

Dartmouth Park Hill Service Tunnel Report

C&I New In-Patient Facility

Camden and Islington NHS Foundation Trust



1.0 Introduction

The current external services strategy is to utilise the C&I Service tunnel running underneath Dartmouth Park Hill to route the generator and LV cables for the new facility, as well as the fibre and fire alarm cables that provide the required interface between the two Highgate facilities (**see Appendix A**). It is key to note that durasteel is required to be used to provide protection to the secondary supply cables within the tunnel.

At the time of developing the design, there was a tunnel survey (undertaken by W.&I. Craig Ltd – **see Appendix B**) available which established the condition of the tunnel but did not provide sufficient information regarding space available to run the necessary cables.

On further review, BAM Construction proposed a point cloud survey be undertaken to assist in establishing the extent of services running through the existing tunnel. BAM Construction appointed Scan to Plan to complete this with scans being undertaken from the opening of the chamber, angled down the shaft and at the bottom of the chamber and thereafter every 2-3metres along the tunnel, as highlighted in below figure 1.

A sample of the result of the survey is shown in **Appendix C**.

Figure 1. Scope of point cloud survey



2.0 Revit Model

Following the release of the point cloud survey, BAM Construction further appointed Glyn Shepherd Media to convert the point cloud information into a Revit Model for a more readable format for the project team.

During discussions with Glyn, it became apparent that the point cloud survey picked up several previous issues raised in the W.&I. Craig Ltd investigation report. Although pumped out of water before the point cloud survey was undertaken, there remained water at the bottom which hindered a clear survey, along with the corrosion/wear and damage of the concrete.

Glyn developed the Revit model to the best of the information available, utilising both the point cloud survey and photos from the original survey to create the model. A selection of screen shots have been provided below (figures 2 – 4) and PDF drawings demonstrating the outcome of this.

Figure 2. Inspection chamber located adjacent to Highgate West – demonstrating a heavily congested area with little space to pull required cables and not possible to route the durasteel that is providing the necessary protection

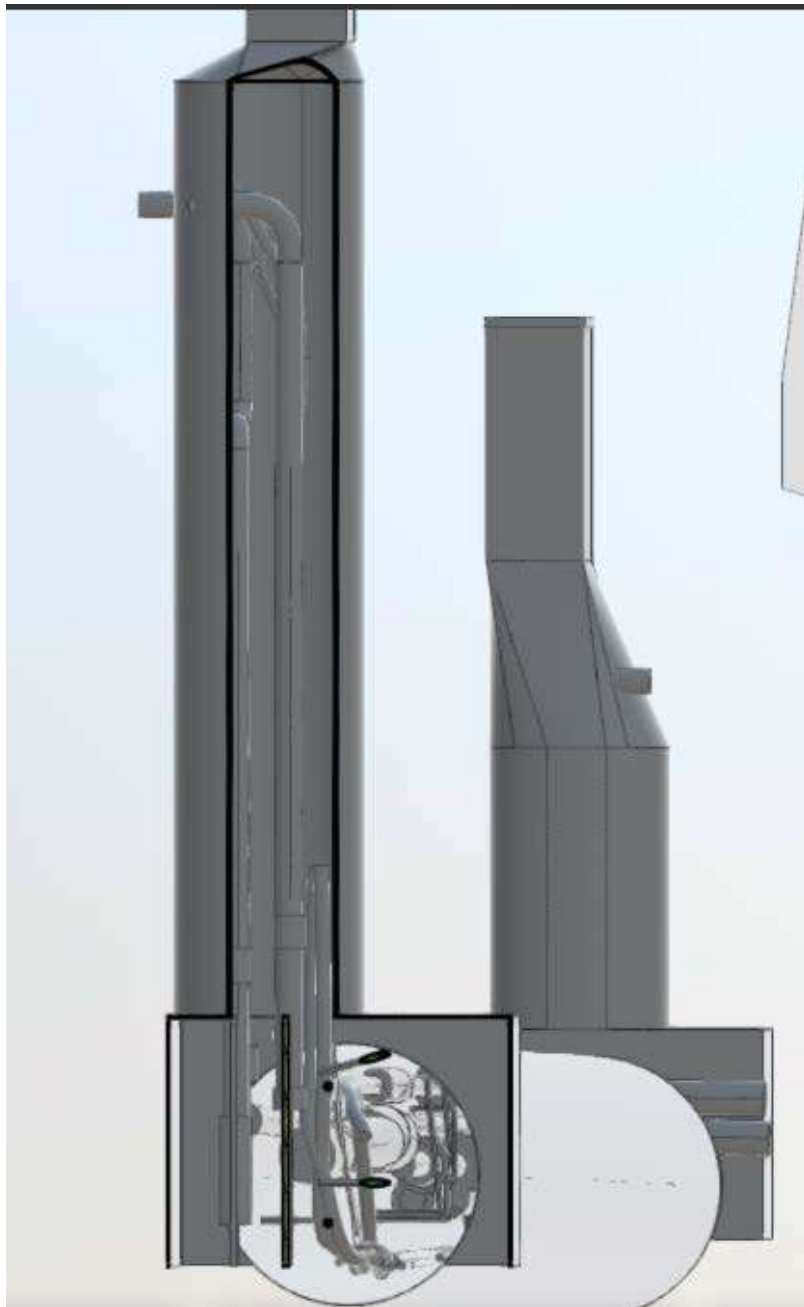


Figure 3. Main pipe routes modelled along tunnel – some cables/pipes were unable to be modelled due to the wear and damage within the tunnel

