Hutton + Rostron
Environmental Investigations Limited

55 Cumberland Terrace: Vaults

Site note 4 for 1 December 2021, job No. 154-11

CONTENTS

Attachments

Distribution:

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1 INTRODUCTION

1.1 AUTHORITY AND REFERENCES

Hutton + Rostron Environmental Investigations Limited carried out a site visit to 55 Cumberland Terrace on 1 December 2021 in accordance with instructions from Antonella Noto by email, on 25 November 2021, reference 55 Cumberland Terrace Vaults Hutton & Rostron. Drawings provided by Michael Barclay Partnership, Ref 8045 were used for the identification of structures. For the purpose of orientation in this report, the front of the property, facing onto Cumberland Terrace, was taken as West

1.2 AIM

The aim of this survey was to investigate the condition and performance of the existing provision for structural waterproofing in the vaults on the west side of the lower ground floor and to make recommendations for remedial works, so as to prevent problems of damp and decay on future occupancy and so as to minimise loss or disruption of historically significant building fabric

1.3 LIMITATIONS

Structures were not examined in detail except as described in this report, and no liability can be accepted for defects that may exist in other parts of the building. We have not inspected any parts of the structure which are covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect or, in the event that such part of the property is not free from defect, that it will not contaminate and/or affect any other part of the property. Any design work carried out in conjunction with this report has taken account of available pre-construction or construction phase information to assist in the management of health and safety risks. The sample remedial details and other recommendations in this report are included to advise and inform the design team appointed by the client. The contents of this report do not imply the adoption of the role of Principal Designer by H+R for the purposes of the Construction (Design and Management) (CDM) Regulations 2015

2 STAFF ON SITE AND CONTACTS

2.1 H+R STAFF ON SITE

Michael Almond

2.2 PERSONNEL CONTACTED

David Terry – Sherlock London

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3 OBSERVATIONS

3.1 GENERAL OBSERVATIONS

The 3 No. vaults on the west side of the lower ground floor were of similar sizes and proportions, approximately 3.5m x 2.5m. Each vault was detailed with a surface drain, set into a remedial floor screed installed on a previous refurbishment. All vaults had been treated with a cementitious render waterproofing system on previous refurbishment, which showed varying degrees of isolated failure but were generally in fair condition. Vault floors were level with or slightly above the paving in the courtyard providing access which was drained by 2 No. surface gullies, at the centre and north ends. The lightwell area paving was in good condition and appeared to be laid to consistent falls to the surface gullies. Inspection of a trial pit, formed in the north-west corner of vault 1 and the south-east corner of vault 3, showed ground water at approximately 400mm below floor level. This was reported to H+R as being a relatively constant water table, with some variation following periods of intense and prolonged rainfall. H+R understands that the vaults are proposed for various plant and storage uses, each requiring a Grade 3 internal environment as described in BS 8102:2009

3.2 EXISTING PROVISION FOR WATERPROOFING

3.2.1 Vault 1

Existing cementitious render waterproofing was in fair condition, with some evidence of historic or intermittent water ingress towards the centre on the north side, where a crack had formed in the render coat. Other cracks, generally running laterally from east to west showed localised surface efflorescence of hygroscopic salts, consistent with salt contaminated water draining through paving surfaces above to the interior, depositing soluble minerals and creating short ‘stalactites’ of calcium carbonate and other water soluble minerals. Service voids had been created in the south-west and north-east corners to link pipework and cabling between the vaults as part of current refurbishment works. Percussion auscultation testing of walls and soffits indicated that the render waterproofing system was firmly adhered to throughout

3.2.2 Vault 2

Cementitious render waterproofing showed more widespread defects associated with progressive failure and were noted in vault 1, with multiple circular patches of staining and salt efflorescence focussed on point defects in the render coatings. These areas linked together at low level on the north and south sides. Waterproof render coatings had failed on the north side of the entrance doorway, consistent with chronic interstitial efflorescence of hygroscopic salts, forcing the impermeable render coating away from the cement render and masonry substrates. Approximately 20 per cent of the wall and ceiling surface had been treated with a remedial render coating on a previous refurbishment, including the full width of the north wall to approximately 0.9m above floor level. Percussion auscultation testing of the render system identified two areas of render detachment: approximately 1m above floor level on the south side of the entrance doorway and at low level at the east end of the south wall. Render elsewhere was firmly adhered. Openings had been formed in the walls separating vault 2 from vaults 1 and 3, at the west ends of the north and south walls, to allow building service conduits, pipes and cables to pass between the vaults. The timber door frame on the east side showed signs of historic decay, where in direct contact with the surrounding structures at the door head

