OAKFORD ARCHAEOLOGY

Archaeological borehole survey at Trews Weir, Exeter, Devon

on behalf of
Exeter City Council

Report No. 19-09

Project No. 1620

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Summary

A geotechnical borehole survey was undertaken in September 2019 by Red Rock Geoscience Ltd for Exeter City Council, at Trews Weir, Exeter, Devon (SX 9244 9162) in advance of major repair works to the weir. The purpose of this survey was to investigate the causes of the weakening of the structure. The excavation of seven boreholes across the length of the weir allowed the recording of the structure and deposits below, providing valuable new information on the construction and date of the weir.

The work identified a thick basal layer of gravel immediately above riverbed deposits in Boreholes 1 and 3, suggesting that an attempt was made to build at least some of the new weir on a 'solid' bedding layer. However, the sequence of deposits identified during the survey, for the most part, consisted of loose core material belonging to the new weir built in 1676 by Richard Hurd underneath a solid Heavitree Breccia capping. This sequence was especially well-preserved in Boreholes 1, 2, 3, 5 and 6. The solid mortared rubble core identified by Wessex Archaeology in March 2015 is likely to represent the 1698-1701 extension of the weir. Finally, evidence of modern repairs were identified in Boreholes 2 and 7.

1. INTRODUCTION

This report has been prepared for Exeter City Council and sets out the results of archaeological monitoring and recording by Oakford Archaeology (OA) during a geotechnical borehole survey undertaken by Red Rock Geoscience Ltd in September 2019 at Trews Weir, Exeter, Devon (SX 9244 9162). The work was commissioned in response to the deteriorating structural integrity of the weir and was monitored by the city council's Principal Project Manager Heritage (PPMH).

1.1 **The site**

Trews Weir lies 1km to the south-east of the City between Trews Weir Island and the former paper factory of John Pitts and Sons Ltd on the north-eastern bank of the River Exe. The weir is orientated approximately northeast-southwest along its long axis, consisting of a submerged stone-built linear structure, with modern concrete repairs. It measures approximately 81m in length and 13m in width, its profile appearing as a shallow scalene triangle, with a short steeply sloped upstream elevation and long, gently sloping downstream face. Elements of the original northeastern weir bank wall survive underneath later repairs, while the southwest bank was completely altered in the mid-late 1960's by the construction of Trews Weir Island.

1.2 **Geological background**

The site lies at a height of between 2.48m and 5.15m AOD, within the River Exe. The underlying geology consists of sandstones with breccias, mudstones and siltstones of the Alphington Breccia Formation, formed between 298.9 and 252.2 million years ago during the Permian period. The local environment at this time was dominated by rivers, with the sedimentary deposits ranging from coarse-grained to fine-grained, and forming beds and lenses reflecting the channels, floodplains and levees of a river estuary. This gives rise to superficial river terrace deposits of sand and gravel. [1]

2. AIMS

The principal aims of the watching brief was to monitor the drilling of boreholes on the site; to examine the borehole cores to determine the state of preservation, type and quantity of any significant archaeological and palaeo-environmental remains uncovered; to ensure that if any environmental evidence was preserved, that a sufficient sample be retained to allow for further analysis and to retrieve any potential dating evidence to establish, describe and if possible interpret the deposit sequence. The objectives of the archaeological work was to identify and record areas of archaeological activity and assess the remains within the areas affected by the proposed works in order to mitigate the impact of the proposed works; and to report on the results of the work as appropriate

3. METHODOLOGY

The work was undertaken in accordance with a project design prepared by Oakford Archaeology (2019), submitted to and approved by the PPMH prior to commencement on site. This document is included as Appendix 1.

A total of seven boreholes were excavated to a depth of between 3.05-8m through the weir structure and underlying deposits, using a Commachio 205 Rotary Rig that was positioned on

[1] http://www.bgs.ac.uk.

the weir by way of an anchored pontoon. The sampling method resulted in the retrieval of a series of individual 1m long and 100mm diameter core samples contained within a clear plastic liner. These were split on site and logged by the engineer and the archaeologist with the aim of recording the deposit sequence, as well as identifying deposits that could be assessed for environmental remains and their potential for geoarchaeological analysis. However, no suitable deposits were identified by OA.

The standard Oakford Archaeology recording system was employed. Stratigraphic information was recorded on *pro-forma* context record sheets, and individual recording forms, plans and sections for each trench were drawn at a scale of 1:10, 1:20 or 1:50 as appropriate and a detailed digital photographic record was made. Registers were maintained for photographs, drawings and context sheets on *pro forma* sheets.

4. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

Exeter possessed no quay prior to the late 16th century as the river is thought to have been too shallow during the Roman and early medieval periods to allow the passage of anything more than the smallest craft. [2] It is thought that a port situated near the head of the estuary handled most of Roman Exeter's trade and that likewise in the later medieval period all goods destined for the city passed through the port of Topsham, owned at this time by the Counts of Devon. [3] The construction of a weir (Countess Wear) in 1284 by Isabella De Fortibus, Countess of Devon, prevented boats from reaching Exeter

The struggles between the City and the Courtenays intensified in the early 14th century when Hugh Courtenay, Earl of Devon, built two further weirs at *Lampreyford* and St James,[4] in order to feed a number of mills along the eastern bank.[5] The blocking of the river resulted in a monopoly on the river tolls for the Earls through their port at Topsham and ensured that it became a flourishing port for Exeter's expanding cloth trade. [6] For the following 250 years the City's economy suffered, but the opportunity presented by the execution of Henry Courtenay in 1538 was seized, and the following year an Act of Parliament was obtained to enable navigation to be restored.[7]

Although numerous attempts at improving the Exe were made in the 1540's and 1550's, it wasn't until 1563 that the engineer John Trew was appointed to construct a waterway three feet deep and sixteen feet wide.[8] Completed in 1566 at a cost of £5,000, it ran to the west of the river for some three kilometres, commencing at what became King's Arms Sluice, and rejoined the river below Countess Wear. It included proper quay and dockside facilities below the city walls, as well as three-pound locks to overcome the fall of six feet and a single pair of lock gates to the seaward end. The completed canal finally allowed lighters to carry goods to the city from sea-going vessels anchored in the estuary. [9] The water supply for this was provided by the construction of a new weir across the river located just below its junction with the canal. [10]

[2] Hoskins 1974, Henderson 1991.
[3] Henderson 1991.
[4] Clew 1984.
[5] MacCaffrey 1978.
[6] Hoskins 1974, Henderson 1991.
[7] Stevens 1957.
[8] De La Garde 1845; Boughey 1994.
[9] Hoskins 1974, Henderson 1991.
[10] Clew 1984.

The construction of the weir and the character of its structure is not covered by contemporary documentary evidence. The earliest map, John Hooker's 1587 map of Exeter (Fig. 2), shows a timber structure named 'Leonards Were'. If this is indeed the weir built by John Trew 20 years earlier, the original structure was likely built of two rows of oak posts driven into the riverbed, with hazel wattles between them supporting a core of stone, gravel and brushwood. This type of construction would have been capable of maintaining a sufficient water level upstream, allowing shallow draft vessels unimpeded passage from the canal to the quay. [11]

However, the canal had a tendency to silt and urgent repairs had to be carried out in 1568, with further extensive repairs and alterations undertaken in 1581. Throughout the late 16th and early 17th century maintenance was neglected by a succession of lessees and in the aftermath of the Civil War the canal required once more required extensive repairs. [12] Further damage to the weir was incurred in 1663, when George Browning built a mill on the riverbank just below Trews Weir. The leat damaged part of the weir and river bank, the canal being closed for a month through shortage of water. Subsequent attempts to work the mill caused barges to be grounded and traffic delayed for weeks at a time, and it took the city Chamber 20 years to close the mill down. [13]

The period following the Restoration was one of renewed prosperity for the City. The volume of trade, in woollen cloth especially, increased rapidly and Exeter became one of the five largest provincial towns.[14] This required further improvements to the canal, which was extended in 1676 for half a mile towards Topsham.[15] The works by Richard Hurd also involved the construction of a large basin and quay, and a reference was made to a 'new and stronger' weir being built near the existing weir. [16] The total cost of the works was between £3-5,000, similar to the original cost of building the canal a century earlier, suggesting fairly substantial alterations and improvements. Although no documentary evidence is available, it is possible that the current structure largely dates to this period, being a re-build on or near the site of the earlier weir.

