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## STRUCTURAL INSPECTION

Serpentine Wall

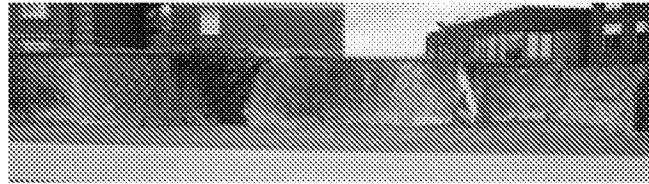
University of Chichester  
Bognor Regis Campus  
Upper Bognor Road  
Bognor Regis  
West Sussex  
PO21 1HR

December 2021

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| Issue | Copies | Distribution    | Format                              | Date            | Status  |
|-------|--------|-----------------|-------------------------------------|-----------------|---------|
| 1     | 1      | Hannah Seabrook | By email only: h.seabrook@chi.ac.uk | 8 December 2021 | Comment |

**1.0 BACKGROUND**

- 1.1 Archibald Shaw was commissioned by Chichester University to undertake a structural inspection and provide outline remedial works for the Serpentine Wall at their Bognor Regis campus. The wall is identified on the attached site plan (Appendix A) with photographs of its current condition in Appendix B.
- 1.2 The wall is believed to be listed however specific records on this cannot be found with an online search.
- 1.3 Nothing in this report confers or purports to confer on any third party any benefit or any right to enforce any term of this report pursuant to the Contract (Rights of Third Parties) Act 1999.

## **2.0 INSPECTION/LIMITATIONS**

- 2.1 An initial visit was undertaken by Mr Peter Willmott on 2 September 2021 with a second visit to oversee the excavation of a trial pit on 29 October 2021. A further visit was made by Elise O'Donovan on 6 December 2021.
- 2.2 Limited areas of the wall were concealed by ivy and the condition of the wall underneath these areas is therefore unknown. It is presumed that the ivy growth has caused some localised deterioration to the wall.

### **3.0 OBSERVATIONS**

- 3.1 The wall is formed in red bricks in a rat trap bond of 225mm thickness and approximately 2400mm height. It is estimated that the wall is at least 150 years old. The wall derives its strength by virtue of its curved plan form and for the most part it retains good verticality and stability. This can be directly compared with the nearby much longer straight runs of wall of the same proportions which have been extensively shored. The wall has been split into 10 sections for ease of discussion, identified on the site plan in Appendix A.
- 3.2 In terms of the topography of the surrounding site, the ground to the south of the wall is relatively flat whilst the ground to the north of the wall rises to the 'Barbara Smith' building. The wall is not retaining any significant depth of soil.
- 3.3 There is one section of the wall which leans noticeably to the south and which has been stabilized by raking shoring. The wall either side of the shore exhibits cracking and has therefore lost its inherent stability. On the north side of this part of the wall there is evidence of root growth where a tree or shrub appears to have been removed. It is considered that the wall has been subject to prising action due to past root growth.
- 3.4 Information about the wall below ground was gleaned from two trial pits excavated on 26 October 2021 with Peter Willmott in attendance. The wall has no foundation as such, but simply extends into the ground to an approximate depth of 900mm. The pits were located on the northern side of the wall opposite the existing raking shore.
- 3.5 The original mortar is a lime mortar. Mortar testing should be carried out to inform the mortar mix to be used in future remedial works. Historic repairs to the wall include use of cementitious mortar, which is not as flexible as lime mortar, allowing less scope for seasonal thermal movement.
- 3.6 The verticality of the wall was measured along the southern elevation. Sections 4, 8 and 10 have good verticality. Section 2 in the location of the raking shore was measured as having a 1:17.5 lean whilst section 6 displayed a 1:30 lean.
- 3.7 There are two manholes approximately 4m to the north of the wall as noted on the site plan in Appendix A. These are assumed to be part of a drainage system that serves the nearby 'Barbara Smith' building. It would be prudent to commission a CCTV survey of the drain runs in this area to exclude any influence of defective drains on the wall.

