Building Digital UK

Schedule 5 – Tender

Building Digital UK

Schedule 5 (Tender)

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Tender Response

1.1   In this Schedule 5 (Tender):

(a)   capitalised terms which do not have a corresponding definition in Schedule 1 (Definitions and Interpretations) shall be interpreted as having the standard industry meaning;

(b)   references to '(Supplier)' shall be interpreted to mean the Supplier and 'we', 'us' and '(Supplier)' shall be construed accordingly;

(c)   statements relating to current business practices and representations of future activities to be undertaken by the Supplier are contractually binding;

(d)   statements describing how the Supplier will comply with specific obligations set out in Schedule 1 (Specification) are contractually binding, provided that:

(i)   where such statements do not fully meet the requirements set out in Schedule 1 (Specification), the Supplier will not be relieved of its obligation to meet the requirement; and

(ii)   where such statements exceed the requirements, the Supplier shall be obliged to comply with the statement;

1.2   Nothing in this Schedule 5 (Tender) shall impose any obligations on the Authority including:

(a)   dependencies in embedded documents;

(b)   dependencies in attached documents

(c)   any other issues that arise in other documents that were not provided for review.

1.3   The following documents are incorporated into the Contract in Atamis with filenames as below:

1.4   Lot 3 Derbyshire Project Plan V2.pdf

("Project Plan")

1.5   Lot 3 Derbyshire Organisation Chart.pdf

("Organisational Chart")

1.6   Lot 3 Derbyshire Wholesale product table templates v1.0.xlsx

("Wholesale Product Template")

1.7   Lot 3 Derbyshire Social Value Project Plan.xlsx

("Social Value Project Plan")

1.8   Lot 3 Derbyshire Risks & Issues Register.xlsx

("Risks and Issues Register")

Network Diagram & Supplier Technical Solution

1. Network Architecture

The proposed Network Architecture has been developed for maximum coverage of the ITT target premises with a fully Gigabit Capable and future-proofed design employing XGS-PON technology and standards.

2. Rationale

The project area is identified by the geographic spread of the 18,219 target premises specified in the ITT. In addition to the target premises, a further 5,845 incidental premises are identified.

A high-bandwidth, low-latency future-proofed network has been designed to maximise the coverage of the target premises of the procurement, while also providing capacity to serve additional incidental premises passed by the required network design. A total of 17,878 of the ITT target premises (98.1%) are served by the network – with fully Gigabit Capable full fibre connections.

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Figure 1. Premises identified in the project area

TCC Cross Reference

An initial high-level design was undertaken for the 18,219 ITT target premises. This identified an indicative CPPP (cost per premises passed) of REDACTED before grant, and REDACTED after grant.

However, the area is very rural. Within the area a small number of very hard-to-reach premises distort the overall cost of deployment. A clustering analysis is used to exclude the hardest-to-reach premises, and so increase the commercial viability of the project. The detailed analysis maximises the coverage of target premises, while maintaining commercial viability.

The final high-level design identified REDACTED premises passed in the project area, including REDACTED ITT target premises passed (REDACTED).

The network deployment is based around a fully Gigabit Capable full fibre network using high-capacity, low-latency resilient backhaul connections to two separate PoP locations connecting through a backbone network to an XGS-PON technology access network to ensure a future-proofed service delivery. The deployment includes:

- Data Centre (DC) connections at REDACTED and REDACTED to ensure resilient high bandwidth connectivity for RSP and internet connectivity. The DC locations provide easy access to onward connectivity for CPs and connect to two local PoP connections.

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- Backbone connections from the PoPs to 14 OLT locations throughout the project area. The OLT locations are selected to ensure effective optical reach to the target premises and effective capacity management at the OLTs.
- Full fibre XGS-PON network providing REDACTED The full fibre XGS-PON access network technology ensures a strong future-proof network throughout the project area with a high-capacity Gigabit Capable network.

TCC Cross Reference:

The project will install new FTTP infrastructure throughout the project area. This includes:

- 14 XGS-PON OLTs
- More than 216km new passive infrastructure
- More than 4,442 km new optical fibre cables installed

The project will make use of:

- Approximately 1,343km of existing PIA duct infrastructure
- Approximately 597km of existing PIA aerial infrastructure

Design Rules

The design rules are developed to ensure a high-performance standards-based network deployment capable of meeting demanding user requirements throughout the life of the project. The design is based around five key technical solution components:
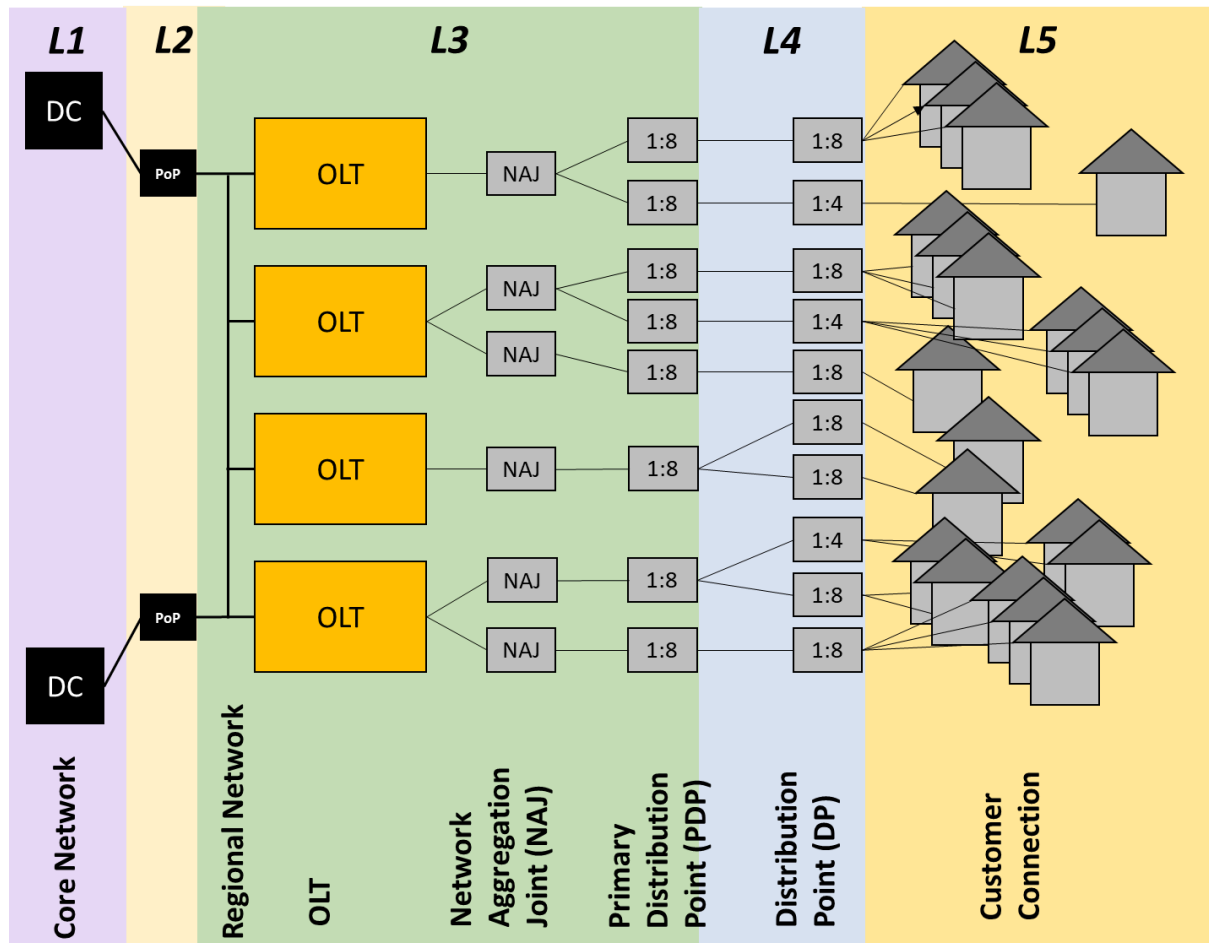
Figure 2. Logical Diagram of full network configuration