Nonetheless, it was soon realised that the three-foot depth of the canal was inadequate, and in 1698 the City Chamber authorised the conversion to a ship canal, 14 feet deep and 42 feet wide to allow larger ships of up to 200 tons access to Exeter's quayside. [17] [18] The work, which included the enlargement of the weir, was completed in 1701, leaving the Chamber heavily in debt.[19] The weir is shown in detail for the first time in John Rocque's c.1743 *'The prospect of the Customs House from Trews Ware'*. The illustration (Fig. 3) shows a sturdy construction anchored on two large masonry abutments on the west and east banks of the river. The structure is clearly identical by this date to the structure present on the site today.

While the new canal was clearly an improvement on the former lighter canal it retained many of the old problems, particularly silting of the main channel and the basin behind the weir. [20]

[11] Davies 2015.
[12] Clew 1984.
[13] Clew 1984.
[14] Henderson 1991.
[15] Clew 1984.
[16] Clew 1984.
[17] Henderson 2000.
[18] Clew 1984.
[19] Clew 1984.
[20] Clew 1984.

Major repairs and dredging were carried out during the first half of the 18th century, and again in the decade after 1786. [21]

By the beginning of the 19th century there was a general appreciation that the City was falling behind again economically, silting having reduced the Canal's depth to 8-9 feet. In 1819 the engineer James Green was appointed to appraise the ship canal and its prospects for improvement. Works followed to widen and deepen the canal, while at the same time, the canal was extended further south to Turf Reach, the extension being formally completed in September 1827. [22] The Canal Basin opened in September 1830 and was surrounded by coalyards and warehouses. [23] The basin was initially linked to the railway main line by a broad gauge connection, though this was subsequently converted to standard gauge. Railway turntables were located at each of the northern corners of the basin, one of which was excavated in 2008. [24] The arrival of the railway ultimately contributed to the decline of the canal as a means of transport, while the latter half of the 20th century saw almost all of the industrial activity disappear from this part of the city. [25]

Finally, after the catastrophic flooding of 1960 new flood defences were built to the west of the weir. A new flood relief channel was excavated between the river and the canal, and a concrete 'side weir' constructed on the west side of the river with a sluice gate just upstream from Trews Weir creating the present Trews Weir Island. This enabled the water level at the weir to be controlled and lowered in order to alleviate flooding upstream and for maintenance to be carried out on the weir itself. The sluice gate and machinery are housed on the island.

5. RESULTS

5.1 **Introduction**

Six or seven cores were removed in one-metre sections from each borehole. The condition of the cores was variable, although it was possible to observe the stratigraphic horizons in five of the cores retrieved. A full description of the soil sequences is included in Appendix 2.

5.2 **Borehole 1**

Borehole 1 (Fig. 5, Pl. 3) was excavated to a depth of 6m. The top of the natural geology, consisting of lenses of mid red silt sand (111) was observed at a depth of 2.7m below the surface (1.94m AOD). This was overlain by layer of mid reddish-brown clayey river silts (110) with small gravel inclusions and interpreted as the residual basal deposit of the former riverbed. This was in turn overlain by smooth rounded gravels of mixed size (109), which are interpreted as a possible bedding layer onto which the weir was constructed. A similar layer of gravel material was observed within Borehole 3. Above gravel deposit 109 within Borehole 1, a Heavitree Breccia stone layer (108) measuring 0.3m deep was observed from between 1.8-2.1m (2.85m+ AOD) below the surface. A similar deposit of solid Heavitree Breccia was retrieved from Borehole 3, though at a lower depth than in Borehole 1. The location of the Heavitree stone immediately above the gravel bedding layer, suggests that it may represent the former solid base of the weir. Above the Heavitree Breccia 'base', lay a succession of mid reddish-brown silty sands (101-107), containing lime mortar and pea gravels, with lenses of larger river terrace gravels and Breccia rubble. In view of the mixed nature of these deposits, with inclusions of

[21] Clew 1984.
[22] Collings 2000.
[23] Clew 1984, 37-8, 41.
[24] Steinmetzer 2010.
[25] Collings 2000.

gravel and Breccia, this material is interpreted as the rubble core of the weir. No finds were retrieved from this material. This was capped by Heavitree Breccia stone 0.3m thick (100).

5.3 **Borehole 2**

In **Borehole 2** (Fig. 5, Pl. 4) the top of the underlying Alphington Breccia Formation, consisting of lenses of mid red clayey silt were observed at a depth of 1.55m (2.26m AOD). These were directly overlain by a succession of mid reddish-brown silty sands (203-207) containing pea gravels, larger gravels of up to 20mm and fragments of Heavitree Breccia. This succession of mixed deposits have been interpreted as the rubble core of the weir. A solid Heavitree Breccia capping material (202) measuring 0.22m in depth, was observed overlying the rubble core of the weir and lay at a depth of 0.28m below the weir surface. Overlying this was a thin lens of grey limestone (201), which was in turn overlain by 0.15m of concrete (200). These top two deposits represent modern repairs. No finds were retrieved from the core material.

5.4 **Borehole 3**

The top of the natural geology, consisting of lenses of mid red clayey silts (309), were observed at a depth of 2.95m below the surface (1.55m AOD) within **Borehole 3** (Fig. 5, Pls. 5 - 6). These were overlain by a 0.25m thick, mid reddish-brown sandy silt containing up to 70% gravel inclusions (308). Similar to deposit 109 in Borehole 1, this has been interpreted as a bedding layer for the construction of the weir. Located immediately above this deposit was a layer of solid Heavitree Breccia (307), measuring 0.3m in depth (2.10m AOD). As with deposit 108 in Borehole 1, this layer is interpreted as the remnant of a possible solid stone base for the weir. Overlying 307, were a series of mixed mid reddish-brown and mid yellowish-brown sandy silts (301-306) with gravel inclusions containing small Breccia fragments and river gravels. Interpreted as the rubble core of the weir, these were in turn overlain by a 0.4m thick Heavitree Breccia capping (300). No finds were retrieved from the core.

5.5 **Borehole 4**

The results from **Borehole 4** (Fig. 5) were comparatively poor due to the washing out of much of the core material. However, the top of the Alphington Breccia Formation deposits, consisting of lenses of mid red clayey silts (402) were observed at a depth of 2m below the surface (1.81m AOD). This was in turn overlain by a mid reddish-brown sandy silt (401) containing Breccia rubble and likely representing the core of the weir. This was capped by Heavitree Breccia stone 0.4m thick (400). No finds were retrieved from this core.

5.6 **Borehole 5**

Borehole 5 (Fig. 5, Pl. 7) was excavated to a depth of 3.05m (1.73m AOD). This exposed a sequence of mid reddish-brown, dark brown and light yellowish-brown silty sands and clays, and Breccia rubble (501-511), interpreted as the core of the weir. These deposits were in turn sealed by a 0.35m thick deposit of Heavitree Breccia stone (500). No finds were retrieved from the core material.

5.7 **Borehole 6**

In **Borehole 6** (Fig. 5, Pl. 8) the top of the underlying Alphington Breccia Formation, consisting of lenses of mid red clayey silt (606), were observed at a depth of 3.3m (0.93m AOD). This was overlain by a mid reddish-brown sandy clay (605) representing the remnants of the former riverbed. This was in turn sealed by a succession of mid reddish-brown, dark reddish-brown and mid-yellowish-brown silty sands, containing river gravels, pea grits, pea gravels and Breccia rubble (601-604). This was capped by Heavitree Breccia stone 0.4m thick (600). No finds were retrieved from the core material.

5.8 **Borehole 7**
The results of **Borehole 7** (Fig. 5, Pl. 9) revealed the underlying natural geology (703), consisting of a compact red clayey silt (702) at 2.6m below the surface (1.51m AOD). This was in turn sealed by a 0.6m thick mid reddish-brown sandy clay (702) representing the remnants of the former riverbed. Above this lay a 0.4m deep deposit of dark reddish-brown sandy silt, fine grit and river terrace gravels (701) which is interpreted as the remnant core of the former weir. This was in turn overlain by a 1.6m deep layer of modern concrete (700). No finds were retrieved from this core.