#### 4.0 RECOMMENDATIONS

- 4.1 Section 2 of wall which is currently buttressed is recommended to be carefully taken down and rebuilt using salvaged bricks and set onto a new 600mm-wide foundation. A proposed detail for this is shown on SK02 in Appendix C. Consideration has been given to leaving the wall in place and utilising injection grouting underneath the wall to restore its verticality and stabilise it. However practical considerations, including potential cracking to the wall, meant that this option was deemed less appropriate.
- 4.2 Section 6 displays a notable lean and it is recommended to allow for a new concrete foundation of 1000mm length x 600mm width x 300mm thickness on the southern face of the wall as shown in SK01.
- 4.3 It is recommended to stitch repair certain parts of the wall at crack locations. This could be done using a proprietary system such as HeliBar by Helifix. SK01 in Appendix C.
- 4.4 Patch repairs to areas where mortar/ bricks are eroded are recommended to be undertaken with a like-for-like mortar and using special bricks to match existing. Locations of this are shown on SK01 in Appendix C.
- 4.5 It is recommended to remove the ivy to expose the wall to determine its current condition and subsequent remedial works.
- 4.6 Remedial works will need to be agreed with the Conservation Officer at Arun District Council prior to construction as part of an application for Listed Building Consent. As part of these discussions, it is recommended to commission a sample panel to demonstrate the proposed appearance of the wall once the works are complete.

Prepared by

.....  
Elise O'Donovan MEng CEng MICE  
Project Engineer

Reviewed by

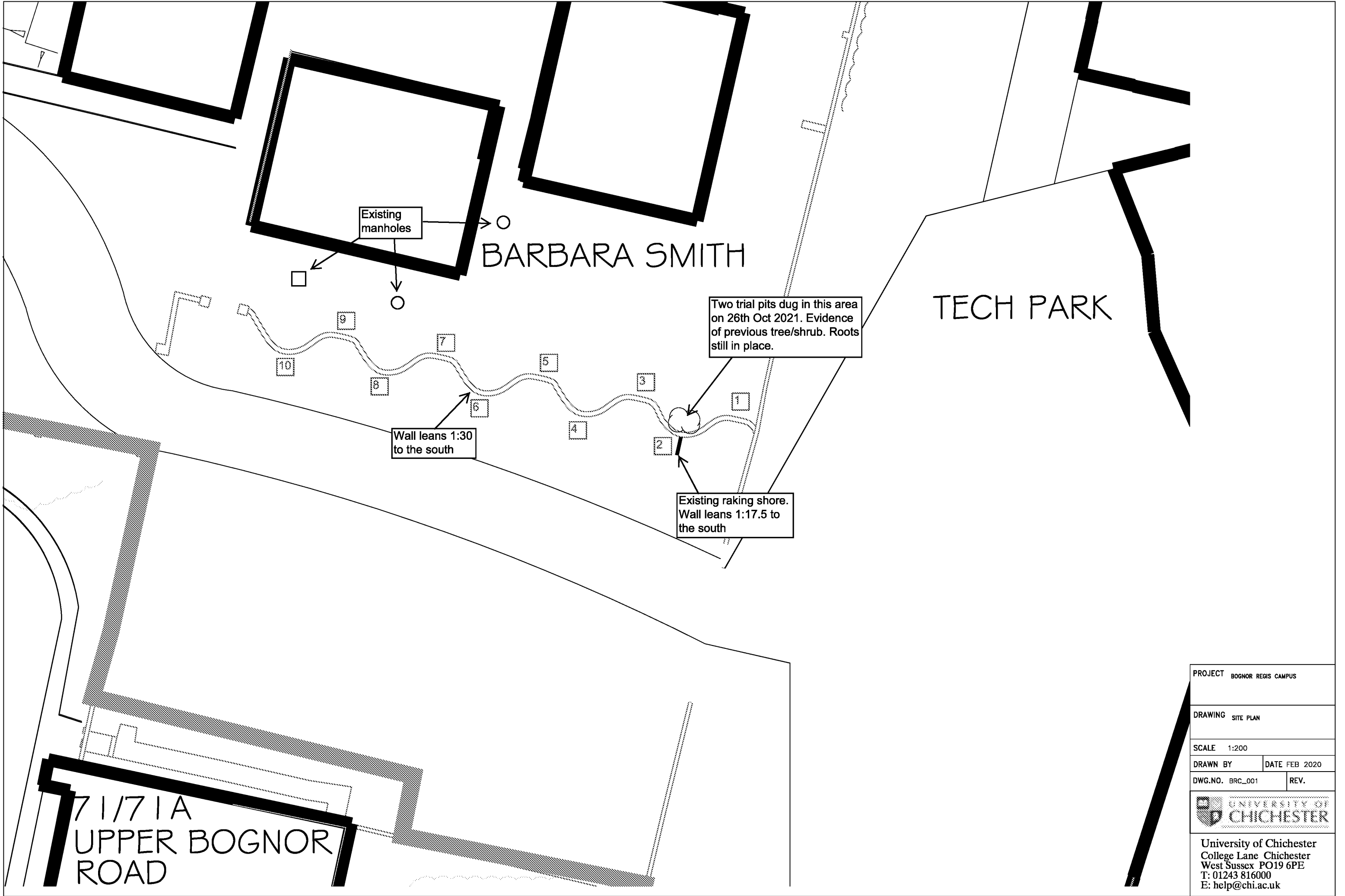
.....  
Peter Willmott CEng FStructE  
Consultant

