic information to best estimate Chorus' financial losses. Therefore, the desktop modelling exercise was adopted as most likely to best give effect to the requirements of the Telecommunications Act and the Input Methodologies.

Where available, equipment volume information for each ESA has been extracted from Chorus' network systems or relevant weekly capacity utilisation reporting and compiled into input sheets. Given the above equipment volumes in each ESA, and the unit footprint requirements for each type of equipment from supplier specifications and our Asset Managers' knowledge, the model derives the overall area that each asset type utilises in each ESA.

These steps are repeated for all major FFLAS and non-FFLAS asset types, noting that the Spark Public Switched Telephone Network (**PSTN**) is excluded because leases are treated differently in Chorus' financial accounts.

For 2022 and beyond, the model forecasts how the volume of network elements will change overtime, based on Chorus' Board-approved FY21 business plan.

### Floor Plan Examples

The objective of the Property Model was to develop a robust and causal way to allocate property space between copper and fibre. An optimal approach would have been to use network records to compile the information. However, these records are limited and we know in some places they are not necessarily accurate.

**Attached** to this response are floor plan examples to demonstrate some of the challenges with network records. These have been sourced from our network records system.

For each example, we manually drew a grid over the floor space, and identified what is copper, fibre or shared. Outcomes from this exercise:

- Waiheke – floor plan last updated in June 2011. As this record update pre-dates UFB, using this approach would allocate 100% of floor space to copper. But in reality, over 75% of customers served from the Waiheke exchange are on fibre.

- South Dunedin – floor plan last updated November 2021. Floor plan shows 52% FFLAS, where the model calculates 48%.

- Red Beach – floor plan last updated in March 2022. Floor plan shows 49% FFLAS, where the model calculates 54%.

To caveat, floor plans are not intended to be used for this purpose, as they are used to record where equipment is located, rather than how they are consumed by regulated and unregulated services. Assumptions have therefore been made on what equipment is supporting FFLAS.

### Outputs

The Property Model provides the following outputs (refer to worksheet *Summary_Output_SPACE*):

- Chorus-owned sites, the percentage of floor space utilised by FFLAS by geography; and

- Spark-owned sites (as these assets relating to Spark leases are treated differently for accounting purposes), the percentage of leased floor space utilised by FFLAS by geography,

where geography is defined as (consistent with the IAV):

- Won – aggregation of ESAs in which the provider of Ultra-fast Broadband (**UFB**) services is Chorus. Not all premises in the ESA are necessarily passed by FFLAS;

- Partially Won – aggregation of ESAs in which the provider of UFB1 services is another local fibre company (**LFC**), but Chorus is the provider of UFB2/2+ (or vice versa);

- Lost – aggregation of ESAs in which the provider of UFB services is another LFC; and

- Non – aggregation of ESAs where there is no provider of UFB.

While the IAV originally used "Partially Won", it was subsequently removed and the small quantity of assets in this geography are pro-rated between Won and Lost areas. For the Property Model, the IAV only uses the Won and Lost values, and ignores Partially Won as it's complex to reallocate resulting in an immaterial difference.

The outputs for Chorus-owned sites are then used:

- IAV Model – to allocate assets that are "shared with copper property space"; and

- Opex Model – to create the "accommodation relationship driver".

Where outputs for Spark-owned sites are used in the IAV Model to allocate assets that are "shared with copper property leased space".

### Inputs

The model uses a number of sources for data inputs, including:

| | |
|---|---|
| *Chorus Board Approved Business Plan* | • Forecast copper connections by site<br>• Forecast fibre connections by site<br>• Forecast growth or lifecycle management of copper and fibre equipment |
| *Chorus Data Warehouse (**CDW**)* | • Copper and fibre connections by site<br>• Copper pairs by site |
| *Element Manager* | • Passive Optical Line Terminators (P**OLTs**) by site<br>• Digital Subscriber Line Access Multiplexers (**DSLAMs**) by site<br>• Fibre Assess Network (**FAN**) switches by site<br>• Regional Ethernet Network (**REN**) switches by site |
| *NetMAP* | • OFDF footprint size by site<br>• ESA shapefiles |

### Time Periods

There are two time periods in the Property Model:

- Actuals 2011 to 2021; and
- Forecast 2022 to 2025.

# Calculations

Refer to worksheet *Summary_Output_SPACE* for the final cost allocators for the percentage of exchange space allocated to FFLAS (as a proportion of total fibre and copper floor areas), which is then used in the IAV Model for allocating:

- 2012 to 2021 – commissioned assets and opex; and
- 2022 to 2025 – forecast capex and opex.