6. DISCUSSION

6.1 **Quality of results**
Understanding of the deposits encountered is hampered by the limited size of the boreholes, extraction from their original context, the variable condition of the cores and by the lack of dating evidence. Nevertheless, a general interpretation (Fig. 6), based on the results of the borehole survey and the building recording carried out by Wessex Archaeology in 2015, can be offered.

6.2 **Pre-weir activity**
The condition of the cores did not allow for substantial analysis of the pre-Weir deposits. However, earlier river deposits of sandy silts and clays were observed below the weir in Boreholes 1, 6 and 7. The extent to which an attempt was made to remove these early riverine deposits in order to achieve a solid base for the construction of the weir is unclear. The presence of a gravel deposit in boreholes 1 and 3 immediately above and partly intermixed with these remnant riverbed deposits suggests that a partial attempt may have been made to provide a solid base for the eastern end of the weir.

6.3 **The weir**
No evidence was found during the survey for earlier structures underneath the weir, suggesting that the current weir is built on an entirely new site. Above an intermittent gravel base layer, the work exposed the core of the weir, consisting of loose lenses of Heavitree rubble within mixed sandy silts and gravels. A series of longitudinal and upright timbers were identified by Wessex within the tail of the weir. Although their function is unclear, they may have helped retain the loose core of the weir. This material had little integrity and bore no resemblance to the solid mortared stone rubble construction identified at the western end of the weir in 2015 by Wessex Archaeology. The similarity of the former across all of the boreholes suggests a single phase of construction, while the latter is perhaps indicative of an episode of extensive rebuilding. In light of this, the single timber post identified by Wessex Archaeology was perhaps instead a timber pile designed to give additional structural integrity to the weir.

A context for the construction of the current stone structure is likely to be the extensive works to the canal and river basin undertaken in 1676, when the engineer Richard Hurd was said to have built a new and stronger weir near the existing weir. Nonetheless, this proved to be inadequate and further works were carried out between 1698-1701, including the construction of an extension to the existing weir. This would account for the difference in build between the works monitored by Wessex Archaeology and the core materials identified by the recent borehole survey.

Despite rebuilding the weir in stone in the late 17th century, the core materials have clearly little integrity and after 343 years have been subject to substantial erosion. In addition, the Heavitree

Breccia capping has been steadily eroded away. This was typically 0.3-45m thick, although in Borehole 2 the breccia was only 0.22m thick, requiring subsequent strengthening with limestone blocks and more recently concrete.

7. CONCLUSIONS

The archaeological investigations have provided a significant new exposure of elements of the weir construction. Although a substantial feature, a full understanding of the structure is hampered by a number of factors, notably the limited nature of the boreholes and the complete absence of secure dating evidence is also a significant constraint. Nevertheless, the investigations have provided a useful level of information regarding the date and nature of the current weir, and an indication of the general level of survival of pre-weir deposits.

The weir built by John Trew in 1566 is likely to have been a timber structure. No evidence of this was identified during the survey and the current structure is likely to date to the 1676 building of a 'new and stronger weir' by Richard Hurd. The work revealed that the eastern and central part of the structure consisted of a breccia rubble and dredged river materials core underneath Heavitree ashlar. Investigated in 2015, the western end of the weir consisted of a mortar bonded rubble core underneath ashlar blocks. This likely represents the extension of the weir in 1698. Despite minor repairs and alterations, the weir has remained relatively unaltered until the present day.

8. PROJECT ARCHIVE

A summary of the archaeological investigations has been submitted to the on-line archaeological database OASIS (oakforda1-369599). Since this report presents the full results of the investigation, no separate project archive will be deposited.

ACKNOWLEDGMENTS

This work was commissioned by Exeter City Council (ECC) and administered on their behalf by Daryl Taylor. The works access were facilitated by Andy Cousins (ECC) and Clinton Currie (ECC). It was administered for Oakford Archaeology by Marc Steinmetzer. Thanks are due to Anthony Cleeve (Red Rock Geoscience Ltd) and Roxy Lewis (Red Rock Geoscience Ltd) and the site crew, Gary Sansom, Matt Clapham and Ryan Rendolls. It was monitored for Exeter City Council by the PPMH, Andy Pye. The fieldwork was carried out by Marc Steinmetzer and Elisabeth Patkai.

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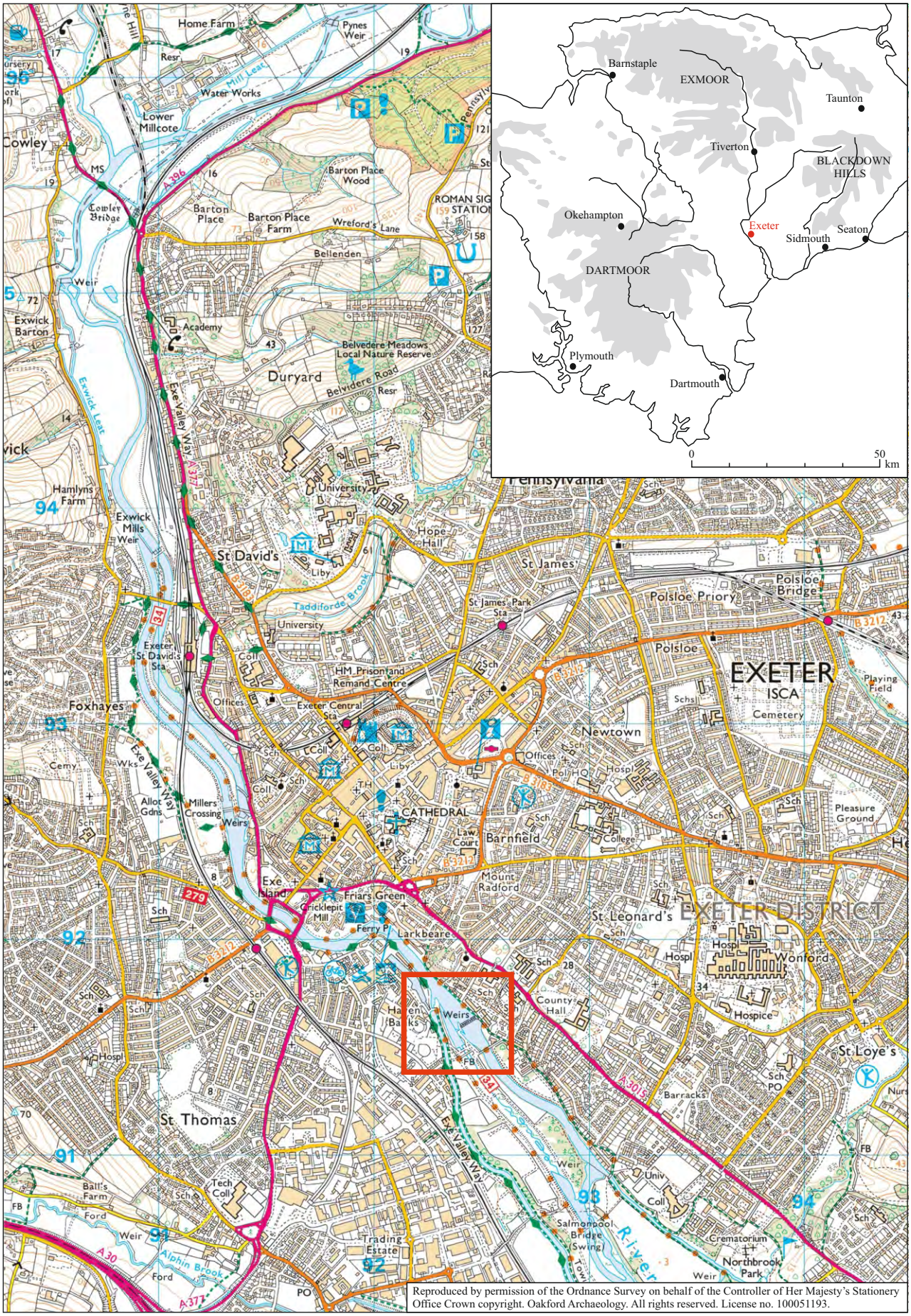

Fig. 1 Location of site.

