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Science & Industry Museum, Manchester

Power Hall: Drainage Engineering Note

180426/K Clark

Approved By: K Clark

17 Oct 2021

Status: For Information

Version: 1

1.0 INTRODUCTION

- 1.1 As the structural and civil engineering consultants for the Power Hall and inter-related areas of the Science & Industry Museum site we have undertaken a detailed assessment of the existing drainage system to confirm its arrangement, operation and condition.
- 1.2 Our assessment has been based on all of the information it has been possible to obtain, including historic information from archive records, previous CCTV surveys, newly commissioned CCTV surveys and targeted intrusive inspections.
- 1.3 Re-roofing works and structural repairs are planned, and confirmation is needed that the above ground rainwater pipes and adjacent below ground drainage routes are in good condition with adequate capacity or to be able to design and action any remedial works required.
- 1.4 The wider aim is to produce a coherent and holistic appreciation of the effectiveness of the Power Hall's existing drainage system strategy, to evaluate flood risk and to identify any consequences of the proposed refurbishment of the Power Hall.

2.0 EXISTING SITE, BUILDING & DRAINAGE

- 2.1 The Power Hall is a large Grade II listed building located at the south east corner of the Science & Industry Museum site. Built in 1855 as a rail/road goods transfer shed the building now houses a large array of static engines, machinery and other industrial exhibits which are used for educational purposes and also for demonstrations to the visiting public.
- 2.2 The land forming the present museum site was developed in the early 19th century, initially for housing, followed by the existing railway related structures constructed from 1830 onwards. The Power Hall and adjoining areas have undergone some changes with earlier Victorian era buildings being demolished and replaced with the current buildings and structures. In terms of topography the site slopes slightly from east to west, from Lower Byrom Street towards the River Irwell.
- 2.3 All the roof areas and hard landscaping areas have been regarded as impermeable for the purposes of our assessment.
- 2.4 The Power Hall roof is of paired double pitched construction orientated in an east-west alignment, hipped roofs being provided at the east end and west end. The roof is supported on substantial timber trusses spanning north/south which bear at the valley gutter on fitch beams and hollow cast iron columns, and on a mix of timber and concrete pads at the perimeter brickwork walls.
- 2.5 This constructional arrangement creates a long central valley gutter and a long perimeter gutter located immediately behind the continuous brickwork parapet. The central valley gutter is drained via the hollow body of alternate cast iron columns while the perimeter parapet gutter is drained via internal rainwater down pipes, all outlets of which connect with a buried network of pipes below the surface of the Power Hall floor. This network combines into a single pipe which emerges below the west end of the Power Hall and flows westwards by gravity through the Upper Yard and Lower Yard before ultimately discharging into the River Irwell a short distance to the west of the site. All discharges from the Power Hall's drainage system derive from rainwater; there are no foul water sources within the building.
- 2.6 Historic information from archive records was neither sufficiently detailed nor current to be of great use, and previous CCTV surveys were found to have focussed on specific areas of the site so proved to be of only limited use to our assessment.

- 2.7 To provide information on condition, flow and drainage patterns along with manhole record sheets giving coordinates and invert levels a comprehensive CCTV survey of the relevant areas of the above and below ground drainage system within and around the Power Hall was therefore commissioned covering the highlighted area shown in Conisbee drawing 180426-CON-X-XX-DR-S-1101 in Appendix A. Several areas of the below ground drainage system were pre-cleansed of blockages by jetting.
- 2.8 The CCTV survey was supplemented with targeted intrusive inspections of critical areas within the Power Hall where the survey equipment was unable to gain access. The intrusive inspections consisted of a small number of strategically located trial pits to expose and inspect the buried routes at the base of the downpipes within the cast iron columns below the central valley gutter which were otherwise accessible via CCTV survey only from roof level.
- 2.9 Relevant survey information is provided in Appendix A. CCTV survey video footage and photographs are available on request.

