Independent verification report – Chorus' PQP2 expenditure proposal (CY2025-2028)

A report prepared in accordance with the Tripartite Deed between the Commerce Commission, Chorus and Synergies

October 2023

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Executive Summary

Synergies Economic Consulting and its project partner Mott McDonald have been engaged as Independent Verifier (IV) for Chorus' expenditure proposal for its second price quality path determination (the PQP2 expenditure proposal). This second price quality path will extend from Calendar Year 25 to Calendar Year 28 (PQP2).

Our role

The IV's Terms of Reference require us to provide the following services to support Chorus' PQP2 expenditure proposal to the Commerce Commission (the Commission):

(a) verify Chorus' proposed expenditure against the Evaluation Criteria and relevant Assessment Factors from Section 2 of Subpart 8 of the Commission's Fibre Input Methodologies Determination 2020 (Fibre Input Methodologies (Fibre IMs));

(b) produce a verification report (Final IV Report) covering all PQP2 forecast expenditure i.e. Base Capex, Connection Capex and Opex (terms as defined in the Fibre IMs); and

(c) meet with Commission staff to provide a briefing on the Draft and Final IV Reports, if requested by the Commission, and be available for follow-up questions.

Summary of verification review process

Our verification review has been underpinned by close engagement with Chorus from project inception, including ensuring that a robust process for the timely sourcing and interrogation of information from Chorus was established.

We have also liaised periodically with the Commission to provide verification updates and discuss specific issues regarding our assessment of Chorus' PQP2 expenditure proposal.

In carrying out our verification work, we note the high degree of assistance and co-operation both Chorus and the Commission have provided to us. We consider this has enhanced the information upon which we have relied to form our verification opinions.

Final IV Report – Key findings and verification opinions

Our Final IV Report is presented as follows:

- Part A – Overarching PQP2 expenditure proposal issues
- Part B – Chorus' PQP2 Capex and Opex forecasts

- Part C – Required additional supporting information and focus areas for the Commission.

The following tables summarise our key findings and verification opinions for each of Parts A, B and C.

Part A

Part A covers issues that have an effect across several areas of Chorus' PQP2 expenditure proposal primarily:

- Asset management
- Stakeholder engagement
- Quality Standards
- Deliverability
- Overarching forecasting methodologies, including those relating to demand and cost estimation.

Table 1 presents our key findings and verification opinions in relation to these Part A issues.

Table 1 Part A – Verification key findings and opinions

Overarching issue	Key IV findings	Verification opinion
Asset management Chorus is required, due to its asset management system being examined thoroughly as part of Chorus's PQ1 price path, to report to the Commission about the state of its asset management system and, in particular, the process of maturing it. To this end, during PQP1, Chorus has developed an Asset Management Roadmap and a complementary Asset Data Roadmap and Cost Estimation Roadmap.	Key strategic and foundational elements of Chorus' asset management system are in place. However, Chorus is less than half-way through a process of at least four years to fully establish its asset management system in accordance with its Asset Management Roadmap required by the Commission. The absence of some important elements of the asset management system, such as portfolio management plans and rigorous, verifiable, and reliable asset data and a centralised cost estimation system currently weaken its ability to demonstrate assurance about the prudency and efficiency of its PQP2 forecast expenditures. For this IV process, this absence has placed greater weight on other supporting information that	We can verify that Chorus is complying with the Asset Management Roadmap that it provided to the Commission pursuant to a section 221 information notice.

Overarching issue	Key IV findings	Verification opinion
	Chorus provides regarding justification of its PQP2 capex forecasts, particularly demonstration of the reasonableness of key assumptions and methodologies (Assessment Factor (t)) and the approach it has taken in developing those forecasts (Assessment Factor (e)).	
Stakeholder engagement Chorus has undertaken four rounds of PQP2 proposal-focused engagement supported by consultation that informs its future investment and other priorities.. Following the earlier engagement stages, the final stage of the engagement was targeted in relation to PQP2 resilience, fibre frontier, hyperfibre and sustainability (solar and electric vehicles) investments, and Chorus' role as an active wholesaler (eg. spending on fixed fibre-related marketing and education).	Chorus' PQP2 engagement is embedded within its existing stakeholder engagement framework. Chorus' stakeholder content and methodology aligns with many of the best practice principles outlined by the International Association for Public Participation (IAP2). This includes encompassing most levels of the IAP2 spectrum of engagement, inclusivity and diversity and access to information. Our overall view is that Chorus has reflected the outcomes of its PQP2 engagement in the key investment areas that its stakeholders indicated were of most concern to them. We consider this to have been of most importance in relation to the proposed PQP2 resilience and fibre frontier investments given their potentially large size and discretionary nature. Chorus' engagement in relation to its quality standards does not appear to have been especially deep other than finding no significant concerns about the levels at which the current mandatory standards are set. However, Chorus has not engaged with its stakeholders on its full PQP2 proposal, including on any overall price-quality testing.	We can verify that Chorus PQP2 stakeholder engagement, in general, satisfies TOR Assessment Factor (j) regarding extent and effectiveness of consultation and engagement, in that it was a planned, tiered engagement process, which sought to identify stakeholder priorities for the PQP2 proposal. The stakeholder engagement was also effective in that feedback received has been incorporated into the PQP2 capex proposal in relation to the targeted investment areas, including most importantly (from an investment size perspective), resilience (reliability) and fibre frontier capex. However, we cannot fully verify Chorus' PQP2 stakeholder engagement as satisfying the Evaluation Criteria because it has not undertaken overall price quality testing of its PQP2 proposal. In forming this opinion, we had particular regard to Assessment Factor (j) regarding the extent and effectiveness of consultation and engagement with stakeholders, including the extent to which that feedback has been incorporated in the PQP2 expenditure proposal.
Quality standards Chorus is currently subject to three mandatory quality standards under the Commission's price quality framework: Layer 1 and Layer 2 Availability and Port Utilisation.	*Availability quality standards* Six of the 23 POIs have less than 10,000 connections and 8 have between 10,000 and 20,000 connections, which we consider creates the potential to distort Chorus' investment and maintenance decision-making to	The following parts of Chorus' PQP2 proposal satisfy the Evaluation Criteria and promote Part 6 of the Telecommunications Act: • Retention of the current Availability and Port Utilisation mandatory quality standards.

Overarching issue	Key IV findings	Verification opinion
Availability standards Chorus proposes to change the measurement of the Availability quality standards from 23 Points of Interconnection (POIs) to 11 Customer Service Areas (CSAs). *Port utilisation standard* Chorus proposes to change the breach threshold from 90% back to 95% to re-align it with the previous UFB contractual arrangements with the Crown and include an exclusion in reported utilisation data in relation to all-cause network equipment failure. .	avoid it breaching a quality standard. Evidence provided by Chorus indicates that its proposed change in reporting to 11 CSAs will not 'hide' poorly performing geographic areas of the fixed fibre network. More disaggregated Availability reporting in the Auckland geographic area will improve transparency of overall reporting. Chorus will continue to report its performance against the 23 POIs in its Information Disclosure reporting, which provides a cross-check for the outcomes reported using the 11 CSAs. *Port Utilisation quality standard* We agree with Chorus there appears to be potential for its real time management of atypical adverse events to maintain customer supply and avoid Availability quality standard breaches to create network congestion, which could result in a breach of the Port Utilisation quality standard. This is likely to present in areas of the fixed fibre network where there is less in-built redundancy i.e. at the outer geographic areas of the network. Chorus proposes an all-cause equipment failure exclusion as a means of mitigating this breach risk noting that such a provision formed part of its UFB contract with the Crown. However, we have concerns that an all-cause equipment failure exclusion could potentially capture failure events that are reasonably within Chorus' control and hence should not be an exclusion from reported data. In relation to changing the breach threshold back from 90% to 95%, Chorus has agreed that additional capex will not be required over time to meet the 90% threshold compared to a 95% threshold. Rather, the key issue for it is the higher potential for breaches under the 90% threshold. We recognise this concern, particularly in light of the increasing peakiness of end user	• Measurement of the Availability quality standards changed from 23 POIs to 11 CSAs; - however, the minutes buffers built into the current Layer 1 and 2 POI breach thresholds need to be re-calculated to set the CSA breach thresholds using 3-5 years of historical (back cast) data. The following parts of Chorus' PQP2 proposal relating to the Port Utilisation quality standard do not satisfy the Evaluation Criteria and promote Part 6 of the Telecommunications Act: • Changing the breach threshold back from 90% to 95%. • Introducing an exclusion for all-cause network equipment failure. While not proposed by Chorus, we recommend incorporating a force majeure mechanism in the Port Utilisation quality standard that will capture significant adverse exogenous events, including severe weather events. In our view, this will substantially address Chorus' concerns regarding equipment failure causing utilisation-related breach events in the context of events like Cyclone Gabrielle and would likely promote Part 6 of the Telecommunications Act and good telecommunications industry practice. In relation to significant atypical demand events affecting Chorus' performance under the Port Utilisation quality standard, as an alternative to changing the breach threshold from 90% to 95%, we have suggested consideration of a 'ratcheted peak throughput event'. It would be an exclusion under the Port Utilisation quality standard. This alternative approach would remove the risk for Chorus of any new network-wide peak throughput events triggering a breach under the Port Utilisation quality standard. We consider our

Overarching issue	Key IV findings	Verification opinion
	demand for fibre capacity but consider there are potentially ways to mitigate this risk that are more likely to promote Part 6 of the Telecommunications Act.	alternative is more likely to promote Part 6 of the Telecommunications Act through encouraging efficient (not over-) investment in the fibre network over time than would reducing the port utilisation breach threshold.
Deliverability Chorus provided a Delivery Report which explained its out-sourcing arrangements and delivery approach across its expenditure sub-categories. Chorus also provided a detailed explanation of the delivery challenges it has faced in PQP1 due to technician shortages caused by factors beyond its control and the proactive steps it has taken to address these shortages having regard to PQP2 deliverability. In this regard, Chorus has noted that its business as usual (BAU) build capability is expected to be close to 100% of build resources required for existing 'BAU' work commitments by end of July 2023. Chorus recently completed market testing of delivery options and pricing for the proposed fibre frontier network extension project in PQP2.	The linkage between Chorus' resourcing and proposed PQP2 capex programs is relatively weakly established in the Delivery Report. However, we consider that Chorus' proactive actions during PQP1 with its field service providers in response to a major technician shortage the cause of which was beyond its control was highly creditable and shows a strong commitment to deliverability. Since the preparation of our Draft IV Report, we have received further supporting information and had more discussions with Chorus' subject matter experts regarding its PQP2 deliverability. This includes in relation to the proactive re-building of technician resourcing in its field service providers, as well as its approach to delivering the fibre frontier investment. Given the additional information that we have received and recognising that Chorus' proposed PQP2 program of work (both capex and opex), is around the same size as that in PQP1, we can verify that in CY23, PQP2 deliverability is well on-track to satisfy Assessment Factor(i). However, recognising that the resolution of the resourcing issues arising from the technician shortage are still being worked through with field service providers, including bedding down new Field Service Agreements, we consider that the Commission should seek an update from Chorus on its deliverability progress in CY24.	Subject to Chorus confirming that the deliverability challenges caused by technician shortages are fully resolved and that the capacity of construction contractors to undertake the fibre frontier project will be available, we can verify that Chorus has satisfied the Evaluation Criteria having regard to Assessment Factor(k) i.e., demonstrating the deliverability of its proposed PQP2 expenditure program. The fibre frontier project is around 15% of the total PQP2 forecast capex program in constant dollar terms. Including the fibre frontier project, the PQP2 annualised capex program is around 9% smaller than in PQP1 (in constant dollar terms). **CCI [** **]**
Overarching forecasting methodologies	*Demand forecasting* Our overall assessment of Chorus' demand forecasting suite	*Demand forecasting* Chorus demand forecasting methodologies provide the basis

Overarching issue	Key IV findings	Verification opinion
Chorus' key overarching forecasting methodologies that are impacting on the PQP2 capex and opex forecasts are demand (including connections and bandwidth capacity), cost allocation and cost escalation.	is that it has sound foundations and can reasonably be relied upon in developing the PQP2 expenditure forecasts. Further, the assumptions Chorus has used in developing its bandwidth and connection demand forecasts appear to be reasonable and satisfy Assessment Factor (t). *Cost estimation* Chorus is reporting to the Commission in relation to a Cost Estimation Roadmap. Based on our review of Chorus PQP2 capex and opex supporting information and financial models, we consider that the transparency of its cost estimation outcomes could be improved. For most of the PQP2 capex programs, we had difficulty tracing the source of unit rate data, including because of the frequent use of hardcoded data in the models. However, to further test Chorus' cost estimation methodologies that have been used to develop its PQP2 capex sub-program forecasts, following the release of our Draft IV Report, we held several in-depth meetings with relevant Chorus' subject matter experts who were able to explain and provide further supporting information in relation to the cost build-ups used. This information exchange enabled us to form a stronger opinion about the reasonableness of the key cost estimation assumptions and methodologies (Assessment Factor (t)), as well as Chorus approach to forecasting its PQP2 capex, including the models used to develop the forecasts. *Cost allocation* Chorus has confirmed that the PQP2 forecast expenditure is based on the current Commission-approved cost allocation methodology. We have observed during this verification process that the effect	for Chorus to develop PQP2 expenditure forecasts that satisfy the Evaluation Criteria. Specifically, we consider that Chorus demand forecasting methodologies satisfy Assessment factor (t) in relation to the reasonableness of key assumptions and methodologies. *Cost estimation* We expect Chorus to continue to report to the Commission in relation to the Cost Estimation Roadmap. Our assessment of Chorus' application of its cost estimation methodologies has been made in relation to specific expenditure programs having regard to the Evaluation Criteria and relevant Assessment Factors. *Cost allocation* We have not sought to verify the cost allocation arrangements against the Assessment Factors or Evaluation Criteria. Chorus confirmed that it has applied the same allocation methods and principles as in PQP1, the outcomes of which are reflected in the past and forecast expenditure data presented in this Final IV Report.

Overarching issue	Key IV findings	Verification opinion
	of cost allocation has been largest in relation to the PQ FFLAS PQP2 opex forecasts, reflecting the larger proportion of opex that is a shared cost (specifically, Chorus' corporate and network-related overhead costs). IT capex is also a significantly shared cost affected by the cost allocation arrangements.	

Part B

Part B covers our analysis of Chorus' PQP2 Base Capex and Connection Capex, and Opex forecasts.

Table 2 presents Chorus' PQP2 capex forecasts in 2022 constant dollar terms.

Table 2 Part B – PQP2 capex forecasts (CY22 dollars)

Capex category	Capex sub-category	CY25	CY26	CY27	CY28	PQP2 Total
Extending the Network	Augmentation	52.1	53.6	54.2	60.7	220.6
	New Property Developments	8.0	9.0	6.9	8.5	32.4
	UFB Communal	-	-	-	-	-
Installations	Standard Installations	84.8	75.9	75.2	62.0	298
	Complex Installations	3.0	2.9	2.8	2.8	11.5
Network Capacity	Access	27.9	31.7	37.6	30.2	127.5
	Aggregation	21.8	21.6	16.9	19.5	79.8
	Transport	26.7	26.1	18.3	13.9	85.0
Network Sustain and Enhance	Field Sustain	29.7	29.4	31.4	30.0	120.5
	Relocations	4.6	4.5	4.5	4.5	18.2
	Resilience	17.7	20.0	17.1	24.8	79.7
	Site Sustain	27.2	22.3	21.4	20.2	91.1
IT and Support	Business IT	17.7	19.6	19	16.2	72.6
	Network & Customer IT	25.2	24.5	23.2	22.1	94.9
	Corporate	1.4	1.9	1.8	7.5	12.7
TOTAL	**N/A**	**348.0**	**343.1**	**330.5**	**323.0**	**1,344.5**

Source: Chorus

Table 3 presents our key findings and verification opinions in relation to Chorus PQP2 capex forecasts.

Table 3 Part B – Verification key findings and opinions

Expenditure category	Key findings	Verification opinion
Capex		
Extending the Network This expenditure category is broken down as follows: • UFB Communal • New Property Development (NPD) • Augmentation – in-fill and network extensions The Commission has identified Augmentation as a Priority Area. *UFB Communal* No expenditure is forecast for this sub-category in PQP2 given the UFB 2/2+ roll-out was only recently completed. *NPDs* NPD expenditure relates to laying fixed fibre as part of new property developments. Chorus' PQP2 forecast capex increases modestly. *Augmentation* Augmentation capex includes in-fill work (building the network to premises within the existing UFB footprint) and extending the fibre network to towns or communities beyond Chorus' current fibre network footprint. *Augmentation – in-fill* Chorus' PQP2 forecast capex is relatively small in dollar terms and flat. *Augmentation – Network Extensions* Chorus' PQP2 forecast network extension capex accounts for around 78% of the Extending the Network forecast capex. The proposed fibre frontier investment is the largest network extension expenditure proposed in PQP2. This investment is intended to geographically extend the fibre network to connect around 41,000 additional households and businesses,	*UFB Communal and NPDs* Top-down assessments of the UFB Communal and New Property Development sub-categories indicates no material issues of concern. *Augmentation – in-fill* Chorus notes the PQP2 forecast followed its gated investment decision-making process, which governs and challenges the reasonableness of the proposed expenditure. Chorus also notes that its PQP2 forecast relies heavily on historic expenditure levels, including because of the uncertainty associated with relatively small volumes of work for this capex sub-category. *Augmentation – network extensions* Chorus provided a fibre frontier strategy document with supporting financial model for the IV's review. We provided initial feedback on this documentation querying some modelling assumptions and sensitivities. Chorus addressed this feedback in a response to the IV. Overall, Chorus has undertaken robust investment analysis, supplemented with stakeholder engagement about pricing options, in relation to the proposed PQP2 fibre frontier investment. We consider the investment to be a challenging one to make from a commercial perspective given the geographically consistent pricing constraint that applies to PQ FFLAS and potentially large social benefits of the investment (which have not been included in the investment analysis). Compared to more typical fibre network investments we consider	*UFB Communal and NPD* The UFB Communal and NPD sub-categories satisfy the Evaluation Criteria. In forming our opinion for UFB Communal PQP2 expenditure, we have had particular regard to: Assessment Factor (c) regarding historic investment; Assessment Factor (m) regarding fibre asset and fibre network information; and Assessment Factor (s) regarding the accuracy and reliability of data. In forming our opinion for NPD PQP2 expenditure, we have had specific regard to: Assessment Factor (c) regarding historic rates of investment; Assessment Factor (e) regarding approach to forecasting capex; Assessment Factor (m) regarding fibre asset and fibre network information; and Assessment Factor (s) regarding the accuracy and reliability of data. *Augmentation – in-fill* Recognising the heavy reliance on historical data to determine the PQP2 in-fill augmentation forecast, we can verify the forecast as satisfying the Evaluation Criteria. In forming this opinion, we had specific regard to Assessment Factors (c) regarding historic capex; Assessment Factor (e) regarding approach to forecasting capex; Assessment Factor (o) regarding the extent of uncertainty regarding the need for the proposed capex; and Assessment Factor (t) regarding the reasonableness of key assumptions and methodologies. *Augmentation – Network Extensions* The fibre frontier investment can be verified as satisfying the Evaluation Criteria, subject to

Expenditure category	Key findings	Verification opinion
extending Chorus' fibre footprint to around 89% of New Zealand households.	this one to have higher risk for Chorus and ultimately its existing fibre customers. However, given customer take-up and initial build cost represent the biggest risk factors for the investment, we think that Chorus can mitigate these risks to a reasonable extent, such that a worst-case scenario of a heavily under-utilised sunk fibre asset and materially higher prices for existing fibre customers is a low probability	confirmation of the outcomes of Chorus' market testing in relation to the size of PQP2 fibre frontier program costs, as well as the implications of this investment on the deliverability of Chorus' broader PQP2 expenditure program. In forming our opinion, we have had specific regard to: Assessment Factor (b) regarding governance relating to the proposed capex; Assessment Factor (d) regarding quantitative or economic analysis related to the proposed capex; Assessment Factor (e) regarding approach to forecasting capex; Assessment Factor (j) regarding the extent that stakeholder feedback has been incorporated into the capex proposal; Assessment Factor (o) regarding the extent of uncertainty related to the need for the proposed capex; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies.
Installations The Installations sub-category relates to infrastructure that connects the communal (shared) network to customers' premises. Installations capex comprises Standard and Complex sub-categories, with by far the largest proportion of expenditure relating to Standard Installations. The Commission has identified Standard Installations as a Priority Area. *Complex Installations* Chorus services a relatively small number of Complex Installations for large customers who require enhanced resilience where additional design and planning is required to facilitate the installation. The PQP2 forecasts is relatively small in dollar terms and flat. *Standard installations*. The Standard installation growth pattern over the past decade has been declining reflecting the development of the communal network under the UFB roll-out	*Complex Installations* A top-down assessment of the Complex Installations sub-category indicates no material issues of concern in terms of the PQP2 forecast which are consistent with historic expenditure. *Standard Installations* The physical build and provisioning components of the Standard Installations forecasts are based on Price x Quantity forecasting approaches. The forecasting models were not developed for regulatory reviews, but rather for efficient operation of Chorus' business and are clearly relied upon both by the key decision makers and operational teams. This is strong evidence that the forecasts these models produce are likely to be prudent and efficient. However, we would expect as part of Chorus now entering the stable phase of fixed fibre asset management and operation, as well as evolving away from the copper network, economic	*Complex Installations* We can verify that Chorus' PQP2 Complex Installations forecast satisfies the Evaluation Criteria. In forming this opinion, we have had particular regard to: Assessment Factor (c) regarding consistency with historic rates of investment; Assessment Factor (m) regarding fibre asset and fibre network information Assessment Factor (o) regarding the extent of uncertainty about the need for the proposed capex; Assessment Factor (s) regarding the accuracy and reliability of data; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon. *Standard Installations* We can verify the PQP2 Standard Installations forecasts as satisfying the Evaluation Criteria. In forming this opinion, we have had particular regard to Assessment Factor (c) regarding historic capex; Assessment Factor (e) regarding the approach

Expenditure category	Key findings	Verification opinion
that was completed in CY22. The PQP2 forecast continues this downward trend. *Customer incentive payments* Customer incentive capex are payments that Chorus makes to retail service providers to incentivise acquisition of new customers on its fixed fibre network, or to incentivise existing customers to upgrade to new services. These are capitalised as customer acquisition expenditure.	analysis and other assessments such as risk *assessments*, options analysis and sensitivity analysis will be undertaken to ensure future capex in new installation is prudent. Nevertheless, the nature of Installations capex, including its demand-driven character and lack of feasible alternative capex or opex options is such that it is unlikely that the lack of this economic analysis would have any material impact on the PQP2 capex forecast. *Customer incentive payments* Chorus applies the economic test articulated by the Commission to calculate the incentive payments. We consider the input assumptions Chorus has used to be sound and generally conservative, resulting in a level of PQP2 forecast customer incentive payments that is unlikely to be materially overstated and in so doing cause competitive harm, while recognising the relatively high degree of uncertainty regarding this expenditure sub-category.	to forecasting capex; Assessment Factor (m) regarding fibre asset and fibre information; Assessment Factor (s) regarding the accuracy and reliability of data; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon. *Customer Incentive payments* We can verify that Chorus' proposed PQP2 customer incentive payments satisfy the Evaluation Criteria. In forming this opinion, we had particular regard to: Assessment Factor (d) regarding quantitative or economic analysis related to the proposed capex; Assessment Factor (e) regarding approach to forecasting capex; Assessment Factor (g), relating to competition effects of sub-categories of capex in PQ FFLAS and other telecommunications markets; and Assessment Factor (t) regarding the reasonableness of key assumptions and methodologies relied upon.
Network Capacity Network Capacity covers the following expenditure sub-categories: • Transport • Access • Aggregation. The Commission has identified Access and Aggregation capex as Priority Areas. *Transport* This expenditure area includes the expansion and replacement of Chorus' transport network assets that provide high-capacity transmission connectivity over long distances. Chorus' PQP2 Transport capex forecast declines sharply from CY26 following a large increase in spend from CY22. *Access* Access capex enables customer connections to Chorus' fixed fibre	*Transport* Chorus identifies the PQ FFLAS mandatory quality standards and demand growth as the key drivers for the PQP2 Transport capex forecasts. Chorus uses a Price x Quantity forecasting methodology. The assumptions and inputs used in the methodology appear reasonable, as does the governance process associated with development of the PQP2 Access forecasts. *Access* Chorus' ONT deployment strategy proposes a reactive replace-at-failure investment option as preferred for PQP2. This deployment strategy recognises there is uncertainty over ONT asset lives and that ONT failure rates are currently very low.	*Transport* We consider that Chorus' PQP2 Transport forecast satisfies the Evaluation Criteria. In forming this opinion, we have had particular regard to: Assessment Factor (a) whether the proposed capex complies with all applicable legal and regulatory obligations associated with provision of PQ FFLAS; Assessment Factor (b) regarding the governance process associated with development of the PQP2 capex forecast; Assessment Factor (c) regarding consideration of historic rates of investment; Assessment Factor (e) approach to forecasting capex, including models used to develop the capex forecasts; and Assessment Factor (t) regarding the reasonableness of the key forecasting assumptions relied upon.

Expenditure category	Key findings	Verification opinion
network by providing lit or ethernet services from customer sites to Chorus' access sites. They also control the speed of the connection. Access electronics include two types of hardware: Optical Network Terminals (ONTs) at the customer end; and Optical Line Terminals (OLTs) at the network building side. Chorus' PQP2 Access capex forecast is somewhat lower (on an annualised basis) than its approved PQP1 expenditure. *Aggregation* Aggregation capex relates to networks that link access networks to Retail Service Providers' Points Of Interconnection (POIs). The networks consist of switches (rack-mounted equipment with interface cards) and the links between them. This expenditure sub-category is forecast to be lower in PQP2 than PQP1 (average annual spend in PQP2 is forecast to be $20.0 million compared to $23.6 million in PQP1.	Further, individually, ONTs have a low asset criticality (because an ONT directly affects service only for an individual end-user). Reflecting PQP2 stakeholder feedback indicating a strong preference that its discretionary investment be directed towards fibre extension and network resilience, Chorus reduced by $10.9 million its ONT forecast capex for PQP2. Chorus' preferred investment option reflects a balancing of least whole-of life cost considerations, stakeholder feedback regarding discretionary expenditure and uncertainty regarding the capex forecast, including due to uncertainty about future new ONT technology take-up rates. *Aggregation* Chorus has demonstrated that the key investment drivers for aggregation expenditure are: • Augmentation: Bandwidth growth drives aggregation expenditure specifically by requiring extra core switches to maintain sufficient capacity. • Renewal: Lifecycle replacement is required to ensure the equipment stays ahead of end-of-life (eg. mitigate functional obsolescence due to lack of compatibility with current and future software releases). Chorus notes that, on average, **CCI [ ]** of total cost for this sub-category is equipment set by key supplier **CCI [ ]** rate cards. Prices for gıven equipment components are **CCI [ ]**. Chorus also notes that **CCI [ ]**, which are considered in developing forecasts based on planned work (and expected volumes). For non-equipment costs, Chorus advises that: • **CCI [ ]** are internal labour (capability) eg. for annual	*Access* We consider that Chorus' PQP2 Access forecast satisfies the Evaluation Criteria. In forming this opinion, we have had particular regard to: Assessment Factor (b) regarding the governance process associated with development of the capex forecast; Assessment Factor (d) quantitative analysis related to the proposed capex; Assessment Factor (e) approach to forecasting capex; Assessment Factor (j) regarding extent and effectiveness of consultation and engagement with stakeholders; Assessment Factor (o) regarding the extent of uncertainty regarding the proposed capex;; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon. *Aggregation* We can verify that Chorus' proposed PQP2 Aggregation forecast satisfies the Evaluation Criteria. In forming this opinion, we have had particular regard to: Assessment Factor (a) whether the proposed capex complies with all applicable legal and regulatory obligations associated with provision of PQ FFLAS; Assessment Factor (b) regarding the governance process associated with development of the capex forecast; Assessment Factor (e) approach to forecasting capex, including models used to develop the capex forecasts; Assessment Factor (h) regarding the linkages between the proposed capex and quality; Assessment Factor (o) regarding the extent of the investment uncertainty; and (q) the impact that the proposed capex has on a layer 1 service; and Assessment Factor (t) regarding the reasonableness of the key forecasting assumptions and methodologies;. .

Expenditure category	Key findings	Verification opinion
	software updates (where it uses observed actuals as this is a repeated annual task) • **CCI [ ]** are field service provider deployments based on observed actual costs for the corresponding task over the past 24 months. Chorus confirms that it has made no adjustments to this costing approach in developing the PQP2 forecasts. In doing so, Chorus has assessed if a modification is required eg. if the technology assumptions lead to a change in installation and commissioning costs. However, the plan for PQP2 uses consistent technology so no such modifications were relevant or required.	
Network Sustain and Enhance The Network Sustain and Enhance category comprises four sub-categories: • Field Sustain • Resilience • Site Sustain • Relocations The Commission has identified Field Sustain and Resilience capex as Priority Areas. *Field Sustain* Field Sustain capex is associated with ensuring the physical fibre assets (cable, joints terminators, splitters and roadside cabinets), ducts, and manholes and poles are maintained and operate as intended. Chorus' PQP2 forecast is materially higher than its PQP1 approved expenditure. *Resilience* Resilience capex is associated with building additional redundancy into the network through duplication of critical and vulnerable assets, which improves network reliability. Chorus' PQP2 forecast is materially higher than its PQP1 approved expenditure. In addition to meeting its quality standards, there is a relatively large discretionary component to resilience expenditure.	*Field Sustain* While the need for the capex is clear and the asset management processes that lead to this sub-category of capex appear to be sound and reflect good telecommunications industry practice, the initial forecasting methodology documentation we reviewed was not transparent, nor was there a clear analysis of PQP2 forecast expenditure, including visibility of unit rates and quantities. The Portfolio Overview Document (PODs) that Chorus subsequently prepared covering Fibre Lifecycle, Fibre Portfolio Rehab and Maintain Service provided useful explanations of the asset portfolios covering prudency (drivers and benefits assessment of options (unquantified), forecast quantities and unit costs, input assumptions, expenditure governance, associated documentation, models, standards and statutory requirements). However, all the PODs are descriptive and unquantified, and key specific details are not included. However, following release of our Draft IV Report, Chorus was able to confirm the following about the basis of its PQP2 forecasts: • **CCI [**	*Field Sustain* We can verify that Chorus' proposed PQP2 expenditure in relation to Field Sustain expenditure satisfies the Evaluation Criteria In forming our opinion, we have had particular regard to: Assessment Factor (a) whether the proposed capex complies with all applicable legal and regulatory obligations associated with provision of PQ FFLAS; Assessment Factor (e) approach to forecasting capex, including models used to develop the capex forecasts; Assessment Factor (k) procurement, resourcing and deliverability of the proposed capex; Assessment Factor (o), the extent of uncertainty related to the proposed capex; Assessment Factor (s) the accuracy and reliability of data; and Assessment Factor (t) the reasonableness of the key forecasting assumptions and methodologies. . *Resilience* We can verify that Chorus' proposed PQP2 expenditure in relation to resilience expenditure satisfies the Evaluation Criteria. In forming our opinion, we had specific regard to: Assessment Factor (e) regarding approach to

Expenditure category	Key findings	Verification opinion
Site Sustain Chorus' Earthquake Remediation Portfolio outlines Chorus' plan to bring earthquake prone buildings up to a consistent standard that meets legislative requirements. Chorus' PQP2 average annual expenditure forecast is around the same level as in PQP1. *Re-locations* Re-location capex is associated with re-location of network assets to accommodate other infrastructure. It is a relatively small expenditure sub-category. Some re-location costs are reimbursed by the requesting (or requiring) party.	]; • It uses historical actual costs – almost always this is the most recent 12 months, though Chorus has the benefit of longer history which can be valuable for less common project types – plus contracted costs for materials, labour; • it uses a combination of historical actuals and FSA rates where it thinks this produces the most reliable estimate – especially for non-standard projects; • it applies regulatory escalations (Consumer Price Index/Real Price Effects) and agreed cost allocators; and • no further adjustments are made to develop the PQP2 forecasts – unless there are known changes eg. equipment costs flagged by a supplier for a future date. Given this additional supporting information and time spent with Chorus' subject matter experts we gained materially more comfort regarding the reasonableness of the key assumptions and forecasting methodologies, and its approach to forecasting PQP2 Field Sustain capex, including models used to develop the forecasts. *Resilience* Substantiation of this discretionary dimension of expenditure is complicated by the lack of a value of lost service (VOLS) estimate that can be used in an economic investment test along the lines of the 'value of lost load' test that is widely used in the electricity network sector. In practice, this places greater weight on stakeholder preferences and the price impact of the proposed expenditure. In this context, the three key factors that have influenced our analysis regarding Chorus' proposed PQP2 resilience expenditure are as follows:	forecasting capex; Assessment Factor (h) regarding the linkages between proposed capex and quality; Assessment Factor (j) regarding incorporation of stakeholder feedback into the PQP2 capex proposal, including in relation to the quantum of investment and associated modest price impact; Assessment Factor (k) regarding resourcing deliverability; and Assessment Factor (t) regarding reasonableness of key assumptions and methodologies. Greater transparency regarding the build-up of the PQP2 forecast would provide greater confidence regarding its quantum but it has been tested with and supported by stakeholders. *Site Sustain* We consider that Chorus' PQP2 Site Sustain forecast satisfies the Evaluation Criteria. In forming our opinion, we have had particular regard to: Assessment Factor (a) regarding whether the capex complies with all applicable legal and regulatory obligations associated with the provision of PQ FFLAS; Assessment Factor (c) regarding historic capex and consideration of historic rates of investment; Assessment Factor (k) regarding procurement, resourcing and deliverability; and Assessment Factor (n) regarding mechanisms for controlling actual capex with respect to proposed capex; and Assessment Factor (t) regarding reasonableness of key assumptions and methodologies. *Re-locations* We consider that Chorus' PQP2 Re-locations forecast satisfies the Evaluation Criteria having regard to Assessment Factor (c) regarding historic rates of investment; Assessment Factor (m) regarding fibre asset and fibre network information; and Assessment Factor (s) regarding the accuracy and reliability of data.

Expenditure category	Key findings	Verification opinion
	• Whether it has received strong stakeholder support revealed during Chorus' PQP2 stakeholder engagement process. • Whether expenditure is well-targeted in terms of maximising the benefit of the investment to end users. • The price impact of the expenditure is not excessive, recognising its cost will be recovered across all FFLAS end users given Chorus must charge the same price for a service that is "materially the same" regardless of location of the end user. Our assessment of the proposed PQP2 Resilience forecast is that it satisfies these three factors. The PQP2 resilience forecast is calculated using a volumetric Price x Quantity model where: • Price is based on contractual rates agreed under the FSAs and actual costs experienced on prior similar projects classified as 'easy', 'medium' and 'hard' routes (using the average price for each deployment type as of February 2023). • Quantities are based on the planned (prioritised) resilience projects and some additional reactive projects. *Site Sustain* Chorus has provided a POD in relation to the Site Sustain sub-category which explains its expenditure drivers, investment options, forecasting approach and governance, which we consider to be reasonably based. *Re-locations* A top-down assessment of the PQP2 forecast for re-location expenditure indicates that it is flat and consistent with historical expenditure levels raising no material issues of concern.	
IT and Support This expenditure sub-category is broken down into the following sub-categories:	Chorus notes that the Business IT and Network & Customer IT capex sub-categories are planned and managed in similar	We can verify that Chorus' proposed PQP2 Business IT and Network & Customer IT sub-

Expenditure category	Key findings	Verification opinion
• Business IT – systems and platforms needed for Chorus' day-to-day business activities. • Network & Customer IT – systems and platforms that help Chorus run the network and manage the processes relevant for its customers. • Corporate – accommodation, office equipment and other related capex. The Commission has identified Business IT and Network & Customer IT as Priority Areas.	ways reflecting Chorus' operational model for IT planning and delivery. Consequently, we have assessed and formed verification opinions in relation to these two IT sub-categories together, with the Corporate sub-category assessed separately with a separate verification opinion. For Business IT and Network & Customer IT, Chorus has a robust and comprehensive approach to managing its IT assets, which is essential for its success. Its Technology Strategy clearly flows out of its corporate strategy. We note that the proposed PQP2 capex program at a business-wide (unallocated level) is substantially lower than has been required in the period from CY16 to CY22. In contrast, the PQ FFLAS IT capex forecast for PQP2 is essentially constant likely reflecting an increasing allocation of IT costs as the copper service declines. We believe the PQP2 forecast is based on good strategies and processes. In the absence of the economic analysis generally expected for investment decision-making in a regulatory context, our review of the additional information provided by Chorus after our Draft IV Report provided us with confidence that strong financial discipline and cost control is being exercised in relation to Chorus' IT spend in an ongoing sense. In our view, this is reflected in the quantum of the unallocated and PQP2 IT capex forecasts. For the Corporate sub-category, we find that the PQP2 forecast is flat except for an uplift in FY28 associated with a planned re-leasing of corporate accommodation in Auckland. Other than this uplift, the PQP2 forecast is flat and consistent with historic investment.	category forecasts each satisfy the Evaluation Criteria. In forming this opinion, we have had particular regard to: Assessment Factor (c) consideration of historic rates of investment; Assessment Factor (e) approach to forecasting capex, including models used to develop the capex forecasts; Assessment Factor (k) procurement, resourcing and deliverability of the proposed capex; Assessment Factor (n) mechanisms for controlling actual capex with respect to the proposed capex; and Assessment Factor (t) the reasonableness of the key forecasting assumptions and methodologies relied upon. We can also verify that the Corporate sub-category satisfies the Evaluation Criteria. In forming this opinion, we have had particular regard to: Assessment Factor (c) regarding historic rates of investment; Assessment Factor (m) regarding fibre asset and fibre network information; and Assessment Factor (s) regarding the accuracy and reliability of data; and Assessment Factor (t) the reasonableness of the key forecasting assumptions and methodologies relied upon.

Expenditure category	Key findings	Verification opinion
Connection Capex The PQP2 connection forecasts are based on forecast installation volumes and associated unit costs for the 10 Commission-approved connection categories. However, no PQP2 forecast has been developed for Connection Group 10 (Non-linear Hyperfibre connections). This is due to a technological change, such that Hyperfibre connections now use the same port cards as GPON services and the installation is not triggered by new connection orders. As such, this category of connection capex is not applicable for PQP2.	To better understand the PQP2 Connection Group unit cost forecasts, we reviewed the real price and volume assumptions underpinning the forecasts having regard to any material changes compared to reported PQP1 forecasts and/or outcomes. In this regard, forecast total volumes across all Connection Groups in PQP2 are lower than for PQP1 except for Connection Group 7 (Standard ONT – Hyperfibre), with the latter expected to increase by around **CCI [ ]**. We regard this connection group as being a difficult one to forecast given it relates to end-user take-up of a new GPON ONT technology. Based on our review of Chorus' forecasting methodologies, we think that the PQP2 connection group volume forecasts can be relied upon to develop the PQP2 volume forecasts (while recognising that these volume forecasts will be subject to the Connection Capex wash-up mechanism under the PQ FFLAS regulatory framework.	We can verify that the PQP2 Connections Capex forecast satisfies the Evaluation Criteria. In forming this opinion, we have had particular regard to: Assessment Factor (a) whether the proposed capex complies with all applicable legal and regulatory obligations associated with the provision of PQ FFLAS; Assessment Factor (c) regarding historic rates of investment; Assessment Factor (e) regarding approach to forecasting capex; Assessment Factor (s) regarding accuracy and reliability of data; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon.

Table 4 presents Chorus' PQP2 opex forecasts in 2022 constant dollar terms.

Table 4 Part B – PQP2 opex forecasts (CY22 dollars)

Opex category	Opex sub-category	CY25	CY26	CY27	CY28	PQP2 Total
Customer	Customer operations	-7.1	-7.2	-7.3	-7.3	-28.9
	Product, Sales and Marketing	28.4	28.7	29.0	29.2	115.3
Network	Maintenance	33.2	34.2	34.8	35.1	137.3
	Network operations	19.5	20.3	20.2	20.4	80.4
	Operating costs	9.7	11.1	11.5	11.3	43.7
Support	Asset management	23.4	23.7	23.8	23.9	94.8
	Corporate	49.8	50.8	51.4	51.6	203.5

Opex category	Opex sub-category	CY25	CY26	CY27	CY28	PQP2 Total
	Technology	22.7	23.4	23.7	23.7	93.4
TOTAL	**N/A**	**179.6**	**184.9**	**187.0**	**187.9**	**739.5**

Source: Chorus

Table 5 presents our key findings and verification opinions in relation to Chorus' PQP2 opex forecasts.

Table 5 Part B – Verification key findings and opinions

Expenditure category	Key findings	Verification opinion
Base Step Trend methodology The forecasting methodology is applied to the Commission's opex sub-categories: • Customer Operations – Product, Sales and Marketing • Network – Maintenance • Network – Network Operations • Network – Operating Costs • Support – Asset Management • Support – Corporate • Support - Technology. The Customer – Customer Operations sub-category is currently reported and forecast to be a negative number so the BST methodology cannot meaningfully be applied to it.	Chorus applies base year adjustments, step changes and trend factors across the opex sub-categories as follows: • Product, Sales and Marketing – Advertising-related base year upward adjustment, trend increase based on 0.65 elasticity assumption and real price escalation. • Maintenance – Property maintenance-related base year upward adjustment; **CCI [** ; and trend increase based on 0.45 elasticity assumption and real price escalation. • Network Operations – **CCI [** **]**; and trend increase based on 0.45% elasticity assumption and real price escalation and real price escalation. • Operating Costs – no base year adjustment, capex/opex trade-off related to solar panels investment (lowering electricity costs) and trend increase based on 0.45% elasticity assumption and real price escalation. • Asset management – no base year adjustments, step changes and real price trend increase. • Corporate – Self-insurance base year upward adjustment; and compliance audit/asset management capability step	The base step trend forecasting methodology is a well-accepted regulatory opex forecasting approach. It can be applied at a total opex or opex-sub-category level. Consequently, it can generate a PQP2 opex forecast that can be verified against the Evaluation Criteria, particularly if the accuracy and reliability of data and reasonableness of the inputs and methodologies used in the BST methodology can be demonstrated.

Expenditure category	Key findings	Verification opinion
	change increase and real price trend increase. • Technology – no base year adjustment, capex/opex trade-off related to selected IT projects (opex savings) and real price trend increase.	
Base year Chorus has chosen CY22 as its base year given that it is the most recent reported data. *Adjustments to base year* Chorus adjusts its base year expenditure to account for the following matters: • Advertising • Property maintenance • **CCI [ ]** • Self-insurance *Step changes* Chorus proposes four step changes in relation to the following: • **CCI [ ]** • Compliance and sustainability audits • Solar production capex • Selected IT projects capex. *Trend – Growth* Chorus' has established that network and advertising costs are linked to new fibre connections, while other network costs (electricity and property maintenance) are linked to total fibre and copper connections. The relationship between these variables is based on elasticities derived for electricity distribution businesses. *Trend – Real cost escalation* The real cost escalators are input materials and labour. The escalators relate to labour costs, producer prices, commodity prices and the consumer price index. Chorus commissioned NZIER to develop a report with forecasts for these escalators in PQP2. *Trend – Productivity*	*Base year* CY22 is an appropriate base year for the PQP2 expenditure proposal given it is Chorus' most recent reported data. Depending on Chorus' reporting of its CY23 financial accounts, it may be possible for CY23 to be adopted as the base year for PQP2, or if not, to be used as a cross-check for CY22 base year expenditure. *Adjustments to base year* The property maintenance **CCI [ ]** adjustments are based on relatively short historical data and some uncertainty whether the upward adjustments proposed by Chorus will eventuate. The advertising and self-insurance adjustments have been reasonably substantiated, including additional information provided by Chorus following our Draft IV Report explaining its overarching approach to insuring its major risk exposures. *Step changes* Based on our Draft IV Report recommendation, Chorus now treats the IT optimisation and Solar capex/opex trade-off projects as separate opex line items outside of the base step trend forecast, subject to the capex being approved / not approved by the Commission. Following the release of our Draft IV Report, Chorus provided additional supporting information in relation to the compliance and sustainability audit step changes, the basis of which have now been reasonably substantiated as externally driven new regulatory obligations. *Trend – Growth*	*Customer – Customer Operations* We are unable to verify that Chorus' PQP2 Customer Operations sub-category forecast satisfies the Evaluation Criteria. In forming our opinion, we have had particular regard to the Assessment Factor regarding the accuracy and reliability of data. *Product, Sales and Marketing* We can verify that this sub-category's PQP2 forecast satisfies: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding competition effects; and Assessment Factor regarding the reasonableness of key assumptions and methodologies relied upon. However, we cannot verify that the PQP2 forecast for this sub-category satisfies Assessment Factor regarding the accuracy and reliability of data as it relates to the use of electric network elasticities in the trend factor. *Maintenance* We can verify that Chorus' PQP2 Maintenance sub-category forecast satisfies: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information; and Assessment Factor regarding the reasonableness of key assumptions and methodologies relied upon. However, we cannot verify that the PQP2 Maintenance sub-category forecast satisfies Assessment Factor regarding the accuracy and reliability of data as it relates to:

Expenditure category	Key findings	Verification opinion
Chorus proposes an opex productivity factor of zero per cent in PQP2. Chorus argues that amongst other things, it is subject to additional administrative costs associated with its move to price quality regulation and has proposed negative productivity-related step changes (related to solar and IT optimisation capex), which supports a zero assumption.	Chorus has provided supporting information in relation to its use of electricity distribution network elasticities for the growth trend. It is difficult to assess how well these electricity-based elasticities are likely to predict future PQ FFLAS opex using historic data. Following our Draft IV Report, Chorus provided additional supporting information and further discussed with us use of these elasticities. We recognise the need for a growth-related trend factor to be applied in Chorus' PQP2 forecast. However, we cannot definitively satisfy ourselves that Chorus' proposed approach satisfies the Evaluation Criteria. Consequently, we have conditionally verified the use of the proposed elasticities in several of the opex sub-categories and identified this issue as one for the Commission to focus on. *Trend – Real cost escalation* Chorus has advised that its approach to real cost escalation for PQP2 is the same as that approved by the Commission for PQP1, which has been applied across all opex sub-categories. *Trend – Productivity* Chorus argues that it has already factored into its PQP2 opex forecast: • the assumption that PQ FFLAS opex will grow more slowly than output because of economies of scale/scope via the trend cost elasticity assumption; and • the expected benefits (in terms of opex reductions) from the IT optimisation and Solar capex projects. Following the release of our Draft IV Report, Chorus provided further supporting information regarding the application of opex productivity factors under the BST methodology (specifically the relationship between the scale/scope elasticity estimate and opex productivity factor) and the above two PQP2 capex	• the base year upwards adjustment in relation to property maintenance • the quantum of the step change in relation to **CCI [ ]** • the use of electricity network elasticities in the trend factor. *Network Operations* We can verify that Chorus' PQP2 Network Operations sub-category forecast satisfies: the Assessment Factor regarding historic rates of investment; the Assessment Factor regarding approach to forecasting opex; the Assessment Factor regarding fibre asset and fibre network information; and the Assessment Factor regarding the reasonableness of key assumptions and methodologies relied upon. However, we cannot verify that the PQP2 Network Operations sub-category forecast satisfies the Assessment Factor regarding the accuracy and reliability of data as it relates to: • the base year upwards adjustment in relation to **CCI [ ]**; and • the use of electricity network elasticities in the trend factor. *Operating Costs,* We can verify that Chorus' PQP2 Operating Cost sub-category forecast satisfies: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor (m) regarding fibre asset and fibre network information; Assessment Factor regarding the dependency and trade-off between the proposed capex and opex; and Assessment Factor regarding reasonableness of key assumptions and methodologies. However, we cannot verify that the PQP2 Network Operations sub-category forecast satisfies Assessment Factor regarding the accuracy and reliability of data as it relates to:

Expenditure category	Key findings	Verification opinion
	projects identified as delivering opex savings. After considering this additional information, we are satisfied that a zero percentage opex productivity assumption satisfies the Assessment Factor regarding reasonableness of key assumptions and methodologies, provided Chorus is committed to proceeding with the solar and IT optimisation capex/opex trade-off projects. As noted above, we have also identified Chorus' use of cost elasticities as an area of focus for the Commission.	• impact of the proposed solar capex/opex trade-off on electricity costs; and • use of electricity network elasticities in the trend factor. *Asset Management* We can verify that Chorus' PQP2 Asset Management sub-category forecast satisfies the Evaluation Criteria. In forming our opinion, we have had particular regard to: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information; and Assessment Factor regarding reasonableness of key assumptions and methodologies. *Corporate* We can verify that Chorus' PQP2 Corporate sub-category forecast satisfies the Evaluation Criteria. In forming this opinion, we had particular regard to: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information; and Assessment Factor regarding reasonableness of key assumptions and methodologies. *Technology* We can verify that Chorus' PQP2 Technology sub-category forecast satisfies: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information and Assessment Factor regarding the reasonableness of key assumptions and methodologies relied upon. However, we cannot verify that the PQP2 Technology sub-category forecast satisfies Assessment Factor regarding the accuracy and reliability of data as it relates to the opex impact of

Expenditure category	Key findings	Verification opinion
		the proposed selected IT project capex/opex trade-off.

Part C

Part C covers our key findings and opinions in relation to additional required supporting information and our recommended focus areas for the Commission's consideration.

Table 6 presents our key findings and verification opinions in relation to supporting information and focus areas.

Table 6 Part C – Verification opinions

Issue	Verification opinion
Additional required supporting information	*Capex forecasting models* The additional required supporting information that will be of most assistance to the Commission relates to the provision of financial models that show how Chorus has applied its Price x Quantity forecasting methodologies to develop the capex sub-category PQP2 forecasts. While the methodologies are generally well explained, the Commission may wish to seek more granular data from Chorus regarding the build-up of the P and Q in these forecasting methodologies for specific capex sub-categories. *Opex base step trend supporting information* We have identified in Chapter 11 of our report that firmer information in relation to Chorus' proposed capex/opex trade-offs regarding selected IT projects and solar panel installations (delivering PQP2 opex savings) would substantiate more robust PQP2 Opex forecasts. While significant further supporting information may not be available, the Commission should also closely assess the basis of Chorus' cost elasticity methodology used for trending purposes in the PQP2 Opex sub-category base step trend forecasts.
Issues for Commission's focus	Based on our review of the PQP2 expenditure proposal and supporting documentation, have identified the following issues as focus areas for the Commission's consideration: • Opex base-step trend methodology, specifically the base year adjustments and trend growth components. As noted above, the two opex/capex trade-offs in relation to IT optimisation and solar productions should also be reviewed to provide further substantiation and firm up the quantum of opex savings. • Proposed changes to reporting of mandatory quality standards. • Fibre frontier capex, primarily in terms of its deliverability and cost. • Deliverability in terms of the total PQP2 capex and opex programs. The main reason for our thinking is that except for deliverability, each of these issues is new and potentially significant in terms of the PQP2 expenditure forecasts (eg.. introduction of opex base step trend methodology and fibre frontier capex), as well as potentially sensitive (eg. changes to mandatory quality standard reporting).

Issue	Verification opinion
	Deliverability is identified because of the re-building of the field services workforce that is currently underway following the major technician shortage in PQP1 and the proposed fibre frontier investment noted above. We do not have any major concerns about Chorus' capability to deliver the PQP2 capex and opex programs given their comparative size to PQP1 but think a cross check of deliverability closer to the commencement of PQP2 is important, including because of the new field service agreements which are still bedding down.

Contents

Figures and Tables

Glossary

Term	Description
AMS	Asset Management System
ATPU	Average throughput per user
Base Capex	Base capital expenditure (excluding connection capital expenditure)
BST	Base step trend operating expenditure forecasting methodology
Capex	Capital expenditure
CSA	Customer Service Area
Connection Capex	Capex related to new fibre connections that is not Base Capex
CPI	Consumer Price Index
CY	Calendar Year
End users	Consumers that receive a fixed fibre telecommunications service
FFLAS	Fixed Fibre Line Access Services, which are subject to price quality regulation
Fibre IMs	Fibre Input Methodologies (approved by the Commerce Commission)
FSA	Field Service Agreement
FSP	Field Service Provider
FWA	Fixed Wireless Access
GPON	Gigabit Passive Optical Network A type of telecommunications network that uses a point-to-multipoint FTTP which uses unpowered optical splitters to enable a single feeder optical fibre to serve multiple premises.
ID	Information Disclosure
In-fill	A new property where the address is created after UFB roll-out in the street and requires a new connection.
IV	Independent Verifier
LFC	Local Fibre Company
MDU	Multi Dwelling Unit (a building which has two or more premises such as an apartment building).
NPD	New Property Development
NPV	Net Present Value
OLT	Optical Line Terminal A GPON Access Node installed in Chorus' exchange building that provides for the delivery of UFB services. The GPON OLT is installed in Chorus exchange buildings.
ONT	Optical Network Terminal GPON network equipment installed in the customer premise that provides for the delivery of UFB services.
Opex	Operating expenditure
POI	Point of Interconnection
POD	Portfolio Overview Document
PQP1	Chorus first' price quality path for FFLAS between CY22 and CY24
PQP2	Chorus' second price quality path for FFLAS between CY25 and CY28
RoW	Right of Way

Term	Description
RPE	Real price effects
RSPs	Retail service providers (that purchase fixed fibre services from Chorus)
SDU	Single Dwelling Unit
TOR	Terms of Reference (for this PQP2 independent verification)
UFB	Ultra-Fast Broadband A fibre to the premises broadband service providing high speed internet connectivity.
VOLS	Value of lost service

1 Introduction

As part of the process for resetting Chorus' price-quality (PQ) path (PQP) for its second regulatory period (PQP2), Chorus is required to submit an independent verifier's (IV's) report as part of its PQP2 expenditure proposal. The IV report covers the following components of Chorus' capital and operating forecast expenditure (capex and opex forecasts respectively) for its fibre fixed line asset services subject to price quality regulation (PQ FFLAS):[1]

- Base Capex
- Connection Capex
- Opex.

The IV's role as it relates to Chorus' PQP2 expenditure proposal is set out in the Terms of Reference (TOR) agreed between Chorus and the Commerce Commission (the Commission) on 4 May 2023 summarised as follows:

- verify Chorus' proposed expenditure against the Evaluation Criteria and relevant assessment factors from Section 2 of Subpart 8 of the Commission's Fibre Input Methodologies Determination 2020 (Fibre IMs);
- produce draft and final verification reports covering all Chorus' forecast expenditure i.e. Base Capex, Connection Capex and Opex (terms as defined in the Fibre IMs); and
- meet with Commission staff to provide a briefing on the draft and final verification reports and be available for follow-up questions.

The IV's final verification report (the Final IV Report) is an important component of Chorus' PQP2 proposal to be submitted to the Commission by 31 October 2023. The Commission will determine allowable revenues for Chorus' FFLAS for a second price quality period that commences from 1 January 2025. Chorus' FFLAS revenues form an increasing component of Chorus' total revenues and as such the Commission's PQP2 final determination will be a key driver of Chorus' financial performance as a New Zealand and Australian listed entity in the medium term.

[1] Chorus also supplies some fixed fibre services that are subject to Information Disclosure regulation not price quality regulation and so are out of scope for this verification process. It also supplies copper network services which are also outside the scope of this verification review.

In presenting historic and forecast expenditure in this Final IV Report, we note that all forecast data is expressed in CY22 constant dollars (excluding any form of price escalation), while historical data is presented in real (CPI-adjusted) terms.

1.1 Structure of our verification report

The remainder of our final verification report is structured as follows:

PART A

- Chapter 2 explains our assessment approach having regard to the IV's TOR.
- Chapter 3 provides relevant contextual information for Chorus' PQP2 expenditure proposal and our verification review.
- Chapter 4 provides a top-down assessment of key aspects of Chorus' PQP2 expenditure proposal with potential impacts across all expenditure categories.
- Chapter 5 assesses Chorus PQP2 stakeholder engagement.
- Chapter 6 provides our verification assessment and opinion on Chorus' proposed mandated quality standards for PQP2.
- Chapter 7 provides our verification assessment and opinion on Chorus' asset management framework used to plan its PQP2 expenditure programs, including enhancements made to this framework during PQP1.
- Chapter 8 assesses and provides our verification assessment and opinion on the deliverability of Chorus' PQP2 forecast expenditure.

PART B

- Chapter 9 provides our verification assessment and opinion on Chorus' PQP2 Base Capex forecasts.
- Chapter 10 provides our verification assessment and opinion on Chorus' PQP2 Connections Capex forecasts.
- Chapter 11 provides our verification assessment and opinion on Chorus PQP2 Opex forecast.

PART C

- Chapter 12 presents our key findings and opinions in relation to additional required supporting information and our recommended focus areas for the Commission's consideration.

APPENDICIES

- Appendix A provides the TOR for this Chorus IV process.
- Appendix B provides a list of the information that we have relied upon in preparing this Final IV Report.

2 Our verification assessment approach

Our approach to this expenditure verification review has been guided by the Evaluation Criteria and associated assessment factors specified in our TOR.

2.1 Evaluation Criteria

The Fibre IMs (and our TOR) set out two evaluation criteria. Forecast capex should:

(a) meet the capital expenditure objective, which means it should:

> reflect the efficient costs that a prudent fibre network operator would incur to deliver PQ FFLAS of appropriate quality, during the relevant regulatory period and over the longer term;

and

(b) reflect good telecommunications industry practice (GTIP), which means:

> the exercise of a degree of skill, diligence, prudence, foresight and economic management that would reasonably be expected from a skilled and experienced asset owner engaged in the management of a fibre network under comparable conditions. A decision on good telecommunications industry practice should take into account domestic and international best practice, including international standards and factors such as the relative size, age and technology of the relevant fibre network and domestic regulation and market conditions, including applicable law.

2.2 Assessment Factors

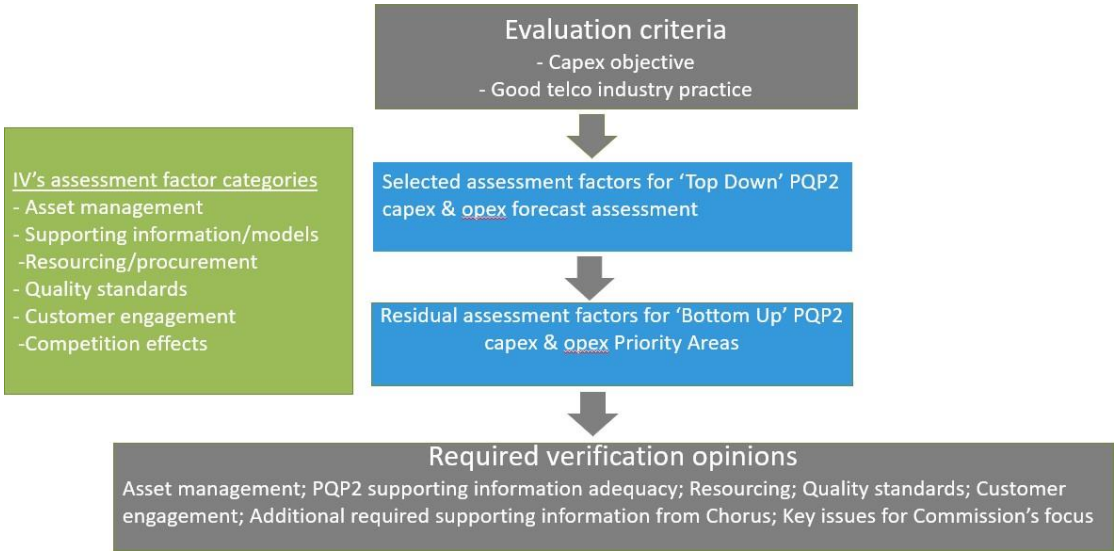
The Fibre IMs also set out 20 Assessment Factors that the Commission may consider 'relevant' when applying the capital expenditure objective criterion. These Assessment Factors are presented in Appendix A of this Final IV Report

Our TOR requires us to form our own view as to the relevance of the Assessment Factors when verifying Chorus' PQP2 expenditure proposal including what factors are relevant for specific expenditure sub-categories, considering feedback from the Commission. We report on how we have applied the Assessment Factors in assessing capex and opex sub-categories in this Final IV Report.

2.3 Applying the Evaluation Criteria and Assessment Factors

Figure 1 illustrates our verification review framework applying the Evaluation Criteria and Assessment Factors.

Figure 1 Verification approach schematic



2.4 Linkage to regulatory prudency and efficiency concepts

We consider that the overarching Evaluation Criteria and more granular Assessment Factors form the basis of regulatory prudency and efficiency tests generally applied by the Commission and Australian economic regulators.

Our experience with this verification review of Chorus PQP2 expenditure forecasts is that the prudency and efficiency tests can be explained and are more easily understood. We consider that these two tests relate directly to the capital expenditure objective in the Evaluation Criteria, with the assessment factors helping us to identify the different aspects of prudence and efficiency in relation to Chorus' PQP2 expenditure proposal.

In this regard, we have assessed Chorus' PQP2 capex and opex forecasts to be prudent if the expenditure is required to meet Chorus' ongoing legal and regulatory obligations, or its contracts with customers (RSPs). This includes mandated service quality standards approved by the Commission for PQP1 and that are expected to be applied in PQP2.

Further, proposed PQP2 capex is prudent if it is required to meet forecast demand growth, renewal of existing infrastructure in a timely manner, or it achieves an increase in the reliability or the quality of supply that is explicitly desired by customers.

Chorus' PQP2 capex and opex forecasts have been assessed to be efficient if they are underpinned by robust cost estimation and forecasting methodologies, including incorporating reported and recent actual costs into the development of PQP2 forecasts.

Chorus' procurement practices have also been assessed in terms of their contribution to delivering efficient expenditure outcomes. The fact that Chorus procures the provision of all its field services from a panel of external service providers supplemented by project-specific competitive tendering has been a pertinent consideration in our prudency and efficiency assessment. This includes the nature of the Field Service Agreements, including embedded service performance indicators, and Chorus' ongoing management and co-ordination of these external resources having regard to the performance and efficiency dimensions of these arrangements.

Further, we have assessed PQP2 capex forecasts to be efficient if Chorus' asset management and capex planning processes are likely to reliably provide for the best means of achieving identified needs (legal, regulatory or contractual) having regard to available options, including the substitution possibilities between capex and opex.

2.5 Summary of our verification review process

Our verification review has been underpinned by close engagement with Chorus from project inception, including ensuring that a robust process for the timely sourcing and interrogation of information from Chorus was established.

We have also liaised periodically with the Commission to provide verification updates and discuss specific issues regarding our assessment of Chorus' PQP2 expenditure proposal.

In carrying out our verification work, we note the high degree of assistance and co-operation both Chorus and the Commission have provided to us. We consider this has enhanced the information upon which we have relied to form our verification opinions.

2.5.1 Information gathering and on-site meetings

In undertaking our verification review, we have relied on:

- a significant volume of written information and documentation that Chorus has made available;
- readily available public-domain information, including the Commission's PQP1 determination, Chorus' 2022 Information Disclosures (ID) and the previous independent verification review undertaken for Chorus' PQP1 expenditure proposal;
- information requested directly from and provided to us by Chorus; and

- two on-site visits and many on-line (video) meetings with Chorus' regulatory team and its expenditure subject matter experts (SMEs).

The information provision process commenced following on-site inception meetings we held with Chorus, in their Wellington office, between 14 and 16 March 2023. After these meetings, Chorus provided a large batch of initial supporting information, which we reviewed to identify any information gaps or issues requiring clarification. We then requested and obtained responses to our queries through formal requests for information (RFIs), which included several follow-up meetings with Chorus' SMEs. The extent of follow-up and additional information required was greater than expected reflecting difficulties Chorus experienced addressing the Evaluation Criteria and Assessment Factors in its supporting documentation.

Consequently, to further supplement the RFI process, we provided further guidance notes to Chorus' SMEs in relation to the prudency and efficiency issues arising from its PQP2 expenditure proposal. In addition, to facilitate our verification assessment, we made available several mini-reports we prepared in relation to Chorus' capex sub-categories and opex.[2] These mini-reports provided our preliminary verification views on the expenditure sub-categories based on the initial supporting information provided by Chorus for our review.

All information provided by Chorus in support of its PQP2 expenditure proposal, as well as our RFIs and Chorus' responses to the RFIs, have been housed in a dedicated cloud-based data platform set up specifically for this verification project.

Further to these on-going information provision and RFI processes, between 13 and 15 June 2023, we undertook a second on-site visit to Chorus' Wellington office. This visit enabled us to meet and closely question key Chorus SMEs, including Executives, involved in developing the PQP2 expenditure forecasts. The key purpose of this on-site meeting was to gain a better understanding of the prudency and efficiency basis of the PQP2 expenditure forecasts, as well as the quality and deliverability aspects of the expenditure proposal. We also had a tour of Chorus' Fibre lab in Auckland on 16 June.

Following the June 2023 on-site meetings, Chorus provided updated and new supporting information for its PQP2 expenditure forecasts focussed on the prudency and efficiency dimensions of the forecasts. This information included Chorus' proposed Fibre Frontier expenditure (a proposed 'greenfields' network extension), which had not formed part of the initial information provided to us.

[2] The mini-reports were prepared in relation to: Aggregation; Field Sustain; Resilience; Installations, Extending the Network – Network Augmentation; Stakeholder Engagement; Access – ONT Deployment; Network, Customer and Business IT; and Opex.

In setting out the information gathering approach for this verification review, we note the full co-operation and assistance that we received from Chorus staff throughout, including arranging meetings with SMEs at short notice as we assessed the PQP2 supporting documentation.

2.6 Draft IV Report and subsequent engagement with Chorus

Following submittal of our Draft IV Report to Chorus and the Commission, we further engaged with Chorus in seeking additional supporting information in relation to specific components of its proposed PQP2 capex and opex.

The purpose of this information gathering was to assist us address feedback received from the Commission on our Draft IV Report and to assess more deeply several expenditure and stakeholder engagement issues where the information we had received at the Draft IV Report stage was not sufficient for us to form a robust verification opinion. This engagement with Chorus included another series of meetings with relevant SMEs and additional written documentation that it provided to us.

2.7 Timeline for final IV Report

Table 7 shows the timeline for preparation of this Final IV Report.

