



Castlegate, Sheffield

Geoarchaeological Monitoring of Ground Investigation (GI) works



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Summary

A programme of geoarchaeological monitoring of GI works was undertaken at Castlegate, Sheffield, building on work carried out during previous phases of geoarchaeological and archaeological works at the site (Wessex Archaeology 2020; 2023). This phase of GI works included a total of 36 geotechnical interventions monitored for geoarchaeological purposes; the resultant sediment descriptions and interpretations were integrated with the existing lithostratigraphic framework for the site and used to update the deposit model presented in Wessex Archaeology (2023). The work was undertaken in order to provide information about the archaeological and geoarchaeological resource that might be impacted by the proposed development, to consider the possible significance of any archaeological and geoarchaeological evidence present, and to inform the scope and requirement for any further archaeological and geoarchaeological work.

A significant proportion of the sediments overlying the bedrock encountered during this phase of GI works have been assigned a post-medieval or modern date, and comprise the various elements of the stratigraphic unit referred to here as 'Made Ground'. In addition, only OP101 and TP101 were undertaken within the anticipated area of the castle motte, and both of these were excavated to levels that recorded only post-medieval/modern made ground/brick structures. No additional information can therefore be provided for the research questions associated with the castle motte.

However, additional stratigraphic data has been provided associated with the castle moat. Suspected moat deposits were discovered in the south-west of the site underlying modern made ground and concrete, with these deposits being identified in borehole DS101, close to Trench 9 and a series of boreholes undertaken during the 2018 archaeological investigation (Wessex Archaeology 2020). Given that the scope of the GI works was engineering led, it was not possible to obtain samples from any of the deposits associated with moat fill.

Previous palaeoenvironmental assessment and radiocarbon dating of organic moat fills at the site (Wessex Archaeology 2019d) demonstrated the complex taphonomy of moat fills, with significant age inversions noted in the results of the radiocarbon dating, and a high degree of uncertainty was placed on the reliability of the palaeoenvironmental data as an indicator of environmental conditions contemporary with the castle. Similar to other records of the earlier moat fills, the sediments in borehole DS101 are exclusively inorganic clays and silts, which appear mixed in places and may be disturbed or redeposited with no visible signs of waterlogging. These moat fills have low potential for palaeoenvironmental assessment and radiocarbon dating, and no further work is recommended. Similarly, the other deposits identified during the GI works are either of post-medieval or modern date (those associated with Made Ground) or of low palaeoenvironmental potential (Archaeological Fills), and no further assessment is recommended on these deposits.

Archaeological excavations at the Site are ongoing, with the results of the set-piece excavations and watching brief and resultant post-excavation assessment due to be reported in 2025, with additional excavation associated with Phase 2 of the construction also expected in 2024. It is recommended that the results of the geoarchaeological monitoring and updated deposit modelling are reviewed as part of the project design for these works, and any relevant results incorporated into the reporting on the archaeological excavations.



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Castlegate, Sheffield, South Yorkshire

Geoarchaeological Monitoring of Ground Investigation (GI) works

1 INTRODUCTION

1.1 Project and planning background

- 1.1.1 Wessex Archaeology has been commissioned by Geotechnical Engineering Ltd ('the Client') to produce a report outlining the results of a programme of geoarchaeological monitoring of Ground Investigation (GI) works at Castlegate, Sheffield, South Yorkshire (the 'Site'). The Site is centred on 435805, 387684 (SK 35805 87684) (**Figure 1**).
- 1.1.2 The GI works at the Site were undertaken as part of a programme of Unexploded Ordnance (UXO) clearance and investigation of the River Sheaf culvert, located towards the east of the Site. The GI works comprised a series of hand-dug and mechanically excavated test pits, as well as boreholes (see below).
- 1.1.3 The works are in advance of proposed development of the Site, which comprises the rejuvenation of the Castlegate area, with current plans at the Castle Site proposing the de-culverting of the River Sheaf, the protection and further interpretation of the archaeology of Sheffield Castle (with a focus upon the remaining gatehouse structure), and the initial development of a community-orientated green space in Sheffield city centre (Sheffield City Council 2021).
- 1.1.4 The geoarchaeological monitoring follows on from a series of evaluation trenching, borehole survey and palaeoenvironmental assessment at the Site in 2018 (Wessex Archaeology 2019a, b, c, d and 2020, Moreland and Hadley 2020), and more recent geoarchaeological borehole survey and deposit modelling undertaken in 2022 (Wessex Archaeology 2023). The deposit model produced by Wessex Archaeology (2023) was supplemented with the information gathered by the 2018 and earlier phases of archaeological investigation (Armstrong 1930; ARCUS 2000, 2002; Met Geo Environmental 2013) and has been updated here to include the results of the current phase of GI works.
- 1.1.5 This phase of geoarchaeological monitoring will provide additional information on the sub-surface deposits at Sheffield Castle, and contribute data for an updated deposit building on that presented in Wessex Archaeology (2023). The overall purpose of the geoarchaeological investigation is to provide further information on the archaeological and geoarchaeological resource that may be impacted by the proposed development, and facilitate an informed decision with regard to the requirement for, and methods of, any further archaeological and geoarchaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource) or a management strategy.

1.2 Scope of works

- 1.2.1 The GI works at the Site comprised the following interventions (see GEL 2024 for a detailed description of the geotechnical works):

- 12 no. Dynamic Sampling boreholes (DS101-DS204B), undertaken using a rotary drilling rig equipped with a dynamic sampling head;
- 9 no. Rotary Core boreholes (VC201-VC207);
- 9 no. Vertical Concrete Core boreholes (VC101-VC109), undertaken to determine the location of either the culvert or rockhead;
- 8 no. Horizontal Concrete Core boreholes (HC101-HC203);
- 9 no. Observation Pits (OP101-OP111), undertaken to inform the location of concrete footings associated with the remaining structure of Castle Market;
- 2 no. Inclined Concrete Core boreholes (IC101 and IC 102), and
- 8 no. Trial Pits (TP101-TP204).

1.2.2 Of these geotechnical interventions, Dynamic Sampling boreholes DS101 and DS201-DS204, Rotary Core boreholes VC201-VC207 and Horizontal Concrete Core boreholes HC 104 and HC105 were subject to monitoring, along with three trenches excavated specifically for Unexploded Ordnance (UXO) clearance (Trenches UXO11, UXO16 and UXO17).

1.2.3 A programme of deposit modelling, integrating the data from the existing deposit model (Wessex Archaeology 2023) with the results of the geoarchaeological monitoring and a review of the geotechnical logs for those interventions not monitored was then undertaken, the results of which are presented in this report.

1.3 Scope of document

1.3.1 To help frame archaeological and geoarchaeological investigations of this nature, Wessex Archaeology has developed a four-stage approach, encompassing different levels of investigation appropriate to the results obtained, accompanied by formal reporting of the results at the level achieved. The borehole survey reported on here represents Stage 2 of this process (**Table 1**).

1.3.2 In format and content, the work conforms to current best practice, including 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 field evaluation* (CIfA 2014a), Historic England's technical guide to Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record (Historic England 2015b) and Deposit Modelling and Archaeology (Historic England 2020).

Table 1 Staged approach to geoarchaeological investigations

Stage 1: Geoarchaeological Desk-based Assessment (GDBA) and deposit modelling	A Geoarchaeological Desk-Based Assessment (GDBA) examines a range of data (published and unpublished ("grey literature"), LiDAR, historic maps) and models existing Ground Investigation (GI) data to inform on the possible Palaeolithic archaeological and geoarchaeological potential of a site. The GDBA may include, dependant on the site and complexity of a site, a Geoarchaeological Landscape Characterisation (GLC) which divides a study area into different zones (Geoarchaeological Characterization Zones – GCZs) based on variations in deposits and potential. The GDBA establishes the requirements for and scope of Stage 2 Palaeolithic archaeological and geoarchaeological field elevation. Geoarchaeological potential is defined as potential for paleoenvironmental and dating evidence. Should Stage 2 evaluation be required, appropriate and proportionate recommendations for each GCZ are provided.
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Stage 2: Geoarchaeological monitoring of GI works and/or geoarchaeological borehole survey	Field evaluation to establish the geoarchaeological and archaeological potential of Quaternary deposits within an evaluation area, which informs on the requirements and scope of further works at Stage 2 (e.g. purposive borehole survey), Stage 3 palaeoenvironmental assessment and/or Stage 4 mitigation. The principal methods of geoarchaeological evaluation are through monitoring of Ground Investigation (GI) works or targeted boreholes. A geoarchaeological evaluation report is produced, which includes deposit modelling (where sufficient data allows) and recommendations for further work at Stage 2 or Stage 3 if required. Further works may include additional interventions (stepped trenches, test pits or boreholes) to retain additional/suitable samples for assessment.
Stage 3: Palaeoenvironmental assessment	Palaeoenvironmental samples recovered during Stage 2 are assessed to inform on the archaeological and geoarchaeological potential of deposits and guide the scope and need for Stage 4 analysis. A report is produced outlining the palaeoenvironmental potential of the deposits including targeted and proportionate recommendations for Stage 4 analysis.
Stage 4: Palaeoenvironmental analysis	Based on the results of the Stage 3 palaeoenvironmental assessment, palaeoenvironmental analysis on selected deposits/samples may be required. In addition to full analysis of suitable samples identified during the assessment, work at Stage 4 may include additional scientific dating where appropriate/required. A final analysis report is provided on completion of mitigation program. Where appropriate, this may include recommendations for publication or other forms of dissemination.
Publication	The scope and location of a publication report will be agreed in consultation with the client and LPA advisor. The publication report may comprise a note in a local journal or a larger publication article or monograph, dependant on the significance of the archaeological and geoarchaeological work.

1.4 Location, topography and geology

- 1.4.1 The Site, covering an area of approximately 1.34 hectares, is in Sheffield City centre, bounded to the north by Castlegate, to the west by Waingate and to the south and south-east by Exchange Street (**Figure 1**). The site lies at levels between 49 m and 56 m above Ordnance Datum (OD).
- 1.4.1 The site was formerly occupied by the 20th-century development of Castle Market. The majority of buildings relating to the former Castle Market complex have been demolished to ground level, with the exception of a limited number of supporting or retaining walls necessary to preserve the topography of the site. In addition, three areas of masonry, part of the castle's structure, survive within the former Markets complex, and are listed as buildings of special architectural or historic interest (Grade II). The site is mostly overlaid by the concrete slab surface of the recently demolished market, with some areas of tarmacadam that were formerly external to the markets.
- 1.4.2 The underlying geology is mapped as Silkstone Rock, a type of sandstone within the Lower Coal Measures (British Geological Survey (BGS) GeoIndex) (**Figure 1**). Superficial alluvial deposits are recorded in the east of the Site (**Figure 2**), associated with the floodplain at the confluence of the rivers Don and Sheaf (**Figure 2**). More detail on the topography of the

underlying bedrock and nature of the overlying superficial, including archaeological, deposits were presented in Wessex Archaeology (2023) and is summarised in **Section 2.2**.

2 GEOARCHAEOLOGICAL BACKGROUND

2.1 Introduction

2.1.1 The following section summarises the geoarchaeological background to the Site. The full archaeological context of the Site has been presented in a series of reports and publications, including the most recent phase of archaeological excavation (Wessex Archaeology 2020) and geoarchaeological borehole survey (Wessex Archaeology 2023), and is not repeated here.

2.1.2 The archaeological excavation and geoarchaeological borehole survey built on two previous desk-based assessments (ARCUS 1998; 2009), which were followed by trial trench and borehole evaluation producing a range of 'grey literature' reports (Wessex Archaeology 2019a, b, c, d), of which the final archive report (Wessex Archaeology 2020) was the culmination. As noted in Wessex Archaeology (2020), Moreland and Hadley (2020) is the definitive account of the archaeological works on the castle site to date.

2.2 Previous geoarchaeological investigations

Geoarchaeological borehole survey (Wessex Archaeology 2019c)

2.2.1 A geoarchaeological borehole survey undertaken during the archaeological evaluation of the Site (Wessex Archaeology 2019c) produced detailed information on the nature of the deposits in the castle mound and castle moat. Three boreholes were inserted across the castle mound, with a further twenty boreholes inserted through the southern arm of the castle moat aligned along three transects. Palaeoenvironmental assessment was subsequently undertaken on selected boreholes (Wessex Archaeology 2019d).

Castle moat

2.2.2 Four key deposits were recorded within the moat sequence, comprising bedrock, clay moat fill, sandstone rubble and made ground. The fine-grained nature of the clay deposit has been taken to suggest slow deposition within a wet/standing water environment, although some possible disturbance and redeposition is indicated in some cores where subangular inclusions have been noted. The extent of any possible disturbance of the fine-grained moat fills is difficult to gauge, but overlying deposits of sandstone rubble in several boreholes is likely to have disturbed the underlying deposits to varying degrees.

2.2.3 In the case of borehole BH11, a dark grey clay with faint darker banding and organic patches was hypothesised to reflect deposition of clays within a standing-water environment (Wessex Archaeology 2019c). The Rivers Don and Sheaf may have formed the northern and eastern parts of the moat system, which would have been extended around the western and southern sides of the castle. The presence of clays and silts would suggest potential water-lain deposits and support the above view. The subsequent infilling of the moat and separation from the River Don and Sheaf may have resulted in the limited survival or waterlogged deposits (e.g. those in borehole BH11). No visible artefacts were recorded from the moat fills, although the date of these deposits is very likely to correspond with similar clay and silt deposits recorded during previous investigations of the moat by ARCUS (2000, 2002).

2.2.4 The full width and depth of the southern arm of the moat was recorded in Transect 2 and measured approximately 11m in width and up to 2.5m (48.39m OD) deep. Partial moat profiles were recorded in Transect 1 with a potential depth to the base of the moat of up to

5m (45.81m OD) and Transect 3 with a potential depth to the base of the moat of up to 4.2m deep (45.96m OD). The disparity between the depths may be as a result of truncation due to later development on the site.

- 2.2.5 Partial moat profiles in Transects 1 and 3 were only possible due to the presence of significant deposits of sandstone rubble, reflecting the turbulent post-medieval history of the castle.