Level 1 – Core Network

Level one (L1) elements are those within the core network and are used to provide intelligent routing to the internet through transit / peering in two data centres and to provide management of aggregated traffic from the XGS-PON nodes within the project area. Two data centres that are geographically and operationally unique have been selected to increase network resilience, located in London (Telehouse South) [THS] and in Slough, Berkshire (Equinix LD7), shown in Figure 3 below.

Connect Fibre has selected core network equipment that will enable network scalability to provide a gigabit-capable network to customers as service take-up increases following network deployment. At each data centre, the core network consists of:

Juniper MX204 router used as Border Network Gateways(BNGs)

- Juniper SRX4600 router providing carrier grade network address translation (CGNAT) enabling sharing of scarce IPv4 across multiple end-users.

- Juniper ACX710 routers used as Core Routers (CR) providing the interconnection between data centres and between each data centre and the regional POPs.
- Adtran SDX8210-54 edge switches (ES) used to provide 10-100GE interconnection with transit/peering partners and to provide interconnection ports for RSPs.
- Each BNG creates external Border Gateway Protocol (eBGP) sessions, aligning with RFC standards 1105 and 4271, with peering partners to advertise Connect Fibre's IPv4/v6 address space to the partner and receive 'partial table' BGP updates. This means that traffic is sent to the appropriate partner for any routes they are directly connected to, but Connect Fibre can choose which partner will terminate all other traffic. The BNGs then use OSPF relationships with the Core Routers (CRs), refer to L2 section.
- The BNGs do not participate in the internal OSPF or the label distribution protocol (LDP) MPLS implementations.

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Figure 3. Map showing data centre and PoP locations

Both data centre locations allow excellent onward connectivity and peering opportunities for RSP interconnection.

Data centres are provisioned with 100G ports connecting to NNIs provided by backbone network providers linking the Core Network to the project areas. The NNIs allow flexible configuration of diverse backbone links at bandwidths between 10G and 100G.

The data centres are strongly positioned within the UK national data network, provisioning RSPs with a competitive choice of connectivity providers.

IP Transit Dark Fibre and Ethernet	Port Provision	Other Products
DC1 – London Telehouse (South)		
Cogent	10Gbps +	
LINX	10Gbps +	
Neos Networks	100Gbps	
Talktalk	100Gbps	
EUNetworks	100Gbps +	Dark Fibre
DC2 – Equinix LD7		
Hurricane Electric	10Gbps +	

LINX	10Gbps +	
Neos Networks	100Gbps	
EUNetworks	100Gbps +	Dark Fibre

Key Level 1 active components are:

Item	Supplier/model	Specification
Firewall	Fortinet 200F	IPv4, IPv6
BNG	Juniper MX204, MX240	10GE, 100GE
CGNAT & Services	Juniper SRX4600	100GE
Core Router	Juniper ACX710	10Gbps, 100Gbps, 400Gbps
InterconnectSwitch	Adtran SDX8210	600Gbps

Level 2 – PoP Connections

The Level 2 network consists of a National Backbone linking the Core Network (2x data centres) to the regional Aggregation Nodes or Points of Presence.

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As with the national backbone, the Regional Network is arranged in rings resulting in the most cost-effective way to create a resilient routed network. Any failure of a fibre or exchange will simply allow traffic to route through the remaining operational side of the ring. Connect Fibre has also included both route and equipment diversity to mitigate faults in data centres or links to TEs. Where possible, links into TEs are provided through separate entry points.

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Level 3 – Primary Distribution Points

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Key Level 3 active components are:

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Level 4 Network - Distribution Network

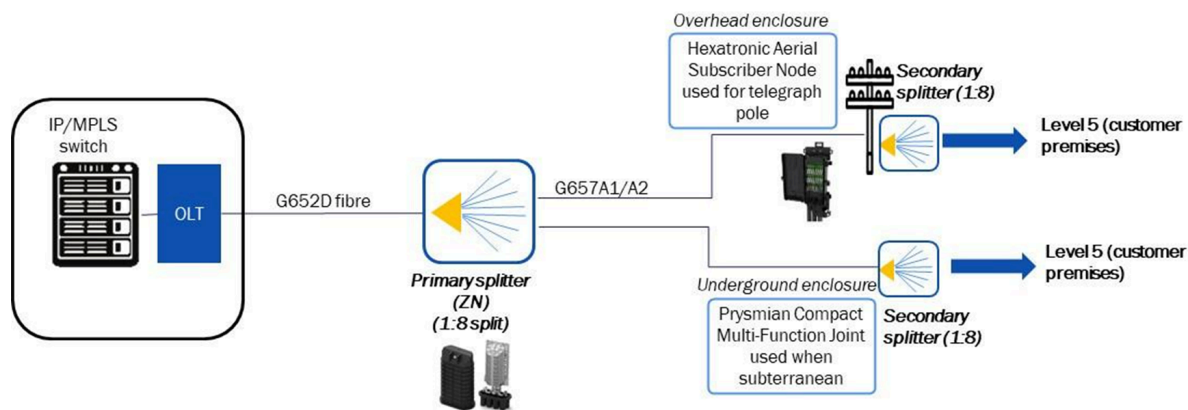**REDACTED COMMERCIALLY SENSITIVE INFORMATION**

Figure 10: Access Network architecture

Level 5 – Customer Connection

The final customer connections to end user premises are made as they are requested by end users through the RSPs. The customer connection is a connectorised fibre connection either overhead from the drop pole, or underground as appropriate. The fibre terminates with a splice connection to the ONT installed at the end user premises.

Key Level 5 active components are:

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Where the RSP is engaged through a white label wholesale agreement, Connect Fibre will additionally provide and configure the final Wi-Fi router in the customer premises to complete the installation.