Table 7 Final verification timeline – Key dates

Task	Timing
Project commences	20 February 2023
On-site project inception meetings – Chorus' Wellington office	14-16 March 2023
Initial PQP2 expenditure forecasts and supporting information provided by Chorus	15 March to 30 May 2023
3 days on-site at Chorus' Wellington office including a visit to Johnsonville exchange in Wellington. Half day tour at Fibre Lab in Auckland	13 -16 June 2023
Further supporting information provided by Chorus	23 June 2023
Draft IV Report delivered to Chorus	17-21 July 2023
Feedback on Draft IV Report received from Chorus	28 July 2023
Draft IV Report delivered to Commission	4 August 2023
Final IV report delivered to Chorus	23 October

It is intended that the Final IV Report will be delivered to the Commission on 31 October 2023. Following delivery of the Final IV Report, it is anticipated that the IV will hold a workshop with the Commission to enable it to gain a better understanding of our verification findings and to discuss more broadly our verification process.

PART A

3 Context for Chorus' PQP2 expenditure proposal

The purpose of this chapter is to provide relevant context for Chorus' PQP2 expenditure proposal.

It includes a summary of Chorus' current and prospective operating environment, including its integrated fixed fibre-copper network service business model, competition for FFLAS and the supply of telecommunications services in rural areas.

The chapter also identifies several initiatives that the Commission's PQP1 final determination required Chorus to progress in the current regulatory period between CY22 and CY24 and are relevant to our verification of the PQP2 expenditure proposal.

3.1 Chorus' supporting information

Our assessment of the context for Chorus' PQP2 expenditure proposal is based on the following documents that it has made available to us:

- Synergies Induction – Day 1 (14 Mar-23).pdf [Document 3A]
- Synergies Induction – Day 2 (15 Mar-23).pdf [Document 3B]
- Synergies Induction – Day 3 (16 Mar-23).pdf [Document 3C]
- Commerce Commission, Fixed line telecommunications regulation overview, Context of the regulatory framework, 2 April 2020 [Document 3D]
- Chorus' price-quality path from 1 January 2022 – Final decision, Reasons paper, 16 December 2021 [Document 3E]
- Chorus, Investor Presentation, Y23 Results, 21 August 2023 [Document 3F]
- Chorus Information Disclosure Requirements, Information Templates for Schedules 1-13 [Document G].

3.2 Summary of Chorus' operating environment

Chorus is a publicly listed fixed line telecommunications network operator supplying wholesale fibre and copper network services.[3] It is precluded by legislation from supplying services in NZ retail telecommunications markets.

Chorus' customers comprise telecommunications retail service providers (RSPs), as well as commercial and residential end users of fixed fibre and copper wire services.

[3] Chorus is listed on both the NZ and Australian stock markets.

3.2.1 Chorus fixed fibre coverage

Chorus' fixed fibre regulatory asset base (RAB) was valued at $5,710,310 on 31 December 2022,[4] which comprises the first and second stages of the NZ Government's nationwide Ultra-Fast Broadband (UFB) roll-out.[5] In December 2022, Chorus completed its contractual commitments in relation to construction of the second stage UFB roll-out (UFB2 and UFB2+). Chorus' component of the fixed fibre network that was formed by the nationwide UFB roll-out covers around 75% of NZ premises.

Total UFB fibre uptake on Chorus' fixed fibre network was 71% on 31 December 2022 comprising:

- UFB 1 areas at 76%
- UFB 2 areas at 52%.[6]

In contrast, Chorus' copper network services are in managed decline. However, there is a significant amount of sharing of fixed line physical network (eg manholes and ducts) and operational resources in the provision of fixed fibre and copper services, which requires a detailed and complex set of cost allocation arrangements approved by the Commission.

The nationwide UFB roll-out has resulted in wide ranging nationwide coverage in urban areas but less so in rural areas, where the cost to build out and maintain the fixed fibre network infrastructure is generally materially higher including due to low population density, remoteness, or challenging terrain. Copper and other telecommunications technologies (such as satellite) have a strong presence in these areas.

3.2.2 Chorus' strategic planning framework

Strategic Planning

In 2022, Chorus shifted to a 10-year planning cycle in preparation for PQP2. Chorus notes that this extended planning horizon allows future PQP submissions to be based on core business planning outputs.

[4] Chorus (2023), Chorus Information Disclosure Requirements, Information Templates for Schedules 1-13, Schedule 4(c).

[5] The nationwide UFB roll-out was delivered under NZ Government Crown partnerships with four fibre companies: Chorus, Enable, Northpower, Ultrafast Fibre (WEL Networks, now TFF).

[6] Chorus (2023), PQP2 Independent Verification, Induction Day 1, Tuesday 14 March, p 22.

10-Year Planning Horizon

2023 is the second 10-year plan that Chorus has produced.

The 10-year plan is produced near the end of each financial year (July-June) in preparation for the following 10 financial years of investment, expenditure, and revenue.

Chorus notes that its PQP regulatory periods are based on calendar years while business planning is still primarily conducted on a financial year basis. The main practical effect of this different basis of reporting is the need for Chorus to re-cast its financial year data into calendar year data when presenting actual and forecast expenditure data under the PQ FFLAS regulatory framework. Chorus has advised us that it does this by preparing half-year forecasting and actuals to allow for easy switching between calendar and financial year data.

Annual Planning Cycle

In support of the long-term plan, an annual planning cycle is anchored on the business planning processes and milestones of the Finance (Chief Financial Officer) business unit.

Draft business plan numbers are required in February each year, with final numbers due in March. The business plan is then validated and challenged, with final approval of the annual expenditure program sought at the Chorus' board meeting each May.

Capex governance

There is CEO delegation to approve business cases included in the 10-Year Plan within DFA policy guideline and are represented within Chorus SAP financial system (project and purchase order approvals).

Business Plan approval consists of the Executives (General Managers of the three operational functional units, as well as Chief Executive Officer and Chief Financial Officer). Business case/drawdown approvals occur monthly to approve all capital projects.

3.2.3 Supply of telecommunications services in rural areas

In April 2020, the NZ Government launched the Rural Capacity Upgrade (RCU) program. The RCU builds on Phase 1 of the Rural Broadband Initiative (RBI1), an earlier program completed in June 2016 that delivered wireless and copper improvements for the urban fringe.

RCU initially upgraded 70 rural wireless broadband towers at the start of the first COVID-19 lockdown to ease network congestion. The RCU has subsequently expanded

to include upgrades for other technology types, including fibre, VDSL (very high-speed digital subscriber line) and WiMAX (Worldwide Interoperability for Microwave Access) wireless broadband.

In February 2022, the RCU program was expanded to, among other things, provide funding for the expansion of VDSL coverage using the copper network infrastructure.

Chorus has not received any material government subsidy to provide fixed fibre services in rural areas. Given the relatively high cost to supply these services in more remote rural areas, in the absence of any such subsidy, it will likely remain uncommercial[7] for Chorus to extend its fixed fibre network into them. This suggests that PQ FFLAS investments in urban fringe and less remote rural areas are likely to be the commercial limit to fixed fibre extensions outside of urban areas. This is particularly the case given the geographically consistent pricing requirement applied to PQ FFLAS that effectively means a cost reflective wholesale price cannot currently be set by Chorus to reflect materially different costs to serve across its fixed fibre network.

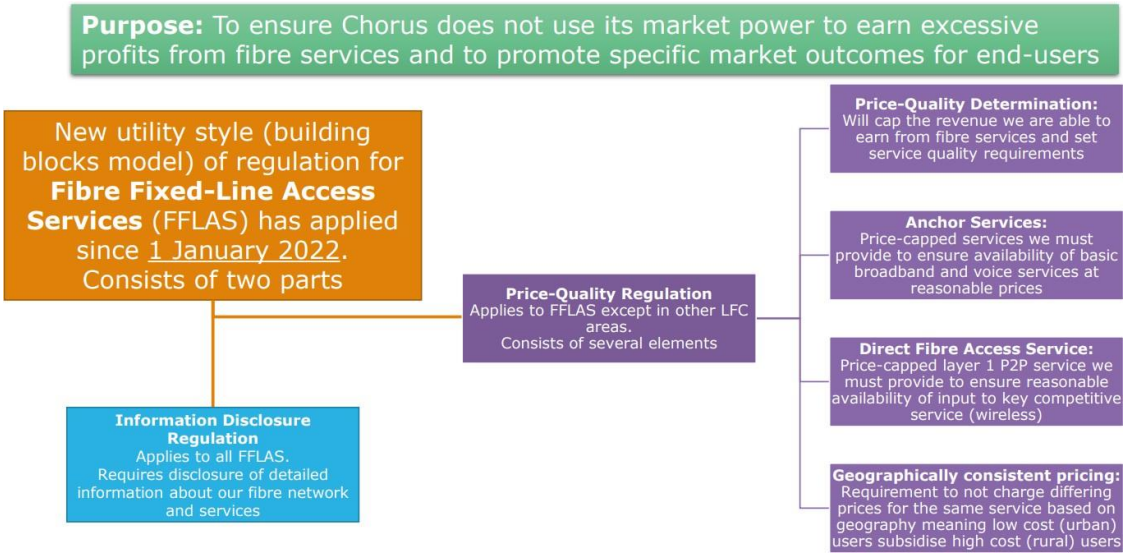
3.3 Key design features of FFLAS regulatory framework

PQ and ID regulation administered by the Commission applies to providers of FFLAS that are regulated under Part 6 of the *Telecommunications Act 2001*.

Figure 2 summarises the purpose and design of the fixed line fibre services provided by Chorus, including the PQ FFLAS prescribed by the Commission which are subject to the PQ regulatory framework.

[7] Uncommercial in the sense that incremental revenue from newly connecting customers does not cover the incremental cost of the connection.

Figure 2 Fixed fibre services regulatory framework



Data source: Chorus

The *Telecommunications (Regulated Service Providers) Regulations 2019* specify the service providers that will be regulated, and what kind of regulation will apply to them – that is, ID-only regulation or both ID and PQ regulation.

Regulation 6 provides that only Chorus will be subject to PQ regulation for FFLAS except to the extent that a fibre service is provided in a geographical area where a regulated fibre service provider (other than Chorus) has installed a fibre network as part of the NZ Government's UFB initiative. Chorus is required to provide most FFLAS on an open access basis.[8]

The Commission sets PQ FFLAS paths for Chorus under Part 6 of the *Telecommunications Act*. The PQ paths limit the total revenue Chorus can recover from providing FFLAS, and the quality at which those services are provided. PQ paths are intended to create incentives for Chorus to act in ways that are consistent with the long-term benefit of end users, such as creating incentives to invest in its network, to innovate and improve efficiency, and to deliver services at a level that meet end-user demands.[9]

Key design features of the Commission's PQ regulatory framework as it is applied to Chorus FFLAS, include:

- the scope of FFLAS subject to PQ regulation is defined in the Commission's PQP1 final determination;

[8] Some FFLAS are subject only to the Information Disclosure regulatory framework and some FFLAS are not subject to open access requirements.

[9] https://comcom.govt.nz/regulated-industries/fibre/fibre-price-quality-paths. Web site viewed 30/06/23.

  - most of Chorus' FFLAS is subject to PQ regulation, but there is a small proportion of these services provided in other Local Fibre Company geographic areas that are subject only to the Commission's ID framework and for which no price regulation applies;

- a fungible capex pool approved by the Commission for each regulatory period, such that Chorus can depart from the Commission's approved capex forecasts within each regulatory period as necessary to meet its service obligations;
- a 'wash up' mechanism applies in relation to new connection number forecast errors, but not connection unit rates – in other words, no forecast risk arises in relation to Chorus' new connection volume forecasts;
- approval by the Commission in CY22 and CY23 of financial incentive payments made by Chorus to RSPs to attract new fixed fibre customers; and
- geographically consistent PQ FFLAS pricing, such that Chorus must charge the same price for a service that is "materially the same" regardless of location of the end user;
  - Chorus can differentiate its PQ FFLAS pricing based only on technical differences (additional equipment), customer experience differences (speed) or use-case.

3.4 Commission's first PQ FFLAS determination and Information Disclosure requirements

Chorus' first price quality regulatory period for FFLAS (PQP1) is a relatively short one of three calendar years from 1 January 2022 to 31 December 2024.

This has had some effect on our verification review from the perspective of the limited observable information available on how Chorus is performing relative to the Commission's PQP1 final determination.

Further, it also appears that the implementation and embedding of the new regulatory regime, including Annual ID and other compliance deliverables, required a significant internal effort across the Chorus' business over an 18-month period up to May 2023.[10]

[10] The initial PQ FFLAS RAB value was finalised in October 2022.

3.4.1 Chorus' additional reporting requirements for PQP1

As part of its PQP1 final determination, the Commission issued a s221 information request in March 2022 that required Chorus to provide by August 2022:

- An asset management development roadmap.
- A cost estimation and asset data improvement roadmap.
- An updated stakeholder engagement plan.

In addition, Chorus was required to provide a report on progress against these three roadmaps by August 2023.

We have reviewed these roadmap/plans and draft report as part of our verification review.

3.4.2 Chorus 2022 Information Disclosure Statement

Chorus provided its 2022 Information Disclosure statements on 31 May 2023 and reports on its assets across various regulatory frameworks and geographic locations as follows:

- PQ FFLAS: Chorus fibre fixed line access services/assets subject to the Telecommunications Act Part 6 Maximum Allowable Revenue (MAR) and Regulated Asset Base (RAB) price-quality (PQ) regime;
  - this verification report is focussed on the PQ FFLAS.
- ID-only FFLAS: Chorus fibre access services/assets that are not subject to price-quality regulation but require information disclosure (e.g. Chorus' fibre network in other Local Fibre Company areas)
- ID FFLAS: combined PQ FFLAS and ID-only FFLAS services/assets.

This Final IV Report has had regard to Chorus' 2022 annual ID reporting which shows how Chorus is performing compared to the Commission's approved PQP1 expenditure forecasts and quality standards.

Chorus has also made available time series data between 2016 and 2029 for its capex and opex broken down by expenditure sub-category agreed with the Commission, which has assisted our top-down review of its PQP2 expenditure forecasts.

3.5 Early stage of PQ FFLAS regulatory framework

It is important to note the early stage of the price quality regulatory framework being applied to Chorus' FFLAS, which has impacted materially on our verification review.

Specifically, it has become evident during our verification review that Chorus is still learning and adapting to the requirements of the PQ FFLAS regulatory framework. In our view and reflecting our experience of working on similar expenditure reviews across energy and water utility sectors, this is understandable.

Chorus as a business has been focussed on the contracted delivery (to the Crown) of the UFB roll-out for much of its existence and is only now transitioning to a more conventional network utility that is focussed on asset management, incremental investments and operations and maintenance. For most of Chorus' staff, particularly in operational areas of the business, the PQ regulatory framework's requirements, including regulatory proposal preparation, are likely to be unfamiliar compared to business requirements during the UFB roll-out.

The lack of familiarity with economic regulatory requirements has manifested mainly in the documentation supporting Chorus PQP2 expenditure proposal that we have reviewed and/or requested during the IV process.

In general, the initial documentation we reviewed while large in volume, was piecemeal in nature and did not adequately substantiate the prudency and efficiency of the proposed PQP2 expenditure nor have regard to the Assessment Factors in the Fibre Input Methodologies (and replicated in our TOR). Large components of supporting documentation reflected a tendency to assert rather than substantiate proposed expenditure having regard to the regulatory requirements.

None of the above is intended to portray Chorus as not assisting us with the IV review. Chorus has been very co-operative and willing throughout the review to provide us with supporting information and make SMEs available to answer our questions.

We think the main challenge for Chorus has been and will be in the coming years, the need to develop as broadly as possible within the business a deeper understanding of the requirements of the PQ FFLAS framework, particularly in relation to expenditure proposals that will be subject to close scrutiny by the Commission. We consider that Chorus is committed to building this internal regulatory capability, but we expect that this will take time because it is fundamentally about business culture and that it will need to be led by Senior Executives.

We have made a start in assisting this learning process during our IV review by stepping through with Chorus SMEs what we consider to be the prudency and efficiency considerations that staff will need to focus on and present in expenditure-related supporting documentation provided to the Commission at each PQ FFLAS determination process.

In the context of Chorus PQP2 proposal and our verification review, the main implication is the challenge we have had developing sufficient comfort in the proposed expenditure having regard to the Evaluation Criteria and Assessment Factors.

This is a somewhat different issue to the financial capital discipline that Chorus faces as a publicly listed entity and some exposure to competition in the broader telecommunications services market that it supplies services into. While we have not relied unduly heavily on this factor, it nonetheless cannot be ignored given the challenges that Chorus faces presenting supporting information for its expenditure proposal in a way that satisfies typical regulatory prudency and efficiency requirements.

In this regard, the financial and product market discipline Chorus faces has influenced our reviews of the efficiency of base year opex and top-down assessments of capex sub-categories. Specifically, Chorus has stronger incentives to exercise financial discipline in making investment decisions and be cost efficient than if these external factors were not present. In our view, there is evidence of this financial discipline in the overall size of Chorus' proposed PQP2 expenditure program and choices that it is making in its investment decisions, including the proposed resilience and fibre frontier expenditure.

4 Top-down assessment of PQP2 expenditure proposal

The purpose of this chapter is to provide our analysis of the following key aspects of Chorus' PQP2 expenditure proposal which have impact across potentially all PQP2 expenditure categories:

- Asset management
- Historical expenditure
- Stakeholder engagement
- Quality standards
- Overarching forecasting methodologies, including demand and cost estimation
- PQP2 deliverability and resourcing
- Competition effects.

4.1 Our assessment factors

The Assessment Factors that we have applied for our top-down assessment are as follows:

- Governance relating to proposed capex, including evidence that appropriate policies and processes have been applied (Assessment Factor (b)).
- Historic capex and consideration of historic rates of investment (Assessment Factor (c)).
- Extent and effectiveness of consultation and engagement with stakeholders and extent that feedback received has been incorporated into the capex proposal (Assessment Factor (j)).
- The linkages between the proposed capex and quality, including the impact the capex would have on price quality PQ FFLAS quality outcomes (Assessment Factor (h)).
- The accuracy and reliability of data (specifically in relation to supporting information) (Assessment Factor (s)).
- Procurement, resourcing, and deliverability of the proposed capex (Assessment Factor (k)).

- Competition effects, including specific information for sub-categories of capex that have potential impacts on competition in PQ FFLAS and other telco markets (Assessment Factor (g)).

We have used these Assessment Factors for our top-down assessment because they capture issues that are relevant across the PQP2 expenditure proposal. This can be contrasted with other Assessment Factors that more closely relate to expenditure sub-programs and how the PQP2 forecast for these sub-programs has been developed.

Each of these aspects of Chorus' PQP2 expenditure proposal are discussed below.

4.2 Asset management

Assessment Factor (b) relates to governance applied to proposed capex, including evidence that appropriate policies and processes have been applied. We consider this Assessment Factor to be of most relevance in considering Chorus' asset management framework and associated expenditure governance processes.

Following its PQP1 Final Determination, the Commission issued an information request that required Chorus to provide an Asset Management Roadmap.

In our view, utilities with a high level of asset management system maturity have developed and evolved their systems in many cases over decades.

Given Chorus has only been in existence for a relatively short period and that its initial and primary focus has been on investment in a significant new nationwide fixed fibre network under contract to the Crown, it is unsurprising that its asset management system is not yet fully mature.

Importantly, the status of Chorus' asset management system and the Commission's guidance in its development have influenced the extent of our review and equally the overall impact that this has on our verification of the PQP2 capex forecasts.

We consider the main implications for our assessment of the prudency and efficiency of Chorus' expenditure relate to the lack of portfolio asset management plans for all asset classes and associated lack of assurance about asset data upon which the need for future capex will depend. In undertaking this verification, it is important to note that this does not imply that Chorus has no or limited knowledge about its assets, but rather that this knowledge has yet to be fully documented in standard utility asset management instruments that we could review.

In practice, the impact of these gaps is to somewhat lower the substantiation thresholds that we can reasonably expect Chorus to provide in relation to the asset management-related aspects of some capex sub-category forecasts. As a result, in assessing the

prudence and efficiency basis of Chorus' PQP2 capex (and opex) forecasts, in addition to reviewing available program-specific asset management information, we have relied more heavily on historical sub-category expenditure analysis (Assessment Factor (c), and particularly Chorus' approach to forecasting capex (Assessment Factor (d), and the reasonableness of key assumptions and methodologies it relied upon (Assessment Factor (t). Chorus has also willingly made its SMEs available to us to discuss asset management-related information and its capex sub-program forecasting approaches, which has informed our verification findings and opinions.

Further, we have been able to review Chorus' capex governance processes having regard to Assessment Factor (b), which in the absence of a mature asset management framework, is more important in understanding the extent to which checks and balances are being applied in relation to investment decisions and the overall size of the expenditure program.

In the context of forming verification opinions regarding Chorus' PQP2 capex forecasts, the asset management documentation issue has been of less concern than several deficiencies in early drafts of PQP2 expenditure supporting documentation discussed further in section 4.6 below.

Chorus' progress against the Asset Management Roadmap is assessed and our verification provided in Chapter 7 of our Final IV Report.

4.3 Historical expenditure

Assessment Factor (c) relates to our assessment of Chorus' historic capex and consideration of historic rates of investment, as well as historic opex. We also think the size of the proposed PQP2 expenditure program relative to historic expenditure, particularly compared to the program being delivered during PQP1, is important for Assessment Factor (k) regarding resourcing and deliverability of proposed PQP2 capex.

4.3.1 Chorus' supporting information

Our top-down assessment of Chorus' PQP2 historical expenditure is based on the following documents that it has made available to us:

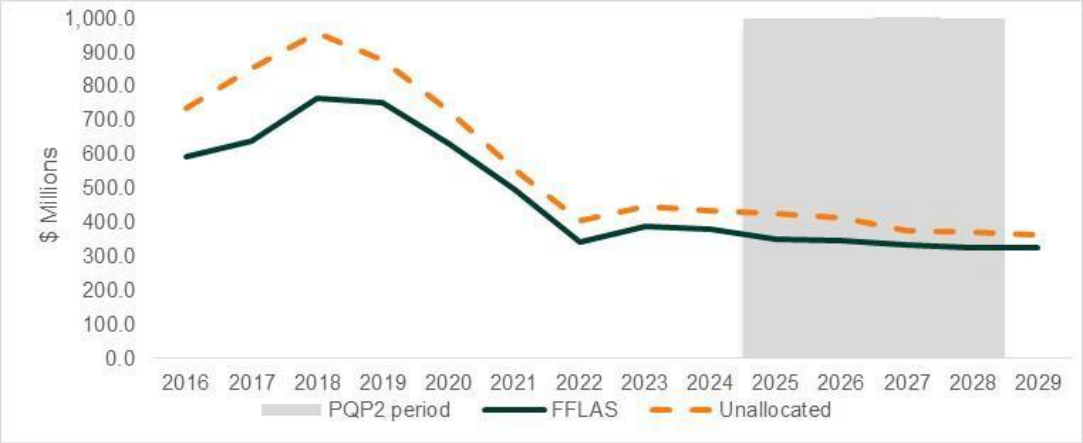
- Chorus Capex 2016-2029 time series data – post Board finalisation.xlsx [Document 4A]
- Chorus Opex 2016-2029 time series data – post Board finalisation.xlsx [Document 4B].

4.3.2 Capex

Recognising that Chorus' component of the nationwide UFB roll-out has been completed during PQP1 (in 2022), Chorus' capex is now trending downward and is reflected in its PQP2 capex (including connections capex) forecast.

Figure 3 shows a historical and forecast time series of Chorus' capex for PQ FFLAS and business-wide (unallocated) capex in constant $CY22.[11] This downward trend is evident between CY25 and CY28 for PQ FFLAS services, indicating that provision of these services is entering a more stable albeit still growing operating environment in PQP2.

Figure 3 Aggregate Capex – PQ FFLAS and unallocated ($CY22)



Data source: Chorus.

The downward trend in PQ FFLAS capex should reasonably be expected and looking to PQP2 and beyond, we would expect the level of capex to be driven primarily by bandwidth demand growth, reflecting growing user bandwidth requirements, new fibre connections as copper services continue to decline, and technological change in terms of asset lifecycle-driven equipment replacement/upgrading. Resilience expenditure is also likely to become an important investment driver over time.

The one large capex project proposed in PQP2 that is not driven by bandwidth or technological change is what Chorus refers to as the fibre frontier investment, where it is proposing to geographically extend its fixed fibre footprint from 87% to 89%.

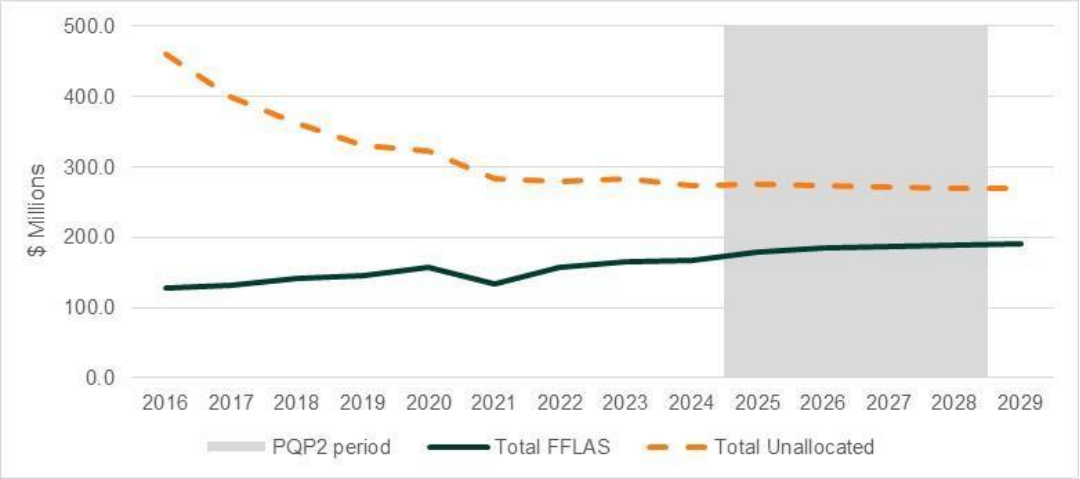
The small decline in capex growth for PQP2 also has implications for Chorus' resourcing and deliverability of its PQP2 expenditure program, which is discussed further in Chapter 8 of our Final IV Report.

[11] Chorus' unallocated capex includes direct and indirect expenditure on its copper services, which are not subject to the PQ FFLAS regulatory framework and must be removed from all PQ FFLAS data.

4.3.3 Opex

In contrast to capex, Chorus' PQ FFLAS opex is slowly trending upwards over time. Figure 4 shows a historical and forecast time series of Chorus' opex for PQ FFLAS and business-wide (unallocated) opex.[12]

Figure 4 Aggregate Opex – PQ FFLAS and unallocated ($CY22)



Data source: Chorus

The slowly increasing PQ FFLAS opex trend over PQP1 and forecast for PQP2 is likely to reflect the effect of the Commission-approved cost allocation arrangements used to determine the PQ FFLAS cost base for price quality regulation. Hence, as Chorus' fixed fibre services grow and copper services decline as customers switch to fixed fibre or other telecommunications technologies, PQ FFLAS opex will receive an increasingly large proportion of shared business-wide (unallocated) opex,

This will require the Commission to separate the effects of cost allocations from underlying PQ FFLAS opex changes. While this does not appear to be a material issue in PQP2 given current moderately high copper penetration levels, particularly outside of urban areas where it is more prevalent, beyond PQP2 the distinction between shared and directly attributable costs of copper and FFLAS services is likely to become sharper as the copper service declines further.

In other words, the extent to which the size of Chorus' currently unallocated shared corporate overhead could reasonably be expected to decline as penetration of the copper service becomes much smaller (ie. how much of it is truly fixed) will become a bigger issue because of its effect on the allocation of costs to FFLAS. It is likely to be the case for

[12] As for capex, Chorus' unallocated opex includes direct and indirect expenditure on its copper services, which are not subject to the PQ FFLAS regulatory framework and must be removed from all PQ FFLAS data.

PQP3 or PQP4, that an assessment of the efficiency of Chorus' opex will need to be undertaken at the business-wide (unallocated) level rather than the FFLAS level.

4.4 Stakeholder engagement

Assessment Factor (j) relates to the extent and effectiveness of Chorus' consultation and engagement with its stakeholders and the extent to which it has been reflected in its PQP2 expenditure proposal.

Chorus has undertaken four rounds of PQP2 proposal-specific stakeholder engagement as part of the development of its PQP2 proposal, which forms part of its ongoing stakeholder engagement activities. The PQP2 engagement captured a wide range of stakeholders and included a range of communication mediums including surveys, a consultation paper and workshops. The PQP2 engagement revealed stakeholder preferences in the earlier rounds, which were then subject to targeted deeper testing in the final (fourth) round of the engagement process during workshops.

Our detailed analysis and verification opinion in relation to Chorus' PQP2 stakeholder engagement are presented in Chapter 5 of this Final IV Report.

4.5 Quality standards

Assessment Factor (h) relates to the linkages between proposed capex and quality, including the impact that capex would have on PQ FFLAS quality outcomes. While this has been a consideration in our assessment of specific PQP2 capex program forecasts, Chorus has also proposed changes to the way the three quality standards (Layer 1 and 2 Availability, and Port Utilisation) that are applying under the PQ FFLAS regulatory framework in PQP1 and are expected to be applied in PQP2.

We consider that Assessment Factor (j) regarding stakeholder engagement in relation to the PQP2 capex proposal is also relevant to our consideration of Chorus' proposed quality standard changes.

However, there are no assessment factors in our TOR that directly address the issue of proposed changes in quality standard reporting. Consequently, our assessment approach has considered the reasons why Chorus is seeking the changes, including it has advised to minimise its exposure to breach events arising from external causes fundamentally beyond its control, while balancing this concern with the interests of fixed fibre customers in ensuring that Chorus is accountable under the PQ FFLAS regulatory framework for key dimensions of its service performance.

We consider our approach reflects the purpose of Part 6 of the Telecommunications Act to promote the long-term benefit of end-users in markets for FFLAS by promoting

outcomes that are consistent with those produced in workably competitive markets. In so doing, this is also likely to be consistent with good telecommunications industry practice.

In terms of the reporting changes, Chorus has proposed to retain the three quality standards set under the two mandatory dimensions, Availability (Layer 1 and 2) and Port Utilisation, in PQP2. However, it has proposed several material changes in the way these three standards are reported.

Most significantly, it has proposed to use a different geographic breakdown of reported areas under the two Availability standards, adopting what it refers to as Customer Service Areas rather than the current Points of Interconnection (POI). This will reduce the number of reported areas at the Layer 1 and Layer 2 network levels from 23 to 11 in PQP2.

The other proposed reporting changes relate to the Port Utilisation quality standard. First, Chorus' proposes to change the breach threshold from 90% to 95% to re-align it with the previous UFB contractual arrangements with the Crown. Second, it proposes an all-cause equipment exclusion under this quality standard.

Our detailed analysis and verification opinion in relation to Chorus' PQP2 quality standards proposal are presented in Chapter 6 of this Final IV Report.

4.6 Supporting information

Chorus has provided a large amount of supporting written documentation, including draft regulatory proposal chapters, and financial models for its PQP2 expenditure forecasts. The status of the written documentation was variable with some artefacts in an early preliminary form and others better developed. However, in general, the supporting documentation was weak in addressing the Commission's Evaluation Criteria and assessment factors in support of the PQP2 regulatory proposal.

In practice, this required the IV to provide a relatively high degree of guidance regarding how these regulatory requirements should be addressed in the additional supporting documentation that we sought. Chorus willingly provided this additional documentation and made best efforts to address our concerns about the original substantiation of the PQP2 proposal.

Following the release of our Draft IV Report, we engaged in further meetings and information exchange with Chorus to minimise conditionality about our verification opinions in areas of concern at that stage of our review. The additional supporting information and intensive discussions with Chorus have enabled us to gain greater

comfort about the prudency and efficiency of its PQP2 expenditure proposal particularly the capex program and its deliverability.

More generally, Chorus advised that documentation of its internal systems and processes is a weakness that it intends to address having regard to the need to present relevant supporting documentation under the Commission's PQ regulatory framework.

We recognise that this situation substantially reflects the still early stage of the PQ FFLAS regulatory framework and consider the supporting information issues that we have faced to be analogous to that facing other networks that are new to this form of regulation, as well what the Commission faced during its assessment of Chorus' regulatory proposal for PQP1 in 2021.

In making these observations regarding Chorus' supporting information, we note that it has always willingly responded to our requests for information and made subject matter experts available as necessary to assist us.

4.7 Overarching expenditure forecasting methodologies

Chorus applies the following forecasting methodologies to create key inputs into the development of its PQP2 FFLAS capex and opex forecasts:

- demand forecasting methodologies in relation to bandwidth, connections and new property developments (NPD)
- cost estimation
- cost allocation.

We have applied Assessment Factor (t) regarding the reasonableness of key assumptions and methodologies that Chorus has relied upon in developing the PQP2 expenditure forecasts.

Each of Chorus' overarching forecasting methodologies is discussed below.

4.7.1 Chorus' supporting information

Our top-down assessment of Chorus' PQP2 overarching forecasting methodologies is based on the following documents that it has made available to us:

Demand forecasting

- RP2 Demand Report to IV.docx [Document 4C]
- Demand (template version) – Certification.docx [Document 4D]

- Demand forecasting.pdf [Document 4E]
- Connections Model_Documentation_FY24 v2.0.docx [Document 4F]
- Connections Model_Fy24 BU_v 1.05_IV_0.02.xlsx [Document 4G]
- Market Model Documentation_FY24 v0.1.pdf [Document 4H]
- Market Model_FY24_BU_1.13a_IV.xls [Document 4I]
- NGA Forecast Model_20223_02 v6_IV.xlsm [Document 4J]
- Sales and Operations Planning documentation v2.0_IV.docx [Document 4K]
- Bandwidth forecast model diagram.docx [Document 4L]
- Bandwidth Model 20230228.xls [Document 4M]
- Bandwidth Forecast Dashboard.pptx [Document 4N]
- Bandwidth TS Model Output 20230228.pdf [Document 4O]
- Bandwidth Forecast TS Model Input 20230228.xls [Document 4P]
- Hyperfibre demand forecast 01-06-23.pdf [Document 4Q]
- Cost estimation Chorus Roadmap – cost estimation – submitted to CC 31 August 22.pdf [Document 4R]
- CONFIDENTIAL C.RP1.09 Modelling and Cost AllcoationReport.pdf [Document 4S]
- Modelling and Cost Allocation Report (template v1).docx [Document 4T]
- Copy of RT02 – Cost escalation v3c.xlsx [Document 4U].

4.7.2 Demand forecasting methodologies

Chorus applies Excel-based forecasting methodologies in relation to the following aspects of FFLAS demand, which drive various aspects of its PQP2 capex forecasts:

- new communal (shared) network extensions drive extension capex;
- demand from developers to lay fibre into new property developments (NPD demand) also drives extension capex;
- demand from end-users to have fibre installed at their premises and smart locations (installation demand) drives installation (connection) capex;

- demand from end-users to activate their connections over the installed network (connection demand) drives capitalised provisioning costs (as well as customer-related opex) and is an input into Chorus' bandwidth demand forecast; and
- associated bandwidth demand across the network drives network capacity-related capex and is related to Chorus' ongoing performance under the PQ FFLAS mandatory port utilisation standard.

The demand forecasts are also important in terms of Chorus' IT planning and investment, field services planning and work co-ordination and forecasts of evolving network electronics technology (eg. investment in optical network terminals).

Chorus has used the following five integrated models to develop its PQP2 (and previously PQP1) demand forecasts:

- Market model
- NPD model
- Sales and Operational Planning (S&OP) model
- Connections model
- Bandwidth model.

Chorus has provided us with good supporting documentation explaining the interaction of these models and underlying assumptions it has used in developing the PQP2 demand forecasts. Governance arrangements regarding ongoing use of the models has also been summarised.

Our overall assessment of Chorus' demand forecasting suite is that it is has sound foundations and can reasonably be relied upon in developing the PQP2 expenditure forecasts.

Chorus' PQP2 demand forecasting assumptions

Chorus notes that it is observing fibre uptake saturation within the existing UFB footprint. However, continuous demand from developers to lay fibre into NPD in combination with the proposed fibre frontier capex project will extend its fibre network footprint giving rise to subsequent installations and connections activity.

Chorus identifies the following key demand trends driving its PQP2 capex forecasts:

- Following historically high growth from 2020 through to 2022, the volume of NPD will slow as the housing deficit erodes and population-driven demand moderates.

- Following the historical peak of fibre installations in 2018-2019, installation and connection volumes will settle at a long-term steady state, largely driven by ongoing NPD demand and plans to increase the current fibre network footprint.
- Total peak traffic on the network (bandwidth demand) is forecast to grow by 25% per annum, predominantly driven by forecast exponential growth in average usage per connection during the busiest five-minute time period of the day (around 9.00pm).

Chorus notes when demand shocks occur, they are usually driven by major external generally uncontrollable event (eg. US computer game release, major streamed sporting event), or due to unexpected impacts from economic or industry change (e.g. Covid, Field Service Agreement Transition).

For PQP1, the Commission is applying a true-up in relation to Chorus' new connection forecasts such that there is no forecast error risk borne by Chorus or its customers in relation to Chorus' connections demand (and associated connection capex). We expect that this true-up mechanism will continue to apply in PQP2.

However, as Chorus has noted, it appears that customer data usage and peak throughput demand driving bandwidth growth (and associated capacity-related capex) have been increasing strongly and becoming more volatile in recent years compared to the earlier historical trend, which increases the potential for demand forecasting errors in future.

For its PQP2 bandwidth growth forecast, Chorus is applying a multiplicative exponential smoothing time series model that has been used to forecast underlying average throughput per user (ATPU) and data usage growth. The ATPU forecast is multiplied by the connection forecast to generate the peak throughput forecast. This approach increases the importance of Chorus' connections forecasting methodology given no true-up mechanism applies in relation to the bandwidth forecast.[13]

We agree with Chorus that an exponential smoothing time series model is reasonable for a stable trend series, with future movements heavily dependent on historical movements in the data set. However, if the increased volatility of the ATPU and peak throughput data sets persists, then an exponential smoothing time series model is likely to become less reliable in predicting future movements in the data sets. From the information and models provided by Chorus, it does not appear that a validation model is used to determine how well the exponential smoothing forecast model is forecasting

[13] Noting that a true-up may not be workable in any event given the complex relationship between bandwidth growth and investment.

future values of bandwidth growth. We consider that this validation would provide a necessary cross-check for the bandwidth forecast, recognising that the observed increase in volatility in bandwidth demand in the last two years is challenging for any forecasting methodology. This cross checking would be additional to the sensitivity analysis currently being applied in relation to outputs of the exponential smoothing forecast model. Chorus has advised that the predictive performance of its bandwidth demand forecast has been robust to date.

Chorus' supporting documentation notes as part of a future high level demand forecasting roadmap that it intends to investigate the incorporation of probabilistic modelling techniques. We consider this intention to be sound given the increasing volatility of customer data usage and peak throughput. At a minimum, use of an alternative forecasting methodology provides a cross-check for the results of a preferred methodology and may over time prove to be a superior forecasting methodology.

In our view, this is an important issue because of the potential for the bandwidth demand forecast to result in future over-investment in capacity. While this is likely to be a relatively low risk for PQP2 because there appears to be limited market evidence suggesting bandwidth demand is likely to materially slow, it could become more significant over time and cannot be completely discounted as a risk.

Finally, while Chorus provided us with supporting written documentation and associated forecasting models which have allowed us to assess its overall demand forecasting approach, we see strong merit in Chorus developing a single demand forecasting manual/handbook during PQP2 as a control document for the business. This document would set out in detail its various demand forecasting methodologies and their inter-relationships, as well as provide details of the supporting forecasting models, none of which currently have user manuals (or explanatory worksheets). This demand forecasting methodology would form part of all its future PQ FFLAS expenditure proposals. As a fundamentally growth-based utility, demand forecasting will be a key component of Chorus' fibre price quality proposals for the foreseeable future.

IV's verification opinion

We can verify that Chorus demand forecasting methodologies provide the basis for Chorus to develop PQP2 expenditure forecasts that satisfy the Evaluation Criteria.

In forming this opinion, we have had particular regard to Assessment factor (t) regarding the reasonableness of key assumptions and methodologies.

4.7.3 Cost estimation methodologies

Following its PQP1 Final Determination, the Commission issued an information request that required Chorus to provide a Cost Estimation Roadmap. The roadmap encompasses all capex, including physical network, network capacity, IT and network maintenance.

The Commission required that the roadmap should indicate areas of improvement that Chorus will undertake during PQP1 on its cost estimation processes for its PQP2 expenditure proposal, including standardisation of cost estimation across expenditure programs.

Chorus notes that its cost estimation is a decentralised accountability within the business, such that it does not have a single enterprise-wide cost estimation function, application or system. Consequently, cost estimation methodologies used to develop the PQP2 capex and opex forecasts are primarily based on unit rates for individual expenditure programs. Further, Chorus has advised to our satisfaction in detailed discussions following release of our Draft IV Report that a large proportion of these unit rates are based on the rate cards of Chorus' Field Service Providers, which are the outcome of a recent competitive tender process.

Based on our review of Chorus PQP2 capex and opex supporting information and financial models, we consider that the transparency of its cost estimation outcomes should be improved. For most of the Capex programs, we had difficulty tracing the source of unit rate data, including because of the frequent use of hardcoded data in the models. Given this issue, following release of our Draft IV Report, we discussed at some length with Chorus' SMEs how costs have been built up in several of the proposed PQP2 capex sub-programs, which has assisted our understanding of Chorus' cost estimation methodologies and provided greater comfort about the cost build-up of the PQP2 forecasts.

In addition, we had difficulty fully understanding the extent to which Chorus used actual costs of completed capex and opex projects and programs, to improve future cost estimates and to ensure Chorus can measure how well it is estimating costs. Again, we were able to gain a better understanding of this issue following discussions with Chorus SMEs.

These transparency-related issues are closely related to the supporting information concerns we discussed in section 4.6 above. In our view, addressing this issue should be one of the highest priorities in Chorus' submission of its PQP2 expenditure proposal to the Commission and in future delivery of the Cost Estimation Roadmap because of its criticality to the integrity and effectiveness of the PQ regulatory framework.

Beyond these immediate priorities, we consider the issue of centralising cost estimation to be an important one looking to Chorus' post-PQP2 expenditure proposals. Chorus notes that by the end of PQP1 (31 December 2024), it will have evaluated whether centralising cost estimation activities would be beneficial.

In our view, the key issue in relation to centralising cost estimation is the nature of it. Specifically, whether to fully centralise the function, or retain a decentralised model but one with strong top-down guidance being applied to cost estimation at the expenditure program level. Under either approach different assets classes will require different cost estimation approaches, but internal consistency of approaches and ongoing rigorous review and challenge of these approaches is necessary.

Our detailed analysis and verification opinion in relation to Chorus' cost estimation methodologies are presented in our assessments of the PQP2 capex and opex sub-category forecasts in this Final IV Report.

4.7.4 Cost allocation methodologies

Chorus' existing cost allocation methodology has been used to develop its PQP2 FFLAS expenditure forecasts. We understand that Chorus is considering proposing changes to the cost allocation methodology to apply in PQP2. The Commission has advised us that the allocators and allocations used to develop the PQP2 forecasts will require its approval.

Further, it is important to note that our verification assessment has entailed applying economic regulatory concepts, not performing an audit of the outcomes of the cost allocation methodology in Chorus' development of the PQP2 forecast expenditure. We understand that such an audit will be undertaken separately prior to Chorus submitting its PQP2 expenditure proposal.

4.8 PQP2 expenditure program deliverability

Assessment Factor (k) relates to procurement, resourcing and deliverability of proposed capex.

In this regard, two of the most significant issues arising in relation to deliverability of Chorus' PQP2 expenditure proposal are:

- Its recent move from using three to two Field Service Providers given a materially lower field services workload following completion of the contracted UFB roll-out; and

- A technician shortage that has affected Chorus' delivery of FFLAS in PQP1 but is now easing, including due to proactive actions taken by Chorus.

These two issues appear to represent the two largest potential risk factors for Chorus' proposed PQP2 expenditure program. However, a mitigating factor for this risk is the broadly comparable size of this proposed expenditure program compared to the PQP1 program, with the proposed fibre frontier investment representing the single largest project planned for PQP2. Chorus has recently undertaken market testing in relation to delivery of the fibre frontier project having regard to overall delivery of its PQP2 expenditure program.

Our detailed analysis and verification opinion in relation to Chorus' PQP2 deliverability are presented in Chapter 8 of this Final IV Report.

4.9 Competition effects of PQ FFLAS

Assessment Factor (g) of the IV's TOR relates to competition effects, including specific information for sub-categories of Chorus' capex that have potential impacts on competition in PQ FFLAS and other telecommunications markets.

Our interpretation of this assessment factor is that there are two key aspects to potential competition effects involving Chorus' provision of PQ FFLAS as follows:

- First by providing high quality FFLAS, Chorus can facilitate competition between RSPs in the downstream retail telecommunications services market (recognising that Chorus is precluded from competing in the downstream retail market) to the ultimate benefits of customers in those markets;
  - this aspect of competition will touch on many aspects of Chorus' PQP2 expenditure proposal, including customer IT capex, capacity augmentation, reliability-driven network resilience expenditure and quality standards.
- Second, Chorus' FFLAS is a competitor to other new and older technologies in the wholesale telecommunications services market, including wireless (eg. 5G technology), satellite and copper services (recognising that Chorus is a major supplier of copper network services);
  - this aspect of competition appears to be most relevant to Chorus' incentive payments currently and prospectively being paid to RSPs to connect new customers to its fixed fibre network;
  - it is also likely to be relevant to Chorus' investment decisions regarding possible network extensions into urban fringe and rural areas (like the

proposed fibre frontier investment), where competing technologies currently provide all wholesale telecommunications services; and

- Chorus' quality standards will also be important in any wholesale telecommunications market competition.

In an investment context, competition effects, whether they relate to downstream retail telecommunications service markets or wholesale telecommunications service markets is potentially an important benefit stream. However, it is not one that is necessarily easily quantifiable. In practice, the benefits will primarily relate to consumer welfare gains from reduced fixed fibre service prices or improved services. In the context of Chorus' PQP2 capex, the issue of competition effects has been most closely considered in the context of its proposed fibre frontier investment discussed in section 9.2.5 and customer incentive payments in section 9.4.3 of this Final IV Report.

5 Stakeholder engagement

The purpose of this chapter is to assess and provide our opinion on Chorus' stakeholder engagement in support of its PQP2 expenditure proposal.

5.1 Our assessment factors

We applied the following assessment factors to assess the extent and effectiveness of Chorus' stakeholder engagement relating to its PQP2 expenditure proposal:

- extent and effectiveness of consultation and engagement with stakeholders and extent that feedback received has been incorporated into the PQP2 capex (and opex) proposal (Assessment Factor (j)); and
- consistency with the International Association for Public Participation Guideline (IAP2 Guideline) for stakeholder engagement (IV assessment factor).

5.2 Chorus' supporting documentation

Our assessment of Chorus' PQP2 stakeholder engagement is based on the following documents that it has made available to us:

- Chorus Engagement (template version)_August 2023.docx [Document 5A]
- Stakeholder Forum Report DRAFT 23 June – including RSP wave v2.pptx [Document 5B]
- Engagement IV Update cover note.pdf [Document 5C]
- Chorus Stakeholder Forum Report DRAFT 23 June.pdf [Document 5D]
- Investment and revenue details – Final.xlsx [Document 5E]
- Investment Intro and Options – Final.xlsx [Document 5F]
- RP2 Consultation videos.docx [Document 5G]
- RELIABILITY APPENDIX.docx [Document 5H]
- HYPERFIBREAPPENDIX.docx [Document 5I]
- FIBRE FRONTIER APPENDIX.docx [Document 5J]
- SUSTAINABILITY APPENDIX.docx [Document 5K]
- ACTIVE WHOLESALER APPENDIX.docx [Document 5L]

- Chorus Stakeholder Forum Discussion Guide.docx [Document 5M]
- Chorus s 221 notice response – Engagement Plan.pdf [Document 5N].

5.3 IAP2 Guidelines

The IAP2's Guidelines are the generally accepted best principles and practice for developing stakeholder engagement plans and activities.

Specifically, the IAP2 spectrum of engagement and principles that underpin stakeholder engagement can provide a valuable framework for assessing a telecommunications stakeholder engagement plan. Generally, a best practice stakeholder engagement process will consider the matters summarised below.

5.3.1 Level of Participation

This refers to the IAP2 spectrum of engagement. A good engagement process should cover all levels of the spectrum, appropriate to different stakeholder groups or situations as follows:

- **Inform**: Does the process outline strategies for consistently and effectively informing stakeholders about the issues, opportunities, and outcomes?
- **Consult**: Does the process include methods to seek stakeholder input on decisions, such as surveys, town halls, or public meetings?
- **Involve**: Are there ways for stakeholders to actively participate in the process, such as through workshops or focus groups?
- **Collaborate**: Does the process allow for stakeholder partnership in each aspect of the decision, including the development of alternatives and identifying the preferred solution?
- **Empower**: Is there any aspect of the decision-making that is placed fully in the hands of the stakeholders? How is their input incorporated into the final decisions of the consulting entity?

Inclusivity and Diversity

Are all stakeholder groups properly identified and included in the engagement process? Is there a recognition of and plan to handle the different needs, interests, and concerns of diverse stakeholder groups?

Accessibility of Information

Is information presented in an accessible, easy-to-understand format? Are there provisions for people with disabilities and non-English speakers?

Timeliness

Does the process provide for early and continuous engagement? Is there a plan for ongoing communication and feedback beyond the initial stages of the project?

Feedback Mechanisms

Are there ways for stakeholders to provide feedback on the engagement process itself? Is there a system to address and integrate this feedback into the engagement plan?

Transparency

Does the process recognise the purpose, process, and constraints of stakeholder engagement? Is the influence of the stakeholder input on the consulting entity' decisions made transparent?

Evaluation and Learning

Is there a process to evaluate the effectiveness of the stakeholder engagement process and to learn and improve for future engagement planning and activities?

5.3.2 Content plan

An industry best practice engagement content process typically contains the following components:

(a) Identification of Stakeholders: This involves identifying the key consumers and categorising them based on their roles, interests, and influence over the consulting entity's operations. Stakeholders could include individual consumers, business clients, consumer advocacy groups, regulators, etc.

(b) Engagement Purpose and Objectives: Clearly define why the consulting entity is engaging with each stakeholder group and what it aims to achieve from the engagement.

(c) Engagement Strategy: The strategy should outline the methods and tools for communication with stakeholders. This could include meetings, surveys, online forums, social media, and more. It should also define how often communication occurs and who within the company is responsible for each type of engagement.

(d) Engagement Activities: These are the specific actions that the company will take to engage with different stakeholder groups. For instance, the company could hold regular focus groups with individual consumers or annual roundtable discussions with consumer advocacy groups.

(e) Communication Management: It is essential to establish a process for managing and responding to feedback from stakeholders, including resolving any conflicts and addressing crises. This would involve clear, open, and prompt communication to maintain trust and respect.

(f) Measuring and Evaluating Engagement: Success in stakeholder engagement should be measurable, including determining metrics for evaluating the effectiveness of engagement activities, such as stakeholder satisfaction scores, feedback quality, or participation rates.

(g) Reporting and Accountability: There should be a system for reporting on engagement activities and their outcomes to the consulting entity's senior management or board. This system would also hold individuals or teams accountable for their roles in stakeholder engagement.

(h) Training and Development: Staff members who are involved in stakeholder engagement should receive adequate training to handle their responsibilities effectively. Regular refresher courses or workshops will help them stay updated on best practices in stakeholder engagement.

(i) Review and Update of the Engagement Plan: Regular reviews of the plan ensure that it remains effective and relevant. These reviews should consider feedback from stakeholders and changes in the consulting entity's external environment.

5.4 IV's assessment of Chorus' ongoing stakeholder engagement

Chorus' PQP2 stakeholder engagement is complementary to its ongoing stakeholder engagement. We think it is important to capture the nature of this ongoing engagement because we would expect it to have an indirect influence on the development of Chorus' PQP2 expenditure proposal. This section first summarises the nature of this ongoing stakeholder engagement before addressing the PQP2-specific stakeholder engagement process.

5.4.1 Chorus' ongoing stakeholder engagement

We have seen evidence to verify that Chorus conducts stakeholder engagement and consultation on a regular, diverse, and broad basis with the objective to make informed

decisions about its operations and future plans. Chorus notes that its customer and stakeholder engagement is vital to the success of its products and services.

Key aspects of Chorus' ongoing stakeholder engagement are summarised below.

Stakeholders

Chorus' stakeholders are varied and include end-users of FFLAS, customers (retail service providers), the telecommunications industry including through the NZ Telecommunications Forum, local government, and technology partners. These engagement activities aim to prioritise product development activity and ensure delivery is commercially and operationally successful. This work spans product development in the consumer, business and network market segments, collaborating with RSPs and technology partners on process and system enhancements to ensure improving customer experience, and activities such as extending its network into NPD.

Engagement channels include:

- seeking feedback on white papers exploring new technology use cases
- industry events, such as Chorus Live
- the UFB Product Forum facilitated by the NZ Telecommunications Forum (TCF).

Chorus notes that there is a formal engagement process with RSPs used to share, seek feedback, and validate types of investments and proposed changes in products and that influences its 'Network and Customer' IT and supporting capex. Chorus also notes that the RSP engagement process has also directly influenced its customer IT capex, product development and customer incentives capex, where the design of the new mass-market incentive offer was directly influenced by RSP feedback on the settings and arrangements that would work best for them.

Communication channels

Chorus uses a multitude of communication channels to interact with its stakeholders. This includes personal communication methods like phone calls and meetings, formal consultation sessions with RSPs and ad hoc engagement with them on specific initiatives participation in NZ Telecommunications Forum working groups including the UFB Product Forum, and industry events such as Chorus Live, and conducting research studies and surveys.

Types of engagement

The types of engagement undertaken appear comprehensive. Chorus involve dedicated account teams interacting with key stakeholders daily or weekly, customer experience teams surveying end-users directly and collaborating with counterparts on service improvements, and regulatory teams interacting with the Commission on PQ FFLAS regulatory framework issues. Moreover, Chorus also conducts product roadmap consultations, which inform key investment areas.

Engagement with end-users

Despite its position as a regulated wholesaler limiting direct engagement with end-users in service delivery, Chorus states that it recognises the importance of understanding end-user needs. It has set up an extensive customer experience (CX) program and conducts regular research studies, employing a consumer monitor tracker to gain insights into the end-user base. Over the 12 months to May 2022, the company received 26,000 survey responses providing ratings and feedback on end-user experiences.

Continuous market feedback

Chorus continually receives market feedback that helps shape and adapt its offer of price and quality of FFLAS. The feedback gained is integrated into day-to-day investment decision processes and network policies.

5.4.2 IV's assessment of Chorus ongoing stakeholder engagement

Chorus has provided evidence to allow us to conclude that its PQP2-specific stakeholder engagement content and methodology align with many of the best practice principles under the IAP2 Guidelines.

(a) **Level of Participation**: Chorus' engagement approach encompasses most levels of the IAP2 spectrum of engagement. It informs and educates stakeholders about the benefits of fibre and how it differs from other technologies. It also consults stakeholders by listening and responding to market trends and end-user demands. It is actively involving stakeholders in their decision-making process and adapting its portfolio based on consumer demands and technology trends. It also strives towards transparent price-quality discussions, which suggest collaboration with stakeholders.

(b) **Inclusivity and Diversity**: The engagement objectives mention end-users, stakeholders, and retail market customers. Chorus has evidenced that they are engaging with a diverse range of stakeholders, such as homeowners, renters, rural users and digital users across a wide variety of life stages, income and ethnicities.

(c) **Accessibility of Information**: Chorus mentions continuous and direct engagement through its account and product teams, and its website. It provides information consistently, targeted at specific audiences, which suggests a level of accessibility. Chorus has also engaged with disability advocates to gain insight into the priorities of consumer categories. However, Chorus has provided little evidence to us as to how provisions for non-English speakers are made.

(d) Timeliness: Chorus undertakes continuous engagement with stakeholders, and it intends to adapt its service offering based on consumer demand and technology trends, which indicates timeliness in its engagement planning and activities.

(e) Feedback Mechanisms: Chorus appears to incorporate its ongoing stakeholder feedback and market intelligence for future improvement, indicating that a feedback mechanism exists. For example, we have seen evidenced feedback gathered during the PQP2 workshops and structured interview processes, and Chorus has developed a draft engagement plan for PQP3 which builds on and proposes to enhance the PQP2 engagement processes (including bringing forward the timing of stakeholder engagement so it has relevant feedback earlier in the business planning process and to carry out a 'final proposal' round of consultation including overall price and quality proposals for stakeholders to consider.

(f) Transparency: Chorus aims for open engagement and strives towards transparent price-quality trade-off discussions.

(g) Evaluation and Learning: While Chorus uses stakeholder feedback for improvement, a specific process to evaluate the effectiveness of its stakeholder engagement plan is not mentioned.

On the content plan side, Chorus has identified stakeholders, stated clear engagement objectives, outlined an engagement strategy, described engagement activities, and has a process for communication management. However, information on measuring and evaluating engagement, reporting and accountability, training and development, and review and update of the plan is not addressed beyond a high-level draft plan for PQP3.

In summary, while Chorus' ongoing stakeholder engagement aligns with many of the IAP2's best practice principles, there are areas that need more clarity or could be further developed in the future for a comprehensive best practice approach.

5.5 Chorus PQP2 stakeholder engagement

5.5.1 Chorus' corporate strategy refresh

In early 2022, Chorus carried out a full review of its corporate strategy with the aim to confirm what it should be working on to deliver FFLAS over the next three to five to ten years. It sought feedback from internal and external stakeholders by way of:

- 18 one-to-one interviews including consumer representatives, RSPs, analysts, investors, and government agencies; and
- a survey of other stakeholders (750 residential New Zealanders and 400 New Zealand businesses with more than five employees).

Chorus notes that the priorities arising from this engagement process informed its investment choices and decisions and flowed into Board decision-making, which has been reflected in the proposed increase in resilience expenditure in PQP2, the plan to extend the fixed fibre footprint as much as is affordable, and its increased focus on sustainability.

5.5.2 Engagement on extending the fixed fibre network

In January 2023, Kantar carried out research on Chorus' behalf to test the views of end-users who reside outside the current fibre footprint, i.e., its potential 'rural' customers. This research objective was to provide Chorus with a better understanding of potential rural customers. It covered the following areas:

- current levels of technology and internet awareness, usage and experiences
- fibre interest levels, perceptions and attitudes
- willingness to pay and willingness to coordinate for fibre services.

Chorus' proposed fibre frontier investment is discussed further in section 9.3.5 of our Final IV Report.

5.5.3 PQP2 proposal-specific engagement

Chorus notes that it has enhanced its PQP2 proposal-focused engagement compared to PQP1, including multiple rounds of engagement and market research. In particular, Chorus has adapted its business-as-usual engagement and research to better fit the PQ FFLAS regulatory context, and to better explain how engagement, research, and market feedback have influenced its PQP2 proposal.

We have reviewed supporting information Chorus provided on the PQP2 engagement process and outcomes, including a Kantar report[14] on customer investment preferences and willingness to pay for fixed fibre services.

Chorus undertook four specific rounds of PQP2 proposal-focused engagement. Following the earlier engagement stages, the final stage of the engagement was targeted in relation to PQP2 resilience, fibre frontier, hyperfibre and sustainability (solar and electric vehicles) investments, and Chorus as an active wholesaler (eg. spending on fixed fibre-related marketing and education).

A summary of the four engagement rounds is shown in Table 8.

Table 8 Chorus' PQP2 stakeholder engagement rounds

Engagement	Timing & nature of engagement	Objective and scope	Responses
Round 1: Initial Survey	November 2021. Survey-based, by way of a Kantar representative sample, and a publicly available survey that was sent to key stakeholders, made available on Chorus' website and publicised through its social media channels.	Focused on gathering initial information on stakeholder preferences and interests to inform subsequent rounds of PQP2 consultation, as well as preferred future methods of communication and general views on the future of fibre.	190 stakeholder responses (15 organisations and 175 individuals), plus 1,000 individuals through the Kantar survey. Chorus notes the results of this engagement round are not directly reflected in the PQP2 proposal as the intention was to gain insights to shape later rounds of engagement.
Round 2: Key issues survey	April 2022. Same survey-based approach as Round 1.	Building on the Round 1 survey to seek views on which investment areas are more or less important to Chorus' stakeholders and end-users to inform Chorus' business planning and PQP2 proposal development. This included on the importance of sustainability, network reliability (resilience) and digital inclusion, as well as the barriers to fibre uptake	312 stakeholder responses (35 organisations and 249 individuals), plus 1001 individuals through the Kantar survey. Chorus notes insights from this survey were also built into the Round 3 consultation paper.
Round 3: Formal consultation	November 2022. A written consultation paper, 'Help us shape New Zealand's fibre future' was published on 8 November 2022. This consultation round	To obtain views on potential areas of change in the PQP2 proposal and stakeholder preferences in terms of options Chorus was considering.	Six written submissions from stakeholders (three from RSPs, two from representative organisations and one from a local authority) and 21 responses to the stakeholder survey.

[14] Kantar (2023), Understanding the investment preferences of Chorus' key stakeholders, June

Engagement	Timing & nature of engagement	Objective and scope	Responses
	comprised written consultation with a stakeholder survey.	Taking themes from the previous consultation rounds, Chorus sought views on expenditure on reliability, extending fibre to rural users, technology, active wholesaler, sustainability and customer experience. Chorus also consulted on aspects of quality standards, demand, price path, use of economic tools to guide investment and approaches to gain further end-user insight.	
Round 4: Stakeholder workshops and interviews: process	April and May 2023, with additional RSP interviews in June and July 2023. Consumer workshops and stakeholder interviews. To ensure the participants were able to make informed comments, Kantar first presented videos and introductory material to educate respondents on each topic and ensure they understood the context. Kantar then presented three options (broadly: base, high and low levels of expenditure) and explained the benefits and end-user cost impacts of each. Kantar recorded participants' preferences and, importantly, the underlying reasons and justifications.	To gain richer insights into the priorities of end-users and other stakeholders regarding Chorus' investment choices. Chorus sought detailed views and price-quality preferences for targeted investment options in network reliability (resilience), fibre frontier (network extension), sustainability, Hyperfibre, and its active wholesaler strategy. Due to time constraints, Chorus notes that no workshop or stakeholder considered all five topics; rather it was two to three each and views were collated across all results to form conclusions.	11 workshops (with 12 participants in each) and 33 structured interviews.

Further to Table 8, Chorus notes that stakeholder feedback from the first three rounds of consultation was factored into the prioritisation of discretionary capex by the Chorus Board in December 2022 and taken into account in its business planning process in the first half of CY23. In turn, this informed the key focus areas for the in-depth engagement in the fourth consultation (workshop) round.

Chorus also notes that the results of the first three rounds of engagement were valuable, but it found responses to the formal consultation document in Round 3 were limited to

larger RSPs and interest groups, while the survey responses indicated preferences without giving insight into the underlying reasons. Consequently, for Round 4, Chorus engaged Kantar to carry out more in-depth engagement with representative consumers through workshops and structured interviews with key stakeholders. These workshops and interviews sought views, including on price-quality trade-offs and relative prioritisation, on key areas of discretionary investment for PQP2.

The key outcomes of these four engagement rounds are discussed in the next section.

5.5.4 PQP2 engagement outcomes

Chorus notes that the investment themes presented to stakeholders (in relation to resilience, fibre frontier, hyperfibre, active wholesale and sustainability) reflected feedback from the first three rounds of its PQP2 consultation. As previously noted, each option included a base case, high case and low case.

Chorus identified the following key overarching observations about its PQP2 engagement outcomes:

- Stakeholders generally supported either the base case or increased expenditure, with equal access to fibre, the importance of network resilience and the need to future-proof the network.
- RSPs were more focused on cost implications than other stakeholders and more concerned with potential cross-subsidy implications of Chorus' investments in fibre frontier and resilience. As such they tended to support lower-investment options.
- However, network reliability/resilience was the highest-rated investment area for non-RSP stakeholders (for access and equity reasons) and for RSPs (for customer experience reasons).

5.6 IV's analysis and findings on Chorus PQP2 engagement

We have seen evidence to verify that Chorus conducts stakeholder engagement and consultation on a regular, diverse, and broad basis with the objective to make informed decisions about its ongoing product development and future plans.

Overall, we consider that Chorus is committed to maintaining open lines of communication with a wide range of stakeholders to inform its operational and strategic decisions. Based on the information provided, Chorus has evidenced an ongoing stakeholder engagement program that involves regular communication and consultation with a diverse range of stakeholders. This includes fibre end-users, customers (RSPs), industry participants, and many other parties.

The PQP2 engagement process is embedded within and building upon this existing business-as-usual stakeholder engagement framework. Chorus indicated that stakeholders are beginning to build an understanding of the new FFLAS regulatory framework and what it means for them, indicating that this will be an ongoing process.

We have reviewed the PQP2 Engagement Plan prepared by Chorus and Kantar's report summarising the outcomes of the Round 4 engagement where the targeted engagement on key PQP2 investment areas was undertaken. We have also assessed the extent to which stakeholder feedback has been incorporated into the PQP2 proposal.

Our overall view is that Chorus has reflected the outcomes of its PQP2 engagement in the key investment areas that its stakeholders indicated were of most concern to them. We consider this to have been of most importance in relation to the resilience and fibre frontier investments given their potentially large size and discretionary nature.

Chorus' engagement in relation to its quality standards does not appear to have been especially deep other than finding no significant concerns about the levels at which the current mandatory standards are set. It has not consulted on the proposed changes to the way it reports against the mandatory standards, the implication of which is likely to have been difficult for end users to comprehend, but less so RSPs.

Chorus also has not engaged with its stakeholders on its full PQP2 proposal, including on any overall price-quality testing. In this regard, Chorus has noted that the more targeted nature of its Round 4 engagement reflected earlier stakeholder feedback and that the revenue and price controls that Chorus is subject to make price quality testing less pertinent.