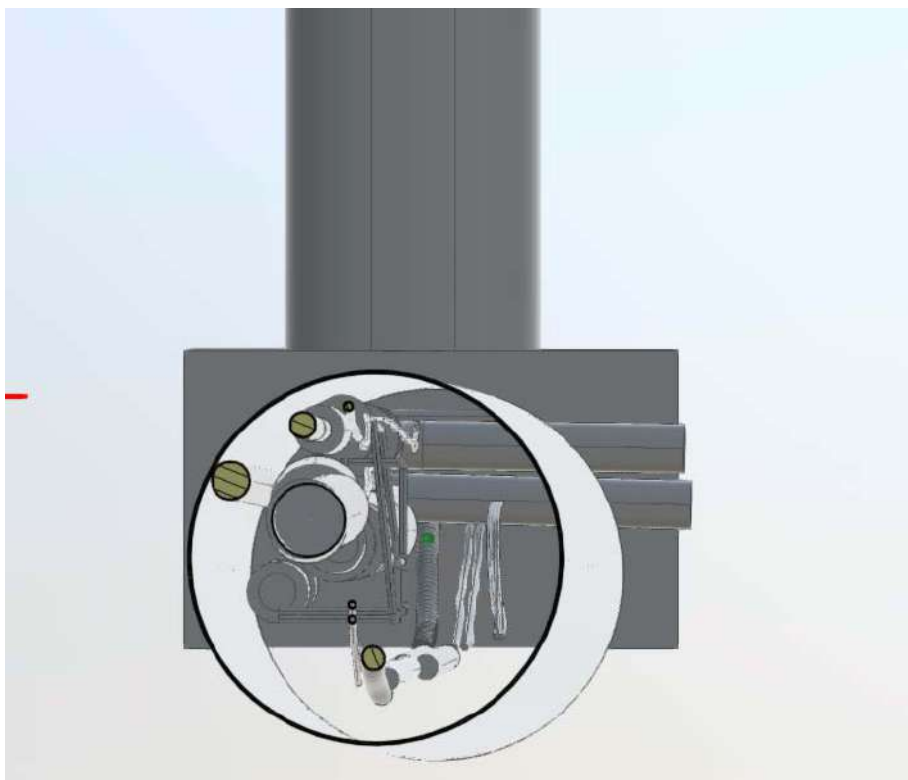
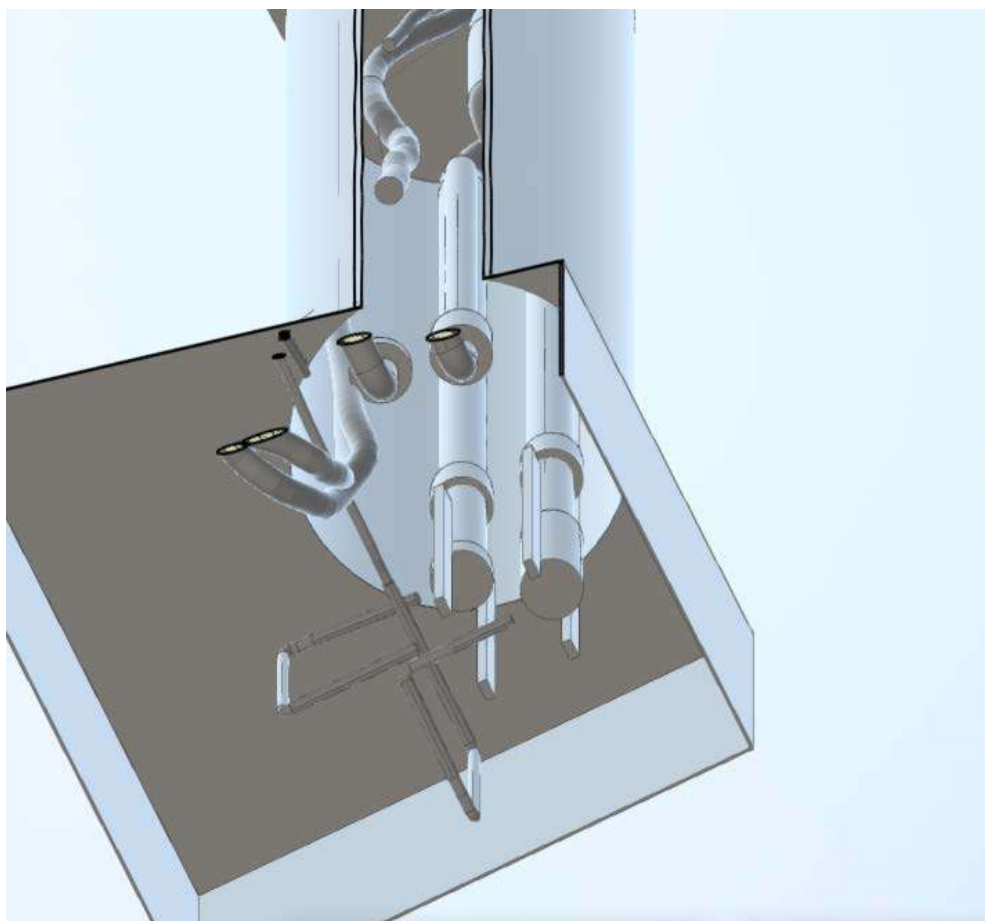


Figure 4. Inspection chamber to side of new facility showing complex run of pipes contributing to difficult spatial fit of new cables



3.0 Recommendations

Following review of the model, BAM Construction would advise that the service tunnel cannot be utilised for the new services as indicated on the current Capita External Services drawings.

The locations of the existing services and the depth of the inspection chamber do not accommodate the necessary spatial requirements for the new services and compartmentation required between primary and secondary supplies.

Unfortunately, the works within the tunnel will need to conform to The Confined Spaces Regulations 1997. These Regulations contain the following key duties.

- Avoid entry to confined spaces, eg by doing the works from the Outside
- If entry to a confined space is unavoidable, to follow a safe system of work, and
- Put in place adequate emergency arrangements before the works start

Under The Management of Health & Safety at Work Regulations 1999 requires employers and self-employed people to carry out a suitable assessment of the risks for all work activities for the purpose of deciding what measures are necessary for safety.

The above information should be provided by C&I Trust FM team.

BAM would recommend that an alternative route will need to be investigated with the possibility of a trench running across Dartmouth Park Hill, however this is subject to further discussions with the necessary parties.

APPENDIX A

Capita External Services Layout

APPENDIX B

W.&I. Craig Ltd Investigation Report

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Report No. WI/WH/0016

For the attention of: - Mr. A. Mead

5th February 2020

Site	Whittington Hospital
Site Location	Dartmouth Park Hill Mental Health Unit to Pedestrian Ramp Plus Pedestrian Ramp to Former Generator Fuel Tank
Date(s) of Survey	18/01/2020 – 19/01/2020

INVESTIGATIVE WORKS TO INSPECTION CHAMBER AND TUNNELS AT DARTMOUTH PARK HILL MENTAL HEALTH UNIT TO PEDESTRIAN RAMP PLUS PEDESTRIAN RAMP TO FORMER GENERATOR FUEL TANK REPORT No. WI/WH/0016

Objective & Methodology

Our operatives were instructed to attend site on 15th – 17th January 2020 to pump out over flowing inspection chamber located at Dartmouth Park Hill Mental Health Unit and then return to site on the weekend dates of the 18th and 19th January 2020 to survey the condition of the chambers and tunnels from Dartmouth Park Hill Mental Health Unit to Pedestrian Ramp plus Pedestrian Ramp to Former Generator Fuel Tank. Our survey would allow us to determine the condition of the tunnel and shaft between Dartmouth Park Hill Mental Health Unit and the Whittington Hospital and the condition of the tunnel and 5 no. chambers along the Dartmouth Park section of the perimeter road.

After carrying out our confined spaces survey we were to note and log all of our findings to be presented in a report to the Whittington Hospital Estates Department, with recommendations for remedial works.

Our operatives attended the Whittington Hospital site during the week and set up pumps to remove water from the overflowing inspection chamber on the Dartmouth Park Hill Mental Health Unit site.

Our operatives returned to site once the chambers were completely pumped out. They set up their confined spaces equipment at the inspection chamber at the rear roadway. They then descended into the manhole chamber and to the bottom. One operative remained at surface level, another at the base of the ladder in the manhole chamber and the third operative travelled through the tunnel to investigate the condition of the same and take photographs. Once the investigations were complete our operatives returned to surface level and disassembled the confined spaces equipment. They repeated the above process on day two for the tunnel to Dartmouth Park Hill Mental Health Unit.

Continued over page

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Findings

Upon the completion of the survey works, and after review of all information and photographs, we can confirm the following observations;

- **Rear Perimeter Roadway (Dartmouth Park Hill road section) Inspection Chambers**
 - Access to each inspection chamber is via a 600mm x 850mm inspection chamber cover.
 - At the bottom of each inspection chamber is a space 1.1m x 1.25m space leading to the tunnel.
 - The tunnel is 1.25 metres in diameter and is constructed with brick and concrete lintels. The tunnel run from the first surveyed chamber to the last surveyed chamber is 52 linear metres.
 - There are steam pipes in the tunnel however they are no longer in use.
 - There are 30mm diameter electrical cables in good condition. There is also a 90mm blue poly fire main connected to the wall in very good condition.
 - The tunnel is in average condition and there are signs of wear. The concrete lintels in the ceiling have started to rust and is cracking/blowing the concrete. There are also a lot of tree roots of mixed diameter. The tunnel is very damp.
- **Dartmouth Park Hill Mental Health Unit Inspection Chamber**
 - Access to the inspection chamber is via a 600mm x 600mm inspection chamber cover.
 - The inspection chamber has a galvanised steel ladder with rungs approximately 250mm apart. The ladder is approximately 6 metres. The ladder is in average condition.
 - At the bottom of the inspection chamber there is a space measuring 1.5m x 2m which leads into the tunnel. However the area is congested with pipework, cables, ducting etc. which restricts access.
 - The tunnel is 2 metres in diameter and is made up of concrete sections which are bolted together. The tunnel run is 33 linear metres.
 - There are steam pipes in the tunnel with lagging which has begun to wear away due to water damage.
 - There are 4 no. 50mm electrical cables though we believe are no longer live. There is also a 100mm diameter black duct which has fibre optic cables running through it.
 - The tunnel is in average condition and there are signs of wear and damage to the concrete.
 - Water was found to have completely filled the tunnel and chambers to within 2 metres of the surface level of the Dartmouth Park Hill manhole entrance.