Key SC4 components are:

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Pathways

In addition to the key nodes described above, the network is comprised of pathways supporting optical fibre cables. These pathways and cables form the main part of the network deployment.

Pathways between nodes can be established through a number of routes, including Openreach PIA duct and poles, or new infrastructure.

Where available, PIA aerial routes, or PIA duct with a 'G' RAG status ('PIA-green') is preferred. 'PIA-amber' and 'PIA-red' routes may also be used, although a cost premium is attached to these routes during planning to allow an element of new infrastructure to be constructed to address problems anticipated in these routes. Where Openreach use Direct-Buried-Cable, the route may be used for efficient route planning, but new infrastructure will be installed along the full length required.

For all PIA duct routes, an allowance is made for desilting and removal of blockages which will be reclaimed through the Openreach network adjustment budget. For all PIA aerial routes an assumption of 5% of poles requiring replacement is made.

Where no PIA infrastructure is available for use, new passive infrastructure will be constructed. During the high-level design stage, the routes of roads are used to guide the infrastructure routes. Different rules are used for different types of roads (based on OS roads data) and different rural/urban characteristics. For example major road routes assume a relatively high proportion of duct laid in the carriageway; minor roads in rural areas will have an option of new aerial infrastructure, or mole-ploughing into a soft verge or field.

Assumptions made during the desk-based high-level design will be verified through the survey and low-level design stage.

Regulation and Industry Standards

The Core network design complies with the following standards:

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Physical Limitations

The key physical limitation of the XGS-PON technology are the capacity capabilities of the active equipment deployed and the optical reach budgets of the connections – this determines the maximum distance possible between OLT and ONT (at customer premises). All physical factors are addressed within the High-Level Design systems used to determine the design capacity and network capabilities and budget requirements.

The high-level design is specified to configure 100% capacity of the identified premises passed in the network design.

Link budget calculations show that an optical reach up to 13.8km is possible using N2 optical and a two stage 1:64 split configuration. Where greater optical reach is required, the second stage can be reduced to a 1:4 split which gives a theoretical maximum range of 20.9km. The high-level design limits the optical reach allowance to 13km for 'premises passed' served by a 1:64 split and 20km for premises passed by a 1:32 split. This conservative approach to the high-level design ensures a high level of confidence that the 17,878 target premises identified as premises passed will be confirmed in the low-level design and will be served in the final network deployment.

Latency, Jitter & Packet Loss

Why do Latency, Jitter and packet loss matter?

On a contended medium such as XGS-PON fibre networks, there will be times where congestion means that some subscribers' packets are dropped due to a lack of available capacity, sometimes called 'tail-drop'. For most traffic, this has no discernible impact as the protocols running over the network, such as transmission control protocol (TCP), are designed to identify tail-drop and request that data is re-sent. Whilst browsing websites, receiving emails or similar, subscribers are unlikely to notice this. For streaming services, a buffer is used to allow content to continue to play while underlying protocols recover any lost information.

Differentiated Services Code Point (DSCP)

Interactive applications such as voice and video calling are much less tolerant of this loss of data as they cannot buffer as much information without the user experiencing a delay to their conversation. It is therefore appropriate to differentiate this type of traffic from other bulk data, reduce its latency, jitter, and packet loss to provide satisfactory user experience.

When deploying 'intent templates' to OLTs and ONTs, which define the bandwidth available to subscribers, Connect Fibre can enable an interactive services classification system to the devices. This allows RSP to use a marker within data headers they are using called the Differentiated Services Code Point (DSCP). The specific values of the DSCP header can be defined on a per-RSP basis. IETF RFC 4594 (2006, https://datatracker.ietf.org/doc/html/rfc4594) indicates that interactive voice traffic should be marked with the DSCP value of EF (decimal value 46), voice signalling should use value CS5 (40) and interactive video with value AF41 (34). The OLT and ONT will be instructed to prioritise traffic with the agreed DSCP values using a dedicated Time Division Multiplexing (TDM) timeslot. This allows such traffic to have regular windows on the network to transmit, meaning it cannot be slowed down by the subscriber or other subscribers' bulk data transfers that would otherwise cause delay, congestion or even tail-drop. This service is aimed at RSPs that may want to offer Quality of Service (QoS) to their customers.

Ethernet and low latency queuing

When traffic egresses the OLT towards the core network or is received from an RSP on an NNI, it is presented as Ethernet. Ethernet is not a TDM based protocol so when these DSCP marked packets are received by the Ethernet network (TE routers and switches), the core devices will instead use Low Latency Queueing (LLQ).

Traffic prioritisation

Both the TDM network and the Ethernet network have soft limits for the rate of prioritised traffic permissible on a subscriber or interface. This is necessary to ensure there is no resource starvation of other types of traffic, as well as to ensure the correct operation of the priority TDM profile and LLQ buffers. As such, Connect Fibre will configure the network to accept up to 10% of the Committed Data Rate (CDR) of each subscriber to use the priority queue before the DSCP marking is re-marked with a value of 0 and the data is handled in accordance with the bulk-data profile.

Industry standards

Connect Fibre's network design parameters ensure that real-time applications can be used by end-users as jitter, packet loss and latency is reduced where possible, by prioritising traffic and using a capacity management approach that is intended to avoid congestion and excessive contention of the network, even during busy periods.

Traffic marked with the appropriate DSCP value and within the prioritisation profile of the subscriber's services would be assured to have a jitter of no more than 2ms as a mean average measured over 30 seconds, meaning the proposed solution aligns with jitter industry standards of 30ms as defined by Cisco, as well as the requirement of 2ms for jitter. In addition to this, within the same profile marked traffic would have a mean average measured over 30 seconds for packet loss under 0.1%. The ITT defines packet loss industry standards as 0.1% for 95% of the time. Therefore, Connect Fibre's solution aligns with industry standards.

Project Plan

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Structure of the plan

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Figure 1: Premises in the two drawdowns

Stage 1 activity

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Government target support REDACTED COMMERCIALLY SENSITIVE INFORMATION

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3. Test Strategy and Plans

Tests to be conducted

The table below describes the tests that we will carry out for each type of installation, at what stage the test will be done, what tools and methods are involved, and the minimum acceptable criteria:

