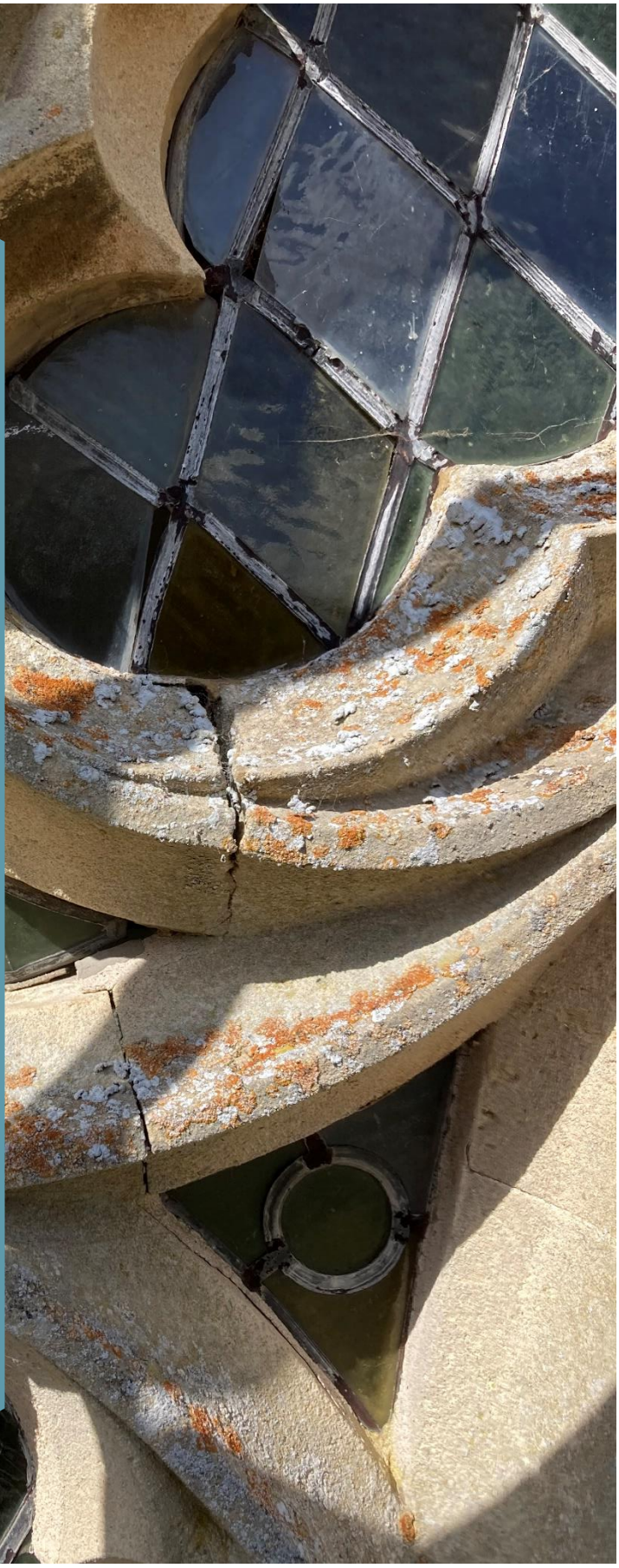
Mann Williams
Consulting Civil and Structural Engineers

St Mary Magdalene, Stockland Bristol

Addendum Report on the Condition of the Structural Fabric

Job Number: 10166



Contents

Appendices

Suitability Codes as stated within QA data describe documents intended use and are in accordance with BS EN ISO 19650-2-2018.

Code	Description
Shared (Non-Contractual – Not For Construction)	
S1	For Coordination
S2	For Information
S3	For Review & Comment
S4	For Review & Authorization
S5	For Review & Acceptance
Published (Contractual)	
A1	Stage 1 Authorized (Not For Construction)
A2	Stage 2 Authorized (Not For Construction)
A3	Stage 3 Authorized (Not For Construction)
A4	Stage 4 Authorized (For Construction)
A5	Stage 5 Authorized (Final Design Record)

Quality Assurance

File Name: Document1

Document Issue Details:

Suitability	Revision	Issue Date	Approved By
S2 - For Information	P2	12 February 2025	J. Mann FICE CEng

Prepared by: J Mann FICE CEng

Checked by:

1.0 Introduction

1.1.1 A preliminary report on the structural fabric was issued in February 2020. The report described the major defects in the fabric, in particular the extensive movement caused by the weathering and expansion of the Blue Lias stone from which the majority of the church is built.