Castle mound

- 2.2.6 The three boreholes (BH1–BH3) from the castle mound provide complementary data on the archaeological and palaeoenvironmental potential of the deposits across the Site. The deposits were considered to represent natural sediments derived from the construction of the moat and used in the formation of the castle mound (Wessex Archaeology 2019c).
- 2.2.7 The upper level of the Silkstone sandstone bedrock was recorded at 0.65m (51.24m OD) in BH5 at the south end of Transect 2, and at 0.8m (50.98m OD) in BH17 and 0.8m (50.99m OD) in BH18 at the north end of Transect 2. When these heights are compared to the height of the bedrock at 4.8m (50.85m OD) in BH3, the upper surface of the bedrock can be seen to be sloping gradually down from the south to the north. It was suggested by Wessex Archaeology (2019c) suggested that the castle mound was wholly anthropogenic in origin rather than a natural high spot incorporated into the mound (see Wessex Archaeology 2019c); however, later detailed deposit modelling undertaken in Wessex Archaeology (2023) (see below) indicated that the castle mound was constructed on a natural bedrock ‘spur’ extending from the west and south.

Palaeoenvironmental assessment and dating

- 2.2.8 The results of radiocarbon dating from boreholes BH11 and BH13 (Wessex Archaeology 2019d) raised important questions regarding the processes involved in the formation of the moat and the moat deposits. The radiocarbon dates extended from the Late Glacial through to the Bronze Age, in the case of BH11 exhibiting significant inversions, and in all cases substantially pre-dating the castle. The radiocarbon dates clearly reflect the inclusion of old carbon substantially pre-dating the castle, and the mechanisms responsible for such early dates, and the implication of these processes for the palaeoenvironmental remains within the moat, were considered in Wessex Archaeology (2019d).
- 2.2.9 The moat deposits were considered likely to represent a highly punctuated sequence with key stages of moat deposition either partially eroded, reworked or removed entirely. A high degree of uncertainty must therefore be placed on the reliability of the accompanying palaeoenvironmental data as an indicator of environmental conditions contemporary with the castle. The program of palaeoenvironmental assessment (Wessex Archaeology 2019d) determined that there was minimal preservation of pollen, diatoms and ostracods in borehole BH13, with these remains only locally preserved in borehole BH11.
- 2.2.10 The palaeoenvironmental assessment was focused on a series of targeted research questions, including whether the moat was wet or dry, and what the environment of the castle was like (see Wessex Archaeology 2019d). However, the anomalous radiocarbon dates and uncertainties regarding the taphonomic factors affecting the moat sediments placed doubts on the reliability of the palaeoenvironmental data as a secure indicator of environmental conditions contemporary with the castle.

2022 borehole survey and deposit modelling (Wessex Archaeology 2023)

- 2.2.11 A programme of geoarchaeological and geotechnical borehole survey was undertaken at the Site in July and August 2022, followed by integration of the various archaeological, geoarchaeological and geotechnical datasets from the Site to produce an updated deposit model (Wessex Archaeology 2023).
- 2.2.12 A total of 28 boreholes were undertaken across five areas of the Site (Areas 1 to 5; see **Figure 3**) in consultation with Historic England and South Yorkshire Archaeological Services (SYAS). These included two additional (contingency) boreholes located in Areas 2 (WA-32) and 3 (WA-33). The results from the borehole survey were integrated with data from the previous phases of work at the Site, resulting in a deposit model constructed using a total of 114 stratigraphic records, including 42 BGS archive boreholes for the wider area of the Site.
- 2.2.13 The results of the work provided additional information on the range of deposits relating to the history of Sheffield Castle, including its layout and form, and data on the wider landscape context of the castle. The deposit model of the underlying bedrock surface, integrating data from the Site and the wider landscape, indicated that the site of the castle sits on a natural 'promontory' in the bedrock surface on the edge of a hill, rising to the west and south from the floodplains of the Rivers Sheaf and Don. The promontory would have provided an elevated position which was exploited by the builders during successive phases of the castle's history from its post-conquest origins.
- 2.2.14 The borehole survey provided additional information on the form and position of the moat, particularly towards the northeast and east of the Site. The southern arm of the moat appears to be an entirely artificial cut in to the underlying bedrock, with the eastern arm of the moat likely embanked on its southern/eastern side against the floodplain of the Sheaf. The north-eastern extent of the moat meanwhile appears to have exploited a former channel of the River Sheaf.
- 2.2.15 The earliest deposits directly associated with the castle are those infilling the moat, the lower parts of which are likely to be medieval in date (perhaps from the 11th century onwards), with upper moat fills dating to the post-medieval, including in places sandstone rubble possibly related to demolition/dismantling of the castle in the 17th and 18th centuries. The earlier moat fills identified within the new boreholes are predominantly inorganic clays and silts, which appear mixed in places and may be disturbed or redeposited with no visible signs of waterlogging. These moat fills were considered to have low potential for palaeoenvironmental assessment and radiocarbon dating, and no further work was recommended on the boreholes.
- 2.2.16 On the basis of the distribution of redeposited alluvium underlying the site, the motte associated with the early castle appears to have been approximately 50 m in diameter, and was potentially slightly longer on its west-east axis (c. 60 m). Its highest point appears to have been in the area of boreholes BH1-3, although its centre may have been slightly north of here, and later phases of activity may have at least partly truncated or altered the form of these deposits. The deposits forming the castle mound are not suitable for OSL dating and have low palaeoenvironmental potential. No further work was recommended on those deposits.

2.3 Ongoing archaeological mitigation

- 2.3.1 Between March and May 2024, Wessex Archaeology undertook set piece excavation and watching brief as part of the phase one enabling works for the development of the Site into

a park. The set piece excavation covered the south-east corner of castle hill, the area of the gatehouse and the east end of the south moat, and extended to the east. The watching brief was conducted over a wider area. Formal report of the excavation and watching brief, and subsequent post-excavation assessment, is due in 2025.

- 2.3.2 Alongside the professional archaeological works, a scheme of volunteer engagement was undertaken, with five members of the public excavating on site. Extensive media engagement was undertaken alongside engagement activities such as site tours and talks.
- 2.3.3 The work uncovered evidence of the pre-13th century castle, including a potential early iteration of the moat, the motte and a potentially early posthole cut into the motte. Remains attributed to the post-13th-century phase of the castle include the moat, the gatehouse and drawbridge abutments, a well, and previously unknown walls extending along the southern side of castle hill. Evidence of the Civil War siege and slighting was seen in the form of Civil-War era moat fills as well as residual finds in later contexts. From the 18th- and 19th-centuries, a range of structures were recorded including walls of high-status housing contemporary with the bowling green, slaughterhouses, workers' housing, a gennel (passageway) and a steelworks, including the remains of a crucible furnace.

3 AIMS AND OBJECTIVES

- 3.1.1 The aims and objectives of the geoarchaeological monitoring of the GI works are presented below.

3.2 Overarching aims

- 3.2.1 The general aims (or purpose) of the monitoring of GI works, in compliance with the ClfA *Standard and guidance for archaeological field evaluation* (ClfA 2020), are:
- provide information about the archaeological and geoarchaeological potential of the deposits within the specific areas of the GI works;
 - update the existing site-wide geoarchaeological deposit model with the results of the new GI works;
 - consider the possible significance of any archaeological and geoarchaeological evidence present, or potentially present, in the context of the wider archaeological investigations at the Site, and
 - inform either the scope and nature of any further archaeological and geoarchaeological work that may be required within the area of the GI works; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

3.3 Overarching objectives

- 3.3.1 The specific objectives of the geoarchaeological monitoring and updated deposit modelling are as follows:
- to record the sequence of superficial deposits at each borehole location;
 - to obtain geoarchaeological samples of relevant deposits (where possible);
 - to undertake deposit modelling of the data arising from the borehole survey, integrating the new data with that of the existing deposit model presented in Wessex

Archaeology (2023), in order to map the extent, thickness and depth of deposits associated with Sheffield Castle;

- interpret the probable environments represented;
- determine the importance of the deposits with regard to their archaeological and geoarchaeological (including palaeoenvironmental) potential; and
- make specific recommendations for further work, where appropriate, which may include additional geoarchaeological boreholes, palaeoenvironmental assessment and/or scientific dating.

4 METHODS

4.1 Introduction

4.1.1 Compliance with health and safety regulations and requirements took priority over archaeological considerations in all works. The fieldwork was carried out under the supervision of a experienced geoarchaeological specialists.

4.2 Geoarchaeological Monitoring of GI works

4.2.1 Experienced members of the Wessex Archaeology geoarchaeology team monitored the excavation of targeted geoarchaeological boreholes undertaken using a rotary drilling rig operated by experienced geotechnical drillers from Geotechnical Engineering Ltd (GEL).

4.2.2 The attending geoarchaeologists liaised closely with the geotechnical drillers in order to ensure effective communication was maintained throughout the works.

4.2.3 The GI works undertaken by GEL at the Site comprised:

- 12 no. Dynamic Sampling boreholes (DS101-DS204B), undertaken using a rotary drilling rig equipped with a dynamic sampling head;
- 9 no. Rotary Core boreholes (VC201-VC207);
- 9 no. Vertical Concrete Core boreholes (VC101-VC109), undertaken to determine the location of either the culvert or rockhead;
- 8 no. Horizontal Concrete Core boreholes (HC101-HC203);
- 9 no. Observation Pits (OP101-OP111), undertaken to inform the location of concrete footings associated with the remaining structure of Castle Market;
- 2 no. Inclined Concrete Core boreholes (IC101 and IC 102), and
- 8 no. Trial Pits (TP101-TP204).

4.2.4 Of these interventions, Dynamic Sampling boreholes DS101 and DS201-DS204, Rotary Core boreholes VC201-VC207 and Horizontal Concrete Core boreholes HC104 and HC105 were subject to monitoring, along with four trenches excavated specifically for Unexploded Ordnance (UXO) clearance (Trenches UXO11, UXO16, UXO17 and UXO35), Observation Pits OP101 to OP111, trial pits for Horizontal Concrete Core boreholes HC201-HC204 and Trial Pits TP101 to TP104. The location of the GI interventions is shown in **Figure 3**.

4.2.5 Hand-dug test pits were excavated to a depth of 1.2m below ground level (bgl) prior to drilling. All hand-dug test pits associated with boreholes selected for monitoring were observed by the attending geoarchaeologist and recorded as described below.

- 4.2.6 At each borehole location sleeved cores 1.0 to 1.5m in length were extracted using a rotary drilling rig (Commachio type) with a windowless sampling barrel. The rig was operated by experienced geotechnical engineers from GEL, under the supervision of an experienced member of the Wessex Archaeology geoarchaeological team. Due to the possible risk of UXO on the site, surface and downhole scanning was undertaken by a suitably qualified UXO Engineer, appointed for that purpose, as the work progressed.
- 4.2.7 The supervising geoarchaeologists recorded and interpreted the sequence of deposits encountered in order to allow assessment of likely geoarchaeological potential.
- 4.2.8 Any exposed archaeological deposits and features were recorded using a pro forma recording system. A record of the datum (either m above Ordnance Datum or m below ground level) levels of the archaeological deposits was recorded by the monitoring geoarchaeologists. This data was tabulated by test pit/borehole and depth.

4.3 Sediment description

- 4.3.1 The boreholes were recorded using Wessex Archaeology's pro-forma digital recording system. For each stratigraphic unit descriptions and interpretations of the deposits are provided. Descriptions of deposits included information such as:
- *Depth*
 - *Texture*
 - *Composition*
 - *Colour*
 - *Inclusions*
 - *Structure*
 - *Shape and nature of contacts between deposits*
- 4.3.2 Interpretations included, where possible, probable depositional environments and formation processes, with reference to the lithostratigraphic framework established in Wessex Archaeology (2023).
- 4.3.3 A full photographic record was made using a digital camera equipped with an image sensor of not less than 10 megapixels. This recorded both the detail and the general context of the principal lithological and stratigraphic features, and the evaluation area as a whole.
- 4.3.4 Digital images were 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 were taken of all areas, including access routes, to provide a record of conditions prior to and on completion of the borehole survey.

4.4 Deposit modelling

- 4.4.1 The deposit model presented in Wessex Archaeology (2023) was updated to include the data arising from the geoarchaeological monitoring, and a review of the geotechnical logs arising from the remaining interventions that were not monitored.
- 4.4.2 Only those stratigraphic records with sufficiently detailed descriptive terminology and location data (including surface elevation) were included in the model. The deposit modelling was undertaken following the guidelines in Historic England (2020).

- 4.4.3 All available data points were entered into industry standard geological utilities software (Rockworks™ 23). Each stratigraphic unit was given a colour and pattern allowing cross correlation and grouping of the different sedimentary units. The grouping of these deposits is based on lithological descriptions, which define distinct depositional environments referred to as 'stratigraphic units'. The deposits recorded during the GI monitoring were correlated with the existing stratigraphic framework for the deposits established in Wessex Archaeology (2023), with additional units where appropriate.
- 4.4.4 Sedimentary units from the boreholes were classified into a total of 22 stratigraphic units, as discussed in **Section 5**. The classified data for these groups were then input into a database within the RockWorks 23™ program.
- 4.4.5 An updated model for the surface of the bedrock at the Site was generated using an inverse-distance weighted (IDW) algorithm (**Figure 4**). Where data points are not uniformly distributed over the area of investigation the reliability of the models is variable. In order to account for this, the modelling algorithm was adjusted to include a maximum distance cut-off filter equivalent to a 100 m radius around each data point, so that only those areas for which sufficient stratigraphic data is present will be included in the model.
- 4.4.6 Two-dimensional stratigraphic profiles ('transects') of selected interventions across the site were also generated using RockWorks 23™. These include west-east orientated Transects 1 to 3 (**Figure 6**), and north-south orientated Transects 4 and 5 (**Figure 8**), showing the main stratigraphic units and their lateral and vertical variability across these areas of the Site. The location of these transects are shown in **Figures 5** and **7** respectively.
- 4.4.7 An annotated plan showing the overall interpretation of these models is shown in **Figure 9**.
- 4.4.8 The key aims of the modelling were to interpret the data, identify the probable depositional environments represented, and determine areas of higher and/or lower geoarchaeological potential where further work may be required (e.g. deposits with potential for the recovery of significant archaeological and palaeoenvironmental remains).

5 RESULTS

5.1 Introduction

- 5.1.1 This section summarises the results of the geoarchaeological monitoring of the GI works, integrating the results of the updated deposit modelling for the Site. A total of 36 geotechnical interventions (see **Appendix 1** and **2**) were monitored for geoarchaeological purposes as outlined in **Section 4.2**. The data arising from this monitoring, along with a review of the remaining geotechnical logs from these GI works, has been integrated with the existing deposit model for the Site presented in Wessex Archaeology (2023).
- 5.1.2 A series of updated deposit models have been produced, including a revised topographic surface model for the bedrock (**Figure 4**) and a series of west-east (**Figure 6**) and north-south aligned transects (**Figure 8**). The results of the geoarchaeological monitoring and deposit modelling are described below.