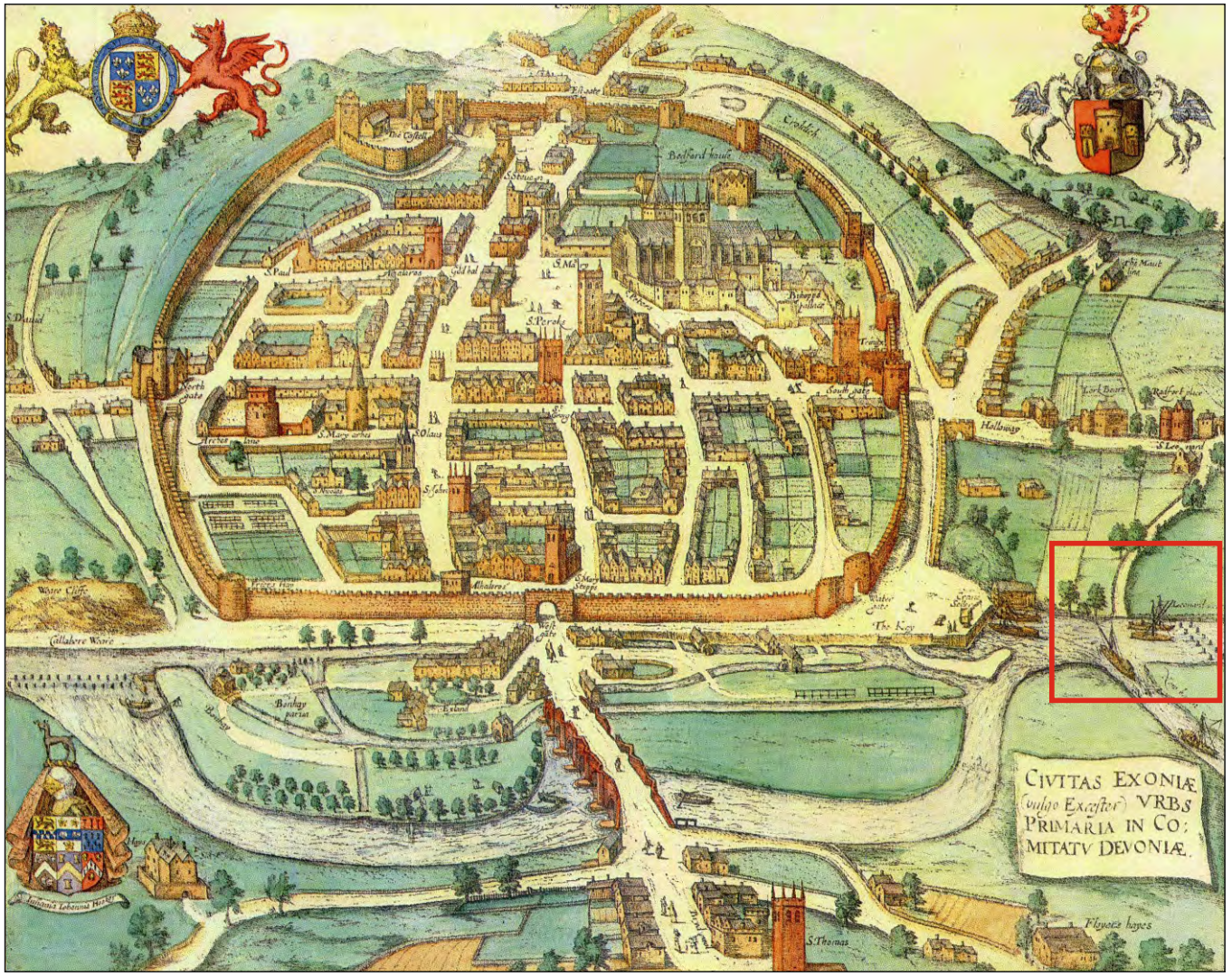

Fig. 2 John Hooker's 1587 Map of Exeter showing 'Leonard's Wear' after the completion of the Canal.

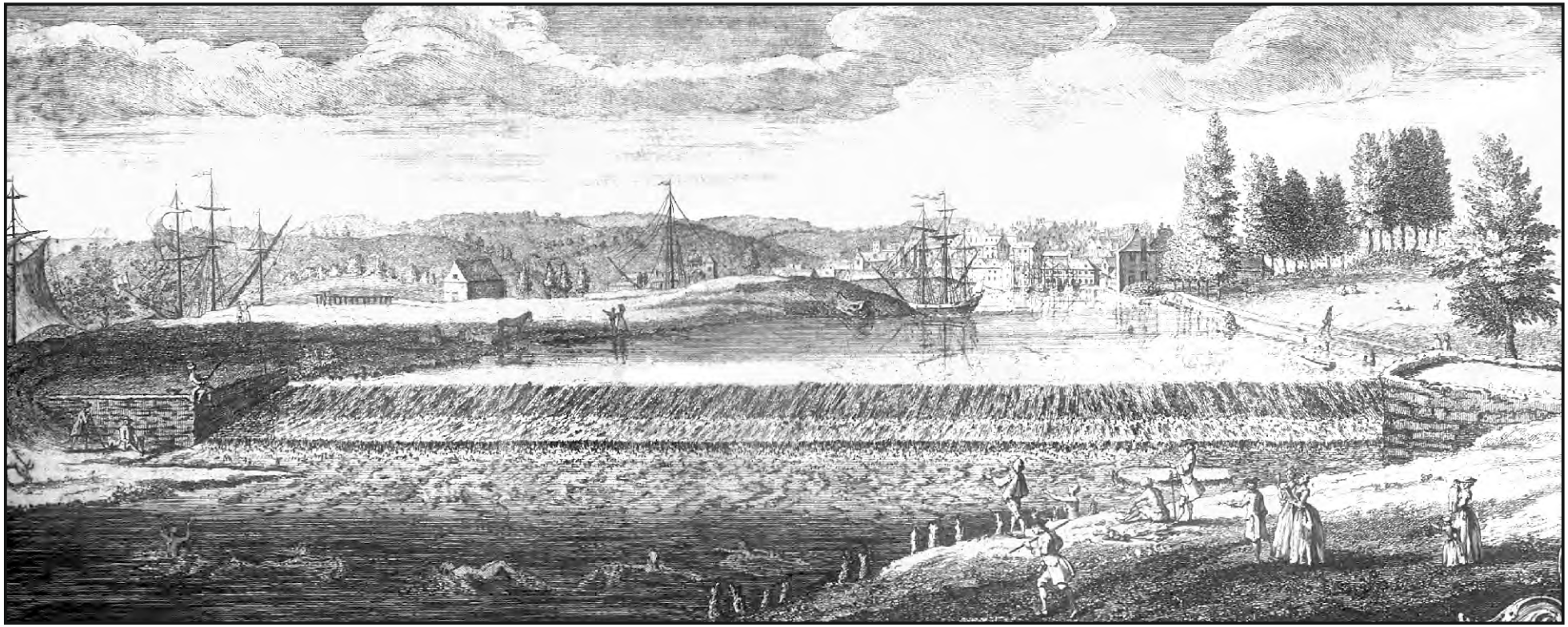

Fig. 3 John Rocque's c.1743 *The prospect of the Customs House from Trews Ware*.