1.1.2 The report recommended that certain investigation works be put in hand to enable a deeper understanding of the main issues.

1.1.3 These further investigations included:

- Hand excavation of trial holes around the building to assess the foundation depths and subsoil conditions.
- Examination by metal detector for hidden embedded ironwork in the areas of fractured stonework.
- Removal of some selected stones from the outer face of the walls to examine the core of the wall and to allow mortar samples to be taken for analysis.
- An abseil inspection of the tower to allow the inaccessible areas of masonry to be assessed and photographed.

1.1.4 The further investigations into the masonry and embedded ironwork, and a rope access survey of the tower were undertaken by Sally Strachey Historic Conservation Ltd during the course of 2024. SSHC also hand excavated trial holes around the building to allow the foundations to be examined by ourselves and Keith Faxon, Archaeologist appointed by the client.

2.0 Trial Holes

2.1.1 Mann Williams specified trial hole locations in 4 locations around the perimeter of the church as indicated on drawing 10166_100. Each hole position was specifically chosen to give information relating to fabric movement in that area.

2.1.2 Trial Hole TH1 was intended to look at the footings under the east window of the porch which has extensive movement around the Bath stone window.

2.1.3 Trial Hole TH 2 was intended to uncover the foundations under the south transept where diagonal cracking is evident in the internal finishes which may be indicative of foundation movement.

2.1.4 Trial Hole TH3 was positioned on the east wall of the chancel. Here, there is obvious movement in the string course beneath the large window. Around this area is a 10m high acer and around the corner is the badly bulging gable wall of the vestry.

2.1.5 Trial Hole TH4 was intended to look at foundation depths, where the string course and window cills can be seen to undulate in level, and near where large yew trees form the churchyard boundary.

2.1.6 The plan size of the trial holes was restricted by the buried archaeology around the church, in particular, of course, by burials. The maximum depth it was feasible to dig was around 900mm. The logs of the holes are described on drawing 1106_102.

2.1.7 In all holes, the foundations comprised rubble lias stone in a hard lime mortar matrix which appeared to be of C19 origin. Keith Foxton confirmed in his opinion all exposed foundation walling in the holes were C19. All footings were in good condition, but in each hole, it was not possible to dig down to the underside because of the restricted hole size.

2.1.8 Tree roots were not in evidence in any of the holes near the foot of the holes. Shallow roots were visible in TH4.

2.1.9 All stonework in the walling below ground level was found to be in good condition, with no evidence of deterioration of the mortar or degradation by deleterious materials in the soil.

2.1.10 Consideration was given to the possibility of the C19 being built using the original foundations. Appendix A shows comparative images of the appearance of the church in its 2 phases.

2.1.11 Any interpretation of the fabric has to be subjective and rely on the accuracy of the print. However, the main differences seem to be:

The present church is set back further from the road; the tower is wider; the south transept is in a different location; the chancel extends further to the east.

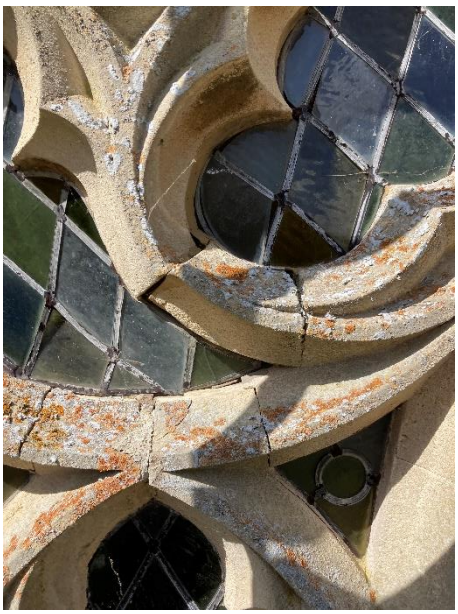
2.1.12 There is no real evidence to support the hypothesis that the original foundations were reused. The walling exposed below ground level all seemed to be of the same period of build and comprising typical C19 mortar.