Installation Stage	Solution Component	Test Criteria	Test Method	Minimum Acceptable Level in Tests
At sign-off of passive fibre segment	**Level 3** – Local Access (XGS-PON)	Passive fibre optical loss (where present)	Handheld optical fibre test meter used to test fibre for loss at 1600nm, 1550nm and 1310nm.	Better than 5dB (dark fibre) Better than 29dB (PON) or as appropriate for network position.
At sign-off of any network element	**Level 1** – Data Centre **Level 2** – PoP Connection **Level 3 –**Local Access	Speed back to parent site	Router to OSS/BSS using Packetfront and EXFO tester FTB4	Property to local handover point: 900Mbps Local handover points to backhaul handover point: 10-100Gbps depending upon provisioned link Backhaul handover point to RSP handover point: 10-100Gbps depending upon provisioned link
At sign-off of a property connection	**Level 1** – Data Centre **Level 2** – PoP Connection **Level 3 –**Local Access **Level 4** – Customer connection	Speed back to internet exchange per connected premises	Router to OSS/BSS using built in speed test in Packetfront. External test using Ookla for customer speed test.	900Mbps
At sign-off of any active network element	**Level 1** – Data Centre **Level 2** – PoP Connection **Level 3 –**Local Access **Level 4** – Customer connection	Peek. Jitter, latency and packet loss during test to parent site	EXFO tester FTB4 and Nokia diagnostic software.	2ms and below for ninety-five percent (95%) for Jitter 10 ms and below for ninety-five percent (95%) for latency (0.1%) for packet loss for ninety-five percent (95%) of the time.
At sign-off of a property connection	**Level 5** – Subscriber router	Speeds achieved over time	Router to OSS/BSS using built in speed test in Packetfront. External test	Not dropping below 50% of service speed for more than 5% of time

Installation Stage	Solution Component	Test Criteria	Test Method	Minimum Acceptable Level in Tests
			using Ookla for customer speed test.	

Reporting and approval

Contractual acceptance testing will be carried out in accordance with the documented contract and regulations to meet legal and safety standards. This will be achieved through user acceptance testing or operational acceptance testing. Where necessary, our test specialists will work with Authority staff to provide acceptance test strategies, plans and scripts. We will also assist staff in running the tests noting any deviations from the scripts and plans.

We expect testing to take place following each installation, carried out by engineers, and accepted by the engineers and the Project Lead. Our benchmark for formally accepting the solution will be that all elements of the solution are signed off following the completion of user acceptance testing (UAT). Any snags or faults will be rectified in a timely manner, tested, and signed-off following UAT, though we expect snagging to be minimal.

All test reports will be made available to the authority. A draft report will be made available within two working days of the test being completed, with a final report being made available within five working days. In addition, Connect Fibre will maintain a Test Issue Management Log which will describe all test issues and their status. This log will be provided to the Authority at a frequency to be agreed (probably monthly)

How the test strategy ensures required performance

All links on the network will be designed to deliver multiples of the minimum speed requirements required in the Gigabit capable specification. The testing of the links will be designed to demonstrate that capability. In addition, the minimum speed at busy hour 95% availability and Gigabit speeds outside the busy hour will be demonstrated using the statistical dimensioning approach described in the response to Question 8.

Testing equipment and software used and their calibration

Connect Fibre Engineers have a wide range of tools available to them in the field to ensure quality standards are maintained during build including:-

1. Tablet computers: Access to latest LLD, OR, GIS data on tablet allowing notification of re-routes, photos of work undertaken and meter readings all geo-located.

2. Optical Time Domain Reflectometer (OTDR): OTDR detects problems with the fibre, such as breaks, bends, or defects and highlights where the issue is.
3. Power Meter: to measure the strength of light signals in fibre optic cables to ensure that they are within the required range.
4. Visual Fault Locator (VFL): the red laser will detect breaks or defects in fibre optic cables. It can also be used to trace the path of a cable.

Calibration of equipment

The primary calibration concern is the OTDR equipment which is critical to the successful testing of the access network. This needs to be returned to the manufacturer periodically and they recalibrate and return for further use. Fusion splicers are also periodically returned to their manufacturers to ensure they are operating within the required tolerances. Less expensive equipment such as gas detectors are replaced rather than recalibrated as this is a much more cost-effective approach than trying to return a £40 piece of equipment to China for recalibration.

Testing Standards

It will be the responsibility of CF to ensure that the backhaul services to the OLT Pass the following standards.

- RFC 2544
- Y.1564 – in cases where QoS is applied

The OLT access platform will be tested using an industry standard tester EXFO tester FTB4 (as well as laptop and customer CPE) to ensure that the service delivery is within acceptable levels for an XGS-PON deployment.

Jitter, Packet loss and Latency are all key test criteria to ensure that the service is 'fit for purpose' and delivers a service that is of the highest possible standard.

Delivery and acceptance

The field engineer will use a EXFO Tester that will be offering a baseline Test result to certify the service (Connect Fibre is currently evaluating VIAVI testers to allow more sophisticated testing to be done in future. The responsibility for the test profiles will be the R&D TDA for the applicable access platforms to provide the test criteria for a pass or fail.

The field engineer will be responsible for testing the service to ensure that the service is carried out in the defined manner given to them.

The tester and engineer will be the judge if the service passes the defined parameters.

Test attendance and witnessing by the authority

We have assumed that representatives from the Authority will be available to attend user acceptance testing from time-to-time at its discretion. The Authority will be informed in advance of all tests and its attendance will be facilitated whenever it wishes to attend.

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Test Plan

Tests will be conducted on all core network elements as they are completed within the project delivery. In particular, key tests will be undertaken on the core (Level 2 and Level 3) nodes in the network (PoP locations, OLT sites, and the links between these sites).

The Core Tests include:

- · Nodes - Router to router using built in Mikrotik speed tester
    - o Speed to parent site
    - o Speed to internet exchange
    - o Peak latency to parent site
    - o Peak latency to internet exchange
- · Links
    - o Passive fibre optical loss
    - o Additional tests will be undertaken as required to ensure the correct function of all network elements as identified in the Test Strategy above.

Test schedule

The Core Tests will be undertaken in accordance with the project delivery plan. Tests will be completed at the following sites on or in advance of the following dates:

Dates may be revised in the detailed planning (Stage 1) and will be confirmed during the build phase (Stage 2).

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<u>Responsibility</u>

CF's test team will undertake all testing of the network to ensure acceptable quality of work by internal and contractor teams.

<u>Test Duration</u>

Most of the acceptance tests are 'real-time' tests undertaken at the point of acceptance. Ongoing tests are also included to ensure the ongoing effective operation of the network.

Wholesale Access Products and Services

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Wholesale Passive Products

Upgrade assurance

Connect Fibre confirms that all of the active products described in the Wholesale Product Template can be upgraded on demand without further engineering work and all of them can be upgraded to the Gigabit Gold Standard if that is what the end user requires.

