ASSESSMENT REPORT ON THE BUILT HERITAGE RECORDING OF A LENGTH OF THE SOUTH MOAT WALL, HM TOWER OF LONDON, LONDON BOROUGH OF TOWER HAMLETS

SITE CODE: TOL 139

PCA REPORT NO. R11796

JULY 2014

PRE-CONSTRUCT ARCHAEOLOGY

Assessment Report on the Built Heritage Recording of a length of the South Moat Wall, HM Tower of London, London Borough of Tower Hamlets

Site Code: TOL 139

Central NGR: TQ 33690 80435

Commissioning Client: Historic Royal Palaces

Written by: Kevin Hayward and Paul McGarrity

Project Manager: Charlotte Matthews (MIfA)

Contractor: Pre-Construct Archaeology Limited
Unit 54 Brockley Cross Business Centre
96 Endwell Road
Brockley
London SE4 2PD
Tel: 020 7732 3925
Fax: 020 7732 7896
E-mail: cmatthews@pre-construct.com
Web: www.pre-construct.com

July 2014

PCA REPORT NO. R11796

DOCUMENT VERIFICATION

SOUTH MOAT WALL, HM TOWER OF LONDON, LONDON BOROUGH OF TOWER HAMLETS

ASSESSMENT REPORT BUILT HERITAGE RECORDING

Quality Control

Pre-Construct Archaeology Limited	
Project Number	K3478
Report Number	R11796

	Name & Title	Signature	Date
Text Prepared by:	Kevin Hayward and Paul McGarrity		24/07/14
Graphics Prepared by:	Mark Roughley		24/07/14
Graphics Checked by:	Josephine Brown	J. Brown	24/07/14
Project Manager Sign-off:	Charlotte Matthews	Charlotte Matthews	24/07/14

Revision No.	Date	Checked	Approved

Pre-Construct Archaeology Limited
Unit 54
Brockley Cross Business Centre
96 Endwell Road
London
SE4 2PD

CONTENTS

Appendices

Figures

1 NON-TECHNICAL SUMMARY

1.1 Pre-Construct Archaeology was commissioned by Historic Royal Palaces to undertake built heritage recording of a 15m stretch of the South Moat Wall at HM Tower of London, London Borough of Tower Hamlets. The Tower of London is a Scheduled Monument, a World Heritage Site and lies in a Conservation Area. The South Moat Wall is Listed Grade II* and is described as: 'Revetment wall to south side of moat...and to north side of Tower Wharf. 1365-70 for Edward III. Built of C14 stone refaced in brick, mostly of C18 and C19 date...'. The recording was carried out as a condition of Scheduled Monument Consent for the rebuilding of this section of wall. It was undertaken before and during dismantling of the north outer face of part of the South Moat Wall from March to May 2014.

1.2 Previous archaeological investigation of the South Moat Wall to the east of the currently recorded section found evidence for a first phase chalk and flint wall at 3.2mOD thought to date to 1389 when it is documented that 'a wharf with two side walls' was to be built. These previous investigations showed that a higher wall had been built from this level with two outer stone faces enclosing an inner rubble core. It is this raised section of wall that now retains the wharf beside the moat. The north and south faces were built mainly of Kentish Ragstone and roughly squared Reigate stone, respectively. It would seem that the north face was rebuilt in 1632, when it is documented that 105 ft of the old wharf was replaced with a new wall with a rubble core behind a facing of Kentish ashlars.

1.3 The first phase chalk and flint wall was not observed during the current investigation. The earliest part of the wall that was recorded was the inner rubble core, which was characterised by Kentish Ragstone rubble and Reigate stone with fragments of 15th to 17th century brick in a sandy mortar. A clay tobacco pipe bowl found within this part of the structure dates from 1680 to 1710. This part of the wall and an area of large blocks of tooled Reigate stone above are thought to have been rebuilt/reworked in the late 17th or early 18th century when the adjacent Proof House and Proof Yard were built. Although the latter had been disturbed by the insertion of a 19th century timber floor, which was visible as a horizontal row of 21 beam slots. This floor and three brick flues inserted into the inner core of the wall were thought to have been connected with a Small Arms Manufactory constructed on the wharf in 1803.

1.4 The outer north face of the South Moat Wall had been re-pointed in 19th/20th century Portland cement. Much of the lower part of the wall had been rebuilt in 19th century red brick. The stone part of the wall was mainly built of Kentish Ragstone. Although the wall may have been rebuilt in 1632, it had been patched, repaired and re-pointed in the 19th and 20th centuries. A number of medieval moulded stones were found within the wall.

1.5 It is recommended that the results of this archaeological work are published in an article that includes the results of other archaeological investigations on the moat wall and the wharf.

2 INTRODUCTION

2.1 Background

2.1.1 Pre-Construct Archaeology Limited (PCA) was commissioned by Historic Royal Palaces to undertake built heritage recording of a 15m stretch of the South Moat Wall at HM Tower of London, London Borough of Tower Hamlets (**Figures 1** and **2**).

2.1.2 The South Moat Wall has seen many phases of repair and rebuilding since its initial construction in the late 14th century. The outer north elevation that was the subject of this recording exercise largely comprised a 17th century rag stone re-facing with later brick repairs. The revetment wall retains the structure of Tower Wharf, a late medieval wharf to its south.

2.1.3 The recording was carried out before and during the dismantling of the north face of this length of the wall, which lies opposite the Well Tower. The face of this wall was rebuilt because the adjacent section of wall to the east had collapsed in 2003 and monitoring had highlighted instability. The localised collapse of the section of wall to the east was caused by the root system of a London Plane tree, several of which had been planted on the wharf in the late 19th century. The roots caused the face of the wall to separate from the structure behind and to collapse. This tree and the adjacent London Planes on the wharf, have since been removed

2.1.4 The Tower of London is a Scheduled Monument, a World Heritage Site and lies in the Tower of London Conservation Area. The South Moat Wall is Listed Grade II* and is described as follows in its listing citation:

> 'The Tower of London: Revetment wall to south side of moat, from Tower Bridge approach to Middle Tower: Revetment wall to moat and to north side of Tower Wharf. 1365-70 for Edward III. Built of C14 stone refaced in brick, mostly of C18 and C19 date, and in mid C19 stone to west end'

2.1.5 Historic Royal Palaces, as custodian of the Tower, seek the agreement of English Heritage regarding any repairs, improvements or alterations that may impact upon historic fabric or archaeological features or deposits. Scheduled Monument Consent has been granted by English Heritage for the rebuilding of this section of wall. The recording of this section of wall before and during dismantling was carried out as a condition of this consent.

2.1.6 The building recording was carried out intermittently from 19th March to 23rd May 2014 in accordance with a Brief (Keith-Lucas, 2013).

2.2 Site Location

2.2.1 The South Moat Wall retains Tower Wharf against the south side of the moat. The length of wall that was recorded lies opposite Well Tower in the south-east corner of the Tower

of London. The recorded wall is located at Ordnance Survey National Grid Reference TQ 33690 80435 (**Figures 1** and **2**). The base of the South Moat Wall was at 2.57m above Ordnance Datum.

3 METHODOLOGY

3.1 Aims and Objectives

3.1.1 The aim of the built heritage recording was to provide a record of this length of wall before and during the dismantling of its north face. This was to lead to the preparation of records providing lasting evidence of the form and development of the wall, suitable for analysis and dissemination in the form of a written report.

3.2 Documentary Research

3.2.1 The historical and archaeological background used in the Brief (Keith-Lucas, 2013) has been repeated in this report and no new documentary research was undertaken for this report.

3.3 On-Site Recording

3.3.1 A rectified photographic survey of a 15m length of the north elevation of the South Moat Wall was carried out on 21st March 2014. The images used for the rectified survey were produced as high resolution (18.0MP) digital images (JEPG and RAW files). Targets were placed along the length of the wall and these were located with GPS (Global Positioning System) survey equipment.

3.3.2 The photographs were rectified by PCA's CAD department where the individual images were joined together as a mosaic to create a continuous photographic image of the north elevation of the wall (**Figure 3**). The process of rectifying the images produces a scaled optically corrected image (in essence 'flattening' them out).

3.3.3 The rectified image was then digitised to produce an AutoCAD drawing with each stone in the wall individually drawn and the brickwork left as one context (**Figures 3** and **4**). Subsequently, when the face of the wall was being dismantled it was realised that a further 3.6m length of the wall to the west needed to be added to the original survey. This stretch of wall was hand drawn at a scale of 1:10 on site and added to the AutoCAD drawing (**Figures 3** and **4**). A photograph, prior to its dismantling and the erection of scaffolding, was supplied by Alex Attelsey, Conservation Building Surveyor, Tower of London, Historic Royal Palaces (**Plates 1** and **2**).

3.3.4 PCA's Petrologist, Kevin Hayward, identified the different stone and mortar types in the north elevation of the wall and marked them on to the drawing (**Figures 3** and **4**; **Appendices 1** and **2**).

3.3.5 During the dismantling of the north face of the South Moat Wall, stone masons numbered and removed each stone from the elevation so that they could be reinstated in their original positions. During this process an archaeologist was in attendance in order to observe and record any features, reused stone, artefacts and any evidence for repair.