3.0 FLOOD RISK ASSESSMENT

- 3.1 The risk of flooding from different sources has been assessed and it has been determined that the risk of flooding from all possible sources is low.
- 3.2 There is no new development on the site and the proposed finished floor levels will be no lower than at present, therefore the flood risk remains unchanged. Consequently all current flood risk mitigation measures remain valid and do not require alteration or enhancement.

4.0 PROPOSED DRAINAGE STRATEGY

- 4.1 As part of essential works to make the building watertight the existing roof finishes will be entirely replaced, including new insulation, new rooflights and new guttering. The proposals do not include any new connections nor the creation of any new foul water sources therefore all discharges from the Power Hall's drainage system will continue to derive solely from rainwater.

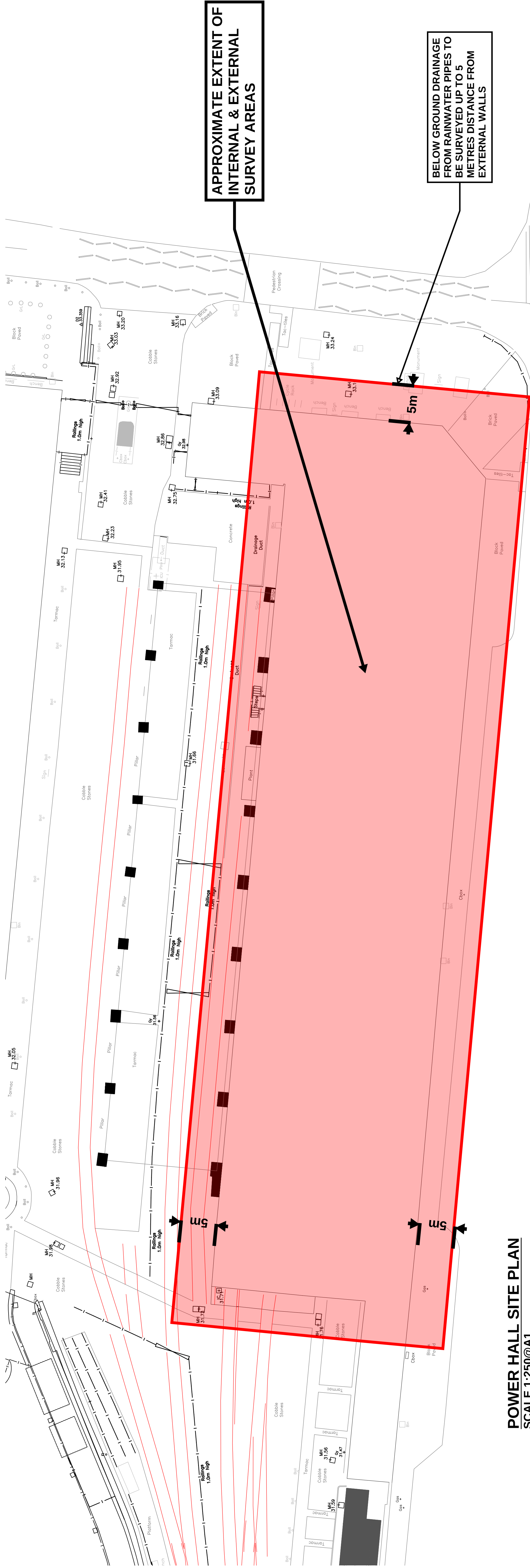
- 4.2 There is no new development on the site and the proposed drainage strategy will not change, therefore the central valley gutter will continue to drain into alternate cast iron columns and the perimeter gutters will continue to drain into the internal rainwater down pipes, all of which have been found to be in good condition with sufficient capacity for current and future drainage requirements.
- 4.3 Equally the below ground drainage pipework below and immediately beyond the Power Hall into which the rainwater pipes discharge is generally in good condition and has sufficient capacity for current and future requirements so will remain unaltered. The expected flows through the system will ensure self-cleansing and will avoid the potential for blockages.
- 4.4 Localised areas of the buried pipework are in need of repair and these will be undertaken in accordance with best practice to improve flows and enhance the robustness of the system as a whole.
- 4.5 The wider repairs to the sitewide drainage system as recommended in the Science Museum Group's Periodic Condition Survey Report dated May 2021 should be actioned. The actions include high pressure jetting of the network where advised, a further CCTV survey will be necessary within localised areas to evaluate the remaining (uninspected) extent of the network, and additional survey work including trial excavations as recommended within the 2019 condition reports, associated with the Viaduct and Undercroft.
- 4.6 In line with industry guidance the following methods of surface water disposal should normally be targeted in descending order of propriety: infiltration; discharge to watercourses and discharge to a surface water sewer.
- 4.7 Ground investigation has shown that the underlying geology comprises made ground over alluvium underlain by sandstone bedrock at depth. The nature of these soils may make infiltration feasible on the site but due to the constrained site layout and complex site history there is insufficient space to provide the 5m minimum distance from a soakaway to the Power Hall structure. The use of green roof and permeable paving could reduce the runoff from the site but these are highly inappropriate for this particular site.