New wholesale product development

Connect Fibre has a well defined process for developing new wholesale products which has a number of distinct steps. Figure 1 shows the steps and the following sections describe what occurs at each step in more detail.
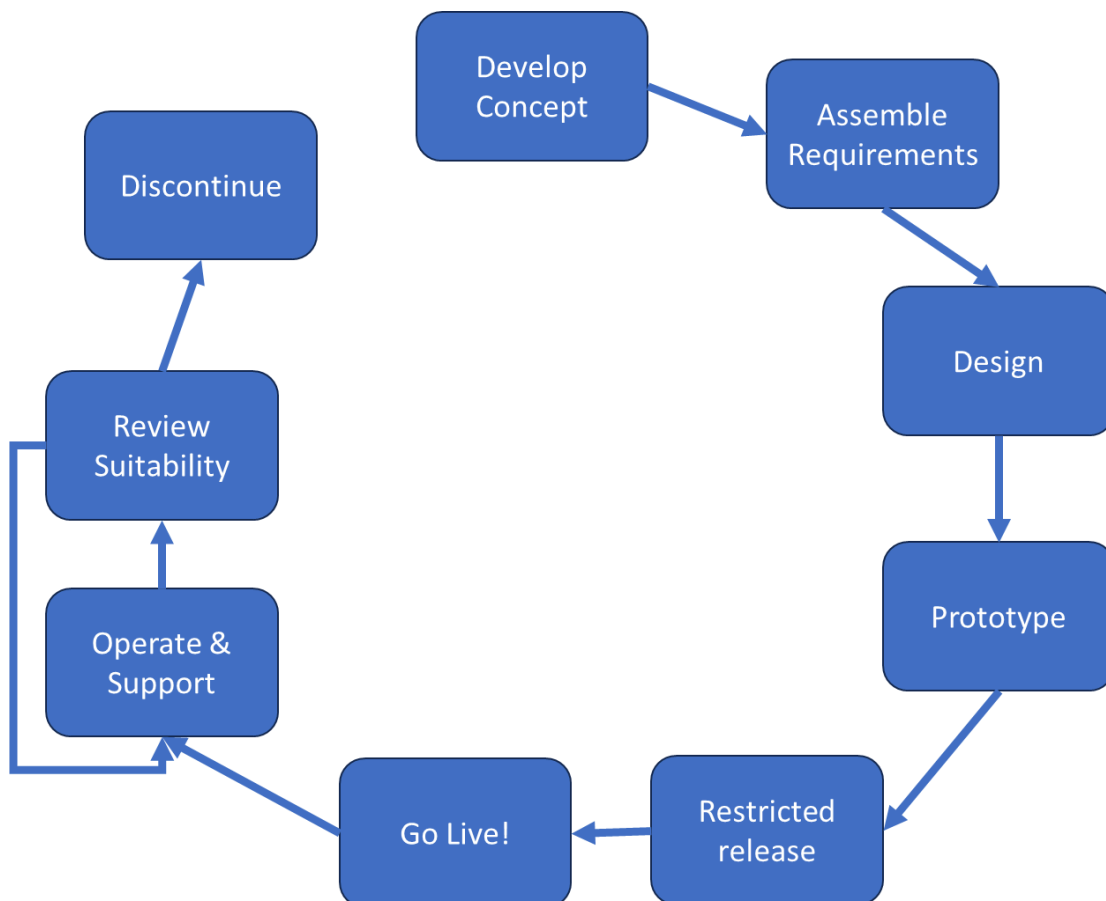

Figure 1: The Connect Fibre Wholesale Product Development process.

Develop concept

Connect Fibre is constantly on the lookout for new product opportunities. The processes followed to help with this identification include:

● Working closely with technology partners to understand the capabilities of their forthcoming products.

- Continuous dialogue with RSPs to understand the types of products that they would find attractive to consume.
- Monitoring the market to understand the products that other operators are planning to make available
- Developing understanding of the likely level of demand for product ideas by different customer segments

When a potential product is identified as having promise then it proceeds to the next stage where what is required to deliver the product will be carefully analysed.

Assemble requirements

The requirements for the new product are identified under the following headings:

- Functional requirements - IP addressing requirements, jitter latency and packet loss thresholds
- Performance requirements - the line speed and reliability required to support products (particularly for demanding customers like businesses and high-end gamers)
- System technology requirements - how well will the new service fit in with the existing Connect Fibre systems and what if any expansions or additions will be needed.
- Support requirements - what are the implications of the new service in terms of additional skills and coverage in the field.
- Training requirements - what new training materials will need to be produced to support sales, engineering, customer services and RSPs.
- Supply chain requirements - will the supply chain need to be extended or can the requirements of the new service be met from existing suppliers?
- Legal and regulatory requirements - make sure that the new service is legally watertight and compliant with the relevant regulations.

When the requirements for delivering the new service are completely understood and there are no serious problems identified, then the design phase begins.

Design

At this stage a Product Champion is appointed to do the detailed planning of the new product. The champion will produce:

- A detailed project plan for the rest of the product development process
- A detailed business case incorporating a financial model which clearly shows the expected return on investment from introducing and delivering the service.
- A RAID analysis of the product introduction
- Detailed product documentation and SLA's that will govern the terms of service delivery

When the business case for the product is clear, approval for prototype development is given.

Prototype

Prototype development involves a range of development activities including:

- Process mapping and documentation - design process maps for all functions across the business that will interact with the product
- Aligning with OSS/BSS - to ensure that the new product interacts with the necessary support systems
- Integration with billing - need to ensure accuracy of billing in line with the specifications
- Alignment with quality standards - does the new product conform to the relevant standards

(ISO 9001, ISO 27001)
- Testing performance to ensure that the prototype conforms to KPIs.

Once the prototype proves the concept, approval is made for a restricted product release for more extensive testing.

Restricted release

A set of customers are chosen to test the product. The choice of customers will aim to cover a diversity of customer types and will identify (where possible) customers with a particular interest in the product development.

This group of customers will be given access to the product and their opinions on the product suitability for their requirements will be sought and recorded. Consistency will be ensured by gathering the same data from all customers at the same frequency.

The impact of the new product on OSS/BSS systems and the monitoring of the service by the customer will be recorded. Billing accuracy will be rigorously checked. Similarly, all process documentation will be double checked to ensure accuracy.

A log of lessons learned will be compiled and adjustments to the product to improve performance and customer satisfaction will be made.

At some point during this process, it will become apparent that the product will proceed to the Go Live stage. At that point, RSPs can be informed that the product will be launched so that they have the required six months' notice of product launch.

Go Live!

In preparation for product launch, the details proposition is finalised describing the USPs, features, benefits. Stakeholder engagement plans are developed to bring interested parties up to speed on the new product. A detailed marketing and communications plan is drafted to ensure key messages reach the relevant stakeholders.

Work is done to ensure that RSPs have access to the new service via their chosen interaction method (portal, API or aggregation platform).

Activity intensifies in the run up to the product launch date, and commercial orders begin to arrive.
Operate and support

As commercial roll-out of the service begins and customers are signed up, careful analysis of how the service is performing is done. The technical performance of the service is monitored to ensure the quality standards expected are met or exceeded. The mix of product variants and how they are being taken up and used is monitored. The customer base is analysed to understand the level of product take up among different customer segments. The service is benchmarked against similar products elsewhere in the market to ensure that it is competitively placed. SLA performance is reviewed periodically to ensure that the cost of delivering the service is within the envelope planned for. Customer satisfaction is monitored through research to make sure that customers are satisfied with the service they and their customers are getting.

The result of the intense scrutiny is that the service is tweaked to improve performance against the expected KPIs. This intense monitoring continues for the first year or so of the service operation as the service becomes embedded in business as usual.