3.0 High level window inspections

3.1.1 During the inspections by SSHC in August 24, scaffold access was made available to view the damaged upper sections of window tracery.

3.1.2 The Bath stone of the tracery and the voussoirs of the main pointed arches have been displaced – by up to 20 - 25mm.

3.1.3 The structural integrity of the tracery is not critical as regards the stability of the main window surrounds, the walling over and roof support, but it does figure significantly in restraining the glass from blowing out under strong winds.



3.1.4 It would be possible, if the glass was removed locally, to take out the slipped tracery stones and reset them, potentially using small diameter stainless pins. The risk involved with pinning is that should long term movement continue, then the pins could cause the tracery stones to fracture rather than become simply displaced.

4.0 Bell Frame Repairs

4.1.1 Marcus Chantrey has obtained 3 quotations and proposals for restoring the bell frames and bells to a condition where they could be rung again.

4.1.2 Two of the three tenderers have noted that in their opinion it was the structural condition of the tower that has prevented the bells from being rung since 1990, and not the bells or frames themselves.

4.1.3 Certainly, the long vertical crack on the north elevation emanating from the ringing chamber window looks like a crack caused by ringing, where the tower sways from side to side. Smaller cracks can be seen in the other elevations.

4.1.4 In the ringing chamber the south tower wall has become structurally detached from the east wall, causing the brick arched lintel over the door to drop.

4.1.5 The bearings of the bell frames cannot be inspected because of the presence of the softwood boarded ceiling. It seems that the corbels visible under the ceiling are concrete ones, and a retrofit repair to improve the bearing of the frames in the external walls. Allowance should be made in the main contact tender documents for repairs to decayed frame bearings.

5.0 Discussion of the Further Investigations

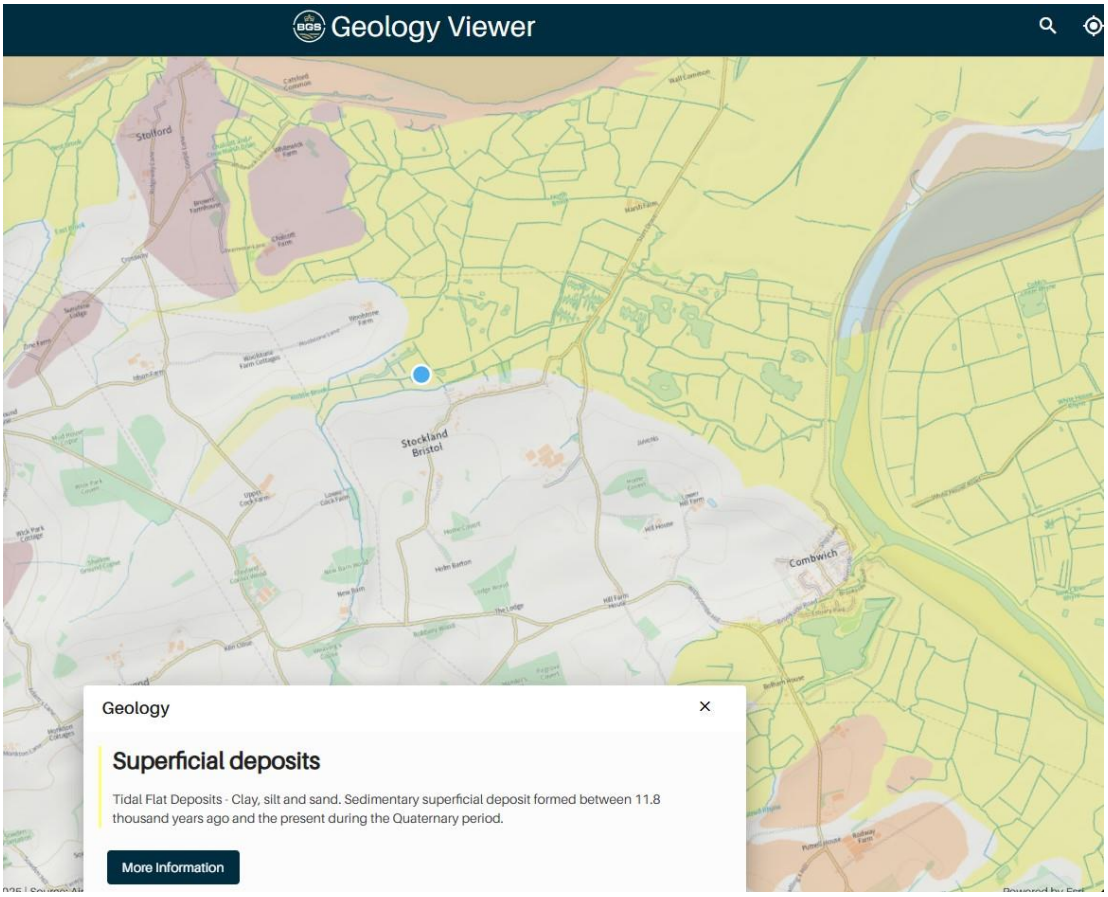
5.1.1 Mention has been made in the SSHC reports on the tower and the walling generally that foundation movement could be a significant contribution to the extensive movement evident in the fabric.