3.3.6 During the process of dismantling, the wall was divided into spits, based on the level of removal at the end of each working day so that finds recovered from the structure could

be assigned to an area of the wall. The spits were numbered 1 to 8, with spit 1 being the highest level and spit 8 being the lowest. In addition, finds were given a small find (SF) number and marked on a copy of the scaled stone by stone elevation drawing of the outer north face of the wall.

3.3.7 Written descriptions were made of the inner core of the wall as it was uncovered. Moulded stone in the inner core of the wall were photographed *in situ* and some of the stones were also drawn at a scale of 1:10.

3.3.8 Once the outer face of the wall had been removed, the inner core of the wall was intensively photographed by PCA's photographer using a high quality digital camera from all angles from the enclosed scaffolding. Some 600 photographs were taken. These were processed to produce a 3d photogrammetric image by ArcHeritage (**Figures 5** and **6**). This image was then digitised to produce an AutoCAD drawing with each stone in the wall individually drawn (**Figures 5** and **6**). PCA's Petrologist, Kevin Hayward, identified the different stone and mortar types in the north elevation of the inner core of the wall and marked them on to the drawing (**Figures 5** and **6**; **Appendices 1** and **2**).

3.3.9 Samples of building material (mortar, brick, tile and stone) in the wall, which had been or were to be removed, were obtained using a 1kg masons hammer and sharp chisel to ensure that a small fresh fabric surface was exposed. The fabric was examined at x20 magnification using a long arm stereomicroscope or hand lens (Gowlland x10). Matches were then made with the London fabric collection.

3.3.10 The bricks were analysed using the system of ceramic building material classification used in archaeological work in Greater London. Each fabric number (e.g. fabric *3032* and *3034*) specifies the composition, form, approximate method of manufacture and date range of the material. Examples of the brick fabrics can be found in the archives of the Museum of London and PCA.

3.3.11 Metal, animal bone, clay tobacco pipe and pottery from the inner core of the wall were recorded and analysed in-house by PCA specialists.

3.4 Project Archive

3.4.1 The project archive is currently held at the offices of Pre-Construct Archaeology Limited in Brockley, London, under the site code TOL 139. It is anticipated that the archive (copies of the report, drawings, photographs and finds) will be lodged in the Historic Royal Palaces permanent archaeological stores at Hampton Court Palace in due course.

3.5 Guidance

3.5.1 All works were undertaken in accordance with standards set out in:

- English Heritage (2006) *Understanding Historic Buildings: A Guide to Good Recording Practice*
- English Heritage (2014). *Greater London Archaeology Advisory Service; Standards*

for Archaeological Work. London Region, English Heritage.

- IfA (1996, revised 2001 and 2008) *Standards and guidance for the archaeological investigation and recording of standing buildings or structures*

4 HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

4.1 Historical Background

4.1.1 The following historical and archaeological background is taken from the Brief (Keith-Lucas, 2013):

4.1.2 Tower Wharf was constructed in stages from west to east during the 14th century, eventually enclosing the south curtain wall so that parts of the Tower that had originally fronted onto the Thames were now shut off from the river. Accounts record the purchase of timber for piles and stone masonry. In 1389 the construction of the eastern section was contracted by Geoffrey Chaucer who was serving as Clerk of the King's Works. 'A wharf with two side walls' was to be built in stone 'from the corner of the east end of the wall of the Tower facing St Katharine's as far as the watergate of the said Tower' (Spooner, 2004).

4.1.3 The wharf provided a mooring point and became essential for loading and unloading goods; serving such institutions as the Royal Mint and the Royal Wardrobe which was responsible for, among other things, provisioning the English forces fighting in Scotland or in France (Davies and Norton, 2004). Clusters of buildings were accumulating here by 1400 and, by the mid-16th century, the eastern end of the wharf was almost completely covered in buildings as shown on Haiward & Gascoyne 1597 plan (OA, 2000).

4.1.4 A concerted scheme of repair work was undertaken on the wharf wall in 1632-3; initiated by Inigo Jones. Large sections were rebuilt and/or refaced. One new section required 235 elm piles to support a masonry wall 7ft 6 inches thick. 105 ft of the old wharf was taken down and rebuilt by William Mason in 1632; recorded as having a rubble core behind a facing of Kentish ashlars (Colvin, 1975 *c.f.* Spooner, 2009).

4.1.5 A defensive wall was commissioned for the wharf in 1680 (Parnell, 1993 *c.f.* Spooner, 2009). In 1682, a 'Proofehouse and Charging House' was built against this north-south wall; as depicted in 1688 by Holcroft-Blood (Impey and Parnell, 2000). The proofing house was a narrow masonry building that was pulled down in 1709 and replaced by a larger building (Spooner, 2004). The replacement proof house is clearly marked, with its associated yard, on a survey of 1742 in the location of the proposed works (Keith-Lucas, 2013, fig. 3).

4.1.6 The development of the wharf reached its zenith during the Napoleonic wars, with a dense array of warehouses, small arms dept. buildings and several guardhouses. Following the infilling of the moat in the 1840s, and with the increasing popularity of the Tower as a tourist destination, the wharf was largely cleared in the 1860s and 70s. It now supports a café, built in 2012.

4.2 Archaeological Background

Wharf Structure

4.2.1 The following specific archaeological background is taken from the Brief (Keith-Lucas,

2013):

4.2.2 The earliest archaeological evidence relating to the wharf was recorded by Oxford Archaeology in 1996 when excavating a series of test pits across the moat. Test Pit 53 (just to the north of South Moat Wall to the east of the current site), revealed a raft of mortared limestone rubble. It was presumed that the raft was laid as part of the wharf foundation; peppered with squared timber piles and supporting a platform of wooden beams. This platform, resting at *c*.0.4-1mOD (Keevill, 2004; current ground level in the moat rests at *c*.2.5mOD) is thought to be from the original late-14th century construction. Elm piles were ordered for repair works to the wharf wall in 1632; but the piles exposed in 1996 were presumed as dating from the 14th century.

4.2.3 The excavation following the collapse of the wharf wall in 2004 revealed much about its construction (Davies and Norton, 2004 [TOL 92]). A schematic cross-section in their report depicts the inferred cross-section of the wharf; with two outer walls enclosing a central area (*ibid*. fig. 11). Evidence for the first phase is of a chalk and flint wall (3054), found at 3.2mOD and thought to date from the documented build of 1389. Higher wharf walls were then raised from this level – perhaps as part of the same build, perhaps during the late-15th century; a late-15th century trample layer was associated with this build but with uncertain stratigraphy. It is this raised section of wall which now retains the wharf over the moat.

4.2.4 This structural addition to the original chalk and flint wall was formed of a double-skin of masonry with a central rubble core. The southern skin was built of roughly squared Reigate with Caen stone, dressed on the southern face only and with no apparent bonding (Dodds, 2003). In preceding investigations, this was seen to have a 20° batter (Wood, 1998). It was evidently built to face in towards to the wharf.

4.2.5 The outer skin comprised a wide variety of stone masonry, including worked and unworked pieces of Reigate, Caen and Portland stone, although the predominant material was Kentish Ragstone (Davies and Norton, 2004). It would seem that this face was rebuilt, almost certainly as documented in 1632 (see 4.1.4 above). Ragstone was documented for the 17th century repairs, but seen here also with residual material reflective of the location and time, for instance the Portland stone as used at the Tower by Inigo Jones. Further evidence from excavation (Mackinder, 2012 [TOL 109]) supports that the northern face was rebuilt, and also that the core appeared to have been raised in lifts as the northern skin was built. A fragment of post-medieval window glass from the rubble of TOL 92 also supports a *terminus post quem* of 15th to 16th century for elements of the wall.

Wharf Stratigraphy

4.2.6 The earliest layers yet dated within the Wharf are late-15th century deposits found during TOL 92 (Davies and Norton, 2004). Construction trample was evident, and also burnt material that, although perhaps dumped rather than scorched *in situ*, has been

associated with the 15th and 16th century ordnance manufacture known to have taken place on the wharf. Evidence of buildings and floor surfaces was also revealed, which may be the remnants of workshops for traders on the wharf in the 16th and 17th centuries.

4.2.7 The large north-south wall documented as having been commissioned in 1680 was found during TOL 109; built of faced Reigate stone and Kentish Ragstone and standing to 5.01mOD (Mackinder, 2012, fig. 3 (1)). A good assemblage of late 17th century clay pipes and pottery was also found in sealed contexts from this excavation (*ibid*.). That the wharf supported trade and manufacture into the 19th century is well reflected in the archaeological record. An array of structures such as stables, storehouses and yards have been found, with evidence also of hearths and a possible casting pit close to the known Arms Manufactory.

4.2.8 Of specific relevance, and preserved behind the section of wall that was dismantled during the current recording exercise, are a set of steps down to a flagstone floor. This sealed an earlier rendered tile floor at 3.35mOD thought to be a remnant from the 1688 Proof House (Mackinder, 2012). Later additions dating from the 19th century are thought to be part of the arms manufactory including a brick floor (100) resting at 4.6mOD (*ibid*. fig. 3).

5 DESCRIPTION

5.1 North elevation of the South Moat Wall

5.1.1 The lower part of the recorded north elevation of the South Moat Wall was predominantly constructed of 19th century red London stock brick in English bond (**Figure 3**). These well-made bricks in fabric *3032R* date from 1800 to 1900. The brickwork also included the occasional yellow 19th/early 20th century London stock brick in fabric *3035*.

