



Land at Northfleet Embankment West SMS Gravesham, Kent

Written Scheme of Investigation for
Archaeological Excavation

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Northfleet Embankment West SMS Gravesham, Kent

Written Scheme of Investigation for Archaeological Excavation

1 INTRODUCTION

1.1 Project and planning background

1.1.1 Wessex Archaeology has been commissioned by RPS Consulting Services Ltd. ('the client'), to produce a written scheme of investigation (WSI) for a proposed archaeological strip, map and sample excavation of a several areas situated within the former Northfleet Cement Works, Gravesham, Kent (hereafter 'the Site'). The excavation area is centred on NGR TQ 61920 74778 (**Fig. 1**).

1.1.2 The proposed development comprises the construction of residential and commercial properties, an open playing field and a Heritage Park, along with associated ground works. Planning permission for EDC/16/0004 was granted in June 2018.

1.1.3 Overall development proposals consist of:

- Residential development in the western area of the Site, following ground regrading. This regrading will involve cut and fill involving infilling areas to the north and cutting down of areas to the south, in order to create a smooth gradient northward towards the river;
- An open playing field and Heritage Park in the eastern part of the Site, to be created with elements of cut and fill, and
- Additionally, the two areas of former quarry to the southwest and southeast of the High Street are to be developed for employment purposes.

1.1.4 As a result of the discovery of extensive remains associated with the former 19th century cement works on site the County Archaeologist for Kent County Council (KCC) issued a brief for archaeological excavation and recording of several parts of the exposed remains (Appendix 1).

1.1.5 The proposed excavation has been preceded by archaeological works including Palaeolithic archaeological and geoarchaeological excavation (Wessex Archaeology 2021) followed by an archaeological watching brief (Wessex Archaeology Ongoing).

1.2 Scope of document

1.2.1 This WSI sets out the aims of the excavation, and the methods and standards that will be employed. In format and content, it conforms to current best practice, as well as to the guidance in *Management of Research Projects in the Historic Environment* (MoRPHE, Historic England 2015a), the Chartered Institute for Archaeologists' (CifA) *Standard and guidance for archaeological excavation* (CifA 2014a) and the KCC *Manual of Specifications Part B: Mitigation – Strip, Map and Sample Requirements*.



- 1.2.2 This document will be submitted to the County Archaeologist to KCC, archaeological advisor to the Local Planning Authority (LPA), for approval, prior to the start of the excavation.

1.3 Location, topography and geology

- 1.3.1 The proposed excavation area is located adjacent to the south bank of the Thames and comprises a large block of land within the former Northfleet Cement Works, Northfleet, Gravesend, Kent, DA11 9AN. The site is surrounded by previously quarried land, and much of the site itself was previously quarried.
- 1.3.2 The natural ground surface reaches c. 30m above Ordnance Datum (aOD) at the southern boundary of the Site. Ground levels within the Site are often substantially lower than they would otherwise have been prior to quarrying (despite substantial backfilling), but generally the ground within the Site slopes down northward to c. 5m aOD.
- 1.3.3 The Northfleet Cement Works were set up as the Knight, Bevan and Sturge Works in the 1850s. These works were reconfigured in 1905 and rebuilt twice, in 1926 and then 1958, before parts were incorporated within the new Northfleet Works, constructed between 1969 and 1970. Cement production ceased at the Site in 2008 and the buildings demolished.
- 1.3.4 The proposed excavation area within the site consists of concrete hard standing where the now demolished cement buildings once stood. A significant portion of this concrete hard standing has been removed during the archaeological watching brief (2021).
- 1.3.5 According to the British Geological Survey mapping (BGS online viewer), the bedrock geology underling the Site consists of Upper Cretaceous deposits of the Seaford Chalk Formation (89.8 – 86.3 MA). At the highest, southernmost part of the Site, this is overlain by Thanet Sand (59.2 – 56.0 MA). Overlying superficial deposits are only recorded along the southern edge and within the western part of the Site. These consist of Pleistocene deposits of the Boyn Hill/Orsett Heath terrace (430 – 350 Ka) of the Thames terrace sequence. It should be noted, however, that the results of previous Palaeolithic archaeological evaluation by Wessex Archaeology in 2019/20 suggests that these terrace deposits belong to an unmapped outcrop of the younger Lynch Hill/Corbets Tey terrace (350 – 280 Ka). (Wessex Archaeology, 2021).

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND.

2.1 Introduction

- 2.1.1 The archaeological background of the site has been assessed in previous works, including the watching brief WSI and is not reproduced in full here.

2.2 Previous investigations within the site

Northfleet Cement Works, Kent Archaeological (Palaeolithic Test Pit) Evaluation Report (WA 2009)

- 2.2.1 In 2009 ten Palaeolithic archaeological and geoarchaeological test pits were excavated in the south-western part of the Site. These demonstrated the presence of Pleistocene deposits preserved beneath a variable thickness of made ground. Although generally heavily truncated by quarrying activity, the full sequence of these deposits was shown to be present within the southernmost part of the evaluation area. The heights above OD of these fluvial deposits suggest that they belong to the Lynch Hill/Corbets Tey terrace of the Thames.

- 2.2.2 These deposits were demonstrated to have Palaeolithic archaeological potential and produced seven typo-technologically undiagnostic flakes. The condition of these artefacts ranged from quite fresh to well-abraded, indicating the potential of the terrace deposits to contain minimally transported and more extensively derived Palaeolithic archaeology. No palaeoenvironmental evidence was recovered. No direct dating evidence was recovered; however, sand units with OSL dating potential were noted.

Land at Northfleet Embankment West, Gravesham, Kent Palaeolithic Archaeological Monitoring of Ground Investigation (GI) Works (WA 2020)

- 2.2.3 In 2020 six GI trial pits in areas with known Palaeolithic archaeological potential were subject to direct archaeological monitoring, whilst the descriptions of the deposits and draft GI logs for a further eight GI trial pits and nineteen cable percussion borehole logs were made available for review by a Palaeolithic archaeological and geoarchaeological specialist.
- 2.2.4 Quaternary deposits were present in two trial pits subject to direct archaeological monitoring. These deposits consisted of fluvial sands and gravels and equate with those that have previously produced Palaeolithic archaeology (WA 2009). No additional archaeological evidence was recovered during archaeological monitoring and no deposits preserving significant paleoenvironment material were encountered.
- 2.2.5 Review of the GI data enabled the lateral and vertical extent of Quaternary deposits in the Site to be refined and allowed previously defined areas of Palaeolithic potential (WA 2009) to be updated and augmented (WA 2020a).

Land at Northfleet Embankment West, Gravesham, Kent Palaeolithic Archaeological and Geoarchaeological Excavation (WA 2021)

- 2.2.6 In 2021 the site was divided into 8 areas of Palaeolithic archaeological and geoarchaeological potential. The excavations demonstrated that Pleistocene deposits are present within Area 2 – 4, and Area 8 of the site, beneath the variable depth of made ground.
- 2.2.7 These deposits belong to a terrace of the River Thames. Although mapped as part of the Boyn Hill/Orsette Heath terrace (430 – 350 Ka) by BGS, these investigations have demonstrated that they principally belong to a later terrace. They are suggested to belong to the Lynch Hill/Corbets Tey terrace (350 – 280 Ka).
- 2.2.8 The report outlines the significance of the Palaeolithic archaeology present in these areas and provides an update on the archaeological and geoarchaeological potential of Quaternary deposits in all areas of the site.

Northfleet Embankment West Watching Brief (Ongoing)

- 2.2.9 Starting in 2021 a watching brief has been undertaken on groundworks at the site, which are ongoing at the time of writing. The watching brief has identified several areas of extensive surviving industrial archaeology associated with the 19th century cement works, and the results form the basis of the proposed excavation.
- 2.2.10 A brick beehive kiln was identified, along with a number of other structures and the entrance to a tunnel, along with a line of buried kilns, a drying room, brick slurry tanks and the 19th century dock for the cement works, along with other structural features and deposits associated with the former cement works.
- 2.2.11 An interim statement on the initial phase of works was completed in March 2022 and is included as Appendix 5 (Wessex Archaeology 2022).

2.3 Archaeological and historical context

- 2.3.1 This section has been largely informed by online resources including the Cement Plants and Kilns in Britain and Ireland website (Dylan Moore), aerial photography on the Britain from Above website, and various historic mapping websites.
- 2.3.2 Northfleet gets its name from the River Fleet now known as the Ebbsfleet River, which joins the Thames at this point. Northfleet is mentioned in the Domesday Survey and was historically rural and marshy. As described in 1797, the parish contained numerous chalk pit quarries along the banks of the Thames between the hamlet of Northfleet Hythe and Gravesend; and many people were employed in the excavation, manufacture and export of chalk and lime. The location of the site was then part an estate called The Hive, held by Mr Wadman (Hastead 1797, 302-308).
- 2.3.3 The area around Northfleet creek, where the brick kiln has been recorded, became a focal point of the cement industry during the late 18th and 19th century.
- 2.3.4 James Parker, who had been engaged in lime burning in the area for more than 10 years, discovered and quickly patented "Roman cement" in 1796. Parker set up the Parker & Wyatt cement works on a site which spanned Northfleet Creek and was centred on an existing tidal water mill which he leased and used as part of the works.
- 2.3.5 However, the Northfleet Tithe Map and apportionment dated 1838 and 1839 (not reproduced) show the location of the surveyed features had not yet been industrialised. It is depicted as plot 85, a pasture which formed part of the park owned by Thomas Sturge and occupied by Mrs Eliza Kirwan.
- 2.3.6 The manufacture of modern Portland cement in the area began with arrival of William Aspdin, son of the owner of the original 1824 patent. William Aspdin began manufacture of Portland Cement at Rotherhithe in 1842. He relocated to Northfleet in 1846, taking over the site of James Parker's original Roman cement works at the Northfleet Creek tidal mill. However, in 1851, Aspdin was excluded from further involvement with the business after financial irregularities came to light. Two of the former partners Robins and Cox then formed a new company called Robins and Co.
- 2.3.7 On leaving the company, Aspdin spent time as a consultant to Thomas Sturge, who set up the adjacent cement works, later called Bevans, in 1851 to the east of Robins and Co.. The surveyed features are located within the Bevans site. Bevans was the fifth plant established on the Thames and became second only to Swanscombe in size during the 19th and early 20th century. Between 1853-1900 it was owned by Knight, Bevan and Sturge who were then amalgamated into the Associated Portland Cement Manufacturers Ltd (APCM) which became known as the Blue Circle Group. APCM operated the Bevans works from 1900 until its closure in 1970.
- 2.3.8 The 1864-79 Kent and 1885 Essex Ordnance Survey maps show that the various cement works at Northfleet then extended as far as terraced housing on (the now truncated) Lawn Road, with a chalk quarry and engineering works further west. The surveyed features are located on the site of a square plan structure, possibly a kiln, shown on the 1864-79 and 1885 OS maps. This structure was the east one of a group of similar buildings in this area (seven or eight by 1885). The maps depict a group of wash mills to the north-east of the surveyed features, Hive House and a series of slurry beds to the south and a gas works to the east.

- 2.3.9 There was a major reorganisation of the Bevans works in the 1870s, centralising a previously dispersed layout. By 1900, there were 59 kilns in operation with a registered capacity of 1700 tons a week.
- 2.3.10 The 1897 Kent and 1898 Essex OS maps suggest that the group of possible kilns had been modified and rebuilt, with further development to the north, and north-east around the docks and south-east to the rear of the terraced housing on Lawn Road. The mid-19th century structure on the site of the surveyed features is one of the buildings that appears to have been rebuilt. It is depicted as a rectangular plan block with a projecting block on its east side and channels extending from the east side leading south to the slurry beds. Hive House had been demolished and the slurry beds expanded by this point, with terraced housing and new residential streets built further south along the High Street. A pre-1898 engraving of the Knight, Bevan and Sturge cement works, shows a view of the works from the river, with Hive House in the background (Wikimedia commons).
- 2.3.11 In 1903, twenty kilns on the Bevans plant were demolished to make way for rotary kilns: the rest were decommissioned by 1911. The 1909 Kent OS map shows what appears to be the same structure as the 1897 and 1898 maps on the location of the surveyed features but with a new, much larger kiln building constructed adjacent to the east and new kiln feed slurry storage/mixers built to the south laid out in a circle.
- 2.3.12 The original rotary kilns were cleared in 1921 to be replaced by larger kilns in the 1920s. However, because of the plant's confined site, the redevelopment could only be accomplished by complete shutdown and demolition of the previous kilns, which took five years. The new kilns opened in 1926.
- 2.3.13 An anonymous article in *Cement and Cement Manufacture*, volume 1 (1928) describes the Bevans plant immediately after its 1920s rebuild. Numerous aerial photographs dated 1927 and 1939 from the NMR Aerofilms collection (Britain from Above website, not reproduced) and the 1938-39 Kent OS map (not reproduced) show the cement works after its redevelopment. They illustrate that the 19th century structure on the site of the surveyed features had been replaced.
- 2.3.14 The Bevans plant remained one of APCM's base-load operations for forty years and was the primary exporting plant. In 1957, one of the kilns (B1) was modified for semi-wet process, but this was relatively unsuccessful, and shut down in 1967. The rest of the plant shut down in 1970. However, much of the cement handling and wharfage remained in use and was incorporated into the adjacent Northfleet plant to the west.

3 AIMS AND OBJECTIVES

3.1 Aims

- 3.1.1 The aims (or purpose) of the excavation, as defined in the *CIfA Standard and guidance for archaeological excavation* (CIfA 2014a), are to:
- examine the archaeological resource within a given area or site within a framework of defined research objectives;
 - seek a better understanding of the resource;
 - compile a lasting record of the resource; and
 - analyse and interpret the results of the excavation, and disseminate them.



3.2 Research objectives

3.2.1 While there is extensive literature on the cement industry in the United Kingdom and countries such as France and the United States of America, it is unclear what aspects and practices of the cement industry were being used and undertaken at the site.

3.2.2 The principle objectives of the proposed excavation are to;

- expose and record the physical remains of the 19th century cement works so a clearer picture of the development and practices in use at the site can be developed with the use of documentary evidence;
- inform decisions regarding the preservation in situ of industrial remains beneath the proposed residential development;
- record evidence to a high enough standard to allow for the creation of a digital reconstruction of the site and its components so that the history of the site can be made available to local residents, visitors and other interested parties;
- inform decisions regarding the heritage park at the site, which will be developed as part of the residential scheme; including the recovery of examples of industrial processes for possibly future conservation and display.

3.3 Site-specific objectives

3.3.1 Following the consideration of the archaeological watching brief (Wessex Archaeology Ongoing), the site-specific objectives of the excavation are to identify:

- the precise number of the kilns, their form, function, date, and condition;
- if all the kilns are the same and part of a single phase of development;
- if the kilns were repaired and/or rebuilt;
- the relationship between the kilns and the adjacent tunnel;
- the relationship between the kilns and tunnel and the adjacent drying platform;
- the context for the construction of the kilns and associated tunnel structure. Were they built into a former quarry area and then backfilled immediately to create a higher-level working area?;
- the methods of loading and unloading the kilns with fuel, raw materials, and cement product;
- if hot air was taken off the top of the kilns and channelled into the adjacent drying floor area;
- the methods for accessing and filling voids for preservation in situ;
- the evidence that should be collected for future assessment, analysis and archiving, such as brick, mortar, fuel, product, and residue samples;
- the purpose of the hoppers and associated wagons;
- the purpose of the perpendicular chambers;
- how the rail system functioned.

4 FIELDWORK METHODS

4.1 Introduction

- 4.1.1 Health and safety will override archaeological considerations in all works since, as stated in ClfA guidance, *Health and Safety regulations and requirements cannot be ignored no matter how imperative the need to record archaeological information; hence Health and Safety will take priority over archaeological matters* (ClfA 2014a, 11).
- 4.1.2 All works will be undertaken in accordance with the detailed methods set out within this WSI. Any significant variations to these methods will be agreed in writing with the County Archaeologist for KCC and the client prior to being implemented.
- 4.1.3 The excavation will comprise the excavation, investigation and recording of a total of seven areas. Areas A-D focus on the area surrounding the kilns (**Figures 1 & 2**). Areas E-G focus on the tunnel system and related industrial infrastructure (**Figure 1**).

4.2 Setting out of the excavation area

- 4.2.1 The excavation areas will be set out using a Global Navigation Satellite System (GNSS) in the approximate positions shown in **Figure 1**, although the precise delineation of the areas are subject to final approval by the County Archaeologist for KCC. Minor adjustments to the layout may be required to take account of any on-site constraints, and to allow for machine manoeuvring. The locations of excavated areas will be tied into the Ordnance Survey (OS) National Grid and Ordnance Datum (OD) (Newlyn), as defined by OSTN15 and OSGM15.