5.1.2 This is indeed what it looks like when the church is first seen.

5.1.3 The geological map suggests the church is underlain by the Blue Lias Formation and Charmouth Mudstone Formation.

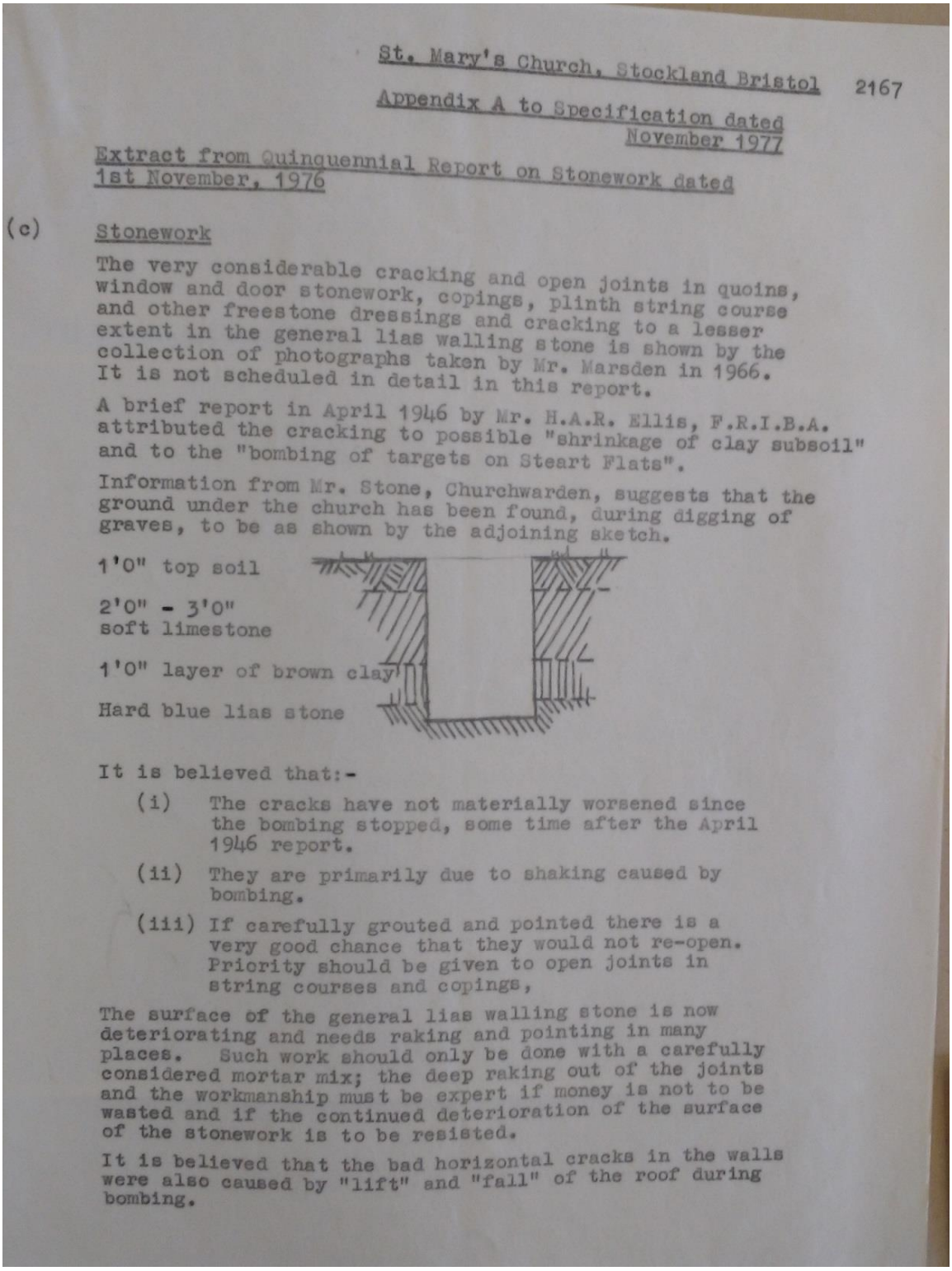
5.1.4 These materials, when uncovered in their unweathered state provide a good bearing stratum off which to build. They can be covered by softer deposits of softer weathered materials in the way of clays etc but the geological survey has no information on this.