Conclusion

Upon the completion of our confined spaces survey, we are able to give an indication of the areas which are of concern and provide recommendations for further survey, investigation or remedial works. Our recommendations are based on the results gleaned from our investigations. Although we have taken every reasonable measure to ensure that our findings and report are accurate, we cannot guarantee that the recommended remedial works will necessarily remove all the possible routes of water ingress into the manhole chambers and tunnels.

The water level filled the tunnel between the Whittington Hospital and the Mental Health Unit and has flooded causing corrosive deterioration of the segmented tunnel/shaft. In the perimeter road tunnel section, (parallel to Dartmouth Park Hill), there are 5 no. patches of corrosion evident to the lintel forcing the base/tunnel roof. These will need to be replaced in the short to medium term.

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Our investigations indicated that the ingress of water in the Dartmouth Park Hill Mental Health Unit may be from ground water at the bottom of the manhole chamber. As there are no functioning pumps in this location the water is not being pumped out and so they are filling with water.

Recommendations

After carrying out our confined spaces investigative survey in the inspection chambers and the tunnels we recommended the following remedial measures be undertaken.

- **Generally**
 - Control the water depth to reduce and slow corrosion.
- **Immediately (Applicable to Both Tunnel Areas)**
 - Installing new pumps and pipe work to the inspection chamber on the pedestrian ramp, (using a confined spaces electrician to determine the type of the existing badly corroded pump currently in use in order to supply and fit a replacement pump to match the existing). Fit water pump failure alarm.
 - In the event of alarm a protocol should be in place to provide emergency pumping or back up pump.
 - Regular maintenance and inspections/survey of the pumps and tunnels every 6 months, (minimum).
- **Medium Term (Applicable to Perimeter Roadway Tunnel)**
 - Replace corroded lintels in sections in 5 no. areas within 12 months as this roadway is the main exit from the Hospital.
 - Ensure no heavy loads i.e. crane, HIAB, mobile works platform, stabilisers/jacks are sited on tunnel.
 - Removal of tree roots between Manhole 4 and Manhole 6.

Declaration

This report was compiled by Donald Craig and Jason Cope of W. & I. Craig (Civil Engineering) Ltd., and validated by David Craig. All reasonable measures were taken to ensure accurate and relevant information was taken and forwarded to you in the form of this report.

Donald Craig
5th February 2020

Jason Cope
Survey Foreman

Validated by
David Craig

Our reports are compiled by trained operatives, and we endeavour to use all reasonable means to diagnose the defect and provide a suitable solution to remedy the problem. However, there can be no guarantee that any diagnosis will be made, nor that any suggested remedial works undertaken will necessarily resolve the problem. W. & I. Craig (Civil Engineering) Ltd. Cannot be held liable in the event that remedial works do not alleviate the problem. This report is intended solely for the Whittington Hospital NHS Trust. Any decisions made or uses of this report by third parties not authorised by W. & I. Craig (Civil Engineering) Ltd., will be the responsibility of such third parties. Decisions made or actions taken as a result of our works shall be the responsibility of the parties directly involved in the decisions or action.

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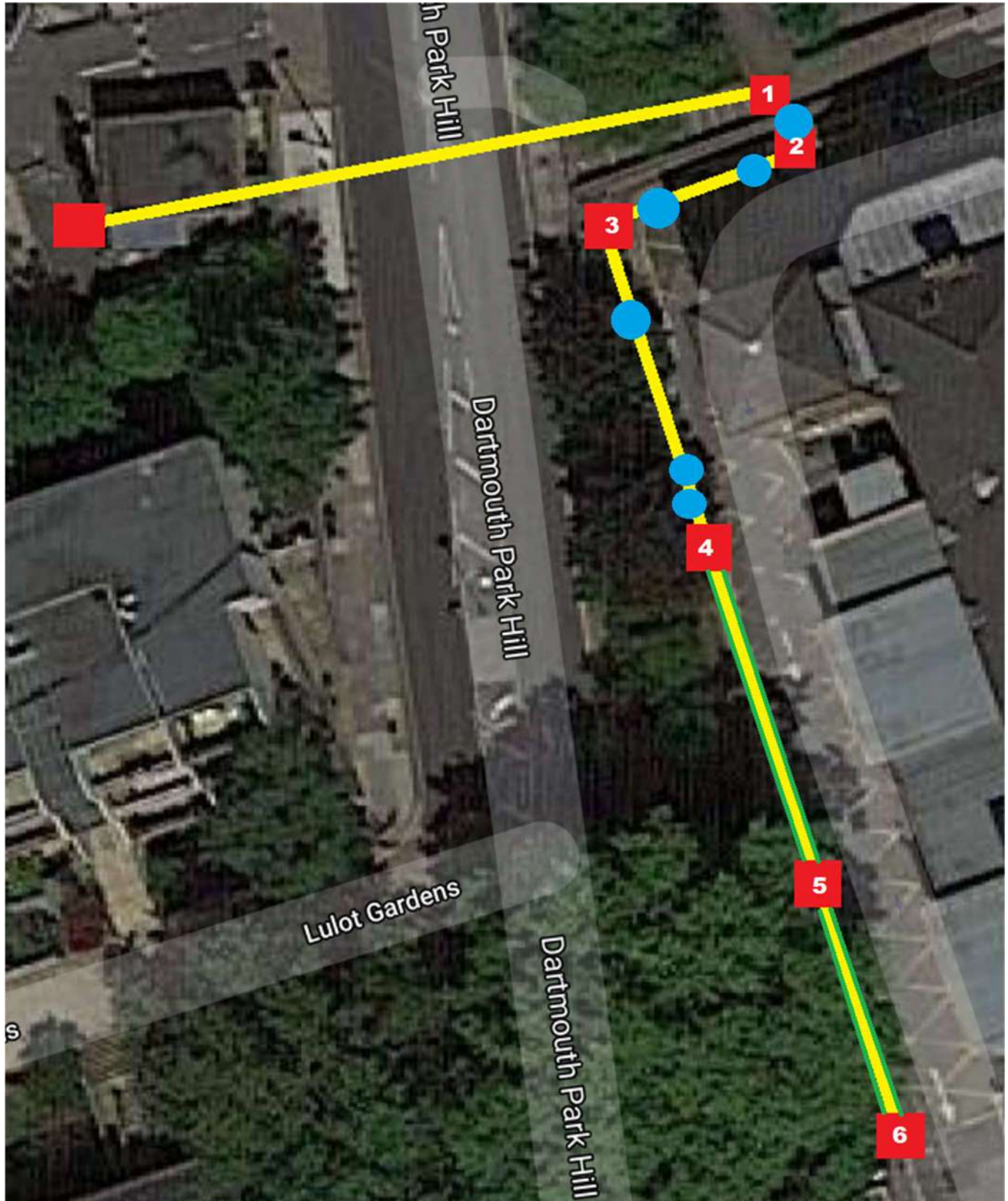
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Locations of tunnels and inspection chambers

Red squares indicate manhole chambers, yellow lines indicate tunnel run, blue circles indicate areas of excessive corrosion to lintels, green lines indicate areas of large tree roots entering tunnel area.