3.2.3 Vault 3

Waterproof cementitious coatings and decorative finishes to the walls and soffit were in fair condition, with isolated detachment of a ‘film forming’ paint system noted, where salt efflorescence had occurred between the paint and the gypsum plaster substrate. Salt efflorescence and ‘stalactite’ formation around cracks in the ceiling render were restricted

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to the east and west ends, notably towards the south-west corner. Percussion auscultation testing of render identified no areas of hollowness or detachment. Inspection of a trial pit, formed in the south-east corner showed standing water 400mm below the floor surface, approximately 100mm below the footings of the east wall, separating the vaults from the access passageway

3.3 PROPOSED SERVICE INLET CUPBOARD ON NORTH SIDE

H+R understand that gas meters and other building services, valves and controls are to be installed in a cupboard at the north end of the vault access passageway/lightwell. The soffit in this location was formed from horizontal paving slabs to the north of the arched structure supporting the access stairs to 55 Cumberland Terrace at upper ground floor level. Gaps in the slabs had been temporarily sealed with waterproof silicone materials, pending further waterproofing works. Walls on the north, east and west sides of the cupboard recess were detailed with cement render and decorative paint or limewash finishes. It was not possible to tell whether the render was of a waterproof type but the absence of focussed salt efflorescence indicated that the render did not include waterproof additives. Localised detachment of the render was noted at low level in the north-east corner, where a rainwater downpipe or similar drain had previously been installed, preventing effective render application locally

3.4 VENTILATION

H+R understand that ventilation louvres are proposed for the doors to be installed to vaults 1, 2 and 3 as part of current refurbishment works. Existing provision for through and cross ventilation of vaults was limited to the ductwork openings formed in walls for building services to pass between the vaults. This may allow the conditions for surface condensation and mould growth to arise within the vaults on their west sides where cross ventilation is likely to be restricted

3.5 TIMBER

The timber door frames to vaults 1 and 2 were in direct contact with the surrounding reveal masonry, which was likely to have provided the conditions for decay, as was noted at the head of the door frame to vault 2

3.6 RESIDUAL MOISTURE IN VAULT MASONRY

3.6.1 Sampling

5 No. masonry samples were extracted from the vault walls and returned to H+R's laboratory, for gravimetric testing of available and hygroscopic moisture content. Results and sample locations are shown on plans at Attachment B

3.6.2 Results

All samples were classified as saturated (8% to 20% available moisture content) or super-saturated (greater than 20% available moisture content). These results were consistent with previous results, as described in H+R Site Note 3, dated 9 July 2021 and were typical of below ground structures of this age and method of construction

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4 RECOMMENDATIONS

4.1 BUILDING CONSERVATION

H+R generally recommend that drained cavity waterproofing is the most suitable system for waterproofing period or historic structures below ground level, due to the minimal impact on the structures themselves, a high degree of reversibility and maintenance of a ‘natural’ and stable residual moisture content in brickwork and masonry. However, where a cement based ‘tanking’ solution has been adopted in the past it is often impossible to remove the render and expose the bricks behind without causing extensive damage to the bricks themselves. In order to resist ground water pressure cementitious renders are required to bond chemically with the bricks to which they applied. Saturation of the brickwork occurs at the interface with the render, which can lead to localised detachment over time but where renders remain firmly attached mechanical removal will be destructive of historic fabric to a degree that is unlikely to be acceptable to the Local Authority Conservation Officer. Whilst the render will become increasingly detached over time, the rate of detachment will gradually slow, as the substrate moisture progressively disperses through exposed areas, removing the vapor pressure from behind the render in areas where it remains strongly adhered

4.2 EXISTING PROVISION FOR VAULT WATERPROOFING

H+R recommend that the existing cementitious render waterproofing should be retained and refurbished, to avoid unnecessary damage to the existing building fabric (see 4.1 above)

4.2.1 Vaults 1 and 3

Loose and damaged decorative finishes should be removed, followed by surface preparation and application of a thin (c.2mm) vapour permeable cementitious render, with flexible 'bandage' repairs to cracks and reinforcement of corners and wall/floor junctions as directed by the specialist installation contractor.