5.2 Stratigraphic sequence

- 5.2.1 The full sequence of superficial deposits recorded during the GI works, including those identified during the monitoring and following the review of GI logs, includes:
- Made ground (modern), incorporating sub-units recorded as:

- Hardstanding
- Concrete (associated with the modern culvert)
- Brick structure (likely associated with modern foundations)
- Archaeological Fill (Medieval/post-Medieval)
- Moat Fill (13th century or later)
- Bedrock (pre-Quaternary)

5.2.2 More detail on the variability and composition of these deposits is described below, with a consideration of their geoarchaeological and archaeological potential outlined in **Section 6**. The deposits are described below in relation to the existing lithostratigraphic framework for the Site, and their contribution to the updated deposit model.

Bedrock

5.2.3 The bedrock was reached in ten of the GI interventions, including DS101, DS201B, DS204 and VC201-207, recorded at depths between 5.5 (DS101) and 7.8 m bgl (VC203). The updated deposit model for the bedrock surface on the basis of the new GI data is presented in **Figure 4**.

5.2.4 Two discrete types of bedrock were identified at the Site, including a brownish grey massive hard sandstone, and a blueish grey fissile weak laminar siltstone. These bedrock units are associated with the Silkstone Rock (a subordinate formation of the Lower Pennine Coal Measures) and the Lower Pennine Coal Measures respectively.

5.2.5 The most significant update to the deposit model on the basis of the new data for the bedrock surface is the artificial cut into the bedrock evident in DS101. This new data extends the base of the moat to a level of 46.3 m OD (see **Figures 4** and **8** Transect 5), similar to the levels for the base of the moat recorded elsewhere at the Site (c. 45-46 m OD in the area of boreholes B3 and C3 (ARCUS 2000) and Trench 10 (Wessex Archaeology 2020) (**Figure 6** Transect 2), and in the area of WA-13 and WA-16 (**Figure 6** Transect 3).

5.2.6 Previous boreholes in 2019 (Wessex Archaeology 2019c) had indicated a higher base of the southwestern arm of the moat, at a level of c. 48.5 m OD in boreholes BH13 and BH14; the new GI data indicates that this previous borehole survey did not encounter the deepest part of the moat and that the basal level of the moat is relatively consistent across those areas of the Site where it has been identified.

Moat Fill

5.2.7 Units interpreted as Moat Fill were recorded towards the southwest of the Site in borehole DS101 from 1.5 to 5.5 m bgl (50.31 to 46.31 m OD; see **Figure 8** Transect 5), and in trench UXO35 from 0.9 to 1.1 m bgl (51.21 to 51.01 m OD), where they were not bottomed. Both of these interventions were located to the southeast of Trench 9 of the 2018 evaluation (Wessex Archaeology 2020) and to the west of the previous borehole survey undertaken in 2018 (Wessex Archaeology 2019c) (see **Figure 3**).

5.2.8 In both cases these deposits are consistent with similar lithological units that were identified within the moat during the previous phases of geoarchaeological and archaeological works (see Wessex Archaeology 2020 and 2023).

5.2.9 The Moat Fill within borehole DS101 had two discrete lithostratigraphic units, with the upper fill being encountered between 1.5 and 2.3 m bgl (50.31 to 49.51 m OD) being a soft, yellowish grey sandy gravelly clay with angular poorly sorted inclusions of sandstone and

coal, with inclusions of possible mortar, slag and burnt stone. The lower fill (2.3 to 5.5 m bgl; 49.51 to 46.31 m OD) had a similar lithological profile of clasts as the upper fill, but was a somewhat soft yellowish greyish brown slightly sandy slightly gravelly silty clay.

- 5.2.10 The Moat Fill in trench UXO35 was a firm yellowish grey silty clay with common inclusions of sandstone and cobbles, with elements of black organic matter also noted to the south of the intervention. This unit was not bottomed.

Archaeological Fill

- 5.2.11 Deposits grouped as 'Archaeological Fill', and consistent with similar deposits identified during the previous phase of deposit modelling (Wessex Archaeology 2023) were identified in boreholes DS204 (3.4-6.7 m bgl) and TP103 (1.4-2.0 m bgl). In DS104 (see **Figure 6** Transect 3) these deposits were described as a brownish grey sandstone gravel, cobbles and boulders in a matrix of moderately dark brownish grey silty clay or sandy silt, with some sub-units possessing very little matrix.
- 5.2.12 In TP103 (**Figure 8** Transect 4) these deposits were described as a firm dark yellowish brown sandy silt with frequent small to large sub-angular and angular pebbles, stones and cobbles, with occasional small sandstone boulders.
- 5.2.13 In these interventions these deposits are interpreted as representing ground raising deposits of 19th or 20th century date, but they may incorporate earlier deposits of 13th century date or later. Here and elsewhere across the Site this unit typically directly underlies modern Made Ground, and overlies either bedrock or, within the area of the moat, moat fill.

Made Ground

- 5.2.14 Made Ground was observed in all of the new GI interventions, and can be divided into multiple sub-units, likely to be of either post-medieval or modern date. Where it was bottomed, the Made Ground was typically between c. 3.4 and 7.35 m thick, and it typically comprised a non-stratified dump layer, with elements of metal, plastic, brick, slate, wood, glass and stone (generally sandstone) within a dark silty sand matrix. At least some of these deposits contained very recent waste material that are associated with the demolition of the Castle Market. In places the Made Ground overlay hardstanding comprising either reinforced concrete or tarmacadam with an underlying hardcore gravel.
- 5.2.15 Other sub-units within the Made Ground included:
- Concrete wall footings
 - Mixed fill
 - Brick-dominated fill
 - Stone slabs
 - Gravel
 - Brick structures
 - Redeposited alluvium
 - Concrete
 - Concrete (culvert)

Concrete wall footings

- 5.2.16 Wall footings were identified in OP102 and OP103, associated with concrete structures remaining from the demolition of Castle Market. The wall footings are themselves made of concrete and present at 0.6 m bgl, recorded as being 30 cm thick in OP102 and not bottomed in OP103.

Mixed fill

- 5.2.17 Mixed fill is variable in matrix between interventions, but trends as a dark silt or sandy silt with uncommon poorly sorted inclusions of CBM, slag, metal, modern ceramic, concrete and oyster shell, with lithological inclusions of sandstone from gravel to small boulder size. Mixed Fill was identified as the topmost unit in DS201, DS201A, DS201B and DS201C, all of which are located in the north-east of the site.
- 5.2.18 The mixed fill is interpreted as a demolition layer, with this unit also described during a Wardell Armstrong watching brief in 2017 in the same area of site; this unit was described as being c. 20th century in age.

Brick-dominated fill

- 5.2.19 Brick-dominated fill is a poorly sorted clast supported silty sandy gravel, with gravel being dominated by man-made materials, with clear glass, concrete, ferrous metal (rusted sheet and rebar wire), slag and, at a significantly higher abundance than the rest of the coarse components, whole and fragmentary brick. These bricks were very weakly sub-horizontally orientated on occasion. Natural stone was also present in the unit at low abundance, with a lithological profile of sandstone, coal, siltstone, marl and slate, the latter two associated with building material.
- 5.2.20 Brick-dominated fill is associated with the culvert, being identified in the south-eastern corner of site only, in OP110, HCTP103, HCTP104, VC204, DS203, DS203A and DS204 and is a possible demolition layer of a structure that predated Castle Market, but post-dating the installation of the culvert.

Stone slabs

- 5.2.21 Stone slabs are uncommon on site, only being identified in the south-east, being identified in HCTP204, VC204 and DS203A, located at 1.1-1.2 m bgl in DS203A and 1.3-1.5 m bgl in VC204. The slab was only visually identified in HCTP104, being the at the base of the intervention on the western side. The stone slabs are off-white to pale grey, calcareous and fossiliferous, with fragmentary fossil bivalves being identified. The top of the unit in DS203A appears to have been mechanically sawn at a shallow angle (approximately 20°). Fragments of the same stone were seen in gravel stratigraphically underlying it (see below).

Gravel

- 5.2.22 A variably coloured coarse to cobbly, poorly sorted gravel with no matrix, with the gravel being almost entirely man-made in origin with elements of glass, metal, brick, ceramic tile, slag, worked wood and concrete along with uncommon sandstone, siltstone and slate, was recorded in VC204, DS203, DS203A, OP106 and UXO17.
- 5.2.23 The contents of this unit are variable across the Site; gravel in the west of the site was dominated by dump material, with OP106 containing the best example, whereas gravel in the east of the site in the area of the culvert generally contained fragmentary building materials.

Brick structure

- 5.2.24 In-situ brick structures, likely walls, with sub-horizontally aligned whole red frogged and frequently stamped bricks, were present in HC105 between 0.35 and 0.44 m bgl, OP101 between 0.4 and 0.85 m bgl and 0.2 to 2.15 m bgl in VC203. The brick in VC203 was mortared, with the mortar being dark grey in colour; the external surfaces of the brick were also tarnished dark grey. An apparent north-south orientation of the structures was noted.
- 5.2.25 Whilst not deposit modelled, several interventions were placed against or had a brick wall on one section face; HCTP203 and OP110 are examples of this, with it being likely that the wall seen in HCTP203 being the one that was drilled in VC203. OP110 had red bricks painted white on the external facing surface, with this wall being part of the southern boundary of site.

Redeposited alluvium

- 5.2.26 Redeposited alluvium was noted in the north-east and east of Site, being identified in DS201, DS201A, DS201B, DS201C and DS204; it is a highly variable unit with colour ranging from a blackish grey to a yellowish brown and composition varying from a sandy silt to a clast-supported gravel. Coarse components include sandstone and siltstone alongside man-made materials, predominantly fragmentary brick but also including glazed ceramic, worked wood, ferrous metal objects (generally construction related items e.g. nails and wire) clear glass and black vesicular slag.
- 5.2.27 This unit is interpreted as redeposited post-medieval or modern alluvium, and was noted to be damp, especially in DS201B between 5.0 and 6.0 m bgl. This unit was recorded overlying concrete in DS201 and DS201A, and was likely utilised as a fill. This unit overlies bedrock in DS201B at 7.2m bgl.

Concrete

- 5.2.28 Concrete, distinct from hardstanding, is present across the Site, being recorded in most interventions. Concrete as a unit contains two discrete types: CBM dominated concrete associated with the culvert structure (see below) and grey concrete. These units are structurally identical, with the main difference between the two types being the lithology of the aggregate and the location in which it is found on Site. Concrete units in the south-eastern corner of site have been observed to be “split” within boreholes, with one type of concrete on one side of the recovery and either the other on the opposite side (VC204) or a void, with a flattened surface being observed (DS203A).
- 5.2.29 Concrete at depth is sometimes observed to have multiple fractures and an increasingly less present matrix, producing a “honeycomb” texture where voids have formed. This texture is most prevalent in VC204 from 6.5 m bgl onwards.

Concrete (culvert)

- 5.2.30 CBM dominated concrete is a concrete with fine gravel to small boulder sized aggregate of predominantly red and purple CBM, with this CBM. Aggregate of sandstone, siltstone, limestone, vein quartz and quartzite were also present. CBM dominated concrete is found most frequently on the east of the Site in the location of the culvert; this concrete type is presumed to be directly correlated with the structure of the culvert.

6 DISCUSSION

6.1 Introduction

- 6.1.1 A programme of geoarchaeological monitoring of GI works was undertaken at Castlegate, Sheffield, building on work carried out during previous phases of geoarchaeological and archaeological works at the Site (Wessex Archaeology 2020; 2023). The phase of GI works reported on here included a total of 36 geotechnical interventions monitored for geoarchaeological purposes. The resultant sediment descriptions and interpretations were integrated with the existing lithostratigraphic framework for the Site, and used to update the previous deposit model presented in Wessex Archaeology (2023).
- 6.1.2 The work was undertaken in order to provide information about the archaeological and geoarchaeological resource that might be impacted by the proposed development, to consider the possible significance of any archaeological and geoarchaeological evidence present, and to inform the scope and requirement for any further archaeological and geoarchaeological work.

6.2 Contribution to research questions

- 6.2.1 A series of research questions and specific objectives were defined for different areas of the Site, as outlined in Wessex Archaeology (2023). Where the new data and updated deposit model can contribute to these research questions, these are discussed below.
- 6.2.2 A significant proportion of the sediments overlying the bedrock encountered during this phase of GI works have been assigned a post-medieval or modern date, and comprise the various elements of the stratigraphic unit referred to here as 'Made Ground'. In addition, only OP101 and TP101 were undertaken within the anticipated area of the castle motte, and both of these were excavated to levels that recorded only post-medieval/modern made ground/brick structures. No additional information can therefore be provided for the research questions associated with the castle motte.
- 6.2.3 However, additional stratigraphic data has been provided associated with the castle moat, and the relevant research questions are discussed below. Suspected moat deposits were discovered in the south-west of the site underlying modern made ground and concrete, with these deposits being identified in borehole DS101, close to Trench 9 and a series of boreholes undertaken during the 2018 archaeological investigation (Wessex Archaeology 2020). Given that the scope of the GI works was engineering led, it was not possible to obtain samples from any of the deposits associated with moat fill.
- Can the chronology of the east and south moats be refined? What are the relative chronologies of the east and south moats? What is the chronology of the west moat?*
- 6.2.4 Based on the results of the previous borehole survey and associated deposit modelling (Wessex Archaeology 2023), it was suggested that the eastern arm of the moat extended for a short distance to the northeast of Trench 10, before joining a former channel of the Sheaf (see **Figure 9**). The new GI interventions were located to the east of the anticipated course of the eastern arm of the moat/former channel of the Sheaf, and therefore do not provide any additional data to that presented in Wessex Archaeology (2023).
- 6.2.5 New GI boreholes in the approximate anticipated area of the western arm of the moat, including HC104 and OP102 in previous 'Area 5', and OP103 and HC105 to the south of 'Area 5', were excavated to a maximum depth of 1.6 m bgl and recorded only modern Made Ground and concrete hardstanding.

- 6.2.6 No deposits were identified within the moat fill in DS101, in the southwestern arm of the moat, that might provide material for scientific dating of this fill (e.g. discrete organic units), although anthropogenic material was noted including possible CBM.

How deep were the east and west moats? What were the shapes of their bases?