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Chorus Sites** | Fibre/(Copper+Fibre) | | | | | | | | | | | |
| Won | 0% | 5% | 7% | 7% | 8% | 10% | 13% | 18% | 23% | 27% | 45% | 51% |
| Partialwon | 1% | 6% | 6% | 6% | 7% | 7% | 11% | 13% | 15% | 18% | 22% | 23% |
| Lost | 0% | 4% | 5% | 6% | 6% | 7% | 8% | 9% | 10% | 11% | 13% | 14% |
| Non | 0% | 1% | 5% | 6% | 7% | 8% | 11% | 13% | 13% | 14% | 20% | 20% |
| Total | 0% | 5% | 6% | 7% | 8% | 9% | 12% | 16% | 20% | 23% | 37% | 41% |
| | | | | | | | | | | | | |
| Weighted average for Spark | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| Won | 0% | 6% | 7% | 7% | 8% | 10% | 14% | 17% | 19% | 23% | 33% | 34% |
| Partialwon | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Lost | 0% | 5% | 5% | 5% | 5% | 5% | 7% | 7% | 8% | 8% | 8% | 8% |
| Non | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Total | 0% | 6% | 6% | 7% | 8% | 9% | 12% | 14% | 16% | 18% | 25% | 26% |

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The calculations that link to this worksheet can be found in worksheet *Method 1 (F C)* – where Fibre floor area as a proportion of total Fibre and Copper floor area by ESA (refer to HB548:HQ560) is calculated using inputs from:

- Fibre floor area by ESA (refer to FR547:GF560):

| Fibre Floor Area | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 31/03/2012 | 31/03/2013 | 31/03/2014 | 31/03/2015 | 31/03/2016 | 31/03/2017 | 31/03/2018 | 31/03/2019 | 31/03/2020 | 31/03/2021 | 31/03/2022 |
| 189.0 | 244.1 | 272.2 | 312.3 | 364.7 | 516.0 | 708.9 | 858.5 | 952.5 | 1554.4 | 1635.4 |
| 10.0 | 10.2 | 10.4 | 10.7 | 11.9 | 18.5 | 22.5 | 26.0 | 28.0 | 35.4 | 35.7 |
| 31.6 | 42.8 | 45.6 | 49.3 | 54.6 | 68.1 | 79.4 | 86.8 | 93.9 | 120.5 | 121.1 |
| 2.5 | 9.5 | 12.6 | 14.7 | 21.2 | 27.5 | 33.1 | 35.7 | 36.1 | 53.0 | 53.8 |
| 233.1 | 306.6 | 340.7 | 387.0 | 452.5 | 630.2 | 844.2 | 1007.3 | 1110.8 | 1763.6 | 1846.3 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 81.1 | 83.6 | 91.3 | 104.2 | 125.7 | 171.7 | 191.5 | 204.0 | 209.9 | 285.7 | 295.8 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 18.4 | 18.6 | 19.8 | 20.0 | 20.6 | 27.0 | 29.7 | 30.1 | 30.3 | 31.0 | 31.1 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 99.5 | 102.2 | 111.0 | 124.2 | 146.2 | 198.7 | 221.2 | 234.2 | 240.2 | 316.7 | 326.9 |

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- Copper floor area by ESA (refer to GH547:GV560)

| Copper Floor Area | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 31/03/2011 | 31/03/2012 | 31/03/2013 | 31/03/2014 | 31/03/2015 | 31/03/2016 | 31/03/2017 | 31/03/2018 | 31/03/2019 | 31/03/2020 | 31/03/2021 | 31/03/2022 |
| 3187.5 | 3358.8 | 3494.2 | 3502.3 | 3483.4 | 3405.0 | 3332.3 | 3170.1 | 2945.3 | 2631.4 | 1908.4 | 1572.0 |
| 143.1 | 149.6 | 152.5 | 154.6 | 152.4 | 150.9 | 154.2 | 150.2 | 142.9 | 132.1 | 122.0 | 117.0 |
| 733.7 | 757.9 | 782.5 | 781.7 | 783.2 | 781.7 | 812.8 | 809.8 | 807.5 | 797.0 | 772.8 | 768.1 |
| 137.4 | 171.5 | 188.8 | 194.4 | 198.0 | 232.1 | 231.4 | 228.6 | 228.8 | 225.4 | 214.1 | 213.2 |
| 4207.8 | 4444.0 | 4624.1 | 4639.1 | 4623.0 | 4575.6 | 4536.2 | 4364.2 | 4129.8 | 3791.2 | 3022.2 | 2675.1 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 1171.6 | 1180.2 | 1194.9 | 1183.2 | 1156.0 | 1101.1 | 1029.2 | 956.5 | 859.5 | 711.8 | 583.8 | 567.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 364.2 | 368.5 | 370.7 | 371.7 | 373.6 | 373.4 | 366.9 | 369.5 | 364.6 | 355.3 | 354.7 | 358.9 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1535.7 | 1548.7 | 1565.6 | 1555.0 | 1529.6 | 1474.6 | 1396.2 | 1326.0 | 1224.1 | 1067.1 | 938.5 | 925.9 |

CCI[ ]

## Fibre floor area by ESA

To calculate the floor space occupied by FFLAS, the formula is:

*Fibre Area = FAN Area + POLT Area + (OFDF Area x %-FFLAS)*

### FAN Area

Refer to columns DV:EJ in the worksheet *Method 1 (F C)*.