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Photographs from Inspection Chambers on Rear Road, Pedestrian Ramp to Former – 18/02/2020



MH2 LOOKING TOWARDS MH1 – CORROSION BEGINS 2 METRES IN FROM MH2 TOWARD MH1



MH2 LOOKING TOWARDS MH1 – CORROSION BEGINS 2 METRES IN FROM MH2 TOWARD MH1

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MH1 TOWARDS MH2 – APPROXIMATE LOCATION ON ROADWAY SURFACE OF CORROSION



MH2 TO MH3



CORROSION BEGINS 2 METRES FROM MH2
TOWARD MH3

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MH2 TO MH3



**CORROSION BEGINS 2 METRES FROM MH3
TOWARDS MH2**



MH3 TOWARD MH4



MH3 TOWARD MH4

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**TWO DAMAGED LINTELS FIVE METRES
FROM MH3 TOWARDS MH4**



**HEAVY CORROSION TO LINTEL ONE METRE
FROM MH4 TOWARD MH3**



**MH4 TOWARDS MH5 – SMALL TREE ROOTS,
ENTIRE LENGTH OF RUN**



**MH6 TOWARDS MH5 – ENTIRE LENGTH OF
RUN**

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MH1 AT SURFACE

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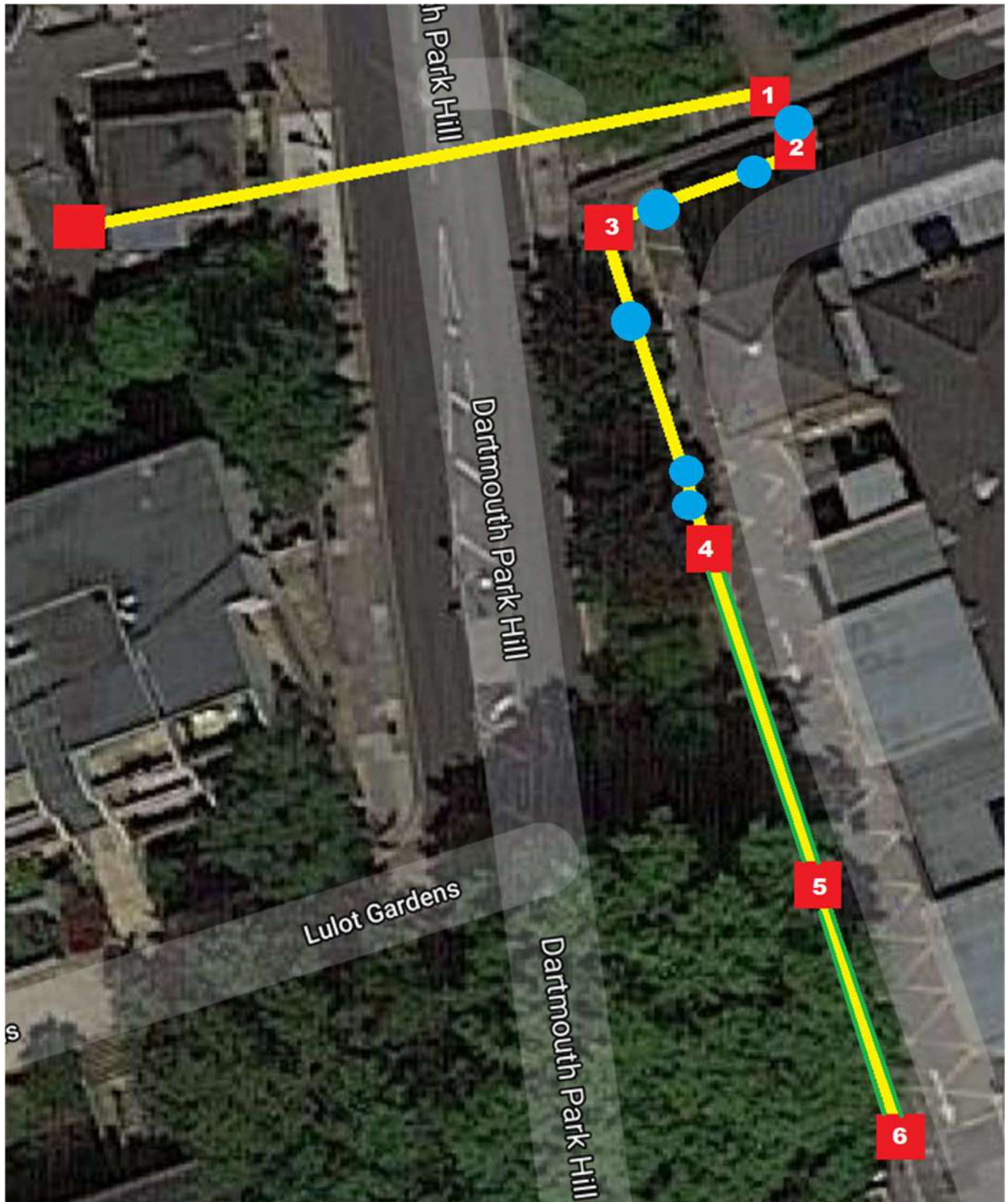
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Locations of tunnels and inspection chambers

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Photographs from Inspection Chambers on Rear Road, Pedestrian Ramp to Former – 18/02/2020



MH2 LOOKING TOWARDS MH1 – CORROSION BEGINS 2 METRES IN FROM MH2 TOWARD MH1



MH2 LOOKING TOWARDS MH1 – CORROSION BEGINS 2 METRES IN FROM MH2 TOWARD MH1

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MH1 TOWARDS MH2 – APPROXIMATE LOCATION ON ROADWAY SURFACE OF CORROSION



MH2 TO MH3



CORROSION BEGINS 2 METRES FROM MH2
TOWARD MH3

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MH2 TO MH3



**CORROSION BEGINS 2 METRES FROM MH3
TOWARDS MH2**



MH3 TOWARD MH4



MH3 TOWARD MH4

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**TWO DAMAGED LINTELS FIVE METRES
FROM MH3 TOWARDS MH4**



**HEAVY CORROSION TO LINTEL ONE METRE
FROM MH4 TOWARD MH3**



**MH4 TOWARDS MH5 – SMALL TREE ROOTS,
ENTIRE LENGTH OF RUN**



**MH6 TOWARDS MH5 – ENTIRE LENGTH OF
RUN**

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Photographs of Tunnel from Dartmouth Park Hill Mental Health Unit to Pedestrian Ramp – 19/02/2020