- 6.2.7 Previous borehole investigations indicated that the base of the moat was cut to a level of c. 45-46 m OD towards the southeast and east of the Site, much lower than had previously been identified in the southern arm of the moat, where the base of the moat was recorded as falling eastwards from c. 50.5 m OD to c. 48 m OD.
- 6.2.8 However, the results of the GI monitoring have provided new data for the bedrock surface in this area of the moat, which demonstrates that the moat was cut to a level of 46.3 m OD on the southwestern arm of the moat, similar to the levels for the base of the moat recorded elsewhere at the Site (c. 45-46 m OD). It is likely therefore that the previous boreholes in the southern arm of the moat in 2019 (BH13-BH15; Wessex Archaeology 2019c) did not encounter the deepest part of the moat, and the depth of the moat here can be extended to c. 4 m on the basis of the new data from geotechnical borehole DS101.
- 6.2.9 This depth is consistent with records elsewhere at the Site which indicated that along much of its length, the moat appears to have been between c. 3 and 4 m deep, with any embankments against the floodplain of the Sheaf along the eastern arm of the moat exceeding this thickness (see Wessex Archaeology 2023). The data from the new boreholes are consistent with the previous interpretation in Wessex Archaeology (2023) that the eastern arm of the moat was likely embanked against the floodplain of the Sheaf on its southern side, but remained rock-cut on its northern side for most of its length (see **Figure 9**). The southern arm of the moat remained rock cut throughout its course.

7 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

- 7.1.1 A programme of geoarchaeological monitoring of GI works was undertaken to refine understanding of the nature and distribution of the superficial geological and archaeological deposits at Castlegate, Sheffield. Deposit modelling integrating the results of the geoarchaeological monitoring with the existing geoarchaeological deposit model presented in Wessex Archaeology (2023) has enabled a correlation of these deposits with the existing lithostratigraphic framework for the Site, and a reconstruction of their distribution, thickness and topography. This has enabled an assessment of their geoarchaeological potential, and contributed to specific research questions originally presented in Wessex Archaeology (2023).
- 7.1.2 A significant proportion of the deposits observed during the monitoring have been assigned a post-medieval or modern date, and are equivalent to Made Ground. However, additional stratigraphic data has contributed to our understanding of the castle moat, specifically the form and depth of its southern arm, and enabled another opportunity to assess the fill of moat (representing some of the earliest deposits directly associated with the castle) and its palaeoenvironmental potential.

7.2 Recommendations

- 7.2.1 Previous palaeoenvironmental assessment and radiocarbon dating of organic moat fills at the Site in boreholes BH11 and BH13 (Wessex Archaeology 2019d) demonstrated the complex taphonomy of moat fills, with significant age inversions noted in the results of the radiocarbon dating. The moat deposits were considered likely to represent a highly



punctuated sequence with key stages of moat deposition either partially eroded, reworked or removed entirely. A high degree of uncertainty was therefore placed on the reliability of the palaeoenvironmental data as an indicator of environmental conditions contemporary with the castle. In addition, the palaeoenvironmental assessment (Wessex Archaeology 2019d) determined that there was minimal preservation of pollen, diatoms and ostracods in borehole BH13, with these remains only locally preserved in borehole BH11.

- 7.2.2 Similar to other records of the earlier moat fills, these sediments in borehole DS101 are exclusively inorganic clays and silts, which appear mixed in places and may be disturbed or redeposited with no visible signs of waterlogging. These moat fills have low potential for palaeoenvironmental assessment and radiocarbon dating, and no further work is recommended on these deposits. Similarly, the other deposits identified during the GI works are either of post-medieval or modern date (those associated with Made Ground) or of low paleoenvironmental potential (Archaeological Fills), and no further assessment is recommended on these deposits.
- 7.2.3 Archaeological excavations at the Site are ongoing, with the results of the set-piece excavations and watching brief and resultant post-excavation assessment due to be reported in 2025, with additional excavation associated with Phase 2 of the construction also expected in 2024. It is recommended that the results of the geoarchaeological monitoring and updated deposit modelling are reviewed as part of the project design for these works, and any relevant results incorporated into the reporting on the archaeological excavations.

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APPENDIX

Appendix 1 Sediment description logs (boreholes)

Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: DS101	
Coordinates (NGR) X: 435761.02		Coordinates (NGR) Y: 387651.88		Level (top): 51.58m OD	
Length: n/a		Width: n/a		Depth: 7.85 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
10101	First attempt only: Hard mid pale brownish grey CONCRETE with aggregate gravel. Gravel finer up to 0.1, coarser after 0.1. Abrupt to coarser material. Becoming more voidy from 0.25, matrix less complete. Abrupt boundary with (10102).	Made ground	0-0.3	51.81-51.51	
10102	First attempt only: Loose friable crumbly mid yellowish brown slightly sandy silty CLAY with abundant very poorly sorted A FG to CG sized gravel of slst mdst and slag. Gravel is weak friable with liths being frequently fe stained. No grading or orientation.	Made ground.	0.3-0.7	51.51-51.11	
10103	Hard mid pale brownish grey CONCRETE with aggregate. Aggregate finer until 0.1, coarser afterwards. Abrupt to coarser aggregate. Becoming more void-y from 0.25, matrix less complete. Abrupt boundary with (10104)	Hardstanding	0-0.7	51.81-51.11	
10104	Moderately firm mid yellowish brownish grey silty sandy gravelly CLAY with abundant poorly sorted weakly subhorizontally orientated VA to A FG to C sized gravel of sst quartz concrete. Matrix supported. Abrupt subhorizontal to (10105).	Made ground	0.7-0.88	51.11-50.93	
10105	Hard mid pinkish grey CONCRETE with aggregate. Abrupt subhorizontal to (10106)	Made ground	0.88-1	50.93-50.81	



10106	Somewhat firm mid brownish grey slightly silty sandy gravelly CLAY with very abundant poorly sorted VA to A FG to SC sized unorientated gravel of sst coal slst. NO RECOVERY 1.2-1.5. Boundary with (10107) not seen.	Made ground	1.00-1.20	50.81-50.61	
N/A	Void/no recovery	Void	1.20-1.50	50.61-50.31	
10107	Somewhat soft mid yellowish grey slightly silty sandy gravelly CLAY with common to abundant poorly sorted VA to SA FG to SC sized unorientated gravel of sst coal slag coal mortar burnt stone. Cobble to base, notably at boundary with (10108). Matrix supported. Sand is medium. Some isolated weak white elements ?cremated material. Sharp sub-horizontal boundary with (10108).	Moat fill	1.50-2.30	50.31-49.51	
10108	Somewhat soft mid yellowish greyish brown slightly sandy slightly gravelly silty CLAY with uncommon to common FG to C sized A to SR red and brown sst slst very weak offwhite ?CBM ?cgl/brec. Clasts predominantly hard. Possible burnt stone? Sand is fine, becoming less sandy with depth.	Moat fill	2.3-5.5	49.51-46.31	
10109	Somewhat soft to slightly firm mid dark greyish brown somewhat gravelly silty CLAY with poorly sorted but sub-vertically orientated A to SA G to CG sized grey and yellow stiff sst weak grey slst. Gravel increases in frequency with depth. Frequent dark patina on some clasts - ?mang staining. SPT refused at 7.	Weathered bedrock	5.5-7	46.31-44.81	
10110	Hard mid brownish yellowy grey massive SANDSTONE.	Bedrock, silkstone	7-7.85	44.81-43.96	



Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: HC104	
Coordinates (NGR) X: 435734.206		Coordinates (NGR) Y: 387680.379		Level (top): 52.29m OD	
Length: n/a		Width: n/a		Depth: 1.60 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
10401	Stiff mid pale pinkish grey CONCRETE with aggregate components. Matrix is good, no voids. Goes brown when wet. Core subhorizontally snapped.	Concrete	0-1.45	52.29-50.84	
10402	Stiff mid greyish brown CONCRETE with aggregate components. Slightly more silky lustre than (10401) with lower abundance of aggregate. Matrix good.	Concrete	1.45-1.6	50.84-50.69	

Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: HC105	
Coordinates (NGR) X: 435739.584		Coordinates (NGR) Y: 387661.009		Level (top): 52.76m OD	
Length: n/a		Width: n/a		Depth: 0.44 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
10501	Pale brown ?wet CONCRETE with fine aggregate. Abrupt horizontal boundary with (10502).	Concrete	0-0.05	52.76-52.71	
10502	Pale greyish brown CONCRETE with medium sized aggregate. Abrupt horizontal boundary with (10503).	Concrete	0.05-0.35	52.71-52.41	
10503	Mid dark purple and reddish brown vesicular BRICK. Red at top and base, otherwise purple.	?structure	0.35-0.44	52.41-52.32	



Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: VC201	
Coordinates (NGR) X:		Coordinates (NGR) Y:		Level (top): m OD	
Length: n/a		Width: n/a		Depth:- 8.5 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20100	concrete onto rubble.	made ground	0-0.5		
20101	concrete. sandstone block at 1-1.2, 1.8-1.9, 2.25-2.5, 5.35-5.5, 6.3-6.48, 6.65-6.85m	made ground	0.5-7.35		
20102	SILTSTONE	bedrock	7.35-8.5		

Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: VC202	
Coordinates (NGR) X: 435860.833		Coordinates (NGR) Y: 387684.784		Level (top): 48.64m OD	
Length: n/a		Width: n/a		Depth: 7 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20201	0.06 of yellowish grey CONCRETE with no seen rebar over slightly pinkish grey concrete with aggregate including CBM, vein quartz, quartzite, sst with no significant concentration of specific aggregate type. Deeper on W side of pit 0.17 at thinnest on E side over void. VOID 0.38-0.48. Abrupt subhorizontal to (20202).	Hardstanding	0-0.75	48.64-47.89	
20202	Orangey grey CONCRETE with aggregate of CBM, quartzite, quartz, bitumen, concrete, sst, slst of FG to SB size. Large proportion of CBM until 1.55, after which decreases in abundance abruptly. Cracked at 1.55 - several stages of deposition? Few small cracklike voids. Abrupt sub horizontal to (20303).	Concrete - ?culvert	0.75-6	47.89-42.64	



20203	Loose black silty sandy GRAVEL with gravel being poorly sorted FG to LC sized VA to SR sst with uncommon CBM (frag brick). Black colour is in matrix only, sst is greyish brown. Matrix has strong dark streak, likely coal dust, staining external edges of unbroken clasts. Weak metallic smell, poss from rig. Clast supported (95:5) no grading or orientation. VOID 6-6.2 Abrupt subhorizontal to (20204).	Made ground	6-6.5	42.64-42.14	
20204	Stiff but weak mid blueish grey subhorizontally fissile laminated/crossbedded siltstone BEDROCK.	Bedrock, ?Pennine coal measures	6.5-7+	42.14-41.64+	



Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: VC203	
Coordinates (NGR) X: 435867.251		Coordinates (NGR) Y: 387654.098		Level (top): 50.70m OD	
Length: n/a		Width: n/a		Depth: 7 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20301	0.01 of dark grey asphalt over over 0.9 of pale yellowish offwhite angular FG to CG hardcore in asphalt matrix. Abrupt subhorizontal to (20302).	Hardstanding	0-0.1	50.70-50.60	
20302	Loose pale yellowish off-white hardcore GRAVEL, gravel being A FG to CG sized ?quartzite ?metallime with rare CBM. Abrupt subhorizontal to (20303) and (20304).	Hardstanding	0.1-0.2	50.60-50.50	
20303	Mortared red BRICK tarnished black on external surfaces aligned subhorizontally. Appears to be generally aligned N-S in situ but difficult to determine with intervention dimensions. Mortar is black. Bricks are 7cm thick, consistent to other structural bricks seen on site. Bricks are frogged. On one half of VC203 only until 0.4 - east half of pit (see photos). Abrupt sub horizontal boundary with (20306).	Structure	0.2-2.15	50.50-48.55	
20304	Hard grey concrete with orangey red aggregate. Aggregate black in upper 0.01. On W side of the pit only - see photos. Abrupt sub horizontal to (20305).	Hardstanding	0.2-0.32	50.50-50.38	
20305	Loose mid dark brownish grey slightly silty sandy GRAVEL, with gravel being poorly sorted CS to CG VA to A of concrete CBM (brick) and sst. Clast supported, matrix dirty. On W side of pit only - see photos. Abrupt subhorizontal to (20303).	Made ground	0.32-0.4	50.38-50.30	



20306	Hard mid pinkish brown CONCRETE with poorly sorted VA to A FG to SB sized aggregate of sst red CBM (brick) quartzite slst slag predominantly CBM no seen orientation. Clast supported, 75:25. Concrete matrix voided out in places, preferentially eroding ?fluvially. SST boulder 4.6-4.8. Abrupt subhorizontal boundary with (20307).	Structure, culvert?	2.15-6.4	48.55-44.30	
20307	Hard somewhat loose mid dark brownish grey silty sandy GRAVEL with gravel being FG to SB orientated subhorizontally orangey brown fine sst. Clast supported 90:10, matrix has dark steek no odour. Abrupt sub horizontal to (20308).	Made ground	6.4-6.8	44.30-43.90	
20308	Hard mid slightly brownish grey fine sst/slst BEDROCK. Slightly crenulate bedding, not fissile.	Bedrock	6.8-7	43.90-43.70	



Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: VC204	
Coordinates (NGR) X: 435874.732		Coordinates (NGR) Y: 387657.507		Level (top): 50.75m OD	
Length: n/a		Width: n/a		Depth: 8.50 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20401	Hard dark grey asphalt (0.04) over aggregated dark grey asphalt, with aggregate being angular FG to CG offwhite material. Abrupt subhorizontal to (20402).	Hard standing	0-0.15	50.75-50.60	
20402	Loose multicoloured (red pale yellow dark grey) poorly sorted GRAVEL, with gravel being VA to SR CS to SC sized CBM (brick) slag, slate, glass (clear) ?quartzite ?metalmst. No matrix, clast supported. Abrupt sub horizontal to (20403).	Made ground, hardcore	0.15-0.3	50.60-50.45	
20403	Weak friable dark grey TARMAC/ASPHALT. Abrupt sub horizontal boundary with (20404).	Made ground	0.3-0.33	50.45-50.42	
20404	Loose dirty mid dark slightly reddish brownish grey slightly silty sandy GRAVEL, with gravel being poorly sorted FG to SB sized CBM, sst, rare modern worked wood, metal (rebar wire), glass (clear reenforced with wire), ferrous metal sheet, concrete. Gravel 75% brick. No orientation or sort seen. Clast supported, 85:15. Matrix has dirty streak. No smell. Bricks are in moderate condition with weak sub horizontal to shallowly angled orientation.	Made ground	0.33-1.3	50.42-49.45	
20405	Hard mid pale brownish white MARL (LMST) with common thin tabular unorientated calcitic clasts FG A to SA fragmentary valve (bivalve?) fossils. Clasts and matrix both fizz well with acid. Could be marl or calcareous sandstone. Abrupt boundary with (20406).	Made ground	1.3-1.5	49.45-49.25	