5.1.5 The Geological Survey does however show the presence of softer clays, silts and sands in the slightly lower lying area north of the church.



5.1.6 When standing on the northern boundary of the churchyard, it does look like the church is founded on the edge of the outcrop of lias, with the lower lying superficial material beyond.

5.1.7 Marcus Chantrey has provided us with this historical note from church records from 1976.



St. Mary's Church, Stockland Bristol 2167

Appendix A to Specification dated November 1977

Extract from Quinquennial Report on Stonework dated 1st November, 1976

(c) Stonework

The very considerable cracking and open joints in quoins, window and door stonework, copings, plinth string course and other freestone dressings and cracking to a lesser extent in the general lias walling stone is shown by the collection of photographs taken by Mr. Marsden in 1966. It is not scheduled in detail in this report.

A brief report in April 1946 by Mr. H.A.R. Ellis, F.R.I.B.A. attributed the cracking to possible "shrinkage of clay subsoil" and to the "bombing of targets on Steart Flats".

Information from Mr. Stone, Churchwarden, suggests that the ground under the church has been found, during digging of graves, to be as shown by the adjoining sketch.

1'0" top soil

2'0" - 3'0" soft limestone

1'0" layer of brown clay

Hard blue lias stone

It is believed that:-

(i) The cracks have not materially worsened since the bombing stopped, some time after the April 1946 report.

(ii) They are primarily due to shaking caused by bombing.