- 4.8 Similarly, while below ground rainwater storage (e.g. a cellular tank with permeable paving above) for potential reuse across the site could theoretically be provided this approach is significantly limited practically due to the constrained site layout together with the highly important and multi-layered historic use of the site which has generated significant protected industrial archaeology across the site, much of which often lies just below ground level. Archaeological considerations alone would therefore rule out the realistic provision of rainwater storage provision on this site.
- 4.9 We have not regarded it necessary to restrict the discharge rate from the site into the River Irwell, therefore the creation of rainwater storage for attenuation purposes is not required.

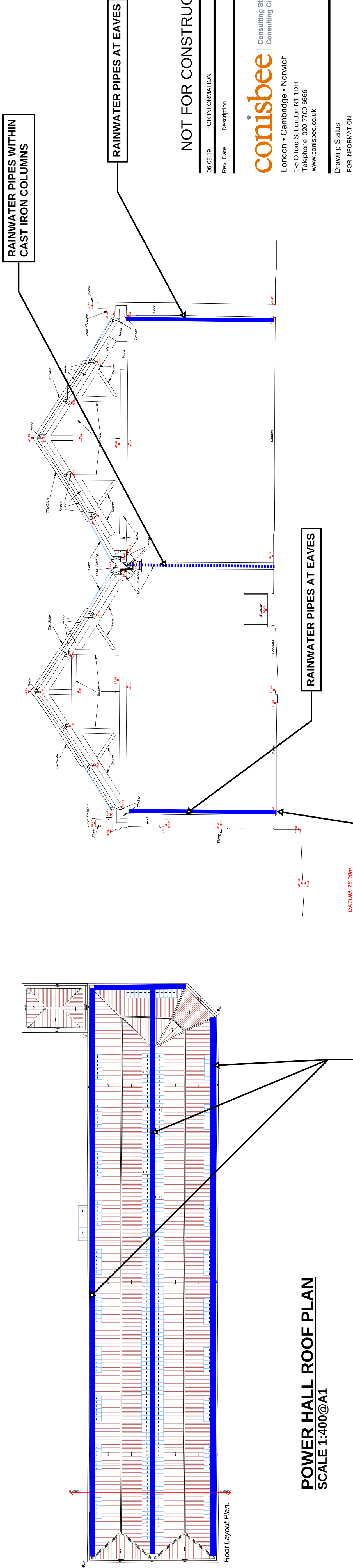
APPENDIX A DRAWINGS

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING IN EITHER PAPER OR DIGITAL FORM. USE WRITTEN DIMENSIONS ONLY.



POWER HALL SITE PLAN
SCALE 1:250@A1



POWER HALL ROOF PLAN
SCALE 1:400@A1

POWER HALL TYPICAL SECTION
SCALE 1:100@A1

**ALL BELOW-GROUND
DRAINAGE LAYOUTS AND
CONNECTIONS CURRENTLY
UNKNOWN**

NOT FOR CONSTRUCTION

05.08.19	FOR INFORMATION	SW	KC
Rev	Date	Description	Drawn Check

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Drawing Status
FOR INFORMATION