Footprint required for FAN switches by site is calculated:

- Standard footprint is 0.8m x 1.0m per FAN rack (with 1 FAN per FAN rack)
- Factor of 3 to allow for the space required around the equipment for access and to complete tasks

### POLT Area

Refer to columns FB:FP in the worksheet *Method 1 (F C)*.

Footprint required for POLTs by site is calculated:

- Standard footprint of 0.8m x 0.6m per POLT rack
- Up to 3 POLTs per POLT rack, where POLTs can be stacked vertically
- Factor of 3 to allow for the space required around the equipment for access and to complete tasks

### OFDF Area

Refer to columns F:T and columns BI:BW in the worksheet *Method 1 (F C)*.

Footprint required for OFDF by site is calculated:

- OFDF footprint by site is sourced from Chorus' network records, NetMAP, using the install date to estimate the time-based profile
- Factor rate of 3 to allow for the space required around the equipment for access and to complete tasks

### %-FFLAS (of OFDF area)

Refer to columns AS:BG in the worksheet *Method 1 (F C)*.

Estimated via a year-by-year analysis of the percentage of fibres used by FFLAS, from Chorus' network records (NetMAP), with forecasted %'s for years beyond 2022 held constant at 2022 %'s.

## Copper floor area by ESA

To calculate the floor space occupied by non-FFLAS, the formula is:

> *Copper Area = REN Area + DSLAM Area + (OFDF Area x (1 - %-FFLAS)) + Copper MDF Area*

### REN Area

Refer to columns DF:DT in the worksheet *Method 1 (F C)*.

Footprint required for REN switches by site is calculated:

- Standard footprint of is 0.8m x 1.0m per REN rack, with 1 REN switch per rack
- Factor of 3 to allow for the space required around the equipment for access and to complete tasks

### DSLAM Area

Refer to columns EL:EZ in the worksheet *Method 1 (F C)*.

Footprint required for DSLAMs by site is calculated:

- Standard footprint of 1.44m$^2$ per DSLAM rack (i.e. 0.6 x 0.8 x 3, which allows for the space required around the equipment for access and to complete tasks).
- Maximum of 2 DSLAM's per DSLAM rack. Where they can be stacked vertically.

### OFDF Area

As per above.

### %FFLAS

As per above.

### Copper MDF Area

Refer to columns CP:DD in the worksheet *Method 1 (F C)*.

Footprint required for Copper MDF by site is calculated based on:

- Number of copper pairs by site (held constant over time)
- 800 copper pairs per vertical
- 350mm x 600mm footprint per vertical
- % Non-FFLAS usage on MDF (ratio of copper lines to total lines at an ESA, to account for the falling use of the MDF as copper lines are replaced by fibre lines), applied to future years.

Where the factor of 3 is already factored into the footprint of the MDF.

# Walk-through of individual worksheets

This section provides a description of each worksheet in the Property Model.

## Assumptions and result

While we have previously provided the Commission with high-level assumptions and risks the following is the further detail requested by the Commission.

| | |
|---|---|
| **Methodology** | **Source**<br>Internal SMEs workshopped approaches for allocating building assets, identifying two options:<br>• Full audit of Chorus-owned ESAs, and timestamp the results for a static view; or<br>• Desktop modelling exercise, utilising network records.<br>Due to time and cost constraints, the full audit wasn't possible. In addition, while it could be replicated in future, it couldn't recreate historic information to best estimate Chorus' financial losses. Therefore, the desktop modelling exercise was adopted as most likely to best give effect to the requirements of the Telecommunications Act and the Input Methodologies.<br>**Assumptions**<br>The building space is used by either FFLAS or non-FFLAS services.<br>The usage of the building space can be determined by using equipment details from the network records systems.<br>Non-FFLAS equipment has lower equipment densities and hence result in a higher utilisation of the building space.<br>The building space used by shared equipment such as the OFDF have been allocated based on the use of the asset by FFLAS and non-FFLAS services.<br>Forecasted building space usage reflects current plans for investment in equipment for fibre services and decommissioning of equipment copper services. The Property Model has used the plans that were available at the time.<br>The space leased by Spark for PSTN purposes in Chorus buildings was derecognised from the book value of the relevant buildings at demerger, in accordance with GAAP, and therefore it is not appropriate to include the Spark space for PSTN when allocating Chorus net book value.<br>The use of the building space by colocation services is not material and is not included in the calculations.<br>Detailed technical assumptions are in the Calculations section below.<br>**Risks and Limitations** |