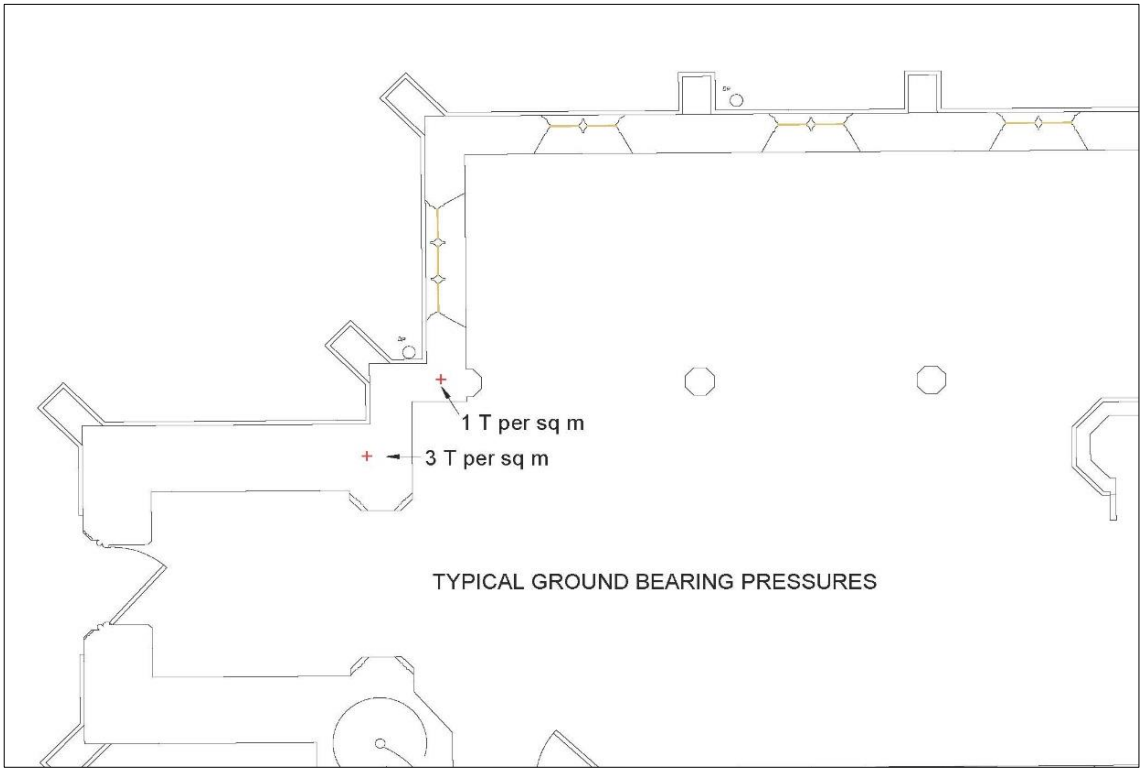
(iii) If carefully grouted and pointed there is a very good chance that they would not re-open. Priority should be given to open joints in string courses and copings,

The surface of the general lias walling stone is now deteriorating and needs raking and pointing in many places. Such work should only be done with a carefully considered mortar mix; the deep raking out of the joints and the workmanship must be expert if money is not to be wasted and if the continued deterioration of the surface of the stonework is to be resisted.

It is believed that the bad horizontal cracks in the walls were also caused by "lift" and "fall" of the roof during bombing.

5.1.8 The gravedigger reported that hard blue lias stone was encountered at some 1200mm below ground level, only 300mm below we were able to dig in our trial holes.

5.1.9 If foundation settlement was to be considered a factor in the fabric distortion, an area of the church should be examined where ground bearing pressures change within close proximity. For instance, the tall tower will be exerting something in the region of 3 tonnes per sq. metre bearing pressure on the material below the footings. The nave walls which immediately adjoin the tower will be exerting much less – a maximum of 1 tonne per sq. metre. If ground movement were a significant factor, then tearing of the fabric at the interface would be apparent. There are no signs of this.



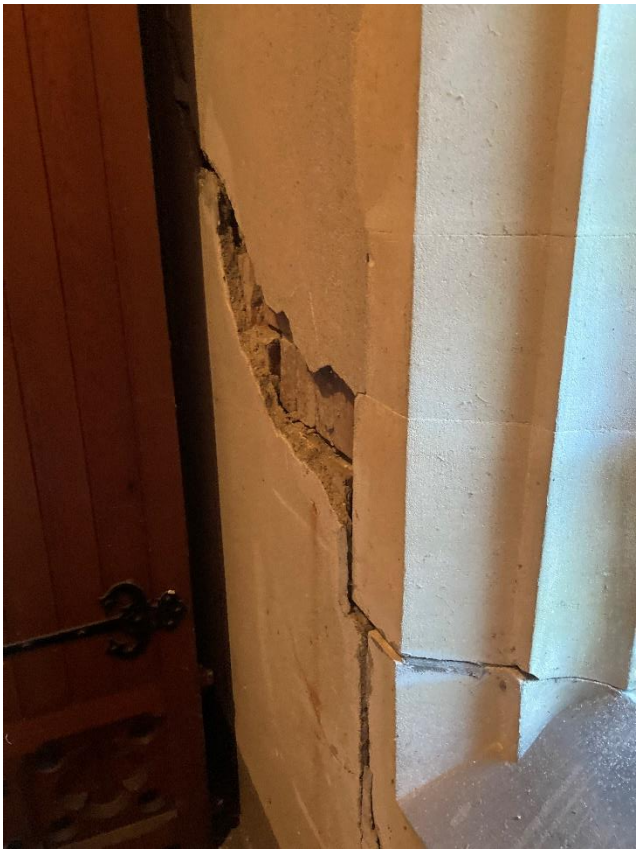
5.1.10 If the south transept is also examined, the SSHC opening up revealed opening up of the brick lining skin of wall, running in a diagonal fashion, typical of foundation movement.