20406	VOID (as in an empty space)	Void	1.5-1.9	49.25- 48.85	
20407	Hard mid pale orangey brownish grey CONCRETE with CG sizes SA aggregate of CBM sst slst predominantly CBM. Section of black and white striped tile seen at 1.9, not attached. Boundary not seen, between runs, probable abrupt subhorizontal.	Made ground	1.9-2	48.85- 48.75	
20408	Very coarse colourful anthropogenic GRAVEL with CG to LC sized A to SA components of CBM (brick) ceramic metal concrete slag. Possible drop into void. Abrupt subhorizontal to (20409).	Made ground	2-2.25	48.75- 48.50	
20409	0.02 of plain black tarmac over aggregated TARMAC, aggregate is VA to A FG to G sized grey. Abrupt horizontal to (20410).	Made ground	2.25- 2.32	48.50- 48.43	
20410	Hard moderately voided poor condition orangey brown CONCRETE with A to SR FG to CG sized aggregate of sst CBM glass (clear) slst. Split with other concrete type that is in better condition and is mid pale yellowish brownish grey but that is distinct from (20411). Boundary with (20411) not seen.	Made ground	2.32- 2.5	48.43- 48.25	



20411	Hard mid pale greyish brown CONCRETE with FG to C sized A to SR aggregate of CBM asphalt sst quartz quartzite slst, even mix of lithologies favouring sst. Becoming rubbly from 6.5 - rubble is VA to A FG to SC with same lithographic profile as concrete aggregate, clast supported with "bands" of more complete concrete. ?Degenerated concrete. Rubble frequently blackened. Large (B) circular CBM object with apparent hollow channel 7.5-7.65 ?landdrain. Abrupt subhorizontal to (20412).	Made ground	2.5-7.8	48.25-42.95	
20412	Stiff but weak subhorizontally fissile mid dark blueish laminated convolute bedded/crossbedded SILTSTONE/MUDSTONE.	Bedrock	7.8-8.5+	42.95-42.25	

Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: VC205	
Coordinates (NGR) X: 435862.877		Coordinates (NGR) Y: 387708.416		Level (top): 49.07m OD	
Length: n/a		Width: n/a		Depth: 7 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20500	poured CONCRETE.	made ground	0-0.15	49.07-48.92	
20501	fairly friable yellowish grey and black gravelly SILT/silty GRAVEL (50:50). occasional slag, coal, glass, wood fragments. Gravel is small to large subangular and angular and subrounded pebbles and stones and occasional large cobble and small boulder (sandstone).	made ground	0.15-0.5	48.92-48.57	
20502	CONCRETE. sandstone boulders at 1.65-1.82, 3.08-3.24, 3.38-4,	made ground	0.5-6.64	48.57-42.43	
20503	SILTSTONE	coal measures	6.64-7	42.43-42.07	



Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: VC206	
Coordinates (NGR) X: 435862.837		Coordinates (NGR) Y: 387704.813		Level (top): 49.08m OD	
Length: n/a		Width: n/a		Depth: 7 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20600	solid concrete. Sharp contact.	made ground	0-0.2	49.08-48.88	
20601	firm light to mid yellowish grey clay gravelly SILT/silty GRAVEL 50:50 SILT: gravel with occasional to moderate CBM (including whole bricks). Gravel is moderate to frequent poorly sorted small to large subangular, subrounded and rounded pebbles and stones (sandstone).	made ground	0.2-0.5	48.88-48.58	
20602	CONCRETE	made ground	0.5-6.20	48.58-42.88	
20603	laminated SILTSTONE	coal measures	6.20-7	42.88-42.08	

Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: VC207	
Coordinates (NGR) X: 435862.36		Coordinates (NGR) Y: 387703.005		Level (top): 49.07m OD	
Length: n/a		Width: n/a		Depth: 6.20 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20700	same as other VCs - tarmac and crush	made ground.	0-0.20	49.07-49.87	
20701	loose rubbly 'fill'	made ground.	0.20-0.50	49.87-49.57	
20702	CONCRETE. sandstone block at 5.73-6.16m.	made ground	0.50-6.20	49.57-42.87	



Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: DS201A/B/C	
Coordinates (NGR) X: 435863.208		Coordinates (NGR) Y: 387712.168		Level (top): 49.06m OD	
Length: n/a		Width: n/a		Depth: 7.50 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20100	friable black sandy SILT. occasional CBM fragments, slag, metal, post med pot, oyster shell, concrete. moderate small to large poorly sorted subangular to subrounded sandstone pebbles, stones and occasional small cobbles. sandstone block (0.4x0.28x0.11m) at 0.3m. [mid yellowish brown sandy SILT with moderate small to large subangular sandstone pebbles and stones from 2.5-3m 301A - 3.4-4.0, 4.4-4.7.301B - from 2.7 to 4.8. 301C from 2.45-?6] [301B - dark blackish grey sandy SILT with fibrous worked wood stained black. Possible coal dust. CBM grannyware seen. Dirty. 5.9-6] abrupt contact.	made ground. possible redeposited natural layer at 2.50m?	0-3.50	49.06- 45.56	
20101	mass concrete fill - concrete with brick and sandstone rubble. comes in at 3.50m in DS301, 4.8 at DS301A, Sandstone block at 4.8 to 5 in DS301B.	made ground - culvert wall	3.50- 4.00	45.56- 45.06	



20102	DS301A - Colourful loose variable A to SA FG to SC sized GRAVEL with gravel of CBM ceramic slag concrete sst ?asphalt. Anthropogenic gravel is notably blunted - fluvial rework? No matrix apparent normal grading. DS301B - 6-7.2, possible drop. As 301A, but also contains ferrous metal (steel?) quartzite cobbles, glass (3mm thick green ?bottle glass) and poor condition worked wood. DS301C - from 6.5-7 (6-6.5 void/NR). Gravel trends SA C sized and contains poor condition worked wood. 301C rejected at 7, base of core contains brick bed structural material that doesn't resemble culvert material elsewhere. Brickish. Sharp boundary back into (30100), yellow silty type, then back to this until (30101) in DS301A. Abrupt to (30103) in 301B.	Made ground	4-4.4	45.06-44.66	
20103	301B - Hard subhorizontally laminated mid neutral grey siltstone BEDROCK. Darker in localised patches.	Bedrock, siltstone	7.2-7.5	41.86-41.56	



Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: DS202	
Coordinates (NGR) X: 435859.575		Coordinates (NGR) Y: 387677.748		Level (top): 48.61m OD	
Length: n/a		Width: n/a		Depth: 1.35 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20201	Hard pale pinkish grey CONCRETE with rebar in first pit only. Significantly deeper in original pit - down to 0.5+ at least. Abrupt subhorizontal boundary with (30202).	Hardstanding	0-0.15	48.61-48.46	
20202	Loose mid dark greyish brown slightly silty SAND AND GRAVEL clast supported (85:15) gravel being C to LC VA to A anthropogenic CBM (overwhelmingly whole stamped frogged bricks) with rare chickenwired asphalt and weak mortar (mortar pale yellow ?lime generally patchily attached to bricks). Brick is orientated sub horizontally to shallowly angled with long edge aligned E-W or N-S. Clearly aligned purposely. Vertical void down to 1.35.	Structure, likely associated with drain	0.15-1.35	48.46-47.26	



Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: DS203	
Coordinates (NGR) X: 435875.593		Coordinates (NGR) Y: 387656.702		Level (top): 50.80m OD	
Length: n/a		Width: n/a		Depth: 5 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20301	Hard dark grey asphalt (0.04) over aggregated dark grey asphalt, with aggregate being angular FG to CG offwhite material. Abrupt subhorizontal to (30302).	Hard standing	0-0.15	50.80-50.65	
20302	Loose multicoloured (red pale yellow dark grey) poorly sorted GRAVEL, with gravel being VA to SR CS to SC sized CBM (brick) slag, slate, glass (clear) ?quartzite ?metalmst. No matrix, clast supported. Abrupt sub horizontal to (30303).	Made ground, hardcore	0.15-0.3	50.65-50.50	
20303	Weak friable dark grey TARMAC/ASPHALT. Black streak. Abrupt sub horizontal boundary with (30304).	Made ground	0.3-0.33	50.50-50.47	
20304	Loose dirty mid dark slightly reddish brownish grey slightly silty sandy GRAVEL, with gravel being poorly sorted FG to SB sized CBM, sst, rare modern worked wood, metal (rebar wire), glass (clear reenforced with wire), ferrous metal sheet, concrete. Gravel 75% brick. No orientation or sort seen. Clast supported, 85:15. Matrix has dirty streak. No smell. Bricks are in moderate condition with weak sub horizontal to shallowly angled orientation. Sporadic boulder sized tabular concrete paving slabs, not in situ. NO RECOVERY 1.3-2 DS303. Boundary with (30305) not seen, abrupt shallowly angled with (30308). Impassible rebar in DS303A at 0.5, drilled from there.	Made ground	0.33-?0.9	50.47-49.90	



20305	Very coarse colourful anthropogenic GRAVEL with CG to LC sized A to SA components of CBM (brick) ceramic metal concrete slag worked. 303A only: wood (plank) marl glazed CBM green concrete bamboo. Possible drop into void. Abrupt subhorizontal to (30306). 1 concrete clast 33cm in length in 303A with one flat edge aligned subvertically. High proportion of glass at boundary in 303A.	Made ground	?1.2-2.1	49.60-48.70	
20306	0.02 of plain black tarmac over aggregated TARMAC, aggregate is VA to A FG to G sized grey. Abrupt horizontal to (30307). Same depths in 303A, but only takes up half of liner, with flat surface orientated subvertically (clipped edge of slab?).	Made ground	2.1-2.18	48.70-48.62	
20307	Hard mid pale greyish brown CONCRETE with FG to C sized A to SR aggregate of CBM asphalt sst quartz quartzite slst, even mix of lithologies favouring sst from 2.33 in 303, favouring CBM 2.18-2.33, crack between CBM favouring and sst favouring. 303 complete at 3. Fracture at 2.8 in 303A. Same depths in 303A, but only takes up half of liner, with flat surface orientated subvertically (clipped edge of slab?). Some drop of (30305) down void end of core. Concrete appears to be taking up more of liner with depth. Large amount of drop 4-4.1. Concrete taken up full liner by 5.	Made ground	2.18-5+	48.62-45.80	
20309	DS303A only - Hard orangey brownish grey CONCRETE with 0.02 of grey concrete at top with 0.005 of pale yellow ?mortar at very top. Aggregate of CBM sst mortar marl seen predominantly CBM. Abrupt shallowly angled to (30309), looks snapped as opposed to sawn.	Made ground	0.9-1.1	49.90-49.70	



20310	DS303A only - Hard mid pale brownish white MARL (LMST) with common thin tabular unorientated calcitic clasts FG A to SA fragmentary valve (bivalve?) fossils. Clasts and matrix both fizz well with acid. Sawn top surface. Could be marl or calcareous sandstone. Abrupt to (30305) in 303A.	Made ground	1.1-1.2	49.70-49.60	
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Site Code: 201545		Site Name: Sheffield Castlegate GI monitoring		Borehole: DS204	
Coordinates (NGR) X: 435866.00		Coordinates (NGR) Y: 387654.10		Level (top): 50.80m OD	
Length: n/a		Width: n/a		Depth: 7 m	
Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20401	0.01 of dark grey asphalt over over 0.9 of pale yellowish offwhite angular FG to CG hardcore in asphalt matrix. Abrupt subhorizontal to (30402).	Hardstanding	0-0.1	50.80-50.70	
20402	Loose pale yellowish off-white hardcore GRAVEL, gravel being A FG to CG sized ?quartzite ?metallime with rare CBM. First pit stopped at 0.2 - brick, pit repurposed into VC203 (see BH sheet 203). Abrupt sub horizontal horizontal to (30403).	Made ground	0.1-0.2	50.70-50.60	
20403	Hard grey concrete with orangey red aggregate. Aggregate black in upper 0.01. Abrupt subhorizontal to (30404).	Made ground	0.2-0.3	50.60-50.50	
20404	Soft to loose mid dark slightly brownish grey slightly clayish silty gravelly SAND, with abundant poorly sorted A to SA FG to SC gravel of concrete CBM (brick) sst metasst. LC of sst at 1.2 DS304. No recovery 1.2-2. Boundary not seen with (30505).	Made ground	0.3-2.6	50.50-48.20	
20405	Loose CG to SB sized A to SA brownish grey fine sst GRAVEL with uncommon inclusions of SA metal slag. Boulder 2.8-3. Sharp boundary with (30406).	Made ground.	2.6-3	48.20-47.80	



20406	Loose slightly mid yellowish brownish grey clayish silty sandy GRAVEL with gravel being poorly sorted A to SA G to C brownish grey fine sst (?siltstone). One red sst clast ?burnt. Matrix is dirty and slightly sticky. Clast supported 90:10. Boundary with (30407) not seen - between runs.	Made ground, redeposited alluvium?	3-3.4	47.80-47.40	
20407	Loose to hard G to B A to SA brownish grey fine sst GRAVEL with larger units/clasts being orientated subhorizontally. SST generally massive/structureless with occasional evidence of bedding (both within Bs and between Bs). Occasional fe staining which follows apparent bedding within Bs. SST very well consolidated weakly friable ?weakly metamorphosed. Some uncommon orangey brown clasts. Some matrix similar to (30406) 4.9-5, poss drop but otherwise matrixless. Gradual to (30408).	?made ground, poss weathered bedrock.	3.4-6	47.40-44.80	
20408	Loose to hard mid dark greenish brownish grey slightly silty sandy GRAVEL with gravel being FG to B VA to A, with larger clasts being orientated subhorizontally. Clasts are sst slst ?metasst coal with possible black vesicular slag seen. Predominantly sst. Clast supported clasts trend C sized. Matrix has dirty grey streak. Some fe and mg staining seen. Poorly sorted. Gravellier than above. One large yellowish brown boulder of sst 6.6-6.7. Abrupt sub horizontal boundary with (30409).	?made ground, poss weathered bedrock.	6-6.7	44.80-44.10	
20409	Hard mid blueish brownish grey siltstone BEDROCK. Structureless.	Bedrock.	6.7-7	44.10-43.80	