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| | It's not possible to identify every asset in every ESA, as Chorus doesn't have a complete set of network records on how the buildings are used. Hence it was derived.<br><br>Dense Wave Division Multiplexing (**DWDM**) assets are shared, and extremely challenging to allocate between FFLAS and non-FFLAS, so has been excluded from the modelling. Power plant, batteries and air conditioning assets are shared, and treated the same as Transport/DWDM. As a result, building space allocated to FFLAS is conservative.<br><br>Factor of 3 to allow for the space required around the equipment for access and to complete tasks, is consistent with Chorus' design rules for copper and fibre. If this is removed (i.e. assumed to be 1) for all asset types, it makes no difference to the outcome of the Property Model.<br><br>Operational data is a snapshot in time.<br><br>The historic use data was derived from that available today and is our best estimate of the usage changes over time.<br><br>The data is operational in nature and is generated and held by us in our systems for particular purposes. It is also often intended to be used by staff and third-party contractors familiar with the information, the systems and their limitations. Accordingly, caution is necessary before utilising information for other purposes or in selecting particular elements of information for use outside of its business context.<br><br>Information for the Property Model has been sourced from both financial systems, network systems and Chorus' network records. While the data appears to be largely consistent, it does not align perfectly. The implications of the differences are not material.<br><br>The Property Model uses data extracted as of 31st March, as this aligns to the updating of forecasting models for Chorus' business plan. While this may differ to the IAV Model, the impact is immaterial. |
| **Connections** | **Data Source**<br><br>Actual Connections – number of connections is extracted from CDW, where source data comes from product inventory, based on active contracts and billable items in SAP.<br><br>UFB vs RONZ – SAP doesn't know the location of copper or fibre services, so do a match to Customer Order Management (**COM**) to find the Telecom Location Code (**TLC**) of the service ID. Alternatively use shapefiles from NetMAP to geolocate an address.<br><br>Exchange Code – sourced from ESA shapefiles from NetMAP.<br><br>Forecast Connections – sourced from Chorus' connection forecast used for business planning.<br><br>**Assumptions**<br><br>Address & Location Management (**ALM**) replaced Integrated Customer Management System (**ICMS**) as the master address system for fibre, where Service Area Management (**SAM**) ID was used in ICMS and with TLC in ALM (so a 1:1 relationship). SAM ID is still used for copper. |

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| | **Risks and Limitations**<br><br>Utilising standard business systems that are the basis of our billing and network inventory – high degree of confidence with the accuracy of the data.<br><br>Shapefiles are drawn by hand, where geo-points come from CoreLogic. Small number of address points fall outside the shapefile but is very hard to fix and overall is immaterial.<br><br>Data issues in some RONZ areas (e.g. huts that serve copper customers only, but we don't know the location). As there is no fibre present, it's excluded from shared assets.<br><br>Only copper access and fibre access are included, excludes non-access products such as backhaul and colocation as they are too challenging to estimate. Impact is immaterial.<br><br>CDW doesn't record copper or fibre connections by ESA pre its establishment. So for years up to 2015, the model estimates connections by ESA based on total connections. |
| **OFDF footprint size** | **Data Source**<br><br>Actuals – sourced from Chorus' network records, NetMAP, which contains the OFDF footprint size by site.<br><br>Forecast – as per business plan (and contract with CIP) new build sites, that don't currently have fibre, but planned as per the UFB2/2+ rollout.<br><br>**Assumptions**<br><br>Minimum footprint for OFDF is 0.3m$^2$ in UFB2/2+ areas – these are small exchanges, so most likely will only require the minimum footprint.<br><br>Chorus builds once based on address points, so would only increase the OFDF for fibre infill (e.g. new subdivision). While copper demand is assumed to remain flat or decrease.<br><br>OFDF is a shared asset, supporting fibre and copper. It is allocated in the property model based on usage of the fibre cables connected to the OFDF.<br><br>**Risks and Limitations**<br><br>NetMAP – operational system so risk of some errors. Records are manually updated by Service Companies, so subject to human error. |
| **MDF footprint size** | **Data Source**<br><br>Actuals – derived from number of copper pairs per site extracted from CDW (input is daily upload from ICMS).<br><br>Forecast – no copper additions or withdrawal until end of FY22. Copper withdrawal assumptions, as per the business plan, beyond that date.<br><br>**Assumptions**<br><br>MDF has line and equipment side (where equipment side is owned by Spark – value is not included in Chorus' accounts, so the area has been excluded by setting 'Both Sides' factor in calculation to 1). |