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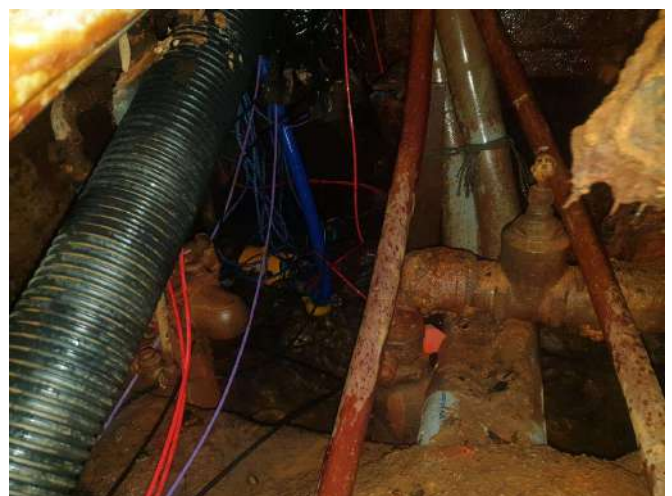
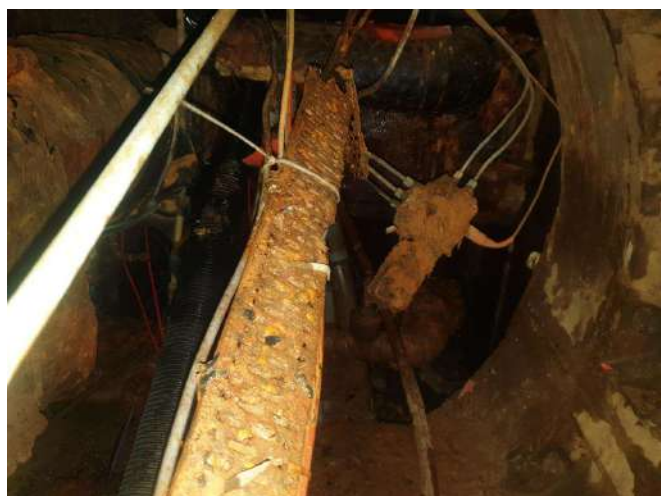
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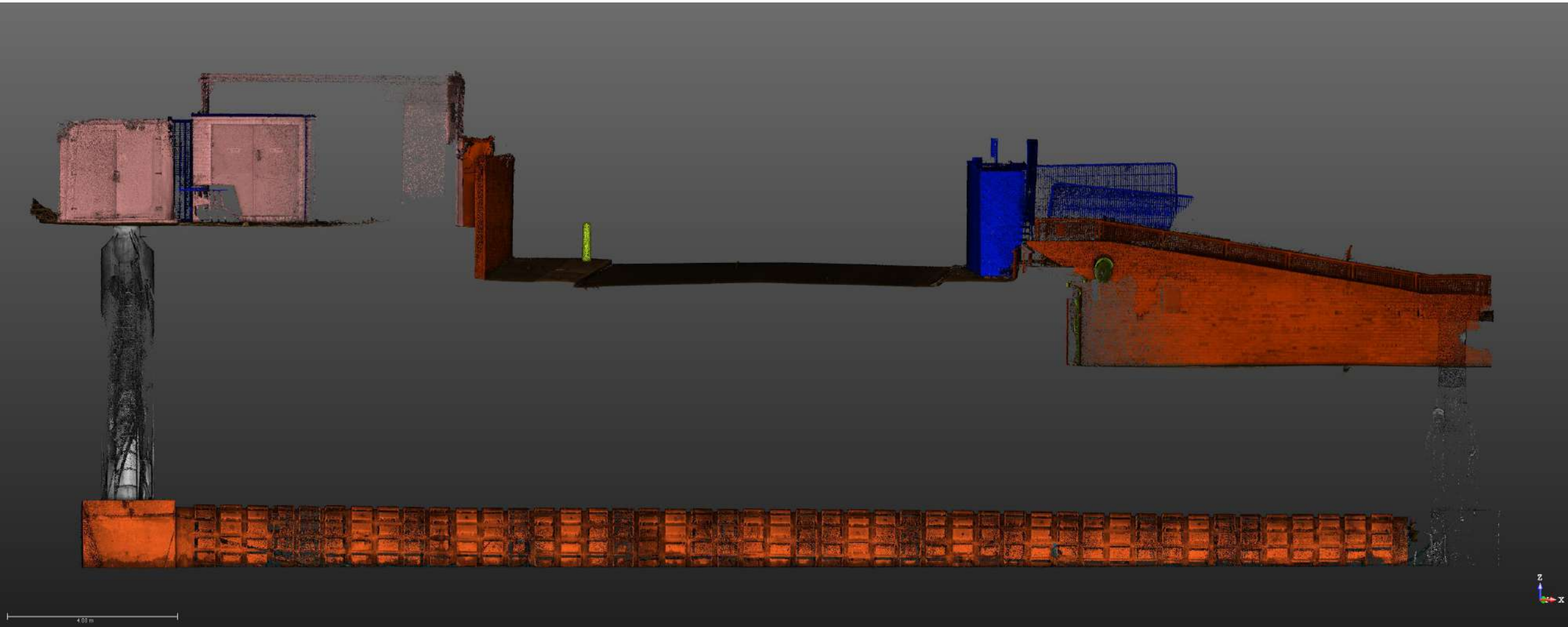
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APPENDIX C

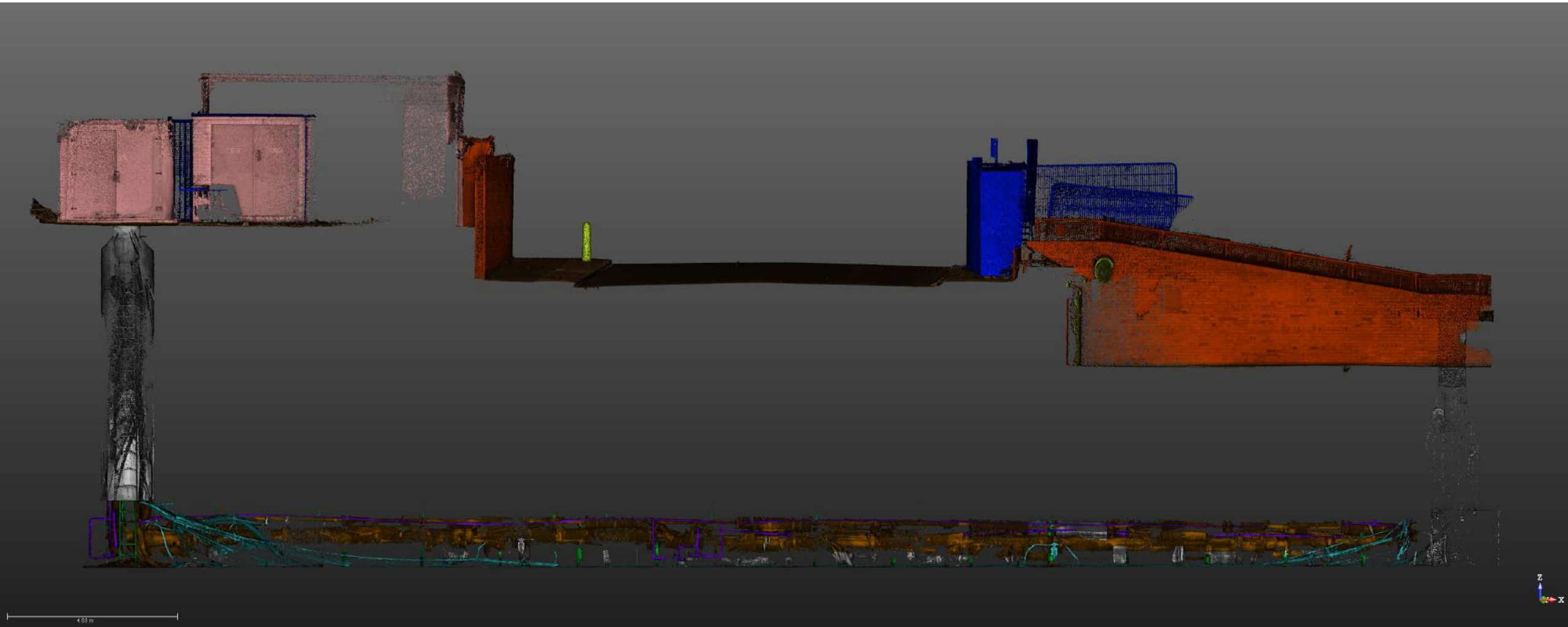
Scan to Plan Point Cloud Survey Screenshots