4.3 Excavation methods

- 4.3.1 The excavation methodology was laid out in the brief provided by the County Archaeologist for KCC (Appendix 1) and is reproduced below.

Areas A & B

- 4.3.2 At the northern and southern ends of the range of kilns the monitoring archaeologist will direct the use of a mechanical excavator to expose the remains carefully and gradually, in such a manner as to allow a detailed record to be made without comprising the health and safety of staff on site. Recording will combine photography, surveying for plans, sections and elevations, context recording and at the appropriate stages, laser scanning and photogrammetry.
- 4.3.3 The investigation and removal of structural remains would initially be to the surface level of the approved development platform. At this point consideration will be given to the possible preservation in situ of remains below that level. In areas of proposed gardens where piling would not be required or the installation of services, the option for preservation in situ will be considered.

Areas C & D

- 4.3.4 Following the work for Areas A and B, the ground to the west and east of the tunnel and row of kilns will be reduced to the level needed for the construction of the development platform, following the same methodology for archaeological control and recording as outlined for Areas A and B. The aim of the work will be to address the research questions outlined above and seek to allow for the preservation in situ of as much of the remains as possible below the development platform. The remains will be exposed from the west and east to allow for safe access and to avoid undermining the structures and to avoid removing the upper elements of the structures until the full structure is understood.

- 4.3.5 The archaeologist will develop a working model on site, using plans, sections and sketches of how the system would have work.

Area E to G - General

- 4.3.6 A method for safely extracting the wagons and related industrial infrastructure/artefacts from within the tunnel system has not been finalised at the time of writing. At least one example of all items such as rails, turning circle, hopper systems, doors, pulleys, etc. will be safely retrieved for study and potential conservation and display relating to the tunnels which are to be infilled and/or otherwise impacted by the development. Additional digital surveying and scanning will be considered to ensure that an appropriate digital data set is captured to allow digital reconstruction of the tunnel systems and related infrastructure.
- 4.3.7 If the ramp is to be moved to the west it may expose the northern end of Tunnels 22A, B and C as well as D and E identified by the previous historic building report (ASE). If these are exposed excavation under the same methodology as the ongoing watching brief.

Area E

- 4.3.8 This area has now been cleaned back to the chalk face (19th January 2022). As the ground to the north is cleared and the present ramp is moved the archaeological investigation will check for any evidence along the full chalk face for structures and tunnels. The work must ensure that there is a full recorded that links all areas of the former industrial site.

Area F

- 4.3.9 The removal of the ramp could allow for controlled excavation in this area to understand the purpose of the tunnels and their perpendicular chambers, hoppers etc. At present the purpose of the hoppers and wagons is not understood. As well as more detailed interpretative recording system samples will be collected from within the hopper systems. This may need to be approached from above and it may be sensible to look at one area initially where present ramp is be removed.

Area G

- 4.3.10 The preparation for the development platform in this area, which it is assumed will include the making safe of the east-facing chalk cliff, could allow for exploration of the tunnel system from the former entrances. This needs further discussion on site about what is proposed here and what recording is possible.
- 4.3.11 Spoil derived from both machine stripping and hand-excavation will be visually scanned for the purposes of finds retrieval. Artefacts and other finds will be collected and bagged by context.
- 4.3.12 If human remains are uncovered, the specific methods outlined below (section 4.9) will be followed.
- 4.3.13 Consideration will be given to the use of accredited local metal detector operators, subject to written agreement regarding disclosure, surrender and ownership of finds not falling under the *Treasure Act 1996*.

4.4 Recording

- 4.4.1 All exposed archaeological deposits and features will be recorded using Wessex Archaeology's pro forma recording system.

- 4.4.2 A complete record of excavated archaeological features and deposits will be made. This will include plans and sections, drawn to appropriate scales (generally 1:20 or 1:50 for plans, 1:10 for sections) and tied to the OS National Grid.
- 4.4.3 A full photographic record will be made using digital cameras equipped with an image sensor of not less than 16 megapixels. This will record the detail and the general context of the principal features and the site. Digital images will be subject to managed quality control and curation processes which will embed appropriate metadata within the image and ensure long term accessibility of the image set. Photographs will also be taken of all areas, including access routes, to provide a record of conditions prior to and on completion of the excavation.
- 4.4.4 Photogrammetry or laser scanning may be used on site to record the kilns or tunnel system upon their exposure. This will be assessed on site as safety will need to be considered, especially with the tunnel system.
- 4.5 Survey**
- 4.5.1 The real time kinematic (RTK) survey of all excavated areas and features will be carried out using a Leica GNSS connected to Leica's SmartNet service. All survey data will be recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSTN15 and OSGM15, with a three-dimensional accuracy of at least 50 mm.
- 4.6 Monitoring**
- 4.6.1 The client will inform the County Archaeologist for KCC of the start of the excavation and its progress. Reasonable access will be arranged for County Archaeologist for KCC to make site visits to inspect and monitor the progress of the excavation. Any variations to the WSI, if required to better address the project aims, will be agreed in advance with the client and the County Archaeologist for KCC.
- 4.7 Reinstatement**
- 4.7.1 Following the completion of the excavation to the satisfaction of the client and the County Archaeologist for KCC the excavated areas will be left open, with no backfilling or other reinstatement undertaken.
- 4.8 Finds**
- General*
- 4.8.1 Archaeological finds will be collected and retained in accordance with the selection strategy outlined in Appendix 3. Due to the industrial nature of the site and the extensive structural remains, brick samples will be recovered from appropriate structural deposits in order to aid in specialist analysis of construction methodology, use and date. Particular attention will be paid to the recovery of finds related to the sites industrial use in consultation with the client and County Archaeologist for KCC.
- 4.8.2 Where appropriate, soil samples may be taken and sieved to aid in finds recovery. Any finds requiring conservation or specific storage conditions will be dealt with immediately in line with *First Aid for Finds* (Watkinson and Neal 1998).
- Human remains*
- 4.8.3 In the event of discovery of any human remains (articulated or disarticulated, cremated or unburnt), all excavation of the deposit(s) will cease pending Wessex Archaeology obtaining a Ministry of Justice Licence (this includes cases where remains are to be left *in situ*).

4.8.4 Should human remains require removal, all excavation and post-excavation will be in accordance with Wessex Archaeology protocols, and in-line with current guidance documents (eg, McKinley 2013) and the standards set out in ClfA Technical Paper 13 *Excavation and post-excavation treatment of cremated and inhumed remains*. Appropriate specialist guidance/site visits will be undertaken if required.

4.8.5 The final deposition of human remains subsequent to the appropriate level of osteological analysis and other specialist sampling/examinations will follow the requirements set out in the Ministry of Justice licence.

Treasure

4.8.6 Wessex Archaeology will immediately notify the client and the County Archaeologist for KCC on discovery of any material covered, or potentially covered, by the *Treasure Act 1996*. All information required by the Treasure Act (ie, finder, location, material, date, associated items etc.) will be reported to the Coroner within 14 days.

4.9 Environmental sampling

Introduction

4.9.1 All sampling will be undertaken following Wessex Archaeology's in-house guidance, which adheres to the principles outlined in Historic England's guidance (English Heritage 2011 and Historic England 2015b).

Site-specific sampling strategy

4.9.2 Due to the industrial nature of the site, the potential for environmental sampling is limited. Any buried soils will be sampled, and samples will be taken from any suitable pre-Industrial features. Environmental sampling of 19th- and 20th-century Industrial deposits will be limited, although some suitable deposits may be encountered, eg drain fills, especially where these may have been sewers. Should significant deposits be identified that are suitable for environmental sampling, it may become necessary to formulate a site-specific sampling strategy. Any change in strategy will be agreed with the County Archaeologist for KCC.

Sampling methods

4.9.3 Bulk environmental soil samples, for the recovery of plant macrofossils, wood charcoal, small animal bones and other small artefacts, will be taken as appropriate from well-sealed and dateable contexts. In general, features directly associated with particular activities (eg, pits, latrines, cesspits, hearths, ovens, kilns, and corn driers) should be prioritised for sampling over features, such as ditches or postholes, which are likely to contain reworked and residual material.

4.9.4 If waterlogged or mineralised deposits are encountered, an environmental sampling strategy will be devised and agreed with the County Archaeologist for KCC as appropriate. Specialist guidance will be provided by a member Wessex Archaeology's geoarchaeological and environmental team, with site visits undertaken if required.

4.9.5 Any samples will be of an appropriate size – typically 40 litres for the recovery of environmental evidence from dry contexts, and 10 litres from waterlogged deposits.

4.9.6 Following specialist advice, other sampling methods such as monolith, Kubiena or contiguous small bulk (column) samples may be employed to enable investigation of deposits with regard to microfossils (eg, pollen, diatoms) and macrofossils (eg, molluscs, insects), soil micromorphological or soil chemical analyses.

4.10 Industrial sampling

- 4.10.1 Any in-situ deposits associated with industrial processes will be considered for sampling for the recovery of industrial waste deposits. The advice of an industrial specialist may be sought, and it may be necessary for the specialist to make a site visit to determine the suitability of deposits for sampling.

5 POST-EXCAVATION METHODS AND REPORTING

5.1 Stratigraphic evidence

- 5.1.1 Initially, the archive will be consolidated: all written and drawn records from the excavation will be collated, checked for consistency and stratigraphic relationships. Context data will then be entered into a database, which can be updated during any future analyses. A stratigraphic assessment of the context data will be made, this will involve:

- a review of context and stratigraphic groups;
- preliminary phasing of the site based on recorded stratigraphic relationships, pottery spot-dates and any other relevant information;
- the identification of any problems with stratigraphic interpretation (due to truncation, redeposition, residuality etc.), and problems with phasing (due to low level of finds etc.);
- the identification of site drawings to be digitised;
- the suggestion of possible contexts for radiocarbon or other scientific dating; and
- a quantification of features.

5.2 Finds evidence

- 5.2.1 All retained finds will, as a minimum, be washed, weighed, counted and identified. They will then be recorded to a level appropriate to the aims and objectives of the excavation. The report will include a table of finds by period and/or feature group. Recording and reporting will conform to the Type 2 (Appraisal) level according to ClfA's *Toolkit for Specialist Reporting*, to include appropriate quantification, characterisation and assessment of significance and potential.
- 5.2.2 Metalwork from stratified contexts will be X-rayed and, along with other fragile and delicate materials, stored in a stable environment. The X-raying of objects and other conservation needs will be undertaken by Wessex Archaeology in-house conservation staff, or by another approved conservation centre.
- 5.2.3 Artefacts and other finds will be suitably bagged and boxed in accordance with the guidance given by the relevant museum and generally in accordance with the standards of the ClfA (2014b).

5.3 Environmental evidence

- 5.3.1 Bulk environmental soil samples will be processed by standard flotation methods. The residues will be fractionated into 5.6/4 mm and 1/0.5 mm and dried if necessary. The coarse residue fraction (>5.6/4 mm), and the fine fraction when appropriate, will be sorted and discarded, with any finds recovered given to the appropriate specialist. The flot will be retained on a 0.25 mm mesh and scanned to assess the environmental remains present and their preservation. Unsorted fine residues will be retained until after any analyses and discarded following final reporting (in accordance with the Selection policy, below).



- 5.3.2 In the case of samples from cremation-related deposits the flots will be retained on a 0.25 mm mesh, with residues fractionated into 4 mm, 2 mm and 1 mm. In the case of samples from inhumation burial deposits, the sample will be wet-sieved through 9.5 mm and 1 mm mesh sizes. The coarse fractions (9.5 mm) will be sorted with any finds recovered given to the appropriate specialist together with the finer residues.
- 5.3.3 Any waterlogged samples will be processed by standard waterlogged flotation methods.
- 5.3.4 If industrial activity requiring environmental sampling is detected, industrial samples and process residues will also be collected and processed following current guidance (Historic England 2015c) and in consultation with an appropriate specialist.
- 5.3.5 Recording and reporting will conform to the Type 2 (Appraisal) level according to ClfA's *Toolkit for Specialist Reporting*, to include appropriate quantification, characterisation and assessment of significance and potential.

5.4 Reporting

General

- 5.4.1 Following completion of the fieldwork and the assessment of the stratigraphic, artefactual and ecofactual evidence, a draft post-excavation assessment report will be submitted for approval to the client and the County Archaeologist for KCC, for comment. Once approved, a final version will be submitted.
- 5.4.2 The report will include the following elements:
- Non-technical summary;
 - Project background;
 - Archaeological and historical context;
 - Aims and objectives;
 - Methods;
 - Results – stratigraphic, finds and environmental;
 - Statement of potential – of the stratigraphic, finds and environmental data – the extent to which the archive might be able to meet the original aims and research objectives of the project;
 - Updated Project Design, including summary of recommendations for any further analyses and updated project aims, with proposals for any publication (including a task list scheduling the personnel and resources required for analyses);
 - Archive preparation and deposition arrangements;
 - Appendices;
 - Illustrations; and
 - References.
- 5.4.3 A copy of the final post-excavation assessment report will be deposited with the HER, along with surveyed spatial digital data (.dxf or shapefile format) relating to the excavation.

OASIS

- 5.4.4 An OASIS (online access to the index of archaeological investigations) record (<http://oasis.ac.uk>) will be created, with key fields completed, and a .pdf version of the final report submitted. Subject to any contractual requirements on confidentiality, copies of the OASIS record will be integrated into the relevant local and national records and published through the Archaeology Data Service (ADS) ArchSearch catalogue.

6 ARCHIVE STORAGE AND CURATION

6.1 Museum

- 6.1.1 The site falls within the collecting area of Dartford Museum. The museum is not currently accepting archaeological archives. Every effort will be made to identify a suitable repository for the archive resulting from the fieldwork, and if this is not possible, Wessex Archaeology will initiate discussions with the local planning authority in an attempt to resolve the issue. If no suitable repository is identified, Wessex Archaeology will continue to store the archive, but may institute a charge to the client for ongoing storage beyond a set period.

6.2 Transfer of title

- 6.2.1 On completion of the excavation, every effort will be made to persuade the legal owner of any finds recovered (ie, the landowner), with the exception of human remains and any objects covered by the *Treasure Act 1996*, to transfer their ownership to the museum in a written agreement.

6.3 Preparation of archive

Physical archive

- 6.3.1 The physical archive, which may include paper records, graphics, artefacts, and ecofacts, will be prepared following the standard conditions for the acceptance of excavated archaeological material by Dartford Museum, and in general following nationally recommended guidelines (SMA 1995; ClfA 2014c; Brown 2011). The archive will usually be deposited within one year of the completion of the project, with the agreement of the client.

Digital archive

- 6.3.2 The digital archive generated by the project will be deposited with a Trusted Digital Repository, in this instance the Archaeology Data Service (ADS), to ensure its long-term curation. Digital data will be prepared following ADS guidelines (ADS 2013 and online guidance) and accompanied by metadata. Full details of the collection, documentation, storage and selection of digital data are included in the project Document Management Plan (DMP), available on request.

Finds archive

- 6.3.3 Any finds (artefacts and ecofacts) will be prepared following the standard conditions for the acceptance of excavated archaeological material by Dartford Museum, and in general following nationally recommended guidelines (SMA 1995; ClfA 2014c; Brown 2011). The archive will usually be deposited within one year of the completion of the project, with the agreement of the client.

Documentary archive

- 6.3.4 The physical archive (paper records and graphics) and born digital data (site records, finds and environmental data, photographs, survey data and reports) will be prepared following the standard conditions for the acceptance of excavated archaeological material by Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) and in general

following nationally recommended guidelines (SMA 1995; ClfA 2014c; Brown 2011). Full details of the collection, documentation, storage and selection of digital data are included in the project Document Management Plan (DMP), available on request.

6.4 Selection strategy

- 6.4.1 It is widely accepted that not all the records and materials (artefacts and ecofacts) collected or created during the course of an archaeological project require preservation in perpetuity. These records and materials will be subject to selection in order to establish what will be retained for long-term curation, with the aim of ensuring that all elements selected to be retained are appropriate to establish the significance of the project and support future research, outreach, engagement, display and learning activities, ie the retained archive should fulfil the requirements of both future researchers and the receiving Museum.
- 6.4.2 The selection strategy, which details the project-specific selection process, is underpinned by national guidelines on selection and retention (Brown 2011, section 4) and generic selection policies (SMA 1993; Wessex Archaeology's internal selection policy) and follows ClfA's *Toolkit for Selecting Archaeological Archives*. It should be agreed by all stakeholders (Wessex Archaeology's internal specialists, external specialists, local authority, museum) and fully documented in the project archive.
- 6.4.3 The project-specific selection strategy is presented here as Appendix 3, which at this stage includes the on-site collection strategy for finds. Further modifications are expected to be made to the selection strategy as the project progresses; specific review points will be at assessment stage, and on project completion prior to final archive preparation.