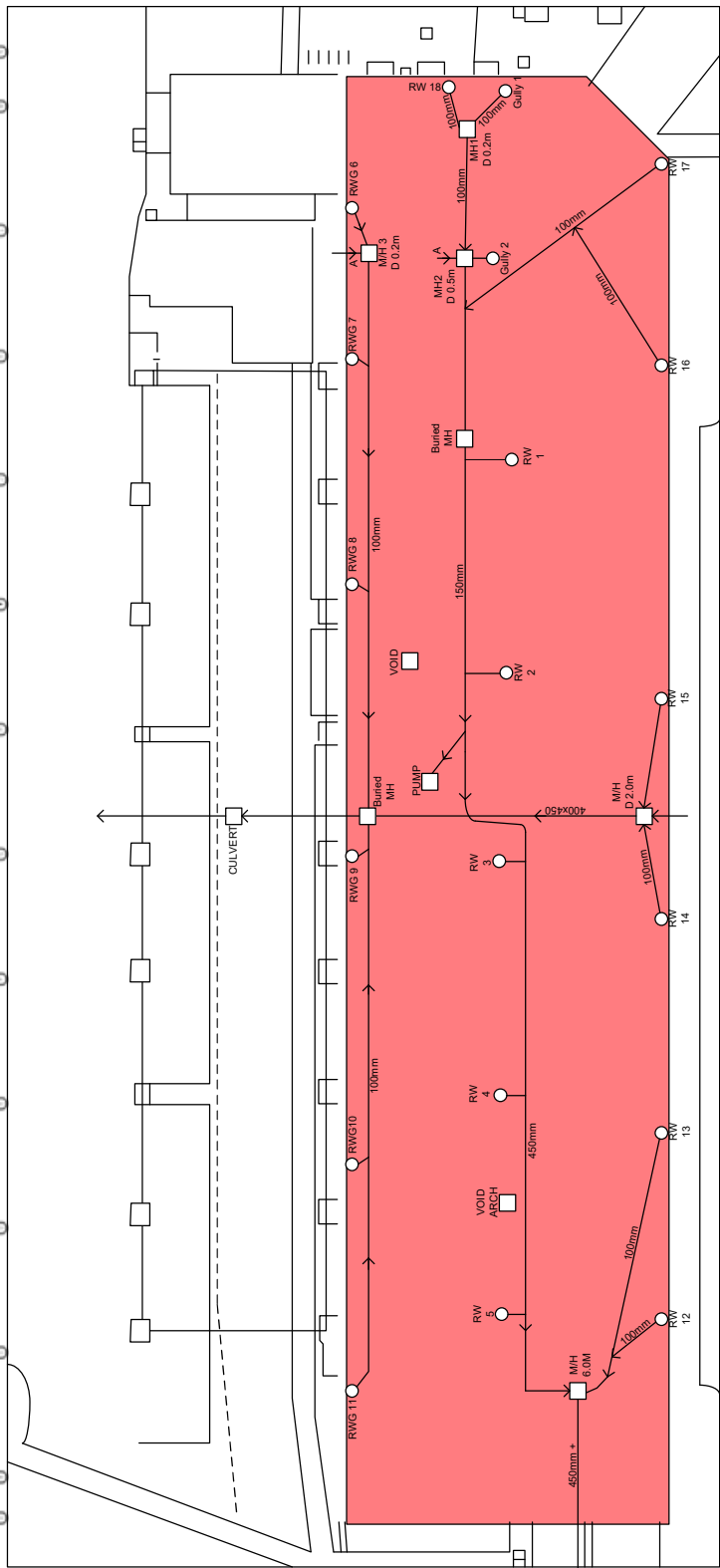
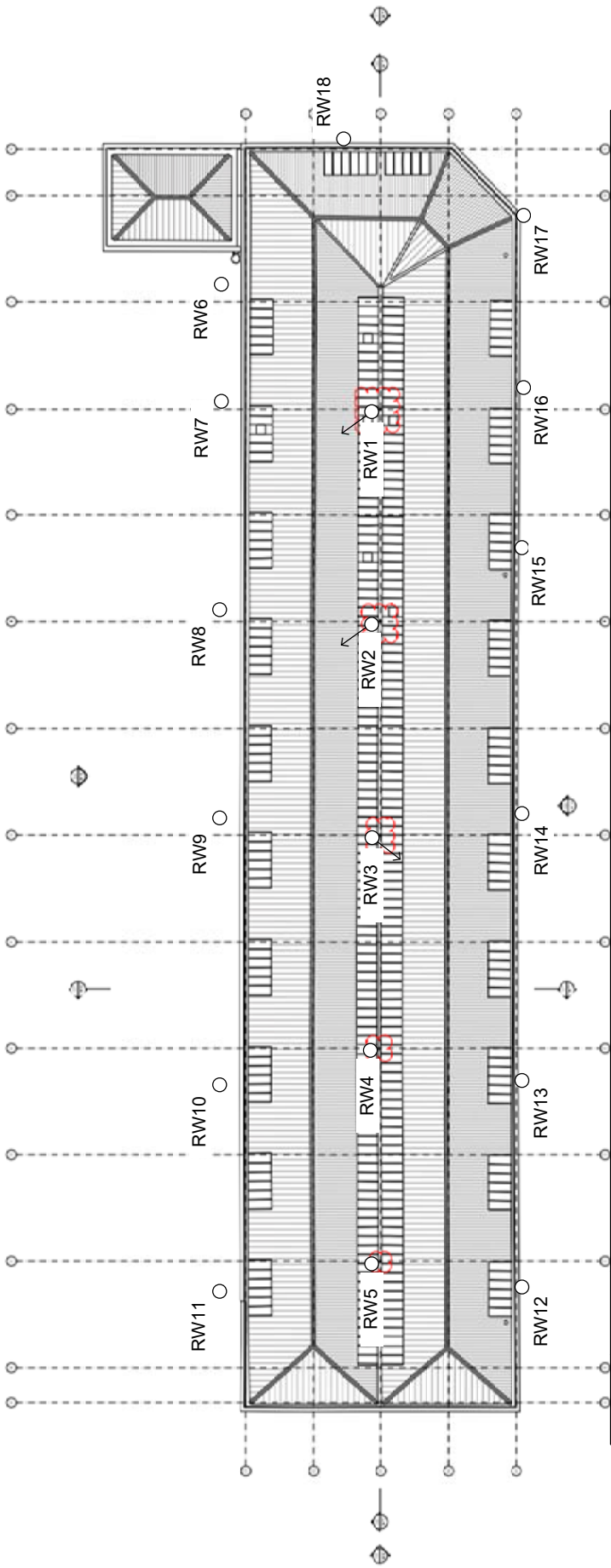
Project	Date AUG 2019
SCIENCE & INDUSTRY MUSEUM, MANCHESTER	Scale AS SHOWN