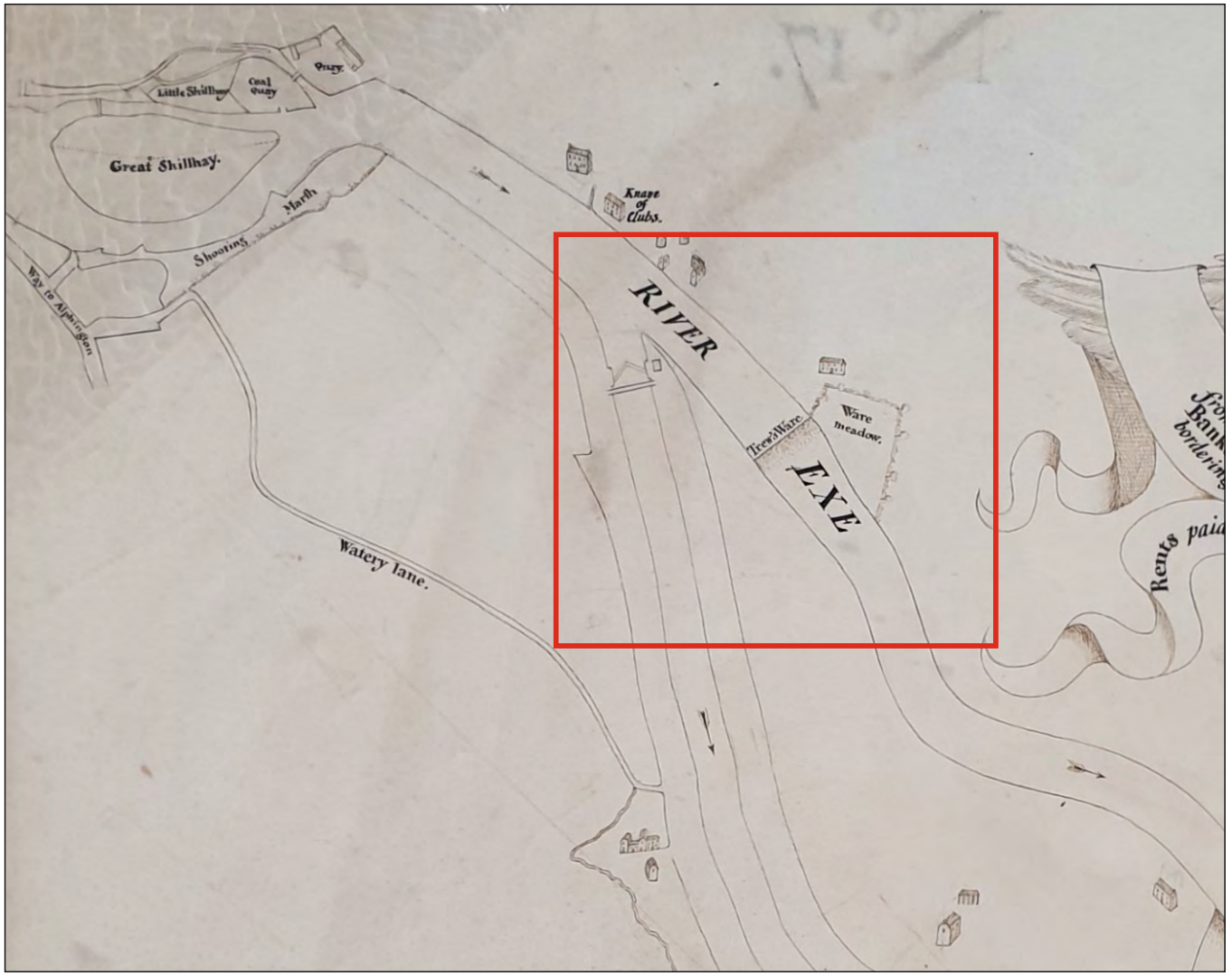

Fig. 4 Extract from the Exeter Chamber Map Book, Map 17, showing the upper section of the Canal in the 1750's.

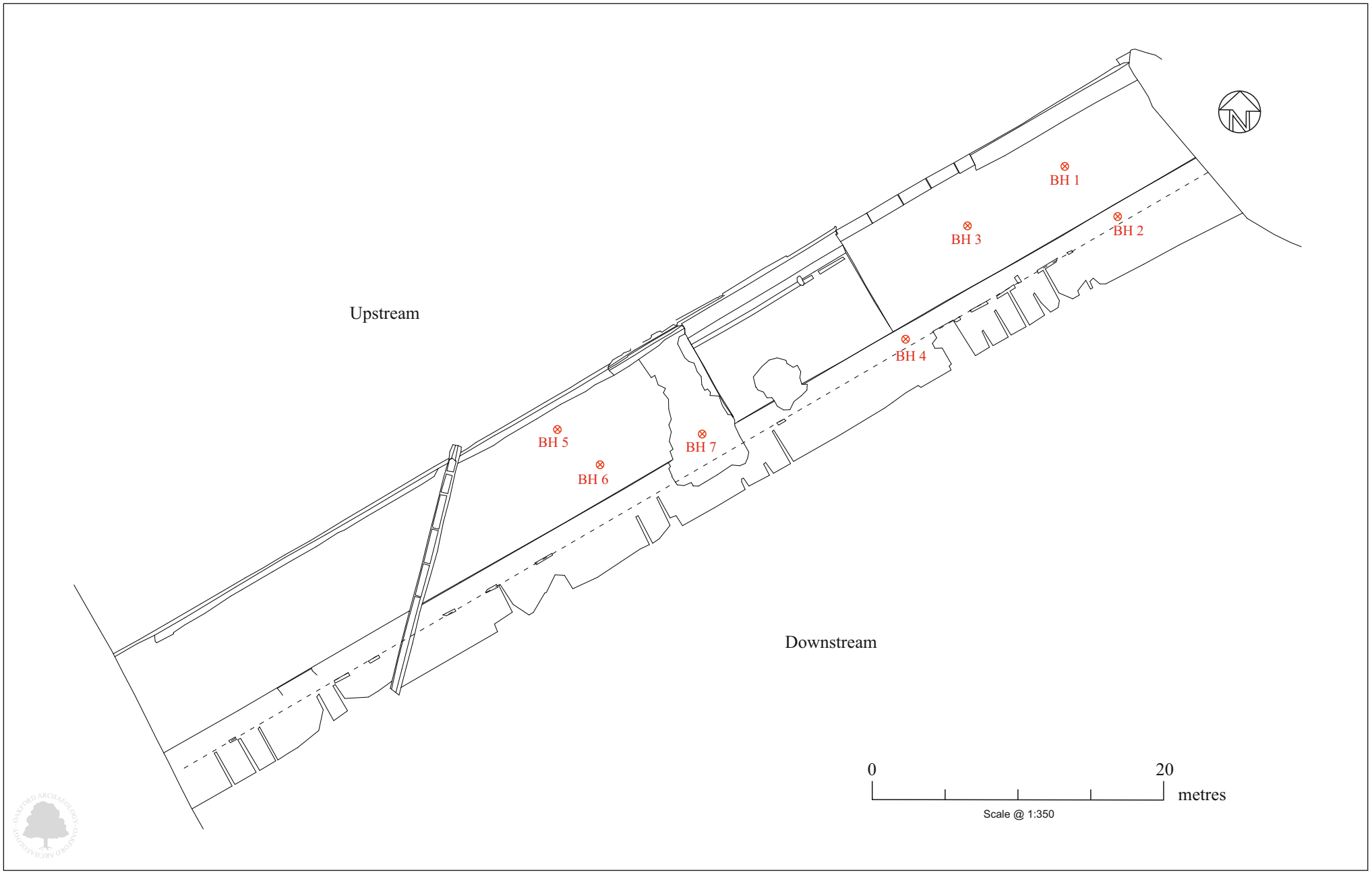

Fig. 5 Plan of Trews Weir showing location of Boreholes.

