CARNARVON ARTISAN TRAINING CENTRE
STATEMENT OF WORK: FIBRE AND NETWORKS

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COMPANY DETAILS

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ABBREVIATIONS

ADSS	All Dielectric Self Supporting
a.g.l.	Above ground level
CATC	Carnarvon Artisan Training Centre
DST	Department of Science and Technology
BOM	Bill Of Material
POP	Point-of-Presence
SARAO	South African Radio Astronomy Observatory
SKA	Square Kilometre Array
TBC	To be confirmed
TBD	To be decided

1 INTRODUCTION

The South African Radio Astronomy Observatory (SARAO) is establishing the Carnarvon Artisan Training Centre (CATC) in the town of Carnarvon. The site comprises a new Training Centre, the existing house which is being converted into a student accommodation facility, and will also accommodate the re-located pre-fabricated classroom being moved from Klerefontein.

The Statement of Work addresses the following:

1 External to the property: The provision of a new ADSS fibre and a fibre drop-off node from the existing SARAO overhead fibre route in close proximity to the CATC property and extension of the fibre route to within the CATC property boundary

2 Internal to the property: The fibre reticulation within the property with connectivity to the new Training Centre building and the staff accommodation facility. Provision is also made to provision a subduct between the staff accommodation facility and the re-located classroom.

3 Supply and installation of the network cabling and associated infrastructure in the training centre, the existing house and to the pre-fabricated classroom. This includes network points for the following:

- Laptop / Desktop connectivity
- Wifi access points
- CCTV IP Cameras and access control

2 GENERAL REQUIREMENTS:

It must be understood that the SARAO overhead fibre link provides the Bonteheuwel Library with internet connectivity. All fibre cuts must be pre-authorised and must be pre-planned to limit the downtime of the systems operating across this fibre link extended through to Cape Town.

SARAO is a project office of the National Research Foundation and is responsible for the ongoing maintenance of the fibre link. The SARAO CATC Project Manager is the authority for all work being performed on infrastructure affecting the Bonteheuwel Library and CATC and must be kept fully informed of all work programes / schedules and must authorise all work prior to the start of the work.

3 LEGAL, ENVIRONMENTAL, HEALTH AND SAFETY

This section describes the legal, environmental and health and safety regulations that the contractor engaged to construct and re-arrange the fibre link must comply with:

- All relevant regulations with regards to local, national and international wayleaves, Telecommunications Act, Railways Act, Roads Act and Forestry Act as well as any other applicable Acts, regulations and bylaws will be adhered to. It will be the contractor's responsibility to make themselves aware of these laws and acts.

- All surplus or waste material is to be removed from the site by the contractor and disposed of in an environmentally responsible manner in accordance with regulations where these exist. Disposal certificates must be presented to SARAO (South African Radio Astronomy Observatory) or their appointed agent.
- All usable surplus material that was supplied by SARAO or their appointed agent must be returned to an agreed location.
- It will be the responsibility of the contractor to adhere to the servitude access arrangements that have been negotiated by SARAO or their appointed agent. Should it be required to enter property outside of the negotiated servitudes, it will be the contractor's responsibility to obtain written permission from land owners to enter or use their premises or land, for what-ever reason.
- Any temporary work sites or storage areas used during the delivery and/or commissioning of the fibre works are to be de-commissioned and restored to the satisfaction of the landowner. Temporary storage area for cable and/or equipment can be made available at the SARAO Klerefontein Support Base. Arrangements and location to be agreed with the SARAO Site Manager.
- The contractor will be required to deliver a warranty on the fibre works and network cabling for a period of one year from final hand-over and any faults occurring within this period shall be corrected at the contractor's cost.

4 PROJECT LOCATION

4.1 SITE CO-ORDINATES

Location	Latitude (S)	Longitude (E)
Carnarvon POP	30° 58' 12.12"	22° 08' 28.52"
Bonteheuwel Library	30° 57' 27.80"	22° 07' 38.42"
Pole 709	30° 58' 0.70"	22° 08' 29.64"
Pole – New Joint opposite CATC	30° 57' 53.83"	22° 08' 11.83"

5 FIBRE SCOPE OF WORK

5.1 FIBRE SPECIFICATION

1. All fibre deployed shall comply to ITU G.657 A1 specification and incorporate Corning or Prysmian glass.
2. All connectors will be LC UPC utilising Huber & Suhner components. All fibre pigtails, patch-leads and splice-trays will be sourced from reputable South African agencies and/or manu-facturers. Low specification components will not be accepted. The Contractor must identify the source of all components in the tender response.
3. The ADSS overhead fibre cable for erection in Carnarvon will be supplied in a single length; no joints will be permitted. The fibre will comply to '24 Fibre SM All-Dielectric (ADSS) cable

- anti-tracking PE sheath'. The fibre will be tested on the drum prior to shipping from the factory and the test results will accompany the fibre to site. The Contractor must identify the manufacturer of all cable in the tender response.