| | |
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| | **Risks and Limitations**<br>Chorus has no network records of the actual size of the MDF footprint, so have calculated it based on the number of copper pairs.<br>Copper pair data is also used for provisioning (i.e. whether there is already a service provided on a working pair) – reasonable degree of confidence, noting:<br>• There are a number of records that shows a worker on a broadband service, because Spark wasn't able to consume naked DSL, but they're required to provide 111 services). Therefore the service was being jumpered and run back to MDF for every Spark worker. ICMS is showing these workers which aren't valid – hence we are counting this as a worker on the MDF, when it's not delivering a service, as it's "in-use" as it can't be "reused" for something else.<br>• Instances where ICMS may still record a copper pair, which has already been removed – thought to be immaterial. |
| **DSLAM (or ISAM)** | **Data Source**<br>Actuals – taken from Chorus' Weekly Growth Data Reports, sourced from:<br>• NetMAP (per port, source splitter information)<br>• AMS (Element Manager – shelf count)<br>• CSOM (provisioning system)<br>• CDW (inputs from Element Manager or provisioning system)<br>Forecasts – using Chorus' forecast connections per site:<br>**Assumptions**<br>Until Chorus fully withdrawals copper at a site, there will be one shelf remaining until the final customer is withdrawn.<br>Chorus' engineering rules requires a maximum of no more than 2 DSLAMs per rack for copper – it's not practical to have more due to heat density.<br>Forecasts:<br>• UFB1/UFB2 areas – as per copper to fibre migration assumptions in the forecast.<br>• Non-UFB areas – limited growth, usually one shelf per site. Where growth is forecast, a small shelf may need to be replaced with a large shelf – same height, just wider.<br>**Risks and Limitations**<br>Overstate the copper footprint, as there is a cost to grooming equipment (i.e. optimising footprint). For example, with PSTN withdrawal, Chorus will groom sites down to one shelf where possible. |

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| | Assume a standard size of footprint depending on the number of DSLAMS, as we don't have records on actual layout in the exchange.<br><br>NetMAP – risk of errors, as records are manually updated by Service Companies, so subject to human error.<br><br>AMS – low risk of error, as element manager system interrogates the electronic boxes themselves, so knows exactly what is there – e.g. cards, shelfs, whether something is connected to a port.<br><br>CSOM – low risk of error, as provisioning system with customer information, and if there were errors it would cause issues with provisioning. |
| **OLT (or GPON or POLT)** | **Data Source**<br><br>Actuals – Chorus has installed equipment to serve the maximum number of address points in an UFB area (i.e. consistent with building out ahead of demand). This is determined by using the average shelf fill rate required to serve the maximum number of connections. Current status comes from Weekly Growth Data Reports, sourced from:<br>• NetMAP (per port, source splitter information)<br>• AMS (Element Manager)<br>• FSOM (provisioning system)<br><br>Forecasts – using Chorus' forecast connection growth rates, apportioned to exchange area, forecast growth/reduction, different rules apply to different areas:<br>• UFB – fibre growing, copper decreasing. Go through different growth rates, and how many shelves that equates to.<br>• Non-UFB – copper remain consistent, with marginal growth/reduction.<br><br>**Assumptions**<br><br>Chorus connection forecasts are accurate.<br><br>Maximum number of address points in an area excludes future infill. For example, a new retirement village drives up the number of address points.<br><br>Infill depends on sites – where a shelf is half-filled, it can accommodate with the increase in demand. Where a shelf is near full, it drives further investment in a new shelf.<br><br>Continue to use Nokia – same space requirements for number of customers per chassis.<br><br>Lifecyle management for obsolescence is a 1:1 swap, so doesn't require additional space. Where legacy chassis are swapped out for new FX chassis as part of asset renewal. This is 4-card chassis in cabinets and/or small exchanges, with 8-card chassis in medium/large exchanges.<br><br>Chorus' engineering rules requires a maximum of no more than 3 POLTs per footprint for fibre.<br><br>Hyperfibre: |

| | |
|---|---|
| | • Same density and same card as GPON.<br>• Uses a different SFP (Small Form-factor Pluggable optical transceiver) and more power, so it will make a difference to power model when connections increase. No change to footprint requirements.<br><br>Applied standard footprint, then multiplied by a factor of a 3 as you need vacant space (consistent with the colocation operations manual for access seekers). Footprint overtime will stay the same for GPON. The next generation card is for Hyperfibre and is the same form factor but supports higher connection speeds.<br><br>**Risks and Limitations**<br><br>NetMAP – higher risk of error, as records are manually updated by Service Companies, so subject to human error.<br><br>AMS – low risk of error, as element manager system interrogates the electronic boxes themselves, so knows exactly what is there – e.g. cards, shelfs, whether something is connected to a port.<br><br>FSOM – low risk of error, as provisioning system with customer information, and if there were errors it would cause issues with provisioning.<br><br>Date of installation – operational data risk, where there may be a discrepancy between date of installation in column C and the table, by year. Therefore the year in column F has been manually adjusted to the latter date when this occurs. |
| **FAN Switches** | **Data Source**<br><br>Actuals – sourced by site from Network Function Manager Packet (NF-MP) – but a separate instance of NF-MP that is used for REN.<br><br>Forecasts – sourced from business planning, where key driver is traffic assumptions, expiring of switches (i.e. can add no more traffic to it), lifecycle management (i.e. replacing older with newer for better cost effectiveness for throughput and power), or asset is no longer supported by manufacturer.<br><br>**Assumptions**<br><br>FAN is a network of ethernet switches that was built for UFB, predominantly used for fibre traffic but can support copper.<br><br>One chassis takes up a fixed area on the equipment rack. Due to power density thresholds only one chassis can be mounted on a single rack. Multiple racks make up an equipment row.<br><br>A rack occupies floor space and requires space to walk around it.<br><br>**Risks and Limitations**<br><br>Actual data sourced from NF-MP we have high confidence, as the system communicates directly with the equipment.<br><br>Planning for removals and additions, the key risk is the accuracy of timing and can only be estimated in advance. |
| **REN Switches** | **Data Source** |