We agree that the use of earlier stakeholder feedback to guide later more targeted and in-depth engagement is a reasonable approach, particularly at this early stage of the PQ FFLAS regulatory framework. However, we consider the lack of price quality testing to be an oversight that will need to be undertaken as part of the Commission's PQP2 assessment process.

While it is outside the scope of this verification review, Chorus has identified a draft plan in relation to its PQP3 stakeholder engagement process. We consider that Chorus' stated intention to align this engagement process with the IAP 2 Guidelines to be a good one and if implemented would be consistent with good telecommunications industry practice.

5.7 Verification opinion

We can verify that Chorus PQP2 stakeholder engagement, in general, satisfies Assessment Factor (j), in that it was a planned, well-tiered engagement process, which

sought to identify stakeholder priorities for the PQP2 proposal. The range of stakeholders consulted was also very wide.

The stakeholder engagement was also effective in that feedback received has been incorporated into the PQP2 capex proposal in relation to the targeted investment areas, including most importantly (from an investment size perspective), resilience (reliability) and fibre frontier capex.

However, we cannot fully verify Chorus' PQP2 stakeholder engagement as satisfying the Evaluation Criteria because it has not undertaken overall price quality testing of its PQP2 proposal.

In forming this opinion, we had particular regard to Assessment Factor (j) regarding the extent and effectiveness of consultation and engagement with stakeholders, including the extent to which that feedback has been incorporated in the PQP2 expenditure proposal.

6 Quality Standards

The purpose of this chapter is to analyse Chorus' proposed quality standards for PQP2 with a specific focus on the three PQP1 quality standards relating to Layer 1 and 2 availability and port utilisation.

6.1 Our assessment factors

The following assessment factors have been applied to assess the extent and effectiveness of Chorus' quality standards:

- Chorus' reported performance against the Commission-set PQP1 quality standards (IV assessment factor).
- Rationale for any changes that Chorus proposes to its PQP1 quality standards (IV assessment factor).

In assessing Chorus' proposed changes to its mandatory quality standard reporting, we had particular regard to the Part 6 purpose statement in the Telecommunications Act, which is to promote the long-term benefit of end-users in markets for FFLAS, which we consider reflects good telecommunication industry practice.

6.2 Chorus' supporting information

Our assessment of Chorus' PQP2 quality standards proposal is based on the following documents that it has made available to us:

- RP2 Quality report 03-04-2023.docx [Document 6A]
- Chorus March 22 Performance Breach Report (7 July 2022).pdf [Document 6B]
- UFB-Performance-Measurement – and-Reporting-17-Nov.pdf [Document 6C]
- Quality Report PQP2 template version to the IV.docx [Document 6D]
- Quality Report PQP2 template version – August Review.pdf [Document 6E].

6.3 Chorus PQP1 mandated quality standards

Chorus is currently subject to three quality standards under the mandatory quality dimensions taken from the Fibre IMs and set in the Commission's PQP1 final determination:

- Availability: average net unplanned downtime

  - Differentiated by geography and at service layers 1 and 2 for 23 Points of Interconnection (POI).

- Performance: port utilisation.

In addition to these three standards, there are also optional quality measures identified in the Fibre IMs under which the Commission has set measures in the ID framework applied to Chorus rather than that set standards under the price path for PQ FFLAS in PQP1.

Table 8 presents the definitions of the three defined mandatory quality standards that are currently being applied to Chorus. The fibre optional quality measures are also identified.

Table 9 Commission's Final Determination on PQP1 quality standards

Mandatory or optional in the Fibre IMs	Quality dimension and metric	Quality standard
Mandatory	Availability: average net unplanned downtime Differentiated by geography (availability POI area) and service layer (Layer 1 and Layer 2)	To comply with the Layer 1 availability quality standard for a given availability POI area in a regulatory year, Chorus' average net unplanned downtime must not exceed, for a Layer 1 aspect of a fibre network, 160 minutes in that availability POI area.
		To comply with the Layer 2 availability quality standard for a given availability POI area in a regulatory year, Chorus' average net unplanned downtime must not exceed, for a Layer 2 aspect of a fibre network, 40 minutes in that availability POI area.
		Downtime attributable to force majeure events, non-diverse transport services and port utilisation equal to or above 95% are excluded from measurement of the availability quality standard.
	Performance: port utilisation	To comply with the performance quality standard for a regulatory year, the percentage of Chorus's ports experiencing port utilisation, upstream or downstream, equal to or exceeding 90% in any five-minute interval in one or more calendar months in that regulatory year, must not exceed 0.12%.
Optional[a]	Ordering	None
	Provisioning	ID-only
	Switching	None
	Faults	ID-only
	Customer Service	ID-only

a Commission's PQP1 Reasons Paper para 7.82 notes "… ID regulation, and external factors such as FWA competition, are sufficient to produce outcomes in the long-term benefit of end-users."

Note: A force majeure clause applies to the Network Availability standard but not to the Port Utilisation standard.

Source: Commerce Commission (2021), Chorus' price-quality path from 1 January 2022 – Final decision, Reasons paper, p 202

In making its final determination on PQP1 quality standards, the Commission noted that the three mandatory quality standards have been set to give it visibility of any FFLAS quality degradation, as well as provide Chorus with incentives to supply FFLAS at a quality that reflects end-user demands.[15]

There are breach limitations for each geographic area. A single breach of the annual downtime limit (Layer 1 or Layer 2) in any availability POI area is sufficient to warrant investigation and potential penalty.

6.4 Reported service performance in PQP1

Chorus has reported one full year of its performance against the quality standards for CY22 in PQP1. This provides a limited basis to assess the reasonableness of the approved quality measures and standards, particularly the three quality standards, as well as Chorus' performance against the optional quality dimensions measured under ID.

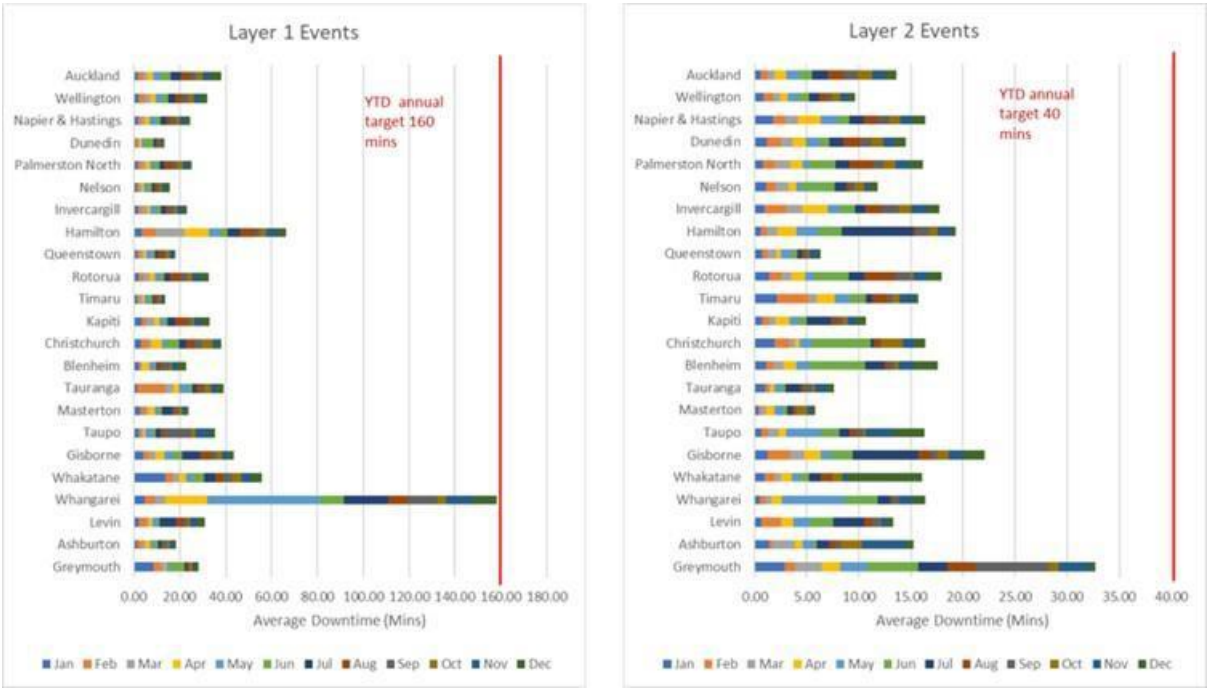
This limited performance data set suggests that a cautious approach should be taken to making changes to existing mandated quality standards or turning any current measures under optional dimensions into mandatory quality standards.

6.4.1 Availability quality standards

Figure 5 shows that Chorus met the Layer 1 and Layer 2 availability quality standards for all 23 POI areas in CY22.

[15] Commerce Commission (2021), Chorus' price-quality path from 1 January 2022 – Final decision Reasons paper, December, p 205

Figure 5 Fixed fibre services regulatory framework



Source: Chorus

Figure 5 indicates that Layer 1 performance at Whangarei POI and Layer 2 performance at Greymouth POI were closest to breaching the availability quality standards in CY22. Performance against all other POIs at the Layer 1 and 2 levels was comfortably within the quality standard threshold.

Chorus argues that its relatively poor performance in Whangarei (an area where it argues that procuring sufficient technical resourcing has always been difficult, especially since COVID-19) was compounded due to an increased resource demand from non-FFLAS work and exacerbated by the transition of its Field Services Agreement (FSA) to a new field supplier which has now been completed.

Chorus advises that it was required to significantly exceed performance above business-as-usual circumstances later in the year because it had to 'claw back' lost performance earlier in the year to stay within the quality standard over the full year.

In response to this situation, Chorus indicates that it has added permanent resources into Northland to provide quicker times to restore supply and has increased performance monitoring and internal reporting requirements across all 23 POI areas to better manage daily performance.

6.4.2 Performance – Port utilisation

The port utilisation quality standard was breached in CY22. The breach related to an update of the 'Fortnite' game which was released during NZ's evening peak fibre broadband usage period. The peak on this day for national traffic was 25% above the average peak of the previous 7 days, setting a new national record of 4.491 Terabits per second.

Chorus advises that during the Fortnite event, 3,812 ports in the fibre aggregation network were active. Of this group, 6 ports exceeded the 90% utilisation threshold over a 5-minute interval, thus breaching the quality standard.

Chorus has made the following observations regarding this breach event:

- To Chorus' knowledge, no end users were impacted due to the reported breach.
- Chorus has adapted its capacity management process to meet the new port peak utilisation threshold for forecast traffic levels;
  - funds were re-purposed to cover this accelerated expenditure.
- The event was unforeseeable, uncontrollable, and an anomaly from normal daily use.

In accordance with PQP1 requirements, Chorus lodged a quality standard breach report with the Commission in July 2022.

6.4.3 Concerns raised by Chorus about PQP1 mandatory quality standards

Network availability

Chorus has concerns with the large differences in size between the 23 POI areas. Hence, it argues the impact of downtime on a single access line in smaller POIs is more significant than on a line in Auckland.

This means Chorus must concentrate network reliability investment and maintenance efforts on POIs where the performance against quality standards is more sensitive to downtime.

Performance: Port utilisation

Chorus considers this mandatory quality standard can result in quality breaches that do not speak to a failure to invest in and manage the network in accordance with good telecommunications industry practice. Specifically, a quality standard breach can occur

due to unprecedented and unforeseeable demand spikes, like the Fortnite breach event, and network failures due to force majeure events like natural disasters.

6.5 PQP2 stakeholder engagement outcomes

Chorus' PQP2 stakeholder engagement activity did not directly address the quality standards that it reports under the FFLAS Information Disclosure framework, or its current mandatory quality standard levels. Chorus also did not seek stakeholder views on the proposed changes to the reporting of its Availability and Port Utilisation mandatory standards.

However, Chorus appears to have interpreted from its PQP2 stakeholder feedback on willingness to pay for fixed fibre services, including concerns expressed by some stakeholders about the affordability of these services, that it should maintain the current mandatory service standards.

More generally, Chorus argues that ongoing market feedback and end-user research informs it if the balance between price and quality is right in its product mix and in the provision of fixed fibre services more broadly.

6.6 Chorus' proposed PQP2 mandatory service quality standards

For PQP2, Chorus is proposing refinements to the way that the current Availability and Port Utilisation standards are defined and reported. However, no additional quality standards are proposed.

6.6.1 Proposed change to Availability standards

Chorus has proposed a significant change in the number of geographic areas that it reports against, with a reduction from the current 23 POIs to 11 Customer Service Areas (CSAs).

Chorus argues there are two main drawbacks to the way the current Availability quality standards are geographically disaggregated:

- First, there is a significant inequality in the number of connections across the 23 POI areas. This creates incentives that are inconsistent with the idea of equality between end-users and generally adverse to efficient reliability planning and management of field resources; and
- Second, the 23 POI areas do not align to how Chorus manages fault response on the fixed fibre network. This makes it more difficult for Chorus to respond to emerging

issues with downtime in a particular area making compliance more resource intensive than it could be.

Chorus notes the POI area with the smallest number of Chorus fibre connections is Christchurch which has 6,320 connections and compares to the single Auckland POI area which has 486,557 connections. There are also a further four POIs with less than 10,000 Chorus fibre connections.

Chorus argues that for over a decade it has used a field management framework which is based on 11 CSAs. The geographical areas for these CSAs were based on each area having roughly the same number of customers, and each area being large enough to support an effective number of technicians. This framework enabled Chorus to benchmark and optimise performance of each area against the other areas.

Chorus has provided the graphic below which shows the average number of connections across the availability areas would increase from currently 40,000 to 89,454. Auckland would be split into three similar sized areas and the smallest area (Taranaki) would have just under 10,000 connections (it would be the only area with fewer than 10,000 connections).

Figure 6 Mapping of POIs to CSAs for reporting purposes

POI	Connections	% of NZ
Invercargill	25,939	3%
Queenstown	21,858	2%
Dunedin / South Dunedin	41,484	4%
Oamaru / Timaru	18,906	2%
Ashburton	7,640	1%
Christchurch / Riccarton	6,320	1%
Greymouth	7,186	1%
Nelson	28,394	3%
Blenheim	12,329	1%
Wellington / Porirua	124,300	13%
Paraparaumu	14,786	2%
Palmerston North / Whanganui	37,548	4%
Levin	8,486	1%
Masterton	11,074	1%
Napier / Hastings	43,011	4%
Taupo	11,012	1%
Tauranga	10,845	1%
Rotorua	18,958	2%
Whakatane	9,589	1%
Hamilton / New Plymouth	19,924	2%
Gisborne	10,415	1%
Auckland	486,557	49%
Whangarei	8,708	1%

CSA	Connections	% of NZ
Lower South Island	124,542	13%
Upper South Island	45,514	5%
Wellington	103,953	11%
Eastern North Island	141,120	14%
BOP	56,027	6%
Taranaki	6,173	1%
New Waikato	11,400	1%
Auckland South	149,511	15%
Auckland Central	161,664	16%
Auckland North	149,171	15%
Northland	34,922	4%

Source: Chorus

Chorus argues that the proposed change to disaggregation would mean downtime on a single access line in the smallest CSA would only have 26 times more impact in terms of reported Availability performance than downtime on a line in the largest CSA. This

would reduce the regional difference in performance impact by roughly 70% compared to the status quo.[16]

In Chorus' view, the proposed change to the Availability quality standard would:

- deliver a more consistent end-user experience across the network;
- allow it to better respond to and manage service restoration issues since each area to which the standard applies would align to a field work management area;
- reduce the incentive to invest more heavily in network reliability for the smaller POI areas to deliver a level of performance that is above what is generally considered good telecommunications industry practice;
- provide more granularity for the greater Auckland area, as it would effectively de-average the Auckland performance by reporting performance separately for the existing three distinct Auckland CSAs (rather than as one greater Auckland area).

Chorus states that it will continue to be required to report availability across the 26 POI areas in its ID reporting for PQP2, so stakeholders have a clear and granular view of any change in availability outcomes over time in all parts of New Zealand.

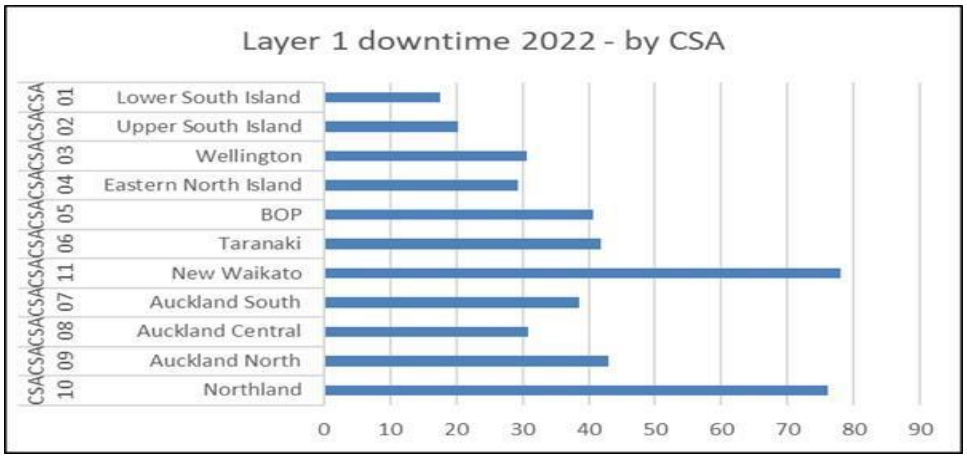
Sensitivity testing – Impact of proposed changes on reported availability performance in CY2022

At the IV's request, Chorus tested the impact of its proposed change using actual performance data for the CY22 disclosure year.

Figure 7 indicates that for Layer 1 CSAs, in all cases downtime for each CSA would have been under the standard of 160 minutes.

[16] The IV's estimate of this impact is close to that of Chorus at around 66% (we estimate a difference of 27 times the impact between the smallest and largest areas when reporting is based on CSAs and 79 times when POIs are reported).

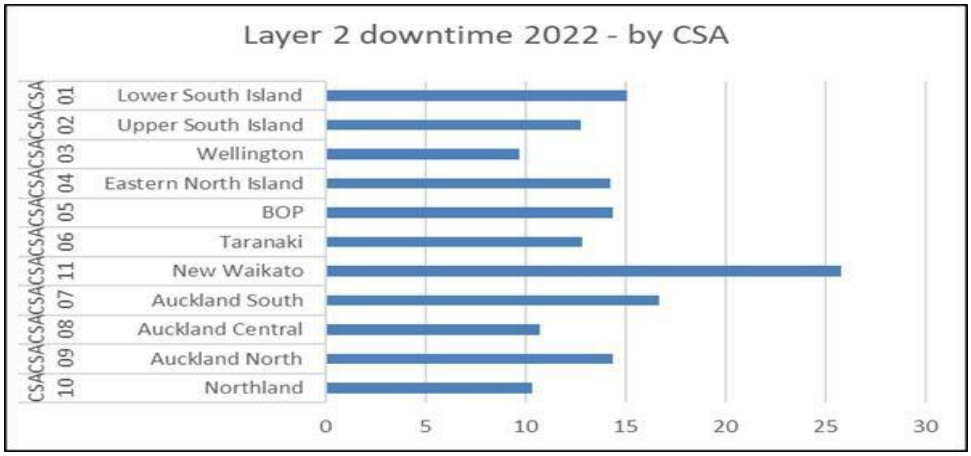
Figure 7 CSA Layer 1 performance in CY22



Source: Chorus

Figure 8 indicates that for Layer 2 CSAs, in all cases downtime for each CSA would have been under the standard of 40 minutes.

Figure 8 CSA Layer 2 performance in CY22



Source: Chorus

Chorus notes that performance in the Northland CSA, including Whangarei, would still have shown up as being materially poorer relative to other CSAs and it would have instigated investigations and, if considered prudent, mitigating actions. Further, poor performance such as in the Whangarei area will still be identifiable through availability outcomes for the Whangarei POI reported under the ID framework. Therefore, Chorus considers the amended Availability quality standard will drive the appropriate investment and maintenance behaviour.

6.6.2 Our IV assessment

We consider that Chorus' proposed change to the way the mandatory Availability quality standards are reported has several reasonable features as follows:

- Six of the 23 POIs have less than 10,000 connections and 8 of the POIs have between 10,000 and 20,000 connections, which we consider creates the potential to distort Chorus' investment and maintenance decision-making to avoid it breaching a quality standard;
  - we agree with Chorus that breaches of quality standards have potentially serious legal and reputational consequences for it that will drive its behaviour in ways to avoid these consequences and that may encourage sub-optimal investment and operational decisions with longer term adverse customer price effects;
  - we think there is an important distinction to be made between Chorus transparently reporting on poorly performing areas at a granular level using POI reporting, which raises the issue of whether it should be planning to take remedial actions to address performance in these areas, including undertaking targeted new investments, compared to reported poor performance in these areas triggering breaches with the associated negative consequences.
- Based on comparative information provided by Chorus shown in Figures 7 and 8 above, it appears that reporting under the 11 CSAs will not 'hide' poorly performing geographic areas of the Chorus fixed fibre network;
  - In this regard, the Whangarei POI and comparable Northland CSA are both reporting as the worst performing Layer 1 areas. In addition, the Hamilton POI and comparable New Waikato CSA are both reporting as the second worst performing Layer 1 areas.
  - Layer 2 comparative reporting using POIs and CSAs is broadly comparable but with somewhat less variability in reported minutes using CSAs – for example, the worst performing area under POI reporting, Greymouth, is subsumed within the Lower South Island area under CSA reporting
- More disaggregated availability reporting in the Auckland geographic area will improve transparency of the overall mandatory quality standard reporting arrangements – CSA reporting at the Layer 1 and Layer 2 levels shows variability in performance across the greater Auckland area.
- Chorus has around 18% of its total connections in the South Island, where the largest effect of the re-aggregation from 23 POIs to 11 CSAs would occur, with 9 POIs reducing to 2 (Lower South Island and Upper South Island) – the number of

connections in each of the two CSAs (124,542 and 45,514 respectively) do not appear unreasonably large compared to other CSAs and POIs.

- Aligning the quality standard reporting to Chorus' field management arrangements, while less important than assessing the customer impact of the proposed change in reporting, nevertheless could result in more efficient management of availability issues to the ultimate long term benefit of customers.
- Chorus will continue to report its performance against the 26 POIs in its ID reporting, which maintains the current level of transparency in reporting and provides a cross-check for the outcomes reported using the 11 CSAs.

In forming our view on the proposed change, our main concern has been whether there is a material reduction in the transparency of Chorus' reported availability performance.

As expected, reducing the number of reported geographic areas will have an averaging effect on reported availability performance. This is reflected in Chorus comfortably meeting the quality standard using CSAs, with no CSAs close to breaching. This indicates that the minutes 'buffers' built into the current minutes downtime threshold for Layer 1 and Layer 2 standards need to be reset for the 11 CSAs based on historical performance.

Under the proposed CSAs, it appears the poorly performing areas evident under 23 POIs will in most cases show up as poorer performing areas under the CSAs. which is important in terms of protecting the long term interests of fibre end-users.

More broadly in terms of the Availability Quality Standards, we support retention of the current exclusions relating to a force majeure event, non-diverse transport services and port utilisation equal to or greater than 95%.

6.7 Proposed change to Port Utilisation quality standard

Chorus proposes some adjustments to the reporting of this mandatory quality standard to reduce the risk of it breaching due to atypical factors that do not reflect a failure to invest in and manage network capacity in accordance with good telecommunications industry practice. Specifically, Chorus notes that these are events caused by unforeseeable and unprecedented demand spikes, like the Fortnite breach, as well as network equipment failures, such as damage caused by natural disasters like Cyclone Gabrielle.

6.7.1 Proposed change to Port Utilisation standard

Chorus' proposed changes are as follows:

- Remove from its reported service performance the impact of significant atypical events arising from:
  - unforeseeable demand spikes; and
  - network equipment failures.
- Increase the port utilisation threshold from 90% to 95% because evidence suggests a breach of the 90% threshold does not impact on user experience but does require Chorus to make inefficient investments to meet the lower threshold and avoid a quality standard breach.

Reasons for proposed change to port utilisation quality standard

Chorus argues that bandwidth demand has never followed a smooth trend and some allowance for variability is prudent to allow for step changes in demand that may occur without warning. However, there is a diminishing overall end-user benefit in providing extra capacity if:

- the potential 'pain' of congestion is limited to a small number of events of short duration per year; and
- the cost of mitigating those events through additional investments rises exponentially.

Chorus expects to continue to see atypical demand spike events, like the Fortnite event, which may increase over time due to various supply and demand factors including:

- Increasing global use of digital channels to deliver new services is increasing the unpredictability of the number, scale and concurrence of high bandwidth demands.
- Instantaneous global distribution of high bandwidth content is a relatively new phenomenon (since 2019) but may become more widely used in other segments beyond gaming.
- Global companies are the source of these bandwidth demands and not sensitive to NZ local market conditions for network performance or pricing signals faced by their customers for inputs including broadband.
- Chorus does not undertake traffic management to slow or reduce demand during peak times as this is difficult given obligations in its customer contracts and is not considered best practice in NZ.
- High access speeds of Chorus' fibre services mean there is no constraint on user connections' ability to demand very high bandwidths simultaneously compared to non-fibre & legacy technologies.

- Broadband networks across NZ, including Internet Service Provider networks, continue to expand to have sufficient capacity for projected bandwidth demand and therefore are not artificially limiting bandwidth spikes before reaching the Chorus fibre network.

Normalise reported port utilisation data to remove effect of atypical events

Chorus states that normalising for the effects of unforeseeable and/or unprecedented demand spikes would have the greatest effect on its reported port utilisation performance and is its main priority in proposing change to the reporting of this quality standard. This is because it would significantly reduce the risk of Chorus breaching the port utilisation quality standard for the occurrence of significant atypical events.

Chorus proposes two normalisation-related quality standard changes be made in PQP2:

- Introduce an all-cause equipment failure exclusion.
- Increase the current 90% utilisation breach threshold to 95%.

We discuss each in turn below.

Equipment failure exclusion

Chorus argues that a network (equipment) failure is an event where an element of a network does not work as intended for any reason. Such a malfunction could result from anything – from a failed software upgrade to the physical destruction of a fibre link by an earthquake or flood. In these circumstances the network will automatically attempt to preserve connectivity by directing traffic around the failed network element. The irregular traffic flows that result will, in turn, cause higher port utilisation on the links the network is using to avoid the failed element. This prevents end-users totally losing service, but the congestion may risk breach of the port utilisation quality standard.

In this regard, Chorus notes the impact Cyclone Gabrielle had on its network and network performance where there were failures to multiple elements of the network which created the potential for a breach of the port utilisation quality standard.

During the cyclone, Chorus notes that it observed in near real-time network elements failing and traffic being re-routed to secondary links. This action created some secondary links to congest, which if serious enough would have resulted in a breach of the Port Utilisation quality standard. In contrast, any downtime that would have occurred in the absence of Chorus taking this mitigating action would have been removed from reported reliability data under the force majeure provisions of the Availability quality standard.

Chorus clarifies that it is not proposing that equipment failures should be excluded from the performance quality standards because they are not its responsibility. Rather, it considers that equipment failure relates to reliability of the network not its capacity and Chorus is subject to the Availability quality standard which captures this service dimension.

In its view, it is not necessary then to capture equipment failure under the Port Utilisation standard, as well as the Availability quality standard, which creates a double jeopardy situation for Chorus and in so doing will either limit network diversity (i.e. make the network less reliable to keep port-utilisation within the 90% utilisation threshold); or substantially over-provision capacity to ensure every link can handle any traffic that could conceivably be directed onto it in any and all equipment failure scenarios.)

Chorus notes that utilisation above the maximum threshold caused by network failure did not count as a breach regarding Chorus' performance measurement regime under the UFB contract with the Crown. In addition, Chorus argues although the exact number changes regularly, there are currently around 2300 uplink ports and 1500 internodal ports in the Chorus fibre network. This means only 4 ports can exceed the maximum utilisation threshold in a month before the standard is breached. This leaves no headroom for 'false positives' where congestion is caused by atypical events rather than insufficient network capacity.

Increase port utilisation threshold to 95%

Chorus argues that consistent with its views expressed in the Commission's consultation process for PQP1 and Fortnite-related breach report, and earlier work undertaken in 2026 and 2017, it believes the port utilisation threshold should be set at 95% not 90%.

To mitigate the risk of further port utilisation breaches in PQP1 given the 90% threshold applying, Chorus notes that it has increased investment in Layer 2 capacity by building more headroom capacity on the network, effectively bringing forward investment. However, it does not consider this approach is a long-term solution.

If the current 90% threshold was carried forward unchanged into PQP2, Chorus argues that it would need sustained funding to build a network with substantial capacity headroom that would allow for these rare and extreme demand spikes to be accommodated. This would ultimately flow on to price increases for Chorus' FFLAS users.

Chorus notes that in designing its fixed fibre network, it is already providing capacity headroom to accommodate an unexpected 50% uplift in demand. It further notes that incremental expenditure required beyond PQP2 is likely to follow an exponential curve

considering the compounding impact of bandwidth growth which it considers is likely to continue.

Chorus argues the challenge is to identify how much capacity headroom to provide given customer willingness to pay to avoid occasional inconvenience is difficult to determine and given any such inconvenience may affect only small groups of customers at any one time.

Finally, in the Fortnite breach event, Chorus states that for network ports where utilisation exceeded 90% but remained below 95%, end-user experience was unimpacted, indicating this event was a 'false positive' and should not have triggered a quality standard breach and chain of compliance actions under the PQ FFLAS regulatory framework.

Chorus' alternative normalisation approach

Further to the proposed change to the port utilisation breach threshold, Chorus suggests an alternative normalisation approach of establishing a clear link between its forecast network capacity-related expenditure and outcomes under the Port Utilisation Quality Standard.

Under this approach, Chorus would link its bandwidth capacity planning and associated demand forecast to the setting of the level of utilisation threshold for this quality standard. Chorus suggests a 50% headroom allowance be used as it directly links to its capacity planning thresholds and therefore the way it forecasts network capacity-related capex. In practice, Chorus states it manages the fibre network such that port utilisation does not exceed 60%, so that in the event of a 50% increase in traffic no breach of the quality standard would occur.

Chorus does not formally propose at this stage that this change to link the Port Utilisation Quality Standard to the bandwidth forecast be made for PQP2, but rather that it is keen to explore the approach further with the Commission and stakeholders as part of the Commission's PQP2 consultation process where initially the focus would be on the policy implications of this proposed change. Chorus expects this would subsequently be followed by a technical consultation phase where the Commission would focus on the implementation through the PQ FFLAS determination (and possibly fibre IM amendments if required) to give effect to any policy decisions it has made.

Given the early stage of development of this possible alternative normalisation approach, we have not attempted to verify it.

6.8 Verification analysis and findings

In simple terms, Chorus' proposed changes to the Port Utilisation quality standard are directed at incorporating a mechanism to remove the effect of significantly atypical or force majeure-type events on its reported performance. This is on the grounds that the occurrence of these events can (and already have) resulted in quality standard breaches that are not reasonably within Chorus' control to manage or mitigate, including through inefficient investment.

In principle, we consider the need for some form of normalisation of reported data and/or reported data exclusions to be a reasonable change to the Port Utilisation Quality Standard and consistent with regulatory practice regarding service performance reporting (and any associated financial service performance incentive schemes). Applying some form of normalisation to the port utilisation data would also be consistent with the force majeure provision currently applying under Chorus' Availability Quality Standard.

In this context, the main issue for the IV is whether the data adjustment mechanisms that Chorus is proposing are consistent with good regulatory design and practice. In addition, we consider any changes should facilitate outcomes in terms of Chorus' future investment and opex decisions affecting its delivered quality performance that are consistent with good telecommunications industry practice, including meeting the service quality requirements of FFLAS users.

Chorus' two proposed changes in the reported Port Utilisation quality standard are as follows:

- Incorporate all-cause equipment failure as an exclusion.
- Increase the port utilisation threshold to 95%

Further to these two proposed changes, we also discuss the possible addition of a force majeure provision into the Port Utilisation Quality Standard, which we consider would address Chorus' concerns about the adverse impact of atypical weather-related events on its reported service performance.

We address each of the proposed changes to the Port Utilisation standard below. In forming our opinions, we note that the outcomes of Chorus' PQP2 stakeholder engagement do not appear to have informed Chorus' proposed changes.

6.8.1 Equipment failure

Chorus proposes that all-cause equipment failure should be an exclusion from its reporting on the Port Utilisation quality standard.

We agree with Chorus that there appears to be the potential for its real time management of the impact of significant atypical external events that cause equipment failure to raise the risk of it breaching the Port Utilisation Quality Standard due to increased reported network congestion captured under this quality standard.

Cyclone Gabrielle appears to provide a case study of this risk factor presenting for Chorus, while noting that Chorus was able to manage the effects of this severe weather event without breaching the Port Utilisation Quality Standard.

It appears to be an unintended consequence of the interaction of the two mandatory quality standards, and is likely to present in areas of the fixed fibre network where there is less in-built redundancy i.e. generally at the outer geographic areas of the network.

In managing any such events in real time, Chorus must consider the interaction between the Availability and Port Utilisation Quality Standards. We would expect equipment failure caused by a weather event like Cyclone Gabrielle to be excluded from Chorus' reporting against the Availability Quality Standard due to the operation of the force majeure provision.

Nevertheless, acting as a responsible network owner in accordance with good telecommunications industry practice, we would expect Chorus to manage the equipment failure with the objective of avoiding fibre network outages (as measured by the Availability Quality Standard),[17] which could result in increased network congestion resulting in a breach to the Port Utilisation Quality Standard. This is because there is no equipment failure exclusion and/or force majeure provision operating under the Port Utilisation Quality Standard.

While recognising Chorus' concerns in relation to the consequential impact of equipment failure on its quality standard reporting, we consider that an all-cause equipment failure exclusion to be inconsistent with good telecommunications industry practice. This is on the grounds that it would potentially capture equipment failure within Chorus' reasonable control rather than failures only caused by significant external events beyond its reasonable control. For this reason, we cannot verify the proposed all-cause equipment failure exclusion as satisfying good industry practice.

6.8.2 Inclusion of force majeure provision in Port Utilisation Quality Standard

As noted above, we support the inclusion of force majeure mechanisms in regulatory service reporting and associated financial incentive schemes. The current mandatory Availability quality standard includes such a mechanism.

[17] We consider this is the approach that Chorus adopted in relation to the Cyclone Gabrielle event.

Our view is that a force majeure mechanism included in the Port Utilisation Quality Standard would capture the severe weather events that Chorus is concerned could cause it to breach the standard. In contrast, we do not accept that an all-cause equipment failure exclusion is appropriate given Chorus has control over its equipment and should accept responsibility for its reported performance subject to the occurrence of force majeure events.

In our view, the inclusion of a force majeure provision in the Port Utilisation Quality Standard would remove the risk of Chorus breaching this standard as a result of it managing greater than usual network congestion arising from equipment failure caused by any future events like Cyclone Gabrielle.

For this reason, we consider that inclusion of such a force majeure provision would facilitate Chorus adopting good telecommunications industry practice in managing equipment failure arising from events both within and out of its reasonable control.

6.8.3 Increase port utilisation threshold

We cannot verify that the increase in port utilisation breach threshold to 95% is likely to deliver any better outcomes consistent with good telecommunications industry practice than retaining a 90% threshold under the Port Utilisation Quality Standard.

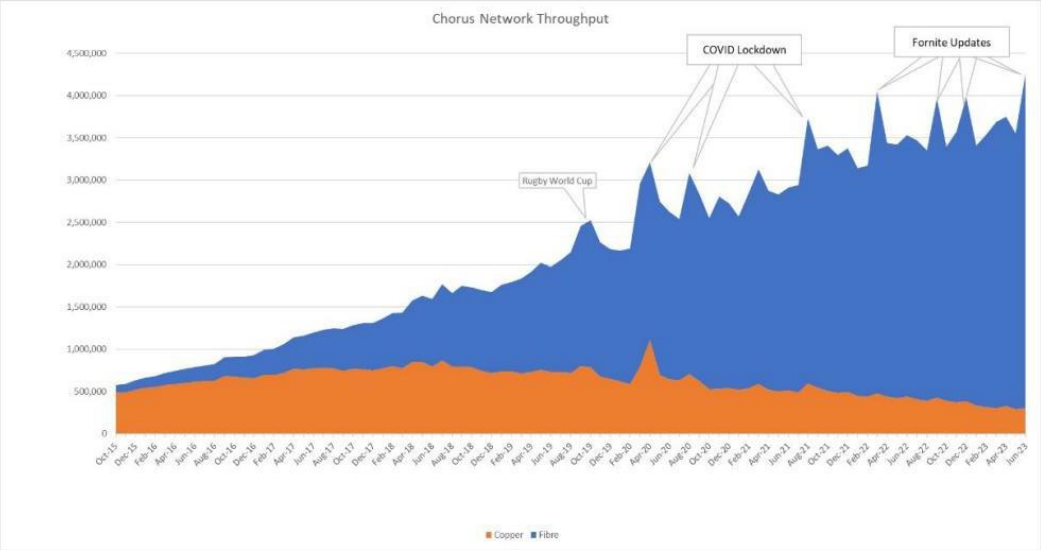
The main reason for this finding is that Chorus has confirmed that no additional capex will be required over time to meet the 90% port utilisation threshold compared to a 95% threshold, with its capex planning using a much lower utilisation threshold (around 60%) for the purpose of determining future network capacity investment needs.

In addition, Chorus' bandwidth demand forecasting is capturing the periodic atypical utilisation peaks and so these peaks are being reflected in its network capacity-related capex forecasts regardless of the level of the utilisation threshold used for quality standard reporting. In making this point, we recognise that Chorus is not attempting to forecast future atypical peak events, but rather that these events are increasing the need for future network capacity augmentation.

Over the course of our verification review and in discussions with Chorus, it became clear that the main driver for Chorus' proposed change to the port utilisation breach threshold is the breach risk it faces under the Port Utilisation Quality Standard. We agree that the Fortnite breach event in 2022 was a significant external demand event that Chorus could not prudently have invested in its fibre network to avoid.

Figure 9 below provided by Chorus shows the effect on its fibre bandwidth capacity of increasingly peaky bandwidth demand between 2019 and 2022.

Figure 9 Chorus' bandwidth capacity – 2019-2022 (gigabits)



Source: Chorus

To manage the occurrence of any such events in future without breaching the Port Utilisation Quality Standard would require significantly more 'headroom' capacity to be built into Chorus' fixed fibre network. We consider that this headroom capacity would be inefficient and inconsistent with good telecommunications industry practice because this capacity would be used rarely. In practice, peak demand on the network is ratcheting up roughly annually, but average demand is materially less than peak demand. We note that Chorus' network capacity forecast for PQP2 is not inclusive of any investment in headroom capacity to try to anticipate atypical peak demand events.

In relation to Chorus' concern that network congestion arising from atypical new peak demand events (like the Fortnite event) can potentially cause Port Utilisation Quality Standard breaches is a more challenging issue to address than including a force majeure provision in the quality standard as discussed in the preceding section.

Standard regulatory practice to address this type of peak demand event is to apply a statistical test to determine whether it should be removed from reported port utilisation data. This approach works well when the data set can be assumed to be normal, with two standard deviations generally applied as the upper threshold above which a specific event is excluded from the reported data. The Commission has applied this approach in setting the minutes buffers for the Layer 1 and 2 Availability Quality Standard thresholds.

In contrast, the port utilisation data is not normally distributed so the standard deviation-based thresholds cannot meaningfully be applied.

Further, it is evident from Chorus' reported maximum throughput data that there is a break in the series in 2019 such that what was previously a strong but stable upward growth trend has since become increasing volatile while underlying demand continues to grow strongly. Further, there is increasing frequency of reported events where observed throughput is materially higher than the underlying growth trend with throughput peak events ratcheting up over time.

Given this increasingly volatile throughput profile we have some concerns about the best way of statistically recognising what could be considered peak demand 'outlier' events that are beyond Chorus' reasonable control in terms of its investment planning and execution. We do not think these events should be a breach under the PQ FFLAS framework.

Recognising that maximum throughput events are becoming an increasingly common one on Chorus' fibre network, a relatively simple solution which we consider would preserve Chorus' incentives to invest to meet the underlying upward throughput growth trend, while lowering its PQP2 port utilisation breach risk, is to incorporate what could be called a 'ratcheted peak throughput event' as an exclusion to this quality standard.

This event would be defined as the highest non-coincident maximum network throughput recorded up to and including the relevant month of its occurrence. This definition essentially provides that Chorus cannot reasonably be expected to meet a 90% port utilisation threshold when the reported maximum throughput on its fibre network is higher than at any previously reported period.

Over the past two years, applying the maximum throughput event threshold would have excluded for breach assessment purposes, events reported in March 2022 (the Fortnite port utilisation breach) and in June 2023, the most recently reported maximum throughput event on the fibre network. The two Fortnite-related events in September and December 2022 would not have been maximum throughput events because they did not exceed maximum throughput reported in March 2022.

6.9 Verification opinion

Those parts of Chorus' PQP2 quality standard proposal that we consider are likely to promote Part 6 of the Telecommunications Act and good telecommunications industry practice are as follows:

- Retain the current three quality standards: Layer 1 and Layer 2 Availability and Port Utilisation.
- Change the measurement of the Availability quality standard from 23 POIs to 11 CSAs;
  - however, the minutes buffers built into the current Layer 1 and 2 POI breach thresholds need to be re-calculated to set the CSA breach thresholds using 3-5 years of historical (back-cast) data.

We consider that changing the breach threshold in the Port Utilisation quality standard from 90% to 95% and inclusion of an all-cause equipment failure exclusion as proposed by Chorus are unlikely to promote Part 6 of the Telecommunications Act and good telecommunications industry practice.

We have recommended for the Commission's consideration the following two changes in relation to reporting of the Port Utilisation quality standard, which we consider would likely promote Part 6 of the Telecommunications Act and good telecommunications industry practice:

- a force majeure mechanism that would capture significant adverse exogenous events, particularly weather events; and
- a 'ratcheted peak throughput event' exclusion that we consider could address Chorus' concerns regarding the breach risk it faces in relation to significant atypical demand events.

In forming this opinion, we had particular regard to Assessment Factor (j) regarding the extent and effectiveness of consultation and engagement with stakeholders, including the extent to which that feedback has been incorporated in the PQP2 expenditure proposal.

7 Chorus' asset management framework

7.1 Our assessment factors

The following assessment factors were relevant in assessing Chorus' asset management system that provide the basis for its PQP2 Capex and Opex forecasts:

(a) governance relating to proposed capex, including evidence that appropriate policies and processes have been applied (Assessment Factor (b)); and

(b) whether the proposed capex complies with all applicable legal and regulatory obligations associated with the provision of PQ FFLAS (Assessment Factor (a)).

Assessment Factor (a) relates to the asset management system as a key component of Chorus' governance framework and Assessment Factor (b) relates to legal and regulatory obligations that a well-developed asset management system will ensure are being managed with the intent of achieving compliance.

7.2 Introduction

Chorus' asset management system (as for all well-established asset management systems) is a significant part of its overall corporate governance framework. Chorus is required, due to its asset management system being examined thoroughly as part of Chorus's PQ1 price path, to report to the Commission about the state of its asset management system and, in particular, its process of maturing it.

These obligations arise in the Commission's Section 221 Notice under the Telecommunications Act 2001[18] and in the requirements for Schedule 13 of Chorus' Annual Information Disclosure.

This assessment will not address these requirements but will simply focus on how the maturity of Chorus' asset management system can be expected to provide assurance about Chorus' PQP2 Capex and Opex forecasts.

7.3 Chorus' supporting information

Our review of Chorus' AMS is based on a review of the following documents that it has made available to us:

[18] Notice to supply information to the Commerce Commission under section 221 of the Telecommunications Act, 25 March 2022

7.3.1 Various asset management documentation

- CONFIDENTIAL C.RP1 01 Our Fibre Plans 120221.pdf [Document 7A]
- CONFIDENTIAL C.RP1 04 Our Fibre Assets.pdf [Document 7B]
- Chorus Asset Information Framework.pptx [Document 7C]
- AMCL – Full Report Final.pdf [Document 7D]
- Asset Management Policy.pdf [Document 7E]
- Asset Management, Strategic Asset Management Plan (Draft), version 2.0.pdf [Document 7F]
- Asset Management Capability (template version) – August Review.docx [Document 7G]
- Chorus Pre-Specified BAU Capial Expenditure Management Plan (9450) v19.0.pdf [Document 7H]
- CADS0046 Network Availability Standard, v2.0.pdf [Document 7I]
- Portfolio Plan - Poles - Draft May v01 Draft for Release [Document 7J]
- PQP2 Governance report 03-04-2023.docx [Document 7K]
- Overview of Delegated Authority.xlsx [Document 7L]
- Current DFA Table.xlsx [Document 7M]
- Chorus Climate Change Impact Assessment – Rev 2.1.pdf [Document 7N]
- Gore Business Case version v2.1.pdf [Document 7O]
- Chorus Roadmap – asset management – submitted to CC 31 August 22.pdf [Document 7P]
- Chorus Roadmap – asset data – submitted to CC 31 August 22.pdf [Document 7Q]
- Current progress of asset capability development roadmaps.pptx [Document 7R]
- Current progress of Chorus asset development roadmaps.docx [Document 7S]
- Delivering our asset development roadmaps.docx [Document 7T].

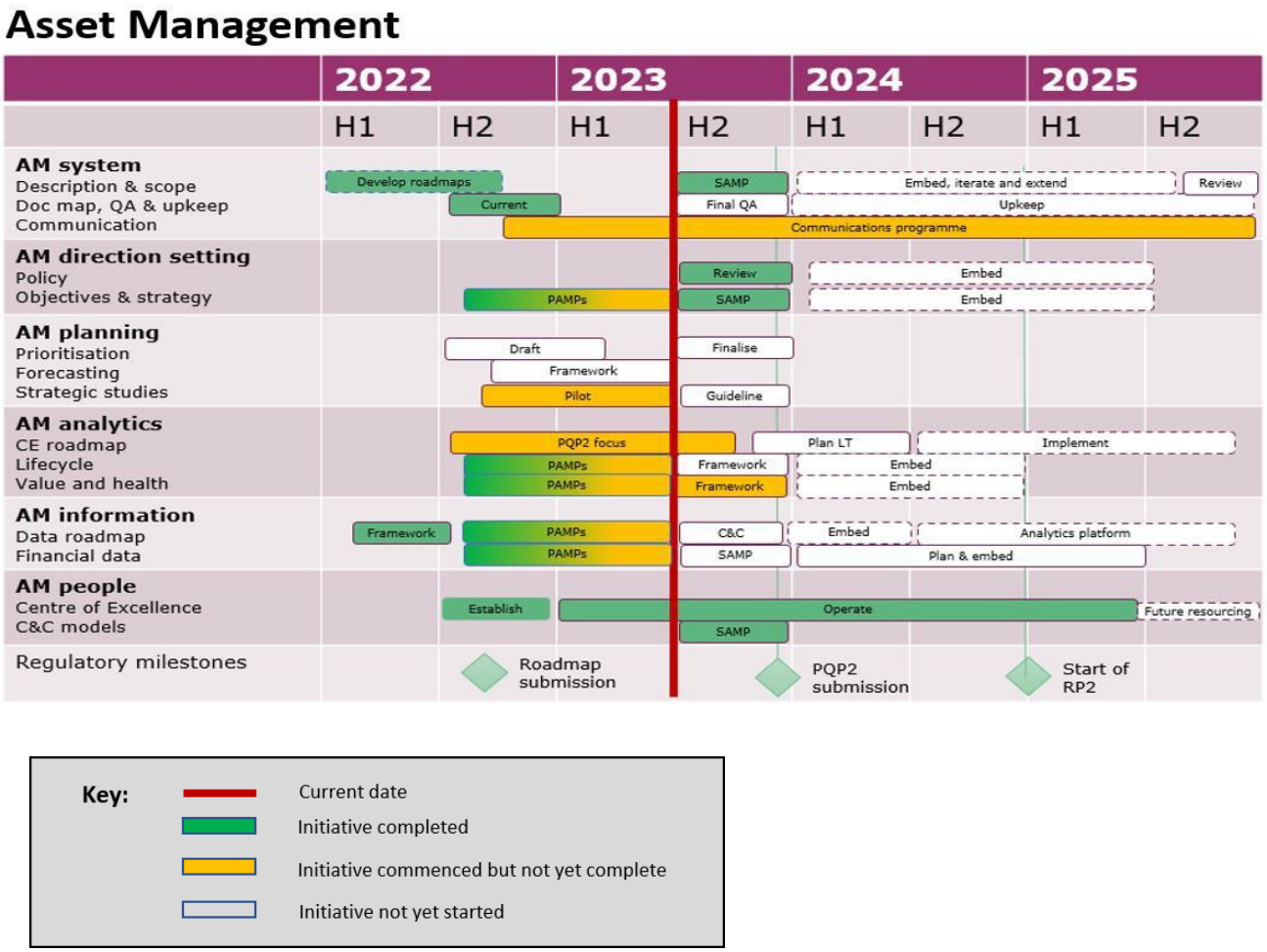
7.3.2 Asset Management Roadmap documentation

- Chorus Roadmap – asset management – submitted to CC 31 August 22.pdf [Document 7U]
- Chorus Roadmap – asset data – submitted to CC 31 August 22.pdf [Document 7V]
- Current progress of asset capability development roadmaps.pptx [Document 7W]

- Current progress of Chorus asset development roadmaps.docx [Document 7X]
- Delivering our asset development roadmaps.docx [Document 7Y].

7.3.3 Asset management roadmap

The following graphic sets out Chorus' Asset Management Roadmap and its progress in implementing it.



The **Asset Management Policy** states that Chorus' asset management objective is to:

> *"Optimise our assets to deliver effortless customer experience and innovate for growth to ensure we maximise the long-term value for our customers & shareholders whilst optimising our total cost of ownership."*

To achieve the objective Chorus' asset management policy is for the AMS to align with international standards (ISO55000:2014, ISO55002:2018). This is consistent with good telecommunications industry practice and regulatory expectations.

The policy furthermore requires asset investments and operations to be planned and implemented in a manner that optimises the costs against the risks and standards of performance that Chorus establishes for its network. The policy also provides guidance on the framework of decisions related to the capex and opex forecasts. This is consistent with good telecommunications industry practice and decision-making governance for prudent and efficient investments.

The policy recognises that Chorus will need to evolve and improve to implement asset management policy.

Chorus' draft **Strategic Asset Management Plan (SAMP)** provides line of sight to the policy confirming alignment with international standards (IOS55000:2014, ISO55001:2014 and ISO55002:2018) and seeks to implement the principles set out in the Asset Management Policy, and to align with Chorus' corporate strategy.

It sets out the asset management objectives, decision-making criteria, incorporation of stakeholder inputs, approach to monitoring progress, and the network and asset data requirements. This aligns with our experience and understanding of asset management system requirements to demonstrate prudency and efficiency.

A key objective of the SAMP is to enable a quantified, consistent, and measured approach to network investment across the asset portfolio. This is consistent with good utility industry and regulation practice.

The main investment drivers identified in the SAMP include health and safety, reliability, resilience, and availability. These investment drivers align with typical network investment drivers. Further drivers that could be considered include growth and compliance.

The SAMP refers to a Chorus Board-approved Managing Risk Policy and Risk Management Framework that underpins Chorus' alignment of the identification, management and mitigation of risks associated with its assets, with the company's policies and procedures.

Chorus' strategic approach to developing its AMS, as stated in the SAMP is to initially focus its asset management capability development on those elements necessary to support its future PQ FFLAS regulatory proposals. These elements include moving towards embedding the components of the ISO55000 framework as follows:

- Asset management policy and practices
- Developing and maintaining the SAMP
- Developing Portfolio Asset Management Plans (PAMPs)

- Identifying all material data sources and converting these into meaningful information necessary to support asset management planning and operations
- Documenting existing forecasting and planning processes.

IV's analysis and key findings

Chorus is making good progress in the more strategic, foundational elements of its asset management framework with completion of:

- description and scope of its AM System,
- asset management policy,
- strategic asset management plan, and
- development of the people requirements of the AMS.

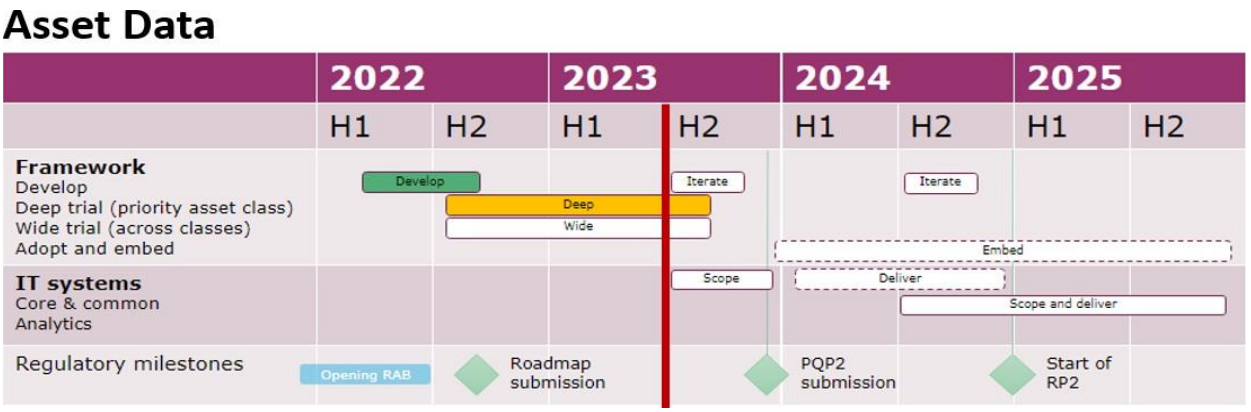
It has also developed its Technical Availability Standard, which will form an important element of the AMS, but has not made as much progress as planned on portfolio asset management plans and other planning processes. There appears to have been only one portfolio asset management plan – for poles – delivered at this stage.

Chorus has recognised the need to develop its internal asset management capability and has proposed an opex step change directed towards building this capability in PQP2. We assess this step change in section 11.2 of this Final IV Report.

7.3.4 Asset data roadmap

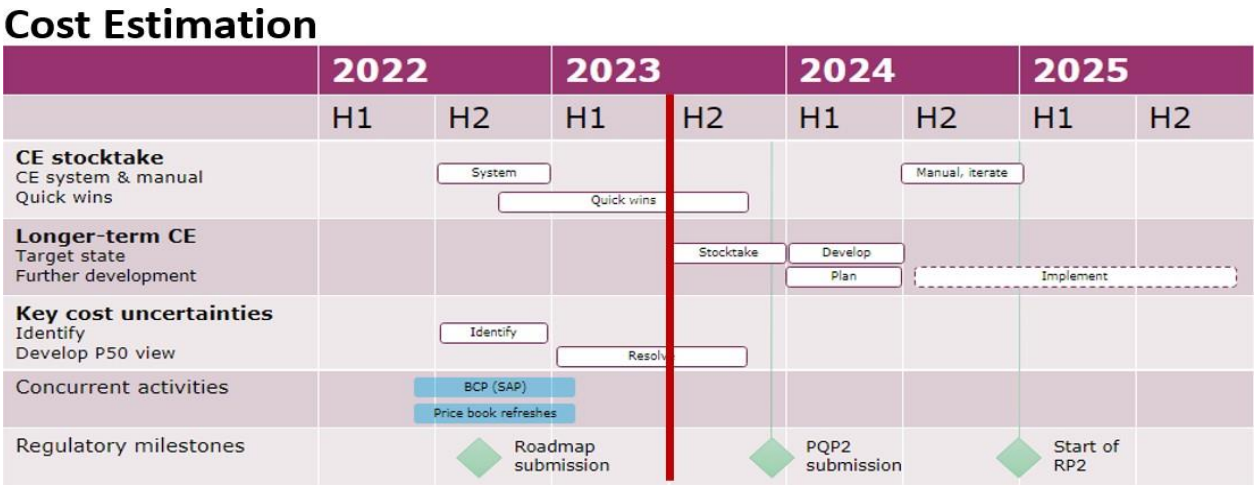
The following graphic set out the Asset Data Roadmap and Chorus' progress in implementing it.

We can observe from this graphic that Chorus has developed its framework for its asset data but has not achieved its desired progress of trialling the framework to particular data sets.



7.3.5 Cost Estimation Roadmap

The following graphic sets out the Cost Estimation Roadmap and Chorus' progress in implementing it.



From this graphic, it appears that Chorus has not been able to make the desired progress on cost estimation processes. However, Chorus has postponed the refinement of its cost estimation framework until the PQP2 proposal has been developed as it considers that the learnings from the process will guide the program of future works for cost estimation updates.

7.4 Gaps in supporting information and recommended improvements

We consider the goal of the asset management roadmaps should be to have all the asset management elements set out in Chorus' AMS.

Utilities with a high level of AMS maturity have been in the process of developing and evolving their asset management systems over a long period of time. Given Chorus has only been in existence for a relatively short period and that its initial focus has been on creation of a significant new fibre network, it is unsurprising that it has much to do for its AMS to become fully mature. The roadmaps provide a sound plan for implementation of Chorus' AMS and Chorus is making reasonable progress against the roadmaps.

In the context of this verification review, the asset management gaps that will have the most important impacts on the prudency and efficiency of Chorus' PQP2 expenditure forecasts – and in being able to demonstrate it – are:

- the lack of portfolio asset management plans for all major asset classes;
- the lack of documented assurance about asset data upon which the need for future capex will depend; and

- the lack of a centralised and consistent system (approaches, processes and procedures) for estimating and forecasting costs.

There are other elements of an AMS that we would expect to see established as Chorus develops it, such as:

- Risk management framework
- Asset health and criticality assessment framework
- Value of lost load/service assessment framework recognising that the value of lost load value would likely need to be developed in consultation with the Commission
- Cost estimation framework
- Lifecycle costing framework.

7.5 Verification opinion

We can verify that key strategic and foundational elements of Chorus' asset management system that we would expect to see having regard to good telecommunication industry practice are in place. These include the asset management policy, the strategic asset management plan and a draft portfolio plan for poles. The contents of these documents were what he would expect having regard to good telecommunications industry practice. However, Chorus is less than half-way through a process of at least four years to fully establish its AMS in accordance with the roadmaps.

The absence of some important elements of the AMS, such as portfolio management plans and rigorous, verifiable, and reliable asset data and a centralised cost estimation system currently weaken its ability to provide assurance about the prudency and efficiency of its forecast expenditures.

This absence has placed greater weight on other supporting information that Chorus has provided to us regarding justification of its PQP2 capex forecasts, including its approach to forecasting capex (Assessment Factor (e)) and the reasonableness of the key assumptions and methodologies underpinning the forecasts (Assessment Factor (t)).

8 Deliverability of PQP2 forecast expenditure program of work

8.1 Our assessment factor

The following assessment factor was used to assess Chorus' PQP2 resourcing and deliverability in relation to its PQP2 expenditure forecasts:

- procurement, resourcing, and deliverability of the proposed capex (Assessment Factor (k))

8.2 Chorus' documentation

Our assessment of Chorus' PQP2 deliverability is based on the following documents that it has made available to us:

- RP 2 Delivery Report 03-04-2023.docx [Document 8A]
- Delivery PQP2 chapter template version – August Review.pdf [Document 8B]
- Commission IV Chorus Session – Serco reset and delivery June 2023.pptx [Document 8C]
- Service Company Resourcing Update – Executive Paper – 18 October – Final.pptx [Document 8D]
- Service Company Resourcing Update – Executive Paper –13 December – Final.pptx [Document 8E]
- Service Company Resourcing Update – Executive Paper –24 January – Final.pptx [Document 8F]
- Service Company Resourcing Update – Executive Paper – 17 April 2023 – Final.pptx [Document 8G]
- Service Company Resourcing Update – Executive Paper – 13 June 2023 – Final.pptx [Document 8H]
- RSP Informer – 1 September 2022.pdf [Document 8I]
- RSP Informer –7 December 2022.pdf [Document 8J]
- RSP Informer – 8 February 2023.pdf [Document 8K]
- RSP Informer – 6 April 2023.pdf [Document 8L]

- RSP Informer – 7 June 2023.pdf [Document 8M]
- Connect Performance – Acct Lead Comms – 140423.msg [Document 8N]
- Connect Performance – Acct Lead Comms – 190523.msg [Document 8O]
- Connect Performance – Acct Lead Comms – 020623.msg [Document 8P]
- Connect Performance – Acct Lead Comms – 160623.msg [Document 8Q]
- Programmes of Work (Contractual Levers to Tender) 20200807.pdf [Document 8R]
- AssetFuture Performance Parameters Input Instructions.pdf3searchassetfuture.pdf [Document 8S]
- Programmed_MSA_Variation 5 restated MSA to include systems and other minor changes clean_211124.pdf [Document 8T]
- PFMN2_Chorus Monthly Report July 2023 Final.pdf [Document 8U]
- SCHEDULE 6 Performance Regime.docx [Document 8V]
- DWR – L2 -FSA – KPI – FY23Q4.pdf [Document 8W]
- DWR – L3 -FSA – KPI – 202306.pdf [Document 8X].

8.3 Key components of Chorus' delivery and procurement activities

8.3.1 Chorus' out-sourcing arrangements

Chorus outsources its in-field, building and network capacity work and recently undertook a review of its in-field services contracts. As a result of this review, it is implementing the following changes, which will positively affect the delivery of its proposed PQP2 expenditure program:

- Reducing from three field service providers (Ventia, UCG and Downer) to two service providers (UCG and Downer) for the build, maintenance and connection activities for its fixed fibre and copper networks.
  - Chorus notes that moving from three to two field service providers has resulted in an average of **CCI [ ]** in opex and capex respectively over three years.
  - **CCI [ ]**.

- Geographical arrangements, including consolidation of field service contracts and geographic regions to help Chorus better deal with worker sustainability, regional ownership, scale and cross-skilling of technicians and improved customer experience.
- Improved communication at the dispatch and technician level.
- Simplified KPI and incentives scheme with improved maintenance service level agreements and clearer links to customer experience.

For property operations, Chorus has a single provider for property maintenance and engineering services, exchanges, huts and towers. Services cover a mixture of:

- Technical – e.g. electrical, mechanical, fuel systems
- Non-technical – e.g. cleaning, grounds maintenance, pest control, glazing, painting & decorating
- Project delivery – e.g. minor asset renewals
- Asset management – using data to inform decisions, strategies, and tools.

8.3.2 Delivery in the field

In-field work will account for an estimated 39% of Chorus' planned expenditure (across opex and capex) in PQP1. Chorus notes that overall, the volume of in-field work to date in PQP1 is higher than expected in the PQP1 proposal and PQP2 work volumes will remain at similar levels due to proposed expenditure on:

- network resilience
- network extension
- installations
- NPD activity.

8.3.3 Major one-off delivery programs

In addition to the areas covered above, Chorus delivers one-off projects or programs in its work plan including:

- major transport fibre route extensions – during PQP1 Chorus completed the Fox Glacier to Haast to Lake Hawea extension,

- Hawea fibre extension and the Te Anau to Milford Sound fibre extension projects. In PQP2, Chorus indicates it is planning a number of further fibre route extensions to improve access to and resilience of services,
- major building refurbishment programs, including seismic strengthening,
- relocation of network for large infrastructure projects, such as Auckland city rail corridor.

For these larger one-off projects or programs Chorus' procurement team works with business owners to negotiate and execute a contract that best balances time, cost and quality objectives.

8.3.4 Delivering site services

Network buildings and engineering services are forecast to account for 3% of Chorus' planned expenditure (across opex and capex) in PQP2. Excluding large projects and programs, the volume of work will remain reasonably steady into PQP2.

Projects are either delivered through Chorus' field service provider for routine work, or through competitive tender for larger and more complex works. For routine work, an annual asset maintenance and replacement program is developed in conjunction with the field service provider, based on asset performance data, with oversight from investment managers.

These projects are procured through competitive tender because this ensures Chorus can select the most suitable provider, balancing time, cost and quality considerations.

8.3.5 Delivering network capacity

Chorus notes that network capacity accounts for 17% of its planned capex in PQP1, excluding initial coverage and capacity fitted as part of extension and connection work.

Network capacity expenditure increased during PQP1 for lifecycle, capacity and obsolescence reasons. Expenditure in this area is forecast to generally decrease in PQP2.

8.3.6 IT delivering separation from Spark, upgrade and continuous improvement

Chorus has had an ongoing program of separation from Spark's IT systems. While a majority of systems are now separate there is some continuing use of shared systems. Chorus' delivery of IT capex revolves around a manpower strategy where Chorus keeps a pipeline of projects that it plans to deliver from a consistent IT development workforce.

Maintaining a competent IT workforce is crucial for Chorus because its IT assets sit alongside its network assets as key enablers for the business.

Chorus' IT capex planning has both a bottom-up and a top-down approaches for which a reconciliation of the two confirms the appropriateness of the final consolidated forecast.

The bottom-up forecast identifies individual assets to be created or purchased at a detailed level. The bottom-up plan should always produce a greater 'backlog' of work than Chorus can execute each year, and/or that it can afford to fund. Ultimately, prioritisation and governance processes within Chorus will determine what work proceeds in what order.

The top-down approach looks at five categories of spend:

- Chorus resources
- Vendor staff augmentation resources
- Vendor statements of work
- Software costs
- Hardware costs

This approach to IT capex does not fit the approach typically used of capex. However, it is focussed on being deliverable, which provides a high level of confidence about Chorus's ability to deliver its IT capex forecast. Our verification of Chorus' PQP2 IT Capex forecasts is discussed in section 9.7.3 of this Final IV Report.

8.3.7 Impact of COVID 19 on Chorus' deliverability capability

Given the global labour shortages and COVID, Chorus has undertaken the following steps to help mitigate the effects of these shortages:

- Developed regular monitoring, reporting and insights on technician shortages;
  - Where, why and how big the technician shortages are
  - Tracking incoming and outgoing and understanding why technicians were leaving.
- Developed retention and recruitment plans;
  - Chorus has worked closely with both field service companies on initiatives
  - Interviewed technicians and field managers to determine most effective initiatives.

  - Strong support in-kind and in managing priorities

- Developed and funded an incentive model with each field service provider;
  - **CCI [ ]**
  - Built teams and governance at each field service provider to support the program.

- Working on international recruitment;
  - Led successful industry lobbying for 'Green List' changes
  - Designed process and offered financial support to facilitate international recruitment.