5.1.2 During the dismantling of this brickwork, hoop iron (a long band of wrought iron some 40mm wide by 1mm thick) had been laid horizontally in at least one of the mortar joints to reinforce the wall (**Plate 3**). Hoop iron was commonly used within brickwork in the late 19th/early 20th century. Over time the iron rusts causing the joint to expand and crack.

5.1.3 The brickwork was mainly bonded in 19th/20th century hard Portland cement (Type 2) (**Figure 4**; **Appendix 2**). A narrow horizontal line within the brickwork had been re-pointed in a late 19th/early 20th century hard brown Roman cement (Type 4). This may relate to previous opening up of the joint caused by hoop iron (which was found in this joint) or bowing of the wall (**Plates 4** and **5**). Dismantling showed that movement of the external face of the wall had caused a void to open up behind the brickwork. Tree roots, presumably from a former plane tree, were also observed clinging to the inner rubble core pushing the outer north face to the north (**Plate 6**).

5.1.4 The rest of the external face of the wall was constructed of stone, mainly (some 85% or more) Kentish Ragstone and the related Hassock stone (**Figure 3**). Kentish Ragstone is documented as having been used to rebuild the South Moat Wall in 1632 (see 4.1.4). Some of the Kentish Ragstone in the recorded South Moat Wall were small rubble pieces typically used in medieval construction e.g. the nearby 14th century Outer Curtain Wall and north elevation of the Develin Tower (Hayward 2014). Others were larger blocks typically used in late 19th century construction such as in the east elevation of the Develin Tower (*ibid*.).

5.1.5 The lower part of the east end of the recorded wall was pointed in a hard black late 19th/early 20th century mortar (Type 3) (**Figure 4**; **Appendix 2**). Most of the rest of the Kentish Ragstone wall was pointed in 19th/20th century hard Portland cement (Type 2).

5.1.6 A total of ten lithotypes was recorded in the north elevation of the South Moat Wall; excluding the predominant Kentish Ragstone and the related Hassock stone, the remaining eight types account for only 63 examples. Many of these stone types are found in post-medieval and 19th century buildings and repairs at the Tower of London.

5.1.7 The wall was capped with a number of freshly dressed Portland coping stones (**Figure 3**). These were pointed in a 20th century hard concrete mortar with flint inclusions (Type 9; **Figure 4**). These large heavy late 20th/early 21st century coping stones may have added to the structural problems of the wall beneath.

5.1.8 Occasional blocks of Portland stone and flaggy Purbeck limestone had been included in the stone part of the outer wall (**Figure 3**). These types are both from Dorset and were

only used on a large scale in London after 1700 (Stanier 2000), although Portland stone was used at the Tower by Inigo Jones in the 17th century (Keith-Lucas, 2013, 6) used at the Tower by Inigo Jones in the 17th century (Keith-Lucas, 2013, 6). A complete Purbeck limestone flagstone (15kg) formed the base of a flue (Flue 1) recorded in the inner core of this wall. This stone was just visible in the outer face of the South Moat Wall. Another Purbeck limestone paving slab had been used to cap Flue 1 and was also visible in the outer face of the wall.

5.1.9 A fine granite block and a coarser Aberdeen Granite lump in the wall were found within an area of wall that had been re-pointed in late 19th/20th century crumbly gravel mortar (Type 10; **Figure 4**; **Appendix 2**). These may have derived from granite setts from the adjacent Tower Walkway or from the 1886-1894 construction of Tower Bridge.

5.1.10 A few good quality freestones, such as Caen stone, Taynton stone, Reigate stone and calcareous Tufa had been included in the face of the stone part of the outer wall. These stone types are found in medieval ecclesiastical and defensive buildings in London (Hayward in prep.) and have all been identified in the 12th century White Tower (Sanderson 1998; Worssam & Sanderson 1998; 2008). It is probable that they derive from late medieval construction in the Tower. In the mid 16th century records state that the east end of the wharf was 'to be employed for bowyers, smiths, fletchers, carpenters, and other crafts needed for the Tower' (Keay 2001). The wharf was an area where materials needed for work on the Tower were worked and stored and it is probable that the masonry found in the South Moat Wall was amongst that stored on the wharf for use at the Tower (Davies and Norton, 2004). Reigate ashlar was used in the south face of the South Moat Wall thought to have been constructed in the late 15th century (*ibid*.) and in the north-south defensive wall built across the Wharf in 1680 (Mackinder, 2012 [TOL 109]).

5.2 North elevation of the inner core of the South Moat Wall

5.2.1 Removal of the large coping stones revealed the top of the wall (0.5m wide) with the stone facing of the outer elevation to the north and an inner rubble core to the south (**Plate 7**). Voids between the outer elevation and the inner rubble core were visible showing the movement of this outer face (**Plates 5** to **7**).

5.2.2 Following the dismantling of the outer face of the South Moat Wall, the inner rubble core was exposed (**Figure 5**). This was predominantly constructed of Kentish Ragstone with a moderate amount of Reigate stone.

5.2.3 Most of the inner core of the wall was bonded in the same loose brown sandy mortar with clinker and calcareous inclusions (Type 7; **Figure 6**; **Appendix 2**). This loose sandy lime mortar has been found in 16th century and mainly 17th century buildings in London (Hayward pers. obs.). It was observed from the base of the wall up to a height of 1.6 to 2.2m. As well as Kentish Ragstone and Reigate stone, a number of fragments of red Tudor/Stuart bricks (fabric *3046)* with a 1450 to 1666 date range, were also found in this

part of the wall. Broken bricks in the same fabric were found in the 1680 north-south stone defensive wall across the wharf (Betts, 2012). A clay tobacco pipe bowl recovered during the dismantling of the outer face was recovered from the inner core (SF 11; spit 8) and is dated 1680-1710.

5.2.4 Although the wall may have been rebuilt in 1632 when it is documented that 105 ft of the old wharf was taken down and rebuilt by William Mason and is recorded as having a rubble core behind a facing of Kentish ashlars (see 4.1.4), the mortar and clay pipe bowl suggests that it was reworked in the late 17th century. During this period, the large north-south defensive wall across the wharf and the narrow Proof House were built in 1680 and 1682, respectively (Mackinder 2012). The north-south wall across the wharf lies a short distance to the east of the recorded length of the South Moat Wall. The 1682 Proof House was a narrow north-south building built in the corner formed by the defensive north-south wall and the South Moat Wall (Building 1; *ibid.*). Alternatively, the recorded South Moat Wall may have been reworked in the early 18th century when the 1709 larger replacement Proof House was built (Building 1; *ibid*.). The Proof House and Proof Yard are shown on the 1742 plan of the east end of Tower Wharf (Keith-Lucas, 2013, fig. 3). The building and yard lie immediately to the south within the wharf and adjacent to this section of the wall with the former just beyond its east end.

5.2.5 The rubble core of the South Moat Wall immediately to the east was revealed in 2012 and is similarly described with Kentish Ragstone and a number of bricks in a yellow sandy mortar with shell inclusions (Mackinder 2012, 4).

5.2.6 Above the loose sandy lime mortar phase of construction and some 0.2 to 0.4m below the top of the wall was a line of large tooled Reigate stone ashlar blocks bonded in a light grey-brown soft mortar with fragments of wood (Type 6) (**Figures 5** and **6**). The date of this construction is not known but may belong to the same 17th/early 18th century phase as the inner rubble core below. However, the Reigate blocks had been disturbed by the insertion of a timber floor in the 19th century (see below). Further to the east neat courses of finely tooled Reigate stone ashlars have been found facing the south elevation of the South Moat Wall (Davies & Norton 2004, fig. 6). These were not visible during this recording exercise but may have been obscured by the inner rubble core at the base of the wall, which was not removed during the current work.

5.2.7 Several pieces of worked stone had been incorporated into the wall. These included a piece of Caen stone which had been carved with a typically Norman/Romanesque (11th/12th century) chevron design (**Plate 8**). Another piece of Caen stone was part of the late medieval (perpendicular) tracery of a window (**Plate 9**) from the inner rubble core at the far west end of spit 8 which is comparable to an example from the collapse of the South Moat Wall further to the east (TOL 92; Davies & Norton 2004, pl. 14) Another Caen block had been chamfered on one side (**Plate 10**). Two pieces of Reigate stone had been worked and appeared to have once formed shafts (**Plates 11** and **12**). A large

block of Reigate stone had been scored with lines (**Plate 13**). Another had a medieval roll-holl moulding (**Plate 14**), while another was L-shaped with a small recess (**Plate 15**). Part of a medieval Westminster plain glazed floor tile fabric (1225-1275) was also found in the wall.

5.2.8 Three brick features were uncovered during the dismantling of the outer face of the wall (**Figure 5**). Flues 1 and 3 were situated towards the east end of the recorded length of wall while Flue 2 lay near the centre. They had been inserted in the inner core of the wall and were visible some 0.5 to 1m down from the top of the wall. Similar features have not previously been found in the two recorded lengths of South Moat Wall to the east (Mackinder 2012; Davies and Norton, 2004). They all had a dark-ashy backfill which suggests that they were flues.