Date

8 December 2021

**APPENDIX A**

Site Plan



|                                                                                                                     |  |       |                     |  |  |
|---------------------------------------------------------------------------------------------------------------------|--|-------|---------------------|--|--|
| PROJECT                                                                                                             |  |       | BOGNOR REGIS CAMPUS |  |  |
| DRAWING SITE PLAN                                                                                                   |  |       |                     |  |  |
| SCALE                                                                                                               |  | 1:200 |                     |  |  |
| DRAWN BY                                                                                                            |  |       | DATE FEB 2020       |  |  |
| DWG.NO. BRC_001                                                                                                     |  |       | REV.                |  |  |
|  UNIVERSITY OF CHICHESTER      |  |       |                     |  |  |
| University of Chichester<br>College Lane Chichester<br>West Sussex PO19 6PE<br>T: 01243 816000<br>E: help@chi.ac.uk |  |       |                     |  |  |

## **APPENDIX B**

### Photographs



1 – View of the southern elevation of the wall



2 – View of the northern elevation of the wall



3 – Raking shore in section 2



4 – Raking shore fixings through northern face of wall at section 2



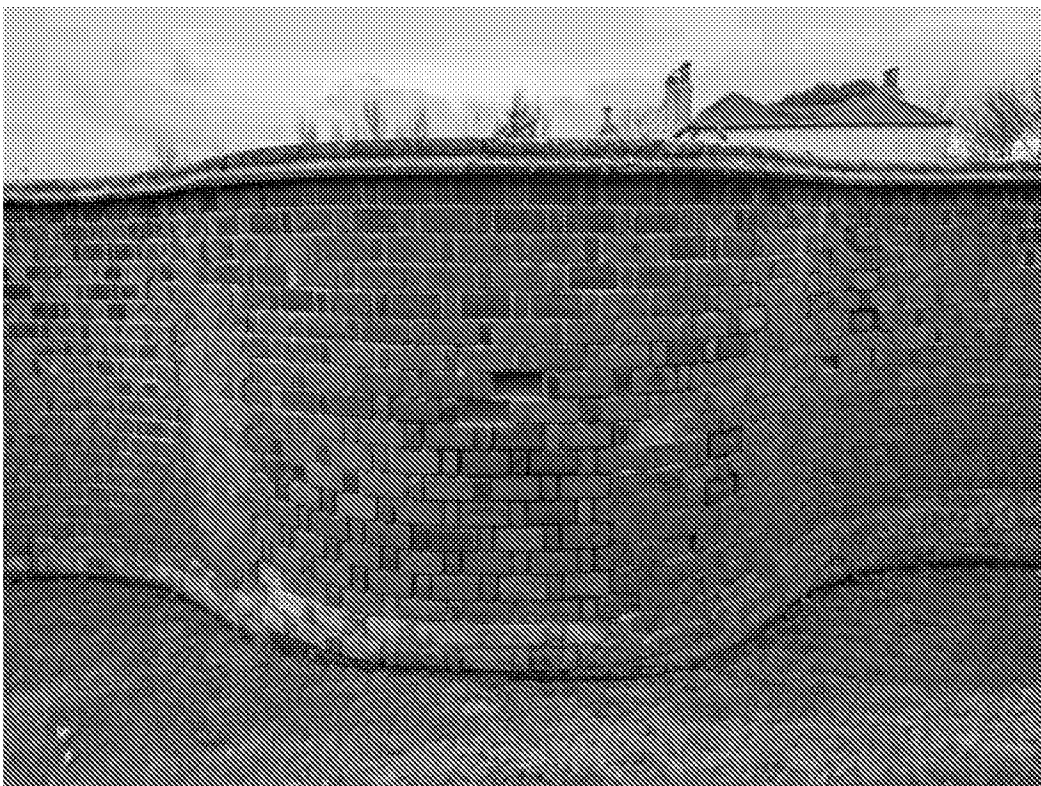
5 – Diagonal cracking on the northern face and evidence of historic repairs in section 2