- Working on productivity improvements:
  - Civil contractors, back-office improvements and technician commitment.

- Communications;
  - Regular customer communications.

Chorus provided us with examples of these documents including weekly updates on fibre connection performance (including data on customers awaiting connection, reschedules and lead times) and field service provider resourcing updates (technician numbers, performance, retention and recruitment updates).

8.3.8 Major event response

Chorus' contracts and processes enable it to respond to major events (e.g. extreme weather events or earthquakes) effectively. It:

- has contracts that allow for temporary suspension of performance management obligations due to Force Majeure events;

- establishes constant operational contact (daily operational calls at minimum). During Cyclone Gabrielle Chorus also established a tactical team across Chorus, the NOC and its service companies;

- there is regular communication between its senior operational managers and general managers;

- establishes a clear prioritisation of work;

- moves technician resources into locations of greatest need (including between the two field service providers by way of cooperative deployment agreements), and from other workstreams into restoration;

- has established additional health and safety management procedures for unusual health and safety risks arising from extreme weather events.

8.3.9 Materials and equipment resourcing

While a large proportion of Chorus' capex and opex comprises labour and field services, whether under a Field Service Agreement or competitively tendered, equally important is availability of equipment and materials. The greatest supply risk is in relation to network electronics, which are provided by **CCI [ ]**. Equipment supply for network electronics is managed through an ongoing contractual relationship with **CCI [ ]**. Supply risks are managed through:

- Forecasting to signal requirements that trigger contract thresholds for delivery times and ordering items early in build project cycles.
- Significant weight on forecasting future requirements.
- Tracking vendor lifecycle notifications, especially end of supply dates where replacement technologies will need to be selected to use in the future. For example, **CCI [ ]** provides End of Life notices for their network electronics.
- Alternatively, ordering on a project-by-project basis for high unit cost and/or low turnover items (to avoid high holding costs and mitigate obsolescence risk during the holding period).
- Chorus monitors **CCI [ ]** activity, lead times and market share to verify their sustainability holding up to six months of local inventory holdings (e.g. ONTs).

The main other equipment supply items are ducts, poles and fibre which are manufactured in New Zealand and or Australia. Similar forward contracting and inventory arrangements apply for these equipment items (to network electronics). As work and materials volumes decline, Chorus adjusts its future forecasts to reflect its changing needs.

8.3.10 Resourcing to support future investment plans

Chorus notes that its business as usual (BAU) Build capability is expected to be close to 100% of build resources required for existing 'BAU' work commitments by end of July 2023.

Chorus is currently testing delivery options and pricing for the additional proposed PQP2 fibre frontier extension work and any other project work in addition to BAU

programs. Civil resource is a key component of build delivery and the civils market in NZ is experiencing high demand currently. Chorus has a hypothesis that by combining rural fibre extension build with the network robustness / fibre lifecycle programs of work it will create a package of work for tender (that uses the same or similar resource types) of sufficient scale and duration **CCI [ ]** to give the field service providers the best chance of securing civil resource at the best rates and delivering the outcome without impacting 'BAU' forecasted work.

Chorus have consulted with the field service providers who have confirmed that they believe the approach proposed will deliver the outcomes sought and provided additional feedback that has been incorporated into a market tender that was released to all service partners on 7 July 2023. Responses were received on 25 August 2023 and will be used to validate the pricing and resourcing assumptions to ensure Chorus' investment plans are valid.

8.3.11 Deliverability risk assessment

Chorus has undertaken risk assessments of deliverability of each of the following cost categories:

- In-field services
- Site services
- Network capacity
- IT capex.

The assessments are thorough and mitigating responses are appropriate and sufficient.

8.3.12 PQP2 Capex profile

One method of assessing the deliverability of the capex forecast is to compare the forecast expenditure profile against historic expenditure profile, to assess whether the future expenditure is unreasonably high when compared to the historic expenditure profile.

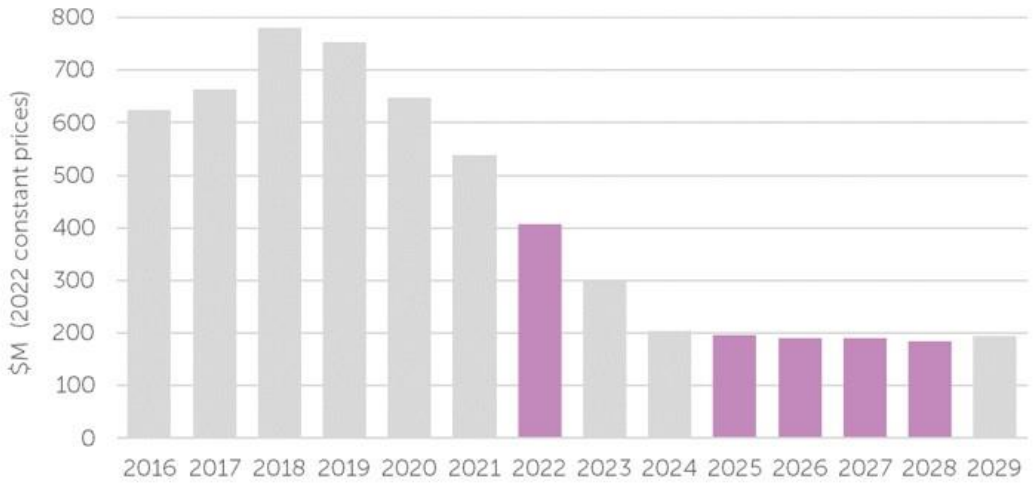
In-field capex

Figure 10 below shows the in-field capex and opex profile. Clearly the forecast is much less than historic expenditure, which has driven Chorus' decision to reduce its field service providers from three to two in PQP1 and suggests strongly that the in-field capex forecast should not be constrained by deliverability issues.

The in-field expenditure in Chart 10 includes the fibre frontier capex. That being said, we note that a large proportion of the fibre frontier project will be civil works, involving trenching conduit and laying and fibre cable insertion not requiring the skills that make up the majority of the workforce of Chorus' field service providers.

Chorus notes that while the capacity of the civil construction market in New Zealand is in demand, by tendering for a sufficient size of project, it is not expecting difficulties in getting construction businesses to tender for the work.

Figure 10 In-field capex plus opex profile



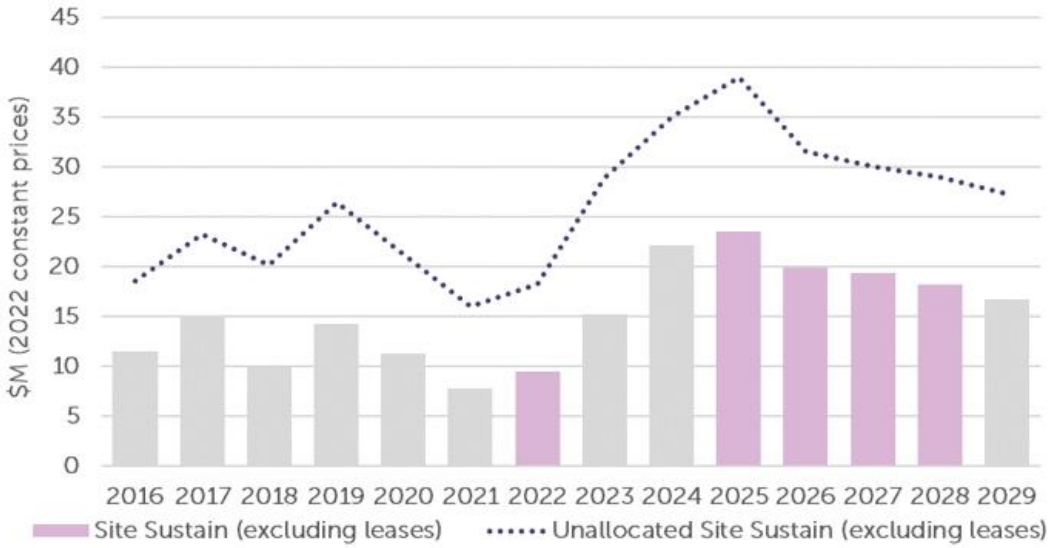
Source: Chorus

Site capex

The Site capex profile is shown in Figure 11 below. Clearly there is a large increase in this category of expenditure forecast for PQP2. However, a large proportion of this relates to buildings, including earthquake resiliency upgrades. Resources for these projects will not compete with field resources and will come from the building construction industry. Chorus does not envisage difficulties resourcing these construction projects in light of the lack of capacity limitations in the construction industry in NZ.[19]

[19] MBIE State of the Building and Construction Sector., Annual Monitor 2021-22

Figure 11 Site capex profile

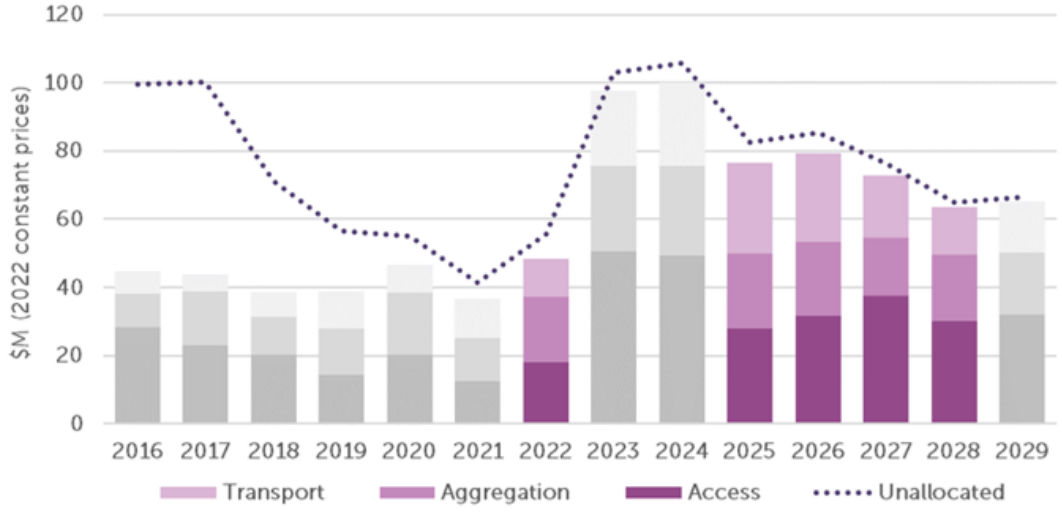


Source: Chorus

Network capacity

Figure 12 shows the expenditure profile for Network capacity, which is an approximate 100% increase in expenditure. However, most of this expenditure is for network electronics rather than labour. Given Chorus' strategies for managing its supply of electronics from **CCI [ ]** there is unlikely to be a supply constraint for this category of capex.

Figure 12 Network capacity capex profile

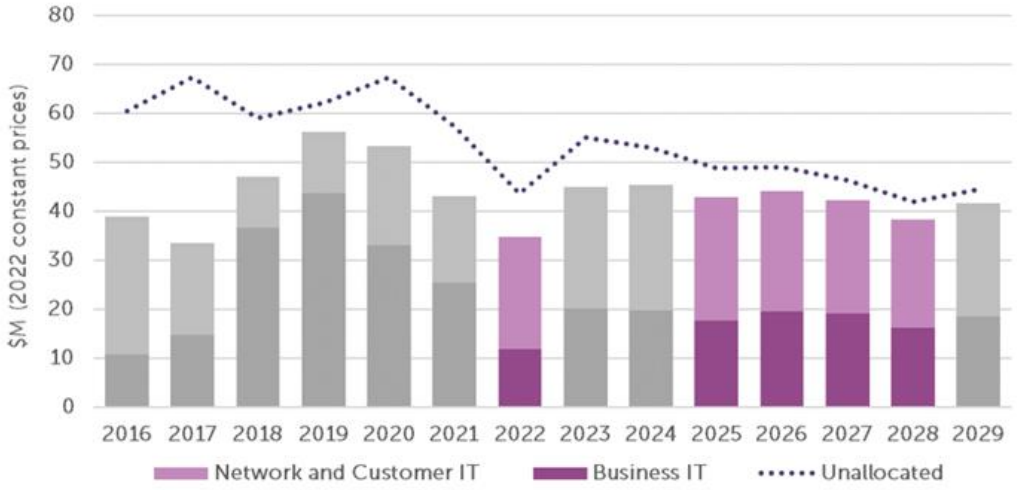


Source: Chorus

Information Technology

Figure 13 shows the profile of IT expenditure since CY16. This shows expenditure is materially lower than the period since 2016 and a slight decline over the PQP2 period. Based on discussions with Chorus subject matter experts, we understand that it has aligned the PQP2 IT workload to its internal and external resource capability (which is discussed further in section 9.7 of this Final IV Report).

Figure 13 Information technology capex profile



Source: Chorus

Overall, the capex profiles do not indicate constraints on Chorus' capacity to deliver its PQP2 capex program.

8.4 IV's analysis and key findings

Further to Chorus' extensive supporting documentation, we met with Chorus SMEs to explore a range of deliverability issues and constraints we had raised earlier in our review. Chorus indicated a number of steps it had taken to address its delivery constraints. These included:

- Investigating the reasons behind significant technical staff losses
- Introducing staff retention incentives and recruitment including internationally
- Cross-skilling technicians
- Building partnerships with adjacent domestic industries[20]

Based on these discussions, together with its comprehensive deliverability risk assessments discussed in the preceding section, we consider that Chorus is undertaking the necessary steps to manage the labour shortages and work with its two field service providers to monitor their ability to deliver on the PQP1 expenditure program and ultimately the proposed PQP2 expenditure program. In addressing the labour force and equipment supply issues that emerged from the COVID-19 pandemic and Cyclone Gabrielle, Chorus is well placed to manage similar events in the future. Some of this work is complete and other work remains in progress.

While the above assessments are consistent with Chorus being able to deliver its forecast capex there is one aspect of its information that raises questions about whether it has yet overcome the loss of field service provider workforce as a result of the COVID-19 pandemic.

The Deliverability Chapter notes that Chorus monitors various aspects of field services delivery, for example, **CCI [**

] We have reviewed a couple of examples. **CCI [**

]. These KPI results are consistent with the reduced number of technicians and/or that the available technicians are yet to be fully competent. **CCI [**

] indicating that they have sufficient numbers of competent technicians.

We consider that Chorus' proactive actions during PQP1 with its field service providers in response to a major technician shortage that was fundamentally beyond its control was highly creditable and shows a well-developed ability for Chorus to manage capex deliverability in an ongoing sense. A range of other considerations provide good support for Chorus being able to deliver its PQP2 forecast capex program.

8.5 Verification opinion

Subject to Chorus confirming that the deliverability challenges caused by technician shortages are fully resolved and that the capacity of construction contractors to undertake the fibre frontier project will be available, we can verify that Chorus has satisfied the Evaluation Criteria

In forming this opinion, we have had particular regard to the rationale for any changes that Chorus proposes to its PQP1 quality standards (IV assessment factor) and the Part 6 purpose statement in the Telecommunications Act, which is to promote the long-term benefit of end-users in markets for FFLAS, which we consider reflects good telecommunication industry practice.

[20] Chorus 2023, Resourcing to Support Future Investment Plans, Slide 14, 11 July.

PART B

9 PQP2 Base Capex Forecasts

The purpose of this chapter is to present our findings and opinions in relation to Chorus' PQP2 Base Capex forecasts. In doing so, we note the relationship between Base Capex and Connection Capex (presented in Chapter 10).

Under the Fibre IM, Base Capex is any capex that does not meet the definition of Connection Capex (or Individual Capex), which is capex that is 'directly incurred by Chorus in relation to connecting new end-user premises, buildings or other access points where the communal fibre network already exists or will exist at the time of connection'.

Chorus has advised that for its PQP2 Capex sub-category forecasts that are based on a price (P) times quantity (Q) forecasting methodology, if the Q is based on connection volumes, then it is presented as Connection Capex, with any remaining costs presented as Base Capex.

Based on our review of Chorus' PQP2 forecasts, it appears that the Installations category is the only one that is affected by this issue with its forecast split between Connection and Base Capex. However, to simplify presentation of our analysis, we have considered Chorus' PQP2 Installations forecast solely in this Base Capex chapter.

9.1 Our assessment factors

Recognising that for PQP1, the Commission identified several Priority Areas in terms of Base Capex (and opex) sub-categories, we decided to apply a top-down assessment across all sub-categories to test whether any that were not identified as a priority should be for PQP2.

The following assessment factors were used to apply a top-down assessment of Chorus' PQP2 Base Capex forecasts:

- Historic capex and consideration of historic rates of investment (Assessment Factor (c))
- Approach to forecasting capex (Assessment Factor (e))
- Fibre asset and fibre network information (Assessment Factor (m))
- Accuracy and reliability of data (Assessment Factor (s))
- The reasonableness of key assumptions, methodologies, planning, and technical standards relied upon (Assessment Factor (t)).

The reason for choosing these Assessment Factors rather than other ones was because we assessed they would reveal any high-level concerns about how Chorus had

developed its PQP2 capex forecast for a specific sub-category having regard to the materiality of the forecast expenditure, the forecasting approach being applied and historic rates of investment, such that more detailed scrutiny of the expenditure was warranted.

The following assessment factors were then used to apply a bottom-up assessment of Priority Areas within Chorus' PQP2 Base Capex forecasts:

- Governance relating to proposed capex, including evidence that appropriate policies and processes have been applied (Assessment Factor (b)).
- Quantitative or economic analysis related to the proposed capex, including sensitivity analysis and impact analysis undertaken (Assessment Factor (d)).
- Approach to forecasting capex, including models used to develop the capex forecasts (Assessment Factor (e))
- Consideration and analysis of alternatives to the proposed capex, including impact of alternatives on PQ FFLAS quality outcomes ((Assessment Factor (i))
- The extent of the uncertainty related to the:
  - need for the proposed capex
  - economic case justifying the proposed capex
  - timing of the proposed capex (Assessment Factor (o)).
- The dependency and trade-off between the proposed capex and related opex to ensure least whole-of-life cost for managing assets and cost-efficient solutions (Assessment Factor (r))
- The reasonableness of the key assumptions, methodologies, planning, and technical standards relied upon (Assessment Factor (t));
  - we recognise that this Assessment Factor has been applied for both top-down and bottom-up assessments. However, for the bottom-up assessments significantly more detailed analysis and testing of assumptions and methodologies has been undertaken.

In applying these Assessment Factors to Priority Areas, it is important to note that some have received greater weight than others reflecting the supporting information that Chorus has provided for this IV assessment. Hence, we have observed a lack of documentation in relation to asset management, as well as economic analysis of proposed investments, which impacts on our ability to apply Assessment Factors (b), (d) (o), (p) and (r). We have noted this issue where relevant in our analysis of specific capex sub-categories.

9.2 Capex sub-categories

Chorus is required to report its capex data in accordance with sub-categories agreed with the Commission. Further, our TOR identify Priority Areas within the capex sub-categories. Table 10 shows this relationship between the Base Capex sub-categories.

Table 10 Capex expenditure sub-categories

Capex sub-category groups	Base Capex expenditure sub-categories	Priority Base Capex expenditure sub-categories
Extending the Network	Augmentation	✓
	New Property Developments	
	UFB Communal	
Installations	Standard Installations	✓
	Complex Installations	
Network Capacity	Access	✓
	Aggregation	✓
	Transport	
Network Sustain and Enhance	Field Sustain	✓
	Relocations	
	Resilience	✓
	Site Sustain	
IT and Support	Business IT	✓
	Corporate	
	Network & Customer IT	✓

The remainder of this chapter assesses each of the Base Capex sub-category groups and individual expenditure sub-categories, with more detailed analysis undertaken in relation to the Priority Areas identified in Table 10.

Chorus PQP2 Base Capex Forecasts by sub-category are presented in Table 11.

Table 11 PQP2 capex forecasts ($CY22)

Capex category	Capex sub-category	CY25	CY26	CY27	CY28	PQP2 Total
Extending the Network	Augmentation	52.1	53.6	54.2	60.7	220.6
	New Property Developments	8.0	9.0	6.9	8.5	32.4
	UFB Communal	-	-	-	-	-
Installations	Standard Installations	84.8	75.9	75.2	62.0	298
	Complex Installations	3.0	2.9	2.8	2.8	11.5
Network Capacity	Access	27.9	31.7	37.6	30.2	127.5
	Aggregation	21.8	21.6	16.9	19.5	79.8
	Transport	26.7	26.1	18.3	13.9	85.0
Network Sustain and Enhance	Field Sustain	29.7	29.4	31.4	30.0	120.5
	Relocations	4.6	4.5	4.5	4.5	18.2
	Resilience	17.7	20.0	17.1	24.8	79.7
	Site Sustain	27.2	22.3	21.4	20.2	91.1
IT and Support	Business IT	17.7	19.6	19.0	16.2	72.6
	Network & Customer IT	25.2	24.5	23.2	22.1	94.9
	Corporate	1.4	1.9	1.8	7.5	12.7
TOTAL	**N/A**	**348.0**	**343.1**	**330.5**	**323.0**	**1,344.5**

Source: Chorus

9.3 Extending the network

The Extending the Network capex category group has three sub-categories:

- UFB Communal – building the UFB network as contracted with the NZ Government under the Network Infrastructure Project Agreement (NIPA). Chorus completed the remaining part of the UFB 2/2+ build in 2022, and as such there is no PQP2 forecast expenditure in this category.
- New Property Development (NPD) – laying fixed fibre as part of new property developments.
- Augmentation – adding to the existing UFB communal network. This includes in-fill (building the network to premises within the existing UFB footprint) and extending the fibre network to towns or communities beyond Chorus' current fibre network footprint.

Table 12 presents the PQP2 expenditure forecasts for the Extending the Network expenditure group.

Table 12 Extending the Network PQP2 forecasts ($CY22 millions)

Sub-category	CY25	CY26	CY27	CY28	Total PQP2
Augmentation (in-fill)	5.0	4.9	4.8	4.8	19.5
Augmentation (extension)	47.1	48.7	49.4	55.9	201.1
New Property Development	8.0	9.0	6.9	8.5	32.4
UFB Communal	-	-	-	-	-
TOTAL	60.1	62.5	61.2	69.2	253.0

Data source: Chorus.

9.3.1 Chorus' supporting information

Our assessment of Chorus' Extending the Network sub-category group PQP2 capex forecasts is based on the following documents that it has made available to us:

General supporting information

- Extending the network draft PQP2 to the IV in 0523.docx [Document 9A]
- Extending the network PQP2 chapter to the IV.docx [Document 9B]
- NPD Model – 2022-12_v4_IV.xlsx [Document 9C]

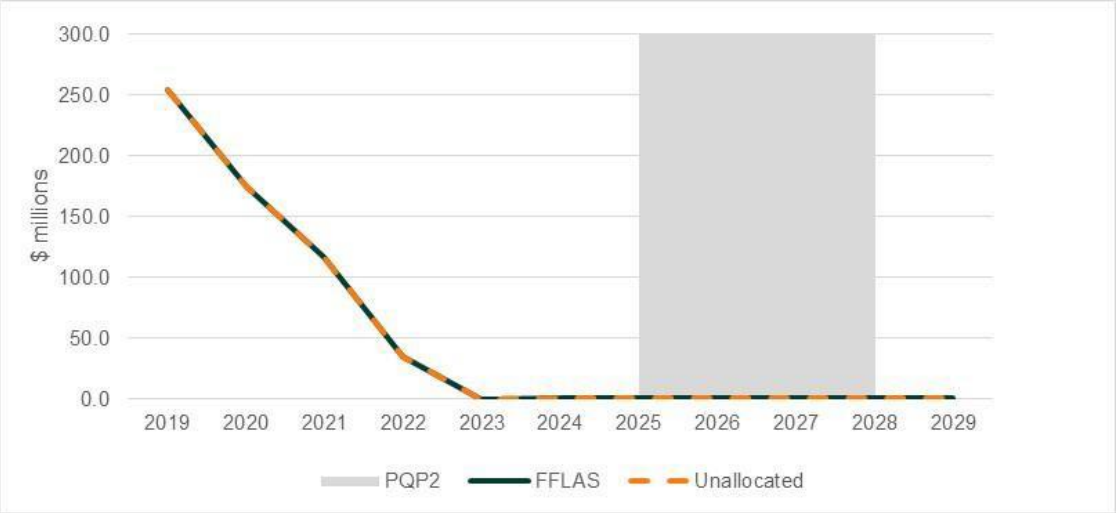
Fibre frontier supporting information

- FF strategy PQP2 VERSION TO IV 1 June.docx [Document 9D]
- Fibre Frontier – IV Feedback 060723.docx [Document 9E]
- FF – Copy of FF – economic modelling.xlsm [Document 9F]
- FF – economic modelling IV tranche 2.xlsm [Document 9G]
- C002 FF expenditure model RP2 v4.xlsx [Document 9H]
- T010 FF Base Model V4 Inputs.xlsx [Document 9I].

9.3.2 UFB Communal

Figure 14 presents a time series between CY16 and CY29 of Chorus' UFB communal capex, with zero PQP2 FFLAS forecast expenditure given completion of the UFB roll-out.

Figure 14 UFB Communal Capex ($CY22 millions)



Data source: Chorus

Given the completion of the UFB rollout in PQP1, Chorus forecasts no expenditure on UFB Communal Capex in PQP2.

Verification opinion

We can verify that Chorus' PQP2 UFB Communal Capex forecast satisfies the Evaluation Criteria.

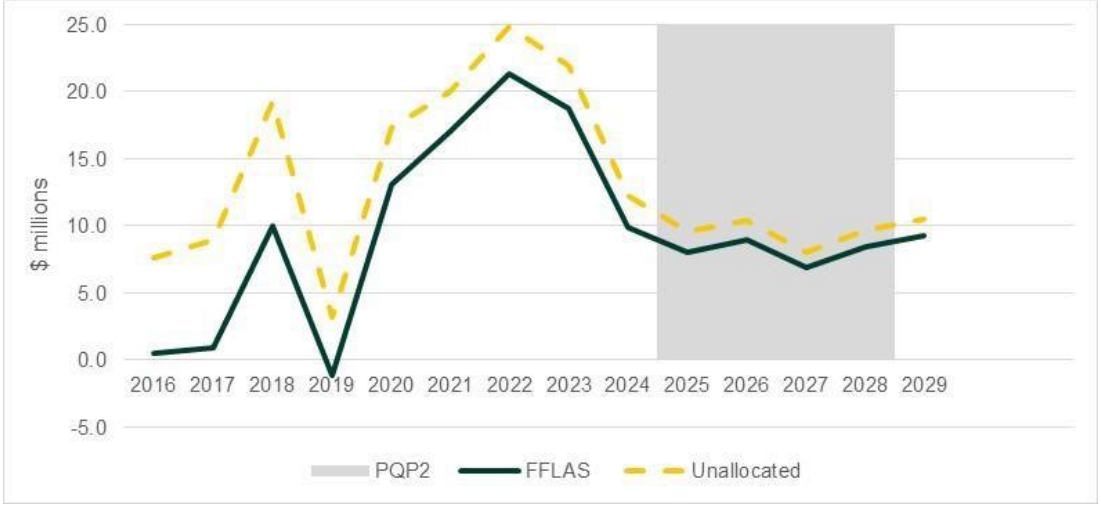
In forming our opinion, we have had specific regard to Assessment Factor (c) regarding historic investment; Assessment Factor (m) regarding fibre asset and fibre network information; and Assessment Factor (s) regarding the accuracy and reliability of data.

9.3.3 New Property Developments

Figure 15 presents a time series between CY16 and CY29 of Chorus' New Property Development (NPD) capex.

Chorus notes the expenditure included in this sub-category is net of any capital contributions it forecasts to receive from developers.

Figure 15 New Property Developments Capex ($CY22 millions)



Data source: Chorus.

The PQP2 NPD capex forecast is relatively small (around $8.1 million per annum), materially lower than PQP1 expenditure and broadly stable.

Chorus forecasting approach

Chorus notes that the main driver for NPD expenditure is demand from NPD activity and its success in winning contracts given it actively competes with other Local Fibre Companies (LFCs) to lay fibre in NPDs near the existing Chorus network.

Historically, Chorus found NPD activity was linked to the same economic cycles that drive other construction work. Since peaking in 2022, it notes the more recent downwards trend in NPD capex is predominantly the result of a change in the mix of dwelling type/area defining the nature of NPD works, which it expects will intensify further over PQP2.

Chorus forecasts NPD expenditure using a volumetric price (P) x quantity (Q) model. The Q is an input taken from Chorus' demand modelling suite (the NPD model) and P is based on an historic average going back twelve months in time. Chorus notes using a 12 month average better ensures the impact of less frequently performed works (e.g. for unusual zone/dwelling combinations) is captured in the forecast unit costs.

IV's finding and analysis

Chorus provides a good description of its forecasting approach and underlying assumptions used to develop its PQP2 NPD Capex forecast. The PQP2 forecast is materially lower than historic rates of investment for this sub-category, which appears to reflect dwelling market conditions and the competition it faces from Local Fibre Companies. Given this is a relatively small expenditure sub-category in PQP2 and we

have identified no concerns with Chorus forecasting approach, we have not subjected it to more detailed analysis.

Verification opinion

We can verify that Chorus' PQP2 NPD Capex forecast satisfies the Evaluation Criteria.

In forming our opinion, we have had specific regard to: Assessment Factor (c) regarding historic rates of investment; Assessment Factor (e) regarding approach to forecasting capex; Assessment Factor (m) regarding fibre asset and fibre network information; and Assessment Factor (s) regarding the accuracy and reliability of data.

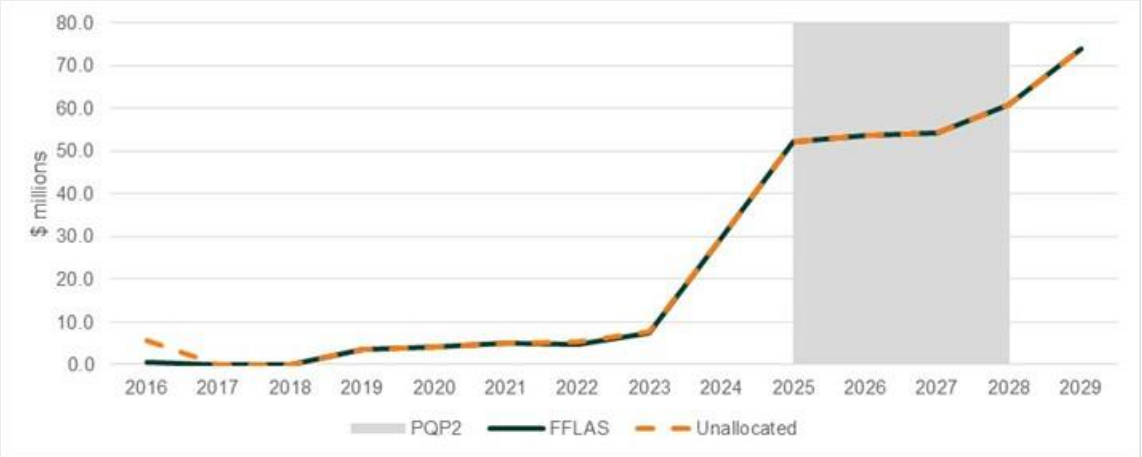
9.3.4 Augmentation

Augmentation-related expenditure, which is one of the Commission's Priority Areas, comprises around 80% of the Extending the Network expenditure group and shows a sharp uplift in spend compared to PQP1 expenditure, primarily reflecting Chorus' proposed fibre frontier investment.

The fibre frontier investment is intended to geographically extend the fibre network to connect around 41,000 additional households and businesses, extending its fibre footprint to around 89% of New Zealand households.

Figure 16 presents a time series between CY16 and CY29 of Chorus' Augmentation Capex.

Figure 16 Augmentation capex time series ($CY22 millions)



Data source: Chorus.

The remainder of this section of the Final IV Report discusses Chorus' PQP2 Augmentation Capex forecasts.

Chorus currently completes two types of augmentation activity, in-fill and network extensions to non-UFB communities.

- In-fill work includes augmenting the fibre network for unforeseen growth within the existing UFB footprint (assessed in section 9.3.4).
- Network extension work includes extending the network to towns or communities that did not meet the threshold for the UFB 2/2+ roll-out contract between Chorus and the NZ Government – for PQP2, this encompasses the proposed fibre frontier expenditure (assessed in section [9.3.5] below).

9.3.5 Augmentation – PQP2 forecast expenditure – in-fill development

Around $23 million of PQP2 Augmentation Capex forecast relates to in-fill development work and is assessed below.

Description of Chorus forecasting approach

For PQP2, Chorus expects demand for NPD returning from historically high levels to steady state levels, which will temper future in-fill development work.

However, Chorus identified several urban areas where feeder capacities are forecast to reach their limits, which will require investment in incremental capacity. In developing the PQP2 forecast, Chorus notes that it has a solid historical cost base for similar types of completed projects and uses historical volumes as a guide, while recognising some uncertainty regarding the PQP2 forecast in-fill volume. Chorus places most weight on the preceding 12 months as a guide to its costs.

Broadly speaking, Chorus states that in-fill work that is forecast for PQP2 falls into three categories:

- Named work projects – these are works that exceed $50,000 in capex and involve build of feeder cables to get capacity from the exchange out towards the joint enclosures in the network. Urban planners exercise professional judgment to estimate the volume of such feeder-related capacity projects in their respective areas with respect to historical trends. Chorus' short-term planning assumption is this will occur on average 24 times annually, which is also informing the PQP2 volume forecast.
  - Named projects make up roughly 48% of Chorus' in-fill augmentation forecast.

- Minor works projects that average around $7,000 each – these are works that introduce capacity on the UFB communal network to accommodate a connection request. On average, Chorus undertakes these works around 240 times annually, which also informs the PQP2 volume forecast.
  - Minor works projects make up roughly 48% of the in-fill augmentation forecast.
- Minor works projects that average around $20,000 each – these are works that build the racks/rows inside the exchange needed to hold new fibre cables. On average, Chorus undertakes these works around 36 times annually, which also informs the PQP2 volume forecast.
  - Minor works projects make up roughly 4-5% of the in-fill augmentation forecast.

Demand from new address creation within the existing fibre network is the main driver for in-fill growth. This occurs when new properties are developed after the communal network is deployed, requiring incremental network capacity to accommodate this growth.

Chorus notes that when it identifies unforeseen growth within the fibre network it basically has three options:

(i) Do not respond. Chorus does not consider this a credible option as the new addresses that are typically driving the unexpected growth would remain unserved and impacted end-users would most likely invest in other network technologies.

(ii) Provide additional network capacity reactively (as needed). This is Chorus' current practice. On the other hand, this approach makes it difficult to predict future in-fill volumes, resulting in forecasting challenges. This is amplified by the low volume of in-fill related works each year (around 20 a year named works, around 400 a year in minor works) and general unpredictability about where and when this work will emerge (hence application of a run-rate).

(iii) Build incremental capacity pro-actively using probabilistic analysis and corresponding modelling techniques. Chorus currently does not possess this capability. While it sees the benefits of this approach, it considers it would be too risky introducing probabilistic methodologies at this stage of Chorus' planning maturity.

In option (ii) above, forecast in-fill expenditure is derived using a volumetric price (P) x quantity (Q) methodology. Chorus notes that, in contrast to the NPD forecasting method, the forecast in-fill volume is not an output from Chorus' demand forecasting

process. Instead, Chorus forecasts in-fill volume within its forecast capex model, using historical averages as an indicator for future volume. Chorus undertakes a sense check against the NPD forecast and adjusts it when necessary to ensure consistency between the two volume forecasts.

To forecast prices (unit rates), Chorus notes that it applies the same method as for deriving NPD unit rates, assuming an average 12-month historical in-fill unit rate is an appropriate indicator of future unit costs.

IV's analysis and key findings

Chorus notes the development of the PQP2 in-fill capex forecast followed the gated investment decision-making process, which governs and challenges the reasonableness of the proposed expenditure.

Chorus notes that it assumes future in-fill volumes correlate with NPD growth expectations – i.e. more NPD equals more in-fill and vice versa. It further notes that this is a rather blunt forecasting approach but is appropriate given Chorus' current state of maturity. We agree unpredictability in terms of where unexpected growth in the network will occur leaves history as the best indicator for future volumes.

Chorus notes that the increase in forecast in-fill capex relative to earlier years is due to additional scope in the type of work that it will have to undertake. In the past, in-fill work did not require significant incremental capacity to be built as the fibre network was still new and had sufficient capacity to deliver the additional service volumes. For the PQP2 period, Chorus expects, but has not justified, that more capacity--related in-fill work will be necessary, generally driving up unit cost per in-fill project.

Finally, Chorus' PQP2 augmentation in-fill forecast is around $5.6 million per annum, which is consistent with reported expenditure in the CY20 to CY23 period.

Verification opinion

Recognising the heavy reliance on historical data to determine the PQP2 in-fill augmentation forecast, we can verify the forecast as satisfying the Evaluation Criteria.

In forming this opinion, we had specific regard to Assessment Factor (c) regarding historic rates of investment; Assessment Factor (e) regarding the approach to forecasting capex; Assessment Factor (o) regarding the extent of uncertainty regarding the need for the proposed capex; and Assessment Factor (t) regarding the reasonableness of key assumptions and methodologies.

9.3.6 Augmentation – PQP2 forecast expenditure – Fibre Frontier

Chorus is proposing to spend $201.1 million ($CY22) in PQP2 to provide communal fibre infrastructure to a further 40,506 premises, which would increase the current overall fibre network coverage in New Zealand from 87% to 89%. This expenditure is the first phase of a potential wider plan to take fibre to potentially 90.5% of the population and provide service to an additional 75,000 premises over the next eight years.

Chorus has developed a Fibre Frontier Strategy document incorporating economic analysis with associated business case modelling undertaken in support of the proposed PQP2 investment.

Chorus' forecasting approach

Chorus presents the underlying assumptions and input costs underlying the fibre frontier investment, drawing upon its experience rolling out the UFB and leveraging its copper network (in terms of duct usage).

Based on its planning, Chorus estimates that it will roll out fibre to 220 areas and 40,506 premises in PQP2 which will require laying 1,046km of fibre using 107km of existing ducting and building 939km of new ducts.

Costings for the various components of the fibre frontier roll out are identified and modelled as shown in Table 13.

Table 13 Fibre frontier forecast ($CY22 millions)

Cost category	Spend	Input 1 (Quantity)	Input 2 (Unit Price)	Notes
Layer 1				
Civils – fibre lay cost	**CCI [ ]**	939km	**CCI [ ]**	Using existing service company civil costs per meter in Chorus' different Customer Service Areas across the country and meterage to be built
Consigned materials – L1 fibre	**CCI [ ]**	1,046km	**CCI [ ]**	Per meter cost of ribbonet and microduct required for rollout
Consigned materials – misc. cost	**CCI [ ]**	107km	**CCI [ ]**	Additional cost required for material leveraging existing ducting
Serco time – installation (hauling, splicing, pits etc.)	**CCI [ ]**	38,691 prems (excl. existing duct prog)	**CCI [ ]**	Using existing service company cost codes in Chorus' different customer service areas (CSAs) across the country

Cost category	Spend	Input 1 (Quantity)	Input 2 (Unit Price)	Notes
Serco time – laterals	CCI [ ]	38,691 prems	CCI [ ]	Using existing service company cost codes in Chorus' different CSAs across the country
Serco time – variations	CCI [ ]	1,046km	CCI [ ]	Based on UFB experience, sometimes the opposite side of the road is fed by aerial drops. As such, route length does not consider the entire route length. CCI [ ] allowance for additional civil works.
GPON costs	CCI [ ]	44 new sites	CCI [ ]	Rolling out fibre into these areas requires either new GPON cabinets at a cost of CCI [ ] per site where needed.
Design costs per premise	CCI [ ]	38,691 prems	CCI [ ]	Small amount of service company design time required per premise
Chorus Project Management	CCI [ ]	$149.4m	CCI [ ]	Chorus PM time represents an additional CCI [ ] of service company field time
Existing duct program	CCI [ ]	1,815	CCI [ ]	Additional notes provided below
Layer 1 sub-total	*$173.8m*			
Layer 2				
GPON cards	CCI [ ]	40,506	CCI [ ]	Layer 2 GPON cards required per premises
Transport fibre	CCI [ ]	141km	CCI [ ]	To roll fibre out to these areas, many require additional backhaul fibre lays. An additional 141km of fibre is needed with costs using current actual service company costings. Additional notes provided below.
Layer 2 sub-total	$27.2m			
TOTAL COST	**$201.1m**			

Source: Chorus

Chorus notes that in terms of its costings, where possible it has used current actual service company codes (the agreed prices for various activities as set in the Field Services Agreements) and current actual material costs. Chorus acknowledges the uncertainty around its cost estimates including when entering new communities where it has not previously built fibre. However, it notes that much of the fibre frontier program is deploying fibre out into urban fringes and small rural communities, like those just

completed as part of the UFB2+ program, giving Chorus a solid baseline of data to estimate the costings.

Chorus notes that its experience has shown that a large-scale build program like fibre frontier generally provides more efficient pricing from its field service providers as larger programs provide certainty and the ability to make longer term commitments on equipment and staff.

Importantly, Chorus notes has tested the market in Q1 FY24 as part of an initial smaller scale build, which will allow it to validate costs and make any adjustments ahead of submitting the final Fibre Frontier proposal.

IV's analysis and key findings

Chorus provided its Fibre Frontier Strategy to the IV in early June 2023. Our preliminary feedback provided to Chorus on its Fibre Frontier Strategy provided in late June 2023 was that:

- the strategy document provides good evidence regarding uptake of high-speed fibre products where available, extracts from surveys about the benefits that high speed fibre brings in terms of user experience, potential economic benefit and internationally sourced evidence of rural fibre in other jurisdictions
- we agreed that Chorus' two preferred benefits quantification methodologies – a workably competitive market test and telecommunications network optimisation test – are appropriate having regard to the narrow characterisation of benefits under the Telecommunications Act. In this context, we recommended the broader social benefits of the proposed fibre frontier roll-out should be presented as a 'non-quantifiable' benefit of the investment.
  - we also agreed with Chorus that a standard regulatory incremental revenue-incremental cost test would likely create an unreasonably high hurdle for investment given Chorus obligation to provide geographically consistent network pricing.

Our key preliminary finding was that the proposed PQP2 investment could satisfy the Evaluation Criteria subject to:

- provision of stronger evidence regarding customer willingness to pay for the fibre frontier network extension;
  - demonstration of the price impact of the fibre roll-out on existing fibre customers should also form part of the investment justification;

- more sensitivity analysis being presented in relation to cost and rural fibre uptake modelling assumptions given their importance to future incremental cost and revenue streams and ultimately the fibre frontier investment paying for itself over its assumed life (43 years);
  - in particular, we had some concerns that the fibre frontier forecast costs err on the side of under-estimation.

The main reason for our request for scenario testing was to better understand the potential for revenue under-recoveries in fibre frontier investment, including due to slower than assumed customer take-up, being paid for by Chorus' existing customer base.

Chorus response to our initial feedback

In response to our initial feedback, Chorus provided additional supporting information and modelling.

Our review of this additional supporting information indicated that it substantially addresses our concerns, specifically in relation to sensitivity analysis being performed on key assumptions in the investment base case. In this regard, Chorus identifies the overall size of the PQP2 fibre frontier expenditure and assumed customer take-up rates as the two key sensitivities in terms of the cost of the fibre frontier extension being entirely covered by revenues earned from the new customer base.

Chorus updated modelling outcomes

Chorus notes that its modelling is based on the expected relatively high PQP2 WACC (used for discounting purposes) and assumes a modest 70% fibre uptake rate, which is aligned to its business plan assumptions.

The 70% uptake assumption is based on market research undertaken by Kantar on behalf of Chorus specifically in relation to the fibre frontier project. This research indicated 84% of rural users would be likely to take up a fixed fibre service. Given

The output of the workably competitive market test shows that the breakeven wholesale price for the proposed PQP2 investment at a 70% uptake would be $55.80**,** which is closely aligned to the wholesale price for fibre that Chorus would charge under the currently proposed price path. This illustrates that those end users who take up fibre via the proposed extension would cover the cost of the installation and ongoing costs of their own fibre connection over the assumed 43 year life of the asset. This is Chorus' fibre frontier investment base case outcome.

Chorus notes the workably competitive market test it used to demonstrate its fibre frontier investment would break-even around the current wholesale fibre price, is most sensitive to changes in:

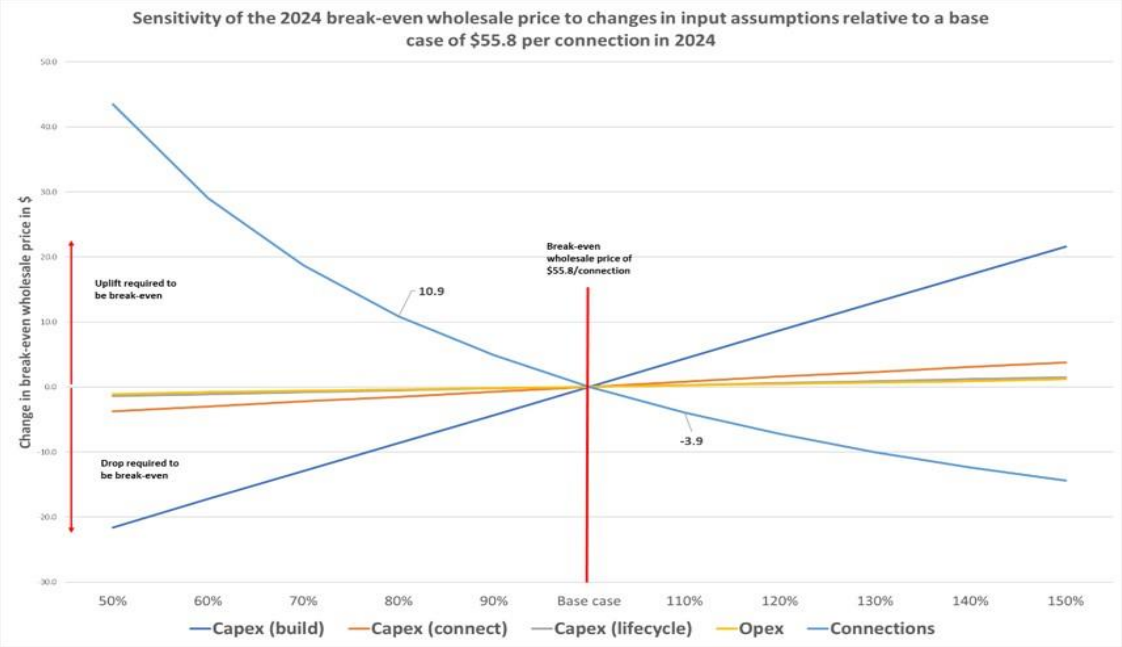
- WACC, which is the discount rate applied in the cash flow modelling;
- the upfront fibre build cost (because these are the highest costs and would be incurred early); and
- the fibre uptake rate because connections drive revenue.

Chorus also tested the impact of the cost of connecting new customers and lifecycle expenditure, which it shows to be negligible (lifecycle more than connection capex) because they are (a) comparatively low and (b) occur later in the investment's life cycle and therefore have a lower time value of money in the discounted cash flow analysis. Chorus also confirmed the that the modelling outcomes are not sensitive to the opex assumptions.

The chart below shows the results of Chorus' sensitivity testing (WACC sensitivity was not presented – Chorus noted it had tested WACC sensitivity separately and at the current wholesale price it would be able to recover the fibre frontier investment at any WACC rate that sits at or below the relatively high PQP2 estimate).

It is evident that the breakeven wholesale fibre price is most sensitive to the fibre uptake rate and upfront build cost assumptions, which is represented by the steepness of the lines in Figure 17 below.

Figure 17 Fibre frontier sensitivity analysis



Source: Chorus

The sensitivity testing shows that if fibre take-up was 10% or 20% lower the base case wholesale price for all Chorus customers would increase by around $4.0 and $10.9 respectively.

In support of the 70% take-up assumption Chorus notes that the $55.80 base case fibre price is materially lower than the likely next best alternative technology, low-earth orbit satellite, whose price is currently around twice as high as Chorus' standard fibre service price. The 10% and 20% lower fibre take-up price impacts noted above would not materially change fibre's competitiveness relative to satellite.

Stakeholder engagement outcomes

In its response to our initial feedback, Chorus provided the results of its PQP2 stakeholder engagement (undertaken by Kantar) where the need for the investment and customer pricing/willingness to pay issues associated with the fibre frontier investment were tested.

It notes Kantar's finding that on balance, "the weight of consumer / social preference was towards continuing the current investment strategy." Only one stakeholder group proposed a decreased level of investment, 5 groups proposed increased investment and 10 groups supported the current sized investment.

In terms of customer pricing, willingness to pay was tested in relation to several higher (than currently) fibre price points. It concludes there is strong evidence that its existing customer base would accept a degree of higher costs for the rural fibre roll out. We agree with this conclusion, although the quantum of higher prices that they would be willing to accept is difficult to reliably test.

Summary of findings

Overall, we think Chorus has made a good case for the fibre frontier investment, which we consider to be a challenging one to make from a commercial perspective given the geographically consistent pricing constraint for regulated fibre services and potentially large social benefits it will likely deliver but for which it cannot earn a return on investment (and are not quantified in the fibre frontier investment case).

Compared to more typical fibre network investments we consider this one to have higher risk for Chorus and ultimately its existing fibre customers. However, given customer take-up and initial build cost represent the biggest risk factors for the investment, we think that Chorus can mitigate these risks to a reasonable extent, such that a worst-case scenario of a heavily under-utilised sunk fibre asset and materially higher prices for existing fibre customers is a low probability.

Verification opinion

Notwithstanding the relatively higher risk nature of the proposed fibre frontier investment, we consider that it satisfies the Evaluation Criteria. This opinion is subject to the outcomes of Chorus market testing in relation to the PQP2 fibre frontier program costs, as well as the implications of this program of work on the deliverability of Chorus broader PQP2 expenditure program, being resolved with its field service providers (we discussed the deliverability implications of the fibre frontier investment in Chapter 8 of our report.)

In forming this opinion, we have had particular regard to the following assessment factors:

- Governance relating to proposed capex, including evidence that appropriate policies and processes have been applied (Assessment Factor (b)).
- Quantitative or economic analysis related to the proposed capex, including sensitivity analysis and impact analysis undertaken (Assessment Factor (d)).
- Approach to forecasting capex, including models used to develop the capex forecasts (Assessment Factor (e))

- The extent and effectiveness of consultation and engagement with stakeholders (Assessment Factor (j)).
- The extent of the uncertainty related to the:
  - need for the proposed capex
  - economic case justifying the proposed capex
  - timing of the proposed capex (Assessment Factor (o)).
- The reasonableness of the key assumptions, methodologies, planning, and technical standards relied upon (Assessment Factor (t)).

9.4 Installations

The Installations sub-category is for infrastructure that connects the communal (shared) network to customers' premises. The infrastructure comprises the fibre lead-in(s) and the Optical Network Terminal (ONT) that connects to the customer's internal network and the provisioning that enables the customer to access the wider communications network.

The Installations expenditure sub-category group includes Standard and Complex sub-categories, with by far the largest proportion of expenditure relating to Standard Installations. The Commission identified Standard Installations expenditure as a Priority Area.

Table 14 presents the PQP2 expenditure forecasts for the Installations expenditure category. Please note that Installations contains both base capex and connection capex. This section of our report discusses the total Installations capex. Chapter 10 presents our analysis and opinion specifically for the connection capex component.

Table 14 Installations PQP2 forecasts ($CY22 millions)

Sub-category	CY25	CY26	CY27	CY28	Total PQP2
Standard Installations	84.8	75.9	75.2	62.0	298.0
Complex Installations	3.0	2.9	2.8	2.8	11.5
TOTAL	87.8	78.9	78.1	64.8	309.6

Data source: Chorus.

9.4.1 Chorus' supporting information

Our assessment of Chorus' Installations sub-category group PQP2 capex forecasts is based on the following documents that it has made available to us:

- Installations draft PQP2 to the IV 0523.docx [Document 9J]
- Installations chapter to the IV.docx [Document 9K]
- CO12 NGA installations (incl splitters) – for FY24 10YP.xlsx [Document 9L]
- 3. Chorus ICP Customer Incentives – 30 June 2022 – Confidential [Document 9M]
- Customer incentives.docx [Document 9O]
- Business Incentives workings ComCom version 31.5.2023.xlsx [Document 9P]
- PQP2 incentive offers economic rtest v 0.7 (CCI, clean).xlsx [Document 9Q]
- Upload backup – Incentives plan Fy24-33 ComCom version 31.5.2023.xlsx [Document 9R]

In addition to this supporting documentation, we also had regard to the documents that we reviewed as part of our assessment of Chorus' demand forecasting methodologies.

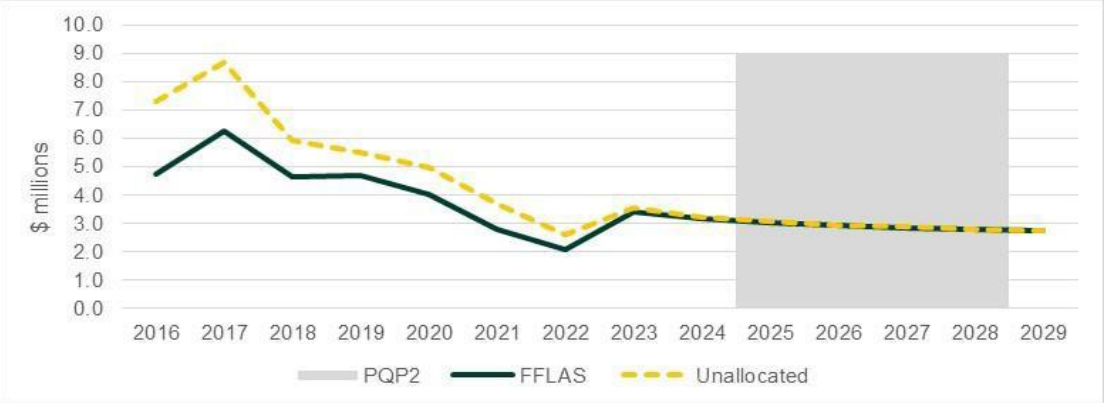
9.4.2 Complex Installations

Chorus services a relatively small number of Complex Installations for larger customers where additional design and planning is required to facilitate the installation due to its more complex nature and can include rural connections and fibre routes to mobile sites.

However, Chorus has advised that its proposed fibre frontier investment is not expected to result in an increase in Complex Installations. Rather, most of the new installations associated with fibre frontier will be Standard Installations.

Figure 18 presents a time series of the Complex Installations capex from CY16 to CY29 showing a forecast modest downward trend since CY24, including the PQP2 forecast.

Figure 18 Complex Installations capex ($CY22 millions)



Data source: Chorus.]

IV's analysis and findings

We consider the bespoke nature of work performed under the Complex Installations sub-category makes it a difficult one to forecast, such that historical expenditure trends are most useful as a guide to forecast expenditure, presuming the major drivers of this sub-category capex are not expected to change in PQP2. Chorus has confirmed that this is the case.

We expect the demand component of the PQP2 Complex Installations forecast will also be subject to the same connections wash-up mechanism as applies in PQP1, which removes demand risk from the PQP2 forecast.

Chorus has provided the forecast unit costs for Complex Installations in PQP2 which are around 10% lower in real terms (CY22) compared to the actual reported unit cost in CY21.

Verification opinion

We can verify that Chorus' PQP2 Complex Installations forecast satisfies the Evaluation Criteria.

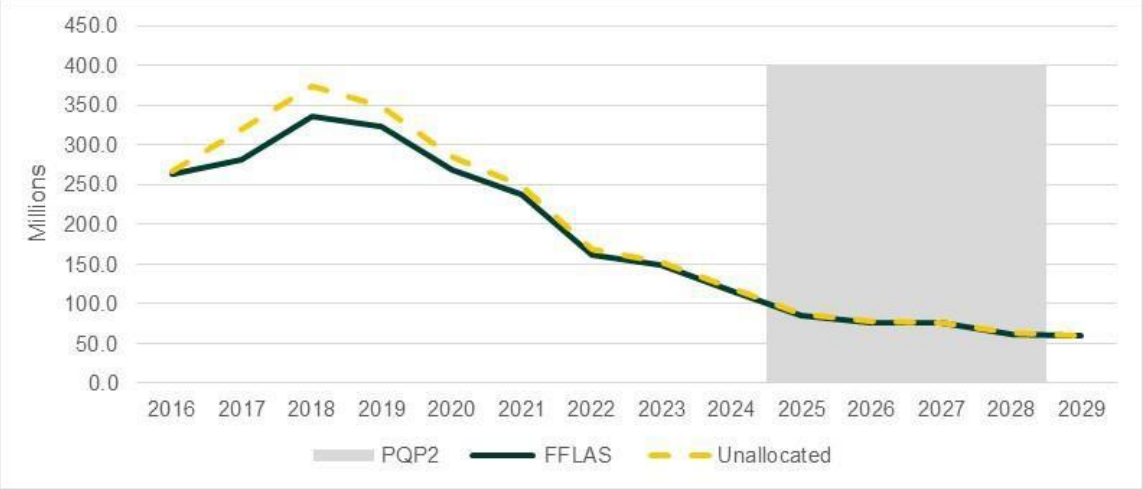
In forming this opinion, we have had specific regard to: Assessment Factor (c) regarding consistency with historic rates of investment; Assessment Factor (m) regarding fibre asset and fibre network information Assessment Factor (o) regarding the extent of uncertainty about the need for the proposed capex; Assessment Factor (s) regarding the accuracy and reliability of data; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon.

9.4.3 Standard Installations

Figure 19 presents a time series of FFLAS (and unallocated) Standard Installations capex, showing a sharp downward trend over time, including the PQP2 forecast.

This growth pattern reflects the development of the communal network under the UFB roll-out that was completed in CY22. Installations relate to new customers connecting to a fixed fibre service.

Figure 19 Standard Installations Capex ($CY22 millions)



Data source: Chorus.

Chorus forecasting approach

There are two types of standard installation for residential and business end-users as follows:

- first-time installations – there are several types of these installations – for single dwelling units (SDUs) or multi-dwelling units (MDUs), rights of way (ROWs) or fibre access extensions such as CCTVs (called smart locations).
- Intact connections, comprising the service provisioning work required when an end-user requests a connection where there is already an installed fibre lead-in. Intact connections are Base Capex only.

Standard Installation capex comprises three types of expenditure:

(a) The physical build cost, comprising:
  - Field technician cost - Rates agreed in contracts with Field Service Providers (FSPs) (i.e., building the fibre lead-in, travel to the premise, installation of the ONT); and
  - Materials cost - Cost of fibre, duct, cables and ONTs which are the physical assets required for a connection.

(b) Chorus internal provisioning cost – provisioning is required for both first-time installations and intact connections. Provisioning costs relate to the process of connecting the customer's internal network to the wider telecommunications network including the internet and the phone system. IT systems automate a

substantial part of these processes, but many orders still require some sort of intervention from Chorus' personnel to ensure the connection is successful.

Consequently, provisioning comprises:

(i) an internal IT cost for systems involved in order processing and

(ii) internal labour cost for connecting end-users managing orders using Chorus' IT processes. This may involve a service desk person dealing with system or service exceptions and liaison with RSP/s and field service providers.

(c) Customer incentive payments – Chorus makes payments to RSPs to incentivise acquisition of new customers for its FFLAS services, or to incentivise existing customers to upgrade to new services. These payments are capitalised under Generally Accepted Accounting Principles and therefore fall within the Standard Installations capex category.

Physical build capex forecast

For physical build capex, Chorus uses a price (P) x quantity (Q) volumetric model for standard installations, where price is the unit cost of new installations.

Chorus has a sophisticated demand forecasting suite of models comprising:[21]

(a) Market Model – which forecasts Chorus' connections in the broad context of the NZ telecommunications market.

(b) Sales and Operational Planning (S&OP) Model – which separates forecasts for copper and fibre products.

(c) Connections Model – takes the information from the Market and S&OP models and applies portfolio assumptions from Product Managers to allocate the forecasts across various product families and thus connection numbers.

The quantity forecasts used in the Installations capex forecast are an output of this demand forecasting model suite.

Unit costs for the physical build of standard installations are based on the average of installation costs for the prior financial year. Chorus considers this is an appropriate approach to forecasting unit costs, as volatility for standard installation costs is low with most installations being for the same item in the Field Service Agreements with field service providers. Further, it notes that roughly 70% of the cost mix is in relation to works carried out using fixed price rate cards of the field service provides for the different types

[21] Chorus' demand forecasting methodologies and models were discussed in section 4.6.1 of this Draft IV Report.

of deployment. An examination of the unit costs in the spreadsheet *RT04 Connections capex v3c.xlsx* shows that unit cost for most of the cost groupings are trending downwards over the PQP2 period and are clearly lower than for PQP1.

Internal provisioning costs

The IT component of provisioning the capex forecast methodology is also based on a prices time quantity (P x Q) formulation. Unit costs are based on historical actuals adjusted for changes in the IT service provider agreement rates with adjustments for future system needs. Chorus' explanation of how the unit costs are adjusted involves a process of amortising future anticipated capitalised new IT provisioning system costs over expected volumes. While we consider this approach appropriate, we have not tested its application. For the labour component of provisioning, the capex forecast methodology is also based on a P x Q formulation. Unit costs are based on historic actuals adjusted for help desk staffing. How these adjustments are made is not transparent.

Quantities for provisioning of first-time installations are the same as used for the physical build of Installations.

In addition to standard and complex customer installations, Chorus is developing a market for Smart Locations. These are connections that do not involve a customer's premises, but rather where high bandwidth and reliable connectivity is critical for uses such as digital billboards, CCTV and traffic management systems. These connections are modelled separately to the demand modelling suite and become inputs into the Installations capex forecast.

Table 15 sets out the basis of Chorus' smart connections forecast, which is based on independent telecommunications forecaster IDC Communications forecast of Chorus' market share. Clearly, this is a new product market that is in early stage of development, which makes reliable forecasting difficult.

Table 15 Chorus' PQP2 forecast of Smart Connections

	FY24	FY25	FY26	FY27	FY28
IDC Addressable market - Fixed	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
Volume growth in addressable market connections	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
New connection volumes (incs 2% disconnection)	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
Base Connections	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
Base connections market share	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
Total new connections	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
New connections - build inc C2F (95%)	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
New connections - intact (5%)	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]

Source: Chorus

The smart location capex forecast methodology is also based on a P x Q formulation. The forecast quantities are provided in the above table, with detail on how they are derived available in Chorus' PQP2 proposal (see attachment to the Demand Report). Unit costs are forecast on the same basis as for the other Standard Installations.

IV's analysis and key findings

The driver for the Standard Installation PQP2 capex forecast is demand growth, which arises from in-fill (customers on the line of the existing communal network), new property development and extending the network beyond the current areas served.

Chorus' Installations PQP2 capex forecast, which applies the methodologies described above and the outputs from the demand forecasting suite of models, are complex and sophisticated. However, these models are not primarily used for regulatory reviews but for efficient operation of Chorus' business and are clearly relied upon both by the key decision makers and operational teams. Chorus has a strong incentive to apply the best possible practice to its 10-year forecasts that are the basis of its business planning, including to manage its business-wide funding needs given that it does not currently fully recover its PQ FFLAS maximum allowable revenue. This is evidence that the forecasts these models produce are best estimates on a reasonable basis and therefore likely to reflect prudent and efficient costs.

As identified elsewhere in this report Chorus' asset management system (AMS) is still under development. It is not surprising that there is no reference to the AMS in the material provided by Chorus that shows Installation capex being linked to Chorus' asset management. We would expect that when the AMS reaches sufficient maturity that all capex associated with Installations (and new connections), will be an important part of asset management plans (Strategic Asset management Plan, Asset Management Plan and Portfolio Asset Management Plan). This will result in increased rigour in Chorus' approach to Standard Installations capex.

Similarly, Chorus has not provided the IV with evidence of important analysis supporting the prudency of Installations capex, in particular economic analysis. This is also not surprising because the building of the UFB communal (shared) fibre network has been a contractual obligation for Chorus, independent of a need for economic analysis to support it.

Now that all connections-related capex will be discretionary for Chorus we would expect it to be able to demonstrate that additional customer connections do not increase the cost to serve of existing customers and instead reduce it through efficient economies of scale or the payment of up-front capital contributions to access the standard fibre tariff (also reflecting a geographically consistent pricing constraint). We would expect as part of

Chorus now entering the stable phase of fixed fibre asset manager and operator, as well as evolving away from the copper network, economic analysis and other assessments such as risk assessments, options analysis and sensitivity analysis will be undertaken to ensure future capex in new connections is prudent. The lack of inclusion of these supporting assessments for PQP2 are not likely to be an issue for PQP2 as the nature of Installations capex –it is standard volumetric capex - is such that it is unlikely that these assessments would have any material impact on the capex forecast.

We have not been provided with a Portfolio Overview Document (POD) for Installations capex, as has been provided for some other capex sub-categories. The matters identified in the previous paragraph that support and confirm capex prudency would ideally be included in a POD for Installations capex, as for all capex sub-categories.

Verification opinion

We can verify the PQP2 Standard Installations forecasts as satisfying the Evaluation Criteria.

In forming this opinion, we have had particular regard to Assessment Factor (c) regarding historic capex; Assessment Factor (e) regarding the approach to forecasting capex; Assessment Factor (m) regarding fibre asset and fibre information; Assessment Factor (s) regarding the accuracy and reliability of data; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies.

9.4.4 Customer incentive capex

Customer incentive capex are payments that Chorus makes to RSPs to incentivise acquisition of new customers on its fixed fibre network or to incentivise existing customers to upgrade to new services. These are capitalised as customer acquisition expenditure and reflected in the FFLAS RAB.

We consider that Assessment Factor (g), relating to competition effects of sub-categories of capex in PQ FFLAS and other telecommunications markets, is of most relevance to assessing Chorus' ongoing payment of customer incentive payments; plus Assessment Factor (d) regarding quantitative or economic analysis related to the proposed capex; Assessment Factor (e) regarding approach to forecasting capex; and Assessment Factor (t) regarding the reasonableness of key assumptions and methodologies relied upon.

Description of Chorus forecasting approach

For PQP1, the Commission approved proposed incentive payments only for the initial year (CY22) and determined that individual capex proposals would subsequently be needed for customer incentive payments in CY23 and CY24.