Review suitability

Once established, the service is reviewed regularly as part of the monitoring of all services to ensure they are meeting the needs of the market. This monitors takeup and looks at competing products that are available or have been announced by other network operators. Technology roadmaps are maintained and how developments will affect the suitability of the service will be understood. Where the need for adjustments to the service are identified, these are implemented.

Discontinue

As services mature and demand plateaus, Connect Fiber looks to manage the declining stage of the service by identifying potential new services that will take the service to the next level and continue to meet the requirements of the RSP customers and their end users.

A successor service to the mature service will be developed as a concept and the whole development cycle will begin again. This will be timed so that the successor service will be in place to meet the needs of the more forward-looking RSPs and migration of the entire customer base will then be managed over time.

When all the customers have been migrated to the successor service, then the original service will be withdrawn from sale, its documentation archived and any dedicated technical resource deployed elsewhere or discontinued.

Benchmark suitability
For active products, benchmarks are set based on published prices by Openreach and Fibrus. For bitstream products with local handover, Openreach pricing has been used. In line with Openreach pricing, we propose to offer standard pricing and offer pricing where volume requirements are met. Standard pricing is based on Openreach standard pricing; offer pricing is based on Openreach Equinox pricing.
The Openreach pricing is considered the most appropriate benchmark for the bitstream products. However, it must be noted that Connect Fibre products offer symmetrical bandwidths – providing an advantage over Openreach products, particularly for business users. For this reason a small premium over Openreach prices is proposed for business products.

White label variants of the products are offered with handover at the Data Centres. For these products, Fibrus has been used as the benchmark price. Standard and Offer prices are proposed. Standard prices are benchmarked to the nearest equivalent Fibrus product. Offer prices are proposed at a small premium to the bitstream product variants (to reflect the potential greater product value to RSPs presented by the Data Centre handover). The Offer is proposed to allow RSPs to match Connect Fibre's established retail price in the markets served.

For passive products, Openreach pricing is used as the most appropriate benchmark.

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Social Value Plan

Social Value: Climate Change

Derbyshire is familiar with the effects of climate change. Extreme weather events are becoming more frequent with harsh winters and extreme rainfall causing severe flooding in recent years which has led to severe damage and even deaths. This is one of the reasons why Derbyshire County Council (DCC) intends to achieve net zero for its own operations by 2032, well ahead of the national net zero target of 2050. DCC is determined that the county as a whole will meet the national target. Connect Fibre is committed to meeting the national target for net zero and has a carbon reduction plan in place and we will do our bit towards making sure Derbyshire is net zero by 2050. The diagram shows the route map that DCC has produced for the county.
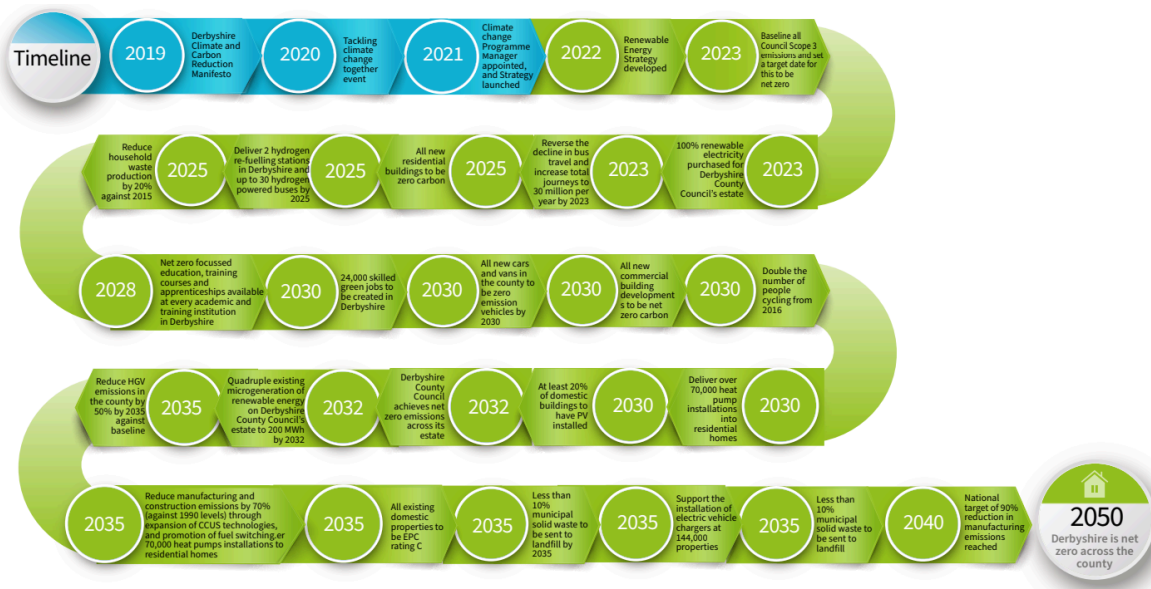
Connect Fibre can fight climate change both:

- Internally by driving down our carbon footprint, and;
- Externally by influencing (and enabling) staff, suppliers', customers' and communities' carbon reduction.

Our strategy will centre around reducing carbon emissions, minimising waste, promoting sustainability, and offsetting unavoidable environmental impacts

Internal Stewardship
Connect Fibre has developed and published a baseline carbon reduction plan. This recognises the wider importance of our role, as well as our responsibility to manage our own impact. Regular review and update of this document will ensure board-level appreciation and give impetus to reduce emissions.

In the next five years, we will reduce our CO_2 emissions per premise passed and customer connected by 38%. By 2033, this will be 60%.

Combined with our growth forecast, the impact of these targets can be seen in the table below:

	2023	2025	2030	2035	2040	2045	2050
Tonnes CO$_2$ Equivalent	148	122	76	47	29	18	12

Key actions are:

MAC Addressed	Activity	Impact
MAC 4.1	Follow our own Carbon Reduction plan. This describes eleven specific ongoing actions to measure then reduce emissions e.g. fleet carbon reduction, local recruitment in IA etc.	Connect Fibre achieves net zero by 2050 as explained at https://www.connectfibre.co.uk/carbon-reduction-plan
MAC 4.1	Our network will be powered using renewable energy wherever possible. In cases where this is not possible then we will implement carbon offsets.	Drive towards net zero as planned.
MAC 4.2	Our suppliers sign a code of conduct which includes a commitment to minimise environmental impact.	Ensures a commitment to protecting the environment so effectuates our end-to-end fight against climate change.
Mac 4.2	Regular vendor relationship meetings regarding social value.	Ensures that zero emissions targets can be tracked to completion.
Mac 4.2	A database of supplier information (contractors, materials, other supplies) gathered through detailed Pre-Qualification Questionnaires and updated twice annually.	Ensures all key information is captured and accurate. Exerts pressure for net zero through our complete supply chain.
Mac 4.1	CF commits to sending zero construction waste to landfill. Through detailed management and waste segregation procedures, all waste will be recycled or repurposed. Detailed monitoring and reporting will ensure high standards, and CF will encourage sub-contractors to embed a zero-waste culture throughout its supply chain.	Waste is reduced to an absolute minimum.