4.2.2 Vault 2

The more advanced failure of the render waterproofing system in Vault 2 indicated that this vault had been waterproofed at a different time to vaults 1 and 3, using different materials. The render system should be overhauled as described at 4.2.1 but preparation should include removal of sections of render that have already become detached from the bricks behind and repair in new materials that match the existing

4.3 PROPOSED SERVICE INLET (GAS METER) CUPBOARD ON NORTH SIDE

Allowance should be made for installation of a remedial concrete soffit structure, detailed to exclude surface water draining from above. Consideration should be given to installing a new structural deck, subject to coordination with the neighbouring property owner, to allow inclusion of a suitable ‘two-part’ waterproof membrane, such as polyurea or a fibreglass resin system. If this proves impractical, the new or retained soffit structure should be treated with a suitable waterproof cementitious render, dressed a minimum 200mm down the walls forming the cupboard recess from the wall/soffit junction. Existing render should be retained and walls lined with a studded plastic vertical drainage and isolating membrane, with a ‘coving’ detail at the wall/soffit junctions. Water draining behind the membrane could discharge below a raised floor in the services cupboard or direct to existing hard landscape materials, from where water could flow to the adjacent surface drain. This would minimise the introduction of further cementitious materials whilst providing adequate levels of protection against penetrating damp. H+R can provide further advice on remedial detailing if required

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4.4 VENTILATION

Consideration should be given to including ventilation pathways between the vaults, perhaps by expanding the existing service conduit openings, to include an air duct subject to requirement for fire separation. Consideration should be given to providing ventilation pathways around the vault doorways at high and low level, to encourage air circulation

4.5 TIMBER

Allowance should be made for removal of existing door frames and for making good of render and the provision for waterproofing behind. On reinstatement, all new and retained timbers should be isolated from the door reveals by continuous strips of a suitable damp-proof material, or by a continuous air gap and plastic packing wedges. Provision of a ventilation slot, the full width of the door openings and above the frame heads, would also provide isolation, which in combination with a gap below the door leaves, say, 20mm wide, could provide the ventilation by fresh external air recommended at 4.4 above

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5 H+R WORK ON SITE

5.1 H+R inspected the structure for defects liable to allow water penetration before and after refurbishment

5.2 H+R took samples from representative masonry masses, so as to determine their gravimetric and hygroscopic moisture content

6 PROPOSED ACTION BY H+R

6.1 H+R will advise on remedial detailing, so as to minimise the risk of damp and decay problems after refurbishment if instructed

6.2 H+R will advise on conservation of original fabric with regard to damp, decay and salt damage, as necessary and if instructed

6.3 H+R will review proposed remedial details as these become available if instructed

6.4 H+R will return to site to inspect sample remedial details if instructed

6.5 H+R will liaise with conservation and historic building authorities, if instructed, so as to ensure the cost-effective conservation of original fabric

7 INFORMATION REQUIRED BY H+R

7.1 H+R require copies of proposed remedial details for comment as these become available

7.2 H+R should be informed as a matter of urgency if further significant water penetration occurs onto site; so that advice can be given on cost-effective remedial measures, to minimise the risk of cost or programme overruns and so as to minimise the risk of damp or decay problems during the latent defect period

8 ADMINISTRATION REQUIREMENTS

8.1 H+R require formal instructions for further investigations and consultancy on this project

8.2 H+R require confirmation of distribution of digital and printed copies of reports and site notes

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Attachment A

Fig 1:

Lower ground floor, west side; showing general arrangement of lightwell access passageway and entrances to vaults 1, 2 and 3

Fig 2:

Access lightwell passageway viewed from west; showing 2 no. surface gullies with surrounding paving in good condition and laid to consistent falls to the drainage outlets

55 Cumberland Terrace
Damp investigation of lower ground floor vaults
1 December 2021
Not to scale

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Fig 3:

Vault 1, viewed from entrance doorway; showing generally good condition of existing cementitious render waterproofing

Fig 4:

Vault 1, east end; showing salt efflorescence around cracks in the render system, with short ‘stalactites’ or soluble minerals forming on the soffit

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Fig 5:

Vault 1, central section; showing mineral deposits and ‘streaking’ on cementitious render surfaces, where water drained intermittently to the interior. Note evidence of patch repair to cracks on previous refurbishment

Fig 6:

Vault 1, north-west corner; showing apparent patch repair to existing cementitious render waterproofing