Appendix 2 Sediment description logs (UXO trenches)

Trench UXO11		Length 1 m	Width 1 m	Depth 1m	
Easting 387688.5206		Northing 387688.5206		m OD 51.25	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
1100	Made ground	Tarmac (0.05m) onto tarmac crush, hardcore and backfill from 201541 BH11.		0–0.30	51.25-50.95
1101	Made ground	Concrete.		0.30–0.37	50.95-50.88
1102	Made ground	Red hardcore		0.37–0.80	50.88-50.45
1103	Made ground	Greyish yellow silty CLAY / clay SILT with moderate medium to large sub-angular sandstone pebbles, stones, boulders and small boulders.		0.80–1.00	50.45-50.25

Trench UXO16		Length 2 m	Width 1.10 m	Depth 0.70 m	
Easting 435828.8127		Northing 387666.2402		m OD 51.87	
Context Number	Interpretative Category	Description		Depth m bgl	
1600	Made ground	Old market ground parking? frozen yellowish brown silty CLAY / clay SILT with rubble including CBM fragments and whole bricks, metal, modern wood, post med pottery, slag.		0–0.60	51.87-51.27
1601	Made ground	Concrete(reinforced).		0.60–0.70	51.27-51.17

Trench UXO17		Length 2 m	Width 1 m	Depth 0.80 m	
Easting 435830.6022		Northing 387661.8294		m OD 51.61	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
1700	Made ground	Slight bank above ground level - topsoil and small rubble.		+0.40–0.0	52.01-51.61
1701	Made ground	GRAVEL pinkish grey rubble containing CBM fragments, metal, cement		0–0.80	51.61-50.81
1702	Made ground	Concrete with thick metal object.		0.80+	50.81+

Trench UXO35		Length 1.50 m	Width 1.50 m	Depth 1.10 m	
Easting 435759.421		Northing 387653.096		m OD 52.11	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
3500	Made ground	Muck on surface from years of trample and machine - dark brown clay SILT with frequent small to large sub-angular and sub-rounded pebbles and stones.		0–0.30	52.11-51.81
3501	Made ground	Tiled floor (0.03m) onto reinforced concrete.		0.30–0.90	51.81-51.21
3502	Layer	Possible moat - firm yellowish grey silty CLAY / clay SILT with moderate small to large sub-angular sandstone pebbles, stones and occasional large cobbles, some patched of organic smears (black) to south.		0.90–1.10	51.21-51.01



Trench OP101		Length 0.70 m	Width 0.50 m	Depth 1.20 m	
Easting 435820.158		Northing 387716.998		m OD 49.69	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
10100	Made ground	(0.25m tarmac onto rubble and tarmac crush). Sharp contact		0–0.40	49.69–49.29
10101	Made ground			0.40–0.85	49.29–48.84
10102	Made ground	Fairly friable light to mid yellowish grey clay SILT with moderate slag and CBM (brick), moderate to frequent poorly sorted small to large sub-angular and angular pebbles and stones and occasional small to large cobbles (sandstone).		0.85–1.20	48.84–48.49

Trench OP102		Length 1m	Width 0.6m	Depth 1 m	
Easting 435735.782		Northing 387681.901		m OD 51.59	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
10201	Hard standing	Hardstanding. Hard pinkish grey CONCRETE with rebar at base. Abrupt boundary to (10202).		0–0.2	51.59–51.79
10202	Made ground	Loose sandy GRAVEL, with gravel being FG to SB A of concrete, brick, sst, slst, quartz. Sharp boundary with (10204). Drain at 0.4.		0.2–0.9	51.79–50.69
10203	Concrete footing of adjacent wall			0.6–0.9	50.99–50.69
10204	Made ground	Mid yellowish brownish grey mottled reddish brown slightly sandy silty CLAY with common to abundant poorly sorted FG to CG sized VA to sub-rounded gravel of weak slst mdst rare stiff quartz. Manganese staining seen. ? coal seen, fragmentary. No orientation no grading.		0.9–1	50.69–50.59

Trench OP103		Length 1 m	Width 1 m	Depth 0.60 m	
Easting 435738.996		Northing 387662.666		m OD 51.82	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
10301	Rubble	Loose mid pale greyish white concrete GRAVEL with rare fragmentary rebar. Gravel is VA to sub-rounded G to SB size. Smells damp.		0–0.60	51.82–51.22
10302	Concrete footing of wall			0.60+	51.22+

Trench OP105		Length 0.70 m	Width 0.70 m	Depth 0.60 m	
Easting 435806.841		Northing 387628.077		m OD 51.93	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD



10501	Structural concrete	Brownish grey with rebar at right angles at 0.4. Sharp sub horizontal boundary with (10502).	0–0.45	51.93-51.43
10502	Made ground	Wet dirty soft mid greyish brown slightly silty sandy CLAY GRAVEL, with very abundant poorly sorted FG to CG VA to A gravel of concrete, sst, coal, vein quartz, mdst, slst, flint (probably from concrete aggregate). difficult to determine lithology due to dirtiness in sample, lithology determined from washed clasts.	0.45–0.6	51.43-51.33

Trench OP106		Length 1.50 m	Width 1.50 m	Depth 0.80 m	
Easting 435779.727		Northing 387635.995		m OD 51.92	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
10601	Hard standing	Hardstanding. Concrete with rebar. Rebar concentrated at 0.1, abrupt boundary with (10602). Near pillar of structure - concrete footing bisects pit.		0–0.1	51.92-51.82
10602	Made ground/infilled void	Loose in sample brownish grey slightly sandy clayish GRAVEL, with gravel being overwhelmingly concrete and CBM (red bricks. Bricks are frogged. Matrix is dry and crumbly. Some weak clasts of shaley mudstone FG to CG A. Frequent tip material, glass and metal (alcohol bottles + cans). Large amount of void at top of unit.		0.1–0.8	51.82-51.12

Trench OP107		Length 2m	Width 2m	Depth 0.05m	
Easting 435761.127		Northing 387653.474		m OD 51.78	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
10701	Made ground	Loose friable dark brownish grey SAND and GRAVEL, with gravel being A to sub-angular FG to SB concrete. Some fragmentary rebar, glass and CBM seen. No sorting or orientation seen.		0–0.05	51.78-51.73
10702	Hard standing	Hardstanding. Concrete.		0.05+	51.73+

Trench OP108		Length 0.8m	Width 0.8m	Depth 0.45 m	
Easting 435822.571		Northing 387659.574		m OD 52.02	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
10801	Hard standing	Hardstanding. Stiff pinkish grey concrete. Rebar at 0.3m. Possible unit change after 0.3 but still looks like concrete, intervention too sporadic and uneven to tell.		0–0.45	52.02-52.57

Trench OP109		Length 0.80 m	Width 1.20 m	Depth 0.30 m	
Easting 435825.238		Northing 387662.206		m OD 52.03	



Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD
10901	Hard standing	Hardstanding. Pale pinkish grey CONCRETE with rebar and utility piping. Rebar concentrated at 0.1m, high density of rebar. Pit base full of rubble - possible boundary / additional units not seen. Slaking away from section below rebar point	0–0.3	52.03–52.73

Trench OP110		Length 6 m	Width 1 m	Depth 1.30 m	
Easting 435860.00		Northing 387652.10		m OD 50.68	
Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD	
11000	Made ground	Tarmac (0.20m) onto hardcore	0–0.25	50.82–50.57	
11001	Made ground	Grey concrete with fine grey aggregate. Abrupt to 11002	0.25–0.26	50.57–50.56	
11002	Made ground	Orangey red concrete, grey matrix red CBM aggregate CG sized. Sharp to 11003	0.26–0.5	50.56–50.32	
11003	Made ground	Loose to somewhat soft dark brownish grey slightly silty SAND CLAY with abundant poorly sorted gravel VA to sub-angular FG to SC sized concrete CBM ceramic sst anthracite. Variable colour in bands, blackish to yellowish.	0.5–1.3	50.32–49.62	
11004	Brick wall N facing side of trench	Bricks are red frogged stamped and painted white on external facing surface.	0–1.3	50.82–49.62	

Trench OP111		Length 1.50 m	Width 0.80 m	Depth 1.10 m	
Easting 435878.816		Northing 387655.439		m OD 50.78	
Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD	
11100	Made ground	Concrete onto hardcore.	0–0.2	50.78–50.58	
11101	Subsoil	Friable dark brown / black sandy SILT. occasional to moderate CBM fragments (including whole bricks), slate, coal, moderate small to large sub-angular and sub-rounded pebbles and stones, occasional small cobbles (sandstone?).	0.2–1.1	50.58–49.68	

Trench HCTP201		Length 2.50 m	Width 1 m	Depth 0.70 m	
Easting 435860.572		Northing 387697.342		m OD 48.97	
Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD	
20100	Made ground	Concrete and brick / loose black sandy silty GRAVEL / gravelly SILT. gravel is mixed roundness and sizes. also slag.	0–0.70	48.97–48.27	
20101	Made ground	Concrete slab	0.70+	48.27+	

Trench HCTP202		Length Unknown	Width Unknown	Depth Unknown	
Easting 435856.822		Northing 387677.543		m OD 49.09	



Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD
20200	Made ground		0–	49.09

Trench HCTP203		Length 4 m	Width 2 m	Depth Unknown	
Easting 435859.29		Northing 387661.472	m OD 50.70		
Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD	
20300	Made ground	Tarmac and 'underlay' (mortar like).	0–0.20	50.70–50.50	
20301	Made ground	Mid greyish brown sandy SILT / silty SAND with frequent CBM fragments and rebar.	0.20–0.40	50.50–50.10	
20302	Made ground	BRICKS / sandy SILT. moderate rebar, cabling, wire etc.	0.40	50.10+	

Trench HCTP204		Length Unknown	Width Unknown	Depth Unknown	
Easting 435873.062		Northing 387661.956	m OD 50.74		
Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD	
20400	Made ground	Exactly the same as HCTP203	0.00–0.40	50.74	

Trench TP101		Length 2.50 m	Width 1 m	Depth 2 m	
Easting 435774.95		Northing 387689.681	m OD 55.64		
Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD	
10100	Made ground	Mid to dark yellowish grey slightly sandy clay SILT with frequent poorly sorted sub-angular pebbles and stones and occasional cobbles and small boulders (0.30x0.12x0.15m). moderate CBM fragments and whole bricks with mortar, plastic, rebar and cables / wires.	0.00–0.50	55.64–55.14	
10101	Made ground	Redeposited natural	0.50–2.00	55.14–53.64	

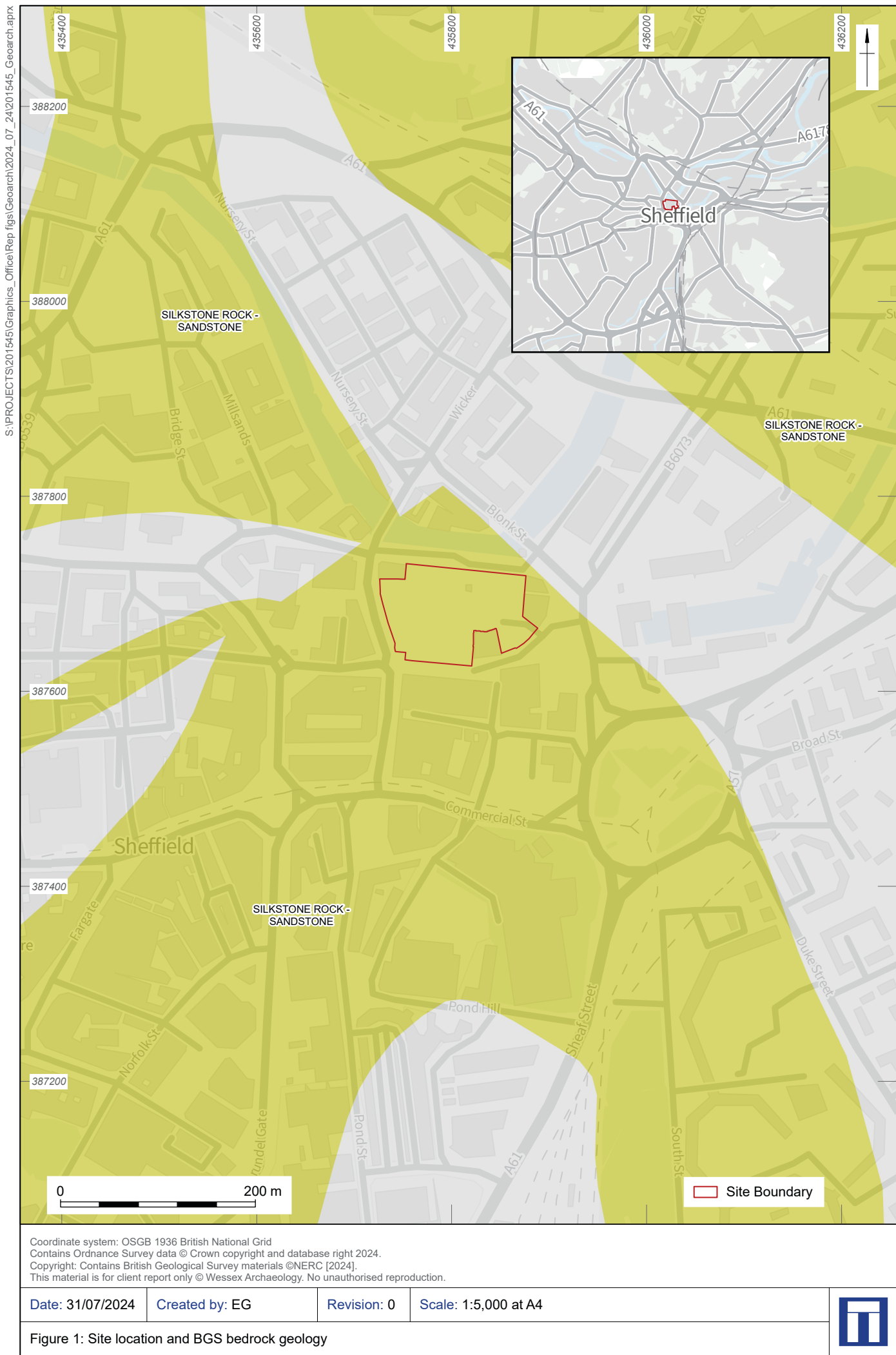
Trench TP102		Length 3 m	Width 1 m	Depth 2 m	
Easting 435809.137		Northing 387675.133	m OD 55.37		
Context Number	Interpretative Category	Description	Depth m bgl	Depth m OD	
10200	Made ground	Fairly friable black sandy SILT with frequent CBM fragments, slag, metal piping / cables	0.00–0.50	55.37–55.87	
10201	Made ground	Redeposited natural - fairly firm greyish yellow clay SILT with moderate small to large sub-angular pebbles, stones and cobbles, occasional small boulders (sandstone), Gwent iron staining. sharp contact.	0.50–1.85	55.87–55.52	
10203	Made ground	Redeposited natural - possibly same as above but unoxidised, buried layer? slightly sandy SILT with slight organic odour and preserved organic material.	1.85–2.00	55.52–53.37	