6.5 Security copy

- 6.5.1 In line with current best practice (eg, Brown 2011), on completion of the project a security copy of the written records will be prepared in the form of a digital PDF/A file. PDF/A is an ISO-standardised version of the Portable Document Format (PDF) designed for the digital preservation of electronic documents through omission of features ill-suited to long-term archiving.

7 COPYRIGHT

7.1 Archive and report copyright

- 7.1.1 The full copyright of the written/illustrative/digital archive relating to the project will be retained by Wessex Archaeology under the *Copyright, Designs and Patents Act 1988* with all rights reserved. The client will be licenced to use each report for the purposes that it was produced in relation to the project as described in the specification. The museum, however, will be granted an exclusive licence for the use of the archive for educational purposes, including academic research, providing that such use conforms to the *Copyright and Related Rights Regulations 2003*.
- 7.1.2 Information relating to the project will be deposited with the Historic Environment Record (HER) where it can be freely copied without reference to Wessex Archaeology for the purposes of archaeological research, or development control within the planning process.

7.2 Third party data copyright

- 7.2.1 This document, the post-excavation assessment report and the project archive may contain material that is non-Wessex Archaeology copyright (eg, Ordnance Survey, British Geological Survey, Crown Copyright), or the intellectual property of third parties, which



Wessex Archaeology are able to provide for limited reproduction under the terms of our own copyright licences, but for which copyright itself is non-transferable by Wessex Archaeology. Users remain bound by the conditions of the *Copyright, Designs and Patents Act 1988* with regard to multiple copying and electronic dissemination of such material.

8 WESSEX ARCHAEOLOGY PROCEDURES

8.1 External quality standards

- 8.1.1 Wessex Archaeology is registered as an archaeological organisation with the Chartered Institute for Archaeologists (CIfA) and fully endorses its *Code of conduct* (CIfA 2014d) and *Regulations for professional conduct* (CIfA 2014e). All staff directly employed or subcontracted by Wessex Archaeology will be of a standard approved by Wessex Archaeology, and archaeological staff will be employed in line with the CIfA codes of practice and will normally be members of the CIfA.

8.2 Personnel

- 8.2.1 The fieldwork will be directed and supervised by an experienced archaeologist from Wessex Archaeology's core staff. The overall responsibility for the conduct and management of the project will be held by one of Wessex Archaeology's project managers, who will visit the fieldwork as appropriate to monitor progress and to ensure that the scope of works is adhered to. Where required, monitoring visits may also be undertaken by Wessex Archaeology's Health and Safety manager. The appointed project manager will be involved in all phases of the investigation through to its completion.
- 8.2.2 The following key staff are proposed:
- Project Manager Nina Olofsson
 - Fieldwork Director Lisa McCaig
- 8.2.3 The analysis of any finds and environmental data will be undertaken by Wessex Archaeology core staff or external specialists, using Wessex Archaeology's standard methods, under the supervision of the departmental managers and the overall direction of the project manager. A complete list of specialists is provided in the Appendix.
- 8.2.4 Wessex Archaeology reserves the right, where necessary due to unforeseen circumstances, to replace nominated personnel with alternative members of staff of comparable expertise and experience.

8.3 Internal quality standards

- 8.3.1 Wessex Archaeology is an ISO 9001 accredited organisation (certificate number FS 606559), confirming the operation of a Quality Management System which complies with the requirements of ISO 9001:2015 – covering professional archaeological and heritage advice and services. The award of the ISO 9001 certificate, independently audited by the British Standards Institution (BSI), demonstrates Wessex Archaeology's commitment to providing quality heritage services to our clients. ISO (the International Organisation for Standardisation) is the most recognised standards body in the world, helping to drive excellence and continuous improvement within businesses.
- 8.3.2 Wessex Archaeology assigns responsibility to individual managers for the successful completion of all aspects of a project including reporting. This includes monitoring progress and quality; controlling the budget from inception to completion; and all aspects of health and safety for the project. At all stages, the project manager will carefully assess and



monitor performance of staff and adherence to objectives, timetables and budgets, while the manager's own performance is monitored by the team leader or regional director. The technical managers in the Graphics, Research, GeoServices and IT sections provide additional assistance and advice.

- 8.3.3 All staff are responsible for following Wessex Archaeology's quality standards but the overall adherence to and setting of these standards is the responsibility of the senior management team who, in consultation with the team leaders/regional directors, also ensure projects are adequately programmed and resourced within Wessex Archaeology's portfolio of project commitments.

8.4 Health and safety

- 8.4.1 All works will be undertaken in accordance with the *Health and Safety at Work Act 1974*; the *Management of Health and Safety at Work Regulations 1999*; and all other applicable health and safety legislation.
- 8.4.2 Wessex Archaeology has a fully compliant health and safety management system that has year on year satisfied the criteria for SSIP certification (Safety Schemes in Procurement). SSIP itself is aligned with PAS91.
- 8.4.3 Wessex Archaeology will, for all projects, produce one or more task and site-specific risk assessments and method statements (RAMS), which will ensure our staff can work safely on the site. A copy of the RAMS and our Health and Safety Policy can be provided to the client. All staff on our sites will be made fully familiar with the RAMS before work commences.
- 8.4.4 We aim to work collaboratively on health and safety with clients and, where separately appointed, with principal contractors. We expect clients to provide in good time all the necessary risk information about a site that may affect the archaeological work, such as locations of utilities or any known ground contamination. We will comply with the project specific Personal Protective Equipment (PPE) requirements, and any other specific additional requirements of the Principal Contractor.
- 8.4.5 All fieldwork staff are certified through the Construction Skills Certification Scheme (CSCS) and have undergone UKATA Asbestos Awareness Training. Staff who carry out specific tasks are suitably trained and competent to do so through training accredited by the Construction Industry Training Board (CITB), Institution of Occupational Safety & Health (IOSH) and the National Plant Operators Recognitions Scheme (NPORS).

8.5 Insurance

- 8.5.1 Wessex Archaeology holds Employers Liability (£10,000,000), Public Liability (£5,000,000) and Professional Indemnity (£5,000,000) policies.

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Robins https://www.cementkilns.co.uk/cement_kiln_robins.html

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Wikimedia commons: File: Knight, Bevan and Sturge cement works, Northfleet.jpg
[https://commons.wikimedia.org/wiki/File:Knight, Bevan and Sturge cement works, Northfleet.jpg](https://commons.wikimedia.org/wiki/File:Knight,_Bevan_and_Sturge_cement_works,_Northfleet.jpg)



APPENDICES

Appendix 1 KCC Site Specific Requirements: A brief for archaeological investigation at Land At Former Northfleet Cement Works, The Shore, Northfleet, Gravesend, Kent, DA11

SITE SPECIFIC REQUIREMENTS

A brief for archaeological investigation at Land At Former Northfleet Cement Works The Shore Northfleet Gravesend Kent DA11

1

21 January 2022

1. Summary:

1.1 An ongoing archaeological watching brief by Wessex Archaeology and RPS (as well as the historic building recording by Archaeology South-East) on behalf of Bellway Homes as part of works subject to Condition 22 (EDC/21/0031) under the Outline planning permission (EDC/16/0004) has revealed significant additional archaeological remains to those previously recorded. These include evidence for the Victorian cement works as well as gravel deposits of Palaeolithic archaeological interest. Some of the remains that have been exposed, including a row of at least eleven kilns dating from the mid-19th century, are potentially of national importance. However, the industrial archaeology has been found within the consented outline scheme which includes an agreed development platform (EDC/20/0147), the construction of which would lead to the total or partial loss of the exposed heritage assets. At present (January 2022) there is insufficient understanding of the extent, date, function and therefore significance of what has been recently exposed to make an informed decision about whether and how much could or should be preserved in situ. In addition, some of the features such as the so-called 'tunnel 22' complex, have been partially recorded and were known about at the time of the planning decision in 2018 (see below for links to planning report and decision notice with conditions on outline scheme EDC/16/0004).

1.2 It has been noted (Dr Chris Down *pers comm* January 2022) that there is a significant 19th century literature about the cement industry in the UK as well as in France, USA and other countries but at present it is difficult to understand what aspects of the cement industry were being developed and put into practice at this site. A key aim of these archaeological investigations, therefore, is to expose and record the physical remains so that, using the documentary evidence, the history of the industry can be as fully understood as possible. This will also allow decisions to be made about what could or should be preserved in situ beneath the residential scheme, details of which are subject of a reserved matters application. At the same time the recording will be of a sufficiently high standard to allow for the detailed digital reconstruction of the site and its components so that this information can be made available to residents, visitors to the area and to those interested in the history of the cement industry which was a fundamental aspect of the industrial revolution. An important role for the heritage park at the site is envisaged for ensuring that artefacts and information is conserved, displayed and communicated to local residents and visitors. The details of what can be achieved at the heritage park will

influence decisions about the balance of mitigation between preservation in situ and archaeological recording at the site.

2. Site Location & Description:

2.1 The site is located adjacent to the south bank of the Thames and comprises a large block of land at the Former Northfleet Cement Works, The Shore Northfleet Gravesend Kent DA11 9AN. See relevant site plans for details.

3. Planning Background & Nature of Development:

3.1 An outline planning application was received on 25th March 2009 and validated on 1st July 2015 (EDC/16/0004). Planning permission was granted on 8th June 2018 for mixed use redevelopment of the former cement works site to provide up to 532 dwellings, 46,000sqm of employment floorspace and community infrastructure. The officer's report can be accessed here -

http://applications.ebbsfleetdc.org.uk/online-applications/files/EAC931F87CABD6244621837A93055079/pdf/EDC_16_0004-OFFICER_COMMITTEE_REPORT-30378.pdf. The decision notice can be accessed here - http://applications.ebbsfleetdc.org.uk/online-applications/files/4ACCFBF7F8B061E66F2D813759C6B35F/pdf/EDC_16_0004-APPROVED_SUBJECT_TO_CONDITIONS-30410.pdf.

The Outline Planning Permission established the principle of development. Subsequent applications have come forward under the conditions of the outline consent, including a site-wide Heritage Management Plan (EDC/19/0201) and detailed residential masterplan (ref. EDC/20/0080). Subsequent Reserved Matters applications for each phase of the residential land are currently being submitted pursuant to the parameter plans under the outline consent and approved detailed residential masterplan.

4. Geological & Topographical Background:

4.1 According to the British Geological Survey mapping (BGS online viewer), the bedrock geology underling the Site consists of Upper Cretaceous deposits of the Seaford Chalk Formation (89.8 – 86.3 MA). At the highest, southernmost part of the Site, this is overlain by Thanet Sand (59.2 – 56.0 MA). Overlying superficial deposits are only recorded along the southern edge and within the western part of the Site. These consist of Pleistocene deposits of the Boyn Hill/Orsett Heath terrace (430 – 350 Ka) of the Thames terrace sequence. It should be noted, however, that the results of previous Palaeolithic archaeological evaluation by Wessex Archaeology in 2019/20 suggests that these terrace deposits belong to an unmapped outcrop of the younger Lynch Hill/Corbets Tey terrace (350 – 280 Ka). (Wessex Archaeology, 2021).

5. Archaeological & Historical Background Potential

5.1 There are two key periods of archaeological interest at the site, the Palaeolithic and the post-medieval/modern. The former comprises Pleistocene Thames gravel and sand deposits, the latter the industrial cement works of the 19th and 20th centuries. Details can be found in the relevant planning documents with key

issues outlined below.

6. Specific Aims of the Archaeological Work:

6.1 This brief sets out the objectives for controlled archaeological investigations of two areas to address present gaps in understanding (including of significance).

6.2 Area 1 – row of kilns and adjacent infrastructure

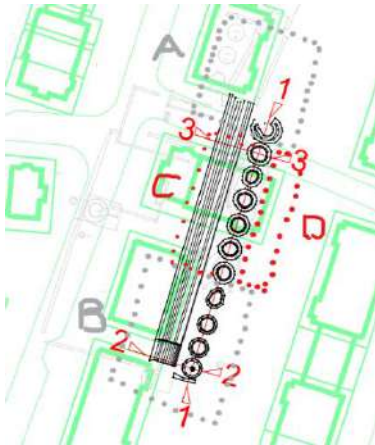
6.3 Area 2 – tunnel 22 complex (tunnels D and E and related industrial infrastructure)

The specific aims of the work where relevant to Areas 1 and 2 are to understand:

1. the precise number of kilns, their form, function, date and condition
2. if all the kilns are the same and part of a single phase of development
3. if kilns were repaired and/or rebuilt
4. the relationship between the kilns and the adjacent tunnel
5. the relationship between the kilns and tunnel and the adjacent drying platform
6. the context for the construction of the kilns and associated tunnel structure.
Were they built into a former quarry area and then backfilled immediately to create a higher-level working area?
7. the methods for loading and unloading the kilns with fuel, raw materials and cement product
8. if hot air was taken off the top of the kilns and channelled into the adjacent drying floor area
9. the methods for accessing and filling voids for preservation in situ
10. the evidence that should be collected for future assessment, analysis and archiving, such as brick, mortar, fuel, product and residue samples
11. the purpose of the hoppers and associated wagons
12. the purpose of the perpendicular chambers
13. how the rail system functioned

7. Methodology:

7.1 See KKB_060122_101A – proposed areas for controlled investigation



Areas A & B – at the northern and southern ends of the range of kilns the archaeologist will direct the use of a mechanical excavator to expose the remains carefully and gradually in such a manner as to allow a detailed record to be safely made. Recording will combine photography, surveying for plans, sections and elevations, context recording and at the appropriate stages, laser scanning and photogrammetry.

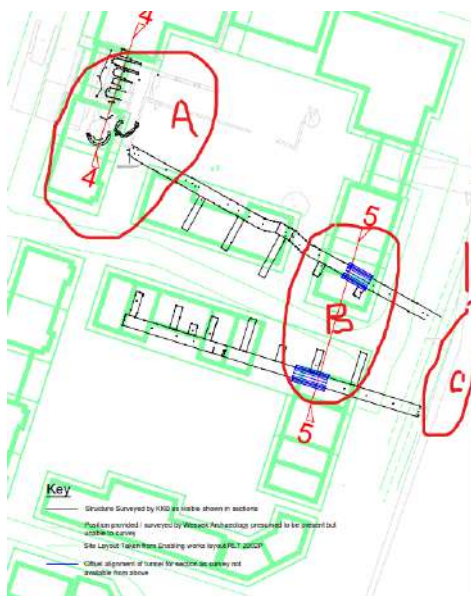
The investigations and removal of structural remains would initially be to the level of the consented development platform surface so that consideration can then be given to preservation in situ of remains below that level. In areas of proposed gardens where piling would not be required or the installation of services, the option for preservation in situ will be considered.

Areas C & D – following the work for areas A and B, the ground to the west and east of the tunnel and row of kilns will be reduced to the level needed for the construction of the development platform and following the same methodology for archaeological control and recording as outlined above. The aim of the work will be to address the research questions outlined above and seek to allow for the preservation in situ of as much of the remains as is possible below the development platform. It is assumed that the remains will be approached from the west and east to allow for safe access and so as not to undermine the structures nor to remove upper elements until the full structure is understood.

Also, to note here if the ramp is to be moved to the west is the recording of the northern end of tunnels 22A, B and C as well as D and E. ASE HBR report (SB1 and SB2 are now recognised as being the top of the kilns structures. To check ASE and WA report overlaps.

The archaeologist will develop a working model on site, using plans, sections and sketches of how the system would have work.

7.2 See KKB_060122_102A – proposed areas for controlled investigation



Areas A – C – The applicant is considering a method for safely extracting wagons and related industrial infrastructure/artefacts from within the tunnel system. At least one example of all items such as rails, turning circle, hopper systems, door and pulleys etc.. will be safely retrieved for study and potential conservation and display of the tunnels are to be infilled and/or otherwise impacted by the development. Additional digital surveying and scanning will be considered to ensure that an appropriate digital data set is captured to allow digital reconstruction of the tunnel systems and related industrial infrastructure. Also, to note here if the ramp is to be moved to the west is the recording of the northern end of tunnels 22A, B and C as well as D and E. ASE HBR report (SB1 and SB2 are now recognised as being the top of the kilns structures. To check ASE and WA report overlaps.

Areas A – This area has now been cleaned back to the chalk face (19 January 2022). As the ground to the north is cleared and the present ramp is moved the archaeological investigation will check for any evidence along the full chalk face for structures and tunnels. The work must ensure that there is a full record that links all areas of the former industrial site.