MAC 4.1	CF is dedicated to fostering sustainability throughout its operations. In every newly constructed parking area designated for staff and the local community, charging stations for electric vehicles will be provided. Encouraging eco-friendly commuting among employees, CF will introduce a program that rewards cycling to work as well as encouraging working from home where practicable. The company will also reduce energy usage by incorporating solar power systems and procuring electricity entirely from renewable sources.	A diverse set of approaches will be adopted to promote sustainability and the sustainability toolkit will be added to as new opportunities arise.
Mac 4.1	In order to reduce the impact of carbon emissions that cannot be eliminated, CF intends to establish a collaboration with local communities and landholders to cultivate 5,500 trees (Total Budget: £110,000). Beyond its role in absorbing carbon, this initiative aims to provide a valuable communal facility and environment. Moreover, the project will encompass school excursions, volunteer opportunities, and information materials, all designed to enhance awareness about sustainability. The tree planting programme will be enhanced with our fibre network's reach via wireless IoT technology. To tackle early years mortality rates, we will provide dendritic sensors for remote monitoring of tree health and growth, ensuring a successful green initiative.	Unavoidable CO_2 emissions will be offset and improved habitat.

External: Influencing Stakeholders and Enabling Actions
Connect Fibre can use the lever of new business to drive environmentally friendly action in its supply chain. Contractual requirements are great drivers of change, which is reflected in our procurement approach. We will ensure successful collaboration with both existing and new vendors through

periodic supplier management meetings including discussion of improving processes and identifying opportunities for reducing greenhouse gas emissions and enhancing the environment alongside contract operations.

For other stakeholders we will undertake at least the following:

MAC Addressed	Activity	Impact
MAC 4.2	Suppliers influenced to encourage cycling to work and (where practicable) working from home.	
Mac 4.2	Customers: businesses are significant emitters according to Govt. We will offer up to 50 small business (non-farm) energy kits based on IoT to help reduce energy consumption.	Kit offers Cold chain, open window, temperature, door sensors with 2 yrs data visualisation. Enables SMEs to cut energy consumption.
MAC 4.2	Customers: residences are one of the largest CO_2 sources mainly through heating. We will offer up to 20 landlords temp, humidity, CO_2 combined sensors with two years data visualisation.	Focus is on energy efficiency, particularly in social housing. Detection of fuel poverty and mould risk are side benefits.
MAC 4.2	Communities: We will offer community groups and organisations grants totalling up to £10k for net zero related works or improvements.	Will help fund improved insulation, installation of solar panels, contribute to purchase of EVs and other measures to promote lower emissions from community resources.

Project Plan and Process

The above methods will be employed over the lifetime of the contract and the plan below quantifies the outcomes.

Target	Number in Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032

Connect Fibre Carbon reduction plan (Total Tonnes of CO_2)	148	133	122	110	100	92	84	76	69	63
Proportion of waste sent to landfill	90%	80%	70%	60%	50%	40%	30%	25%	20%	15%
Sustainability initiatives added to the CTF sustainability Toolkit	2	2	2	2	2	2	2	2	2	2
Trees planted	550	550	550	550	550	550	550	550	550	550
Supplier database updates	2	2	2	2	2	2	2	2	2	2
Proportion of vendors provided regular scheduled review meetings	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Proportion of tender documents containing carbon reduction questions	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Proportion of tender activities considering environmental solutions in market analysis phase	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Proportion of contracts where a Code of Conduct will be signed	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Number of annual environmental reviews of the project contracts	1	1	1	1	1	1	1	1	1	1
Small Business energy monitoring kits	10	10	10	10	10					

Landlord sensor kits	5	5	5	5					
Grant support for community net-zero projects	£10k	£10k	£10k	£10k					

To ensure delivery against this plan, a member of the Stakeholder Engagement team will be appointed Social Value Champion to take ownership of the Plans and to monitor progress. The Champion will produce an internal monthly report on how CF is performing against the targets. Where it looks like there might be a shortfall, the Social Value Champion will have an escalation path to the CEO to ensure that the required remedial action is taken. The Champion will also generate a quarterly Social Value Report which will be delivered to the Local Authority and to BDUK. This report will detail progress against the project plan and, where necessary, highlight where remedial action is being taken and describe the actions.

The key metrics for delivering the Social Value Plan will be achievement of the required activities and outcomes against the project plan. The plan will be monitored carefully by the Social Value Champion and timely achievement of the activities and outcomes will be monitored.

Each quarterly report to Derbyshire County Council and BDUK will describe how the project plan objectives have been met and will describe a plan for meeting the objectives for the next quarter. Following delivery of the quarterly report, we will meet with representatives of Derbyshire County Council (Digital Derbyshire) and BDUK to discuss how CF is performing on meeting its social value commitments and whether there is scope for improvement.

Social Value Tackling Economic Inequality

Enormous benefits will flow from Connect Fibre (CF) making fibre available to thousands of premises stimulated by this project. Making gigabit broadband available at an affordable price in Derbyshire will have a transformational effect on the creation of new businesses, jobs, and skills. It will make a significant contribution to meeting two of the four-year objectives listed in the Derbyshire County Council Plan towards the objective of achieving a prosperous and green Derbyshire by having:

- ensured access to superfast infrastructure for all residents and businesses in Derbyshire
- created more jobs through increased levels of domestic and international inward investment into the county

In fact, this project goes well beyond the ambitions for superfast infrastructure with gigabit capable infrastructure being made widely available.

As we do not intrusively monitor customers these benefits will be difficult to measure but they will be real.

Beyond the clear benefits arising from widespread gigabit broadband availability, ConnectFibre is committed to using the Project Gigabit contract as a catalyst for tackling economic inequality. The company will achieve this through an inclusive recruitment strategy targeting disadvantaged groups, providing digital skills training to improve employability, partnering with colleges to develop the next generation of talent and increasing supply chain resilience and capacity.