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Fig 7:

Vault 1, north-west corner; showing trial pit, with standing water approximately 400mm below the vault floor surface

Fig 8:

Vault 1, north end of east wall; showing void formed in structure for building services. The wall thickness in this location was 400mm

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Damp investigation of lower ground floor vaults
1 December 2021
Not to scale

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Fig 9:

Vault 1, north side of entrance reveal; showing water draining through a defect in the cementitious render waterproofing, leaving soluble mineral deposits on the wall surfaces. Note timber door frames not isolated from surrounding masonry and vulnerable to decay

Fig 10:

Vault 2, general view from east doorway; showing condition of existing cementitious waterproofing render system

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Fig 11:

Vault 2, east wall to north of entrance doorway; showing areas of render detachment, exposing semi-engineering brickwork behind

Fig 12:

Vault 2, east wall to north of entrance doorway; showing detail of exposed brickwork, with surface and interstitial efflorescence of hygroscopic salts causing disruption to the sand and cement basecoat and thin cementitious waterproof render that had been applied on previous refurbishment

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Fig 13:

Vault 2, south side; showing widespread surface staining and salt efflorescence consistent with progressive failure of the cementitious waterproofing system and a limited residual service life. However, the render was found to be firmly adhered on percussion testing

Fig 14:

Vault 2, north wall; showing the general application of remedial cementitious render to approximately 0.9m above floor level on a previous refurbishment

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Fig 15:

Vault 2, arched soffit; showing ‘point’ defects, with circular patterns of staining and salt efflorescence indicating progressive failure of the cementitious waterproofing system

Fig 16:

Vault 2, east side; showing headrail of doorframe subject to historic decay where in direct contact with damp affected masonry

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Fig 17:

Vault 3, view from entrance doorway; showing general condition of existing cementitious waterproof render

Fig 18:

Vault 3, south-west corner; showing salt efflorescence and ‘stalactite’ formation around a crack in the ceiling render system

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Fig 19:

Vault 3, north side; showing isolated patch of paint detachment from the gypsum based plaster substrate

Fig 20:

Vault 3, east end; showing salt efflorescence and ‘stalactite’ formation in isolated locations, focussed on hairline cracks in the soffit render system

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Fig 21:

Vault 3, south-east corner; showing trial pit in floor structure with standing water approximately 400mm below the floor surface and 100mm below the footings of the east wall

Fig 22:

Vault 3, east end; showing typical surface drainage gulley set into the vault floor. This detail was common to all three vaults

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Fig 23:

Lightwell access passageway, north end; showing locations for proposed building services inlet cupboard

Fig 24:

North end of access passageway/ lightwell; showing underside of concrete paving slabs forming the soffit of the proposed services inlet cupboard. Note open joint between the slabs sealed with adhesive silicone at the time of inspection

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Fig 25:

North-east corner of proposed services inlet cupboard; showing detached and incomplete render application, where a vertical drainage or soil/vent pipe had been removed on previous refurbishment

Fig 26:

Building services inlet cupboard, west side; showing build-up of cement render and decorative finishes applied to brickwork locally

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Fig 27:

Proposed building services inlet cupboard, north side; showing salt efflorescence affecting brickwork above the wall render at high level indicating intermittent drainage of surface water through the structure