Area B – The removal of the ramp could allow for controlled excavation in this area to understand the purpose of the tunnels and their perpendicular chambers, hoppers etc.. At present the purpose of the hoppers and wagons is not understood. As well as more detailed interpretative recording of the system samples will be collected from within the hopper systems. This may need to be approached from above and it may be sensible to look at one area initially where the present ramp is to be removed.

Area C – The preparation for the development platform in this area, which it is assumed will include the making safe the east-facing chalk cliff, could allow for exploration of the tunnel system from the former entrances. This needs further

discussion on site about what is proposed here and what recording is possible allowing for all necessary safety and engineering constraints.

Issues to consider. The present outline plan for the residential blocks illustrates units directly above the tunnel 22 complex. What foundation method is proposed here? If piles are to be used then is the intention to remove the tunnel 22 system rather than fill the voids? If the tunnel structures are to be removed to facilitate piling then the safest method may be to approach the investigations from the side and from above rather than attempting to enter the tunnels.

Palaeolithic archaeology – this is covered by the Wessex Archaeology methodology for the ongoing watching brief and is therefore not discussed further here.

8. Site Recording:

8.1 See generic requirements for strip, map and sample excavation.

9. Site Reporting and Archiving:

9.1 See generic requirements for strip, map and sample excavation.

10. Monitoring:

10.1 Monitoring visits by the County Archaeologist will be arranged by the contractor.

11. General:

11.1 See generic requirements for strip, map and sample excavation.

Appendix 2 Finds and environmental specialists

Name	Qualifications	Specialism
Sander Aerts	BA, MSc	Archaeoentomological remains, animal bone, marine shell and archaeobotanical remains (carbonised)
Phil Andrews	BSc; FSA; MCIfA	Slag and metal working debris
Ceridwen Boston	BSocSc; MA; MSc; DPhil	Osteoarchaeology; funerary archaeology
Elina Brook	BA; MA; PCIfA	Later prehistoric and Romano-British pottery, and small finds
Alex Brown	BA; MSc; PhD	Geoarchaeology, palynology
Kirsten Egging Dinwiddy	BA; MA; MCIfA	Human remains (inhumations)
Erica Gittins	BA; MA; PhD	Prehistoric flint
Phil Harding	PhD	Prehistoric flint, particularly Palaeolithic flint
Lorrain Higbee	BSc; MSc; MCIfA	Animal bone
Matt Leivers	BA; PhD; ACIfA	Prehistoric pottery and flint
Inés López-Dóriga	BA; MA; PhD	Archaeobotanical remains
Erica Macey-Bracken	BA; ACIfA	Post-medieval finds, ceramic building material and worked wood
Katie Marsden	BSc	Pottery from prehistoric to post-medieval/modern. Metalwork of all periods, including coins. Small and bulk finds including fired clay, ceramic building material, worked bone
Jacqueline McKinley	BTech; FSA	Human remains (inhumations and cremations)
Lorraine Mephram	BA; MCIfA	Pottery and other ceramic finds of all dates, concentrating on later prehistoric and post-Roman; ceramic building material; clay tobacco pipe; glass of Saxon or later date; small finds
Nicki Mulhall		Geoarchaeology and archaeobotanical remains
David Norcott	BA; MSc; MCIfA	Geoarchaeology
Richard Payne	BSc; MSc; MPhil	Geoarchaeology
Holly Rodgers	BA; MSc	Geoarchaeology
Emma Robertson	BA; MSc	Human remains (inhumations)
Megan Scantlebury	BA, MSc	Archaeobotanical remains
Rachael Seager Smith	BA; MCIfA	Pottery with particular emphasis on Roman ceramics; and metalwork, fired clay, ceramic building material, stone, worked bone, shale, glass, and wall plaster
Andrew Shaw	BA; MA; PhD	Palaeolithic lithic artefacts and Pleistocene geoarchaeology
Amy Thorp	BA; MA	Pottery with emphasis on Roman ceramics, small finds
Ed Treasure	BSc; MRes; PhD	Archaeobotanical remains, including plant remains and charcoal/wood



Appendix 3 Selection Strategy

232994
Northfleet Embankment West SMS
v.1 04.02.2022

Selection Strategy

Project Information

Project Management

Project Manager	Nina Olofsson	
Archaeological Archive Manager	Lorraine Mephram	
Organisation	Wessex Archaeology (WA)	
Stakeholders		Date Contacted
Collecting Institution(s)	Dartford Museum Archaeology Data Service	
Project Lead / Project Assurance	Lead: Lisa McCaig Assurance: Nina Olofsson	N/A
Landowner / Developer	Bellway Homes	
Other (external)	External finds & environmental specialists (see WSI) Senior Archaeology Advisor KCC	
Other (internal)	WA Finds Manager (Rachael Seager Smith) WA Environmental Officer (Inés López Dóriga) WA Geomatics & BIM Manager (Damien Campbell-Bell) WA internal finds & environmental specialists (see WSI)	N/A; briefed as part of standard project process

Resources

Resources required

WA Finds and Environmental specialists; external finds and environmental specialists; WA archives team

Context

This overarching selection strategy document is based on the ClfA Archives Selection Toolkit (2019) and relates to archaeological project work being undertaken by Wessex Archaeology as defined in the WSIs.

Relevant standards, policies and guidelines consulted include:

General

- *Selection, Retention and Dispersal of Archaeological Collections* (Society of Museum Archaeologists, 1993)
- *Archaeological archives: a guide to best practice in creation, compilation, transfer and curation* (AAF, revised edition 2011, section 4)
- *Dartford Museum guidelines*

Relevant research agendas

Finds

- *Standard Guidance for the collection, documentation, conservation & research of archaeological materials* (CIFA, 2014)
- *A Standard for Pottery Studies in Archaeology* (Prehistoric Ceramics Research Group, Study Group for Roman Pottery, Medieval Pottery Research Group 2016)

Environmental

- *Environmental Archaeology: A Guide to the Theory, Practice of Methods, from Sampling and Recovery to Post-excavation* (English Heritage 2011)
- *Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record* (Historic England 2015)
- *Guidelines for the Curation of Waterlogged Macroscopic Plant and Invertebrate Remains* (English Heritage 2008)
- *Waterlogged Wood: Guidelines on the Recording, Sampling, Conservation and Curation of Waterlogged Wood* (English Heritage 2010)
- *Waterlogged Organic Artefacts: Guidelines on their Recovery, Analysis and Conservation* (Historic England 2018)

Research objectives of the project

Following consideration of the archaeological potential of the site, the research objectives of the excavation are to:

- the precise number of the kilns, their form, function, date, and condition;
- if all the kilns are the same and part of a single phase of development;
- if the kilns were repaired and/or rebuilt;
- the relationship between the kilns and the adjacent tunnel;
- the relationship between the kilns and tunnel and the adjacent drying platform;
- the context for the construction of the kilns and associated tunnel structure. Were they built into a former quarry area and then backfilled immediately to create a higher-level working area?;
- the methods of loading and unloading the kilns with fuel, raw materials, and cement product;
- if hot air was taken off the top of the kilns and channelled into the adjacent drying floor area;
- the methods for accessing and filling voids for preservation in situ;
- the evidence that should be collected for future assessment, analysis and archiving, such as brick, mortar, fuel, product, and residue samples;
- the purpose of the hoppers and associated wagons;
- the purpose of the perpendicular chambers;
- how the rail system functioned.

REVIEW POINTS

Consultation with all Stakeholders regarding project-specific selection decisions will be undertaken at a maximum of three project review points:

1. Data gathering: on site, if any unforeseen discovery necessitates an amendment to the proposed collection strategy, or if adjustments are made to any sampling strategy
2. End of data gathering (assessment stage)
3. Archive compilation

1 – Digital Data

Stakeholders

WA Project Manager; WA Archives Manager; WA Geomatics & BIM Manager; Dartford Museum; KCC Senior Archaeology Advisor; ADS

Selection

Location of Data Management Plan (DMP)

This document is designed to link to the project Data Management Plan (DMP), which can be supplied on request.

To promote long-term future reuse deposition file formats will be of archival standard, open source and accessible in nature following national guidance from ADS 2013, ClfA 2014c and the requirements of the digital repository.

Any sensitive data to be handled according to Wessex Archaeology data policy to ensure it is stored and transferred securely. The identity of individuals will be protected in line with GDPR. If required, data will be anonymised and redacted. Selection and retention of sensitive data for archival purposes will occur in consultation with the client and relevant stakeholders. Confidential data will not be selected for archiving and will be handled as per contractual obligation.

Document type	Selection Strategy	Stakeholders	Review Points
Site records	Most records will be completed digitally on site (with the exception of registers). All will be selected for deposition.	As above	3
Reports	To include WSIs, Interim reports, post-excavation assessment reports, publication reports. Final versions only will be selected for deposition.	As above	2, 3
Specialist reports	Specialist reports will generally be incorporated in other documents with only minimal editing (reformatting, etc), and will be selected only if the original differs significantly from the incorporated version.	As above	2, 3

Photographic media (site recording)	Substandard and duplicate images will be eliminated; pre-excavation images may not be selected where duplicated by post-excavation shots; working shots will be very rigorously selected to include only good quality images with potential for reuse and those integral to understanding features, their inter-relationships and location on site; site condition and reinstatement photos will not be selected.	As above	2, 3
Photographic media (objects)	Images of individual or groups of objects, to include those of significance selected for publication and reporting. Substandard and duplicate images will be eliminated; all others will be selected.	As above	3
Photographic media (photogrammetry)	All terrestrial photogrammetry recording will generate orthographic photos. For those features or finds which are particularly archaeological significant, 3D models will be generated and deposited but raw photos will only be selected where models have been selected and OBJs are to be deposited, where re-processing may have some archaeological value (eg very significant features, or where the model is less accurate than the surveyed georeference targets or of lower quality and the quality of the original photos is good enough to represent a reasonable chance of better future outcomes). Aerial photogrammetry topographic surveys will generate 3D models and orthographic photos, and the final outputs in the form of the report. These will all be selected, but not the raw photos from aerial surveys.	As above	2, 3
Photographic media (community engagement and other activities)	General shots, promotional videos, etc. None will be selected, unless images are generated that are not duplicated in the main site record, but which have specific archaeological value.	As above	3
Survey data	Site survey data will be used to generate CAD/GIS files for use in	As above	2, 3

	post-excavation activities. Shapefiles of both the original tidied survey data, and the final phased drawings will be selected.		
Databases and spreadsheets	Context, finds and environmental data in linked databases. Final versions will be selected. Any specialist data submitted separately will also be selected.	As above	2, 3
LIDAR data	All will be selected	As above	2, 3
Laser Scan data	All will be selected	As above	2, 3
Geophysical data	RAW data and Interpretation Geo-tiffs	As above	2, 3
Administrative records	Includes invoices, receipts, timesheets, financial information, email correspondence. None will be selected, with the exception of any correspondence relating directly to the archaeology.	As above	3

De-Selected Digital Data

De-selected data will be stored on WA secured servers on offsite storage locations. The WA IT department has a backup strategy and policies that involves daily, weekly and monthly and annual backups of data as stated in the DMP. This strategy is non-migratory, and original files will be held at WA under their unique project identifier, as long as they remain useful and usable in their final version format. This data may also be used for teaching or reference collections by the museum, or by WA unless otherwise required by contractual or copyright obligations.

Amendments

Date	Amendment	Rationale	Stakeholders

2 – Documents

Stakeholders

WA Project Manager; WA Archives Manager; Dartford Museum; KCC Senior Archaeology Advisor

Selection

A security copy of all paper/drawn records is a requirement of ClfA guidelines. This will be prepared on completion of the project, in the form of a digital PDF/A file. If the security copy is not required for deposition by Stakeholders, it will be retained on backed-up servers belonging to

Wessex Archaeology.

Note that some information may be redacted to comply with GDPR legislation (personal data).

Document type	Selection Strategy	Stakeholders	Review Points
Site records	Selected records only will be completed in hard copy on site (registers, some graphics). All will be selected for deposition.	As above	3
Reports	Hard copies of all reports (SSWSIs, Interim reports, post-excavation assessment reports, publication reports). All will be selected for deposition, with the exception of earlier versions of reports which have been clearly superseded.	As above	2, 3
Specialist reports & data	Specialist reports will generally be incorporated in other documents with no significant editing. Supporting data is more likely to be included in the digital archive, but if supplied in hard copy and not incorporated elsewhere, this will be selected.	As above	2, 3
Photographic media	X-radiographic plates: all will be selected.	As above	3
Secondary sources	Hard copies of secondary sources will not be selected.	As above	3
Working notes	Rough working notes, annotated plans, preliminary versions of matrices etc, will not be selected.	As above	3
Administrative records	Invoices, receipts, timesheets, financial information, hard copy correspondence. None will be selected, with the exception of any hard copy correspondence relating directly to the archaeology.	As above	3

De-Selected Documents

De-selected sensitive analogue data will be destroyed (shredded) subject to final checking by the WA Archives team with the remainder recycled. Possible exceptions include records retained for business purposes, including promotional material, teaching and internal WA library copies of reports.

Amendments			
Date	Amendment	Rationale	Stakeholders

3 – Materials

Material type	Artefacts (bulk and registered finds)	Section 3.	3.1
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Stakeholders

WA Archives Manager; WA Finds Manager; WA internal specialists; external specialists; Dartford Museum; Senior Archaeology Advisor; landowner

Selection

Note that human remains are not included in this selection strategy; their recovery and subsequent treatment and curation will be governed by a Ministry of Justice licence(s).

The on-site finds recovery strategy is given below; it is of necessity fairly generic. It is anticipated that this will be reviewed and updated at the project assessment stage, once all collected finds have been processed and quantified. Amendments may be made prior to that on site in the event of unforeseen discoveries necessitating adjustments to recovery or sampling strategies (eg production sites, large concentrations of building debris, 'burnt mounds').

Throughout the following section, 'stratified' is taken to include topsoil deposits, while 'unstratified' indicates anything completely separated from context eg spoilheap finds, or surface finds other than those directly associated with underlying features.

Find Type	Selection Strategy	Stakeholders	Review Points
Animal bone	All will normally be collected from stratified contexts. Selection could be recommended at next review point, dependent on stratigraphic integrity, condition and size of assemblage.	As above	2, 4
Building materials (other, eg, mortar, plaster, <i>opus signinum</i>)	If found <i>in situ</i> , these should be recorded on site and, if appropriate, a small sample of <i>opus signinum</i> or wall plaster (not mortar) retained for further examination. Loose fragments of mortar or <i>opus signinum</i> should not be collected, but their presence on site should be noted. All loose wall plaster will be collected from stratified contexts.	As above	2, 4

	Selection likely to be recommended at next review point.		
Burnt (unworked) flint	All will normally be collected from stratified contexts. Selection likely to be recommended at next review point.	As above	1 (if large quantities encountered), 2, 3
Ceramic building material	All CBM from stratified contexts will be collected and reviewed at the processing stage. If <i>in situ</i> structures are encountered, these should be fully recorded on site, but samples of components may be collected for a closer examination of form, fabric and dimensions. Selection likely to be recommended at next review point.	As above	1 (if large quantities encountered), 2, 3
Ceramic objects	Includes spindlewhorls, loomweights, slingshot, portable kiln furniture, etc. All will be collected, including any unstratified examples.	As above	2, 3
Clay tobacco pipes	All will normally be collected from stratified contexts. Selection likely to be recommended at next review point.	As above	2, 3
Coins	All will be collected, including unstratified finds.	As above	2, 3
Fired clay	Includes structural material ('daub') as well as briquetage, and undiagnostic fragments. All will be collected from stratified contexts. Selection likely to be recommended at next review point.	As above	2, 3
Glass, vessel and window	All will normally be collected from stratified contexts. Unstratified post-medieval/modern material will not be collected, unless of intrinsic interest. If large-scale post-medieval/modern bottle dumps are encountered, items will be recorded <i>in situ</i> as far as possible, and a small sample collected. Selection likely to be recommended at next review point.	As above	1 (if large quantities encountered), 2, 3

Glass, objects	All will be collected, including unstratified finds	As above	2, 3
Jet, shale, amber	All will be collected, with the possible exception of unstratified unworked shale or shale-working waste. Selection could be recommended at next review point, dependent on condition.	As above	2, 3
Leather and textile	All will be collected, including unstratified finds. Selection could be recommended at next review point, dependent on date and condition.	As above	2, 3
Marine shell	All will normally be collected from stratified contexts. If large-scale dumps are encountered, an appropriate sampling strategy may be employed with the aim of characterising the shell assemblage (species, condition, potential sources, management of oyster beds, etc). All shell-working waste will be collected. Selection likely to be recommended at next review point.	As above	1 (if large quantities encountered), 2, 3
Metalwork	All will be collected from stratified contexts, with the exception of obviously modern (19 th -/20 th -century) objects found in topsoil/overburden or unstratified. Selection likely to be recommended at next review point.	As above	2, 3
Metalworking residues	All will be normally collected from stratified contexts. Selection likely to be recommended at next review point.	As above	2, 3
Pottery, prehistoric	All will be collected, including unstratified finds.	As above	2, 3
Pottery, all other periods	All will be collected from stratified contexts. From unstratified contexts, only pieces of intrinsic interest will be collected, unless this is the only datable material recovered. Selection could be recommended at next review point.	As above	2, 3
Stone, building	<i>In situ</i> architectural fragments and	As above	2, 3

	other building material may be recorded on site rather than collected, and samples taken for geological identification. Other building stone will be collected from stratified contexts. From unstratified contexts, only pieces of intrinsic interest (eg, architectural fragments). Selection likely to be recommended at next review point.		
Stone, portable objects	All will be collected from stratified contexts. From unstratified contexts, only identifiable objects.	As above	2, 3
Stone, unworked	Unworked stone will only be collected if considered to be archaeologically significant, ie included in features intentionally, or thought to have fulfilled a specific function.	As above	2, 3
Worked bone and antler	Includes finished objects as well as boneworking waste. All will be collected, including unstratified finds.	As above	2, 3
Worked flint	All will be collected.	As above	2, 4
Worked wood	This includes all structural timbers as well as any portable objects (e.g. vessels, implements, etc). Structural timbers found <i>in situ</i> should be recorded stratigraphically but may be sampled for species identification and/or dating without full recovery. All other will be collected, with the exception of unstratified and undiagnostic pieces. Selection could be recommended at next review point.	As above	1 (if <i>in situ</i> finds encountered), 2, 4

Uncollected Material

Finds which fall outside the categories proposed for on-site collection will not normally be recorded beyond a general comment on site recording sheets on the presence and nature of large concentrations (eg building materials, modern debris), but if specific sampling strategies are employed to deal with, for example, production waste, then a more accurate guide to the actual size of the parent assemblage (and thus the sample percentage) will be given.