5.2.9 Flue I was visible as a patch of brickwork in the north (outer) elevation of the South Moat Wall before it was dismantled (**Figure 3**). The bricks had been re-pointed in a late 19th/20th century Roman cement. During the lowering of the outer face of the wall, the flue became visible in plan (**Plates 16** and **17**). It had been infilled with fragments of clay peg tile and brick. The square flue had been lined with bricks which had been burnt and blackened with soot (**Plates 18** to **21**). The flue was backfilled with a black ash. Towards the base of the flue it became apparent that two bricks in the north elevation of the outer wall had infilled an opening from the flue (**Plates 22** and **23**). A gulley carved in a large slab of Purbeck limestone (stone 578; 15kg) appeared to have acted as a drain from the base of the flue to the north elevation of the wall (**Plates 23** to **26**). The narrow red bricks (230 x 95-100 x 63mm; fabric *3032R*, *3034R*) lining the flue are in keeping with the legislation on brick size from 1780 to 1850. Flue 1 was the only flue to include some yellow London stock bricks (fabric *3035*), which date from 1780 to 1940. One of these yellow stock bricks was a large 'special' and formed the lintel of the flue opening in the north elevation of the South Moat Wall (**Plates 22** and **23**). The bricks in the flue lining were bonded in a late 18th/19th century pale cream with clinker mortar.

5.2.10 Flue 2 was uncovered towards the centre of the recorded section of the South Moat Wall. It was again first identified in plan within the inner core of the wall during the dismantling of the outer face of the wall (**Plates 27** and **28**). This flue was also lined with bricks and filled with black ash (**Plates 29** and **30**). The red bricks were in fabric *3032R* and *3034R* as in Flue 1 and some narrower bricks were also found above Flue 2. The flue had been constructed in the same late 18th/19th century mortar as Flue 1.

5.2.11 Flue 3 was uncovered between Flues 1 and 2. It was visible as a patch of brickwork in the north elevation of the South Moat Wall before the outer face was dismantled. This flue was also lined with red bricks in fabric *3032R* and *3034R* and filled with black ash (**Plates 31** and **32**) with the same late 18th/19th century mortar as Flues 1 and 2.

5.2.12 The flues were presumably inserted into the South Moat Wall as part of the Small Arms Manufactory, which was constructed on the wharf in 1803 in response to the Napoleonic

Wars. Two patches of brickwork in the north outer face of the South Moat Wall corresponding roughly with Flues 1 and 3 had been re-pointed in a hard dark brown, grey late 19th/20th century Roman cement (Type 4; **Figure 4**).

5.2.13 The dismantling of the outer face of the South Moat Wall uncovered a total of 21 beam slots at the western end of the inner core of the recorded wall. These had been inserted from the south side of the wall. Many of the slots still contained degraded pieces of timber. The slots were larger than the timber joists and had been packed with a hard concrete mortar from the south side of the wall. The slots also contained fragments of red bricks (fabric *3032,* 1666-1900). The brick fragments and hard concrete mortar suggest that the slots are 19th century in date. The floor had clearly been inserted into an adjacent building on the south side of the South Moat Wall, possibly Building 2 or 3 (Mackinder, 2012; fig. 4). These buildings had brick walls, although the latter appears to have had brick floors (*ibid.*). They were part of the Small Arms Manufactory constructed in 1803.

5.2.14 The upper 0.2 to 0.4m of the inner rubble core of the recorded South Moat Wall contained some 19th century stone types, such as Portland Whit Bed, and red bricks (fabric *3032*) bonded in the same hard Portland cement (Type 2) that had been used to re-point the brick and stone facing of the north outer elevation. These brick, mortar and stone types suggest a 19th to early 20th century date and may represent the raising and re-facing of the Moat Wall after the infilling of the moat in 1840 and the clearance of the wharf in the 1860s and 70s.

6 FINDS

6.1 Ceramic Building Material (Kevin Hayward)

6.1.1 Apart from a Westminster Floor Tile, the ceramic building material collected during the dismantling of the outer face of the South Moat Wall consisted of post-medieval brick, roof and floor tiles.

Medieval

6.1.2 A nearly complete 13th century plain glazed yellow Westminster floor tile [24] (120 x 120 x 27mm) was recovered from the inner rubble core of the wall characterised by late 17th/early 18th century loose brown sandy clinker mortar. The tile is in fabric *2892* which dates to 1225 - 1275.

Post Medieval

Brick

6.1.3 Late 16th/17th century red bricks (fabric *3046* (1450-1700)) produced from local brickearth sands formed a small component of the inner rubble core of the South Moat Wall. A small voussoir brick in this fabric was identified bonded in the 18th/19th century Type 6 woody mortar associated with the insertion of the beam slots. Fragments of brick in this fabric were the only bricks found in the lower rubble core associated with the 17th/early 18th century loose brown sandy clinker mortar (Type 7). It is possible that these bricks originate from an earlier building or wall on the wharf.

6.1.4 By contrast, all of the internal structures in the wall including the three flues and the beam slots have examples of purple-brown-red clinker rich post great fire bricks (fabric *3032R*, *3034R* (1666-1900)). They are typically 230 x 105 x 65mm in size, although examples found lining Flue 1 and a group of bricks above Flue 2 are narrower (230 x 95-100 x 63mm). These dimensions are in keeping with the brick legislation on size from 1780 to 1850. One frogged brick from the lowermost corner of Flue 1 is particularly well made, with sharp arrises suggests a construction date of between 1850 and 1900. All the bricks in the flue structures were bonded with a clinker rich late 18th/19th century (Type 11) mortar, whilst those associated with the beam slots have a hard concrete mortar typically produced after the early-mid 19th century. By contrast the brickwork in the north face of the South Moat Wall is bonded in a hard grey shelly 19th/20th century Portland mortar (Type 2).

6.1.5 Yellow London stock bricks (fabric *3035* (1780-1940)) were produced from estuarine clays around the mouth of the Medway from the late 18th century onwards. This brick type was only found in the internal facing of Flue 1. One example was frogged. Another was a very large “special” brick used as a lintel for an opening for this flue (**Plates 22** and **23**).

Peg Tile

6.1.6 Flat rectangular peg tiles in local common London sandy fabric *2276* had been used to infill 19th century Flues 1 to 3. They had all been burnt. Their fine moulding sand indicates a date of 1700 to 1900.

Pan Tile

6.1.7 A 17th to 19th century curved pan tile was used to line Flue 3.

Floor Tile

6.1.8 A large (35mm thick) plain-glazed bevelled edged floor tile in local red sandy fabric *3047* (1690-1900) was recovered from the capping of Flue 2.

6.2 The Stone (Kevin Hayward)

6.2.1 A number of stone types (**Appendix 1**) were identified in the external face and inner rubble core of the recorded South Moat Wall. The main types are described below in order of their frequency:

Kentish Ragstone 3105/Hassock stone 3106

A hard dark grey calcareous sandstone - Lower Greensand (Lower Cretaceous) West Kent/East Surrey – Maidstone area interbedding with the softer glauconitic Hassock stone

6.2.2 Kentish Ragstone/Hassock stone was the most common stone type within the wall (estimated 75% of all stone). This robust Wealden stone was commonly used in the Roman Town wall and in the construction of the Tower of London.

Portland stone (Whit Bed) 3110PM

Very fine grained oolitic-pelletal grainstone – Upper Jurassic (Portlandian) Isle of Portland Dorset

6.2.3 Portland Whit Bed was used for the coping stones and was also commonly found in the inner rubble core of the recorded South Moat Wall, particularly in the uppermost 0.4m associated with 19th/20th century Portland cement (Type 2). Most of the stone fragments had once been worked as tool marks are apparent on their surfaces. A fragment of a cornice was found associated with 19th/20th century Portland cement (Type 2) from the top of the inner core.

6.2.4 Portland stone only began to be used in London on a large scale from the late 17th century onwards, although it was used at the Tower by Inigo Jones in the 17th century (Keith-Lucas, 2013, 6). This stone type was not found in the lower 1.5m of the inner rubble core.

Purbeck Limestone 3126

Hard dark grey fissile shelly limestone packed with banded black or grey/white oyster fragments Upper Jurassic (Purbeckian) Isle of Purbeck, Dorset

6.2.5 Flaggy slabs/blocks of this fossiliferous limestone were found in the upper 0.4m of the inner core of the recorded South Moat Wall. A large (15kg) flagstone (stone 578) had a carved gulley (**Plate 26**). It was found at the base of 19th century Flue 1. Like Portland stone, Purbeck limestone only began to be used in London on a large scale from the late 17th century onwards. This stone type was not found in the lower 1.5m of the inner rubble core.

Reigate stone 3107

A fine grained micaceous glauconitic sandstone – Upper Greensand (Lower Cretaceous) Reigate-Mertsham, Surrey

6.2.6 Dismantling of the outer facing wall of the recorded length of the South Moat Wall uncovered a large number of low density Reigate stone ashlar, typically 240 x 180 x 120mm in size. Unlike the adjoining section of the wall, where the Reigate stone formed regular facing blocks (Mackinder 2012, 4), these had been disturbed and re-inserted at fairly regular intervals by the inserted 19th century timber floor. They were found some 0.8 to 2m from the top of the wall and were associated with 17th/early 18th century brown mortar (Type 7). One large lump of Reigate stone was scored with incised lines (**Plate 13**).