As part of the final decision for PQP1, the Commission noted that an economic test would apply when assessing the future need for incentive payment expenditure, which is whether the expected incremental revenue derived from incremental end-users/upgrades outweigh the incremental costs, including the incentive payments.

- Chorus made an application for customer incentives capex for CY23 and the Commission approved the majority of the proposed capex (adjusting for the clawback amount, inclusion of a contingency amount and number of incentives to be paid in CY23).[22]
- Chorus did not make an application for incentives payments for CY24, as this application process would have been a distraction from the PQP2 proposal. However, Chorus will continue its customer incentives payments in that year (as shown in the CY24 capex forecast) and is proposing continued incentive payments for CY25 – CY29.

Chorus' customer incentive forecast for PQP2 is $54.1 million, which includes $34m on incentives to connect new end-users to the network and $28m on incentives to upgrade existing fibre users to faster speed plans, less $8m clawback. Table 16 presents the PQP2 forecast.

Table 16 Customer Incentive Payment PQP2 forecasts ($CY22 millions)

	CY25	CY26	CY27	CY28	Total PQP2
Incentive payments	$15.2m	$11.9m	$15.9m	$11.1m	$54.1

Data source: Chorus.

Chorus' customer incentives capex for the first year of PQP2 ($15.2m) is at a higher level than actual customer incentives capex in CY22 or approved incentives capex for CY23 ($12.5m).

Chorus notes that it plans to increase customer incentives capex in CY24 as part of a refresh of the incentive offerings, reflecting the increased costs of attracting customers to fibre given competing technologies and the nature of late adopters. However, Chorus is forecasting a generally declining trend of incentives capex over time; the step up in CY27 reflects an expected **CCI [ ]** in that year.

[22] Commerce Commission (2022), Chorus' individual capex proposal for customer incentives 2023 – Final decision – Reasons paper, December, p13.

IV's analysis and key findings

Chorus has confirmed that in developing its PQP2 customer incentive forecasts, it has applied the same estimation methodology as that used for its CY23 incentive payment application made to the Commission.[23]

We have reviewed this estimation methodology, including application of the economic test articulated by the Commission, and how it has been used by Chorust to develop the PQP2 customer incentive payment forecasts. We have reviewed the relevant calculation spreadsheets for residential and business customer incentive payments, as well as the economic test spreadsheet, to better understand the basis of the PQP2 incentive payment forecasts.

Chorus has advised that the input assumptions used to develop the PQP2 forecasts are either based on recently reported data or are taken from its 10-Year Plan. We have reviewed these assumptions and their application in the economic test, which shows a positive net benefit over an 8-year period arising from the forecast customer incentive payments spread over the 4-year PQP2 period. Chorus also present sensitivity analysis in relation to the key input assumptions. The results of Chorus applying the economic test are as follows:

- For new connection offers, there is an estimated net benefit of **CCI [ ]** based on incremental revenue from moving end-users from off-network (eg cable) to fibre, and copper to fibre, which would provide an average revenue per user (ARPU) uplift, while incurring incremental costs from the incentive credits provided and new lead-ins.
- For upgrade offers, there is an estimated net benefit of **CCI [ ]** based on the ARPU uplift provided by current incentives being partly offset by the incremental costs from the credit and new ONTs (where end-users upgrade to Hyperfibre).
- For both incentive types, a net benefit outcome is maintained under a range of scenarios.

We consider the input assumptions Chorus has used to be sound and generally conservative, resulting in a level of PQP2 forecast customer incentive payments that is unlikely to be materially overstated and in so doing cause competitive harm, while recognising the relatively high degree of uncertainty regarding this expenditure sub-category.

[23] While it is out-of-scope for our review, Chorus is also proposing two possible alternative ways of estimating customer incentive payments in the future.

We also consider that the level of incentive payments proposed by Chorus for PQP2 are consistent with maintaining its competitive position in the NZ broadband services market, as well as facilitating the transfer of customers using its copper broadband services to fixed fibre services. This would deliver a longer term unquantified benefit associated with additional fixed fibre connections (to share recovery of fibre fixed costs), as well as assist to bring forward closure of the copper network (a broader economic efficiency gain).

In respect to Chorus' legal obligations regarding its customer incentive payments and specifically the non-discrimination obligations under s 201 of the Telecommunications Act, we note that the proposed payments in PQP2 will be offered to all RSPs in all locations and will not be linked to the locations of end-users.

Verification opinion

We can verify that Chorus' proposed PQP2 customer incentive payments satisfy the Evaluation Criteria.

In forming our opinion, we have had particular regard to: Assessment Factor (d) regarding quantitative or economic analysis related to the proposed capex; Assessment Factor (e) regarding approach to forecasting capex; Assessment Factor (g), relating to competition effects of sub-categories of capex in PQ FFLAS and other telecommunications markets; and Assessment Factor (t) regarding the reasonableness of key assumptions and methodologies relied upon.

9.5 Network Capacity

The Network Capacity capex group covers the following expenditure sub-categories:

- Access
- Aggregation
- Transport.

The Commission has identified Access and Aggregation as Priority Areas.

Table 17 presents the PQP2 expenditure forecasts for the Network Capacity expenditure group.

Table 17 Network Capacity PQP2 forecasts ($CY22 millions)

Sub-category	CY25	CY26	CY27	CY28	Total PQP2
Access	27.9	31.7	37.6	30.2	127.5
Aggregation	21.8	21.6	16.9	19.5	79.8
Transport	26.7	26.1	18.3	13.9	85.0
TOTAL	***76.4***	***79.5***	***72.7***	***63.7***	***292.3***

Data source: Chorus.

9.5.1 Chorus' supporting information

Our assessment of Chorus' Network Capacity sub-category group PQP2 capex forecasts is based on the following documents that it has made available to us:

Network Capacity

- Network capacity PQP2 chapter template version August Review.pdf [Document 9S]

Access

- CO4 ONT FY24-33 Planning Scenarios v2.0.xlsx [Document 9T]
- ONTs economics.xlsx [Document 9U]
- PQP2 Network Capacity expenditure chapter.docx [Document 9V]
- ONTs deployment strategy.docx [Document 9W]
- ONTs – Whole of life cost analysis.xlsx [Document 9X]
- ONTs deployment strategy – note to the IV.docx [Document 9Y]
- ONTs Replacement analysis.docx [Document 9Z]
- ONT Modelling Assumptions.docx; ONTs deployment strategy (template version) – Certification.docx [Document 9AA]
- DP2991 Growth Fibre Layer 2 Access POD – v01.docx [Document 9AB]

Aggregation

- RFI – aggregation_26Sept.docx [Document 9AC]
- DP 2989 Growth Fibre Layer 2 Aggregation POD – v01.docx [Document 9AD]
- CO23 Aggregation Plan_FY24_33_IV.xlsx [Document 9AE]

- Chorus Aggregation Lifecycle Plan_Q1_ed03_draft.pdf [Document 9AF]

Transport

- DP 2425 Transport POD -v01.docx [Document 9AG].

9.5.2 Access

Access expenditure enables customer connections to Chorus' fixed fibre network by providing lit or ethernet services from customer sites to Chorus' access sites. They also control the speed of the connection.

Access electronics include two types of hardware: Optical Network Terminals (ONTs) at the customer end; and Optical Loss Terminals (OLTs) at the network building side.

Figure 20 shows a somewhat lower level of PQP2 Access forecast expenditure (on an annual basis) compared to PQP1.

Figure 20 Access Capex ($CY22 millions)

Data source: Chorus

Chorus' forecasting approach

Chorus' ONT deployment strategy to date has been primarily driven by the UFB rollout.

Chorus argues that a key benefit of the fibre network is the ability to support enormous capacity growth through upgrades to electronics and optics. As new generations of fibre technology emerge and mature, the cost of upgrades is low relative to the cost of deploying the fibre network.

Chorus states there is an argument for adopting and implementing new generations of fibre technology that makes sense even if cost optimisation is the only consideration. This is because new technology moves from leading edge to mainstream over time, while previous generation technologies eventually move out of support and cannot be expanded to support growth. The mainstream technology of the day tends to deliver additional capacity at the lowest cost and lowest energy consumption.

Installing a GPON ONT (the current technology) has been a key feature of the ONT deployment strategy to date, allowing broadband speeds that satisfy the needs of the vast majority of New Zealanders.

However, Chorus has begun rolling out next generation broadband technology (XGS-PON ONT), which allows for much faster speeds. While still in its infancy it has started in the last two years to gain some momentum where Chorus has responded to changing end-users needs only upon request.

Chorus considers it prudent with a view to PQP2 to review the current reactive ONT replacement strategy, given an increase in demand for faster broadband speed products, which is expected to make the current GPON technology obsolete at some point in the future. In addition, some of the earliest ONTs installed in the fibre network are now becoming ten years old, raising the issue whether the low failure rates observed historically are likely to ramp up, possibly warranting an early replacement program to maintain a positive customer experience.

In reviewing the ONTs deployment strategy, the following were key considerations articulated by Chorus:

(a) ONT failure rates

(b) Technology obsolescence and transition benefits

(c) Hyperfibre uptake

(d) Truck Rollout Volumes and Service Technician Capacity, including associated cost variables

(e) XGS-PON ONT availability and associated price changes over time

(f) Price difference between GPON and XGS-PON ONTs

(g) End-user self-installation uptake

(h) Cost/Benefit of deploying GPON compared to XGS-PON at new installations and for fault replacement.

Chorus identified the following key risks relating to the current ONT strategy:

- Increasing failure rates resulting in loss of service for consumers and pressure on field technicians and supply chains.
- Being forced into a large scale, reactive replacement program with consequent labour force, supply chain and reputational issues.
- GPON ONTs not meeting the needed product speeds (and possibly not being technically supported) as the move to the next generation of broadband technology unfolds.
- **CCI [**

].

In reviewing the ONT deployment strategy having regard to PQP2, Chorus considered the following five options, ranging from very reactive deployment approaches to highly pro-active approaches that would deploy XGS-PON ONTs ahead of demand and at scale:

- Option 1 – very reactive (current practice) – when an ONT fails or when Chorus performs a new install at an end-user's premise, GPON ONTs continue to be deployed over the ten-year planning horizon; XGS-PON ONTs deployment just tracks customer demand for Hyperfibre products.
- Option 2 –– Option 1 + from July 2024, Chorus will use only XGS-PON ONTs for all ONT replacements and new ONT installs (where this is possible).
- Option 3 – Option 2 + every time an ONT's power supply unit (PSU) fails, Chorus performs a truck-roll and installs an XGS-PON ONT.
- Option 4 – Option 2 + every time there is a new connect (or reconnect) for a 1G service an XGS-PON ONT is installed.
- Option 5 – Option 2 + all GPON ONTs are replaced at the end of their accounting life (10 years) with an XGS-PON ONT. As the assessment below shows, this option very clearly marks the extreme end of the range.

Chorus ONT forecasting approach

Chorus uses a Price x Quantity approach to forecast ONTs capex for PQP2.

The quantities Chorus inputs into capex modelling reflect drivers and forecast drivers in Table 1 (above):

- Historic ONT failure rates inform forecast failure rate assumptions.
- The installations forecast drives first-time installations ONTs capex.
- The Hyperfibre demand forecast drives end-user initiated XGS-PON ONT deployment.

Chorus has contractual arrangements that lock in the key unit cost used in its capex modelling.

- **CCI[**

]

- Chorus cannot precisely forecast movements in unit cost beyond 2024 as these are mass market products that follow global trends.
- In its modelling, Chorus assumes unit cost for:
  - **CCI [**

].

Truck-roll costs are determined using rate cards in the Field Services Agreements. Current unit costs are **CCI [ ]**

Chorus' ONT deployment strategy proposes Option 1 as the preferred option at this point. However, it considers Option 2 will likely be adopted during PQP2. Option 2 has higher initial costs, but Chorus analysis indicates this will have the lowest whole-of-life cost. This option would be reactive - replace at failure – supplemented with proactive replacement in limited circumstances.

This deployment strategy recognises there is uncertainty over ONT asset lives and that ONT failure rates are currently very low. At this point, Chorus is not observing fleet-wide failure modes in the different generations of ONTs. Further, individually, ONTs have a low asset criticality (because an ONT directly affects service for an individual end-user but does not impact other end-users). Chorus notes its intention to continue to develop its understanding of ONT performance, failure modes, expected lives and adjust its ONT strategy over time.

In recognition of concerns that the IV expressed about possible uneconomic proactive deployment of XGS-PON ONTs in PQP2, Chorus has opted to retain the current ONT strategy (Option 1) for its PQP2 expenditure proposal. This decision also reflects PQP2 stakeholder feedback indicating a strong preference that Chorus' discretionary investment be directed towards fibre extension and network resilience. Chorus estimates that making this adjustment removes $11 million from its ONT forecast capex for PQP2.

Chorus suggests there is an opportunity for the Commission to consider this adjustment and Chorus' preferred option in its assessment of Chorus' PQP2 proposal and to engage further with stakeholders as part of its consultation process. Alternatively, Chorus may, at its discretion, change to a more proactive ONT strategy during PQP2.

IV's analysis and key findings

We consider Chorus has proposed a relatively cautious and prudent approach to its ONT deployment strategy, choosing Option 1 as the preferred approach for the PQP2 expenditure proposal with a potential shift to Option 2 during PQP2.

The key difference between its current deployment strategy (Option 1) and Option 2 is that Option 2 entails replacing existing GPON ONTs with XGS-PON ONTs when it does a truck roll to an end-user's premises, because Chorus argues this produces the lowest whole-of-life cost for replacement of the ONT. Chorus notes that managing its ONT fleet is challenging as ONTs are installed in end-users premises, which is disruptive for them and costly for Chorus (due to truck roll costs).

Option 1, the basis of the PQP2 proposal, is the lower cost alternative in PQP2 and means replacing GPON ONTs as needed on a like-for-like basis. GPON ONTs are currently significantly cheaper than XGS-PON ONTs **CCI [ ]**[24] However, this alternative would require an additional truck roll with associated costs at some future point if the GPON ONT required replacement, including if the customer sought a Hyperfibre service which uses the new technology. Hence, the lower short term ONT replacement cost would not be in the long term interests of Chorus' customers.

The documentation Chorus provided in support of its PQP2 ONT forecast shows it has undertaken some economic and quantitative analysis to inform the proposed ONT deployment strategy and associated investment including:

- Options analysis of total capex impacts associated with different deployment strategies.

[24] $US/$NZ exchange rate = $1.60

- NPV analysis of ONT deployment choice.
- Sensitivity analysis relating to the impact from decreases in ONT costs and the uptake of self-installations on the proposed expenditure forecast – the outcomes supported its preferred Option 2.

The supporting documentation also provides substantiation of key assumptions and planning methodologies relied upon in the development of the ONT deployment strategy.

The following limitations in relation to its modelling assumptions are noted in the supporting documentation:

- Availability of global ONT failure rate data.
- **CCI [**

  ]
- Future pricing for XGS-PON ONTs are uncertain, particularly as they become mainstream technology globally.

In contrast, Chorus indicated reasonable certainty over truck-roll unit costs used in the model based on current Field Service Agreements and specified annual cost adjustments.

Overall, we are satisfied about the reasonableness of the key assumptions and methodologies Chorus has used to develop its PQP2 ONT forecast. We recognise that there is a relatively high degree of uncertainty about aspects of the forecasts, including failure rates and future cost of XGS-PON ONTs. However, we consider that Chorus has recognised this uncertainty in its modelling approach.

Verification opinion

We consider that Chorus' PQP2 ONT forecast expenditure approach satisfies the Evaluation Criteria, reflecting a balancing of whole-of life cost considerations, stakeholder feedback regarding discretionary expenditure and uncertainty regarding the capex forecast including due to uncertainty about future new ONT technology take-up rates.

In forming this opinion, we have had particular regard to: Assessment Factor (b) regarding the governance process associated with development of the capex forecast; Assessment Factor (d) quantitative analysis related to the proposed capex; Assessment Factor (e) approach to forecasting capex; (j) regarding the extent and effectiveness of consultation and engagement with stakeholders, and its reflection in the capex proposal;

Assessment Factor (o) regarding the extent of uncertainty regarding the proposed capex; Assessment Factor and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon.

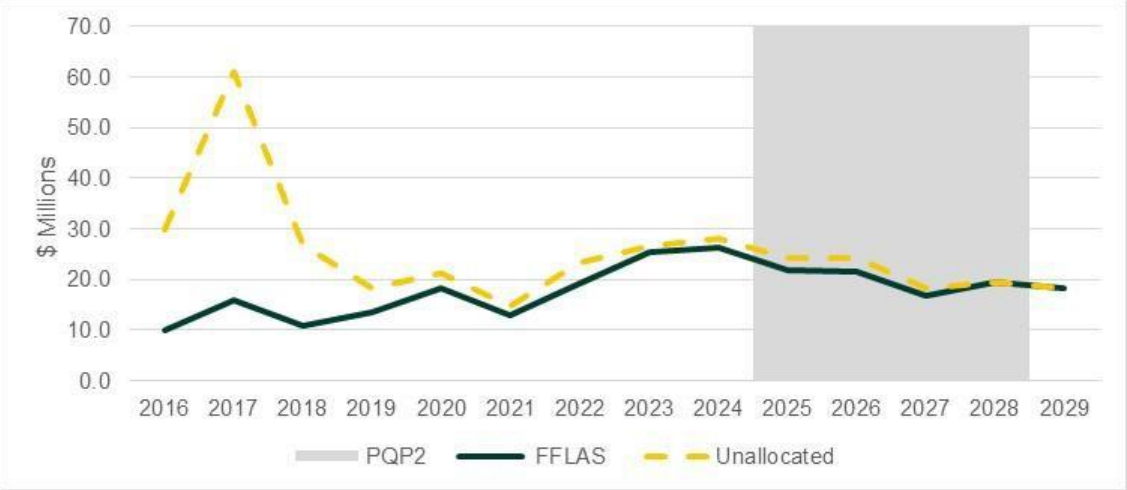
We also recognise Chorus' proposed Option 1 for PQP2 has regard to stakeholder feedback on its discretionary investments. However, we still consider that a change to Option 2 if hyperfibre fibre take-up rates supported it would provide a lower whole-of-life outcome and is likely to better satisfy the Evaluation Criteria.

9.5.3 Aggregation

The Aggregation expenditure sub-category relates to networks that link access networks to RSPs' Point of Interconnect (POI). The networks consist of switches (rack-mounted equipment with interface cards) and the links between them.

Figure 21 indicates declining expenditure on Aggregation Capex since CY20, which is forecast to continue in PQP2.

Figure 21 Aggregation Capex ($CY22 millions)



Data source: Chorus.

Description of Chorus forecasting approach

Chorus operates two aggregation networks:

- The regional ethernet network (REN) that supports copper services, and
- The fibre aggregation network (FAN) that supports fibre services.

The key drivers of Aggregation expenditure are:

- Augmentation: Bandwidth growth drives aggregation expenditure specifically by requiring extra core switches to maintain sufficient capacity.
- Renewal: Lifecycle replacement to ensure relevant equipment stays ahead of end-of-life (e.g. mitigate functional obsolescence due to lack of compatibility with current and future software releases).

Chorus notes that new products are not a direct driver of aggregation spend, although over time they may lead to bandwidth growth.

Investment justification and approvals:

The DP 2989 Growth Fibre Layer 2 Aggregation | Portfolio Overview Document explains the basis for prudency of the investment by considering the key investment drivers of:

- Quality standards set under the mandatory dimensions
- Demand growth
- Asset lifecycle
- Customer (RSP) contracts, and
- Asset criticality.

Three credible options have been considered as follows:

- Do nothing
- Increasing network capacity only
- Increasing network capacity and address technical obsolescence.

The PQP2 expenditure forecasting approach considers:

- Three main streams of work (chassis replacement dealing with equipment obsolescence; expanding of existing network chassis' to enable new existing ports for use in the network; and migration activities).
- Forecast quantities are based on optimised and prioritised deployment plans for meeting obsolescence considering forecast peak throughput demand, modelling of expansion requirements, and modelling of migration requirements considering the volume of work able to be completed in a given period.
- Cost estimations based on FSA unit rates calibrated against historical costs, and **CCI [ ]** equipment costs from supplier price list. The single vendor **C C I [ ]**

equipment costs have been verified through a previous contested commercial process, and ongoing price benchmarking against past and current purchases. Evidence of the benchmarking was not reviewed at the time of writing this report.

The governance process for developing the investment forecast included:

- Internal peer reviews.
- Benchmarking of cost estimates comparing modelled costs to historical costs.
- Internal challenge of inputs, assumptions, results, and consideration of the need for changes in the planned approach are undertaken. The technology roadmap inputs are reviewed and challenged where material changes are evident. A top-down challenge focused on expenditure levels, for example specific annual funding levels are undertaken.
- Cost / Benefit analysis undertaken from a customer perspective.
- Consideration of expected efficiencies and/or quality and performance improvements.

Deliverability of the proposed investment program has been considered, having regard to volumes, historical experience, known process improvements, resource logistics and management, and supply chain management.

Investment Model

The Aggregation capex forecast is based on a volumetric price (P) x quantity (Q) model where:

- The unit costs are based on **CCI [ ]** purchase agreement contracts covering hardware, software and labour. The PQP2 forecast assumes similar pricing terms and contractual volume discounts. Bulk purchase contracts are also implemented as required.
- Quantities are determined from the number of expected new connections (based on the connections model demand forecast), the forecast growth in peak bandwidth demand, asset lifecycle stage and expected replacement requirements, the capacity headroom on the network, aggregation network architecture and performance against PQ FFLAS quality standard requirements.

It is noted that forecast expenditure is build up from equipment costs from a single supplier, **CCI [ ]**, where price lists and commercial terms are in place (Technology Partnership Agreement), historical service provider costs for similar types of work, and

internal labour cost for activities such as project management. The expenditure is weighted towards equipment costs.

A key assumption in the PQP2 forecast is that network traffic will continue to grow at the historical rate. However, there is a risk that network traffic grows at a higher rate, which could result in increased spend to keep the network uncongested and meet the PQ FFLAS Port Utilisation quality standard.

The aggregation, access and transport capex models are developed to translate the demand forecast into a capex forecast. These models are used as the base for the PQP2 capex plans. The demand forecasts consist of:

- Expected new installations/connections forecast (connections model) that underpins the expected new network transport products.
- Bandwidth forecast that provides the expected total bandwidth demand and growth rates that underpins the network capacity modelling.

Chorus notes a key risk with aggregation assets is product updates from Chorus' vendors (particularly **CCI [ ]**) impacting on the interoperability of electronic devices. The risk is mitigated through regular communication with **CCI [ ]** and other vendors.

IV's analysis and key findings

We are satisfied Chorus has demonstrated that the key investment drivers for aggregation expenditure are:

- Augmentation: Bandwidth growth drives aggregation expenditure specifically by requiring extra core switches to maintain sufficient capacity.
- Renewal: Lifecycle replacement to ensure the equipment stays ahead of end-of-life (e.g. mitigate functional obsolescence due to lack of compatibility with current and future software releases).

The documentation Chorus provided for review also demonstrates:

- Qualitative justification of the need to invest during PQP2.
- Consideration of good telecommunications industry governance frameworks, practices and decision-making processes.
- Consideration of processes for internal challenge and reasonableness testing of the key assumptions, methodologies, planning, and technical standards relied upon, and including deliverability and procurement risks.

- Consideration of historical service provider and internal labour cost for similar activities, procurement contract pricing.
- The basis for volume forecasts that are consistently applied across the portfolio of proposed capex for PQP2 considering the connections model demand forecast, the forecast growth in peak bandwidth demand, the lifecycle stage and expected replacement requirements, the capacity headroom on the network, and the aggregation network architecture and performance against the quality standard requirements.
- The need for investment applying the connections model demand forecast, the forecast growth in peak bandwidth demand, the lifecycle stage and expected replacement requirements, the capacity headroom on the network, and the aggregation network architecture and performance against the quality standard requirements, including consideration of the criticality of the aggregation assets.

However, no documented evidence was initially provided in relation to:

- A framework (for example a quantified risk approach) for justifying investment volumes, targeting investments, and prioritising investments.
- The investment development process, benchmarking, and options analysis described in decision packet (DP) 2989.
- The internal challenge, assumptions, methodologies, planning, and performance quality standards to test the reasonableness of the proposed investment(s) described in DP 2989 Growth Fibre Layer 2 Aggregation | Portfolio Overview Document.
- Historical investment volumes and costs have been considered in the quantitative evaluation of the proposed investment forecast.
- The extent of the risk associated with not investing and or not investing within PQP2 having been considered.
- The cost estimation processes described in DP2989 have been applied in the development of the aggregation expenditure forecast.
- A quantified options analysis investigating the options and selection of the lowest whole-of-life cost option to achieve the required outcomes.
- The reasonableness assessment of the key assumptions, methodologies, planning, and technical standards have been applied in the quantitative assessment and development of the expenditure forecast. For example, the extent to which key risks

associated with expected network growth, and vendor product updates have been considered in the expenditure forecast.

Build-up of PQP2 forecasts

Following preparation of our Draft IV Report and review of the initial documentation provided by Chorus, we engaged in further discussions with Chorus' subject matter experts regarding the basis of its Aggregation PQP2 forecasts.

Chorus advised that, on average, **CCI [ ]** of total cost for this sub-category is equipment set by **CCI [ ]** rate cards. Prices for given equipment components are **CCI [ ]**.

We also discussed the challenges (and benefits) of sole supplier and contractual provisions available to Chorus to ensure competitive pricing and based on this discussion consider that its procurement approach is reasonable and likely to deliver efficient outcomes.

Chorus advises that **CCI [ ]**, which are considered in developing forecasts based on planned work (and expected volumes).

For non-equipment costs, Chorus advises that:

- **CCI [ ]** are internal labour (capability) eg. for annual software update (where it uses observed actuals as this is a repeated annual task)
- **CCI [ ]** are field service provider deployments based on observed actual costs for the corresponding task over the past 24 months.

Chorus confirms that it has made no adjustments to these cost inputs for PQP2. Its approach is to assess if a modification may be required eg. if the technology assumptions lead to a change in installation and commissioning costs. However, the plan for PQP2 uses consistent technology so no such modifications were relevant or required.

Forecast costs are subject to regulatory cost escalators (CPI/RPE) and cost allocations.

Chorus notes that given equipment is the largest component of this expenditure sub-category, the main area of uncertainty in its PQP2 forecasts is foreign exchange risk for equipment purchases (which it manages through rate hedging by its Treasury team with details of the hedging arrangements summarised in the Chorus' Annual Report). A detailed assessment of Chorus' foreign exchange risk management is beyond the scope of our review.

Using demand forecasts in developing Aggregation forecasts

Chorus advises that demand can be viewed at a national level as peak throughput. This needs to be disaggregated to a very granular level to assess how demand growth will materialise locally at the network link level (the percentage growth will vary for each link according to connection saturation (i.e. how much further growth is expected) and consumption patterns.

This is compared to current capacity for each link to identify the point in time where it will exceed capacity thresholds triggering the need for capacity expansion. The planning threshold to initiate capacity expansion was reduced from 60% to 50% after the Commission reduced the threshold on the Port Utilisation Quality Standard from 95% to 90% for PQP1.

If link capacity is forecast to expire (exceed planning thresholds) investigation is undertaken to assess whether additional links can be enabled with existing equipment, meaning a low cost upgrade, or if new line cards and therefore more expensive equipment will be required. The result of these assessments and judgements are reflected the quantity model that is then taken into the P x Q forecasting model.

Chorus explained to us that it is part way through a generational change in aggregation equipment. This started in 2020 and is driven by technological obsolescence and a 'stop sell' notice from **CCI [ ]**. In other words, **CCI [ ]** will no longer sell the older technology equipment.

In this regard, the timing of the lifecycle program underpinning the PQP2 forecast is a co-optimisation of the following factors:

- Demand growth for each location
- Existing network capacity for each location
- Delivery constraints and scheduling efficiency
- Outage window availability
- Capex availability (within Chorus' capital funding envelope).

Overall, Chorus argues that it is attempting to realise the lowest cost outcome taking these factors into account. Given exponential growth in data use, it is very reliant on realising a sharp decline in 'cost per bit' (total traffic divided by cost) which it has, to date, achieved. This observed cost reduction over time has relied on adopting newer versions of technology rather than price erosion of existing versions. This works well in conjunction with need to replace technology versions approximately every 10 years.

Lifecyle replacement considerations

Chorus is currently and will continue in PQP2 to implement a lifecycle program to replace 2012-era aggregation equipment technology interwoven with the need to meet bandwidth growth. The choice to change platforms entails an upgrade cost but produces lower cost per bit. Planned obsolescence and supplier 'stop sells' force equipment change over, which is beyond Chorus' control other than to maintain close contact with suppliers (primarily **CCI [ ]**) to receive early warning and manage these change overs.

The current version of the plan commenced in 2020 prior to PQP1 based on decisions that trace back to preparing for the 2019 Rugby World Cup broadcast via internet in NZ.

The earlier versions of Aggregation equipment were severely limited in the ability to support high scale 100G links for connecting Aggregation switches together and the forecasts for 100G uplinks from Access OLTs. The initial plan to deploy high capacity high scale devices in the Aggregation network came from this.

Later when new lifecycle notices were received by **CCI [ ]** that set an end of life date for the earlier equipment generations there was only one solution available to keep meeting growth and replace the equipment that was now identified as being obsolete in future. As such the planning did not involve much in the way of economic options analysis (it only had one option) and choices were about how quickly replacements and capacity upgrades could be made.

Explaining further a lack of options analysis, Chorus notes that it did explore feasibility of potentially upgrading earlier versions of equipment to replace the obsolete components rather than to completely replace them. However, during its capacity modelling, it realised the earlier technology could not be upgraded or be kept supported, as well as meet capacity demand so new chassis were required either way. This meant any investment in the earlier chassis became stranded/wasted investment that did not delay growth expenditure. Once this was discovered and partly due to the short runway to act, the current lifecycle plan commenced.

As such, there were no new decisions during PQP1 or PQP2 to explain the lifecycle dimension of Aggregation expenditure, including alternative choices. Chorus notes that in future, as its process and documentation practice matures, it expects more of this type of analysis may be captured than in the past.

Verification opinion

We can verify that Chorus' proposed PQP2 Aggregation sub-category forecast satisfies the Evaluation Criteria.

In forming this opinion, we have had particular regard to: Assessment Factor (a) whether the proposed capex complies with all applicable legal and regulatory obligations associated with provision of PQ FFLAS; Assessment Factor (b) regarding the governance process associated with development of the capex forecast; Assessment Factor (e) approach to forecasting capex, including models used to develop the capex forecasts; Assessment Factor (h) regarding the linkages between the proposed capex and quality; Assessment Factor (o) regarding the extent of the investment uncertainty; (q) the impact that the proposed capex has on a layer 1 service and Assessment Factor (t) regarding the reasonableness of the key forecasting assumptions and methodologies;.

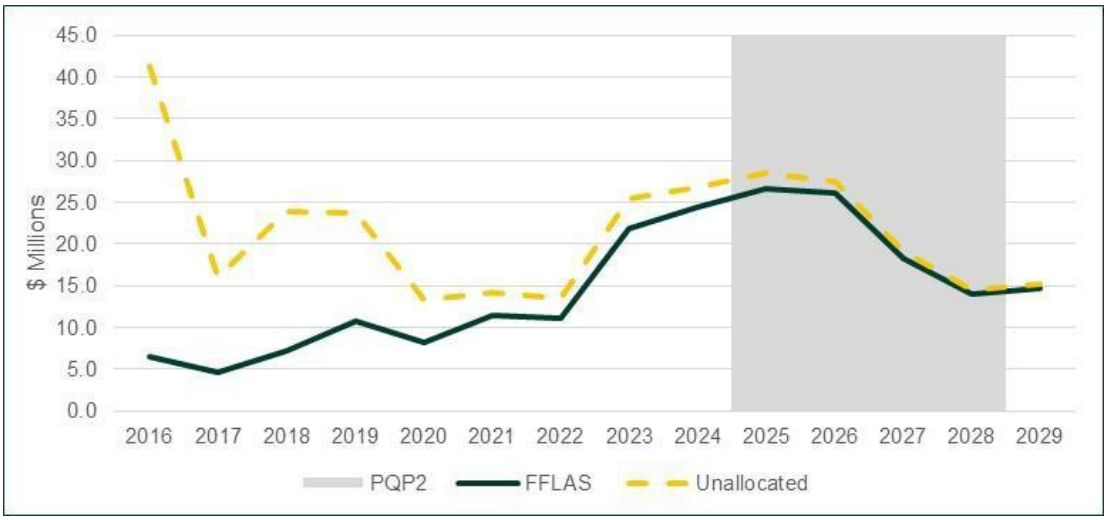
9.5.4 Transport

This expenditure area includes the expansion and replacement of Chorus' transport network assets that provide high-capacity transmission connectivity over long distances between the Access Optical Line Terminal's (OLT's) and Aggregation Chassis required to carry end user demands for bandwidth.

Chorus notes the major driver of expenditure during PQP1 and PQP2 is the forecast increase in demand (peak throughput bandwidth) that is driving expansion of existing or the build of new Transport assets.

Figure 22 shows the PQP2 Transport forecast declining sharply from CY25 following a sharp increase in spend from CY22.

Figure 22 Transport Capex ($CY22 millions)



Data source: Chorus.

Chorus' forecasting approach

Chorus develops its PQP2 Transport forecast using a price (P) x quantity (Q) basis.

Prices are based on field service provider unit rates which are based on field service agreements, **CCI [ ]**. Recent historical data is used to calibrate the cost per activity assumptions in Chorus' models. **CCI [ ]** equipment from Technology Partnership Agreement (TPA) price lists are used to inform the cost of forecast equipment costs.

Quantities for new regional chassis are based on the replacement of **CCI [ ]** equipment and bandwidth growth, with quantities for expansions based on the purchase and installation of new line cards and pluggable optics to support OLT uplinks and Network Links.

Chorus notes that its Metro and Core networks use **CCI [ ]** equipment and are not facing **CCI [ ]** forced obsolescence issues impacting regional chassis. Further, forecast growth can be met by adding equipment to the existing network chassis with limited additional chassis required in some locations.

Chorus identifies the governance process associated with its Transport forecasting.

IV's analysis and key findings

Chorus identifies the mandatory PQ FFLAS quality standards and demand growth as the key drivers for the PQP2 Transport forecasts. Asset lifecycle expenditure determined by equipment vendors' product cycles and Chorus' service obligations under its contracts with RSPs also drive PQP2 forecast Transport expenditure.

We have discussed in depth with Chorus' subject matter experts how it has built up its PQP2 forecasts using P x Q methodologies, including in relation to the Field Sustain and Aggregation expenditure sub-categories. Chorus has confirmed that this approach is also used for the Transport expenditure sub-category.

Consequently, having regard to Assessment Factor (t), we are satisfied that Chorus P x Q forecasting methodology and the assumptions and inputs used in the methodology are reasonable. We are also satisfied that Assessment Factor (b) regarding the governance process associated with development of the PQP2 Transport forecast is satisfied.

Finally, the PQP2 Transport forecasts are around the same level as in PQP1 in $CY22 terms ($21.2 million in PQP2 compared to $19.1 million in PQP1).

Verification opinion

We can verify that Chorus' proposed PQP2 Transport sub-category forecast satisfies the Evaluation Criteria.

In forming this opinion, we have had particular regard to: Assessment Factor (a) whether the proposed capex complies with all applicable legal and regulatory obligations associated with provision of PQ FFLAS; Assessment Factor (b) regarding the governance process associated with development of the capex forecast; Assessment Factor (c) regarding historic rates of investment; Assessment Factor (e) approach to forecasting capex, including models used to develop the capex forecasts; and Assessment Factor (t) regarding the reasonableness of the key forecasting assumptions and methodologies.

9.6 Network Sustain and Enhance

The Network Sustain and Enhance category is concerned with the maintenance of the reliability, safety and service quality performance of the fixed fibre network and comprises four sub-categories:

- Field Sustain – ensuring the physical fibre network assets are maintained and operate as intended and covers fibre assets (cable, joints terminators, splitters, roadside cabinets), ducts, manholes and poles.
- Re-locations – capex associated with re-location of network assets to accommodate other infrastructure. Some relocation costs are reimbursed by the requesting (or requiring) party.
- Resilience – capex associated with building redundancy into the network through duplication of critical assets, which improves network reliability.
- Site Sustain – network structures and buildings, including exchanges, are an essential component in supporting the delivery of Chorus fibre infrastructure and services.

Table 18 presents the PQP2 expenditure forecasts for the Sustain and Enhance expenditure group.

Table 18 Sustain and Enhance PQP2 forecasts ($CY22 millions)

Sub-category	CY25	CY26	CY27	CY28	Total PQP2
Field Sustain	29.7	29.4	31.4	30.0	120.5
Resilience	17.7	20.0	17.1	24.8	79.7
Site Sustain	27.2	22.3	21.4	20.2	91.1
Relocations	4.6	4.5	4.5	4.5	18.2

Sub-category	CY25	CY26	CY27	CY28	Total PQP2
TOTAL	*79.2*	*76.2*	*74.5*	*79.5*	*309.5*

Data source: Chorus

9.6.1 Chorus' supporting documentation

Our assessment of Chorus' Network Sustain and Enhance sub-category group PQP2 capex forecasts is based on the following documents that it has made available to us:

Network Sustain and Enhance

- PQP2 Network Sustain and Enhance expenditure chapter.docx updated to September 2023C015 New Fibre Life Cycle Plan v1.xlsx [Document 9AP]
- Network Sustain and Enhance PQP2 chapter template version – Certification.docx [Document 9AQ]

Field Sustain

- Portfolio Plan - Poles - Draft May v01 Draft for Release.pdf [Document 9AR]
- DP 2437 and DP 2703 Network Field Sustain poles.docx [Document 9AS]
- DP 2444 Network Field Sustain Rehab Fibre.docx [Document 9AT]
- DP 2445 & 2570 Network Field Sustain Maintain Service Fibre-Copper.docx [Document 9AU]
- DP 6015 Fibre Lifecycle POD FY23.docx [Document 9AV]
- Pit lid update March 2022 Final.pptx - Read-Only.pptx [Document 9AW]
- Slotted Core fibre cables and closure systems v1.0.pdf [Document 9AX]
- Chorus Proactive Pole Testing and Assessment Program (ND13102)v1.2.pdf [Document 9AY]
- Chorus Manhole and Pit Identification and Remediation (ND13171).pdf [Document 9AZ]
- Portfolio Overview Documents (PODs):
  - Field Sustain – Fibre Lifecycle (DP6015); Field Sustain Fibre Portfolio Rehab (2444); and Field Sustain Maintain Service (2445 & 2570) [Document 9AAA]
- Capex forecasting – field sustain estimation summary.docx [Document 9AAB]

- CO15 New Fibre Life Cycle Plan v1.xlsx [Document 9AAC]

Resilience

- Robustness Diversity Workings summary Model v1 2023.xlsx [Document 9AAD]
- DP2430 Field Sustain Resilience/pdf [Document 9AAE]
- DP2430 Field Sustain Resilience updated.docx [Document 9AAF]
- Network GTechnology Resilience Update February 2023.pdf [Document 9AAG]
- Board Paper_14 April_Strategy Resilience.pdf [Document 9AAH]

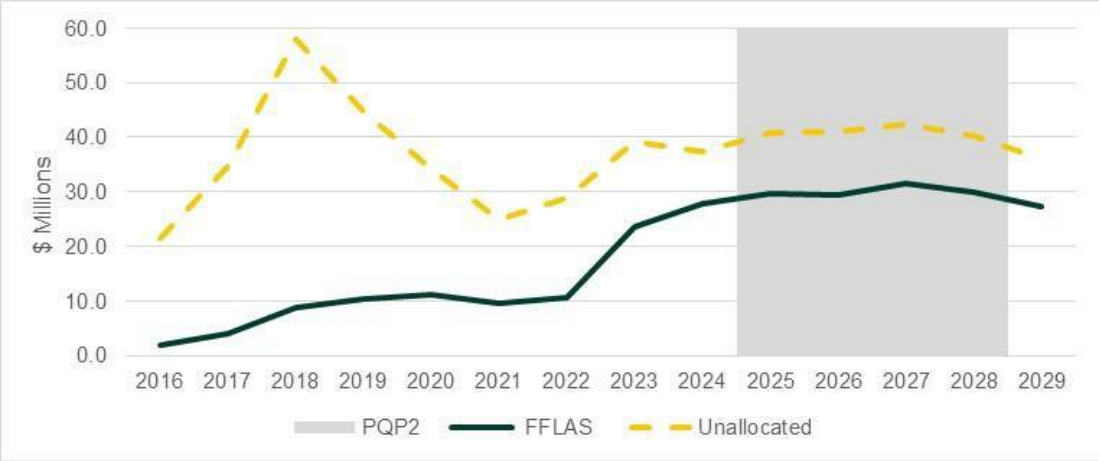
Site Sustain

- Site Sustain DP2181 Earthquake Remediation.pdf [Document 9AAI]
- Executive Paper Earthquake Strengthening Building Importance Rating dated 0702021.pdf [Document 9AAJ].

9.6.2 Field Sustain

Figure 23 presents the time series of Chorus' field sustain capex from CY16 to CY29. It indicates a significant step up in PQ FFLAS expenditure during PQP1 (CY22 to CY24), which is forecast to flatten during PQP2. We understand from Chorus that this uplift in expenditure since CY22 reflects its re-prioritisation of field sustain activities following completion of the UFB build in CY22.

Figure 23 Field Sustain Capex ($CY22 millions)



Data source: Chorus.

Description of Chorus forecasting approach

Chorus' field sustain forecasting methodologies for asset classes within this sub-category are as follows:

- Fibre assets - Fibre assets are replaced when they have degraded and are affecting service levels and effectiveness of capex for this group is measured against the mandatory Layer 1 and 2 Availability quality standards and compliance with performance objectives established under the Network Infrastructure Project Agreement with Fibre Holdings Limited:
  - Fibre lifecycle – based on individual project cost estimates. These estimates are based on identification of network locations where slotted fibre cables have increasing fault rates. In addition, opportunities are taken when Spark is planning on replacing cables to share the cost of cable replacements reducing the costs by 50%. Once routes and distances for cable replacement projects are known, unit rates are built up from FSA-contracted rates for three types of ground conditions. The methodology is systematic and sensible and reflects the approach of a prudent and efficient service provider.
  - Fibre flexible joint rehabilitation – a Price x Quantity estimation basis. This work involves proactively replacing fibre flexible joints where they generate high reactive fault quantities improving reliability and reducing cost. Quantities are based on the available contracted field service labour capacity, setting a cap on how much work is done. This sets the quantity of work that can be completed to 1,000 per annum resulting in a 4,000 forecast for PQP2. Unit costs are calculated using historic actuals adjusted for anticipated changes to cost components.
  - Maintain service fibre – a price x quantity estimation basis. Quantities are based on historic rates of replacement adjusted to reflect network growth, which is based on inter-exchange traffic forecasts, which are in turn informed by bandwidth demand forecasts and network capacity planning. To forecast the cost of this program, Chorus estimates each growth project because they are non-standard using historic actuals and FSA rate cards.
- Ducts and manholes – Ducts and manholes are replaced for health and safety reasons based on condition assessments. Manhole covers, in particular, have been the cause of slip and fall incidents by the public. Chorus has a well-developed program for identifying and replacing pits and lids that present a danger to the public. Chorus' current inspection failure rate for remediation is 18%, which equates to 4,635 manholes per annum to be remediated. Chorus has confirmed

that, like the maintain fibre service category above, forecast unit costs reflect FSA rates, or are based on historical cost for work tendered outside the FSA.

- Poles – Poles carry fibre ducts for some parts of the network where ducts (and cable that is inserted through them) are not installed underground. Poles have an expected economic life of 40 years. Chorus has a well-developed program of pole health assessment to assist in targeting the poles that need replacement. These are forecast on a price x quantity estimation basis. Unit costs are based on historic costs adjusted for known cost increases for poles and contractor rates. Chorus has explained to us what appears to be a rigorous asset condition-based approach to forecasting pole replacement volumes using survivor curve analysis. This analysis forecasts that 8,800 poles will need to be replaced during PQP2.

IV's analysis and key findings

Consistent with the stage of maturity of Chorus' asset management system and associated governance and current practice of not preparing business cases for regulatory purposes, full quantitative analysis using where applicable economic analysis and associated options analysis, risk assessments and sensitivity analysis are not available. Hence, while the need for the capex is clear and the asset management processes that lead to this sub-category of capex appear to be sound and reflect good telecommunications industry practice, the forecasting methodologies are not transparently documented, nor is there full visibility of PQP2 forecast expenditure, including of unit rates and quantities used in the price time quantity forecasting methodologies.

In addition, the Portfolio Overview Documents (POD) documents provide useful explanations of the asset portfolios covering prudency (drivers and benefits assessment of options (unquantified)), method for forecasting forecast quantities and unit costs and some high level indication of quantities (but no historic actual and forecast), input assumptions, expenditure governance (as described above), associated documentation, models, standards and statutory requirements). However, it is all descriptive and unquantified, and key details are not included.

In light of this situation, following release of our Draft IV Report, we spent further time with Chorus' subject matter experts discussing the forecasting approach it had used in developing the PQP2 forecasts, focused particularly on the use of FSA rates and historical project costs, including the extent to which adjustments were being made to these key inputs into the forecasts. We found these additional discussions to be helpful in addressing our concerns. As a result, Chorus was able to confirm the following about the basis of its PQP2 forecasts:

- always uses FSA rates (plus labour and contracted costs for materials) unless a project is separately tendered;
- uses historical actuals - almost always this is the most recent 12 months, though Chorus has the benefit of longer history which can be valuable for less common project types – plus contracted costs for materials, labour;
- uses a combination of historical actuals and FSA rates where it thinks this produces the most reliable estimate – especially for non-standard projects;
- applies regulatory escalations (CPI/RPE) and agreed cost allocators; and
- no further adjustments are made to develop the forecasts – unless there are known changes eg. equipment costs flagged by a supplier for a future date.

Given this additional information and time spent with Chorus' subject matter experts we gained materially more comfort regarding the PQP2 forecasts and specifically Assessment Factor (t) regarding the reasonableness of the key assumptions and forecasting methodologies, Assessment Factor (e) regarding its approach to forecasting capex, including models used to develop the forecasts and Assessment Factor (s) regarding the accuracy and reliability of data.

Verification opinion

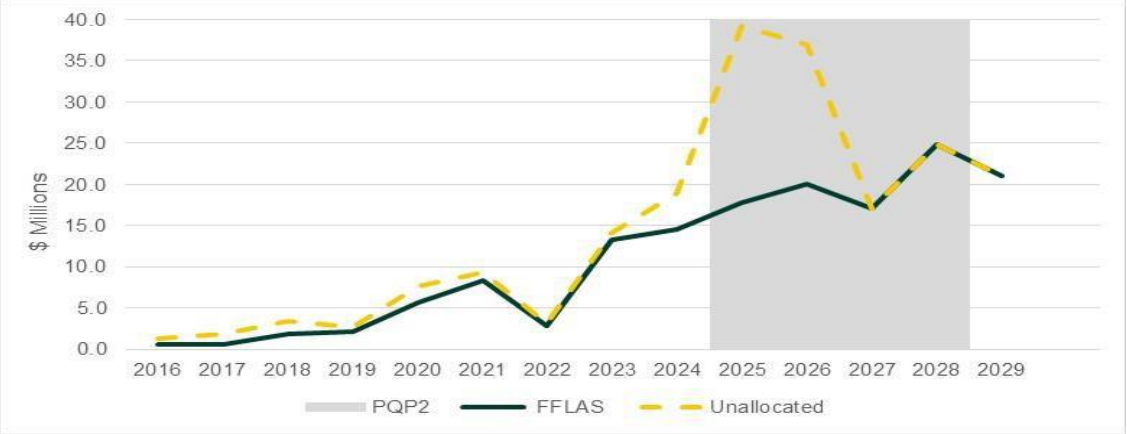
We can verify that Chorus' proposed PQP2 Field Sustain sub-category forecast satisfies the Evaluation Criteria.

In forming this opinion, we have had particular regard to Assessment Factor (a) whether the proposed capex complies with all applicable legal and regulatory obligations associated with provision of PQ FFLAS; Assessment Factor (e) approach to forecasting capex, including models used to develop the capex forecasts; Assessment Factor (k) procurement, resourcing and deliverability of the proposed capex; Assessment Factor (o), the extent of uncertainty related to the proposed capex; Assessment Factor (s) the accuracy and reliability of data; and Assessment Factor (t) the reasonableness of the key forecasting assumptions and methodologies.

9.6.3 Resilience

Figure 24 indicates that the PQP2 forecast for resilience expenditure is materially higher than PQP1 expenditure, primarily reflecting Chorus' intention to undertake a targeted investment program to enhance through creation of dual fibre paths some of the more vulnerable sections of its fibre network.

Figure 24 Resilience Capex ($CY22 millions)



Data source: Chorus.

Chorus' forecasting approach

Scope of PQP2 forecast resilience expenditure

Chorus' PQP2 forecast resilience expenditure involves mainly:

- Duplication of critical network assets to improve reliability performance (i.e. reduce outages) primarily by converting single to dual fibre paths.
- Investment in new exchange sites to accommodate new connections and upgrade existing sites, and improving capacity headroom in network electronics.
- Contingency expenditure on critical spares, such as transportable containerised network nodes, complete roadside cabinets, cable drums.

Network duplication covers the bulk of the proposed PQP2 resilience expenditure program, which includes:

- Ongoing expenditures related to compliance requirements for single element failures impacting over 3,000 consumers – this program commenced in 2019 – and no access site supplies more than 25,000 connections;[25]
  - Chorus notes that these standards originated in the Network Infrastructure Project Agreement (NIPA) with the Crown and have subsequently been approved by Chorus' Board - the standards now form part of Chorus' network architecture standard.

[25] Additionally, Chorus notes that dual path fibre routes or partially diverse routes should be planned for all communities greater than 1,000 premises and for all regional transport routes. Communities between 100 and 1,000 premises are provided with dual path fibre if possible and may be part of other diversity enhancing activity.

  - Chorus also notes the PQ FFLAS mandatory quality standards and its contracts with RSPs (which include availability targets) also drive its decision-making regarding resilience expenditure.

- Incrementally transferring Auckland CBD and six other exchanges' traffic to other sites as it reaches functional limits – this is an ongoing program that started prior to PQP1.

- Improving contingency beyond redundancy and robustness measures in situations when the network still loses connectivity eg during cyclone events. This entails holding critical spares (equipment over and above normal operational spares, including mobile exchanges), as well as proactively surveying major fibre routes (to action remedial works to exposed fibre cable and marking routes to reduce risk of damage by landowners and contractors). Equipment spares are categorised in the following two groups, "normal" and "critical".
  - Forecast PQP2 expenditure for this expenditure sub-category is $0.7 million.

Planning and prioritisation of resilience projects

New resilience projects are planned and prioritised by considering the risk (likelihood and impact) of network outages that the proposed network infrastructure would avoid. Outage impact is based on:

- the number of customers affected (driven by the location of the line, including how close to the POI handover point it is).

- the length of time the network is unavailable (driven by, amongst other factors, the remoteness of the network and the length of the line that needs to be inspected).

Basis of PQP2 resilience forecast

Chorus' forecast is calculated using a volumetric P x Q model.

The price component is based on historical information using the average price for each deployment type as of February 2023 with costs based on previous build activity.

Quantities are based on Chorus' planned resilience programs and some additional reactive projects. The forecast for reactive projects is based on the demand modelling assumptions.

Projects are budgeted on contractual rates agreed under the FSAs and actual costs experienced on prior similar projects. These produce historical rates per metre (overall, not broken down by material), which vary based on different civil construction

conditions, and are classified as easy, medium and hard routes. All dual path projects will be tendered during PQP2.

IV's analysis and key findings

Our assessment is based on our review of the following documents provided by Chorus:

- PQP2 Network Sustain and Enhance expenditure chapter.docx
- Board paper_14 Apr 2023_Strategy_Resilience.pdf
- Network Technology Resilience Update February 2023.pdf
- C016 Robustness Diversity Workings Model v1 2023.xlsx
- DP 2430 Field Sustain Resilience.pdf

Chorus is proposing a step increase in resilience expenditure from around $10 million per annum in PQP1, to a forecast of around $20 million per annum during PQP2 ($79.7 million in aggregate.

Chorus' substantiation of its PQP2 resilience expenditure forecast is based on meeting its network architecture standards (based on the former NIPA UFB contract), the PQ FFLAS mandatory quality standards and its contracts with RSPs. We consider these to be appropriate expenditure drivers. There is also a discretionary dimension to the size of PQP2 resilience expenditure arising from the fact that it is always possible for Chorus to keep building extra redundancy into the network to improve service reliability, but this will ultimately result in a significantly more expensive network service which may exceed end users' willingness to pay.

Substantiation of this discretionary dimension of resilience expenditure is complicated by the lack of a value of lost service (VOLS) estimate to use in an economic investment test along the lines of the 'value of lost load' test is widely used in the electricity network sector. In practice, this places greater weight on stakeholder preferences and the price impact of the proposed expenditure. In this context, the three key factors that have influenced our analysis regarding Chorus' proposed PQP2 resilience expenditure are as follows:

- Whether it has received strong stakeholder support revealed during Chorus' PQP2 engagement process.
- Whether expenditure is well-targeted in terms of maximising the benefit of the investment to end users.

- The price impact of the expenditure is not excessive, recognising its cost will be recovered across all FFLAS end users given Chorus must charge the same price for a service that is "materially the same" regardless of location of the end user.

PQP2 stakeholder engagement

In the final round of Chorus' PQP2 stakeholder engagement, it directly tested preferences for resilience expenditure, including 'current', 'decreased' and 'increased' investment options with majority support for the highest investment option. PQP2 engagement found resilience is the top investment priority for end-users, RSPs and other stakeholders.

Chorus notes that the Kantar surveys were held just a few months after Cyclone Gabrielle, when the importance of resilience was highlighted. It has considered this timing in proposing PQP2 resilience expenditure that is consistent with the 'current' rather than 'increased' investment option noting that the 'current' option is still a step-up relative to PQP1.

We consider Chorus has effectively consulted with its stakeholders in relation to the size of its proposed PQP2 resilience expenditure. Chorus provides a sound reason for adopting the 'current' rather than 'increased' investment option. The 'current' option is also likely to be more consistent with overall stakeholder concerns about fixed fibre affordability than the 'increased' investment option. We are also aware that Chorus is not fully recovering its maximum allowable revenue, which provides support for it taking a prudent and disciplined approach to its investment.

Targeted resilience expenditure

We are satisfied that Chorus has a long term planning process that identifies resilience projects and prioritises their implementation based on benefit maximisation to affected end users.

Price impact

The price impact of the proposed PQP2 expenditure program appears to be moderate and has been tested in depth with Chorus' stakeholders as part of its PQP2 stakeholder engagement process.

Value of loss of service

We support Chorus' intention to develop a measure of the VOLS estimate to test the economic benefits of investments. It indicates that it has carried out some initial analysis to start the process of developing a VOLS that is suitable for Chorus' FFLAS business

but that has not yet delivered a reliable methodology for testing the economic benefits of resilience capex.

Chorus' intention to develop a VOLS estimate is a good one that would provide value in its investment decision making not just for resilience expenditure but other programs where avoided outages are a primary driver of investment. Such an estimate would underpin Chorus' greater use of economic analysis in its investment planning for PQP3.

In our view, a reasonable approach to establish a VOLS estimate would be to use a combination of contingent valuation and choice modelling survey techniques. Essentially, the contingent valuation would be used to determine the end user's willingness to pay to avoid a baseline outage scenario, with choice modelling used to determine the increment (or decrement) in value that end users placed on specific outage attributes in addition to the baseline outage scenario.

This type of surveying is expensive if done thoroughly and given the importance of a VOLS estimate to the PQ FFLAS regulatory framework, we think Chorus should be provided additional dedicated funding to undertake the work with the Commission providing oversight and input into the development of the VOLS methodology.

Verification opinion

We can verify that Chorus' proposed PQP2 Resilience expenditure satisfies the Evaluation Criteria.

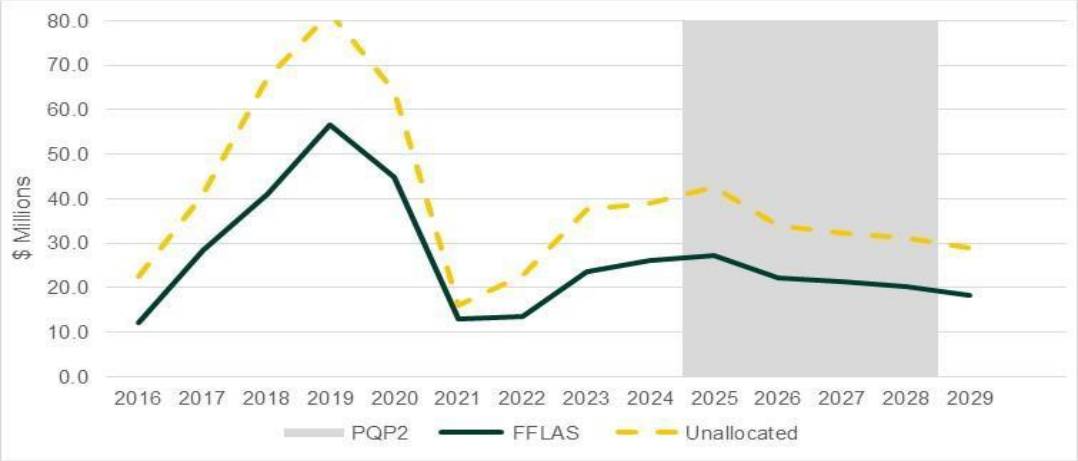
In forming our opinion, we have had particular regard to: Assessment Factor (e) approach to forecasting capex; Assessment Factor (h) regarding the linkages between proposed capex and quality; Assessment Factor (j) regarding incorporation of stakeholder feedback into the PQP2 capex proposal, including in relation to the quantum of investment and associated modest price impact; Assessment Factor (k) regarding procurement, resourcing and deliverability; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon.

Greater transparency regarding the build-up of the PQP2 forecast would provide greater confidence regarding its quantum but it has been tested with and supported by stakeholders.

9.6.4 Site Sustain Capex

Figure 25 presents the times series for Site Sustain expenditure sub-category from CY16 to CY29, with average annual expenditure forecast to be around the same level in PQP2 as in PQP1 notwithstanding the declining trend in PQP2.

Figure 25 Site Sustain Capex ($CY22 millions)



Data source: Chorus.

Chorus' forecasting approach

Chorus' Earthquake Remediation Portfolio outlines its plan to bring earthquake prone buildings (EPB) up to a consistent standard that meets legislative requirements. Chorus has approximately 2,600 structures/buildings, of those it estimates it has around 500 that support fibre services.

In New Zealand, the Building Act assigns an Importance Level (IL) 1-5 to a building that is determined by risk to human life, the environment, economic cost and other risk factors in relation to its use. The Importance Level of a building is determined in accordance with AS/NZS 1170.0.

Up to 2021, Chorus had considered all of its buildings to have an Importance Level of 3. Level 3 (IL3), structures may contain crowds, have contents of high value to the community or pose a risk to large numbers of people in close proximity, such as conference centres, stadiums and airport terminals.

In 2021, the Chorus executive endorsed that Chorus adopt an Earthquake Importance level four (IL4) as its standard for core, mesh sites as these sites aggregate traffic and provide the critical handover functions to RSPs where up to one hundred thousand (unprotected) customers are dependent on the site, making them of significant importance from a Lifeline perspective.

IL4, structures must be operational immediately after an earthquake or other disastrous event, such as emergency shelters and hospital operating theatres, triage centres and other critical post-disaster infrastructure. Chorus' assessment is that its Core and Mesh sites must be operational after an earthquake or disastrous event as those sites supply

the Chorus network and other services such as backhaul for mobile providers and are therefore critical for post-event communications.

Chorus has provided a Portfolio Overview Document (POD) in relation to the Site Sustain sub-category, which explains its expenditure drivers, investment options, forecasting approach and governance.

In developing its PQP2 forecast, Chorus notes that it is not possible, without detailed structural engineering drawings, nor sensible, to get detailed scope of work drawn up or costed until it has identified and or chosen the best course of action for each earthquake prone building (EPB). Options are very site-specific and may change over time.

However, Chorus has established a process that identifies the costs associated with all the activity that is required to be undertaken on an EPB over the next 10 years to keep the site at an acceptable level of repair, safety and watertightness. This is compared to the cost of other options that would allow it to exit the site or change the importance level of the EPB.

Until it has undertaken this site options analysis, high level cost estimates are used – large, medium and small – which are related to the size of the building, the number of stories, and the issues identified. The cost estimates are based on Chorus' experience to date with earthquake strengthening projects.

The budget of each EPB remediation project is a Prices x Quantity calculation. However, once an option has been chosen the work involved will be subject to competitive tender.

IV's analysis and key findings

Based on our review of the POD, we consider that Chorus is taking a prudent approach to meeting legislative requirements associated with earthquake prone buildings and structures. This includes consideration of various options and detailed planning of the best approach to remediation on a site-specific basis.

We also accept that estimating forecast costs for this type of expenditure is likely to be very difficult and subject to a high degree of uncertainty given its site-specific nature. Chorus' intention to seek competitive tenders for remediation work once detailed remediation planning is completed should deliver an efficient cost outcome.

Given these factors, we consider that Chorus is taking a prudent and efficient approach to its Site Sustain forecast expenditure in PQP2.

Verification opinion

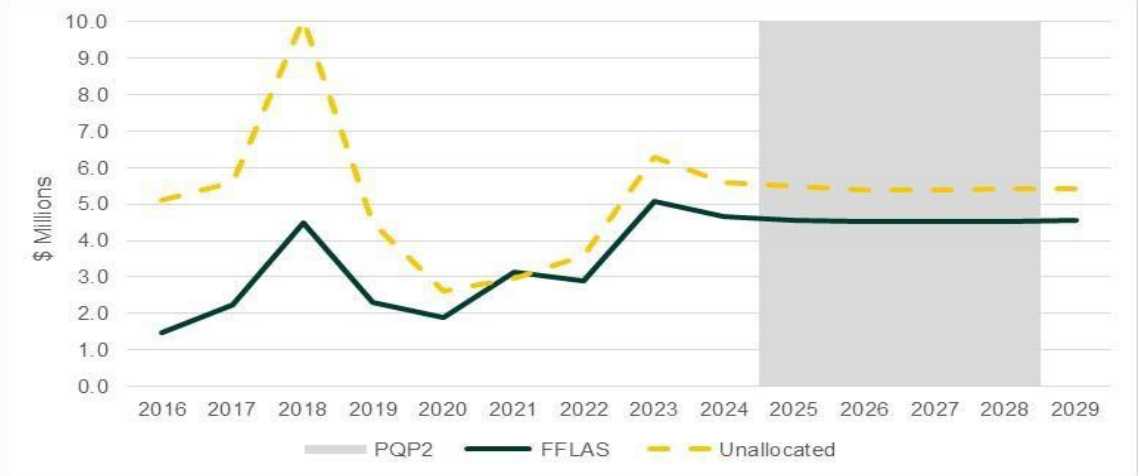
We can verify that Chorus' proposed PQP2 Site Sustain expenditure satisfies the Evaluation Criteria.

In forming our opinion, we have had particular regard to: Assessment Factor (a) regarding whether the capex complies with all applicable legal and regulatory obligations associated with the provision of PQ FFLAS; Assessment Factor (c) regarding historic capex and consideration of historic rates of investment; Assessment Factor (k) regarding procurement, resourcing and deliverability; and Assessment Factor (n) regarding mechanisms for controlling actual capex with respect to proposed capex and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon.

9.6.5 Re-locations

The Re-location expenditure time series between CY16 and CY29 in Figure 26 indicates that the PQP2 forecast for re-location expenditure is flat.

Figure 26 Re-locations ($CY22 millions)]



Data source: Chorus.

Chorus' forecasting approach

Chorus notes that Re-locations expenditure capex has grown over time as the fibre network has grown but remains relatively modest because a large portion of costs are recovered from road authorities (with demand arising from changes to road layout, new road construction, utilities, bridges or seal replacement). Removing cables from poles and installing replacement routes in underground ducts, as well as third-party requests are other reasons for requested fibre re-locations.

This expenditure sub-category is demand driven (but not Chorus' typical demand drivers) and largely reactive and as such Chorus expects spending to remain relatively steady in real terms over PQP2.

In terms of the PQP2 forecast, re-locations costs for individual projects vary depending on the scale and type of affected network elements with unit costs based on FSA rate cards for different types works.

Chorus indicates that its PQP2 forecast expenditure is calculated using a P x Q method based on historical average costs and volumes. This approach is appropriate as roadworks re-locations work has relatively consistent costs and volumes. Prices are calculated based on historical costs over the previous 12-month period and quantities are calculated based on a historical average run rate.

IV's analysis and findings

Chorus provides a good explanation of its forecasting approach and underlying assumptions used to develop its PQP2 Relocations forecast.

The PQP2 forecast is flat and consistent with PQP1 expenditure. Given this is a relatively small expenditure sub-category in PQP2 and we have identified no concerns with Chorus forecasting approach, we have not subjected it to more detailed analysis.

Verification opinion

We can verify that Chorus' PQP2 Re-locations forecast satisfies the Evaluation Criteria.

In forming our opinion, we have had particular regard to: Assessment Factor (c) regarding historic rates of investment; Assessment Factor (m) regarding fibre asset and fibre network information; and Assessment Factor (s) regarding the accuracy and reliability of data.

9.7 IT and Support

The IT and Support sub-category group is broken down into the following sub-categories:

- Business IT – systems and platforms needed for Chorus' day-to-day business activities.
- Network & Customer IT – systems and platforms that help Chorus run the network and manage the processes that are important for its customers.
- Corporate – accommodation, office equipment and other capital expenditure.

Of these sub-categories, Business IT and Network & Customer IT are identified as Priority Areas and account for most of IT and Support forecast expenditure in PQP2.

Table 19 presents the PQP2 expenditure forecasts for this expenditure sub-category group.