Whittington Hospital Tunnel



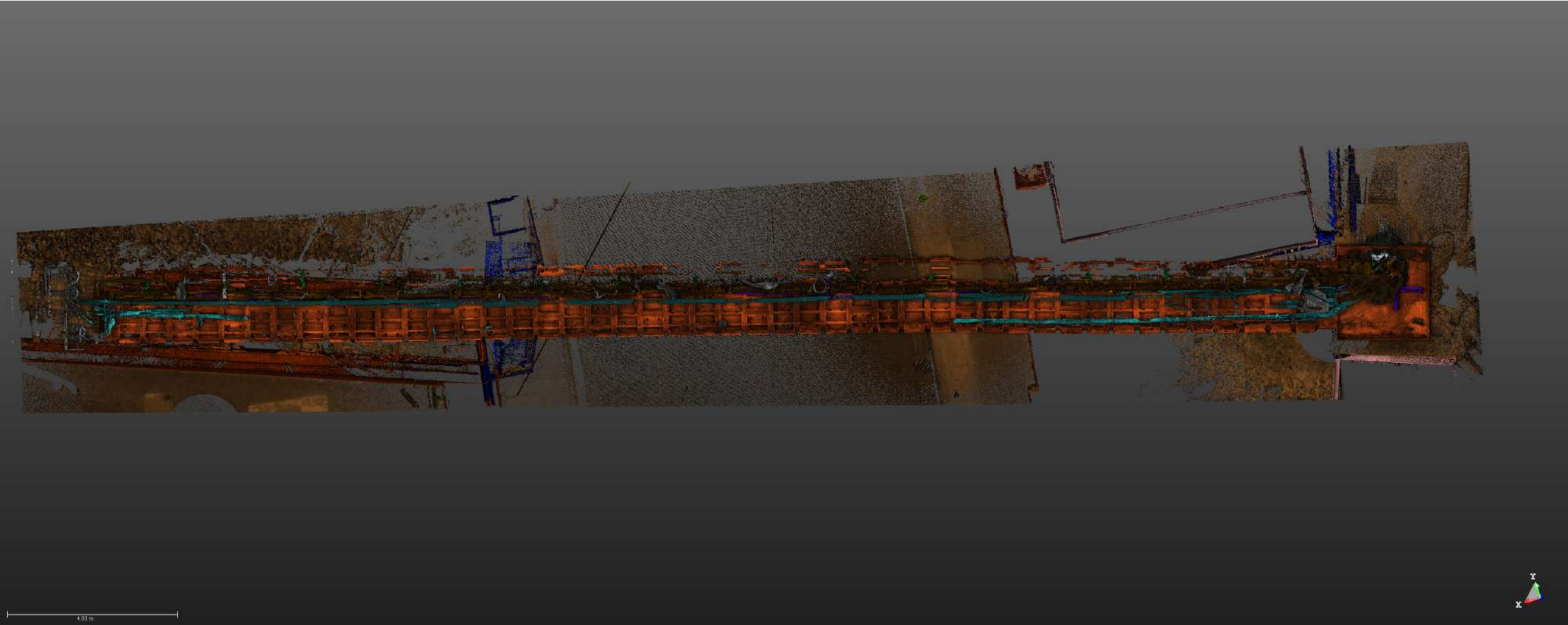
Elevation looking North

Whittington Hospital Tunnel



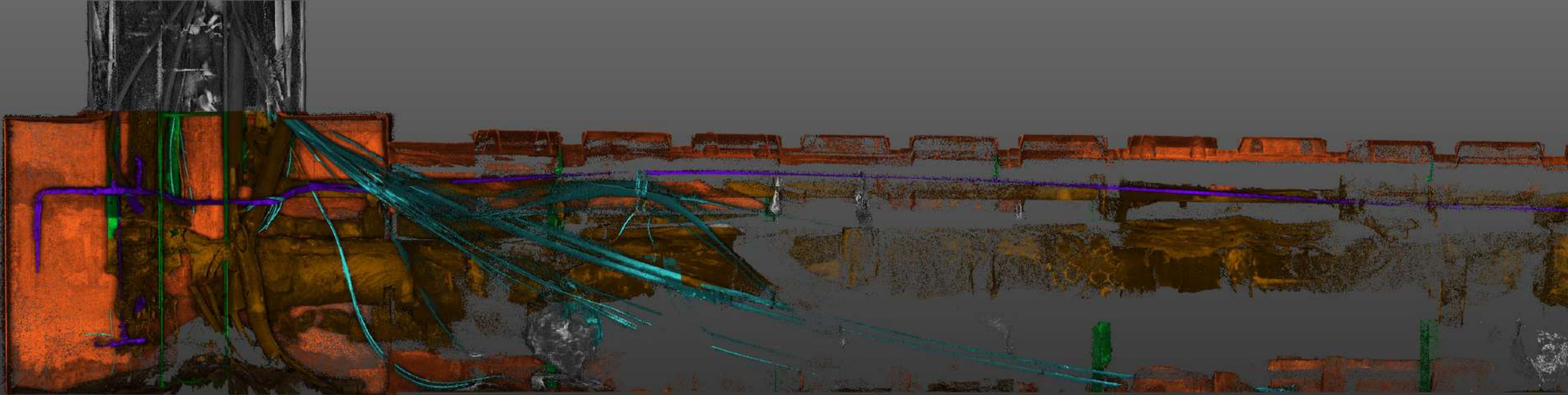
Elevation looking North – less Tunnel Casing

Whittington Hospital Tunnel



Reverse Plan

Whittington Hospital Tunnel



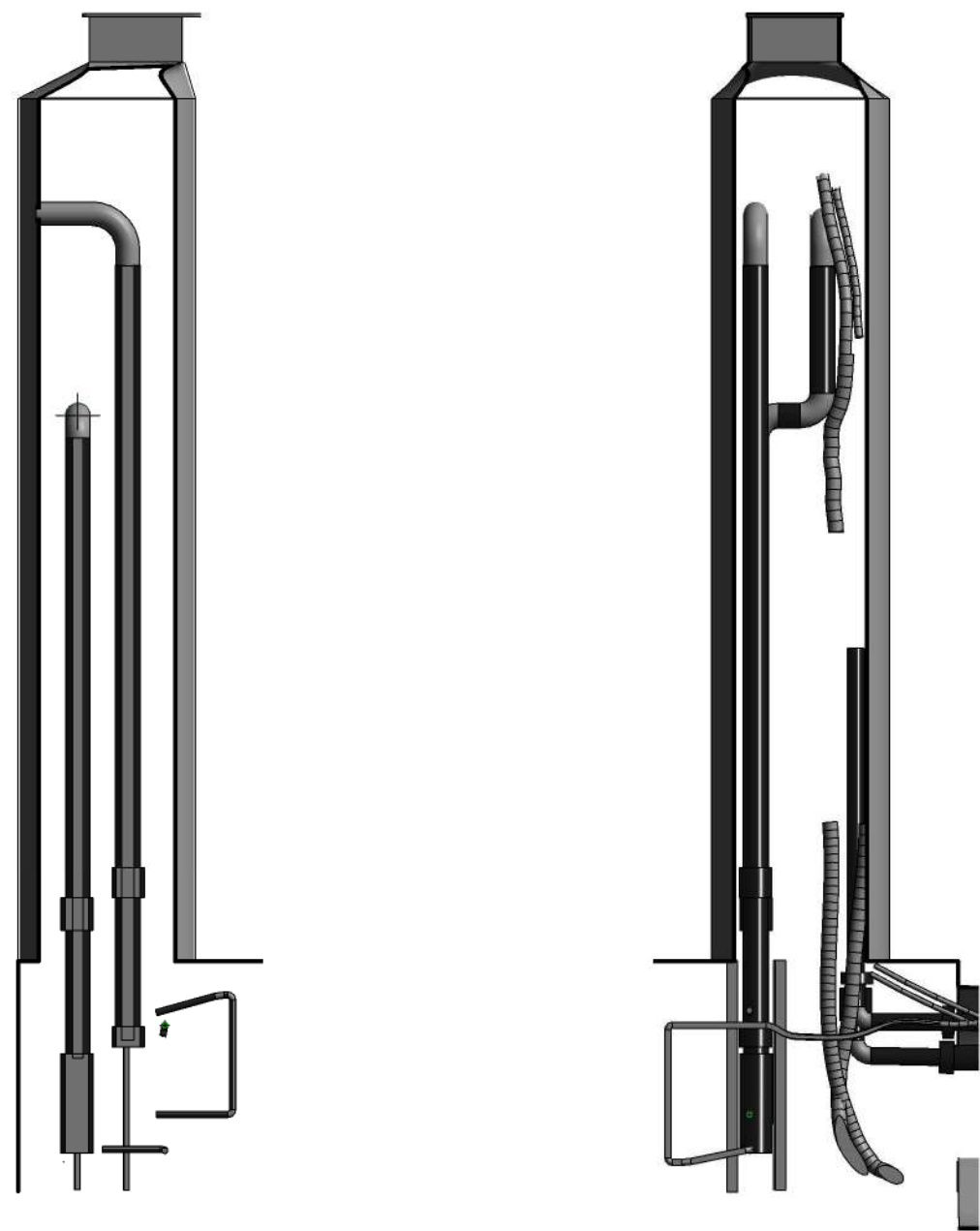
Detailed Elevation cut through

APPENDIX D

Glyn Shepherd Media Tunnel Plan/Sections (taken from Revit Model)