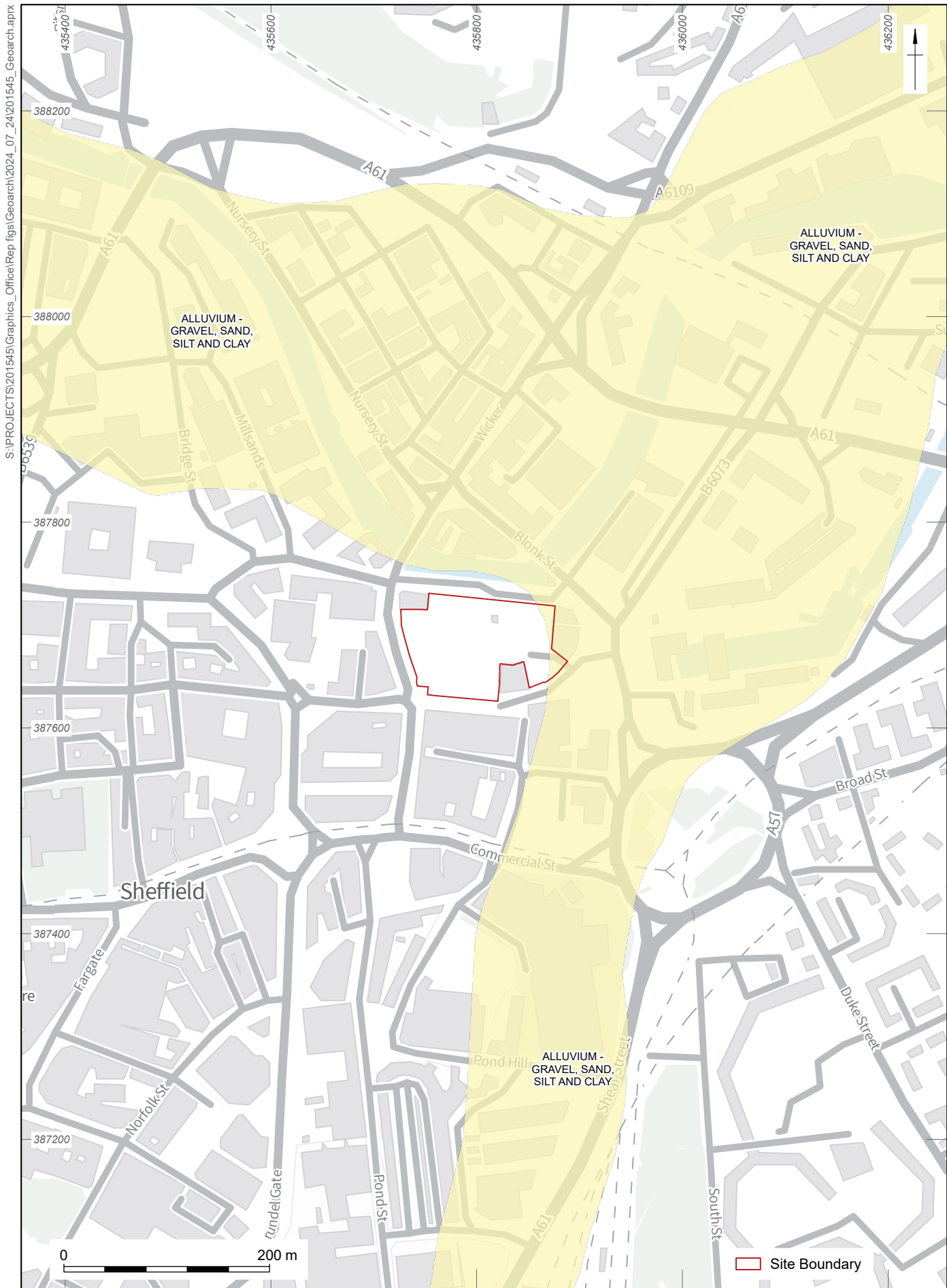
Trench TP103		Length 2.50 m	Width 1 m	Depth 2.50 m	
Easting 435801.116		Northing 387655.56	m OD 52.00		



Context Number	Interpretative Category	Description		Depth m OD
10300	Made ground	Concrete, and hardcore.	0.00–0.50	52.00-51.50
10301	Made ground	Sandy GRAVEL (gravel is CBM fragments, metal wires / rebar, plastic, tin can, rubble). clear contact.	0.50–0.80	51.50-51.20
10302	Archaeological Fill	Firm dark yellowish brown sandy SILT with frequent small to large sub-angular and angular pebbles, stones and cobbles, occasional small boulders (sandstone)	0.80–2.50	51.20-49.50

Trench TP104		Length 2.50 m	Width 1 m	Depth 3.20 m	
Easting 435855.154		Northing 387695.877		m OD 49.03	
Context Number	Interpretative Category	Description		Depth m bgl	Depth m OD
10400	Made ground	Tarmac and concrete onto cement / bricks and bar / pipe.		0.00–0.60	49.03-49.43
10401	Made ground	Loose black sandy SILT / GRAVEL (60:40), gravel is fine to coarse sub-rounded and sub-angular . moderate CBM (including whole bricks), occasional slate, metal.		0.60–3.20	49.43-45.83