Table 19 IT and Support PQP2 forecasts ($CY22 millions)

Sub-category	CY25	CY26	CY27	CY28	Total PQP2
Business IT	17.7	19.6	19.0	16.2	72.6
Network & Customer IT	25.2	24.5	23.2	22.1	94.9
Corporate	1.4	1.9	1.8	7.5	12.7
TOTAL	**44.3**	**46.0**	**44.0**	**45.8**	**180.2**

Data source: Chorus

Of the capex sub-category groups that we have reviewed, IT and Support is the most highly shared between Chorus FFLAS and its copper line services, such that FFLAS capex is more strongly affected by cost allocations than the other capex sub-category groups. This also means that as the copper service declines in PQP2 (and PQP3), an increasing proportion of IT and Support Costs will be allocated to PQ FFLAS capex.

9.7.1 Chorus' supporting information

Our assessment of Chorus' IT and Support sub-category group PQP2 capex forecasts is based on the following documents that it has made available to us:

Pre-Draft IV Report

- IT & Support PQP2 chapter template version.docx [Document 9AAK]
- Delivery PQP2 IT only section.docx [Document 9AAL]
- 8.0 IT PQP2 Draftv3.docx [Document 9AAM]
- IT PQP2 Supplementary Information.docx [Document 9AAN]
- CO21 CTO IT Capex cost_model_10YP FY24-FY33 (v2).xlsx [Document 9AAO]
- CTO IT Capex Cost model_10YP FY24-33 (FOR IV).xlsx [Document 9AAP]
- CO21 CTO IT Capex Model spreadsheet explanation.mp4 [Document 9AAQ]
- 2.CNO-606 Epic.docx [Document 9AAR]
- 3.Appointment Capability assessment.pptx [Document 9AAS]

- 4.CNO-606+Serco+appointment+booking+capability.doc [Document 9AAT]
- 5.CusESG Pack - 24th November 2022.pptx [Document 9AAU]
- 6.CAMS Funding request.pptx [Document 9AAV]
- 7.Epic+Design+-+CNO-606_+Serco+Appointment+Booking.doc [Document 9AAW]
- 8.Tier 1 BC – Serco Appointment booking capability.xlsm [Document 9AAX]
- 9.RE_ Technology business case approvals - May 23.msg [Document 9AAY]
- A.Chorus+New+Technology+&+Solution+Options+Assessments+(5i+ Assessment)+ Guidance.doc [Document 9AAZ]
- B.Cloud Data Ingestion.pptx [Document 9AAAA]
- Service Company Gateway.pptx [Document 9AAAB]
- **CCI [ ]**
- RFI_IT estimation and BCs_26 Sept.docx [Document 9AAAD]

Post-Draft IV Report

Chorus also provided further supporting information for its approach to forecasting IT and Support capex, including several past IT business cases as follows:

- **CCI [ ]**
- **CCI [ ]**
- **CCI [ ]**
- **CCI [ ]**
- Tier 1 – Facilities Management Integration.xlsm [Document 9AAAI]
- **CCI [ ]**
- **CCI [ ]**
- Serco Appointment Booking Capability.xlsm [Document 9AAAL]
- **CCI [ ]**

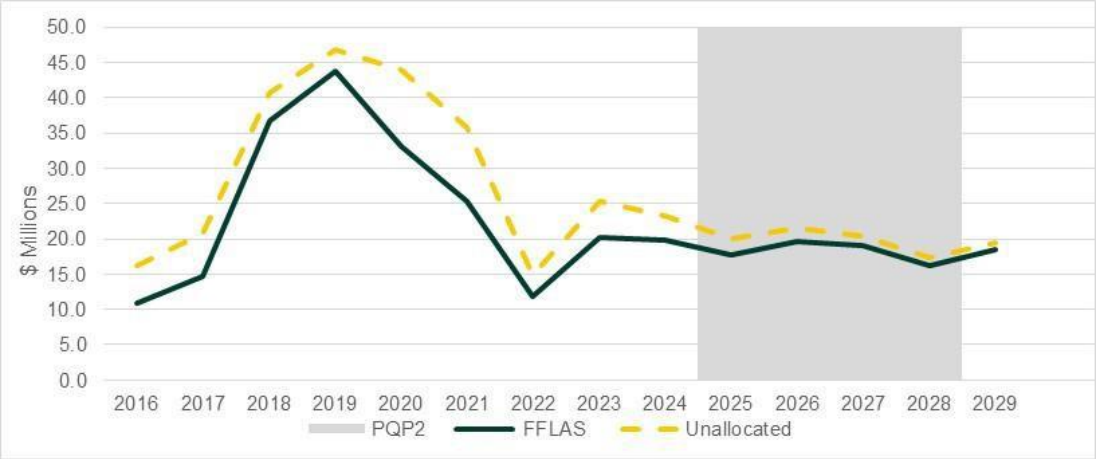
9.7.2 Description of Chorus' forecasting approach: Business IT and Network & Customer IT

Chorus notes that the Business IT and Network & Customer IT capex sub-categories are forecast and managed in similar ways reflecting Chorus' operational model for IT planning and delivery. Consequently, we have assessed and formed verification opinion in relation to these two IT sub-categories together, with the Corporate sub-category assessed separately with a separate verification opinion (at the end of the chapter).

Business IT

Figure 27 presents the time series of Chorus' Business IT capex from CY16 to CY29. Forecast expenditure for PQP2 is broadly in line with PQP1 expenditure.

Figure 27 Business IT Capex ($CY22 millions)

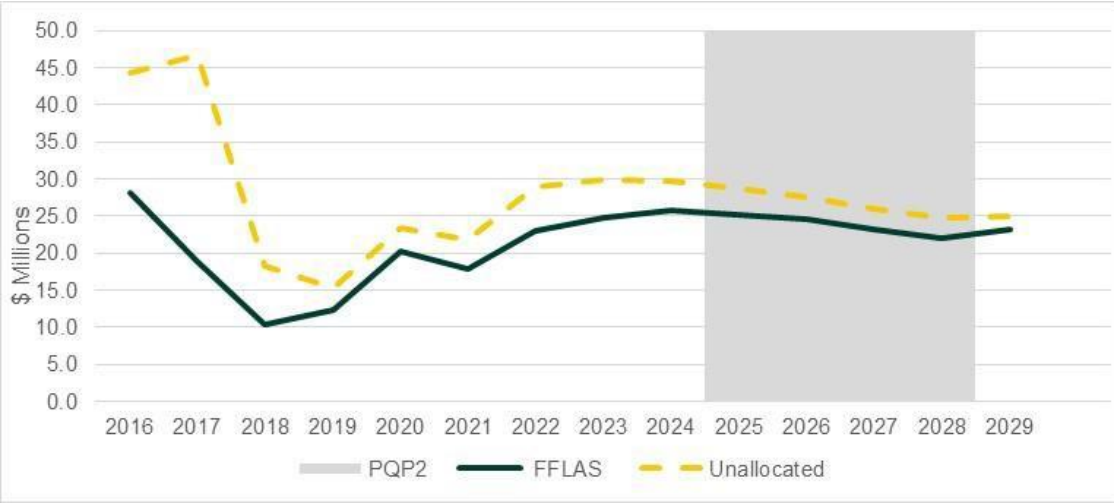


Data source: Chorus.

Network & Customer IT

Figure 28 presents the time series of Chorus' Network and Customer IT capex from CY16 to CY29, with PQP2 forecast expenditure trending down at a somewhat slower rate than business-wide (unallocated) expenditure, most likely indicating an increasing allocation of costs to FFLAS as the copper service declines.

Figure 28 Network & Customer IT Capex ($CY22 millions)



Data source: Chorus.

Chorus applies the same forecasting approach across the Business IT and Network & Customer sub-categories described above.

Chorus has identified three ongoing investment drivers for its IT expenditure in these two IT sub-categories: Lifecyle & Compliance, Product & Customer, and Chorus Optimisation.

The breakdown of PQP2 forecast IT expenditure by these three drivers is as follows:

- Lifecycle & Compliance (57% of expenditure),
- Product and Customer (24%) and
- Chorus Optimisation (19%).

Lifecycle & Compliance

Chorus states that the PQP2 expenditure will fund several major software upgrades including:

- A major version upgrade or replacement of the 'trouble' ticketing software
- A major version upgrade of the fibre service order manager
- A major version upgrade of the virtualised server hosting and firewall platform
- Continued software licence purchases and upgrades to support the integration and automation systems
- Continued hardware purchases for the laptop fleet and Chorus data centres.

Product & Customer

This category involves the improvement and refinement of product offerings and RSP support tools, such as continued capability to create self-service experiences for RSPs to offer to end-users. The Product & Customer roadmap is typically only 18 months long and so specific initiatives for the PQP2 period are not yet developed by Chorus.

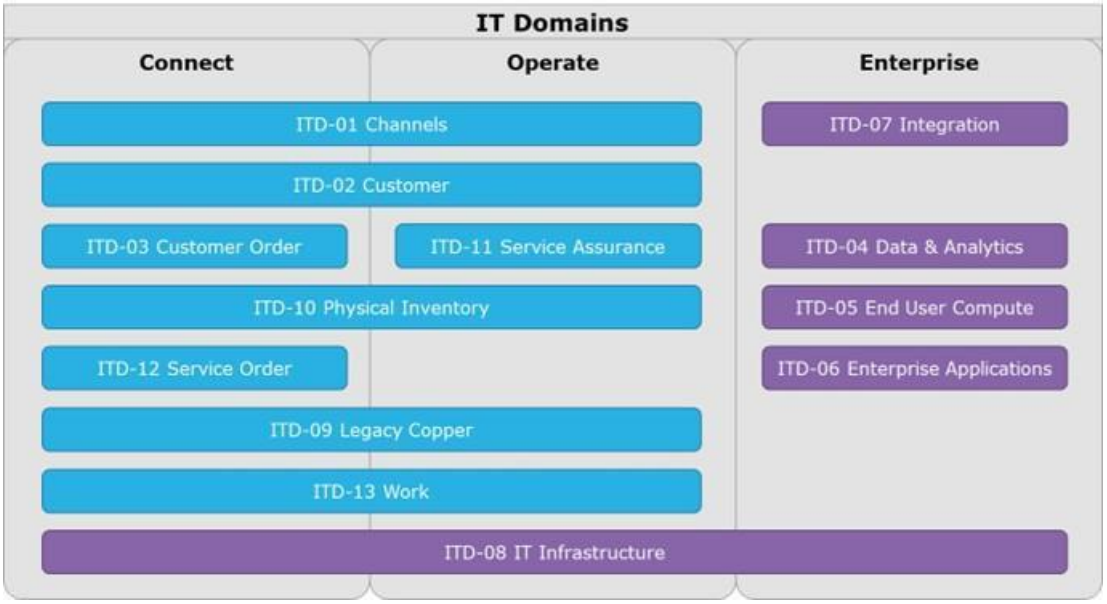
Chorus Optimisation

This expenditure will fund several new organisational capabilities, as well as continue to tune, automate, and optimise the existing business operations. This includes investment to further evolve asset management capability as outlined in the three asset management roadmaps submitted to the Commission in August 2022.

Management of IT

Chorus notes that it has organised IT planning, forecasting, delivery, operations, and expenditure around 13 IT Domains. Figure 29 shows the organisation of the IT sub-categories into IT domains, which reflect Chorus' operational model for IT planning and delivery and the three drivers of IT investment (Connect, Operate and Enterprise) applied to these domains as part of Chorus' planning and forecasting methodology.

Figure 29 Chorus' IT Domains



Blue domains are Network and Customer IT.

Purple domains are Business IT.

PQP2 forecasting approach

Following a shift to its organisation-wide 10-year planning horizon in 2022, Chorus's IT forecasting approach evolved to place more emphasis on its investment strategy and top-down planning including:

- Chorus' new technology delivery operating model is aimed at more predictable and recurring IT investment where its available resources are under direct Chorus planning and remain relatively stable over time. This has allowed Chorus to better marry top-down forecasts of capacity with bottom-up forecasts of initiatives, purchases, and statements of work from vendors.
- Previously, Chorus had outsourced more of its technology delivery and organised and delivered projects using a Price x Quantity waterfall methodology for each individual investment initiative across domains. It used historical spend to validate feasibility and overall forecasts. Historical spend is still relied on for estimating some project costs but does not directly drive planned projects or programs in PQP2.

Chorus considers this approach to be strategically and tactically sound because it recognises the need to steward IT resources prudently. Communications services are highly IT dependent and are at the heart of effective and efficient fibre and copper service provision. Within this framework, effective governance at the project level will be the final element in ensuring prudent and efficient IT capex.

There are three steps to Chorus' forecasting approach.

(a) Investment strategy. Understand Chorus' changing environment over a longer-term horizon informed by internal and external priorities. Chorus applies a Technology Strategy that flows out of Chorus' corporate strategy and objectives. The Technology Strategy is founded on five strategic focus areas each with its own objective. From these objectives it identifies the initiatives with desired outcomes and implementation timing.

(b) Bottom-up plans. Identify key drivers of investments across the 13 technology domains noted above, considering technology suppliers' roadmaps and organisational and stakeholder priorities for each domain. Chorus then undertakes needs and options assessments to develop a bottom-up list of projects and plans over a 10-year horizon. The bottom-up plan will always produce a greater 'backlog' of work than Chorus can execute each year, and/or that it can afford to fund. Ultimately, prioritisation and governance processes within Chorus will determine what work proceeds in what order. A portfolio (top-down) view is then overlaid to identify within the constraints of Chorus' largely fixed resourcing, the optimal mix

of projects and programs that provide the best value, aligning with longer term investment priorities and delivering customer preferences. Optimisation continues within each period as annual business plans are validated and challenged, and subject to final Chorus Board approval.

The top-down view considers the following five components:

- Chorus Resources account for approximately 61% of the capital cost of the 10-year plan. This is the capital cost of the Chorus permanent and contract resources who play a role in the delivery of the IT business plan.
- Vendor Staff Augmentation Resources account for approximately 15% of the capital cost of the 10-year plan. This is the capital cost of the highly specialised vendor resources that Chorus uses to augment Chorus Resources on specific domains for the delivery of the IT business plan.
- Vendor Statements of Work account for approximately 15% of the capital cost of the 10-year plan. Chorus can engage existing or new vendors for IT professional services over time. This method is used for more infrequent work where permanent resourcing would not be appropriate, or to manage complex components of initiatives in a fixed-price manner for better certainty.
- Software Costs account for approximately 3% of the capital cost of the 10-year plan. Although Chorus now consumes more cloud and software-as-a-service-based software, it still purchases and is able to forecast future investment to acquire software and licensing.
- Hardware Costs account for approximately 3% of the capital cost of the 10-year plan. Chorus acquires hardware when required to support new capability, or to replace existing hardware in line with asset lifecycle treatment. This ranges from large equipment within its data centres down to individual laptops.

This capital plan workbook attempts to reconcile both top-down and bottom-up planning inputs to produce a consolidated output.

Specific planned expenditure that has a high level of confidence can be elevated from the bottom-up plan to the top-down plan. All these assumptions that drive future macro planning provisions, changes in macro resourcing, major replacement projects, or major software/hardware purchases are recorded in this plan and are visible in the top-down planning section.

Chorus has a governance and approval process for the introduction of new technology that covers the key areas of:

- Innovation
- Investment
- Integrity and risk assessment
- Integration
- Information and data management.

Governance of the IT function occurs within Chorus' business wide governance framework, which includes quarterly and annual planning cycles. On an annual basis, Chorus holds a business plan domain review. This involves a 2-day thorough review of the plans for each domain. The quarterly review process is embodied in what Chorus calls 'Big Room Planning' (applying the Agile project management framework), which occurs over three days. As part of this process, Chorus undertakes Quarterly Domain Reviews, which involve a thorough review of the status and progress for each domain and activities to be undertaken in the quarter ahead.

9.7.3 IV's analysis and key findings

Chorus provided us with a document titled IT PQP2 – Supplementary Information that is like what would have been developed as a Portfolio Asset Management Plan. The document sets out the strategy, plan and processes for managing its IT assets covering investment drivers, risk frameworks, planning, deliverability, governance and domain summaries. We have not had the opportunity to review documents that are the outworking of the Supplementary Information.

Chorus initially provided supporting information regarding the need for the proposed PQP2 capex but did not include any PQP2-related business cases with economic or quantitative analysis, such as cost-benefit assessments, options analysis justifying the capex and timing. We understand that PQP2-related business cases will be undertaken as part of the IT capex governance process and will not be available until about 12 months before the expenditure is required.

However, to gain a better understanding of Chorus' IT business case and associated governance processes, following the release of our Draft IV Report, we reviewed several past IT capex business case and approval processes. Based on this review, it is evident that Chorus does not apply standard economic regulatory investment tests for its IT expenditure forecasts. This is a matter that over time we think it should address. Nevertheless, Chorus has a robust and comprehensive approach to managing its IT assets, which is essential for its success. Its Technology Strategy clearly flows out of its corporate strategy.

We have also been able to review Chorus' comprehensive model of its IT capex (CO21 CTO IT Capex cost_model_10YP FY24-FY33 (v2).xlsx). It shows how the bottom-up and top-down forecasts are undertaken but does not provide an explanation of how the costs were estimated for the 576 capex items in the bottom-up forecast or their timing. Given the large volume of information in this model, it has not been possible for us to verify the accuracy and reliability of underlying data used in the cost build-up of the IT expenditure forecast. Consequently, we have relied more upon Chorus' approach to forecasting IT capex and the reasonableness of its key assumptions and forecasting methodologies in forming our verification opinion.

Overall, Chorus' approach to forecasting IT capex is fundamentally different from physical assets, such as its fibre network assets, but we find this approach to be well thought through stewarding its IT investments in a way that is more fit-for-purpose than would be the case for physical assets. Its approach reflects the critical importance of the role of IT assets in a telecommunications business.

We note that the proposed PQP2 capex program at a business-wide (unallocated) level is substantially lower than has been required in the period from CY16 to CY22. The PQ FFLAS IT capex forecast for PQP2 is consistent with historic expenditure and remains essentially constant. Overall, we believe the PQP2 IT capex forecast is based on good strategies and processes.

Post-Draft IV Report discussions

Given the concerns we had at the Draft IV Report stage about the lack of economic analysis underpinning the PQP2 IT and Support capex forecasts, we spent further time discussing the basis of the PQP2 forecasts with Chorus subject matter experts, including in relation to the CO21 CTO IT Capex cost_model_10YP FY24-FY33 (v2).xlsx. Chorus also provided further supporting information for its approach to forecasting IT and Support capex, including several past IT business cases noted above.

Chorus notes that the additional supporting documents are a mix of lifecycle, obsolescence, customer demand, compliance and cost reduction business case and Board papers. We agree with Chorus that some business cases present more inputs/analysis than others. However, Chorus notes there will always be detailed information outside its business case template, with the completed template showing just the aggregate input e.g. capex by year, plus a description of what the investment is for, usually the options it has considered and risks.

The business case template is not in a standard regulatory format but is used to provide what is needed to satisfy a commercial investment decision by an informed Executive(s). Chorus has advised that it intends to adjust the business case templates to more cleanly

address regulatory expectations. However, it does not think this will alter decision making, but rather will make the business cases more useful for regulatory evidencing purposes. We agree with this assessment and support Chorus' intent.

Cost recording and estimation accuracy over time

Chorus tracks actual costs for each IT initiative to compare actual with forecast (estimate) to validate / improve estimation accuracy. It provided us with evidence of this tracking process, which appears to be rigorous and shows close tracking of actual and estimated costs. In our view, this shows a strong disciplined approach to managing IT costs.

The estimation process for large projects in the 10-Year Plan file and PQP2 proposal is as follows:

- Having identified the expected initiatives (the Q in the Price x Quantity estimate), Chorus uses actual cost of comparably sized 'epics/initiatives' (if similar exist) to estimate cost for the epics/initiatives in the PQP2 plan.[26] 'Epics/initiatives' are sized based on previous experience and observed actual costs. In doing this, it takes account of previous estimation accuracy to improve future estimates and remove any biases.
- If outside labour is required, Chorus uses a similar process ('t-shirt size') to estimate the quantity of support needed, contract prices (or best estimate if contract price is not available). For equipment or software, it applies contracted rates where available or a best estimate (which may be historic actuals or market survey / insight).
- In the absence of the economic analysis generally expected for investment decision-making in a regulatory context noted above, our review of the additional information provided by Chorus provided us with confidence that strong financial discipline and cost control is being exercised in relation to Chorus' IT spend in an ongoing sense. In our view, this is also reflected in the quantum of the PQP2 IT capex forecasts, which as previously noted are consistent with Chorus' historic IT expenditure.

Verification opinion – Business IT and Network & Customer IT

We can verify that Chorus' proposed PQP2 Business IT and Network & Customer IT sub-category forecasts satisfy the Evaluation Criteria.

[26] Chorus applies the Agile project management tool in its IT operations.

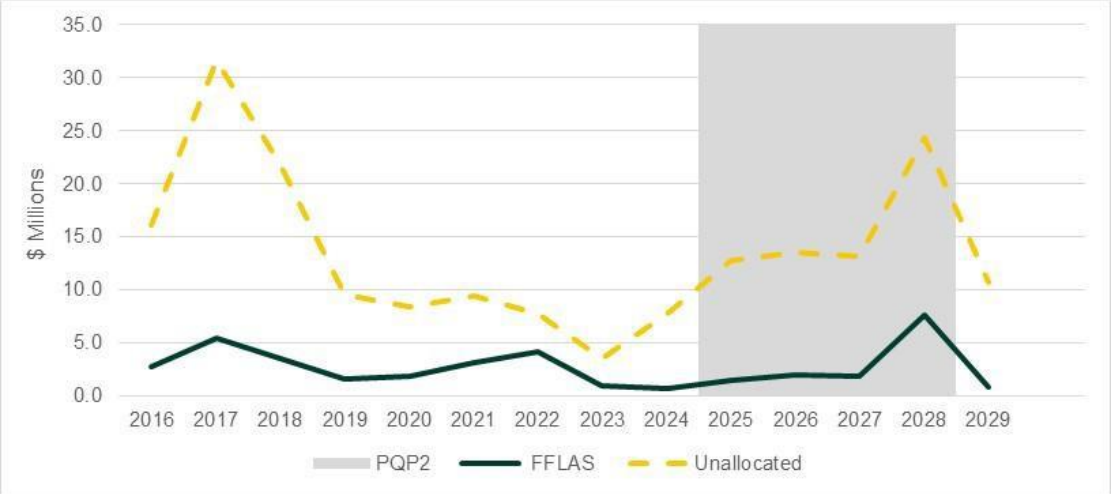
In forming this opinion, we have had particular regard to: Assessment Factor (c) consideration of historic rates of investment; Assessment Factor (e) approach to forecasting capex, including models used to develop the capex forecasts; Assessment Factor (k) procurement, resourcing and deliverability of the proposed capex; Assessment Factor (n) mechanisms for controlling actual capex with respect to the proposed capex; and Assessment Factor (t) the reasonableness of the key forecasting assumptions and methodologies relied upon.

9.7.4 Chorus' forecasting approach: Corporate

Chorus' Corporate capex has somewhat different drivers to the Business IT and Network & Customer IT sub-categories, with this sub-category expenditure driven primarily by Chorus' corporate accommodation needs (ie. office equipment and any associated capex). Figure 30 presents the time series of Chorus' FFLAS Corporate capex from CY16 to CY29. Forecast expenditure for PQP2 FFLAS is flat notwithstanding an increase in business-wide (unallocated) expenditure.

The spike in FFLAS Corporate capex in FY28, which is driven by an office and an associated allocation from business-wide Corporate capex, reflecting the heavily shared nature of this expenditure sub-category.

Figure 30 Corporate Capex ($CY22 millions)



Data source: Chorus.

Chorus forecasting approach

The PQP2 Corporate forecast is based on a Price x Quantity approach, with the forecast reflecting upcoming accommodation-related lease events (renewal or expiry), occupancy and space requirements. Chorus notes this planning and spending is within its control and therefore uncertainty regarding the PQP2 forecast is low.

The PQP2 forecast assumes Chorus will **CCI [**

], resulting in an $8 million spike in expenditure that year. Other than this uplift, Chorus notes its intention to keep business-related corporate expenditure steady.

IV's finding and analysis

We agree with Chorus that this should be a relatively predictable capex sub-category to forecast and that periodic uplifts in expenditure are likely as corporate accommodation leases expire and are renewed.

Other than the FY28 lease renewal, the PQP2 forecast is flat and consistent with PQP1 expenditure. Given this is a relatively small expenditure sub-category in PQP2 and we have identified no concerns with Chorus forecasting approach, we have not subjected it to more detailed analysis.

Verification opinion – Corporate IT

We can verify that Chorus' PQP2 Corporate forecast satisfies the Evaluation Criteria.

In forming our opinion, we have had particular regard to: Assessment Factor (c) regarding historic rates of investment; Assessment Factor (m) regarding fibre asset and fibre network information; and Assessment Factor (s) regarding the accuracy and reliability of data; and Assessment Factor (t) the reasonableness of the key forecasting assumptions and methodologies relied upon.

10 PQP2 Connection Capex Forecasts

The purpose of this chapter is to discuss Chorus' PQP2 Connection Capex forecast.

The Fibre IMs define Connection Capex as capex that is directly incurred by Chorus in relation to connecting new end-user premises, buildings or other access points where the communal fibre network already exists or will exist at the time of connection.

Chorus is required by the Fibre IMs to identify Connection Capex separately from the rest of Base Capex, split between variable costs (those costs that vary linearly with connections) and non-linear costs (those that do not vary linearly with connections).

10.1 Our assessment factors

The following assessment factors were used to assess Chorus' PQP2 Connection Capex forecasts:

- Whether the proposed capex complies with all applicable legal and regulatory obligations associated with the provision of PQ FFLAS (Assessment Factor (a)).
- Historic capex and consideration of historic rates of investment (Assessment Factor (c)).
- Approach to forecasting capex, including models used to develop the capex forecasts (Assessment Factor (e)).
- Accuracy and reliability of data (TOR Assessment Factor (s)).
- The reasonableness of key assumptions, methodologies, planning, and technical standards relied upon (TOR Assessment Factor (t)).

These Assessment Factors were chosen because we consider that the demand-driven nature of the Connection capex sub-category requires most focus on the forecasting methodologies and assumptions that underpin the PQP2 forecasts, with some regard to historic capex levels.

In reviewing the PQP2 Connection Capex forecasts, our assessment of Chorus' connection demand forecasting methodology is also relevant.

10.2 Chorus' supporting information

Our assessment of Chorus' Connection sub-category group PQP2 forecasts is based on the following documents that it has made available to us:

- Connections capex report.docx [Document 10A]

- Connection capex PQP2 chapter template version.pdf [Document 10B]
- Copy of RT04 – Connections capex v3c_No links version.xlsx [Document 10C]

In addition to this supporting documentation, we also had regard to the following documents that we reviewed as part of our assessment of Chorus' demand forecasting methodologies:

- Connections Model_Documentation_FY24 v2.0.docx [Document 4F]
- Connections Model_Fy24 BU_v 1.05_IV_0.02.xlsx [Document 4G].

10.3 Description of Chorus' forecasting approach

Chorus has developed PQP2 Connection Capex forecasts for each year of PQP2 that include:

- a connection capex baseline allowance forecast for each connection type approved by the Commission for PQP1 as follows;
  - 10 connection capex unit cost groups used to calculate the Connection Capex baseline allowance; and
  - forecast volumes by each connection type used to calculate the Connection Capex baseline.

10.3.1 Chorus' PQP2 Connection Capex baseline forecasts

Table 20 provides the forecast connection volumes and associated unit costs underpinning Chorus' aggregate PQP2 Connection Capex forecast.

Table 20 PQP2 Connections Capex baseline forecasts ($CY22 millions)

Group	Description	CY25 ($m)	CY26 ($m)	CY27 ($m)	CY28 ($m)	PQP2 Total ($m)
Standard – installation						
1	Simple – installation to greenfield, or to MDU or ROW extension	15.043	12.731	12.714	10.009	50.498
2a	SDU general (excl. civil)	13.115	12.761	12.249	10.778	48.904
2b	SDU civil	7.233	5.581	3.789	3.309	19.912
Standard – extension						
3	Class 1 (two to five MDU drop-off points or ROW buildings) and fibre access	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]

Group	Description	CY25 ($m)	CY26 ($m)	CY27 ($m)	CY28 ($m)	PQP2 Total ($m)
4	Class 2 (six to 12 MDU drop-off points or ROW buildings)	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
5	Class 3 (13 to 48 MDU drop-off points or ROW buildings)	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
6	Class 4 (49+ MDU drop-off points or ROW buildings)	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
Standard – ONT						
7	Hyperfibre	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
8	Non-Hyperfibre	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]	CCI [ ]
Complex						
9	All complex	2.526	2.476	2.409	2.342	9.754
Hyperfibre access						
10	Non-linear Hyperfibre costs	-	-	-	-	-
Total connection capex baseline forecast		***55.526***	***50.261***	***46.395***	***37.867***	***190.048***

Around $119.3 million (or around 63%) of Chorus' PQP2 Connection Capex baseline forecast relates to Standard Installations (simple and single dwelling unit (SDU) installations), with Group 3 (Class 1 extension) also relatively large at **CCI [ ]**.

Further, Table 20 indicates that Chorus' Connection Capex is forecast to decline over PQP2 in line with Chorus' PQP2 connections forecast, which is primarily driven by a reduction in Standard Installations connections of around 46%.

We assess the underlying drivers of the PQP2 Connection baseline forecasts in section 10.3.2 of this chapter.

Connection groups

Chorus has characterised the connection groups in Table 20 as follows:

- Group 1 – Standard Installations – once extension work is completed, no additional work is required to visit the site and fit fibre-to-the-premises.

- Groups 2(a) and (b) – Standard Installations – once extension work is completed (if applicable) each installation request triggers additional work to visit the site and fit fibre to the premises.
- Groups 3, 4, 5, 6 – Standard Extensions – if an end user is not in a standalone building fronting a public street, a connection request may trigger work to extend the communal network. This can involve fitting fibre in the shared areas of a Multi Dwelling Unit (MDU) or down a Right of Way (ROW). Requests for non-premises fibre access (e.g. for digital billboards) trigger similar network extension work.
- Groups 7 and 8 – ONT – this is the separated cost of Optical Network Terminals (ONTs) between Hyperfibre ('new' technology) and non-Hyperfibre ('old' technology) installations.
- Group 9 – Complex Installations – installations for sites such as cell towers, hospitals, schools, banks and large offices are lower volume and specifically designed projects compared to Standard Installations.

The other connection groups are **CCI [ ]**, with Standard ONT Group 7 and 8 forecast to be **CCI [ ]** and Complex Installation connections forecast to be $9.8 million (or around 5% of total), the only other reasonably large contributors to the PQP2 Connection Capex baseline forecast.

There are no PQP2 connection forecasts for Connection Group 10, Non-linear Hyperfibre connections. In PQP1, Chorus applied a non-linear cost function to address line cards that are only sometimes required to enable Hyperfibre connections. However, due to a technological change, Hyperfibre connections now use the same port cards as GPON services and the installation is not triggered by new connection orders. As such, this category of connection capex is not applicable for PQP2.

The volume component of the PQP2 Connection Capex forecasts is generated from Chorus' Connections Model. The real price component of the forecasts is generated from the underlying Standard Installations forecast models.

10.3.2 Treatment of customer incentive payments

In presenting its PQP2 Connection Capex forecasts, Chorus notes that it does not believe it is optimal to continue to include customer incentives capex in Base Capex. It recommends the Commission amend the Fibre IMs to provide a more fit-for-purpose method for reviewing and approving incentives capex. In its view, either of the following options would be reasonable and a material improvement on current settings:

- include customer incentives capex in the connection capex category, such that there is a connection capex variable adjustment to apply to incentives. Under this approach the Commission could specify an efficient unit rate up front, which can be confirmed as being lower than the expected incremental revenues per added connection;
  - Chorus bears the risk of any commercial need to spend more than that amount per connection, but the volumes are washed-up – removing the risk associated with forecasting incentives uptake.
- Specifying a ring-fenced 'use-it-or-lose-it' fund at the start of PQP2, where the fund may only be used for customer incentives capex. Chorus could then draw down on the fund to the extent that it is efficient for it to do so. However, risk of approving more funding than will be spent is removed.

Chorus prefers the first of these two options.

Our assessment of Chorus' PQP2 customer incentive payment forecasts was presented in section 9.4.3 of this Final IV Report.

10.4 IV's analysis and key findings

10.4.1 Chorus' forecasting approach

Chorus advises that most capex in the Installations capex sub-category is Connection capex, which we reviewed in section 9.4 of this Final IV Report.

We also reviewed Chorus' demand forecasting methodologies and models in section 4.5.1 of this Final IV Report. Our findings in that section were that Chorus' demand forecasting methodologies as described appear robust and the demand assumptions reasonable.

A review of the granular unit cost and volume data in the 'RT04 – Connections capex' Excel spreadsheet enabled us to gain a better understanding of the underlying basis of the PQP2 Connection Capex forecasts.

10.4.2 Unit cost assessment

To better understand the PQP2 Connection Group unit cost forecasts, we reviewed the real price and volume assumptions underpinning the forecasts having regard to any material changes compared to reported PQP1 forecasts and/or outcomes.

Table 21 below indicates that forecast total volumes across all Connection Groups in PQP2 are lower than for PQP1 except for Connection Group 7 (Standard ONT –

Hyperfibre), with the latter expected to increase by around **CCI [ ]**. We regard this connection group as being a difficult one to forecast given it relates to end-user take-up of a new ONT technology. Based on our review of Chorus' forecasting methodologies, we think that the PQP2 connection group volume forecasts can be relied upon to develop the PQP2 volume forecasts (while recognising that these volume forecasts will be subject to the Connection Capex wash-up mechanism under the PQ FFLAS regulatory framework.)

Table 21 Comparison of PQP1 and PQP2 volumes and unit costs

Connection Group	PQP1 Total Volume	PQP2 Total Volume	PQP1 Average unit cost $CY22	PQP2 Average Unit Cost $CY22
Standard – Installation				
1	87,366	75,791	$669	$664
2(a)	112,169	44,891	$1,077	$1,088
2(b)	49,447	14,490	$1,365	$1,359
Standard – Extension				
3	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**
4	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**
5	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**
6	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**
Standard - ONT				
7	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**
8	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**	**CCI [ ]**
Complex				
9	3,258	4,512	$3,239	$2,162
Hyperfibre access				
10	177	-	$662	-

The forecast PQP2 average unit costs (expressed in real $CY22 dollars) across the Connection Groups varies, with some falls and modest increases across the high volume Connection Groups 1, 2(a), 2(b) and 3.

The exceptions to this unit cost profile are Group 6 (Standard Extensions – Class 4) with an average increase of around **CCI [ ]** and Group 4 (Standard Extensions – Class 2) with an average increase of around **CCI [ ].** It appears that the **CCI [ ]** is driven primarily by the forecast composition of connection sub-activity within these two groups. This reflects the fact that the aggregated unit costs for each Connection Group are calculated as the total cost of the group divided by total volume of the group, which we consider can be affected by forecast compositional sub- activity changes in a group. Further, the PQP2 forecasts for Connection Groups 4 and 6

are **CCI [ ]** in volume terms as well as in the total PQP2 Connection Capex baseline forecast, accounting for around **CCI [ ]** respectively of the baseline capex forecast.

10.5 Verification opinion

Based on the information provided by Chorus, we can verify that the PQP2 Connections Capex forecast satisfies the Evaluation Criteria

In forming our opinion, we have had particular regard to: Assessment Factor (a); regarding whether the proposed capex complies with all applicable legal and regulatory obligations associated with the provision of PQ FFLAS; Assessment Factor (c); Assessment Factor (e) regarding approach to forecasting capex; Assessment Factor (s) regarding accuracy and reliability of data; and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon.

11 PQP2 Opex Forecasts

The purpose of this chapter is to present our verification findings and opinions in relation to Chorus' PQP2 PQ FFLAS Opex forecasts.

In assessing these forecasts, we have also had regard to Chorus' business-wide (unallocated) Opex, recognising that PQ FFLAS expenditure is partly a function of allocations from Chorus' unallocated shared cost pool and that a relatively large portion of Chorus' opex, including corporate overhead, is a shared cost (primarily between its copper services and PQ FFLAS).

11.1 Our assessment factors

The following assessment factors were used to assess Chorus' PQP2 Opex forecasts, including both the base step trend and expenditure sub-category components of the forecasts:

- Historic opex and consideration of historic rates of expenditure.
- Quantitative or economic analysis related to the proposed opex, including sensitivity analysis and impact analysis undertaken.
- Approach to forecasting opex, including models used to develop the opex forecasts.
- Relevant financial information including evidence of efficiency improvements in proposed opex.
- Linkages between the proposed opex and quality, including the impact the opex would have on FFLAS quality outcomes.
- Competition effects, including specific information for sub-categories of opex that have potential impacts on competition in PQ FFLAS and other telecommunications markets.
- Fibre asset and fibre network information.
- The extent of the uncertainty related to the:
  (i) need for the proposed opex;
  (ii) economic case justifying the proposed opex; and
  (iii) timing of the proposed opex.
- The dependency and trade-off between the proposed opex and related capex to ensure least whole-of-life cost for managing assets and cost-efficient solutions.
- The accuracy and reliability of data.

- The reasonableness of the key assumptions, methodologies, planning and technical standards relied upon.

In the context of Chorus use of a base step trend forecasting methodology for its PQP2 Opex forecast, we also assessed the following factors:

- Appropriateness of selected base year; removal of non-recurrent items; basis of efficiency.
- Any step change must satisfy prudency in terms of identified need and cost efficiency.
- Appropriateness of trend growth factors and basis of their calculation:
  - Real cost escalation – e.g labour, materials
  - Network growth
  - Productivity offset.

Further to these assessment factors, we considered the following matters in assessing Chorus' PQP2 Opex BST forecast:

- Appropriateness of selected base year; removal of non-recurrent items; basis of efficiency.
- Any step change must satisfy prudency in terms of identified need and cost efficiency.
- Assessment of appropriateness of trend growth factors and basis of their calculation:
  - Real cost escalation – e.g. labour, materials
  - Network growth
  - Productivity offset.

11.2 Chorus' supporting documentation

Our assessment of Chorus' PQP2 Opex forecast is based on the following documents that it has made available to us:

11.2.1 BST supporting information

- Opex dataset for IV – historic actuals plus BST forecast.xlsx[Document 11A]
- Opex dataset for IV – historic actuals plus BST forecast – updated for IV queries.xlsx [Document 11B]

- BST PQP2 chapter template version.docx [Document 11C]
- PQP2 Forecasting opex_BST chapter_IV.docx [Document 11D]
- Opex insights (template version) – Post principals.docx [Document 11E]
- BST simple model_IV model.xlsx [Document 11E]
- BST simple model_IV 2 model_2023.xlsx [Document 11F]
- BST adjustment evidence_Self Insurance.docx [Document 11G]
- BST adjustment evidence.docx [Document 11H]
- BST adjustment evidence_Property Maintenace.docx [Document 11I]
- **CCI [ ]**
- BST adjustment evidence_Compliance.docx [Document 11K]
- BST adjustment evidence_Marketing.docx [Document 11L]
- **CCI [ ]**
- BST adjustment evidence_Elasticities
- BST adjustment evidence_Productivity
- Cost escalation forecasts, Outlook and forecasting methodologies, NZIER report to Chorus_160623.pdf [Document 11M]
- AON, Chorus Self Insurance Quantiofication_26 June 2023.pdf [Document 11N]
- Filenote Chorus opex docs.cocx [Document 11O]
- DRAFT NERA Recommendations for Chorus BST model for RP2.pptx [Document 11P]
- Advertising evidence_Category spend 2023 11.04update.pptx [Document 11Q]
- Evidence C_KPMG FFLAS ID Engagement Letter.pdf [Document 11R]
- Compliance Step Data.xlsx [Document 11S]
- 230815 – Chorus BST – additional analysis final.pdf [Document 11T]
- Evidence A_Chorus 31 December 2021 ID Assurance.pdf [Document 11U]
- Evidence B_Chorus Regulatory Assurance Proposal.pdf [Document 11V]

- Evidence D_Chorus Other Regulatory fee letter (final).pdf [Document 11W]
- Note on productivity assumption.pdf (002).pdf [Document 11X]
- Insurance summary_RP2.docx [Document 11Y]
- IT Optimisation benefits RP2v2.xlsx [Document 11Z]
- Solar summary IV.xlsx [Document 11AA]
- Capex-Opex Tradeoffs Evidence.docx [Document 11AB]
- Chorus BST model documentation for Commission (draft notes) V0.0 9 Aug23.docx [Document 11C]
- 230623 Recommendations for Chorus BST model for RP2 v.3.0.pdf [Document 11AD]
- Prep for IV Oct 05 2023.pptx [Document 11AE]
- Synergies debrief 27 September 2023.pptx [Document 11AF]
- NERA, Additional Analysis in Response to Independent Verifier comments, August 2023.pdfI

11.2.2 Opex sub-category supporting information

- BST by Narrative Category.xlsx [Document 11AH]
- High-level opex prudency and efficiency.docx [Document 11AI]
- PQP2 Customer opex expenditure chapter.docx [Document 11AJ]
- PQP2 Support opex RP2_IV.docx [Document 11AK]
- PQP2 Network opex Draft_IV.docx [Document 11AL]
- Opex prudency and efficiency one-pager Corporate.docx [Document 11AM]
- Opex prudency and efficiency one-pager Product Sales Marketing.docx [Document 11AN]
- Opex prudency and efficiency one-pager Technology.docx [Document 11AO]
- Opex prudency and efficiency one-pager Asset Management.docx [Document 11AP]

- Opex query response to IV.pptx [Document AQ].

11.3 Basis of Chorus' PQP2 Opex forecasts

There are two critical components of Chorus PQP2 Opex forecasts that require identification before presenting our analysis and verification opinion:

- first, applying the BST methodology (for the first time) to the Commission's opex sub-categories.
- second, understanding the impact of cost allocations from Chorus' broader business (unallocated opex) to PQ FFLAS.

Each of these issues is discussed below.

11.3.1 Base step trend methodology and opex sub-category build-up

Our assessment of Chorus' PQP2 Opex forecasts has been complicated somewhat by Chorus' decision to present these forecasts for the first time using a BST methodology. During our IV review, Chorus has made adjustments to its BST methodology, including most importantly switching from applying it to 'business categories' used for external reporting at the Draft IV Report stage to the Commission's expenditure sub-categories post-Draft IV Report.[27]

The BST methodology has been applied to all Customer, Network and Support opex sub-categories identified by the Commission but removes scale trends from most of the Support opex areas.

The TOR for this IV assessment also identifies several Priority Areas within the Commission's opex sub-categories, which we are required to apply closer scrutiny to because of their relative size and/or importance as an expenditure sub-category. It is also open to the IV to identify any additional Priority Areas if our assessment of the sub-categories reveals any preliminary concerns about the prudency and/or efficiency of the PQP2 forecasts.

Figure 31 presents the Commission's opex sub-categories, including Priority Areas.

[27] The BST methodology was originally developed with the following six expenditure sub-categories: fibre maintenance; non-network; other network; advertising; and insurance.

Figure 31 Commission's opex sub-categories

Opex sub-category groups	Opex sub-categories	Priority opex sub-categories
Customer	Customer operations	
Customer	Product, Sales & Marketing	✔
Network	Maintenance	✔
Network	Network Operations	
Network	Operating costs	
Support	Asset Management	✔
Support	Corporate	✔
Support	Technology	✔

Table 22 presents Chorus' PQP2 Opex forecasts by the opex sub-categories.

Table 22 PQP 2 opex forecasts ($CY22 dollars)

Opex category	Opex sub-category	CY25	CY26	CY27	CY28	PQP2 Total
Customer	Customer operations	-7.1	-7.2	-7.3	-7.3	-28.9
	Product, Sales and Marketing	28.4	28.7	29.0	29.2	115.3
Network	Maintenance	33.2	34.2	34.8	35.1	137.3
	Network operations	19.5	20.3	20.2	20.4	80.4
	Operating costs	9.7	11.1	11.5	11.3	43.7
Support	Asset management	23.4	23.7	23.8	23.9	94.8
	Corporate	49.8	50.8	51.4	51.6	203.5
	Technology	22.7	23.4	23.7	23.7	93.4
TOTAL	**N/A**	**179.6**	**184.9**	**187.0**	**187.9**	**739.5**

Source: Chorus

11.3.2 Effect of cost allocation on PQP2 forecasts

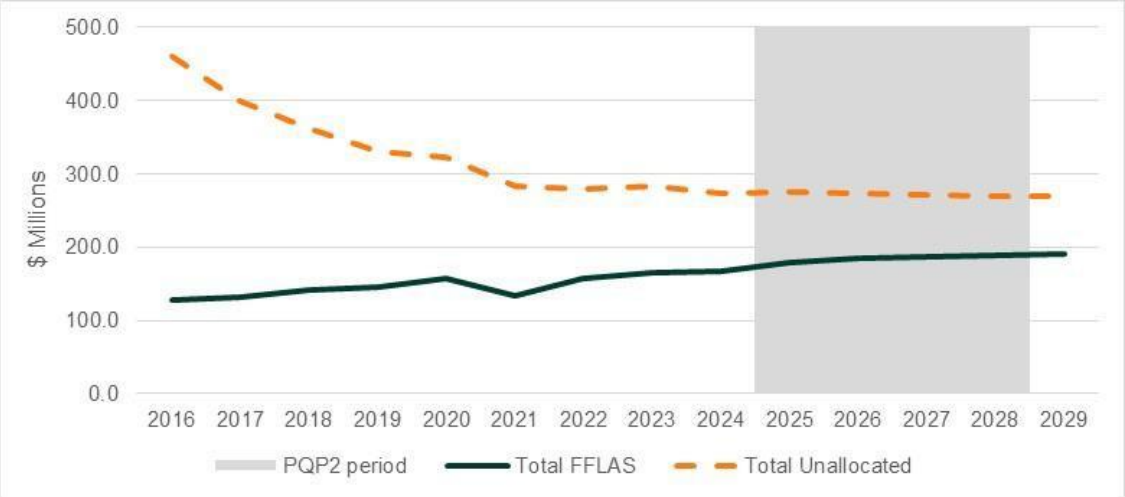
Given Chorus provides fixed fibre, copper and some other services, cost allocation from Chorus business-wide expenditure to PQ FFLAS is a critical element of the PQ FFLAS regulatory framework.

The outcomes of the approved cost allocation arrangements affect the quantum of PQ FFLAS capex and especially PQ FFLAS opex in the PQP2 forecasts. This is an important issue because of the need for the IV to separate the effect of allocations of shared costs, such as fixed business-wide costs, on PQP2 Opex forecasts from any underlying fibre-related structural drivers of those forecasts.

To draw this distinction, in the first instance, we have assessed movements in Chorus business-wide (unallocated) expenditure compared to its PQ FFLAS expenditure over the period from FY16 to FY29. While not precise, it is possible to identify the effects of increasing cost allocations to PQ FFLAS over this period as Chorus' copper network services decline. This ongoing process of copper service decline will impose a medium to long term upward trend on the PQ FFLAS opex, which needs to be recognised in any efficiency assessment of it.

Figure 32 shows the CY16 to CY29 time series in Chorus unallocated and PQ FFLAS opex, including the forecast for PQP2, with some evidence of a medium term slow upward trend in PQ FFLAS opex, which is forecast to continue in PQP2.

Figure 32 Chorus' unallocated and FFLAS opex ($CY22)



Data source: Chorus

What is also evident in Figure 32 is the sharp decline in unallocated opex between CY16 and CY21 most likely reflecting the decline in copper services and associated removal of variable copper service-related costs from the business. The flattening of the unallocated time series since CY21 (albeit still forecast to decline in PQP2) suggests that a larger proportion of the remaining costs are fixed and will form the shared cost pool that will increasingly be allocated to PQ FFLAS as it grows and copper services continue to decline.

Further to the initial top-down assessment of PQP2 forecast opex, the other way in which we have tested the effects of cost allocations compared to underlying cost drivers is through our assessment of the unallocated and PQ FFLAS data as it relates to the Commission's opex sub-categories, including Priority Areas.

In the remainder of this chapter, we first assess Chorus' proposed BST methodology and then move onto our assessment of how it has been applied in the development of PQP2 forecasts for the opex sub-categories determined by the Commission.

11.4 Chorus' BST forecasting methodology for PQP2

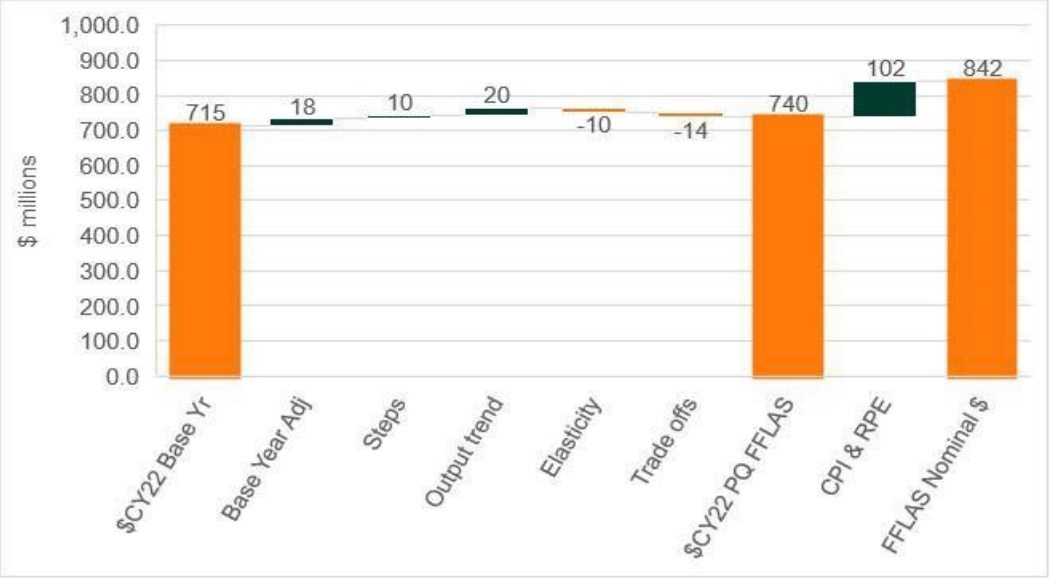
In simple terms, Chorus' BST methodology can be summarised as follows:

- Chorus first identifies the base year and base year cost categories.
- Next, base year adjustments by opex sub-category are made to exclude non-recurrent costs (and to include recurrent costs excluded from the base year) to arrive at base year expenditure.
- Adjusted base year expenditure is then escalated to account for changes in growth (scale), input prices and productivity, although this escalation is not applied uniformly across all opex sub-categories (which we identify where relevant in our opex sub-category analysis in section 11.5).
  - Where relevant, scale is accounted for using expected growth in an opex sub-category based on an appropriate explanatory driver of costs. Based on advice Chorus received from NERA, the key driver for certain cost sub-categories are the number of new fibre connections, which are based on analysis drawn from Chorus' separate PQP2 demand forecast report.
    - In turn, elasticities are then applied to these drivers to account for economies of scale / scope (i.e. the relationship between connections growth and opex is not one-for-one).
    - Having considered several options, including calculating elasticities from its own data and from telcos overseas, Chorus adopted elasticities used by NZ electricity distribution businesses.
    - Expected productivity-related efficiency improvements are separately accounted for by use of the elasticity assumptions plus identified opex savings from proposed PQP2 investments in new solar production and a subset of IT projects.
    - Where relevant for an opex sub-category, input cost adjustment (real cost escalation) is accounted for using input prices forecast by NZIER.

- Finally, where relevant for an opex sub-category, step changes are incorporated to reflect costs not otherwise accounted for in the base year.

The aggregate BST cost components used by Chorus to calculate its BST PQP2 Opex forecasts are summarised in Figure 33 and are discussed in more detail in the sections below.

Figure 33 Chorus' total PQ FFLAS forecast for PQP2 applying its BST methodology



Data source: Chorus

The following sections present our analysis and opinions in relation to the composition of Chorus' aggregate PQP2 BST forecast. In section 11.5 of this chapter, we assess how the BST methodology has been applied at the opex sub-category level.

11.4.1 IV's analysis and key findings

Base year and base year adjustments

Chorus has adopted CY22 as its base year. Chorus indicated this was the most recent year for which reported data is available while CY22 data is also less affected by COVID-19 economic effects than in previous years.

CY22 base year

We consider the base year chosen by Chorus, CY22, satisfies the BST-specific matters we have considered. CY22 is the most recent reported actual data and should reflect a more normal year compared with preceding years that were affected by COVID-19 economic effects.

We understand CY23 information may become available for Chorus to update its PQP2 proposal in CY24, but it may be too late in the Commission's evaluation and decision-making process. If possible, we support use of CY23 data for the base year once available, as we think the most recent available reported data should be used to set the base year for PQP2 consistent with standard regulatory practice applying the BST methodology. We also think that an additional year of reported data will provide a stronger evidentiary base for the PQP2 BST Opex forecast, particularly Chorus' proposed base year adjustments.

Chorus adjusted upwards its base year costs in CY22 by a total of $4.6 million (in $CY22). The base year adjustments are summarised as follows:

- Advertising: was $2.2 million lower than usual in CY22 due to staff and technician shortages and is expected to return to normal in PQP2. Base year costs have been adjusted up by this amount.
- Property maintenance: these costs were lower than usual in CY22 and are expected to return to normal in PQP2 adding $0.5 million to the base year.
- **CCI [**

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- Self-insurance: these costs are not otherwise accounted for, and based on an actuary's report, increase base year opex by $1.2 million.

Chorus provided supporting information for each of these base year adjustments, which are discussed below.

Advertising cost adjustment

Based on five years of data, expenditure in CY22 is $2.4 million below average. Given evidence provided by Chorus, the expected future expenditure compares favourably with expenditure by other telcos in New Zealand and compared with expenditure in the base year, which appears to be comparatively low.

We agree this expenditure is necessary and therefore satisfies Assessment Factor (g) regarding competition effects, including specific information for sub-categories of opex that have potential impacts on competition in PQ FFLAS and other telecommunications markets. When compared with Chorus' competitors, we consider the expenditure to be efficient, reflecting good telecommunication industry practice.

Property maintenance cost adjustment

The proposed upward adjustment of $0.5 million to the base year for Property Maintenance costs is based on the average costs incurred over a five-year period up to and including 2022. Chorus has provided data that shows its costs for Property Maintenance vary between $11.4 million and $15.7 million over the past 6 years (+/- 15%). Chorus is proposing to use the average cost over this period rather than the reported CY22 base year cost.

Under the BST methodology, unless there is something significantly atypical that can be substantiated about the base year cost then it should be used. Following release of our Draft IV Report, Chorus provided further evidence to argue that CY22 is significantly atypical arising from a changeover in external service provider contracts for its Property Maintenance, which caused the observed drop in expenditure in the second half of the year, which then rebounds in 2023.

We agree with Chorus that the expenditure dip reported in CY22 appears to be atypical and it has established a plausible reason why. On these grounds, we consider this base year adjustment satisfies Assessment Factor (s) regarding the accuracy and reliability of data and Assessment Factor (t) regarding the reasonableness of the key assumptions and methodologies relied upon.

However, recognising that CY23 is yet to be completed, we recommend that the Commission consider this base year adjustment once Chorus' CY23 Information Disclosure Statement is submitted, which will provide a stronger evidentiary base than available to us now.

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Self-insurance

Self-insurance is often a contentious topic in regulatory decision making. Regulators are typically wary of claims for self-insurance costs, especially if the coverage is vaguely specified and other means exist through which unexpected costs might be recovered (for example, cost pass through or deferral of other discretionary expenses). At the same time, regulated utilities consider they should be adequately reimbursed for the potential cost of unforeseen events for which they are not insured.

Regulators typically seek an assurance and / or evidence from a regulated entity that a decision to self-insure for a specific event (or events) has been made at an appropriate level given the relevant risk exposure.

A prudent utility would develop an internal self-insurance policy having regard to the sort of information that might be contained within a product disclosure statement for a commercially available insurance product. Further, it would be expected that a decision to self-insure would be subject to testing in the market to compare self-insurance costs.

In this regard, Chorus provided specific event information in regard to earthquake related self-insurance events, but also refers to broad coverage of its self-insurance for 'losses on uninsured assets'. The self-insurance cost estimates are supported by an actuarial report prepared by Aon.

We accept the self-insurance costs estimated by Chorus are reasonable given they are supported by an actuarial report. Following release of our Draft IV Report, we sought further supporting information from Chorus regarding its overall exogenous risk management policy, including how it uses externally sourced insurance and self-insurance to manage all key network risk exposures.

In response to this information request, Chorus documented that its insurance program essentially replicated Telecom's program at demerger (but with lower limits reflecting the smaller size of stand-alone Chorus). Additionally, in 2016, Aon Risk Consulting completed an insurable risk review and gap analysis to ensure that all insurable risks were identified, and that adequate insurance cover was in place. Other than inclusion of a cyber risk policy, the insurance program has remained substantially unchanged.

Chorus notes the majority of its self-insurance (89%) is driven by the policy limits and exclusions of its insured assets so there is limited scope for it to increase external insurance coverage. For the remaining self-insurance (11%), Chorus retains a liability in respect of losses on assets that are not insured ie. losses on uninsured assets where it has assessed the insurable risk as being low. Chorus has identified underground cables and associated ducts outside of the four CBD areas covered by external insurance policy as the only significant fibre-related uninsured risk.

Based on the additional supporting information provided by Chorus following the release of our Draft IV Report and specifically its explanation of the role of its self-insurance policy within its overall insurance program, we can verify the proposed self-insurance base year adjustment as satisfying the Assessment Factor regarding reasonableness of key assumptions and methodologies and the Assessment Factor regarding approach to forecasting opex.

11.4.2 Base year (CY22) efficiency

Use of the BST methodology requires a high degree of confidence that the base year is efficient given it will underpin the opex forecast for the next regulatory period. For Chorus, this is likely to be challenging given the newness of the PQ FFLAS regulatory framework being applied to it, as well as the effect of changing cost allocations on base year PQ FFLAS.

Chorus provided a range of information to support its view that the CY22 base year expenditure is prudent and efficient. In particular, Chorus refers to the:

- fully worked up assessment of corporate costs,
- opex chapters for Customer, Network and Support sub-category costs, and
- BST chapter and supporting evidence of its base year efficiency.

Further, Chorus also notes that its approach to the following issues combine to deliver and therefore demonstrate CY22 efficiency:

- accumulation of cost control and efficiency measures required to deliver UFB and fund significantly higher than forecast demand to connect to fibre services in PQP1;
- the discipline and efficiency necessary to perform in a rapidly evolving and intensely competitive market and withstand investor scrutiny as a listed company; and
- efficiency gains (in the form of foregone cost increases) realised through the recent re-tendering of field services contracts and the shift from three to two field service providers due to declining work volumes compared to the UFB roll-out period.

Chorus highlights that its adjusted CY22 base year opex is equal to the CY22 opex allowance previously set by the Commission in its PQP1 Final Determination. According to Chorus, the alignment of these values gives comfort that the base year expenditure is efficient. That is, no substantive change or material additional cost has been implemented since the Commission's PQP1 Final Determination to change the view that Chorus's CY22 (adjusted) base year opex is efficient.

We acknowledge Chorus' claim that its actual costs in CY22, being equal to forecast cost, provides some evidence of efficiency based on the assumption that the opex allowance for CY22 in the Commission's final determination for PQP1 was set at an efficient level.

However, any presumption that reported CY22 opex is efficient stems in part from the incentives inherent in the PQ FFLAS regulatory framework to which Chorus is subject, particularly where such incentives are applied over an extended period. While these

frameworks can deliver efficient outcomes, there is no certainty this has been achieved in CY22 given the short period over which Chorus has been subject to price quality regulation and the limited availability of historical data post-UFB roll-out to demonstrate this efficiency.

However, we accept that aspects of Chorus delivery systems, such as competitive tendering across various opex sub-categories, are indicative of efficiency in service delivery and that there is an external cost and funding discipline imposed from being a publicly listed entity and experiencing wholesale telecommunications competition at the margins.

As noted by Chorus, the BST methodology is inherently reliant on historical and reliable data. This weakens the ability of Chorus now to rely on its BST methodology alone to demonstrate the efficiency of the forecasts that its methodology produces. This is simply a function of the limited period that Chorus' PQ FFLAS have been subject to price quality regulation.

The incentives in the regulatory regime driving efficiency across Chorus have only applied for a short period of time (with the possibility of additional incentives to be added in future years).[28] We anticipate that with every year of additional outturn data, Chorus will be able to use the additional revealed costs to better demonstrate the efficiency of its operations. As a result of data limitations, Chorus is relying on a forecasting method not well suited to a regulated entity early on in its regulatory evolution, making demonstration of base year efficiency problematic. NERA noted in its description of the BST method, that efficient base year costs will be revealed over time due to the nature of incentive-based regulation.[29]

In the absence of third-party benchmark comparisons, or a well-established history of revealed cost outcomes, it is difficult to definitively confirm that Chorus' CY22 Opex base year costs are efficient but nor can we definitively find that CY22 revealed costs are inefficient. However, we have tested key components of CY22 base year costs in our opex sub-category analysis in section 11.5 below to establish a stronger evidentiary base to be satisfied about CY22 base year efficiency.

11.4.3 Trend

To account for changes in opex costs over time, Chorus has used fibre connections as the cost driver and elasticities to forecast growth in opex sub-categories recognising that the

[28] Such as an opex efficiency financial incentive scheme.

[29] NERA 2023, Draft NERA recommendations Chorus BST Model for RP2, Slide 5, June

relationship between connections and opex is not one-for-one. According to Chorus (and its advisor NERA), the expected number of new fibre (and copper connections) can be used to calculate the future cost of key opex sub-categories. There are three key steps in Chorus approach to forecast opex costs:

- find one or more appropriate key explanatory variables that can explain future movements in total opex;
- determine the relationship between the explanatory variable and an opex sub-category; and
- obtain forecasts of the chosen explanatory variables to calculate future opex.

Relying on the work by NERA, Chorus has established that network and advertising costs are linked to new fibre connections, while other network costs (electricity and property maintenance) are linked to total fibre and copper connections. As previously noted, the relationship between these variables is based on elasticities derived for electricity distribution businesses. This approach has been previously accepted by the Commission (for electricity).

In-principle, we have no objection to this forecasting approach. However, we do have some concerns with the way in which this approach has been applied to derive forecasts of Chorus' FFLAS opex in PQP2.

With support from NERA, Chorus argues its fibre and/or copper connections are the best available drivers of its future network and some non-network opex costs. At face value, this appears simplistic. Intuitively, the relevance of copper connections to any aspect of FFLAS is difficult to accept. The observed correlation may simply reflect autocorrelation often associated with time series data. NERA acknowledges the difficulties making opex forecast for Chorus given data limitations or the availability of suitable comparisons/benchmarks.[30] Notably, NERA recommended an approach that would use Chorus data (instead of electricity data) for PQP3.

In developing a BST methodology for Chorus, NERA compared elasticities based on historic Chorus data, a UK telco, and elasticities developed in NZ for electricity distribution businesses. Comparing the different elasticities, NERA recommended the elasticities based on electricity network data be adopted by Chorus to calculate its PQP2 forecasts.[31] The main reasons for this were:

[30] NERA 2023, Draft NERA recommendations Chorus BST Model for RP2, Slide 21, June

[31] NERA 2023, Draft NERA recommendations Chorus BST Model for RP2, Slide 22-24, June

- Chorus-based estimates of elasticities were based on too little reliable historical data.
- UK estimates appeared high and therefore could be used as an upper boundary only.
- NZ electricity distribution businesses appeared reasonable as the nature of the costs was comparable to Chorus for non-network opex, while for network opex the elasticities were likely to understate costs.[32]

Chorus has proposed trend elasticities for growth of network (0.45) and advertising costs (0.65) based on NERA's analysis.

The suitability of electricity-based elasticities (reflecting electricity network data) being applied to Chorus is also difficult to accept without more detailed supporting analysis. NERA's analysis is undertaken at a relatively high level, perhaps for expedience, but is not compelling. For example, NERA states, "other network & non-network [elasticities] exceed one but have wide confidence intervals, so are not statistically different from zero**",** is not an accurate statement without additional statistical evidence.[33]

At the Draft IV Report stage, we considered that Chorus needed to better substantiate each component of the proposed trend estimation, including stronger rationale for use of electricity network sector elasticities. It is apparent that NERA identified weaknesses in the use of these elasticities.[34] While the Commission has previously accepted the use of elasticities to forecast opex, we had concerns about whether the chosen proxy elasticities can be applied to Chorus' FFLAS opex forecasts and so provide robust outcomes.

Chorus provided further supporting information in response to our Draft IV Report, including additional analysis undertaken by NERA. This additional information assisted somewhat but is not compelling in justifying the use of electricity network elasticities as proxies for a FFLAS network. However, we recognise that there is a need to apply some form of scaling factor in the growth component of the BST in relation to the relationship between connections growth and opex in PQP2.

Given the Commission's expertise in this area, we recommend that it consider Chorus' supporting information regarding the use of electricity network elasticities as a proxy

[32] ibid 2023, Slide 22.

[33] ibid 2023, Slide 20.

[34] Ibid 2023, Slide 24.

for a FFLAS network in estimating growth/scale in the trend component of Chorus PQP2 forecast.

Input prices

Chorus forecasts an increase in opex in real terms using real cost escalators of input materials and labour. The escalators relate to labour costs, producer prices, commodity prices and the consumer price index.

Chorus has advised that its approach to cost escalation for PQP2 is the same as that approved by the Commission for PQP1.

Estimates of real cost escalation for PQP2 have been prepared by NZIER for Chorus. We have reviewed the NZIER report and consider its forecasts to be reasonably based having regard to expected economic conditions in PQP2. We can verify that the NZIER cost escalation forecasts satisfy the Assessment Factor regarding reasonableness of key assumptions and methodologies.

Opex Productivity

The productivity component of the BST methodology is intended to measure the ratio between the outputs that a network produces relative to the cost of the inputs it uses to do so (opex partial productivity).

Chorus notes that according to its consultant, NERA, productivity estimates of between 0 and 1.25% are typical and appropriate for infrastructure businesses like Chorus.[35]

Chorus considers the opex efficiency gains embedded in the proposed installation of solar panels and investment in selected IT projects in PQP2, plus the cost elasticity assumption bult into the trend component, adequately capture the likely future efficiency gains across its business.[36]

Further, the PQ FFLAS regulatory framework under which Chorus now operates is leading to higher administrative costs of business. For this reason, Chorus has proposed a productivity factor of zero.[37]

We consider Chorus may be underestimating its ability to achieve efficiency gains across PQP2. We do not agree the projects referred to by Chorus necessarily fully capture its ability to make productivity improvements in PQP2 given these are targeted investments. Further, given the fluid state of Chorus operating arrangements as copper

[35] NERA 2023, Draft NERA recommendations Chorus BST Model for RP2, Slide 26-27, June

[36] Ibid, p15.