6.2.7 Moulded Reigate stone found in the wall included a piece with medieval roll-holl moulding adjacent to Flue 1 (**Plate 14**) and a number of shafts (**Plates 11** and **12**). These were also associated with the 17th/early 18th century brown mortar (Type 7).

Caen stone 3119

Fine yellow pelletal limestone (packstone) Middle Jurassic (Bathonian) Caen, Normandy

6.2.8 This high quality French limestone is more conducive to intricate carving than the softer Reigate stone. One example of high quality carving included a rare fragment of a Norman/Romanesque 11th/12th century chevron arch found adjacent to Flue 1 (**Plate 8**). This may have come from a former medieval building within the Tower of London. Caen stone is the most important freestone material associated with the White Tower (Worssam & Sanderson 2008).

Flint 3117

Hard fine chemically precipitated silica rock with fine chonchoidal fracture Upper Cretaceous (Upper Chalk) Thames Basin

6.2.9 Only a couple of fragments of flint were recorded within the inner rubble core of the South Moat Wall.

6.3 Clay Tobacco Pipe (Chris Jarrett)

6.3.1 Only eight examples of Clay Tobacco Pipe were recorded (**Table 1**). Although there is a wide date range for the stems, the bowls (SF 8 from Spit 1 and SF 11 from Spit 8) are late 17th/early 18th century in date.

Table 1: Clay tobacco pipes found in the inner core of the South Moat Wall

SF Number	Context	Object Type	Material	Comments	Date
1	Spit 5	CTP	Clay	Clay Pipe Stem	1580-1910
2	Spit 5	CTP	Clay	Clay Pipe stem	1580-1910
4	Spit 4	CTP	Clay	Clay Pipe Stem	
8	Spit 1	CTP	Clay	Clay Pipe Bowl	1700-1740
11	Spit 8	CTP	Clay	Clay Pipe Bowl	1680-1710
13	Spit 5	CTP	Clay	Clay Pipe Stem	1580-1910
25	Spit 8	CTP	Clay	Stem and start of bowl	1580-1910
26	Spit 1	CTP	Clay	Stem	1580-1910

6.4 Pottery (Chris Jarrett)

6.4.1 A sherd of pottery (SF12) was found in Spit 1 of the inner core of the South Moat Wall. It was a piece of 17th century Surrey-Hampshire Border White ware with brown glaze. This fabric was also identified in the Wharf Cafe area (Blackmore 2012).

Table 2: Pottery found in the inner rubble core of the South Moat Wall

Find Number	Context	Object Type	Material	Comments	Date
12	Spit 1	Pottery	Clay	BORDB Surrey-Hampshire border Whiteware with brown glaze	1600-1700

6.5 Animal Bone (Kevin Reilly)

Table 3: Animal bone found in the inner rubble core of the South Moat Wall

Find No.	Context	Comments
3	Spit 2 east end	Cattle 2nd phalange (large) from late post-medieval animal
5	Spit 5 (within Flue 2)	Sheep-size lumbar vertebra fragment, goose humerus shaft
7	Spit 4 rubble fill west end	Sheep-size lumbar vertebra
18	Spit 6 top rubble infill Flue 2	Sheep/size maxillary molar
20	Spit 5	Cattle scapula shaft

6.6 Metal and Slag

6.6.1 Iron objects recovered during the dismantling of the outer face of the South Moat Wall

included nails, a peg and a spike. Hoop iron had been used in the brickwork of the external face of the wall (**Plate 3**).

Table 4: Iron objects and slag found during the dismantling of the outer face of the South Moat Wall

Find No.	Context	Object Type	Comments
6	West behind facing stone 421	Iron slag	19th century mortar attached
9	Spit 6 rubble infill between Flues 2 and 3	Iron spike	Attachment
14	Behind facing stone 493	Iron slag	18-19th century mortar attached
15	Top of Flue 3	Iron peg	Large iron peg
16	Spit 5 iron strap east side stone 519	Iron strap	Large Iron Strap attachment 18th-19th century mortar
17	Just above brick line beneath facing stone 426	Hoop iron	Hoop iron used to steady bowing out of brick wall associated with C20 Roman cement
19	Top of Flue 3	Iron nail	Corroded Iron Nail
21	Spit 8	Iron strap	Heavily corroded
22	Spit 8	Iron nail	Attached to peg tile
23	Spit 8	Iron nail	Large Iron nail/spike

7 CONCLUSION

7.1 The built heritage watching brief during the dismantling of the north outer face of part of the South Moat Wall has added to our understanding of the South Moat Wall and the wharf (Davies and Norton, 2004; Mackinder, 2012). The earliest chalk and flint wall of 1389 was not observed, as recorded some 5m to the east (Davies & Norton, 2004, 5). The earliest part of the wall that was recorded was the inner rubble core. This was characterised by Kentish Ragstone rubble and Reigate stone with fragments of mid 15th to late 17th century bricks bonded in a loose brown sandy mortar with clinker and calcareous inclusions. A clay tobacco pipe bowl found within this part of the structure dates from 1680 to when it is documented that 105 ft of the old wharf was taken down and rebuilt by William Mason and is recorded as having a rubble core behind a facing of Kentish ashlars. It appears to have been reworked in the late 17th or early 18th century when the adjacent Proof House and Proof Yard were built to test gun barrels.

7.2 Large blocks of tooled Reigate stone in the upper part of the inner core of the wall appear to have been reworked in the same late 17th/early 18th century period. However, these had been disturbed by the insertion of a 19th century timber floor.

7.3 Three brick flues had been inserted into the inner core of the wall. They had been filled with black ash and the bricks that lined their sides had been burnt and blackened. One of the flues had a large limestone slab at its base with a gulley carved in it that drained into the moat. The flues appear to have been inserted in the early 19th century in connection with the Small Arms Manufactory constructed on the wharf in 1803.

7.4 A horizontal row of 21 beam slots inserted into the Reigate stone part of the inner core indicate the position of a former timber floor on the south side of the wall. Hard concrete mortar associated with the beam slots suggest a 19th/20th century date for the floor. It is thought that the floor was associated with one of the early 19th century Small Arms Manufactory buildings, such as Buildings 2 or 3, the brick walls of which were found during recent archaeological investigations (Mackinder, 2012).

7.5 The outer north face of the South Moat Wall had been re-pointed in 19th/20th century Portland cement. Much of the lower part of the wall had been rebuilt in 19th century red brick. The stone part of the wall was mainly built of Kentish Ragstone. The wall may have been rebuilt in 1632 when it is documented that 105 ft of the old wharf was replaced with a new wall with a rubble core behind a facing of Kentish ashlars (see 4.1.4).

7.6 A number of medieval worked stone pieces were found within the South Moat Wall, including part of a Caen stone 11th/12th century Romanesque chevron arched moulding and a decorative late medieval (perpendicular) Caen stone window tracery. Part of a medieval Westminster plain glazed floor tile fabric (1225-1275) was also found. These medieval high-status items may have become incorporated into the wall as a result of being stored on the wharf. Here materials needed for work on the Tower were worked and stored in the late 16th century.

7.7 It is recommended that the results of this archaeological work are published in an article that includes the results of other pieces of archaeological investigation on the moat wall and the wharf. The latter is an extremely interesting part of the Tower of London where ordnance and small arms were manufactured, goods were loaded and unloaded onto boats in the Thames, materials for use on the Tower were worked and stored. The 1742 plan shows the wharf covered with a range of structures including a wheelwright's shed, a proof house, a proof yard, stables, a forge, shops and warehouses. The results of the current recording further adds to our understanding of this area of the Tower of London.

8 ACKNOWLEDGEMENTS

8.1 Pre-Construct Archaeology Limited would like to thank Historic Royal Palaces for commissioning the built heritage recording of part of the South Moat Wall. The help and assistance of Alex Attelsey, Alden Gregory and Fiona Keith-Lucas at Historic Royal Palaces is gratefully acknowledged.

8.2 The built heritage recording was managed for Pre-Construct Archaeology by Charlotte Matthews. The on-site recording was undertaken by Paul McGarrity, Kevin Hayward and Adam Garwood. Strephon Duckering, photographer, and Rik Archer, surveyor carried out the photographic survey and surveying to produce the rectified and 3d photogrammetric images. Marcus Abbott at ArcHeritage processed Strephon's photographs to produce the 3d photogrammetric image. Paul and Kevin wrote this report and Mark Roughley prepared the illustrations.

9 BIBLIOGRAPHY

Published and Secondary Sources

Betts, I.M. (2012). *Building Materials.* In MoLA (2012) HM Tower of London Wharf Cafe; London EC3. (TOL 109). Unpublished post-excavation assessment. MoLA

Blinkhorn, P. (2004*). Appendix 2 Pottery Assessment/Spot Dating.* In Davies, T. & Norton, A. (2004). H.M. Tower of London Moat Revetment Wall Restoration (TOL 92). Unpublished Investigation Report prepared by Oxford Archaeology.