Any uncollected material will be left *in situ* or (if collected and then de-selected), re-incorporated into the site.

De-Selected Material

Consideration will be given to the suitability for use for handling or teaching collections by the museum or Wessex Archaeology, or whether they are of particular interest to the local community. De-selected material will either be returned to the landowner or disposed of. All will be adequately recorded to the appropriate level before de-selection.

Amendments

Date	Amendment	Rationale	Stakeholders

3 – Materials

Material type	Palaeoenvironmental material	Section 3.	3.2
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Stakeholders

WA Archives Manager; WA Environmental Officer; WA internal specialists; external specialists; Dartford Museum; KCC Senior Archaeology Advisor

Selection

All contexts suitable for environmental sampling will be considered for sampling. All environmental sampling will be undertaken following Wessex Archaeology's in-house guidance, which adheres to the principles outlined in Historic England's guidance (English Heritage 2011 and Historic England 2015a) and as stated in relevant WSI.

Env Material Type	Selection Strategy	Stakeholders	Review Points
Unprocessed samples	In the event of any samples being eliminated from processing due to lack of archaeological significance, these will not be retained.	As above	2, 3
Unsorted residues	Residues from samples not proposed for further analysis will be de-selected, with the possible exception of any taken for the recovery of human remains.	As above	2, 3
Assessed flots with no extracted materials	Assessed flots with no extracted materials are considered to be devoid of any significant environmental evidence and will be de-selected.	As above	2, 3
Assessed or analysed flots with extracted materials	All analysed samples will be selected; assessed flots with extracted materials with no further	As above	2, 3

	research potential (to be established on a sample by sample case) may be de-selected.		
Charred & waterlogged plant remains	All extracted plant remains will be selected	As above	3
Mollusca	All extracted mollusca will be selected	As above	3
All other analysed material (eg insects, pollen)	All material will be selected	As above	3
Uncollected Material			
Any uncollected material will be left <i>in situ</i> or re-incorporated into the site.			
De-Selected Material			
De-selected material from samples will be disposed of after processing and post-excavation recording. All processed material will be adequately recorded to the appropriate level before de-selection.			
Amendments			
Date	Amendment	Rationale	Stakeholders



Appendix 4 WSI addendum



Land at Northfleet Embankment West Gravesham, Kent

Addendum to Written Scheme of Investigation

1 INTRODUCTION

- 1.1.1 During the course of 2021 and 2022 a series of archaeological works have been undertaken at the former Northfleet Cement Works in Gravesham, Kent, comprising an ongoing watching brief and archaeological excavation of the former works. As of June 2022 the archaeological excavations have exposed extensive structural remains associated with the former cement works, including kilns, tunnels and drying rooms amongst others.
- 1.1.2 This addendum details additional research aims to be included in the continued excavation of the site, specifically relating to the managed demolition and removal of the currently identified structural elements that cannot, for development-construction reasons, be retained, and the County Archaeologist for Kent County Council, advising Ebbsfleet Development Corporation (the LPA) has requested that where preservation in situ cannot be achieved, archaeological recording and interpretation will be to an exemplary standard as set out in this WSI and associated documents.

2 ADDITIONAL RESEARCH OBJECTIVES

- 2.1.1 The following research objectives are proposed in addition to the objectives as laid out in the previous Written Scheme of Investigation (WSI; Wessex Archaeology 2022) and do not supersede them. They are designed to further guide the ongoing works and should be viewed in conjunction with the previous WSI. The additional research objectives are as follows;
- Determine where possible the phasing of the structural remains including
 - o Different types of construction materials. As part of this at least 1 brick sample should be recovered from all distinct structures, with special attention paid to any bearing identifying marks – particularly stamps and logos – and additional samples should be recovered as needed to allow for detailed assessment;
 - o Different construction methodologies. Extra care should be taken to record the style of brickwork, relationship with concrete, types of foundations, mortar, etc
 - o Different alignments. Continually assess if the alignment of different structures is consistent with contemporary development or ongoing evolutionary development with the original orientations being respected or disregarded.
 - o Evidence for redevelopment/remodelling. Particular attention should be paid at all connections between structural features to determine if they show signs of being part of a later addition/remodelling, are buildings flush or buttressed, evidence of bricked up entrances/openings, etc



- o Evidence of flooring changes/scarring from removed structures such as former trackways.
- o Evidence of a change in the gauge of rail and tramlines
- o Further laser scanning and photogrammetry of the southern kiln complex should be considered to fill in any gaps missing from the initial recording and to understand the topography of the area in which the kilns were constructed in the 19th century. In the event that such work is required, it will necessarily be undertaken in accordance with regard to appropriate health and safety measures.
- o Consideration should also be given a detailed aerial drone photography from multiple viewpoints to capture the present level of detail at the surface above the underlying tunnels with regards to Tunnels 22d-f. As with potential laser scanning and photogrammetry works, appropriate health and safety measures will be implemented should this work be required.
- Determine the function of structural remains
 - o Evidence for the structures place within the wider site. Are they part of a phased sequence of activities, such as transport or prepping for additional processes. Pay particular attention to any alignments of tram tracks, evidence of storage areas, etc
 - o Look for evidence of industrial build-up such as waste left by various industrial processes, soot, waste cement, etc
 - o Prior to the demolition of each structure attempt to determine a possible use, and if that use aligns with the known activities within the site.

3 BIBLIOGRAPHY

Wessex Archaeology 2022. *Land at Northfleet Embankment West SMS. Written Scheme of Investigation for an Archaeological excavation Northfleet Embankment West, Gravesham*. Unpublished report ref 232994.01



Appendix 5 Interim Statement

Document Information

Document title	Land at Northfleet Embankment West, Gravesham, Kent
Document subtitle	Interim statement on archaeological works at the southern kiln complex
Document reference	232994.03
Client name	RPS Group
Address	20 Farringdon Street London EC4A 4AB
Site location	Northfleet Embankment West, Gravesham
County	Kent
National grid reference	TQ 61931 74731
Statutory designations	N/A
Planning authority	Gravesham Borough Council
Planning reference	EDC/16/0004
Museum name	Dartford Museum
Museum accession code	TBC
WA project name	Land at Northfleet Embankment West, Gravesham, Kent
WA project code	232994
Dates of fieldwork	8/2/22- ongoing
Fieldwork directed by	Lisa McCaig
Project management by	Nina Olofsson
Document compiled by	Lisa McCaig

Quality Assurance

Issue	Date		Author	Approved by
1	14/03/2022	Internal (incomplete)	LM	NO
2	15/03/2022	External (incomplete)	LM	NO
3	25/03/2022	Internal	LM	NO
4	25/03/2022	External	LM	NO
5	29/03/2022	Revised following comments	LM	NO

DATA LICENCES

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Figure 2 Structural Remains, working plan with 1868 estate mapping
Figure 3 Site Plan with underlying client topographic data

Plates

- Plate 1** The drying floor chimney, viewed from the east
Plate 2 The southern kiln complex, viewed from the south
Plate 3 Interior of the kiln tunnel, with railway tracks at base, niche/recess in the side wall and first floor flooring joists.
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Land at Northfleet Embankment West, Gravesham, Kent

Interim statement for ongoing excavation works

1 INTRODUCTION

1.1 Project and planning background

- 1.1.1 Wessex Archaeology has been commissioned by RPS Consulting Services Ltd. ('the client'), to undertake an archaeological strip, map and sample excavation across several areas situated within the former Northfleet Cement Works, Gravesham, Kent (hereafter 'the Site'). The excavation area is centred on NGR TQ 61920 74778.
- 1.1.2 The proposed development comprises the construction of residential and commercial properties, an open playing field and a Heritage Park, along with associated ground works. A planning application for EDC/16/0004 was granted in June 2018.
- 1.1.3 Overall development proposals consist of:
- Residential development in the western area of the Site, following ground regrading. This regrading will involve cut and fill involving infilling areas to the north and cutting down of areas to the south, in order to create a smooth gradient northward towards the river;
 - An open playing field and Heritage Park in the eastern part of the Site, to be created with elements of cut and fill, and
 - Additionally, the two areas of former quarry to the southwest and southeast of the High Street are to be developed for employment purposes.
- 1.1.4 As a result of the discovery of extensive remains associated with the former 19th century cement works on site the County Archaeologist for Kent County Council (KCC) issued a brief for archaeological excavation and recording of several parts of the exposed remains.
- 1.1.5 The (ongoing) excavation has been preceded by archaeological works including Palaeolithic archaeological and geoarchaeological excavation (Wessex Archaeology 2021) followed by an archaeological watching brief (Wessex Archaeology Ongoing).
- 1.1.6 A Written scheme of investigation (WSI) was prepared for the strip map and sample excavation (Wessex Archaeology 2022) which set out the research objectives and the aims and methods by which this would be achieved.

2 RESEARCH OBJECTIVES

- 2.1.1 While there is extensive literature on the cement industry in the United Kingdom and countries such as France and the United States of America, it is unclear what aspects and practices of the cement industry were being used and undertaken at the site.
- 2.1.2 The principle objectives of the proposed excavation are to;

- expose and record the physical remains of the 19th century cement works so a clearer picture of the development and practices in use at the site can be developed with the use of documentary evidence;
- inform decisions regarding the preservation in situ of industrial remains beneath the proposed residential development;
- record evidence to a high enough standard to allow for the creation of a digital reconstruction of the site and its components so that the history of the site can be made available to local residents, visitors and other interested parties;
- inform decisions regarding the heritage park at the site, which will be developed as part of the residential scheme; including the recovery of examples of industrial processes for possibly future conservation and display.

2.2 Site-specific objectives

2.2.1 Following the consideration of the archaeological watching brief (Wessex Archaeology Ongoing), the site-specific objectives of the excavation are to identify:

- the precise number of the kilns, their form, function, date, and condition;
- if all the kilns are the same and part of a single phase of development;
- if the kilns were repaired and/or rebuilt;
- the relationship between the kilns and the adjacent tunnel;
- the relationship between the kilns and tunnel and the adjacent drying platform;
- the context for the construction of the kilns and associated tunnel structure. Were they built into a former quarry area and then backfilled immediately to create a higher-level working area?;
- the methods of loading and unloading the kilns with fuel, raw materials, and cement product;
- if hot air was taken off the top of the kilns and channelled into the adjacent drying floor area;
- the methods for accessing and filling voids for preservation in situ;
- the evidence that should be collected for future assessment, analysis and archiving, such as brick, mortar, fuel, product, and residue samples;
- the purpose of the hoppers and associated wagons;
- the purpose of the perpendicular chambers;
- how the rail system functioned.

3 BACKGROUND

3.1 Correlation with the historic mapping and archival evidence

- 3.1.1 A wide range of resources have been made available to aid in the interpretation of the site. Most notably numerous documentary evidence has been provided by Dylan Moore, the author and creator of www.cementkilns.co.uk, found to be the most comprehensive collaboration of materials dedicated to the understanding of the UK cement industry in the 19th and 20th centuries. Notwithstanding Chris Down's archival research and publications pertaining to the history of the north Kent cement industry, his unrivalled access to the Blue circle archives among others has provided the invaluable 1868 estate map and sales particulars which include the area of the southern kiln complex. More anecdotal evidence was provided by Geoff Baker of Gravesham Borough Council, who trawled the local press archives to identify articles which helped to shed light on the day to day running of the cement plant, quarries and what it was like to live in the vicinity of these industries.
- 3.1.2 At this interim stage it has not been possible to fully assimilate this wealth of data and as such only a small number of the available materials have been referenced below. A more detailed assessment of the archive material will take place on completion of the fieldwork in preparation for the final report (and any publications which may result).
- 3.1.3 To understand the structures discussed below it should be clarified that a cement plant needs a number of specific elements to function, key to this are the following;
- Access to a source of raw materials (chalk and clay) to make cement.
 - ✓ Blue clay is brought via barge and unloaded at the docks to the north while chalk is extracted from the chalk pits to the south and brought in via a tramline, this evidence is provided through an article dating from January 24th 1880, written for the Dartford and Gravesend Reporter which described the process of cement manufacturing at the MSSRS. Knight, Bevan and Sturge's Works.
 - A Wash Plant or Wash mills to mix the raw materials
 - ✓ A series of wash mills are depicted on the 1868 estate maps immediately north of the kiln complex adjacent the docks, though nothing survives *in situ* in this area due to later ground disturbance, later wash mills (built circa 1903-09) have been recorded during the watching brief to the southeast.
 - Slurry Backs where the mixed wet materials are left to settle
 - ✓ A substantial area of slurry backs are depicted on the 1868 estate maps immediately south of the kiln complex adjacent the chalk workings. There are no remains of these features
 - Drying floor, an area where the final drying of the slurry occurs, has to be dry enough to be broken in to briquettes ready to be loaded into the kilns.
 - ✓ A drying floor is depicted on the 1868 estate map immediately west of the kiln complex. During the watching brief the foundations of a large rectangular building were identified along with the remains of a large chimney base located at the centre

of the building. Exhaust flues were also identified on the western sides of the kiln tops connecting to the drying floor, a methodology later employed commonly with Chamber Kilns.

- Kilns which can burn for 3-5 days and reach temperatures around 1400°C
 - ✓ The southern Kiln complex comprises a total of 14 kilns, a row of 11 which flank the main kiln tunnel to its east, (resembling a bottle bank like those at Robins), while a further row of 3 kilns were located on the western side of the tunnel at the open section (2 were quickly decommissioned).
- Mills, Grinding or crushing mills, typically 2-3 mills which reduce the clinker in stages to result in the finished powder product.
 - ✓ 'Mills' are depicted on the 1868 estate map to the north of the kiln complex

3.2 Aspdins 1824 Cement Patent

- 3.2.1 Aspdins patent remains vague about the particulars of his design and methodology, apparently due to fierce competition at the time, but a useful reference none the less;

A.D. 1824 No. 5022

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, JOSEPH ASPDIN, of Leeds, in the County of York, Bricklayer, send greeting.