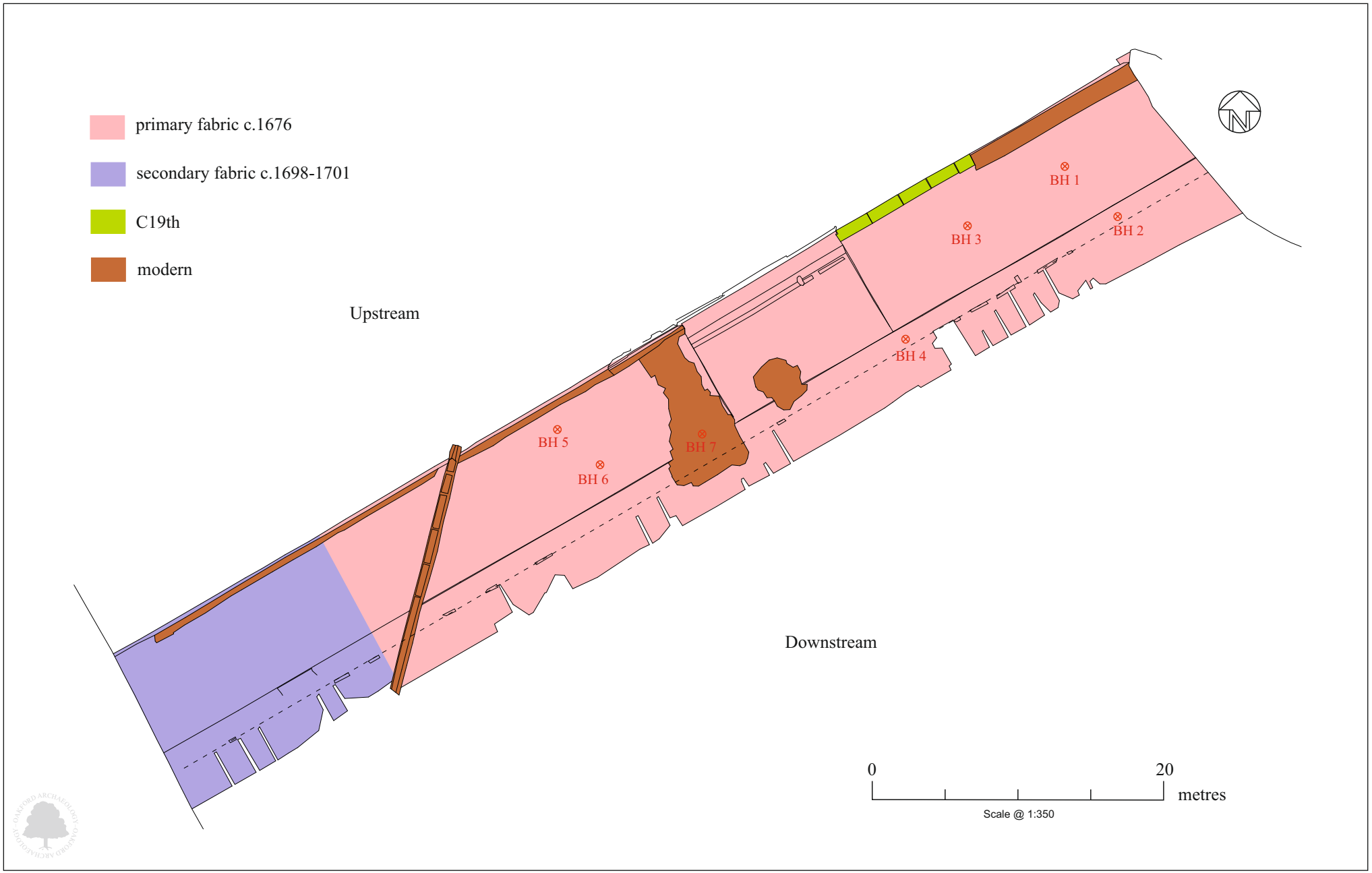

Fig. 6 Provisional phasing of Trews Weir.

Pl. 1 General view of the borehole survey on Trews Weir. Looking northwest.

Pl. 2 General view of the rotary rig positioned on Trews Weir, excavating borehole 2. Looking southeast.

Pl. 3 Borehole 1 showing deposit sequence. 1m scale.

Pl. 4 Borehole 2 showing deposit sequence. 1m scale.

Pl. 5 Borehole 3 showing deposit sequence extending to the right (pl. 6) with basal deposits below. 1m scale.

Pl. 6 Borehole 3 showing continuation of deposit sequence from the left (pl. 5). 1m scale.

Pl. 7 Borehole 5 showing deposit sequence. 1m scale.

Pl. 8 Borehole 6 showing deposit sequence. 1m scale.

Pl. 9 Borehole 7 showing depth of modern concrete repair overlying weir core.1m scale.

Appendix 1:

Method statement

1. INTRODUCTION

1.1 This document has been prepared by Oakford Archaeology (OA) for Exeter City Council to describe the methodology to be used during a borehole survey at Trews Weir, Exeter (SX 9244 9162) to be undertaken by Red Rock Geoscience Ltd. This document represents the 'Written Scheme of Investigation' for archaeological work required for the borehole assessment.

The monitoring of boreholes, even when these are not primarily designed for archaeological evaluation, can provide useful information on the nature and extent of archaeological deposits. This will contribute to the formulation of a strategy for the preservation or management of those remains; and/or the formulation of an appropriate response or mitigation strategy to the repair and stabilization works to Trews Wear.

1.2 Trews Weir occupies a site 1km to the south-west of the City between Trews Weir Island and the northeastern bank of the River Exe. The wear comprises a submerged stone-built linear structure, which is orientated approximately northeast - southwest along its long axis. The basic construction is of red Heavitree Breccia blocks with later repair episodes in concrete and cement. The weir measures approximately 81m in length and 13m in width and has been constructed so that in profile it appears as a shallow scalene triangle, with a shorter and steeper sloped upstream face and long, sloping downstream face.

At its eastern end the weir is built up against a red sandstone wall; at the west end, it appears to butt-up against the stone-faced wall of Trews Weir Island which was constructed in the mid-late 1960s. The present weir is located close to Trews Mill and Trews Weir Leat. The latter, on the upstream side of the weir, is an historic feature that once fed water into the rear side of Trews Mill, exiting into the river in the centre of the mill and downstream of the weir. The leat today is lined-out with modern bricks with a new sluice immediately to the south of Trews Weir.

1.3 A weir on the site of the present Trews Weir, known as St Leonard's Weir, appears to have been in existence since at least the medieval period, while surviving records indicate that a structure, known as 'Lampreyford Weir', was constructed by the Earl of Courtenay in *c.*1311 to feed a leat powering a nearby mill. Hogenburg's 1618 map of Exeter shows St Leonard's Weir, a typical medieval fish weir made of rows of upright poles connected by transverse rods or beams, which were themselves interwoven with brushwood or withies. The poles were sunk directly into the riverbed the gaps filled by a net or a wickerwork basket with a hole at one end.

1.4 Exeter possessed no quay prior to the late 16th century as the river is thought to have been too shallow during the Roman and early medieval periods to allow the passage of anything more than the smallest craft. [26] It is thought that a port situated near the head of the estuary handled most of Roman Exeter's trade and that likewise in the later medieval period all goods destined for the city passed through the port of Topsham. [27]

[26] Hoskins 1974, Henderson 1991.
[27] Henderson 1991.

1.5 The growth of the woollen industry in the 16th century led to increasing disputes between the City authorities and the Courtenay family. The Counts of Devon had built a weir 3.2km southeast of the city in the 13th century to ensure a monopoly of river tolls through their port at Topsham. The attainder and execution of Henry Courtenay, Marquess of Exeter, by King Henry VIII led to the construction of the Exeter Canal between 1563-66. Successfully completed by John Trew of Glamorganshire the canal began upstream and rejoined the river at Matford Brook, below Countess Wear. The water supply for the canal was provided by the construction of a new weir, named '*Trews Weir*' after the engineer, and which was built across the Exe just below its junction with the canal at Exeter.

1.6 Clew's book states that in 1663, a mill owner, George Browning, built a fulling mill for serge cloth on the riverbank just below Trews Weir. To provide power for the mill he cut a 58ft. (17.7m) wide leat from the river above the weir, which rejoined the river below the weir. The leat damaged part of the weir and river bank, the canal being closed for a month through shortage of water. Subsequent attempts to work the mill caused barges to be grounded and traffic delayed for weeks at a time, and it took the city chambers seven to close the mill down.

1.7 With the Restoration came a period of renewed prosperity for the City, with the volume of trade, in woollen cloth especially, increasing rapidly. [28] This in turn led the City Chamber in 1676 to start work on improving the Exeter Canal and Quay that continued piecemeal until 1701. [29] In 1676 Richard Hurd extended the canal to the south and constructed a large basin and quay, while the original canal was further enlarged and deepened between 1698 and 1701 to allow larger ships of up to 200 tons access to Exeter's quayside.[30] A reference to a '*new and stronger*' weir being built near Trews Weir at a time when the quay at Exeter was expanded may suggest that the original Trews Weir was enlarged or strengthened during this period. This is mentioned again in a further reference to Trews Weir in 1698, when the city chamber made an agreement with William Bayley, an engineer from Winchester, [31] suggests that he was to widen the canal to 42ft (12.8m) and deepen it to 14ft (4.3m). As part of this work, Clew's book states that Trews Weir was to be 'enlarged'.