6 – Close-up of diagonal crack between sections 1 and 2 in photograph 5



7 – Cracking on the northern face on section 6



8 – Mortar and brick erosion on northern face of section 7



9 – Variable mortar types on the southern face of sections 6 & 7



10 – Loss of mortar and bricks in southern face of section 9



11 – Ivy growth on southern elevation of section 5



12 - Ivy growth on northern elevation of section 5



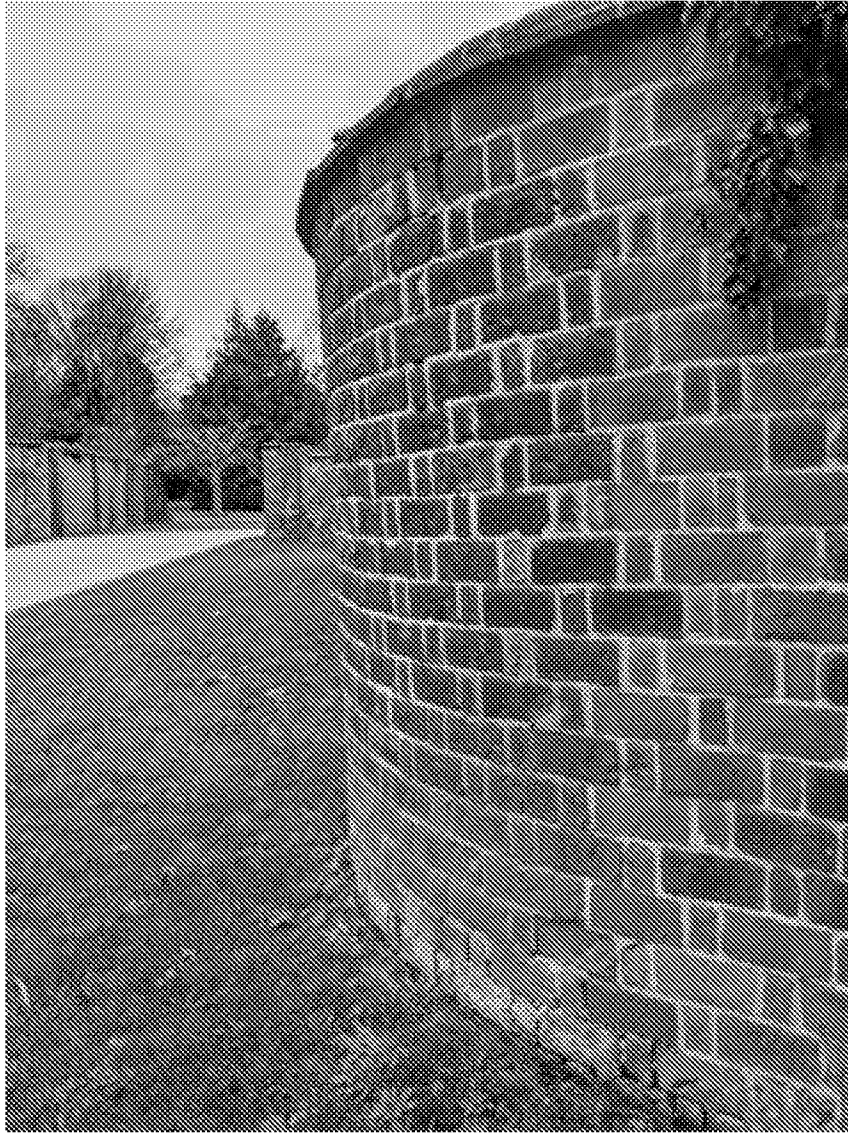
13 – Trial pit - evidence of root growth which may have affected the wall's stability