WHEREAS His present most Excellent Majesty King George the Fourth, by His Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Twenty-first day of October, in the fifth year of His reign, did, for Himself, His heirs and successors, give and grant unto me, the said Joseph Aspdin, His especial licence, that I, the said Joseph Aspdin, my exors, admors, and assigns, or such others as I, the said Joseph Aspdin, my exors, admors, and assigns, should at any time agree with, and no others, from time to time at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales and the Town of Berwick-upon-Tweed, my invention of "AN IMPROVEMENT IN THE MODES OF PRODUCING AN ARTIFICIAL STONE;" in which said Letters Patent there is contained a proviso obliging me, the said Joseph Aspdin, by an instrument in writing under my hand and seal, particularly to describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, and to cause the same to be inrolled in his Majesty's High Court of Chancery within two calendar months next and immediately after the date of the said part recited Letters Patent (as in and by the same), reference being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Joseph Aspdin, do hereby declare the nature of my said Invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof (that is to say):-

My method of making a cement or artificial stone for stuccoing buildings, waterworks, cisterns, or any other purpose to which it may be applicable (and which I call Portland cement) is as follows:- I take a specific quantity of limestone, such as that generally used for making or repairing roads, and I take it from the roads after it is reduced to a puddle or powder; but if I cannot procure a sufficient quantity of the above from the roads, I obtain the limestone itself, and I cause the puddle or powder, or the limestone, as the case may be, to be calcined. I then take a specific quantity of argillaceous earth or clay, and mix them with water to a state approaching impalpability, either by manual labour or machinery. After this proceeding I put the above mixture into a slip pan for evaporation, either by heat of the sun or by submitting it to the action of fire or steam conveyed in flues or pipe under or near the pan till the water is entirely evaporated. Then I brake the said mixture into suitable lumps and calcine them in a furnace similar to a lime kiln till the carbonic acid is entirely expelled. The

mixture so calcined is to be ground, beat, or rolled to a fine powder, and is then in a fit state for making cement or artificial stone. This powder is to be mixed with a sufficient quantity of water to bring it into the consistency of mortar, and thus applied to the purposes wanted.

In witness whereof, I, the said Joseph Aspdin, have hereunto set my hand and seal, this Fifteenth day of December, in the year of our Lord One thousand eight hundred and twenty-four.

JOSEPH (L.S.) ASPDIN.

AND BE IT REMEMBERED, that on the Fifteenth day of December, in the year of our Lord 1824, the aforesaid Joseph Aspdin came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Inrolled the Eighteenth day of December, in the year of our Lord One thousand eight hundred and twenty-four.

3.3 1868 Estate Map and sales particulars

3.3.1 An estate map dating to 1868 (**Figure 1**), along with sales particulars for 'Portland Cement Works', sold at auction in October 1868 provided a detailed insight into the cement works lay out during this period, though only covering the southern kiln complex.

3.3.2 The 1868 estate map within the area now identified as *The Southern Kiln Complex* depicts a large rectangular area labelled *Drying Floor*. An unlabelled circular structure is depicted towards the centre of this feature. A bank of 8 kilns, labelled *Kilns* is depicted on its eastern flank while a single kiln is depicted and labelled to the north. To the south of the bank of kilns an area of chalk working is depicted, and a tunnel is labelled heading towards the kilns. To the north of the single kiln is a building labelled *Office*, located adjacent to a feature labelled as a *Road* and partially overlaying a series of unlabelled features.

3.3.3 The sales particulars pertain to the 'newly erected' Portland Cement Works covering 36 acres. The area of the southern kiln complex is covered by the following particulars;

A RANGE OF EIGHT SLURRY OR SETTLING BACKS, A NEWLY-ERECTED DRYING FLOOR, 156 feet by 73 feet 6, with iron plate flooring, iron column and tram rails, CIRCULAR CHIMNEY SHAFT about 80 feet, TWO SQUARE SHAFTS, each about 40 feet high, and Flues constructed for consuming gases from EIGHT NEWLY-ERECTED KILNS, one other large kiln, an office with counting house and room over, facing the road.

3.3.4 The particulars go on to talk about a second range of 8 kilns which likely refer to the those depicted on the estate map immediately to the north (of which nothing survives except the dock and wash mills);

SECOND RANGE OF 8 KILNS, with an enclosed DRYING FLOOR attached in three compartments, 55 feet by 75 feet, 77 feet by 54 feet and 29 feet by 39 feet, and Flues for utilising the gases from the kilns; under the greater part of the Drying Floor are Large and Lofty Arches 75 feet by 17 feet, 74 feet by 16 feet 9, and 81 feet 4 by 16 feet 6, forming CEMENT STORES.

3.3.5 Unfortunately, not all features depicted or discussed have been identified as surviving structures at the site, and not all of the structures on site cooperate with the information held. Further work at the post excavation after completion of the on-site investigations will

hopefully iron out discrepancies and provide answers, particularly regarding phasing of construction at the site.

4 PRELIMINARY FIELDWORK RESULTS

4.1 Introduction

- 4.1.1 Prior to the excavation phase it had been established during the ongoing watching brief that a large 'bee-hive' kiln survived against the former cliff face in the northern part of the site. This structure was deemed far too unstable for preservation and had to be recorded rapidly. This was done via building recording, laser scanning and photogrammetry. The structures were then systematically demolished under archaeological supervision.
- 4.1.2 Meanwhile a large kiln complex with associated tunnels was identified in the southwest portion of the site, immediately west and running broadly parallel to the former Hive Lane.
- 4.1.3 The southern area had been levelled/infilled historically and reused for later buildings which have more recently been cleared. During the watching brief phase it was concluded that the truncated 'tops' of 14 kilns and large associated tunnel survived, in varying degrees of completion, below the current ground level.
- 4.1.4 Wessex Archaeology commenced the excavation of the southern kiln complex on the 8th February 2022, undertaking detailed recording including laser scanning and photogrammetry. While this area of works is now complete, further excavations are still due to take place to the east.
- 4.1.5 A watching brief is still maintained at other locations at the site and during the demolition of any approved historical structures.

5 ITEMISED LIST OF THE SURVIVING STRUCTURES

- 5.1.1 The following section presents each aspect of the surviving structures recorded in the area of the southern kiln complex and the northern kiln complex along with a preliminary discussion of their form and probable function (**Figure 2**). Some features from the watching brief phase are included on this plan but are not discussed at this stage (**Figure 3**).

6 THE SOUTHERN KILN COMPLEX

6.1 Introduction

- 6.1.1 The southern kiln complex comprises of 14 kilns and a directly associated kiln tunnel, along with a further 3 tunnels and a drying floor. While most of the structures were built as part of a single phase of construction there are several amendments to the layout of the complex and later editions followed by eventual re-use, particularly during WWII.
- 6.1.2 The southern kiln complex is spread across two levels. The area immediately north of the complex is the lower level and meets the bank of the river Thames. The tunnels and kiln complex are set against a cut chalk face, i.e. the area has been quarried to enable the insertion of the structures into a (substantial)man made recess. To the east and west of the kiln complex structures sit upon undisturbed natural geology, which is approximately 8m higher than the riverside levels. The structures built within the cut ground have been built to a height satisfactory to create a working surface which allows a continuous working platform at this higher level.

6.2 The drying floor

- 6.2.1 The remnants of the drying floor and its associated chimney (discussed below) were identified immediately west of the kiln and tunnel complex, this structure corresponds with the 1868 estate map, which depicts a large stepped rectangular structure butting what appears to be a bank of kilns corresponding with its length to the east.
- 6.2.2 The drying floor remains consisted of only foundations surviving in places of up to three courses of un-mortared brickwork set into the natural chalk geology. They indicate a large sub rectangular building measuring 48m (156ft) long and 22.5m (73ft) wide. Although very little of this structure remained, the pattern of loose brick which survived only in patches, indicated lines of underfloor brickwork forming squares and rectangles suggesting an underfloor flue/heating/ventilation was present (see 6.10 Exhaust Flue System, below).
- 6.2.3 A deep water filled shaft, presumed to be a well was identified close to the western wall of the drying floor. The vertical shaft was cut into chalk and is mostly un-lined, it extended approximately 10m below ground and was only lined with mortared red brick for approximately 1m down from the current ground surface. This feature does not correlate with any feature depicted on the 1868 estate map.
- 6.2.4 Two square features depicted on the state map immediately north and on the southwest corner of the drying floor likely represent chimneys, but no evidence of these structures survived on site.

6.3 Drying floor chimney

- 6.3.1 At the centre of the building adjacent the western (rear) wall a brick foundation pad and the base of a brick chimney structure were identified (**Plate 1**). The chimney is circular in plan and survives for a total of 14 courses, measuring 1.08m high. The chimney had an external diameter of 4.3m and an internal diameter of 2.4m, with an arched opening facing east, measuring 1.6m, the partial remains of brickwork set within the floor suggest the opening was controlled by 2 small doors, since removed.

6.4 Kiln Tunnel

- 6.4.1 The main kiln tunnel comprises a 55m long (N-S), 4.6m wide, 8m high brick structure (**Plate 2**). The tunnel has a round headed arched roof with straight walls which gradually taper in to give a horse-shoe profile. This tunnel is aligned broadly north-south and serves a row of 11 kilns on its eastern flank, a D shaped chimney forms the southern terminus while to the north a 15m long 'open' section is recorded which then becomes a covered tunnel measuring 9.7m long (both discussed separately below). This gives the kiln tunnel complex an overall length of 80m.
- 6.4.2 At the floor of the tunnel (which appears broadly flat) a rail track is set on a rough chalk floor, the track is not central to the tunnel, where exposed during the excavation the track is off set to the west (**Plate 3**). The track is 720mm (2ft 4inch) gauge, no sleepers could be identified beneath the track, it should be noted that the track appeared segmented i.e. broken in places, and it is quite likely that the track may be slightly displaced due to historic reclamation of materials to use elsewhere on site. A second possible *insitu* track was partially observed along the eastern side of the tunnel which was a 0.8m gauge, this track was laid at the same level as that to the west, suggesting contemporary use. It should be noted that the lack of identified sleepers raises the possibility that the track gauge was originally different to what was recorded on site. It is possible that one track was used for hand pushed carts while perhaps the other worked in conjunction with a steam locomotive.

However it is considered more probably that steam locomotion on site was principally used for the 'main line', transporting materials long distance, rather than internal and relatively short distance tracks identified within the tunnels. Significant limitations on the excavation in this area means it is not possible to confirm at this stage.

- 6.4.3 No other features could be observed at the base of the tunnel due to the limitations on excavation from the unstable nature of the backfill.
- 6.4.4 A single niche could be identified in the western wall of the tunnel at track level (**Plate 3**), this is possibly a 'transit-point', allowing for pedestrians to move out of the way of moving carts, or a storage area, measuring 2m high, 1.8m wide 1.1m deep, cut into chalk. It is likely there are several such recesses along the length of the tunnel.
- 6.4.5 Along the crown of the tunnel at the centre point and in line with the centre of each of the kiln loading chambers are a series of metal hoops which would have allowed materials to be lifted (or lowered) from track level to the kiln loading platform either by hand or by using a series of pulleys and winches (**Plate 4**).
- 6.4.6 Along the eastern wall of the tunnel at track level a pattern of bricked up arched tunnels was observed (**Plate 5**). One was located at the foot of each kiln where the lower kiln 'draw door' access tunnel is located (opening to the east, discussed below. See also Tunnel 22B). The more intricate nature of this brickwork suggests that these openings were in use only during the construction phase of the kilns and were carefully bricked up as part of the completion of the tunnel. This tells us that the kiln tunnel was only used in association with the upper kiln access points for the loading or unloading of materials from the kilns.
- 6.4.7 Evidence for a first floor once existing along the length of the tunnel is indicated by a series of cut wooden floor joist, sometimes surviving just as square niches 0.25x0.25x0.25m and located every 1.8m, they are visible in the eastern and western walls of the tunnel (visible on **Plate 3**). The even cutting of the floor joists suggests they were removed at a later date to be reused elsewhere on site. The joists are set approximately 4m above the track level and match the level of the floor of the kiln loading tunnels. The floor may not have spanned the entire width of the tunnel or would have operated a series of trap doors which allowed materials to be winched up from track level but no evidence to support either theory survives.
- 6.4.8 Along the eastern side of the tunnel set into the roof, the remains of 5 openings were identified (there was likely at least one more but a large section of the tunnel towards the southern end was too significantly damaged to interpret). The openings are carefully constructed and form (truncated) above ground structures, D shaped in plan (**Plate 6**).
- 6.4.9 These features are currently open to further interpretation, although several theories are proposed;
- They may have formed structures like chimneys which could improve airflow during the cooling process.
 - They may have been providing ventilation and/or light into the first floor and the kiln loading chambers.
 - They may have a more direct association with the drying floor to the west, operating as part of the flue system sending out more hot air.

- Finally, perhaps they operated in a chute like function to transport the dried slurry cakes from the drying floor outside to the kiln loading chambers inside the tunnel 4m below the level of the drying floor.

6.4.10 The southern end of the tunnel has a large D shaped projection, which may represent the remains of a chimney.

6.4.11 The tunnel has been almost completely backfilled, a large amount of the backfill has been deposited through the surviving above ground openings, particularly the tunnel 'chimneys', artefacts recovered from the backfill suggest this occurred in at least two phases. The first occurring around 1920's with further, more significant backfill occurring in the 50's-70's.

6.5 Kiln loading chambers

6.5.1 A kiln loading chamber (**Plates 7 & 8**) was built contemporary with the main kiln tunnel to access each kiln for loading and unloading through its 'side door'. There are 11 kiln loading chambers along the eastern wall of the kiln tunnel. Each loading chamber butts the outer conical wall (west) of its pairing kiln, demonstrating that the kiln had to be built first so that the butting brickwork created a tight seal against the kiln.

6.5.2 The kiln loading chambers are all of equal dimensions. They measure 3.4m high, 1.2m wide and 2.3m long. The chamber provides access to two arched openings (side doors) in the kiln which would have been used to feed or load the kiln with hard cake (sometimes referred to as 'pug'), a dried slurry which could be broken into lumps and stacked in layers inside the kiln prior to firing.

6.5.3 The doorways into the kiln each measured just 0.9m high and 0.6m wide, each doorway would have been bricked up during the firing process, which could take anything between 3-5 days.

6.6 The open section of the kiln tunnel

6.6.1 A 15m long section towards the northern end of the tunnel has no arched roof structure and no indication could be identified to suggest it ever had, it is therefore presumed that this section of the tunnel was designed to be open (**Plate 9**). The floor joists for the first floor did continue through this open section of the tunnel and beyond.

6.6.2 It seems most likely that during the kiln tunnels main period of use, this section did not have a roof and was designed to be open. There is no indication from any of the structural elements on site that any roof structure existed. An open section of the tunnel adjacent the northern end of the drying floor would provide a substantial loading area to deliver (presumably utilising a crane, although no evidence for this can be inferred) to deliver the load of hard cakes of slurry to the first floor of the kiln tunnel which is located approximately 4m below the level of the drying floor and to load trolleys utilising the rail system at the ground floor 8m below.

6.6.3 Study of an aerial photograph from 1939 (Historic England Photo Viewer) shows that this section of the tunnel remains open at the site, but it is covered by what looks like a derelict curved roof frame which has fallen into a state of disrepair. Suggesting that at some point prior to 1939 a roof was installed, perhaps around the time of the Hive Lane overpass construction.

6.7 The northern section of the kiln tunnel

- 6.7.1 The most northerly section of the main kiln tunnel is closed similar to its southern counterpart, with a round headed arch. The sidewalls in this section however appear straight where exposed (**Plate 10**). The tunnel appears to have a projected square brick abutment facing north, but a much later concrete wall has been built abutting the northern face of the brickwork so any potential architectural embellishments at the northern mouth of the tunnel are currently hidden.
- 6.7.2 Floor joists continuing at the same level as those seen in the other sections of the tunnel are also identifiable here, indicating the first floor spanned the entirety of the kiln tunnel.
- 6.7.3 Very little of this section of the tunnel can be investigated due to the insertion of later structures currently hampering its investigation, in particular the later inserted buttress wall, discussed below.

6.8 The buttress wall

- 6.8.1 To the rear of the northern section of tunnel, a substantial buttressed wall almost 6m in height and over 1m thick has been built within the kiln tunnel, presumably to close off access from the north (visible on **plate 10**). Presumably the buttress wall was built to the rear of this covered section so that it could remain in use as a storage bay for works continuing at the dock area level to the north.