4. All microduct fibre cable for underground installation will be installed as a single length; no joints will be permitted. The fibre will be tested on the drum prior to shipping from the factory and the test results will accompany the fibre to site. The Contractor must identify the manufacturer of all cable in the tender response.
5. The fibre cable will be tested on the drum prior to installation and the test results correlated with the factory test results supplied. No dead or high loss fibres in the cable will be accepted.
6. The fibre cable will be installed according to the manufacturer's installation guidelines and in accordance with best practice. The cable shall not be dragged on the ground during installation. The overhead cable shall not be over-tensioned during installation.
7. Full fibre testing will be carried out on completion of the installation as specified in the Scope of Work section and handed over to SARAO in electronic format. All fibre losses / splice losses will meet or be better than ITU specification G.652 D / G.657 A1.

5.2 MICRODUCT SPECIFICATIONS

1 All trenched microduct will be laid as a single length. No underground joints will be accepted.

2 All microduct shall be laid in suitable bedding according to manufacturers' specification, guidelines and best practice methods. Microduct will not be twisted during the laying process and bend radii specifications will not be exceeded. The microduct will be laid in specified bedding layers as specified by the manufacturer. The Duraline 'DuraMulti DB Technical Specification' is a good reference document.

5.3 MANHOLE / DRAWPIT REQUIREMENTS

1 All manholes and drawpits will be of concrete manufacture with a choice of concrete lids or lockable lid arrangements.

6 PHASED IMPLEMENTATION PROGRAMME

The contract will be implemented in two phases:

1. Phase 1: External to the CATC property:
   - The laying of microducts and manholes in conjunction with the power cable and trenching operations.
2. Phase 2: Fibre Cable Installation External and Internal to the CATC property:
   - The replacement of the overhead ADSS cable, creation of a fibre drop-off in close proximity to the CATC property, and blowing of microcable from the fibre drop-off to the CATC property in microducts provisioned by Phase 1 of the project.
   - The microduct and fibre reticulation within the property and the termination of the microcables in the Training Centre and Accommodation quarters.
   - Testing of the fibres from the Carnarvon POP to both the CATC and Bonteheuwel Library,

and fibre within the property.

- Installation of network cabling and infrastructure within the existing and new buildings.

7 FIBRE STATEMENT OF WORK

7.1 PHASE 1: EXTERNAL TO CATC PROPERTY

Phase 1 work is external to the CATC property and is to be done in conjunction with the power cable installation:

7.1.1 4-Way microduct is to be laid in parallel with the power cable in the power trench from pole located at 30° 57' 53.83"S 22° 08' 11.83"E, through a 110mm duct across the road, under the CATC boundary fence to be terminated in a 1m manhole in the corner of the CATC property.

7.1.2 3 X 110mm ducts are to be installed at the road crossing: 1 for power, 1 for fibre, and a spare pipe for the Kareeberg Municipality. The allocation of the pipes is to be done in conjunction with the power and fibre cables and must prevent crossing of these cables if possible.

7.1.3 Two 1m manholes are to be installed on either side of the fibre 110mm duct. One below the powerline and the second within the CATC property. See Figure 1 below.

7.1.4 The 4-Way microduct must be led up the centre of a galvanised 50mm Bosal pipe of minimum 3 metres above ground level secured to the pole by s/s bandit straps at 1m intervals. The 4-Way microduct must reach the existing overhead ADSS fibre cable with 1 metre slack allowance. On completion the Bosal pipe must be sealed at both ends with high density foam filling.

7.1.5 The 4-Way microduct must be led through the 1 metre manhole below the powerline. The bend radii must not be exceeded and the microducts shall remain encased in their outer sleeve for protection.