1.8 In 1966 new flood defences, chiefly to the west and north of the weir, were built. The issue of flooding along the river has always been an issue so, as part of a wider scheme of flood alleviation on the River Exe by the Devon River Authority, a flood relief channel was dug between the river and the canal and, as part of this work, a concrete 'side weir' was constructed on the west side of the river with sluice gate just upstream from the weir creating the present Trews Weir Island. This enables the water level at the weir to be controlled and lowered in order to alleviate flooding upstream and for maintenance to be carried out on the weir itself. The sluice gate and machinery are housed on the island.

[28] Henderson 1991.
[29] Henderson 1991.
[30] Henderson 2000.
[31] Clew 1984.

2. AIMS

2.1 The aims of the watching brief are to monitor the drilling of boreholes on the site; to record the borehole cores; to record the presence of sensitive archaeological material within these and to retrieve any potential dating evidence to establish, describe and if possible interpret the deposit sequence; and to ensure that if any environmental evidence is preserved, that a sufficient sample be retained to allow for further analysis; and to report on the results of the work as appropriate.

3. METHOD

Liaison will be established with the client and their contractor prior to the works commencing, in order to obtain details of the works programme and to advise on OA requirements.

3.1 6 boreholes of 100mm diameter will be augured across Trews Weir.

3.2 The archaeologist will be in attendance throughout the borehole survey to monitor and record all geotechnical site investigations (boreholes) and to identify the deposit sequence revealed by the works, with reference to the anticipated sequence described above (1.2-1.8). The engineer's sampling method will result in the retrieval a series of individual 1m long and 100mm diameter core samples contained within a clear plastic liner. These will be split on site, logged by the engineer and the archaeologist and, if necessary, i.e. if contexts suitable for environmental analysis survive and can be practically retrieved in a useful state (see separate geotechnical method statement), retained by the archaeologist for further analysis.

If it becomes clear that environmentally sensitive deposits will be impacted upon by the subsequent repair works that are anticipated to Trews Wear, then in mitigation of this impact any further analysis that is necessary will be undertaken in accordance with the HE Guidelines for Environmental Archaeology, and this work will be set out in a further written scheme to be submitted with a further application for these repair works.

3.3 The description and recording of all deposits will follow standard archaeological terminology and will aim to characterise the visible properties of each deposit, in particular relating to its texture, colour, structure, depositional boundaries, inclusions and evidence for depositional and post-depositional processes. The datum height will be recorded by the engineer and the archaeologist for all the boreholes.

The results will be used to produce a preliminary interpretation and depositional sequence and environment. Description of the soil sequences recovered will provide important, primary information on the nature of the depositional environment through time.

3.4 Health and Safety requirements will be observed at all times by archaeological staff working on site, particularly when machinery is operating nearby. Personal protective equipment (safety boots, helmets and high visibility vests) will be worn by staff when plant is operating on site. A risk assessment will be prepared prior to excavation.

3.5 If present, environmental deposits will be assessed on site by a suitably qualified archaeologist, with advice as necessary from Allen Environmental Archaeology or the Historic England Regional Science Advisor, to determine the possible yield (if any) of environmental or microfaunal evidence, and its potential for radiocarbon dating. If deposits potential survives, these would be processed by Allen Environmental Archaeology (AEA) using the HE Guidelines for Environmental Archaeology (HE CfA Guidelines 2002/1) and Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (Historic England, second edition, August 2011), and outside specialists (AEA) organised to undertake further assessment and analysis as appropriate.

3.6 Initial cleaning, conservation, packaging and any stabilisation or longer-term conservation measures will be undertaken in accordance with relevant professional guidance (specifically 'First Aid for Finds' Watkinson, D and Neal V, (London: Rescue/UKICAS 2001) and CI*f*A 2014 'Standard and guidance for the collection, documentation, conservation and research of archaeological materials') and on advice provided by A Hopper-Bishop, Specialist Services Officer, RAM Museum, Exeter.

3.7 Should artefacts be exposed that fall within the scope of the Treasure Act 1996, then these will be removed to a safe place and reported to the local coroner according to the procedures relating to the Act. Where removal cannot be effected on the same working day as the discovery suitable security measures will be taken to protect the finds from theft.

3.8 The project will be organised so that specialist consultants who might be required to conserve artefacts or report on other aspects of the investigations can be called upon (see below). The client will be fully briefed and consulted if there is a requirement to submit material for specialist research.

3.9 The PPMH will be informed of the start of the project and will monitor progress throughout and will wish to inspect the works in progress. A date of completion of all archaeological site work related to the borehole survey will be confirmed with the PPMH and the timescale of the completion of items under section 5 will run from that date.

4. ARCHAEOLOGICAL RECORDING

4.1 The standard OA recording system will be modified, and recording will consist of annotated borehole recording sheets; standardised single context record sheets; survey drawings, plans and sections at scales 1:10,1:20, 1:50 as appropriate; and colour digital photography;

5. REPORTING AND ARCHIVING

5.1 The reporting requirements will be confirmed with the PPMH on completion of the site work. If little or no significant archaeology is exposed then reporting will consist of a completed ECC HER entry, including a plan showing location of the boreholes and of any significant features found. The text entry and plan will be produced in an appropriate electronic format suitable for easy incorporation into the HER and sent to

the client and the PPMH within one month of the date of completion of all archaeological fieldwork.

5.2 Should significant remains be found then a summary report will be produced within one month of the date of completion of the fieldwork. Any summary report and will contain the following elements as appropriate:

- location plan and overall site plans showing the positions of the boreholes, as well as copies of any relevant historic maps;
- a written description of the exposed features and deposits and a discussion and interpretation of their character and significance in the context of the known history of the site;
- plans and sections at appropriate scales showing the exact location and character of significant archaeological deposits;
- a selection of photographs illustrating the principal deposits found;
- specialist assessments and reports as appropriate.

5.3 A pdf version of the summary report will be produced and distributed to the Client and the PPMH on completion of sitework within the timescale above. A copy of the report and.pdf version will also be deposited with the site archive.

5.4 An ordered and integrated site archive will be prepared with reference to *The Management of Archaeological Projects* (English Heritage, 1991 2nd edition) upon completion of the project.

The archive will consist of two elements, the artefactual and digital - the latter comprising all born-digital (data images, survey data, digital correspondence, site data collected digitally etc.) and digital copies of the primary site records and images, compiled in accordance with the ADS Guidelines for Depositors (2015).

The digital archive will be deposited with the Archaeology Data Service (ADS) with the permission of the landowner within 6 months of the completion of site work, while the artefactual element will be deposited with the Royal Albert Memorial Museum (ref. number *pending*). Any artefacts not taken by the RAMM will be offered to the landowner before being discarded. The hardcopy of the archive will be offered to the RAMM and if not required will be disposed of by OA.

OA will notify the PPMH upon the deposition of the digital archive with the ADS, and the deposition of any material (finds) archive with the RAMM.

Should no artefacts be recovered or should the RAMM not wish to retain any that are, then, with the agreement of the ECC PPMH, the report submitted to OASIS will form the sole archive for this project.

5.5 A .pdf copy of the updated summary report will be submitted, together with the site details, to the national OASIS (Online AccesS to the Index of Archaeological investigationS) database within six months of the completion of site work.

5.6 A short report summarising the results of the project will be prepared for inclusion within the "round up" section of an appropriate national journal, if merited, within 12 months of the completion of site work.

5.7 Any amendments to the method or timescale set out above will be agreed in writing with the PPMH before implementation.

6. COPYRIGHT

6.1 OA shall retain full copyright of any commissioned reports, tender documents or other project documents, under the Copyright, Designs and Patents Act 1988 with all rights reserved, excepting that it hereby provides an exclusive licence to the client for the use of such documents by the client in all matters directly relating to the project as described in this document.

7. PROJECT ORGANISATION

7.1 The project will be undertaken by suitably qualified and experienced archaeologists, in accordance with the Code of Conduct and relevant standards and guidance of the Chartered Institute for Archaeologists (*Standards and Guidance for Archaeological Evaluation,* 1994, revised 2008, and *Standards and Guidance for an Archaeological Watching Brief,* 1994, revised 2008), plus *Standards and Guidance for Archaeological Excavation* 1994, revised 2008). The project will be managed by Marc Steinmetzer MCI*f*A. Oakford Archaeology is managed by a Member of the Chartered Institute for Archaeologists.