Figure 18 Second coat of plaster removed to reveal the brick inner skin of the wall

Figure 19 Detail of cracking through the joints of the brickwork

5.1.11 However, there is no matching crack on the external skin of lias, proving that foundation movement is not a significant factor, and that it is an interplay between the relatively dimensionally stable brickwork and the expanding lias that is creating the movement.

5.1.12 As one last piece of commentary on the potential foundation issues, the severe cracking in the vestry could as first sight be attributed to settlement. However, there are no matching cracks on the outside face of this wall. The foundations of the vestry bear on the boiler room below which is founded some 2.20 metres below external ground level. Foundations at this depth below ground would hardly be likely to be showing sings of ground movement. Indeed, there are no signs of cracking externally.



5.1.13 It can be safely concluded that foundation movement is not a significant factor in the extreme movements evident in the external fabric. It is breakdown and subsequent expansion of the blue lias which is causing the damage.

5.1.14 Where the two external stones were removed for inspection by SSHC, the core could be seen to be well compacted and with a reasonable quality of C19 mortar. It seems that there is a mechanism by which the external leaf of lias can expand without causing too much of a problem with the inner skin, where it is also lias. Some degree of relative movement can be seen via the “stretch marks” in the plaster of the nave and north aisle.

5.1.15 Where the internal leaf however is of brickwork, then it appears there is less of a vertical slip mechanism between the inner and outer skins, and the brickwork is being lifted upwards by the expanding outer skin. This is perhaps because of brick headers protruding into the core and being lifted by the lias expansion.

5.1.16 This is especially severe in the vestry. The displacement is so great that the north wall especially must be considered potentially unstable. We are recommending the brickwork lining wall should be taken down and rebuilt, in short lengths as in an underpinning operation.

5.1.17 The situation in the south transept is not so severe. In this instance we recommend that the inner leaf be tied back to the lias with resin bonded ties to ensure that the brickwork does not become detached as it has in the vestry.

6.0 The Tower

6.1.1 Two of the bell specialists have stated that it is almost certain the bells were stopped ringing many years ago because of the structural condition of the tower. We are recommending the existing cracks, probably ringing cracks, are repaired by means of Cintec anchors. These would be installed from the outside scaffolding and provide tensile strength to the masonry such that the cracks are held together and no further cracks would appear in that wall. If significant sums of money are to be expended and specialist skills employed on getting the bells ringing again then it seems eminently sensible to provide additional strengthening measures to the tower walls which are not presently cracked but which could be in the future if other walls are being strengthened.

6.1.2 We are therefore recommending Cintecs be installed to form tension rings around the ringing chamber, below the bearing points of the belfry beams.

Appendix 1 Comparison Images

St Mary Magdalene as it stands now

Original St Mary Magdalene before demolition as per print in vestry.

Appendix 2 – Trial Hole Locations

St. Mary Magdalene's Church

TH 1
TH 2
TH 3
TH 4
ST01
ST02
ST04
ST05
ST06
OSBM
BX
DP
DR
ToW 13.25
ToW 15.55
ToW 15.58
Steps Up
Steps Up
Steps Up
Concrete
Concrete
Concrete
Concrete
Stone Wall
Stone Wall
Paved
Bench
Gravel
Water Butt
P/R 1.1h
P/R 0.9h
P/R 0.9h
THL 15.42
THL 14.93
THL 15.09
Footpath (Concrete)
Grass
Graves
Grave
Yew 20h
Yew Multi 4h
Acer Multi 10h
Dense Vegetation 3h

NOTES

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4. All dimensions to be checked on site and any discrepancies reported to the engineer before work commences.
5. Only figured or calculated dimensions should be used and no drawing , in any format should be scaled.