Blackmore, L. (2012). *Clay Tobacco Pipe.* In MoLA (2012) HM Tower of London Wharf Cafe; London EC3. (TOL 109). Unpublished post-excavation assessment. MoLA

Blackmore, L. (2012). *The Pottery*. In MoLA (2012) HM Tower of London Wharf Cafe; London EC3. (TOL 109). Unpublished post-excavation assessment. MoLA

Davies, T. & Norton, A. (2004). H.M. *Tower of London, Moat Revetment Wall Restoration; Archaeological Investigation Report* Oxford Archaeology. TOL 92.

Dodds, D. 2003. *Tower of London: North wharf wall collapse.* Oxford Archaeology, Unpublished report. TOL 91

English Heritage (2009). *Greater London Archaeology Advisory Service; Standards for Archaeological Work.* London Region, English Heritage. External (online) Consultation Draft.

Hayward, K.M.J. (2014). *Assessment report of the results of the Historic Building Recording of the Develin Tower, H.M. Tower of London, London, EC3 (TOL141).* Unpublished report, Pre-Construct Archaeology.

Hayward, K.M.J. (in prep.) *Petrology of the moulded stone*. In Douglas, A. (in prep) Excavations at Bermondsey Square, Southwark. Forthcoming PCA monograph

Impey, E. and Parnell, G. (2000), *The Tower of London: The Official Illustrated History*, Merrell Publishers in association with Historic Royal Palaces

Keay, A. 2001 *The Elizabethan Tower of London. The Haiward and Gascoyne plan of 1597*. London Topographical Society, Publication No. 158

Keevill, G. 2004. *The Tower of London Moat; Archaeological Excavations 1995-9.* Oxford, Oxford

Archaeology with Historic Royal Palaces.

Keith-Lucas, F. (2013). *Brief for archaeological recording and watching brief, Moat south wall, TOL 139, HM Tower of London.* Unpublished Document Historic Royal Palaces

Mackinder, T. (2012). *H.M. Tower of London; Wharf Café. Post excavation assessment*. London. Museum of London Archaeology, Unpublished document TOL 109 (WTX10)

Oxford Archaeology, 2000. *The Wharf, The Tower of London; Archaeological Watching Brief.* TOL 83

Sanderson, R.W. (1998). *Petrological analysis of some building stones from the White Tower, South Elevation, H.M. Tower of London. Unpublished report.*

Spooner, J. 2004. *Desk-top Survey of the moat*. Unpublished internal document, Historic Royal Palaces.

Spooner, J. 2009. *The Wharf Chronology.* Unpublished internal document, Historic Royal Palaces.

Stanier, P. (2000). *Stone quarrying landscapes*. Tempus, Stroud.

Wood, D. 1998. *Tower of London Archaeological Recording; TOL 78.* Unpublished report, Oxford Archaeological Unit. TOL 78

Worssam, B.C. & Sanderson, R.W. (1998). *Geology of the White Tower South Elevation, H.M. Tower of London*. Unpublished petrological assessment

Worssam, B.C. & Sanderson, R.W. (2008). *Appendix III. Petrography of the South Elevation* in E. Impey (Ed.) (1998) *The White Tower*, Yale University Press, London: 305-306.

APPENDIX 1: Stone types identified in the South Moat Wall

Listed below by frequency of occurrence (from most to least) in the north elevation of the South Moat Wall

Kentish Ragstone/Hassock stone: Hard dark grey calcareous sandstone - Lower Greensand (Lower Cretaceous) West Kent/East Surrey – Maidstone area interbedding with the softer glaucontiic Hassock stone

Portland stone (Whit Bed): Very fine grained oolitic-pelletal grainstone – Upper Jurassic (Portlandian) Isle of Portland Dorset

Purbeck Limestone: Hard dark grey fissile shelly limestone packed with banded black or grey/white oyster fragments Upper Jurassic (Purbeckian) Isle of Purbeck, Dorset

Reigate stone: Fine grained micaceous glauconitic sandstone – Upper Greensand (Lower Cretaceous) Reigate-Merstham, Surrey

Caen stone: Fine yellow pelletal limestone (packstone) Middle Jurassic (Bathonian) Caen, Normandy

Flint: Hard dark-grey chemical precipitated siliceous rock. Upper Chalk (Upper Cretaceous) Thames Valley

Taynton stone: orange banded shelly oolitic limestone. Middle Jurassic (Bathonian) Taynton/Burford, West Oxfordshire

Tufa: white nodular low-density calcareous spring water deposit. Holocene River Thames and its tributaries or the River Medway

Fine Granite: fine crystalline pink/grey igneous rock: Pre-Cambrian/ Palaeozoic western or northern Britain with many possible sources such as Cornwall, Cumbria or Scotland

Aberdeen Granite: coarse pale grey to pink two mica igneous rock. Cambrian, Aberdeenshire

APPENDIX 2: Mortar types identified in the South Moat Wall

Mortar Type	Description	Date/Association
T1		Early 21st century mortar used to point the South Moat Wall to the east of the recorded length of wall (**Figure 4**).
T2	Portland type mortar: Fine hard light grey-brown concretionary shelly lime quartz mortar, occasional small flecks of charcoal	19th/20th century mortar Associated with nearly all of the external north elevation brickwork and the Kentish Ragstone of the refaced South Moat Wall. It was also found on some Portland stone and Reigate stone and in the brick infill of Flue 1 (**Figures 4** and **6**)
T3	Hard black render/mortar	Late 19th/early 20th century mortar(**Figure 4**)
T4	Roman cement: Very hard fine dark brown-grey cementitious mortar. Weathers light brown on surface	Late 19th/20th century repairs. Repointing of patches of brickwork in the north outer face associated with Flues 1 and 3. Associated with a patch of stonework repairs in the inner core (**Figures 4** and **6**).
T5	Tufaceous Mortar: White mortar with tufa like residue.	Date not known (**Figure 6**) Limited to a single example of Reigate stone from the inner core of the wall. It was possibly a calcareous residue rather than a mortar.
T6	Loose light grey sandy lime mortar	18th/19th century (**Figure 6**)
T7	Loose brown sandy clinker mortar	17th/early 18th century (**Figure 6**) The most common mortar type to be used in the inner rubble core of the South Moat Wall.
T8	Hard very dark grey concrete type mortar. Like T4 but with angular red brick inclusions and flint up to 30mm.	Late 19th/20th century (**Figure 6**) Identified in the rubble infill of Flue 2 was possibly the mortar sealing this feature.
T9	Light-cream-grey concrete mortar similar to T8 with large flint inclusions and no brick inclusions.	20th century (**Figure 4**) Associated with Portland stone coping stones.

Mortar Type	Description	Date/Association
T10	Crumbly gravel mortar	Late 19th – early 20th century (**Figure 4**)
T11	Pale cream to dark grey mortar, softer than T1 with numerous charcoal/clinker inclusions	Late 18th century to mid-late 19th century (**Figure 6**) Adhered to the peg tile, brick and Purbeck limestone associated with Flues 1 and 3 including their blocking up and possible render.

APPENDIX 3: Oasis Form

OASIS ID: preconst1-186265

Project details

Project name	South Moat Wall, Tower of London
Short description of the project	Pre-Construct Archaeology was commissioned by Historic Royal Palaces to undertake built heritage recording of a 15m stretch of the South Moat Wall at HM Tower of London, London Borough of Tower Hamlets. The Tower of London is a Scheduled Monument, a World Heritage Site and lies in a Conservation Area. The South Moat Wall is Listed Grade II*. The recording was carried out as a condition of Scheduled Monument Consent for the rebuilding of this section of wall from March to May 2014. The earliest part of the wall that was recorded was the inner rubble core and the upper part of the inner core which was characterised by large blocks of tooled Reigate stone. These parts of the wall are thought to have been rebuilt in 1632 and reworked in the late 17th or early 18th century. Three brick flues had been inserted into the inner core of the wall in the early 19th century in connection with a Small Arms Manufactory. The outer north face of the South Moat Wall had been re-pointed in 19th/20th century Portland cement. Much of the lower part of the wall had been rebuilt in 19th century red brick. The stone part of the wall was mainly built of Kentish Ragstone. Although the wall may have been rebuilt in the 17th century it had many later repairs. A number of medieval worked stone pieces were found within the South Moat Wall.
Project dates	Start: 19-03-2014 End: 23-05-2014
Previous/future work	Yes / Yes
Any associated project reference codes	TOL 139 - Sitecode
Type of project	Building Recording
Site status	Scheduled Monument (SM)
Site status	Conservation Area
Site status	Listed Building

Current Land use	Other 6 - Land boundary
Monument type	WALL Post Medieval
Significant Finds	WORKED STONE Medieval
Significant Finds	FLOOR TILE Medieval
Methods & techniques	"Measured Survey","Photogrammetric Survey","Photographic Survey","Rectified photography","Survey/Recording Of Fabric/Structure"
Prompt	Scheduled Monument Consent

Project location

Country	England
Site location	GREATER LONDON TOWER HAMLETS TOWER HAMLETS South Moat Wall, Tower of London
Postcode	E1W 1LE
Study area	0 Square metres
Site coordinates	TQ 33690 80435 51.5065121757 -0.0734425197735 51 30 23 N 000 04 24 W Point

Project creators

Name of Organisation	Pre-Construct Archaeology Limited
Project brief originator	Historic Royal Palaces
Project design originator	Fiona Keith-Lucas
Project director/manager	Charlotte Matthews
Project supervisor	Kevin Hayward
Project supervisor	Paul McGarrity
Type of sponsor/funding body	Historic Royal Palaces