6.9 Kiln Bank (11)

- 6.9.1 A bank of 11 kilns aligned north-south running parallel to the east of the kiln tunnel (**Plate 11**). These kilns are all certainly constructed during the same phase as the main kiln tunnel. The kilns are attached to the tunnel via the kiln loading chambers, on completion of the brickwork the entire structure was encased in wet-pour concrete up to the bottom of the neck of the kilns. This probably served numerous functions, encasing the kiln complex in concrete likely helped retain heat, stabilised the entire structure, lessened the need for iron work on the outside of kilns (as seen on the typical bottle kilns i.e. 'Aspdins' at Robins) it also weather proofed the entire structure and importantly created a stable floor surface over the footprint of the kiln complex which could be utilised as part of the Drying floor.
- 6.9.2 The kilns measure 4m in diameter (13 foot) at the widest point, the kilns have a 'beehive' profile, narrower at the base and neck. The main body of the kiln measures 8m high, this finishes at the same level as the kiln tunnel roof, above this height the chimney would have projected above.
- 6.9.3 The kilns are constructed from three skins of bricks. The outer skin is a double skin constructed on a stretcher bond (changing to a single course on header as the kiln narrows) of yellow stock brick with a cement and sand mortar. The quality of the external pointing on the kilns varies significantly from south to north, the quality declines significantly (**Plates 12 & 13**), perhaps this is in response to an encroaching deadline for the kiln complexes completion. The internal kiln skin is a single skin made from fire bricks laid on a header bond, no pointing is used on this skin, but thin beds of sand are used to lock the bricks during construction.
- 6.9.4 Only the southern most of the kilns has an 'intact' chimney (**Plate 13**), which survives to a height of approximately 1m above the rest, though this structure is also likely partly demolished it suggests the full height of the kilns to be at least 9m. An aerial photograph of the site from 1939, where the area of the Southern Kiln Complex is depicted is a level area

of land covered by low vegetation, the upstanding chimney of the southernmost kiln is the only part of the kiln bank visible, it is possible to infer at least another 1m in height, putting the total height of the kilns over 10m.

- 6.9.5 With the exception of the northern most kiln, all of the surviving kilns of this row have been historically truncated, from approximately the shoulder of each kiln, the removed upper sections of the kilns were deposited within the kilns as part of the backfill process. All of the kilns were then fully backfilled with other waste materials, including corrugated iron sheeting, timber, tiles, bricks and waste clinker. The tops were then capped with wet pour concrete. It is difficult to ascertain when this took place, but it was likely around the 1920's when the cement works was closed down for 5 years for a period of extensive remodelling. Certainly, by 1939 almost all above ground structures have been completely levelled and only tunnels 22A and 22B remain in use.

6.10 The Exhaust Flue System

- 6.10.1 Evidence for an exhaust flue system present at the site has already been suggested due to the presence of a potential underfloor duct system operating beneath the footprint of the drying floor (3.2.2 above). The underfloor heating system is directly fed via an intricate system of interconnecting brick-built flues which in turn connect to an exhaust flue set at the shoulder of each kiln on its western side (**Plate 14**).
- 6.10.2 This system is designed to take a proportion of the expelled heat and gases from the kiln during firing and relay it beneath the adjacent drying floor. The chimney located at the centre of the drying floor is connected to the end of this system to generate the draw.
- 6.10.3 On site these flues survived typically as only a single course of curving brickwork (the very base of the flue) but several small sections of surviving side walls were identifiable and a slag like residue has formed a coating along the inside of these structures which was suitable for sampling.

6.11 Kiln Bank (3)

- 6.11.1 A further 3 kilns are located on the western side of the tunnel at the northern end which are also aligned north-south. While these kilns are also encased in concrete and are likely contemporary with the construction of the kiln complex, it appears 2 of the 3 kilns were later (perhaps fairly quickly) decommissioned to make way for Tunnel 22A. These kilns are located in the 'open' tunnel section, where no roof structure has been discernible. All three kilns have been fully recorded with two of them removed and one partially removed (lower half remains in situ).
- 6.11.2 All three kilns suffered significant historic disturbance prior to the excavation, with the remnants mostly surviving as a cast left in the encasing concrete. They appear to have the same height, diameter and profile to those seen to the west, although their upper loading access was less formal, simply a 0.8m deep arch set into the western tunnel wall, which the kilns must have simply butted (**Plate 15**).
- 6.11.3 Only the northmost of the kilns was kept in use as the draw door for this kiln is still accessible from the base of the open section of kiln tunnel through the western wall (**Plates 16 & 17**). The two southern kilns draw doors have been neatly bricked up when tunnel 22A was extended to the southwest (**Plate 18**). The early decommissioning of two kilns in this area corresponds with the 1868 estate map depicting a single kiln (however no tunnel in indicated).

- 6.11.4 The three northern kilns certainly appear more hastily built and as there is evidence of fairly rapid decommissioning; perhaps these kilns were more of a necessity during the construction phase, either as a stop gap to keep cement production up during the main building works or to provide materials for the construction of the main kiln complex.

6.12 Tunnel 22B

- 6.12.1 Tunnel 22B is the firing tunnel for the 11 kiln bank, this tunnel leads to the draw doors located at the base (rear) of each kiln. The tunnel is aligned north-south, with the kilns to its west. Inside the tunnel is a series of 11 smaller tunnels, approximately 1.5m long (set at 90°) which serve as access to the 'draw doors' (see 3.11.3 above) located at the base of each kiln for firing and lower extraction on completion of firing.
- 6.12.2 This tunnel also has a series of chimneys or shafts which draw the air through the tunnel to keep the kilns fired. Five of these chimneys or shafts were identified at the higher level of the site and once stood as projecting above ground structures. The upstanding remains of four of these chimneys can still be seen in the aerial photograph from 1939 located alongside the Hive Lane footpath
- 6.12.3 Cart tracks (0.8m gauge) survive partially *insitu* at the base of this tunnel, running its length, although the level of the tunnel has been brought up to the height of the track with concrete at a later stage.
- 6.12.4 Tunnel 22B is a branch off the northeast section of tunnel 22A, it appears to be a single phase of building although the roof of this tunnel is of round headed arch design while the connecting section of 22A has a pointed arch.
- 6.12.5 This tunnel also connects to the Northern Kiln Complex via a small 'adit' or 'pedestrian' tunnel heading east (**Site Plan**), the western opening in within tunnel 22B has been bricked up at an unknown date. This small tunnel measures approximately 34m long but is just 0.9m high and 0.8m wide at the eastern end (**Plate 18**), its function is unclear as its small size would make it particularly difficult to navigate, it is also not located at the working floor level identified at the northern kiln complex, but approximately 1m above it.
- 6.12.6 Tunnel 22B was later converted into an air raid shelter. Access to the kilns draw door was blocked off in line with the tunnel, except for two towards the centre of the tunnel, which were bricked up immediately adjacent the draw door and half bricked in line with the tunnel, creating small private areas which likely served as male and female toilets.
- 6.12.7 All but the southernmost chimney was backfilled with wet pour concrete from above and a number of blast walls were installed along the length of the tunnel.
- 6.12.8 The southern terminus of the tunnel has not yet been confirmed.

6.13 Tunnel 22A

- 6.13.1 Tunnel 22A is aligned northeast-southwest, the tunnel is diagonal to all other structures on site but ties in with a road depicted on the 1868 estate map at the dock level. This tunnel is broken into two sections, projecting northeast and southwest from the main kiln tunnel.
- 6.13.2 The section to the northeast of the kiln is certainly contemporary with the original construction of the kiln complex. It measures approximately 30m long, it is 4m wide and 3m high but has a pointed arch roof.

- 6.13.3 The southwestern part of the tunnel (**Plate 19**) is probably a later extension, its construction required the decommissioning of 2 kilns on the west (**Plate 20**). The tunnel is approximately 60m+ long continuing southwest from the main kiln tunnel, it has an arched roof which tapers in slightly towards the base giving a horse shoe profile, it measures approximately 3m wide and 3m high.
- 6.13.4 The base of this tunnel is approximately 0.8m higher than the level of the kiln tunnel, cart or railway tracks are partially buried within this concrete, these tracks are 0.6m or 2 foot gauge, indicating an entirely different rail system, no longer connected to the main kiln tunnel has been installed at a later date.
- 6.13.5 This tunnel has been converted during the second world war for use as an air raid shelter with a series of blast walls and air pump ventilation systems installed. There are no bricked up features in this tunnel and therefore no indications of side passageways, draw doors, shafts etc.
- 6.13.6 The southwest terminus of the tunnel has not yet been identified; historic mapping suggests the tunnel leads to an area of open chalk workings and it is still visible in aerial photographs from 1939 and appears to be a functioning rail tunnel.

6.14 The Adit

- 6.14.1 As discussed in 6.12.5 (and **Plate 21**) above, a small tunnel or adit appears to connect the southern kiln complex with the kiln complex centred approximately 60m to the northeast, hereafter dubbed The Northern Kiln Complex, suggesting that the two areas of works had an overlapping timeframe of use to necessitate a physical connection.

7 NORTHERN KILN COMPLEX

7.1 Introduction

- 7.1.1 The Northern Kiln Complex was investigated and assessed under the watching brief phase of works. The chance discovery of this previously unknown kiln complex sparked the need to re-evaluate the level of archaeological mitigation across the remainder of the site, which has resulted in much more detailed recording elsewhere and will be utilised in the next phases of work.
- 7.1.2 Much of the northern kiln complex had been dismantled historically to make way for newer technologies, particularly in the 1920s when the site was redeveloped to use rotary kilns. Many of the features within the northern kiln complex were almost completely destroyed, anything that could remain *insitu* was blocked off with concrete.
- 7.1.3 Full assimilation of the watching brief data is still underway in conjunction with the laser scanning and photogrammetry undertaken by Wessex Archaeology (WA 2021), unlike the southern kiln complex this area of the site is not covered by the 1868 estate map and so far no map has been found which details the earlier cement works in this part of the site.

7.2 The Beehive Kiln and its associated truncated structures

- 7.2.1 Approximately 2/3 of the beehive kiln survived *insitu*, its northern side and top had been completely eradicated by the later building works (**Plate 22**). Approximately 8m in height and measured approximately 4.5m in diameter (14ft 7 inches), making it slightly larger than the typical size of kiln in the Southern Kiln Complex.

7.2.2 The standing kiln is actually the southernmost kiln of a row of up to four kilns, the three northern kilns were almost completely eradicated during the remodelling, with only the lower access chambers, which lead to the base of the kiln surviving.

7.2.3 Immediately east of what would have been a north-south aligned kiln bank is its associated firing tunnel and immediately west are the remnants of its associated kiln (loading) tunnel. This complex follows almost the exact same layout as the southern kiln complex but on a reduced scale.

7.3 Associated structures

7.3.1 To the west of the kiln loading tunnel a further three bays, almost 4m wide are identified, these were likely used for material stockpiles or drying areas and have evidence for a first floor. The Adit which leads to the southern kiln complex is located at the rear of the middle bay.

7.3.2 Partial remains of a series of rectangular buildings immediately west of the kiln complex likely represent further ancillary buildings associated with the preparation and storage of materials.

7.4 Tunnel 22D

7.4.1 Tunnel 22D (and therefore 22E) is directly connected to the northern kiln complex, they join at the southern end of the kiln firing tunnel (**Plate 23**) from the east. Tunnel 22D/E will be further explored as part of the upcoming excavation works but is already fairly extensively recorded (CgMs 2009). Although the function of a number of features could not be clarified in the CgMs report it is expected that a number of features including at least one more kiln will be associated with this structure. This will be explored during the next stage of fieldwork.

8 FUTURE WORKS ON SITE

8.1.1 The Eastern Area, which is currently in use as a ramp for the groundworks contractor plant to gain access to the higher-level working platform, is due to be excavated as part of the archaeological scope of works. This area includes Tunnel 22D/E and Tunnel 22F. While it can be inferred from examination of the CgMs tunnel data that a third kiln complex is likely to sit within the vicinity of the ramp, the extent to which it survived the 1920's remodelling is yet to be established.

8.1.2 This next phase of work will hope to answer to specific aims as set out in the WSI which relate to tunnels 22 D and F;

- the purpose of the hoppers and associated wagons;
- the purpose of the perpendicular chambers;

8.1.3 An additional future objective may be to attempt to trace the ends of tunnels 22A and 22B, although this is outside the scope of the currently agreed scheme of works.



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Online Resources

Historic England Aerial Photo Viewer Aerial photo EPW060573 The Bevan Portland Cement Works 27th February 1939. accessed 22/3/22
[EPW060573 - Aerial Photo | Historic England](https://www.historicengland.org.uk/aerial-photo-viewer/EPW060573)

Cement Kilns www.cementkilns.co.uk

PLATES



Plate 1 The drying floor chimney, viewed from the east



Plate 2 The southern kiln complex, viewed from the south



Plate 3 Interior of the kiln tunnel, with railway tracks at base, niche/recess in the side wall and first floor flooring joists.



Plate 4 Metal hoop set at the crown of the tunnel for use in loading chambers



Plate 5 Intricately bricked up openings at the floor of the kiln tunnel



Plate 6 Upstanding structural remains of one of the kiln tunnel roof openings



Plate 7 The Kiln loading doors



Plate 8 The kiln loading chamber butting the external kiln wall (after its concrete encasement is removed).



Plate 9 The open tunnel section, viewed from the north



Plate 10 The northern tunnel section with later inserted buttress wall, viewed from the south



Plate 11 The kiln bank (only 6 in view) and its associated tunnel, viewed from the southwest



Plate 12 Kilns at the southern end of the surviving row with high quality pointing, viewed from south



Plate 13 The northern surviving kiln, with poor quality pointing, viewed from the northeast



Plate 14 The only surviving kiln chimney (& the southernmost kiln), viewed from the southwest



Plate 15 The exhaust flue system and the southernmost kiln, viewed from the southwest



Plate 16 Loading chamber for the remaining kiln on the western side of the tunnel



Plate 17 The draw door at the base of the open section of tunnel, viewed from the east



Plate 18 The fire box and a stoke hole at the base of the kiln



Plate 19 The southwestern section of Tunnel 22A, its associated (later) railway tracks are visible at the base of the open section of tunnel, viewed from the northeast



Plate 20 Bricked up draw door to allow for the insertion of tunnel 22A, viewed from the east



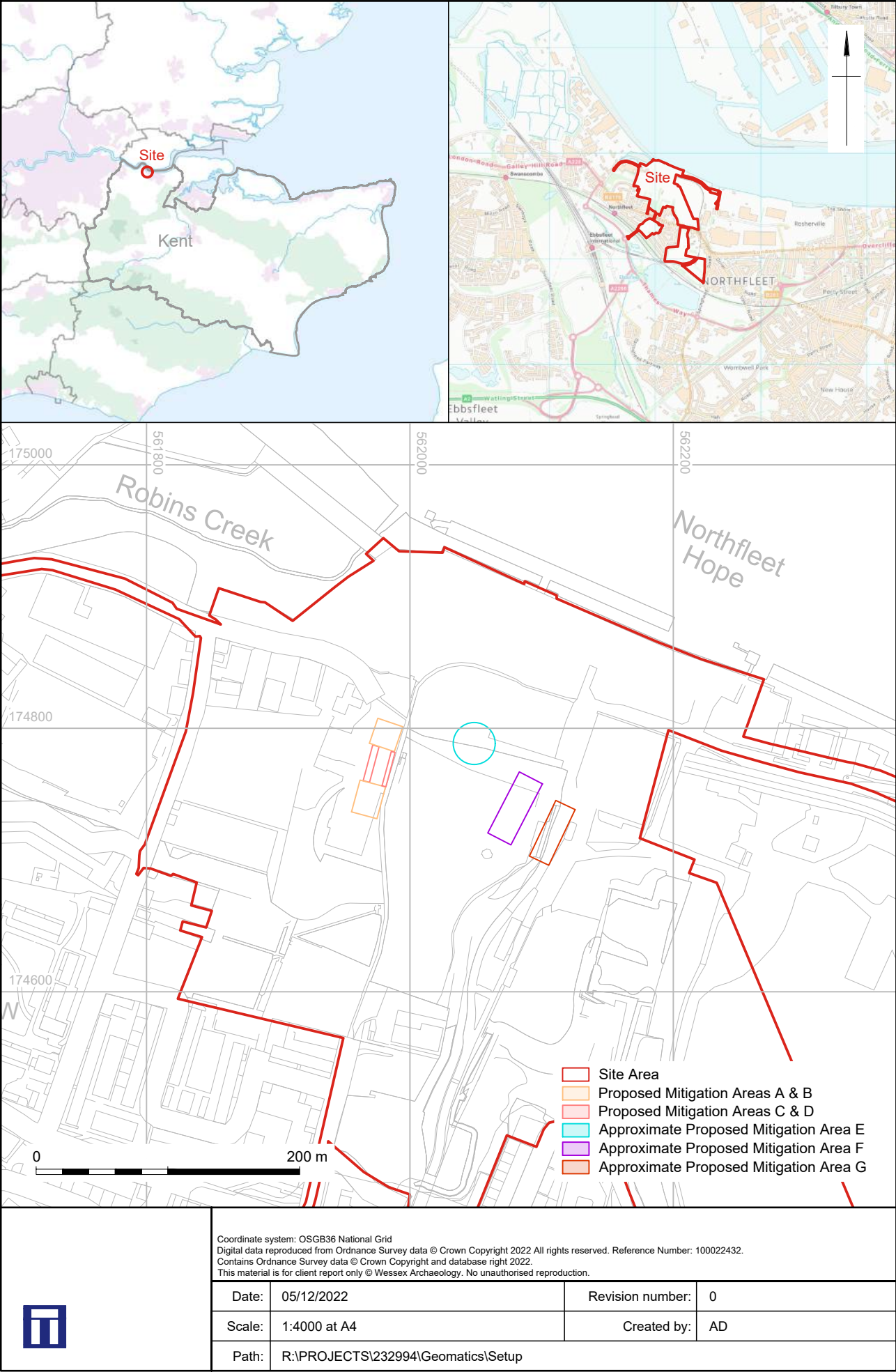
Plate 21 The Adit or 'pedestrian' tunnel in the chalk face, viewed from the northeast