All trial holes to be hand dug to depth of 1200mm below external ground level to reveal ground conditions and underside of existing foundations. Plan size approx 1000mm x 800mm but sufficient to allow ready excavation. If any trace of burials are found, stop and inform Architect for instructions. Allow Engineer to log the holes before backfilling with as dug material, using a hand held petrol compactor. Check for all services before digging holes, using a CAT scanner for electrics. Do not damage or undercut the footings.

TH1 to help investigate movement in porch masonry

TH2 to investigate significant cracking visible on inside face of wall

TH3 to investigate movement in masonry above

TH4 to investigate typical foundation depths on north side in relation to nearby line of yew trees and a degree of movement in the wall.

REV	DESCRIPTION	BY	DATE
P1	PRELIMINARY ISSUE	JM	31.07.24
P2	TH3 LOCATION ADJUSTED	JM	11.02.25

P-PRELIMINARY T-TENDER C-CONSTRUCTION

PROJECT
ST MARY MAGDALENE
STOCKLAND BRISTOL

TITLE
TRIAL HOLE LOCATIONS
FOR
GROUND INVESTIGATION

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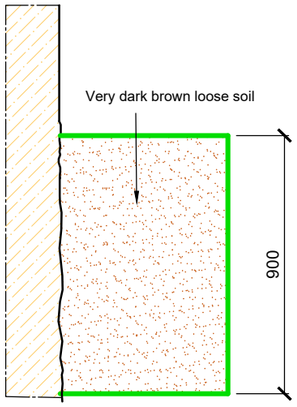
DRAWN	CHKD	SIZE	SCALE	DATE
JM		A1	1:50	JULY 2024

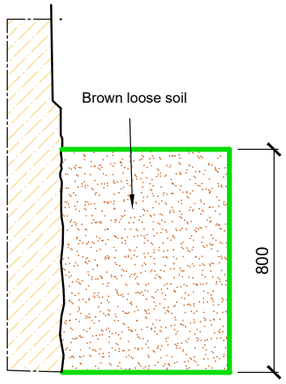
STATUS
PRELIMINARY

PROJECT	DRAWING	REV
10166	100	P1

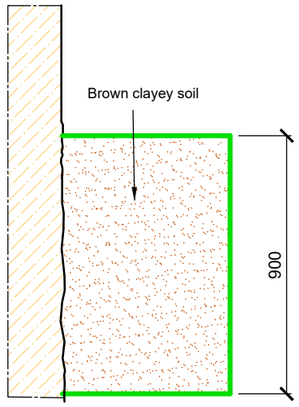
Appendix 3 – Trial Hole Logs



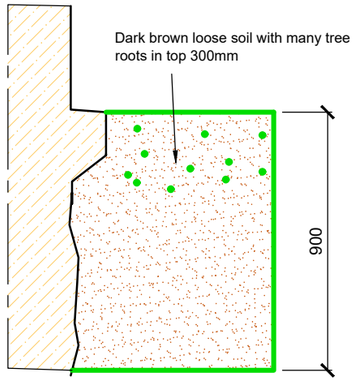
TH 1



TH 2



TH 3



TH 4

NB UNDERSIDE 0F FOOTINGS NOT FOUND IN ANY TRIAL HOLE. ARCHAEOLOGICAL RESTRICTIONS DUE TO BURIED REMAINS PRECLUDED THE HOLES FROM BEING SIGNIICANTLY ENLARGED

IN ALL HOLES THE EXPOSED WALLING BELOW GROUND LEVEL WAS RANDOM RUBBLE LIAS IN A LIME MORTAR MATRIX. ALL WERE IN GOOD CONDITION WITH NO EVIDENCE OF CRACKING OR DECAY OF THE MORTAR.

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Rev	Description	By	Date
P1	PRELIMINARY ISSUE	JM	11.02.25

P - Preliminary T - Tender C - Construction

Project

MARY MAGDALENE
STOCKWOOD BRISTOL

TRIAL HOLE INVESTIGATION

Title

TRIAL HOLE LOGS

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Drawn	Checked	Size	Scale	Date	Job No.
		A3	1:10	OCT 24	10166

Suitability Status: Fit for

XX | PRELIMINARY

Zone	Level	Type	Role	Classification	Originator
2					MNW

Project	Number	Revision
10166	101	P1