Name of sponsor/funding body	Historic Royal Palaces

Project archives

Physical Archive recipient	Historic Royal Palaces
Physical Archive ID	TOL 139
Physical Contents	"Animal Bones","Ceramics","Worked stone/lithics"
Digital Archive recipient	Historic Royal Palaces
Digital Archive ID	TOL 139
Digital Contents	"Animal Bones","Ceramics","Worked stone/lithics"
Digital Media available	"Images raster / digital photography","Survey","Text"
Paper Archive recipient	Historic Royal Palaces
Paper Archive ID	TOL 139
Paper Contents	"Animal Bones","Ceramics","Survey","Worked stone/lithics"
Paper Media available	"Report","Survey "

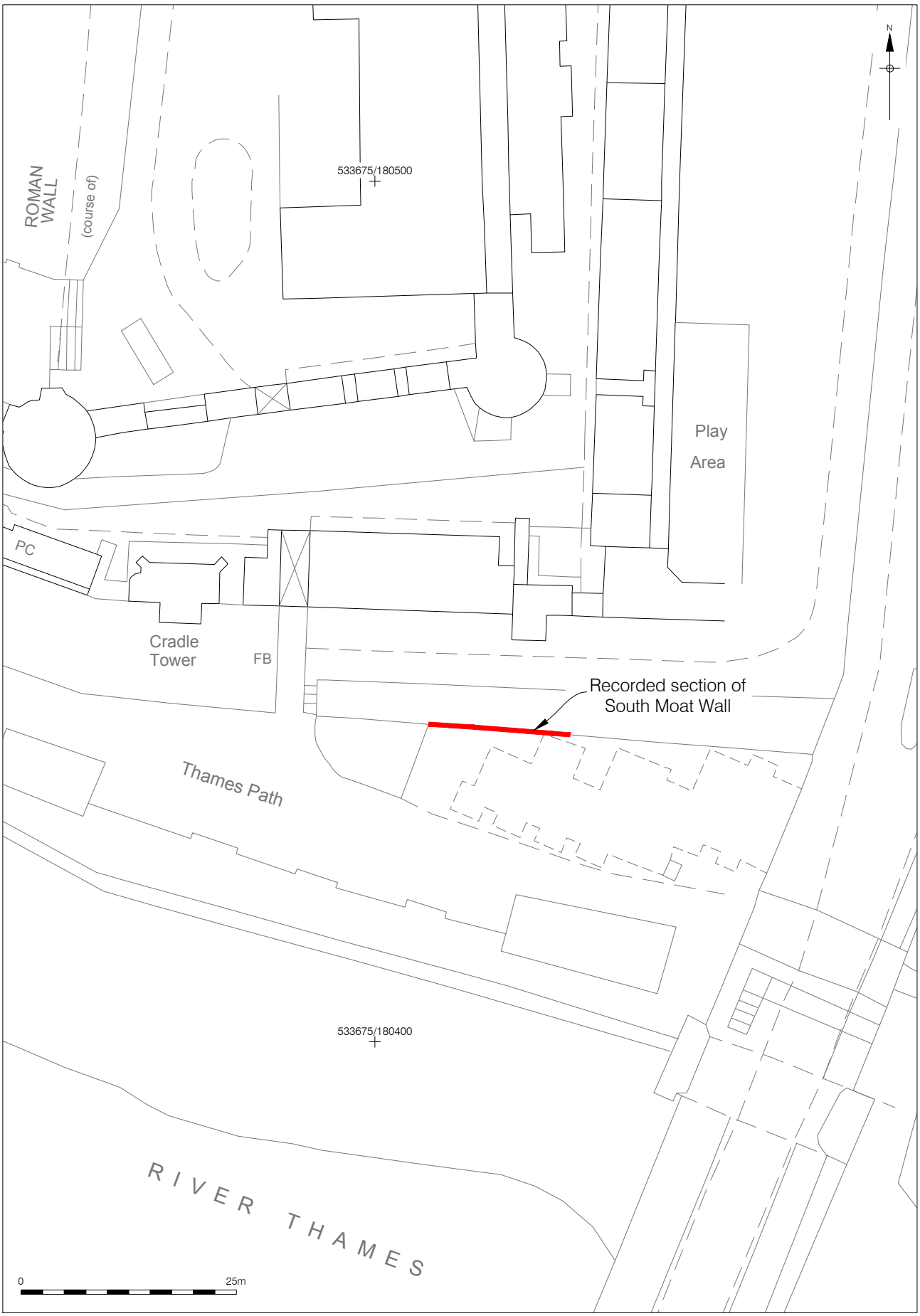
Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Assessment Report on the Built Heritage Recording of a length of the South Moat Wall, HM Tower of London, London Borough of Tower Hamlets
Author(s)/Editor(s)	Hayward, K. and McGarrity, P.
Other bibliographic details	PCA Report No R11796
Date	2014

Issuer or publisher	Pre-Construct Archaeology Limited
Place of issue or publication	Brockley, London
Description	A4 report
Entered by	Charlotte Matthews (cmatthews@pre-construct.com)
Entered on	31 July 2014

29/07/14 MR

Figure 1
Site Location
1:12,500 at A4

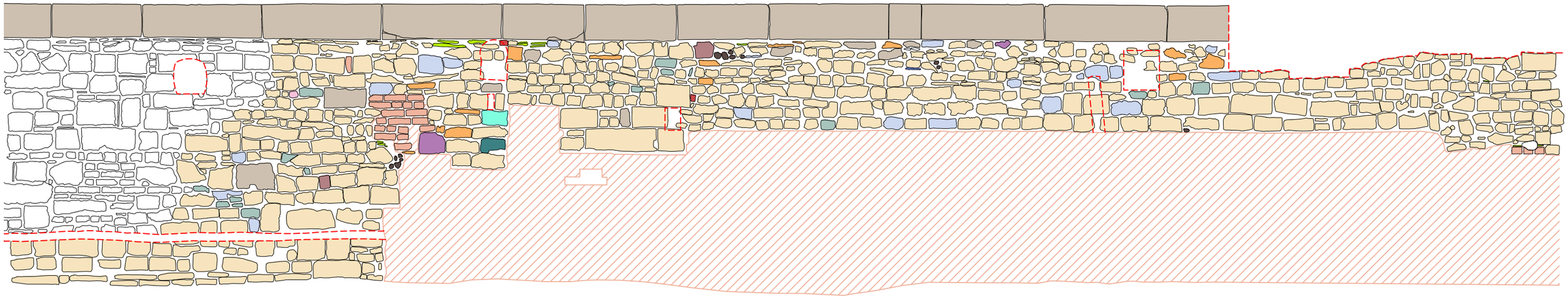


29/07/14 MR

Figure 2
Detailed Site Location
1:625 at A4

EAST

WEST



Kentish Ragstone
Hassock stone
Portland stone
Caen stone
Reigate stone
Purbeck Limestone
Flint
Aberdeen Granite
Fine Granite
Taynton stone
Tufa
Tudor brick
Post-Medieval brick
Brick
Tile
Obscured/Partially obscured

0 2m

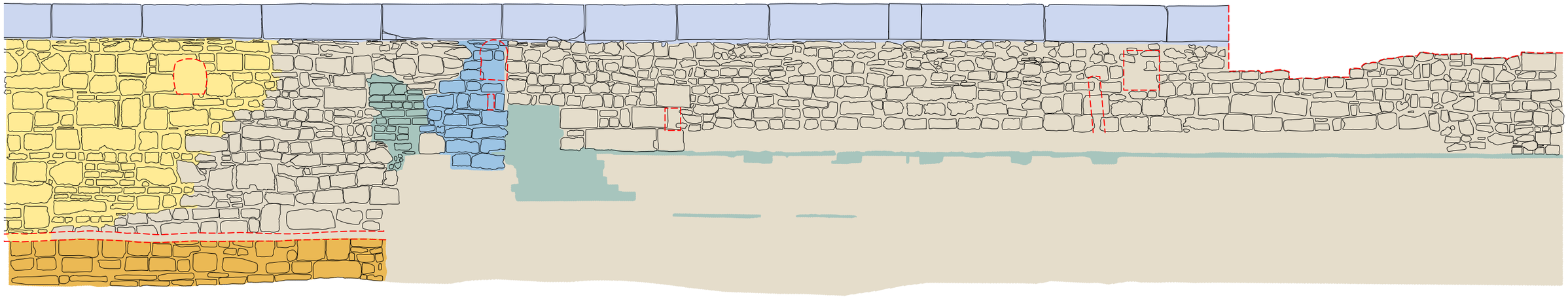
5.00mOD
4.00mOD
3.00mOD
2.00mOD

30/07/14 MR

Figure 3
North elevation of the South Moat Wall
1:40 at A3

EAST

WEST



Type 1: Hard light grey-brown Portland type mortar
Date: C19th-20th

Type 2: Pale cream-dark grey clinker/charcoal rich mortar
Date: Late C18th - Mid/Late C19th

Type 3: Pale cream-dark grey clinker/charcoal rich mortar
Date: Late C18th - Mid/Late C19th

Type 4: Roman mortar. Very hard fine dark brown-grey concretionary mortar
Date: Late C19th - C20th