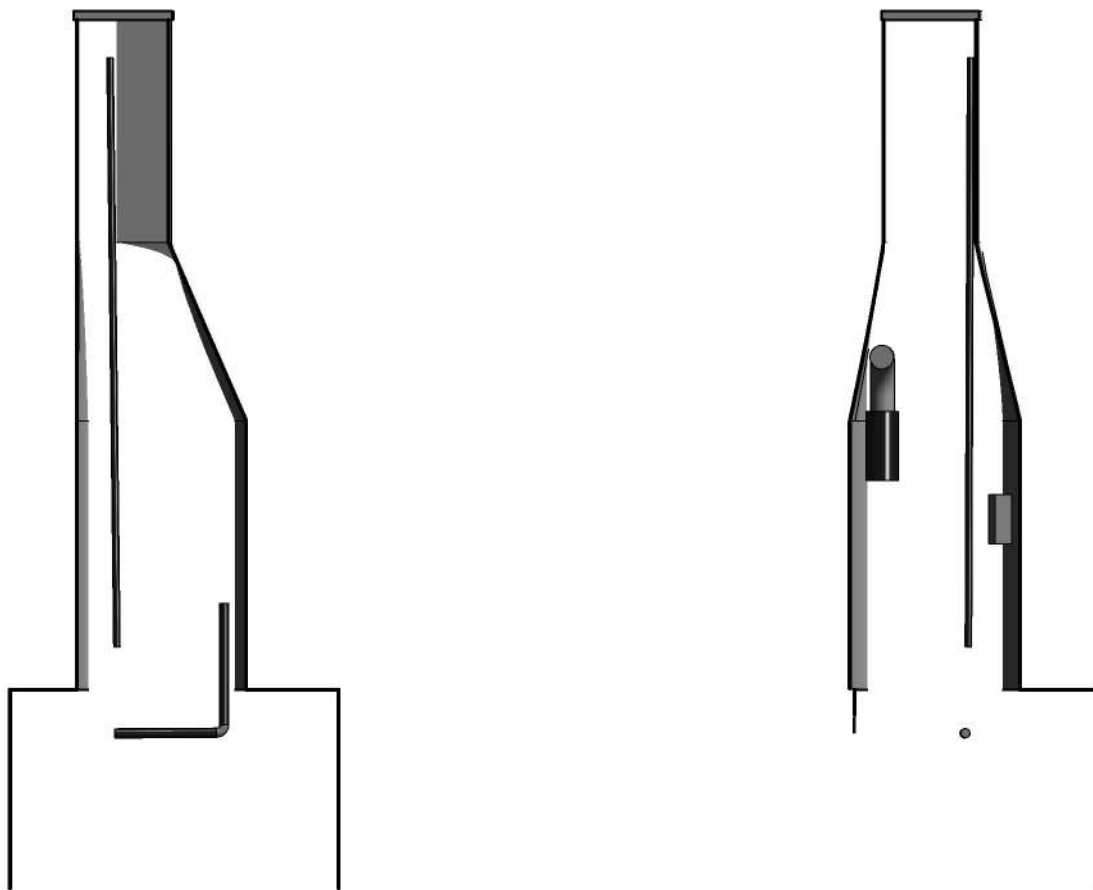
CHAMBER 1

CHAMBER 2



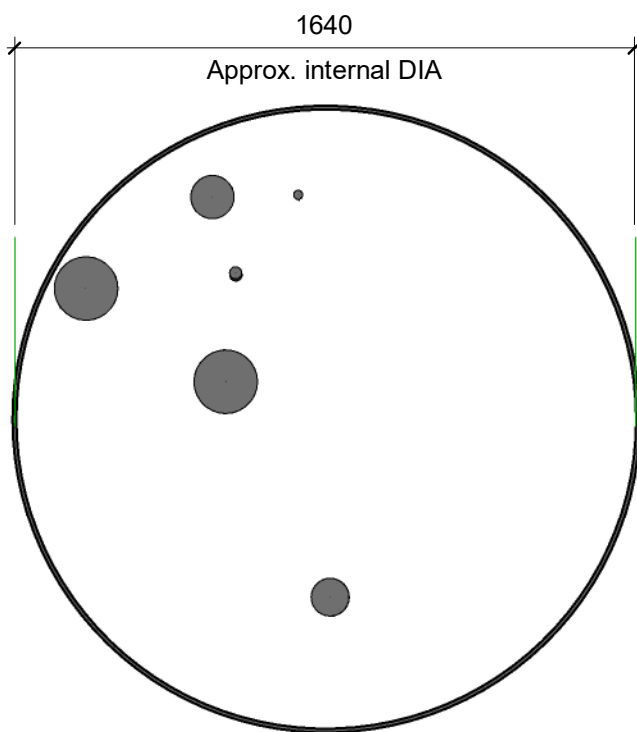
3 Section CH 1.1
1 : 50

4 Section CH 1.2
1 : 50

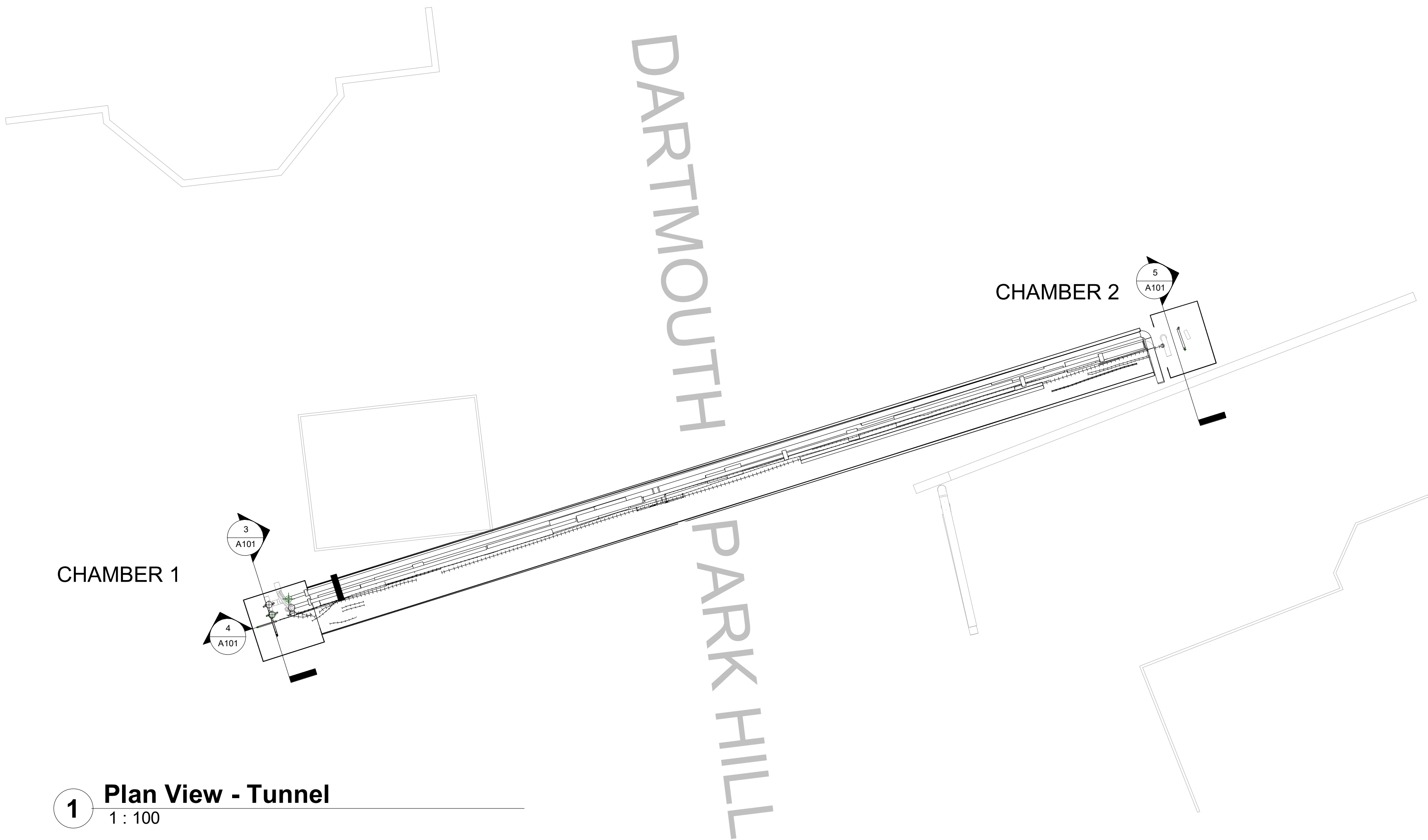


5 Section CH 2.1
1 : 50

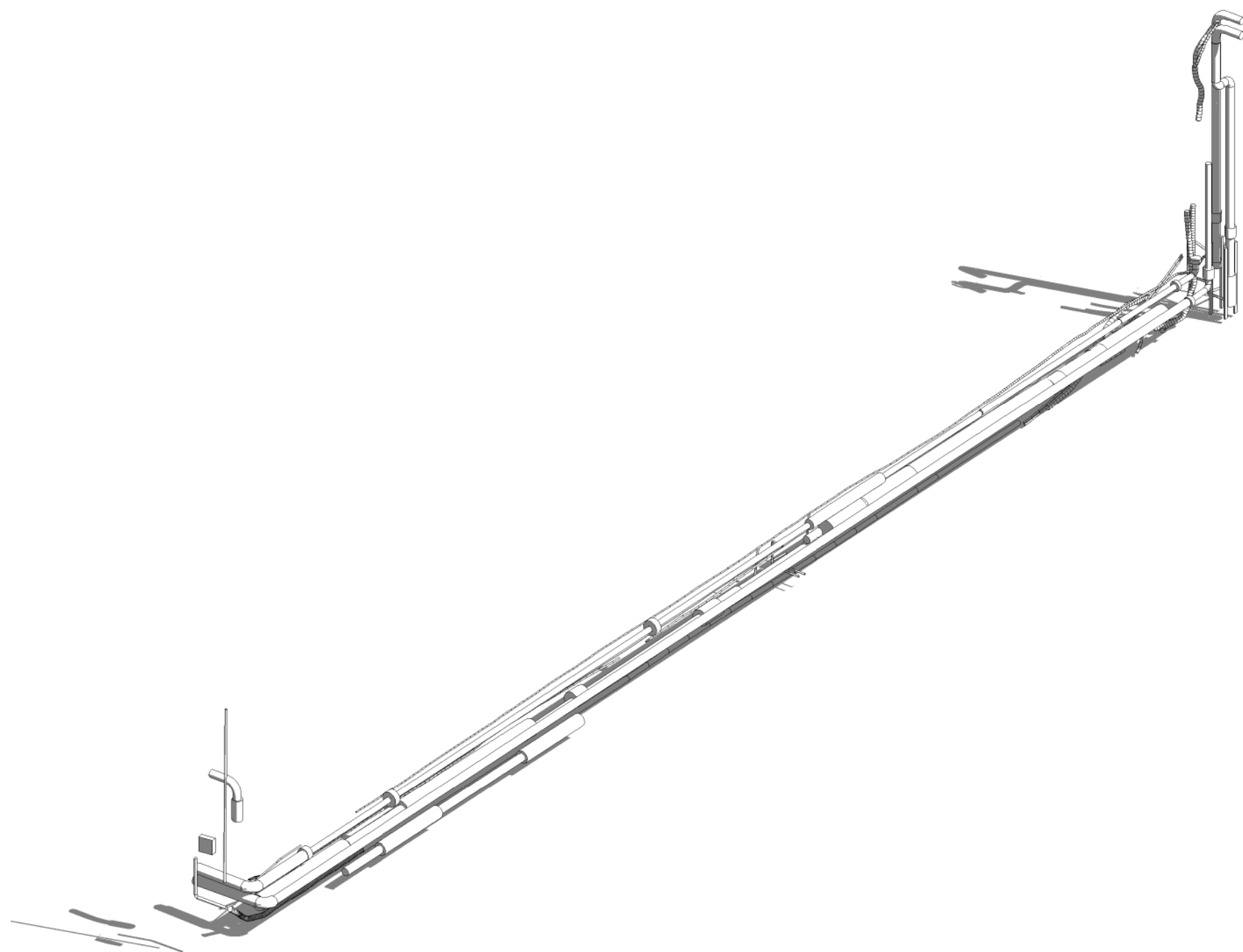
6 Section CH 2.2
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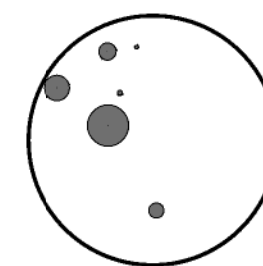
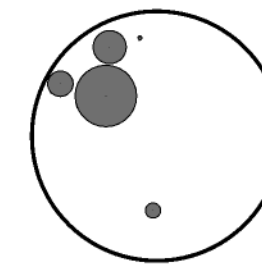