[37] Chorus 2023, Base Step Trend Forecasting Chapter, pp 14-15, June

services are wound back and replaced with fibre services, there could be opportunities to deliver productivity improvements, although whether these opportunities relate solely to copper services or are more in the character of overhead costs spread across both copper services and FFLAS is hard to determine.

However, in considering the level at which to set a productivity factor under the BST methodology, the Commission has previously noted that it does not consider it appropriate to use a high productivity factor to 'incentivise' (electricity) distributors to find gains because this would have the effect of passing gains onto consumers in anticipation of their discovery, which is not the purpose of the productivity factor.[38] We agree with this approach.

Having regard to the Commission's and Chorus' positions, the comparative rates of productivity improvement reported by NERA suggest a zero-productivity assumption may be reasonable, with Chorus' proposed opex savings arising from the proposed IT projects and solar investment in PQP2 pertinent considerations.

Hence, Chorus argues that it has already factored into its PQP2 opex forecast:

- the assumption that PQ FFLAS opex will grow more slowly than output because of economies of scale via the cost elasticity assumption; and
- the expected benefits (in terms of opex reductions) from the selected IT and solar projects.

Following the release of our Draft IV Report, Chorus provided further supporting information regarding the application of opex productivity factors under the BST methodology (specifically the relationship between the scale/scope elasticity estimate and opex productivity factor) and the above two PQP2 projects identified as delivering opex savings.

After considering this additional information, we are satisfied that a zero percentage opex productivity assumption satisfies Assessment Factor (t) regarding reasonableness of key assumptions and methodologies, provided Chorus is committed to proceeding with the selected IT and solar projects. Based on this additional information, we consider this is the case for the IT projects, but the solar project is less clear with a business case still to be prepared and forecast cost savings not firm.

If these projects were not to proceed, we consider a relatively conservative productivity rate of 0.25%, which is within the productivity range identified by NERA, would be more

[38] Commerce Commission (2019), Default price-quality paths for electricity distribution businesses from 1 April 2020 – Final decision Reasons paper, November, p 107

likely to satisfy the Assessment Factor regarding reasonableness of key assumptions and methodologies.

In this regard, Chorus notes reasonably that any productivity factor should be applied only to FFLAS-dominant categories recognising that it is calculating the BST first at the business-wide (unallocated level), including copper services that are not subject to the PQ FFLAS framework. Specifically, this would be the fibre maintenance, other network, non-network and advertising FFLAS sub-categories only.

11.4.4 Step changes

Chorus propose four step changes with a total cost of negative **CCI [ ]**. This net negative value stems largely from savings expected from the proposed IT optimisation investment and, to a lesser extent, from installation of solar panels in PQP2 (i.e. these are two capex-opex trade-offs).

The proposed step changes relate to:

- the new Field Services Agreements (reflecting the reduction from three to two field service providers) – **CCI [ ]**
- compliance and sustainability audits - +$5.5 million in PQP2
- solar network capex/opex trade-off – -$1.2 million in PQP2
- selected IT project capex/opex trade-off – -$12.7 million in PQP2.

Each proposed step change is discussed below.

Field services agreement

According to Chorus, it expects its field services maintenance costs to experience **CCI [ ]** following completion of the UFB roll-out in FY22. Reflecting this **CCI [ ]**, Chorus has recently moved from three contracted FSPs to two. **CCI [ ]**.

Following the release of our Draft IV Report, Chorus provided further supporting information for this step change. Based on pricing revealed through the recent FSP re-tendering exercise, Chorus presented data which suggested that maintaining three FSPs would have resulted in an additional cost uplift of around **CCI [ ]** for both capex and opex field work. Reviewing this data, it appears that the reduction in capex field work due to the completion of the UFB roll-out is the **CCI [**

].

Chorus argues these **CCI [** **]** and are therefore not captured elsewhere in the BST forecast and that its estimate is robust given it was revealed through the recent FSP re-tendering process.

In addition, FFLAS customer connections are forecast to grow in PQP2, albeit at a slower rate, such that Chorus expects PQ FFLAS maintenance costs to rise over time. Our opex sub-category analysis presented in section 11.5 also reveals an upward trend in Chorus' maintenance sub-categories, which appears to be a function of both growth and increasing cost allocations.

Chorus estimate the field work volume and increasing fibre connections factors will result in an overall step change **CCI [** **]** across PQP2 commencing in FY25.

Chorus estimates that for PQP2 the step change cost is **CCI [**

].

Based on the additional supporting information provided by Chorus, we can verify that the field service agreement step change satisfies the Assessment Factor (t) regarding reasonableness of key assumptions and methodologies. However, it is less clear that the Assessment Factor regarding the accuracy and reliability of the data upon which the **CCI [** **]** million step change is estimated is satisfied.

Compliance and sustainability audits

Chorus argues that additional audit and asset management capability build costs are anticipated during PQP2 and stem from:

- new information disclosure and PQ FFLAS regulatory compliance audit requirements
- climate-related disclosure audit requirements
- incremental costs associated with development of a new asset management capability having regard to the PQ FFLAS regulatory framework.

Chorus' PQP2 forecast for this step change is $5.5 million.

FFLAS information disclosure and regulatory proposal audits

Chorus has calculated the additional cost of PQ-related audit compliance is **CCI [ ]** in PQP2.

Following release of our Draft IV Report, we sought further supporting information from Chorus regarding these additional audit costs. In response, Chorus provided information which supports the quantum of claimed cost, which we consider to be reasonable given the scope of audit work.

We are also now satisfied that the tasks for which the additional audit costs are claimed do represent additional compliance obligations that Chorus faces in relation to the price quality framework and that are beyond its reasonable control.

Based on the additional supporting information provided by Chorus, we can verify that the PQ-related regulatory compliance step change costs satisfy Assessment Factor (s) regarding the accuracy and reliability of data and Assessment Factor (t) regarding reasonableness of key assumptions and methodologies.

Climate-related audits

Chorus has calculated the additional cost of climate-related audit compliance is **CCI [ ]** in PQP2.

Following release of our Draft IV Report, Chorus provided supporting information in relation to new legislative climate-related reporting obligations that it is now subject to.

The obligations relate to the Financial Sector (Climate-related Disclosures and Other Matters) Amendment Act 2021 (the CRD legislation). Under the CRD legislation, Chorus as a defined climate reporting entity will be required to:

- prepare an annual climate statement that discloses information about the effects of climate change on their business or any fund they manage;
- prepare climate statements in accordance with climate standards issued by the independent External Reporting Board (XRB);
- obtain independent assurance about the part of the climate statement that relates to the disclosure of greenhouse gas emissions;
- make the climate statements available to the public, and
- comply with record-keeping requirements.

The XRB expects to issue the first climate standard by December 2022, which means climate statements will likely be required to be published from early 2024 (at the earliest), for accounting periods that start on or after 1 January 2023.

Based on the additional supporting information provided by Chorus, we can verify that this compliance step change costs satisfy Assessment Factor regarding reasonableness of key assumptions and methodologies recognising that this is an externally driven step change over which Chorus has no control.

Development of asset management capability

Chorus has proposed to develop its asset management capability in PQP2 on the grounds that having such a capability is a key requirement for it under the PQ FFLAS regulatory framework. Chorus has forecast the additional cost of this capability building is **CCI [ ]** in PQP2.

We understand that Chorus currently only has **CCI [ ]** assigned to develop this capability in the context of Chorus' Asset Management Roadmap delivery and associated reporting to the Commission.

In PQP2, Chorus is proposing to engage **CCI [ ]**.

Based on our verification review of Chorus asset management maturity (discussed in Chapter 7 of this Final IV Report, we consider that the intent to enhance this capability is an important one and, if implemented well, will enhance the operation of the PQ FFLAS regulatory framework over time which will be in the interests of all stakeholders. Specifically, it will assist in providing greater confidence about the overarching framework that Chorus uses to develop its PQ FFLAS capex forecasts.

Recognising that this would be a relatively large step increase in opex in PQP2, we see merit in Chorus reporting its progress developing its asset management capability and the outcomes delivered by this enhanced capability to the Commission as part of its Annual Information Disclosure Statement. This would provide confidence to the Commission and Chorus' stakeholders that the additional expenditure will deliver tangible benefits, including most importantly quicker progress fully implementing the Asset Management, Asset Data and Cost Estimation Roadmaps.

Based on the additional supporting information provided by Chorus, including basis of the capability cost build-up, we can verify that the asset management capability step change costs satisfy Assessment Factor regarding reasonableness of key assumptions and methodologies.

Solar panels capex/opex trade-off

In its PQP2 capex proposal, Chorus is seeking approval for funding the installation of solar panels on property sites that it owns.

It is evident this is not a stand-alone step change. Rather, it is a consequential outcome directly linked to the PQP2 capex proposal for an investment in solar panels. For this reason, we suggest the opex savings be included as a separate opex line item outside of the opex BST, subject to the capex cost being approved/not approved by the Commission.

Following the release of our Draft IV Report, Chorus provided us with further supporting information for this capex/opex trade-off, including indicative costing. However, it also noted that a business case for the capex/opex trade-off has yet to be developed (most likely in CY24) and the quantum of costs will not be firm until that process is completed.

For this reason, we can verify this opex saving as satisfying Assessment Factor (r) regarding the dependency and trade-off between the proposed capex and related opex, but not verify this step change as satisfying Assessment Factor (s) regarding the accuracy and reliability of data or Assessment Factor (t) regarding reasonableness of key assumptions and methodologies. We consider that if Chorus intends to proceed with this capex-opex trade-off in PQP2 it should develop and submit the business case to the Commission as early as possible in CY24.

Selected IT project capex/opex trade-off

Chorus has identified $12.7 million in aggregate opex efficiency savings in PQP2 that are allocated to PQ FFLAS and associated with its IT capex proposal. This negative step change is based on assumptions that:

- 8% of IT capex is for selected projects that reduce opex, which amounts to $12.7 million for PQ FFLAS in PQP2;
- to breakeven, opex reduction projects need to achieve on average a reduction of $3.7 million per year for five years; and
- the timing of opex reduction projects is uncertain, so Chorus has spread savings across the period (starting from 2023).

This is clearly not a standalone step change. Rather it is a consequential outcome of proposed PQP2 selected IT capex projects. We suggest the step change be considered as a separate opex line item outside of the opex BST, subject to the capex being approved / not approved by the Commission.

Following the release of our Draft IV Report, Chorus provided us with further supporting information for this capex/opex trade-off, including NPV analysis. Chorus explains that the PQP2 forecast FFLAS opex saving is based on its PQP2 business-related IT optimisation expenditure of $14.1 million. The PQ FFLAS saving is 81% of the business-wide (unallocated) opex saving. Effectively, each dollar of IT optimisation capex is assumed to deliver around 25 cents of annual opex saving.

We can verify that the selected IT projects capex/opex trade-off satisfies Assessment Factor regarding the dependency and trade-off between the proposed capex and related opex. We recommend the Commission confirm that Assessment Factor regarding reasonableness of key assumptions and methodologies is satisfied.

11.5 IV's opex sub-category analysis

In this section of the chapter, we assess Chorus PQP2 opex forecast presented in the expenditure sub-categories approved by the Commission, including Priority Areas.

As previously noted, the BST methodology has been applied at the opex sub-category level, including base year adjustments, step changes and trend factors. The table below summaries the application of these variables, plus cost allocation impact, across the sub-categories.

Table 23 Comparison of PQP1 and PQP2 volumes and unit costs

Sub-category group & sub-category	Base year adjustments	Step changes	Trend	Cost allocation impact
Customer				
Customer operations	Not considered	Not considered	Not considered	Not considered
Product, Sales and Marketing	Advertising expenditure increase	No	Yes (0.65 elasticity based on connections)	Low
Network				
Maintenance	**CCI [** Property maintenance increase	**CCI [** **]**	**CCI [** **]**	**CCI [** **]**
Network Operations	No	No	No	Moderate
Operating Costs	No	Capex/opex trade-off related to solar production investment (lower electricity costs)	No	High
Support				
Asset Management	No	No	No	High

Sub-category group & sub-category	Base year adjustments	Step changes	Trend	Cost allocation impact
Corporate	Self-insurance cost increase	Compliance audit and asset management capability cost increase	No	High
Technology	No	Capex/opex trade-off related to IT project investments (opex savings)	No	High

11.5.1 Customer sub-category group

The Customer opex sub-category group has two sub-categories that reflect the following two activities:

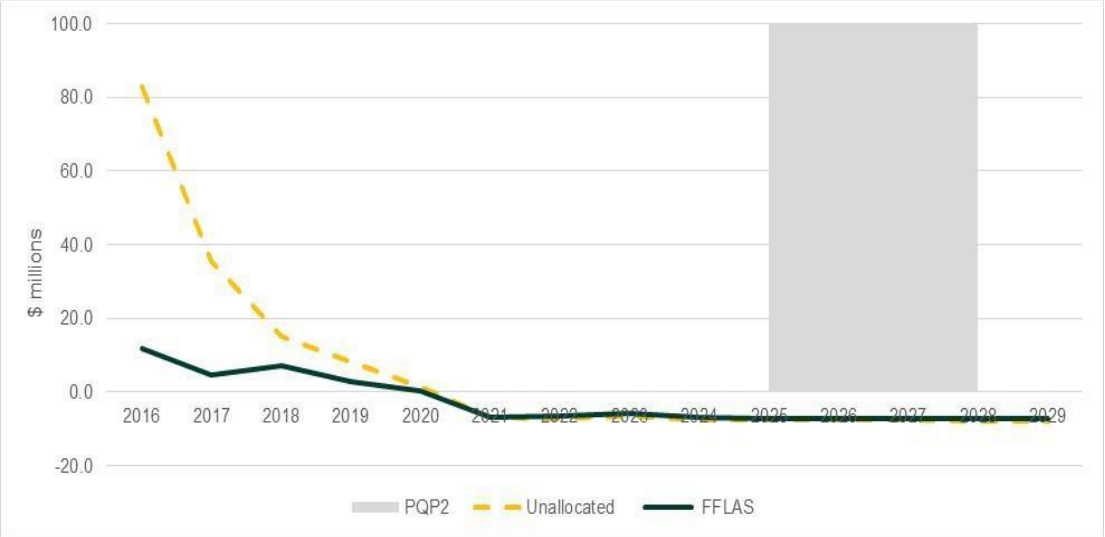
- Customer Operations – expenditure incurred by the customer-facing teams in Customer and Network Operations, including connecting end-users by managing installations and provisioning network services.
- Product, Sales and Marketing – expenditure incurred by Product, Sales and Marketing team, including marketing campaigns, data insights, product management, account management and innovation.

We assess the PQP2 forecast for these two opex sub-categories below.

Customer Operations

Chorus reports this sub-category as being negative beyond 2019, as shown in Figure 34, which it advises is a function of having to split cost centres across the Commission's opex sub-categories. Consequently, we have not been able to assess or verify this category and consider that it is a matter for Chorus and the Commission to resolve.

Figure 34 Customer Operations ($CY22)



Data source: Chorus

Verification opinion

We are unable to verify that Chorus' PQP2 Customer Operations sub-category forecast satisfies the Evaluation Criteria.

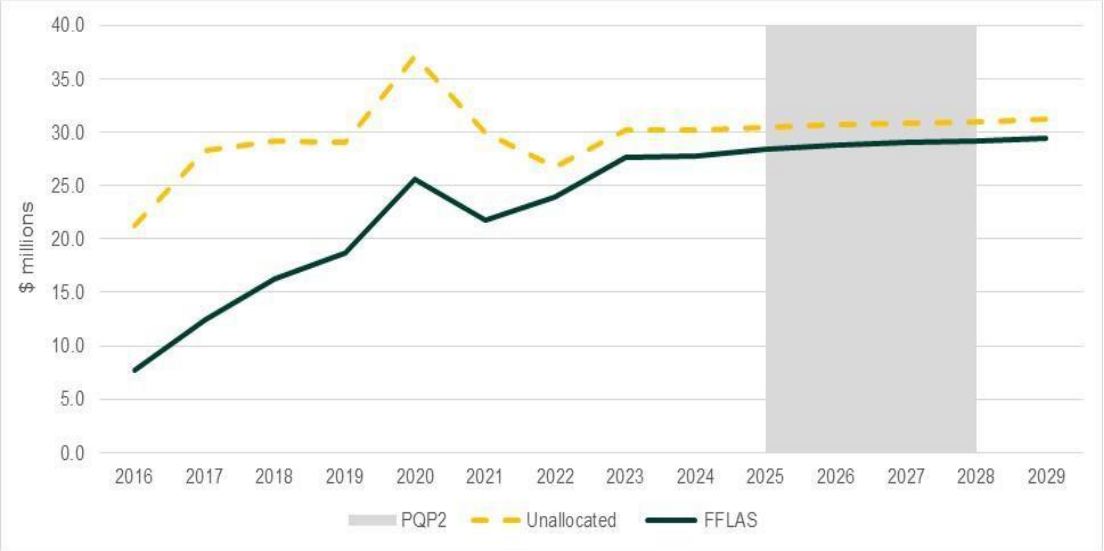
In forming our opinion, we have had particular regard to Assessment Factor (s) regarding the accuracy and reliability of data.

Product, Sales and Marketing

The PQP2 forecast for PQ FFLAS Product, Sales and Marketing opex is $115.3 million (or $28.8 million per annum) compared to $26.5 million per annum in PQP1.

Chorus's product, sales and marketing activities in relation to PQ FFLAS has grown steeply between 2016 and 2023. This is largely a function of the roll-out of the UFB network, as shown in Figure 35 reflecting Chorus' efforts to encourage take-up of fixed fibre services. This upward trend is forecast to flatten somewhat in PQP2.

Figure 35 Product, Sales, & Marketing ($CY22)



Data source: Chorus

Chorus' forecasting approach

Chorus breaks the Product Sales and Marketing sub-category group into the following two secondary sub-categories:

- Product and Sales
- Marketing

Product and sales

This secondary sub-category covers product management and wholesaling costs associated with fibre products. These include:

- consumer and market research
- product strategy and development
- product lifecycle planning
- product pricing
- sales and retail service provider (RSP) account management
- incentives program management.

Chorus notes the growth from 2016-2020 in Product and Sales is explained by:

- growth in its RSP count as it on-boarded fibre re-sellers;

- growth in its product suite as it added fibre products to its service offering; and
- growing complexity of the telecommunications market, with strategic challenges from competing fixed wireless and satellite technologies.

The two most recent years were affected by the following one-off factors:

- 2020 included a 'big push' on copper-to-fibre migration work to support fibre uptake and the first use of copper withdrawal.
- 2021 was impacted by COVID-related disruptions, which reduced product and sales activity.

In contrast, 2022 was a more typical year, materially in-line with the average of the prior two years. As such, Chorus considers CY22 is an appropriate base year for the PQP2 forecast without any adjustments.

Hence, the PQP2 forecast carries the CY22 base year forward with no adjustments, steps, and only a real price trend, with cost allocation being the main driver of change. Chorus notes that it does not expect declining copper volumes to have any impact on product and sales expenditure until such time as copper products are removed altogether.

Marketing

Marketing includes expenditure managing and promoting the Chorus brand, the fibre category and fibre products. It includes internal management costs, and external marketing activities.

For its PQP2 forecast, Chorus has:

- added $2.2 million to the base year to adjust for abnormally low expenditure in CY21;
- not added any step changes; and
- added a trend that includes real price effects and scales product and sales expenditure with growth in fibre connection numbers, assuming a 0.65 elasticity (i.e., falling cost per connection).

IV's analysis and key findings

Product and sales

Chorus's description of the need for the Product and Sales sub-category is clear and succinct and reflects the types of activity to be expected for a fibre telecommunications network provider that has strong natural monopoly elements, while also being subject

to competitive pressure from alternative technologies, such as fixed wireless, satellite and 5G. However, we would have expected more description and detail around managing RSPs, given that they are an essential part of Chorus' business model and are a significant channel to the retail telecommunications services market.

Figure 36 shows the historic trend in unallocated Product and Sales opex. The chart highlights significant movements the period from 2016.

Figure 36 Chorus' historical Product and Sales unallocated opex ($CY22)

Source: Chorus

Chorus' explanations of the volatility in product and sales opex are helpful and provide support for 2022 as the base year for this expenditure category. Most helpfully, the chart is for unallocated product and sales opex and therefore does not include the complication of the cost allocation process, which makes any assessment of efficiency difficult.

However, trend analysis for this series is also difficult because of Covid-related events during 2020 and 2021. The best interpretation is that from CY16 to CY22 there has been an increase in the Product and Sales sub-category of expenditure in line with growth in UFB installations and connections with a subsequent flattening, and even possible decline, as the remaining unconnected customers reduces.

There would appear to be two sorts of cost types within the Product and Sales sub-category:

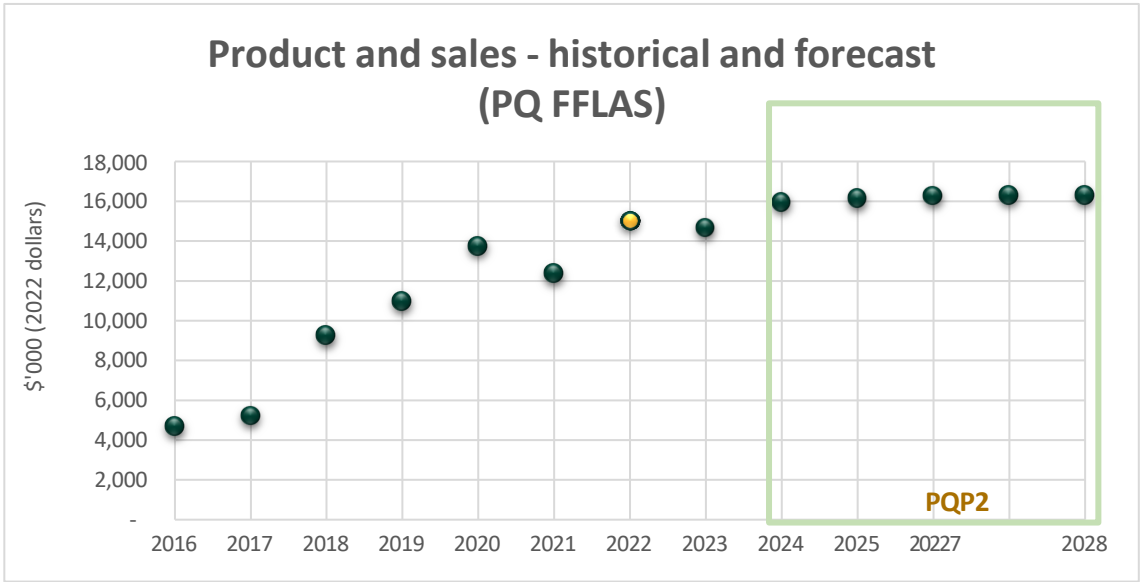
(a) activities that must be done as part of essential business processes i.e., administrative tasks such as incentives program management, RSP account management and product pricing, for which efficiency is hard to gauge, other than through revealed costs as a result of a BST forecasting approach,

(b) discretionary activities that are normally considered part of marketing i.e. product promotion and management.

For cost type (b) we would expect an economic assessment to ensure that the cost of the activities is more than offset by the incremental revenue expected to be generated from these activities. We acknowledge that quantifying the incremental revenue would be subject to considerable uncertainty. However, an assessment of this type should be part of effective governance and prudent and efficient management that demonstrates the activity is earning more than it costs. We are not aware of this analysis being done.

Figure 37 provides the PQ FFLAS time series for the Product and Sales sub-category and is consistent with the narrative of rapid growth followed by plateauing as PQ FFLAS is now in an organic growth phase, but subject to competition from competing technologies.

Figure 37 Chorus' Product and Sales PQ FFLAS opex] ($CY22)



Source: Chorus

It is not possible to determine definitively from this sort of analysis that opex is prudent and efficient, but the evidence in the form of a clear description of the activities undertaken under this opex sub-category and the associated trend analysis are consistent with prudence and efficiency. However, in future, we would expect to see an

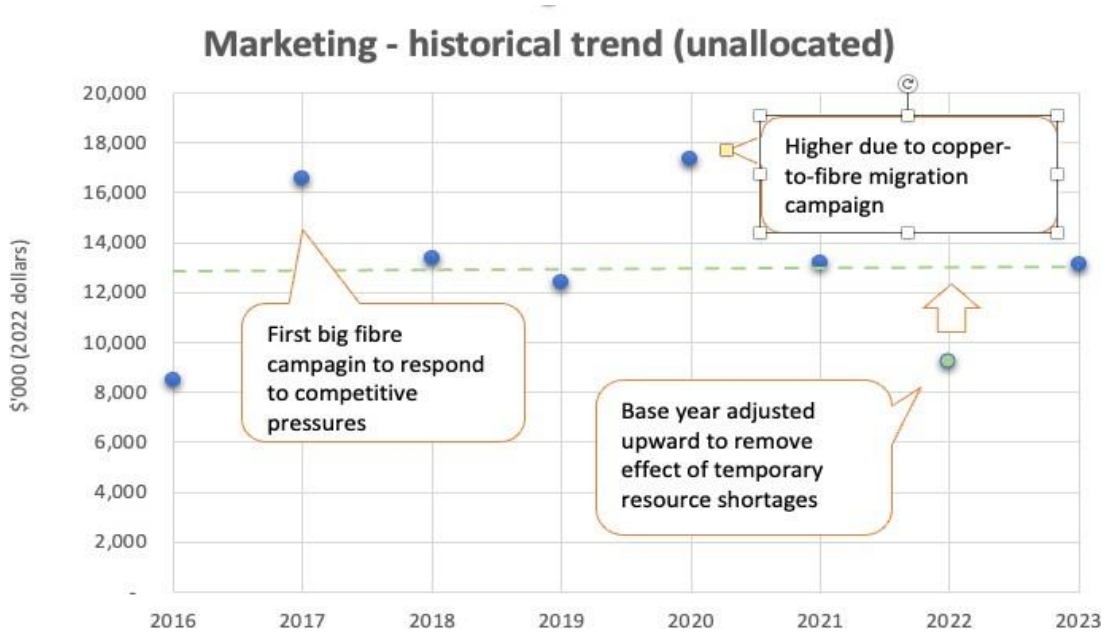
economic assessment of the product related/discretionary expenditure as a matter of sound business practice.

Marketing

As for the Product and Sales sub-category, Chorus's description of the need for Marketing sub-category is clear and succinct and reflects the types of activity to be expected for a fibre telecommunications network provider that has strong natural monopoly elements, while also being subject to competitive pressures.

Trend analysis of unallocated Marketing opex shown in Figure 38 is similarly helpful, providing insight into the drivers of expenditure volatility and interpreting a trend amid that volatility. We consider Chorus' trend assessment as being reasonable.

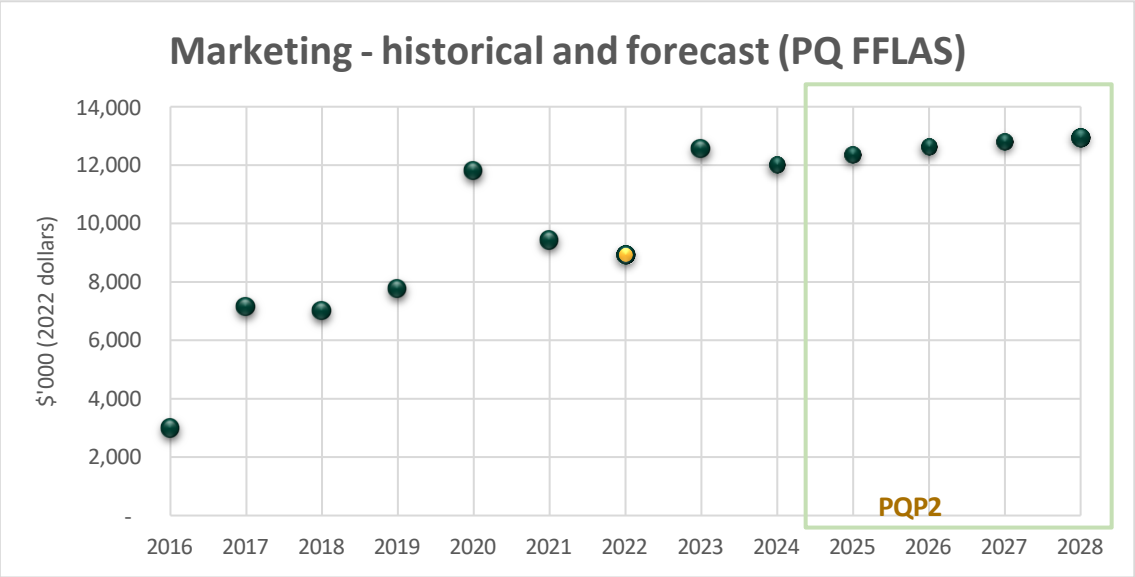
Figure 38 Chorus' Marketing unallocated opex ($CY22)



Source: Chorus

Figure 39 below provides the time series for the PQ FFLAS Marketing sub-category and is consistent with the Product and Sales expenditure profile that is indicative of PQ FFLAS now being in an organic growth phase, while subject to competition from competing technologies.

Figure 39 Chorus' Marketing PQ FFLAS opex ($CY22)



Source: Chorus

However, marketing expenditure, as for product management (which is normally undertaken as part of marketing) is a discretionary activity that ideally needs to be supported by economic analysis demonstrating the level of expenditure is more than offset by the resulting increased revenue resulting from the marketing activity. We consider such a piece of analysis as necessary in definitively determining if prudence and efficiency are satisfied.

As for the Product and Sales sub-category, it is not possible to determine definitively from the information provided by Chorus that its Marketing opex is prudent and efficient, but evidence in the form of a clear description of the activities undertaken and the associated trend analysis are consistent with prudence and efficiency.

Ideally, economic analysis and associated sensitivity analysis should be undertaken in future to seek to optimise the level of Marketing opex, while noting that forecasts of incremental revenue developed in an economic analysis are subject to significant uncertainty.

Verification opinion

We can verify that Chorus' PQP2 Product, Sales and Marketing sub-category forecast satisfies Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding competition effects; and Assessment Factor regarding the reasonableness of key assumptions and methodologies relied upon.

However, we cannot verify that the Product, Sales and Marketing sub-category forecast satisfies Assessment Factor regarding the accuracy and reliability of data as it relates to the use of electric network elasticities in the trend factor (discussed in section 11.4.3 of this chapter).

11.5.2 Network sub-category group

The Network sub-category group includes spending on the following three sub-categories:

- Maintenance – the outsourced costs to FSPs of physical network inspection and repairs, property maintenance and materials;
- Operating Costs – costs related to running the network, including electricity and leases; and
- Network Operations – primarily the labour costs of running the Network Operation Centre, the assure service desk, the Security Operations Centre, customer billing and escalations, and other customer-facing network services.

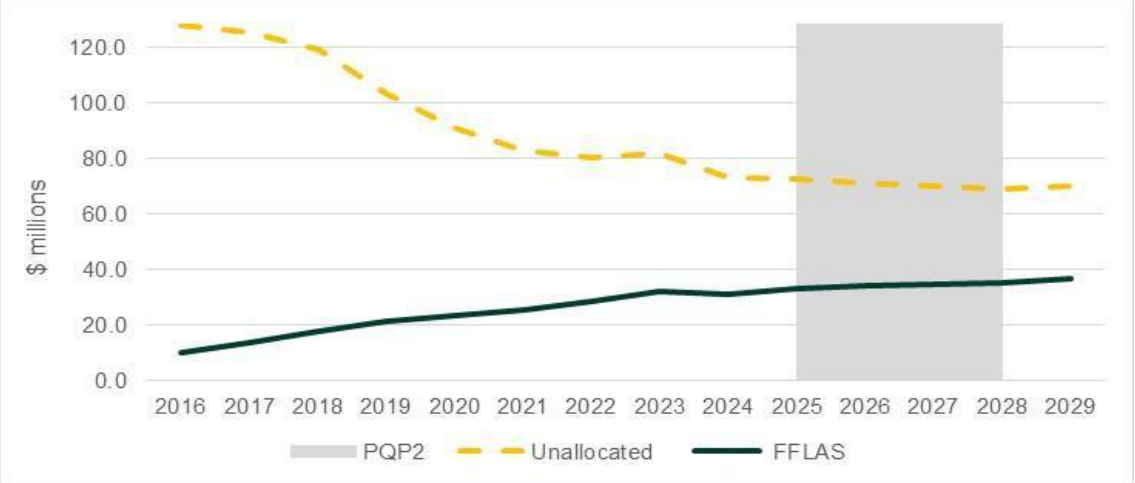
The PQP2 forecast for each of these Network sub-categories is assessed below.

Maintenance

The PQP2 forecast for PQ FFLAS Maintenance is $137.3 million (or $34.3 million per annum) compared to $30.5 million per annum in PQP1.

As variable maintenance activities related to the copper network decline, unallocated maintenance costs (i.e. for both copper and FFLAS) are reducing. However, PQ FFLAS Maintenance opex is increasing as PQ FFLAS connections increase and shared costs are increasingly re-allocated from copper to fibre services, as shown in Figure 40 below.

Figure 40 PQ FFLAS Maintenance opex ($CY22)



Source: Chorus

The decline in copper maintenance costs appears to be sharper than the slower upward trend in FFLAS maintenance costs, which is to be expected given fibre network assets are generally less maintenance-intensive than copper network assets.

Chorus' forecasting approach

Chorus breaks the Maintenance sub-category into three further cost sub-categories:

(a) Facilities

(b) Reactive maintenance

(c) Preventative maintenance

Facilities

Facilities opex covers network property maintenance, including inspections, programmed services and repairs of buildings, grounds, and building services.

Chorus' PQP2 Facilities forecast is based on the following approach:

- CY22 is the base year with an upwards adjustment for property maintenance applied (CY22 expenditure was around $3.4 million).
- No step changes applied.
- Applied a trend that includes real price effects and scales costs with connections growth applying a 0.45 elasticity – ie, a historical trend of declining cost per connection.

Reactive maintenance

Reactive maintenance opex covers outsourced network fault response (i.e., loss of service) and defect response (e.g., pit repair) for field assets. Fault response restores service to meet quality standards, and customer service level agreements (SLAs). Defect response addresses public and worker safety risks, prevents faults, or manages lifecycle costs.

Chorus' PQP2 Reactive Maintenance forecast is based on the following approach:

- Adjust the 2022 base year upward by $0.7 million to capture FSPs' abnormally low performance payments in 2022 (CY22 expenditure was around $23.9 million).
- **CCI [**

  ].
- apply a trend including real price effects and scales costs with connections growth, using a 0.45 elasticity – ie, an historical trend of declining cost per connection.

Preventative maintenance

Preventative maintenance comprises physical network inspections, scheduled maintenance, and other proactive maintenance for field assets. It also includes location services for third parties (for underground assets) and scheduled maintenance on electronic equipment (e.g., filter cleaning).

Additional benefits from inspections are that they provide asset information and awareness that allows Chorus to manage public safety, identify defects, and support investment planning, while scheduled and proactive maintenance manages lifecycle costs.

Chorus' PQP2 Preventative Maintenance forecast is based on the following approach:

- CY22 is the base year with no adjustments – Chorus notes that **CCI [**

  ]
- No step changes applied.
- Apply a trend including real price effects and that scales costs with connections growth using an elasticity of 0.45 – ie, falling cost per connection.

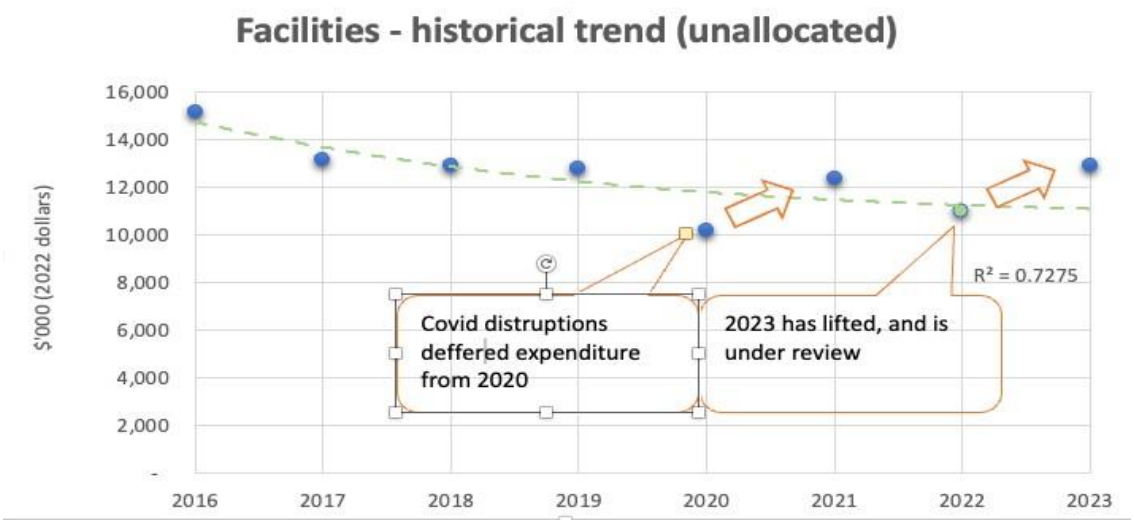
IV's analysis and key findings

Facilities

Chorus provided a clear and succinct description of why the Facilities sub-category is needed and why its approach is efficient. Most of the expenditure is outsourced to a specialist service provider through competitive tender. The activities and the competitively tendered outsourcing are consistent with prudent and efficient opex.

Chorus further supports this claim with trend analysis of unallocated Facilities opex as shown in Figure 41.

Figure 41 Facilities Maintenance historical unallocated opex ($CY22)



Source: Chorus

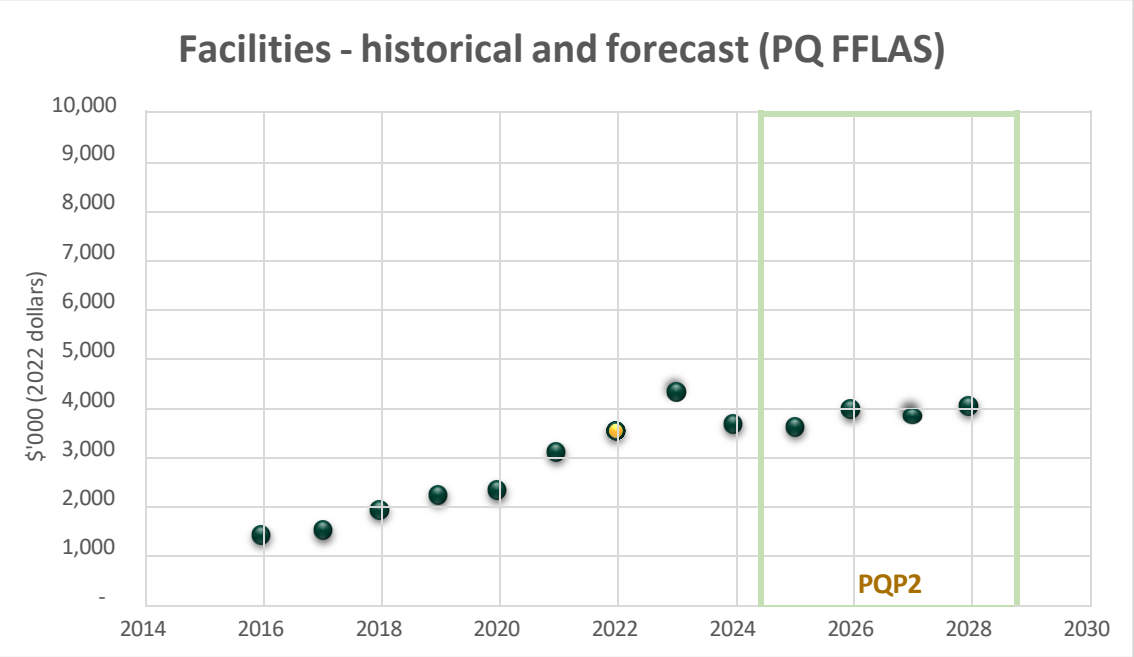
Chorus has assessed the trend using a third order polynomial, which provides an acceptable fit to the data. However, a third order polynomial is not appropriate for a couple of reasons. There is no underlying reason that the trend would have a third order structure and with such a small amount of data a simpler (mononomial) relationship should be considered. A straight-line relationship can be eliminated on the grounds that cost reductions which are a result of the decreasing maintenance on the copper network cannot be expected to be constant as the copper network declines and the growth of the FFLAS network slows, suggesting that a hyperbolic relationship ($y = a/x + b$) is more appropriate at least up to 2023. However, the trend indicates an expected flattening of the unallocated costs.

Figure 42 below provides insight on the historic trend for PQ FFLAS for the Facilities secondary sub-category showing a steady increase in opex from CY16 levelling out in

CY23. This trend is consistent with the growth of the fibre network and the increasing allocation of costs to FFLAS.

The level of PQ FFLAS (and unallocated Facilities) opex for CY23 appears anomalous. The value is part actual and part forecast and Chorus advises that it is reviewing the size of increase in the first six months of CY23. It is assessing if this is an ongoing change, or a one-off catch up. This has not resulted in a base year adjustment and is subject to further analysis.

Figure 42 Facilities Maintenance PQ FFLAS opex ($CY22)



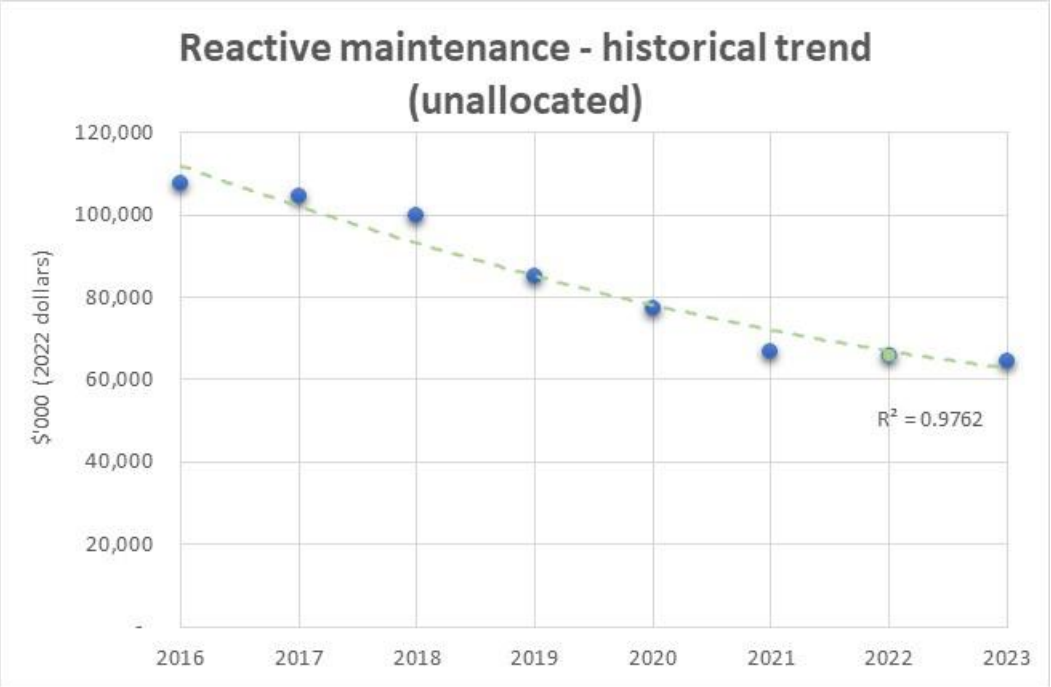
Source: Chorus

Applying a top-down assessment for the Facilities secondary sub-category, it is not possible to determine definitively that opex is prudent and efficient, but the evidence in the form of a clear description of the activities undertaken, including the use of competitive tendering for the bulk of the expenditure together with the associated trend analysis are consistent with prudence and efficiency.

Reactive Maintenance

Chorus provided a clear and succinct description of the need for the Reactive Maintenance activity and noted the use of outsourcing to FSPs via competitive tender for delivery of this work. Figure 43 shows the time series for unallocated Reactive Maintenance.

Figure 43 Reactive Maintenance Unallocated opex ($CY22)



Source: Chorus

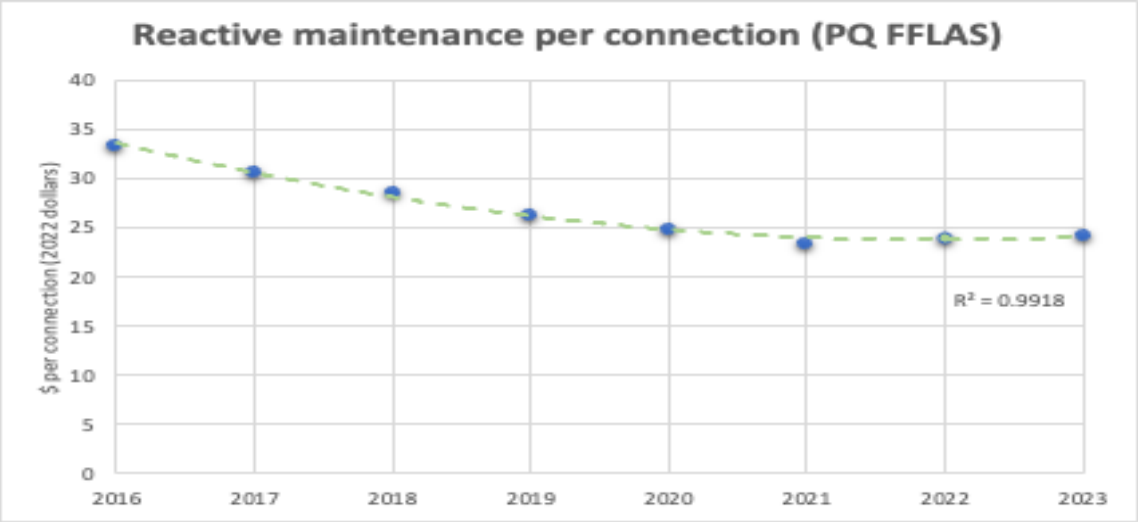
The trend analysis shows a steady and significant decline in unallocated Reactive Maintenance opex consistent with the reduction in the number of copper network connections, representing a reduction of approximately 40% over the period. This is the sort of trend reduction in variable maintenance costs to be expected as Chorus transitions from its much older copper network, which is inherently more likely to fail than the new fibre optic technology. While not definitively demonstrating that Chorus' unallocated Reactive Maintenance opex is efficient, it is consistent with efficient behaviour.

However, it is unclear whether this opex sub-category has reached the end of the reductions as Chorus still has a material number of live copper connections (particularly outside the largest urban areas). Use of a hyperbolic regression of the time series may have provided a clearer indication than the quadratic regression used by Chorus. However, as the number of copper connections can be expected to continue to decrease (at a decreasing rate) we would expect that the unallocated Reactive Maintenance will continue to decrease, although at a slower rate than has been experienced over the 6 years to CY22.

For the cost per connection trend analysis, Chorus again applied a third order polynomial regression trend line (See Figure 44 below). For the same reasons as for the Facilities sub-category, the polynomial regression should be replaced with a hyperbolic regression ($y = a/x + b$).

Regardless, the usefulness of the trend is questionable. First, use of PQ FFLAS (i.e., allocated costs) is substantially affected by the cost allocation methodology and second the trend decline is enhanced by the growth in PQ FFLAS connections. The narrative that results from this is that Chorus has increased its allocation of shared Reactive Maintenance costs to PQ FFLAS (as is appropriate) but fibre customer numbers have grown reducing the cost per customer, which is generally to be expected for network infrastructure. Figure 44 of itself provides little insight into the efficiency of Chorus's PQ FFLAS costs.

Figure 44 Reactive Maintenance historical FFLAS opex ($CY22)

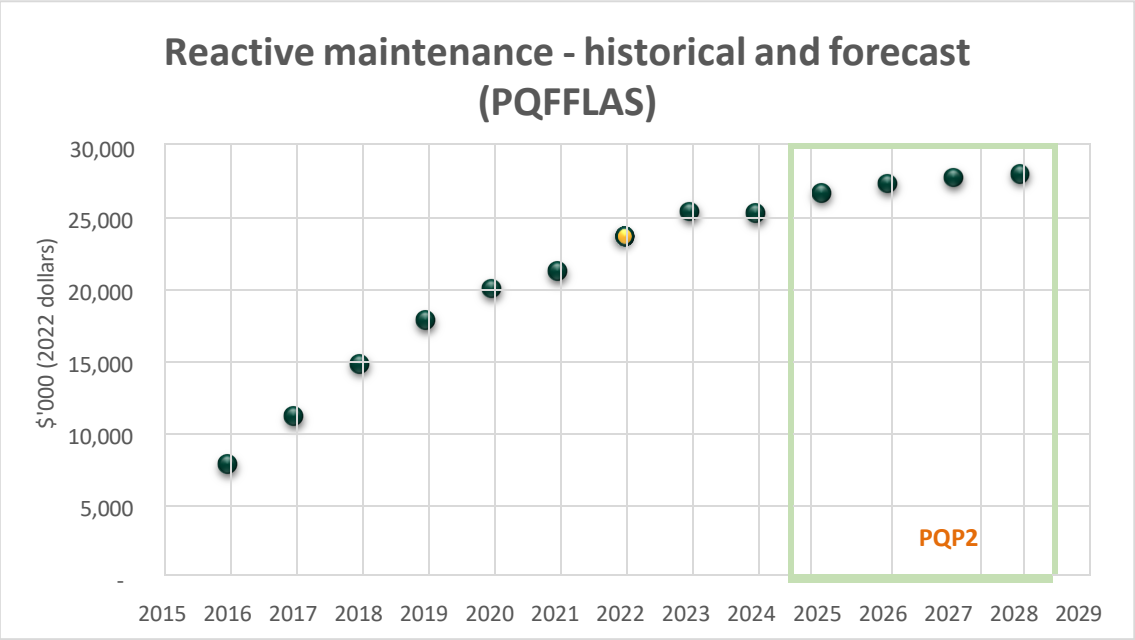


Source: Chorus

The use of a hyperbolic regression would have provided a more reasonable and plausible fit and removed the slight up-tick for FY23.

Figure 45 shows strong growth of PQ FFLAS Reactive Maintenance from CY16 to CY22; from then on, costs plateau. Much of this trajectory reflects growth in the fixed fibre network plus an increasing allocation of shared Reactive Maintenance costs to PQ FFLAS and is to be expected.

Figure 45 Reactive Maintenance historical and forecast PQ FFLAS opex ($CY22)



Source: Chorus

Applying a top-down assessment for the Reactive Maintenance secondary sub-category, it is not possible to determine definitively that opex is prudent and efficient, but the evidence in the form of a clear description of the activities undertaken, including the use of competitive tendering for delivery of this work program together are highly consistent with prudence and efficiency.

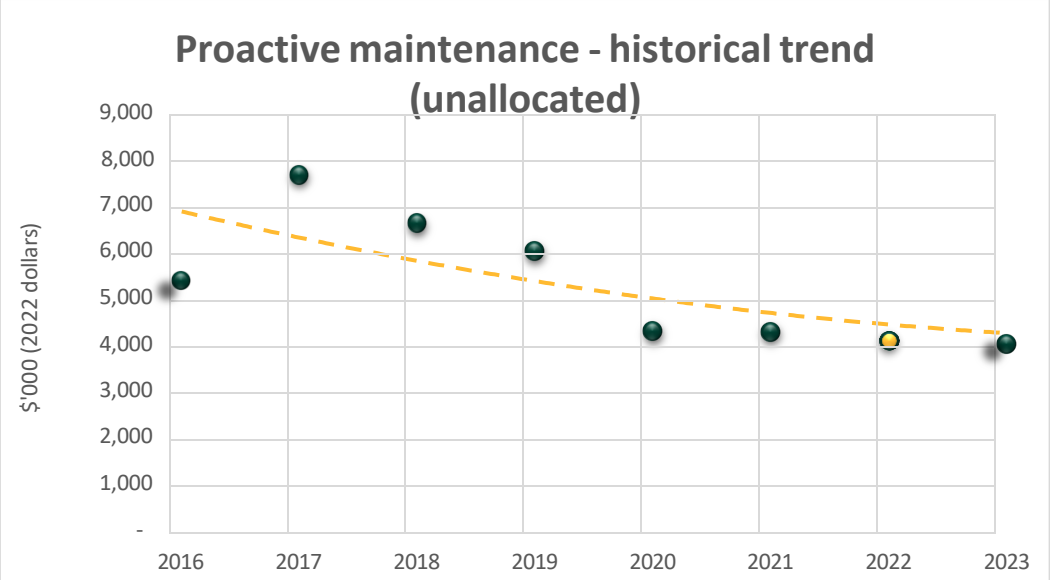
The trend analysis using unallocated Reactive Maintenance opex is supportive of an understanding that Chorus is behaving efficiently. However, the PQ FFLAS and PQ FFLAS per connection does not provide a clear basis for assessing the trends.

In addition to Chorus' proposed **CCI [ ]**, the reasons for the increase in Reactive Maintenance costs in PQP2 are the **CCI [ ]** and trend effects (0.45% elasticity assumption), which were assessed in section 11.4.1 of this chapter.

Preventative (proactive) Maintenance

The trend analysis for Preventative Maintenance opex in Figure 46 shows a similar pattern of steady significant reduction as Reactive Maintenance opex with a similar reduction (40% approximately) between CY16 and CY23 as use of the copper network declines. While not definitively demonstrating that Chorus' Preventive Maintenance opex is efficient, it is consistent with efficient behaviour.

Figure 46 Preventative Maintenance unallocated opex ($CY22)



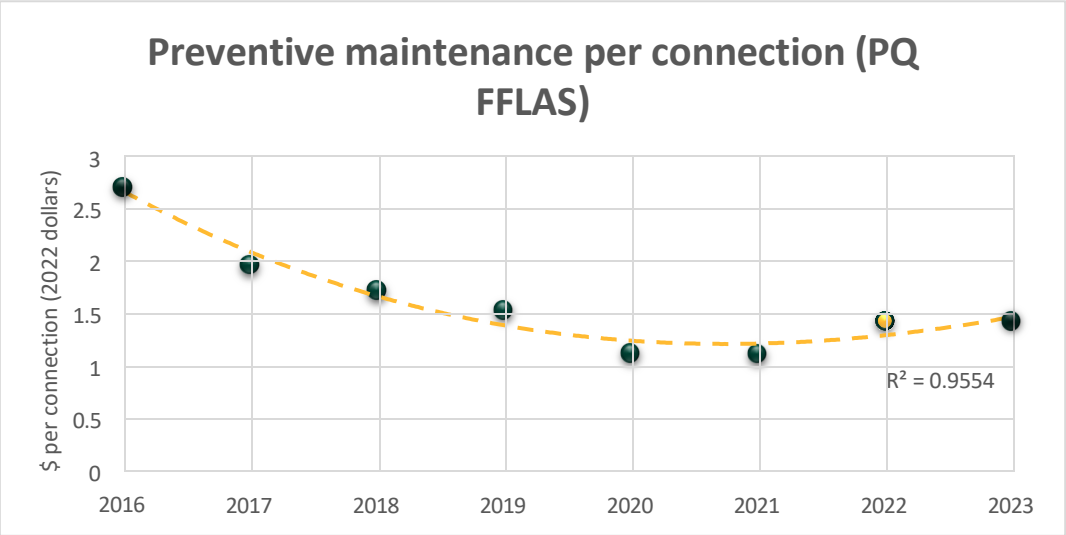
Source: Chorus

As for Reactive Maintenance, it is unclear whether the Preventative Maintenance opex sub-category has reached the end of the reductions given Chorus still manages a material number of live copper connections.

Use of a hyperbolic regression of the time series may have provided a clearer indication than the quadratic regression used by Chorus. However, as the number of copper connections can be expected to continue to decrease (at a decreasing rate) we would expect that the unallocated Preventive Maintenance will continue to decrease, although at a slower rate than has been experienced over the 6 years to CY23.

For the cost per connection analysis, Chorus again applied a third order polynomial regression trend line (See Figure 47 below). For the same reasons as for the Facilities secondary sub-category the polynomial regression should be replaced with a hyperbolic regression ($y = a/x + b$). The use of a hyperbolic regression would have provided a more reasonable and plausible fit and remove the uptick for 2023.

Figure 47 Preventative Maintenance historical FFLAS opex ($CY22)



Source: Chorus

As for Reactive Maintenance the trend in this chart is mainly a reflection of increasing fibre connections likely offset somewhat by increasing allocation of shared Preventative Maintenance costs to PQ FFLAS and does not give any insight into efficiency of the Preventative Maintenance opex.

However, Figure 48 for PQ FFLAS Preventative Maintenance shows a different trend to PQ FFLAS Reactive Maintenance in that while it shows strong growth from FY16 to FY22, costs do not plateau for the forecast years until FY27.

Figure 48 Preventative Maintenance historical and forecast FFLAS opex ($CY22)

Source: Chorus

The reasons for forecast costs not plateauing until FY27 could be driven by **CCI [**

]. However, this is not identified by Chorus as a step change for this opex sub-category, which suggests that cost allocations to PQ FFLAS could be having an increasing effect in PQP2 (and more so than is the case for Reactive Maintenance).

Overall, applying a top-down assessment for the Preventive Maintenance sub-category, it is not possible to determine definitively that opex is prudent and efficient. The unallocated historical trend appears to be consistent with efficient behaviour by Chorus. In contrast, the PQ FFLAS forecast for PQP2 is difficult to interpret, increasing sharply from a low base (around $1.5 million in CY22 to around $2.3 million in FY28), which appears to reflect the effects of trend growth (cost elasticity assumption of 0.45%) and increasing cost allocation.

Verification opinion

We can verify that Chorus' PQP2 Maintenance sub-category forecast satisfies: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information; and Assessment Factor regarding the reasonableness of key assumptions and methodologies relied upon.

However, we cannot verify that the PQP2 Maintenance sub-category forecast satisfies Assessment Factor (s) regarding the accuracy and reliability of data as it relates to:

(i) the base year upwards adjustment in relation to property maintenance (discussed in section 11.4.1 of this chapter) and

(ii) the quantum of the step change in relation to **CCI [ ]** (discussed in section 11.4.4 of this chapter)

(iii) the use of electricity network elasticities in the trend factor.

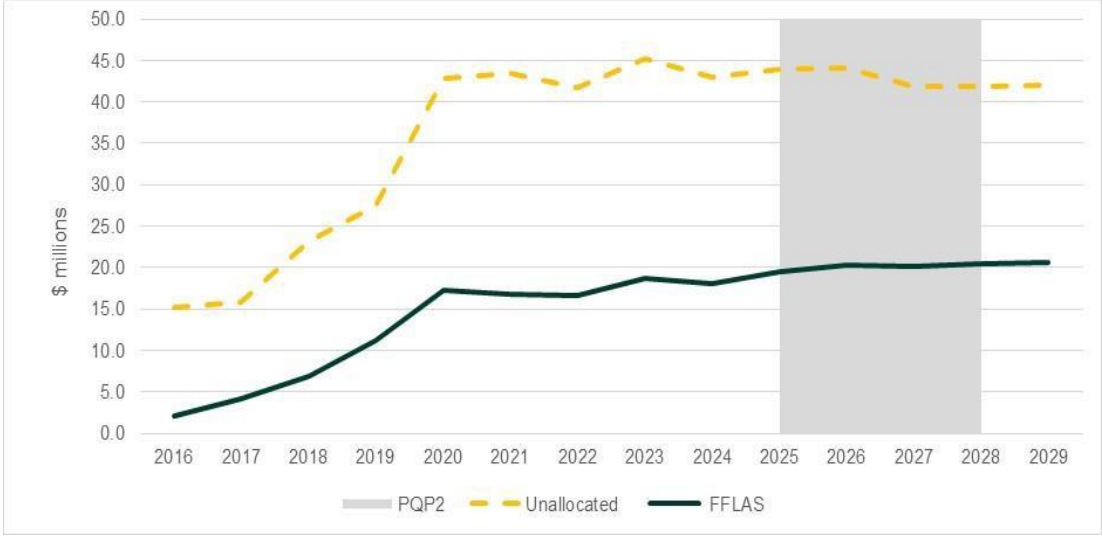
Network Operations

The PQP2 forecast for PQ FFLAS Network Operations is $80.4 million (or $20.1 million per annum) compared to $17.8 million per annum in PQP1.

Figure 49 shows the PQ FFLAS component of this opex sub-category has been rising quite sharply since CY22 but is forecast to flatten somewhat in PQP2.

This can be contrasted with business-wide (unallocated) costs, which are forecast to decline somewhat in PQP2 while remaining broadly consistent with costs observed since CY20.

Figure 49 Network Operations ($CY22)



Source: Chorus]

Chorus forecasting approach

Chorus identifies the following key activities associated with the Network Operations opex sub-category:

- network operations internal labour – labour cost of teams involved in network operations;
- Network Operations Centre – cost of outsourcing support and workforce management services;
- **CCI [**

  ];
- shared Spark systems – cost of supporting legacy systems;
- other software license and technology hardware maintenance – eg. licenced software maintenance, firewalls and routers; and
- project opex – costs of supporting capital projects.

Chorus notes its Network Operations costs are expected to remain relatively stable in PQP2 as its fibre network build activity falls and its focus changes to a UFB network operator role.

However, Chorus has proposed a base year adjustment of **CCI [**

]. It has also applied a trend factor including real price effects and cost elasticity of 0.45% to

develop the PQP2 forecast linked to fibre connections growth (but applies no step changes).

Given Network Operations costs are largely shared in nature, Chorus expects the PQ FFLAS portion of these costs to increase over time as the fibre network grows and copper services continue to decline.

IV's analysis and findings

Given the heavily shared nature of this opex sub-category, the forecast decline in unallocated Network Operations costs since CY23, including a steady forecast decline in PQP2, provides reasonable evidence that the PQ FFLAS forecast for PQP2 is likely to be efficient based on Chorus' apparent business-wide cost discipline.

Chorus' proposed CY22 base year adjustment in relation to **CCI [ ]** was assessed in section 11.4.1 of this chapter and the use of cost elasticities in section 11.4.3 of this chapter.

Verification opinion

We can verify that Chorus' PQP2 Network Operations sub-category forecast satisfies, the Assessment Factor regarding historic rates of investment; the Assessment Factor regarding approach to forecasting opex; the Assessment Factor regarding fibre asset and fibre network information; and the Assessment Factor regarding the reasonableness of key assumptions and methodologies relied upon.

However, we cannot verify that the PQP2 Network Operations sub-category forecast satisfies the Assessment Factor regarding the accuracy and reliability of data as it relates to:

(i) **CCI [ ]** (discussed in section 11.4.4 of this chapter); and

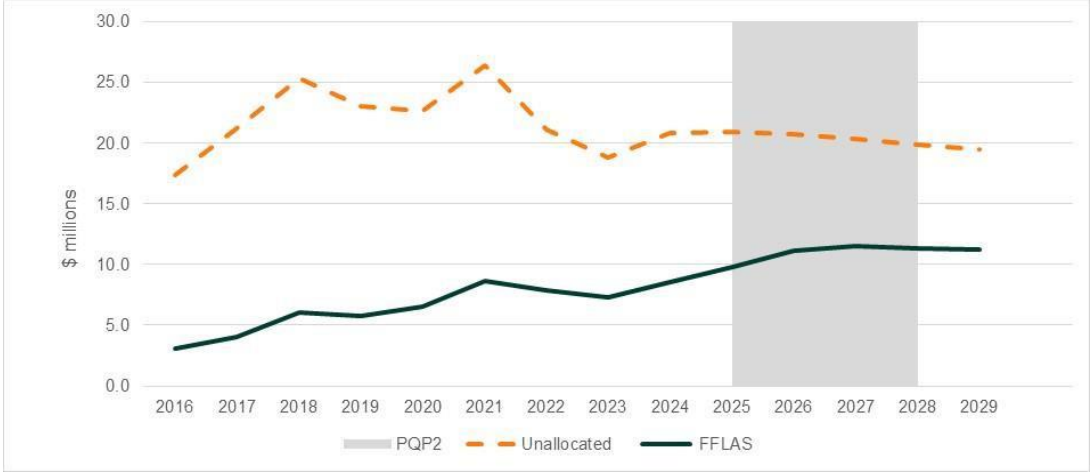
(ii) the use of electricity network elasticities in the trend factor (discussed in section 11.4.3 of this chapter).

Operating Costs

The PQP2 forecast for PQ FFLAS Operating Costs is $43.7 million (or $10.9 million per annum) compared to $7.9 million per annum in PQP1.

Figure 50 shows CY22 unallocated operating costs are essentially flat from CY20 onwards**.** In contrast, PQ FFLAS costs increase at a slow rate from FY22 onwards, reflecting what is likely to be an increasing allocation of shared (unallocated) costs to PQ FFLAS.

Figure 50 Operating costs ($CY22)



Source: Chorus

Chorus forecasting approach

Chorus notes that it is **CCI [ ]**, which is reflected in its PQP2 forecast. It also has an ongoing program of work to optimise network property-related costs, which includes network leases (shared costs).

Chorus expects declining copper connections to have a favourable impact on total electricity costs. However, FFLAS expenditure is expected to stay at a similar level or increase as more shared costs are needed to support fibre assets, such as network electronics. Chorus has proposed an investment in the installation of solar panels on its property sites in PQP2 which is expected to reduce its electricity costs over time (but not significantly in PQP2. This capex/opex trade-off was assessed in section 11.4.4 of this chapter.

Chorus also expects its total rates expenditure to increase over time as its fibre infrastructure grows and council rates increase at higher rates than general inflation. It notes that rates are treated as a pass-through cost under the Fibre IMs.

Chorus expects other costs in this sub-category to move in line with inflation.

It has applied a trend factor to this sub-category including real price effects and cost elasticity of 0.45% linked to forecast fibre connections, which was assessed in section 11.4.3 of this chapter (but applies no step changes).

IV's analysis and findings

PQ FFLAS Operating Costs is a relatively small opex sub-category with a relatively large, shared cost component, which indicates that PQ FFLAS will likely receive a higher allocation of these costs as copper services decline over time.