Type 9: Light cream-grey concrete mortar
Date: C20th

Type 10: Very loose grey mortar
Date: C18th - C19th

Obscured/Partially obscured

0 2m

5.00mOD

4.00mOD

3.00mOD

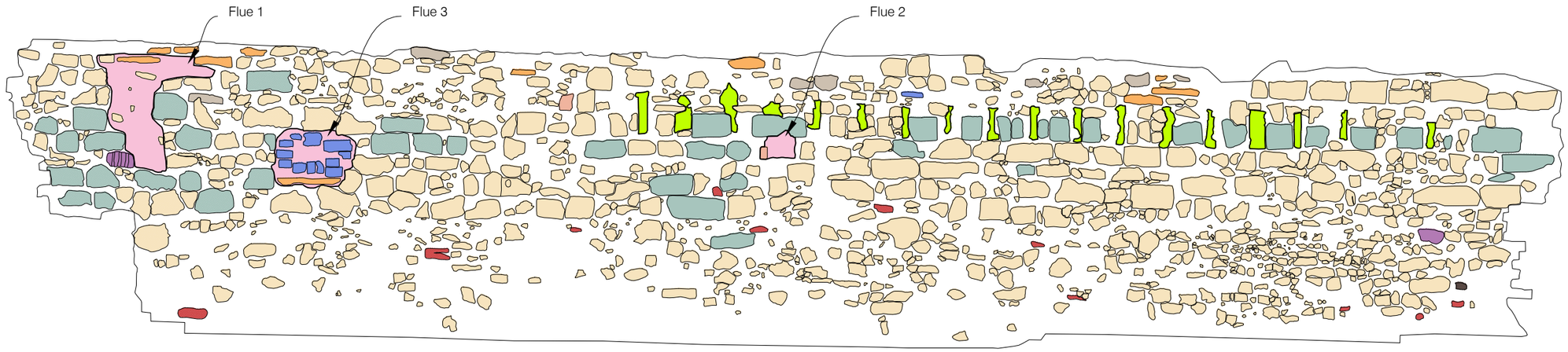
2.00mOD

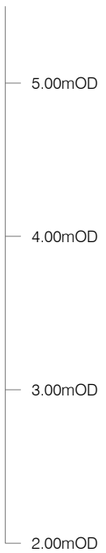
30/07/14 MR

Figure 4
Mortar types in the north elevation of the South Moat Wall
1:40 at A3

EAST

WEST





Kentish Ragstone
Caen stone
Tudor brick
Flue
Reigate stone
Purbeck Limestone
Post-Medieval brick
Beam slots
Portland stone
Flint
Brick

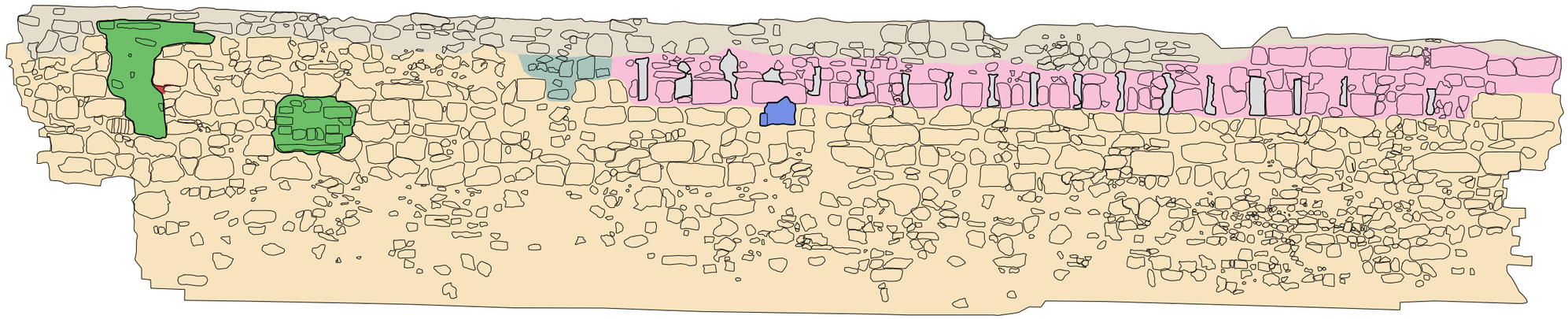
0 2m

30/07/14 MR

Figure 5
North elevation of the inner core of the South Moat Wall
1:40 at A3

EAST

WEST



5.00mOD

4.00mOD

3.00mOD

2.00mOD

Type 2: Pale cream-dark grey clinker/charcoal rich mortar
Date: Late C18th - Mid/Late C19th

Type 4: Roman mortar. Very hard fine dark brown-grey concretionary mortar
Date: Late C19th - C20th

Type 5: Tufaceous mortar - white mortar with tufa like residue
Date: not known

Type 6: Loose grey sandy lime mortar
Date: C18th - C19th

Type 7: Loose brown sandy clinker mortar
Date: C17th - Early C18th

Type 8: Hard very dark grey concrete type mortar with angular red brick inclusions
Date: Late C19th - C20th

Type 11: Pale cream to dark grey mortar with charcoal/clinker inclusions
Date: Late C18th - Mid/Late C19th

Beam slots

0 2m

30/07/14 MR

Figure 6
Mortar types in the north elevation of the inner core of the South Moat Wall
1:40 at A3

Plate 1: West end of the recorded length of the north elevation of the South Moat Wall (photograph provided by Alex Attelsey)

Plate 2: West end of the recorded length of the north elevation of the South Moat Wall (photograph provided by Alex Attelsey)

Plate 3: Hoop iron in a mortar joint within the brickwork of the outer north elevation found during dismantling, looking south

Plate 4: Bowing of the South Moat Wall at the west end of the recorded length, looking west

Plate 5: Lean of the brickwork in the recorded South Moat Wall, looking east

Plate 6: Tree roots observed once the outer face of the South Moat Wall had been dismantled, looking east

Plate 7: Dismantling of the outer face at the top of the South Moat Wall, looking east

Plate 8: Moulded Caen stone within the inner rubble core to the east of Flue 1, looking south

Plate 9: Window tracery in Caen stone found during the dismantling of the outer face of the South Moat Wall

Plate 10: Caen stone chamfered on one side found during the dismantling of the outer face of the South Moat Wall

Plate 11:Worked Reigate stone possibly from a shaft found during the dismantling of the outer face of the South Moat Wall

Plate 12:Worked Reigate stone possibly from a shaft found during the dismantling of the outer face of the South Moat Wall

Plate 13: Reigate stone with incised lines within the inner rubble core to the east of a beam slot, looking south

Plate 14: Reigate stone with medieval roll-holl moulding within the inner rubble core to the east of Flue 1, looking south

Plate 15: Worked Reigate stone within the inner rubble core, looking south

Plate 16: Plan view of Flue 1, looking down and south

Plate 17: Plan view along the top of the wall during dismantling showing rubble inner core and Flue 1, looking down and south-east

Plate 18: Plan view of Flue 1 during dismantling, looking down and south

Plate 19: Plan view of Flue 1 during dismantling, looking down and south

Plate 20: Plan view of Flue 1 during dismantling, looking down and south

Plate 21: Plan view of Flue 1 during dismantling, looking down and south

Plate 22: North elevation of Flue 1 during dismantling, looking south

Plate 23: North elevation of Flue 1 during dismantling, looking south

Plate 24: Plan view of Flue 1 during dismantling, looking down and south

Plate 25: Plan view of Flue 1 during dismantling, looking down and south

Plate 26: Plan view of *ex-situ* stone spout at the base of Flue 1 (0.5m scale)

Plate 27: Plan view of Flue 2 during dismantling, looking down and south

Plate 28: Plan view of Flue 2 during dismantling, looking down and south

Plate 29: Plan view of Flue 2 during dismantling, looking down and south

Plate 30: Plan view of Flue 2 during dismantling, looking down and south

Plate 31: Flue 3 during dismantling, looking south

Plate 32: Flue 3 during dismantling, looking south

P C A

PCA SOUTH
UNIT 54
BROCKLEY CROSS BUSINESS CENTRE
96 ENDWELL ROAD
BROCKLEY
LONDON SE4 2PD
TEL: 020 7732 3925 / 020 7639 9091
FAX: 020 7639 9588
EMAIL: info@pre-construct.com

PCA NORTH
UNIT 19A
TURSDALE BUSINESS PARK
DURHAM DH6 5PG
TEL: 0191 377 1111
FAX: 0191 377 0101
EMAIL: info.north@pre-construct.com

PCA CENTRAL
THE GRANARY, RECTORY FARM
BREWERY ROAD, PAMPISFORD
CAMBRIDGESHIRE CB22 3EN
TEL: 01223 845 522
FAX: 01223 845 522
EMAIL: info.central@pre-construct.com

PCA WEST
BLOCK 4
CHILCOMB HOUSE
CHILCOMB LANE
WINCHESTER
HAMPSHIRE SO23 8RB
TEL: 01962 849 549
EMAIL: info.west@pre-construct.com

PCA MIDLANDS
17-19 KETTERING RD
LITTLE BOWDEN
MARKET HARBOROUGH
LEICESTERSHIRE LE16 8AN
TEL: 01858 468 333
EMAIL: info.midlands@pre-construct.com