| | |
|---|---|
| | Actuals – sourced by site from Network Function Manager Packet (NF-MP) – but a separate instance of NF-MP that is used for FAN.<br><br>Forecasts – sourced from business planning, where key driver is lifecycle management rather than traffic (i.e. growth in average traffic per user (**ATPU**) is offset with reductions in copper broadband connection volumes.<br><br>**Assumptions**<br><br>REN is a network of ethernet switches that was originally built pre-demerger for the copper broadband services.<br><br>One chassis takes up a fixed area on the equipment rack. Due to power density thresholds only one chassis can be mounted on a single rack. Multiple racks make up an equipment row.<br><br>A rack occupies floor space and requires space to walk around it.<br><br>Where there is one switch still in use, it is still in the footprint until the last customer exits. For example, one ethernet switch in Wellington has to remain in operation for the one DSLAM serving one customer in Makara.<br><br>**Risks and Limitations**<br><br>Actual data sourced from NF-MP we have high confidence, as the system communicates directly with the equipment.<br><br>Planning for removals, the key risk is the accuracy of timing and can only be estimated in advance. |

## Data Sources

This sheet contains a list of sources for input data used in the model. Further information is provided in the following table:

| Input Information | Description | Actuals or Forecasts | Data Source | Used By | Business Unit |
|---|---|---|---|---|---|
| Connections | Copper and Fibre | Actuals | SAP<br>COM<br>NetMAP | %-FFLAS and %-non-FFLAS calculation | Chief Technology Office and Customer & Network Operations |
| | | Forecasts | FY21 Chorus business plan | | Products Sales & Marketing |
| Exchange Equipment | OFDF footprint | Actuals | NetMAP | Copper Floor Area by ESA and Fibre Floor Area by ESA calculation | Customer & Network Operations |
| | | Forecasts | FY21 Chorus business plan | | Chief Technology Office |
| | MDF footprint (copper pairs) | Actuals | ICMS | Copper Floor Area by ESA calculation | Chief Technology Office |
| | | Forecasts | FY21 Chorus business plan | | Chief Technology Office |
| | DSLAMs | Actuals | AMS<br>CSOM<br>NetMAP | Copper Floor Area by ESA calculation | Chief Technology Office |
| | | Forecasts | FY21 Chorus business plan | | |
| | OLTs | Actuals | AMS<br>FSOM<br>NetMAP | Fibre Floor Area by ESA calculation | Chief Technology Office |
| | | Forecasts | FY21 Chorus business plan | | |
| | FAN Switches | Actuals | NF-MP | | Chief Technology Office |

| | | | | | |
|---|---|---|---|---|---|
| | | Forecasts | FY21 Chorus business plan | Fibre Floor Area by ESA calculation | |
| | REN Switches | Actuals | NF-MP | Copper Floor Area by ESA calculation | Chief Technology Office |
| | | Forecasts | FY21 Chorus business plan | | |

### Summary_Output_Space

Final cost allocators for the percentage of exchange space allocated to FFLAS (as a proportion of total fibre and copper floor areas), which is then used in the IAV Model for allocating:

- 2012 to 2021 – commissioned assets and opex
- 2022 to 2025 – forecast capex and opex

The calculations that link to this worksheet can be found on Method 1 (F C).

### Forecast GPON

List of ESAs and sourced from business planning, existing and forecasted additional POLTs required for FY22 per site using Chorus' forecast connection growth rates. This data is no longer used in the model. The data for the calculations is now sourced from the "POLT" sheet. The sheet was used to develop an ESA summary in the "Method 1 (F C)" sheet columns A:B.

### Forecast ISAM

List of ESAs and sourced from business planning, existing and forecasted reduction in ISAMs per site using Chorus' forecast connections per site.

The data for the calculations is now sourced from the "xDSL DSLAM" sheet. The sheet was used to develop an ESA summary in the "Method 1 (F C)" sheet columns A:B

### Source Copper vs Fibre Split

Actual number of copper and fibre connections by site each quarter, from 2015 to 2021. Extracted from CDW, where source data comes from product inventory, based on active contracts and billable items in SAP. As SAP doesn't know the location of services, so does a match to COM to find the TLC of the service ID. Alternatively, we can use shapefiles from NetMAP to geolocate an address. Exchange code is sourced from ESA shapefiles from NetMAP.

Forecast number of copper and fibre connections by site is sourced from Chorus' connection forecast used for business planning.