Title
POWER HALL - RAINWATER PIPES & BELOW
GROUND DRAINAGE SURVEY SCOPE

Engineer	SW
Project No	180426

Drawing No
180426-CON-X-XX-DR-S-1101

Revision
P1



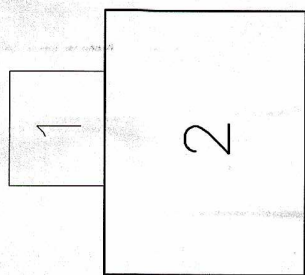
Surveyed 17m
Suspect runs to main culvert that
runs through the centre of the site



Revision	Date	Description
A	10.05.16	Notes added to western, central and eastern arches. Extent of eastern arch amended.

[illegible]

Sheet Layout



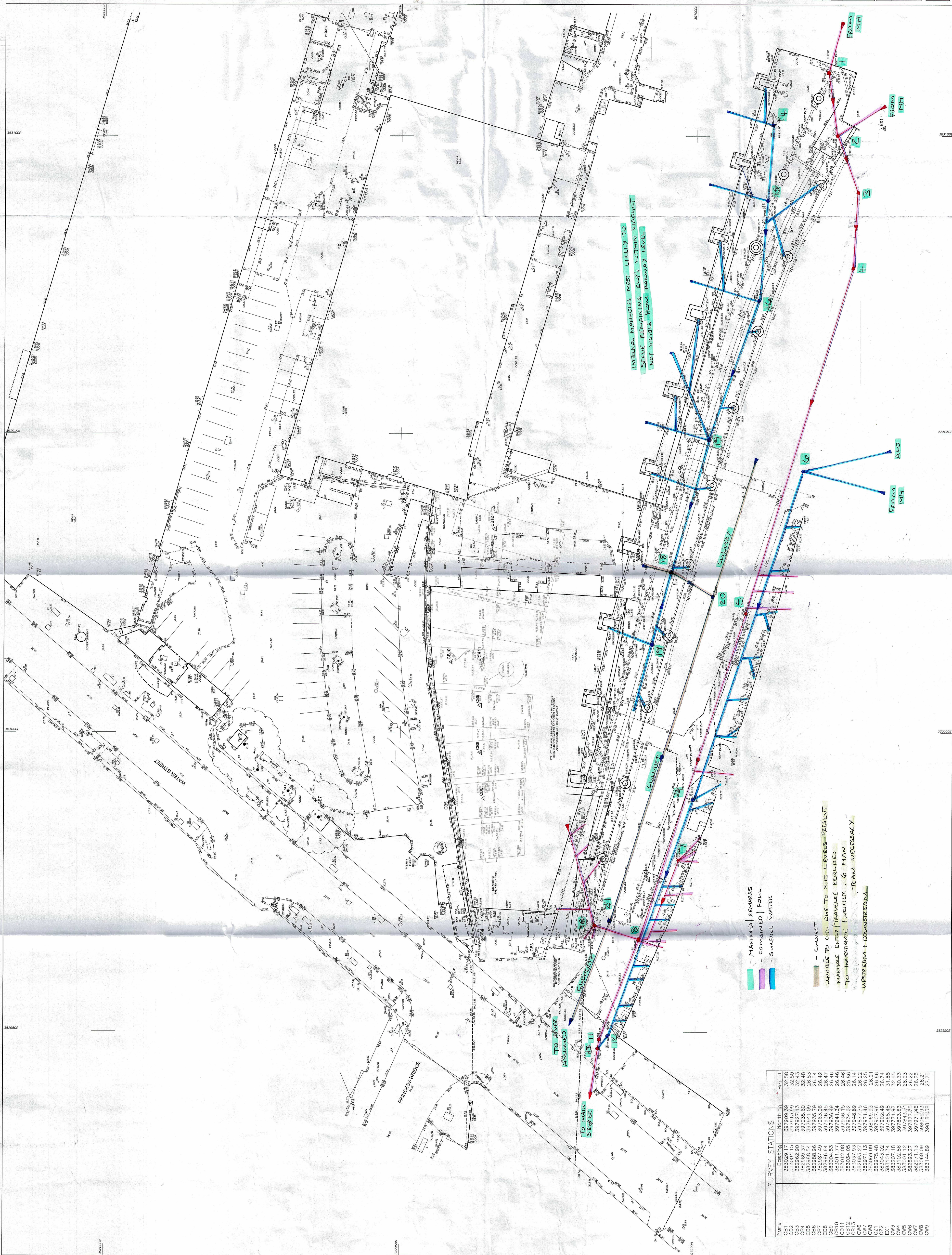
Survey



**The Factory
Manchester**

Scale(s)	1:200	Surveyor	CW
Date	MAR 16	Drawn	AS
Job Number	16A267	Checked	SO

Sheet Size & Org Number & Revision



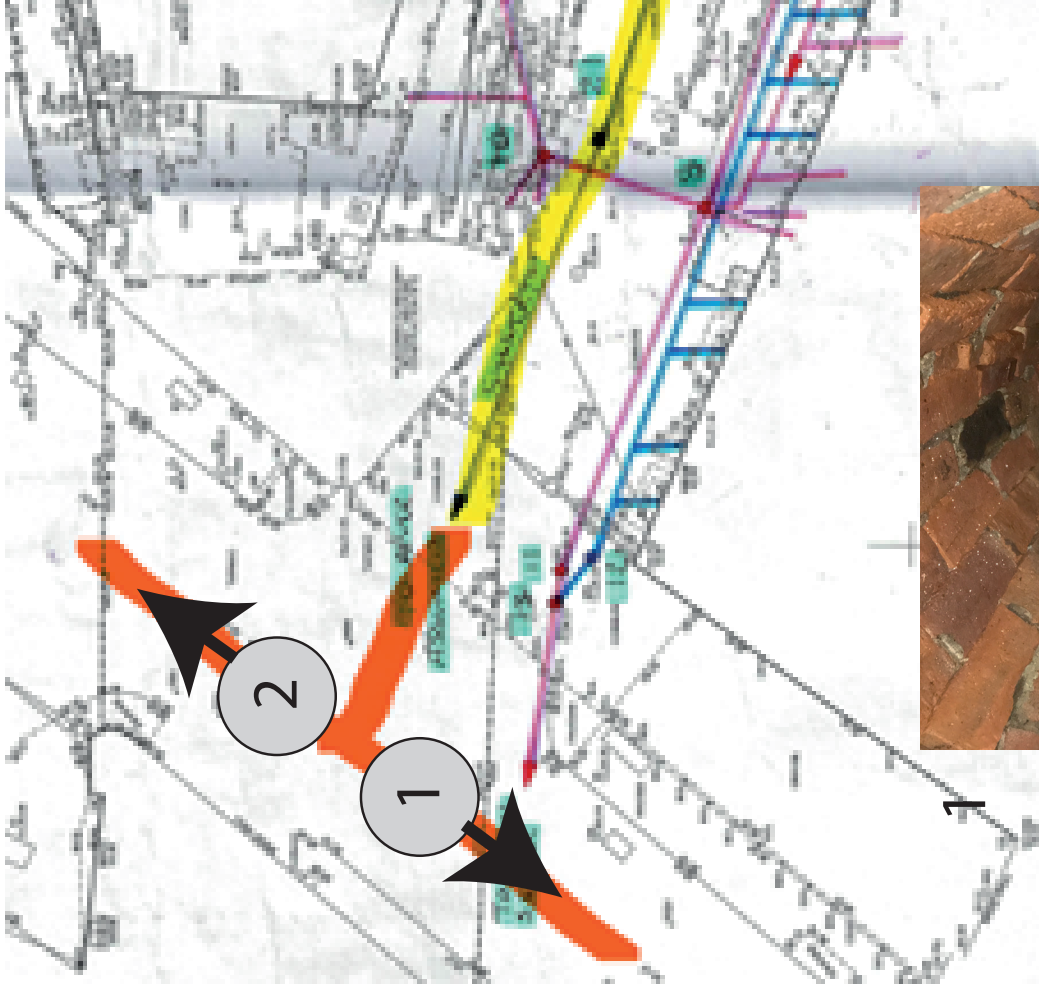
Name	Easting	Northing	Height
C81	33529.17	37993.93	32.58
C82	33529.17	37993.93	32.58
C83	33529.17	37993.93	32.58
C84	33529.17	37993.93	32.58
C85	33529.17	37993.93	32.58
C86	33529.17	37993.93	32.58
C87	33529.17	37993.93	32.58
C88	33529.17	37993.93	32.58
C89	33529.17	37993.93	32.58
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C93	33529.17	37993.93	32.58
C94	33529.17	37993.93	32.58
C95	33529.17	37993.93	32.58
C96	33529.17	37993.93	32.58
C97	33529.17	37993.93	32.58
C98	33529.17	37993.93	32.58
C99	33529.17	37993.93	32.58
C100	33529.17	37993.93	32.58

Culvert Downstream

Clear downstream from Lower Yard manhole to T junction in Water street. Both upstream and downstream from T junction in Water street both clear.