Plate 22 The Northern Kiln Complex, viewed from the north

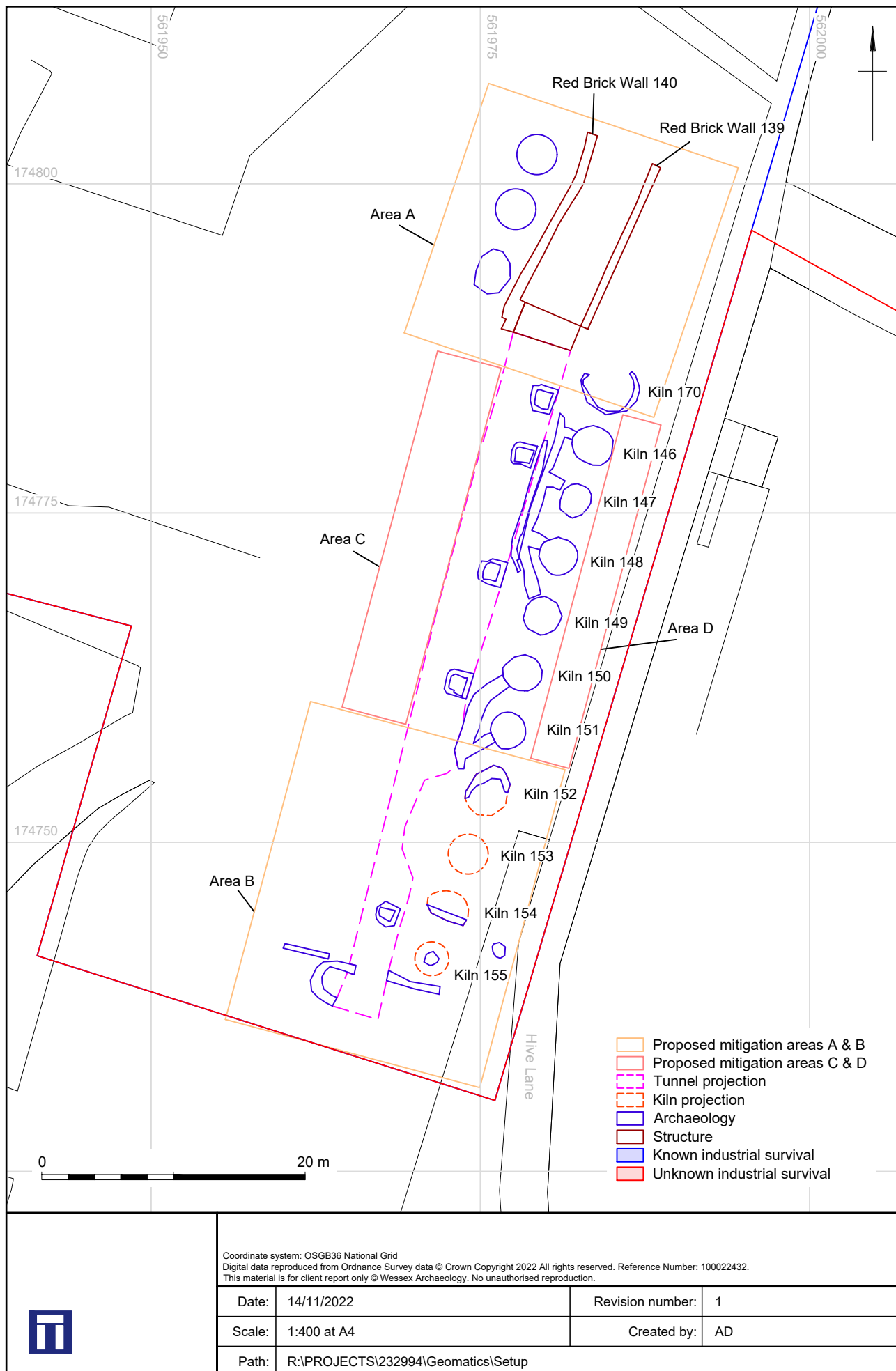


Plate 23 Tunnel 22 D where it meets the kiln firing tunnel



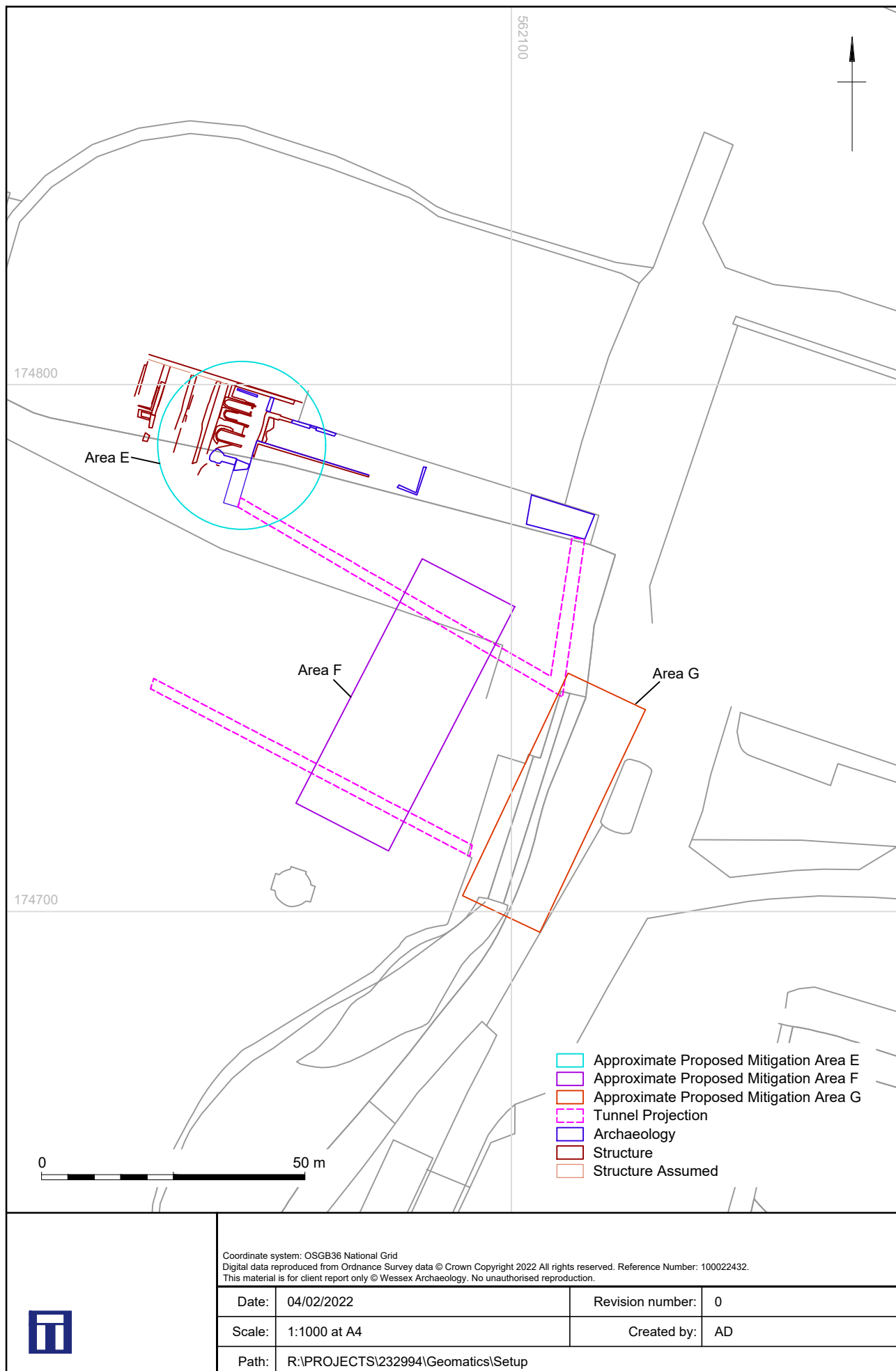
Site location

Figure 1



Proposed mitigation areas A, B, C and D

Figure 2



Approximate Proposed Mitigation Areas E, F and G

Figure 3

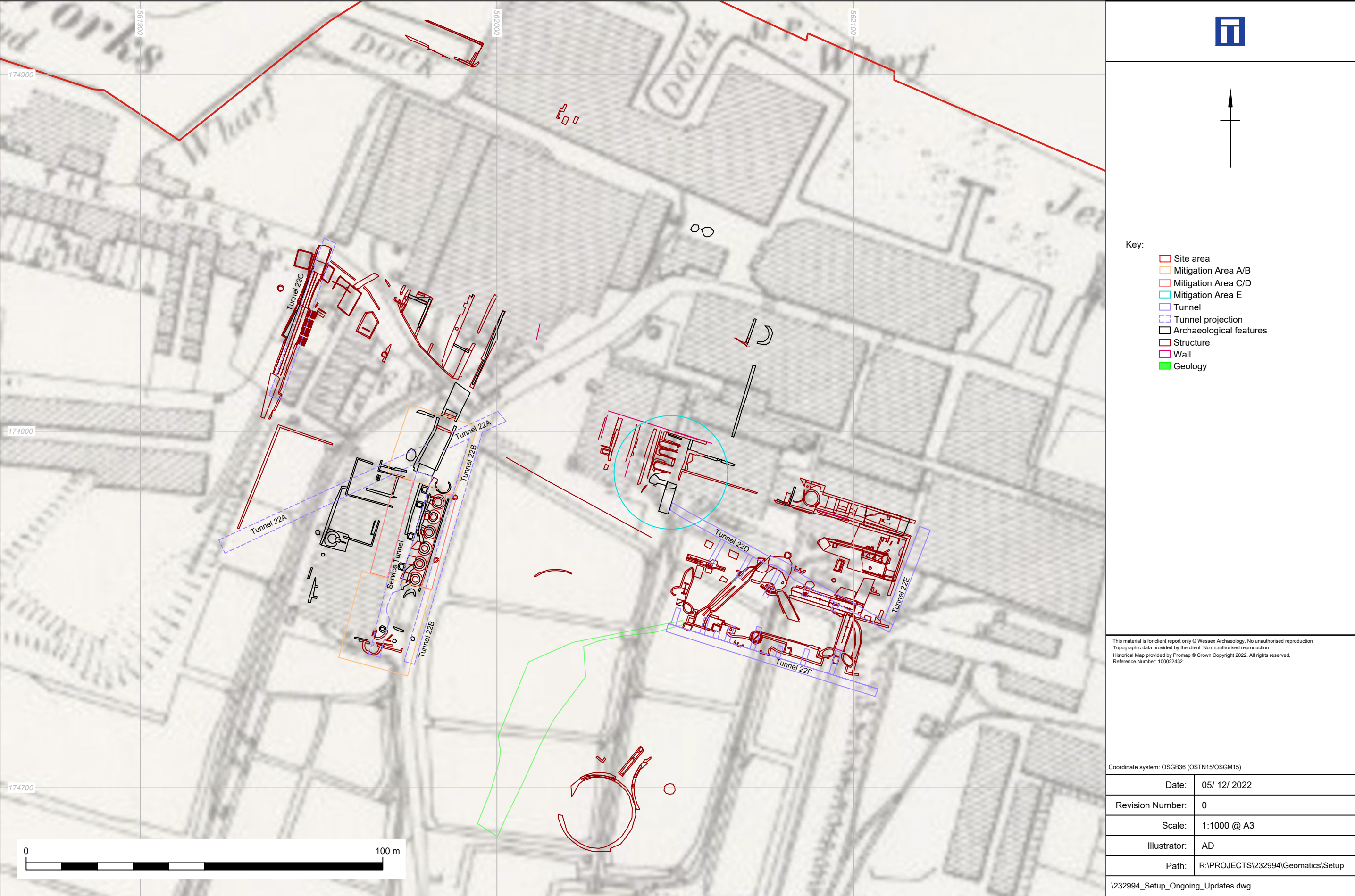
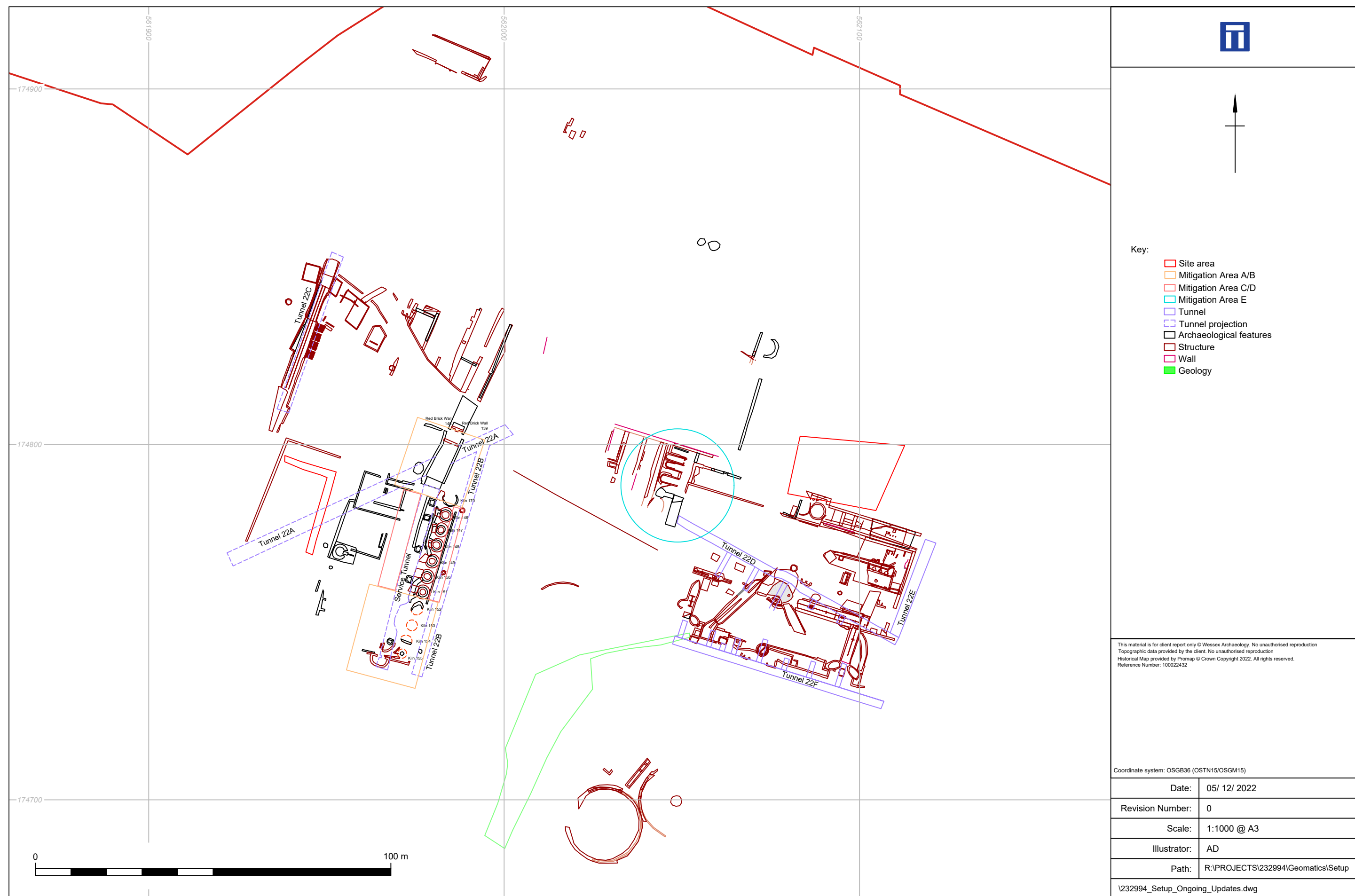


Figure 4 - Northfleet site plan with 1895 OS map





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