Where copper methodology applied is:

- Source Copper pre 2012 to 2015 – estimates for each ESA is movement of historical connections at a total level across all UFB, RONZ and LFC areas; and
- Source Copper forecast – based on growth forecasts from Chorus' business plan at the UFB, RONZ and LFC level (i.e. not individual ESA level).

Where fibre methodology is:

- Source Fibre 2012 to 2015 – estimates are based on a linear estimate using data from 2016 to 2020 at each ESA level; and

- Source Fibre forecast – based on growth forecasts from Chorus' business plan at the UFB, RONZ and LFC level (i.e. not individual ESA level).

The data in sheet has been used to populate the "Source Copper" and "Source Fibre sheets" columns E:O.

### Source Copper

Actual number of copper connections by site annually from 2011. Extracted from CDW, where source data comes from product inventory, based on active contracts and billable items in SAP. As SAP doesn't know the location of services, so does a match to COM to find the TLC of the service ID. Alternatively, we can use shapefiles from NetMAP to geolocate an address. Exchange code is sourced from ESA shapefiles from NetMAP.

The 2011 to 2015 copper lines per ESA is estimated based on the overall total movement in copper lines weighted by the 2016 copper lines in each ESA.

Forecast number of copper connections by site is sourced from Chorus' connection forecast used for business planning.

Data is used as input into worksheet Copper to Fibre Split.

### Source Fibre

Actual number of fibre connections by site, annually from 2011.

- 2016 onwards – extracted from CDW, where source data comes from product inventory, based on active contracts and billable items in SAP. As SAP doesn't know the location of services, so do a match to COM to find the TLC of the service ID. Alternatively, we can use shapefiles from NetMAP to geolocate an address. Exchange code is sourced from ESA shapefiles from NetMAP.

- 2011 to 2015 – pre the establishment of CDW, the model estimates connections by ESA using the trend function in Excel from 2016 to 2020 (consistent with the submission of the IAV model in March 2020). In the true-up version of the model, 2021 is not included in the trend function, otherwise it will restate historical data – i.e. the true-up is to only replace forecasts with actuals, not restate history.

Forecast number of fibre connections by site is sourced from Chorus' connection forecast used for business planning.

Data is used as input into worksheet Copper to Fibre Split.

### Copper to Fibre Split

List of ESAs and the percentage of total connections that are non-FFLAS. Key inputs into this worksheet are the Source Copper and Source Fibre.

Data is used in Method 1 (F C) to calculate %-FFLAS in the space formula for copper MDF floor space.

### REN Power by Switch

List of individual REN switches in Chorus' network, average power usage per year, and power limit as per the manufacturer. Extracted from element manager NF-MP.

List of ESAs and when new REN switches are expected to be installed. Forecasts are sourced from business planning, where the key driver is lifecycle management rather than traffic (i.e. growth in ATPU is offset with reductions in connection volumes).

While this data isn't used in the Property Model it is used in the Power Model.

### FAN Power by Switch

List of all FAN ethernet switches, average power usage per year, and power limit as per the manufacturer. Extracted from element manager NF-MP.

While this data isn't used in the Property Model, it is used in the Power Model.

### Forecast FAN New Switches

List of ESAs and sourced from business planning, where key driver is traffic assumptions, expiring of switches (i.e. can add no more traffic to it), lifecycle management (i.e. replacing older with newer for better cost effectiveness for throughput and power) or asset is no longer supported by manufacturer.

This data has been used to help populate the sheet "FAN Switches" in the model but isn't linked.

### Method 1 (F C) Marginal

This sheet is not used by the IAV model.

### Method 1 (F C)

Refer to Calculations section above for further information.

Note that Christchurch Technology Park (**CTP**) is not included in the fibre count. This is an exceptional situation where copper equipment was deployed to the site, rather than having the functionality of an exchange serving copper.

### ESA

List of ESAs and their geographic status so the Property Model outputs can be produced with consistent geographies used in the IAV Model. Information includes:

- Total number of address points
- Number of address points covered by UFB
- Number of address points not covered by UFB
- Geographic status – Won, PartialWon, Lost, Non.

### Chorus Site Category

List of ESAs and identifies those owned by Spark, so we can calculate floor space utilised in Spark-owned sites separately. This is because the space leased by Chorus in Spark buildings are treated differently for accounting purposes.

In addition, the space leased by Spark in Chorus buildings for PSTN purposes was derecognised from the book value of the relevant buildings at demerger, in accordance

with GAAP, and therefore it is not appropriate to include the Spark PSTN space when allocating Chorus net book value.

### ESA-CSA Mapping

This data has been used to populate the "Method 1 (FC)" sheet columns GZ:HA.

### POLTs

List of all POLTs that were installed (or forecasted to be installed) and when (0 = not present, 1 = installed). Data sourced from Weekly Growth Data Report, which sources data from NetMAP, AMS and FSOM.

Forecasts are sourced from Chorus' business planning, using forecast connection growth rates, apportioned to exchange area, forecast growth/reduction.