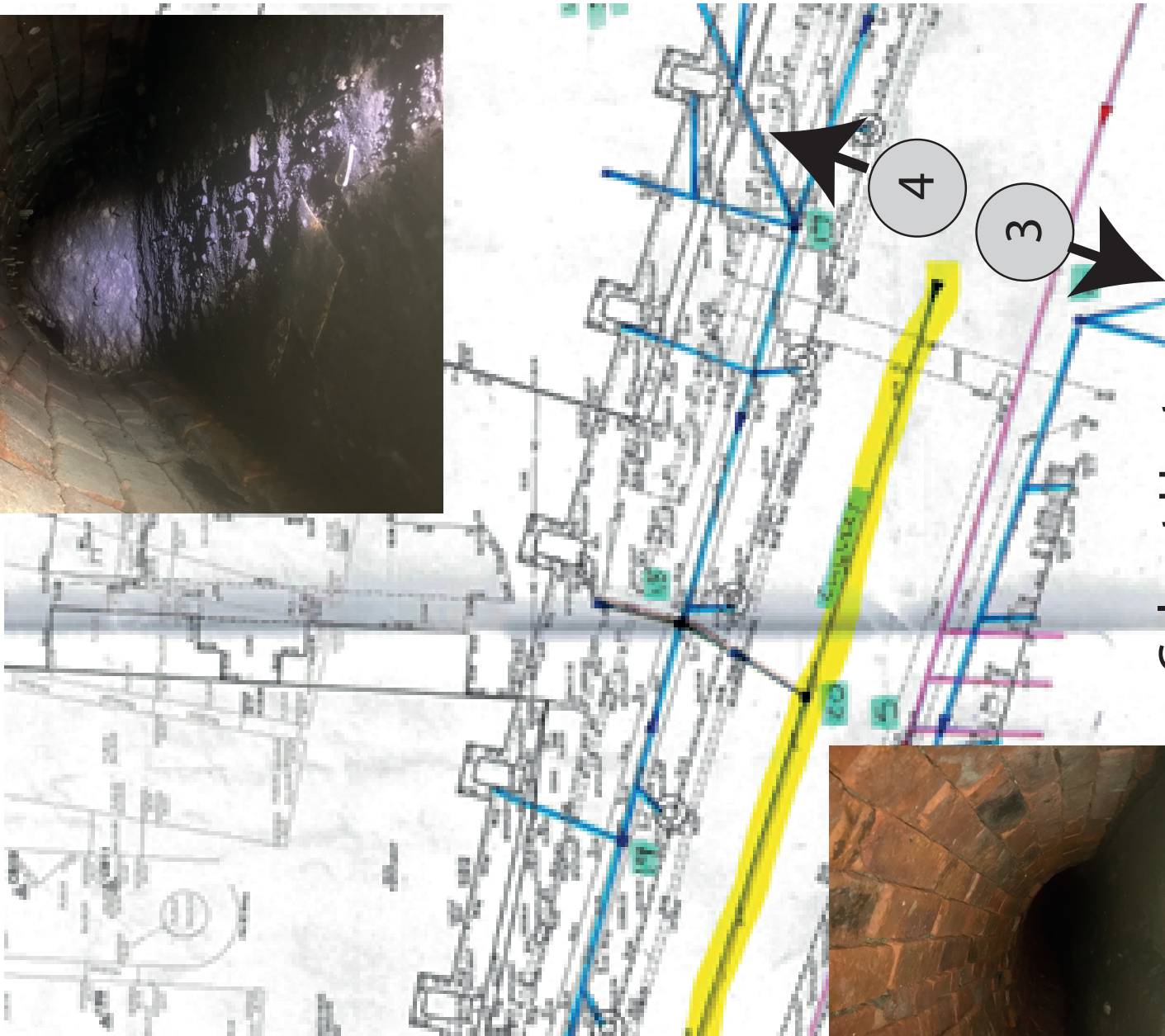
2



1



3



Culvert Upstream

Culvert runs in a straight line for approximately 22m with various inlets on both sides. At 22m the culvert reaches a junction going both left and right. To the left is a full collapse or 100% full of silt, to the left is 90% full of silt. Unable to carry on, this would need an excavation on the T junction to gain access to clear both jways and a manhole constructed.



4

3