14 – Trial pit



15 – Lean of section 2. Loss of mortar



16 – Lean of section 6

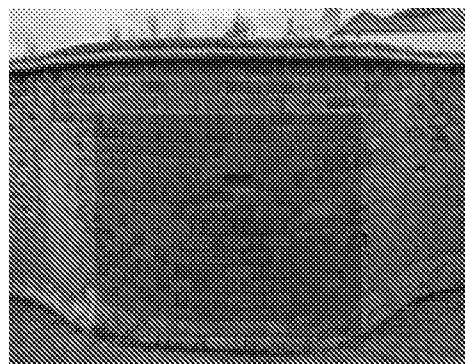
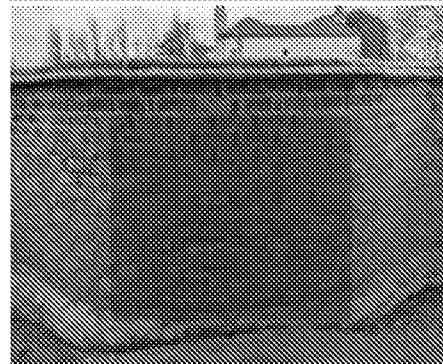


17 - Manholes

## **APPENDIX C**

### Remedial Works

Re-pointing to face of wall.  
Allow for 2no. areas of 2m x 2m

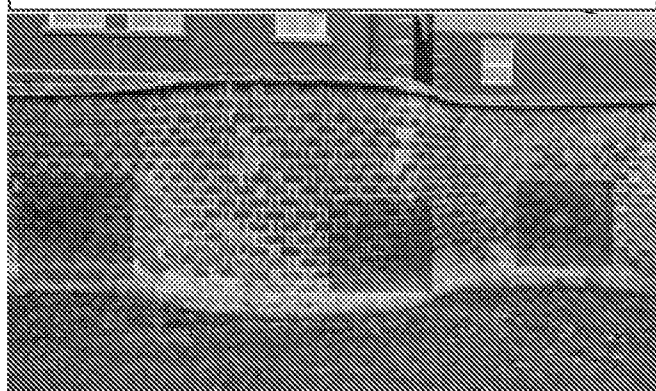


BARBARA SMITH

Remove ivy on both sides to  
expose condition of face of  
wall. Allow for re-pointing in  
this area.

TECH P

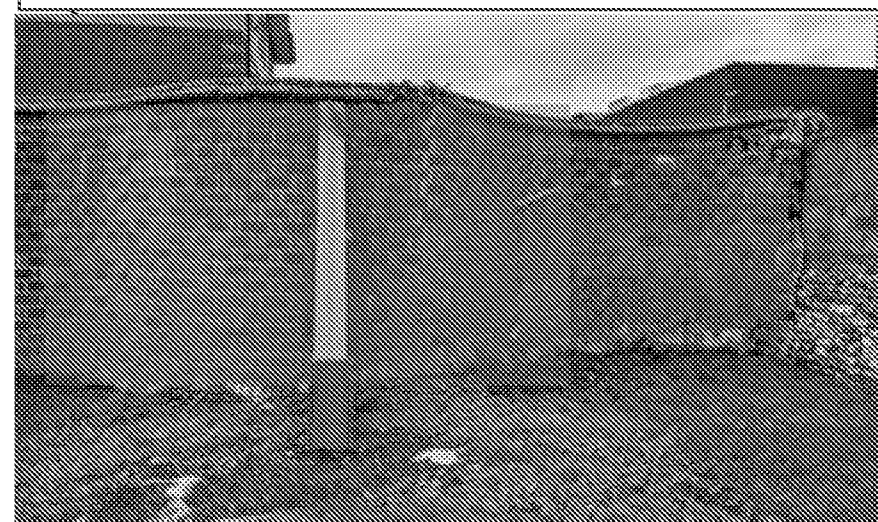
Re-pointing to face of wall.  
Allow for 3no. areas of 1m x 1m



Helibars. Allow for 7m-long bars installed  
horizontally over the full height of the wall  
Allow for new concrete footing 1000mm lng  
x 600mm wide under front face of wall



Carefully take down and rebuild area shown in red.  
New foundation 3m long x 600mm wide  
Install Helibars. Allow for 7m-long bars installed horizontally  
over the full height of the wall  
Allow for re-pointing an area of 3m x 2.5m



Tidy up end of wall  
where it meets  
perpendicular wall

Existing  
shoring

71/71A  
UPPER BOGNOR  
ROAD

- Notes**
1. Contractor to submit proposals to Archibald Shaw prior to construction.
  2. Proposals subject to Listed Building Consent.