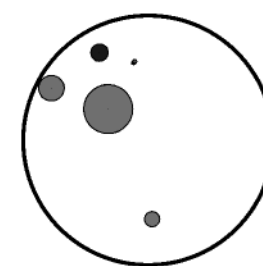
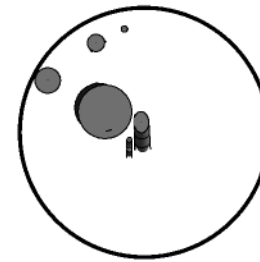
7 Section (Nominal)
1 : 20



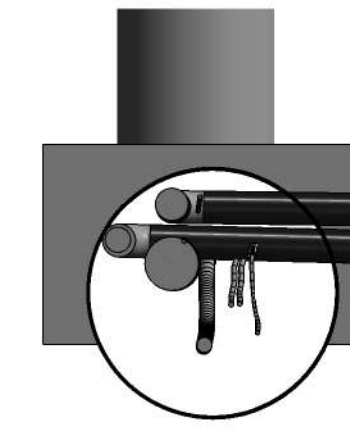
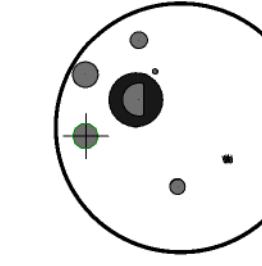
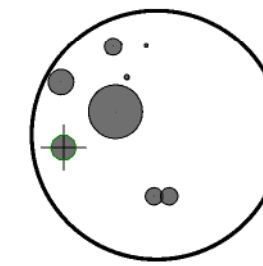
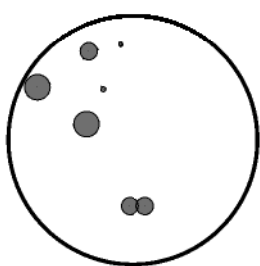
1 Plan View - Tunnel
1 : 100



2 Isometric view



8 Section T8
1 : 50



15 **Section T15**
1 : 50

16 Section full length
1 : 50