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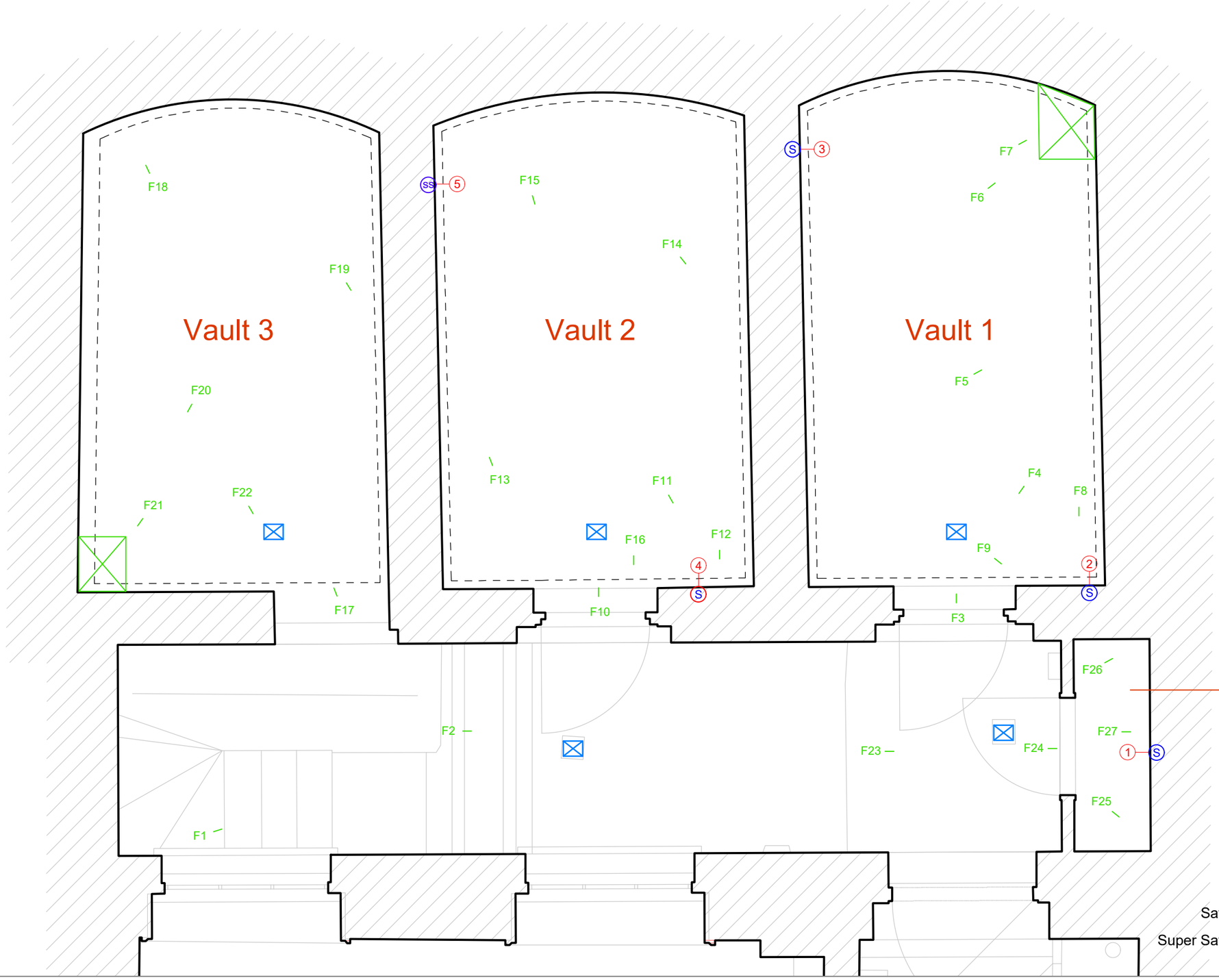
Attachment B



	High salt content	Low salt content	
Dry	D	D	0-2% w/w available moisture content
Moist	M	M	2-5% w/w available moisture content
Wet	W	W	5-8% w/w available moisture content
Saturated	S	S	8+% w/w available moisture content
Super Saturated	SS	SS	20+% w/w available moisture content

Key:
- (1) Masonry sample location
- Surface drain
- Trial pit in floor (by others)
- F Approximate location of photograph

H+R

55 Cumberland Terrace

Remedial damp-proofing investigation of lower ground floor vauts

1 December 2021

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Attachment C

Table of material moisture contents **Attachment C**

Samples of masonry were drilled from walls in areas vulnerable to damp penetration. The samples were placed in sealed containers and tested at the H+R laboratory in accordance with the procedure for gravimetric measurement of moisture content as described in the appendix to BRE Digest 245

Sample Number/Location	Moisture content % w/w			Hygroscopic moisture content % w/w	Available moisture content % w/w
1	21.56	S		1.96	19.60
2	18.69	S		0.53	18.16
3	20.18	S		1.88	18.30
4	11.39	S	H	2.70	8.69
5	23.54	SS		1.09	22.45

Hygroscopic moisture is the ‘air dry’ moisture content of the sample at 75 per cent relative humidity. High levels above, say, 2 per cent are attributable to salt contamination. Hygroscopic salt commonly accumulates in old plaster and masonry that has been subject to dampness penetrating from the ground over many years. High levels above, say, 2 per cent of available moisture (liquid water) in the sample indicate continuing dampness due to liquid water in the sample usually resulting from faulty rainwater and plumbing goods

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