**Archibald Shaw**  
Consulting Civil and Structural Engineers

Project **Serpentine Wall** Date **Dec 21**  
Task **SK01 Remedial works** Eng **EOD**  
Project No. **31951** Rev **-**

Sketch/Calc ☒ Site Visit ☐ Memo ☐  
 Phone Call ☐ Meeting ☐ File Note ☐

# Archibald Shaw

Consulting Civil and Structural Engineers

Project No./Ref: 31951/SK02

Project: CHICHESTER UNL Listed Wall

Section: SECTION 2 - Footing

Prep

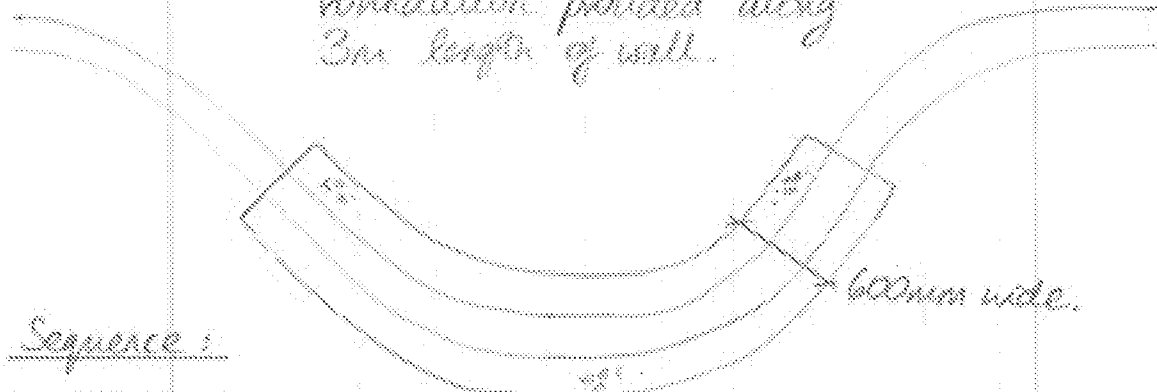
Checked

Date: DEC 21

Time:

## Section 2 - concrete footing

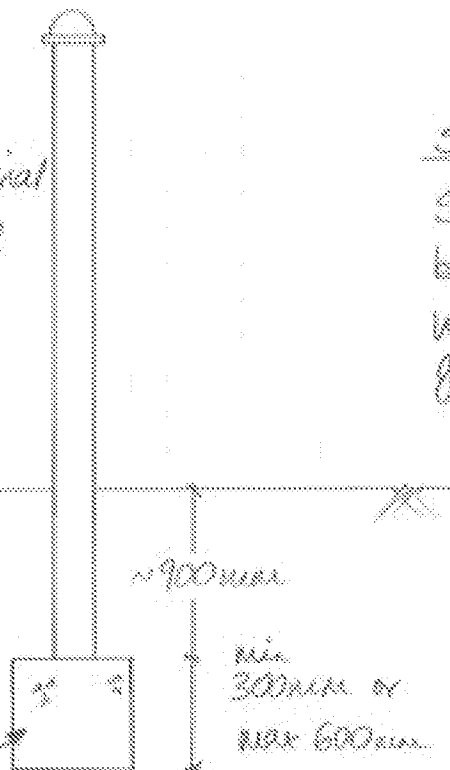
Foundation provided along  
3m length of wall.



### Sequence:

1. Wall carefully taken down, bricks cleaned and stored for reuse.
2. Foundation cast.
3. Wall built back with original bricks. Mortar to match original mortar. Stainless steel masonry reinforcement 'Helibar' to anchor into adjacent section of wall retained.

Formation to be agreed in site.



### Safety note:

Sides of excavation to be shored if ground unstable and/or groundwater present.

Total depth min 1200mm or max 1500mm