7.1.6 The 4-Way microduct must terminate in 1 metre manhole within the CATC boundary.

7.2 PHASE 2: INSTALLATION OF FIBRE CABLE EXTERNAL AND INTERNAL TO CATC PROPERTY

Phase 2 work is to be carried out both external to, and within the CATC property, and is to be done in conjunction with the power cables installation:

7.2.1 A new length of ADSS 24 fibre G.657 A1 fibre cable is to be suspended from pole 709 to the pole located at 30° 57' 53.83"S 22° 08' 11.83"E. At pole 709 the full 24 fibres are to be spliced to the existing ADSS fibre cable utilising the existing fibre dome joint. At the pole identified for the fibre drop-off to the CATC, 18 fibres are to be spliced through to the existing ADSS fibre cable feeding Bonteheuwel Library, 6 fibre are to be dropped off for connectivity to the CATC. A new 4-Entry dome joint is to be provided. See Figure 1**Error! Reference source not found.** below.

7.2 2 The existing damaged section of ADSS fibre cable is to be dismantled and removed for safe disposal.

7.2.3 4-Way microduct is to be laid in parallel with the power cable in the power trench from the 1 metre manhole within the CATC property as per Figure 2 below. Required manholes and drawpits are to be installed and implemented.

7.2.4 A 40mm duct is to be laid from the existing house to the ex-Klerefontein classroom via the fibre manhole and drawpit and led into both facilities to the network racks. See **Error! Reference source not found.** below.

7.2.5 12 Core G.657 A1 fibre microcable is to be blown into the microduct from the new dome joint on the power pole to a new 24 port LC patch panel installed in the CATC building and terminated. 6 Fibres are to be spliced to the ADSS cable back to the Carnarvon POP at the overhead joint and all 12 fibres are to be terminated on the first 12 connectors on the fibre panel.

7.2.6 12 Core G.657 A1 fibre microcable is to be blown from the new 24 port LC patch panel installed in the CATC building in the microduct to a new 24 port LC patch panel installed in the existing house. This fibre is to be terminated on both ends.

7.2.7 On completion of installation and splicing, full fibre OTDR and fibre loss measurements must be done, witnessed by SARAO personnel, and provided in electronic format for SARAO records:

- Carnarvon POP to new CATC patch panel (6 fibres)
- Carnarvon POP to Bonteheuwel Library (18 fibres)
- New CATC patch panel (new building) to new CATC patch panel (existing house) – (12 fibres).

7.3 INSTALLATION NOTES:

7.3.1 SARAO will provide the following:

- Concrete manholes and drawpits
- 40mm Subduct

7.3.2 The 4-Way microduct, plus the 40mm subduct, must be laid in suitable bedding as per the manufacturer's guidelines and the bend radii must not be exceeded. The Duraline 'DuraMulti DB Technical Specification is a good reference document.

7.3.3 2 X 110mm ducts are required across the CATC entrance gate: 1 for power, 1 for fibre.

7.3.4 The 19" patch panels must have LC UPC connectors, come supplied with necessary pigtails and splice trays, and must fold out and be accessible from the front. The panels will be installed in network racks supplied by SARAO.

7.3.5 Where the microduct is led up an external wall for access to the ceiling void, a suitable weatherproof metal protective trunking must be implemented to protect the 4-Way microduct and 40mm subduct.

7.4 FIBRE TESTING REGIME

On completion of the fibre installation the following fibre routes will be tested with OTDR tests and Fibre Loss measurements taken. These tests will be witnessed by a SARAO representative and the test results handed to SARAO in digital format:

7.4.1 Carnarvon POP to Bonteheuwel Library – fibres 1 to 18

7.4.2 Carnarvon POP to CATC – fibres 19 to 24

7.4.3 CATC property – fibres from Training Centre to Accommodation Quarters – fibres 1 to 12

8 NETWORKS

8.1. CAT6A network cabling, patch panels and keystones to be used for all installations.

8.2. 2x 9U racks are to be provided and installed at the locations indicated in Figure 3.

8.3. 2x 24 port CAT6A patch panels to be installed, one in each rack - one in the new training centre building and one in the existing house.

8.4. 1m CAT6A Patch leads are to be provided per patch panel point to connect to switch in rack. Switches, UPS and Wifi Access points will be provided by SARAO.

8.5. Refer to map in Figure 3 below for location of network points to be installed:

8.5.1. Blue network points to be installed at floor level unless stated “Roof Mount” in which case they are to be mounted on the roof for connection to future Wifi Access Point.