Theme (MAC addressed)	Activity	Impacts
Entrepreneurship (MAC2.1)	Through our procurement, we will actively seek diversity of supply, encouraging local companies to bid for contracts where they have the potential to deliver the products and services required by CF. We will set a target for at least 30% of project expenditure to be spent with regional SMEs. Where necessary we will break contracts into smaller lots to enable SME bids. SMEs will also be paid within 14 days of submission of invoices.	New jobs in local companies
Entrepreneurship *Digital Skills* *(MAC 2.1 and 2.3)*	With our wireless IoT partner Netmore we will distribute to farmers a minimum of 100 smart farming kits, plus training and 24 months portal service. LoRaWAN IoT complements fibre beautifully providing a holistic smart farm solution already proven across Cornwall.	Higher agricultural productivity. Digital skills improvement.
Entrepreneurship (MAC 2.1)	We will offer support to organisations supporting new businesses. Where schools and colleges provide support for students to learn about this we will also offer volunteer support. Direct support will include 12 months free broadband for start-ups and active engagement with our procurement team.	Support new local businesses income by direct purchasing.
Jobs (barriers) (MAC 2.2)	We will advertise relevant jobs locally and focus on local recruitment. We are already neuro and otherwise diverse and will promote inclusive employment. We will also encourage our supply chain to recruit locally.	New jobs for locals of all abilities.
Jobs (barriers) (MAC 2.2)	Central to CF's ethos is the commitment to extend job prospects to those in greatest need. The company will ensure that a minimum of 10% of its construction workforce is recruited from regions grappling with significant unemployment rates. In order to empower individuals in these positions, CF will collaborate closely with job centres	Promote effective and inclusive employment and acquisition

	and nonprofit entities to furnish training and secure interviews for eligible applicants. Emphasising skills and potential over formal qualifications or work experience, the hiring process will be skill-based and forward-looking. CF will also encourage applications from former services personnel and will ensure that a minimum of 3% of our workforce will have a forces background. CF is a signatory to the Armed Forces Covenant and takes our responsibility to former services personnel very seriously.	of work-related skills.
Jobs (training) *(MAC 2.2)*	Apprenticeships will serve as an additional avenue to elevate underprivileged segments and cultivate inclusivity. CF is dedicated to extending a minimum of 10 apprenticeship opportunities in the realm of digital infrastructure. These positions will be tailored for marginalised groups such as NEETs, women, ethnic minorities, individuals with disabilities, and ex-offenders. Upon the successful culmination of the program, these apprentices will secure permanent positions. Through hands-on training that leads to accredited qualifications, CF will aid those who may lack formal credentials in honing fresh proficiencies and future possibilities.	New jobs and training for local people.
Digital Skills *(MAC 2.3)*	We will offer free Gigabit connections to any Derbyshire Community Learning and Derbyshire Libraries sites in the project area as well as free practical support for their courses and IT buddy programmes.	Free and excellent connectivity to support learning.
Digital Skills *(MAC 2.3)*	Improving digital skills is important in addressing inequality. CF is committed to funding community initiatives aimed at imparting digital skills to disadvantaged groups, including the elderly, disabled individuals, and those with limited incomes. With a dedicated budget of £50,000, the company's objective is to empower more than 500 underserved learners, focusing on fundamental skills such as online safety, utilisation of web-based public services, job hunting strategies, and use of communication tools. Moreover, CF plans to invest in developing the next generation of students through collaborations with local colleges and schools. CF's staff will contribute by offering curriculum assistance, delivering guest lectures, presenting project illustrations, engaging in STEM activities, facilitating	Inspire the young re digital careers.

	work exposure opportunities, and organising educational visits.	

Building Digital UK

Risk and Issue Register

Risk Identification

Connect Fibre employs a structured approach to risk management and risks are identified at Project Conceptualisation and tracked throughout the lifetime of the build with regular reporting for risk management and resolution.

    I.   Define the Scope of Work for a Project.
    II.   Identify Risks as Early as Possible.
    III.   Assign Importance status to the Risk.
    IV.   Analyse how to respond to the Risk.
    V.   Maintain a regularly updated Risk Log.
    VI.   Regularly Review Project Risks.

Risk Assessment and Prioritisation

The Projects risk register uses standard Risk management templates to track **probability of occurrence** against **impact severity** and is used for all internal and construction projects as well as forming part of the regular management meeting reporting.

CF uses Red, Amber, Green status indicators for our risk register with the pre-forma template below being the capture and management of risks and their status indicator. Risks can move between statuses as the project progresses and are prioritised and actioned based on their severity and status indication.

Risk Mitigation

We can mitigate a great deal of risk by introducing our tried and tested management processes which will be adapted to suit the contract deliverables. The Risk Management Team will spend time with each individual owner of procedures, policy, operating instructions etc. to ensure they are concise and capture the processes and all personnel that need referencing.

There will be regular project board meetings, where the senior management team will attend alongside representatives from all the different departments including the site delivery teams. This meeting will be the forum for all to air any identifiable concerns they have with the management teams to quickly action a response in order to reduce risk to acceptable levels. The agenda will cover quality, health, safety and environment, safety critical staff, materials, suppliers and subcontractors, training, staff, incidents, and accidents. Individuals will be encouraged between workshops to feedback any concerns they have so they can be addressed.

This will enable us to quickly identify and evaluate the potential of any risks so we can put a control measure in place.

Risk Monitoring

Once risks have been identified, they are subject to monitoring and review to ensure the risk understanding is current and to ensure that any mitigation measures proving effective. This forum will also be ideal to inform staff of any change of management process that may be planned and that will affect them or others for whom they have responsibility.

The risk Log will be maintained using this approach to risk assessment.

Risk Reporting

The CF project team will have Risk and Opportunities as a standing item at its regular internal progress meeting and the monthly meetings with the Authority as set out in clause 15.3 of the Core terms and Call-off schedule 1 c11.1.b/11.2.d. The content of such reporting will enable the Authority to adequately understand all project progress as well as threats to the achievement of project Milestones, along with any associated risks and opportunities, including:

- Summary of current and post mitigation risk profiles
- Details of risks and opportunities & their assessed cost and time profiles
- Significant changes to the risk profile (Early Warning Notifications) and/or proposed mitigations
- Any strategic risk / decisions that have wider programme impact or require escalation.

How risk will be managed by the Project

Identification and assessment have already occurred with provisional risks highlighted in the associated risk register (see attachment Q14.2 Risk register). The attached RAID (Risks, Actions, Issue, Decisions) Log will form the basis for our project team and contractors to facilitate a common approach to risk management and ensure all key stakeholders are

aware of each risk and how to identify and report new ones. At monthly intervals during stage one and two, risk reviews will bring together key stakeholders, monitoring developments and emerging issues.

The risk register will be located on a shared folder accessible to both the project Team within CF and agreed representatives of the authority. Adding or deleting risks from the register will be done only by the Risk Management Team. The need to report potential risks to this team will be circulated widely in CF and staff will be reminded periodically that any emerging risks should be reported to the risk management team for assessment.

Besides such qualitative risk management procedures, CF has full-suite Primavera risk module to facilitate quantitative risk management processes, such as Monte Carlo analysis and sensitivity analysis. Features include:

- Risk Register to view and prioritise project risk;
- Tools to define risk thresholds;
- Monte Carlo analysis on schedule data;
- Curves showing expected time and cost outcomes
- Risk response plans
- Time and Cost schedule risk analysis

How risks and issues will be reported to the Authority

In normal operations, the risk register will be reviewed at the regular meetings between the Authority and CF.

In the event that a new risk is identified, and it is deemed to be likely and severe, the Project Manager will inform the authority by email of the new risk. The Project Manager will interact with the authority to agree whether this risk warrants a meeting for discussion immediately or whether it can be inserted in the register and dealt with in the regular scheduled meetings.