Cell D1 contains the footprint area (in $m^2$) for a POLT rack, and cell E1 the uplift factor to account for the space required around the equipment for access and to complete tasks.

### xDSL DSLAMS

List of all DSLAM that were installed and when, and when we plan to remove (1 = installed, 0 = removed or not installed). Data sourced from Chorus' Weekly Growth Data Reports, which sources data from NetMAP, AMS, CSOM and CDW.

Forecasts are sourced from Chorus' business planning, using Chorus' forecast connections per ESA.

Cell C1 contains the footprint area (1.4 $m^2$) for a DSLAM rack, which includes for the space required around the equipment for access and to complete tasks. This sheet is used by the 'Method 1 (F C)' sheet to calculate space requirements for installed DSLAMs in each ESA.

### FAN Switches

List of all FAN ethernet switches, ESA location, and date installed. Data sourced from NF-MP.

This worksheet calculates the footprint required per switch, given the equipment footprint area per FAN switch in column E (assuming max of 1 FAN switch per rack due to power density limitations) and the uplift factor in column F to account for the space required around the equipment for access and to complete tasks. Output is used in Method 1 (F C) to calculate total FAN area in each ESA.

### REN Switches

List of all REN ethernet switches, ESA location, and date installed. Data sourced from NF-MP.

This worksheet calculates the footprint required per switch, given the equipment footprint area per REN switch in column E (assuming max of 1 REN switch per rack due to power density limitations) and the uplift factor in column F to account for the space required around the equipment for access and to complete tasks. Output is used in Method 1 (F C) to calculate total REN area in each ESA.

At the end of the table is REN switches tagged as SAS-SX, with no footprint. These are additional rows for REN switches, where manual adjustments have been made for the true-up period, recognising we can't restate data pre 30 June 2020.

# Replacing Forecasts with Actuals

The process for replacing forecasts with actuals involved:

- Updating data inputs, as per below, for the period 1 July 2020 to 31 December 2021, including new sites where applicable. There has been no changes to historic data prior up to 30 June 2020
- Certification of the replacement of forecasts with actuals.
- No change to forecasts from 1 January 2022 onwards.

## Data inputs

The following is a list of data inputs that have been updated in the model:

- Copper and fibre connections from CDW.
- OFDF footprint from NetMAP
- Copper pairs by exchange from ICMS.
- DSLAMs from Element Manager.
- POLTs from Element Manager.
- FAN switches from Element Manager
- REN switches from Element Manager.

# Glossary

| | |
|---|---|
| ALM | Address & Location Management. Address master database, receives information from CoreLogic. |
| AMS | Access Management System. A network element manager for the fibre access nodes. |
| COM | Customer Order Management. System taking care of customer orders, product orders, quotation, product catalogue and inventory, notification management, jeopardy management. |
| CoreLogic | Chorus' Business partner for address management. |
| DSLAM | Digital Subscriber Line Access Multiplexer – a device that connects many digital subscriber lines to a network by multiplexing the DSL traffic onto one or more network trunk lines. |
| DWDM | Dense Wave Division Multiplexing. An industry term used for a data transport technology that uses multiple different wavelengths densely grouped together on a single optical fibre. |
| Element Manager | System that manages elements in Chorus' network. |
| ESA | Exchange Service Area. |
| FAN | Fibre Aggregation Network. New Ethernet aggregation network built in a simple way especially for UFB. |
| FCOM | Fibre Customer Order Management. System taking care of customer orders, product orders, quotation, product catalogue and inventory, notification management, jeopardy management. |
| FFLAS | Fibre Fixed Line Access Service. Scope of the regulated service. |
| GPON | Gigabyte Passive Optical Network. This is a fibre standard that supports point-to-multipoint delivery of fibre to multiple premises. |
| HyperFibre | Next generation technology that supports speeds up to 10Gbps. |
| ICMS | Integrated Customer Management System. Order, inventory, workorder and billing management system. |
| ISAM | Intelligent Service Access Manager. Alcatel DSL equipment. |
| MDF | Main Distribution Frame. Distribution frame for connecting plant to cables and outside plant. |
| NF-MP | Network Function Manager Packet. A network element manager for the ethernet switching nodes |
| NetMAP | Network management of assets and plant. NetMAP is a Geographic Information System (**GIS**). |

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| OFDF | Optical Fibre Distribution Frame. Used to terminate the fibre. |
| OLT | Optical Line Termination. A GPON Access Node that provides for the delivery of NGA services. |
| POLT | Passive Optical Line Terminator. GPON equipment in the exchange. |
| REN | Regional Ethernet Network. The five rings up and down the country that all our exchanges connect to for aggregation and transport of traffic. |
| SAM ID | Service Area Management. The address ID within ICMS. |
| SAP | Enterprise system used by Chorus, including general ledger. |
| TLC | Telecom Location Code. Address database Chorus uses to identify the service address entered into the sales order, replacing the need to enter the address manually. |