Health & Safety

7.2 All monitoring works within this scheme will be carried out in accordance with current *Safe Working Practices (The Health and Safety at Work Act 1974*).

ADDITIONAL INFORMATION

Specialists contributors and advisors
The expertise of the following specialists can be called upon if required:

Bone artefact analysis: Ian Riddler;
Dating techniques: University of Waikato Radiocarbon Laboratory, NZ;
Building specialist: Richard Parker;
Illustrator: Sarnia Blackmore;
Charcoal identification: Dana Challinor;
Diatom analysis: Nigel Cameron (UCL);
Environmental data: Vanessa Straker (Historic England);
Faunal remains: Lorraine Higbee (Wessex);
Finds conservation: Alison Hopper-Bishop (Exeter Museums);
Human remains: Louise Loe (Oxford Archaeology), Charlotte Coles;
Lithic analysis: Dr. Linda Hurcombe (Exeter University);
Medieval and post-medieval finds: John Allan;
Metallurgy: Gill Juleff (Exeter University);

Numismatics: Norman Shiel (Exeter);
Petrology/geology: Roger Taylor (RAM Museum), Imogen Morris;
Plant remains: Julie Jones (Bristol);
Prehistoric pottery: Henrietta Quinnell (Exeter);
Roman finds: Paul Bidwell & associates (Arbeia Roman Fort, South Shields);
Others: Wessex Archaeology Specialist Services Team

MFR Steinmetzer
25 August 2019
WSI/OA1620/01

Appendix 2:

Borehole descriptions

Core 1

Context	*Depth*	*Description*	*Interpretation*
100	0-0.3m	Heavitree Breccia	Capping material
101	0.3-0.7m	Mid reddish-brown silty sand, pea gravel (1-2%)	Weir core
102	0.7-0.78m	Mid reddish-brown gritty silty sand, pea gravel (10-15%)	Weir core
103	0.78-0.84m	River terrace gravels	Weir core
104	0.84-0.94m	Heavitree Breccia rubble	Weir core
105	0.94-1.17m	Mid reddish-brown silty sand, small angular gravel (4-5%), light grey pink lime mortar (lime flecks 1%, slate flecks 1%)	Weir core
106	1.17-1.69m	Mid reddish-brown silty sand	Weir core
107	1.69-1.8m	Mid reddish-brown silty sand, greyish white lime mortar (slate flecks 1%, lime flecks 1%), small angular stone (1%), pea gravel (1%)	Weir core
108	1.8-2.1m	Solid Heavitree Breccia	Possible base of weir
109	2.1-2.2m	Rounded gravels between 10mm-30mm	Possible bedding layer
110	2.2-2.7m	Mid reddish-brown clayey silt, small sub-angular gravels (5-10%)	Earlier river deposits
111	2.7m+	Thin lenses of mid reddish-brown sandy silt and silty clays, river deposits with small pea gravel (1-2%)	Alphington Breccia Formation

Total depth 6m – top of core 4.64mAOD.

Core 2

Context	*Depth*	*Description*	*Interpretation*
200	0-0.15m	Concrete	20th century repair
201	0.15-0.28m	Grey limestone slab	19th-20th century repair
202	0.28-0.5m	Heavitree Breccia	Capping material
203	0.5-0.65m	Mid reddish-brown silty sand, small sub-angular-sub-rounded gravel (40%)	Weir core
204	0.65-0.89m	Mid reddish-brown silty sand, small sub-angular gravel (10%)	Weir core
205	0.89-0.95m	Mid reddish-brown compact silty sand, small Heavitree Breccia (2%)	Weir core
206	0.95-1.06m	Mid reddish-brown silty sand, pea gravel (20%)	Weir core
207	1.06-1.55m	Mid reddish-brown sandy silt, sub-rounded gravels from 5mm-20mm (<30%)	Weir core
208	1.55m+	Thin lenses of mid red silty clays and sandy clays, river deposits with small pea gravels (1-2%)	Alphington Breccia Formation

Total depth 7m – top of core 3.81mAOD.

Core 3

Context	*Depth*	*Description*	*Interpretation*
300	0-0.4m	Heavitree Breccia	Capping material
301	0.4-0.57m	Mid reddish-brown sandy silt, Heavitree Breccia (5%), pea gravels (10%)	Weir core
302	0.57-0.75m	Mid reddish-brown sandy silt, small Heavitree Breccia (<10%)	Weir core
303	0.75-0.84m	Compact mid red sandy silt, comprised of Heavitree Breccia fragments	Weir core
304	0.84-1.3m	Mid yellowish-brown soft sandy silt, rounded river gravels up to 30mm (5%)	Weir core
305	1.3-1.7M	Mid reddish-brown sandy silt with lenses of greyish brown, angular gravel 2mm-20mm (20%)	Weir core
306	1.7-2.4m	Mixed reddish-brown silty sand and gravels, pea gravels (20%), Heavitree Breccia lenses (20%)	Weir core
307	2.4-2.7m	Solid Heavitree Breccia	Possible base of weir
308	2.7-2.95m	Mid reddish-brown silty sand, sub-angular and sub-rounded gravels 20mm-50mm (70%)	Possible bedding layer
309	2.95m+	Lenses of mid red sandy silts and silty clays	Alphington Breccia Formation

Total depth 8m – top of core 4.5mAOD.

Core 4

Context	*Depth*	*Description*	*Interpretation*
400	0-0.4m	Heavitree Breccia	Capping material
401	0.4-2m	Mid reddish-brown sandy silt, Heavitree Breccia rubble	Weir core
402	2m+	Lenses of mid red sandy silts and silty clays	Alphington Breccia Formation

Total depth 3.5m – top of core 3.81mAOD.

Core 5

Context	*Depth*	*Description*	*Interpretation*
500	0-0.35	Heavitree Breccia	Capping material
501	0.35-0.95	Heavitree Breccia rubble	Weir core
502	0.95-1.1m	Mid reddish-brown sandy silt, pea grit (5-10%), river gravels (5%)	Weir core
503	1.1-1.25m	Light yellowish-brown firm silty clay, pea grit (5%)	Weir core
504	1.25-1.35m	Heavitree Breccia rubble	Weir core
505	1.35-1.4m	Mid to dark brown silt, gravel (5%)	Weir core
506	1.4-1.55m	Mid reddish-brown silty sand, pea grit (5-10%)	Weir core
507	1.55-1.65m	Dark reddish-brown silty sand, pea grit (5-10%)	Weir core
508	1.65-1.85m	Dark reddish-brown silty sand, pea gravel (10-15%)	Weir core
509	1.85-1.95m	Dark reddish-brown silty sand, pea gravel (5%), pea grit (10-15%)	Weir core
510	1.95-.2.35m	Dark reddish-brown silty sand, pea grit (5-10%)	Weir core
511	2.35-3.05m	Heavitree Breccia rubble, gravel (5%)	Weir core

Total depth 3.05m – top of core 4.78mAOD.

Core 6

Context	*Depth*	*Description*	*Interpretation*
600	0-0.55	Heavitree Breccia	Capping material
601	0.55-0.95	Mid yellowish-brown sandy silt, gravel (15-20%)	Weir core
602	0.95-1.15m	Mid yellowish-brown silty sand	Weir core
603	1.15-1.25m	Mid reddish-brown silty sand, river gravels, pea grit (10-15%), gravels (10-15%)	Weir core
604	1.25-2.2m	Dark reddish-brown silty sand (5%), pea grit (5-10%), pea gravel (5-10%), Heavitree Breccia (5%)	Weir core
605	2.2-3.3m	Thin lenses of mid reddish-brown silty sand and clays	Earlier river deposits
606	3.3m+	Lenses of mid red sandy silts and silty clays	Alphington Breccia Formation

Total depth 7.4m – top of core 4.27mAOD.

Core 7

Context	*Depth*	*Description*	*Interpretation*
700	0-1.6m	Concrete	20th century repair
701	1.6-2m	Dark reddish-brown sandy silt, pea gravel (10-15%)	Weir core
701	2-2.6m	Dark reddish-brown sandy silt, fine grit and river terrace gravels	Earlier river deposits
702	2.6m+	Lenses of mid red sandy silts and silty clays	Alphington Breccia Formation

Total depth 5.6m – top of core 4.11mAOD.