8.5.2. Magenta network points to be installed in a suitable location for connection to externally mounted IP CCTV Cameras.

8.6. Each installed network point is to be provided with a 3m CAT6A patch lead.

8.7. All cabling to be run in existing trunking where possible. Where no trunking exists, the contractor is to provide and install trunking.

8.8. Training Centre: Installation of 22 network points.

8.9. Existing House: Installation of 8 network points

8.10. Ex-Klerefontein Classroom: Installation of 3 network points. Network cables to be run through a previously installed duct between classroom and existing house.

8.11. Confirm with local SARAO personnel that power points have been provided at the network rack to provide power for UPS and switch; alternatively arrange with SARAO personnel to install the required power points.

8.12. Test results to be provided for each installed network point - from the patch lead at the patch panel to the patch lead provided with the network point.

8.13. Patch panel and installed network points must be labelled - one should be able to trace any keystone to its corresponding point on the patch panel.

8.14. Each 1m patch lead provided for each patch panel port to be uniquely labelled on either end.

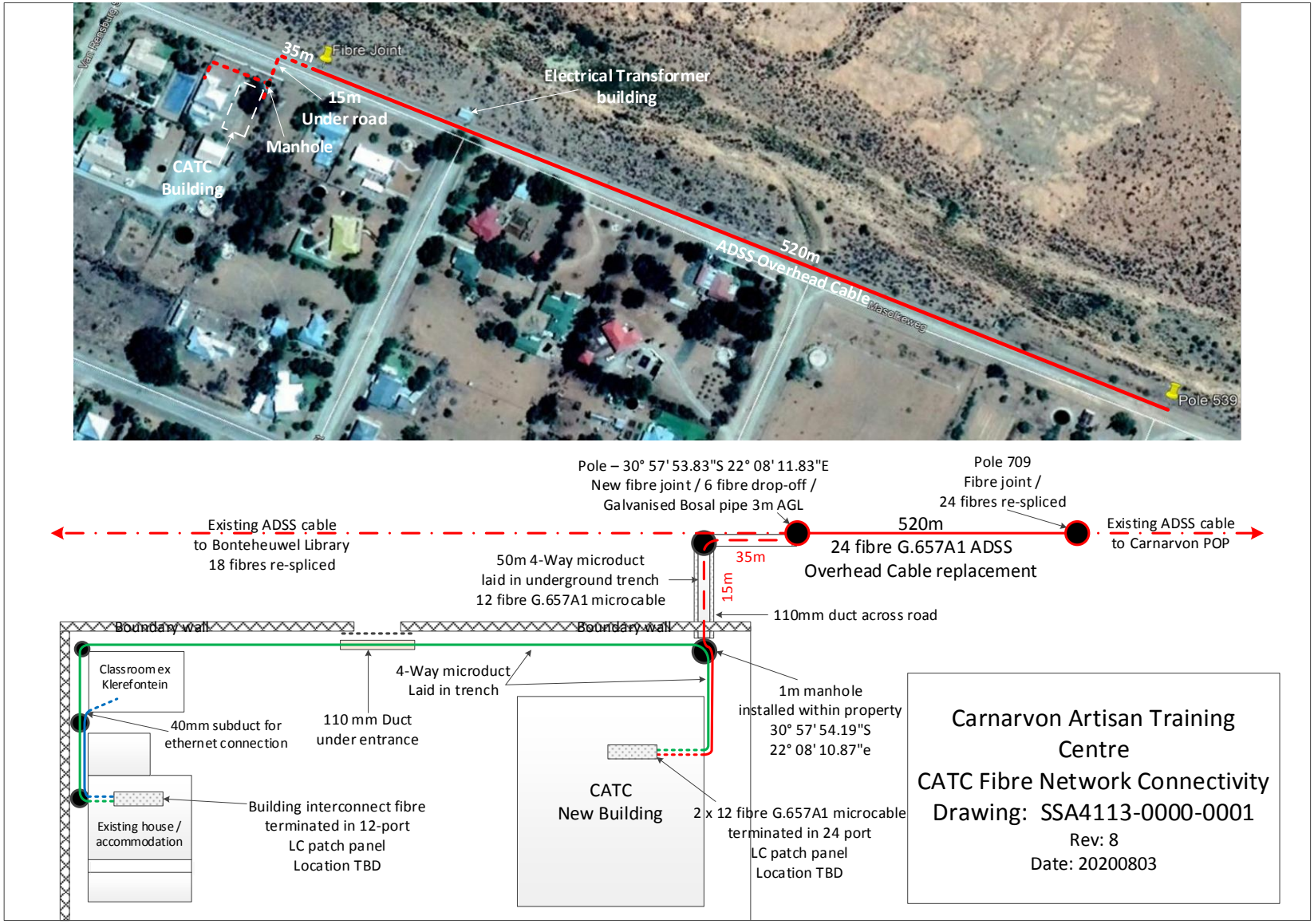

Figure 1 - Carnarvon Artisan Training Centre Fibre connectivity

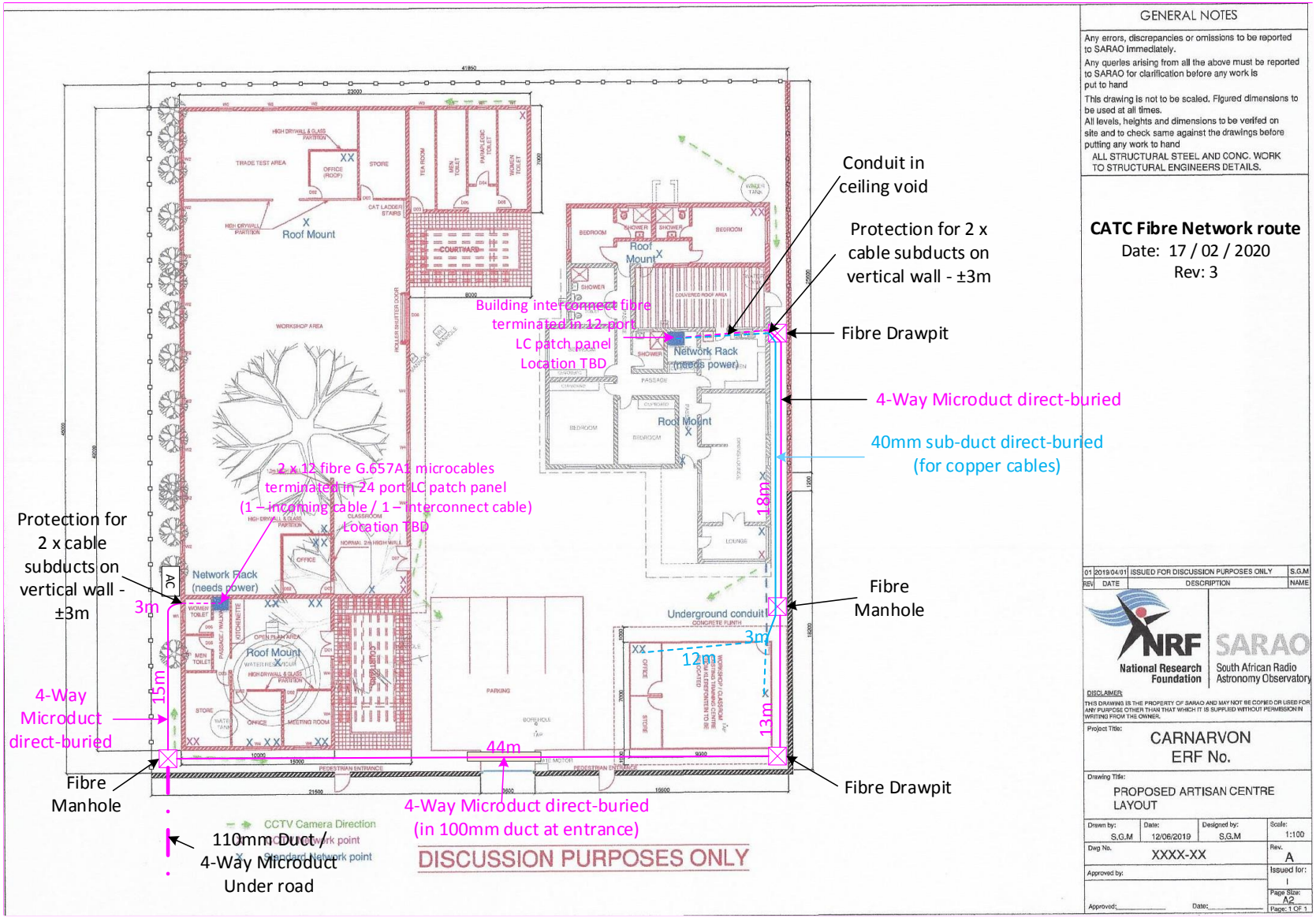

Figure 2 – Carnarvon Artisan Training Centre fibre network layout

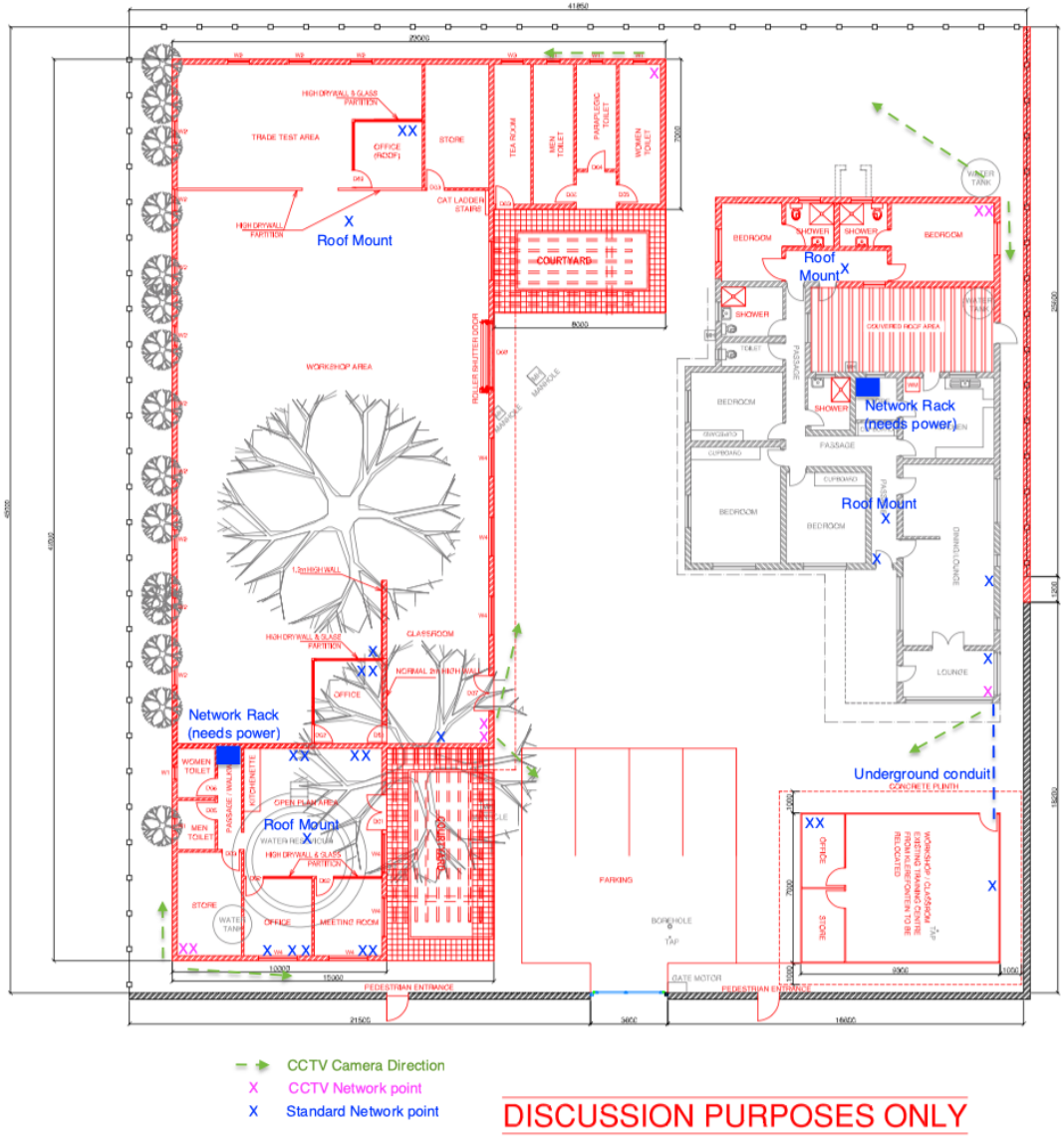

Figure 3 - Network point and rack locations for installation

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