The reasonably sharp decline in unallocated Operating Costs since CY21, including a small decline forecast for PQP2, provides reasonable evidence that the PQ FFLAS forecast for PQP2 is likely to be efficient based on apparent business-wide cost discipline.

Verification opinion

We can verify that Chorus' PQP2 Operating Cost sub-category forecast satisfies: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information; Assessment Factor regarding the dependency and trade-off between the proposed capex and opex; and Assessment Factor regarding reasonableness of key assumptions and methodologies.

However, we cannot verify that the PQP2 Network Operations sub-category forecast satisfies Assessment Factor regarding the accuracy and reliability of data as it relates to:

(i) impact of the proposed solar capex/opex trade-off on electricity costs (discussed in section 11.4.4 of this chapter); and

(ii) use of electricity network elasticities in the trend factor (discussed in section 11.4.3 of this chapter).

11.5.3 Support sub-category group

The Support sub-category group covers the following three sub-categories:

- corporate – Chorus' functional teams, accommodation and other expenses, such as insurance, office expenses and regulatory levies;
- asset management – internal labour costs for the Chief Technology Office (CTO) and the Customer and Network Operations (CNO) teams that support Chorus' asset management processes and operations; and
- technology – non-capital project work, support contracts, IT services and licences for Chorus' IT systems.

We consider the Support sub-category group includes the largest component of shared costs within Chorus' business, so it is more likely to reflect application of Chorus' cost allocation methodology, including a trend increase in PQ FFLAS Support as the copper service declines and fibre services continue to grow (albeit at a slower rate).

Our assessment of each of the Support sub-categories is presented below.

Chorus' forecasting approach

Asset Management

The Asset Management sub-category is undertaken by two key departments, the Chief Technology Office (CTO) and the Customer Network Operations (CNO).

The CTO is responsible for strategy and asset management planning for Chorus' copper and UFB networks, covering:

- defining, planning, and executing Chorus' technology strategy
- defining, planning, and executing our Chorus' asset management strategy
- planning and ensuring network capacity and coverage
- deploying new network technologies
- delivering IT change and operating its technology.

CNO is responsible for the implementation of the work of the CTO and involves management of:

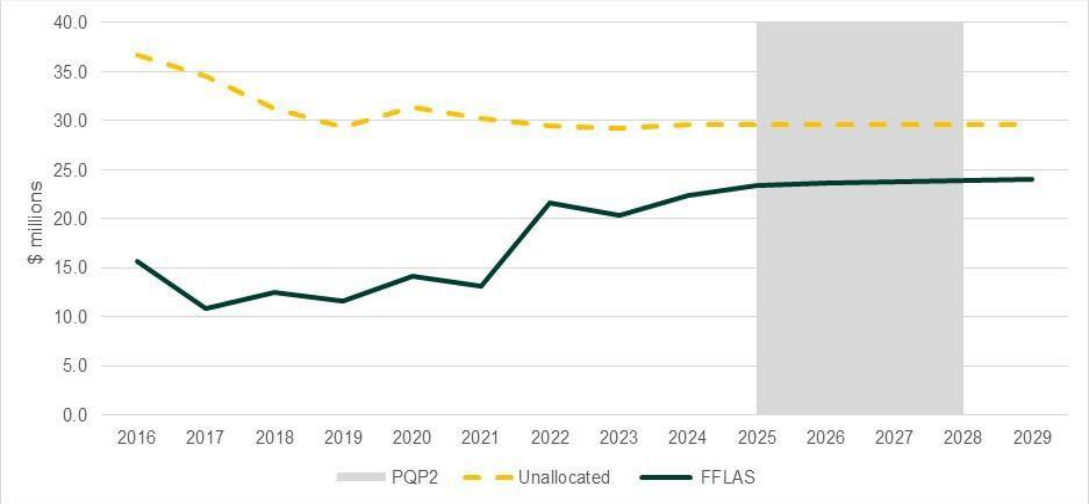
- field services and facilities management agreements, operational risks, and compliance (incl. building, health and safety, and environmental
- network build projects, including engineering design, consenting and procurement and contract administration.

The services provided by these two departments are largely through in-house teams supplemented by personnel with specialist skills and expertise, as needed.

The PQP2 forecast for PQ FFLAS Asset Management is $94.8 million (or $23.7 million per annum) compared to $21.4 million per annum in PQP1. Chorus has applied no base year adjustments, step changes and only a real price trend to develop the PQP2 forecast.

Figure 51 shows FFLAS asset management costs are forecast to rise in PQP2 materially against the 2022 base year. Given that unallocated opex is essentially flat from 2023, the increase appears to be a result of the way that cost allocation operates in Chorus' FFLAS forecast rather than any major changes in either Asset Management activity or underlying efficiency of the opex.

Figure 51 Asset management ($CY22)

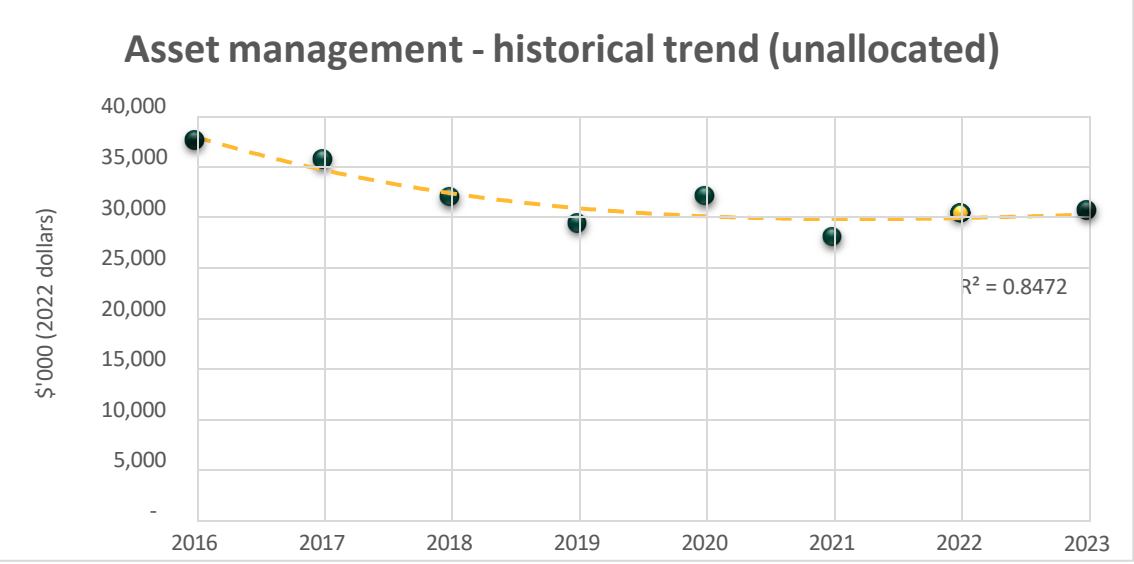


Source: Chorus

IV's analysis and key findings

Figure 52 shows Chorus' trend analysis of unallocated (business-wide) Asset Management opex. As for previous trend analysis, Chorus has used a third order polynomial regression. For the reasons identified above a hyperbolic regression is more appropriate ($y = a/x + b$). Despite the inappropriate selection of regression equation, the trend suggested is a reasonable fit – except for the slight uptick for 2023 – and is consistent with the ongoing movement of end users from the copper network to the UFB network.

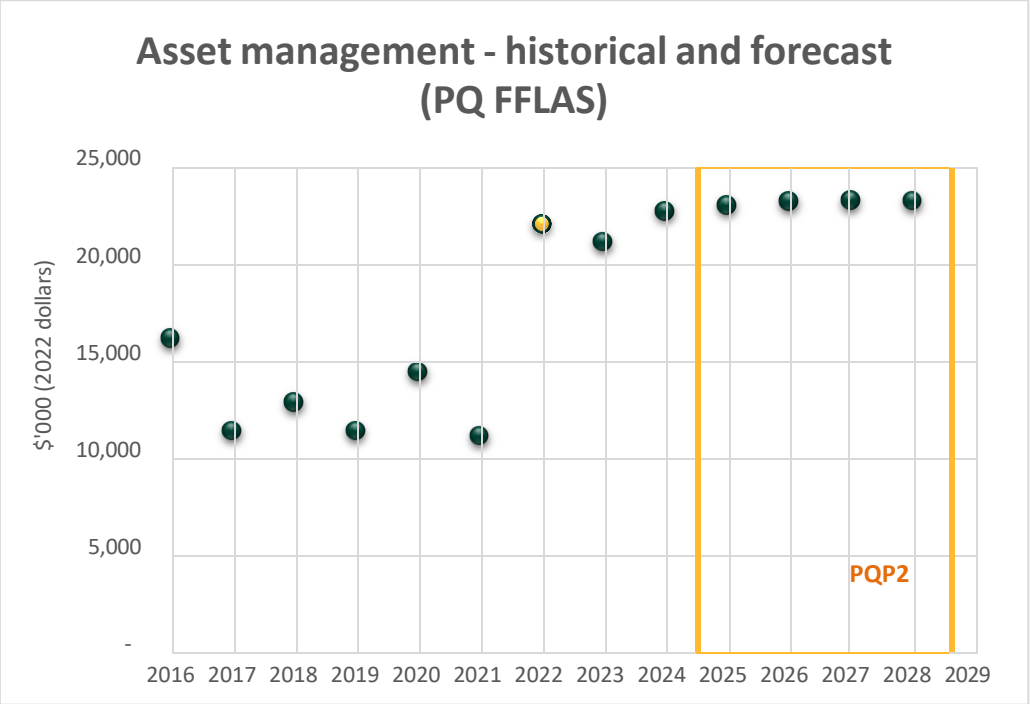
Figure 52 Asset management historical unallocated opex ($CY22)



Source: Chorus

Figure 53 shows PQ FFLAS for Asset Management increasing in a step change pre- and post-FY21. This large increase does not reflect the historical unallocated Asset Management opex, indicating that the step change appears to arise from Chorus' cost allocation to PQ FFLAS, with PQ FFLAS receiving around 80% of the unallocated Asset Management cost post-CY21.

Figure 53 Asset management FFLAS opex ($CY22)



Source: Chorus

Applying a top-down assessment for the Asset Management sub-category, it is not possible to determine definitively that opex is prudent and efficient, but the evidence in the form of a clear description of the activities undertaken under this sub-category, and how it is resourced is consistent with prudency and efficiency. Use of unallocated historical Asset Management opex and a hyperbolic regression to interpret the trend would provide much greater clarity and confidence about the nature of the trend and what it indicates about efficiency.

In addition, without the unallocated Asset Management opex trend we do not have a plausible explanation for the sharp step increase in PQ FFLAS in CY22 other than it is a result of the shared cost allocation between PQ FFLAS and copper network services.

Verification opinion

We can verify that Chorus' PQP2 Asset Management sub-category forecast satisfies the Evaluation Criteria.

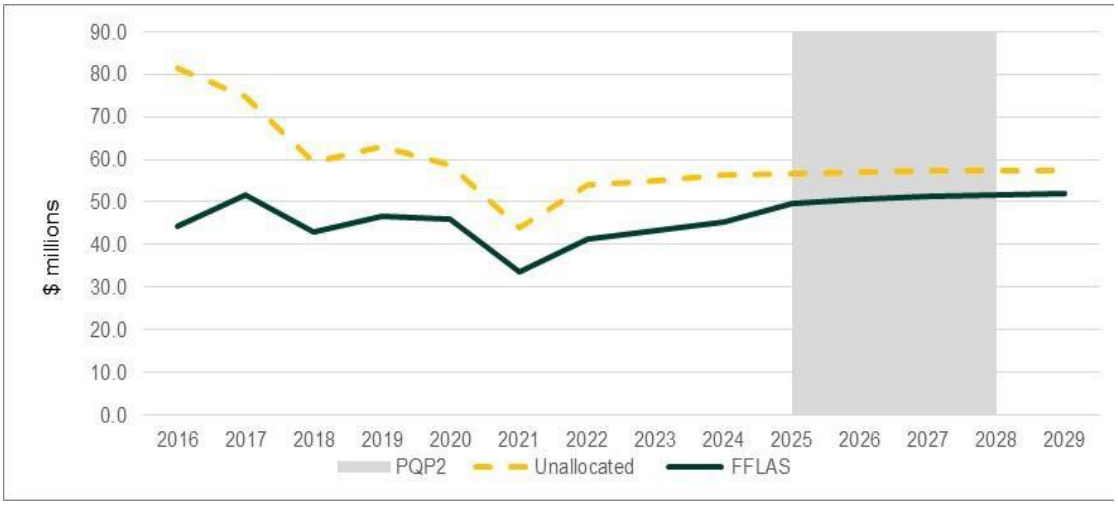
In forming our opinion, we have had particular regard to: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information; and Assessment Factor regarding reasonableness of key assumptions and methodologies.

Corporate

The PQP2 forecast for PQ FFLAS Corporate is $203.5 million (or $50.9 million per annum) compared to $43.3 million per annum in PQP1.

Figure 54 shows unallocated corporate costs are forecast to be flat in PQP2. The gentle rise in PQ FFLAS in PQP2 following a steep rise between CY21 and CY 25 appears to be because of Chorus' cost allocation methodology, reflecting the increase in fibre connections and reductions in copper connections.

Figure 54 Support - Corporate ($CY22)



Source: Chorus

Chorus' forecasting approach

Chorus presents the Corporate opex sub-category using the following three sub-categories:

- Assurance, including financial, climate / sustainability, tax, and regulatory audits by external entities.
- Levies, including telecommunications legislation pass-through levies and financial/securities market non-pass-through levies.
- Core corporate, including internal labour cost (eg. salaries, recruitment, development for core corporate functions); director's fees; insurance cover for

corporate and business risks, consultancy and legal services, including specialist advice, internal audit and other assurance activities; office accommodation, including leases, power, cleaning, maintenance, and security; and operating expenses, including communications, printing, postage, and stationery.

Assurance

Chorus' PQP2 forecast is based on CY22 costs, with:

- no base year adjustment – it notes CY22 costs are typical and reflect stable operation in an environment of careful cost control;
- only a real price trend is applied – Chorus does not think costs will be materially impacted by the scale of changes in fibre or copper connection volumes in PQP2, as these will not materially alter the complexity of its business;
- a permanent step change of around **CCI [ ]** in PQP2 (around **CCI [ ]** of the compliance audit step change discussed in section 11.4.4 of this chapter), which covers the forecast additional cost of assurance for two new disclosure obligations:
  - regulatory information disclosure for FFLAS, and
  - market-driven climate-related disclosures.

Levies

Chorus notes the levies are required by law due to the nature of Chorus' activities and its listing on the New Zealand and Australian stock exchanges.

Chorus also notes the telecommunications-specific levies are pass-through costs, meaning it will only recover actual costs through regulated revenues (with wash-ups for under or over-recovery).

Core corporate

Chorus' has identified the following cost items under the Core Corporate cost category:

- internal labour cost – for governance and senior management (executive), finance, investor relations, administration, people & culture, corporate risk, stakeholder relations, regulatory, and legal
- directors' fees
- insurance cover for corporate and business risks
- consultancy and legal services, including specialist advice, internal audit and other assurance activities not covered above

- office accommodation, including leases, power, cleaning, maintenance, and security
- operating expenses, including communications, printing, postage, and stationery.

Chorus' PQP2 Core Corporate forecast is based on CY22 costs, with:

- a base year adjustment in relation to self-insurance (discussed in section 11.4.1 of this chapter); and
- no trend factors.

Chorus notes that falling copper connections are not flowing through to reductions in corporate core opex because it does not reduce organisational complexity or scale of activity. It means that a larger share of a relatively fixed set of costs is being funded by PQ FFLAS.

IV's analysis and findings

Assurance

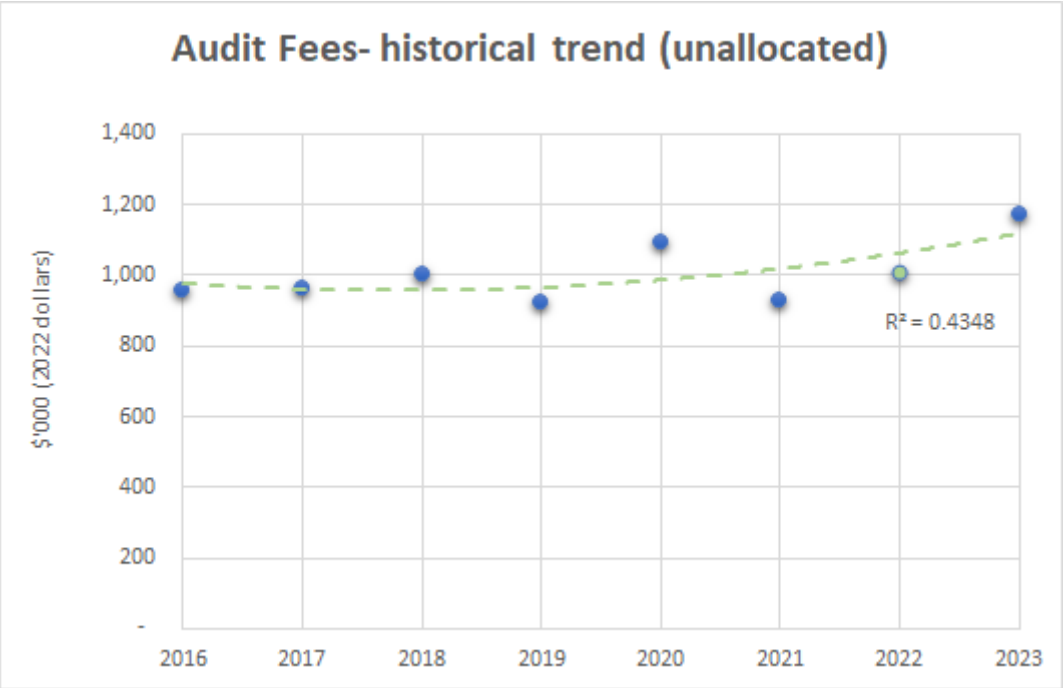
Chorus has provided a clear and succinct explanation of its Assurance opex, which relates to external assurance engagements, including financial, climate/sustainability, tax, and regulatory audits, but does not include Chorus's internal audit program or independent verification.[39] All the assurance activities are statutory obligations and cover all general corporate obligations together with industry specific information disclosure obligations under Part 6 of the Telecommunications Act and price-quality operation audits and related economic regulatory obligations and reporting to the Commission.

Chorus has supported its forecast for this opex sub-category as being efficient through its consideration of the scope and tenor of its engagement of assurance and audit. In tendering for assurance services, it states it balances the benefits of competitive tendering with continuity leading to periodic re-tendering. It also evaluates which tier of advisory firm (top or second tier) and when to use single or multiple service providers. These practices are clearly designed to get the best value from assurance firms. Chorus has provided supporting information in relation to the quantum of audit costs.

Following our request, Chorus has undertaken trend analysis of the historic unallocated audit fees as shown in Figure 55 below.

[39] Note that this section only captures audit services provided by KPMG at present, because capturing other assurance costs would require transaction-level interrogation of historical costs. KPMG provides financial and regulatory audits, but some tax assurance is provided by other vendors and is currently covered under "core" corporate rather than assurance sub-category.

Figure 55 Support - Corporate audit historical costs ($CY22)



Source: Chorus

This figure indicates a compound average growth rate in audit fees of 2.5-2.7%p.a. which would seem reasonable. Chorus has cited increased requirements for audit in relation to its new FFLAS regulatory obligations and associated proposed step change, which we found in section 11.4.1 satisfied the Evaluation Criteria and relevant Assessment Factors.

The evidence in the form of a clear description of the activities undertaken under this cost sub-category, and Chorus' approach to managing its assurance engagements is consistent with prudency and efficiency, the nature of the expenditure and the trend analysis also support consistency with prudency and efficiency of the audit costs.

Levies

Chorus pays a range of levies that can be grouped as:

(i) "pass-through" levies that arise from the Telecommunications Act and are passed through in Chorus's tariffs; and

(ii) "non pass-through" levies that arise as part of Chorus' corporate obligations to the Australian Securities & Investments Commission (ASIC) and Financial Markets Authority.

These are statutory obligations. To pay them and ensure that the correct amounts are paid is both prudent and efficient. In support of the efficiency of these costs, Chorus has provided a trend analysis of PQ FFLAS levies. We have not reproduced it here, because:

(a) a trend is irrelevant other than to show the rate at which government authorities raise their levies, which is not a matter of Chorus' efficiency, and

(b) deriving a meaningful trend from allocated (PQ FFLAS) opex is of limited, if any value, as has been identified above.

Core Corporate

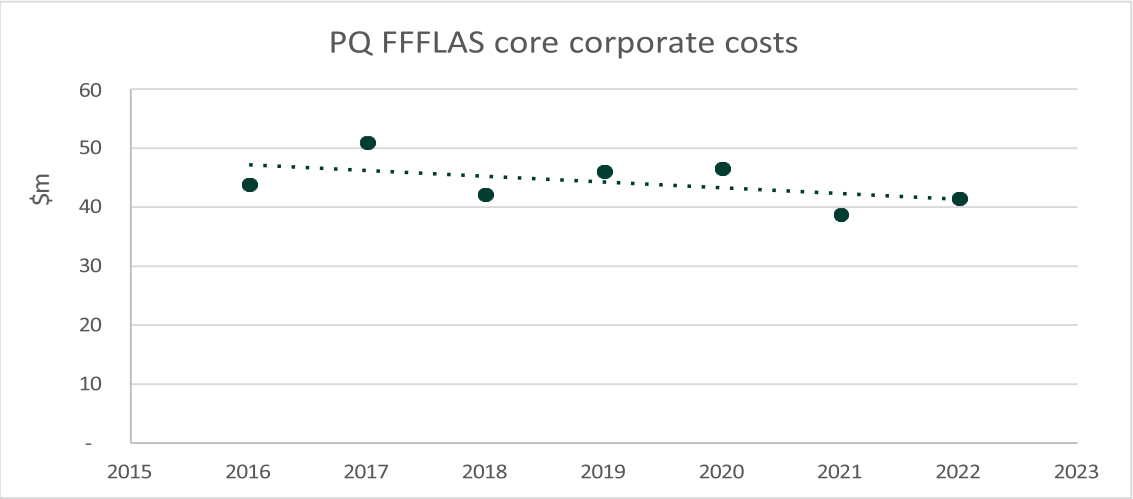
The Core Corporate expenses are necessary for the effective executive management and governance of Chorus as a business and reflect good practice of large corporations.

Chorus highlights practices to ensure that the costs incurred for the Core Corporate activities, including outsourcing some of these functions (e.g. legal), and undertaking some of the activities by internal staff such as for training use of system automation, are efficient.

For this opex sub-category, Chorus has proposed a base year adjustment in relation to its self-insurance costs of $1.2 million, which we considered in section 11.4.1 satisfied the Evaluation Criteria

In support of its demonstration of the efficiency of Core Corporate opex, Chorus has provided two trend analyses as shown in Figure 55 Core Corporate Unallocated and Figure 56 Core Corporate PQFFLAS per customer cost.

Figure 56 Support – Core Corporate unallocated opex ($CY22)



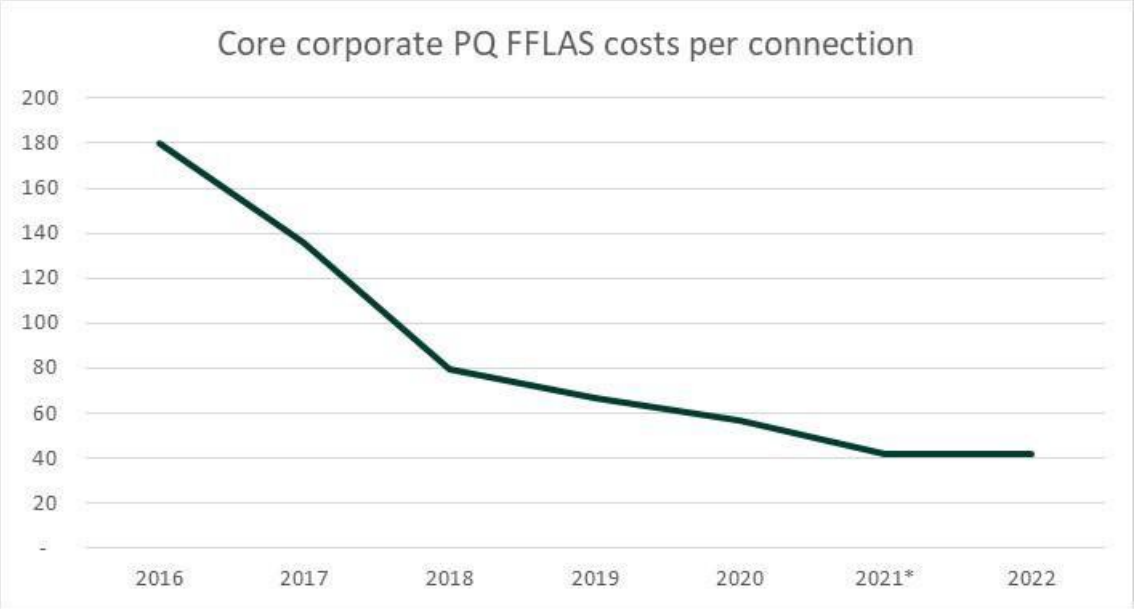
Source: Chorus

Figure 56 shows unallocated Core Corporate costs have declined since 2016 and appear to have bottomed out. No doubt this trend reflects Chorus' establishment and UFB

growth phase. Whether it is reasonable that Chorus should continue to see a reduction in corporate core costs beyond 2022 is unclear and probably unlikely.

Figure 57 shows that even with increasing allocation of Core Corporate costs to PQ FFLAS these have been in a straight-line decline, suggesting that PQ FFLAS costs could still decline further. However, we would expect any further decreases in real terms are not likely to be as significant as the historical decline.

Figure 57 Support – Core Corporate FFLAS opex per customer ($CY22)



Source: Chorus

While it is desirable that both these graphs indicate that Core Corporate costs are declining, and they are consistent with and supportive of prudency and efficiency, that in itself does not prove a clear picture of whether these costs are as low as they could be. The completion of the UFB build and adjustment to a more organic growth phase suggests that corporate activity will be less focused on Chorus as project build organisation to being more of an operating organisation and may leave room for a gentle future decline in Core Corporate costs.

As for other opex categories, it is not possible to definitively determine if Chorus' Core Corporate opex is prudent and efficient. What can be said is that Chorus' practices are reflective of prudent good industry practice and in pursuing maximum value for its Core Corporate opex are the sorts of things that should lead to an efficient cost level for this cost sub-category. The declining trends are consistent with Chorus pursuing efficiency in its Core Corporate opex.

Verification opinion

We can verify that Chorus' PQP2 Corporate sub-category forecast satisfies the Evaluation Criteria.

In forming this opinion, we had particular regard to: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information; and Assessment Factor regarding reasonableness of key assumptions and methodologies.

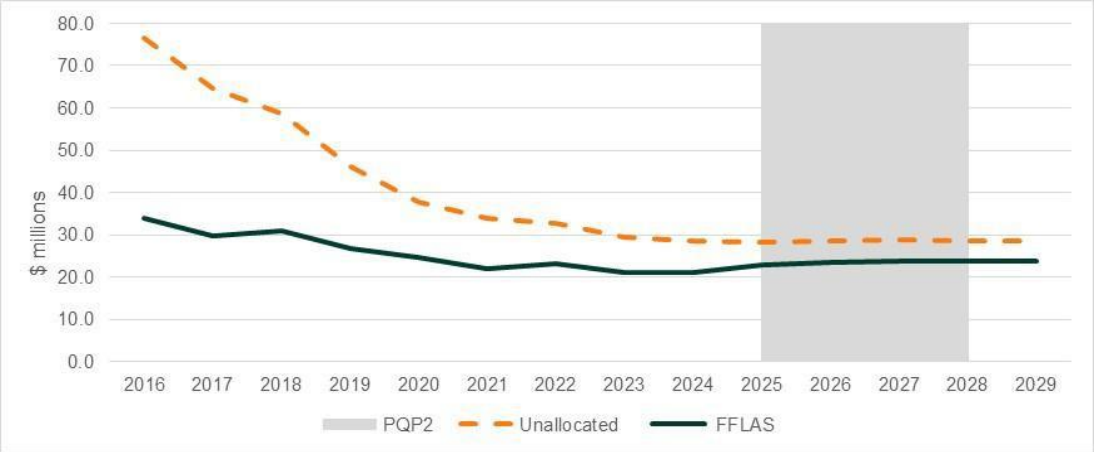
Technology

The Technology sub-category relates to Chorus' external costs associated with IT systems, including licenses, support contracts, maintenance, and outsourced IT services.

The PQP2 forecast for the PQ FFLAS Technology sub-category is $93.4 million (or $23.4 million per annum) compared to $21.8 million per annum in PQP1.

Figure 58 shows PQ FFLAS costs are forecast to increase modestly in PQP2 reflecting flat unallocated Technology costs. Slight increases in PQ FFLAS between FY21 and FY24 appear to be a result of Chorus's cost allocation methodology given declining unallocated costs in this period.

Figure 58 Technology ($CY22)



Source: Chorus

Chorus' forecasting approach

Chorus' unallocated PQP2 forecast caries the CY22 base year expenditure forward with:

- no base year adjustments;
- real price trend;

- a negative step change arising from a capex/opex trade-off involving selected IT capex projects, which is forecast to reduce PQ FFLAS by $12.7 million in PQP2 (discussed in section 11.4.4 of this chapter);
- an ongoing increase in allocation to PQ FFLAS – Chorus notes that it does not expect the decline in copper connections to drive any cost savings in this expenditure category (so more shared costs are reallocated to fibre services over time).

IV's key findings and analysis

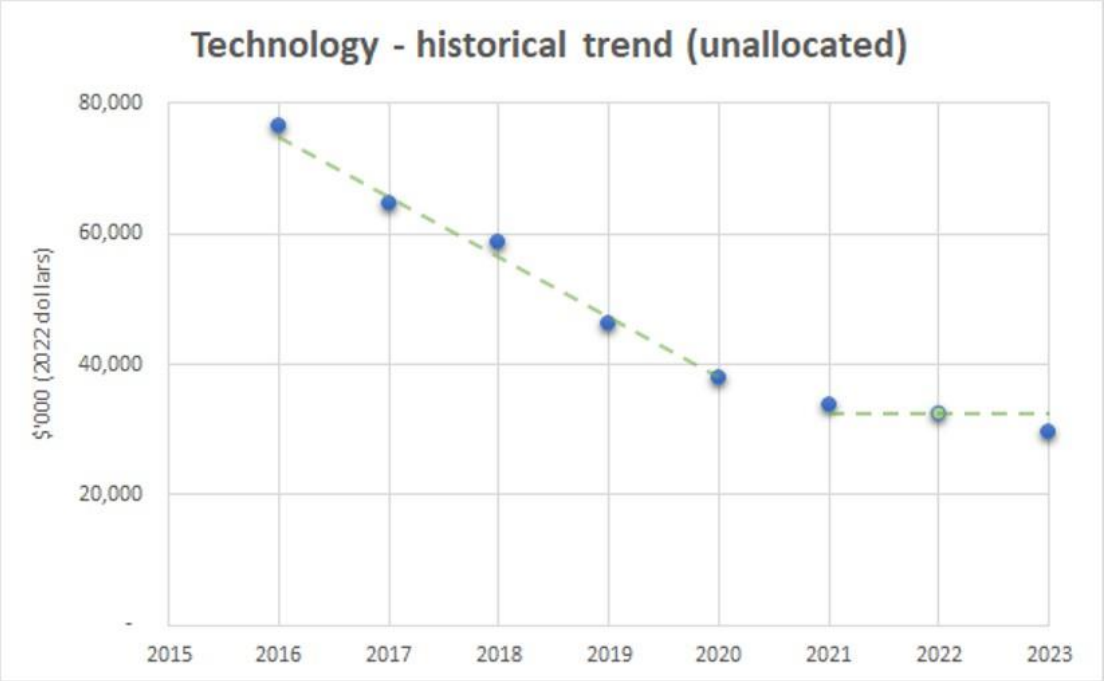
Chorus provided a succinct and clear description of Technology opex explaining that the IT licences and associated support and maintenance activities enable and maintain the IT systems that support customer, network, or business functions.

Outsourced IT service costs arise from IT processes that are undertaken by external technology suppliers who are better suited (either through capability or ability to scale) to run those processes than Chorus. These services maintain access to systems and their operation, manage faults and failures, coordinate changes, maintain systems security and their currency.

Chorus supports its claims of efficiency in describing its approach to software licences, software support and maintenance outsourcing (largely involving specialists and consultants) and IT services such as service desk, security and change management, incident and problem management and capacity management.

A significant issue for Chorus has been a process of separation from systems shared with Spark. Chorus has had an ongoing process reducing dependence on the shared systems. This has involved investment in systems that are independent of Spark. As a result of these investments and other approaches to cost reduction, including optimising opex and capex trade-offs and reducing costs at service contract renewals, Chorus has seen significant reductions in Technology opex (approximately 50%) as illustrated in Figure 59, which shows the historic trends in unallocated Technology opex.

Figure 59 Technology historical unallocated opex ($CY22)



Source: Chorus

In undertaking the trend analysis in Figure 59, Chorus' claims that opex for the three years 2021-2023 are consistent with a flat trend associated with the separation from Spark's systems. Whether cost reductions available to Chorus have been exhausted and whether CY22 is an appropriate base year, given that CY23 is forecast to be less than CY22, is open to question. Chorus is of the view that it has reached a minimum in its Technology opex.

Overall, Chorus' practices are reflective of prudent and good industry practice and its ongoing investments in software to separate from Spark and its outsourcing for IT services opex are the sorts of actions that should lead to efficiency for this opex sub-category.

Verification opinion

We can verify that Chorus' PQP2 Technology sub-category forecast satisfies: Assessment Factor regarding historic rates of investment; Assessment Factor regarding approach to forecasting opex; Assessment Factor regarding fibre asset and fibre network information and Assessment Factor regarding the reasonableness of key assumptions and methodologies relied upon.

However, we cannot verify that the PQP2 Technology sub-category forecast satisfies Assessment Factor regarding the accuracy and reliability of data as it relates to the opex

impact of the proposed selected IT project capex/opex trade-off (discussed in section 11.4.4 of this chapter).

PART C

12 Further supporting information and focus areas for Commission

The purpose of this section is to provide our preliminary thinking on further supporting information that Chorus may need to provide to the Commission, as well as potential focus areas for the Commission's attention.

12.1 Further supporting information

12.1.1 Chorus price quantity forecasting methodologies

Chorus makes heavy use of price times quantity forecasting methodologies in developing its PQP2 capex forecasts. While the methodologies are generally well explained, the Commission may wish to seek more granular data from Chorus regarding the build-up of the Price and Quantity components in these forecasting methodologies for specific capex sub-categories to provide a stronger evidentiary basis for the forecasts.

12.1.2 Base step trend opex data

We have identified in Chapter 11 of our report that firmer information in relation to Chorus' proposed capex/opex trade-offs regarding selected IT projects and solar panel installations would substantiate more robust PQP2 forecasts.

Similarly, while significant further supporting information may not be available, we identified in Chapter 11 of our report that the Commission should closely assess the basis of Chorus' cost elasticity methodology used for trending in the PQP2 Opex sub-category base step trend forecasts.

12.2 Focus areas

Based on our review of the PQP2 expenditure proposal and supporting documentation, we have identified the following issues as focus areas for the Commission's consideration:

- Opex base-step trend methodology
- Proposed changes to reporting of mandatory quality standards
- Fibre frontier capex
- Deliverability.

Each of these issues has been chosen because they are either new and/or potentially significant in terms of PQP2 (eg. introduction of opex base step trend methodology and

proposed fibre fronter capex), as well as potentially sensitive (eg. changes to mandatory quality standard reporting).

Each of these issues is summarised below.

12.2.1 Opex base step trend methodology

We consider that the Commission should review all aspects of Chorus BST methodology as it has been applied across opex sub-categories, given it is the first time this methodology has been used applied under the PQ FFLAS framework.

Specific areas that we consider the Commission should have closest regard to are the base year adjustments for property maintenance and **CCI [ ]** where we consider that an additional year of data (for FY23) may allow a more informed decision to be made about their recognition and associated quantum.

The other key area of the BST that we consider the Commission should review closely is the trend component and specifically the opex productivity and growth elements of the trend where Chorus is using electricity distribution business (EDB) cost elasticities as a proxy. We accept that there is a need for a growth component to be included in the trend and that connections are likely to be reasonable as the growth variable. Our concern is how reasonable a proxy are EDB cost elasticities likely to be for a fixed fibre network.

We also think that the Commission should consider the need for a conservative opex productivity factor or rather rely on Chorus' proposed solar and IT optimisation projects that will deliver opex savings in PQP2.

12.2.2 Proposed changes to mandatory reporting standards

We are aware of the sensitivity of changes to quality standards under the Commission's price quality frameworks and consider that Chorus' proposed changes to both the Availability (Layer 1 and Layer 2) and Port Utilisation Standards are significant and require the Commission's detailed consideration.

In rejecting Chorus' proposed changes to the Port Utilisation quality standard, we have raised for the Commission's consideration alternative possible changes that we consider are more likely to be in the interests of fibre end users.

12.2.3 Fibre frontier capex

We are satisfied that Chorus' proposed fibre frontier investment satisfies the Evaluation Criteria. However, given the significance of the investment in the context of the PQP2

capex program, we consider that the Commission should review the underlying assumptions of the cost benefit analysis and stakeholder engagement that Chorus has undertaken in support of the investment. The other issue that we consider the Commission should review in relation to fibre frontier relates to deliverability. We are aware that Chorus has recently completed market testing in relation to this issue but consider that a better understanding of the deliverability issue regarding fibre frontier and the broader PQP2 capex program is likely to be available in 2024.

12.2.4 Deliverability

Further to the fibre frontier investment, deliverability is identified as a focus area for the Commission because of the re-building of the field services workforce that is currently underway following the major technician shortage in PQP1. While we consider that this re-building is tracking well, we think it will be valuable for the Commission to further assess this issue closer to the commencement of PQP2.

We do not have any major concerns about Chorus' capability to deliver the PQP2 capex and opex programs given their comparative size to PQP1 but think a cross check of deliverability closer to the commencement of PQP2 is important, including because of the new field service agreements which are still bedding down.

A. Independent Verifier's Terms of Reference

A.1 The Verifier's role and obligations

The Verifier will provide the following Services to support Chorus' PQP2 proposal submission to the Commerce Commission (Commission):

(a) verify Chorus' proposed expenditure against the evaluation criteria and relevant assessment factors from Section 2 of Subpart 8 of the Commission's Fibre Input Methodologies Determination 2020 (Fibre IMs)

produce a verification report (Final Report) covering all expenditure i.e. base capex, connection capex and opex (terms as defined in the Fibre IMs)

meet with Commission staff to provide a briefing on the Draft and Final Report, if requested by the Commission, and be available for follow-up questions.

The Fibre IMs set out two evaluation criteria. Proposed capex should:

(a) meet the capital expenditure objective, which means it should:

reflect the efficient costs that a prudent fibre network operator would incur to deliver PQ FFLAS of appropriate quality, during the relevant regulatory period and over the longer term;

and

(b) reflect good telecommunications industry practice, which means:

the exercise of a degree of skill, diligence, prudence, foresight and economic management that would reasonably be expected from a skilled and experienced asset owner engaged in the management of a fibre network under comparable conditions. A decision on good telecommunications industry practice should take into account domestic and international best practice, including international standards and factors such as the relative size, age and technology of the relevant fibre network and domestic regulation and market conditions, including applicable law.

A.2 IV's Assessment Factors

The Fibre IMs also set out 20 assessment factors that the Commission may consider 'relevant' when applying the capital expenditure objective criterion. The Verifier must form its own view as to the relevance of the following assessment factors when verifying the proposal including what assessment factors are relevant for specific expenditure sub-categories, taking into account feedback from the Commission.

The verifier must discuss its view with the Commission as per paragraph 9a and report how the assessment factors have been applied in the draft and final report as per paragraph 5b:

(a) whether the proposed capex complies with all applicable legal and regulatory obligations associated with the provision of PQ FFLAS;

(b) governance relating to proposed capex, including evidence that appropriate policies and processes have been applied;

(c) historic capital expenditure and consideration of historic rates of investment;

(d) quantitative or economic analysis related to the proposed capex, including sensitivity analysis and impact analysis undertaken;

(e) approach to forecasting capital expenditure, including models used to develop the capital expenditure forecasts;

(f) relevant financial information including evidence of efficiency improvements in proposed capex;

(g) competition effects, including specific information for sub-categories of capital expenditure that have potential impacts on competition in PQ FFLAS and other telecommunications markets;

(h) the linkages between the proposed capex and quality, including the impact the capital expenditure would have on PQ FFLAS quality outcomes;

(i) consideration and analysis of alternatives to the proposed capex, including the impact of the alternatives on PQ FFLAS quality outcomes;

(j) the extent and effectiveness of consultation and engagement with stakeholders and the extent that feedback received has been incorporated into the capex proposal;

(k) procurement, resourcing, and deliverability of the proposed capex;

(l) common costs and benefits between PQ FFLAS, ID-only FFLAS and services that are not regulated FFLAS;

(m) fibre asset and fibre network information;

(n) mechanisms for controlling actual capital expenditure with respect to the proposed capex and achieving the PQ FFLAS quality outcomes;

(o) the extent of the uncertainty related to the:

  (i) need for the proposed capex

  (ii) economic case justifying the proposed capex

  (iii) timing of the proposed capex

(p) the extent that a risk-based approach has been applied;

(q) the impact that the proposed capex has on a layer 1 service in respect of PQ FFLAS;

(r) the dependency and trade-off between the proposed capex and related operating expenditure to ensure least whole-of-life cost for managing assets and cost-efficient solutions;

(s) the accuracy and reliability of data; and

(t) the reasonableness of the key assumptions, methodologies, planning and technical standards relied upon.

The Verifier must apply the same evaluation criteria and relevant assessment factors from the above list, with necessary modifications, to opex.

A.3 Content of verification report

In the Final Report, the Verifier will provide opinions on:

(a) whether information provided in Chorus' expenditure proposal meets the expenditure objective and reflects good telecommunications industry practice, while having regard to relevant assessment factors

(b) how the evaluation criteria has been applied including which assessment factors it has had regard to and why as well as the techniques used to verify the proposal

(c) whether Chorus' proposed quality standards and quality targets (if any) are appropriate in terms of the purpose of Part 6 of the Telecommunications Act 2001

(d) whether the analytical approaches, the assumptions, and the alternatives considered when forecasting expenditure are appropriate and adequately addressed within the context of each expenditure category and sub-category where relevant, and the inherent uncertainties involved.

(e) the effectiveness of stakeholder engagement with respect to shaping the proposal and the extent to which stakeholder feedback has been incorporated into the proposal.

(f) the extent to which Chorus' relevant policies and governance processes are consistent with good asset management practice.

(g) the extent to which Chorus' key policies and governance processes on which the proposal or its implementation depend have been demonstrably followed and applied in the development of the proposal.

(h) the extent to which Chorus has adequately addressed in its proposal its ability to deliver against its proposal during PQP2, taking into account the expected availability of the required resources.

(i) a list of key issues and areas that it considers the Commission should focus on when the Commission evaluates Chorus' PQP2 proposal. The key issues identified should also relate to the relevant assessment factors and the relevant items included in the information notices, where possible the effectiveness of the processes used to develop the quantitative information that informs the proposal to the extent that it informs Verifier's conclusion.

(j) whether Chorus has provided the Verifier with the type and depth of information it needed to verify whether aspects of Chorus' proposal meets the expenditure objective and good telecommunications industry practice

(k) whether Chorus needs to or should provide additional information to the Commission (whether required or not) for the Commission to evaluate Chorus' proposal against the evaluation criteria and whether this information is reasonably available to Chorus.

A.4 Key process matters

For the avoidance of doubt, the Verifier is not required:

(l) to provide opinions on:
  (i) cost allocation modelling, or proposals for changes to allocators (if any)
  (ii) quality incentives proposals (if any)
  (iii) expenditure efficiency mechanism proposals (if any)
  (iv) forecast depreciation, write-offs, disposals costs or disposal proceeds
  (v) depreciation profiles or asset lives
  (vi) capitalisation modelling
  (vii) revenue modelling or proposals, including price-path smoothing
  (viii) cost of capital (WACC) and tax.

As soon as reasonably practicable after agreeing these Services and the commercial terms, the Verifier and Chorus will agree:

(a) a timeline for the verification process
  (i) draft report circa June 2023
  (ii) final report circa September 2023

(b) communication protocols regarding the sourcing and use of information.

In carrying out the verification work, the Verifier will engage with Chorus and the Commission on an ongoing basis during each stage of the proposal development. Without limitation, the Verifier will:

(a) engage with the Commission at the outset of the verification on its approach to the verification, the intended focus areas for its analysis, and the intended depth of its review. This includes how the Verifier proposes to consider the requirements of the expenditure objective, good telecommunications industry practice, and have regard to the assessment factors and the information sought within the information notice in its verification of Chorus' expenditure proposal.

(b) produce a draft verification report that is provided to Chorus:
   (i) for comment
   (ii) to allow Chorus an opportunity to take account of draft comments prior to submitting its proposal for final verification.

(c) produce a further draft verification report that is provided to the Commission:
   (i) which takes into account Chorus' feedback on the first draft
   (ii) to assist the Commission to plan its evaluation of the PQP2 proposal
   (iii) to allow the Commission an opportunity to comment on the draft.

(d) ensure the final verification report is available for submission to the Commission alongside Chorus' PQP2 proposal in October 2023

(e) be available to meet regularly with Chorus, including weekly coordination meetings

(f) be available to meet both jointly with Chorus and the Commission and independently with the Commission to:
   (i) respond to questions regarding the draft and final verification report
   (ii) discuss with and consider feedback from the Commission on the Verifier's approach to the verification
   (iii) help inform the Commerce Commission's evaluation of Chorus' PQP2 proposal
   (iv) discuss any other matters within the scope of the engagement e.g. relevance of assessment factors
   (v) discuss and ask questions of the Verifier before and after Chorus submits its PQP2 proposal to confirm the Commission's understanding of the verification

report and to inform the Commission's plan for evaluation of Chorus' PQP2 proposal.

As part of the verification, the Verifier will have regard to:

(a) the base capex, connection capex and opex information requests that will be issued to Chorus by end of February 2023. The information requests must be met by Chorus in its expenditure proposal and will form the basis of the information that is evaluated by the Commission in determining the expenditure allowance for PQP2.

(b) the principle that scrutiny applied should generally be commensurate with the price and quality impact on consumers of the aspect of the proposal being scrutinised. In applying proportionate scrutiny, the verifier should communicate these decisions as early as possible to Chorus and the Commission and have regard to the PQP2 expenditure information requests which identify priority expenditure areas.

B. Supporting information used in our verification assessment

Appendix B provides a list of the information that we have relied upon from Chorus in preparing this Draft IV Report.

Chapter 3 – Context for Chorus' PQP2 expenditure proposal

- Synergies Induction – Day 1 (14 Mar-23).pdf [Document 3A]
- Synergies Induction – Day 2 (15 Mar-23).pdf [Document 3B]
- Synergies Induction – Day 3 (16 Mar-23).pdf [Document 3C]
- Commerce Commission Fixed line telecommunications regulation overview, Context of the regulatory framework, 2 April 2020 [Document 3D]
- Chorus' price-quality path from 1 January 2022 – Final decision, Reasons paper, 16 December 2021 [Document 3E]
- Chorus, Invest or Presentation, Y23 Results, 21 August 2023 [Document 3F]
- Chorus Information Disclosure Requirements, Information Templates for Schedules 1-13 [Document 3G].

Chapter 4 – Top-down assessment of PQP2 expenditure proposal

- Chorus Capex 2016-2029 time series data – post Board finalisation.xlsx [Document 4A]
- Chorus Opex 2016-2029 time series data – post Board finalisation.xlsx [Document 4B]
- RP2 Demand Report to IV.docx [Document 4C]
- Demand (template version) – Certifcation.docx [Document 4D]
- Demand forecasting.pdf [Document 4E]
- Connections Model_Documentation_FY24 v2.0.docx [Document 4F]
- Connections Model_Fy24 BU_v 1.05_IV_0.02.xlsx [Document 4G]
- Market Model Documentation_FY24 v0.1.pdf [Document 4H]
- Market Model_FY24_BU_1.13a_IV.xls [Document 4I]

- NGA Forecast Model_20223_02 v6_IV.xlsm [Document 4J]
- Sales and Operations Planning documentation v2.0_IV.docx [Document 4K]
- Bandwidth forecast model diagram.docx [Document 4L]
- Bandwidth Model 20230228.xls [Document 4M]
- Bandwidth Forecast Dashboard.pptx [Document 4N]
- Bandwidth TS Model Output 20230228.pdf [Document 4O]
- Bandwidth Forecast TS Model Input 20230228.xls [Document 4P]
- Hyperfibre demand forecast 01-06-23.pdf [Document 4Q]
- Cost estimationChorus Roadmap – cost estimation – submitted to CC 31 August 22.pdf [Document 4R]
- CONFIDENTIAL C.RP1.09 Modelling and Cost AllcoationReport.pdf [Document 4S
- Modelling and Cost Allocation Report (template v1).docx [Document 4T]
- Copy of RT02 – Cost escalation v3c.xlsx. [Document 4U]

Chapter 5 – Stakeholder engagement

- Chorus Engagement (template version)_August 2023.docx [Document 5A]
- Stakeholder Forum Report DRAFT 23 June – including RSP wave v2.pptx [Document 5B]
- Engagement IV Update cover note.pdf [Document 5C]
- Chorus Stakeholder Forum Report DRAFT 23 June.pdf [Document 5D]
- Investment and revenue details – Final.xlsx [Document 5E]
- Investment Intro and Options – Final.xlsx [Document 5F]
- RP2 Consultation videos.docx [Document 5G]
- RELIABILITY APPENDIX.docx [Document 5H]
- HYPERFIBREAPPENDIX.docx [Document 5I]
- FIBRE FRONTIER APPENDIX.docx [Document 5J]

- SUSTAINABILITY APPENDIX.docx [Document 5K]
- ACTIVE WHOLESALER APPENDIX.docx [Document 5L]
- Chorus Stakeholder Forum Discussion Guide.docx [Document 5M]
- Chorus s 221 notice response – Engagement Plan.pdf [Document 5N].

Chapter 6 – Quality Standards

- RP2 Quality report 03-04-2023.docx [Document 6A]
- Chorus March 22 Performance Breach Report (7 July 2022).pdf [Document 6B]
- UFB-Performance-Measurement – and-Reporting-17-Nov.pdf [Document 6C]
- Quality Report PQP2 template version to the IV.docx [Document 6D]
- Quality Report PQP2 template version – August Review.pdf [Document 6E].

Chapter 7 – Chorus' Asset Management System

Various asset management documentation

- CONFIDENTIAL C.RP1 01 Our Fibre Plans 120221.pdf [Document 7A]
- CONFIDENTIAL C.RP1 04 Our Fibre Assets.pdf [Document 7B]
- Chorus Asset Information Framework.pptx [Document 7C]
- AMCL – Full Report Final.pdf [Document 7D]
- Asset Management Policy.pdf [Document 7E]
- Asset Management, Strategic Asset Management Plan (Draft), version 2.0.pdf [Document 7F]
- Asset Management Capability (template version) – August Review.docx [Document 7G]
- Chorus Pre-Specified BAU Capial Expenditure Management Plan (9450) v19.0.pdf [Document 7H]
- CADS0046 Network Availability Standard, v2.0.pdf [Document 7I]
- Portfolio Plan - Poles - Draft May v01 Draft for Release [Document 7J]
- PQP2 Governance report 03-04-2023.docx [Document 7K]
- Overview of Delegated Authority.xlsx [Document 7L]

- Current DFA Table.xlsx [Document 7M]
- Chorus Climate Change Impact Assessment – Rev 2.1.pdf [Document 7N]
- Gore Business Case version v2.1.pdf [Document 7O]
- Chorus Roadmap – asset management – submitted to CC 31 August 22.pdf [Document 7P]
- Chorus Roadmap – asset data – submitted to CC 31 August 22.pdf [Document 7Q]
- Current progress of asset capability development roadmaps.pptx [Document 7R]
- Current progress of Chorus asset development roadmaps.docx [Document 7S]
- Delivering our asset development roadmaps.docx [Document 7T]

Roadmap documentation

- Chorus Roadmap – asset management – submitted to CC 31 August 22.pdf [Document 7U]
- Chorus Roadmap – asset data – submitted to CC 31 August 22.pdf [Document 7V]
- Current progress of asset capability development roadmaps.pptx [Document 7W]
- Current progress of Chorus asset development roadmaps.docx [Document 7X]
- Delivering our asset development roadmaps.docx [Document 7Y].

Chapter 8 – Deliverability of PQP2 forecast expenditure program

- RP 2 Delivery Report 03-04-2023.docx [Document 8A]
- Delivery PQP2 chapter template version – August Review.pdf [Document 8B]
- Commission IV Chorus Session – Serco reset and delivery June 2023.pptx [Document 8C]
- Service Company Resourcing Update – Executive Paper – 18 October – Final.pptx [Document 8D]
- Service Company Resourcing Update – Executive Paper –13 December – Final.pptx [Document 9E]
- Service Company Resourcing Update – Executive Paper –24 January – Final.pptx [Document 8F]
- Service Company Resourcing Update – Executive Paper – 17 April 2023 – Final.pptx [Document 8G]

- Service Company Resourcing Update – Executive Paper – 13 June 2023 – Final.pptx [Document 8H]
- RSP Informer – 1 September 2022.pdf [Document 8I]
- RSP Informer –7 December 2022.pdf [Document 8J]
- RSP Informer – 8 February 2023.pdf [Document 8K]
- RSP Informer – 6 April 2023.pdf [Document 8L]
- RSP Informer – 7 June 2023.pdf [Document 8M]
- Connect Performance – Acct Lead Comms – 140423.msg [Document 8N]
- Connect Performance – Acct Lead Comms – 190523.msg [Document 8O]
- Connect Performance – Acct Lead Comms – 020623.msg [Document 8P]
- Connect Performance – Acct Lead Comms – 160623.msg [Document 8Q]
- Programmes of Work (Contractual Levers to Tender) 20200807.pdf [Document 8R]
- AssetFuture Performance Parameters Input Instructions.pdf3searchassetfuture.pdf [Document 8S]
- Programmed_MSA_Variation 5 restated MSA to include systems and other minor changes clean_211124.pdf [Document 8T]
- PFMN2_Chorus Monthly Report July 2023 Final.pdf [Document 8U]
- SCHEDULE 6 Performance Regime.docx [Document 8V]
- DWR – L2 -FSA – KPI – FY23Q4.pdf [Document 8W]
- DWR – L3 -FSA – KPI – 202306.pdf [Document 8X]
- PQP2 Delivery Report 03-04-2023.docx [Document 8Y]
- Delivery PQP2 Chapter template version – August review.docx [Document 8Z]
- Commission IV Chorus Session Serco Reset and Delivery.pptx [Document 8AA]
- Service Company Resourcing Update – Exec Papers (several papers dated in 2022 and 2023) [Document 8AB]
- RSP Informer (several dated papers) [Document 8AC].

Chapter 9 – PQP2 Base Capex Forecasts

Extending the Network

- Extending the network draft PQP2 to the IV in 0523.docx [Document 9A]
- Extending the network PQP2 chapter to the IV.docx [Document 9B]
- NPD Model – 2022-12_v4_IV.xlsx [Document 9C]

Augmentations – Fibre Frontier

- FF strategy PQP2 VERSION TO IV 1 June.docx [Document 9D]
- Fibre Frontier – IV Feedback 060723.docx [Document 9E]
- FF – economic modelling.xlsm [Document 9F]
- FF – economic modelling IV tranche 2.xlsm [Document 9G]
- C002 FF expenditure model PQP2 v4.xlsx [Document 9H]
- T010 FF Base Model V4 Inputs.xlsx [Document 9I].

Installations

- Installations draft PQP2 to the IV 0523.docx [Document 9J]
- Installations chapter to the IV.docx [Document 9K]
- Installations draft PQP2 to the IV_0523.docx [Document 9L]
- Installations chapter to the IV.docx [Document 9M].

Standard installations

- CO12 NGA installations (incl splitters) – for FY24 10YP.xlsx [Document 9N]
- 3. Chorus ICP Customer Incentives – 30 June 2022 – Confidential [Document 9O]
- Customer incentives.docx [Document 9P]
- Business Incentives workings ComCom version 31.5.2023.xlsx [Document 9Q]
- PQP2 incentive offers economic rtest v 0.7 (CCI, clean).xlsx [Document 9R]
- Upload backup – Incentives plan Fy24-33 ComCom version 31.5.2023.xlsx [Document 9S]
- C012 NGA installations (including splitters) -for FY 10YP (2).xlsx [Document 9T]
- NGA Forecast Model 2023-02_v6_IV.xlsm [Document 9U]

- Demand Forecasting–June23.pdf [Document 9V].

Network Capacity

- Network capacity PQP2 chapter template version August Review.pdf [Document 9W]
- PQP2 Network Capacity expenditure chapter.docx [Document 9X]

Access

- CO4 ONT FY24-33 Planning Scenarios v2.0.xlsx [Document 9Y]
- ONTs economics.xlsx [Document 9Z]
- ONTs deployment strategy.docx [Document 9AA]
- ONTs – Whole of life cost analysis.xlsx [Document 9AB]
- ONTs deployment strategy – note to the IV.docx [Document 9AC]
- ONTs Replacement analysis.docx [Document 9AD]
- ONT Modelling Assumptions.docx [Document 9AE]
- ONTs deployment strategy (template version) – Certification.docx [Document 9AF]
- DP2991 Growth Fibre Layer 2 Access POD – v01.docx [Document 9AG]

Aggregation

- RFI – aggregation_26Sept.docx [Document 9H]
- DP 2989 Growth Fibre Layer 2 Aggregation POD – v01.docx [Document 9I]
- CO23 Aggregation Plan_FY24_33_IV.xlsx [Document 9J]
- Chorus Aggregation Lifecycle Plan_Q1_ed03_draft.pdf [Document 9K]

Transport

- DP 2425 Transport POD -v01.docx [Document 9AL].

Network Sustain and Enhance

- PQP2 Network Sustain and Enhance expenditure chapter.docx updated to September 2023 [Document 9AM]
- Network Sustain and Enhance PQP2 chapter template version – Certification.docx [Document 9AN]

Field Sustain

- C015 New Fibre Life Cycle Plan v1.xlsx [Document 9AO]
- Portfolio Plan - Poles - Draft May v01 Draft for Release.pdf [Document 9AP]
- DP 2437 and DP 2703 Network Field Sustain poles.docx [Document 9AQ]
- DP 2444 Network Field Sustain Rehab Fibre.docx [Document 9AR]
- DP 2445 & 2570 Network Field Sustain Maintain Service Fibre-Copper.docx [Document 9AS]
- DP 6015 Fibre Lifecycle POD FY23.docx [Document 9AT]
- Pit lid update March 2022 Final.pptx - Read-Only.pptx [Document 9AU]
- Slotted Core fibre cables and closure systems v1.0.pdf [Document 9AV]
- Chorus Proactive Pole Testing and Assessment Program (ND13102)v1.2.pdf [Document 9AW]
- Chorus Manhole and Pit Identification and Remediation (ND13171).pdf [Document 9AX]
- Portfolio Overview Documents (PODs):
  - Field Sustain – Fibre Lifecycle (DP6015); Field Sustain Fibre Portfolio Rehab (2444); and Field Sustain Maintain Service (2445 & 2570) [Document 9AY]
- Capex forecasting – field sustain estimation summary.docx [Document 9AZ]

Resilience

- Robustness Diversity Workings summary Model v1 2023.xlsx [Document 9AAA]
- DP2430 Field Sustain Resilience/pdf [Document 9AAB]
- DP2430 Field Sustain Resilience updated.docx [Document 9AAC]
- Network Technology Resilience Update February 2023.pdf [Document 9AAD]
- Board Paper_14 April_Strategy Resilience.pdf [Document 9AAE]

Site Sustain

- Site Sustain DP2181 Earthquake Remediation.pdf [Document 9AAF]

- Executive Paper Earthquake Strengthening Building Importance Rating dated 0702021.pdf [Document 9AAG]

IT and Support

Pre-Draft IV Report

- IT & Support PQP2 chapter template version.docx [Document 9AAH]
- Delivery PQP2 IT only section.docx [Document 9AAI]
- 8.0 IT PQP2 Draftv3.docx [Document 9AAJ]
- IT PQP2 Supplementary Information.docx [Document 9AAK]
- CO21 CTO IT Capex cost_model_10YP FY24-FY33 (v2).xlsx [Document 9AAL]
- CTO IT Capex Cost model_10YP FY24-33 (FOR IV).xlsx [Document 9AAM]
- CO21 CTO IT Capex Model spreadsheet explanation.mp4 [Document 9AAN]
- 2.CNO-606 Epic.docx [Document 9AAP]
- 3.Appointment Capability assessment.pptx [Document 9AAQ]
- 4.CNO-606+Serco+appointment+booking+capability.doc [Document 9AAP]
- 5.CusESG Pack - 24th November 2022.pptx [Document 9AAP]
- 6.CAMS Funding request.pptx [Document 9AAP]
- 7.Epic+Design+-+CNO-606_+Serco+Appointment+Booking.doc [Document 9AAQ]
- 8.Tier 1 BC – Serco Appointment booking capability.xlsm [Document 9AAR]
- 9.RE_ Technology business case approvals - May 23.msg [Document 9AAS]
- A.Chorus+New+Technology+&+Solution+Options+Assessments+(5i+ Assessment)+ Guidance.doc [Document 9AAT]
- B.Cloud Data Ingestion.pptx [Document 9AAU]
- Service Company Gateway.pptx [Document 9AAV]
- **CCI [ ]**
- RFI_IT estimation and BCs_26 Sept.docx [Document 9AAX]

- Chorus also provided further supporting information for its approach to forecasting IT and Support capex, including several past IT business cases as follows:
- **CCI [ ]**
- **CCI [ ]**
- **CCI [ ]**
- **CCI [ ]**
- Tier 1 – Facilities Management Integration.xlsm [Document 9AAB]
- **CCI [ ]**
- **CCI [ ]**
- Serco Appointment Booking Capability.xlsm [Document 9AAE]
- FSOM LNI Replacement – Build – Board paper [Document 9AAF].

Chapter 10 – PQP2 Connection Capex Forecasts

- Connections capex report.docx [Document 10A]
- Connection capex PQP2 chapter template version.pdf [Document 10B]
- Copy of RT04 – Connections capex v3c_No links version.xlsx [Document 10C]
- Connections Model_Documentation_FY24 v2.0.docx [Document 10D]
- Connections Model_Fy24 BU_v 1.05_IV_0.02.xlsx [Document 10E].

Chapter 11 – PQP2 Opex Forecasts

BST opex forecast

- Opex dataset for IV – historic actuals plus BST forecast.xlsx[Document 11A]
- Opex dataset for IV – historic actuals plus BST forecast – updated for IV queries.xlsx [Document 11B]
- BST PQP2 chapter template version.docx [Document 11C]
- PQP2 Forecasting opex_BST chapter_IV.docx [Document 11D]

- Opex insights (template version) – Post principals.docx [Document 11E]
- BST simple model_IV model.xlsx [Document 11E]
- BST simple model_IV 2 model_2023.xlsx [Document 11F]
- BST adjustment evidence_Self Insurance.docx [Document 11G]
- BST adjustment evidence.docx [Document 11H]
- BST adjustment evidence_Property Maintenace.docx [Document 11I]
- **CCI [ ]**
- BST adjustment evidence_Compliance.docx [Document 11K]
- BST adjustment evidence_Marketing.docx [Document 11L]
- **CCI [ ]**
- BST adjustment evidence_Elasticities
- BST adjustment evidence_Productivity
- Cost escalation forecasts, Outlook and forecasting methodologies, NZIER report to Chorus_160623.pdf [Document 11M]
- AON, Chorus Self Insurance Quantiofication_26 June 2023.pdf [Document 11N]
- Filenote Chorus opex docs.cocx [Document 11O]
- DRAFT NERA Recommendations for Chorus BST model for RP2.pptx [Document 11P]
- Advertising evidence_Category spend 2023 11.04update.pptx [Document 11Q]
- Evidence C_KPMG FFLAS ID Engagement Letter.pdf [Document 11R]
- Compliance Step Data.xlsx [Document 11S]
- 230815 – Chorus BST – additional analysis final.pdf [Document 11T]
- Evidence A_Chorus 31 December 2021 ID Assurance.pdf [Document 11U]
- Evidence B_Chorus Regulatory Assurance Proposal.pdf [Document 11V]
- Evidence D_Chorus Other Regulatory fee letter (final).pdf [Document 11W]
- Note on productivity assumption.pdf (002).pdf [Document 11X]

- Insurance summary_RP2.docx [Document 11Y]
- IT Optimisation benefits RP2v2.xlsx [Document 11Z]
- Solar summary IV.xlsx [Document 11AA]
- Capex-Opex Tradeoffs Evidence.docx [Document 11AB]
- Chorus BST model documentation for Commission (draft notes) V0.0 9 Aug23.docx [Document 11C]
- 230623 Recommendations for Chorus BST model for RP2 v.3.0.pdf [Document 11AD]
- Prep for IV Oct 05 2023.pptx [Document 11AE]
- Synergies debrief 27 September 2023.pptx [Document 11AF]
- NERA, Additional Analysis in Response to Independent Verifier comments, August 2023.pdf

Opex sub-categories forecast

- BST by Narrative Category.xlsx [Document 11AG]
- High-level opex prudency and efficiency.docx [Document 11AH]
- PQP2 Support opex RP2_IV.docx [Document 11AI]
- PQP2 Network opex Draft_IV.docx [Document 11AJ]
- PQP2 Customer opex expenditure chapter.docx [Document 11AK]
- Opex prudency and efficiency one-pager Corporate.docx [Document 11AL]
- Opex prudency and efficiency one-pager Product Sales Marketing.docx [Document 11AM]
- Opex prudency and efficiency one-pager Technology.docx [Document 11AN]
- Opex prudency and efficiency one-pager Asset Management.docx [Document 11AO]