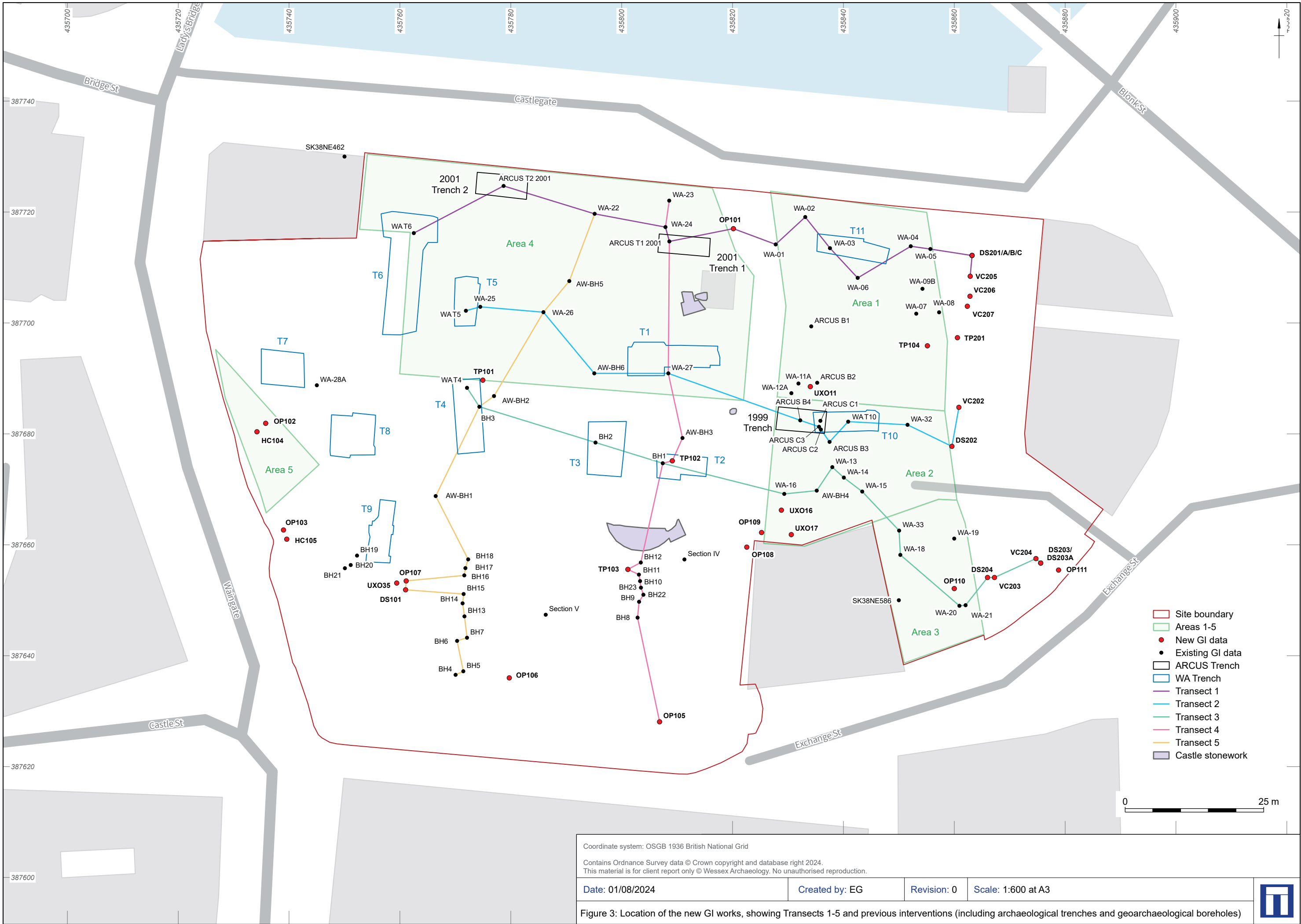


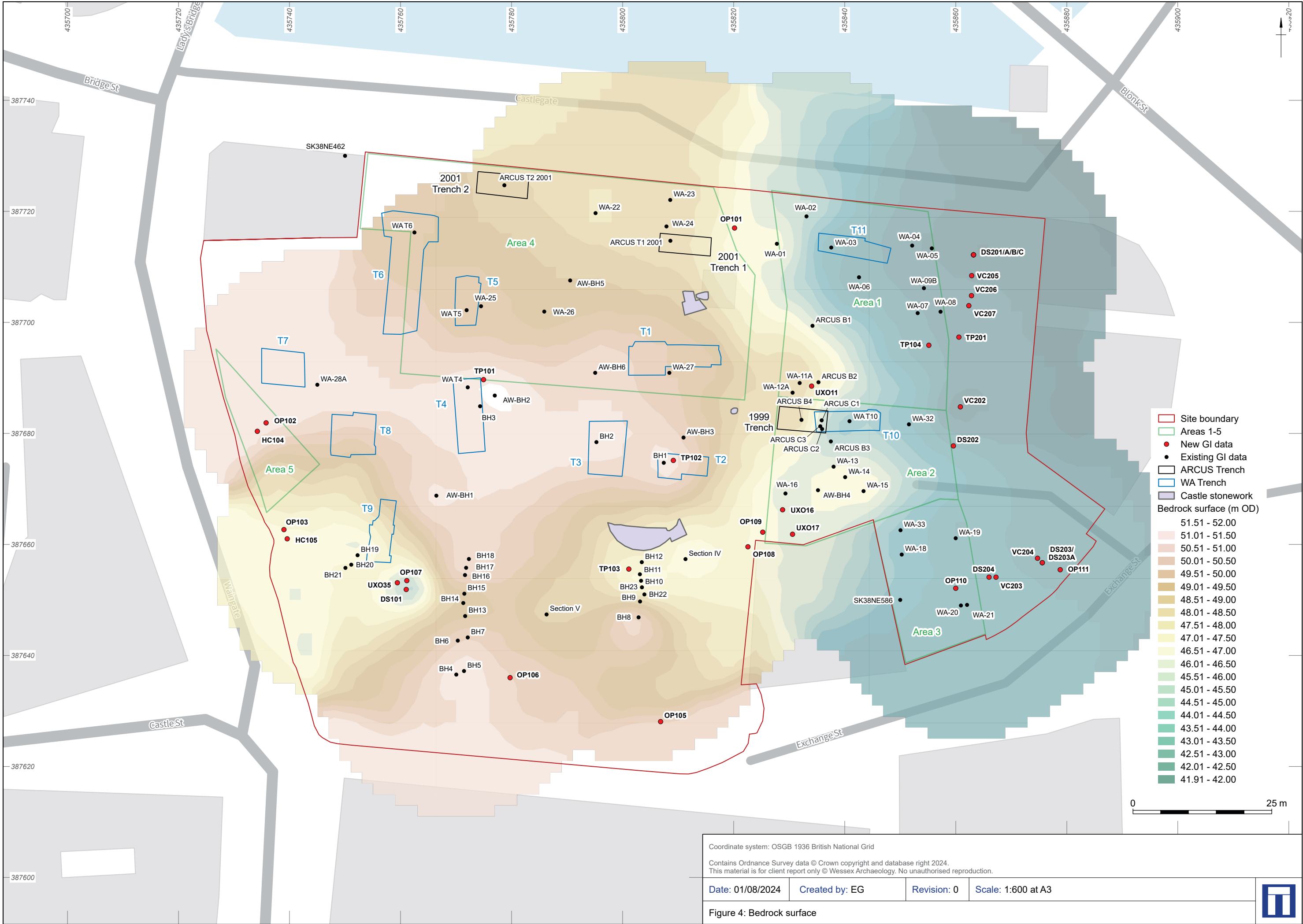
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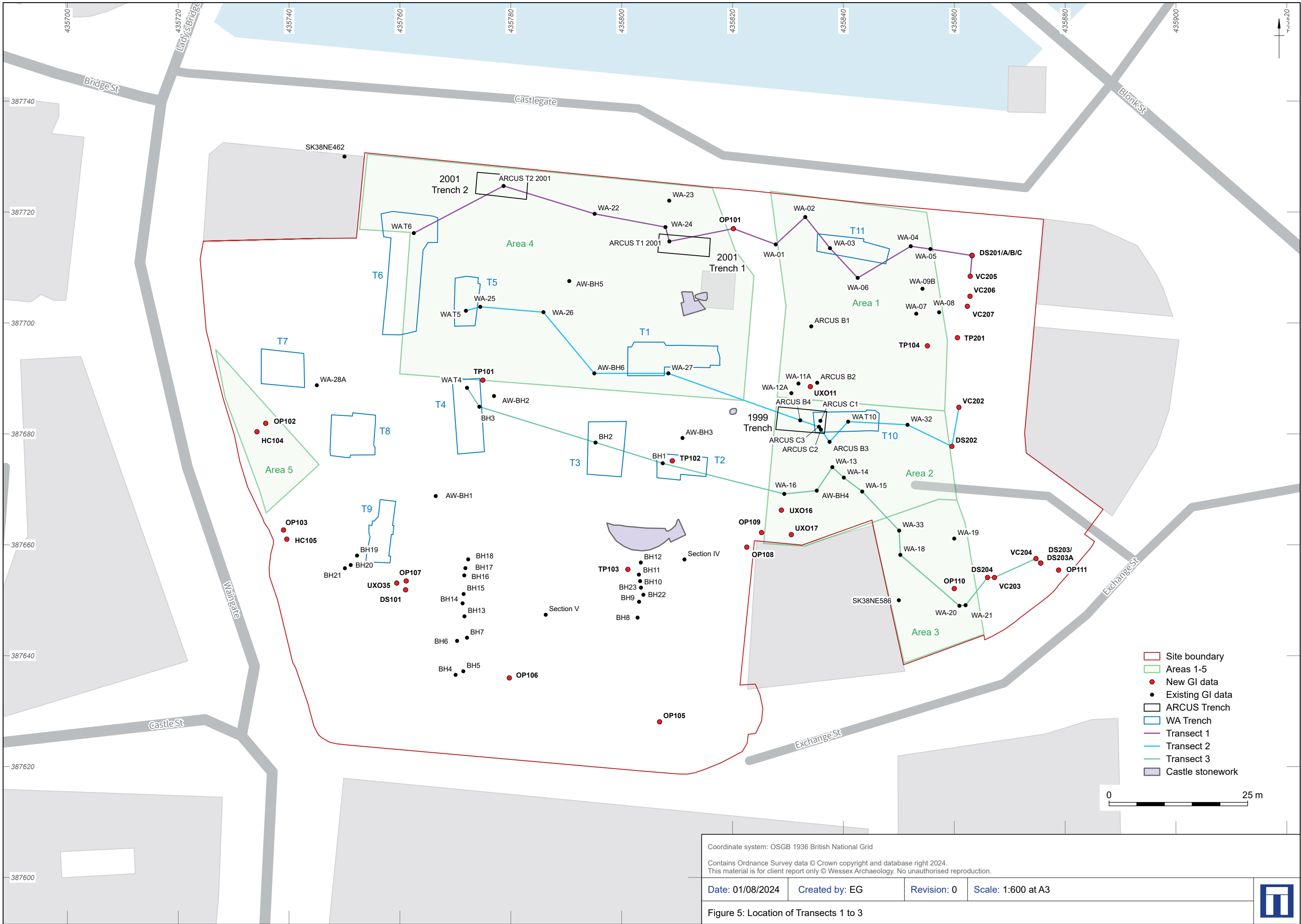
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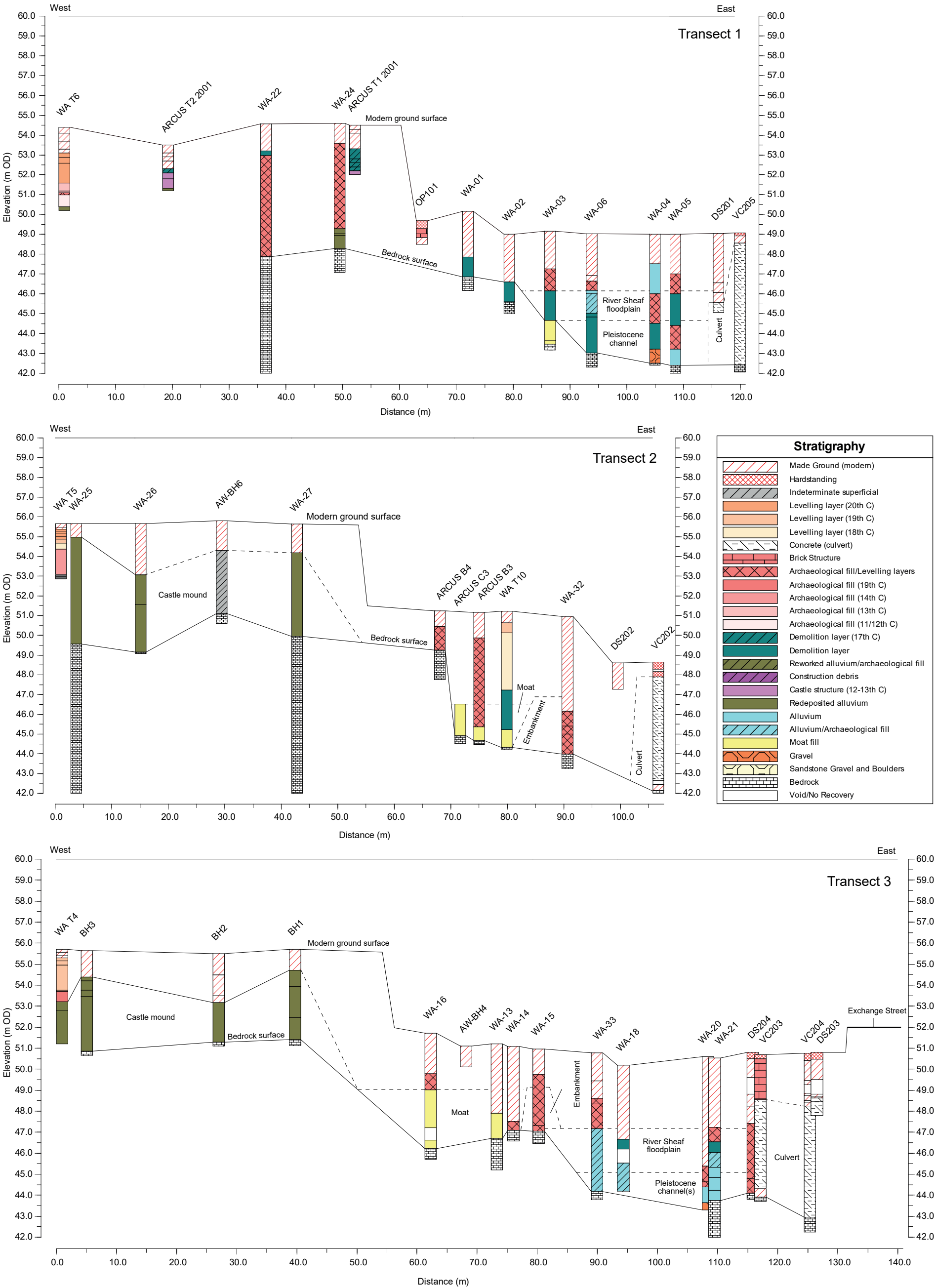
Figure 2: Site location and BGS superficial geology











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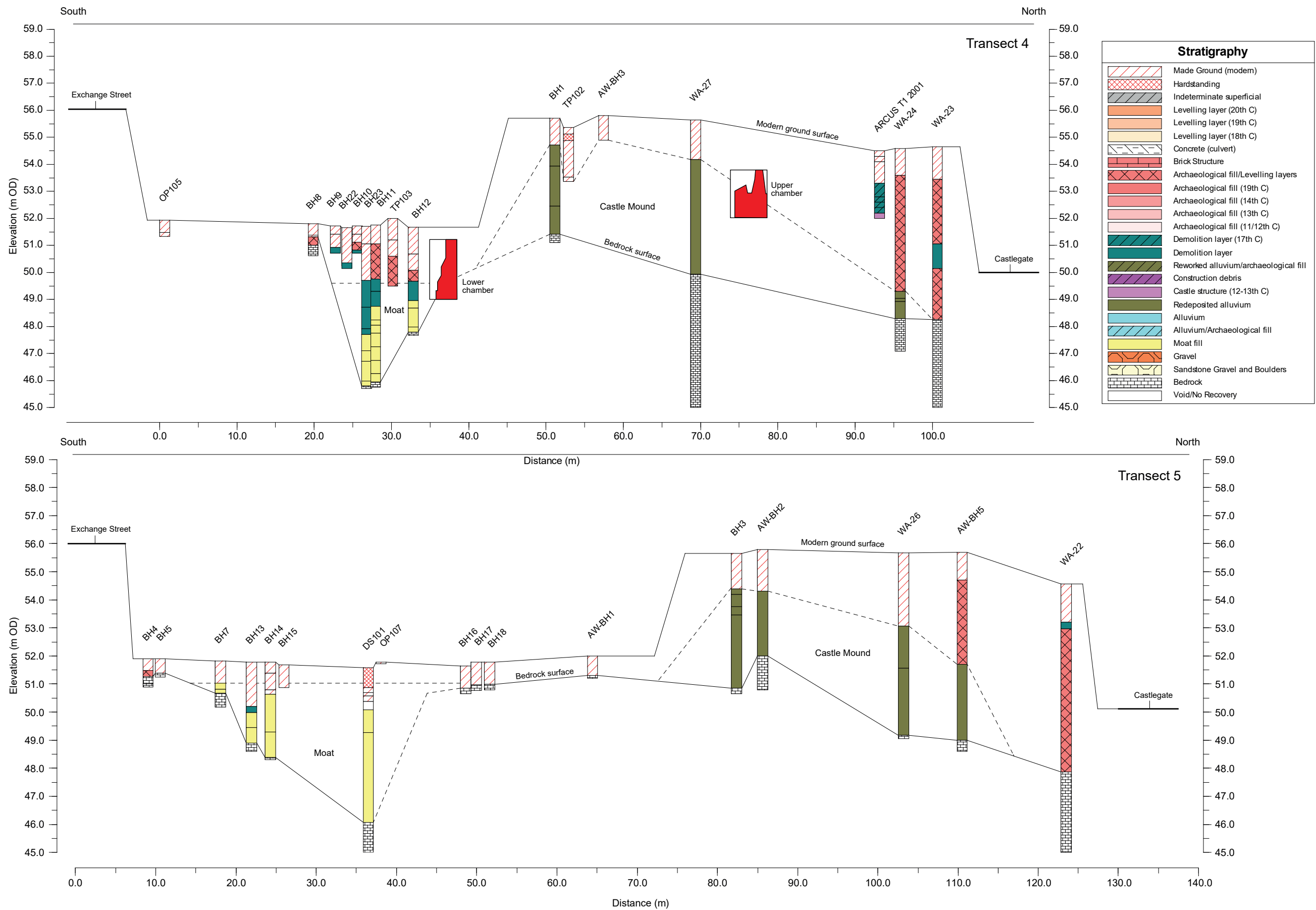
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Figure 6: Transects 1 to 3





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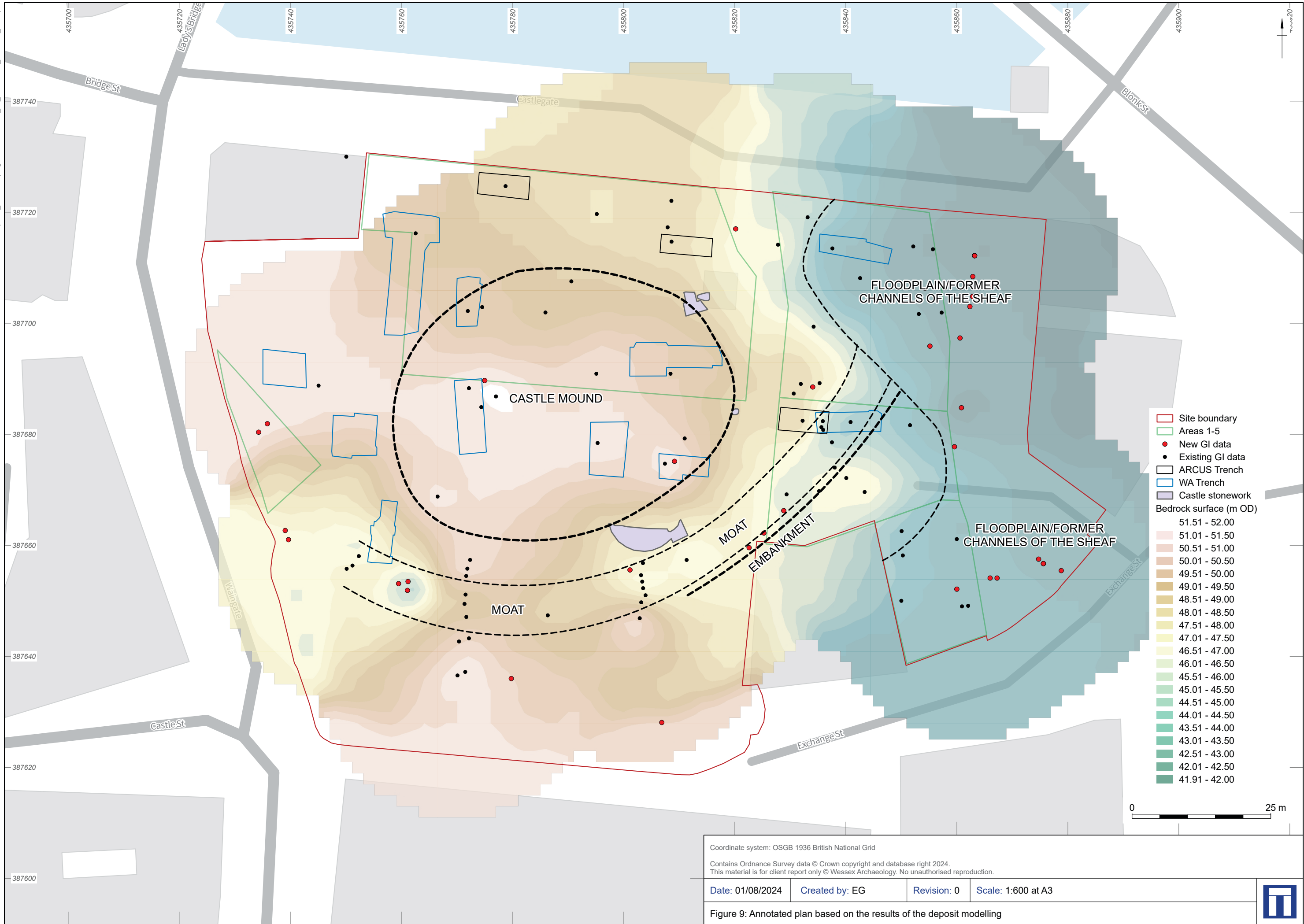
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Figure 8: Transects 4 and 5







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